

# HOMEOSTASIS: A BALANCING ACT

## AT A GLANCE

Students will participate in activities that illustrate homeostasis in the human body.

### OBJECTIVES

Students will:

- Understand the process of homeostasis in the human body
- Explain how positive and negative feedback influence homeostasis in the human body
- Know that homeostasis is regulated by the nervous system and the hypothalamus
- Be able to demonstrate an example of homeostasis in the human body

### KEY VOCABULARY

homeostasis, negative feedback, positive feedback, hypothalamus

### SUGGESTED GRADE

LEVELS: 6—8

### ILLINOIS STATE LEARNING GOALS Late Elementary

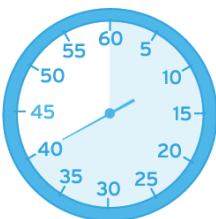
1: B, C; 5: A; 6: B; 7: A; 11: A;  
23: A

### Middle/Junior High

1: B, C; 3: C; 5: A; 6: B; 7: A; 11: A;  
23: A

### PACE YOURSELF

40 MINUTES



museum of  
science+industry  
chicago



### ADVANCE PREPARATION

Copy student handouts.



### MATERIALS

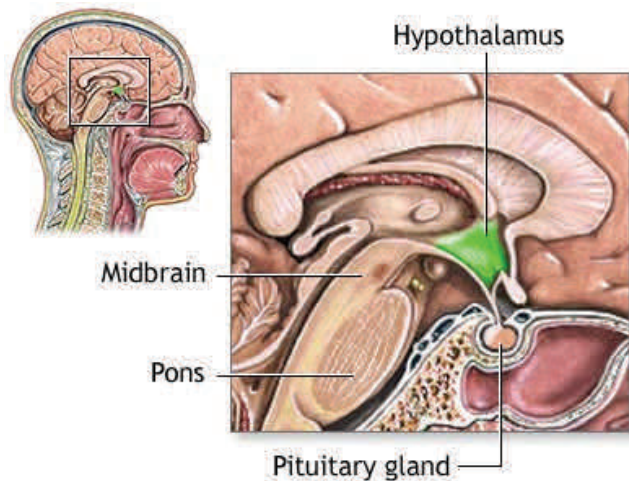
#### Per Group:

Pen/pencil  
Stopwatch  
Handouts  
Graph paper  
Flashlight



### WHAT YOU NEED TO KNOW

**Homeostasis** (Greek for “staying the same”) is a process by which the body maintains a stable internal environment. The **hypothalamus** is a part of the brain that helps the body maintain homeostasis. It is located in the brain just above the brain stem and is a group of neurons that forms the primary link between the nervous system and the endocrine system. This small part of the brain is responsible for regulating many key body processes including internal body temperature, hunger, thirst, blood pressure, and daily (circadian) rhythms.



ADAM.

Image from: <http://www.nlm.nih.gov/medlineplus/ency/images/ency/fullsize/19239.jpg>

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Most body systems maintain homeostasis by using positive or negative feedback mechanisms. When the brain receives messages from the body about an internal change in one of its systems, it works to restore the system to its normal state. **Negative feedback mechanisms** are found in the regulation of blood pressure, heart rate, and internal temperature controls. For example, the normal internal temperature for the human body is approximately 98.6°F. If the body temperature rises because of exercise, the body will start to try and cool itself off. This happens through coordination between the hypothalamus and the various body systems that are affected. Signals are sent that allow blood vessels to return to the normal state, sweat to be produced, pores to be dilated, and heart and breathing rate to normalize. This is very similar to the way a thermostat works. When the temperature of a room becomes too warm, the thermostat will switch on the air conditioning and cool the room. When the room temperature reaches a set desired temperature, the system turns off.

Body systems work to maintain homeostasis in ways we are not even aware of. For example, the body is constantly working to maintain a normal glucose level in your blood. When you eat something that contains a lot of sugar, the glucose concentration in your body rises above normal. When glucose levels are too high, the body releases a hormone called insulin which stimulates the absorption of glucose by the pancreas to help return the blood sugar level to normal.

**Positive feedback** is a mechanism that is much rarer in a healthy body. Instead of restoring the body to a normal state, the positive feedback mechanism causes an even greater change. An example of positive feedback can be found in the release of oxytocin, a hormone that intensifies the contractions that take place during childbirth. As the baby's head is ready to move out of the mother's body, oxytocin increases and the levels of contractions increase thus pushing the baby out. In this instance, the body responds to an event with more "force" or in a stronger way.



## WARM UP

1. Ask all students to stand up and balance themselves on one foot until you tell them to put their other foot down. Encourage them to talk about what they are experiencing with the other students.
2. After several minutes, have them sit back down in their seats. Ask the students what happened to them during this activity? What did they notice? Did it get more difficult to balance as time went on? What did they want to do? Tell the students they just experienced homeostasis. Their bodies were trying to keep them upright maintaining their balance.
3. Explain the process of homeostasis in the human body and give example of how the body is constantly readjusting itself to maintain normal functioning. If we get hot, the body sweats, if we are cold, the body shivers, if we are hungry we have an urge to eat, thirsty, we get an urge to drink, and so on.



## ACTIVITY

1. Tell students another good example of the body maintaining homeostasis happens when we exercise. As our respiration increases during exercise, our bodies respond by increasing our breathing and heart rate to remove the extra carbon dioxide we are producing and increase the amount of oxygen. When we are finished exercising, the body will work to normalize our breathing and heart rate. Explain to students that the negative feedback mechanism in our body is responsible for normalizing breathing and heart rate after exercise.
2. Ask students to take their pulse for 15 seconds. They can multiply this number by 4 to get their resting pulse rate at 1 minute.

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3. Next, ask students what they think will happen to their pulse rate after they do jumping jacks for one minute. Ask for predictions for how much they believe their pulse rate will increase. Then ask students to stand up, spread out, and do jumping jacks for 1 minute.
4. Immediately after the exercise, ask students to again take their pulse for 15 seconds. Students can again take this number and multiply it by 4 to get their pulse rate at 1 minute. How much did their pulse rate increase?
5. Ask the class to predict how long it will take their pulse rate to return to the resting pulse rate they first measured. Have students take their pulse rate after 2 minutes, 3 minutes, etc. until it returns to their resting pulse rate.
6. A third example of homeostasis in the body can be illustrated by watching the eyes for pupil reactions to different lighting situations. Divide students into small groups to try experimenting with a flashlight. Ask for volunteers within the small groups to briefly shine a flashlight at their eyes. The other students should observe what happens to the volunteer's pupils. How quickly do the pupils dilate? How quickly do they return to a normal size? Depending on your class, it may be better to try turning the lights on and off in your classroom and have the students observe each other's eyes for changes in their pupils.



## CHECK IN

Ask students to explain one example of how homeostasis is maintained in the body as a journal entry. Make sure they include the term “negative feedback” and explain how that mechanism is used in the body to maintain constancy.



## DIFFERENTIATED INSTRUCTION

For students who have difficulty organizing information, create a Cause and Effects chart. Model an example: the room gets cold-your body shivers; the room gets hot-your body sweats. Have students come up with other examples of how the human body reacts to changes in the environment to stay stable.

Explain that “negative feedback” does not mean something bad or wrong. It just means that an action stops instead of continuing. Use the illustration of the thermostat to further explain how the body shuts off or on in order to maintain a constant body temperature. Students may understand this relationship more easily if they participate in drawing a negative feedback loop from the brain to the body and back again.



## WHAT'S HAPPENING?

By participating in these activities, students will have the opportunity to experience how their bodies work to maintain normalcy. The brain constantly receives messages from the body, and uses negative and positive feedback mechanisms to remain healthy and survive. These activities demonstrate that the body works to remain upright and maintain its balance, that the body works to regulate heart rate, and that the body uses muscle contractions around the pupils of the eyes to regulate the amount of light entering the eyes.

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## EXTENSIONS

### LANGUAGE ARTS

Ask students to do a creative writing assignment where they describe an alien living on another planet. The students should describe at least one of the body systems of the alien and how the alien's body maintains normal body functioning through homeostasis.

### MATH

Graph the material that was gathered in the experiment.

If another group studied the same parameters, compare and graph the results. What does the data tell you? Similarities? Differences? Discuss your findings in a two to three paragraph mini essay.



## RELATED EXHIBITS

*YOU! The Experience*

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## LISTEN TO YOUR HEART/PULSE RATE

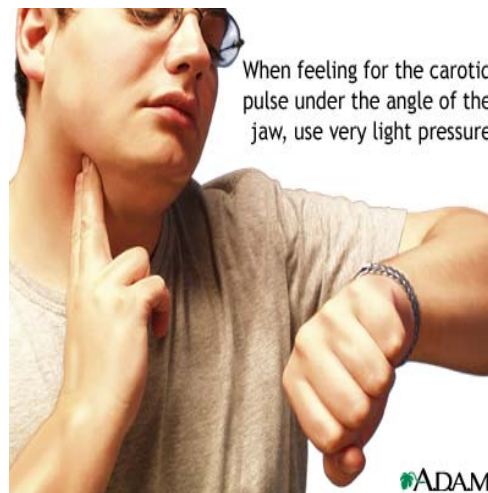
Each time the heart contracts, we feel a pulse. Measuring the number of times per minute you can feel the pulse, you can determine your heart rate. Pulse rate tends to increase as the level of activity increases.

To take your pulse, take your index or middle finger and place it on the palm side of your wrist.



Image from: [myhealth.ucsd.edu](http://myhealth.ucsd.edu)

You can also take your pulse in your neck. Place your index or middle finger along your carotid artery.



[http://www.mercksource.com/ppdocs/us/cns/content/adam\\_cg/exercise/images/19386.jpg](http://www.mercksource.com/ppdocs/us/cns/content/adam_cg/exercise/images/19386.jpg)