

Using *Wolbachia* to Halt Dengue

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About the video

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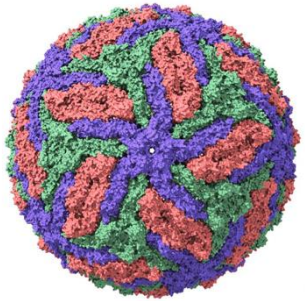
Related Research Organizations: World Mosquito Program, Monash University...

Dengue and *Aedes aegypti*



https://sciencephotogallery.com/



Dengue is a viral disease transmitted to humans through the bite of infected mosquitoes.

- Common in tropical and subtropical regions.
- Symptoms include high fever, headache, muscle pain and rash.
- Severe cases can cause serious complications and even death.

Ae. aegypti is the main mosquito responsible for spreading dengue.

- Recognizable by its black body and white stripes.
- Usually bites during the daytime.
- Breeds in containers with stagnant water.
- Also spreads Zika, chikungunya and yellow fever...

World Mosquito Program

A non-profit organisation aims to protect communities worldwide from mosquito-borne diseases.

- Founded: Originated from decades of research at Monash University.
- Main Mission: Prevent diseases such as dengue, Zika, chikungunya and yellow fever...
- Main Approach: Uses naturally occurring ***Wolbachia*** bacteria to reduce mosquitoes' ability to transmit viruses.
- Global Impact: Its Wolbachia method has protected over 17 million people across 16 countries.

World Mosquito Program

Wolbachia

A natural bacterium that helps mosquitoes become less capable of transmitting dengue and other viruses.

Geographical context

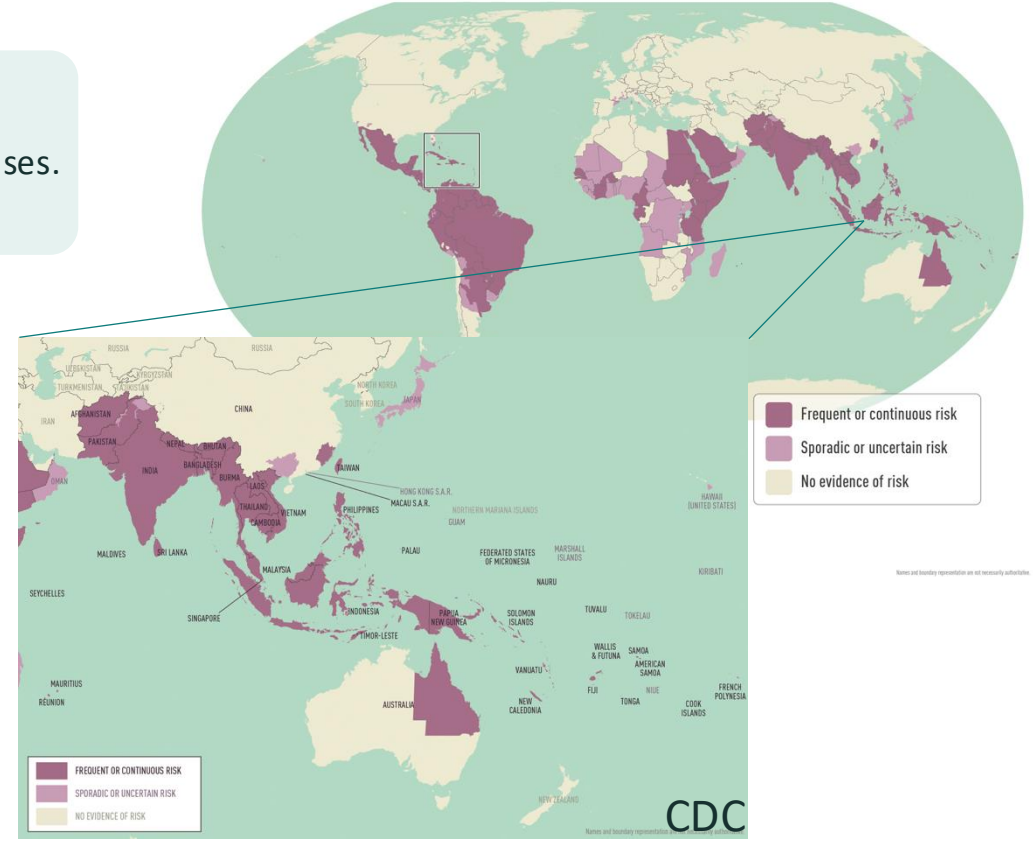
Indonesia

Second in the world for total dengue cases. About 7 million cases a year.

Yogyakarta

The city where the major study takes place. The first mosquitoes were released here in 2014.

A regional map of Asia and Oceania displaying areas with dengue risk



Main concepts and topics

1. Dengue and *Ae. aegypti*

Why the disease is so hard to stop

2. *Wolbachia*: a natural bacterium

How it blocks viruses and spreads by itself

3. Community engagement

Working with residents before and during releases

4. Results and ambition

Fewer dengue cases, and a goal of 100 million people

1. Dengue by the numbers

40%

of the world's population is at risk of dengue this year(2019)

30×

rise in dengue cases over the last 50 years

2 billion

more people could be at risk by 2080 as temperatures rise

No. 2

Indonesia's rank in the world for total dengue cases

Symptoms range from mild to internal bleeding, shock and death. It is nicknamed "breakbone fever".

1. Why is dengue so hard to stop?

The mosquito: *Ae. aegypti*

- Lives in homes and cities: “the cockroach of the mosquito world”
- Bites 2–3 times a day, so whole families get sick
- Breeds in tiny puddles: millions of sites, impossible to kill them all
- Also spreads yellow fever, chikungunya and Zika

The virus: four types

- Dengue has 4 types: dengue 1, 2, 3 and 4
- After one infection, antibodies protect only against that type
- Those antibodies can make a different type more severe
- You could catch dengue up to four times

2. Use a bacterium, not poison

1

Put Wolbachia in

Inject the bacterium into freshly laid eggs. Introduce Wolbachia bacteria into *Ae. aegypti.*

2

Virus blocked

Mosquitoes with Wolbachia cannot pass on dengue, Zika, yellow fever or chikungunya.

3

Release and spread

Release them into the community. The bacteria then spread on their own through breeding.

Wolbachia lives naturally in 60–70% of insect species, but not in *Ae. aegypti.*

Mosquitoes without *Wolbachia* transmit viruses



Mosquito bites person with virus

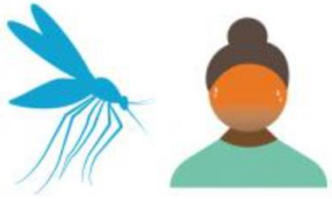


Mosquito bites another person

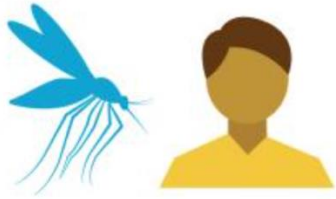


That person is infected with virus

Mosquitoes with *Wolbachia* block virus transmission



Mosquito with *Wolbachia* bites person with virus



Mosquito with *Wolbachia* bites another person



That person is not infected with virus

2. The breeding rule

	Male WITH Wolbachia	Male WITHOUT
Female WITH Wolbachia	Eggs carry Wolbachia	Eggs carry Wolbachia
Female WITHOUT	Eggs die	Normal eggs, no Wolbachia

Why it matters

Only mothers with Wolbachia can produce healthy offspring, so the bacteria spread through the whole population without “infecting” anyone.

Mother to egg = vertical transmission

3. Community engagement

Explain first

The team explained that the target is the virus, not just the mosquitoes, before any release.

Join in

Residents look after buckets of eggs until they hatch.

Keep monitoring

Teams release mosquitoes until enough wild ones carry Wolbachia, then stop.

4. Results and ambition

≈70%

fewer dengue cases where Wolbachia mosquitoes were released (the team thinks this is an underestimate)

3M → 100M

people covered: about 3 million now, a goal of at least 100 million by 2023

"Eliminating diseases is very challenging." Polio is close to elimination, and smallpox is one of the few diseases ever eliminated.

Vocabulary

Word	Meaning and example from the video
eradicate (v.)	To destroy something completely, leaving nothing behind, especially a disease, harmful organism, or deeply rooted problem.
eliminate(v.)	To remove or get rid of something, especially a problem, risk, threat, or unwanted condition.
colony (n.)	A large group of insects living together. The team built a colony of a few thousand mosquitoes.
vertical transmission (n.)	Passing from mother to offspring through the egg.
threshold (n.)	The level that must be reached before something changes.

Vocabulary

Word	Meaning and example from the video
nuisance (n.)	Someone or something that annoys you. Mosquitoes are “more than just a nuisance”.
spectrum (n.)	A wide range between two extremes. Dengue symptoms run from mild to extreme.
underestimate (n. / v.)	To think something is smaller or less important than it really is. “A big underestimate.”
inoculate (v.)	To protect against disease by putting something into the body. The team “inoculates” mosquitoes.
monumental (adj.)	Extremely large and difficult. Spreading Wolbachia across half the planet is a monumental task.

Vocabulary

Mosquito、tropical disease、breakbone fever、internal bleeding、shock、symptom、infection、transmission、infectious、insect、cockroach、offspring、breed、reproduce、hatch、mate、inject、laboratory、trial、monitor、funding、non-profit、initiative、outbreak、yellow fever、Zika virus、Mayaro virus、polio、smallpox、disease prevention、disease transmission、mathematical modeling、coordinated effort

Be careful with the three “demic” words

Epidemic

A sudden, fast spread of a disease in one region.

Aedes aegypti causes “explosive epidemics”.

Pandemic

A disease that spreads across the whole world.

Covid-19 is a pandemic.

Endemic

A disease that is regularly present in one area.

Dengue is endemic in Yogyakarta.

Pronunciation tips

Dengue

/ˈdɛŋ.gi/

Stress the first syllable. The g is hard, as in “get”.

Wolbachia

/wʊlˈbæk.i.ə/

Starts like “wool”. Stress the second syllable.

Aedes aegypti

/eɪˈiː.diːz iˈdʒɪp.taɪ/

“ay-EE-deez”. The j sound in the second word.

Bacterium

/bækˈtɪə.ri.əm/

Stress the second syllable. Plural: bacteria.

It’s time to watch the video



https://www.youtube.com/watch?v=4jaqnQ_GMWU

Thanks for your attention