**SAMRC Clinician-Scientist Conference Abstract Submission**

**Title**

“Investigating the effects of impermeant anions and electrodiffusion on the electrical and computational properties of neurons”

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**Background**

The brain processes information via highly intricate non-linear interactions between chemical and electrical signals varying along narrow spatiotemporal scales. Cable Theory and equivalent circuit models provide valuable predictions of how neural signals propagate; however, are limited in that they fail to account for impermeant anions. Impermeant anions are implicated in cerebral oedema, neurodegenerative disorder, and epilepsy, among other disorders. It remains unknown whether impermeant anions impact the computational and electrical properties of neurons and hence influence pathological states.

**Objectives**

I propose constructing a computational model that will incorporate impermeant anions. Using this model, I will (i.) determine whether impermeant anions can alter the isopotential status of neurons; (ii.) assess whether impermeant anions can alter the propagation of synaptic input, and possibly affect neuronal output; (iii.) probe how such alterations could play a role in disease processes.

**Methodology**

I have programmed an electrodiffusion based multicompartmental neural model using the Python 3 programming language, with user-interfacing developed in the Jupyter/Voila environments. This program will allow me to run computational simulations to elucidate the impact impermeant anions have on the biophysical and computational properties of neurons.

**Results**

Preliminary results from our group indicate impermeant anions play a crucial role in neuronal osmoregulation. We anticipate that the outcome of the simulations will further suggest that impermeant anions affect the neuronal isopotentiality and neuronal signal processing.

**Conclusion**

This work will provide better theoretical descriptions of normal and pathological neuronal functioning.

**Key words:** impermeant anions; electrodiffusion; computational model