Explore!

Bones of Contention

Facilitator Background Information

Astronauts may seem to have a lot of fun in microgravity — doing flips in mid-air, pushing off effortlessly from one part of the spacecraft to sail to another part. However, there are some down sides for astronaut health!

One of the biggest challenges facing space travelers is the loss of bone mass. The bones become brittle and are at higher risk of fracture. Bones need physical stress to maintain their health. In microgravity, bones do not get the kind of workout that they do on Earth, and they deteriorate. To counteract this bone loss, astronauts must spend up to two hours every day exercising and they must get proper nutrition (for example, adequate calcium, vitamin D, and other nutrients). And it is not just *astronauts* that need to get enough exercise and calcium. Kids on Earth do, too!

Our bones form the support structure of our bodies. They protect our organs, help us to move around, store minerals (like calcium), and produce blood cells. Bone is living material that is constantly being broken down and formed. Bones are our body's "calcium bank;" calcium is constantly being removed — or resorbed — from the bones to use for other bodily processes. To maintain healthy bones, in addition to good nutrition (like calcium and vitamin D), we also need to get lots of exercise — because building bone requires physical stress. On Earth, most of our bone growth occurs until we are about 18–20. This is why it is so important to make sure that you drink lots of milk and eat other sources of calcium and get lots of physical activity when you are young. If you don't build healthy bones by the time you are 15–20 years old, you won't be able to make it up later in life. Once you are in your 20's and older, you are no longer building bones, you are maintaining them with good nutrition, vitamin and mineral supplements, and exercise.

In microgravity, little physical effort is needed to move around or perform tasks or to hold our body in a rigid posture. Because we don't need bones in space, our body stops devoting resources and energy to maintain them. Astronauts lose approximately 1 to 2% of their bone mass for each month they are in space. This means that they lose 10% of their bone mass in less than a year — on Earth, humans over the age of 50 lose about 10% of their bone mass over a period of 10 years! Too much bone loss can lead to a disease called osteoporosis — where the bones are at much higher risk for fractures and breaks.

Bone mass loss — on Earth or in space — means that bones become more brittle, they fracture and break more easily when stressed. To make the challenge to health even more complex, that calcium coming from bones can be deposited elsewhere in the body and cause problems — like kidney stones. To counter bone loss astronauts undergo almost two hours of exercise each day, including resistive exercises — strength training — and aerobic exercises — bicycling and walking or running on the treadmill. This physical stress helps to reduce bone loss. NASA medical researchers define how much calcium and other minerals and vitamins are needed by each astronaut, and their meal plans are adjusted to meet these requirements.

Once the astronauts return to Earth, the bone loss stops. Scientists are working to understand if the lost bone can be completely replaced, and if the new bone is the as strong as the original bone. Because space travel has been limited to relatively short visits — very few people have flown more than 6 months, and the longest has been about 14 months — we are still working to understand the impact of extended weightlessness on the human body. NASA is testing new exercise equipment and routines, nutrition, medications, and other ways to help combat the changes to the human body in space.