**Culex mosquitos are the maintenance vectors for West Nile virus.**

Once infected, a mosquito carries WNV for life.

Female mosquitos take up the virus when feeding on the blood of an infected bird.

The virus travels from cells in her gut to her salivary glands, where it mixes with salivary secretions and is injected when she bites a new vertebrate host.

WNV doesn’t make mosquitos sick: they can still fly, take blood meals, and lay eggs.

Therefore, they are the perfect hosts for the virus to be carried to new animals!

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**Did you know that humans are considered DEAD END hosts for West Nile virus?**

That’s because humans do not develop high enough levels of virus in their blood (called viremia) to efficiently infect a mosquito upon biting.

Therefore, the virus cannot spread from person to person (except through blood or organ transplants, or from mother to baby via the placenta or breast milk)/

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**Birds are the amplifying hosts for West Nile virus.**

Although WNV can infect many different vertebrates, only in birds is the virus able to replicate to high enough levels in the blood to be passed on to the next mosquito coming along for a meal.

Not all birds are equally affected:

1. **Immune vs. susceptible** - After surviving a WNV infection, that bird is now immune for life. Immunity levels of bird populations have a big impact on disease transmission.

2. **Super spreaders vs. dead ends** – “Super spreaders” are birds that reach high enough levels of virus in their blood to infect mosquitos but don’t experience severe disease. Other birds may have the highest viral levels but also have high death rates, limiting the transmission chain.

A single bird can infect 100s of mosquitos!

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**WEST NILE VIRUS the “microbes after hours” series**

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West Nile virus has been detected in 65 species of mosquitos and over 300 species of birds – but not all infections are created equal.

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**Different regions of the US have different mosquito carriers**

- **West** – *Culex tarsalis*
- **North** – *Culex pipiens*
- **South** – *Culex quinquefasciatus*
Risk of neuroinvasive disease increases 2x for every decade of life!

Additional risk factors include:
- Male gender
- Immunosuppression
- Underlying health conditions (hypertension, diabetes, cancer, renal disease, alcohol abuse, and possibly genetics)

Infection:
60-80% of infected individuals never experience any symptoms.

In fact, many of the vertebrates infected by West Nile virus are asymptomatic.

That’s why it’s hard to track number of infections.

Fever:
20% show febrile symptoms - fever, headaches, muscle pain or aches, nausea, and vomiting

Neuroinvasive disease:
Less than 1% develop neurological symptoms - meningitis, encephalitis, paralysis

Who gets neuroinvasive disease?

Surveillance is key to detecting and preventing West Nile virus outbreaks!

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What happens when you get infected with West Nile virus?

You get infected with West Nile virus when bitten by an infected mosquito.

The virus makes its home in skin cells and blood. Then it moves on to dendritic cells (a type of immune cells – the ones in our skin are called Langerhans cells).

Dendritic cells allow the virus to access the lymph system, which takes viral progeny all over the body.

Even though West Nile virus can infect all body systems, it never replicates to a high enough level for new mosquitos to become infected when they bite an infected person.

In about 1/100 infections, West Nile virus is able to cross the blood brain barrier where it infects the central nervous system, causing neurological symptoms.

How can we prevent West Nile virus outbreaks?

Control of mosquito populations
- Prevent egg laying by eliminating breeding pools.
- Control of egg and larval populations through mosquito-specific water treatments.
- Spray pyrethroid or organophosphate insecticide against adult mosquitos.

Personal protective measures
- Clean up potential mosquito habitats on personal property.
- Take precautions during nighttime activity when mosquitos are out:
  - Cover exposed skin at dusk and use spray repellants.

Development of a vaccine
- Designing a WNV vaccine may be technically challenging but not impossible. Already a vaccine has been used for horse protection.
- However, economic and regulatory barriers prevent serious consideration of a similar vaccine for humans.
The best preventative measure is surveillance!

Mosquito trapping and testing for WNV infection is critical to predicting when outbreaks will occur. Mosquitoes carry other diseases as well, so trapping programs can be applied to other health threats.

Blood bank screening is critical to preventing transmission.

Although a mosquito can’t pick up WNV from biting an infected human, patients have become infected through transplanted blood or organs. Because most people don’t show symptoms of WNV infection, testing donated blood is important for protecting the blood supply.

West Nile virus is now endemic in the United States:

- By 2012, only 117 (out of 3140) counties have never reported WNV human cases.
- WNV is represented in all states in the continental US.