

NSERC Discovery grant:

“Cellular and molecular mechanisms of ion transport by the insect excretory system”

April 2021 to March 2026

Research objectives:

One of the central themes in our research is the contribution of airway epithelia to pathobiology of cystic fibrosis lung disease. Particularly, we are interested in understanding why the mutation of an anion channel (i.e. CFTR) expressed in the lung epithelium causes a collapse of the innate immune response. One of the central hypotheses is that mutation of CFTR, in addition to reducing anion and fluid flux into the airway, dysregulate the function of Epithelial Na⁺ Channels (ENaC) which triggers dehydration of the airway and collapse of the mucociliary apparatus that keeps the lung clear of bacteria. Despite several decades of research, the mechanism of interaction between CFTR and ENaC are unknown. We use insect osmoregulatory organs to as a model to study the interaction between anion channels and Na⁺ transporters. Insect osmoregulatory epithelia are an ideal system for this study since their function is very similar to that of airway epithelia and offer genetic and physiological experimental opportunities not available in mammalian tissues.

Our NSERC grant aims to study the intracellular mechanism that connect the activities of ion channels, transporters and pumps. We hypothesized that this interaction is mediated by intracellular Ca²⁺ signaling and the WNK1 kinase pathway. Our research using insect models will allow us to better understand the interaction among epithelial transporters. We expect that the mechanism of interaction among transporters will be present in mammalian tissues. Thus, these results may shed light on the effect of CFTR mutation on the function of airway epithelia.

Team:

This is a collaborative research program. All members of our research team contribute to this project, including the Ianowski Lab members Drs. Xiaojie “Jay” Luan and Yen “Emma” Le, Brendan Murray, Liz van Wyk. As well as our collaborators Drs. Julian Tam and Veronica Campanucci.