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Stretched Nerve 'Bridges' Trigger Repair

The tissue creates a scaffold for nerve tissue regeneration.

By Kristina Grifantini

Researchers have shown that artificially stretched nerve "bridges" can guide the natural regrowth of damaged nerve tissue in rats. This technique may eventually provide an effective treatment for people who suffer nerve damage as a result of injury or surgery.

Nerve fibers, called axons, extend from neurons and carry electrical signals around the body. When a nerve is severed, both the axon and its supportive myelin sheath are damaged. Although axons grow back after being severed, they do not do so fast enough, or over sufficient distance, to repair major damage.

At present, surgeons lack effective treatment for these injuries. Small amounts of nerve tissue can be harvested from elsewhere in a patient's body and longer stretches of nerve fibers can sometimes be supplied by tissue donors, but in the latter case, a patient must take immunosuppressant drugs so that the donor tissue is not rejected.

A team led by Douglas Smith (http://www.med.upenn.edu/cbir/faculty/douglas_h2.html), professor and director of the University of Pennsylvania's Center for Brain Injury and Repair (http://www.med.upenn.edu/cbir/), has been able to grow artificially stretched nerve tissues and place them inside guiding tubes. They then used these tissue tubes to bridge the gap between severed nerve tissues in rats and found that the scaffolds promoted the regrowth of axon tissue at either end.

"What we've done is created a 3-D neural network, a mini nervous system that is kind of like jumper cables," says Smith. The research is reported in the latest issue of the journal *Tissue Engineering* (http://www.liebertpub.com/products/product.aspx?pid=315).

To begin, the researchers placed rat neurons in two dishes and chemically coaxed them to sprout axons. Using a computer-controlled system, they gradually pulled the two dishes apart, stretching the axons to about a centimeter over seven days. Finally, the

axons were embedded in a supportive collagen scaffold and inserted into tubes made of polyglycolic acid.

The team used these tubes to connect severed sciatic nerves, which run from the lower back into the leg. As the axons from the rats' severed nerves grew into the tubing, the new and transplanted tissue intertwined. The outer synthetic tube disintegrated over four months, leaving a normal-functioning nerve in its place. By measuring electrical signals passing through the damaged nerves and performing behavioral tests, the researchers found that the nerves had regrown successfully.

In more than 20 animals, the team had "almost 100 percent success of transplant," says Smith. "They survived and promoted growth from the host in a stunning way." Additionally, although the nerve tissue was not their own, the rats' bodies accepted the transplants without the use of an immunosuppressant. The team now plans to test the procedure in larger animals.

The axons must grow quickly, before the part of the severed nerve detached from the neuron dies. "We actually grow [axons] faster than what is thought possible," says Smith, noting that they can grow axons at a rate of up to a centimeter per day, while previously axons in dishes grow about 1 millimeter per day.

"What I like about this is that it takes a different approach than the standard biological approaches," says Jennifer Elisseeff (http://www.jhu.edu/JLAB/) , an assistant professor of biomedical engineering at Johns Hopkins University. She adds that a major obstacle to nerve regeneration is getting the nerves to grow fast enough. "This would be a more efficient way of inducing regeneration," she says. "This really accelerates it."

"This is a very interesting approach that demonstrates how bioengineering and cell therapy approaches can be combined to solve an important medical problem," says Ali Khademhosseini (http://www.tissueeng.net/lab/people.php?cat=1) , an assistant professor at Harvard University who works on tissue engineering. "The bridging of the severed spine by using the process that has been described is highly promising." He adds that researchers still need to achieve results in primates and humans, as well as to demonstrate the technique's effectiveness in treating different nerve injuries.

Upcoming Events

Cleantech Capital Summit (http://www.infocastinc.com/cleantech)
San Diego, CA
Wednesday, April 22, 2009 - Friday, April 24, 2009
http://www.infocastinc.com/cleantech (http://www.infocastinc.com/cleantech)

South By Southwest (http://www.sxsw.com/interactive)
Austin, Texas
Friday, March 13, 2009 - Tuesday, March 17, 2009
http://www.sxsw.com/interactive (http://www.sxsw.com/interactive)

Web 2.0 Expo San Francisco (http://www.web2expo.com/sf)
San Francisco, CA
Tuesday, March 31, 2009 - Friday, April 03, 2009
http://www.web2expo.com/sf (http://www.web2expo.com/sf)

MIT Sustainability Summit: Discovering New Dimensions for Growth (http://sustainabilitysummit.mit.edu/)
Cambridge, MA
Friday, April 24, 2009
http://sustainabilitysummit.mit.edu/ (http://sustainabilitysummit.mit.edu/)

The Front End of Innovation (http://www.iirusa.com/feiusa/fei-home.xml)
Boston, MA
Monday, May 18, 2009 - Wednesday, May 20, 2009
http://www.iirusa.com/feiusa/fei-home.xml (http://www.iirusa.com/feiusa/fei-home.xml)

MIT Sloan CIO Symposium: Sustaining CIO Leadership in a Changing Economy (http://www.mitcio.com/)
Cambridge, MA
Wednesday, May 20, 2009
http://www.mitcio.com/ (http://www.mitcio.com/)