Infectious Diseases—Making Progress on a Perpetual Challenge

Infectious diseases are a perpetual threat to human health. Some, like polio and smallpox, are largely a memory in most countries because medical research produced lifesaving vaccines. But just as one infectious disease is conquered, a new one emerges—or an old enemy reappears. Most recently, bird flu has caused alarm among researchers and the public.

According to the 2004 World Health Report of the World Health Organization (WHO), infectious diseases accounted for about 26 percent of the 57 million deaths worldwide in 2002. Infectious diseases are the second-leading cause of death globally after cardiovascular disease, but the leading cause of death in infants and children. While deaths in the United States from infectious diseases declined markedly during the 20th century, influenza and pneumonia remain the 7th leading cause of death, according to the U.S. Centers for Disease Control.

The National Institutes of Health (NIH), principally through the National Institute of Allergy and Infectious Diseases (NIAID), supports research at the nation's medical schools and teaching hospitals to combat HIV/AIDS, influenza (including bird flu), malaria, tuberculosis, SARS, West Nile virus, viruses that cause fatal diarrhea in infants, and potential bioterror agents. Here are just a few examples of laboratory research and patient studies.

Bird Flu

Bird flu, known as H5N1, is a highly contagious form of influenza spread by birds. It was first detected in humans in Southeast Asia in the late 1990s. As of early March, the WHO had confirmed 175 cases of avian flu in humans, with 96 reported deaths. U.S. medical schools and teaching hospitals are playing a critical role in the nation’s preparations for a potential bird flu pandemic.

- An NIAID-supported network of seven medical schools and teaching hospitals is leading the NIH’s effort to evaluate new vaccines for avian flu. Numerous clinical trials with this vaccine are currently being conducted in healthy adults, healthy seniors, and children. Preliminary results of the initial trial show promise that the vaccine is safe, and causes an immune response that will protect those vaccinated. The seven institutions are:
  * Baylor College of Medicine
  * University of Cincinnati Children’s Hospital Medical Center
  * Saint Louis University Health Sciences Center
University of California, Los Angeles, Center for Vaccine Research
* University of Maryland School of Medicine
* University of Rochester School of Medicine and Dentistry
* Vanderbilt University Medical Center

• Last year, NIH-funded researchers at the University of Pittsburgh School of Medicine developed a novel viral vector method of producing vaccines in only six weeks, four to six times faster than usual. Reducing vaccine production time will help to curb disease outbreaks before they reach pandemic proportions. Using this method, a vaccine against avian flu was created, and preliminary animal testing has shown its efficacy in significantly reducing symptoms.

• Also backed by a grant from the NIAID, scientists at Indiana University School of Medicine are collaborating with Purdue University’s College of Agriculture and School of Veterinary Medicine to study a harmless form of adenovirus as a transmitting agent for a vaccine to fight off highly virulent strains of the avian flu viruses.

HIV/AIDS

HIV/AIDS was an emerging disease just beginning to garner the attention of the scientific community. Today, approximately 40 million people throughout the world are infected with HIV—and 90 percent of new infections occur in developing countries. In Botswana, for example, one in three adults is infected. In 2004, 3 million people died from AIDS. HIV/AIDS continues to be a major threat in the United States as well, where 40,000 new infections occur every year.

One of the great triumphs of medical research is the development of potent antiretroviral drugs that have prolonged and improved the lives of people infected with HIV. Deaths in the United States have dramatically declined since the 1990s, when combination antiretroviral therapy was introduced. In 2004, 15,798 people died of AIDS in the United States—less than one-third the number of deaths in 1995. U.S. medical school researchers are working hard to end this worldwide scourge.

• In 2006, the NIH-sponsored Strategies for Management of Anti-Retroviral Therapy (SMART) study found that continuous antiretroviral therapy is superior to episodic therapy. This international HIV/AIDS trial was conducted through the NIH-supported Community Programs for Clinical Research on AIDS network of 318 clinical sites in 33 countries. Researchers at Columbia University College of Physicians and Surgeons served as members of the SMART study team.

• Supported by the NIH, researchers at the Weill Medical College of Cornell University recently found that a combination of microbicides successfully blocked vaginal transmission of a virus similar to SIV and HIV in non-human primates. Based on these results, a combination of microbicides could potentially provide a safe, effective and practical way to prevent vaginal transmission of HIV to women. The next step is to conduct clinical trials in humans to determine safety and optimal dosage.

• Individuals who have more copies of a gene that helps to fight HIV are less likely to become infected with the virus or to develop AIDS than those with fewer copies of the gene, according to a 2005 NIH-funded study by researchers at the University of Texas Health Science Center and the Veterans Administration Center for AIDS.
and HIV-1 Infection in San Antonio. This discovery could lead to a screening test that identifies individuals who have a higher or lower susceptibility to HIV/AIDS, potentially enabling clinicians to adapt treatment regimens, vaccine trials, and other studies accordingly.

- In 1999, a joint U.S.-Uganda study, led by researchers at the Johns Hopkins University School of Medicine in Baltimore, found an inexpensive, simple, and effective drug regimen to reduce HIV transmission from an infected mother to her newborn. With support from the NIH, they found that a single dose of the antiviral drug nevirapine given to an HIV-infected woman and her infant within 72 hours of birth significantly reduced HIV transmission. This study has helped provide a viable and inexpensive strategy to prevent mother-to-child transmission in developing countries where HIV-infected mothers regularly practice breastfeeding.

- In an NIH-supported study in the early 1990s, Emory University School of Medicine scientists discovered two anti-HIV drugs, lamivudine and emtricitabine. Lamivudine is currently used by 80 percent of HIV-infected patients in the United States, as part of a combination therapy.

Bioterror Preparedness

Since the 2001 anthrax attacks, the United States has become more cognizant of the potential for terrorist attacks using agents of bioterrorism. This heightened awareness has compelled the federal government to expand its biodefense research program. The NIAID has at least 50 major research initiatives underway involving NIH scientists, medical school researchers, and industrial partners.

- Within weeks of the 2001 anthrax attacks, Harvard Medical School scientists, funded by the NIH, discovered that small molecules they had created were able to prevent the bacteria’s lethal toxin from entering cells. Researchers currently are using this technique to develop a potential therapy against anthrax.

- In 2005, NIAID completed a national network of 10 Regional Centers of Excellence for Biodetection and Emerging Infectious Diseases (RECs), to support research focused on countering threats from bioterror agents and emerging infectious diseases. Each center is working to develop next-generation treatments, vaccines, and diagnostic tools for diseases such as anthrax, plague, smallpox, tularemia, botulism, and West Nile virus. Several of the nation’s medical schools are involved in these centers, including:

  * University of California, Irvine, School of Medicine
  * University of Colorado School of Medicine
  * Duke Medical Center
  * Harvard Medical School
  * University of Chicago Pritzker School of Medicine
  * University of Maryland School of Medicine
  * University of Massachusetts Medical School
  * University of Texas Medical Branch, Galveston
  * University of Washington School of Medicine
  * Washington University School of Medicine, St. Louis

For more information about how medical schools and teaching hospitals are fulfilling the promise of medical research, go to: www.aamc.org/research/ftp