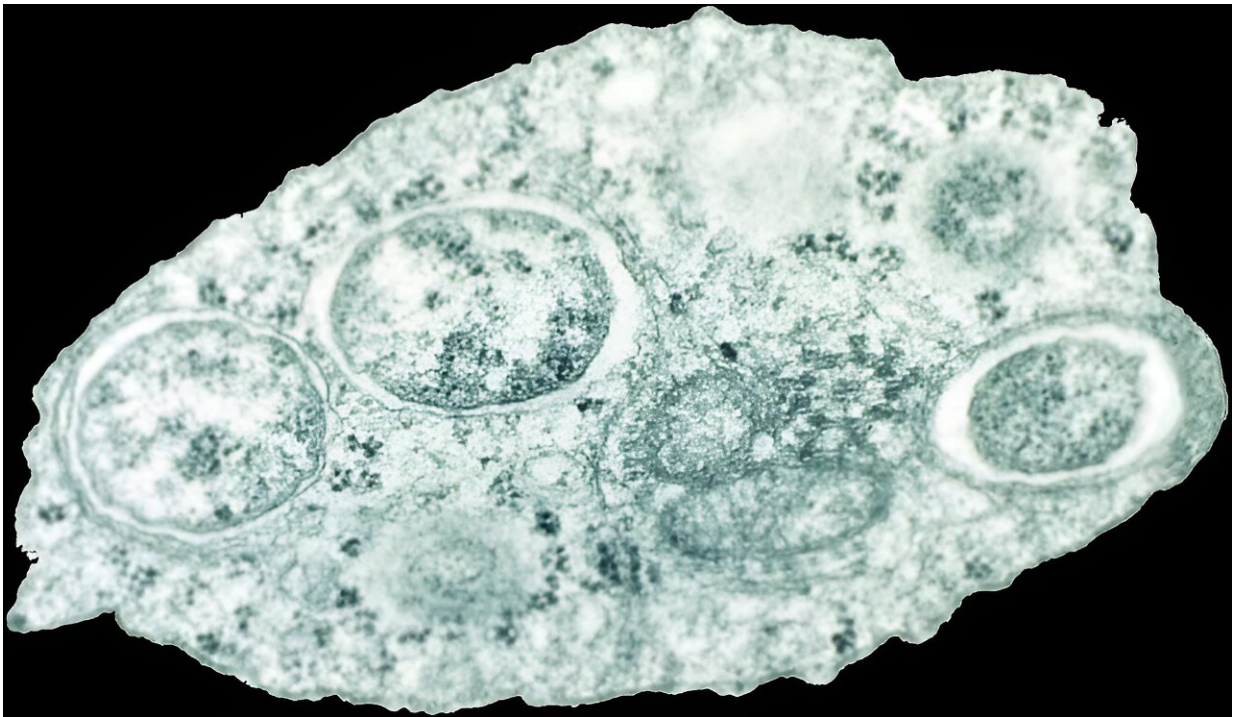


# Scientists and government agencies are targeting mosquitoes with bacteria

February 29 2024, by Ary Hoffmann and Nancy Endersby-Harshman

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Transmission electron micrograph of Wolbachia within an insect cell. Credit: Wikimedia

Dengue fever is one of the most [common tropical diseases in the world](#), affecting several million people every year.

It is transmitted by mosquitoes, particularly a species known as Aedes

aegypti, the yellow fever mosquito.

If you've ever contracted dengue, you'll know that patients are often bedridden for weeks with swollen glands, muscle and joint pain, extreme fatigue and abdominal pain.

But this painful disease also [kills thousands of people each year](#).

In Australia, the *Aedes aegypti* mosquito is common in North Queensland, but dengue fever is rare—typically people contract the disease overseas.

It would be unusual to acquire a dengue infection in north Queensland now because mosquito populations there all carry a bacterium known as *Wolbachia*. This bacterium prevents the mosquito transmitting the dengue virus from the bloodstream of one person to another while causing no harm to humans.

*Wolbachia* is a natural infection in many species of insect, but we can transfer it to those that don't yet have it to achieve beneficial effects in health and agriculture—which include [reducing disease transmission in humans](#) and plants, along with the [suppression of pest insects](#).

## **A self-spreading bacteria**

Almost 15 years ago, our team [released mosquitoes carrying this bacterium in Cairns](#). Over several years, the bacterium spread until almost all of the local *Aedes aegypti* had acquired *Wolbachia*.

The *Wolbachia* bacterium can self-spread in mosquito populations. Male mosquitoes carrying the bacterium can sterilize female mosquitoes lacking it, whereas female mosquitoes infected with *Wolbachia* cannot be sterilized.

Because the bacterium is transmitted through a mother mosquito to all her offspring, this can create a huge reproductive advantage for the infection, allowing it to spread.

It also means that almost all mosquitoes in the population remain infected with the bacterium across generations, ensuring that Wolbachia is a self-maintaining dengue control even after releases cease.

The strain of Wolbachia that now [dominates Queensland mosquitoes](#) has also been released in other countries.

But Wolbachia does have a weakness. The bacterial density in mosquitoes can decrease under very hot conditions, making it harder to spread. And this decrease can cause its dengue-blocking properties to drop as well.

Researchers, including our group and others, have discovered new strains of Wolbachia that are suited to different environmental conditions where dengue and the Aedes mosquitoes both occur.

To do this, we transfer different strains of Wolbachia from other insects into mosquitoes. If the mosquitoes survive and reproduce, we can raise a colony containing the new strain of Wolbachia.

We can then look at how the strain affects the mosquitoes. Do they still lay as many eggs as mosquitoes with no Wolbachia? Do they live very long? Can they survive in hot and dry conditions without losing the Wolbachia infection? Can they block the [dengue virus](#)?

But questions like these are the subject of ongoing research.

## **New strain in Malaysia**

In 2017, one of these new strains was released in Malaysia in dengue hotspots around the capital, Kuala Lumpur.

Together with the University of Glasgow, our team at the Pest and Environmental Research Group in the Bio21 Institute have collaborated with the Malaysian Ministry of Health to test its effectiveness.

Our early work showed that invasion by the strain led to a substantial decrease in dengue fever outbreaks in hotspots around high-rise residential blocks.

Mosquitoes here tended to remain mostly in and around the same housing blocks throughout their lifetime, which helped with the spread of Wolbachia in these local populations.

This early success led to the Malaysian Government making Wolbachia releases part of their standard operations to suppress dengue fever.

Starting in 2019, the government established many more release sites around these hotspots and retrained their pesticide teams to work with Wolbachia mosquitoes. Initially, they released mosquito eggs and later used mosquito adults.

Our new evaluation of 20 locations, [published](#) in *iScience* shows that dengue fever has now been suppressed by more than 60% overall—but this figure goes up to 70% or more at sites where Wolbachia has a high frequency in the mosquito population.

This reduction in a disease that has caused deaths in the recent past is now saving lives. Some [community leaders](#) have their own motto: "Ada Wolbachia tiada Dengii" (Where there is Wolbachia there is no dengue.)

This success should spur further efforts to spread Wolbachia across

wider areas to help suppress [dengue fever](#). It is a powerful and proven approach to tackling this challenging tropical disease.

**More information:** Ary A. Hoffmann et al, Introduction of *Aedes aegypti* mosquitoes carrying wAlbB *Wolbachia* sharply decreases dengue incidence in disease hotspots, *iScience* (2024). [DOI: 10.1016/j.isci.2024.108942](#)

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