

## All Systems Go -- Space Physiology, Grade 5 –8

### Program Description:

What happens to the human body during long space flights? Using the latest research from NASA and others on physiological changes in space, students learn about the human systems through a series of whole group and learning station activities. They view segments from Shuttle missions that illustrate how human systems are affected by microgravity. Simulated blood typing, measuring blood pressure, heart rate, lung volume, and other respiratory functions, and other activities allow students to become familiar with the various systems. They use microscopes, digital blood pressure equipment, spirometers, computer probeware, and other technologies in gathering their data.

**A modified version of this class is available for grades 9-12:**

### All Systems Go - Space Physiology - grades 9-12

Do the heart, lungs, and blood vessels function differently in space than here on Earth? Why is it important to understand the changes that occur in the functioning of these systems? Join us in finding answers to these questions as we explore human physiology and examine topics such as cardiac output, the effects of fluid shift, tidal volume, expiratory reserve volume, and vital capacity.

### Vocabulary:

cardiovascular	fluid shift	respiratory	systolic
capacity	gravity	physiology	tidal volume
diastolic	microgravity	pulse	vestibular organs
earth normal	neurosensory	space normal	volume

### Possible Class Activities:

- Introduction: What happens to the human body during long space flights? How do our hearts and lungs function under prolonged microgravity conditions? What do we know about space physiology?
- “To Be an Astronaut” video clip.
- Examine the science behind the Disposable Absorption and Containment Trunk (DACT) -- otherwise known as the “diaper.”
- Whole-group activity related to the loss of balance in space.
- Learning stations are introduced: heart rate monitor and printout tasks, blood pressure measurements, lung capacity calculations using spirometers, lung volume measurements, vestibular balance boards, microscopic views of blood cells, skin temperature

measurements, "Heart In Space" CD (NASA), and research on physiological changes in microgravity.

- Share class data from various stations.
- Closure: What did we find out? This is the time to review highlights of today's investigations and acknowledge any questions that may have arisen as a result.

### **Pre-Visit Activities (in your school):**

- Explain reasons for field trip (discuss theme).
- Stress following directions exactly and listening carefully.
- Introduce vocabulary if appropriate.
- Practice performing tasks in pairs and recording data. Try the following:
- Ask your students to balance on one leg and time how long the first effort lasts. Time two more attempts (trials) and compare times. Students should work in pairs and record this information.
- How many breaths do you take in a minute at rest? After running in place for a minute? Record results.
- Measure pulse rates at rest and after running in place for a minute. Record data. Discuss what gravity is and how it affects different objects.

### **Post-Visit Activities:**

- Have students keep a diet log, a diary that records everything one eats and drinks.
- Use the book *Blood and Guts: A Working Guide to Your Own Insides* by Linda Allison for a broad selection of activities related to anatomy and physiology.
- Visit the International Space Station exhibit and see how this environment has been modified to help humans move about and work under microgravity conditions.
- Visit one of the Web sites for further explorations.

### **Web Site Reference(s):**

Life Sciences Web: Research information about human physiology in space is provided by NASA. <http://lifesci.arc.nasa.gov/resamesoverview.html>

### **State of California Science Standards:**

#### **Fifth Grade Life Sciences**

**2.** Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept, students know:

**b.** how blood circulates through the heart chambers, lungs, and body, and how carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) in the lungs and tissues.

## **Seventh Grade Structure and Function in Living Systems**

**5.** The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept, students know:

- a.** plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.
- b.** organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
- c.** how bones and muscles work together to provide a structural framework for movement.
- g.** how to relate the structures of the eye and ear to their functions

## **Physical Principles in Living Systems (Physical Science)**

**6.** Physical principles underlie biological structures and functions. As a basis for understanding this concept, students know:

- h.** how to compare joints in the body (wrist, shoulder, thigh) with structures used in machines and simple devices (hinge, ball-and-socket, and sliding joints).
- j.** that contractions of the heart generate blood pressure, and that heart valves prevent backflow of blood in the circulatory system.

## **Ninth through Twelfth Grades Physiology**

**9.** As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic), despite changes in the outside environment. As a basis for understanding this concept, students know:

- a.** how the complementary activity of major body systems provides cells with oxygen and nutrients, and removes toxic waste products such as carbon dioxide.
- b.** how the nervous systems mediates communication between different parts of the body and interactions with the environment.
- g.** the homeostatic role of the kidneys in the removal of nitrogen wastes, and the liver in blood detoxification and glucose balance.