STS-131: Protein Expression in Heart and Salivary Glands: Effects of Extended Space Flight

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Secretory and cardiac tissues respond to a variety of environmental stimuli, including zero gravity (ØG), encountered during space travel. Previous studies of short duration (~1 week) space flight missions showed that the expression of specific proteins was modified by exposure to both ØG and hypergravity conditions. The objectives of the present study were to determine, at the tissue, cellular and molecular levels, the effects of extended space flight (15 days) on secretory and regulatory proteins, and to test if these ØG conditions have an additive effect on protein expression. Adult female C57Bl/6J mice housed in Animal Enclosure Modules (AEMs) were flown on the STS-131 mission. Ground control mice were housed in AEMs for 15 days. Tissues were collected within 5 hr of landing. Salivary glands and heart ventricles excised from flight animals and ground-based controls were frozen at -80°C for biochemical (electrophoresis, Western and Northern blotting) experiments, or fixed and processed for morphological (electron microscopy, immunocytochemistry) experiments. Electrophoretic cardiac protein profiles of flight animals differed significantly from those of controls. A major high molecular size peak (~75kD) and a faster-moving component (~15kD) were both increased, while mid-range components were either the same or variable, indicating possible cardiac responses to ØG. In the parotid glands, expression of RII and amylase was decreased, as seen by Western blotting and immunocytochemistry. Parotid secretory protein (PSP) was unchanged, and demilune cell and parotid protein (DCPP) was increased as measured by immunocytochemistry. Rodent salivary glands are structurally and functionally similar to those of humans. Proteins present in secretion granules of salivary gland cells are released into saliva and can be used to monitor effects of environmental stress. Employing saliva as a diagnostic test medium could have clinical applications and be useful in measuring human responses to space flight. Support: NASA grant NNX09AP13G