Paul Martino, Ph.D.

**Award:** Research Infrastructure Program; $9956.00

**Title:** Associate Professor, Biology

**Project:** The Effects of Zelevated CO2 and Anxiety Vulnerability on Stress and Performance: Potential Implication for Extended Space Travel

**Abstract:** (First Paragraph of Proposal)Carbon dioxide (CO2) is an important gas involved in the neural control of breathing. It is the primary driver of the normal resting breathing cycle (eupneic breathing). Humans have evolved with relatively constant and low atmospheric levels of CO2 in the range of 0.04% of total atmospheric gases. There is a direct relationship between arterial blood partial pressure of CO2 and the acidity of the blood. With increasing partial pressure of CO2 in the blood leading to increasing acidity and there decreased arterial pH (Dempsey, 1982, Martino, 2006 and 2007, and Forster 2008)2. Normal human arterial pH is in the range of 7.35 – 7.45. In 1965 Schwartz et al. (Schwartz, 1965) demonstrated that the pH is vigorously defended and at all inspired levels of CO2. Jennings and colleagues demonstrated in conscious dogs that after breathing a mixture of 5% CO2 for 2,4,7, and 14 days that there was a triphasic response when studied beginning a day after being removed from chronic 5% CO2. During acute hypercapnia (elevated CO2) there was an increased response compared to controls, and this was followed by a decrease in breathing below initial control levels, and finally elevated breathing levels for 4-14 days after being removed from chronic 5% CO2 (Jennings et al.). In their review of the rate of acclimatization to chronic hypercapnia, Clark et al. demonstrated using evidence from numerous studies that indeed the human body will acclimatize to chronically elevated levels of CO2. Acclimatization is the process by where an organism upregulates defense mechanisms to adapt to an environmental insult such as elevated CO2, and thus the organism is able to maintain homeostasis (an active regulation of a physiological variable such as CO2 so that the variable remains relatively constant). On average the acclimatization to chronically elevated CO2 for physiologic variables such as respiration, arterial pH, cerebral spinal fluid pH takes approximately 3-5 days with the majority of the acclimatization occurring within the first 24 hours (Clark, 1971). That being said, there are still many unknown changes in many other physiologic variables that might be a consequence of exposure to chronically elevated CO2, such as changes to all of the human hormones, and changes to the nervous system, both in the central (brain and spinal cord) and the peripheral (all other parts of the nervous system) portions.

**Biography:** Dr. Paul F. Martino earned a B.A. in Natural Sciences and Mathematics from Dowling  
 College in 1993, an M.S. in Exercise Physiology from Ball State University in 1996, a Ph.D. in Physiology from Medical College of Wisconsin in 2006, and completed an American Heart Post-Doctoral Fellowship at Wright State University in 2008, as well as an additional post-doctoral training in breathing research at Medical College of Wisconsin in 2009. He has collaborations on research projects both at his current institution, Carthage College in Kenosha, Wisconsin, and at Medical College of Wisconsin located in Milwaukee, Wisconsin. His research interests have spanned the breadth of physiology in awake and sleeping rats, goats, and humans. Of interest in this research have been the cellular and molecular mechanisms involved in the neural control of breathing responses to changes in pH, and CO2. He has also studied human physiologic responses to changes in pH, CO2, sleep, strength and endurance exercise, and vitamin E and C. His current research collaborations at Carthage College investigate the endocrine, respiratory, and cardiovascular responses to anxiety, behavioral inhibition, and chronic exposure to CO2 in college age adults.

**Congressional District**: 1

**Congressional Representative**: Paul Ryan