

GENETICALLY MODIFIED MOSQUITOES-WHO GUIDELINES



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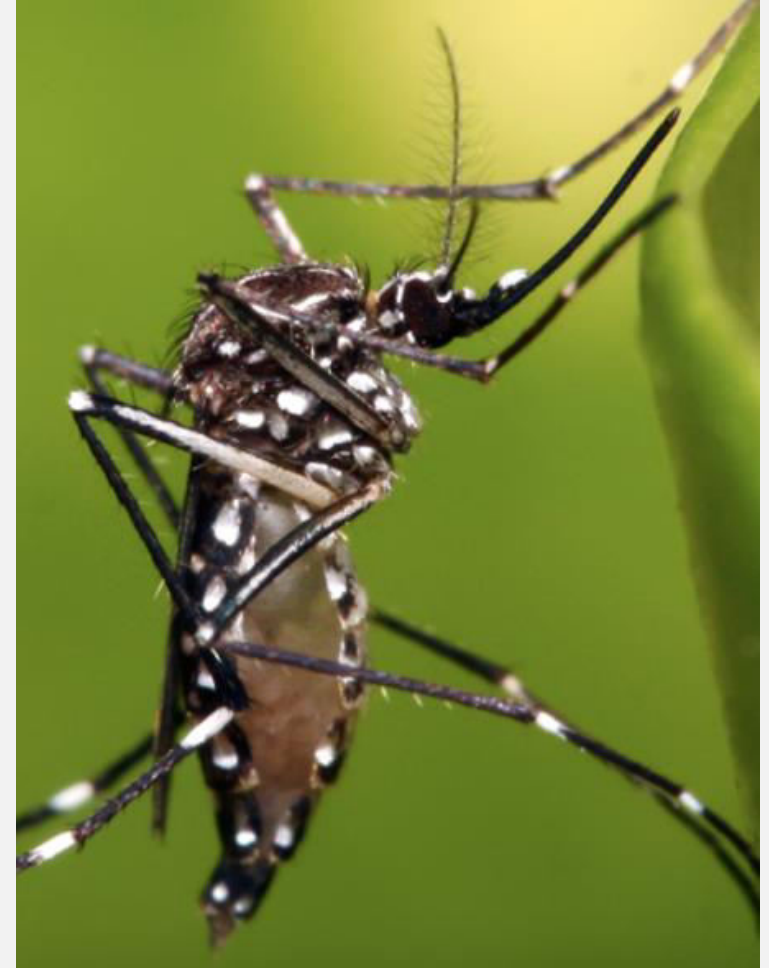
New guidance from the World Health Organization (WHO) sets essential standards to inform future research and development on genetically modified mosquitoes, particularly in addressing issues relating to ethics, safety, affordability and effectiveness.

Malaria and other vector-borne diseases, including dengue and Zika, affect millions globally.

More than 400 000 people a year die from malaria alone.





If proven safe, effective and affordable, genetically modified vector mosquitoes could be a valuable new tool to fight these diseases and eliminate their enormous health, social and economic burden.





The guidance framework for testing genetically modified mosquitoes, developed in partnership with TDR, the Special Programme for Research and Training in Tropical Diseases, and the Gene Convene Global Collaborative, an initiative of the Foundation for the National Institutes of Health,




Current strategies for limiting transmission of mosquito-borne diseases are only partially effective.

New, complementary approaches are needed to close the gaps in current vector control interventions, such as effective control of outdoor biting, and to provide alternatives to manage the increasing threat of insecticide resistance.





Research suggests genetically modified mosquitoes could be a powerful and cost-effective tool to supplement existing interventions.



Like any new public health intervention, genetically modified mosquitoes raise new questions for researchers, affected communities and other stakeholders,





The updated guidance framework aims to answer these questions and help ensure that testing of genetically modified mosquitoes is as rigorous as it is for other public health products and that it generates quality results to guide decisions about if and how these technologies are used.




The guidance builds on an earlier document published by TDR and FNIH in 2014, incorporating the latest scientific advancements related to genetic modification of mosquitoes, as well as other key updates and learnings related to safety and ethics

It Includes:

1. methods for understanding the implications of genetically modified mosquitoes for human health, animal health and the environment
2. a concrete set of safety and efficacy considerations that should be evaluated at each phase of testing, to inform decisions about further testing and implementation.





3. Increased understanding of the most effective strategies for risk assessment and stakeholder engagement

4. Clearer criteria for projects to proceed from one testing phase to the next, incorporating descriptions of the steps needed to safely and responsibly take genetically modified mosquito technologies including those incorporating gene drive – into the field

GENE CONVENE GLOBAL COLLABORATIVE



The Gene Convene Global Collaborative is an initiative of the Foundation for the National Institutes of Health that advances best practices and informed decision making for development of genetic biocontrol technologies to improve public health.

Gene Convene offers technical information, advice, training and coordination for research on gene drive and other genetic biocontrol technologies.



TDR



TDR is a global programme of scientific collaboration that helps facilitate, support and influence efforts to combat infectious diseases of poverty.

It is co-sponsored by the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the World Bank and the World Health Organization (WHO).



GENETICALLY MODIFIED MOSQUITOES





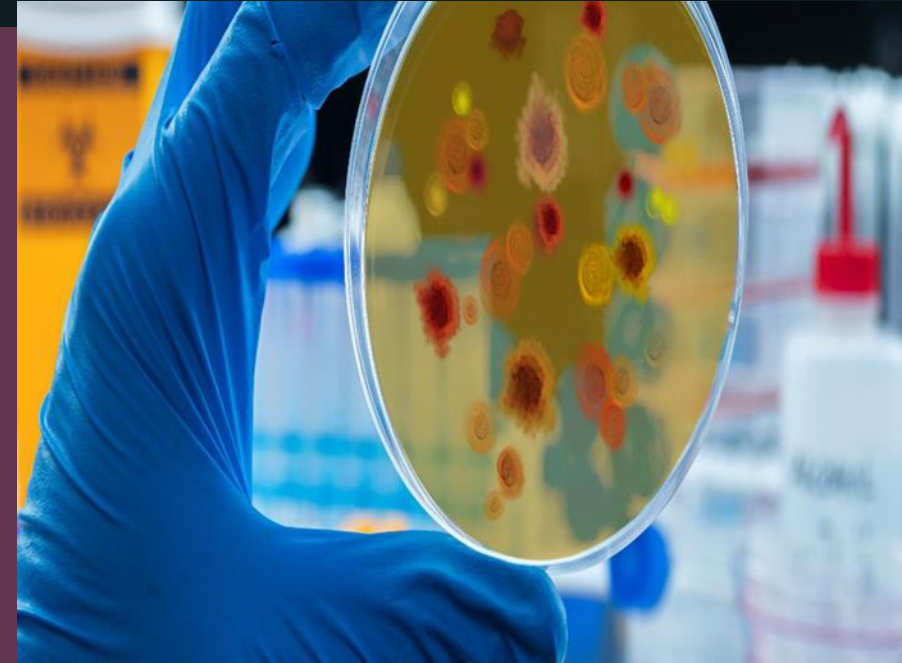
Aedes aegypti mosquitoes spread viruses including dengue, Zika, and chikungunya. *Aedes* mosquitoes are common throughout many areas of the United States.

Aedes aegypti mosquitoes can be genetically modified and used to control other *Ae. aegypti* mosquitoes in a community.



This EPA authorization allows local mosquito control programs to evaluate how effective GM mosquitoes are in reducing *Ae. aegypti* mosquitoes in areas where they have been released.

In the United States, the U.S. Environmental Protection Agency (EPA) has authorized use of OX5034 genetically modified *Ae. aegypti* mosquitoes for release in counties in Florida and Texas.



How genetically modified (GM) mosquitoes are used to control *Ae. aegypti* mosquitoes?

GM mosquitoes are mass-produced in a laboratory to carry two types of genes:

- **A fluorescent marker gene** that glows under a special red light. This allows researchers to identify GM mosquitoes from wild mosquitoes.
- **A self-limiting gene** that prevents female mosquito offspring from surviving to adulthood.





GM male mosquito eggs that carry the self-limiting gene are released into an area.

Once they have hatched and develop through to the adult stage, they are available to mate with wild females.

The genes are passed on to offspring

Effectiveness of GM mosquitoes in reducing numbers of mosquitoes



GM mosquitoes have been successfully used in parts of Brazil, the Cayman Islands, Panama, and India to control *Ae. aegypti* mosquitoes. Since 2019, over 1 billion mosquitoes have been released.

When GM mosquitoes stop being released into an area, the *Ae. aegypti* mosquito population will slowly return to “normal levels.”

GM mosquitoes for outbreak control

Release of GM mosquitoes is not intended to stop an outbreak.

However, releasing GM mosquitoes over several months can reduce the number of a specific mosquito species, such as *Ae. aegypti*.



GM mosquitoes and integrated mosquito management



Using GM mosquitoes may be more effective if used along with other mosquito control methods as part of an integrated mosquito management (IMM) approach, It includes

Educating the community about how they can control mosquitoes in and around their homes

Conducting mosquito surveillance
(tracking and monitoring the number
of mosquitoes, types of mosquitoes
in an area)

Removing standing water where
mosquitoes lay eggs



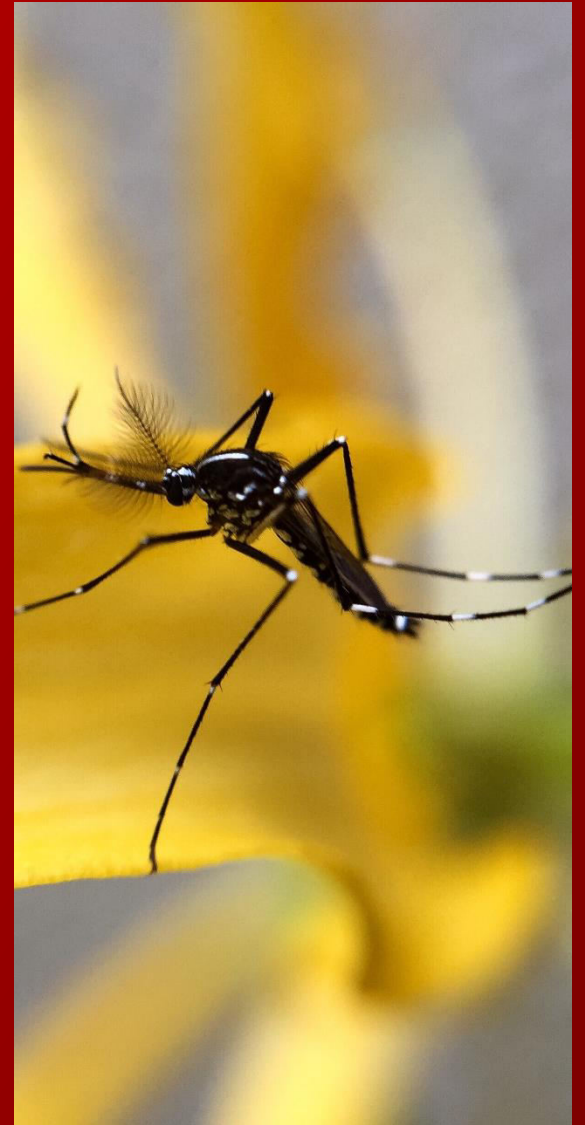
MOSQUITO BORNE DISEASES

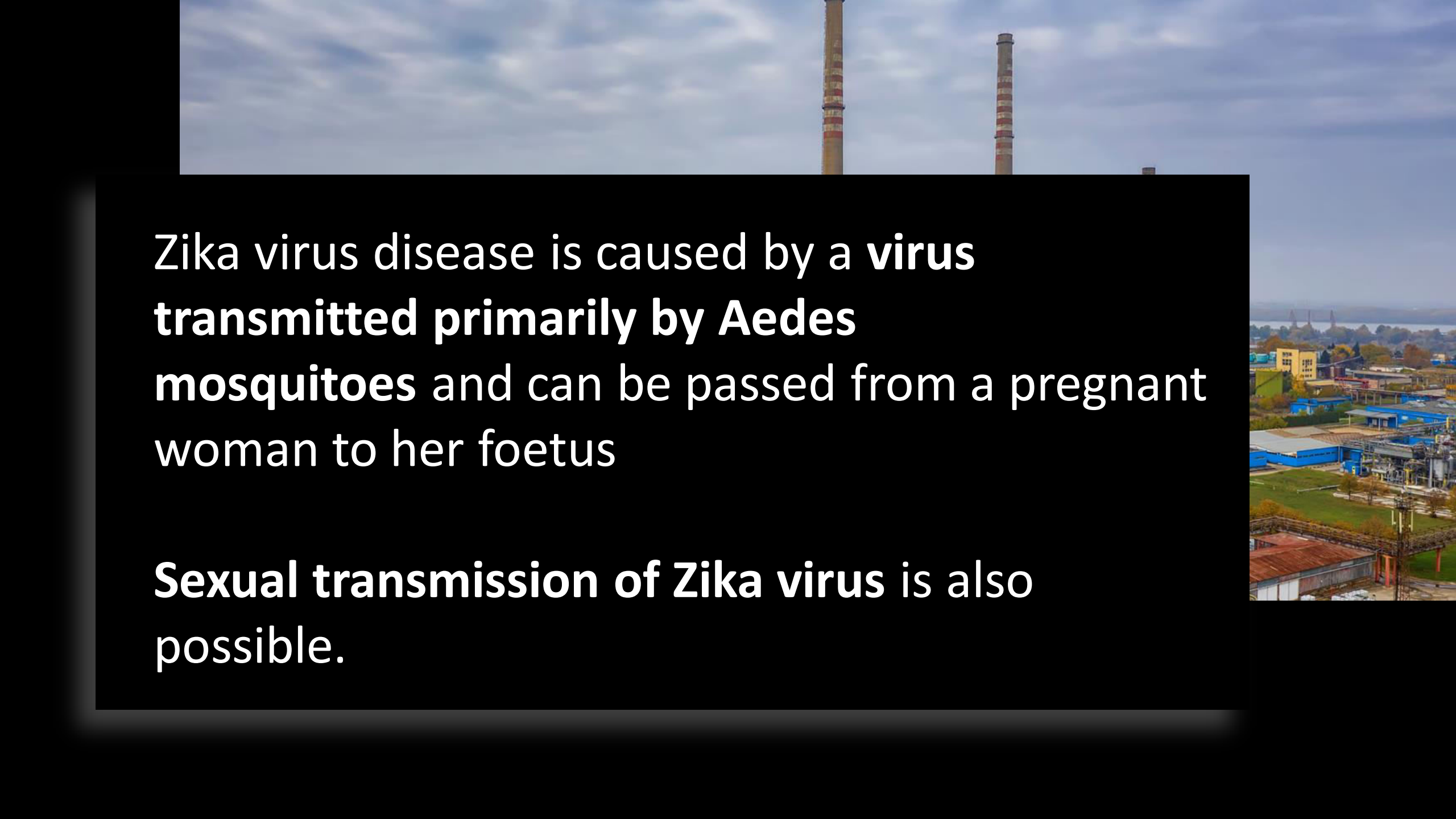


Zika Virus

Zika virus is a **mosquito-borne flavivirus** that was **first identified in Uganda in 1947 in monkeys.**

It was later **identified in humans in 1952 in Uganda** and the United Republic of Tanzania. Outbreaks of Zika virus disease have been recorded in Africa, the Americas, Asia, and the Pacific.



The background of the slide is a composite image. The top portion shows two tall, grey industrial smokestacks against a blue sky with wispy white clouds. The bottom right portion shows an aerial view of an industrial facility with various buildings, pipes, and a green field, with a city skyline visible in the distance under a hazy sky.

Zika virus disease is caused by a **virus transmitted primarily by Aedes mosquitoes** and can be passed from a pregnant woman to her foetus

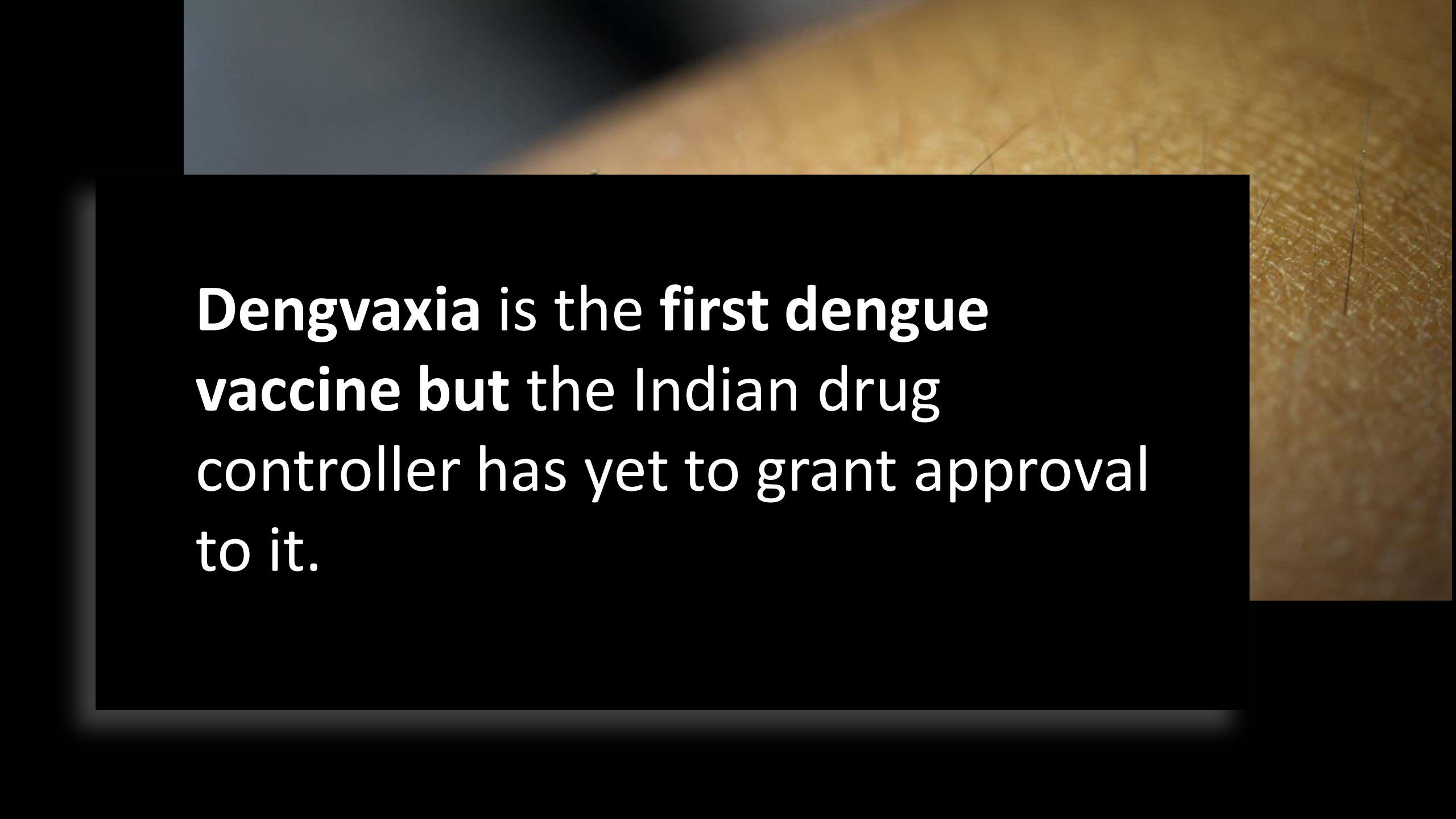
Sexual transmission of Zika virus is also possible.



Dengue

Dengue is transmitted by **several species of mosquito within the genus Aedes.**

Symptoms include fever, headache, muscle, and joint pains, and a characteristic skin rash that is similar to measles.



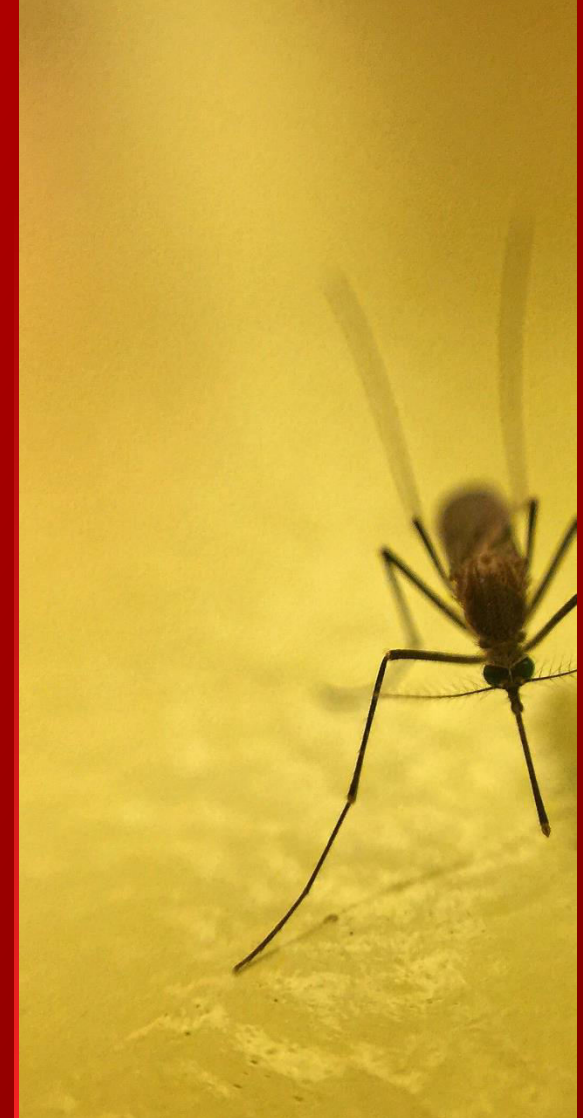
Dengvaxia is the first dengue vaccine but the Indian drug controller has yet to grant approval to it.

Chikungunya

Chikungunya is caused by a **mosquito-borne virus**.

It is **transmitted** by **Aedes aegypti** and **Aedes albopictus mosquitoes**.

Its symptoms are characterized by abrupt fever and severe joint pain, often in hands and feet, and may include headache, muscle pain, joint swelling or rash.



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