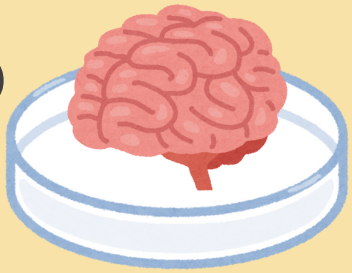
ADVANCES IN BRAIN ORGANOID SCIENCE



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22-25 SEPT, 2025

9 AM - 1 PM

DIP. INGEGNERIA INFORMAZIONE

Aula Riunioni, Via G. Caruso 16, Pisa – Ground Floor

Brain organoids have emerged as transformative tools to model human neurodevelopment and neurological disease with unprecedented fidelity. This doctoral-level course explores cutting-edge advances in brain organoid science, covering methodologies for organoid derivation from pluripotent stem cells, including region-specific differentiation protocols and bioengineering approaches to enhance structural and functional complexity. Participants will examine the use of brain organoids in in vitro disease modeling, gaining insights into neurodevelopmental disorders, neurodegeneration, and personalized medicine. A key focus will be on systems biology and multi-omics strategies to decode organoid biology at molecular, cellular, and network levels. The course emphasizes interdisciplinary collaborations, particularly the integration of engineering sciences, such as microfluidics, bioprinting, and computational modeling, to overcome current limitations and propel organoid research into new frontiers.

DAY 1

Generation and Characterization of Brain Organoids: Explore protocols for deriving brain organoids from pluripotent stem cells and methods to assess their cellular composition, architecture, and functional maturity.

DAY 2

Multielectrode Array Measurements – Electronics Meets Biology: Learn how multielectrode array technology enables recording and analysis of neuronal network activity in organoids, bridging electronic engineering with neuroscience research.

DAY 3

In Vitro Disease Modeling with Organoids: Examine how brain organoids serve as human-relevant models to study neurological diseases, uncover pathomechanisms, and screen therapeutic compounds.

DAY 4

Systems Biology and Multi-Omics: Understand how integrative multi-omics and systems biology approaches reveal molecular networks and dynamic processes within brain organoids.

DAY 5

Self-Organization versus Determination – Biology vs Engineering: Discuss the balance between natural self-organization in organoid development and engineering interventions to guide structure and function toward specific research goals.

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