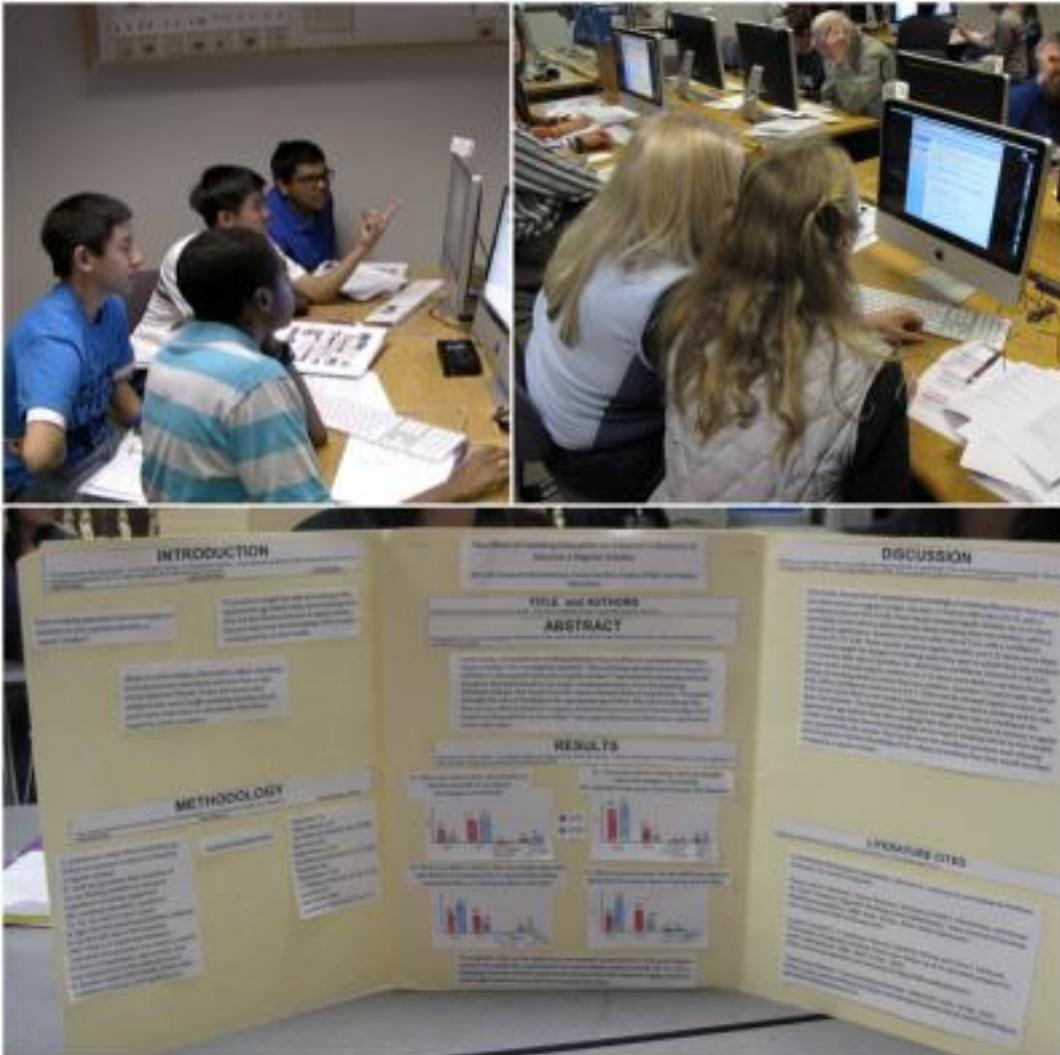


High-school course on smoking behavior research wins Science magazine prize

EurekAlert!

Students use database and blood samples to assess environmental, genetic influences



Science educator Maureen Munn will never forget a classroom experience that seemed to crystallize her ideas about bringing real science to high-school students. A 10th-grade girl, having used electrophoresis and staining on a DNA sample to reveal its components, was so excited that she grabbed the results and ran out of the classroom to show her friends. "Look what I did," she said, showing them how the sample's millions of DNA molecules had separated into bands.

"I was learning just how important it is for students to have a real science experience," says Munn, director of education outreach in the University of Washington's Department of Genome Sciences, "not just through a textbook, but through their hands."

By engaging students in the real practice of science, Munn and her colleagues at the University of Washington have been selected to win the *Science* Prize for Inquiry-Based Instruction (IBI). Their prize-winning course module, Exploring Databases, allows students to compare genetic and environmental influences determining why people smoke.

The *Science* Prize for Inquiry-Based Instruction was developed to showcase outstanding materials, usable in a wide range of schools and settings, for teaching introductory science courses at the college level. The materials must be designed to encourage students' natural curiosity about how the world works, rather than to deliver facts and principles about what scientists have already discovered. Organized as one free-standing "module," the materials should offer real understanding of the nature of science, as well as providing an experience in generating and evaluating scientific evidence. Each month, *Science* publishes an essay by a recipient of the award, which explains the winning project. The essay about Exploring Databases—co-authored by Munn, Hiroki Oura, Mark Gallivan, Katie Van Horne and Andrew W. Shouse—will be published on July 26.

"Improving science education is an important goal for all of us at *Science*," says Bruce Alberts, *Science* editor-in-chief emeritus. "We hope to help those innovators who have developed outstanding laboratory modules promoting student inquiry to reach a wider audience. Each winning module will be featured in an article in *Science* that is aimed at guiding science educators from around the world to these valuable free resources."

Munn grew up in Canada, primarily in Winnipeg. Her parents had both been raised on farms and were always interested in nature and birds, Munn says. Most of the family's vacations were camping trips. Munn says it seemed a natural extension of her upbringing for her to develop an interest in science. "My parents had a general awareness of the natural world around them, which is so important, especially for children to experience."

Munn underwent an intensive undergraduate program in biochemistry and microbiology at the University of Victoria, where she was one of just four full-time majors in her department. The small size of their group translated into high expectations on each of the four, and by the summer of their third year, Munn was working in a forestry lab. After graduating, she went to work as a research technician in Edmonton, which led her to graduate school at the University of California at San Francisco—where she studied DNA replication—and to a post-doc at Yale University.

It was after being at Yale that Munn decided she wanted to be involved in science education. She worked with Nancy Hutchison, of the Science Education Partnership at the Fred Hutchinson Cancer Research Center, and later took a position at the University of Washington, where she worked on the High School Human Genome Program, sequencing human DNA with high-school students.

One of the genes Munn investigated with students was implicated in nicotine

addiction. The high school teachers whose students were involved gave Munn and her colleagues the feedback that students wanted to know more about the smoking behavior of the subjects whose DNA was being studied. The students had a personal interest, with their teachers reporting that at some schools, the students' families or friends had experience with drugs of abuse, including tobacco and cocaine.

"They were very interested in learning about those topics because they did affect them," Munn says.

Over time, the project morphed into an epidemiological study involving people who smoked and controls, who had smoked between 11 and 100 cigarettes over the course of their lives but then stopped.

"Our study would focus on people who continued smoking by looking at people who didn't," Munn says.

The resulting course module looks at a database built from a survey of the study subjects regarding environmental influences on their smoking behavior. It also examines the results of a small blood sample provided by the subjects, which was used to genotype their DNA at three gene regions shown in other studies to be associated with smoking. Developing their own hypotheses and then testing them, students learn case-control study design, epidemiological analysis and the fundamentals of statistics, used to distinguish actual causality from mere association. The students even learn the limits of their study, such as its relatively small size, its inclusion of three gene regions when many others have also been implicated in smoking behavior and its susceptibility to recall bias as subjects recount their experiences.

"Part of their learning experience is recognizing the shortcomings of the study," says Munn. "The important thing is that students are able to propose their hypothesis, to be able to say whether the data supports it and to defend their results—or to reconsider them."

Exploring Databases is packed into seven one- and two-hour lessons. Making use of the Smoking Behavior database, as opposed to having students gather their own data, makes the course doable and affordable.

"Exploring Databases not only gives students access to a wealth of data for them to test their hypothesis with, but also has the additional advantage of zero cost implementation," says Melissa McCartney, associate editor at *Science*.

Munn's hope is that the Exploring Databases essay in *Science* will cause other science educators to become interested in the course module, or to develop other kinds of case-control studies for use in their classrooms.

"The best thing for me would be to get emails from teachers around the country and around the world who would say, 'I'm interested in using this, but I had some questions,'" Munn says. "Establishing a continuing dialogue would be wonderful."

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