

# Taking a Midnight Stretch

Segment 4

## Purpose

- To measure the effects of gravity on the spine
- To simulate the effect of a reduced gravity environment on the human body

## Background

The force of gravity on Earth pulls down on the body all day, creating resistance that keeps bones and muscles strong. This force also compresses or pushes down on the cartilage discs in the back. These cartilage discs are like flexible sponges that act as shock absorbers as our bodies move. Just like sponges, the cartilage absorbs water, which can be squeezed out when a force pushes on it. During a night of rest, without gravity pressing them down, the cartilage discs expand, creating a temporary height increase.

Space travel has many effects on the human body. One effect is that an astronaut's height increases while he or she is in space. The increase in height happens because there is less gravity to compress the cartilage discs between the vertebrae in the spine. However, the astronauts do not continue to "grow" in space. Once the cartilage has expanded, it will not get any larger, but this phenomenon can cause an astronaut's height to increase by up to five centimeters. When the astronaut returns to Earth, his/her height also returns to normal. The effects on cartilage do not appear to cause any harm to astronauts, but space suits must be designed to compensate for this temporary change in height.

## Procedure

1. Remove your shoes.
2. Stand straight with your back against the wall and your heels against the base of the wall.
3. Place a book, spine up, on top of your head. Make sure the edge of the book is against the wall above your head. See diagram 1.
4. Gently move your head back and forth until it feels like the bottom of the book is flat against the top of your head.
5. Hold the book tightly in position against the wall and carefully lower your head away from the wall.
6. Turn around and lightly mark with a pencil where the bottom edge of the book meets the wall.
7. Measure from this mark on the wall to the floor in centimeters.
8. Record the measurement as your "End of Day Height."
9. As soon as you get up in the morning, repeat steps 1–7.
10. Record the new measurement as your "Beginning of the Day Height."
11. Calculate the difference between the two marks. This difference is your "Overnight Height Change."
12. After walking around for 15 minutes, repeat steps 1–7.
13. Continue to walk for 30–45 minutes and repeat steps 1–7 again.
14. Record your findings.
15. Repeat the experiment each day for at least three days.
16. Be sure to keep notes about your sleep habits for each day, including the number of hours you slept each night and whether you got up during the night.
17. Compare your results with friends and family who are conducting the same experiment.

## Materials

- cm measuring tape
- hardback book
- pencil
- height data sheet

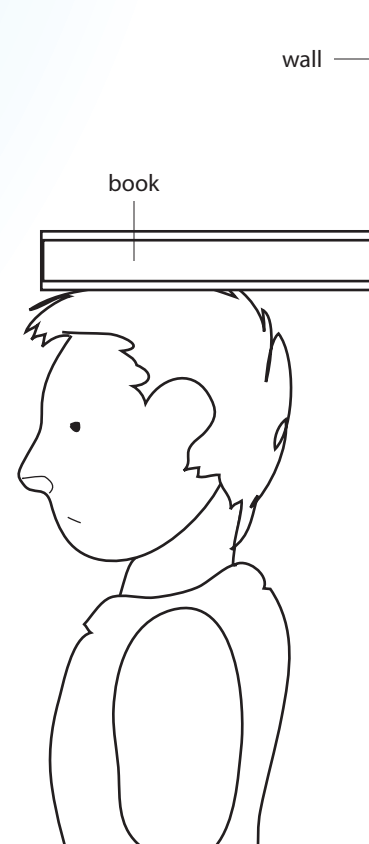


Diagram 1

# Taking a Midnight Stretch

## Discussion

1. What happened to your height each morning? Why?
2. How did this experiment simulate the effects of space on astronauts?
3. If an astronaut stays in space for an extended period of time, will he/she continue to grow?
4. What design changes would you make to ensure that a space suit fits an astronaut during flight?

## Height Data Sheet

	End of Day Height	Beginning of Day Height	Overnight Height Change	Time Asleep	Notes About Sleep
Day 1					
Day 2					
Day 3					

## Record the time at which height returns to End of Day Height

Time Elapsed (minutes)	15	30	45
Height (cm)			