Health Oasis in the Desert Southwest

In the desert Southwest, communities are slaking their thirst for knowledge with an outreach program that is overflowing with environmental health information. The Southwest Environmental Health Sciences Center (SWEHSC) at the University of Arizona in Tucson is one of 21 such centers that, along with 5 Marine and Freshwater Biomedical Sciences Centers and 1 Developmental Center, make up the 28 NIEHS core centers. Each center includes a Community Outreach and Education Program (COEP) that serves as an "information aqueduct," carrying the results of research on environmental health issues to the people affected by them, particularly those who are the most vulnerable.

At the SWEHSC, outreach efforts especially target schoolchildren. COEP director Stefani Hines, who holds master's degrees in both education and environmental science, has 10 years' experience in K–12 education. "Because of my comfort and connections in education, the majority of our program focuses on that target audience," she explains.

K–12 Education

The COEP Web site, located at http://swehsc.pharmacy.arizona.edu/coep/, is a centerpiece of the center's outreach efforts. Although it proves informative for anyone who is interested in toxicology, it is aimed mainly at teachers and their students. Among the educational resources are downloadable lectures, presentations, activities, and curricula, primarily intended for seventh- to twelfth-grade students.

The materials cover topics such as air quality and naturally occurring pesticides; lectures and presentations introduce users to cancer processes, toxicology basics, effects of nicotine and alcohol, and drug development from plant compounds. The site also describes K–12 programs in toxicology and environmental health science and programs that are currently in development. One Web-based offering is Cluster Busters, a curriculum that presents information on disease clusters and casts students as scientists charged with investigating the outbreaks.

The COEP also holds summer workshops for teachers. These workshops, collectively titled "Integrating High School Science Content Through Toxicology," adopt a different toxicologic focus each year and offer lectures by center researchers, research discussions, and hands-on activities. "I am proud to say we get many repeat participants, which is the ultimate compliment to a program," says Hines. Another program, the Environmental Health Sciences Training & Education Program, partners with eight other COEPs to incorporate toxicology into K–9 lesson plans. The program is taught to teachers who then further disseminate the guidelines to their colleagues.

Hines is especially proud of the Integrating Multiple Perspectives Across the Curriculum for Today and Tomorrow (IMPACTT) program. Beginning with the 2000–2001 school year, this program links all elements of the high school core curriculum to a central environmental health sciences theme. For example, one major project focuses on cancer, particularly tobacco-related cancer. In the basic biology portion of the project, students use the Ames test to see if a chemical causes cellular mutations. Math concepts and computer skills are used in learning about population statistics and conducting data analysis. Students then create a storyboard, write narration, and develop interview questions for a video that they film and edit themselves. Cancer treatment and prevention are researched, and students plant a garden containing foods high in antioxidants. A cultural aspect is included in the project with a guest speaker on American Indian uses of tobacco.

The program is designed with a particular emphasis on attracting American Indian students. Community members are asked to help infuse American Indian culture into the curriculum, for example, by providing the Indian names and traditional uses for plants being studied. As the program evolves it will address specific environmental health issues that disproportionately affect the American Indian community, such as mining, water rights, water pollution, and beryllium exposure through smokestack emissions. Hines says American Indians have a severe shortage of people working in the environmental health and monitoring field. "One of our goals is to connect Native American students with their unique cultural history and environmental stewardship and hopefully get them excited about a career in environmental health sciences," she says.

Hines helped corral some of the resources and expertise supporting the program, bringing in faculty and graduate students in toxicology and microbiology from the University of Arizona. She also helped design and develop the IMPACTT curriculum, coordinate program activities, and provide supplies and materials. "The partnership [with the COEP] has been extremely valuable for utilizing resources at the university in a creative and beneficial way," says Ron Ransom, director of the Native American Education Program for the Sunnyside Unified School District. "I can definitely say that the program would not have taken off without their assistance and help."

The IMPACTT program is currently available only at one Tucson school, Sunnyside High School, says Ransom. Recently it was expanded through a supplement to the center from the NIEHS. The 2001–2002 school year cohort for the IMPACTT program will include 160 students, and 6 teachers will cover the core curriculum.

Ransom says the curriculum exceeds state academic requirements and also provides students with opportunities for internships and employment with organizations and agencies in the environmental health sciences field. "We wanted to give [students] a sense of how what they were learning connected with real life," says Ransom. "In this program they get a chance to see that their

A new kind of education yields a rich harvest. Ninth-graders participating in the IMPACTT program plant a garden of native plants as part of two overlapping projects, one on the relationship between diet and cancer, the other on organic gardening using American Indian planting techniques.

Terry Seward, Sunnyside Unified School District

learning has real value and importance." Some students may even decide to pursue further education in the environmental health sciences. "We want to expose students to the sciences as much as possible and show that it's not dry, boring stuff," Ransom says.

Partnerships

Carrying out the mission of public outreach and education usually involves forming partnerships, says Hines. The SWEHSC has partnered with other University of Arizona programs such as The Biology Project, an interactive Web site for biology education located at http://www.biology.arizona.edu/, which was designed mainly for high school and college students. The SWEHSC collaborated on the Chemicals & Human Health portion of the site, which offers lessons and tutorials on metal toxicity and the kidneys, general toxicology, and lung toxicology.

Other partnerships link the COEP with external organizations. A newly funded grant through the U.S. Environmental Protection Agency (EPA) Environmental Monitoring for Public Access and Community Tracking program teams the COEP with Tucson Water, the utility that manages the city's water supply. Water resources are a key environmental concern in the desert Southwest. Groundwater has been Tucson's major water source, and it is rapidly diminishing, leading to serious environmental consequences such as land sinking, declining groundwater quality, and disappearance of riparian areas. Additionally, any lowered EPA drinking-water arsenic standards could mean that Tucson Water would need to close several wells.

In May 2001, the utility plans to recharge the aquifer with water diverted from the Colorado River through the Central Arizona Project (CAP), a state system that oversees the water supply. Hines says Tucson Water first introduced CAP water to the city several years ago. The piped-in water differed from groundwater in pH and mineral content; as a result, the "new" water dislodged rust in water pipes and became orange and smelly. Weakened pipes that were essentially held together by rust or scaling broke, adding to public ire. "Most people perceived the water to be highly polluted and corrosive and refused to drink it," Hines says. The water itself was fine and needed only a pH adjustment. But at that point, people were in no mood for a chemistry lesson, and even after the problem was identified the public wanted nothing to do with CAP water. With the reintroduction of CAP water—this time mixed with groundwater into a more palatable blend—the COEP is developing plans to help educate the public about the new water. "[But] there is a lot of anger and skepticism to overcome," Hines says.

In another project under this same EPA program, the COEP pairs with the Pima County Department of Environmental Quality to address air quality education. "The Tucson community has to date enjoyed the benefits of good air quality," says Beth Gorman, a program manager for the department. However, she adds, the area is experiencing enormous growth. In addition, the Tucson area is bordered on two sides by National Parks, which need special protection. Initially, the department had ample information on air pollution levels, but it still lacked a strong public health knowledge base.

High-impact learning. The IMPACTT program teaches students about the role of diet—including eating traditional native foods such as squash—in some forms of cancer as well as how antioxidants protect against cancer.

To remedy this lack, the COEP and the Department of Environmental Quality developed several electronic tools for learning about air quality, which are available on the COEP Web site. They include summaries for health professionals and tutorials and interactive activities for the general public on topics such as local air pollutants, how air pollution can affect health, who is at risk, and actions that can help curb air pollution. Other materials will be posted at the soon-to-be-launched Air Info Now Web site (http://www.airinfonow.com/), a partnership between the COEP, the Pima County Department of Environmental Quality, and several other agencies and organizations. The site will offer real-time air quality data plus information on Pima County air pollutants, how they affect health, and what can be done to reduce them.

"[The COEP staff] have helped us immensely to provide up-to-date, accurate, and in the case of the Web-based classroom activities, highly interactive information to the public," says Gorman. The COEP will also help inform health professionals about services available to them through the SWEHSC and the Department of Environmental Quality.

Support for Success

Hines asserts that the outreach program wouldn't succeed nearly as well without the support of the center and especially its director, Dan Liebler. Liebler plays an important role in setting the center tone for outreach, as well as scientist involvement with outreach, says Hines.

From the beginning of his tenure, Liebler has emphasized that the COEP is an important, integral part of the center, Hines says. Under his leadership, COEP activities are ensured presentation at the annual center Science Fair and other public events. Liebler requires that center investigators participate in the COEP, and he has invited Hines to participate on the center's internal advisory board, in the administrative core, and in pilot project reviews. Furthermore, he has also actively championed the IMPACTT program by securing funding from the university Center for Toxicology and by applying for NIEHS supplemental funds, says Hines.

Hines predicts that the center's outreach activities will always have a strong K–12 education focus. However, she also anticipates expanding COEP activities to include more of the general public. "They, too, are a very important constituency to educate," she notes. For example, in addition to the partnership with Tucson Water, Hines will be participating with the Unified Community Advisory Board for the Tucson International Airport Area Superfund site, and the COEP hopes to host an NIEHS Town Meeting in the future, she says. Such meetings often serve as a catalyst for more community interaction, Hines notes, which is, after all, a main goal for all environmental health sciences centers. **–Julia R. Barrett**

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