Crows Falling From the Sky: The Transmissions Story

Transmissions: Gone Viral is an interactive, web-based comic book created by NYSCI that explores diseases that can be spread from animals to humans. *Transmissions* was inspired by the 1999 West Nile Virus epidemic, a real-life mystery that involved crows, a zoo pathologist, the CDC, and a virus never before seen in the United States.

It was very hot and dry during that August in 1999 in New York City, and crows seemed to be falling from the sky. At the Bronx Zoo, headquarters for the Wildlife Conservation Society, many exotic birds were dying.

For weeks, Dr. Tracey McNamara, the zoo pathologist at the Wildlife Conservation Society, had been examining scores of dead birds, many of them crows, as well as exotic birds under her care, trying to discover the cause of the unusual neurological symptoms and eventual deaths of these birds. It seemed clear to her, and confirmed by her necropsies, that an infection was causing severe bleeding in the birds' brains and other organs. In her years as a veterinary pathologist, she had never seen such an extensive die-off of birds.

She was able to eliminate some pathogens based upon her knowledge of pathogens that kill different birds, but she needed help in determining what exactly is killing the birds. She made numerous telephone calls to the Centers for Disease Control (CDC), the premier federal government public health organization, but they were busy dealing with human illnesses. Dr. McNamara sent samples to the NY State Department of Environmental Conservation, but they were not equipped to analyze the samples.

Around the same time, and unknown to Dr. McNamara, several elderly patients in Queens had mysteriously fallen ill. They all lived in the same neighborhood

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and all had the same severe neurological symptoms. The patients had been admitted to Flushing Hospital where Dr. Deborah Asnis, an infectious disease expert, suspected that viral encephalitis, a brain infection, was the culprit. Encephalitis is especially dangerous for the elderly. On August 23, Dr. Asnis reported this unusual cluster to the NYC Department of Heath, where it came to the attention of Dr. Marcelle Layton, a staff epidemiologist. After visiting Flushing hospital and confirming the seriousness of the outbreak, Dr. Layton also asked the CDC for help. Since this request involves humans, the CDC sends a team of six epidemiologists to investigate and search the environments where the sick people live, work and play for clues.

On September 1, the six CDC investigators, including Dr. Varuni Kulsekera, an entomologist from the American Museum of Natural History who often works with the NYC Department of Health, investigated the homes of several of the ill patients. Dr. Kulsekera discovered abundant eggs and larvae of Culex pipiens in stagnant water around the homes of several of the patients. It is a common household mosquito that transmits several viral diseases. The CDC's test of the patients' blood samples on September 3 confirmed the NYS Department of Health's finding of a St. Louis encephalitis-like (SLE-like) virus in their blood and spinal fluid. SLE-like because the blood test cannot tell the difference between St. Louis encephalitis and other viruses of the same type. St. Louis encephalitis is not common on the East Coast, but the symptoms presented by the patients were very consistent with St. Louis encephalitis. However, the CDC could not determine exactly which virus is infecting both the birds and humans, unless they also test Tracey McNamara's samples.

On September 3, after CDC's test of patient's blood and Kulsekera's discovery of Culex pipiens at ill patients' homes, New York City Mayor Rudolph Giuliani held a press conference announcing that a number of elderly people in Queens had St. Louis encephalitis and several had died. In response, based on the CDC's findings and recommendations, the city launched a pesticide spraying campaign across the city targeting Culex pipiens, the mosquito they believe is transmitting the virus. At the press conference, Drs. Layton and Arlene Fine, her colleague, first hear about the dead crows from local residents. In fact, Dr. Fine almost steps on a dead crow when she leaves her car to attend the press conference.

When Dr. McNamara heard about the mayor's announcement, she realized that the patients in Queens exhibited the same symptoms as her birds in the Bronx. She knows that humans and animals share many illnesses due to their common evolutionary histories. Based upon this knowledge, she strongly suspected that there is a connection between her birds and the patients in Queens. But the identification of the culprit as St. Louis encephalitis virus really concerns her. She knows that St. Louis encephalitis virus can make people sick and that Culex mosquitos transmit the virus. But St. Louis encephalitis virus rarely kills birds.

She is convinced that it must be something else.

Convinced there is an important relationship between the birds' and the patients' illness, Dr. McNamara increased her efforts. She sent samples to other national laboratories. They found a flavivirus related to the St. Louis encephalitis virus, but they cannot identify it. A frustrated Dr. McNamara then called in a favor from a friend at the U.S. Army Medical Research Institute. Here, scientists study how to defend against biological weapons. At her request, the friend tests tissue samples from her dead birds against a range of viruses, not just those known to exist in the United States. A few days later, he has the answer: The birds were infected by West Nile Virus. This virus, new to the Western Hemisphere, could kill humans.

Dr. McNamara's bird data was instrumental in making the connection between the bird deaths and the ill and dying patients, creating the link that helped solve the mystery. Eventually, a scientist in California and the CDC retest her samples. Using genetic testing, they verified the culprit as West Nile virus, a flavivirus closely related to St. Louis encephalitis (SLE) virus. So closely do these flaviviruses resemble each other that the CDC's initial blood test misidentified it as St. Louis encephalitis, labeling it as SLE-like.

West Nile virus was first identified in Africa (the West Nile district of Northern Uganda, East Africa in 1937) and spread to Asia, the Middle East, Israel and parts of Europe by migrating birds. West Nile Virus can kill birds and humans and it is also transmitted by Culex pipiens. The citywide spraying campaign drastically reduced the number of mosquitos, and public education efforts educated people on how to avoid infection. However, nothing manages to completely stop the spread of West Nile Virus. Within two years of its identification in New York, it appeared in all 48 contiguous states and remains a public health threat today.