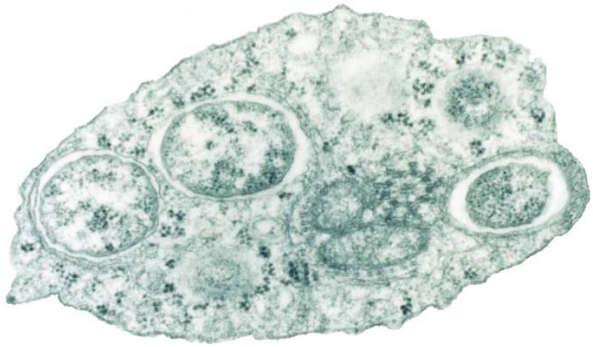
STANDARD DEVIATIONS: Backing Bugs in Battle

Greetings,

Ever wonder what public health is about? Today, I'm revisiting the month of August where we spent a bunch of time talking about dengue virus. Because, despite the doom and gloom of my posts, there is a response effort in progress that buffers that message with a glimpse of hope.

The **World Mosquito Program (eliminatedengue.com)** is using a naturally occurring bacteria to alter the dengue landscape. *Wolbachia* is a genus of gram-negative bacteria infecting arthropods around the world. Researchers have put this bacteria into *Aedes aegypti* and found that it disrupts the cycles of mosquito-borne viruses such as dengue, yellow fever, Zika, and chikungunya.

Wolbachia is one of the most common parasitic microbes (this guy is really mutualistic) and is possibly the most common reproductive parasite in the biosphere. Some host species cannot reproduce, or even survive, without *Wolbachia* colonization, and possibly 70% of all insect species are thought to be potential hosts.

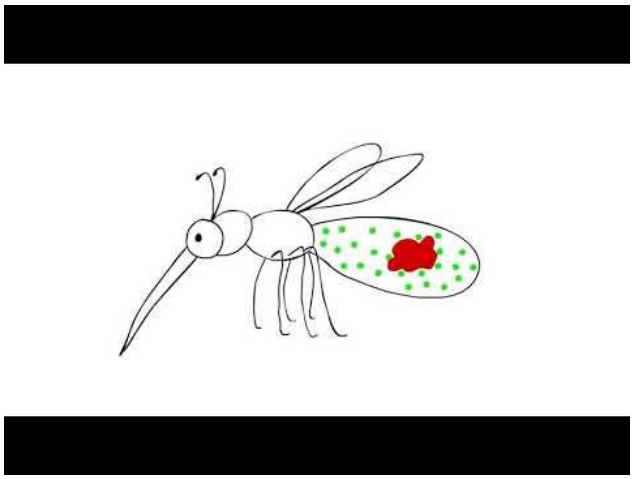


{*Wolbachia* within an insect cell}

Very briefly, the bacterium works in a couple ways:

- Cytoplasmic incompatibility. *Wolbachia* affects mitosis in parental chromosomes. The result is that infected males can only reproduce with infected females, and infected females only produce infected offspring. This drives the population towards 100% infection over time. Infected mosquitoes are better for us.
- Viral inhibition. Viruses in *Wolbachia*-infected mosquitoes don't replicate well. It induces cellular pathways that inhibit viral proliferation. They don't spread virus well.
- Pathogenicity. Infected insects have shorter lifespans and are thus less likely to transmit virus.

Here's a short video that explains the project:



{Click for a 3 minute video}

In 2011, *Wolbachia* positive mosquitoes were introduced in an Australian study and demonstrated a significant reduction in dengue transmission. The project has expanded to Western Pacific countries and South America.

In 2016, Columbia and Brazil funded breeding and release efforts to fight Zika and dengue. Singapore is now using this insect in urban settings. And, in 2017, we saw California and 20 other states begin efforts to release *Wolbachia*-infected mosquitoes. The world is watching the twelve countries currently using the *Wolbachia* method.

Now, this is a simple overview. The *Wolbachia* strain is an important variable. Some pathogens are facilitated by the host response to *Wolbachia* (e.g. river blindness, elephantiasis in humans, and heartworm in dogs). And some mosquito species are already *Wolbachia* hosts and have adapted to those strains with the viruses they transmit (infected mosquitoes actually carried the West Nile virus (WNV) more frequently). *Wolbachia* also seems to confer some insecticidal resistance in some insects.

So, a lot of careful deliberation is needed before we make this our go-to response. On the other hand, this strategy is using a naturally found organism without genetic modification and it shows great promise for suppression of arthropod viral transmission.

Dengue is having a robust year across the globe. 2.5 billion people are at risk and we see an increasing number of deaths attributed to infection with separate dengue strains. Vaccine issues are stifling that avenue of response and its use is being scaled back for many groups. We spent all of August painting a picture of dengue doom; some good news is welcome. The *Wolbachia* mosquito project is an example of public health in action.

Have a great week and be safe,

Bryan