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## Vaccines for the Coming Epidemic

Worldwide efforts to vaccinate children against infectious diseases have proven that an ounce of prevention is indeed worth a pound of cure. Hughes investigator Barry Bloom believes that in addition to completing the unfinished agenda for vaccines against infectious diseases, it is now time to develop vaccines for some of the big killers of adults.

"As more children survive childhood infectious diseases to become adults, diseases of adulthood, such as heart disease and cancer, will constitute the major part of next century's 'coming epidemic,'" said Bloom, an HHMI investigator at Albert Einstein College of Medicine in New York. He and co-author Roy Widdus of the World Health Organization's Children's Vaccine Initiative in Geneva, Switzerland, outline their hopes for widening vaccination programs in a commentary in the May 1 issue of *Nature Medicine*.

"This article is a research agenda for a new frontier in the therapeutic use of vaccines," said Bloom. "The science is now getting there," he said. "What is lacking is a shared commitment to this vision of a future in which all countries benefit from the protection that vaccines can bring."

The use of vaccines to treat childhood infectious diseases has been "an astounding success story," said Bloom. Two decades ago no one believed all of the children in the world could be vaccinated against diseases. In fact, about 25 years ago only five percent of children worldwide were being immunized. By the mid-'90s, however, more than 90 percent of children worldwide had received vaccinations for tuberculosis, and 75-85 percent had received vaccines for other infectious diseases, including diphtheria, measles and mumps.

"There hasn't been a single case of paralytic poliomyelitis in children in the western hemisphere since 1991, which is remarkable," Bloom said. The growth of vaccination programs is illustrated by the fact that in 1996, 121 million children in India were vaccinated against polio during two "National

Vaccination Days." Furthermore, the economic value of vaccines is unparalleled: The entire cost of a \$32 million international effort to eradicate smallpox is returned every 20 days by not having to vaccinate travelers, according to Bloom and Widdus.

Despite decreasing deaths from infectious diseases, the work begun by agencies such as the World Health Organization is unfinished, Bloom said. Infectious diseases cause the death of 17 million people annually, by far the largest cause of death and disability in the world. Vaccines against malaria and other parasitic diseases, which cause more morbidity worldwide than either viral or bacterial diseases, are still not available. Likewise, the infection rate for sexually transmitted diseases, including HIV, continues to spiral out of control in many developing countries, Bloom says.

Given that average life expectancy is increasing, the epidemics of the next century will not only be communicable diseases, in Bloom's opinion, but cancer and heart disease - the major killers of people in industrialized societies.

Researchers have made great strides in identifying pathogens that cause or exacerbate some of the more common diseases in industrialized nations, such as coronary artery disease or stomach cancer. Vaccines offer a good chance of lowering the mortality rate of these diseases by preventing infection.

The potential threat of emerging infectious agents that can cross borders in "this international global village" is another factor in favor of widening the use of vaccines, says Donald Henderson, professor of epidemiology and international health at The Johns Hopkins School of Public Health. Henderson agrees with Bloom that the scientific community is entering a new era of vaccine and immunologic research that has "enormous dimension and possibilities."

Bloom acknowledges that a clear vision of where vaccine research should be headed is not enough. "The easy vaccines have been made," he says. "Many scientific challenges stand between us and the new vaccines." Among those challenges, Bloom says, are research hurdles that will take time to clear and "operational" problems, such as devising new distribution strategies.

More problematic still may be finding the financial backing for this new initiative, says Bloom. "Science can produce the technical answers, but new mechanisms are needed to reduce the financial risks and costs to industry of

developing vaccines. However important to public health, vaccines effective against diseases that primarily afflict the 85 percent of the world's population that live in developing countries are unlikely in the foreseeable future to have adequate financial return," he says. "We may need to develop a new kind of public-private collaboration for this effort."