Major discovery on spinal injury reveals unknown immune response

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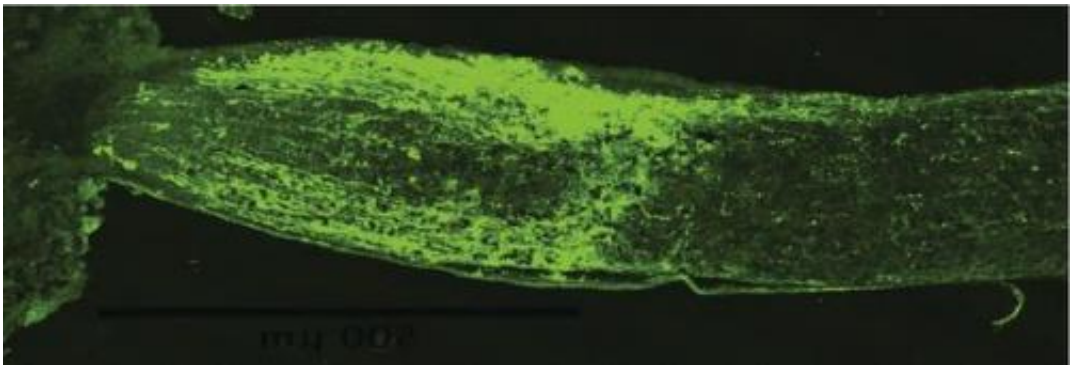

A slide of an axon, or nerve fiber, shows regrowth after an injury.

In a discovery that could dramatically affect the treatment of brain and spinal cord injuries, researchers at the University of Virginia and elsewhere have identified a previously unknown, beneficial immune response that occurs after injury to the central nervous system. By harnessing this response, doctors may be able to develop new and better treatments for brain and spinal cord injuries, develop tools to predict how patients will respond to treatment, and better treat degenerative conditions such as Alzheimer's disease, multiple sclerosis, glaucoma and Lou Gehrig's disease.

The newly discovered immune response occurs independently of the process that typically goads the immune system into action. In that process, the body identifies and attacks substances known as antigens,

such as bacteria and viruses.

"What we have shown is that the injured central nervous system talks to the immune system in a language that hasn't been previously recognized in this context," said Jonathan Kipnis, a professor in the Department of Neuroscience at U.Va.'s School of Medicine and director of the Center for Brain Immunology and Glia. "It sends 'danger signals' and activates the immune system very rapidly. These danger signals cause immune cells to produce a molecule called interleukin 4, which happens to be indispensable for immune-mediated neuroprotection after [central nervous system] trauma."

Interleukin 4 helps protect the body's neurons (nerve cells) and promote their regeneration, whereas uncontrolled inflammation can destroy them. As such, understanding how the body responds to damage to the central nervous system is critically important.

"Once [central nervous system] neurons die, they're gone for life. They don't come back. So I think the CNS has evolved along with the immune system to respond in this protective fashion," explained U.Va.'s James T. Walsh, lead author of the paper outlining the discovery. "[The immune system in the CNS] has to be very metered with how it responds. It can't attack everything like it does in a lot of other tissues, because it causes a lot of collateral damage. You really need the right kind of response in the CNS. It can be a double-edged sword. The immune system can cause damage to the CNS, but it can also be beneficial, and we're showing here how it's beneficial."

Currently there are no effective treatments to promote neuronal survival and regeneration after central nervous system injury. Treatments for spinal injuries historically relied on immune suppression to prevent the collateral damage that results from the immune response, but growing evidence has shown that approach to be ineffective. The new findings

suggest that doctors may instead want to increase the interleukin 4 response, to boost the protection it provides. They also may be able to determine how well a patient will respond to treatment by developing a test to detect the number of interleukin 4-producing cells present.

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