Buzz Off

by Kirsten Weir

Can Bioengineering Mosquitoes Stop The Spread Of Tropical Diseases?

It's a bright, sunny day in the Caribbean. You roll out your beach towel and settle down in the sand when- *drat!*-a mosquito interrupts the serenity. You reach over and swat it.

If you happened to be on the island of Grand Cayman not long ago, you needn't have bothered. In a test on the island, scientists released millions of lab-created mosquitoes. The insects were engineered to self-destruct. No need for swatters.

AP Photos

A female Aedes aegypti mosquito

Although a tropical vacation without biting bugs sounds like a true paradise, there's a bigger goal at stake. Mosquitoes transmit *dengue fever*, a devastating and sometimes fatal disease. No vaccine or cure for it exists. Could tailor-made mosquitoes be the answer?

No Fly Zone

Dengue fever strikes about 100 million people each year in tropical and subtropical regions. It's also called *breakbone fever* for the joint and muscle aches and the intense headaches it causes. In some cases, the fever worsens into *dengue hemorrhagic fever*, which leads to internal bleeding, organ damage, and possible death.

AP Photos

Patients suffering from dengue fever lie on cots in a military hospital in Bogor, Indonesia.

Dengue fever is caused by a virus, which the mosquito *Aedes aegypti* spreads through its bite. Until now, the best way to control the disease has been to prevent contact between mosquitoes and humans, says Anthony James, a molecular biologist at the University of California, Irvine. One way to do that is to put up window screens. Another is to douse people and places with *insecticides* (chemicals that kill insects). Unfortunately, insecticides can harm other organisms, including beneficial insects. And mosquitoes can develop a resistance to them over time.

James believes there's a better option: *genetically engineering* the *A. aegypti* mosquito. Genetic engineering is the process of manipulating an organism's *deoxyribonucleic acid* (*DNA*). James tweaked *A. aegypti* by adding some extra *genes* to its DNA. Genes are short DNA segments that are responsible for individual traits in an organism. The genes that James added prevent flight muscles from forming in female mosquitoes. "Only the adult females feed on blood and therefore are responsible for transmitting diseases," he says. Unable to fly, the engineered females can't mate, bite, or spread dengue fever.

Umar Qayyum/Xinhua/Photoshot/Newscom

Fumigating a Pakistani city to kill dengue-transmitting mosquitoes

In order to get flightless females, James actually engineered male skeeters instead. The *transgenic* (genetically engineered) males mate with females and pass on their extra genes to their offspring. Any female mosquitoes born to those fathers are unable to fly and, therefore, unable to mate. As the genes spread, the population dwindles. "The idea is to get a zero population," James says.

So far, James has tested his mosquitoes in the lab and in large outdoor mesh cages in Mexico.

He's now working on securing approval to test the engineered mosquitoes in the wild. Meanwhile, Oxitec, a British company James has collaborated with, has marched ahead and released engineered mosquitoes into nature.

Into The Wild

The Oxitec mosquitoes are engineered in a slightly different way from those James designed. The males are unable to produce healthy offspring. In 2009, the company released a batch of those males into a small area of Grand Cayman. Wild females mated with the engineered males, and their offspring died before they reached adulthood. Within three months, the mosquito population in the area fell by 80 percent.

Mohsin Raza/Reuters

A young man being treated for dengue fever in a hospital in Lahore, Pakistan

Despite the success of that first experiment, it may be awhile before transgenic mosquitoes are released on a bigger scale. The next step, James says, is to prove that the dip in a mosquito population actually reduces the number of dengue fever cases.

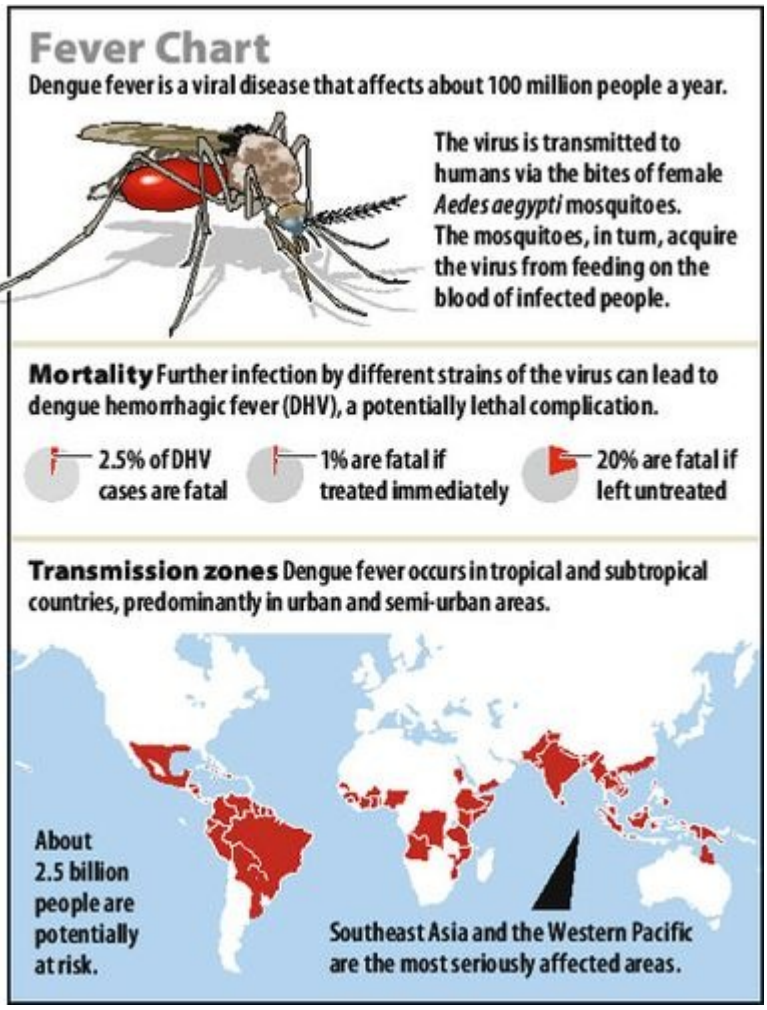
An even bigger problem may be dealing with critics who are wary of releasing transgenic organisms into the environment. Oxitec reportedly chose Grand Cayman for the experiment because of weak regulations there. Most other countries, including Mexico, where James works, have stricter policies about releasing transgenic organisms.

Genetic engineering has been going on for years. In fact, much of today's packaged food contains genetically engineered corn or soy. Still, many people are suspicious of genetic engineering. The environmental organization Greenpeace, for instance, likens transgenic organisms to "a giant genetic experiment" that could have unforeseen consequences for the environment and for human health.

James is sensitive to the criticisms. But, he says, "we don't think there are risks." For one thing, the engineered mosquitoes won't persist in the environment indefinitely. After all, they're designed to die. And in most of the world, *A. aegypti* is a nonnative species, he adds. Getting rid of the buzzing pests would actually return those habitats to a more natural state.

If the experiment is a success, dengue fever may be just the start. "Mosquitoes can transmit a number of diseases," James says. The most devastating is malaria, which kills close to 1 million people every year. Unlike dengue fever, which is spread by just one mosquito species, more than 30 species can transmit the malaria parasite. That makes it a trickier target for genetic engineering, but James contends the goal is within reach.

"We develop vaccines and medications, but for some diseases we have no tools," he says. "It's important that we look at all the science available to find something that will actually work."



AFP/Newscom; Source: WHO

Name: _____ **Date:** _____

1. Which of the following is not a symptom of dengue fever?

A. internal bleeding

B. blindness

C. fever

D. joint and muscle aches

2. James and other molecular biologists are genetically engineering mosquitoes in order to solve what problem?

A. the irritating noise of buzzing mosquitoes and the itchiness of mosquito bites

B. the spread of insecticides, which are harmful to the environment

C. flight muscle damage in female mosquitoes, which prevents them from flying

D. the spread of dengue fever, an infectious disease spread by mosquitoes

3. Which of the following conclusions about science is *best* supported by the passage?

A. Science can have unforeseen consequences for the environment and for human health.

B. Science is a useful tool for understanding the world around us but can do nothing to solve problems.

C. It is interesting to study science so that we can better understand the problems humans and the environment face.

D. If used responsibly, science can be used to help solve problems humans and the environment face.

4. Read the following sentences and answer the question below:

"For one thing, the engineered mosquitoes won't persist in the environment indefinitely. After all, they're designed to die."

In this context, what does the word **indefinitely** mean?

A. accidently

B. aggressively

C. slowly

D. forever

5. The primary purpose of this passage is to

A. persuade the reader to oppose genetic engineering

B. warn people about dengue fever

C. advertise a vacation to the Grand Canyon

D. explain a problem and identify possible solutions

6. What are two consequences of spraying *insecticides* to get rid of mosquitoes?

_____

_____

_____

7. How are the Oxitec mosquitoes different from the mosquitoes that Anthony James engineered?

_____

_____

_____

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

James understands the criticism of transgenic organisms, ____ he believes his genetically engineered mosquitoes will not be harmful to the environment.

A. because

B. but

C. so

D. before

