Strain- The Heart of the Matter

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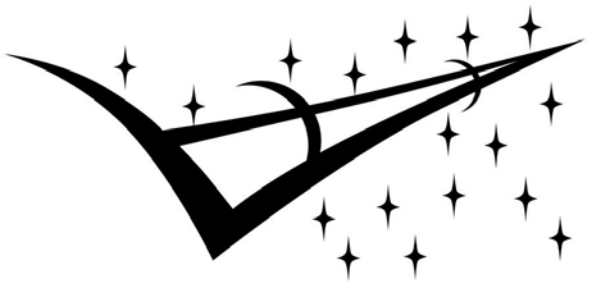
Exercise Physiology & Countermeasures Project (B.261)

SPACE LIFE SCIENCES
SUMMER INSTITUTE



Introduction:

Originally from beautiful Northing Michigan

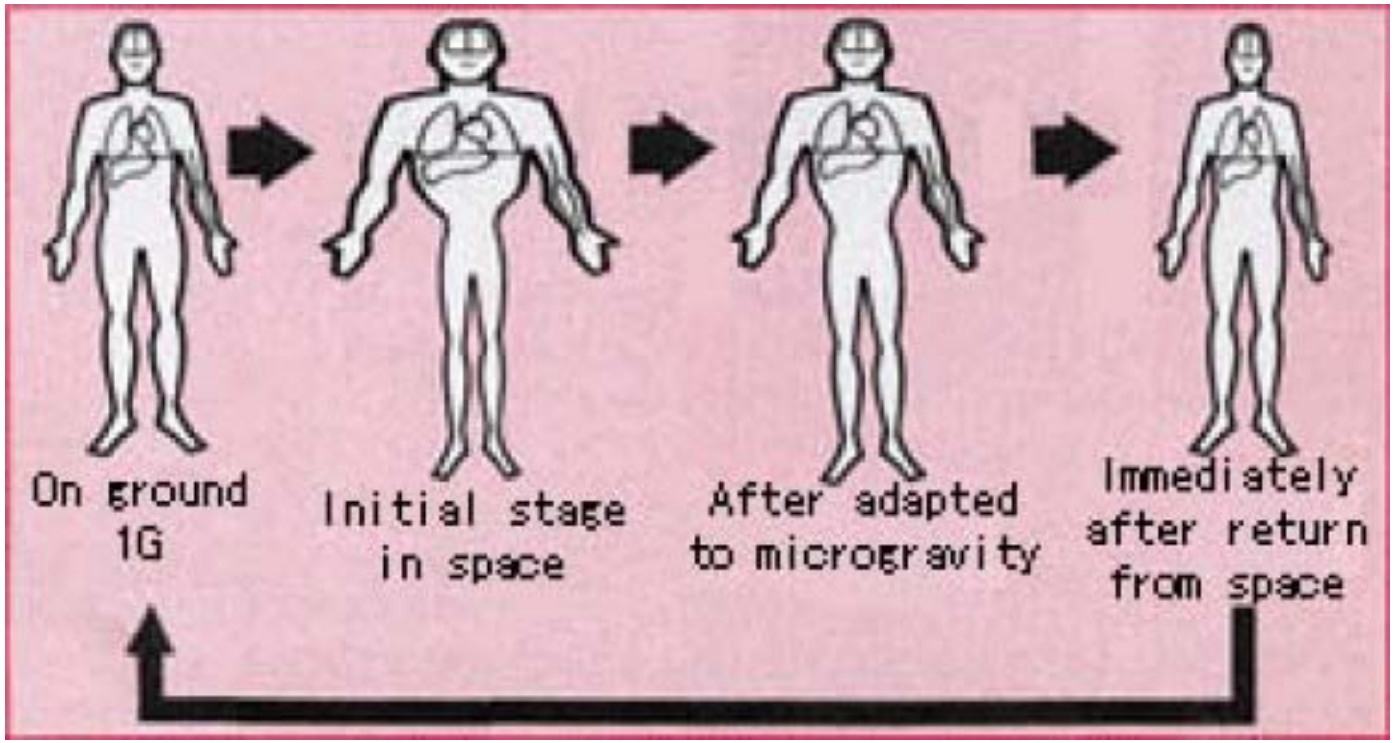
Graduated in 2007 from Central Michigan University with a Bachelors in Health Fitness In Preventative and Rehabilitative medicine

Graduated in 2010 from Texas A&M University with a Masters in Exercise Science

Summer Objectives

- Become overall knowledgeable in echocardiography
- Identify basic cardiac structures and function measures
  - Novel cardiac function measures (tissue Doppler, speckle tracking)
- View ultrasound acquisition during bed rest
- Analysis of echocardiography images
  - Demonstrate reliability in analyzing longitudinal strain
  - Setup spreadsheet for speckle tracking data
  - Analyze longitudinal strain bedrest data in Q-lab at 7 timepoints (BR-2, BR7,21,31,70, +0, +3)
  - Analyze Q-lab output in Matlab
  - Compile longitudinal strain results
  - Twist analysis (time permitting)

Background: Space Flight & Cardiovascular Effects



- Fluid Shift towards the head
- Decrease in overall blood & plasma volume
- Atrophy of the LV
- Reduction of LV chamber size
- Decrease LV end diastolic volume (EDV)
- Reduction of LV chamber size

Study Background:

- Objective: Identify how much exercise is needed to maintain pre-bedrest / pre spaceflight strength, minimize any flight complications and reduce time required to reacclimate to Earth's gravity.

- Subjects volunteered to participate in a 70 day 6º head down tilt (HDT) study at UTMB hospital in Galveston.

  HDT are used to study microgravity for several reasons:

  1. Allows subjects to experience atrophy of lower extremities from disuse
  2. Allows scientist to study the fluid shifts and the subject's cardiovascular & physiological effects
  3. Allows several studies to be measured & conducted simultaneously in a safe and monitored environment

- Throughout those 10 weeks, subjects were either in an exercise or control group

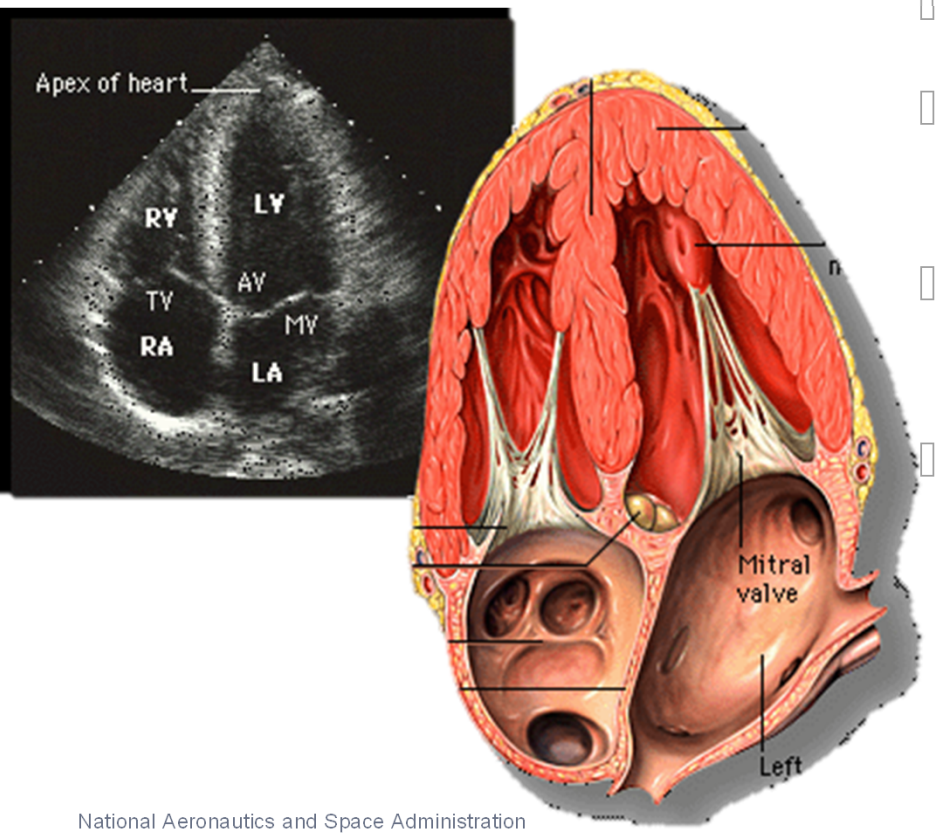
Exercise Modalities

Bed Rest

VS

Spaceflight

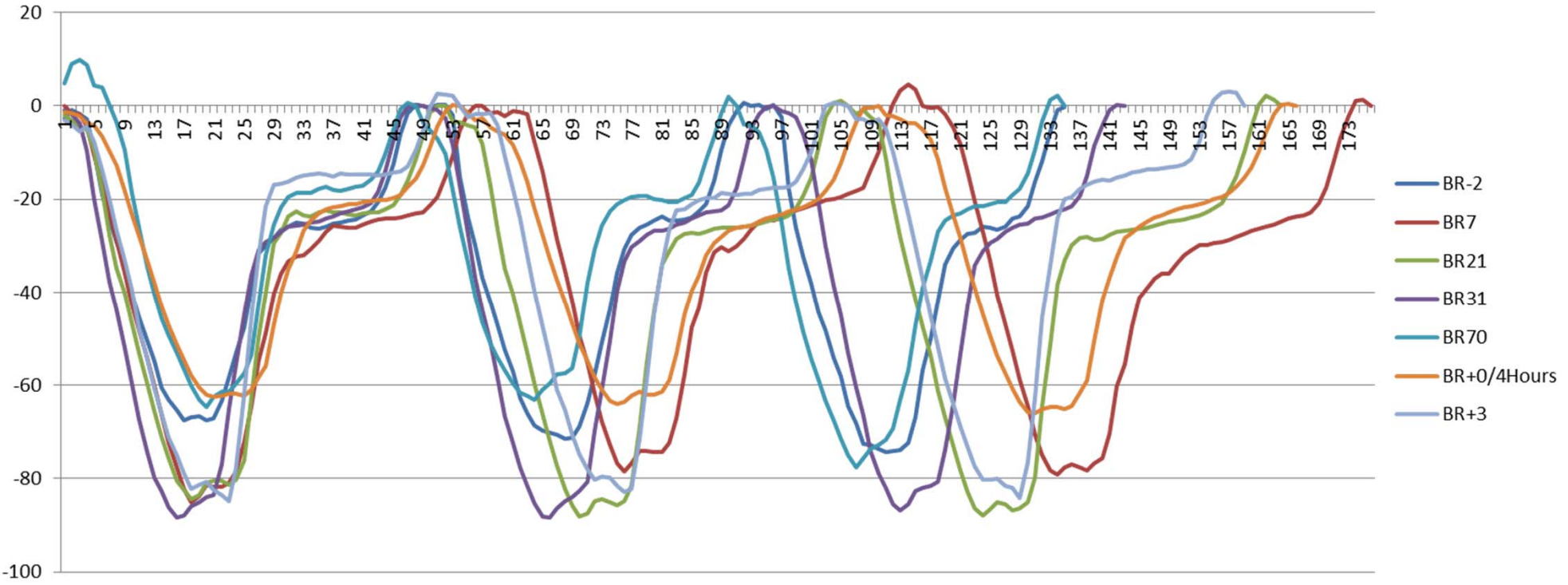
Echo Timeline & Methodology



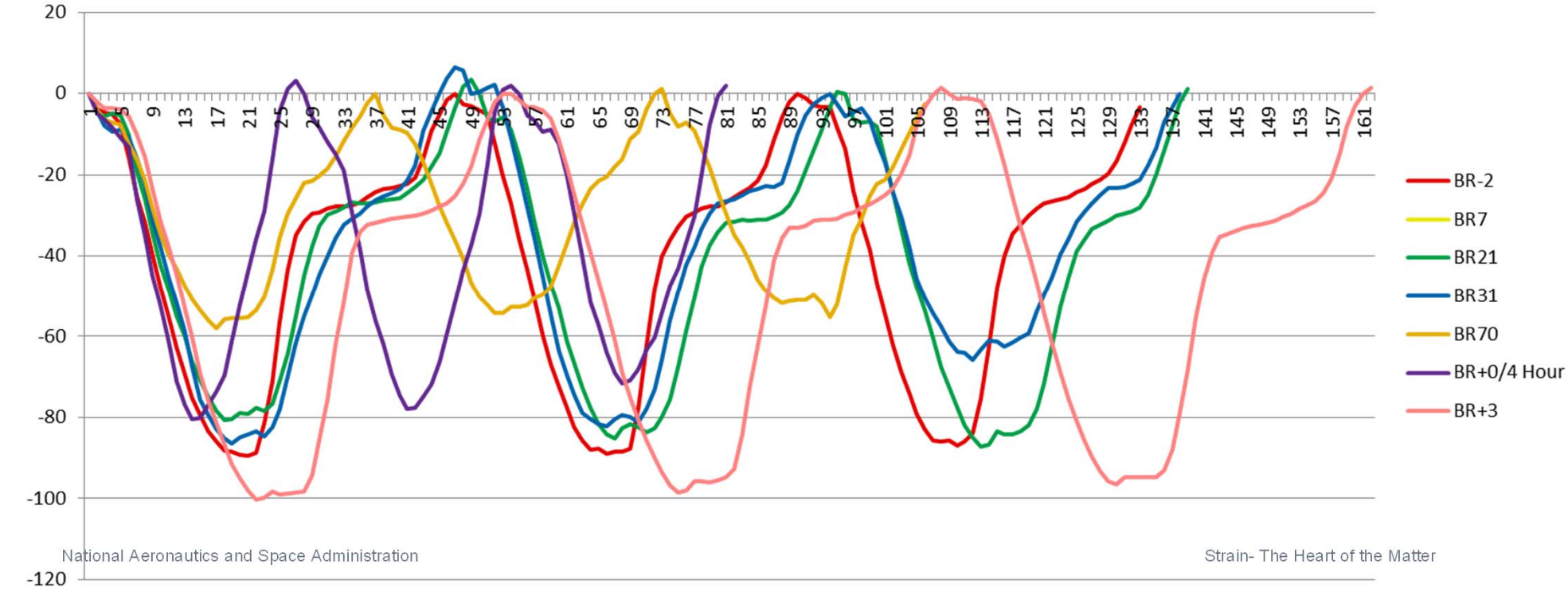
- N= 19
- Each subject had a total of 7 echoes over a span of 75 days, 70 of which were spent in HDT
- Phillips Q-Lab Cardiac Analysis was used to analyze all 133 echoes
- 4 Chamber echoes were used to measure strain and track the movement of the LV

Phillips QLab

Longitudinal Strain: The change in the sarcomere length within the walls of the left ventricle (LV)



LONGITUDINAL STRAIN OVER TIME



Why is this important?

- Never before has cardiac strain been monitored at set time points throughout spaceflight or bed rest study.
- Once we clearly understand this technique, protocols can be formulated for astronauts to use on the ISS as both a diagnostic and monitoring tool.
- Echoes could have the possibility to predict & monitor heart health, cardiac strength, endurance, and overall rate of muscle degradation.
- Also, echoes can act as an additional factor in determining exercise prescriptions and effectiveness.

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