DFG-NSF Workshop “New Perspectives on Neuroengineering and Neurotechnologies”

November 12-14, 2014
NSF Headquarters, Arlington, Virginia

Agenda

**Wednesday, November 12, 2014**

4 – 6 pm  Poster Set-up  
NSF Atrium

6:30 – 9 pm  Reception  
Grand Cru Wine Bar & Bistro

**Thursday, November 13, 2014**

7:30 am  Registration and Continental Breakfast  
NSF Stafford I, Room 375

8:30 am  Welcome Addresses by the Steering Committee  
NSF Stafford I, Room 375  
Rajesh Rao, University of Washington  
Wolfram Burgard, University of Freiburg

8:45 am  Welcome Addresses by the Funding Agencies  
NSF Stafford I, Room 375  
Kelsey Cook, Acting Section Head, International Science & Engineering, NSF  
Gerald Gerlach, DFG Senate Member

9:05 am  Funding Opportunities and Discussion  
NSF Stafford I, Room 375  
Denise Caldwell, Division Director, Division of Physics, NSF  
Michael Lentze, Program Director, Engineering Sciences, DFG, and Max Voegler, Director, North America Office, DFG

9:45 am  Coffee Break and Poster Session  
NSF Atrium

10:30 am  Computational Neuroscience & Computer Science Approaches I – Understanding Brain Data  
NSF Stafford I, Room 375

Chair: Stefan Rotter, University of Freiburg; Co-chair: Bingni Brunton, University of Washington
Speakers (in alphabetical order)
Richard Andersen, CalTech: Decoding Cognitive Variables from Populations of Posterior Parietal Neurons in a Human with Tetraplegia
Bingni Brunton, University of Washington: Spatial-temporal coherent patterns in ECoG
Kai Miller, Stanford University: Exploring the Features that Make up the Brain Surface Electrical Potential
Stefan Rotter, University of Freiburg: Spike Train Correlations Induced By Anatomical Microstructure

Scribe
Dev Sarma, University of Washington

11:50 am  Lunch and Poster Session
NSF Atrium

1:20 pm  Computational Neuroscience / Computer Science Approaches II – Decoding and Plasticity in Brain-Computer Interfaces
NSF Stafford I, Room 375

Chair: Chet Moritz, University of Washington; Co-chair: Raj Rao, University of Washington

Speakers (in alphabetical order)
Benjamin Blankertz, TU Berlin: Brain-Computer Interface Technology beyond Medical Applications
Jose Carmena, University of California, Berkeley: The Neural Basis of Neuroprosthetic Skill Learning
Andreas Kreiter, University of Bremen: Acquiring Sensory Information and Cognitive States with Weakly Invasive Epidural High-Resolution Electrode Arrays
Chet Moritz, University of Washington: Brain-Controlled Spinal Stimulation for Reanimation of the Paralyzed Forelimb

Scribe
Sadra Sadeh, University of Freiburg

2:40 pm  Brain Computer Interface Technologies I – Surface and Depth Probes
NSF Stafford I, Room 375

Chair: Patrick Ruther, University of Freiburg; Co-chair: Tim Harris, HHMI Janelia Farm

Speakers (in alphabetical order)
Sam Kassegne, San Diego State University: Glassy Carbon-based Multi-Tunable Micro-ECoG Arrays for Neural Signal Recording and Stimulation
Michel Maharbiz, University of California, Berkeley: Neural Dust and Neural Interfaces
Patrick Ruther, University of Freiburg: Advanced Si Probes for Large-Scale Neural Recording
Thomas Stieglitz/Tonio Ball, University of Freiburg: Flexible Neural Interfaces in Fundamental and Translational Research

Scribe
Heiko Stemmann, University of Bremen

4:00 pm  Coffee Break
NSF Atrium

4:30 pm  Communication & Ethical, Legal, and Social Considerations
NSF Stafford I, Room 375

Chair: Oliver Mueller, University of Freiburg; Co-chair: Sara Goering, University of Washington

Speakers
Jens Clausen, University of Tuebingen: Neurotechnology, Knowledge Transfer and the Importance of Neuliteracy
Peter Reiner, University of British Columbia: The Value of Engaging with the Public when Considering Issues of Neuroethical Import
Sarah Goering, University of Washington: Disability Perspectives in the Design of Neuroprosthetics

Scribe
Lise Johnson, University of Washington

7:00 pm  Dinner and Dinner Speech
Hilton Arlington, Room Gallery II

Introduced by Raj Rao, University of Washington

Niels Birbaumer, University of Tuebingen: Neurotechnology: Another Curious Habit of Mankind? I Confess, I am Puzzled. (free after Ezra Pound)

Friday, November 14, 2014

7:30 am  Continental Breakfast
NSF Stafford I, Room 375

8:00 am  Brain Computer Interface Technologies II – Opto-Probes
NSF Stafford I, Room 375

Chair: Ilka Diester, University of Freiburg; Co-chair: Ed Boyden, MIT

Speakers (in alphabetical order)
Polina Anikeeva, MIT: Flexible Optoelectronic Fibers for Multimodal Interaction with Neural Circuits
Ed Boyden, MIT: Tools for Mapping and Engineering the Brain
Ilka Diester, University of Freiburg: Optogenetic Manipulation in the Motor Cortex
Ulrich Schwarz, University of Freiburg: Microengineered Probes for Optogenetics

Scribe
Falk Barz, University of Freiburg

9:20 am  Brain Computer Interface Technologies III – Implantable, Wireless, Intelligent Devices
NSF Stafford I, Room 375

Chair: Thomas Stieglitz, University of Freiburg; Co-chair: Jose Carmena, University of California, Berkeley

Speakers (in alphabetical order)
Arto Nurmikko, Brown University: Electronic Interfaces to the Brain - Role of Implantable Microdevices
Jan Rabaey, University of California, Berkeley: A Roadmap for Longterm BMI Interfaces
Joern Rickert, University of Freiburg: The Brain-Interchange System, a Novel Closed-Loop Implant for Neurotherapeutic Applications
Alfred Stett, University of Tuebingen: Leadless - Wireless – Energy-Efficient: Miniaturized Smart Implants

Scribe
Linda Rudmann, University of Freiburg

10:40 am  Coffee Break
NSF Atrium

11:00 am  Brain Computer Interface Technologies IV – Deep Brain Stimulation
NSF Stafford I, Room 375

Chair: Tim Denison, Medtronic; Co-chair: Volker Coenen, University of Freiburg
Speakers (in alphabetical order)
Volker Coenen, University of Freiburg: *Deep Brain Stimulation as Research Platform for Psychiatric Diseases*
Tim Denison, Medtronic: *The Application of “Brain-Machine-Interfacing” to Neuromodulation: Enabling an Evolutionary and Translational Prosthetics Roadmap?*
Jeffrey Herron, University of Washington: *Development Platform for Mobile Closed-Loop Deep Brain Stimulation System for Ambulatory Patient Tremor Mitigation*
Alik Widge, Harvard University: *Closing the Loop for Psychiatric Brain Stimulation*

Scribe
Dongjin Seo, University of California, Berkeley

12:20 pm  Lunch and Poster Take Down  
NSF Atrium

1:35 pm  Brain Computer Interface Technologies V – Brain-Machine Interfaces in Humans  
NSF Stafford I, Room 375

Chair: Silvestro Micera, EPF Lausanne; Co-chair: Jeff Ojemann, University of Washington

Speakers (in alphabetical order)
Niels Birbaumer, University of Tuebingen: *Brain-Machine-Interfaces (BMI) in Paralysis and Behavioral Disorders*
Silvestro Micera, EPF Lausanne: *Closing the Loop in Neuroprosthetics*
Jeff Ojemann, University of Washington: *User Adaption to a BCI*
Raj Rao, University of Washington: *Probabilistic Co-Adaptive Brain-Computer Interfaces*

Scribe
Amy Orsborn, New York University

2:55 pm  Neurobotics & Assistive Devices – Combining Brain and Autonomous Control in Assistive Devices  
NSF Stafford I, Room 375

Chair: Dario Farina, University of Goettingen; Co-chair: Jose del Millan, EPF Lausanne

Speakers (in alphabetical order)
Wolfram Burgard, University of Freiburg: *High Density Probe Data Analysis, Brain-Controlled Autonomous Service Robots and Motion Capture for Closed-Loop Stimulation*
Jose del Millan, EPF Lausanne: *Translating Brain-Machine Interfaces to End-Users*
Andy Schwartz, University of Pittsburgh: *Recent Work toward High-Performance Neural Prosthetics*

Scribe
Joe O’Doherty, University of California, San Francisco

4:15 pm  World Café with Refreshments  
NSF Stafford I, Room 375

5:15 pm  Summary and Next Steps  
NSF Stafford I, Room 375

5:45 pm  Adjourn

Poster Presenters
Maria Asplund, University of Freiburg: *Electroactive Functionalized Coatings: The Next Generation of PEDOT Microelectrode Systems*
Falk Barz, University of Freiburg: *Modular Assembly Concept for 3D Neural Probe Prototypes Offering High Freedom of Design and Alignment Precision*
Matthias Duempelmann, University of Freiburg: *Early Seizure Detection for Closed Loop Devices in Epilepsy*

Ulrich Egert, University of Freiburg: *Autonomous Learning of Closed-Loop Control of Network Activity*

Dario Farina, University of Goettingen: *Efficient Neuromuscular Activation in Chronic Stroke Patients by an Associative Brain-Computer Interface*

Alexander Gail, University of Goettingen: *Implant Technology for Chronic Myo- and Corticolelectric Recordings*

Moritz Grosse-Wentrup, Max Planck Institute for Intelligent Systems: *A Brain-Computer Interface Based on Self-Regulation of Gamma Oscillations in the Superior Parietal Cortex*

Tim Harris, HHMI Janelia Farm: *Very High Channel Count Si Probes: Technical Plans and Data Digestion Needs*

Lise Johnson UW, University of Washington: *Direct Electrical Stimulation of the Somatosensory Cortex in Humans Using Electrocorticography Electrodes: A Qualitative and Quantitative Report*

Eran Klein, University of Washington: *Perspectives of Potential Endusers of BCI Devices: Focus Group of Individuals with Spinal Cord Injuries*

Vivian Mushawar, University of Alberta: *Intraspinal Microstimulation for Restoring Standing and Walking after Spinal Cord Injury*

Joseph E. O'Doherty, UC San Francisco: *Mitigating Electrical Stimulation Artifacts for Bidirectional Neural Interfaces*

Juan Ordonez, University of Freiburg: *Hybrid Multimodal DBS-Probe for Advanced Brain Research*

Amy Orsborn and Bijan Pesaran, New York University: *Chronic Chamber System for Simultaneous Subdural Electrocorticography, Local Field Potentials, and Spike Recordings*

David Rejeski, Wilson Center: *A Frontier We Don't Know Much About: An Early Analysis of the Public Perception of Neural Engineering*

Matt Reynolds, University of Washington: *Wireless Power and High Data Rate Communication for Implanted Devices*

Linda Rudmann, University of Freiburg: *Hermetic Feedthrough Approach for Long-Term Stable Packaging of Optogenetic Tools with Integrated Lens Structures*

Sadra Sadeh, University of Freiburg: *Processing of Visual Information in Rodent-Like Cortical Networks*

Devapratim (Dev) Sarma, University of Washington: *Novel Electrocorticographic Brain-Computer Interface Framework for Dexterous Control of a Robotic Hand*

Robert Schmidt, University of Freiburg: *Basal Ganglia Dynamics during Movement Initiation: A Computational Model for Transient Beta Oscillations*

Dongjin Seo, University of California, Berkeley: *Neural Dust: An Untethered, Distributed Ultrasonic Backscattering System for Scalable Neural Interfaces*

Josh Smith, University of Washington: *Backscatter Communication and Wireless Power Delivery to Neural Implants*

Surjo Soekadar, University of Tuebingen: *Home-Based Hybrid Brain-Machine Interface (BMI) Training for Rehabilitation of Paralysis*

Heiko Stemmann, University of Bremen: *Open Hardware: Towards A Fully-Wireless Sub-Cranial Neuro-Implant for Measuring Electrocorticography Signals And Future Prospects*

Michael Tangermann, University of Freiburg: *Towards Aphasia Rehabilitation with Non-Invasive Brain-Computer Interfaces*

Euisik Yoon, University of Michigan: *Neural Interface for High-Density Electrical Recording and Optical Stimulation*

**Further Participants**

- **Andrew Bryon**, Defense Advanced Research Projects Agency (DARPA) / Biological Technologies Office (BTO)
- **Maija Kukla**, Program Director, Office of International Science and Engineering, NSF
- **Eduardo Misawa**, Program Director, Division of Engineering Education and Centers, Directorate for Engineering, NSF
- **Jessica Mickey**, Defense Advanced Research Projects Agency (DARPA) / Biological Technologies Office (BTO)
- **Keith Roper**, Program Director, Division of Engineering Education and Centers, Directorate for Engineering, NSF
- **Justin Sanchez**, Program Manager, Defense Advanced Research Projects Agency (DARPA) / Biological Technologies Office (BTO)
- **Kenneth Whang**, Program Director, Division of Information and Intelligent Systems, Directorate for Computer & Information Science & Engineering, NSF