RESEARCH TOPIC MEM20

Investigating the molecular identity of Pacemaker neurons in cortical development
Curriculum MEM

Clinical Unit name and address
Department of Surgery - IRCCS Humanitas Research Hospital

Laboratory name
Lodato Laboratory, IRCCS Humanitas Research Hospital

Pre-clinical Supervisor
Simona Lodato
simona.lodato@hunimed.eu
Michela Matteoli
michela.matteoli@hunimed.eu

Abstract
Spontaneous activity is a prominent feature of the immature brain. While spontaneous dynamics in the cerebral cortex have long been overlooked, recent clinical data on preterm infants and preclinical studies have spurred a renewed interest for this early activity. However, appreciation of the role of spontaneous activity during the perinatal stages remains elusive. It is still unknown how spontaneous patterns arise, and whether distinct cortical subtypes can trigger these events acting as pacemaker (Pm).

Our project aims to shed light on how cortical neuronal diversity influences early spontaneous activity. By integrating innovative molecular strategies with in vivo optical recordings and behavioral assays, we plan to characterize and spatially resolve the subtype-specific molecular footprints correlated with electrical profiles of neuron subtypes; assess molecular, cellular and circuit consequences of subtype-perturbations; identify novel functional modulators of early activity in the CSF around birth.

Main technical approaches
Ideal candidates will have a Master level education in Neuroscience or equivalent background. Computational skills and previous wet lab experience are welcome and considered a plus. We are looking for a creative, highly motivated individual with a deep and genuine curiosity about brain development and function.

Scientific references
Lodato S*, Arlotta P* (*corresponding author) Generating Neuronal Diversity in the Mammalian Cerebral Cortex. Annual Review of Cell and Developmental Biology, 2015;31:699-720.
Fontana C et al., Early maternal care restores LINE-1 methylation and enhances

neurodevelopment in preterm infants. BMC Medicine, 2021 Feb5;19(1):42, 10.1186/s12916-020-01896-0.
Zuccaro et al., Human-specific enrichment of schizophrenia risk-genes in callosal neurons of the developing neocortex. Biorxiv, 2021, 10.1101/2021.09.10.459747, revision in Neuron.
Yuan et al., Temporally-divergent regulatory mechanisms govern neuronal development and diversification in the neocortex. Biorxiv, 2020, accepted at Nature Neuroscience, 10.1101/2020.08.23.263434.
Carloni et al., Identification of a Choroid Plexus Vascular Barrier whose closure upon Intestinal Inflammation leads to Behavioral Impairments. Science, 2021 Oct 22;374(6566):439-448, 10.1126/science.abc6108.

Type of contract

PhD scholarship of € 18.000 gross per year awarded by Humanitas University. This sum is exempt from IRPEF income tax according to the provisions of art. 4 of Law no. 476 of 13th August 1984, and is subject to social security contributions according to the provisions of art. 2, section 26 and subsequent sections, of Law no. 335 of 8th August 1995 and subsequent modifications.

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Humanitas University
Via Rita Levi Montalcini 4
20090 Pieve Emanuele (Milano) Italy
Tel +39.02.8224.1 - Fax +39.02.8224.2394
info@hunimed.eu
Website: www.hunimed.eu
C.F. 97692990159