SEMINAR CYCLE

of the PhD in Neuroscience of Turin

6th Appointment

Dott. Marco Canepari

Université Grenoble Alpes

"Optical analysis of neuronal ionic currents in acute brain slices"

26th June, 2023 h 11:00 AM

The lecture will last 1 hour and it will be followed by discussion.

Host: Prof. Valentina Carabelli

Aula B Biochimica - Dipartimento di Oncologia
Via Michelangelo 27

Link: https://bit.ly/3W7TWaj

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DOTT. MARCO CANEPARI

Marco Canepari (MC) obtained his diploma in physics at the University of Genoa in 1994 and his PhD in Biophysics at the International School for Advanced Studies in Trieste in 1999. He was postdoctoral scientists at the National Institute for Medical Research in London, then senior research associate first at the Yale University School of Medicine and later at the Biozentrum of the University of Basel. Since 2010, he is tenured researcher of the Institut National de la Santé et de la Recherche Médicale (INSERM) working in Grenoble. MC is recognized expert in several optical techniques applied to neuroscience, in particular in membrane potential imaging (https://link.springer.com/book/10.1007/978-1-4419-6558-5). He co-authored over 60 peer-reviewed publications listed in Pubmed, he organized several international schools and workshops and he is fellow member of the Physiological Society.

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ABSTRACT

Neurons are spatially-complex cells where ionic currents cannot be measured using the patch clamp technique because the membrane potential (Vm) is not uniform. In my team, we developed techniques to measure optically Ca2+ currents [1] and Na+ currents [2] from various compartments of neurons in the native environment of the brain slice. These approaches are combined with Vm optical measurements using voltage-sensitive dyes, in order to correlate the behaviour of ion channels with the associated Vm change in the different compartments of interest. In addition, the use of selective pharmacology and of computational analysis using NEURON modelling allows dissecting the contribution of diverse ion channels contributing to neuronal excitability as well as their functional synergistic interaction. Starting from a seminal study conducted in the hippocampus [3], we analysed the Ca2+ current associated with climbing fibre synaptic inputs in cerebellar Purkinje neurons [4] and unravelled the biophysical mechanisms underlying local supra-linear Ca2+ signals associated with paired parallel fibre / climbing fibre synaptic activity [5]. The same approaches were more recently used to investigate the interplay of the diverse ion channels responsible for the generation [6] and back-propagation of action potentials in neocortical layer-5 pyramidal neurons. In summary, optical analysis of neuronal ionic currents makes possible the understanding of the sequential activation of different ion channels under physiological and pathological conditions.

[1] Jaafari N, De Waard M, Canepari M (2014) Biophys J 107: 1280-1288 107 : 1280-1288.
[2] Filipis L, Canepari M (2021) J Physiol 599: 49-66.
[3] Jaafari N, Canepari M (2016) J Physiol 594: 967-983.
[4] Ait Ouares K, Filipis L, Tzilivaki A, Poirazi P, Canepari M (2019) J Neurosci 39: 1969-81.
[5] Ait Ouares K, Canepari M (2020) J Neurosci 40: 1795-1809.
[6] Filipis L, Blömer LA, Montnach J, De Waard M, Canepari M (2022) BioRxiv doi: 10.1101/2022.04.12.488116.

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