**Homeostasis and Heart Rate Lab**

***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:**

P*lease see your teacher’s website for explanation of proficiency level for each standard*

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| --- | --- | --- | --- | --- |
| ***Science Standard 1:*** *Planning & Evaluation* | Exceeds  | Meets  | Nearly Proficient | Beginning |
| ***Science Standard 2:*** *Data Analysis & Technology* | Exceeds  | Meets  | Nearly Proficient | Beginning |

**Nutrition Standard 1:** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis (**LS1-3).**

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| **Exceeds** | **Meets** | **Nearly Meets** | **Beginning** |
| *All of the following are completed* ***as well as conditions of Meets****:*❑ Contains at least 5 constants❑ Describes how each constant will remain the same for all trials❑ Graph combines all data to visualize results❑ Accurately and thoroughly answers the Exceeds analysis components | *All of the following are completed:*❑ Includes appropriate: - Hypothesis - Independent Variable - Dependent Variable - 3 or more constants - Part F post lab Q’s❑ Repeatable multi-step procedure❑ Appropriate data table and graph to visualize results of investigation❑ Accurately and completely answers the Meets analysis questions | *Any of the following occur:* * Any of the following are incorrect or incomplete:

 - Hypothesis - Independent Variable - Dependent Variable  - 3 constants - Part F post lab Q’s* Procedure directions are not repeatable
* Data table and graph do not show results of investigation and/or are incorrectly formatted
* Analysis questions are incomplete or inaccurate (Any portion of Meets section)
 | *Any of the following occur:** Missing any of the following:

 - Hypothesis - Independent Variable - Dependent Variable  - 3 constants - Part F post lab Q’s* Missing multi-step procedure
* Data table and/or graph are missing

 * Analysis questions are not attempted
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**PURPOSE:**

To study the human body's reaction to the application of a moderate stress. To determine if relaxation can lower resting heart rate, and if there is a significant difference reaching cardiovascular homeostasis between sexes and between athletic and non-athletic individuals.

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

1. What is the function of the heart?
2. Why do cells in the organs need a constant supply of blood?

**Part B: Investigation**

**Variables:**

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

**Part C : HYPOTHESES:** Make 2 hypotheses: ( #1 What will happen to the resting heart rate? Example: Relaxation will lower resting heart rate because... #2 hypothesis should be about what factors will allow someone to reach homeostasis first and why you think so. **Hint:** Use some common knowledge about muscle size and exercise that increases endurance)

**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).*

**Part E: Conducting the Investigation:**

* Carry out the investigation with your group. Write the names of the those completing the following roles:
	+ Exercise volunteers:
	+ Timer:
	+ Recorder:

**PROCEDURES:**

**1.** One partner take the other’s standing resting heart rate **(#1 rest)**.

- Heart rates are obtained by taking the radial pulse or carotid pulse for 10 seconds and then

multiply by 6.

**2.** For one minute, close your eyes and concentrate on taking deep, slow breaths and try to lower

or slow your heart rate down.

**3.** At the end of the minute, take the pulse again and record that as the **(#2 rest)**.

**4.** Start exercising (you can choose your exercise, but it should get your blood pumping!). Obtain and record 1, 2, 3, 4, 5, and 6 min. exercise heart rates.

• To obtain the exercise heart rates, after each minute have subject stop and take a 10 second pulse.

**5.** After the subjects complete the sixth minute of exercise, they should remain standing and a 1 minute **(#1 Recovery)** and 5 minute recovery **(#2 Recovery)** heart rate should be taken.

**6.** During the exercise session the recorder should also note any bodily changes occurring and record these observations in the data.

**7.** Convert all your heart rates to beats per minute by multiplying by 6 and record them on the

group data table.

**8.**  Obtain the data from other groups and fill in the remainder of the chart. The the data to complete your analysis.

**Class Data Table:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Group Number** | **Gender:** | **Rest #1** | **Rest #2** | **Exercise 1 min.** | **Exercise 1 min.** | **Exercise 1 min.** | **Exercise 1 min.** | **Exercise 1 min.** | **Exercise 1 min.** | **Recovery #1** | **Recovery #2** |
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**ANALYSIS:** Make a graph with lines to represent the data collected from each group. The x-axis (independent variable) will be the TIME increment of when you took a pulse reading. Be sure to properly label and title your graph.

**CONCLUSION:** This is the most important section of ANY lab report! Be detailed! Restate your hypothesis and support or reject with SPECIFIC data gathered from the experiment. Be sure to address why you think the graph leveled off for each group. Comment on how your individual group compared to the class average and other groups. Note any human errors that could have skewed the data. Mention any suggestions for future labs.

**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 groups.**
3. **Evaluate why everyone’s heart rate changes different amounts during exercise.**

**Part G: Nutrition Standard 1 Assessment: Focus on Homeostasis**

***Meets*:**

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?**
3. **Illustrate any evidence (data and observations) you collected in this investigation that suggested the body was able to maintain homeostasis?**

***Honors*:**

1. **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?**
2. **For a body system other than the cardiovascular system, describe how the body uses feedback mechanisms to maintain homeostasis during exercise.**