

Title: Activation of respiratory response to cold air

Introduction:

- The paper will discuss how the respiratory system responds to cold air and the mechanisms that control the response.
- Motivation (helps to understand the critical design parameters and motivation for a breath warmer I am designing)
- There are several known physiological responses to breathing cold air, identifying which signal triggers which response is the area with the greatest degree of uncertainty.

Background

- Overview of the respiratory system and a chronology of O_2 / CO_2 /heat/humidity transfer as air is inhaled and exhaled
- Description of known responses to cold air exposure
 - Bronchoconstriction (as a reflex response)
 - Rhinorrhea (runny nose)
 - Vasodilation of nasal passages (short term vs. long term behavior)
 - Increased nasal air resistance

Methods/Results

- What responses are triggered by cold sensors in the nasal mucosa?
 - Method 1: comparison of breathing cold air through the nose vs. through the mouth while in a warm room
 - Method 2: spray Freon up the nose (someone actually did this study)
 - Results
- Are long term effects regulated by temperature sensors or osmolarity sensors?
 - Method: comparison of breathing cold dry air vs. warm dry air
 - Results

Discussion

- The short term effects of cold sensor stimulation in the nasal mucosa is fairly well understood
 - Mechanism
- In general the mechanisms regulating the effects of long term exposure to cold air are less well understood
 - Difficulties with isolating the different possible mechanisms
 - Implications of current data/what we still do not know.