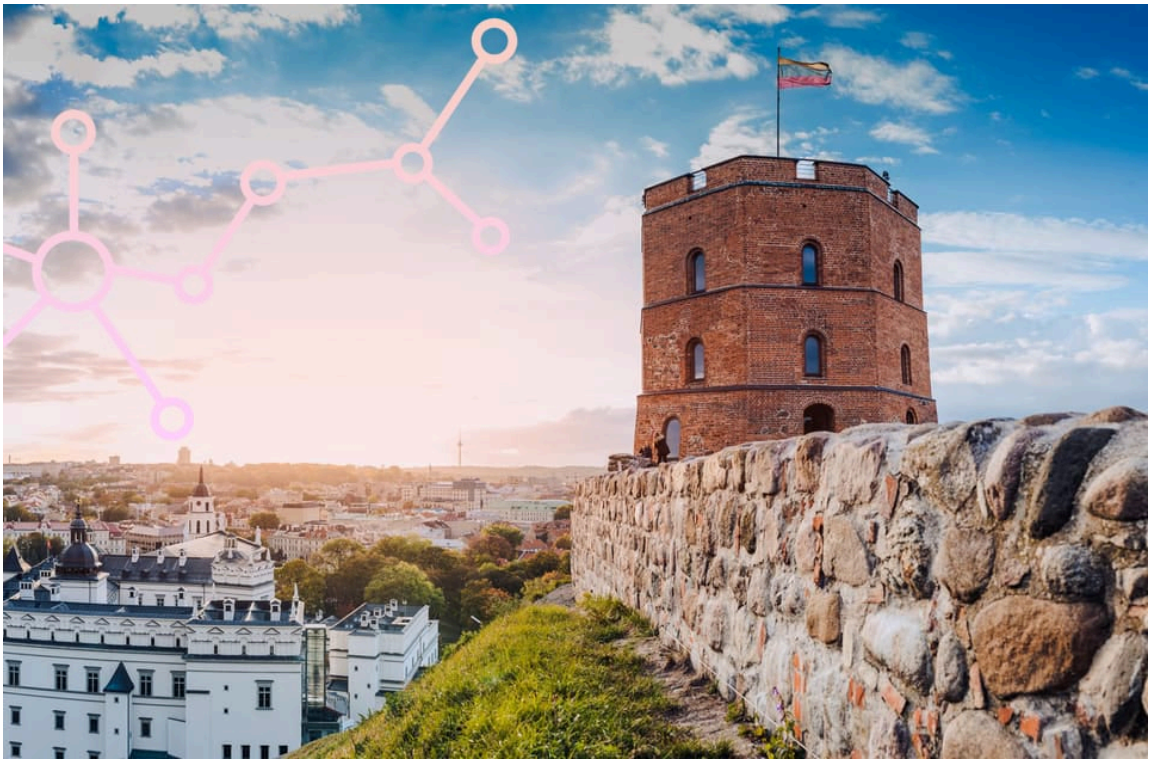
Pan-European Network For Neuroscience Research Infrastructure and Strengthening of Support Capacities (PANERIS)

PANERIS Summer school lectures

At the Life Sciences Center, Vilnius University

25th-29th August 2025

Vilnius, Lithuania



IDIBAPS Institut d'Investigacions Biomèdiques August Pi i Sunyer

Instytut Farmakologii im. Jerzego Maja Polskiej Akademii Nauk

Instituto de Medicina Molecular João Lobo Antunes

Vilniaus universitetas

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Giulia Quattrocolo, PhD

Biography:

Dr. Giulia Quattrocolo earned her Bachelor's degree in Biology and Master's degree in Neurobiology from the Università di Pavia, Italy. In 2009, she relocated to Northwestern University in Chicago to pursue a Ph.D. in Neuroscience under the supervision of Dr. Gianmaria Maccaferri, where she studied the integration of Cajal-Retzius cells in the postnatal hippocampal circuit.

In 2014, she joined the laboratory of Dr. Gord Fishell at NYU to investigate genetic and environmental factors influencing the differentiation of cortical and hippocampal interneurons. In 2017, Dr. Quattrocolo returned to Europe to work with Dr. Edvard Moser at the Kavli Institute for Systems Neuroscience, NTNU, Trondheim, focusing on the role of Cajal-Retzius cells in hippocampal circuit maturation.

Since 2021, she has led the Circuit Development Lab at the Kavli Institute, and in July 2023, she was appointed Associate Professor. Her research is centered on understanding how diverse cell types interact during development to form functional neural circuits, with a particular focus on the hippocampal formation—crucial for learning and memory.

Giulia Quattrocolo, PhD
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Lecture Title: Building the Hippocampal Circuit: From Growth Cones to Place Cells

This lecture will explore two distinct aspects of hippocampal circuit development. The first part focuses on the role of Cajal-Retzius (CR) cells in the postnatal hippocampus. Utilizing a combination of transgenic mouse models and targeted viral vector approaches, the lab selectively ablated CR cells to assess their contribution to circuit maturation. This manipulation led to layer-specific alterations in dendritic complexity and spine density of CA1 pyramidal neurons, as well as differential expression of synapse- related genes and proteins. Subsequent in vivo electrophysiology and behavioral experiments revealed impaired learning and significant disruptions in CA1 place cell function in CR cell-ablated mice.

The second part introduces a new line of research aimed at characterizing the molecular composition of growth cones as axons navigate different hippocampal subregions. By analyzing the growth cone proteome from both the entire hippocampus and the dentate gyrus at early postnatal stages, region- and time- specific protein subsets were identified. These findings shed light on the dynamic and localized nature of growth cone signaling during hippocampal circuit formation.

Catarina Miranda Lourenço, MD, PhD

Biography:
Dr. Catarina Miranda Lourenço earned her PhD in Biomedical Sciences and MD from the University of Lisbon, where she also completed a Master's in Neuroscience and a degree in Biochemistry. Her research focuses on the molecular mechanisms underlying Rett Syndrome, particularly BDNF signaling and adenosinergic system dysregulation, and explores their therapeutic potential.
She has contributed to projects on Alzheimer's disease, epilepsy, depression, and synaptic dysfunction related to aging and obesity. With sixteen peer-reviewed publications, she also lectures in Pharmacology and Neuropharmacology and has supervised several Master's theses.
Currently completing her medical residency in General and Family Medicine, Dr. Lourenço bridges neuroscience and clinical practice, aiming to advance translational therapies for neurodevelopmental disorders while promoting holistic, patient-centered care.

Catarina Miranda Lourenço, MD, PhD
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Lecture Title: Synaptogenesis and Synaptopathies: From Mechanisms to Disease

Synaptogenesis—the formation, maturation, and remodeling of synapses—is a fundamental process in the development and plasticity of the central nervous system. Proper regulation of this process is crucial for the formation of functional neural circuits, and its disruption is increasingly implicated in a range of neurodevelopmental and neuropsychiatric disorders collectively referred to as synaptopathies.
This lecture will first provide an overview of the key molecular and cellular mechanisms underlying synaptogenesis, including the roles of neurotrophic factors, cell adhesion molecules, and purinergic signaling. The clinical implications of synaptic dysfunction will be addressed, highlighting shared alterations across multiple disorders.
The second portion will focus on current research into Rett Syndrome, a severe X-linked neurodevelopmental condition caused by MECP2 mutations. This work examines how imbalances in excitatory/inhibitory signaling, BDNF pathway impairment, and dysregulation of the adenosinergic system contribute to the disease's pathophysiology. Insights from preclinical models will be discussed in the context of potential therapeutic interventions.
By bridging foundational neuroscience with translational approaches, the lecture aims to demonstrate how synaptic dysfunction offers both a mechanistic understanding and a therapeutic window for complex neurological disorders such as Rett Syndrome.

Andrés Beccari, PhD

Biography:
Dr. Andrés Beccari is a developmental neurobiologist focused on gene regulation during human brain development. He earned his PhD in Paola Bovolenta's laboratory in Madrid, where he studied forebrain patterning and the transcription factors Sox2 and Six3.
He later joined Denis Duboule's laboratory at the University of Geneva, investigating 3D chromatin architecture and pioneering the use of gastruloids to model early embryogenesis. In 2022, he was awarded a Ramón y Cajal fellowship and established his group at CBMSO in Madrid.
His research combines brain organoids with functional genomics to study how cis-regulatory elements, chromatin structure, and epigenetic mechanisms influence neurodevelopmental gene expression and how their disruption contributes to brain disorders.

Andres Beccari, PhD
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Lecture Title: Decoding human neurodevelopment gene regulation through brain organoid models

Recent advances in functional genomics have revealed the critical role of the non-coding genome and 3D chromatin architecture in orchestrating neurodevelopmental gene expression. Despite identifying over a million regulatory elements in the human genome, the functional significance of most remains elusive. Concurrently, clinical genetic studies have uncovered numerous single nucleotide polymorphisms and structural variants associated with brain disorders—mutations that often disrupt the regulatory landscape of key neurodevelopmental genes.
Traditional animal models, while invaluable for elucidating cortical development, are limited in their capacity to model human-specific regulatory mechanisms due to evolutionary divergence. Brain organoids, derived from pluripotent stem cells, provide a promising alternative. These three-dimensional models replicate the cellular composition and structure of human brain regions, making them ideal for investigating development, pathology, and evolutionary processes.
This course will introduce the principles of brain organoid technology and its applications in studying human brain development. It will further explore the transcriptional mechanisms that regulate gene expression during neurodevelopment and how their disruption contributes to disease phenotypes. Brain organoids will be presented as a powerful model system for linking genetic regulation to pathophysiology in human neurodevelopment.

Ainhoa Plaza-Zabala, PhD

Biography:
Dr. Ainhoa Plaza-Zabala earned her Ph.D. in Biomedicine in 2012 from Pompeu Fabra University in Barcelona, where she studied the role of the hypocretin/orexin system in nicotine addiction. Her doctoral work combined behavioral pharmacology with neurochemical analyses, laying a foundation in translational neuroscience.
She completed her postdoctoral training at the Vall d'Hebron Research Institute, expanding her expertise by incorporating in vitro models to explore autophagy. She then joined the Achucarro Basque Center for Neuroscience, focusing on autophagic processes in microglia within the context of ischemic stroke.
Currently, Dr. Plaza-Zabala is an Assistant Professor and Principal Investigator leading a research project on autophagic and lysosomal pathways in oligodendrocytes and their implications for chronic cerebrovascular disease. Her work integrates cellular and molecular neuroscience to uncover novel mechanisms of glial dysfunction in neurological disorders.

Ainhoa Plaza-Zabala, Ph.D.
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Lecture Title: Glial Cells in Brain Development: Timing, Plasticity, and Pathological Vulnerability

Glial cells play indispensable roles in brain development, extending far beyond their classical supportive functions. This lecture will examine how astrocytes, microglia, and oligodendrocyte lineage cells contribute to neurodevelopment through processes such as synaptic refinement, immune surveillance, myelination, and neurovascular regulation. Emphasis will be placed on how glial cells integrate intrinsic and environmental signals to shape brain architecture.
Particular attention will be given to microglia and oligodendrocyte progenitor cells (OPCs), focusing on recent discoveries regarding the role of autophagy and lysosomal pathways in regulating glial maturation and neuron-glia interactions. Drawing from in vivo and in vitro studies—including current research using models of cerebrovascular disease—this lecture will illustrate how disruptions in these pathways during development can increase susceptibility to neurological disorders.
By linking basic glial biology with clinically relevant disease models, this session will highlight the translational potential of targeting glial function to mitigate developmental and adult brain pathologies.

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