Neurotechnologies to Restore Functions for Spinal Cord Injury

November 24

Tuesday, 12:30pm

Live Webinar
via Zoom Conference

Speaker: Grégoire Courtine, Ph.D.
Professor of Neuroscience and Neurotechnology
Swiss Federal Institute of Technology, Lausanne
Neurosurgery Department, University Hospital Lausanne
Faculty of Medicine and Biology, University of Lausanne

Host: Yutaka Yoshida, Ph.D.

For more information, please contact
Darlene White
daw9085@med.cornell.edu

Burke Neurological Institute
Academic Affiliate of Weill Cornell Medicine
785 Mamaroneck Avenue
White Plains, NY 10605
burke.weill.cornell.edu

Abstract

Over the past 15 years, my research team have developed a multipronged intervention that reestablished voluntary control of paralyzed legs in animal models of spinal cord injury, and recently in humans. This intervention acts over two time-windows. Immediately, electrical and chemical stimulations applied to the lumbar spinal cord reactivate lumbar executive centers located below the injury that coordinate leg movements, enabling voluntary control of paralyzed muscles. In the long term, will-powered training regimens enabled by these electrochemical stimulations and cutting-edge robotic assistance promote the reorganization of residual connections that restores voluntary movements without stimulation. We recently exploited these neurotechnologies to target the sympathetic circuitry, which allowed us to develop a neuroprosthetic baroreflex that precisely controls hemodynamic instability after SCI in preclinical models and humans. During my talk, I will discuss the technological and conceptual development underlying these interventions in preclinical models, how we translated these developments in humans with SCI, and how we envision the next steps to establish a clinically viable treatment.

1. Targeted neurotechnology restores walking in humans with spinal cord injury. Wagner FB, Mignardot JB, Le Goff- Mignardot CG, Demesmaeker R, Komi S, Capogrosso M, Rowald A, Seáñez I, Caban M, Pirondini E, Vat M, McCracken L, Heimgartner R, Fodor I, Watrin A, Seguin P, Paoles E, Van Den Keybus K, Eberle G, Schurch B, Pralong E, Becce F, Prior J, Buse N, Buschman R, Neufeld E, Kuster N, Carda S, von Zitzewitz J, Delattre V, Denison T, Lambert H, Minassian K*, Bloch J* and Courtine G*. Nature. 2018 Nov;563(7729):65-71. doi: 10.1038/s41586-018-0649-2. Epub 2018 Oct 31.
2. Cortico-reticulo-spinal circuit reorganization enables functional recovery after severe spinal cord contusion. Asboth L, Friedli L, Beauparlant J, Martinez-Gonzalez C, Anil S, Rey E, Baud L, Pidpruzhnykova G, Anderson MA, Shkorbatova P, Batti L, Pagès S, Kreider J, Schneider BL, Barraud Q, Courtine G. Nature Neuroscience 2018 Apr;21(4):576-588. doi: 10.1038/s41593-018-0093-5. Epub 2018 Mar 19. PMID: 29556028
3. A brain-spine interface alleviating gait deficits after spinal cord injury in primates. Capogrosso M, Milekovic T, Borton D, Wagner F, Moraud EM, Mignardot JB, Buse N, Gandar J, Barraud Q, Xing D, Rey E, Duis S, Jianzhong Y, Ko WK, Li Q, Detemple P, Denison T, Micera S, Bezard E, Bloch J, Courtine G. Nature. 2016 Nov 10;539(7628):284-288. doi: 10.1038/nature20118. PMID: 27830790

Burke Neurological Institute | Weill Cornell Medicine