AGING

UNDERSTANDING THE DAMAGED BRAIN

Timing is everything. But for stroke survivors, poor timing and rebellious muscles can make even simple movements difficult. **Brian Schmit**, Ph.D., associate professor of biomedical engineering, and **Sheila Schindler-Ivens**, Ph.D., assistant professor of physical therapy, are searching for new tools to help stroke survivors conquer those challenges.

Although Schindler-Ivens and Schmit are supported by the American Heart Association and the National Institutes of Health for their own stroke studies, their collaboration is key in advancing what is known about the interaction between a damaged brain and impaired movement.

"What we know about people with stroke is that they don't produce enough muscle activity, and when they do produce enough, it's abnormally timed," Schindler-Ivens says. "In other words, muscles turn on and off at the wrong point in the cycle. So we're trying to figure out two things: One, why is their muscle timing poor, and two, what can we do to fix it."

Schindler-Ivens' earlier research yielded a surprising discovery: Stroke survivors performed better when pedaling backward on a stationary bicycle than when pedaling forward. Now she's trying to understand why.

While the subjects pedal, she magnetically stimulates their brains and records responses in their legs. She also uses electrical stimulation to activate nerves in the legs to see how the sensory information is controlled.

Stroke reduces excitability in the brain. But Schindler-Ivens believes that a novel task, such as pedaling backward, could counteract that effect.

"We think when the brain excitability goes up, the sensory feedback is improved and that also improves the muscle activation pattern," she says. "If it's the case that a more difficult or novel task actually increases brain excitability and improves walking, it could change the way we think about rehab."

With Schmit's help, Schindler-Ivens is adding a motor to the bike so she can control the speed and distinguish between changes in the post-stroke nervous system that are caused by simply being moved as opposed to locomotion, or the act of physically pedaling.

But to truly understand what's happening in the brain, the researchers need to be able to peer inside the brain while stroke survivors are pedaling — something they can do with an MRI. That's the next stage in their collaboration.

"Nobody has ever looked at locomotion in people with stroke while they're scanning the brain," Schindler-Ivens says. "And one of the reasons it hasn't been done is technically it's very challenging."

"The problem is if you take a bicycle into an MRI room, it becomes a ballistic missile because the metal from the bike is rapidly drawn into the magnet," Schmit explains. To prevent that, he and a biomedical engineering graduate student are building a bike out of plastic.

"This whole idea of building devices that can be used in an MRI environment is really interesting," Schmit says. "It could have a lot of applications."

Nobody has ever studied locomotion in stroke survivors while scanning the brain.

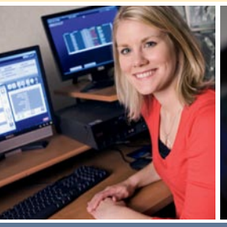
Schmit is also examining the role of sensory feedback. For stroke survivors, simply reaching out and grasping something is difficult. Schmit is experimenting with different devices and techniques, such as applying vibration to a muscle, that modify sensory feedback and make the brain think the arm is in a different place than it really is.

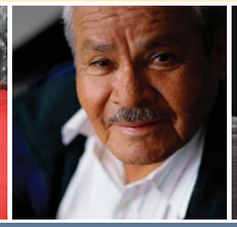
"What we're trying to do is trick the brain," Schmit says. "It seems kind of backward, but at least the subconscious part of the brain is going to be fooled, and that will make it easier for them to reach out and grasp."

Schmit's four-year study is exploratory, but he hopes to end with a design for a clinical trial. By unlocking the key to improving sensory feedback, he and others could accelerate stroke survivors' recovery.

Brian Schmit, Ph.D., is an associate professor of biomedical engineering, and **Sheila Schindler-Ivens**, Ph.D., is an assistant professor of physical therapy. Their research could help accelerate the recovery of stroke survivors.

More than half of the 120 research awards won by Marquette faculty in fiscal year 2006 included funds for student participation, reflecting Marquette's commitment to the teacher-scholar model.





Scrutinizing elder law

Alison Barnes, J.D., had a clear mission: after caring for her dying mother while she was in her mid-20s, she wanted to use her law degree to make a difference for people late in their lives. Today, as a leading scholar in the area of elder law, she has done just that.

Barnes' expertise is often sought after. She served as a senior policy analyst for the U.S. Senate Committee on Aging and then spent a year conducting research at the University of Cambridge. Soon after, she co-authored the first edition of *Elder Law*, the law text that defined the academic field and is used at more than 80 law schools. Barnes is completing the fourth edition with new cases and analysis of issues such as "reverse" age discrimination, intergenerational responsibility and elder care quality.

Barnes' research targets elder law and public policy questions, particularly health law and benefits. The Medicare prescription drug benefit implemented in 2006, for example, presents a multitude of issues, including the law's prohibition of drug price negotiation by federal government and the difficulty many seniors have in comparing the complicated plans. "You can't have competition among the plans if you can't compare them," she says. "And you can never compare them effectively when your health care needs and the plan itself are subject to change — as they are — every year."

Barnes is also examining the 2005 restrictions on Medicaid planning for long-term care. "This is an issue polarized by stereotypes that depict the rich elder as willing to hide assets to get that government-paid nursing home bed," she says. "The truth is far more complex, so understanding is stalled." The Law School is holding a national symposium on the topic in 2007.

She is the founder and adviser of the law review *Elder's Advisor*, which examines topics ranging from tax and estate planning to nursing home emergency preparedness after Hurricane Katrina. "Some of our most extraordinary students staff this law review," says Barnes. "They bring their intellect and passion to this field critical to us all."

Bringing clarity to delirium

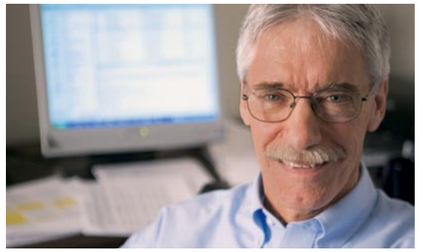
For aging patients, delirium can be a frightening and potentially dangerous condition. But it often goes undetected in hospitals, nursing homes, home health care and adult day centers.

Margaret Bull, Ph.D., a leader in elder health care, wants to change that. Bull is researching the prevalence of delirium in elders attending adult day centers. "Delirium is marked by a sudden change in cognitive status. If delirium is detected and treated early, it can usually be reversed," says Bull, a professor of nursing. "But if left untreated, it can lead to quicker decline in functioning or even death."

Previous research showed that health care providers are often "not tuned in to assessing for delirium," says Bull. Hospitals frequently discharged patients without detecting their delirium, which further deteriorated the patients' health and created confusion and worry for their caregivers. To prevent that, Bull is using a four-minute screening that could lead to early detection of delirium. She is the first researcher to use the screening in community settings.

Why is delirium so often missed? The nationwide nursing shortage means that often the same nurse does not interact with the patient for long enough to recognize the sudden onset of confusion or disorientation that marks delirium. Family members often dismiss the symptoms as part of the aging process. Shorter hospital stays also mean that providers might not notice a change in cognitive status.

Bull hopes her research will lead to improved understanding of care for elders in community settings. "As adult day care and similar arrangements become part of long-term care plans for those living at home or with relatives, this information is important," she says. "People in contact with elders on a regular basis are key to recognizing symptoms of a condition that can be readily treated."



Protecting muscles on and off Earth

What does growing older have to do with floating in space? Just ask **Robert Fitts**, Ph.D., a space biologist whose research on astronauts could apply to the elderly on Earth.

Fitts, professor and chair of the Department of Biological Sciences, has studied muscle wasting for NASA for more than a decade. His team was the first to study astronaut muscle at the molecular level and one of just two in the world to ever biopsy astronaut muscle.

NASA is counting on researchers such as Fitts to help astronauts go to Mars. Going to Mars would likely be a three-year mission, and after just six months in space, astronauts lose an average of 20 percent of their calf muscles. Researchers need to find ways to stave off muscle wasting and determine whether the rate of atrophy levels off after time.

Their solutions could help more than just astronauts.

"Muscle wasting in space is more accelerated than what you get from aging," Fitts says. "But with aging, especially from age 50 and onward, one loses a lot of lean body mass, which is mainly muscle. So the type of exercises that we will ultimately develop to prevent the wasting of the astronaut muscle will ultimately be applicable to aging populations."

It's particularly important for bed-ridden patients. In Fitts' earlier research, he used bed rest studies with subjects' heads tilting slightly downward, mimicking the effects of space flight. The cardiovascular response and bone and muscle atrophy were similar to that of astronauts.

Diet is also important. Fitts and collaborators have found that an essential amino acid supplement used during bed rest can protect muscle power.

"A lot of elderly don't eat right, and some lose their appetites, which is exactly what happens to astronauts," Fitts says. "So what happens is when they exercise, they use their muscle as fuel. It's sort of a vicious cycle: The aging process loses muscle anyway, and then you get a little more inactive, and that accelerates the loss, and then you don't eat properly, and that accelerates it further."