Medical Xpress

# From rats to humans: Project NEUWalk closer to clinical trials

September 24 2014

The Gait Platform consists of custom-made equipment like a treadmill and an overground support system, as well as 14 infrared cameras that detect reflective markers on the patient's body and two video cameras, all of which generate extensive amounts of information about leg and body movement. Lausanne, 2014. Credit: Alain Herzog / EPFL

Lausanne, Switzerland. EPFL scientists have discovered how to control the limbs of a completely paralyzed rat in real time to help it walk again. Their results are published today in *Science Translational Medicine*.

Building on earlier work in rats, this new breakthrough is part of a more general therapy that could one day be implemented in rehabilitation programs for people with spinal cord injury, currently being developed in a European project called NEUWalk. Clinical trials could start as early as next summer using the new Gait Platform now assembled at the CHUV (Lausanne University Hospital).

## How it works

The human body needs electricity to function. The electrical output of the human brain, for instance, is about 30 watts. When the circuitry of the nervous system is damaged, the transmission of electrical signals is impaired, often leading to devastating neurological disorders like paralysis.

Electrical stimulation of the nervous system is known to help relieve these neurological disorders at many levels. Deep brain stimulation is used to treat tremors related to Parkinson's disease, for example. Electrical signals can be engineered to stimulate nerves to restore a sense of touch in the missing limb of amputees. And electrical stimulation of the spinal cord can restore movement control in spinal cord injury.

But can electrical signals be engineered to help a paraplegic walk naturally? The answer is yes, for rats at least.

"We have complete control of the rat's hind legs," says EPFL neuroscientist Grégoire Courtine. "The rat has no voluntary control of its limbs, but the severed spinal cord can be reactivated and stimulated to perform natural walking. We can control in real-time how the rat moves forward and how high it lifts its legs."

The scientists studied rats whose spinal cords were completely severed in the middle-back, so signals from the brain were unable to reach the lower spinal cord. That's where flexible electrodes were surgically implanted. Sending electric current through the electrodes stimulated the spinal cord.

They realized that there was a direct relationship between how high the rat lifted its limbs and the frequency of the electrical stimulation. Based on this and careful monitoring of the rat's walking patterns – its gait – the researchers specially designed the electrical stimulation to adapt the rat's stride in anticipation of upcoming obstacles, like barriers or stairs.

"Simple scientific discoveries about how the nervous system works can be exploited to develop more effective neuroprosthetic technologies," says co-author and neuroengineer Silvestro Micera. "We believe that this technology could one day significantly improve the quality of life of people confronted with neurological disorders."

Taking this idea a step further, Courtine and Micera together with colleagues from EPFL's Center for Neuroprosthetics are also exploring the possibility of decoding signals directly from the brain about leg movement and using this information to stimulate the spinal cord.

## Towards clinical trials using the Gait Platform at the CHUV

The electrical stimulation reported in this study will be tested in patients with incomplete spinal cord injury in a clinical study that may start as early as next summer, using a new Gait Platform that brings together innovative monitoring and rehabilitation technology.

Designed by Courtine's team, the Gait Platform consists of custom-made equipment like a treadmill and an overground support system, as well as 14 infrared cameras that detect reflective markers on the patient's body and two video cameras, all of which generate extensive amounts of information about leg and body movement. This information can be fully synchronized for complete monitoring and fine-tuning of the equipment in order to achieve intelligent assistance and adaptive electrical spinal cord stimulation of the patient.

The Gait Platform is housed in a 100 square meter room provided by the CHUV. The hospital already has a rehabilitation center dedicated to translational research, notably for orthopedic and neurological pathologies.

"The Gait Platform is not a rehabilitation center," says Courtine. "It is a research laboratory where we will be able to study and develop new therapies using very specialized technology in close collaboration with medical experts here at the CHUV, like physiotherapists and doctors."

**More information:** "Closed-loop neuromodulation of spinal sensorimotor circuits controls refined locomotion after complete spinal cord injury," by N. Wenger et al. *Science Translational Medicine*, 2014. stm.sciencemag.org/lookup/doi/ … scitranslmed.3008325

Provided by Ecole Polytechnique Federale de Lausanne

Citation: From rats to humans: Project NEUWalk closer to clinical trials (2014, September 24) retrieved 2 May 2024 from https://medicalxpress.com/news/2014-09-rats-humans-neuwalk-closer-clinical.html