

Targeting mosquito spit to halt yellow fever, dengue and Zika

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A molecule in mosquito spit has been identified as a potential new target for vaccination against a range of diseases for which there is no protection or medicine.

University of Leeds Virus Host Interaction Team researchers have discovered that the molecule, called sialokinin, makes it easier for a number of [viruses](#) to pass from mosquitoes to human, where they can then take hold—leading to unpleasant and potentially deadly diseases.

These viruses include [yellow fever](#), which causes serious illness in around 15% of people infected; dengue, which can develop into the potentially fatal disease dengue fever, and Zika, which caused a global medical emergency in 2016.

Previous research determined that sialokinin was able to alter the function of blood vessel cells grown in a lab, allowing increased blood flow and more effective feeding for the mosquito. But experts did not know what role it played in helping the virus to infect the body.

Inspecting the behavior of sialokinin on skin cells from mice, the team discovered that the molecule causes [blood vessels](#) to become permeable, allowing contents to leak out into the skin, which inadvertently helps viruses to infect the host.

Research supervisor Dr. Clive McKimmie, Associate Professor in the University of Leeds School of Medicine, said, "We have identified sialokinin as a key component within mosquito saliva that worsens infection in the [mammalian host](#)."

"Our research suggests that blocking sialokinin, for example through a vaccine or a topical treatment, may be an exciting new approach that prevents severe disease following infection with numerous distinct viruses."

The study is published in *Proceedings of the National Academy of Sciences*. Lead author Dr. Daniella Lefteri worked on the study as a Ph.D. researcher in Leeds School of Medicine. She is now a

Postdoctoral Researcher at the University of Glasgow.

She said, "Our findings may also explain why some mosquitoes can spread infection to humans, while some cannot. Anopheles mosquitoes cannot spread most viruses. Crucially, we show that their saliva, which cannot cause leaky blood vessels, and cannot enhance infection of virus in mammalian host, does not contain sialokinin.

"Our work has increased our understanding of the way mosquito-derived factors influence infection in a host's body."

Mosquito-borne viruses

Viruses spread by [mosquitoes](#) are known as arboviruses. They can affect humans and other mammals, such as cattle. In humans, symptoms generally occur three to 15 days after exposure, and can last three to four days. The most common symptoms are a debilitating fever and headache, but more serious disease can occur and some infections prove fatal.

The Aedes mosquito, which is found on all continents except Antarctica, spreads arboviruses. Species include the Asian tiger mosquito and the yellow fever mosquito.

- Yellow fever infects people living in and visiting parts of South America and Africa. Symptoms include fever, chills, headache, backache, and muscle aches. About 15% of cases develop into serious illness that can be fatal.
- Dengue is contracted by people visiting or living in Asia, the Americas or the Caribbean. According to the World Health Organization, 5.2 million people contracted the disease in 2019. Half of the world's population is now at risk of infection.
- Zika virus is found in parts of South and Central America, the

Caribbean, the Pacific islands, Africa and Asia. It can harm a developing baby. In 2016, thousands of babies were born brain-damaged after their mothers became infected while pregnant.

There are currently no specific treatments or vaccines for [dengue](#), Zika, and other potentially serious mosquito-borne viruses including Chikungunya, West Nile Virus, Semliki Forest virus and Rift Valley Fever virus.

The research team says future work should focus on identifying the other factors in mosquito saliva that help viruses infect hosts, and developing therapeutics to target and block them.

Dr. McKimmie said, "One way to do this would be to develop a vaccine that generates neutralizing antibodies that bind to these factors, and thereby stop them from working and helping the virus."

More information: Daniella A. Lefteri et al, Mosquito saliva enhances virus infection through sialokinin-dependent vascular leakage, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2114309119](#)

Provided by University of Leeds

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