FORGOTTEN PEOPLE, FORGOTTEN DISEASES
Forgotten People, Forgotten Diseases
The Neglected Tropical Diseases and Their Impact on Global Health and Development

Peter J. Hotez, M.D., Ph.D.
The George Washington University
and
Sabin Vaccine Institute
Washington, DC
Cover art: “A Ray of Hope” by Emma Burns (from PLoS NTDs, Oct. 2007, vol. 1, no. 1), depicting the darkness of disease contrasted with the light and hope that scientific research brings to global health and wellness.

Copyright © 2008 ASM Press
American Society for Microbiology
1752 N Street, N.W.
Washington, DC 20036-2904

Library of Congress Cataloging-in-Publication Data
Hotez, Peter J.
Forgotten people, forgotten diseases : the neglected tropical diseases and their impact on global health and development / Peter J. Hotez.
p. ; cm.
Includes bibliographical references and index.
1. Tropical medicine. I. Title.
RC961.H68 2008
362.196’9883—dc22 2008010700

All Rights Reserved
Printed in the United States of America
10 9 8 7 6 5 4 3 2 1

Address editorial correspondence to: ASM Press, 1752 N St., N.W., Washington, DC 20036-2904, U.S.A.

Send orders to: ASM Press, P.O. Box 605, Herndon, VA 20172, U.S.A.
Phone: 800-546-2416; 703-661-1593
Fax: 703-661-1501
Email: Books@asmusa.org
Online: estore.asm.org

Downloaded from www.asmscience.org by
IP: 54.70.40.11
On: Sat, 14 Sep 2019 20:45:12
Dedicated to my youngest daughter,
Rachel Kate Hotez,
who teaches me every day about disabilities

To the memory of my brother,
Richard Eric Hotes, M.D.

And to the Bill and Melinda Gates Foundation
for the opportunity to devote my
life to the Neglected Tropical Diseases
Contents

Foreword, Sonia Ehrlich Sachs and Jeffrey D. Sachs   ix
Foreword, Alyssa Milano   xiii
Preface   xv
Acknowledgments   xvii

chapter 1   Introduction to the Neglected Tropical Diseases   1
chapter 2   “The Unholy Trinity”: the Soil-Transmitted Helminth Infections
Ascariasis, Trichuriasis, and Hookworm Infection   13
chapter 3   Schistosomiasis (Snail Fever)   29
chapter 4   The Filarial Infections: Lymphatic Filariasis (Elephantiasis) and
Dracunculiasis (Guinea Worm)   39
chapter 5   The Blinding Neglected Tropical Diseases: Onchocerciasis
(River Blindness) and Trachoma   55
chapter 6   The Mycobacterial Infections: Buruli Ulcer and Leprosy   69
chapter 7   The Kinetoplastid Infections: Human African Trypanosomiasis
(Sleeping Sickness), Chagas’ Disease, and the Leishmaniasis   81
chapter 8   The Urban Neglected Tropical Diseases: Leptospirosis, Dengue,
and Rabies   103
chapter 9   The Neglected Tropical Diseases of North America   113
chapter 10  The Global Network for Neglected Tropical Disease Control  127

chapter 11  Future Trends in Control of Neglected Tropical Diseases and the Antipoverty Vaccines  143

chapter 12  Repairing the World  157

Appendix: What are the Neglected Tropical Diseases?  164

Notes  167

References  183

Index  207
Foreword

Like a great general mustering his forces, Prof. Peter Hotez is gathering the forces of the world community to the fight against mankind's most ancient scourges: leprosy, worm infections, blinding trachoma, and other harrowing tropical diseases. Hotez is an able leader in this great battle. His crystal clear and powerful text displays the mind of a great scientist and humanist, one who knows every technical detail about the diseases which afflict billions of people and kill millions each decade. But Hotez never overlooks the afflicted themselves, the poor people of Africa, Asia, and Latin America among whom he's worked throughout his path-breaking career. Most importantly of all, he provides not only facts but also solutions, how we can finally triumph in an age-old struggle by deploying the best of modern public health and medical science.

In recent years, Hotez and several other world leaders in public health, including David Molyneux (Liverpool School of Medicine), Alan Fenwick (Imperial College London), and Lorenzo Savioli (World Health Organization), have been alerting the world to new possibilities to confront crippling diseases that have been long out of the limelight—indeed, often stigmatized to the point of systematic neglect, but taking a huge and devastating toll nonetheless. These leaders have christened these diseases the Neglected Tropical Diseases, or NTDs, and, in a crusade that combines elegant science with public education on a global scale, have created a new awareness of the possibility of making decisive advances in disease control. In essence, Hotez aims to take the “N” out of NTDs and to replace it with an “F,” so that these become the Former Tropical Diseases, at least in the sense of being brought decisively under control if not fully eliminated.

This book is an amazing and invaluable primer. It can be read by the general reader but also by the Infectious Diseases specialist. The general reader will no doubt feel stretched by the countless disease pathways, pathogenic agents, types of controls, and variations around the world. Yet at the same time, the
reader will feel exhilarated by seeing this complex and fascinating world presented with the utmost clarity, historical insight, and optimism. For this is a tale not only of harrowing suffering, but also of largely, and sometimes wholly, remediable suffering. As shocking and devastating are some of the stories, figures, and pictures, there is no gloom, only the steely determination to do all that we can as a global society to get these diseases under control.

The book is organized in a compelling manner. After a powerful overview showing that these diseases, despite their relative neglect, carry a combined disease burden on the same order of magnitude as AIDS, tuberculosis, and malaria, Hotez takes us on a remarkable tour of the world of worms and other pathogens, the disease vectors (such as mosquitoes and flies) which transmit them, and the state of public health and medical science. The agenda is daunting, with no fewer than thirteen killers playing a leading role and countless lesser infections also making cameo appearances. Yet the writing is so clear and compelling that, instead of jumble, Hotez provides us with an intellectual framework to keep the big picture even as we tour the water holes, lymph nodes, intestines, and mosquito salivary glands which constitute the settings of Hotez’s dramatic stories.

After explaining clearly and compellingly, but never condescendingly, the complexities of these tropical infections—including the pathogens which cause them, their transmission routes, the links to poverty, the pharmacology, and the history of control methods, right up to the present—Hotez rounds off the text with four crucial chapters. In chapter 9 he reminds us, forcefully but not alarmingly, that these are not only diseases of the tropical nations but also of the United States (at least in some cases). We have to care, not only for what these diseases mean for global suffering and for global political stability, but also for what they mean right at home in the U.S. In chapter 10 he describes the heroic efforts of many leaders, such as former President Jimmy Carter, and countless organizations and the new hopes for a stronger global leadership pulled together by a new Global Network for NTD Control, an effort in which Hotez has played a decisive role. In chapter 11 he reminds us that all effective public health programs, including the comprehensive control of the NTDs, must combine the comprehensive use of our existing tools—medicines, bed nets, surveillance, and others—with the research and development of new and more powerful tools, including vaccines against many of the NTDs. Characteristically, Hotez himself is a pioneer in research and development of a hookworm vaccine.

In the closing chapter 12, Hotez again raises the stakes. Controlling the NTDs is nothing less than “healing the world.” The control of the NTDs is a matter not only of disease control, but also of global security. Hotez argues persuasively that the NTDs, together with other killers such as AIDS, tuberculosis, and malaria, not only are exacerbated by upheavals of violence and conflict, but also are causes of conflict through their devastating effects of poverty, hunger, and despair, all precursors to violence in the poorest countries.

This book is thrilling on all levels. It is a unique opportunity for a wide readership to understand the science behind many of the world’s leading afflictions.
It is an opportunity to draw hope from countless examples of how science is contributing to solutions and the chances for comprehensive control of these killer diseases. And it is an invitation to all of us to engage personally with one of the greatest challenges of our time: using our heads and our hearts to help solve some of the longest-standing scourges facing humanity, and thereby building a world of greater justice, shared prosperity, and security.

Sonia Ehrlich Sachs, M.D., M.P.H.
Coordinator of Public Health Programs
Millennium Village Project of The Earth Institute
Columbia University, New York, New York

Jeffrey D. Sachs, Ph.D.
Special Advisor to UN Secretary General Ban Ki-Moon
Director of The Earth Institute
Columbia University, New York, New York
Foreword

In my humanitarian missions to Angola and elsewhere in developing countries, I am always struck by the devastation wrought by disease and malnutrition. Watching children and young women fall ill or fail to reach their full potential because of circumstances beyond their control has imprinted many indelible images in my mind. Although I have tried to capture some of this human suffering in my black and white photography, I also know there is so much more hidden misery that cannot be captured through pictures.

In my role as Lead Ambassador for the Global Network for Neglected Tropical Diseases, I have learned firsthand about the largely silent suffering that results from these terrible afflictions. Hookworms rob children of their daily iron and protein requirements and prevent them from growing and learning. Elephantiasis, Buruli ulcer, and leprosy cause disfigurement. River blindness and trachoma cause permanent vision loss. African sleeping sickness results in a slow and agonizing death.

Forgotten People, Forgotten Diseases explains in straightforward language where these neglected tropical diseases occur and how they have become the most common diseases among the world’s poorest people. It also highlights the chronic and debilitating aspects of these diseases and their poverty-promoting features. Of particular importance to me, the book illustrates how people afflicted with neglected tropical diseases suffer from stigma in their communities, especially young women, who are often abandoned by their husbands and prevented from holding their children. Portrayed here is human suffering on an almost unimaginable scale.

Finally, Forgotten People, Forgotten Diseases teaches us about an incredible opportunity we have to control these neglected tropical diseases on a massive scale, with both existing drugs and new vaccines being developed in nonprofit research laboratories. I am excited by the possibility of witnessing the elimination of some of these terrible scourges in my lifetime. For all of these reasons, I am hopeful that this book will inspire you and stimulate you to get involved
in stamping out the neglected tropical diseases, thereby taking an important step to reaching out in a very tangible way to the world’s poorest and most vulnerable people.

Alyssa Milano

*Lead Ambassador, Global Network for Neglected Tropical Diseases*
Ever since junior high school, I have been fascinated by the application of scientific knowledge for solving tropical public health problems of global importance. Starting with an M.D.-Ph.D. dissertation begun in 1980, my adult life has been a quest to develop experimental vaccines for human hookworm infection. Now, after more than 25 years of laboratory investigation and thanks to the support of the Bill and Melinda Gates Foundation, I have the opportunity and good fortune to head a multidisciplinary team that is developing and manufacturing these vaccines and then testing them in an area of Brazil where hookworm is endemic. While reaching this goal has been intensely satisfying at both a professional and personal level, I have also come to realize that completing early-stage development of a new product for a disease such as hookworm has in many ways been the easy part! Hookworm infects approximately 600 million people worldwide, but they almost all live on less than US$2 per day and only in the poorest regions of sub-Saharan Africa, Asia, and the tropical regions of the Americas. Because the people at risk for hookworm infection cannot afford to pay for a vaccine, unless there is greater general awareness about the public health and economic importance of hookworm and other parasitic infections there will never be the political will and large-scale financial investment necessary to ensure the global access of a hookworm vaccine, or indeed any other product for the diseases of poverty. Simultaneously, as it becomes evident to me that vaccine development is a decades-long process, I feel a need to do more in order to reach out to the world’s poor and provide them with better access to the existing treatments for hookworm, even if our currently available anti-hookworm drugs are imperfect.

Partly as a means to increase access to essential medicines and innovation, I have begun a concerted effort to raise public awareness of hookworm and other parasitic infections and to advocate for the largely voiceless poor people living in remote and rural regions of endemicity. However, it was only after I met three scientific “soul mates,” medical parasitologists who were simultaneously

Preface
launching their own advocacy efforts, that I felt an important breakthrough was achieved in terms of placing parasitic diseases on the global radar screen. Since 2003 I have engaged in intense colloquy with Professor David H. Molyneux of the Liverpool School of Tropical Medicine (David is also the Director of the Global Alliance to Eliminate Lymphatic Filariasis), Professor Alan Fenwick from Imperial College, London (Alan is also the Director of the Schistosomiasis Control Initiative), and Dr. Lorenzo Savioli from the World Health Organization (as well as some of his close colleagues there, including Drs. Denis Daumerie, Dirk Engels, and Jean Jannin) about some of the common features of all parasitic infections affecting poor people. During these long and detailed but also joyful conversations, which took place in Washington, DC, Atlanta, New York, London, Liverpool, Glasgow, Geneva, Berlin, and Stockholm, we soon realized that the major parasitic infections, as well as some selected bacterial and viral infections, could be thought of in aggregate as a group under the banner of the neglected tropical diseases, or NTDs for short. The NTDs are the most common infections of poor people, and also among the most important in terms of their health and economic impact. In many respects, their burden of disease rivals those of better-known conditions including HIV/AIDS, even though most people have never heard about the NTDs. This lack of recognition continues to surprise us given that the NTDs are ancient conditions that have plagued humankind for centuries (as documented in many of our earliest writings such as Egyptian medical papyri and religious texts, including the Bible), and they represent one of the most important reasons why the populations living in low-income countries of Africa, Asia, and Central and South America remain mired in a vicious cycle of poverty, destitution, and despair. The continued presence of NTDs in North America represents that region’s most striking health disparity and a sad legacy of the Middle Passage, the Atlantic slave trade between the 15th and 19th centuries.

Professor Jeffrey Sachs and Dr. Sonia Ehrlich Sachs of Columbia’s Earth Institute and Dr. Eric Ottesen (then at Emory University) subsequently joined our informal NTD working group, and in a series of policy papers published in PLoS (Public Library of Science) and the \textit{New England Journal of Medicine}, we were able to articulate the concept of the NTDs and how we can control or eliminate them through a global scale-up of access to essential medicines. These policy documents also provided a rationale for us to establish a new Global Network for NTDs, which is working to coordinate global advocacy and resource mobilization efforts for these conditions.

\textit{Forgotten People, Forgotten Diseases} summarizes in mostly nontechnical language the major concepts about the NTDs and how they cause human suffering, as well as their global importance and the unique and unusual opportunity we now have to lift the world’s poorest people out of poverty through low-cost and highly cost-effective control measures.

Peter Hotez
\textit{Washington, DC}
Acknowledgments

The idea for this book’s title came from a 2002 paper on helminth infections written by David Crompton and Michael Nesheim in the Annual Review of Nutrition, in which they quoted the phrase “forgotten diseases of forgotten people” (attributed to M. G. Schultz). I was inspired to write an “NTD Manifesto” in part from Jeff Sachs’s success in educating the general public about poverty in low-income countries in his landmark book, The End of Poverty, and also because of a very accessible book entitled Essentials of Global Health, written by my friend and colleague Richard Skolnik.

In addition to the individuals mentioned above and in the Preface, there are also many others who inspired me to write this book. They include my colleagues from the Global Network, including my associates at the Sabin Vaccine Institute, Kari Stoever (who provided leadership in helping to launch the Global Network, as well as her “A team”), Azalea Kim, Karen Palacio, Colin Burke, and Lindsay Wheeler; Kathy Spahn and Chad MacArthur from Helen Keller International; Jacob Kumaresan and Ibrahim Jabr from the International Trachoma Initiative; Mark Rosenberg, Eric Ottesen, and Nana Twum-Danso from the Task Force for Child Survival and Development; Joanna Rubinstein and Josh Ruxun from the Earth Institute at Columbia University; and John McCullough from Liverpool Associates in Tropical Health. I also want to acknowledge the leadership of the WHO, including Margaret Chan (Director-General), Anarfi Asamaoah Baah (Deputy Director-General), and David Heymann (Assistant Director-General, Communicable Diseases); the leadership of the Carter Center, including Donald Hopkins, Frank O. Richards, and former President Jimmy Carter and Rosalynn Carter; the Division of Parasitic Diseases of the CDC; Marcel Tanner, Juerg Utzinger, and Jennifer Kaiser at the Swiss Tropical Institute; Michael Katz at the March of Dimes Birth Defects Foundation; and Mirta Roses Periago, Director-General, Steven Ault, and the NTD group at the Pan American Health Organization for their exemplary dedication to NTDs, as well as the leadership at Merck & Co., Pfizer Inc., GlaxoSmithKline, Johnson
& Johnson, Novartis, Merck KgaA, Med Pharm, and Sanofi-Aventis for donating NTD drugs to the world. Sandeep Kishore and Prabhjot Dhadialla, two M.D.-Ph.D. students at the Weil Cornell Medical College and Rockefeller University, and Rajesh Gupta, a Stanford medical student, have helped to launch an important student-led campaign to tackle the NTDs. I wish to acknowledge with deep gratitude and respect my former mentors from Yale and Rockefeller Universities and the Massachusetts General Hospital: Curtis Patton, Frank F. Richards, George Miller, Anthony Cerami, and Jose Ignacio Santos.

Of enormous importance to the NTD enterprise is the Sabin Vaccine Institute Board Chairman, Philip K. Russell, who is my very important mentor on all things vaccines and global health, as well as his wife, Connie Russell. Ciro de Quadros, one of the giants of vaccinology and global health, has also been a source of inspiration and much-needed advice and wisdom. I also want to extend my deepest appreciation to my close friends and colleagues at the Human Hookworm Vaccine Initiative (HHVI) based at the Sabin Vaccine Institute, H. R. Shepherd, the Founding Chair, and his wife, Carol Ruth; Heloisa Sabin; Mort and Chris Hyman for their particular commitment to NTDs and their very important early support for schistosomiasis vaccine development; and to the rest of the Sabin Board members: Mary Ann Chaffee, Lou Cooper, Brian Davis, Jeffrey Fuisz, Lance Gordon, Nancy Gardner Hargrave, Axel Hoos, Michael and Jacqueline Kempner, Clark McFadden, Walter Orenstein, Ciro de Quadros, Kevin L. Reilly, Adan Rios, and Michael Whitham. I acknowledge the support of some very important people at The George Washington University Medical Center, including Jim Scott, Allan Goldstein, Richard Skolnik, Richard Southby, Ruth Katz, George Davis, Victor Barbiero, Gary Simon, Alan Wasserman, and John F. “Skip” Williams, past GWU President Stephen Joel Trachtenberg, and the new GWU president, Steven Knapp.

I want to thank my close scientific colleagues and friends at the HHVI, including Jeff Bethony, Maria Elena Bottazzi, Simon Brooker, Ami Shah Brown, David Diemert, Ricardo Fujiwara, Gaddam Narsa Goud, Kathryn Jones, Alex Loukas, Beth Martins, Rodrigo Correa Oliveira, Isaias Raw, Helton Santiago, Peter Smith, and Bin Zhan, as well as Vehid Deumic, Richi Gupta, Desheng Jiang, Brian Keegan, Patti Lieblich, Aaron Miles, Julie Ost, Jordan Plieskatt, Tracey Smith, Irene Thuo, Weston Williams, Nate Wolf, and Sharon Wu. Sophia Raff and Tania Govanlu were especially helpful in working with me to prepare the manuscripts for this book. A special thanks to Sophia Chung-Debose.

The outstanding staff at PLoS Neglected Tropical Diseases, including Gavin Yamey, Dan Sarna, and Shab Sigman, and the leadership at PLoS, including Harold Varmus, represent important individuals in our NTD advocacy efforts. The open-access neglected disease series of papers from PLoS Medicine were extremely useful and authoritative references and provided many of the figures for this book, as did the Public Health Image Library of the CDC.

I want to express deepest gratitude to the program officers of the Gates Foundation, who advocated for us and made it possible for me to pursue a dream and have a career devoted to hookworm vaccine development and NTD control. They include David Brandling-Bennett, Julie Jacobson, Gordon Perkin,
Gina Rabinovich, Tadataka Yamada, and Gabrielle Fitzgerald. I am especially grateful for the active and personal involvement of Bill and Melinda Gates.

I am deeply appreciative of my good colleagues at Geneva Global and Legatum for rolling the dice with us on the scale-up of NTD control, and John Robbins at the NIH for all his advice and support. In addition, former President William Jefferson Clinton, Senator Hillary Rodham Clinton, and the outstanding staff of the Clinton Global Initiative (including Tom Kalil, Chris Jennings, and Sara Richlin) have lent a powerful voice to NTDs. Senators Sam Brownback, John Kerry, and Edward Kennedy and their staffs have also made the NTDs a major priority.

Based on his personal experiences in the Democratic Republic of Congo and elsewhere in developing countries, Dikembe Mutombo of the Houston Rockets has been a powerful force behind the movement to raise awareness of the NTDs. I also thank the comedian Jill-Michele Meleán.

Beloved everywhere, Alyssa Milano, our Global Network for NTDs Ambassador, has given a fresh and beautiful face to these conditions and new hope to people everywhere who suffer from the stigma and disfigurement of the NTDs. She has been an eloquent and passionate spokesperson for these conditions.

Finally, I want to thank my loving family, Ann, Matthew, Emy, Rachel, and Daniel Hotez, as well as Larry and Linda Hotes, Liz and Warren Kirshenbaum, Andrea Hotes, and parents Ed and Jean Hotez; nephews and nieces Gennifer, Josh, Todd, Andrew, Alyssa, Marissa, Sammy, and Julia; in-laws Don, Marsha, Julia, and David Frifield, Mark and Judy Conway, and Irv and Peggy Goldberg; Daniel and Nancy Goldberg and their families, and all of the others in my extended family and circle of friends for putting up with me all of these years!
Index

A
Acid-fast organisms, mycobacteria as, 77
Acquired immunodeficiency syndrome, see HIV/AIDS
AEterna Zentaris GmbH, 148
African Programme for Onchocerciasis Control, 62–63, 132, 133
African trypanosomiasis, 82–90 clinical manifestations of, 84–86 control of, 88–90 East African (Rhodesian), 82–85, 88–89 epidemiology of, 84, 85 geographic distribution of, 82, 84, 85 history of, 82, 85–87 immune defenses against, 83 pathophysiology of, 82–83 protozoan causing, 82–84 socioeconomic consequences of, 86 transmission of, 82, 84–85 treatment of, 86–89 West African (Gambian), 82, 84–85, 88–89
AIDS, see HIV/AIDS
Alaska, NTDs in, 122–124
Albendazole donation of, 135 for echinococcosis, 124 for helminth infections, 25–27 for lymphatic filariasis, 46 in mass drug administration programs, 131 in rapid-impact package, 144
Aleppo evil (leishmaniasis), 97
Alexander the Great, armies, leprosy spread by, 74
Alveolar echinococcosis, 123–124
Amarelao, see Hookworm infections
Amastigotes, in leishmaniasis, 97
Amazigo, Uche, in onchocerciasis control, 62, 132
Amebiasis, geographic distribution of, 125
American Leprosy Mission, 151
American trypanosomiasis, see Chagas’ disease
Amphotericin B, for leishmaniasis, 100
Ancient conditions, vs. emerging infections, 6
Ancylostoma duodenale, see Hookworm infections
Anemia in African trypanosomiasis, 85 agriculture-related, 139–140 in helminth infections, 19 in hookworm infections, 22–23 in leishmaniasis, 98 reduction of, 135 in schistosomiasis, 34
Angola, African trypanosomiasis in, 89
ANGOTRIP, African trypanosomiasis work of, 89
Anthelmintic drugs, 24–27
Antibiotics for Buruli ulcer, 72 for leprosy, 78 for leptospirosis, 105 for trachoma, 65–67
Antigenic variation, in trypanosomes, 83–84
Antimony compounds, for leishmaniasis, 99–100
Antitrypanosomal drugs for African trypanosomiasis, 86–90 for Chagas’ disease, 94
Appetite loss, in leishmaniasis, 98
Arctic region, NTDs in, 122–124
Arsenic compounds, for African trypanosomiasis, 86
Artemisinin, for schistosomiasis, 37
Arthritis, in guinea worm infections, 49
Arthropods, in filariasis transmission, 40
Ascariasis in children, 18–19 clinical manifestations of, 19–20 epidemiology of, 14–19 geographic distribution of, 114–115 history of, 14 larvae in, 22 mass drug administration programs for, 131 pathology of, 19–20 risk factors for, 17–18
Ashford, Bailey K., on hookworm infections, 20
Assassin bugs, in Chagas’ disease transmission, 90–95
Asthma, in toxocariasis, 116–117
Atroxil, for African trypanosomiasis, 86–87
Avicenna
on leishmaniasis, 95
on lymphatic filariasis, 40
Azithromycin
donation of, 135
in mass drug administration programs, 131
in rapid-impact package, 144
for trachoma, 65–67

Bacterial infections, 166
Baghdad boil (leishmaniasis), 97
Balkh sore (leishmaniasis), 97
Bacterial infections, 166

Bladder, schistosomiasis
Blindness
in leprosy, 73–74
in schistosomiasis, 31, 33–35
Blair, Tony, 1, 2
Blindness
in leprosy, 78
Blood flukes, see Schistosomiasis
Blood loss
in hookworm infections, 22–23
in schistosomiasis, 34, 35
Blood vessels, schistosome eggs in, 33–34
Bone marrow, leishmaniasis manifestations in, 95, 98
Bono, 1–2
Brain, NTD manifestations in
in African trypanosomiasis, 85
in cysticercosis, 117–119
in leptospirosis, 105
in rabies, 109–110
Brazil
dengue fever in, 106
helminth infections in, 14–15
leptospirosis in, 104
Break bone fever, 105–108
Brel, Anton, arsenical drug development by, 86
Brigade for Pentamidinization, 89
Brooker, Simon, 139
Brownback, Sen. Sam, on drug production, 143
Brownback-Brown Elimination Brigade for Pentamidinization, 89
Brownback, Sen. Sam, on drug production, 143

C
Campbell, William, ivermectin discovery by, 61–62
Canada, NTDs in, 122–124
Cancer, bladder, in schistosomiasis, 35
Cardiomyopathy, in Chagas’ disease, 93–94
Caribbean, NTDs in, 125
Chang, Margaret, 11
Chancr, 93
China
dengue fever in, 107
helminth infections in, 16–18
lymphatic filariasis program of, 44–46, 129
schistosomiasis in, 30
Chlamydia trachomatis infections, see Trachoma
Chlorosis, see Hookworm infections
Chronic conditions, 6
Ciracadian rhythm, of filariae, 42–43
City life, see Urbanization
Clinton, Bill, 1–2, 11, 127
Clinton Global Initiative, 137–138
Coloan, for leprosy, 78
Colombia, conflicts in, 159
Colom, enlargement of, in Chagas’ disease, 93–94
Commission on Macroeconomics and Health, 2
Conflict, diseases in, 158–159

Downloaded from www.asmscience.org by IP: 54.70.40.11
On: Sat, 14 Sep 2019 20:45:12
Conrad, Joseph, on sleeping sickness, 81, 86
Cook, Joe, of International Trachoma Initiative, 66
Cook, Sir Albert, Buruli ulcer discovery by, 70
Copepods, in guinea worm life cycle, 48–51
Cornea eyelash damage to, in trachoma, 65 opacity of, in onchocerciasis, 59
Costs, of treatment programs, 136
Cote d’Ivoire
Cough, in ascariasis, 22
Cystic echinococcosis, 123–124
Cysticercosis, 117–119
Cytokine storm, in filariasis, 43

D
Damien, Father, 75–76
Dams, schistosome population and, 30
Dapsone, for leprosy, 78
Darwin, Charles, as Chagas’ disease
Deworming, 24–27
Dietylcarbamazine
donation of, 135
for lymphatic filariasis, 44–47, 129
in mass drug administration programs, 131
in rapid-impact package, 144
Disability, 6–7
Disability-adjusted life years (DALYs), 7, 9, 128
in hookworm infections, 24
in leishmaniasis, 95–96
Disfigurement, 6–7
in leprosy, 73–76
in onchocerciasis, 58
Doctors Without Borders (Médecins Sans Frontières) activities in African trypanosomiasis, 87–88
in leishmaniasis, 96
Dog(s), diseases related to echinococcosis, 123–124
leptospirosis, 104–105
rabies, 109–110
toxocariasis, 114–117
Dog heartworm, 40
Donovan, Charles, Leishmania discovery by, 99
DOTS therapy, for tuberculosis, 70
Dracunculus Eradication Program, 51

E
Echinococcosis, 123–124
Economic issues, see Socioeconomic consequences
Ectoparasitic infections, 166
Eggs
ascarid, 115
Echinococcus, 123–124
helminth, 15
pork tapeworm, 117–118
schistosomes, 29, 33–34
Wuchereria bancrofti, 41
Egypt
helminth infections in, 14
leprosy origin in, 73
lymphatic filariasis in, 40
schistosomiasis in, 29–31
Ehrlich, Paul, arsenal drug development by, 86, 87
Elephantiasis, 8
clinical manifestations of, 43–44
diagnosis of, 42–43
elimination of, 39
eradication of, 39
pathophysiology of, 42–43
treatment of, 44–47
Ellis Island, trachoma inspection in, 64
Emerging infections, vs. ancient conditions, 6
“Empty granary” disease, 49
Encephalitis, in cysticercosis, 118
Encephalopathy
in African trypanosomiasis, 85
posttreatment reactive, 87
Enteritis, in strongyloidiasis, 117
Eosinophilia, in toxocariasis, 115
Epidemiology, 4–5, 127–128; see also specific diseases
Eshmuca Code of Babylon, on bites from rabid dogs, 103
“Evil eye,” Buruli ulcer due to, 71–72
Eye, NTD manifestations in
in Chagas’ disease, 93
in onchocerciasis, 55–63
in toxocariasis, 115
in trachoma, 55–63

F
Fenwick, Alan, in schistosomiasis control, 36, 130
Fever
in African trypanosomiasis, 84
in Chagas’ disease, 93
dengue, 105–108
in leishmaniasis, 98
in leptospirosis, 105
in lymphatic filariasis, 43
“Filarial dance sign,” 43
Filariasis
lymphatic, see Lymphatic filariasis onchocerciasis, 55–63, 125, 131, 151
types of, 40; see also specific diseases
FIOCruz, 91
Flatworms, see Schistosomiasis
Flavivirus infections, 107
Flukes, blood, see Schistosomiasis
Flushing, in dengue fever, 107
Focusing Resources on Effective School Health (FRESH), 25
Foege, William, of Carter Center, 62
Food and Agriculture Organization, in Onchocerciasis Control Program, 60–63
Fraunhofer USA Center for Molecular Biotechnology, vaccines of, 151
FRESH (Focusing Resources on Effective School Health), 25
Friedham, Ernst, arsenical drug development by, 86–87
Fungal infections, 166

G
Gandhi, Mahatma, 1
on civilization, 113
on funding health programs, 127
Gardner, John, on battle against disease, 157, 161
Garnier, Jean-Pierre, on new drug development, 147
Gastrointestinal disorders, in Chagas’ disease, 93–94
Gates, Bill and Melinda, support of research and control, 1–3
African trypanosomiasis, 88
Buruli ulcer, 73
guinea worm infections, 51
product development partnerships, 149, 162
schistosomiasis, 36
Geldof, Bob, 1
Genital schistosomiasis, 35
Geographic distribution, 134, 139; see also specific diseases
Ghana, Buruli ulcer in, 70
Giardiasis, 121
GlaxoSmithKline programs, 25, 135
Glennerster, Rachel, on new drug development, 147
Global Alliance for the Elimination of Leprosy, 78–79
Global Alliance to Eliminate Lymphatic Filariasis, 46–47, 130
Global Buruli Ulcer Initiative, 73
Global Fund to Fight AIDS, Tuberculosis, and Malaria, 3, 70
Global Network for NTDs, 11, 47, 127–142
Glossina, in trypanosome transmission, 82, 84–85
Ground itch, in hookworm infections, 22
Group of 8 nations
mass drug administration and, 132
Report of the Commission on Africa, 2
tuberculosis control programs of, 70
Growth and development, NTD effects on
helminth infections, 19
hookworm infections, 22–23
schistosomiasis, 34

Guinea worm infections, 8, 47–51
clinical manifestations of, 49
epidemiology of, 47
eradication of, 47, 50–51
history of, 47
larvae in, 48–49
life cycle in, 48–49
pathophysiology of, 48–49
treatment of, 50–51
village epidemics of, 49

H
Halstead, Scott, on dengue hemorrhagic fever, 107
“Hanging groin,” in onchocerciasis, 58
Hansen, G. H. Armauer, Mycobacterium leprae discovery by, 77
Hansen’s disease, see Leprosy
Hawking, Frank, lymphatic filariasis research of, 44–45
Hawking, Stephen J., lymphatic filariasis connection with, 44–45
Headache
in African trypanosomiasis, 84, 85
in Chagas’ disease, 93
in dengue fever, 107
in leptospirosis, 105
Heart, Chagas’ disease effects on, 93–94
Heartworm, 40
Helen Keller International, 130
in onchocerciasis control, 63
in trachoma management, 66–67
Helminth infections, 166; see also Ascariasis; Hookworm infections
HIV/AIDS
as emerging infection, 6
impact of, 1–4
leishmaniasis with, 96
mortality in, 7, 9
NTDs with, 9, 140–141
schistosomiasis with, 35
tuberculosis with, 70
Hookworm infections, 19–25
absence in developed countries, 20
epidemiology of, 14–20
eradication of, 20–21
geographic distribution of, 14, 114–115, 125
history of, 14
introduction from Africa, 20
larvae in, 21–22
mass drug administration programs for, 131
pathophysiology of, 19–20, 22
in pregnancy, 23
prevention of, 24
risk factors for, 17–18
transmission of, 21–22
in United States, 20
vaccine for, 150–153
Huang zhong bing; see Hookworm infections
Human African trypanosomiasis, see African trypanosomiasis
Human Hookworm Vaccine Initiative, 27, 150
Human immunodeficiency virus infection, see HIV/AIDS
Humphreys, Margaret, on hookworm infections, 20, 114
Hunt, Paul, 11
Hydrocele, in lymphatic filariasis, 43–44
Hydrocephalus, in cysticercosis, 118
Hydrophobia (rabies), 108–110

I
Immune response, to filariae, 42–43
INCOSUR, in Chagas’ disease control, 94–95
India
dengue fever in, 107
lymphatic filariasis in, 44
rabies in, 109
Indian Council for Medical Research, African trypanosomiasis work of, 88
Infectious Disease Research Institute, vaccines of, 150
Iniciativa de los paises de Centroamerica, in Chagas’ disease control, 94–95
Institut Pasteur projects
African trypanosomiasis, 88
vaccine development, 149
Institute of Experimental Pathology of Manguinhos, 91
Institute of Health Metrics and Evaluation, 128
Instituto Oswaldo Cruz, 88, 91
International Commission for the
Certification of Dracunculiasis
Eradication, 50–51
International Federation of Anti-
Leprosy Associations, 79
International Health Education Act,
161
International Trachoma Initiative,
64–67, 130
International Vaccine Institute,
150–151
Intestine
helminth infections of, 13–27
schistosomiasis effects on, 34–35
Inuit people, NTDs in, 122–124
Itching, see Pruritus
Ivermectin
donation of, 135
for lymphatic filariasis, 46–47,
51
in mass drug administration
programs, 131, 132
for onchocerciasis, 61–63
in rapid-impact package, 144
resistance to, 63
Jamot, Eugene, African
trypanosomiasis work of, 88
Jaundice, in leptospirosis, 105
Johnson & Johnson programs, 25,
135
Jolie, Angelina, 1
Jones, Sir Alfred Lewis, founding
Liverpool School of Tropical
Medicine, 86
Kala-azar (visceral leishmaniasis),
95–100, 121
Katayama syndrome, 30
Kazatchkine, Michel, 141
Kennedy, Sen. Edward, on new drug
development, 143
Kenya, coinfections in, 139
Kenya Medical Research Institute,
African trypanosomiasis work of,
88
Kessel, John F., on filariasis
prevention, 44
Kidney failure, in leptospirosis, 105
Kinetoplastid infections, 81–102
African trypanosomiasis, 82–90
Chagas’ disease, 90–95, 121, 125
drugs for, 148
leishmaniasis, 95–100, 121
Kissing bugs, in Chagas’ disease
transmission, 90–95
Kissing, see Pruritus
Kissinger, Henry, on global
cooperation, 162
Koberle, Fritz, Chagas’ disease work
of, 93
Koch, Robert, 86
Kremer, Michael, on new drug
development, 147
Kristof, Nicholas, 138
Kumaresan, Jacob, of International
Trachoma Initiative, 66
L
Lammie, Pat, on disease carried in
slave trade, 125
Larva migrans
ocular, 115
visceral, 114–117
Larvae, see specific parasites
Larvicides, for blackfl y control, 60–61
Laveran, Alphonse, trypanosomiasis
research of, 86
Lazarettos, for leprosy, 74
Lazarus bell, 74
Lazowski, Rabbi Philip, 157
“Lazy Southerner” concept, 114
Leishman, William, 99
Leishmaniasis, 95–100, 121
anthropogenic, 100
clinical manifestations of, 97–99
control of, 100
cutaneous, 95–97, 99–100, 121
epidemiology of, 95–96, 100
geographic distribution of, 95–96
mortality in, 95, 96, 98–99
mucocutaneous, 95
parasites causing, 96–97
pathophysiology of, 97–99
risk factors for, 95–96
socioeconomic consequences of,
95–97
transmission of, 96–97
treatment of, 99–100
vaccines for, 150
visceral (kala-azar), 95–100, 121
Leontiasis, 74
Leprosy, 73–79
clinical manifestations of, 77–78
control of, 78–79
diagnosis of, 78–79
epidemiology of, 76–77
geographic distribution of, 76–77
history of, 73–76
lepromatous, 77–78
origin of, 73–74
stigma of, 73–76
transmission of, 77
vaccines for, 144
in United States, 74–76
vaccines for, 151
Leptospriosis, 104–105, 122
geographic distribution of, 125
vaccines for, 151
Liver, NTD manifestations in
in Chagas’ disease, 93
in echinococcosis, 123–124
in hookworm infections, 19
in leishmaniasis, 95, 98
in leptospirosis, 105
in schistosomiasis, 34–35
Liverpool School of Tropical
Medicine, 86
Livingston, David, trypanosomiasis
research of, 86
lobato, Monteiro, on hookworm
infections, 23–24
Lung, NTD manifestations in
in ascariasis, 22
in echinococcosis, 123–124
in toxocariasis, 115
Luria, Rabbi Isaac, 157
Lymphadenopathy, in African
trypanosomiasis, 85
Lymphangiectasia, in filariasis,
42–43
Lymphatic filariasis, 40–47, 131
case example of, 10
clinical manifestations of, 42–44
diagnosis of, 42–43
evermatous, 39, 45–47
epidemiology of, 40
eradication of, 39, 51
gastrointestinal distribution of, 125
history of, 40
parasite life cycle in, 41–43
pathophysiology of, 40–43
prevention of, 44–47
Lymphedema, in filariasis, 43–44
MacLean, J. Dick, trichinellosis work
of, 123
McNamara, Robert, onchocerciasis
program of, 55, 59
Malaria
diagnosis of, 7, 9
in United States, 74–76
control of, 144
NTDs with, 9, 139–140
Malnutrition
in helminth infections, 19
in schistosomiasis, 34
Manson, Sir Patrick
on disease transmission by
mosquitoes, 41
lymphatic filariasis studies of, 45
Mao Zedong (Mao Tse-tung)
lymphatic filariasis program of,
44–46
schistosomiasis control program
of, 50
Mass drug administration programs,
129–141
Maudlin, Ian, African
trypanosomiasis work of, 88
Meat, parasitic diseases from,
122–124
Mebendazole
donation of, 135
for helminth infections, 25–27
in mass drug administration
programs, 131
in rapid-impact package, 144
Mectizan, for onchocerciasis, 61–62
Mectizan Donation Program, 132
Médecins Sans Frontières (Doctors
Without Borders) activities
in African trypanosomiasis, 87–88
in leishmaniasis, 96
MedPharm, drug donations from,
135
Megacolon, in Chagas’ disease,
93–94
Megesoophagus, in Chagas’ disease,
93–94
Melarsoprol, for African
trypanosomiasis, 86–87
Meningitis, in leptospirosis, 105
Meningoencephalitis, in African
trypanosomiasis, 85
México, NTDs in, 125
Michener, James, on elephantiasis,
39
Microfilariae
in lymphatic filariasis, 41–44
in onchocerciasis, 56–59
Milano, Alyssa, 11, 138
Milken, Mike, 153
Millennium Declaration, 2
Millennium Development Goals,
2, 3
Miltetosine, 100, 148
Ministry of Health of Malaysia,
African trypanosomiasis work
of, 88
Miracidia, in schistosomiasis, 34
Molluscicides, for snail control, 31, 35
Molokai Colony, Hawaii, for lepers,
75–76
Molyneux, David H., lymphatic
filariasis work of, 47, 130
Moodie, Michael, on destabilizing,
160
Moran, Mary, on new drug
development, 147, 148
Morel, Carlos, 152–153
Morocco, National Blindness
Control Program of, 66–67
Mortality, 7
in African trypanosomiasis,
81–82, 85
child, in conflict areas, 159–160
in dengue hemorrhagic fever, 107
in leishmaniasis, 95, 96, 98–99
in leptospirosis, 105
in rabies, 108–110
in trichinellosis, 123
Mosquitoes, in disease transmission
dengue fever, 106–108
filariasis, 40–46
malaria, 144
Moxidectin, for helminth infections,
146
Mucocutaneous leishmaniasis, 95
Multidrug therapy, for leprosy, 76,
78, 79
Murray, Chris, disability-adjusted
life years studies of, 128
Muscles
cysticercosis of, 118
Trichinella in, 123
Mycobacterium leprae, see Leprosy
Mycobacterium ulcerans
Buruli ulcer in, 69–73
vaccine for, 151
Mycolactone toxin, in Buruli ulcer, 71
Myocarditis, in Chagas’ disease,
93–94
Nagana, of cattle (bovine
trypanosomiasis), 82–83, 86,
88, 151
Napoleon’s army, schistosomiasis
in, 29
National Collaborative
Chicago-Based Congenital
Toxoplasmosis Study, 120–121
National Hansen’s Disease Center,
75
National Institutes of Health, study
programs of, 162
Nausea and vomiting, in
leptospirosis, 105
Necator americanus, see Hookworm
infections
Neglected Diseases Initiative, 88
Neglected tropical diseases, core
group of, 3–4, 165–166
“Negro lethargy,” 85
Nematodes
filarial, see Filariasis
soil-transmitted, 13–27, 114–117,
131
Neurocysticercosis, 117–119
Neurologic disorders
in African trypanosomiasis, 85
in cysticercosis, 117–119
in helminth infections, 19
in leprosy, 77
in rabies, 108–110
Niclosamide, for snail control, 31
Nifurtimox
for African trypanosomiasis, 88
for Chagas’ disease, 94
Nigeria
NTD control in, 138
onchocerciasis in, 58
Nile River, schistosomes in, 30–31
Nippon Foundation, leprosy
elimination activities of, 79
Nodules
in Buruli ulcer, 71
in leishmaniasis, 97
Novartis
institute for NTDs, 146
leprosy drugs from, 78–79
NTDs, see Neglected tropical
diseases
 Nunavik Regional Board of Health
and Social Services, 123
Nye, Joseph, Jr., on
humanitarianism, 162
Ocular larva migrans, 115
Onchocerciasis, 55–63, 131
clinical manifestations of, 58
control of, 59–62
epidemiology of, 55–57, 59
forest form, 56
geographic distribution of, 56–57,
125
larvae in, 57–58
microfilariae in, 56–59
parasite life cycle in, 57–58
pathophysiology of, 58–59
savanna form, 56
socioeconomic consequences of,
58–59
transmission of, 57–58, 60–61
treatment of, 61–63
vaccines for, 151
Onchocerciasis Control Program,
59–63
Onchocerciasis Elimination
Program for the Americas, 63
Oocysts, Toxoplasma gondii, 119–120
Order of Lazarus, 74

Downloaded from www.asmscience.org by
IP: 54.70.40.11
On: Sat, 14 Sep 2019 20:45:12
Index 213

Oriental sore, 97
ORSTROM (Office de Recherche Scientifique et Technique Outre-Mer), onchocerciasis control program of, 60–63
Oswaldo Cruz Foundation, African trypanosomiasis work of, 88
Ottesen, Eric, lymphatic filariasis work of, 47

P
Pain
in dengue fever, 107
in guinea worm infections, 49
in schistosomiasis, 34
in trachoma, 64–65
Pan American Health Organization, on disease carried in slave trade, 125
Paromomycin, for leishmaniasis, 100
Partners for Parasite Control, 130
Pasteur, Louis, rabies vaccine of, 110
Peace Corps, 161
Pediatric Dengue Vaccine Initiative, 150–151
Pentamidine, for African trypanosomiasis, 87, 89
Perera, Myrtle, on lymphatic filariasis, 43–44
Pfizer
drug donations from, 65–66, 135
oxamniquine development by, 146
Pica, in hookworm infections, 22
Pitt, Brad, 1–2
Pizza-like sore, in leishmaniasis, 97
Pneumonitis, in toxocariasis, 115
Polio vaccines, 160–161
Polyparasitism, 134
Pork, Trichinella spiralis spiralis in, 122–123
Pork tapeworm, 117–119
Povity, 5–6, 9–10
Buruli ulcer in, 70–73
Chagas’ disease in, 121
cysticercosis in, 117–119
dengue fever in, 105–108, 122
echinococcosis in, 123–124
giardiasis in, 121
guinea worm infections in, 47
helminth infections in, 13–14, 17–18, 114–117
leishmaniasis in, 96, 121
leptospirosis in, 104–105, 122
lymphatic filariasis in, 43–44
onchocerciasis in, 56–59
rabies in, 108–110
 toxoplasmosis in, 119–121
trachoma in, 64, 121–122
trichinellosis in, 122–123
in United States, 113–122
urban, see Urbanization vs. “worm index,” 17–18
Poverty in America Project, 114
Praziquantel
 donation of, 135
in mass drug administration programs, 131
in rapid-impact package, 144
for schistosomiasis, 31, 35–37
Pregnancy
hookworm infections in, 23
toxoplasmosis in, 119–120
President’s Emergency Plan for AIDS Relief, 3, 161
President’s Malaria Initiative, 3
Product RED, 2
Protozoan infections, 166
Proulx, Jean-Francois, trichinellosis research of, 123
Pruritus
in hookworm infections, 22
in onchocerciasis, 56
Psychiatric disorders
in African trypanosomiasis, 84, 85
in helminth infections, 19
in toxocariasis, 115
Pulmonary hemorrhage, in leptospirosis, 105
Q
Quarantine, for leprosy, 75–76
R
Rabies, 108–110
Ramaiah, K. D., on lymphatic filariasis, 44
Raso, Giovanna, 133
Rats, leptospirosis transmitted by, 104–105
Report of the Commission on Africa, 2
Reproductive tract, schistosomiasis of, 35
Richards, Frank O., 62–63, 139
Rifampin
for Buruli ulcer, 72
for leprosy, 78
River blindness, see Onchocerciasis
Rockefeller Foundation, hookworm eradication program of, 20–21
Rockefeller Institute for Medical Research, arsenical drug development by, 86
Rockefeller University, research facilities at, 21
Romana’s sign, in Chagas’ disease, 93
Rockefeller Institute for Experimental Therapy, 86
Ruiz-Tiben, Ernesto, in dracunculiasis eradication, 51
S
Sabin, Albert B., 143, 160–161
Sabin Vaccine Institute, 136, 150
Sachs, Jeffrey, 1–2, 11, 127, 140
SAFE acronym, for trachoma management, 65–67, 129
St. Vincent de Paul Daughters of Charity, leprosarium of, 75
Salt, fortified with diethylcarbamazine, 44–47
Sandfly, in leishmaniasis transmission, 96–97, 100
Sandler Center for Basic Research in Parasitic Diseases, African trypanosomiasis work of, 88
Sanitation, for trachoma prevention, 64–65
Sasakawa Foundation, leprosy drugs from, 78
Savimbi, Jonas, 89
Savioli, Lorenzo, as deworming advocate, 26
Schistosoma haematobium, 30–32, 34–35
Schistosoma japonicum, 30, 31, 33–34
Schistosoma mansoni, 30, 32–35
Schistosomiasis, 29–38
clinical manifestations of, 34–35
case control of, 30–31, 35–37, 130
eggs in, 33–34
epidemiology of, 29, 31–32, 34–35
geographic distribution of, 125
history of, 29–31
larvae in, 32–33
life cycle in, 32–34
mass drug administration programs for, 131
pathophysiology of, 32–35
transmission of, 32
vaccines for, 149, 151
Schistosomiasis Control Initiative, 36–37, 130
Scientists without Borders, 147

Downloaded from www.asmscience.org by
IP: 54.70.40.11
On: Sat, 14 Sep 2019 20:45:12
Scrotum, filariasis of, 43–44
Seattle Biomedical Research Institute, African trypanosomiasis work of, 88
Seizures, in cysticercosis, 118–119
Sherman, Irwin W., on history of leprosy, 74
Shock, on dengue hemorrhagic fever, 107
Shriver, Bobby, 2
Simulium (blackfly), in Onchocerca volvulus transmission, 57–61
Skin
Buruli ulcer of, 70–73
Chagas’ disease manifestations in, 93
guinea worms in, 48–49
hookworm larva penetration of, 21–22
leishmaniasis manifestations in, 95–97, 99–100, 121
leprosy manifestations in, 95–97, 99–100, 121
leptospire penetration of, 104–105
onchocerciasis of, 58–59
Sleeping sickness, see African trypanosomiasis
Snail fever, see Schistosomiasis
Social stigma, 9
Socioeconomic consequences, 11; see also Poverty
of Buruli ulcer, 71–72
of guinea worm infections, 49, 51
of helminth infections, 19
of hookworm infections, 20–21
of leishmaniasis, 95–97
of lymphatic filariasis, 43–45
of onchocerciasis, 58–59
of rabies, 109
Soil, helminth infections transmitted in, 13–27, 114–117, 131
South America
Chagas’ disease in, 90
dengue fever in, 106–107
leishmaniasis in, 96
Southern Cone Initiative, for Chagas’ disease, 90
Sowda (onchocerciasis), 57
Spahn, Kathy, Helen Keller International, 130
Special Programme on Tropical Disease Research, African trypanosomiasis work of, 88
Spleen, NTD manifestations in Chagas’ disease, 93
leishmaniasis, 95, 98
Squamous cell carcinoma, bladder, in schistosomiasis, 35
Sri Lanka, dengue fever in, 107
Stibogluconate, for leishmaniasis, 96, 100
onchocerciasis in, 55–56
Suramin, for African trypanosomiasis, 87
Surgery for Buruli ulcer, 72
for trachoma, 64
Swiss Tropical Institute, 133
T
Taenia solium, 117–119
Tapeworm Echinococcus, 123–124
pork, 117–119
Task Force for Child Development and Survival, 25, 132
Tatu, Jeca (fictional character), hookworm infection in, 23–24
Temephos for blackfly control, 60–61
for guinea worm eradication, 50–51
Tetanus, in guinea worm infections, 49
Tetracycline, for trachoma, 66
Three Gorges Dam, schistosomes in, 30
Tikkun olam (repairing the world), 74
Time Global Health Summit, 2
Toxocariasis, 114–117
Toxoplasmosis, 119–121
Trachoma, 63–67, 121–122, 131
elimination of, 130
environmental factors in, 64
epidemiology of, 63–64
geographic distribution of, 64, 125
pathophysiology of, 64–65
prevention of, 65–67
socioeconomic consequences of, 64
transmission of, 64
treatment of, 65–67
vaccines for, 151
Triatoma bugs, in Chagas’ disease transmission, 90–95
Tribendimidine, for helminth infections, 145–146
Trichiasis, in trachoma, 65
Trichinellosis, 122–123
Trichuris
clinical manifestations of, 19
epidemiology of, 14–19
geographic distribution of, 114–115
history of, 14
mass drug administration programs for, 131
risk factors for, 17–18
Trypanosoma brucei brucei, 82–83
Trypanosoma brucei rhodesiense, 82–85, 88–89
Trypanosoma gambiense, 82, 84–85, 88–89
Trypanosomiasis
African, 82–90
American (Chagas’ disease), 90–95, 121, 125
Tryparsamide, for African trypanosomiasis, 87
“Tsetse belt,” 84
Tsetse fly, in trypanosome transmission, 82, 84–85
Tuberculosis, 69–70
disability-adjusted life years for, 7, 9
leprosy cross-immunity and, 74
U
Uganda, African trypanosomiasis in, 89–90
Ulcers
Buruli, 69–73
in guinea worm infections, 49
in leishmaniasis, 95–97, 99–100
Ultrasoundography, in filariasis, 42–43
Undulating membrane, of trypanosomes, 82
“Unholy trinity,” see Ascariasis; Hookworm infections; Trichuriasis
United Nations
Development Programme, in Onchocerciasis Control Program, 60–63
Millennium Declaration, 2
United States, NTDs in, 113–122
United States Agency for International Development, 161
University of California, Sandler Center for Basic Research in Parasitic Diseases, African trypanosomiasis work of, 88
Urbanization, diseases related to
dengue fever, 105–108
helminth infections, 18
hookworm infections, 20–21
leptospirosis, 104–105
rabies, 108–110
Urinary tract, schistosomiasis
manifestations in, 31, 33–35
Urine, leptospires in, 104–105
Utzinger, Juerg, 133

V
Vaccines
anthelmintic, 27
Buruli ulcer (Mycobacterium
ulcerans), 73
development of, 149–153
international cooperation on,
160–162
polio, 160–161
rabies, 109, 110
Vagelos, Roy, onchocerciasis research
of, 61–62
Vinchuca, in Chagas’ disease
transmission, 90–95
Viral infections, 166
Visceral larva migrans, 114–117
Visceral leishmaniasis (kala-azar),
95–100, 121
Visual impairment
in leprosy, 78
in onchocerciasis, see
Onchocerciasis
in trachoma, 55–67

W
Water-borne diseases
Buruli ulcer, 72
giardiasis, 121
guinea worm infections, 47–51
schistosomiasis, 29–38
Wei, Wen-po, on schistosomiasis, 29
Weight loss, in leishmaniasis, 98
Weil’s disease, 105
Weiss, Mitchell, 10
Welburn, Sue, African
trypanosomiasis work of, 88
Wheezeing, in toxocariasis, 115
Whipworm infections, see
Trichuriasis
Wiesel, Elie, 1, 163
Wilson, Woodrow, antitrachoma
legislation and, 64
Winfrey, Oprah, 1
Winterbottom’s sign, in African
trypanosomiasis, 85, 89
Witchcraft, Buruli ulcer due to,
71–72
Wolbachia infections, 58, 146
World Bank, in Onchocerciasis
Control Program, 59–63
World Economic Forum (2006), 2
World Health Assembly resolutions
Buruli ulcer, 73
deworming, 25
filariasis, 46–47
guinea worm, 50–51
leprosy, 78
mass drug administration,
129–130
World Health Organization
DengueNET, 108
Global Buruli Ulcer Initiative of, 73
leprosy elimination target of,
78–79
Onchocerciasis Control Program,
60–63
Stop TB Partnership, 70
trachoma management program
of, 65–66
Wuchereria bancrofti, see Lymphatic
filariasis

Y
Yangtze River, schistosomes in, 30
“Yellow disease,” see Hookworm
infections