



RESEARCH TOPIC MEM19

Role of CSF in Spontaneous Activity During Development: Cortical Research on Human 3D Models MECM standard

Research Area

Neuroscience

Laboratory name

Developmental neurobiology Lab

Research Supervisor

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Abstract

Spontaneous activity is a characteristic of the immature brain. Even before birth and without stimuli, neurons organize into networks and generate correlated activity. Recent studies on premature infants have renewed interest in this early activity. However, the role of perinatal spontaneous activity remains unclear. It is unknown how different neuronal classes generate this activity or if "pacemaker" neurons are involved. Defects in this activity could affect neuronal assembly and physiological behaviors. Our project explores how neuronal diversity influences early spontaneous activity and identifies functional modulators of pacemaker activity in the CSF around birth. These studies could provide new strategies for perinatal disorders.

Main technical approaches

- Culture and maintenance of induced pluripotent stem cells and embryonic stem cells;
- Generation of cortical organoids and assembloids;
- Immunofluorescence and in situ hybridization on cells and tissues;
- Sample preparation for live imaging;
- Metabolomics/proteomics.

Scientific references

1. Carloni, Sara, Alice Bertocchi, Sara Mancinelli, Martina Bellini, Marco Erreni, Antonella Borreca, Daniele Braga, et al. 2021. "Identification of a Choroid Plexus Vascular Barrier Closing during Intestinal Inflammation." *Science* 374 (6566): 439–48.
2. Mancinelli, S., and S. Lodato. 2018. "Decoding Neuronal Diversity in the Developing Cerebral Cortex: From Single Cells to Functional Networks." *Current Opinion in Neurobiology* 53. <https://doi.org/10.1016/j.conb.2018.08.001>.

3. Nolan, Matthew F., Gaël Malleret, Josh T. Dudman, Derek L. Buhl, Bina Santoro, Emma Gibbs, Svetlana Vronskaya, et al. 2004. "A Behavioral Role for Dendritic Integration: HCN1 Channels Constrain Spatial Memory and Plasticity at Inputs to Distal Dendrites of CA1 Pyramidal Neurons." *Cell* 119 (5): 719–32.
4. Pellegrini, Laura, Claudia Bonfio, Jessica Chadwick, Farida Begum, Mark Skehel, and Madeline A. Lancaster. 2020. "Human CNS Barrier-Forming Organoids with Cerebrospinal Fluid Production." *Science* 369 (6500). <https://doi.org/10.1126/science.aaz5626>.

Type of contract

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