Objectives

• Address significant lack of data regarding immune status *during* flight.
• Replace several recent immune studies with one comprehensive study that will include in-flight sampling.
• Determine the in-flight status of immunity, physiological stress, viral immunity/reactivation.
• Determine the clinical risk related to immune dysregulation for exploration class spaceflight.
• Determine the appropriate monitoring strategy for spaceflight-associated immune dysfunction, that could be used for the evaluation of countermeasures.
ASSAYS FOR INTEGRATED IMMUNE

JSC Immunology Laboratory
- Leukocyte subsets
- T cell function
- Intracellular/secreted cytokine profiles

Mercer University
- Plasma cytokine balance
- Leukocyte cytokine RNA

Microgen Laboratories
- Virus specific T cell number
- Virus specific T cell function
- Plasma stress hormones

JSC Microbiology Laboratory
- Latent herpesvirus reactivation (saliva/urine)
- Saliva/urine stress hormones
- Circadian rhythm analysis
SUBJECTS

Completed to date:

10 Short duration
5 Long duration

Total ‘n’:

17 Short duration
17 Long duration
A. Immunophenotype, T cell function, intracellular/secreted cytokine profiles.
• No in-flight changes in bulk leukocyte subsets
• Post-flight granulocytosis
• Late in-flight/postflight elevated B cells, reduced NK cells
• In-flight, post-flight trend towards elevated CD4:CD8 ratio, elevated memory T cell subsets
• Elevated effector memory, central memory in-flight
• No change in peripheral constitutively activated T cells
CD8+ T CELL FUNCTION: A+B 24 hours

ISS

SEA+SEB 24hr

CD4/CD69
CD4/CD69/CD25
CD8/CD69
CD8/CD69/CD25

CD8+ T CELL FUNCTION: A+B 24 hours
CD8+ T cell – Intracellular IFNg

Secreted Cytokine Profiles (CD3/CD28 48hr)
B. Leukocyte cytokine mRNA
Gene Expression of Markers of Innate (A) and Adaptive (B) Immune Responses (short-duration flights).

A.

Intervals of sample collection

B.

Gene Expression of Markers of Innate (A) and Adaptive (B) Immune Responses (short-duration flights).
Gene Expression of Markers of Innate (A) and Adaptive (B) Immune Responses (long-duration flights).

A.

1. **TNF-α, IL-1, IL-6**
   - Subj 6
   - Subj 7
   - Subj 8

B.

1. **IFN-γ (Th1 clones), IL-4 (Th2 clones), IL-10 (Treg clones)**
   - Subj 6
   - Subj 7
   - Subj 8
C. Virus specific T cell number, function, plasma stress hormone levels.
Plasma cortisol levels - ISS

Collection Time

L-180 L-45 14d 2-4m 6m R+0 R+30

ug/dL

Cortisol on ISS

 ug/dL

Collection Time

L-180 L-45 14d 2-4m 6m R+0 R+30
Collection Time

EBV T cell function - ISS

% CD8 T-cells

Collection Time

EBV T-cell function - ISS

L-180 L-45 14d 2-4m 6m R+0 R+30
D. Latent herpesvirus reactivation (saliva/urine), saliva/urine stress hormones, circadian rhythm analysis.

JSC Microbiology Laboratory
Urine CMV Assessment

ISS

CMV copies/ml

L-180 L-10 R+0 R+14

CMV copies/ml
Saliva VZV Assessment

SHUTTLE

VZV copies/ml

Pre flight
During flight
Post flight

Sub 7
Sub 15
Sub 12
Sub 9
Sub 8
Sub 14
Sub H

0
200
400
600
800
1000
1200

0
d-200
d-180
d-160
d-10
0
10
16
4
14
24
Saliva VZV Assessment

ISS

VZV copies/ ml

Pre flight

During flight

Post flight

Sub 3
Sub 5
Sub 2
Sub 11
Sub 13
Questions?