PROGRESS IN NEUROSCIENCE PINS

Seminar Series of the
Brain & Mind Neuroscience Institute
Weill Cornell Medical College (WCMC)
&
The Graduate Program in Neuroscience of
WCMC and Sloan Kettering Institute

Thursday, 2/9/17, 3:45 PM
Weill Auditorium

Presentation 1: Network analysis of frontal cortical microcircuit dynamics after chronic stress hormone exposure and ketamine treatment

Rachel N. Moda, PhD candidate

Chronic stress exposure has been shown to alter neuronal morphology within the prefrontal cortex (PFC), inducing changes such as dendritic retraction and spine loss. Additionally, clinical studies have shown that subanesthetic doses of ketamine, an NMDA antagonist, can act as a fast-acting antidepressant in treatment-resistant depressed patients. These effects may be mediated by a ketamine-induced increase in postsynaptic dendritic spine density in PFC pyramidal cells. How changes in synapse number and dendritic morphology affect PFC microcircuit function, however, has yet to be established. In an effort to address this question, we have leveraged in vivo spine imaging and calcium imaging to understand neural network dynamics in dorsal PFC microcircuits following chronic corticosterone exposure and ketamine treatment.

Presentation 2: Specification of Positional Identity in Forebrain Organoids

Gustav Cederquist, MD-PhD Candidate

Human pluripotent stem cells (hPSCs) have the amazing ability to differentiate into any cell type within the body. Our lab utilizes hPSCs as a tool for cell replacement therapy, drug discovery, and to study human development and disease, with a focus on the nervous system. The utility of hPSCs as an experimental tool relies on technologies that allow hPSCs to recapitulate the complexity of the human brain in a dish. Standard directed differentiation methods provide access to a multitude of neural cell types. More recently it was discovered that when grown in specialized three-dimensional cultures, referred to as brain organoids, hPSCs could grow into neural tissues that exhibit histological features of the human brain with striking fidelity. Although directed differentiation and organoid technologies recapitulate the cellular diversity and micro-architectural features of the brain, they lack in one critical aspect: topographic organization. Developing neural tissue is patterned along its antero-posterior, medio-lateral, and dorso-ventral axes such that discrete regions of the human brain achieve an invariant topography. This topography provides the framework onto which long-range brain circuits are formed and is thus critical for the emergence of brain function. The fundamental challenge addressed here is to develop a three-dimensional hPSC culture system that specifies the major subdivisions of the human forebrain and patterns them with appropriate topographic organization. This work aims to advance hPSC-related technologies one step closer to recreating a brain in a dish.

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