BIOGRAPHY

Grégoire **COURTINE**

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Grégoire Courtine was trained in Mathematics, Physics, and Neurosciences. He received his PhD degree in Experimental Medicine in France and Italy in 2003. After obtaining the Chancellor Award during his post-doctoral training at the University of California Los Angeles (UCLA), where he was also associate for the Christopher and Dana Reeve Foundation, he established his own laboratory at the University of Zurich in 2008. He received the Schellenberg Prize for his work in paraplegia and prestigious fellowships from the European Research Council in 2009 and 2016. In 2012, he became Professor in the Center for Neuroprosthetics at the Swiss Federal Institute of Technology, Lausanne (EPFL). The results of this research in spinal cord repair were published in various high-profile publications such as Science and Nature journals, and discussed extensively in national and international media. In 2013, he was invited to share his scientific journey at TEDGlobal. In 2014, Grégoire launched his startup, GTX Medical, which aims to translate the medical and technological breakthroughs gained over the past 15 years into a treatment to accelerate and augment functional recovery after spinal cord injury.

LOCOMOTOR PROSTHETICS

Over the past decade, we developed a multipronged intervention that restored supraspinal control over leg movements in animal models of spinal cord injury. The intervention acts over two time windows. Immediately, electrochemical neuromodulation of spinal circuits enables motor control of the paralysed legs. In the long term, will-powered training regimens enabled by electrochemical neuromodulation

and robotic assistance promote neuroplasticity of residual connections—an extensive rewiring that reestablishes voluntary control of movement. To identify the physiological principles underlying the therapeutic effects of this intervention, we used computational modelling, inactivation techniques and genetic manipulations. We found that our electrochemical neuromodulation therapy enables motor control through the recruitment of muscle spindle feedback circuits. This framework steered the design of spatially selective spinal implants that specifically target these circuits to modulate muscle synergies responsible for flexion and extension of the legs. To reproduce the natural activation pattern of these muscle synergies during locomotion, we interfaced the leg motor cortex activity with electrochemical neuromodulation therapies in non-human primates. This wireless brain spinal interface instantly restored robust locomotor movements of a paralyzed leg in a non-human primate model of spinal cord injury. Preliminary clinical studies suggest that our concepts and technologies are directly translatable to therapeutic strategies to augment motor recovery after spinal cord injury in humans.

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