Seminar Title: Mechanisms of emergence & maintenance of nervous system architecture; insights from *C. elegans*

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Abstract:

The remarkable accuracy of functional neural circuits relies on proper assembly of their architecture by glia-neuron interactions, is susceptible to environmental change, and if impaired leads to neuropathology. We investigate cellular and molecular mechanisms underlying the early initiation of circuit assembly and its maintenance during age-progression. The *C. elegans* brain circuit is a powerful setting to tackle these directions *in vivo*, with well-characterized anatomy and connectivity, glia largely dispensable for neuronal viability, embryos and animals amenable to *in vivo* manipulation, real-time and single-cell-resolution imaging, single-gene and large-scale genetics. We recently provided a comprehensive cellular and molecular view of how a living embryo initiates circuit assembly. We established that *C. elegans* brain assembly progresses in a hierarchical manner, we identified molecularly-defined pioneer neurons and astroglia, and their interactions that guide circuit components using conserved cues. We establish *in silico* pipelines, experimental large-scale screens and single-gene studies to dissect the early hallmark of assembly, the formation of pioneer neurons and glia. We investigate transcription and transmembrane factors driving formation of molecularly-defined pioneers, largely understudied in other settings. We uncovered molecular synergies underlying hierarchical circuit assembly, and we devise and utilize strategies to uncover hidden molecular redundancies. We also dissect an interplay between glia, extracellular matrix, cell junctions and biomechanics, ensuring age-dependent fidelity of astroglial integrity and circuit architecture. We highlighted cross-species analogies of astroglia, pioneer neurons and circuit architecture. Leveraging our findings to provide insights beyond *C. elegans*, we aim to delineate principles of circuit development, pioneer signatures and glia signaling.

Bio-sketch:

Georgia Rapti earned her BSc in Biology, cum laude (2005), from the University of Athens in Greece, her MSc in Genetics, cum laude (2006), and her Ph.D. in Cellular Molecular Biology (2010) from the University Paris Diderot in France. She has long-lasting commitment in studying nervous system architecture. Her undergraduate work identified biochemical interactions of the Amyloid Precursor Protein. Her graduate work contributed to establishing the C. elegans neuromuscular junction as a setting to study synaptic and acetylcholine receptors in vivo. Georgia completed her doctoral studies under the guidance of Prof. Jean-Louis Bessereau, in 'Ecole Normale Supérieure in Paris. She characterized receptor extracellular scaffolding, synaptic clustering factors and an auxiliary subunit. Her postdoctoral research, at The Rockefeller University in the lab of Prof. Shai Shaham, established a C. elegans setting to dissect circuit assembly, providing a comprehensive view of how pioneer neurons and glia initiate brain assembly in a living embryo. Her research included advanced genetics, real-time imaging, genome-engineering and biochemistry using C. elegans, mouse and Drosophila cell lines, Xenopus oocyte or mouse extracts. Georgia joined the European Molecular Biology Laboratory in December 2019. Her research group investigates mechanisms underlying embryonic circuit assembly and maintenance during age-progression. Georgia has been a lecturer of City College of New York, and is currently a lecturer at MSc, PhD modules and summer courses at IZN Heidelberg and at EMBL, as well as co-organizer and faculty of the EMBO C. elegans course and the 2018 Glia Symposium NYC. She is a recently-elected ASCB Associate member a FENS-Kavli Network of Excellence Scholar. Her research has been supported by the EMBL, Kavli-NSI, Leon-Levy Foundation, EMBO, Bodossaki Foundation, Association Française des Myopathies, Greek and French Ministries of Education.