Dengue virus turns on mosquito genes that make them hungrier

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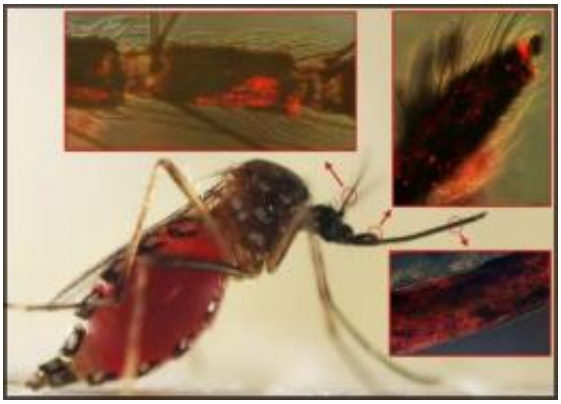

This picture shows the presence of the dengue virus in the mosquitoes chemosensory (antennae and palp) and feeding organs (proboscis). Credit: Johns Hopkins Bloomberg School of Public Health

Researchers at the Johns Hopkins Bloomberg School of Public Health have, for the first time, shown that infection with dengue virus turns on mosquito genes that makes them hungrier and better feeders, and therefore possibly more likely to spread the disease to humans. Specifically, they found that dengue virus infection of the mosquito's salivary gland triggered a response that involved genes of the insect's immune system, feeding behavior and the mosquito's ability to sense odors. The researchers findings are published in the March 29 edition of *PLoS Pathogens*.

Dengue virus is primarily spread to people by the mosquito *Aedes aegypti*. Over 2.5 billion people live in areas where dengue fever is endemic. The World Health Organization estimates that there are between 50 million and 100 million dengue infections each year.

"Our study shows that the dengue virus infects mosquito organs, the salivary glands and antennae that are essential for finding and feeding on a human host. This infection induces odorant-binding protein genes, which enable the mosquito to sense odors. The virus may, therefore, facilitate the mosquito's host-seeking ability, and could—at least theoretically—increase transmission efficiency, although we don't fully understand the relationships between feeding efficiency and virus transmission," said George Dimopoulus, PhD, senior author of the study and professor with the Bloomberg School's Malaria Research Institute. "In other words, a hungrier mosquito with a better ability to sense food is more likely to spread dengue virus."

For the study, researchers performed a genome-wide microarray gene expression analysis of dengue-infected mosquitoes. Infection regulated 147 genes with predicted functions in various processes including virus transmission, immunity, blood-feeding and host-seeking. Further analysis of infected mosquitoes showed that silencing, or "switching off," two odorant-binding protein genes resulted in an overall reduction in the mosquito's blood-acquisition capacity from a single host by increasing the time it took the for mosquito to probe for a meal.

"We have, for the first time shown, that a human pathogen can modulate feeding-related genes and behavior of its vector mosquito, and the impact of this on transmission of disease could be significant," said Dimopoulos.

"Dengue virus infection of the *Aedes aegypti* salivary gland and chemosensory apparatus induces genes that modulate infection and

blood-feeding behavior" was written by Shuzhen Sim, Jose L. Ramirez and George Dimopoulos.

More information: S Sim et al. Dengue virus infection of the Aedes aegypti salivary gland and chemosensory apparatus induces genes that modulate infection and blood-feeding behavior. PLoS Pathogens DOI: 10.1371/journal.ppat.1002631 (2012). dx.plos.org/10.1371/journal.plpa.ppat.1002631

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