In Their Own Back Yard
Students in rural schools need extra support to learn science. And educators are bringing it to them.

By Andrea Widener & Illustration by Nomoco
at Lake City High School in rural South Carolina, Patsy Williamson was approached by a student in her environmental and marine science class. He was writing about the local beaches and couldn’t figure out when visitors should go. Williamson suggested he draw on his own experience. “I said, ‘You’ve been to the beach and seen all the jellyfish, haven’t you?’” The boy looked back blankly. “He said, ‘No, ma’am. I’ve never been to the beach.’”

“I was dumbstruck,” says Williamson, a long-time teacher who was a newcomer to rural schools. “He lives 50 miles from the Atlantic Ocean.… That’s poverty. It’s not lack of motivation. It’s just poverty.”

Students in rural areas are often separated from their urban and suburban counterparts by more than just distance. Many live in communities that have faced decades of decline in the agricultural and manufacturing industries, and they grow up without money or opportunities. It can put them at a disadvantage in school—about half the children in rural schools fail to meet federal reading and math proficiency goals—and later, when they are choosing a college or a career.

That’s why many of HHMI’s science education grantees are focusing their outreach efforts on teachers and students from rural schools. Because long-distance travel is often out of the question, they are sending curricula and materials to rural teachers and finding research experiences within the rural communities.

“We recognize that it doesn’t do any good to tell rural teachers to take their kids to a great museum or somewhere else that would only be accessible in a city. There are special needs in a rural community,” says Robin Fuchs-Young, who directs an educational program at the University of Texas MD Anderson Cancer Center campus in Smithville, Texas, that focuses, in part, on rural schools. “We realized we could not only help provide resources for our rural community but also work on building a model that better meets the needs of rural school systems.”

Keeping Field Trips Local
More than 10 million students nationwide attend rural schools, according to a 2009 report by the Rural School and Community Trust, a nonprofit advocacy group. Getting to college is a long road for many of them because more than 40 percent of rural students live in poverty, and only 69 percent graduate from high school.

Rural school districts want to help their students overcome these barriers, but most just can’t afford it. Science is a special problem because of the expense. Districts often don’t have a tax base to support even the most basic science class supplies, like prisms and beakers, much less the expensive equipment needed for modern biology and chemistry labs. While some urban and suburban schools face similar budget problems, teachers in rural schools have fewer places to go for help: fewer local businesses to ask for donations of money or equipment, fewer scientists nearby to share their expertise, fewer universities and museums to illustrate why science matters.

“One of our biggest issues is showing kids how science can benefit them in the real world,” says Keith Starr, a science teacher at a charter high school built in a former peanut field in Gaston, North Carolina. Starr, who has worked with the Trust, doesn’t have many opportunities to invite scientists into his classes, but he has found the occasional scientist from outside who is willing to visit, including Howard University physics professor Walter Lowe who grew up in the area and NASA astrophysicist Harvey Moseley who Starr met through a member of his school’s board of directors.

Field trips are a great way to spark student interest, many teachers say. They offer a real-world view of science, but distance, time, and money make trips especially difficult for rural schools. That’s why Sara Swearingen and two dozen of her fellow teachers in rural Texas visited a hydroelectric power plant on the Guadalupe River between Austin and San Antonio, straining to hear over the rushing water and the loud buzz of the power equipment. On a sticky July afternoon, these central Texas teachers visited three sites for field trips that they may be able to re-create in many rural areas: a power plant, a cave, and an organic farm.

The visits are part of the Rural Schools Initiative run by Fuchs-Young at MD Anderson in Smithville, itself a rural community. “It was a response to the needs expressed to us by teachers, who are concerned about their students who want to stay in their rural community [after graduation]. They have very bright students who don’t have the kinds of scientific career opportunities that those in more urban and suburban districts might have,” Fuchs-Young explains. She and her colleague Heather Reddick started looking around their own rural town. “We found all kinds of resources and places that are in and around rural communities that provide rich learning environments and also show off scientific or health-related career opportunities.”

Every small town has a wastewater treatment plant, a farm, or a local hospital, for example. The Rural Schools Initiative trains
teachers to create local field trips at these kinds of nearby, low-cost venues. Field trips give students a chance to meet people who work in science, like Scott Kolbe, the technician who explains how water turns into electricity at the hydroelectric power plant, or Malcolm Beck, the organic farmer who wowed the teachers by showing them how garden waste feeds the fish he farms; and the fish waste provides organic fertilizer for the garden.

Swearingen, who teaches fourth grade in Smithville, says field trips have been canceled in her district because of budget cuts. No more trips to the state capitol or the Blue Bell ice cream factory 60 miles away. But field trips closer to home might be an option. “There are things out there,” she says, “we just don’t know what is available.” Reddick, Fuchs-Young, and the rest of the team help them find these resources.

**Science in a Box**

In far eastern Oregon, Rachel Aazzerah is the only science teacher for the tiny K–12 school in Monument, Oregon. She teaches the required science classes for all of the school’s 60 students starting in seventh grade until they graduate.

Aazzerah is lucky enough to have a great science lab with hoods and a prep room; many of her fellow rural teachers work out of aging classrooms with carpeting and no access to water, which can be both dangerous and discouraging for a teacher who wants to tackle hands-on activities. And she’s been successful in getting grants to help pay for equipment, like spectrometers and DNA gel electrophoresis machines, in part because with a master’s degree in biochemistry, she knew where to look.

Aazzerah’s biggest problem is time. Because she teaches so many different subjects, she has to prepare lessons and grade tests for up to five different classes daily (to save money, the school is on a four-day week). When she chooses to do hands-on labs, which is fairly often, Aazzerah spends her nights and weekends getting ready.

“Guts In A Box” and other science education kits offered by Oregon Health & Science University (OHSU) are a big help. The school has created six “In A Box” science kits specifically for rural teachers. They are funded by HHMI and distributed statewide through Oregon’s Area Health Education Centers (AHEC), which do educational outreach to rural communities.

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With a grass-covered dam in front of him and the fish-filled Guadalupe River behind, technician Scott Kolbe tells two dozen rural Texas teachers how a hydroelectric power plant operates and what training he needed to do his job.
and schools. (All 50 states have their own rural health centers.) Around 3,700 students used the boxes during the 2009–2010 school year.

OHSU’s Shera Felde, who helped design the kits, explains that they aim to give students a series of connected lessons on the same topic and, perhaps most important for cash-strapped rural teachers, the equipment needed to make the lessons fun. For the “Ear In A Box” kit, which Aazzerah has used in her classes, the lessons include ear anatomy using a plastic model ear, the science of hearing loss using a sound meter, pitch and volume, complete with a rollout piano and hearing aids, plus a lesson on how sound travels from the ear to the brain. Students also learn about science careers in audiology and hearing research.

Aazzerah says her students learned a lot from the lessons, especially the focus on hearing loss. As a teacher, she appreciated the guidance about what activities fit the state standards for different grade levels—and that it’s free. “It’s great especially when you don’t have that kind of equipment in your room. You are able to use it and send it back,” says Aazzerah, whose small budget barely covers textbooks. “[OHSU and AHEC] even pay for the shipping.”

The original idea was for OHSU to train teachers in person on how to use the “In A Box” kits, but the distances proved too difficult to overcome. Now the boxes come with written instructions and a teacher training video. Like Aazzerah, who lives more than three hours from the nearest community college or university, many rural teachers don’t have regular access to teacher training. “It’s hard for working teachers in a non-city environment to get their science courses,” says Barbara Speziale, who directs HHMI’s science education program at South Carolina’s Clemson University.

Speziale and her colleagues learned that rural teachers can’t take classes that meet once a week at a college hours away. So they designed intensive graduate-level summer classes to help rural teachers learn new skills or incorporate more hands-on science in their classes. The Clemson team created short classes—one to two weeks on campus—based on the teachers’ interests and state standards. The eclectic mix that resulted includes focused lab science courses like “Welcome to the Gene Age” and “What is Bioinformatics?” as well as ecology and natural science courses like “Ethnobotany and Ethnoecology of South Carolina” and “Teaching Your Watershed.”

Deb Whittington, a science specialist at J. Paul Truluck Middle School in Lake City, South Carolina, has taken several Clemson classes, both the intensive summer courses and newer online offerings. “I probably wouldn’t be able to do it if these were traditional courses offered only during the normal school year,” she says. What’s more, Clemson often provides materials—microscopes, electronic sensors, stains, or cellular growth media—that the schools wouldn’t be able to fund otherwise. “They make it so you’re comfortable that you can go back and use it in your classroom,” Whittington says.

Do and Learn

Seventeen-year-old Severin Gilbert lives just outside Ulm, Montana, population 750, and goes to a kindergarten through 12th grade school in the slightly larger town of Cascade. Because the school is so small—about 30 students per grade—most classes are offered only during one class period each year, and scheduling conflicts can often mean that science classes take a back seat

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**Exposure to the Possibilities**

*In bad financial times, field trips are often the first cut that rural school districts make. But if someone else is paying the bills, taking students to visit a university can be immensely valuable.*

Every year, Patsy Williamson takes a few of her students more than 200 miles from Lake City, South Carolina, to Clemson University, where students from nine rural, largely minority high schools and middle schools tour the campus, meet scientists, visit labs, and talk to college students. The trip involves a four-hour bus ride each way and a biology achievement test once they get there, but Williamson’s students fight for the chance to visit a college campus, most for the first time. “They find out a lot about possibilities, about opportunities, what kind of jobs you might be able to get. And when they see [Lake City graduates] there they realize ‘I can get there too,’” Williamson says. “These kids are really poor, but they are good kids. This is the best teaching experience I’ve had.”

*Barbara Speziale, who directs HHMI’s science education program at Clemson, was inspired to help rural students and teachers by the grim reality facing South Carolina: only 14 percent of South Carolina-born state residents have bachelor’s degrees, and the state ranks 48th in the percentage of ninth graders who graduate from high school within five years and go on to college. As the tobacco farming and textile manufacturing industries have declined, the problems in the state have gotten worse. “I have visited many of these rural communities,” Speziale says. “In some, there is no opportunity as far as the eye can see.”*

*A visit to Clemson during high school changed Satoya Murray’s path. She grew up in Clio, South Carolina, a former textile town with a population of less than 1,000. “It definitely got me more interested in science, seeing all of the opportunities that they had to offer,” says Murray, now a junior majoring in biological and health science at Clemson and the first in her family to go to college. After her visit, she thought, “Man, this is like a whole new world. A world you definitely want to be a part of.” —A.W.*
She stumbled across Bennett’s Mill pond one day and thought it would be the perfect place to teach students the frustrations and rewards of real research.

Farmers brought corn to the mill pond for grinding for hundreds of years. Today, the mill is gone, but Karl and the teachers take students onto the 100-acre pond in canoes and help them decide what would make a good research topic. The young researchers then spend the next two years at this local site collecting and analyzing their data, with the help of their teachers as well as state biologists and extension workers. “It is an experience they can’t get in a regular classroom,” Karl says. “The biggest value to the students is that they are empowered when they work on a project like this. They have total ownership of it.”

Student Joel Moreland spent his childhood fishing on the mill pond, Karl says. He wondered whether a drought in 2007 had harmed the black crappie population, so he designed an experiment with local fish and wildlife scientists to determine the age of the remaining black crappies by looking at their length, weight, and a bone in the fish’s heads. Joel, currently a senior, is still collecting data, but so far the fish that would have been born in 2007 are missing from the lineup. “This is Joel’s learning laboratory,” Karl says. “He’s really excited about this work and knows what he’s doing is making a difference.” Of the 74 students who have participated in the project, 86 percent are attending a four-year college and 70 percent are majoring in science.

Research centered on local resources is a model that is applicable anywhere, says Karl. “Not every county has a mill pond, but they have other resources. Projects like this work really well in our rural communities,” she adds. “We do have great resources. We just need to learn how to use them.”

Heather Reddick (left) from University of Texas MD Anderson Cancer Center campus in rural Smithville, Texas, identifies field trips that can be done in almost any small town. Sara Swearingen (right), a fourth grade teacher from Smithville, plans to encourage her cash-strapped district to organize local field trips, to sites like farms, recycling centers, or power plants.

To see an audio slideshow of this summer’s field trips sponsored by the Texas-based Rural Schools Initiative, visit www.hhmi.org/bulletin/nov2010.

Matt Rainwaters

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