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We've Got Your Back: New Studies in Spinal Cord Regeneration

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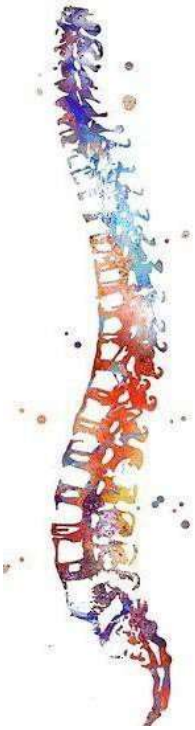
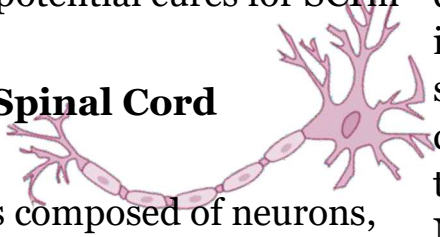


When you clicked the scroll button to move through this magazine, your brain sent a signal through your spinal cord and to your finger. Nerves in your finger then sent sensory information back through the spinal cord to the brain in a fraction of a second. Every day, the spinal cord transmits messages between the brain and body at speeds of 270 miles per hour. The spinal cord allows us to walk, run, or swim. However, for 200,000 Americans who suffer from spinal cord injury (SCI), simply standing up is often not a possibility. This number rises by approximately 17,000 cases a year as a result of sports injuries, car accidents, motorcycle collisions, or falls. Unlike many cells in the body, the neurons in the spinal cord cannot regenerate after an injury, which means spinal cord injuries tend to last for the remainder of one's lifetime. Scientists have proposed theories as to why SCI tends to be irreversible, and new studies show promise of potential cures for SCI in the future.

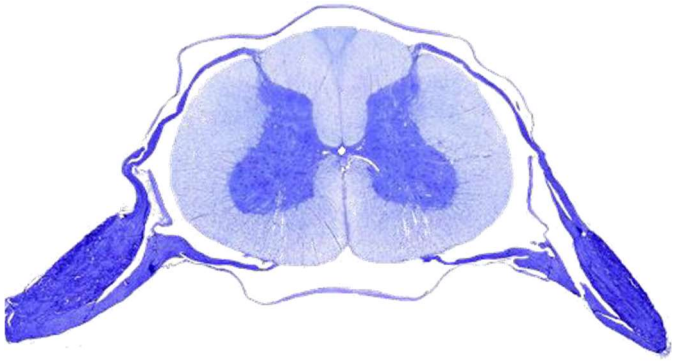
What Inhibits Spinal Cord Regeneration?



The spinal cord is composed of neurons, which contain long, threadlike appendages known as axons. Motor signals are able to travel through these axons, passing from neuron to neuron until the signal reaches its destination in the body. This signaling is hindered when axons in the spinal cord cease to regenerate after an injury; however, axons in the peripheral nervous system regenerate readily. By comparing axons in the spinal cord to the peripheral nervous system, scientists have proposed that certain inhibitory elements produced by the myelin surrounding the spinal cord prevent axon regeneration. Other researchers have compared the growing embryonic spinal cord to the stagnant adult spinal cord. In doing so, these researchers were able to isolate another set of molecules that may inhibit spinal cord axon regeneration.

Scientists have had some success in inducing regeneration by altering the environmental conditions of the spinal cord. For example, in 2001, researchers found that the molecule cAMP was involved in spinal cord maturation during development. By increasing the presence of cAMP in the spinal cord, the researchers observed increased spinal cord axon growth. Additionally, in 2000, researchers found that Nogo-A, a molecule associated with myelin, inhibited axonal growth in the spinal cord. The scientists were able to observe

axonal growth by blocking the receptors for these molecules.[1]



A New Advancement in Spinal Cord Regeneration

Another theory as to why axonal growth is inhibited in the spinal cord has to do with glial scar tissue. Glial cells are responsible for the formation of myelin and they help protect neurons. After an injury, these cells form scar tissue in order to protect the spinal cord from harmful substances in the body.

Just this year, a team of researchers from Pennsylvania attempted to find a new way to induce spinal cord axonal growth by focusing primarily on the role glial scar tissue plays in inhibiting growth. Using previous research, the team concluded that the inhibitory environment created by glial scar tissue prevented axon growth. They hypothesized that if this inhibitory effect could be reversed, axons would be able to regenerate. Using fruit flies as their model organism, the researchers determined that increasing glycolysis (breakdown of glucose) in glial cells can help promote spinal cord regeneration. The levels of signaling molecules produced by the glial cells increase in response to glycolysis. These molecules can bind to receptors on nearby neurons, thus increasing the production of cAMP, which leads to axonal growth. The researchers then applied these signaling molecules to the spinal cords of injured mice to see if their results held. The mice that received treatment showed improved function and behavior, thus supporting the results of the study.[2]

There is still much research to be done on long term treatments for SCI and on the interplay of different factors involved with axonal growth. While a way to completely heal SCI is not visible in the near future, studies like these demonstrate that such a remedy is possible.

References

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