



Chapter 35 Project

The Beat Goes On

Project Goal + Timeline

One of the best ways to understand the circulatory system is to test your own. In this project, you will investigate how heart rate reflects your physiological state by measuring your heart rate before and after performing certain activities. You'll analyze your results to identify activities that are associated with significant changes in heart rate. This project should be completed over the course of a day.

Directions

The circulatory system moves gases, nutrients, cells, and waste throughout the body. Since it regulates and transports many disparate molecules, the circulatory system needs to respond to a variety of stimuli. Your normal, everyday activities provide some of these stimuli. Things like eating, exercising, and performing certain movements may alter your blood pressure and/or your body's oxygen demands, and, in turn, your heart rate. To see this process in action, you'll measure your heart rate before and after performing the activities listed in Table 1.

There are several ways to measure your heart rate. A simple way is to measure the rate at your wrist by placing two fingers over the radial artery (on the thumb side of your wrist). Once you detect your pulse, count how many times you feel the pulse in 15 seconds. Multiply this number by 4 for a measurement in beats per minute (bpm).

For each activity listed in Table 1, complete Questions 1 through 3 and record your responses in the table.

1. How do you think the activity will affect your heart rate? Make a prediction for the effect and provide a rationale for your prediction based on your knowledge of the circulatory system. You may also consider the relationship between blood pressure and heart rate in developing your rationale.
2. Take three measurements of your heart rate before engaging in the activity and then again afterwards. What was your average heart rate before the activity and your average heart rate after the activity?
3. Did the activity have a significant effect on your heart rate? Use Student's t test to determine if your mean heart rate after the activity significantly differed from your mean heart rate before the activity. To perform the test, you can use an online t test calculator (hawkes.biz/ttest).
 - Enter the three heart rate measurements taken before performing the activity in one column and your three heart rate measurements taken after performing the activity in the other column.
 - Conduct an unpaired t test.
 - Examine the p -value, which gives the probability that the differences in the means of your measurements were due to random factors. Generally, a p -value of less than 0.05 (5% chance the differences were due to random factors) is considered statistically significant. If your p -value is less than 0.05, you have strong evidence to conclude that the activity affected your heart rate.
 - Provide the p -value and state a conclusion about the effect of the activity in Table 1.

TABLE 1: Effect of Different Activities on Heart Rate

Activity	Prediction for Effect of Activity on Heart Rate	Heart Rate Before Activity (bpm)	Heart Rate After Activity (bpm)	Statistical Significance (p -value) and Conclusion
Perform one minute of exercise (such as jumping jacks, walking, jogging, or pushups)				
		Average:	Average:	
Eat a meal				
		Average:	Average:	
Stand up after sitting or lying down for at least 30 minutes				
		Average:	Average:	
Another activity of your choice:				
		Average:	Average:	

After completing Table 1, complete these questions.

4. Compare your results for each activity to your prediction for each activity. Were your predictions supported? Do you think there were any confounding variables that affected your results?
5. Which activity appeared to have the greatest impact on heart rate? Propose an explanation for why you obtained this result.
6. Compare your results with those of a classmate. Were there any similarities? Why do you think this is?
7. Describe the differences between a closed and open circulatory system. What is one benefit of a closed circulatory system compared to an open circulatory system?

Project Materials

- Project worksheet
- Pen or pencil
- Access to online Student's t test calculator (hawkes.biz/ttest)
- A meal
- Timekeeping device (such as a stopwatch, clock, or phone)

Student Checklist

- ☐ Complete predictions for all activities (Table 1)
- ☐ Record heart rate measurements before and after activities (Table 1)
- ☐ Analyze results for significance and state conclusions (Table 1)
- ☐ Complete all questions