John Glenn's Return to Space

Lesson Development **GRADES 9-12**

Apollo capsule (Image: NASA)

Earth (Image: NASA)

John Glenn STS-95 portrait (Image: NASA)

INSTRUCTIONAL OBJECTIVES

Students will

- experiment to observe some effects of calcium loss on bones;
- use Internet resources to identify similarities and differences between John Glenn's two flights; and
- develop a PowerPoint™ presentation to organize and share their understanding about:
  - the similarities and differences of Friendship 7 and STS-95;
  - challenges of living in space; and
  - ways to maintain bone mass in space and on Earth.

BACKGROUND

On February 20, 1962 NASA launched one of the most important flights in American history. NASA's mission was to send a man to orbit Earth, observe his reactions and return him home safely. Astronaut John Glenn accomplished this mission, making history when he rocketed into space on the first American manned orbital mission aboard the Mercury –Atlas 6 Friendship 7 spacecraft, returning safely to Earth 4 hours, 55 minutes and 23 seconds later.

Thirty-six years later, on October 29, 1998, Glenn added another milestone to NASA's history when at age 77, he returned to space. Serving as a payload specialist on STS-95 aboard the Space Shuttle Discovery, Glenn spent most of his time, during the 213 hour and 44 minute flight, participating in investigations on the aging process. His experiments tested how his body responded to the reduced gravity environment, focusing on balance, perception, immune system response, bone and muscle density, metabolism, blood flow and sleep.

Glenn's return to space provided valuable physiological and psychological research on the physiology of aging. Scientists learned that the aging process and a space flight experience share a number of similar physiological responses, including bone and muscle loss, rising calcium levels in the blood, balance disorders and sleep disturbances. The results of this research may help counter some of the effects of the aging process of people on Earth.

ENGAGE

Use the Discovery Now audio clips, Project Mercury, Friendship 7, and John Glenn Returns to Space to discuss with your students their understanding of John Glenn's role in Project Mercury and STS-95. The clips can be found at: ***http:// www.discoverynow.us/2008/nasa50.html***

NATIONAL EDUCATION STANDARDS

National Science Education Standards

- **Science as Inquiry**
  - Abilities necessary to do scientific inquiry
  - Understandings about scientific inquiry
- **Physical Science**
  - Motions and forces
- **Life Science**
  - Matter, energy, and organizations in living systems
  - Behavior of organisms
- **Science and Technology**
  - Abilities of technological design
  - Understandings about science and technology
- **Science in Personal and Social Perspective**
  - Natural and human induced hazards
  - Science and technology in local, national and global challenges
- **History and Nature of Science**
  - Science as a human endeavor
  - Nature of scientific knowledge
  - Historical perspectives

National Educational Technology Standards

- Creativity and Innovation
- Communication and Collaboration
- Research and Information fluency
- Critical Thinking, Problem-Solving & Decision Making
- Digital Citizenship
- Technology Operations and Concepts

National Council of Teachers of Mathematics

- Algebra
- Measurement
- Problem Solving
- Communication
- Connections
- Representation

Apollo capsule (Image: NASA)

Earth (Image: NASA)

Space Shuttle Discovery at night (Image: NASA)

These questions can help guide your discussion:

- Who were the "Mercury Seven"? Can you name them?
- What was significant about the Friendship 7 flight?
- Why was the STS-95 mission a success for NASA and John Glenn?
- How do you think John Glenn's return to space helped people on Earth?

EXPLORE

In a reduced gravity environment, less physical stress is placed on astronauts' bones and muscles. Studies have shown that astronauts can lose 1-2% of their bone density for every month they are in space. Resistive exercise and good nutrition can help prevent bone loss and weakened muscles in space and on Earth.

During this EXPLORE Activity; your students will examine what happens when there are changes in the amount of calcium in bones.

This activity is a modification of the NASAexplores lesson "Bendy Bones." This and other related resources can be found at: ***www.NASAexplores.com***.

A. Changing Bones

1. Prepare for the Lesson:
   - Organize students into teams of three or four.
   - Copy Student Handout 1 for each student.
2. Gather these materials for each team of students:
   - 2 chicken leg bones, meat and gristle removed
   - White vinegar
   - Bleach
   - 2 jars with lids
   - Paper towels
   - Triple beam balance
   - Flexible tape measure
3. Distribute copies of Student Handout 1 to students. Review these directions with your students.
   a. Dry off any excess moisture on your team's bone.
   b. Weigh and measure the bone, recording its mass and length in the first block under the appropriate section of Student Handout 1.
   c. Examine the bone carefully.
   d. Try to bend the bone and record your observations on the handout.
   e. Place the bone in the jar with enough vinegar to completely cover the bone.
4. Repeat Step 3 with a second bone using bleach instead of vinegar.
5. Use caution when handling the bones, especially the ones placed in bleach. You may wish to wear kitchen gloves to protect your hands.
6. Weigh and measure the bones each day at the same time for the next week.
7. Record mass, length and your observations in the appropriate block on Student Handout 1.
8. Lead your students in a discussion about the changes they observed in the bones after soaking them in vinegar and in bleach.

Apollo capsule (Image: NASA)

STS-95 Space Shuttle Discovery Crew with John Glenn in the middle. (Image: NASA)

John Glenn aboard STS-95 (Image: NASA)

EXPLAIN

A. Use these questions to help lead a discussion with your students about the EXPLORE experience:
- How did the bones change over the course of the week?
- What happened when you tapped the bones on the table?
- How did this experiment simulate changes to an astronaut's bones in a reduced gravity environment?
- What might you do to prevent the bones from changing in the vinegar or bleach?
- What might astronauts do to help prevent changes in their bone mass while in a reduced gravity environment?

ELABORATE

A. Share these resources with your students to deepen their understanding about the effects of bone loss and the challenges John Glenn faced in space.

1. John Glenn
   - John Glenn: NASA Biography
     http://www.nasa.gov/centers/glenn/about/bios/glennbio.html
   - John Glenn
     http://www.johnglennhome.org/john_glenn.shtml
   - John Glenn
     http://starchild.gsfc.nasa.gov/docs/StarChild/whos_who_level2/glenn.html
2. Friendship 7 and STS-95
   - Spacecraft Comparison
     http://spaceflight.nasa.gov/shuttle/archives/sts-95/veh_comparison.html
   - STS-95
     http://science.ksc.nasa.gov/shuttle/missions/sts-95/mission-sts-95.html
   - STS-95 Discovery
     http://www.thespaceplace.com/shuttle/missions/sts-95.hmtl
   - MA-6 (23)
     http://science.ksc.nasa.gov/history/mercury/ma-6/ma-6.html
   - In Their Footsteps: The Mercury 7
     http://www.nasa.gov/centers/kennedy/about/history/mercury7_prt.htm
   - Glenn Orbits the Earth
     http://www.nasa.gov/centers/glenn/about/bios/mercury_mission_prt.htm
   - Friendship 7 MA-6 (23)
     http://www-pao.ksc.nasa.gov/kscpao/history/mercury/ma-6/ma-6.htm
3. Bone Loss in Space
   - How Long Does it Take to Rebuild Bone Lost During Space Flight?
     http://www.nasa.gov/mission_pages/station/science/subregional_bone.html
   - Foot Reaction Forces During Space Flight
     http://www.nasa.gov/mission_pages/sttation/science/experiments/Foot.html
   - Space Station Research Yields New Information About Bone Loss
     http://www.nasa.gov.home/hqnews/2004/mar/HQ_04084_station_bone_loss.html
   - Good Vibrations
     http://astrobiology.arc.nasa.gov/news/expandnews.cfm?id=1127

Apollo capsule (Image: NASA)

Original Mercury 7 astronauts (John Glenn is third from the left on the first row.) (Image: NASA)

"Black Eye Galaxy" M64 (Image: NASA)

- Gravity is Bone Glue?
  http://www.astrobio.net/news/modules.php?op=modload&name=News&file=article&sid=2009&mode=thread&order=0&thold=0

B. Challenge your students to create a brief PowerPoint™ presentation that answers one of the questions below:
- What comparisons can you make between Friendship 7 and STS-95 Discovery?
- What challenges do astronauts face when living in space?
- What can be done to help maintain bone mass in space and on Earth?

The students may find it helpful to review this Nortel LearniT video tutorial when creating their own PowerPoint™ presentations. The tutorial can be found at: ***http://nortellearnit.org/technology/PowerPoint_Presentations/***

Encourage your students to put a descriptive title screen, credits and references at the end of the project. Please remind students to use only images that they have permission to include. Review copyrights and copywrongs by watching the Nortel LearniT video tutorial at: ***http://nortellearnit.org/technology/Digital_Ethics/***

EVALUATE

Through discussion and the results of the EXPLORE experience, determine if your students have an accurate and deeper understanding of the differences and similarities between the Apollo 11 capsule and the Orion CEV.

To evaluate PowerPoint™ slides, use a rubric found at the Nortel LearniT site:
- PowerPoint™ Presentations
  http://nortellearnit.org/resources/Handouts/

EXTEND

This activity may be used to extend or continue your students' exploration.

A. Encourage your students to listen to these additional Discovery Now audio clips from previous Discovery Now seasons:
- Spinning Brains ***http:// www.discoverynow.us/2008/shuttle.html***
- Good Vibes ***http:// www.discoverynow.us/2008/shuttle.html***
- Women in Space ***http:// www.discoverynow.us/2007/shuttle.html***
- Mercury 13 ***http:// www.discoverynow.us/2007/shuttle.html***
- Staying Sane in Space ***http:// www.discoverynow.us/2007/shuttle.html***
- Centrifuge for Astronauts ***http:// www.discoverynow.us/2007/shuttle.html***
- Bone Loss in Space ***http:// www.discoverynow.us/2007/shuttle.html***

Once your students have listened to the clips, urge them to write and record their own audio and video Discovery Now clips. They might imagine they are reporters interviewing John Glenn. Possible interview questions include:
- What interested you in space travel?
- How has space travel changed your life?
- What technological advancements made the STS-95 mission easier, or more difficult, than the Friendship 7 mission?
- Which experiment(s) did you find the most interesting when aboard STS-95?
- What advice can you give young men and women who wish to become astronauts?

Directions: Record your measurements (length and mass) and observations in the spaces provided. Use one block for each day. Be sure to document the initial mass and length of your bones.

Vinegar	Bleach