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Astrocytic gap junctions contribute to potassium redistribution over the neocortex

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Extracellular potassium ion concentration ($[K]_e$) is tightly regulated throughout the brain because it has a major impact on brain functionality. Potassium concentration is disrupted in many brain diseases such as stroke and epilepsy. My project is designed based on a well-developed experimental platform to investigate the effects of extracellular potassium redistribution in physiological states. All experiments were conducted *in vivo* in mouse neocortex. Two double-barreled K-sensitive electrodes coupled with local field potential (LFP) electrodes were placed 4 mm apart. 50 mM KCl solution was injected focally closer to one of the K-LFP electrodes. $[K]_e$ levels and LFP were measured in two different scenarios: 1) Pharmacological intervention (gap junction blockage); 2) Optical intervention (optogenetics). Focally increased $[K]_e$ was associated with a transient depolarization which in turn spreads into neighboring tissues so called spreading depolarization. Gap junctional blockade in the peri-injection site simultaneously increased the amplitude and duration of the local $[K]_e$ response, and the local field response was greatly prolonged. While in the remote injection site, $[K]_e$ response was decreased after gap junctional blockade application. Optical stimulation decreased the $[K]_e$ both in the peri-injection and remote site. Our preliminary results are evidence of slow K redistribution (take for minutes) throughout the astrocytic syncytium which is partly mediated via astrocytic gap junctions. Potassium redistribution across a large area of the cortex is not a well-studied area because most studies have limited their focus on focal potassium dynamics. In this project we are addressing this gap using novel tools to elucidate potassium redistribution dynamics.

Biography

Azin Ebrahim Amini is a second year Master's student at University of Toronto in the Department of Biomedical Engineering within Neuroscience platform. She has completed her Bachelor's at University of Toronto where she double majored in Neuroscience and Physiology. She is interested in integrative sciences and that's why she continued her graduate studies in an engineering program after obtaining her Bachelor's degree in Sciences. Her interest to multidisciplinary sciences motivated her to learn advanced programming software along with designing a new method for recording intracranial brain activities. Along with being active in academic world she also takes on community service responsibility and engages in leadership and mentorship programs.

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