

Name _____ Period _____

HOMEOSTASIS: Human Respiration and Heart Rate Lab

Introduction:

The body can store many of the things it needs to function such as vitamins and food in the form of fat. Oxygen is one item that cannot be stored in sufficient quantities for more than a few minutes. At rest, the blood holds about a quart of dissolved oxygen, but it is continually being used by the cells to produce energy. The lungs need to be constantly working to furnish a sufficient supply for various activities.

Human respiration rate is controlled by a part of the brain called the medulla. The **autonomic motor portion of the medulla** sends signals to the body to adjust the breathing speed to provide enough oxygen for every activity sleeping, eating, exercising, etc. The level of carbon dioxide, not oxygen, in the blood is measured by the brain, which in turn makes needed adjustments in the respiration rate. During exercise, the cells burn oxygen faster to produce more energy for the body, which creates more carbon dioxide as a waste product. Carbon dioxide will quickly combine with water to cause **increased carbonic acid** in the blood. This increased carbonic acid level is detected by the **chemosensory portion of the medulla**, which signals for a **higher respiration rate** to lower carbon dioxide in the blood and increase the amount of oxygen for the cells.

Breathing is an involuntary action controlled by the brain, but it can also be controlled voluntarily. Holding your breath is one example. This can be done only for a few minutes before we become faint and the involuntary control takes over and restores breathing to a normal rate.

Hyperventilating is abnormally rapid, deep breathing and usually occurs when anxiety or emotional stress stimulates the part of the brain that regulates breathing (the medulla). Kidney failure and diabetes may also cause hyperventilation. Too much carbon dioxide is exhaled, leaving less in the blood. This causes the vessels to constrict, decreasing the flow of blood. With too little blood reaching the brain, the person may become dizzy and faint. Hyperventilation attacks may last a half hour. They can be controlled by trying to slow the breathing rate. Exhaling into a paper bag and rebreathing the air can increase the carbon dioxide content in the blood and shorten the attack.

The lungs have two ways to increase oxygen intake in response to a changing demand during exercise. One is to breathe faster (respiratory rate) and the other is to breathe deeper (volume). The heart also has two ways to increase blood to muscles. The heart can beat faster (pulse rate) or pump more blood with each beat (increased stroke volume).

Problem:

Hypothesis:

Materials: watch or stopwatch

Procedure:

1. Respiration rate is the number of breaths taken each minute (a breath is one inhalation and one exhalation).
 - a. Find your pulse and count the number of heartbeats in 15 seconds. Multiply by 4 to determine your heart rate in beats per minute. Record in the table below
 - b. While watching a clock, count the number of times you breathe in one minute and record.
 - c. Make three trials, and find the averages.

	Heartbeats per Minute	Breaths per Minute
Trial 1		
Trial 2		
Trial 3		
Average		

Record your averages on the at the appropriate place on the board in the classroom.

Boys Average Resting Heartbeats Per Minute	Boys Average Resting Breaths Per Minute	Girls Average Resting Heartbeats Per Minute	Girls Average Resting Breaths Per Minute

2. Survey the class to determine if gender has an effect on heartrate and breathing rate. What did you conclude?
3. What other factors might affect respiration rate?
4. Investigate the effect exercise has on heart rate and breathing rate. Walk in place for two minutes then measure heartrate and breathing rate as you did before and record below:

Beats per Minute While Walking	Breaths per Minute While Walking

5. How does the rate after exercising compare to that of normal breathing?

6. The higher the level of oxygen intake, the harder the cells are working. Investigate both running in place and jumping jacks on breathing and heart rate. Exercise for two minutes for each activity, and then measure and record as before:

beats per Minute While Running in Place	breaths per Minute While Running in Place	beats per Minute While doing Jumping Jacks	breaths per Minute While doing Jumping Jacks

7. Investigate the effect of two other activities your group decides on. Count heartrate and breaths in one minute as before and fill in the table.

Activity:		Activity:	
b.p.m:	breaths:	b.p.m.	breaths:

8. Construct a graph on the back of this page to show the respiration rate per minute of the various activities. Label all parts of the graph and include a title.

Conclusion: Write a paragraph explaining what happened. How is this an example of homeostasis? What kind of feedback loop is this? What parts of the body acted as the parts of a feedback loop? (stimulus, sensor, integrator, effector and effect.) HINT: read the intro to this lab again!

Respiratory Rate for Different Activities

