

Introductory Remarks to Symposium 35

Insights into the neural basis of cognition from human intracranial electrophysiology

Caspar Schwiedrzik, Goettingen

The human brain produces complex cognitive operations and behaviors, some of which are arguably uniquely human. The primary means to investigate their neural basis have been noninvasive techniques. However, the limited spatiotemporal resolution of noninvasive imaging hampers progress in understanding health and disease.

Human intracranial electrophysiology has emerged as a key technology in overcoming these difficulties. In particular, the high spatiotemporal resolution of intracranial EEG (iEEG) in epilepsy patients undergoing presurgical evaluation enables studying (sub)cortical dynamics underlying human cognition. With specialized research electrodes, it has become possible to extend these investigations across spatial scales, to the level of cortical layers and single cells. This allows unraveling the neural basis of complex behavior directly in the human brain in unprecedented detail.

This symposium aims to elucidate neural mechanisms underlying human cognitive processes using intracranial recordings. We will address different facets of cognition, taking complementary perspectives from different recording and analysis techniques; as well as providing insight into ethical aspects and technical challenges when working with patients. H. Zhang will demonstrate how the reinstatement and transformation of stimulus-specific memories can be studied using multivariate analyses to identify meso- and macroscale networks. L. Melloni will show how continuous input is segmented into episodic memories using tasks involving sequences and visual narratives using electrocorticography. R. Helfrich will talk about how population dynamics of human prefrontal cortex integrate contextual cues and prior evidence to guide human goal-directed behavior. C. Schwiedrzik will present recordings with laminar resolution investigating neural computations underlying predictive processing in perception. M. Bausch will address the question how content and context are combined to process relevant memories using single neuron recordings in the medial temporal lobe. Together, these talks will provide an exciting overview of the burgeoning field of human intracranial electrophysiology.

Symposium 35

Friday, March 24, 2023
13:00 - 15:00, Lecture Hall 103

Chair: Caspar Schwiedrzik, Goettingen

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| 13:00 | Opening Remarks |
| 13:05 | Hui Zhang, Bochum
TRACKING MEMORY REPRESENTATIONS WITH IEEG (S35-1) |
| 13:30 | Lucia Melloni, Frankfurt/Main
FROM CONTINUOUS STREAMS TO SEGMENTED UNITS: UNDERSTANDING HOW EVENTS STRUCTURE COGNITION & MEMORY (S35-2) |
| 13:55 | Randolph Helfrich, Tuebingen
POPULATION CODING AND OSCILLATORY SUBSPACE SYNCHRONIZATION INTEGRATE CONTEXT INTO ACTIONS (S35-3) |
| 14:20 | Caspar M. Schwiedrzik, Goettingen
DISSOCIABLE MECHANISMS FOR "WHAT" AND "WHEN" PREDICTIONS IN THE HUMAN BRAIN (S35-4) |
| 14:45 | Marcel Bausch, Bonn
DISTINCT POPULATIONS IN HUMAN MTL COMBINE ITEMS AND CONTEXTS ACROSS TEMPORAL GAPS (S35-5) |
| 14:55 | Concluding Remarks |

