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An Electrical Jolt for Paralysis Research

A New Technique That Stimulates Key Nerve Cells in the Spinal Cord Offers Hope for Patients, Scientists Say

By KATHERINE HOBSON

In a potential breakthrough for the treatment of spinal-cord injuries, a man paralyzed below the chest has regained some ability to move and stand through the use of electrical stimulation coupled with intense physical rehabilitation—a combination previously shown to work only in animals.

This is the first such success in humans, so researchers on the case—from the University of Louisville, the University of California, Los Angeles, and the California Institute of Technology—remain cautious. They say findings must be replicated in many patients, and many technological questions answered, before spinal stimulation could be considered for wider use.

Still, spinal-cord injury experts say the work, if it holds up under further research, opens the door to new therapies that could improve the outlook for paralyzed patients.

Rob Summers, 25 years old, was hit by a car in 2006 and paralyzed below the chest, though he retained some feeling in the area below his injury. As part of a research project at the University of Louisville, he underwent 26 months of locomotor training, a rehabilitative technique in which he was suspended in a harness over a treadmill while therapists moved his legs to make a stepping motion. (That by itself can produce improvements in patients who retain some motor function.)

Mr. Summers then had surgery to implant a device with 16 electrodes placed on key parts of the spinal cord. With the device delivering constant electrical stimulation, Mr. Summers has been able to stand up using his own leg muscles while holding on to bars for support. He can remain standing, bearing his own weight for up to four minutes at a stretch, and take steps on a treadmill with assistance, according to the researchers.

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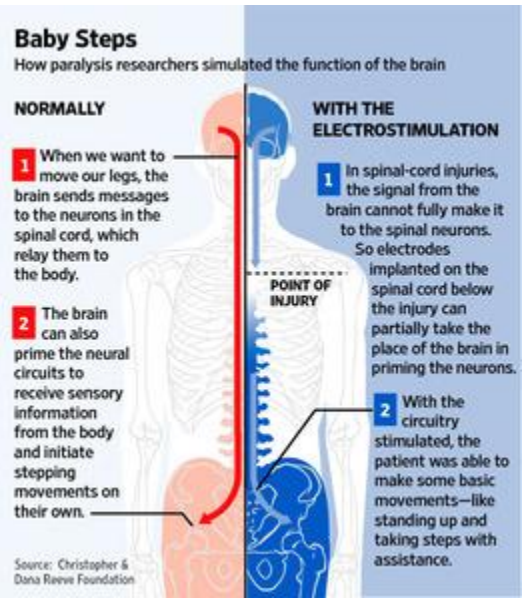
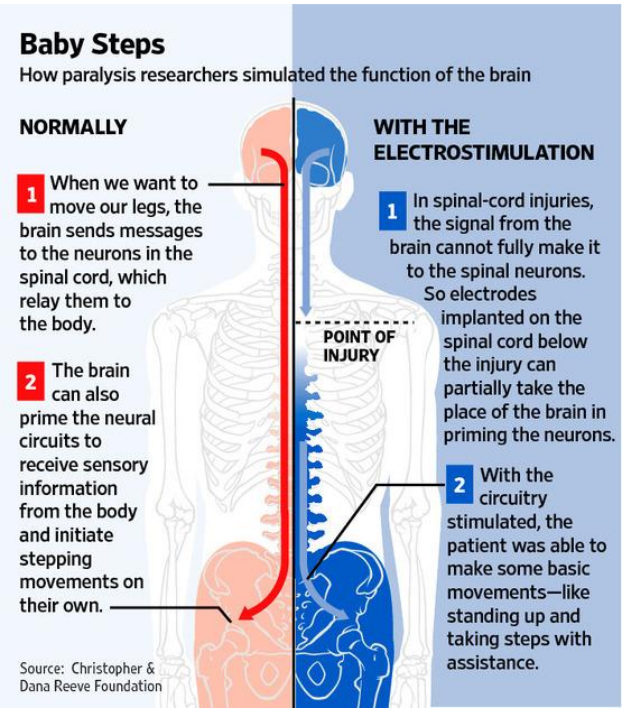
"I didn't move a toe for four years," said Mr. Summers. "I stood up on the third day they turned the stimulator on," he said. "There are not enough words to describe how I felt."



Under stimulation, Mr. Summers is also able to voluntarily move his hips, ankles and toes. And he has gotten back some bladder and sexual function.

"This probably changes the field fairly dramatically," said Ronald Reeves, vice chairman of the department of physical medicine and rehabilitation at the Mayo Clinic in Rochester, Minn., who wasn't involved in the research. "It's the first time that there's compelling scientific evidence that you can, with the electrostimulation of the spinal cord, create a favorable motor response."



As in most spine injuries, Mr. Summers' spinal cord wasn't totally severed, though the damage was severe enough to prevent the brain from signaling the spinal cord to initiate movement.

The research, published Thursday by The Lancet, suggests using electrical stimulation to stand in for the signals the brain usually sends to the spinal cord is enough to produce at least basic movement. The stimulation primes nerve cells that, even without the brain, can receive sensory information and act on it.

"Not only can they sense and feel what's happening, they know what to do next. If you're

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standing on one leg and your joints are in a certain position, that's a sign you're getting ready to step," said study co-author Reggie Edgerton, of the department of integrative biology and comparative physiology at UCLA.

One unknown: whether the stimulation could produce movement in patients whose spinal cords were completely severed.

Further research is also needed on more-sophisticated stimulation devices—the current one is normally used in pain control—and on the possibility of adding drugs to further sensitize neural circuits in the spinal cord, said study co-author Susan Harkema, rehabilitation-research director at the Kentucky Spinal Cord Injury Research Center at the University of Louisville.

The research was supported by the Christopher & Dana Reeve Foundation and the National Institutes of Health.