

Northwestern University
McCormick by Design

Robert R. McCormick School of Engineering and Applied Science

Fall 2003

Research fair

showcases undergraduate work

Derek Shiell (electrical engineering '04) is surrounded by a gaggle of classmates. In his hand is a plastic box the size of a pack of cards, Shiell's prototype for a personal ultraviolet wave detector — a device that may one day find its way into beach bags everywhere. With input from users about their skin types and the SPF number of their sunscreens, the detector will be able to monitor their exposure to UV radiation and sound an alarm if that level reaches potentially harmful levels.

The venue for Shiell's ad hoc presentation is a lakeside room in Norris University Center, where some 200 undergraduates have come together at Northwestern's first Undergraduate Research Symposium (held last May), displaying posters highlighting work they did under faculty direction. The topics presented during the daylong symposium cover everything from ethics to breast cancer, with a predictably healthy number of entries from McCormick students.

The symposium has the air of a ramped-up high school science fair. Although the work presented is more complex and subtle than the projects that fill gymnasiums across American, the air of excitement is comparable — with proud faculty substituting for doting parents.

"I never thought I'd be able to do this much research as an undergraduate," says Shiell, who credits the help and encouragement he received from his faculty sponsor, Manijeh Razeghi, Walter P. Murphy Professor of Electrical and Computer Engineering. "She was gung-ho. She makes you want to do this stuff. Her idea was to make a device to demonstrate a real-world application



of the material I was studying" — a wide-bandgap III-Nitride semiconductor photo-detector grown at Northwestern's Center for Quantum Devices. Razeghi assigned Shiell a graduate student mentor who helped with the circuitry, design, and packaging of the device. Shiell hopes to refine his device further, perhaps integrating it into a biological and chemical agent detection system.

Razeghi, standing nearby, explains her enthusiasm for undergraduate research: "I'm not only teaching, I'm showing them the applications, how they can build devices that demonstrate theory." Shiell's project, Razeghi says, was the fourth generation of a project that started nine years ago — one she has used as a teaching device for undergraduates and graduate students. Razeghi especially likes to link undergraduates to graduate student mentors. "Each teaches the next," she says.

One row over, senior industrial engineering major Elaine Cao explains research she did under the direction of Karen Smilowitz, assistant professor of industrial engineering and management sciences. Cao's poster sports a shiny Mercedes Benz



Above: Derek Shiell and Manijeh Razeghi.
 Left: Karen Smilowitz and Elaine Cao.

logo in one corner, a map of the United States, several charts, and a summary of the Traveling Salesman Problem: Given a finite number of cities and the cost of travel between each pair of them, find the cheapest way of visiting all the cities and returning to your starting point. Cao has applied routing heuristics and mathematical programming to develop the most efficient system to transport and distribute the German luxury cars.

Cao's project grew out of her internship with the carmaker the previous summer, and she did the research as part of her honors thesis and course work with Smilowitz, who wrote a thesis on a related topic as an undergraduate at Princeton. "Elaine did an impressive job getting the necessary data, and she brought a lot of creativity to the project," says Smilowitz. "We have a great pool of undergraduates at Northwestern, and students who do research tend to be very motivated. It's exciting to see them take on that challenge." Best of all, she says, is that research gives undergraduates an opportunity "to go beyond the textbook, to take what they learned in the classroom and apply it to a real-world problem."

All in all, a great day at the fair.

—*Leanne Star*