Promising new nanotechnology for spinal cord injury

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A spinal cord injury often leads to permanent paralysis and loss of sensation below the site of the injury because the damaged nerve fibers can't regenerate. The nerve fibers or axons have the capacity to grow again, but don’t because they're blocked by scar tissue that develops around the injury.

Northwestern University researchers have shown that a new nano-engineered gel inhibits the formation of scar tissue at the injury site and enables the severed spinal cord fibers to regenerate and grow. The gel is injected as a liquid into the spinal cord and self -assembles into a scaffold that supports the new nerve fibers as they grow up and down the spinal cord, penetrating the site of the injury.

When the gel was injected into mice with a spinal cord injury, after six weeks the animals had a greatly enhanced ability to use their hind legs and walk.

The research is published today in the April 2 issue of the *Journal of Neuroscience*.

"We are very excited about this," said lead author John Kessler, M.D., Davee Professor of Stem Cell Biology at Northwestern University's Feinberg School of Medicine. "We can inject this without damaging the tissue. It has great potential for treating human beings."

Kessler stressed caution, however, in interpreting the results. "It's

important to understand that something that works in mice will not necessarily work in human beings. At this point in time we have no information about whether this would work in human beings."

"There is no magic bullet or one single thing that solves the spinal cord injury, but this gives us a brand new technology to be able to think about treating this disorder," said Kessler, also the chair of the Davee Department of Neurology at the Feinbeg School. "It could be used in combination with other technologies including stem cells, drugs or other kinds of interventions."

“We designed our self-assembling nanostructures -- the building blocks of the gel -- to promote neuron growth,” said co-author Samuel I. Stupp, Board of Trustees Professor of Materials Science and Engineering, Chemistry, and Medicine and director of Northwestern’s Institute for BioNanotechnology in Medicine. “To actually see the regeneration of axons in the spinal cord after injury is a fascinating outcome.”

The nano-engineered gel works in several ways to support the regeneration of spinal cord nerve fibers. In addition to reducing the formation of scar tissue, it also instructs the stem cells --which would normally form scar tissue -- to instead to produce a helpful new cell that makes myelin. Myelin is a substance that sheaths the axons of the spinal cord to permit the rapid transmission of nerve impulses.

The gel's scaffolding also supports the growth of the axons in two critical directions -- up the spinal cord to the brain (the sensory axons) and down to the legs (the motor axons.) "Not everybody realizes you have to grow the fibers up the spinal cord so you can feel where the floor is. If you can't feel where the floor is with your feet, you can't walk," Kessler said.

Now Northwestern researchers are working on developing the nano-engineered gel to be acceptable as a pharmaceutical for the Food & Drug

Administration.

If the gel is approved for humans, a clinical trial could begin in several years.

"It's a long way from helping a rodent to walk again and helping a human being walk again," Kessler stressed again. "People should never lose sight of that. But this is still exciting because it gives us a new technology for treating spinal cord injury."

Source: Northwestern University

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