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Researchers regenerate axons necessary for voluntary movement

For the first time, researchers have clearly shown regeneration of a critical type of nerve fiber that travels between the brain and the spinal cord and which is required for voluntary movement. The regeneration was accomplished in a brain injury site in rats by scientists at the University of California. "This finding establishes a method for regenerating a system of nerve fibers called corticospinal motor axons. Restoring these axons is an essential step in one day enabling patients to regain voluntary movement after spinal cord injury," said Mark Tuszynski, MD, PhD, professor of neuroscience.

The corticospinal tract is a massive collection of nerve fibers called axons – long, slender projections of neurons that travel between the cerebral cortex of the brain and the spinal cord, carrying signals for movement from the brain to the body. Voluntary movement occurs through the activation of the upper motor neuron that resides in the frontal lobe of the brain and extends its axon down the spinal cord to the lower motor neuron. The lower motor neuron, in turn, sends its axon out to the muscle cells. In spinal cord injuries, the axons that run along the corticospinal tract are severed so that the lower motor neurons, below the site of injury, are disconnected from the brain.

"Previous spinal cord injury studies have shown regeneration of other nerve fiber systems that contribute to movement, but have not convincingly shown regeneration of the corticospinal system," said Tuszynski. The UC San Diego team achieved corticospinal regeneration by genetically engineering the injured neurons to over-express receptors for a type of nervous system growth factor. The growth factor was delivered to a brain lesion site in injured rats. There, the axons were able to respond to the growth factor and regenerate into the injury site.

Although functional recovery in the animals was not assessed, the new study shows for the first time that regeneration of the corticospinal system – which normally does not respond to treatment – can be achieved in a brain lesion site."

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Sum up this article and explain the main ideas using your scientific knowledge