BIOENGINEERING SEMINAR

“The JNK Signaling Links the CNS Architectural Balance to Motor Activity in Drosophila Embryos”

Wednesday – May 9, 2018 – 10h00
EPFL – room SV1717

Enrique Martín-Blanco, Ph.D.
Instituto de Biología Molecular de Barcelona (IBMB), CSIC, Barcelona (E)

host: Prof. Andrew Oates

Abstract

In higher organisms, behavioral and cognitive functions are directed and coordinated by neural networks. Both for vertebrates and for invertebrates, the structural organization of these networks appears to serve as a benchmark for sensory, integrative and motor functions. While the molecular mechanisms underlying neural specification, axon guidance, dendrite formation and synaptogenesis are in part known, those that guide the structural organization and functional integration of neural networks remain uncharacterized. Two fundamental issues arise, first, how neural networks acquire their architecturally stable and mechanically balanced 3D structure and second, how their spatial and topographical organization influences neural functions. Employing the Drosophila embryonic Ventral Nerve Cord (VNC) as a model system, we found that the VNC is organized in an iterated robust pattern of structural elements (nodes or cross-pieces) conserved throughout evolution dependent on the regulated attenuation of the JNK pathway. The attainment of a correct geometrical and structural organization is the result at a molecular level of a delicate balance of JNK signaling activity in pioneer neurons that affects axonal fasciculation and VNC condensation.

The JNK pathway autonomously modulates mitochondrial transport, axon integrity and dendrites formation and non-autonomously Fasciclin 2 expression. Last we found that the precise levels of JNK activity necessary for correct VNC condensation are instrumental for the integration of embryonic motor circuitries. Altering JNK activity levels resulted in a failure in the coordination of muscle contractions and the inability to build the harmonic peristalsis essential for embryo hatching. Altogether, our data elucidates some of the essential molecular and cellular mechanisms underpinning robustness in tissue architecture and highlights the links between structural/topographical and functional optimization in the CNS.

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