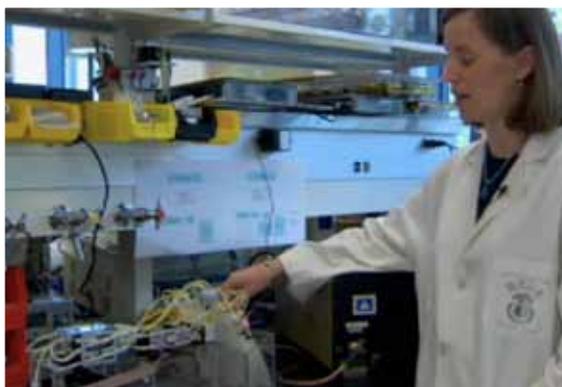




Cells in Space

Growing Cells on the Space Shuttle



Washington, DC (Walter Reed Army Institute of Research) -- Scientists and engineers build automated devices that grow cells for experiments on the space shuttle. On the space shuttle, the cells grow in a "weightless" environment. Analyzing the cells may help scientists understand astronauts' "wasting" symptoms (loss of muscle mass, reduced immune function) which are similar to symptoms experienced by patients on long-term bed rest.

"We thought it would be a good idea to compare the results of growing bone and muscle cells on the ground with muscle cells up in space." Peter Quinn, engineer

Framework

Middle School

Standards

- NSES - B.ii.3 ➤ Unbalanced forces cause changes in speed and direction.
- NSES - C.i.5 ➤ The human organism has systems.
- NSES - C.iii.2 ➤ An organism's internal environment is regulated.
- NSES - D.iii.3 ➤ Gravity holds us to the Earth's surface.
- STL - 14.G ➤ Innovations in medical technologies are described.

Content Illustrated

- A space shuttle orbits the Earth.
- Technology mimics human organ systems.



Content



Physical Science

- Astronauts float because both they and their spaceships are falling around the Earth. There's 11 percent less gravity in the space shuttle than on Earth. They still have weight, but float because they're "falling." It's comparable to being on the downward track of a roller coaster ride.
- The space shuttle is within the pull of the Earth's gravity. The right velocity is needed to keep the ship in orbit.

Life Science

- Effects of weightlessness on humans include: bone demineralization, muscle mass reduction, and weakening of the immune system.
- Scientists investigate cell growth and renewal on Earth compared with growth and renewal in a weightless environment.

Technology

- The bioreactor equipment is designed to mimic human physiological function, run tests simulating different biological conditions, and record results.

Engineering

- Researchers use the cell culture module to model the human body: brain as a circuitboard, heart as a pump, veins as a series of tubes, and blood as a circulating cell-culture medium.

Math

- Proportional Reasoning: compare weights on Earth and in orbit. Weight while in orbit is 11 percent less than Earth weight.
- Compound Inequalities: the range of velocities needed to keep the space shuttle in orbit.

Guiding Questions

- What parts of the human body are mimicked in the webisode?

Suggested Activities

To think about as you watch:

- Research the history of significant problems that have had an impact on space travel.
- Watch this webisode as an additional resource for *Engineering Now: Proteins - Challenge 1: Bioreactor*.

Keywords

bioreactor, cell culture module, culture medium, demineralize, gravity, orbit, shock, trauma, wasting symptoms, weightless