CONVERGENCE - GREAT BIOLOGICAL MIXING BOWL

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"As the HIV disease pandemic surely should have taught us, in the context of infectious diseases, there is nowhere in the world from which we are remote and no one from whom we are disconnected." - Institute of Medicine, the National Academies of Science

Yellow fever results in more than 30,000 deaths annually, infecting more than 200,000 people living in tropical areas of Africa and the Americas. Symptoms range from a mild flu to severe illness, including jaundice from which yellow fever gets its name.

Mosquitoes are a natural source of yellow fever. It has been present in Africa and the Americas since the 1500s, can easily transmit from infected mosquitoes to humans, and has been detected in other countries carried by returning travelers.

Although an effective vaccine does exist, the number of yellow fever cases is growing worldwide due to humankind's manipulation of the world's ecology. Deforestation, which claims an estimated 13 million hectares of forest annually, and urbanization, the migration of humans to urban settings, contribute to mosquito contact and aid viral spread.

Yellow fever is an example of an existing microbe that has adapted, crossed species lines or relocated to new geographic or new niche settings. Humans' modification of the environments in which microbes live and thrive has formed new pathways for the evolution and spread of current and emerging infectious diseases. The creation is a biological mixing bowl with a "survival of the fittest" theme, pitting man against animal against pathogen.

MICROBES MOVING ALONG NETWORKS

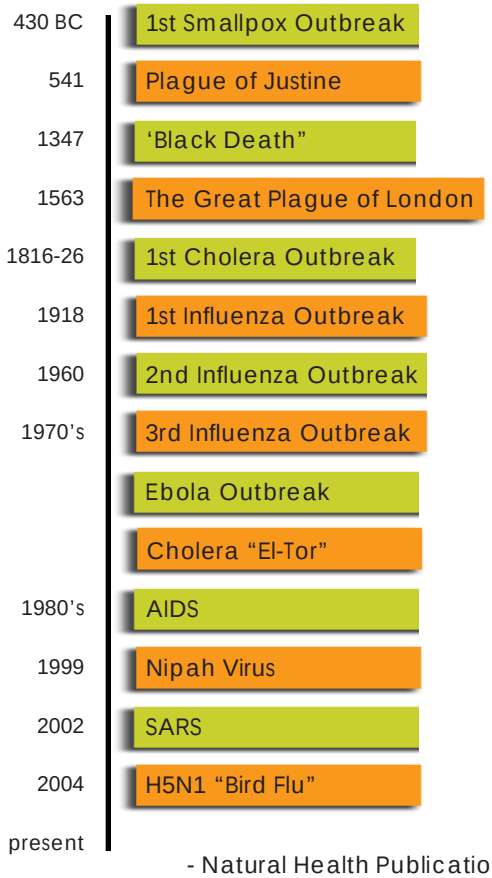
A new era of infectious disease is at hand, with the reemergence of old diseases and emergence of new ones. The extreme growth of the world's population, changing environmental factors such as deforestation and the depletion of natural resources, urbanization, and the establishment of concentrated animal production systems all contribute to a convergence of human, animal and microbial health. As human populations increasingly share a closer physical commons among themselves and with domestic and wild animal species, the risk for infectious diseases to cross from one species to another has increased.

Evidence of this interdependence of humans, animals and microbes is seen within animal production. Growing global wealth is generating a demand for meat and animal products. To answer demand, industrial animal production systems are now dominant in developed societies. Characterized by large numbers of animals of similar genotype being raised, predominantly in confinement, such systems may place less emphasis on bioexclusion and biocontainment measures resulting in an increased animal and public health risks. The emergence of new, more virulent and more resistant microbes is one of these risks.

Swine influenza, a disease that is endemic in pigs and carries a subtype that can cross over to humans, is a product of highly-dense animal production. More became known about "swine flu" in the early part of the 20th century, as it caused the Spanish Flu pandemic of 1918 to 1920 and killed upwards of 20 million people. The Flu emerged again in 1976 in the U.S., promoting public health officials to announce a nationwide vaccination program. Public relations problems and delays led to the cancellation of the program, but not before 24 percent of all U.S. citizens had received the vaccine and the government had spent $400 million on the effort. Epidemics of swine flu still occur regularly in North America and Europe, and are seen in other parts of the world.

Food-animal production systems in developing countries also figure heavily into potential epidemics. According to the FAO, by 2020 there will be a 50 percent increase in foods of animal-origin, especially in developing countries. In concentrating upon demand, production systems based in developing countries may lessen the attention

A HISTORY OF MAJOR EPIDEMICS



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put upon risk management. Coupled with already poor public and animal health infrastructures, this presents a dire prospect for those concerned with diseases such as avian influenza and the potential for disease outbreaks affecting human health.

The rise in the populations of food-producing animals to meet demand is one ingredient in this emerging mixing bowl of human, animal and microbes. An added element is the movement of production toward major population centers in order to reduce the costs of the transportation of goods and other food products. Coupled with environmental stresses, resource over-use, and inadequate service and social infrastructures, these areas may very well become the infectious disease "hot spots" of tomorrow.

TOOLS AND TECHNOLOGIES HOLD PROMISE

To promote and protect public health in our own nations and contribute to improving the health of others around the world, we must change the paradigm that has driven how we traditionally approach public health and disease control.

Jared Diamond's book, "Guns, Germs and Steel," discusses an era some 8,000 to 10,000 years ago when human populations became stable and communities emerged due to the advent of agriculture. New diagnostics, social networking technologies and the semantic Web are creating a new social order in this era and ways in which we can fight disease. The latest tools and technologies offer hope. Bottom-up approaches to outbreak reporting and communication made possible through technology-based networks enable collaboration to halt outbreaks while also forming a new health commons.

A victim of the devastating tsunami in December 2004, the southeastern Indian state of Tamil Nadu felt its effects long after the event. Amidst decreased sanitary conditions and contaminated water supplies, the transmission of disease was a serious concern. Health officials were desperate for a surveillance network that would allow disease monitoring in real time in order to prevent and mitigate the further spread of pathogens within Tamil Nadu and into other states.

In 2005, Voxiva, an international information management provider, launched Tamil Nadu Health Watch. Now health workers even in remote areas could immediately report disease incidence data to health managers to initiate an informed response. The phone and Web-based system has already reduced incidences of disease, mitigating the potential spread within and beyond the borders of India.

One lesson reinforced by the Voxiva example is that infectious disease does not need to pose a direct health threat to a country or region in order to have a profound impact on that nation's well being. As the threat of avian influenza crosses borders to find new hosts, the reality of the ability of infectious diseases to move from local origins to global destinations becomes clear, as well as the need for tools and technologies to facilitate a bottom-up approach to disease surveillance.

SUMMARY

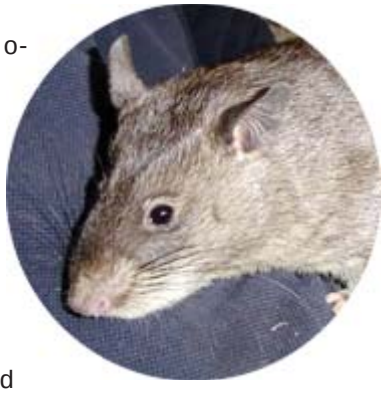
Individual health is influenced by the people and animals around us, as well as the environment in which we all live. To best contribute to improving the health of others around the world, we must change the paradigm that has driven how we traditionally approach the intersection of animal and public health and disease.

Such new challenges call for leaders to adopt a new paradigm for addressing infectious disease in this complex, interconnected world. Building on the successes of the past and learning from more recent experiences, we need to realign ourselves and our partnerships in ways that will improve our ability to protect the health of the country and the world.

To effectively address the new and changing health challenges of today, we must shift from thinking in terms of "interdependence"; we must recognize and work within the context of our being a part of a larger biologic system that links all of these components together.

MONKEY BUSINESS: WHO IS IN CHARGE?

On April 9, 2003, a shipment of 762 exotic rodents originating in Accra, Ghana, reached the United States. That shipment contained giant Gambian pouched rats (50 animals), rope squirrels (53), brushtail porcupines (2), tree squirrels (47), striped mice (100), and dormice (510). Accompanying these animals to Texas was an unexpected virus that eventually found its way into at least two other animal species in the United States (prairie dogs and humans) and spread to at least six other states. That unexpected agent, previously unseen in the United States, was a member of the orthopoxvirus group known as monkeypox (CDC, 2003b). It brought a scare to a public health and homeland security infrastructure, already in a state of heightened awareness for smallpox, and challenged the ability to address an emergent health threat in the United States that did not conveniently fall under the domain of any single federal agency.



Gambian pouched rat