

# Deadly dengue virus hijacks mosquito saliva to spread sickness

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The dengue virus combines molecules from its RNA with mosquito saliva to foil the human immune system and spread dengue fever and related diseases. Credit: Emily Faith Morgan, University of Virginia Communications

The saliva of mosquitoes infected with dengue viruses contains a

substance that thwarts the human immune system and makes it easier for people to become infected with the potentially deadly viruses, new research published in *PLOS Pathogens* reveals.

Dengue has spread in recent years to Europe and the southern United States in addition to longstanding hotspots in tropical and subtropical areas such as Southeast Asia, Africa and Latin America. The new discovery, from a University of Virginia School of Medicine scientist and his collaborators, helps explain why the disease is so easily transmitted—and could eventually lead to new ways to prevent infection.

"It is remarkable how clever these viruses are. They subvert mosquito biology to tamp down our immune responses so that infection can take hold," said Dr. Mariano A. Garcia-Blanco, who recently joined the UVA faculty as chair of the Department of Microbiology, Immunology and Cancer Biology. "There is no doubt in my mind that a better understanding of the fundamental biology of transmission will eventually lead to effective transmission-blocking measures."

Garcia-Blanco suspects that researchers will find similar immune-dampening substances accompanying other mosquito-borne infections such as Zika, West Nile and yellow fever. "Our findings are almost certainly going to be applicable to infections with other flaviviruses," he said. "The specific molecules here are unlikely to apply to malaria, but the concept is generalizable to viral infections."

## Understanding dengue

Approximately half the world's population is at risk for dengue and roughly 400 million people are infected every year. Dengue's [symptoms](#), including fever, nausea and skin rash, are often mistaken for other diseases. Most people will have mild cases, but about 1 in 20 will

develop severe illness that can lead to shock, internal bleeding and death. Unfortunately, it's possible to contract dengue repeatedly, as it is caused by four related viruses transmitted primarily by the *Aedes aegypti* species of mosquito. There is no treatment, but the new discovery from Garcia-Blanco and his colleagues identifies an important contributor to the disease's spread as researchers seek to find better ways to combat it.

Garcia-Blanco and his team found that infected mosquitoes' saliva contained not just the expected dengue virus, but a powerful conspirator: molecules produced by the virus that can blunt the body's immune response. The injection of these molecules, called sfRNAs, during the mosquito bite makes it more likely that the victim will become infected with dengue, the scientists conclude.

"By introducing this RNA at the biting site, dengue-infected saliva prepares the terrain for an efficient infection and gives the virus an advantage in the first battle between it and our immune defenses," the researchers write in a new scientific paper outlining their findings.

Scientists who study [mosquitoes](#) had previously suspected that the insects' [saliva](#) might contain some type of payload to enhance the potential for infection. Garcia-Blanco's team's new findings pinpoints one weapon in the viruses' arsenal and opens the door to finding new ways to help reduce transmission and control the disease's spread. For now, the best way to avoid getting seriously sick with dengue remains to avoid getting bitten.

"It's incredible that the virus can hijack these molecules so that their co-delivery at the mosquito bite site gives it an advantage in establishing an infection," said researcher Tania Strilets, a graduate student with Garcia-Blanco and co-first author of the scientific paper. "These findings provide new perspectives on how we can counteract [dengue virus](#) infections from the very first bite of the mosquito."

**More information:** Shih-Chia Yeh et al, The anti-immune dengue subgenomic flaviviral RNA is present in vesicles in mosquito saliva and is associated with increased infectivity, *PLOS Pathogens* (2023). [DOI: 10.1371/journal.ppat.1011224](https://doi.org/10.1371/journal.ppat.1011224)

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