Inspired air is conditioned (warmed and humidified) by the upper airways to prevent cooling and desiccation of the lung parenchyma. Although this process is usually successful, under severe conditions such as strenuous exercise in frigid environments, unconditioned air penetrates into the peripheral airways. Acute airway obstruction in asthmatic humans is common after this stimulus.

A late phase response of mild airway obstruction and inflammation may also occur. Most importantly, the high incidence of chronic airway disease in people that repeatedly exercise in frigid environments suggests that repeated cooling and drying can lead to persistent airway injury. Racehorses and racing sled dogs routinely perform strenuous exercise in cold environments, and pilot studies suggest that these animals also experience peripheral airway cooling and drying. If these animals experience the same spectrum of airway injury and dysfunction as is reported in humans, then racehorses and racing sled dogs could serve as valuable animal models for study of cold weather-induced airway disease in humans. In this project, we will examine the acute, delayed, and long-term peripheral airway responses to strenuous cold weather exercise in these models to determine their usefulness in the study of the analogous human condition. Specifically, dogs and horses will perform strenuous treadmill exercise while breathing frigid air, and we will measure pulmonary resistance, reactivity, and a wide range of markers of airway inflammation to characterize the airway responses to a single cold air challenge in the same manner as existing data derived from humans. We will use these same measurements to determine the changes in pulmonary mechanics and airway inflammation in dogs that perform repeated exercise in frigid environments.