

Stopping Zika: Here come the mutant mosquitoes!

By Sandee LaMotte, CNN

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Everything you need to know about Zika 01:42

Story highlights

Using bacteria that keep Zika from replicating inside the mosquito is one approach

Sterilizing males with gamma radiation and releasing them in the millions is another

GMO mosquitoes with lethal genes that kill their young could soon be used in Florida

(CNN) — Imagine a hairy, bug-eyed monster that hides under your bed, in your closet and in your shower, waiting for just the right moment to attack. Her belly grows, glowing bright red, as she sucks your blood to create her babies -- which she produces by the thousands -- leaving a virus to grow inside of you that could harm *your* babies if you are pregnant.

No, this is not a B-rated horror movie. It's a Hollywood-style description of one of the craftiest little creatures on the planet, the female [Aedes aegypti](#) mosquito. (All male mosquitoes are exonerated because they don't bite.)

Over the centuries, she has adapted to live as close as she can to her favorite prey -- us -- and can breed in receptacles as small as flower vases and shower drains. Forgotten tires and discarded plastics? Even better. In other words, she's perfect for spreading disease in any bustling, overpopulated, tropical city or slum.

While the *aegypti* transmits the viruses that cause [yellow fever](#), [dengue](#), [chikungunya](#) and now Zika, her sister species, the *Culex quinquefasciatus*, carries [West Nile](#) and [encephalitis](#). Another 40 species of mosquitoes, in the genus *Anopheles*, spread the [malaria parasite](#). The *Anopheles* is such an efficient bloodsucker that a single female can infect more than 100 people. Together, these ladies have killed and maimed more humans than any other animal on earth, even mankind with all of its wars.



An *Aedes aegypti* mosquito digests a blood meal.

If this was a traditional Hollywood horror flick, there would be a happy ending: All the monsters would be exterminated. But history shows man has tried that again and again with these mosquitoes, often using dangerous pesticides. And like every great villain, they always return.

"And of course in today's world, you and I, along with any mosquito or virus, can hop a plane and get anywhere within less than 24 hours," said [Uriel Kitron](#), chairman of Emory University's Department of Environmental Studies. "I always say the mosquito is not a great flier, but it's a wonderful hitchhiker. So it's very easy to reintroduce."

Which is why a growing number of scientists are touting the need for a "mutant mosquito," a helpful Frankenstein designed to win the fight against these deadly females.



Related Article: The mosquitoes that changed history

The 'Alien' within: Wolbachia

Remember the movie "Alien," where the creature grows in the crewman's belly until it finally [rips through his stomach](#) to the outside world? Now imagine a kinder, gentler creature living [inside the cells of up to 60% of the insects](#) around us. This creature, a genus of bacteria called Wolbachia, manages to live off its hosts and transform them, but doesn't have to kill them to survive. A [nonprofit group](#) out of Australia discovered this helpful alien stops the growth of viruses inside the *Aedes aegypti*, keeping her from transmitting disease.

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A researcher carries a container of Wolbachia-carrying mosquitoes.

Not the Hulk: The gamma-irradiated male

The International Atomic Energy Agency [recently announced a plan](#) to help Brazil and other countries hard hit by Zika produce sterile "gamma-irradiated" *Aedes aegypti* mosquitoes for mass release in those countries. Within the next few months, the agency says it will send a cobalt-60 gamma cell irradiator to Brazil in order to create billions of sterilized male mosquitoes that researchers hope will mate with wild females to keep them from reproducing. But unlike their famous gamma-radiated movie cousin, the Hulk, these guys may not have the strength or stamina to do their jobs.

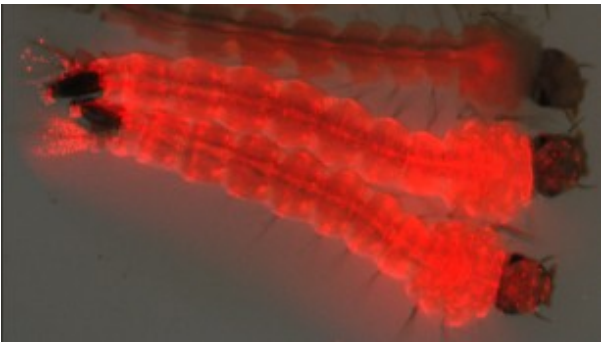
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A gamma cell irradiator is a tool in the battle against mosquitoes.

'Frankenstein': The GMO mosquito

Meet OX513A, a male *Aedes aegypti* mosquito genetically engineered to pass along a lethal gene to wild females that makes her offspring die. He's the [product of Oxitec](#), a small biotechnology company launched by Oxford University professors in 2002, now owned by biotech giant Intrexon.



This male is created by injecting very small amounts of synthetically made DNA into thousands of mosquito eggs until finally one of the eggs accepts the DNA into its genome, creating two genes. One gene, based on DNA from coral, is used to implant a fluorescent red marker in OX513A so researchers can more easily find and track him. The other gene, artificially modeled after *E. coli* and the herpes simplex virus, is lethal because it creates a protein called tTAV which interferes with a cell's activity, killing the infected mosquito before it can reach adulthood.

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The OX513A mosquito at bottom has a
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Gene drives are considered the cutting edge of genetics. In labs around the world, enterprising researchers are using new tools such as [CRISPR's Cas9](#) to splice a helpful gene into a mosquito's bloodline, "driving" it into the entire population, at a much higher rate than the standard genetics you learned in school.

"It's forcing those genes into the population," explained [molecular biologist Omar S. Akbari](#). "Instead of a gene being transferred to 50% of the offspring, now it can transfer to 99%, maybe even 100% of their progeny."

Before you can "drive" a beneficial gene into a population, you have to create it. That's where genetic engineers can get really clever. Take what University of California-Irvine [microbiologist Anthony James](#) and his team did to create a drive against one strain of malaria.

"Frankenstein's not a fair comparison," explains James, "because [Frankenstein](#) was made of all human parts. We're making what's called a [Chimera](#), an animal that is made from parts of several creatures."

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Smaller male *Aedes aegypti* mating larger female.

Will the mutants really succeed?

From Wolbachia to radiated males, from OX513A to gene drives, all of these solutions have significant issues, say critics: expense, proof of disease reduction, environmental impact studies, community support, and especially the need for mosquito control during any outbreak. After all, officials aren't going to let Zika-carrying mosquitoes continue to spread disease while we wait for a takeover by mutants.



"If you're releasing mosquitoes for doing control and on top of that you have to do mosquito spraying, then in a way you're killing your investment," said [Emory University ecologist](#) Gonzalo Vazquez Prokopec. "You're releasing mosquitoes that cost money but at the same time you cannot stop helping people. So how this integration of genetically modified mosquitoes works in the context of ongoing control activity, I think it's still an open question."

Oxitec CEO Hadyn Parry disagrees. What's needed, he says, is coordination with local authorities.

"It's a very sensible, logical strategy to go into a town,

A woman walks through a haze of pes

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completely susceptible and they'd all fall down dead.

Whereas ironically, the wild ones have quite high levels of insecticide resistance."

"The key is to mobilize the community," agreed Emory's Kitron. "The challenge is that often the community is not into it, or they do not like some of the measures that were applied, or they did not feel that the disease was that important. Zika is different because the potential complication is so severe that I think that on its own will be a major mobilizing force for the community."

But, he adds, it's too soon to determine if the mutant mosquito can truly win the war against man's deadliest enemy.

"I think that the jury is still out on all of these techniques," said Kitron. "I think they will play a role, and I think they will add to the many tools that we already have. But none of them, I don't think, will be a silver bullet."