

# “LOSS IN SPACE”



## **Background:**

Astronauts in space face many risks while on their missions. One risk they must deal with before they ever reach space is the bone loss experienced during their time in microgravity. Astronauts spend years training to go into space, and there are many precautions taken. One way astronauts prepare to go into space is by strengthening their muscles and making sure their bones are as strong as possible by eating right and exercising.

On short flights, astronauts generally workout for at least a half hour a day. They have special machines that simulate gravity’s resistance on their muscles and bones. Because astronauts on the International Space Station are exposed to the harsh condition of microgravity for longer amounts of time, they must work out for about two hours each day in order to keep up their bone density. Certain parts of the body suffer from greater bone density loss than others. This results from not using muscles that are used often on Earth (such as using our legs muscles for walking on Earth). During this lesson students will explore activities that will help build bone density while in space, as well as keep the muscles and bones that are used less in space strong and healthy.

## **Procedure:**

1. Ask students to think of some cardiovascular activities they do on a regular basis. List these activities on the board (examples might include running, swimming, basketball, soccer, gymnastics, bike riding, etc.)
2. Have the students identify the activities on the list that would be different without gravity. Which parts of the body do these activities use? (For instance, soccer without gravity would be difficult because both the ball and player would not be pulled to the ground).
3. Have the students think of ways to do these activities when there is less gravity than we have on Earth (the astronauts run on a treadmill that they are strapped to, to work their muscles).
4. In groups, ask students to develop a set of exercises that do not need the pull of gravity in order to be affective. Provide students with supplies they can use to design instruments to help with the exercises. Some examples are listed in the box on the right. The set should include at least one resistance exercise for the arms, one for the legs, one for the abdomen, and one for the back. It should also include a cardiovascular plan. Remember, all these exercises need to be conducted in microgravity, and in a small space (examples may include a device that uses a rubber band to create resistance, or foam to push against while strengthening muscles).
6. Bring students together as a group and have them present their ideas.
7. With each group’s ideas in their heads, ask your students to put together a week long exercise routine for an astronaut on the International Space Station. (Remember, these astronauts exercise for about 2 hours a day to keep their muscles and bones strong).
8. Have student complete the handout on bone density loss in space. Ask them if their activity schedule helps fight the bone loss in the areas of the body most at risk to losing bone density. After completing this handout, ask the students to evaluate their exercise routine to see if the areas of the body discussed on the handout are all taken care of.

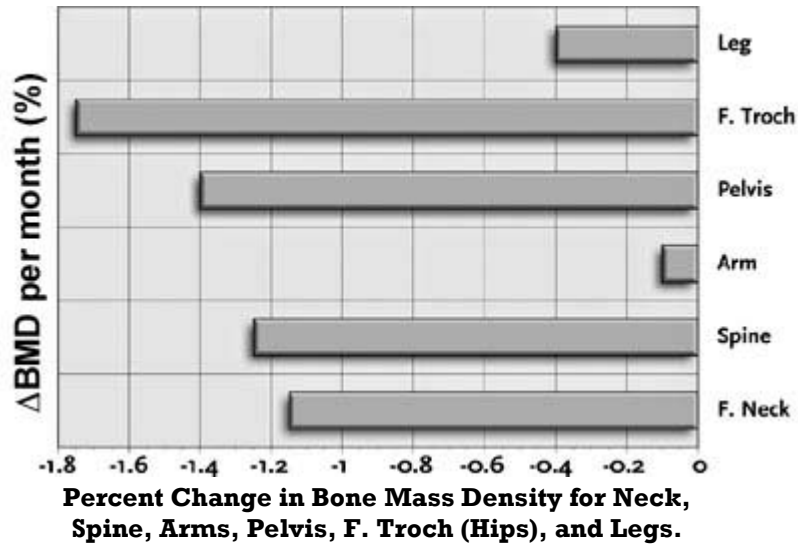
## **Possible supplies**

- Rubber bands
- String
- Paperclips
- Popsicle sticks
- Foam
- Bubble-wrap
- Balloons
- Cardboard
- Tape
- Ruler

Name: \_\_\_\_\_

## Loss in Space: Student Handout

The following activity uses real data collected from the astronauts. Use the table given below and your class discussion to answer the questions about bone loss.



The table above shows the percent of bone density loss for different parts of astronaut's bodies during their time in microgravity.

1. Which parts of the body lose the most bone density?

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2. Explain why bones from these parts of the body lose so much more density than other parts?

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3. Why do astronauts' arms not lose as much bone density as other parts of their body?

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4. What types of activities did you come up with to help exercise each of these areas?

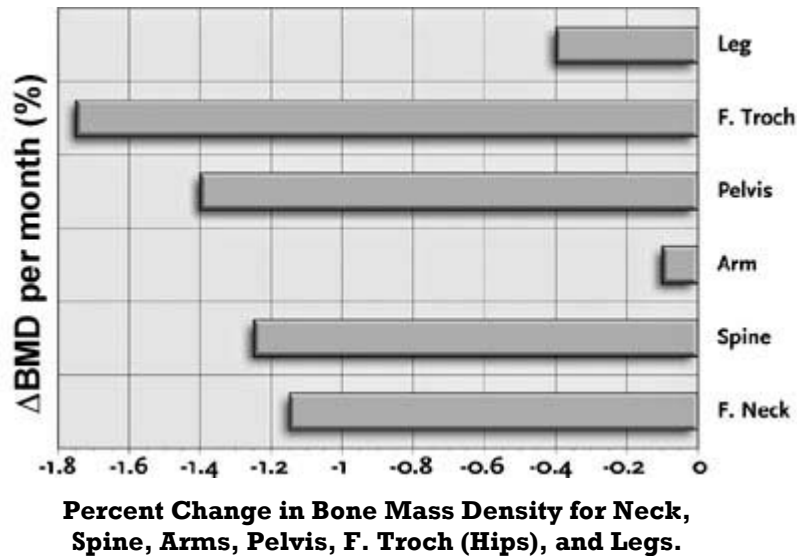
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## Loss in Space: Teacher Guide

The following activity uses real data collected from the astronauts. Use the table given below and your class discussion to answer the questions about bone loss.



### 1. Which parts of the body lose the most bone density?

*The Trach (hips), Pelvis, Spine and Neck lose the most bone density.*

### 2. Explain why bones from these parts of the body lose so much more density than other parts?

*These parts of the body are used a lot less in space than on Earth, where there is gravity. We constantly use our hips and pelvis almost constantly to support our body on Earth, and in space these parts of our body are not used nearly as often. The same can be said for our neck and spine, which are holding up our head and body against gravity on Earth.*

### 3. Why do astronauts' arms not lose as much bone density as other parts of their body?

*Astronauts use their arms to pull themselves around the space station or shuttle. Because they are in microgravity, they float around and have to use their arms to hold onto things that might otherwise float away.*

### 4. What types of activities did you come up with to help exercise each of these areas?

*Answers will vary, but should include some resistance exercises and some cardiovascular exercises that do not include the pull of gravity (the astronaut will need to be strapped onto something or pulling against something other than gravity).*