

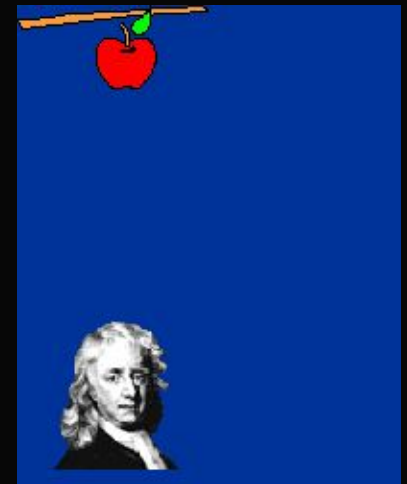
# Life in Space





# Gravity

- Gravity is one of the most fundamental forces in the universe.
- Acceleration due to gravity near the Earth's surface is  $9.8 \text{ m/s}^2$  this is called 1 'g'.





# Microgravity



- Once in orbit spacecraft and space stations are microgravity environments.
- As they “fall” around the Earth astronauts experience weightlessness.



# Science in Microgravity

- The microgravity environment of space can be used by scientists to remove the effects of gravity while undertaking experiments.





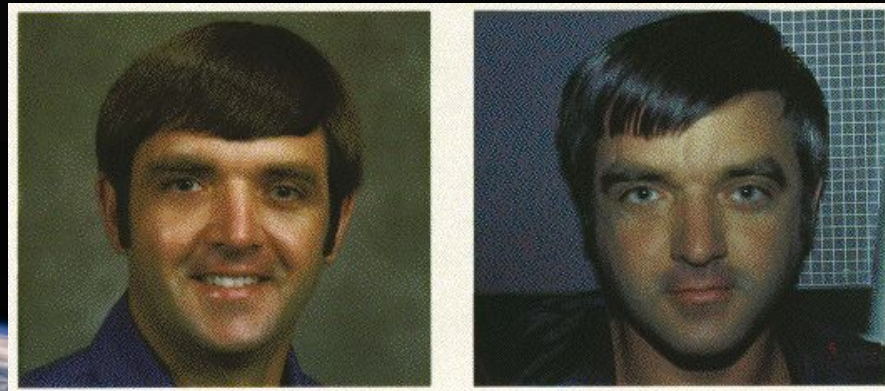
# Microgravity

- Life on Earth has developed in a 1 'g' environment and many of our bodies system rely on gravity.
- The reliance of the human body on gravity is clearly seen when gravity is removed.



# Humans in Microgravity

- When exposed to a microgravity environment humans experience many side effects.
- Headward fluid shift or “Puffy Face” is the first effect noticed as the absence of gravity allows blood to move from the lower body to the head.



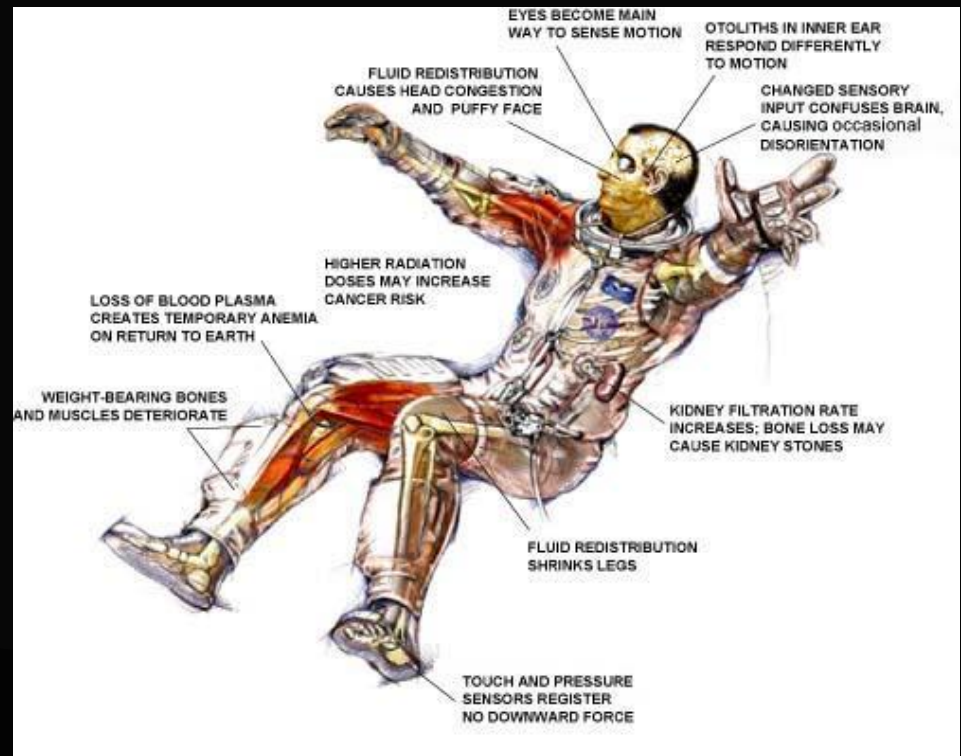
# Humans in Microgravity

- The microgravity environment causes a rapid loss of bone density.
- This is thought to be caused by gravity playing a role in the generation of the hormones responsible for bone growth.



# Humans in Microgravity

- In the absence of gravity muscles in the legs and back begin to weaken and atrophy as they are no longer required to support the weight of the astronauts.







# Space and the Brain

- The effect of the space environment on the brain and nervous system is an important area of study.
- The space environment has a large effect on the biological clock and sleeping patterns of astronauts.



# The Vestibular System



# The Vestibular System

- The Vestibular System maintains balance by sending information to the brain about position and movement by sensing gravity.
- In microgravity the vestibular system becomes confused and astronauts can experience dizziness and space motion sickness.
- As astronauts adapt to the microgravity environment they begin to rely on visual sensory input for reference.





# Space Motion Sickness

- ❑ Space Motion Sickness is experienced by more than 50% of all astronauts during their first few days exposure to microgravity.
- ❑ It results in nausea and vomiting and is detrimental to crew performance.





# The Spacecraft Environment

- The spacecraft or space station must provide a pressurised environment, safe air and drinking water.
- The environment must be monitored to avoid microbial contamination this leads to a decrease in the astronaut's immune function.





# Radiation

- ▣ Astronauts are exposed to ionizing radiation from the sun.
- ▣ The effects of radiation are separated into two categories: acute and long term.



**DANGER**  
Radiation  
risk



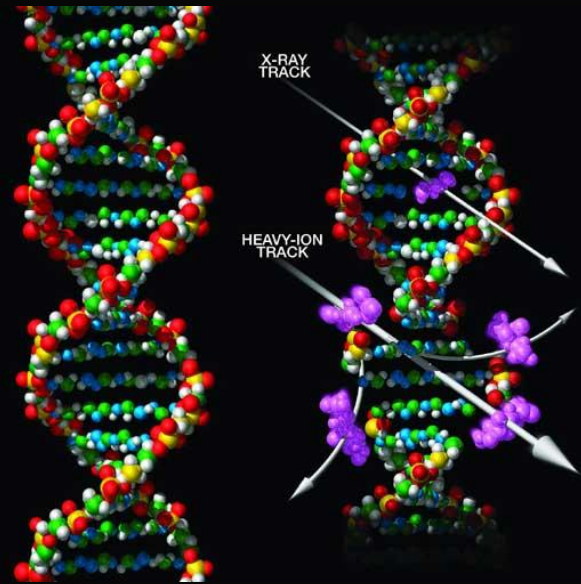
# Acute Effects of Radiation

- The acute effects of radiation exposure are those that are immediately seen:
  - Nausea
  - Vomiting
  - Skin-reddening
  - Dehydration
- Because only moderate doses of radiation are encountered these effects aren't usually seen in astronauts.



# Long Term Effects of Radiation

- The long term effects of radiation exposure are much more dangerous to astronauts.
- The passage of a charged particle through a cell causes ionisation of the cellular structure causing cell death.
- Most dangerous is the non-lethal mutation of DNA molecules which can lead to cancer.





# Long Duration Space Flight

- As human space flight moves from relatively short term missions into long duration space flight like the 3 year trip to Mars we must study the effect of long term exposure to the space environment.



# Studying Plants and Animals

- In order to understand the effect of space on biology scientists study plants and animals in space.
- This is important not only for biological study but also for investigating plants for food and environmental functions in space.

