

Technologies for neuroengineering

The meeting will discuss exciting advances in the design, implementation, and clinical translation of technology for interfacing with the central and peripheral nervous systems in the context of human disease and health. The technologies will include bioelectronic interfaces, neuromodulation strategies, neuroprosthetics, and brain–machine interfaces. Discussions will cover concept design through to proof-of-concept applications and optimization of neurotechnologies for clinical uses, and will specifically highlight neuroengineering strategies for both motor and cognitive control. A multidisciplinary panel will explore issues surrounding neuroethics, patient advocacy, and future neurotechnologies for psychiatric conditions and mental health. The aim of the conference is to bring together experts in neuroscience, materials science and engineering, biomedical engineering and clinical neurology, to stimulate thinking, debate and even spur collaborations that can help advance research in neurotechnologies.

Virtual Conference Program

**times are in BST (London time)*

Day 1: October 25, 2022 – 12:00 p.m. – 6:00 p.m.

Session I: Bioelectronic Interfaces – 1

Session Chair: Suk-Won Hwang (Korea University, South Korea)

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| 12:00 p.m. – 12:10 p.m. | Opening Remarks |
| 12:10 p.m. – 12:35 p.m. | <i>Paths toward Bio-Integrated Neuromorphic Electronic Skins</i>
Benjamin Tee (National University of Singapore, Singapore) |
| 12:35 p.m. – 1:00 p.m. | <i>Polymer Bioelectronics: A Multidisciplinary Approach to Communicating with The Body</i>
Rylie Green (Imperial College London, UK) |
| 1:00 p.m. – 1:25 p.m. | <i>Functional Biohybrid Neuromorphic Interfaces</i>
Francesca Santoro (RWTH Aachen and Forschungszentrum Juelich, Germany) |
| 1:25 p.m. – 1:40 p.m. | Questions |
| 1:40 p.m. – 2:00 p.m. | Coffee Break |

Session II: Neuromodulation – 1

Session Chair: Jerzy Szablowski (Rice University, USA)

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| 2:00 p.m. – 2:25 p.m. | <i>Transcranial Magnetic Stimulation as A Neuromodulation Tool: New Innovations and Opportunities for Growth</i>
Colleen Hanlon (Wake Forest School of Medicine, USA) |
| 2:25 p.m. – 2:50 p.m. | <i>Spatiotemporal Patterns of Functional, Structural, and Genetic Changes in Tissue Surrounding Implanted Electrodes in the Brain</i> |

Erin Purcell (Michigan State University, USA)

2:50 p.m. – 3:15 p.m. *Probing Central and Peripheral Neural Circuits with Biologically Informed Neurotechnologies*
Polina Anikeeva (Massachusetts Institute of Technology, USA)

3:15 p.m. – 3:30 p.m. **Questions**

3:30 p.m. – 4:30 p.m. Poster session

Session III: BMI – 1

Session Chair: Jennifer Collinger (University of Pittsburgh, USA)

4:30 p.m. – 4:55 p.m. *Seeing the Forest and the Tree: Decomposing Neural Population Activity into Collective and Individual Dynamics*
Eva Dyer (Emory University, USA)

4:55 p.m. – 5:20 p.m. *Intelligent, Wireless Neural Interfaces for BMI and Neuromodulation*
Rikky Muller (University of California, Berkeley, USA)

5:20 p.m. – 5:45 p.m. *Cognitive Neural Prosthetics*
Richard Andersen (California Institute of Technology, USA)

5:45 p.m. – 6:00 p.m. **Questions**

Day 2, October 26, 2022 – 12:00 p.m. – 6:15 p.m.

Session IV: Neuroprosthetics

Session Chair: Vivian K Mushahwar (University of Alberta, USA)

12:00 p.m. – 12:10 p.m. Opening

12:10 p.m. – 12:35 p.m. *The Myokinetic Control Interface: Tracking Implanted Magnets as A Means for Prosthetic Control*
Christian Cipriani (the Scuola Superiore Sant'Anna, Italy)

12:35 p.m. – 1:00 p.m. *Transforming Hearing Aids Through Large-Scale Electrophysiology and Deep Learning*
Nicholas Lesica (University College London, UK)

1:00 p.m. – 1:25 p.m. *Participatory and inclusive approaches in neurotechnology research: beyond ethics-by-design*
Philipp Kellmeyer (University of Freiburg, Germany)

1:25 p.m. – 1:40 p.m. **Questions**

1:40 p.m. – 2:00 p.m. Coffee Break

2:00 p.m. – 2:45 p.m. Panel discussion

Session V: BMI – 2

Session Chair: Christian Cipriani (the Scuola Superiore Sant'Anna, Italy)

- 2:45 p.m. – 3:10 p.m. *Intracortical Brain-Computer Interfaces to Restore Dexterous Hand Function*
Jennifer Collinger (University of Pittsburgh, USA)
- 3:10 p.m. – 3:35 p.m. *Tactile Brain-Computer Interfaces - home use and learning*
Andrea Kübler (University of Würzburg, Germany)
- 3:35 p.m. – 4:00 p.m. *Next-Generation Brain-Machine Interfaces for Neurological and Neuropsychiatric Disorders*
Maryam Shanechi (University of Southern California, USA)
- 4:00 p.m. – 4:15 p.m. **Questions**
- 4:15 p.m. – 4:45 p.m. Coffee Break

Session VI: Neuromodulation – 2

Session Chair: Ritchie Chen (Stanford University, USA)

- 4:45 p.m. – 5:10 p.m. *Relevant Neural and Kinematic Controllers for Closed Loop Deep Brain Stimulation in Parkinson's disease*
Helen Bronte-Stewart (Stanford University School of Medicine, USA)
- 5:10 p.m. – 5:35 p.m. *Biomolecular Ultrasound for Noninvasive Imaging and Control of Cellular Function*
Mikhail Shapiro (California Institute of Technology, USA)
- 5:35 p.m. – 5:50 p.m. **Questions**

Day 3, October 27, 2022 – 12:00 p.m. – 4:35 p.m.

Session VII: Bioelectronic Interfaces – 2

Session Chair: Francesca Santoro (RWTH Aachen and Forschungszentrum Juelich, Germany)

- 12:00 p.m. – 12:10 p.m. Opening
- 12:10 p.m. – 12:35 p.m. *Soft, Expandable Bioelectronics for the Bladder*
Suk-Won Hwang (Korea University, South Korea)
- 12:35 p.m. – 1:00 p.m. *Bioelectronic Tools to Study the Gut-Brain Axis*
Róisín M. Owens (University of Cambridge, UK)
- 1:00 p.m. – 1:25 p.m. *Soft Neural Interfaces for Discovery And Translational Research*
Stephanie Lacour (EPFL Center for Neuroprosthetics, Switzerland)

1:25 p.m. – 1:40 p.m. **Questions**

1:40 p.m. – 2:00 p.m. Coffee Break

Session VIII: Neuroprosthetics – 2

Session Chair: Christian Cipriani (the Scuola Superiore Sant'Anna, Italy)

2:00 p.m. – 2:25 p.m. *Restoring Words: Towards a Speech Neuroprosthesis*
Edward Chang (University of California, San Francisco, USA)

2:25 p.m. – 2:50 p.m. *Intraspinal Neuroprosthesis for Restoring Functional Mobility after Spinal Cord Injury*
Vivian K Mushahwar (University of Alberta, USA)

2:50 p.m. – 3:15 p.m. *Bi-Directional, Real Time Neuroprosthesis for Individuals with Limb Loss*
Dustin Tyler (Case Western Reserve University, USA)

3:15 p.m. – 3:30 p.m. **Questions**

Contributed talks

Session Chair: Steven Lukman (*Nature Materials, UK*)

3:30 p.m. – 3:40 p.m. *NeuroString: A Tissue-Like Neurochemical Sensor for Brain And Gut*
Jinxing Li (Michigan State University, USA)

3:40 p.m. – 3:50 p.m. *Encoding Natural Sensory Information through Model-Based Biomimetic Neural Stimulation*
Giacomo Valle (ETH Zurich, Switzerland)

3:50 p.m. – 4:00 p.m. *Synthetic Torpor Induced by US –Neuromodulation*
Yaoheng Yang (Washington University in St Louis, USA)

4:00 p.m. – 4:10 p.m. *A Novel Dry-EEG Headset for Motor Rehabilitation That Can Be Placed with One Arm*
Eduardo López-Larraz (Bitbrain, Spain)

4:10 p.m. – 4:25 p.m. **Questions**

4:25 p.m. – 4:35 p.m. **Closing remarks**