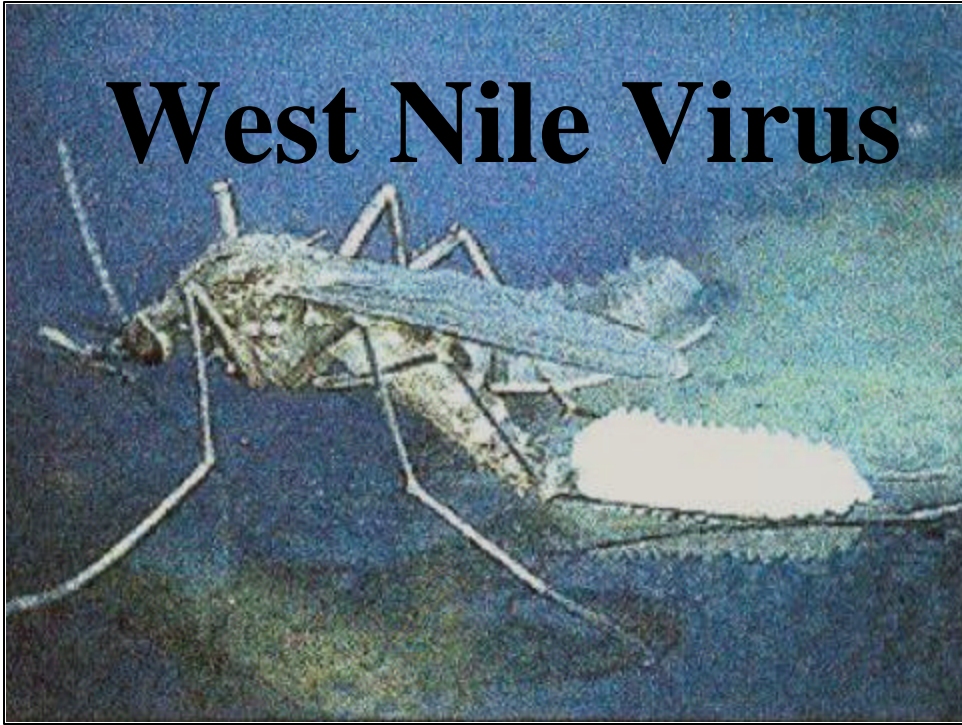


# West Nile Virus

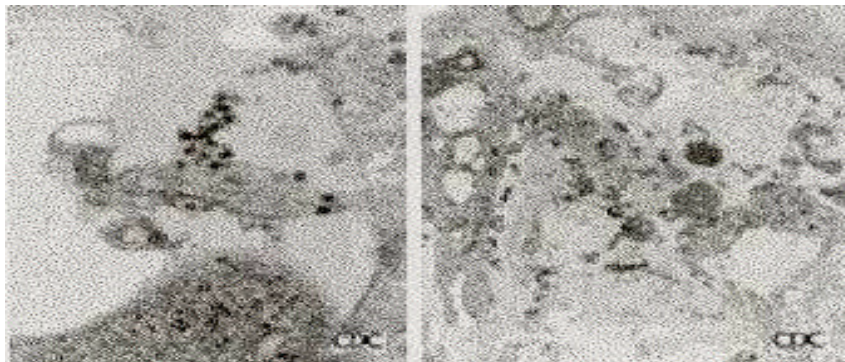


## West Nile Virus

- **Family:** Flaviviridae
- **Genus:** Flavivirus Japanese Encephalitis Antigenic Complex
- **Complex Includes:** Alfuy, Cacipacore, Japanese encephalitis, koutango, Kunjin, Murray Valley encephalitis, St. Louis encephalitis, Stratford, Usutu, Yaounde, and West Nile viruses.
- **Common Size:** 40-60 nm
- **Symmetry:** Enveloped, icosahedral nucleocapsid
- **Nucleic Acid:** Positive sense, ssRNA, 10,000-11,000 bases

## West Nile Virus

- Images of West Nile Virus are representative for this group of viruses in electron microscope.



# West Nile Virus

- What is it?

West Nile Virus is a mosquito- borne virus that can cause encephalitis (inflammation of brain) or meningitis (inflammation of lining of brain and spinal cord).

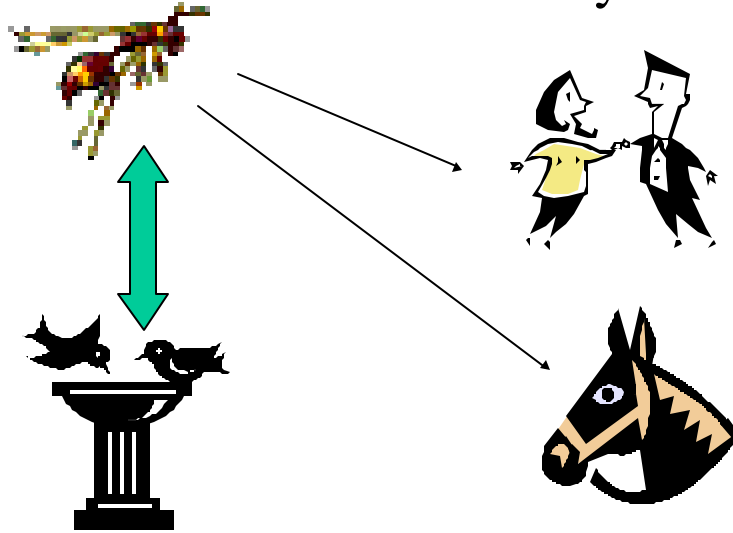
- Symptoms vary from mild illness with fever, headaches, body aches, swollen lymph nodes to more severe illness: neurological damage, loss of consciousness, muscle weakness, and even death-15%.

- No treatment for this virus. Severe cases- hospitalization, intravenous fluids, respiratory support, prevention of secondary infections (pneumonia, urinary tract, etc.)

# History

- First isolated: 1937 in West Nile District, Uganda.
- Recognized as severe encephalitis during outbreak in Israel in 1957.
- Appearance of WNV in North America in 1999.
- **Geographic Distribution:** Africa, Europe, Middle East, West/Central Asia, and most recently in North America- New York State, Maryland, Connecticut, New Jersey, and New York City.

# West Nile Transmission Cycle



## Transmission Cycle

- Continuous transmission between mosquito vectors and bird reservoir hosts.
- Mosquito carries virus particles in salivary glands and infect susceptible bird species- *Culex pipiens*
- Incidental infections to humans and other mammals upon bloodmeal, virus injected into blood system.
- Incubation period in human (time from infection to onset of disease symptoms) usually 5-15 days.
- Humans usually dead end host.

## New York Outbreak

- August 1999 WNV recognized for first time in Western Hemisphere-New York City metropolitan area.
- 62 identified cases
- 7 deaths
- Before and concurrent with outbreak, there were observed increased fatalities among New York City birds.
- Observed changes in horse behaviors.



## New York Outbreak

- Identification: Tissue specimens from infected animals tested for common avian pathogens. Results all negative.
- Sent to CDC- Sept 23- PCR and DNA sequencing of isolates identified WNV.
- Originally thought the N.Y.C. outbreak to be unique since never seen before. After sequencing, this strain is consistent with the Romanian outbreak in 1996.

## New York Outbreak

- CDC has finished the complete genome sequences on N.Y.C. WNV isolate, Italy 1998 virus, Romania 1996 virus, 1997 Australian virus.
- There are a number of A.A. differences among and between these viruses. What the changes mean is not known at this time.
- Noting existence of two international airports in New York City area where WNV was prevalent- Potential routes for introduction of the virus into the Eastern United States? Importation of infected birds? Mosquitoes? Viremic human beings?

## Global Warming?

- Interaction between weather, mosquitoes, and virus probably went something like this...
- Mild winter of 1998-1999 enabled mosquitoes to survive into spring, which arrived early
- Drought in spring and summer concentrated nourishing organic matter in their breeding areas and simultaneously killed off mosquito predators, such as lacewings and ladybugs.
- Drought would have also lead birds to congregate more, as they shared fewer and smaller watering holes

## Global Warming?

- Once mosquitoes acquired virus, heat wave that accompanied the drought would speed up viral maturation inside insects
- Torrential rains toward the end of August provided new puddles for the breeding of *C. pipiens*, unleashing an added crop of potential virus carriers.
- Will warmer winter, warmer nights, intense droughts, and massive bursts of precipitation become more common??? Mosquitoes on the march???

## Current Tasks

- Complete genome sequence of Israel 1998 WNV. These results will tell us the absolute relatedness of the WNV of N.Y.C. And Israel 1998 WNV.
- Define changes in WNV strain to help explain its virulence, ability to cause illness in birds and mammals. Researchers must construct a full-length, infectious cDNA clone of WNV and perform mutagenesis studies to assign virulence properties to each of the identified a.a. changes between WNV.
- Continue molecular epidemiology studies to better define the geographic distribution of the WNV beyond the U.S. and Israel.

## Current Tasks

- Developing new species-specific diagnostic tests for detecting WNV antibody in horses and chickens. Critical for detecting WNV presence in community before human illness is detected.

