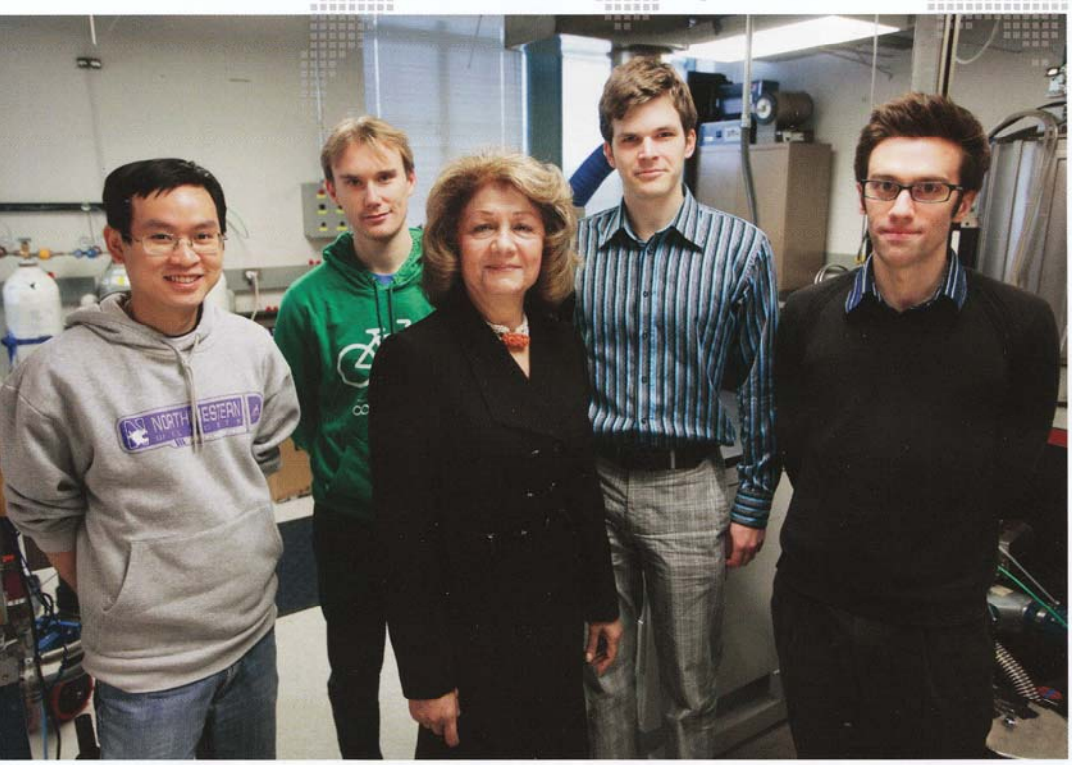
French connections

Manijeh Razeghi thinks globally



Andrew Campbell

Manijeh Razeghi (center) with her students (from left) Minh Binh Nguyen, Pierre-Yves Delaunay, Simeon Bogdanov, and Nicolas Pere-Laperne

Part of Manijeh Razeghi's heart and soul will always be in France. Though she came to the United States more than 17 years ago, she got her start in Paris, and all of her family is still there. She keeps up her French connections by collaborating with prestigious French universities — and recruiting their best students.

"The French students are hard working with good backgrounds," she says. "Our connection with France is growing all the time."

Razeghi, the Walter P. Murphy Professor of Electrical Engineering and Computer Science and director of the Center for Quantum Devices, received her MS, PhD, and ES science doctorate in physics from the University of Paris 6 and 11. She began her career in France, first as a senior research scientist and then head of the Exploratory Materials Lab at Thomson CSF, one of the leading international companies in semiconductor devices. At that time, she already had many connections with the academic world, especially with the Ecole Normale Supérieure in Paris and the Ecole Polytechnique, and she has continued those relationships to this day.

Each year Razeghi hosts several visiting student researchers from France. Many come from the Ecole Polytechnique, where every student must perform a four-month internship. Now every time Razeghi goes back to Paris, she interviews students who want to come to her lab. "From 8 o'clock in the morning, they come group by group," she says. "I want to be sure they know it's hard, and I want to see how good they are. This collaboration works well for me because they send very strong students, and working in my facility is hard. It's a very competitive area."

Some students have even decided to pursue their PhDs at Northwestern after completing their four-month internship. To formalize this type of arrangement, she is in discussions with Ecole Normale Supérieure and Ecole Polytechnique to create a collaborative PhD program. Razeghi also receives master's students from the Université Pierre et Marie Curie for internships.

When students arrive in Razeghi's lab, they find that the work is challenging, but it ultimately pays off. Ecole Polytechnique alumnus and current McCormick PhD student Simeon Bogdanov says that he heard about Razeghi's lab from his adviser and then contacted Razeghi to see about doing a master's thesis in her lab. "I was expecting a master's thesis in six months," he says. "She said, 'No. You have to apply for a PhD.' It only took me 30 seconds to decide."

"I don't want to accept students for just six months," Razeghi laughs. "I want them for their PhD. I want to invest for the long term."

Another former Ecole Polytechnique student, Minh Binh Nguyen, says his time in Razeghi's lab changed his life. "I realized that experimental work is just as important as the theoretical work. Professor Razeghi told me I could do theory here as long as it was applied to what we are doing. Once I saw the results in our group, I realized how lucky I am to have invaluable experimental data to build and to support a theory."

PhD student Can Bayram likened Razeghi's lab to a steel factory. "She can take iron and mix it with other materials and make it stronger," he says. "We know that we are strong, but now we know that, thanks to her persistence, we will graduate stronger."

Such an environment isn't available in Europe, Bogdanov says. "I think every European scientist should come to the United States at least once and see how people work here."

In addition to lab work, Razeghi's students are involved in research with Nanovation, a French company founded by Razeghi's daughter, F. Hosseini Teherani, who was the Eshbach Scholar at McCormick in 2008. Nanovation manufactures and commercializes high-quality zinc oxide thin-film coatings and nanostructures. The collaboration between Razeghi's lab and Nanovation has brought about new designs for white light–emitting diodes, which may eventually replace light bulbs for lighting applications.

With such a successful track record, Razeghi says she will continue to do her best to facilitate future collaborations with France. She is confident that these collaborations strengthen both McCormick's relationship with France and the scientific community as a whole.

—Emily Ayshford

South Korean catalyst fuels materials research

While McCormick continues to seek out international collaborations, other countries are looking here for partnerships as well. In South Korea, for example, an initiative called Brain Korea 21 that funds interactions between South Korean and American universities spurred Wooyoung Lee, a materials science professor at Yonsei University in Seoul, to contact Peter Voorhees, the Frank C. Engelhart Professor of Materials Science and Engineering and chair of the department, about a collaboration. A deal was struck and in 2007 Voorhees traveled to South Korea for the kickoff meeting — which, it turned out, was scheduled for Thanksgiving Day.

"I said, 'Do you realize that's Thanksgiving?'" Voorhees says. "And they said, 'No, but could you still come?' So I was the only Westerner in the hotel."

Since that Thanksgiving two and a half years ago, the two professors have traveled to each other's universities once or twice a year to combine research strengths in the field of nanowires. Lee explains why he chose McCormick for the $2 million program. "We wanted to work with a good university, and Northwestern has one of the top materials science departments in the country. And it shows: Northwestern has been very active, and our collaboration has developed well."

Since the collaboration started, Voorhees and several other materials science and engineering faculty members from McCormick have traveled to Yonsei to give talks and meet with professors. Several Yonsei faculty members and students have in turn come to Northwestern to use McCormick's equipment, such as the three-dimensional atom probe, for research.

"It gives our graduate students interactions with people overseas," Voorhees says. "And Northwestern benefits from bringing our name overseas."

Lee first sought a collaborator because he had developed a simple way to grow single-crystal nanowires that have unique transport and thermoelectric properties but needed Voorhees's expertise in the growth mechanisms of nanowires. "He knows the physics of thermoelectric materials, and I help with the mechanism," Voorhees says.

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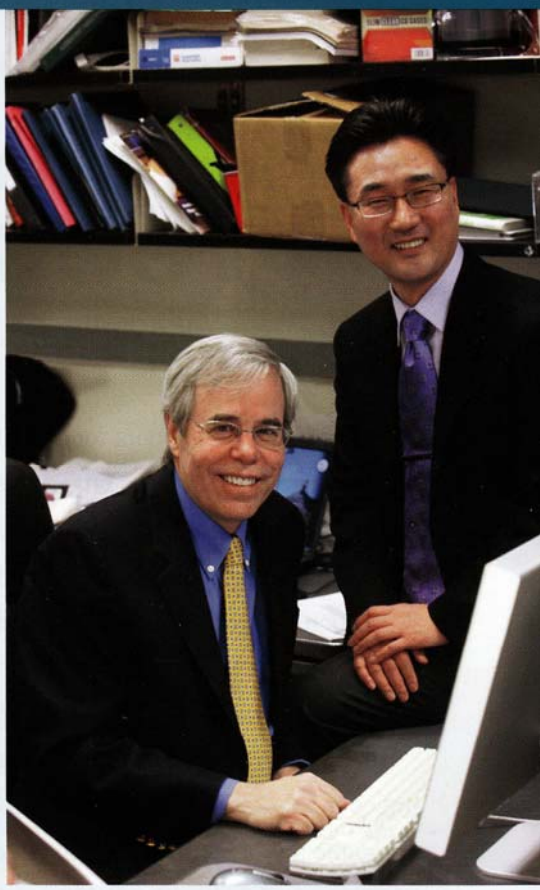

Peter Voorhees and Wooyoung Lee

The professors say efficient thermoelectric nanowires could replace Freon in appliances like refrigerators, and that would reduce pollution. "It's hard to come up with materials that are efficient enough to do that," Voorhees says. "If this works, it would have a big impact."

Because the two see each other only about twice a year, most of their communication happens via e-mail. When Lee visited Evanston recently, he and Voorhees set aside an afternoon to discuss a paper they hope to publish. Both hope the collaboration continues for years to come.

"Peter has been very generous and has been a good friend," Lee says. "Our strengths make a good combination."

"I had never been to South Korea before," Voorhees says. "It has given me a window into a new culture that I wouldn't have known without this. And it's been delightful. Hopefully we can keep this relationship going in the long term. It can be hard with schedules, but it's collaborations like these that create big progress."

—Emily Ayshford