Engineered Mosquito

These male engineered mosquitoes carry a gene that means their offspring will die during development unless they are fed a necessary chemical that is only available in the lab. The engineered male mosquitoes are released to mate with wild females. The offspring inherit the lethal gene from the engineered male. It is the males who are engineered because they don't bite humans. The next generation of mosquitoes dies before they are mature enough to mate. This reduces the number of mosquitoes in the following generation because only females that mated with wild males will produce fertile offspring.

PROS:

Fewer mosquitoes in the area means less transmission of Zika.

If the mosquito population gets low enough, it becomes practically impossible to transmit Zika, even if the population isn't zero.

Genetically engineered mosquitoes reduce the need for insecticides and bed nets, which are becoming less effective as mosquitoes adapt to them.

CONS:

Mosquitoes can evolve resistance to the lethal gene, so population reduction might not go as planned. Modified female offspring might also bite humans.

In the lab, a small percentage of mosquitoes with the lethal gene were still able to survive, even without the necessary chemical.

In some places, the chemical that keeps the GE mosquitoes alive might be present in the environment, so they might be able to survive and reproduce.

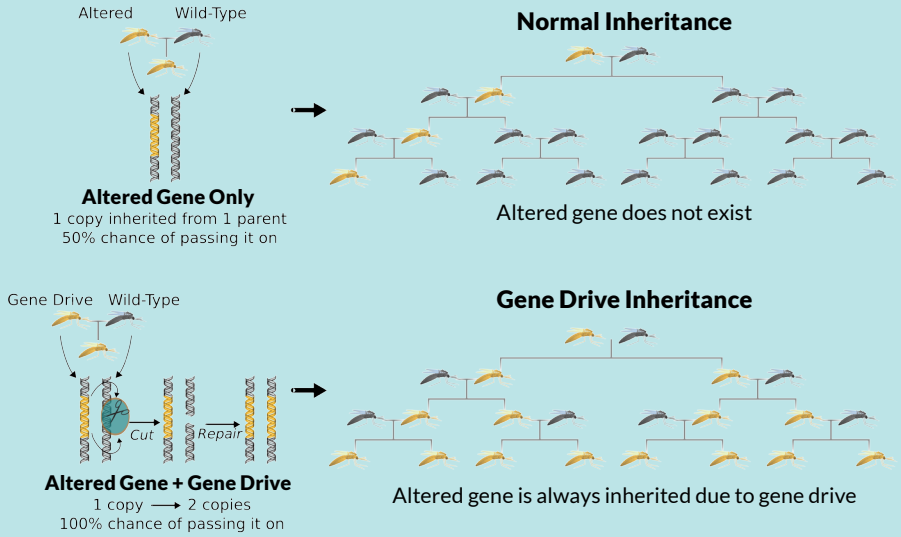
Engineered males are not yet good enough at mating to reduce the mosquito population.

For more information, see the Supplemental Information Sheet on Engineered Mosquitoes.

Gene Drive

Part 1: Overview

Some genes found in nature are more likely to be passed on to offspring. By using elements of these genes, engineers have developed gene drive systems. Genes with gene drives spread through a population quickly over just a few generations.



Kevin Esvelt, MIT Media Lab

CONSIDERATIONS:

Some scientists suggest that we could release a second gene drive that would reverse the first gene drive if something went wrong. This strategy would not completely return the population to "normal" because the genes from the second gene drive would still be present.

Gene drives have been tested successfully in the lab but no mosquitoes with gene drives have ever been released in the wild.

OPTIONS:

One possible gene drive could target the mosquito itself.

For more information, see the Supplemental Information Sheet on Engineered Mosquitoes.

Gene Drive

Part 2: Target

TARGET: Mosquito

The gene drive targeting mosquitoes causes sterility to spread through the mosquito population, which reduces the number of mosquitoes.

PROS:

This is likely to permanently reduce the mosquito population. With a small enough mosquito population, Zika cannot be transmitted.

CONS:

This might affect species that eat or interact with that species of mosquito.

This might wipe out São Paulo's entire population of this species of mosquito, which might impact the ecosystem and food chain.

For more information, see the Supplemental Information Sheets on Engineered Mosquitoes and Zika and Traditional Detection Methods.

Release Options

Who should release the GE mosquitoes and/or Vaccine?

A. **Local São Paulo government**

B. **Governmental authorities** such as the Brazilian Ministry of Health

C. **Companies** who developed the mosquitoes an/or vaccine

D. **A nonprofit/NGO** that developed the mosquitoes and/or vaccine in collaboration with academics and government

E. **Other**

At what scale?

A. **Group releasing the mosquitoes/vaccine determines** the scale

B. **Limited local release** followed by a one year study period

C. **Large scale release**

D. **Other**

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