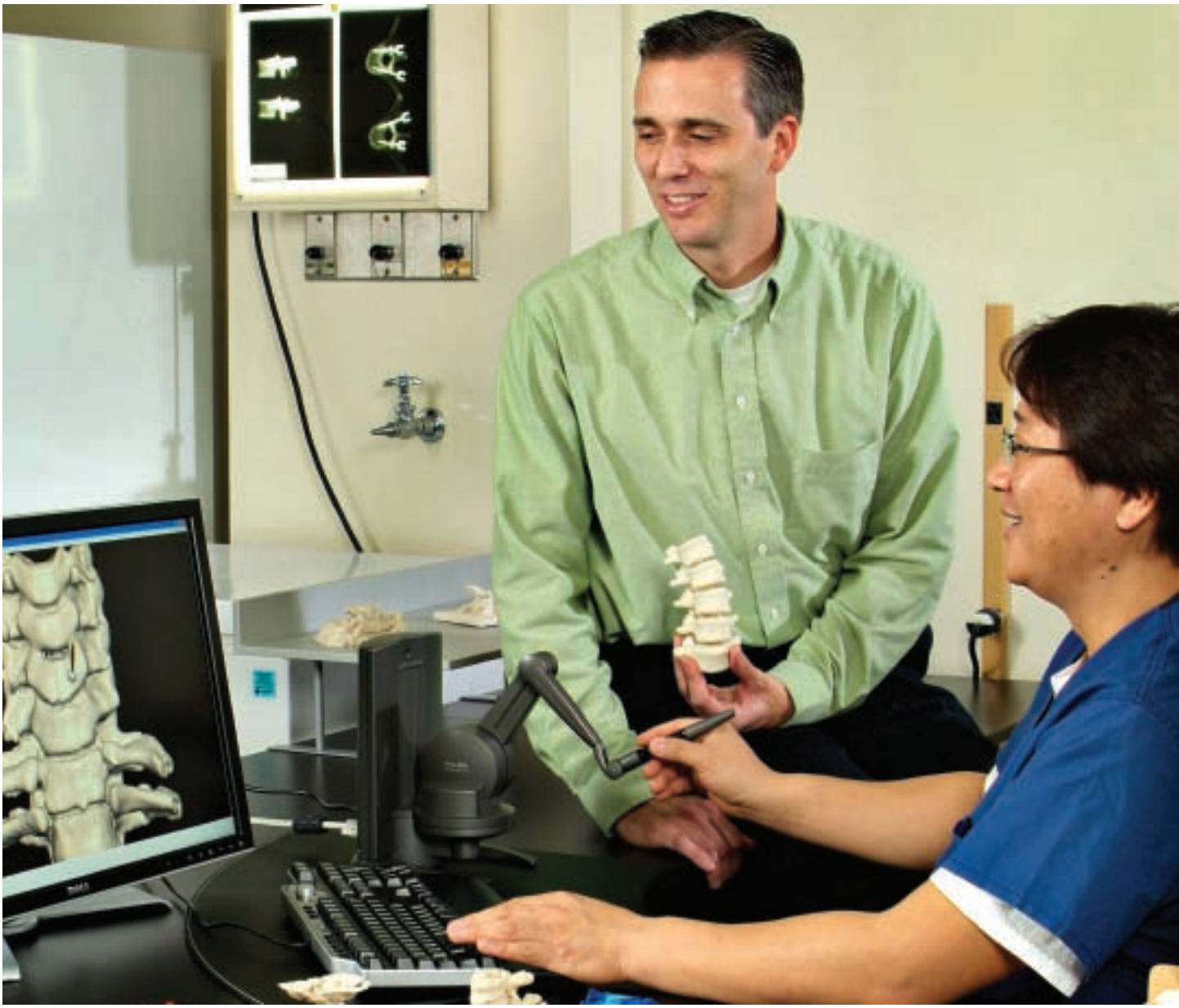
spinal-cord research

Barrow scientists and physicians investigate new ways to repair spine injuries

by Sally J. Clasen



Neil Crawford, PhD, and Andy Baek, MS, examine a computerized model of a patient's spine created by technology at Barrow. The three-dimensional replica helps surgeons detect complexities and subtleties of the spine not revealed through traditional imaging.

What if there were a drug that could reduce or even reverse the damage caused by spinal-cord injuries? Or technology that enabled a neurosurgeon to study a replica of a patient's spine in exact detail before ever entering the operating room? While such ideas might sound like elements of science fiction, they and other investigative theories are closer to medical reality, thanks to research that Barrow scientists and physicians are conducting to improve spine-injury outcomes.

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Modeling the problem

The use of computer technology to see inside the body is not new, but its application in spine surgery is somewhat limited. Now, a three-year, $500,000 grant from the National Institutes of Health is helping Barrow scientists develop a computerized planning tool that creates a three-dimensional model of a patient's spine before surgery takes place.

"While rapid-prototyping technology is used in the industrial and engineering field, it's relatively new in the medical field," says Neil Crawford, PhD, a principal investigator of the study.

The technique involves computer software that generates a virtual model of the injured spine based on a patient's CT scan. With the model, surgeons can perform virtual surgery and create anatomical drilling guides to improve precision during actual surgery. The three-dimensional replica helps surgeons detect complexities and subtleties of the spine that traditional imaging procedures cannot reveal.

"There's so much we don't know about the bio-mechanics of the spine and how the spine responds to external forces and injury," explains neurosurgeon Nicholas Theodore, MD, director of the Neurotrauma Program and a co-investigator in the study. "Rapid prototyping is the springboard into the future of spinal surgery. It will allow us to make spine surgery safer."

Barrow Neurological Foundation has provided funding for this project.

Undoing spinal-cord injuries

Little is available to reduce the serious effects from spinal-cord injury, but Cethrin, a new drug currently in clinical trials at Barrow and other select institutions in North America, is showing significant promise in restoring functional movement. A recombinant protein, engineered by BioAxone and recently licensed to Boston Life Sciences, Cethrin is applied directly to the spine during surgery. It appears to stimulate regeneration and repair of nerves.

Nicholas Theodore, MD, principal investigator of the study, was the first in the world to administer the therapy and has the most experience using the therapy. "Cethrin provides an opportunity to set up a local environment in an injured spinal cord and maximize the healing potential," explains Dr. Theodore, who first treated a patient at Barrow with Cethrin in March 2005.

"Of the 36 patients who've participated in the study worldwide, one-third have shown some neurological improvement. From where I sit, this is amazing."

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One trial participant from Yuma was paralyzed in a car accident in December 2005. Dr. Theodore administered Cethrin to his injury while performing surgery to reduce pressure on the 18-year-old's spine. "He showed demonstrated function within several

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weeks and through rehabilitation, is now able to walk with the help of therapists," Dr. Theodore says.

According to Dr. Theodore, the study has completed dosing at four levels and interim results for patients completing a six-week assessment were released in November 2006. " One-third of the patients who've participated in the study have shown some neurological improvement. From where I sit, this is amazing."

Process of elimination

Some experimental studies at Barrow have helped steer researchers to investigate alternative methods to reduce the effects of spinal-cord injuries. Eric Horn, MD, PhD, chief resident in Neurosurgery, recently examined the effectiveness of draining fluid in severe spinal-cord injuries.

"When you decrease pressure, you have a greater chance of increasing blood flow and providing nutrients to the spinal cord," Dr. Horn says.

Though the results of the study indicated the technique is not effective for acute injury, the results showed promise for less severe spine injuries, says Dr. Horn.

"While most treatments don't work in complete paralysis, we learned that positive results do occur in moderate cases. Sometimes you discover that something doesn't work. That's the hallmark of scientific investigation."

Dr. Horn will continue to examine the role of spinal-cord drainage in moderate cases and says the beauty of the application is that it would be a "very simple way to restore function, and is a procedure that could be done at any hospital."

Injury, heal thyself

In the Neural Regeneration Laboratory (NRL), researchers are examining ways the body can help heal itself naturally from damage caused by stroke, traumatic brain injury and spinal-cord injury.

"What we are trying to do is help the natural healing response, nudge it along, so to speak, along a pathway that maximizes recovery of function," says the lab's principal investigator, Nicholas Bambakidis, MD.

"There are many ways scientists around the country are doing this. At Barrow we are trying to use growth factors and small protein molecules. These molecules can stimulate the growth of stem cells, which can develop into any kind of cell and which all adults have. By stimulating these cells to grow and respond to injury, we hope we can get them to replace the cells that are damaged," Dr. Bambakidis explains.

Researchers are furthest along in studying the responses of the spine to injury, according to Dr. Bambakidis, who anticipates their efforts will lead to therapeutic trials in humans in five to 10 years.

Initial results show that certain agents, when placed in the injured spinal cord shortly after injury, stimulate stem cells to grow and replace some damaged tissue. Because agents have to be directly injected into the spinal cord, the NRL scientists are attempting to develop newer molecules that can be given intravenously or even orally.

"We have a long way to go, but with time there is great promise in such methods to improve recovery and restore function," Dr. Bambakidis says. ■