Scientists restore walking after spinal cord injury

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Spinal cord damage blocks the routes that the brain uses to send messages to the nerve cells that control walking. Until now, doctors believed that the only way for injured patients to walk again was to re-grow the long nerve highways that link the brain and base of the spinal cord. For the first time, a UCLA study shows that the central nervous system can reorganize itself and follow new pathways to restore the cellular communication required for movement.

Published in the January edition of *Nature Medicine*, the discovery could lead to new therapies for the estimated 250,000 Americans who suffer from traumatic spinal cord injuries. An additional 10,000 cases occur each year, according to the Christopher and Dana Reeve Foundation, which helped fund the UCLA study.

“Imagine the long nerve fibers that run between the cells in the brain and lower spinal cord as major freeways,” explained Dr. Michael Sofroniew, lead author and professor of neurobiology at the David Geffen School of Medicine at UCLA. “When there’s a traffic accident on the freeway, what do drivers do? They take shorter surface streets. These detours aren’t as fast or direct, but still allow drivers to reach their destination.

“We saw something similar in our research,” he added. “When spinal cord damage blocked direct signals from the brain, under certain conditions the messages were able to make detours around the injury. The message would follow a series of shorter connections to deliver the brain’s command to move the legs.”

Using a mouse model, Sofroniew and his colleagues blocked half of the long nerve fibers in different places and at different times on each side of the spinal cord. They left untouched the spinal cord's center, which contains a connected series of shorter nerve pathways. The latter convey information over short distances up and down the spinal cord.

What they discovered surprised them.

"We were excited to see that most of the mice regained the ability to control their legs within eight weeks," said Sofroniew. "They walked more slowly and less confidently than before their injury, but still recovered mobility."

When the researchers blocked the short nerve pathways in the center of the spinal cord, the regained function disappeared, returning the animals' paralysis. This step confirmed that the nervous system had rerouted messages from the brain to the spinal cord via the shorter pathways, and that these nerve cells were critical to the animal's recovery.

"When I was a medical student, my professors taught that the brain and spinal cord were hard-wired at birth and could not adapt to damage. Severe injury to the spinal cord meant permanent paralysis," said Sofroniew.

"This pessimistic view has changed over my lifetime, and our findings add to a growing body of research showing that the nervous system can reorganize after injury," he added. "What we demonstrate here is that the body can use alternate nerve pathways to deliver instructions that control walking."

The UCLA team's next step will be to learn how to entice nerve cells in the spinal cord to grow and form new pathways that connect across or around the injury site, enabling the brain to direct these cells. If the researchers succeed, the findings could lead to the development of new strategies for restoring mobility following spinal cord injury.

“Our study has identified cells that we can target to try to restore communication between the brain and spinal cord,” explained Sofroniew. “If we can use existing nerve connections instead of attempting to rebuild the nervous system the way it existed before injury, our job of repairing spinal cord damage will become much easier.”

Source: University of California - Los Angeles

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