

Biology 125- Human Physiology  
Laboratory 11- Cardiovascular Measurements

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## I. Purpose

During this lab, in addition to the electrocardiogram, various cardiovascular measures may be evaluated that indicate a person's overall health. These characteristics include pulse rate, blood pressure, and heart sounds. A person's level of physical fitness may be determined by comparing the values obtained during rest and activity. You will use a variety of instruments in this lab to test how exercise and changes in posture affect various cardiovascular parameters. A technique for assessing a person's level of physical fitness will be shown.

## II. Procedure

### 11-A: Determination of blood pressure

Blood pressure (BP) generally refers to the pressure of blood that is applied to the arterial walls. Systolic, the highest, blood pressure results when the ventricles contract. Diastolic, the lowest, blood pressure results when the ventricles relax. Blood pressure is normally expressed as systole over diastole and in millimeters of mercury (e.g. 120mmHg/ 80mmHg). Pulse pressure is the difference between systolic and diastolic blood pressures. Hypertension, high blood pressure, may affect both systolic and diastolic measurements. Hypertension may result in vascular damage and is especially dangerous when it affects diastolic blood pressure.

Blood pressure is measured with a sphygmomanometer. These devices are of three general types: aneroid sphygmomanometers measure pressure by displacing a spring, mercurial sphygmomanometers by displacing a column of mercury, and electronic sphygmomanometers by increasing electrical resistance.

1. Wrap the pressure cuff of the sphygmomanometer snugly around the upper left arm of your lab partner. Your lab partner should assume a relaxed, sitting or supine position.
2. Place the stethoscope securely over the brachial artery. Close the pressure valve and begin pumping up the rubber ball.

3. You will begin to hear the arterial pulse as you pass the diastolic pressure. Continue pumping until the pulse is not heard, approximately 10mmHg above your partner's normal systolic pressure. The brachial artery is now totally occluded.
4. Slowly open the pressure valve and listen for the pulse sounds to reappear as the pressure drops. These are known as Korotkoff sounds.
5. The first sound heard signals the systolic BP. Record this value from the scale.
6. The sound will become louder as the pressure drops until it finally starts to become muffled. Record the pressure at which the sound vanishes. This signals the diastolic BP. Record your blood pressure as systole/diastole.
7. Alternate with your lab partner and repeat these procedures.
8. Next, measure the BP of each of you immediately upon standing. (NOTE: be sure to have your cuff inflated prior to standing, so that you can begin to release pressure immediately upon standing.)
9. Lastly, measure the BP three minutes after standing. Record these values for your use and on the chalkboard.
10. Discuss the orthostatic response in terms of the receptors used and the effects of postural change. Include any limitations to obtaining reliable results.

### 11-B: Demonstration of a Measure of Physical Fitness

A general measure of physical fitness is the ability to resume a normal resting pulse rate shortly after a brief period of exercise. One is considered to be less fit if increased periods of time are required to regain the resting pulse rate. Fitness may be considered a function of the degree to which the cardiovascular system has been developed.

Fitness may be measured in a number of standardized tests, however we will be measuring the changes in heart rate as it relates to activity and participant's age. We will monitor the change in pulse rate that occurs when a resting student exercises and, then, attempts to return to a resting pulse rate. We will compare these changes in heart rates between students who exercise regularly and students who do not and determine the target heart rate range for exercise for these students.

1. Select three students who exercise regularly and three students who do not. Each student will take his/her resting pulse rate for one minute and record this value.
2. Each student will then run the track twice at a fast but comfortable pace.
3. Immediately upon returning to the laboratory, each student will record his/her pulse after exercise.
4. Each student will take his/her pulse at one minute intervals until the resting pulse is reestablished. (NOTE: The best method to employ is to take the pulse rate for 15 seconds and multiply by 4.).
5. These results will be recorded on the chalkboard for discussion. Is there a difference between the exercisers and the non-exercisers? Which student(s) do you consider to be in better physical condition? Why?
6. Determine the target heart rate range for each student (if the ages are available) and for yourself. The target heart rate range determines the heart rate that should be maintained for 20-30 minutes, at least 3 times per week for cardiovascular fitness. To determine your target heart rate range, do the following calculations for the Karvonen formula (only use numbers rounded off to whole numbers):
  - a.  $220 - \text{your age} = \text{maximum heart rate (max HR)}$
  - b.  $\text{Max HR} - \text{resting HR} = \text{HR reserve}$  (to find your resting heart rate, take your pulse before getting out of bed each morning for three days and then take the average)
  - c.  $\text{Target heart rate range} = (\text{HR reserve} \times 60\%) + \text{resting HR} = \text{low target heart rate}$   
 $(\text{HR reserve} \times 80\%) + \text{resting HR} = \text{high target heart rate}$

Example: 20-year-old with a resting heart rate of 65 beats per minute

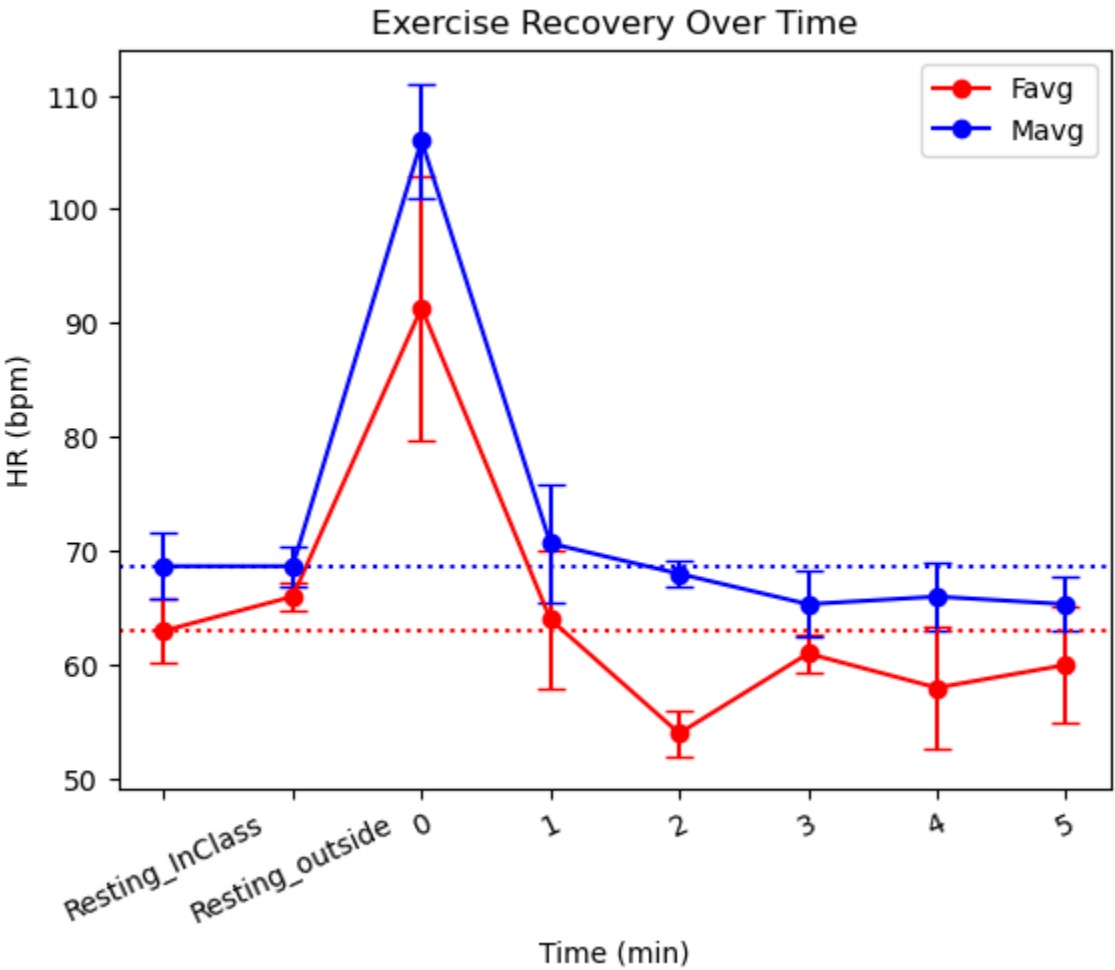
$$220 - 20 = 200 \text{ (max HR)}$$
$$200 - 65 = 135 \text{ (HR reserve)}$$
$$(135 \times 60\%) + 65 = 81 + 65 = 146$$
$$(135 \times 80\%) + 65 = 108 + 65 = 173$$

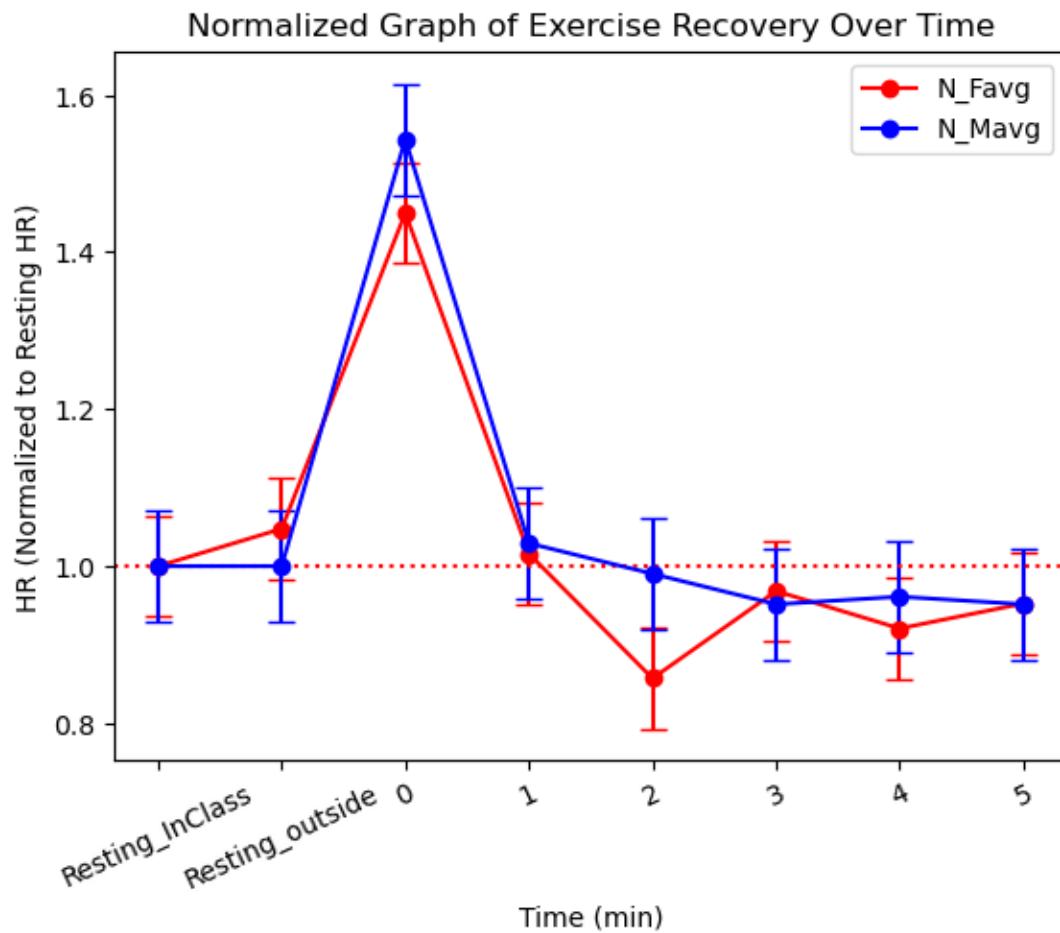
This student's target heart rate range would be 146 – 173 beats per minute.
7. Include your calculations for your target heart rate in the results section of your report.
8. Evaluate the class results in terms of target heart rate and level of fitness for each individual.

III. Result

11-A: Determination of blood pressure

	Group	F1	F2	F3	Favg	Fdev	Fsem	M1	M2	M3	Mavg	Mdev	Msem
0	Resting (In Class)	58	68	63	63.000000	5.000000	2.886751	64	74	68	68.666667	5.033223	2.905933
1	Resting (Outside)	66	64	68	66.000000	2.000000	1.154701	66	72	68	68.666667	3.055050	1.763834
2	0	72	112	90	91.333333	20.033306	11.566234	116	102	100	106.000000	8.717798	5.033223
3	1	68	52	72	64.000000	10.583005	6.110101	70	80	62	70.666667	9.018500	5.206833
4	2	56	56	50	54.000000	3.464102	2.000000	68	70	66	68.000000	2.000000	1.154701
5	3	58	64	61	61.000000	3.000000	1.732051	66	70	60	65.333333	5.033223	2.905933
6	4	48	66	60	58.000000	9.165151	5.291503	68	70	60	66.000000	5.291503	3.055050
7	5	50	66	64	60.000000	8.717798	5.033223	64	70	62	65.333333	4.163332	2.403701

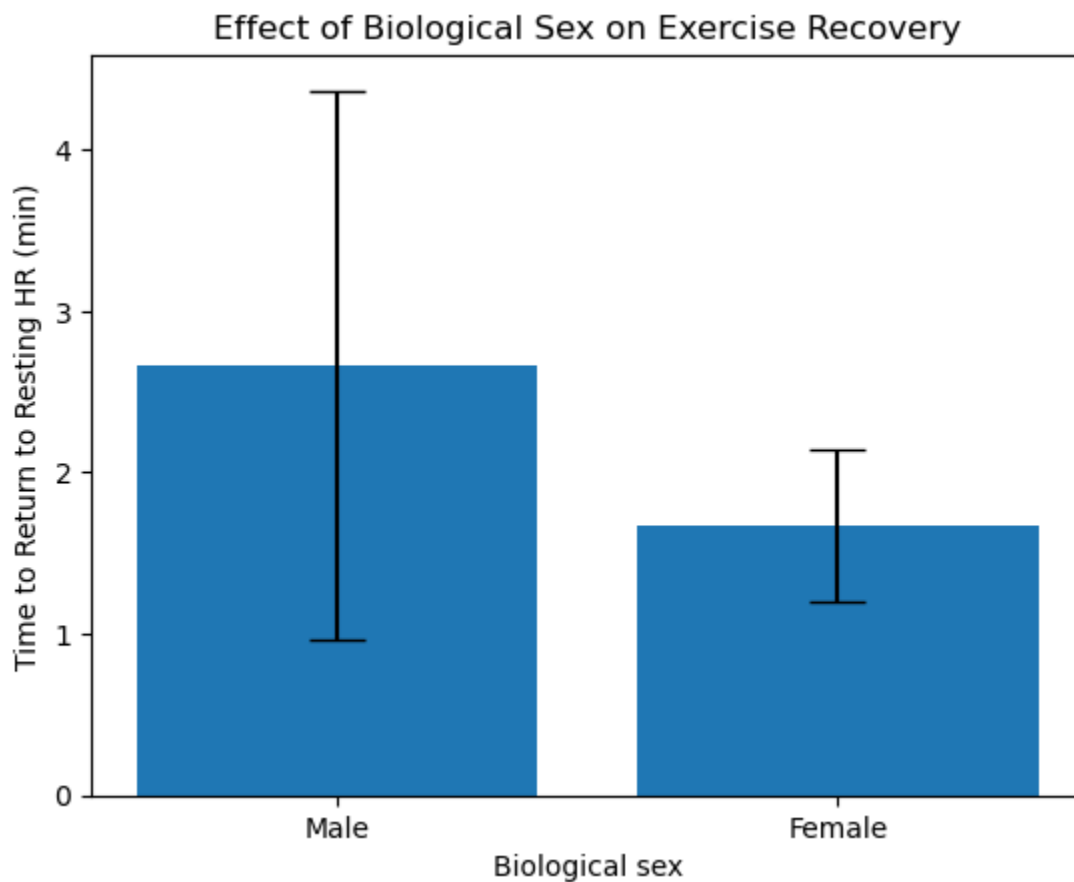




### 11-B: Demonstration of a Measure of Physical Fitness

	Group	F1	F2	F3	Favg	Fdev	Fsem	M1	M2	M3	Mavg	Mdev	Msem
0	Resting (In Class)	58	68	63	63.000000	5.000000	2.886751	64	74	68	68.666667	5.033223	2.905933
1	Resting (Outside)	66	64	68	66.000000	2.000000	1.154701	66	72	68	68.666667	3.055050	1.763834
2	0	72	112	90	91.333333	20.033306	11.566234	116	102	100	106.000000	8.717798	5.033223
3	1	68	52	72	64.000000	10.583005	6.110101	70	80	62	70.666667	9.018500	5.206833
4	2	56	56	50	54.000000	3.464102	2.000000	68	70	66	68.000000	2.000000	1.154701
5	3	58	64	61	61.000000	3.000000	1.732051	66	70	60	65.333333	5.033223	2.905933
6	4	48	66	60	58.000000	9.165151	5.291503	68	70	60	66.000000	5.291503	3.055050
7	5	50	66	64	60.000000	8.717798	5.033223	64	70	62	65.333333	4.163332	2.403701

Group	N_Favg	N_Mavg	N_Fsem	N_Msem
Resting (in class)	1.000000	1.000000	0.063971	0.070704
Resting (outside)	1.047619	1.000000	0.063971	0.070704
0	1.449735	1.543689	0.063971	0.070704
1	1.015873	1.029126	0.063971	0.070704
2	0.857143	0.990291	0.063971	0.070704
3	0.968254	0.951456	0.063971	0.070704
4	0.920635	0.961165	0.063971	0.070704
5	0.952381	0.951456	0.063971	0.070704



#### IV. Discussion

Both genders' pulse rates returned to resting levels after a minute of no exertion. The pulse decreased significantly more with each subsequent minute that was measured.

## **V. Conclusion**

I learned from this experiment that males recover their resting heart rates more quickly than females, with the former taking around one minute shorter.