Cardiovascular Consequences of Social Stress: Implications for Cardiovascular Disease

Introduction

The current Great Journeys project is focused on the negative cardiovascular consequences of social stress. Specifically, this project will utilize a unique rodent model to investigate the mechanisms through which social stress contributes to the development of cardiovascular disease. This is an extension of studies that are currently funded by a National Institutes of Health (NIH) R15 grant (*Mechanisms of social isolation and environmental enrichment in an animal model*; 1R15HL112350; 08/05/12 – 08/04/15; National Heart Lung and Blood Institute, NHLBI), as well as projects that have been funded by previous Great Journeys Awards. The present research is necessary to generate data for the submission of a new NIH R01 grant application to be submitted in 2015 (at the completion of my R15 award).

Using a novel animal model, the socially monogamous prairie vole, this research will investigate the interactions of the social environment with cardiovascular health. This research will directly inform our understanding of risk factors for cardiovascular disease, and therefore has a very high chance of securing additional external funding. This research also will provide excellent training for a Graduate Assistant in both technical and conceptual knowledge in the context of social behavior, stress, and cardiovascular regulation.

Significance and Goals of this Project

Cardiovascular disease is the leading cause of death for both men and women in all developed countries. In the United States alone, over 81 million people have some form of cardiovascular disease, and it claims the lives of over 600,000 people each year. Aside from traditional cardiovascular risk factors such as high cholesterol, high blood pressure, smoking, and mood disturbances, specific stress from the social environment takes a significant toll on cardiovascular health. For instance, individuals who experience loneliness, social isolation, or disruptions of social bonds are at an increased risk of developing – and dying from – cardiovascular disease. The interactions of the social environment and health have received a great deal of national attention recently (for instance, Oprah Winfrey's *Just Say Hello* Campaign, http://www.oprah.com/packages/just-say-hello.html).

The specific psychological and biological mechanisms through which social stress leads to cardiovascular disease are not well understood. It is essential to better understand these mechanisms to facilitate improved treatments for cardiovascular disease. This project will therefore investigate the cardiovascular consequences of several social stressors using the socially monogamous prairie vole. Prairie voles are rodents that provide an extremely powerful translational model for studying interactions of the social environment with biological systems. Similar to humans (but unlike other rodents), prairie vole behaviors and biology are intimately linked to their social environment. They display several unique characteristics, including the formation of long-term social bonds, living in extended family groups, and displaying several behavioral and biological changes when exposed to social stressors. This project will address the following aims in the prairie vole model:

- **Aim 1:** To investigate the mechanisms through which short- and long-term social stressors in prairie voles influence cardiovascular function. It is hypothesized that social stressors will negatively influence the autonomic nervous system, thereby leading to cardiovascular consequences (increased heart rate and blood pressure).

- **Aim 2:** To investigate the neural mechanisms through which social stressors influence the autonomic nervous system and the heart in prairie voles. It is hypothesized that blockade of oxytocin, a peptide produced in the brain, will negatively influence social behaviors in prairie voles, thereby leading to dysfunction of the autonomic nervous system and cardiovascular consequences.