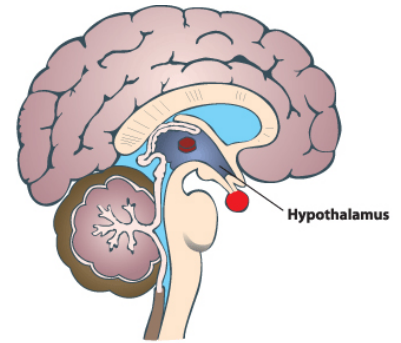


## Homeostasis and Heart Rate Lab developed by Kelly Perry

**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 brainstem 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.



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. Similarly, 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.

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 rare 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.

### Assessment:

CA.3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

**Part A: Pre-Lab Questions:**

1. Summarize the above information to demonstrate that you understand the concept of negative feedback:
2. What is the function of the heart?
3. Why do cells in the organs need a constant supply of blood?

*Data Table 1: Resting Heart Rate*

|                               | <b>Student 1</b> | <b>Student 2</b> | <b>Student 3</b> | <b>Student 4</b> |
|-------------------------------|------------------|------------------|------------------|------------------|
| <b>Actual<br/>(beats/min)</b> |                  |                  |                  |                  |

1. Create a sentence comparing everyone's resting heart rate. Why was this the case?
2. Create a sentence stating the range of heart rates for your group (**don't forget units**).
3. Create a sentence stating the mean heart rate for your group.

**Part B: Investigation**

**Question: How do different levels of exercise affect heart rate?**

- As a group, brainstorm and agree on a form of light exercise.
- As a group, brainstorm and agree on a form of vigorous exercise.
- As a group, brainstorm and agree on a control group.
- Decide how long exercise should be performed for (You only have one class period.)
- Decide when and how measurements should be taken.

**Variables:**

|   |  |
|---|--|
| <b>Independent Variable (IV):</b> <i>The variable you manipulated or changed</i>  |  |
| <b>Dependent Variable (DV):</b> <i>The variable that will respond to the independent variable (what you measure).</i>                                     |  |
| <b>DV units:</b> <i>How will the dependent variable be measured</i>   |  |
| <b>Control Test:</b> <i>What the IV is compared to in order to know the change was due to your test, and not some random variable.</i>                    |  |
| <b>Constant Variables:</b> <i>What you try to keep the same during the experiment to ensure the IV was the only important variable affecting results.</i> |  |

**Write a Hypothesis** (*If Independent Variable, then expectation of Dependent Variable*)

**Part C: Designing the Investigation**

1. Materials List:

2. Procedure (NUMBERED! This should include more than 4 steps):

**Part D: Collecting Data** (*create a data table to record all of your results; each group data table will look different than other groups since each group has their own experiment; at least three people should be tested before and after exercising*).

*YOU MUST CREATE AND ATTACH A DATA TABLE TO YOUR LAB!!*

**Part E: Conducting the Investigation:**

- Repeat your investigation with **three total exercise volunteers**.

**Part F: Post-Lab Questions**

1. Use data to describe how the heart rate changed during exercise?
  
  
  
  
  
  
  
  
  
  
2. Reference the data to compare and contrast the heart rate between different activities.
  
  
  
  
  
  
  
  
  
  
3. Evaluate why everyone's heart rate changes different amounts during exercise.
  
  
  
  
  
  
  
  
  
  
4. Evaluate what happens to heart rate after exercise is finished?

**Part G: Standard CA.3 Assessment: Focus on Homeostasis**

- 1. Explain why heart rate changes during exercise.**
- 2. What other changes did you observe during your exercise? Describe how these changes relate to changes in heart rate. (2 part question!)**
- 3. Illustrate any evidence (data and observations) you collected in this investigation that suggested the body was able to maintain homeostasis after exercise was finished.**
- 4. Predict what would happen if your heart rate failed to increase during exercise and describe why. Evaluate what would happen if your body failed to return to normal after exercise. (3 part question!)**