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Healthy Animals, Healthy Humans

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Diseases that spread from animals to people sicken tens of thousands of Americans each year. Some of these diseases are familiar, such as the flu, and others are largely unknown in the U.S., such as Rift Valley fever. Some are transmitted by direct contact with animals, but others are passed along by mosquitoes or ticks. All of them are described by the same adjective: zoonotic.

Protecting humans from zoonotic diseases requires understanding the complex interactions between animal and human health. One concern is that diseases could spread around the world if the wrong person or animal travels at the wrong time.

Kansas State University researchers are fighting many of the nation’s and the world’s most devastating zoonotic diseases.

“K-State research is crucial to national security and public health,” said Peter Dorhout, K-State vice president for research. “We study several diseases that are priorities for the National Bio and Agro-defense Facility, and as we do this work, we are training the workforce needed to provide future biodefense.”

Rift Valley fever virus, transmitted by mosquitoes, causes abortions in cattle, sheep and goats and can kill young animals. The virus also causes severe fever in infected animals and can cause fatal illness in humans, who contract the disease by handling infected animals or animal products. Although Rift Valley fever has not reached the U.S., it has devastated other areas of the world. According to the World Health Organization, an outbreak earlier this year killed more than 950 animals in Kenya, Uganda and Rwanda from June 22 through July 2. Human deaths reached the double digits. In 2006, the virus killed 150 people in Kenya.

Ongoing U.S. Department of Homeland Security-sponsored research and training at the K-State Bioscience Research Institute is helping develop and improve vaccines. A team from the K-State Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD, collaborated with U.S. Department of Agriculture Agricultural Research Service scientists to develop and patent a safe subunit vaccine. The vaccine uses only a specific protein from the virus rather than the whole particle, and the team has licensed it to a private company. The group also confirmed that the common native white-tailed deer is susceptible to infection by the Rift Valley fever virus. See page 17 for more research on white-tailed deer.

“Our work is an example of how collaborative and translational research can result in a tool to control this devastating disease if it ever comes to our shores,” said Jürgen Richt, director of CEEZAD and Regents distinguished professor of veterinary medicine.
Japanese encephalitis

Japanese encephalitis virus is a relative of West Nile virus and it is the leading cause of vaccine-preventable brain inflammation in Asia and the western Pacific, according to the Centers for Disease Control and Prevention. The virus thrives in pigs and wading birds and is transmitted to humans by infected mosquitoes. Although most infected people do not develop symptoms, a small percentage experience sudden onset of headache, high fever and other dangerous symptoms. Around 1 in 4 cases is fatal and a total of about 13,000 to 20,000 people die each year.

College of Veterinary medicine researchers Dana Vanlandingham, associate professor of invertebrate biology and pathobiology, and S. Lee Park, third-year veterinary medicine resident and concurrently enrolled veterinary student in pathology, recently co-authored a study demonstrating that North American domestic pigs could be susceptible to Japanese encephalitis virus. That means if the virus is introduced to the U.S., it could take hold and ultimately infect both pigs and humans. This research was supported by the U.S. Department of Agriculture Agricultural Research Service and its scientists in Manhattan. Studying foreign animal diseases and understanding their transmission cycles is an important part of pandemic preparedness, Vanlandingham said. The U.S. learned this the hard way with West Nile virus. Since 1999, West Nile virus has infected the million people and killed several thousand people. “This sort of information would have been useful for past introductions such as West Nile virus, which is similar to Japanese encephalitis virus,” Vanlandingham said. “If we studied West Nile virus prior to its arrival in the U.S., we may have been better able to minimize the spread when it came into New York in 1999.”

Influenza

Influenza virus strains can originate in avian, human or bat populations and spread to humans. (Photo credit: CDC/Janice Haney Carr)

Contaminated food is a major source of zoonotic disease spread. Most consumers have heard of Escherichia coli, or E. coli, and know that it’s something to be avoided, but only a few strains sicken people. The types that produce Shiga toxin, known as STEC, can cause illness with symptoms that include stomach cramps, diarrhea, vomiting and fever. Some infections can be life threatening. STEC strains cause an estimated 265,000 illnesses in the U.S. each year according to the Centers for Disease Control and Prevention, with 16 percent of illnesses attributed to the worst STEC strain type, O157:H7. Randy Phebus, professor of animal sciences and industry in the College of Agriculture and industry in the College of Veterinary Medicine, also co-authored a paper that discovered a unique antibody effect between Zika and dengue viruses. His called cross-reactivity may mean that vaccines for Zika and dengue virus are developed and approved, people need to receive them at the same time to avoid the antibodies from one virus enhancing the other. Researchers said. A resurgence is possible, and K-State researchers are helping the world prepare. Stephen Higgs, director of K-State’s Biocomplexity Research Institute and Dana Vanlandingham, associate professor of invertebrate biology and pathobiology in the College of Veterinary Medicine, co-edited a book released earlier this year, “Chikungunya and Zika Viruses: Global Emerging Health Threats.” The book provides both historical and current information on these important viruses.

Zika

Zika virus was all over the news just two summers ago, but scientists remain uncertain about why infections have declined sharply. This virus is spread by certain mosquito species and causes potentially fatal birth defects in infants whose mothers were infected during pregnancy. Last year, 437 people in the U.S. were infected with Zika while traveling abroad, according to the Centers for Disease Control and Prevention. A resurgence is possible, and K-State researchers are helping the world prepare. Stephen Higgs, director of K-State’s Biocomplexity Research Institute and Dana Vanlandingham, associate professor of invertebrate biology and pathobiology in the College of Veterinary Medicine, co-edited a book released earlier this year, “Chikungunya and Zika Viruses: Global Emerging Health Threats.” The book provides both historical and current information on these important viruses.

Shiga toxin-producing E. coli

Shiga toxin-producing E. coli can infect humans when they eat contaminated food, such as contaminated beef or veal. (Photo credit: CDC/Janice Haney Carr)