

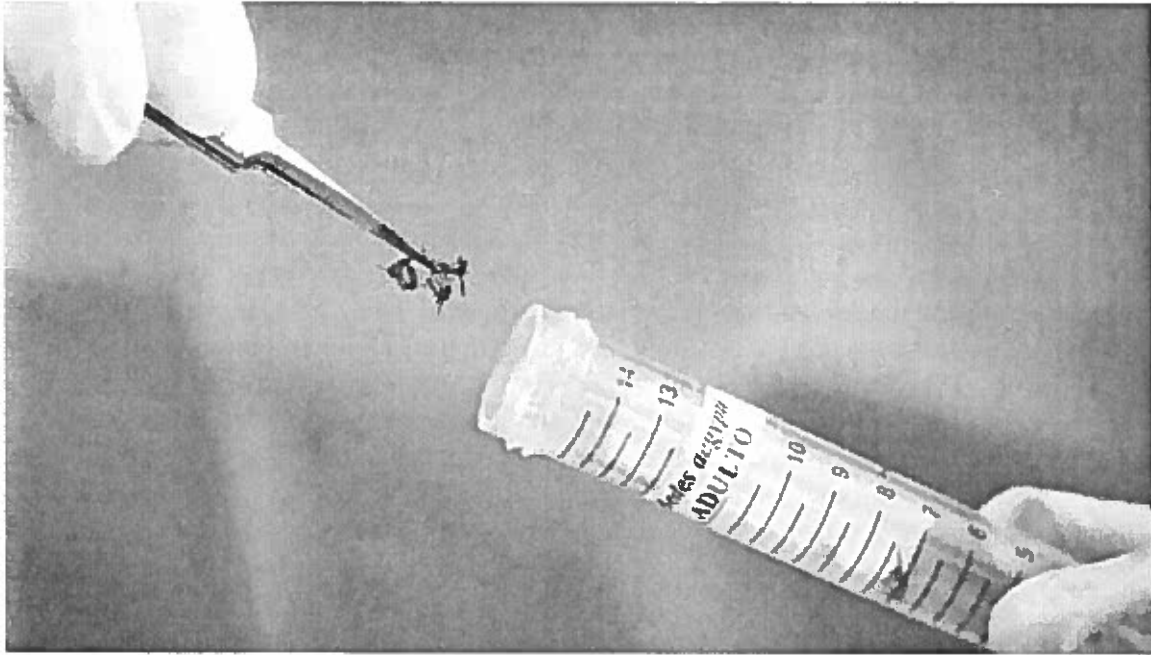
STEM Friday 4

Zika Virus Mosquitos & the Scientific Method

Write a peer review paper describing the steps taken by the researcher and summarize the data that they collected using quotes from the text. Be sure to note how the scientific method was used and point out each different step!

A peer review paper is basically a more simplified example of what was discussed in the original paper for readers who would not understand some of the terminology used in the original paper. It may be 1-2 pages depending on how well you cover the topic.

Make sure your handwriting is neat and legible! I cannot give you a grade if I can't read your writing!



Researchers in Brazil have captured thousands of mosquitoes to test them for Zika and other viruses.

Scientific sleuths hunt for Zika-carrying mosquitoes

By Gretchen Vogel Jun. 1, 2016, 2:15 PM

Zika virus, the once obscure pathogen now widely feared for causing birth defects and other problems, has spread very far very quickly since an outbreak was first noticed in northeast Brazil in early 2015. It has reached more than 40 countries across the Americas, even making it to the Cape Verde islands, off the western coast of Africa. More than a million people have become infected.

As public health officials try to contain the epidemic, researchers are racing to answer a key question with important implications for which areas are at risk, and what methods might work to slow its spread: Which mosquitoes are transmitting the virus? Answering the question is no small challenge. Scientists need evidence from both lab-raised and wild-caught mosquitoes to make the case that a given species is guilty.

Just last week, a team in Rio de Janeiro announced that it had nabbed several *Aedes aegypti* infected with Zika—the first infected mosquitoes found in Brazil. The species, the yellow fever mosquito, has long been the prime suspect, but some scientists believe the Zika virus must have other carriers to have spread so quickly—and they have field and lab studies underway to resolve the issue. Until that evidence is in, “we shouldn’t jump to conclusions,” says Duane Gubler, a virologist at Duke-NUS Medical School in Singapore.

break

A. aegypti has earned suspicion because it spreads dengue and chikungunya as well as yellow fever and is common in urban areas of Brazil where major outbreaks have occurred and throughout Latin America. But evidence of wild mosquitoes infected with Zika has been lacking. It is harder than one might expect to find them. In dengue outbreaks, says Sander Koenraadt, an entomologist at Wageningen University in the Netherlands, researchers typically find that fewer than 1% of sampled mosquitoes are infected with the dengue virus, even where people are falling sick. "You have to look at a lot of mosquitoes to find [infected ones]," Gubler says. The mosquitoes "infect people and die before anyone shows up at the hospital" with disease symptoms, says Oliver Brady, an entomologist at the University of Oxford in the United Kingdom.

For the insects to transmit a virus, they must take up infected blood from a human or animal and become infected themselves. The virus then has to travel from their gut to their saliva. Only some species are susceptible to particular viruses.

To test whether a given species is able to transmit a virus, researchers feed insects on infected blood in the lab and a week or so later collect saliva from them. If the saliva contains infective virus, the species is considered a "competent" vector. Not all lab-competent vectors spread disease, however. That depends on several factors, such as how often the species bites, whether it feeds primarily on humans or other animals, and how long it lives. To confirm that a species is transmitting disease, researchers also need to find virus-infected mosquitoes in the wild.

"You have to look at a lot of mosquitoes to find [infected ones]."

Duane Gubler, Duke-NUS Medical School

The team that reported the first Zika-infected mosquitoes in Brazil, led by Ricardo Lourenço-de-Oliveira, an entomologist at the Oswaldo Cruz Foundation (Fiocruz) in Rio de Janeiro, vacuumed up mosquitoes from homes and streets in Rio de Janeiro neighborhoods that were home to people complaining of Zika symptoms. Over 10 months they collected more than 1500 mosquitoes, identified them, and tested pooled samples of the same sex and species for the presence of Zika and other viruses. Nearly half were *A. aegypti*, and most of the rest were *Culex quinquefasciatus*, another common mosquito in urban Brazil. Roughly 5% were other species. A species called *A. albopictus*, widely known as the Asian tiger mosquito, which can also transmit Zika in the lab and has been found infected with the virus in Mexico and Gabon, made up only about 2% of the catch, Lourenço-de-Oliveira says. They found Zika virus in three sets of female *A. aegypti* mosquitoes, but none of the other species.

The lack of virus in *C. quinquefasciatus* is somewhat reassuring, Lourenço-de-Oliveira says, but the case is not closed. Constância Ayres, an entomologist at Fiocruz in Recife, Brazil, says that her lab has evidence that the species is a possible vector; they have found Zika virus in the saliva of *C. quinquefasciatus* that had fed on infected blood. (Her team has submitted its work for publication.)

Lab tests can be misleading, however. "There is a classic discordance between what you see in the lab and what happens in the wild," Brady says. "*Albopictus* and *aegypti* are both highly competent in the lab" as vectors for dengue. "But in Europe, where we have

widespread *albopictus* and almost no *aegypti*, you don't have huge dengue outbreaks.”

Ayres and others are still searching for Zika in the wild. She and her colleagues have collected and identified more than 5000 mosquitoes in the Recife area since March, from homes where confirmed Zika patients lived and from urgent care centers. She is waiting for promised grant money before she can run the polymerase chain reaction tests to find which viruses the mosquitoes are carrying, she says.

Culex mosquitoes transmit several viruses related to Zika, and it would not be particularly surprising if both *Culex* and *Aedes* species could spread Zika, Ayres says. Gubler agrees that *Culex* is a plausible carrier. He notes that several Zika relatives spread by *Culex* mosquitoes, including the West Nile virus, target the nervous system, which Zika also seems to do.

If *Culex* mosquitoes can transmit Zika virus, that will make slowing its spread even more difficult. *C. quinquefasciatus* is found as far north as Iowa and Indiana in the United States, although people there are protected by window screens and other factors. In Latin America, most vector control methods are targeted at *A. aegypti*. Those efforts have made barely a dent in curtailing spread of the Zika virus so far, notes Paul Reiter, an entomologist at the Pasteur Institute in Paris. Targeting multiple vectors at once will only make the job harder. “If [*C.*] *quinquefasciatus* is a vector,” he says, “we can forget anything about mosquito control.”

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