INTRODUCTION
Herpesviruses belong to a group of medically important viruses that may pose an unacceptable health risk to astronauts. Control over herpesviruses is primarily mediated by cellular immunity, which is decreased during and after space flight. We have been gathering evidence from Shuttle missions that herpesvirus reactivation occurs more frequently in astronauts than in normal healthy adults. We have also found that the magnitude of herpesvirus reactivation increases with mission duration. Thus, a major concern on long-duration missions is the possibility of disease arising from reactivation of latent herpesviruses. This study was undertaken to assess antigen-specific immunity in long-term space flight to correlate with changes in viral reactivation.

CURRENT STATUS OF RESEARCH
Methods
Multiple pre- and post-flight samples were collected in this study to better characterize changes in neuroendocrine hormones, immune function, and latent herpesvirus reactivation. To date, we have collected longitudinal samples from six International Space Station crewmembers from Expeditions 5 and 6; the duration was 184 days and 161 days, respectively. We measured plasma and urinary cortisol, plasma cytokines (IL-6, -10), intracellular cytokine production by antigen-specific T cells, and viral load in peripheral blood.

Results
Elevated levels of cortisol were found in blood and urine after landing. Altered levels of IL-6 and IL-10 were also observed. Production of intracellular tumor necrosis factor-alpha (TNF-α) and interferon-gamma (IFN-γ) by CD4+ T cells were decreased just before launch as compared to baseline levels indicating a generalized stress-induced decrease in immune function. Cytokine production was also decreased immediately after space flight and returned to baseline levels within a few days after landing. Notably, viral load was higher in peripheral blood collected at landing as compared to preflight levels suggesting an expansion of virally-infected lymphocytes during flight. Collectively, these preliminary data indicate that stress- and space flight-associated changes (e.g., anticipation of launch, acute changes in g-forces, sleep deprivation, etc.) resulted in a decline in cellular immunity and an increase in viral load after space flight.

FUTURE PLANS
These data, although preliminary, indicate that decreased immunity and latent herpesvirus reactivation occur during long-term missions. We will continue to collect samples from both short- (Shuttle) and long-term (ISS) missions; our next missions are STS-114 and Expedition 11. We are also developing a ground-based model of space flight in order to develop and test countermeasures.