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Emerging Infectious Diseases
A Clear and Present Danger to Humanity

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EXTRAORDINARY STRIDES IN IDENTIFYING AND ELIMINATING the pathogens behind many of the major scourges of the last century prompted the US Surgeon General in 1967 to declare that the war against infectious diseases had been won.[1] But the announcement was premature. The steady stream of emerging and reemerging infectious diseases since the 1960s has been a sobering wake-up call. Despite many accomplishments in the realm of antibiotics and vaccines, such a declaration of victory was not justified. It is now clearer than ever that the human species is in the midst of a war with the microbial world—a resilient foe that will never be completely defeated.[2-4]

The AIDS pandemic illustrates how a new human pathogen emerged as a result of a complex series of opportunities that were presented to an unusual virus that first infected primates.[5] After the virus crossed over to humans, most likely as a result of genetic mutations together with accidental transmission, human immunodeficiency virus (HIV) rapidly spread among different population groups due to profound changes in social and economic conditions in certain countries.[6]

Today, public health officials are closely monitoring a massive outbreak of avian influenza in chickens that emerged in January 2004 in Southeast Asia.[7] Ominously, the H5N1 strain of influenza virus involved in the epidemic crossed over to humans, resulting in at least 24 human deaths. In July 2004, the disease reemerged. At least 6 additional individuals in Vietnam and Thailand have died, and more suspicious deaths are under investigation.[7] Public health officials are fearful that the avian form of the virus will acquire the genes of human influenza, allowing it to spread from person to person, potentially sparking a global outbreak to rival the 1918 influenza pandemic that killed 20 to 50 million individuals worldwide.[8]

The United States is now witnessing another wave of West Nile virus infections.[9] In 1999, the disease first appeared in humans in eastern states, but now West Nile virus infection is seen throughout the country. This year, more western states, particularly Arizona and California, have been hit hard with more than 860 cases and 20 deaths reported through September 2004 in those 2 states alone.[9]

To add to these naturally occurring diseases, the threat of infectious agents that are deliberately introduced remains a major concern.[10] The post–September 11 anthrax attacks alerted the world community to its vulnerability to potential acts of bioterrorism in which a host of deadly pathogens, including anthrax, smallpox, tularemia, botulism toxin, Ebola, and other lethal microbes could be unleashed at any time.

As frightening as this may seem, there is cause for some cautious optimism. Fortunately, clinicians now have an ever-growing toolbox of sophisticated technologies and strategies at their disposal. These will help detect, prevent, treat, and respond to new and old infectious agents as they emerge, whether by an act of nature or by deliberate design.[1,2,4] The challenge is to put these tools to good use by vigilantly tracking and responding to potential outbreaks and epidemics as they arise, and by rapidly developing new technologies and strategies to help in the detection, prevention, treat-

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ment, and containment of new infections. Moreover, powerful new tools, including ones that expose the genetic signature of microbes, are being used to detect and identify known and novel pathogens and to develop new drugs and vaccines.[1,2]

New approaches for drug discovery and development have led to the availability of more than 20 anti-HIV medications that have greatly reduced AIDS mortality and extended the healthy life spans of those living with the disease.[11] Scores of vaccine candidates are now in the pipeline to prevent infection by emerging microbes such as HIV, Ebola, West Nile virus, dengue virus, H5N1 avian influenza virus, and the virus that causes severe acute respiratory syndrome (SARS). The first new tuberculosis vaccines in 60 years recently entered clinical trials, and vaccines against the most menacing bioterrorist threats are being developed.[2]

At the same time, sophisticated satellites, geographic imaging systems, and information technology are helping researchers track changes in climate, vegetation, and water reservoirs. These technologies will monitor other environmental changes that might lead to new ecological niches that could promote emerging infections.[2]

In the ongoing war against these formidable microbial foes, there is no room for complacency, but rather it is critically important to remain ever-vigilant, poised to recognize and contain both old foes and new enemies. It is essential to continue to monitor factors that might lead to disease outbreaks, and to concurrently support the development of new technologies that help detect, prevent, and treat new and reemerging diseases.[1-4]

Microbial foes have the advantage of an extraordinary capacity to rapidly reproduce and adapt, thereby propagating themselves even in the face of impressive advances in public health and the availability of countermeasures such as diagnostics, therapeutics, and vaccines.[12] This inherent adaptability of microbes can only be matched with the continual application of wit and technological capability.

The best defense for the human species against elimination by the ever-evolving waves of microbial pathogens are public health measures coordinated with biomedical research that will continue to provide innovative tools to counterbalance these endless microbial challenges.[1-4,12] Ultimately, if medical science continues to fight these microbial foes to a draw, as has occurred for much of the past century, humanity will have won.

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