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Broken nerves can be fixed in a flash

17 November 2008 by [Alison Motluk](#)
Magazine issue [2682](#). [Subscribe](#) and get 4 free issues.

RATS with breathing problems caused by damage to their nerves have had normal breathing restored by bursts of visible light aimed onto the spinal cord. This achievement raises hopes that a miniature light source implanted near the spine might one day allow people with similar injuries to breathe normally.

In 2005, Ed Boyden at the [Massachusetts Institute of Technology](#) infected neurons in Petri dishes with viruses carrying the *ChR2* gene, which codes for a light-sensitive protein called channelrhodopsin-2. The neurons started expressing the protein, and this allowed the researchers to [use pulses of light](#) to control when the neurons fired (*Nature Neuroscience*, vol 8, p 1263). "The nerve cells think they are photoreceptors," says neuroscientist [Jerry Silver](#) at

[Case Western Reserve University](#) in Cleveland, Ohio.

Silver has now taken things a step further with a study to investigate how this light-operated neuronal switch might be used to restore function lost as a result of nerve damage. His team cut part way through the spinal cords of rats at the second vertebra from the top, where the neck pivots, severing the connection between the spinal cord and the nerves that control one side of the diaphragm. This prevented messages from the brain getting to the diaphragm, leaving the animals with problems breathing. Similar injuries are the leading cause of death in people with spinal cord damage.

The researchers then injected a virus containing *ChR2* just below the injury. Four days later they cut into the animals again to expose the spinal cord and shone light onto the damaged section. A 1-minute sequence of half-second pulses produced some activity in the neurons, and consequently in the damaged side of the diaphragm.

The big breakthrough came when they extended the treatment to three 5-minute cycles of 1-second light pulses followed by 5 minutes of rest. "A bizarre seizure activity started," says Silver. When the seizure ended, normal breathing resumed and lasted for about a day and a half (*The Journal of Neuroscience*, DOI: [10.1523/JNEUROSCI.3378-08.2008](#)). Surprisingly, the two sides of the diaphragm were working in tandem.

In uninjured animals, the two sides are synchronised by the brain - raising the question of how they could remain in sync when the nerve to one side was still severed. Silver reckons that in his rats, the light activates a latent network of neurons that span the spinal column, allowing the two sides to communicate independently of the brain.

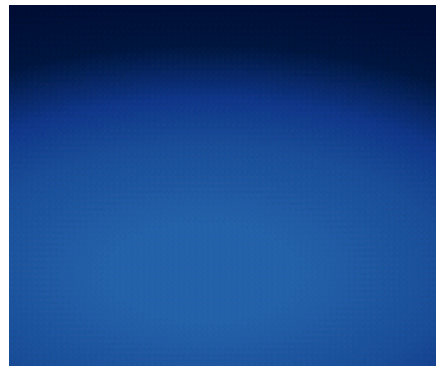
Boyden sees Silver's discovery as a powerful proof of principle. "It opens up the investigation on how you can recruit existing circuits to compensate for lost ones."

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X-ray of spine and skull. (Image: Stock.xchng/Introgic)

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14:35 18 November 2008

A committee of scientists set up by the Department of Veterans Affairs has concluded that the syndrome is not a psychological

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Silver says the light-switch technique could one day be used to treat people with breathing problems resulting from nerve damage. Patients could be given an implant that would shine light on damaged nerves, eliminating the need for repeated surgery.

Patients with breathing problems could one day be given an implant that would shine light on damaged nerves

A similar device might be used to relieve constriction of the bladder caused by nerve damage. Boyden is working on a device that would achieve this without the need to surgically expose the neurons. Samarendra Mohanty at the [Beckman Laser Institute](#) in Irvine, California, is developing an infrared light source that can be piped into nerves through fibres about 50 micrometres thick, also with the aim of activating nerves remotely.



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Speed Of Light

Mon Nov 17 11:31:07 GMT 2008 by [Dk2](#)

Prediction:

"Live at the speed of light" will be Verizon's new slogan when they enter the fibre optic spinal cord replacement business.

Just hope you can afford the broadband, cause 56K spinal cords are gonna suck...

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Speed Of Light

Mon Nov 17 19:38:05 GMT 2008 by [Jeremy](#)

I can imagine an internet-based spinal cord regulator for spine-damaged patients. For those who can't afford it, the internet signal going to their spine can have embedded advertisements which cause

<http://www.newscientist.com/article/...>

disorder

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14:07 18 November 2008

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17:45 14 November 2008

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11:21 14 November 2008

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the patient to sing an advertising jingle, which pays for the treatment.

But seriously, this is interesting research. Does this mean that spinal nerves are sensitive to light? Does any sunlight normally reach these nerves?

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Speed Of Light

Tue Nov 18 16:44:56 GMT 2008 by Benim

No. Simply put: As aforementioned, the scientists have modified nerve cells (neurons) locally such that they gained the ability to be excited by light. What they did was in fact to use a biological vector, in this case a virus, a non-pathogenic carrier, to introduce the gene ChR2 into the affected neurons' genome. Naturally, the neurons began to biosynthesize the encoded protein Channelrhodopsin-2 and augmented their cellular membrane with it. It is a light-sensitive cation channel - a transmembrane protein, a pore, which "opens up" after absorbing light of certain wavelength.

If you know the basics of neural excitation, or how action potentials form, it should become clear why said neurons became sensitive to light.

This is an incredibly impressive feat. It is fascinating what can be done with our limited understanding of these systems.

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Light Clinics Franchises Now Available For \$1m

Mon Nov 17 23:33:50 GMT 2008 by Spinal Dr's Failure Patient Serial # 367,890,890,456,345,765

We'll have to get more land for Light clinics franchises now beside the new multi-funded research centres setup in every State of US..Soon we'll have to have a vault too, for their secret spinal repair recipe...

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