Whole Organism Changes on the International Space Station

Tara M Ruttle, Ph.D.,
Associate ISS Program Scientist, NASA
Tara.m.ruttle@nasa.gov
Astronauts experience a spectrum of adaptations in flight and postflight.

- Balance disorders
- Cardiovascular deconditioning
- Decreased immune function
- Muscle atrophy
- Bone loss

- Neurovestibular
- Cardiovascular
  - Bone
  - Muscle
  - Immunology
    - Nutrition
    - Behavior
    - Radiation
Plant Systemic Changes In Response to Spaceflight

- Plants as a food source
- Plants for life support
  - Growth and development
  - Gravitropism, Circumnutation
  - Plant responses to the environment: light, temp, gases, soil
  - Stress responses
  - Stem cells/pluripotency

Moss grown in the dark
On the Space Shuttle

Peas grown on ISS
Model Organisms
Spaceflight Impacts on Vision

Hyperopic Shifts Up to +1.75 diopters

Journal of Nutrition, Zwart, et. al February 2012
Ophthalmology, Mader, et. al October 2011

Source: ISS Program Scientist, NASA
13 days of spaceflight caused significant changes in rodent eye structure and gene expression (STS-133)

- Changes in optic nerve consistent with mechanical injury did not resolve upon landing.
- Changes in the expression of DNA damage repair genes and those in cell death pathways.
- Changes in the expression of genes that help cells cope with oxidative stress in the retina, possibly caused by radiation exposure, were partially reversible upon return to Earth.
