# Single Neuron Studies of the Human Brain

### PROBING COGNITION

Organized by: Moran Cerf Gabriel Kreiman Ueli Rutishauser William Andersen Itzhak Fried

Baltimore, MD November 13-14, 2014

#### SCHEDULE OF EVENTS

#### DAY 1: (THURSDAY 11/13/14)

- 8:00am Vendor setup starts
- 8:45am Registration (Location: Zayed 2119A in Zayed Tower) breakfast available.

9:00am Room Opens

9:15am Introductions and Welcome

#### Session 1: Decision Making

- 9.30am Sameer Sheth (Columbia): The Physiology of Human Cognitive Control: Investigations in the Dorsal Anterior Cingulate Cortex
- 10:00am Kareem Zaghoul (NIH): Single unit activity in the human subthalamic nucleus during decision making
- 10:30am Ziv Williams (MGH/Harvard): Prefrontal recordings in relation to cognitive control

#### 11:00am Break

#### 11:15am Keynote 1: Itzhak Fried (UCLA), tbd

#### Session 2: Recognition, Faces

- 12.00pm Katalin Gothard (U Arizona): Naturalistic social stimuli elicit eye-selective neural responses in the monkey amygdala
- 12.30pm Moran Cerf (Northwestern): Single neuron correlates of content learning in natural stimuli

#### 1:00pm Lunch (provided)

#### 2:00pm Flash poster presentations (4 presenters)

- Shaun Patel (MGH), Rapid Intermittent Deep Brain Stimulation Biases Behavior in Financial Decision-Making Task
- Juri Minxha (Caltech), Fixation-Aligned Single Cell Responses in Human and non-Human Primate Amygdala
- Taufik Valiante (U Toronto), Laminar specific specialization in regular spiking neurons in superficial and deep cortical laminae of human cortex maintained in vitro
- Aibel-Weiss (UCLA), Searching for synchrony: a microelectrode study of neuronal spike firing during human seizures

#### 2:20pm Posters (including Break)

#### Session 3: Clinical neuroscience (Epilepsy, Seizures, DBS)

- 4:00pm Catherine Schevon (Columbia): Unraveling the electrophysiology of human seizures
- 4:30pm Nathan Crone (Hopkins): Neural population dynamics in human cortical function
- 5:00pm Stan Anderson (Hopkins): Clinical and therapeutic implications of cortical neural network modeling
- 5:30pm Helen Mayberg (Emory): Therapeutic Modulation of Cingulate-Cortical Oscillations in Major Depression: Groundwork for next-generation closed-loop technologies

#### 6:00pm: End of official program day 1

#### Schedule of Events

DAY 2: (FRIDAY 11/14/14: Room: Hurd Hall in Nelsen/Harvey - note different location than first day)

8.45am Registration opens; breakfast available

9:00am Room opens

9:00am Welcome

#### Session 4: Memory I

- 9.15am Elizabeth Buffalo (Seattle): Neural activity related to visual exploration and navigation in primates
- 9.45am Ueli Rutishauser (Cedars-Sinai/Caltech): Neural population dynamics during declarative memory retrieval
- 10.15am Keynote 2: Larry Squire (UCSD): The medial temporal lobe, spatial navigation, and spatial cognition

#### 11.00am Break

#### Session 5: Memory II

- 11.15am John Wixted (UCSD): Sparse and Distributed Coding of Episodic Memory in Neurons of the Human Hippocampus
- 11.45am Florian Mormann (Bonn): Single unit activity during perception and memory in the human medial temporal lobe
- 12.15pm Andreas Schulze-Bonhage (Freiburg) and Michael Kahana (U Penn): The spatial context of retrieved memories is reflected by neural activity in the human hippocampal formation

#### 12.45pm Lunch (provided; and posters up)

#### Session 5: Memory II (continued)

1:45pm Josh Jacobs (Drexel): Entorhinal neuronal representations in human spatial navigation

#### Session 6: Neural prosthesis

- 2:15pm Richard Andersen (Caltech), Decoding motor imagery from the posterior parietal cortex of a tetraplegic human
- 2:45pm Carlos Varagas-Irwin (Brown), Exploring the neural representation of Attempted, Imagined, and Observed actions in human motor cortex using Spike train similarity analysis
- 3:15pm Technology presentation (Designated by primary sponsor Neuralynx)

#### 3:30pm Break

#### Session 7: Special topics

- 3.45pm Josef Parvizi (Stanford): Intracranial EEG and Electrical Brain Stimulation
- 4.15pm Ed Lein and Jonathan Ting (Allen Institute), Multimodal interrogation of the cellular and local circuit architecture of the human neocortex
- 5.00pm Dion Khodagholy (NYU), NeuroGrid: Recording action potentials from the surface of the brain

#### 5.30pm Conclusion

#### POSTERS

Aibel-Weiss S, Rojas CA, Bragin A, Fried I, Engel J, Staba R: Searching for synchrony: a microelectrode study of neuronal spike firing during human seizures.\*

Bagdasaryan J, Valderrama M, Lehongre K, Navarro V, Van Quyen M: Cross-level coupling during voluntary modulation of theta oscillations.

Birch K, Mamelak A, Chung J, Rutishauser U: Sleep Staging in Epilepsy Patients Undergoing Single Unit Recordings.

Fu Z, Mamelak AN, Ross I, Chung J, Adolphs A, Rutishauser U: Response error signalling by single neurons in human anterior cingulate cortex, amygdala and supplementary motor area.\*

Gelinas JN, Khodagholy D, Buzsaki G: Hippocampal interictal discharges and sleep spindles: interference with physiological consolidation?

Hill M, Weber B, Bostroem Jan, Elger C, Mormann F: Single neuron correlates of personal preference and satiation in the human amygdala.

Ison M, Quiroga Q, Fried I: Rapid encoding of new memories by single neurons in the human brain.\*

Khodagholy D: Neurogrid.\*

Maoz U, Mudrik L, Rutishauser U, Mamelak A, Adolphs R, Koch C: Delibrate and random decisions and the casual role of consciousness.\*

Matsuo, T: Decoding phonation from unit firing pattern and high gamma activity in frontal face-motor cortex.

Minxha1 J, Mosher CP, Mamelak AN, Gothard KM, Adolphs R, and Rutishauser U: Fixation-Aligned Single Cell Responses in Human and non-Human Primate Amygdala\*

Mukamel R: tbd

Nelson M, Karoui I, Rangarajan V, Pallier C, Parvizi J, Cohen L, Naccache L, Dehaene S: Constituent structure representations revealed with intracranial data.

Niediek J, Reber T, Gast H, Bostrom J, Coenen V, Elger C, Mormann F: Single-unit activity in the human medial temporal lobe during an episodic memory task and subsequent sleep.\*

Patel S, Sheth S, Mian M, Bourne S, Yang J, Flaherty A, Eskandar E: Rapid Intermittent Deep Brain Stimulation Biases Behavior in Financial Decision-Making Task.\*

Possel J, Self MW, Peters JC, callus S, Baaijen JC, Roelfsema PR: Imagery influences neuronal responses in human early visual cortex (V1/V2): a case study

Pearson J, Hickey P, Lad S, Platt M, Turner D: Pattern analysis of low-frequency power predicts stopping behavior in human subthalamic nucleus.

Racz A, Navratil M, Niediek J, Reber T, Karnath HO, Bostrom J, Coenen V, Elger C, Mormann F: Invariance of single unit responses in the human medial temporal lobe to image transformations in a visual object presentation task.\*

Reber T, Racz A, Bostrom J, Coenen V, Elger C, Mormann F: Single Unit Activity in the Human Medial Temporal Lobe during Conscious and Unconscious Perception at Comparable Physical Stimulus Intensities.

Rojas CA: Single-unit activities during epileptic discharges in the human hippocampal formation.

Van Quyen M, Muller L, Dehghani N, Cash S, Halgren E, Hatsopoulos N, Destexhe A: High-frequency oscillations in human and monkey cortex during sleep.\*

Wang L, Moradi-Chameh H, Ayatollahzadeh S, Valiante T: Laminar specific specialization in regular spiking neurons in superficial and deep cortical laminae of human cortex maintained in vitro.\*

Wang S, Mamelak A, Adolphs R, Rutishauser U: Neurons in the Human Medial Temporal Lobe Encode Target Saliency during Visual Search.

## The Next Generation of HUMAN CORTICAL EXPLORATION

High Definition High Density Clinically Validated<sup>\*</sup> Mission Critical Human Subdural Micro/Macro Unit Recording

With the ATLAS Neurophysiology System By Neuralynx , FDA cleared and CE/MDD marked Stend et al., (2020) Microseizures and the spatiotemporal scales of human partial epilepsy. Brain 23(2) 298-97. Cuiroga et al., (2005) Invariant visual representation by single neurons in the human brain. Nature 43(52202-2207.

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Last Generation		Next Generation - The ATLAS Neurophysiology System.	
Channels	128	512	4 times more channels!
Analog to Digital	16 bits	24 bits	8 more bits
Precision/Accuracy	14 bit linear	19 bits linear	32 times more range/resolution
AC Input Range	-8.1 mV to 8.1 mV	-132 mV to 132 mV	16 times more input range - "throw away the gain knob"
DC Input Range	NA	-1V to 1V	Record DC shifts
Common mode rejection	90 dB	110 dB	How well the amplifier extracts signal from noise
Sample Rate	32 kHz	40 kHz	Highest sampling rate
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System Configuration	Stand-alone	Stand-alone Parallel operation with clinical EEG Networked operation with NetCom nodes	Neuralynx ATLAS gets you to PUBLICATION FASTER!
The ATLAS Neurophysiology System is compatible with: • Macro grid arrays • Hybrid macro and microwire grid arrays • Microwire electrodes 12-50µm (AdTech or PMT)		ATLAS works with your existing conventional EEG systems. ATLAS works in parallel with clinical EEG and video recording systems.	
		ATLAS can be used with experimental control network nodes.	
		ATLAS can be used in a network with additional monitoring stations.	

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