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SpineRepair RTD 2014

FNSNF

Spinal Cord Stimulation for Locomotor Disorders

Ivan Minev[1], David Borton[1], Grégoire Courtine[1], Silvestro Micera[1], Janos Vörös[2], Alain-Serge Porret[3], Andreas Hierlemann[2] and Stéphanie P. Lacour[1]

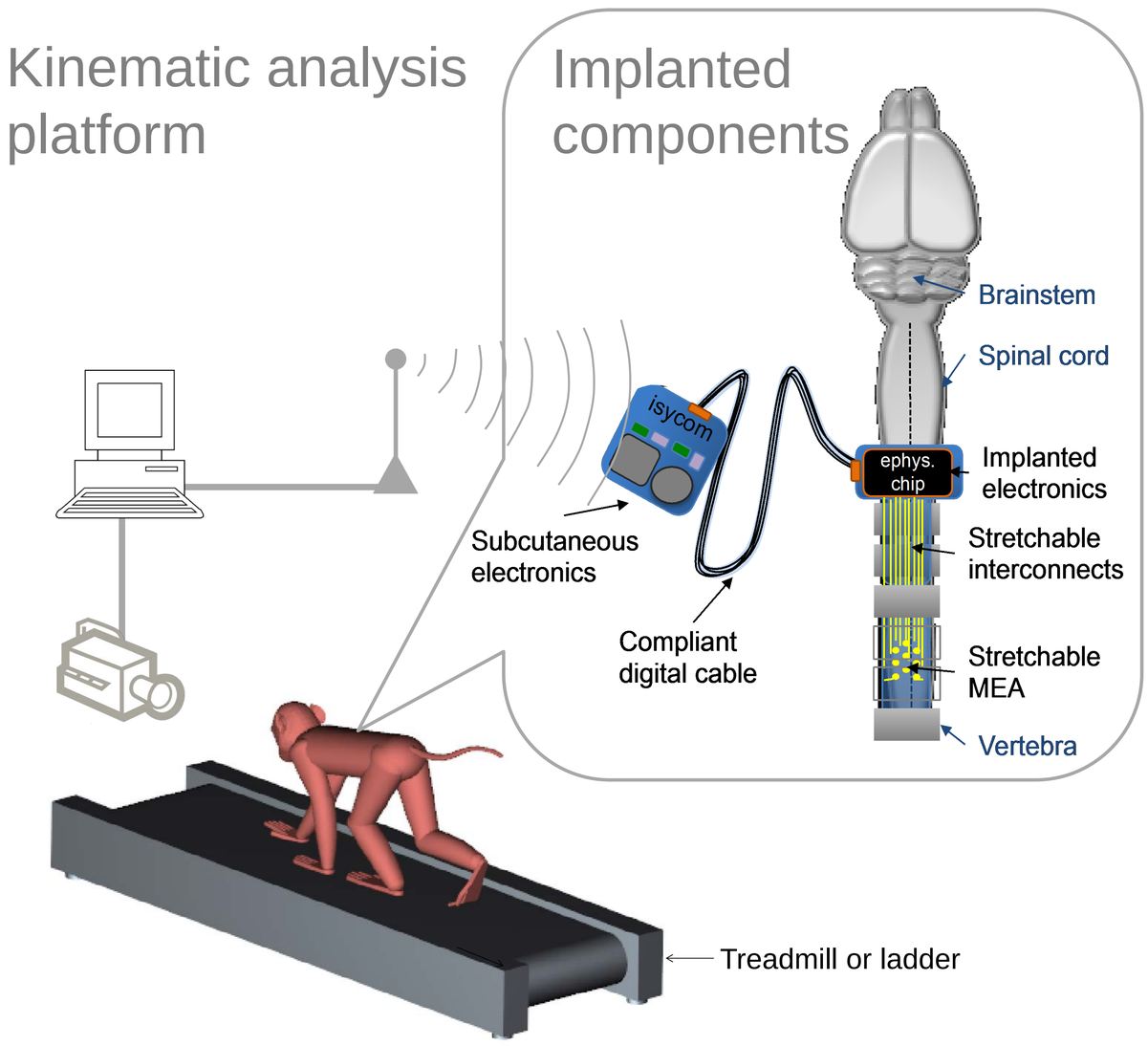
[1]EPFL, [2]ETHZ, [3]CSEM

Context

Innovative neuroprosthesis technology combined with robotic training is a promising path to facilitate motor control and functional recovery after chronic ***spinal cord injury***, Parkinson's disease or motor neuron disease.

Concept

An integrated spinal neuroprosthesis



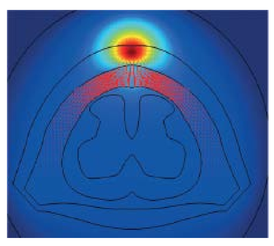
Integrated spinal neuroprosthesis. The soft neural implant is interfaced with miniaturised and power-efficient electronic circuitry linked to subcutaneous telemetry. Real time kinematic analysis is used to control electrode function

Mission

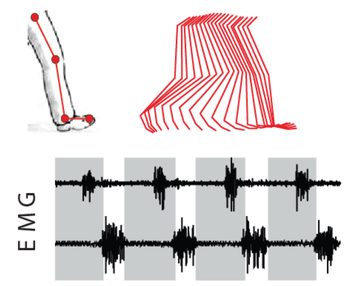
The SpineRepair mission is to develop and optimize the enabling technologies to implement a cutting-edge spinal cord neuroprosthesis. Prototypes of the novel integrated devices will be evaluated in SCI animal models. Our findings pave the way towards fundamentally new technological solutions and treatment paradigms to improve functional recovery in severely paralyzed individuals in a timely manner.

Technological advances

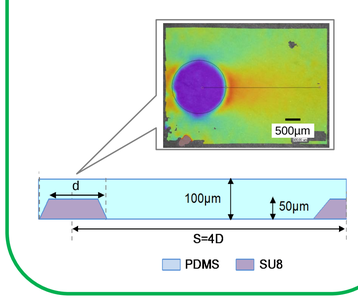
Computational model of Spinal cord stimulation



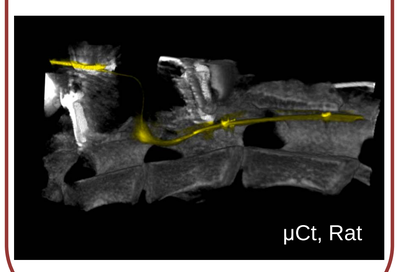
Restoration of natural locomotion



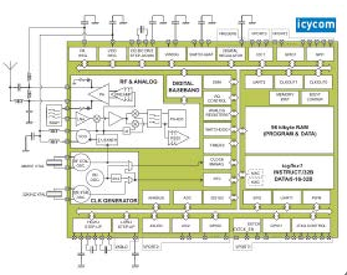
Hybrid integration: chip with soft electrode array



Stretchable Microelectrode array



Power efficient wireless neuroprosthesis



Electrophysiology chip

Interdisciplinary team

Experts at the forefront of research in ***nanomaterials***, ***biology*** and ***engineering.***
More than 8 PhD students and post-docs to be trained in the project.

Project outcomes

In technology

- nano-microfabrication of polymeric neural interfaces
- production and characterization of nanostructured materials
- hybrid integration of electronic devices with elastomeric based sensors
- design and realization of low-power integrated circuits and telemetry circuitry for neural implants
- models for *in vivo* restoration of sensorimotor functions after CNS disorders, especially spinal cord injury

Project impact

In the neural prosthetic community

•improve patients' quality of life
•significant impact on the prosthetic market
•further applications beyond spinal cord injury reaching an even wider industrial as well as patient community.

References:
van den Brand, R., J. Heutschi, et al. (2012). "Restoring Voluntary Control of Locomotion after Paralyzing Spinal Cord Injury." Science 336(6085): 1182-1185.

Team

EPFL: **Grégoire Courtine**, Jérôme Gandar, David Borton, Jean Laurens, Nikolaus Wenger, Natalia Pavlova, Pavel Musienko, Simone Duis
EPFL: **Silvestro Micera**, Marco Capogrosso, Eduardo Martin Moraud, Stanisa Raspopovic
ETH: **Janos Vörös**, Flurin Stauffer, Alexandre Larmagnac
CSEM: **Alain-Serge Porret**, Daniel Severac, Vincent Peiris, Pierre-François Ruedi, Dragan Manic
ETH: **Andreas Hierlemann**, YongHong Tao, Yihui Chen
EPFL: **Stéphanie P. Lacour**, Arthur Hirsch, Ivan Minev