

## Fire Ant!

MISSISSIPPI HIGH SCHOOL STUDENTS ARE GETTING UP CLOSE AND PERSONAL WITH THIS PERVERSIVE PEST—ALL IN THE NAME OF BIOLOGY.



KATHY MCKONE KNEW SHE WAS FALLING BEHIND. BY 2005, THE veteran high school biology teacher in rural Bogue Chitto, Mississippi, couldn't recognize many biotechnology topics covered in the newest textbooks. Even the products listed for sale in teacher catalogues—everything from thermal cyclers to amplification primers—were unfamiliar.

"It was all foreign to me," McKone says.

But not for long. McKone took action and, using the Internet, found teacher workshops in molecular biology that brought her to the campuses of some of the nation's premier universities, including Princeton, Harvard, and Cornell. Her newfound excitement and knowledge are having a big impact in Bogue Chitto, a crossroads community an hour south of Jackson that consists of a post office, two country stores, two gas stations, and a few churches. Now they are spreading elsewhere in the state.

McKone is one of five Mississippi high school teachers collaborating with scientists from the University of Mississippi Medical Center in Jackson and the Marine Biological Laboratory (MBL) in Massachusetts to develop a biology curriculum centered on a pervasive Southern pest—the fire ant *Solenopsis invicta*. HHMI has supported development of the curriculum, and Millsaps College in Jackson is also part of the team.

"Most everybody in the South has been stung by a fire ant," McKone says. As a child, McKone was often a victim as she played outside or worked in the family garden. And it hasn't stopped now that she's an adult: she was stung around eight times earlier this school year when she stood too close to a fire ant mound outside her K–12 school.

With apologies to William Shakespeare—who invoked "a muse of fire" in seeking inspiration for *Henry V*—the Muse of Fire project draws its inspiration from a venomous creature whose

sting has disrupted many a family picnic or football game. It leaves its victims with a distinctive white blister and, on occasion, a life-threatening allergic reaction. Swarms have been known to kill livestock and invade nursing homes.

"The fire ant is a unique point of interest, especially among children," explains Rob Rockhold, a scientist and administrator at the University of Mississippi Medical Center who has studied fire ant venom and conjured the Muse of Fire name from his college literature classes. "It also became obvious to us that fire ants just opened up a world of scientific disciplines."

Rockhold, who oversees the fire ant project with colleague Donna Sullivan and MBL scientist William Reznikoff, says the Muse of Fire project speaks directly to students and will enable them to learn about subjects ranging from molecular biology and environmental science to toxicology and human health.

Teams of scientists and teachers met last summer in Jackson to develop the coursework and a variety of experiments. Then each of the five high school teachers tested one part of the curriculum in a class to make sure the lessons moved students beyond fire ants to wider biology concepts. Some teachers took their students to fields filled with tall grass to observe how fire ants affect other insects in their local environment. Others devised experiments that allowed students to understand how fire ants prey on their victims—in this case, crickets—by using venom substitutes to determine the concentration of a fatal dose.

This past fall, McKone incorporated elements from Muse of Fire in Bogue Chitto's first biomedical research course. One September afternoon, she led seven seniors to a sandy area just outside the cafeteria that serves the school of 630 students. Although they searched for fire ants, their real quarry that day was a type of bacteria called *Wolbachia*, which lives inside the ant. Their goal? To determine whether Mississippi fire ants are infected with *Wolbachia* and, if so, the prevalence of the bacteria.

*Wolbachia* are complicated critters. They infect spiders and many insects, influencing their reproductive behavior in a variety

Left: Teacher Kathy McKone quizzes Bogue Chitto high school seniors Britney Saucier and Blake Sasser about extracting fire ant DNA. Right: Senior Tracy Adams concentrates on pipetting the DNA.

of ways. For example, the bacteria can cause all an insect's offspring to develop as females or allow only infected insects to reproduce. The bacteria live inside insect cells and are passed from generation to generation through the eggs. *Wolbachia* may also play a complex role in human diseases such as river blindness.

"The interesting thing is that one can use fire ants and other insects as investigative tools to find out if only some of them are infected with *Wolbachia* and why," says Reznikoff, who helped McKone design the *Wolbachia* portion of the fire ants project.

Back in McKone's large, bright classroom, the seven students huddle in three groups, smashing ants with the sealed end of a pipette tip. They make sure to crush the ant's abdomen, where *Wolbachia* are typically found. The next step comes straight from a molecular biology textbook: finding the bacterial DNA (if it is present) inside the fire ant cells. Using polymerase chain reaction machines borrowed from Florida A&M University—the same thermal cyclers that so puzzled McKone in 2005—the students go through the step-by-step process of extracting the DNA samples.

McKone occasionally stops to quiz the students on what they're doing, making sure they know what each chemical does or why they are heating up the sample. "They love it. They like understanding why."

Getting her students interested in fire ants has been easy, McKone says. She doesn't have to push them to read research papers or ask questions. They are motivated to learn because they are already interested in fire ants. "I didn't know there were so

many types of ants," says student Jerry Fry. "I thought an ant was just an ant."

So far, four ants from Bogue Chitto have tested positive for the *Wolbachia* parasite, all from the mound outside the cafeteria. Ants from another mound at the school and from two mounds off campus had no evidence of the parasite. When the students get the full *Wolbachia* DNA sequence back from MBL, McKone hopes it will tell them how these fire ants are related to those elsewhere or provide some insight into how the bacteria might manipulate fire ants' reproduction.

This summer, McKone, her fellow teachers, and the scientists will assess what they have learned and then finalize the five-part curriculum. They plan to make it available to teachers wherever fire ants are found.

Rockhold hopes the students' *Wolbachia* research can eventually be combined with that from other students throughout the South to help scientists find out what makes fire ants infected with the bacteria different from those not infected. "If there are enough folks doing the work at different sites, it might ultimately become a comprehensive and meaningful addition to the science," he says.

Meanwhile, McKone is happy her students have learned about molecular biology using a subject close to home. Perhaps it will inspire them to become researchers—and find a solution to a local problem, she says. "They would love for somebody—and I would love for them to be a part of it—to find a way to control fire ants." ■

—ANDREA WIDENER

## 2008 Holiday Lectures: Making Your Mind



HHMI investigators Eric Kandel (left) and Thomas Jessell (second from left) headlined the 2008 Holiday Lectures on Science, an annual December seminar that welcomes Washington, D.C.-area high school students to the Institute's headquarters in Chevy Chase, Maryland. This year's lectures delved into the complexities of the mind, memory, and movement. For fun, the students got to dabble in the ancient, now debunked, art of phrenology (far right). To learn more, visit [www.hhmi.org/biointeractive/](http://www.hhmi.org/biointeractive/).