Being in space affects astronauts’ bodies, with some visible and measurable effects starting within the first 10 minutes. On Earth, gravity causes most of the body’s fluids to be distributed below the heart. However, in space there is less gravity, allowing fluids to spread equally throughout the body. Within a few days of coming back to Earth, astronauts’ circulation returns to normal. Before going to space, astronauts go through many simulations to experience what a lack of gravity does to their bodies. On Earth, simulation in low gravity is done underwater in a giant swimming pool. This simulation is called neutral buoyancy.

In the U.S., astronauts practice in the NASA Neutral Buoyancy Laboratory. It is 62 meters (202 feet) in length, 31 meters (102 feet) in width and 12 meters (40 feet) in depth — 6 meters (20 feet) above ground level and an equal distance below ground. Astronauts spend seven hours training in the water for every hour they will spend spacewalking during a mission. Astronauts in the pool have two-way communication capability with flight controllers in the Mission Control Center, several miles away. An Extravehicular Mobility Unit, (EMU) suit worn by each astronaut in the pool weighs about 127 kilograms (280 pounds).

When astronauts first travel to the International Space Station (ISS), they feel as if they have colds and their faces look puffy. The circumference of their legs also becomes smaller. This happens because there is little gravity in space to pull the fluids in their bodies outward, like blood from their heads down to their feet. Consequently, astronauts get puffy faces and skinny bird legs. Within a few days of coming back to Earth, astronauts’ bodies return to normal.
YOUR MISSION

Simulate the fluid shift felt by astronauts when they travel to space.

PART 1

1. With a partner, stand up and tie a piece of yarn around the widest part of your calf.
2. Your partner should measure the distance around the mid calf portion (widest part) of your leg where the yarn is.
3. Record the measurement in the data table on the following page. Repeat steps 1-3 with your partner.

PART 2

1. Predict what will happen to the distance around your leg if you lie down for 10 minutes.
2. Record your predictions on the data table.

PART 3

1. You and your partner take turns lying down on the floor with legs raised against the wall at a 90 degree angle for 10 minutes.
2. After 10 minutes, before you stand up, have your partner measure the distance around your calf using the yarn as a guide.
3. Record the measurement on the data sheet.
4. Repeat steps 1-3 for your partner.
5. Compare your results to your partner’s results.

IMPORTANT!

While team members are completing their turns on the floor they should brainstorm with each other and invent two exercises astronauts can do while on the ISS that would keep blood flowing throughout their bodies. Every astronaut is required to exercise for two hours every day; help them from getting bored by suggesting new exercises to do. Write your ideas on the back of your data sheet and share with the class later.

YOUR TASK

MEASURE LEG BEFORE EXPERIMENT & RECORD YOUR RESULTS

CAN YOU PREDICT WHAT WILL HAPPEN?

PROP LEGS UP AGAINST A WALL FOR 10 MINUTES

MEASURE LEG WITH YARN AGAIN, AND RECORD YOUR RESULTS
## DATA SHEET

<table>
<thead>
<tr>
<th>NAME</th>
<th>MEASUREMENT STANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PREDICTIONS

Will my leg become smaller? Larger? Remain the same?

### MEASUREMENT LYING DOWN

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

## QUESTIONS

1. What happened to the distance around your leg after it was raised for 10 minutes? 
   Why do you think this happened?

2. Do your results compare with what might happen to astronauts when they are on the ISS?

3. Why do astronauts get a puffy face and bird legs when they are on the ISS? Did you get bird legs during this activity?

4. What do you think astronauts do to help lessen the effects of this problem?

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*Left: NASA Commander Barry (Butch) Wilmore enjoys Zero-G.*

*Right: NASA Commander Terry Virts exercises on a treadmill onboard the ISS. The crew is required to exercise at least two hours every day.*