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Summer Undergraduate Research (SUR) Programme 2024

We are interested in the function of ion channels and work mostly with acid-sensing ion channels, "ASICs". ASICs are Na^+-permeable channels of the nervous system that are transiently activated by extracellular acidification (Vullo & Kellenberger, 2020). These channels are expressed in the neurons of both the central and peripheral nervous systems, and they can alter neuronal excitability. Rapid local acidification occurs in synapses during neuronal activity, whereas slower and sustained tissue acidification develops in ischemia, inflammation, and tumors. Since pH changes occur in many conditions, ASICs have different implications in physiology, such as neuronal plasticity, fear sensing, and pain sensation, and are involved in various pathologies such as epilepsy, neurodegenerative diseases, and neuronal cell death following ischemic stroke. Characterizing the activation and modulation mechanisms of these channels is critical for developing new therapeutic strategies to treat these pathologies. Four different ASIC genes (ACCN1-4) encode six different subunits (ASIC1a, ASIC1b, ASIC2a, ASIC2b, ASIC3, and ASIC4). Functional ASICs consist of three subunits that form a trimeric channel. A channel is made of either identical (homotrimeric channel) or of different subunits (heterotrimeric channel). Biophysical properties of the ASICs, such as pH dependence and current kinetics, depend on the subunit composition. ASIC1a is especially important in the central nervous system, while ASIC3 appears to be important in the peripheral nervous system.

Projects: In our laboratory we are interested in the activation mechanism of ASICs, in their modulation by diverse compounds, as for example calcium ions, and in their cellular roles. Diverse projects in these areas are available.

Techniques: We use cell culture, molecular biology, biochemistry and electrophysiological measurements, either by two-electrode voltage-clamp of Xenopus laevis oocytes, or patch-clamp of mammalian cells.

Reference

Vullo S & Kellenberger S. (2020). A molecular view of the function and pharmacology of acid-sensing ion channels. Pharmacol Res 154, 104166.