IN CLASS

Design Time

Senior biomedical engineering students design medical devices for hospitals and industry.

By Kathleen McGarvey

When Lynn Wood at Unity Health System in Rochester used to help patients rehabilitating from strokes and traumatic brain injuries to improve their walking gait, she paid a physical price.

"The work was taxing on our bodies," says Wood of her team of physical therapists. "We're bent way over and have to lift the limb, and we could only do it for a short time."

So when Amy Lerner and Scott Seidman, associate professors of biomedical engineering, asked if the therapists might have a project for Rochester's senior design course, the answer was an emphatic yes.

The students—supervised by Seidman—went to work, consulting with Wood over six months as they proposed solutions, developed designs, and manufactured prototypes for a chair that today is in constant use at Unity Health.

"I love it," says Wood. "We use it for rehabilitation, but it could also be useful for older people, or for gardening."

The chair also caught the attention of a local company, which is in the process of licensing the students' design.

"It was a lot of fun—to have this thing that worked, that did what we wanted it to do, and that people would pay for," says Brian Flynn '09, a member of the team, called Therassist.

Flynn's experience is what a yearlong, capstone course required of all biomedical engineering majors aims to provide. Senior Design is built around hands-on experience in designing medical devices or research instruments. "Our goal is for students to apply as much as they can of what they've learned in biomedical engineering to a real-world problem," says Lerner.

"We try to make it a realistic experience for them," Seidman says. "What's not real is the nine-month time frame. These things can take years. But the frustrations they encounter are very real."

▲ **PROBLEM SOLVERS: "The students create the solution," says Amy Lerner, an associate professor of biomedical engineering who helps lead a course in which students design medical devices for area hospitals and health care companies.**

Students collaborate in 15 four-member teams, and apply to work on specific projects by demonstrating the skills and experiences that they bring to the group.

Collaboration is a critical skill, says Kevin Staton '09, a Therassist team member and now a research specialist at the University of Pittsburgh Cancer Institute. "When you're interviewing for biomedical engineering jobs, one of the questions employers will ask is, are you comfortable working on a team?"

Ideal projects, Lerner says, are "backburner" ideas that need brainstorming, significant improvements, or a fresh look.

"For some projects, they just have a need," she says. "Other times, there's an existing device that needs to be refined. And it's open-ended. The customers aren't married to a solution. The students create the solution."

Customers typically come from the Medical Center, the community, local industry, and area hospitals. But they needn't be based in Rochester. This year's projects include three carried out with students and

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faculty at Pontificia Universidad Católica del Perú in Lima, Peru.

Among this year's other projects are a portable and cost-effective *E. Coli* detector, a dynamic brace to extend chronically contracted arm and wrist muscles in patients with traumatic brain injuries, a radiation exposure detection system for urban populations, and improvements to a childbirth simulator for training medical professionals.

"We're thinking about real people and how our project will affect them," says Nicholas Vavalle '10, from Binghamton, N.Y. He's on one of this year's design teams, called Lens Metrix, which has created a device for Bausch & Lomb to test the material properties of soft contact lenses.

Renea Faulknor '10, from New York City, and her teammates met with representatives of Becton, Dickinson and Co.—a New Jersey–based medical supply, device, and technology company—to compare ideas on an injection test device that nurses and EMTs could use to learn how to draw blood.

Faulknor and members of Injector Perfectors designed a simulator that reproduces the challenges medical technicians and others often encounter.

"We're trying to model venous system complications such as collapsible veins and small or fragile veins," Faulknor says.

Students are treated in the same manner as faculty and staff with respect to intellectual property, and "the University is very supportive of their being inventors and holding patents," Seidman says.

Corine Farewell, the director of the University's Office of Technology Transfer, meets with the students to discuss intellectual property, confidentiality issues, and the disclosure process for commercially viable projects.

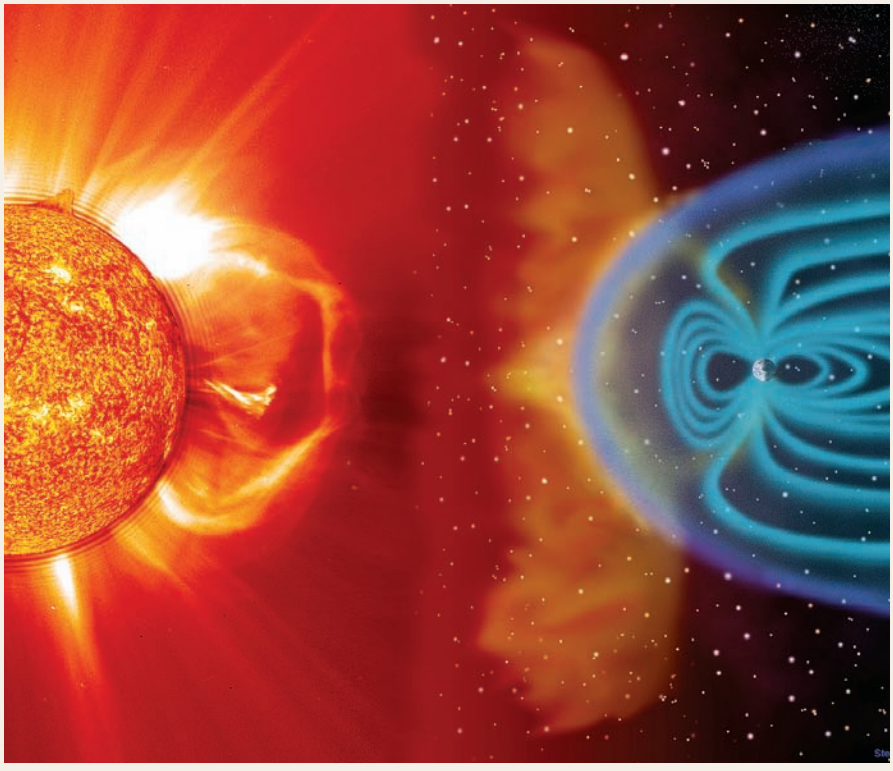
The course also covers what Lerner and Seidman call "realistic constraints" on the design process, including economic, social, political, ethical, regulatory, environmental, safety, and manufacturing issues.

Ten years in, Senior Design is a signature element of Rochester's biomedical engineering curriculum.

This year, Lerner and Seidman had so many interested customers they had to turn projects away.

"The community is realizing how valuable it is having a team of students working towards their goals," Lerner says.

"Our students are interested in solving problems with a global impact." R



EARTH SCIENCE

A New Look at Ancient Earth

SOLAR STORY: About 3.5 billion years ago, Earth faced a bombardment of solar wind (shown here in a NASA illustration) that likely stripped much of the water out of the young planet's atmosphere. That's according to new research led by Rochester geophysicist John Tarduno that indicates the Earth's magnetosphere, the boundary where the planet's magnetic field shields the planet from the energetic particles released by the Sun, was once only half as strong as it is today. The work was published this spring in the journal *Science*.

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—Scott Hauser

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