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Using Technology to Kill Mosquitos

At this year's CE Week in NYC the press had the opportunity to see many new products that might become the next great thing to enter the marketplace. At the Mosclean booth, company representatives were introducing an inexpensive capture/kill device designed to eliminate many mosquitos and other bugs from your home or backyard. To learn more about this device, view its testing by Dr. Phil Koehler, an entomology professor at the University of Florida, at www.youtube.com/watch?v=1_SalzzFdcQ.

The stimulating conversation with their company representative, plus my knowledge of the Zika virus threat, motivated me to explore the mosquito problem as a topic for this month's column.

The mosquito that carries the Zika virus is the *Aedes aegypti* (Photo 1). The birth defects it causes are so frightening that most people are now ready to declare the tiny mosquito public enemy number one. As I write this column in July, Congress is struggling to hammer out a \$1.1 billion funding bill to combat Zika and the other viruses transmitted by mosquitos.

Past solutions to mosquito-borne diseases have been the development of vaccines, increasing the use of insecticides, and the development of inexpensive and effective mosquito traps like Mosclean. A new biotechnology solution now exists, and it involves using altered DNA to wipe out specific mosquito species. This biotechnology genetically modified (GM) solution is fascinating.

On our recent trip to South America, my wife and I covered all exposed skin with an insect repellent that contained DEET. The application of a good insect repellent works for a trip to a known infected zone. However, it probably is an inefficient way to keep us safe at home. Zika has our atten-

tion because of the birth defects it causes, and the fact that the mosquitos that transmit it could soon be flying in many of our own backyards.

Of all the diseases carried by mosquitos, malaria is the most lethal. "Over one million people die from malaria each year, mostly children under five years of age, with 90% of



Photo 1—Of the over 3,500 mosquito species, less than a dozen can transmit diseases to people. This one can spread the Zika virus.

malaria cases occurring in Sub-Saharan Africa." (www.unicef.org/health/files/health_africamalaria.pdf)

A biotech solution that can work with any mosquito species has recently been developed at Imperial College London. This highly ranked research college in the United Kingdom has already proven that it can eliminate the mosquito that transmits malaria. With funding from the Gates Foundation, their Target Malaria research consortium now has the approval of three African governments to set up safe facilities to release slightly modified mosquitos.

This first batch of GM mosquitos that will be released cannot stop the spread of malaria. They will be used to teach proper handling procedures to the people who will eventually handle the mosquito killer population. How soon the potent release will take place is anyone's guess because so many scientists worry

about unexpected consequences of such a mass mosquito killing.

To eliminate the mosquitos that cause malaria, scientists used the CRISPR/Cas9 protocol to create a selfish gene in the laboratory population of male mosquitos. When these mosquitos are released, they mate with local unaltered females of their species. All of the male baby mosquitos from this mating will have this selfish gene and this gene will continually be passed to future generations of males. The population will begin to dwindle because all the females that are born from these matings will be born sterile. The new male mosquitos will just keep spreading their selfish gene until the local wild population of mosquitos goes extinct.

The Target Malaria consortium wants to move forward with a release of selfish gene mosquitos as soon as possible. Before this takes place the Gates Foundation wants to make certain that it has strong support of the local population in the three African countries where the release would take place. In Florida, the FDA has just approved the use of genetically modified mosquitos.

There are over 3,500 different mosquito species. Could scientists driving a few selected mosquito species to extinction have unintended negative effects? If you want to really explore this topic further enter "Gates Foundation Selfish Gene Malaria" into your favorite search engine.

Taking It a Step Further

1. Do you feel that these altered mosquitos should be released? Why?
2. What might be some of the unexpected consequences of such a release?
3. Build a better bug/mosquito trap: Working in teams, research and design your own bug-capturing system. This could be a design-only project, or a class project. If your class builds them, have a competition to see which team can catch the most bugs. 🐞

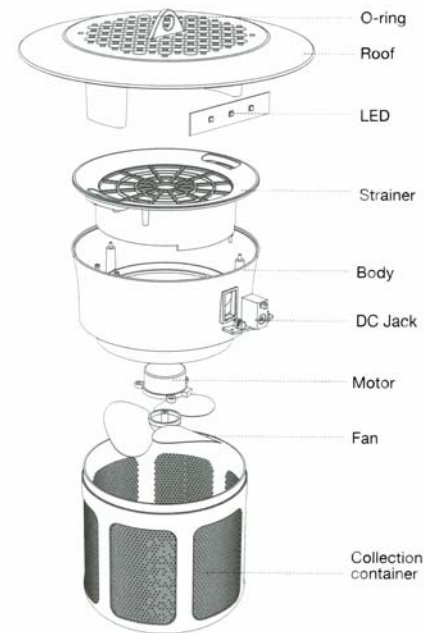
Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.

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Mosclean Insect Trap

The Mosclean mosquito trap is responsible for getting me to research this topic, so let's take a quick look at the device they sent me to test. See photos. It is inexpensive (\$34.95) and uses ultra violet LEDs that are set to the ultraviolet wavelengths that attract mosquitos and other bugs. Without a strong source of CO₂ the trap does most of its catching at night. It does have a Titanium dioxide (TiO₂) coated plate that is supposed to release a little CO₂ through a photocatalytic process. During trials that took place during daylight hours it failed to catch any bugs, so its CO₂ output must be minimal at best. At night it caught a lot of bugs including mosquitos.

When a bug flies close to its LED attractant a small fan causes them to be sucked into its container to die naturally. If unplugged, bugs that are not yet dead would be able to escape. On the positive side it did catch a lot of bugs including mosquitos at night. On the negative side it is not water proofed enough to handle a rainstorm. I considered this to be a major negative that I hope the company will correct when they release a new model. In a conference call with the team that developed Mosclean, I was informed that they will soon have a water resistance classification for this and all future models of the Mosclean.



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