Public Abstract
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The studies described in this dissertation focus on several different aspects of physiology.

The Na pump is a cell protein that couples the hydrolysis of ATP to the movement of sodium and potassium across the cell membrane. Maintaining proper sodium and potassium gradients across the cell membrane is important for cellular homeostasis. Peroxynitrite is a reactive nitrogen species produced in the cell when superoxide reacts with nitric oxide. Peroxynitrite reacts with tyrosine residues to form 3-nitrotyrosine. Interestingly, 3-nitrotyrosine levels have been shown to be elevated in a number of pathologies.

Chapters 2 and 3 focus on elucidating the effects of a peroxynitrite on Na pump activity.
Studies presented in these chapters show that: 1) peroxynitrite is a potent inhibitor of Na pump activity, 2) peroxynitrite treated Na pump contains 3-nitrotyrosine residues and modifications to cysteine residues and 3) the Na pump may be a target of peroxynitrite in cells. Overall these studies suggest that peroxynitrite could be a regulator of Na pump activity.

Chapter 4 focuses on identifying a putative denitrase activity in red blood cells. A denitrase activity capable of reversing 3-nitrotyrosine back to native tyrosine would have implications for cell signaling, protein repair and overall 3-nitrotyrosine levels. In chapter 4 I describe experiments investigating the presence of a denitrase activity in red blood cells. The red blood cell would be an ideal cell for a denitrase activity. However, experiments could neither rule a denitrase activity in nor rule one out.

In chapter 5 I present a study investigating the effects of perivascular adipose tissue on the reactivity of coronary arteries and show that this adipose tissue can in some situations blunt agonist induced constriction. Interestingly this effect appeared to be altered by exercise. This study suggests the possibility that the fat surrounding blood vessels can impact the reactivity of those blood vessels.

Lastly, in chapter 6 I present a study focusing on some basic aspects of Na pump functioning. Specifically, we demonstrate that terbium is a non-competitive inhibitor of rubidium uptake suggesting it does not bind to the outside transport site of the Na pump. In contrast we show that chrysoidine competes with sodium and potassium for ATPase activity suggesting chrysoidine binds to the inside transport site. Together these results support chrysoidine, but not terbium, might be a useful probe for the transport site. We also show that the outside transport site is very specific for monovalent cations over divalent cations.

The findings from these studies, which are contained in this dissertation report, add to the larger scientific community by contributing to our understanding of peroxynitrite, pumps and perivascular adipose tissue.