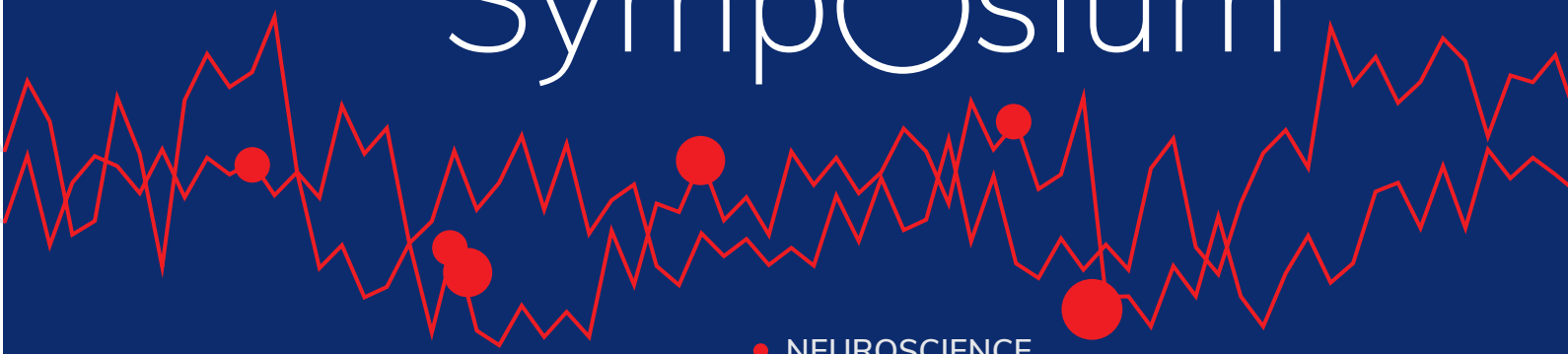
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Center for Neuroprosthetics

November 23, 2018
Campus Biotech · Geneva

Neuroprosthetics Annual Research SympOsium



NEUROSCIENCE
ENGINEERING
MEDICINE

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Localization of functions in the human brain

Prof J. Parvizi – Stanford University, CA, USA

Following a historical overview of how we have considered functions to be localized or distributed in the brain, Prof. Joseph Parvizi will present some of the most recent studies using intracranial electrocorticography (ECoG) and electrical brain stimulation (EBS) in neurosurgical subjects. These studies are providing novel insights about the localization of functions in the human brain.

Prof. Josef Parvizi is Professor of Neurology and Neurosurgery at Stanford University and specializes in the field of epilepsy surgery with interest in functional mapping of the brain using a combination of functional imaging, intracranial EEG, and electrical brain stimulation. Parvizi graduated from the University of Oslo with MD Cum Laude in 1996 and earned his PhD in neurosciences from the University of Iowa in 1999. He completed his medical internship at Mayo Clinic, neurology residency at Harvard, and epilepsy fellowship at UCLA. He has worked at Stanford University Medical Center since 2007 and specializes in treating patients with uncontrollable seizures.

Advanced implantable brain computer interface technologies and systems: the translation gap between concept

Prof F. Solzbacher – University of Utah, UT, USA

In an effort to further advance technologies for neural interfaces and reach the ultimate goal of a fully implantable, high density neural interface system for diagnostic and treatment of human subjects with mobility or neurological disorders, engineers and scientists sometimes forget the patient's view and priorities, and overlook solutions that may already be at hand. Conversely, technological readiness of some novel approaches is often overestimated. Prof. Florian Solzbacher will engage the audience in a discussion on the key materials and system integration challenges associated with implants' encapsulation, interconnects and metallization, and the understanding, modeling and accelerated testing in the context of selected user cases and applications.

Prof. Florian Solzbacher is Chair of the Department of Electrical and Computer Engineering, Co-Director of the Utah Nanotechnology Institute, President and Executive Chairman of Blackrock Microsystems and of Blackrock Neuromed and holds faculty appointments in Electrical and Computer Engineering, Materials Science and Bioengineering at the University of Utah. Prof. Solzbacher received his M.Sc. EE from the Technical University Berlin in 1997 and his Ph.D. from the Technical University Ilmenau in 2003. He is co-founder of several companies such as Blackrock Microsystems, Blackrock Neuromed, and First Sensor Technology.

SCIENTIFIC SESSION 1 · **NEUROSCIENCE**

Electrophysiological and hemodynamic correlates of confidence in committed and observed decisions

Dr M. Pereira

Laboratories of Professors Blanke and Millán

Decision-making often goes with a sense of confidence about the odds of being correct. We investigated the contribution of committed decisions in building a sense of confidence during a perceptual task using simultaneous EEG-fMRI recordings and computational modeling.

Brain in action: network dynamics and spinal cord with fMRI

Dr G. Preti and N. Kinany

Laboratories of Professors Van De Ville and Micera

Functional magnetic resonance imaging allows probing functional activity and connectivity in the central nervous system, during a task or at rest. Novel frameworks to explore the dynamics of functional brain networks and the link with the brain structure underneath will be presented. Then, we will assess how fMRI can be used to non-invasively investigate the role of the spinal cord in processing sensory and motor signals.

SCIENTIFIC SESSION 2 · **ENGINEERING**

Neurotechnologies for vision restoration

Dr E. Raffin and V. Gaillet

Laboratories of Professors Hummel and Ghezzi

Loss of vision can be studied and improved with invasive and non-invasive stimulation. In this talk, we will present a model of transient lesion of the visual system using a unique approach of TMS-fMRI and introduce a new non-invasive brain stimulation based on co-entrained interregional oscillatory interactions. Finally, in line with computational model findings, we will show how electrical stimulation of the optic nerve with the OpticSELINE implant could help restore sight in blind patients.

Recording and modulation of neural activity ex vivo in microchannel electrodes

S. Gribi and E. Formento

Laboratories of Professors Lacour and Micera

Eliciting biomimetic neural activity is challenging but essential for neuroprosthetic applications. We designed a stimulation strategy based on amplitude-modulated high-frequency stimulation bursts that trigger highly biomimetic patterns of neural activity. We tested this protocol in silico and in vitro in a nerve-on-a-chip platform. Our results show this strategy produces desynchronized neural activity, similar to naturally occurring patterns of activity produced by the nervous system. These protocols promise new strategies for sensory feedback encoding.

SCIENTIFIC SESSION 3 · **TRANSLATIONAL MEDICINE**

Wireless brain spine interfaces

Dr G. Schiavone and F. Raschellà

Laboratories of Professors Lacour, Micera and Courtine

Translating science from laboratory to pre-clinical models: we present a case study of successful collaboration across research in technology and neuroscience, enabling the development of neuroprosthetic tools and therapies for the treatment of locomotor deficit in a Parkinson's disease model.

Clinical stroke & primate model of subcortical stroke

Dr M. Wessel and Prof J. Bloch

Laboratory of Prof Hummel and Neurosurgery Department, Lausanne University Hospital, CHUV

Stroke is a network disorder. Recovery has been associated with dynamic changes in the architecture of the underlying neuronal network. We will summarize the current knowledge of the underlying network interactions and how these inform novel brain stimulation paradigms. Subsequently, we will present a primate model of subcortical stroke.

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Auditorium H8 01 A

9:00	Arrival, Coffee & Welcome
9:45	KEYNOTE
	Localization of functions in the human brain Prof J. Parvizi, Stanford University, CA, USA
10:30	SCIENTIFIC SESSION 1 · **NEUROSCIENCE**
	Electrophysiological and hemodynamic correlates of confidence in committed and observed decisions Dr M. Pereira
	Brain in action: network dynamics and spinal cord with fMRI Dr G. Preti and N. Kinany
11:30	Poster session – Authors presenting posters with even numbers
12:00	Lunch
13:30	Poster session – Authors presenting posters with odd numbers
14:00	SCIENTIFIC SESSION 2 · **ENGINEERING**
	Neurotechnologies for vision restoration Dr E. Raffin and V. Gaillet
	Recording and modulation of neural activity ex vivo in microchannel electrodes S. Gribi and E. Formento
15:00	SCIENTIFIC SESSION 3 · **TRANSLATIONAL MEDICINE**
	Wireless brain spine interfaces Dr G. Schiavone and F. Raschellà
	Clinical stroke & primate model of subcortical stroke Dr M. Wessel and Prof J. Bloch
16:00	Break
16:15	KEYNOTE
	Advanced implantable brain computer interface technologies and systems: the translation gap between concept and product Prof F. Solzbacher, University of Utah, UT, USA
17:00	Closing remarks
17:15	Apero
18:30	End of the event

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