Purpose
In this laboratory, you will measure the effects of postural change and exercise on these cardiovascular parameters using several different types of equipment. A method of determining the physical fitness of an individual will be demonstrated.

Procedures

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 10 mmHg 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.

Procedure

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):

- 220 – your age = maximum heart rate (max HR)
- Max HR – resting HR = 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)
- target heart rate range =
  (HR reserve x 60%) + resting HR = low target heart rate (HR reserve x 80%) + resting HR = high target heart rate

Example: 20 year old with a resting heart rate of 65 beats per minute 220–20=200(maxHR)
200 – 65 = 135 (HR reserve)
(135 x 60%) + 65 = 81 + 65 =146

(135 x 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.

11-C: Demonstration of the diving response

Marine mammals are known to experience bradycardia upon becoming immersed in water. This behavior is known as the diving response. Humans may also experience such a response, though, not as pronounced as that of marine mammals. We will attempt to establish a diving response in the following exercise with the help of the computer.

Procedure

1. Fill a large tub with ice cold water.
2. Select one student volunteer and hook him/her up to the computer.

3. Recordings of a Lead II ECG and pulse pressure from a thumb will be obtained with the student at rest for a baseline measurement.

4. Recordings will then be taken with the student holding his/her breath for at least 20 seconds, hopefully for 30 seconds.

5. The experiment will be repeated with the student holding his/her breath and placing his/her head into a bucket of ice cold water.

6. Include copies of the results in your lab report.

7. Evaluate the three sets of data in terms of the bradycardia and vasoconstriction. What are the adaptive advantages of these reflexes?

11-D: Monitoring and recording heart sounds (Optional)

Heart sounds are produced by the closing of heart valves. Two distinct sounds are easily detected using a stethoscope. The closing of the atrioventricular (AV) valves produces the first sound, a long low frequency “lub”. The second heart sound, a sharp high frequency “dup”, is produced by the closing of the semilunar (SL) valves. Refer to Figure 11-1 for specific locations of the four main ausculatory areas.

A heart sounds microphone allows these acoustical changes to be monitored and amplified to display on a chart recorder. Resulting traces are a graphical representation of the sequence of closing of the AV and SL valves.

Procedure

1. Attach the heart sounds microphone to the chest over the area of the apex of the heart. Make sure the transducer is switched to “HS”.
2. Switch on the amplifier and set the chart recorder to “stand by”.
3. Center the stylus and switch the chart recorder to 25 mm/sec.
4. Record several good tracing of the heart sounds.
5. Switch the recorder to “stand by” and examine the record. Identify and label each heart sound and indicate the chart speed of the trace.
6. Include this tracing in your report.
7. Assist your lab partner in obtaining a similar tracing.
8. Prepare to perform the next exercise.

11-E: Monitoring and recording of arterial pulse waves (Optional)

Arterial pulse waves, produced by the contraction and relaxation of the ventricles, are often monitored to determine pulse rate, expressed as the number of pulse waves per minute. A

pulse transducer coupled to an amplifier and chart recorder can be used to record this rate. When examined, the tracing provides an accurate record of the pulse rate.

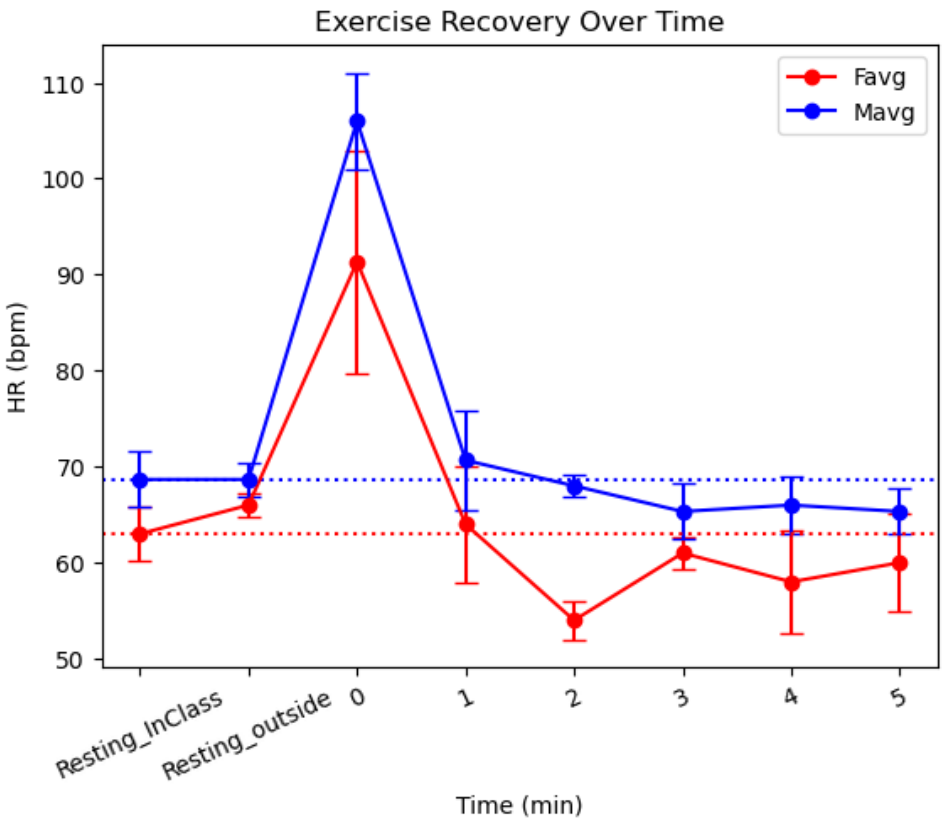
Arterial pulse waves may also be recorded to reveal other characteristics of the cardiovascular system, including pulse velocity and relative elasticity of the arterial walls. A pulse transducer modified to integrate the pulse wave signals will produce a trace similar to that shown in Figure 11-2.

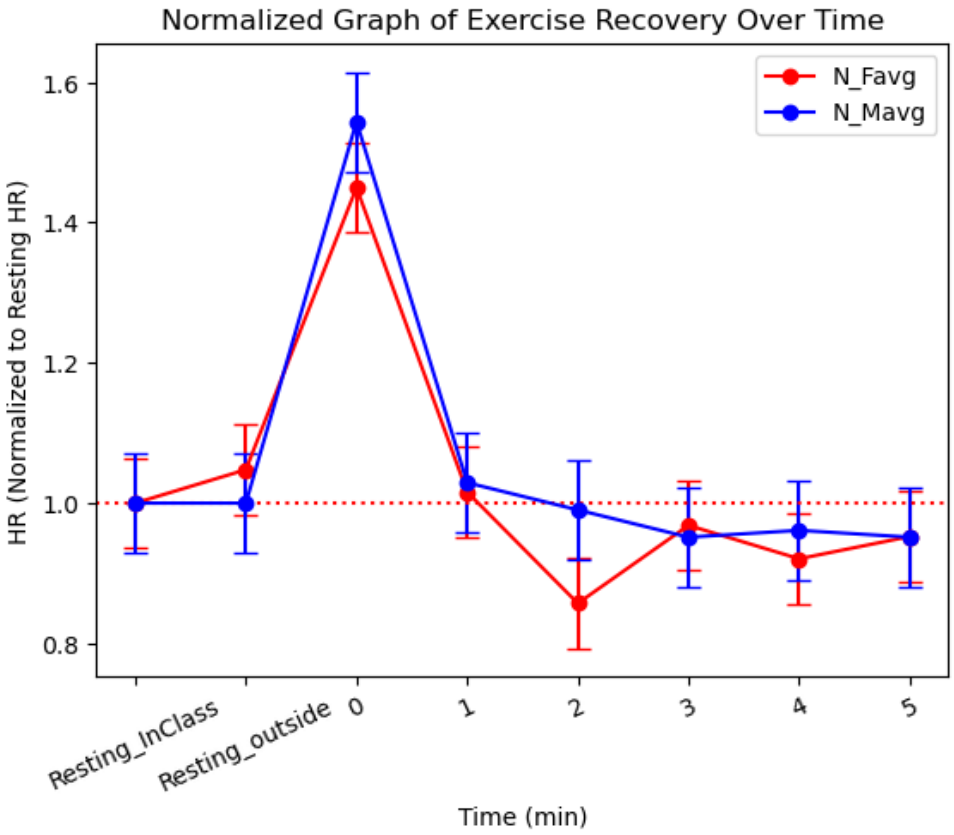
Close examination of an arterial pulse wave will reveal a pressure peak known as the dicrotic notch. The dicrotic notch results when the elastic aorta forces the blood against the aortic semilunar valve, causing a slight increase in pressure.

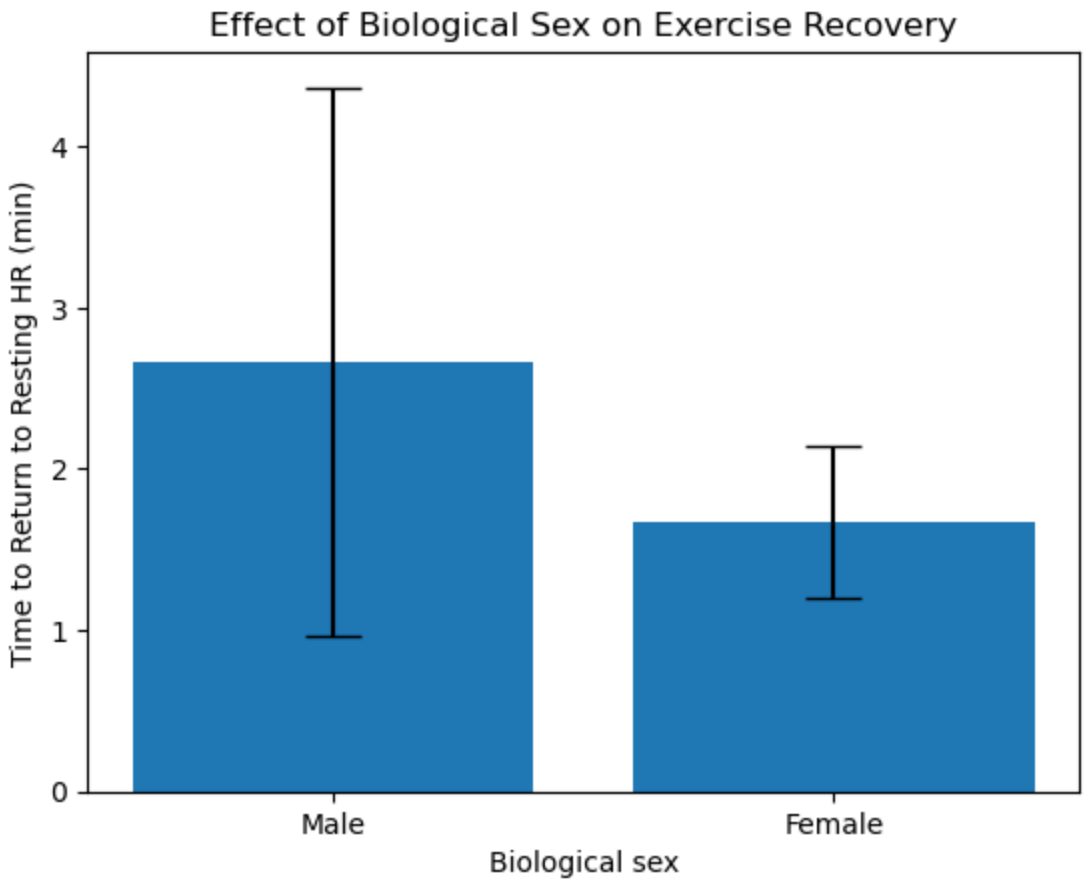
Procedure

1. Attach the heart sounds microphone to your wrist, just over the radial artery. Switch the transducer to the “pls” mode.
2. Center the stylus and set the chart recorder to 25 mm/sec.
3. Record several good traces of the pulse rate.
4. Switch the recorder to “stand by” and examine the record. Determine your pulse rate and indicate the chart speed on the record.
5. Record these values.
6. Switch the heart sounds microphone to the “HS” mode.
7. Center the stylus and set the chart recorder to 25 mm/sec.
8. Record several good traces of the arterial pulse wave.
9. Switch the recorder to “stand by” and examine the record. Identify and label the parts of the pulse wave.
10. Include these tracings in your report. Assist your partner in obtaining a similar set of tracings. Turn off the amplifier and chart recorder when completed.

Results


Exercise Recovery Over Time
Favg
Mavg
HR (bpm)
110
100
90
80
70
60
50
Resting_InClass
Resting_outside
0
1
2
3
4
5
Time (min)


Normalized Graph of Exercise Recovery Over Time
N_Favg
N_Mavg
HR (Normalized to Resting HR)
1.6
1.4
1.2
1.0
0.8
Resting_InClass
Resting_outside
0
1
2
3
4
5
Time (min)



Discussion

I predicted males would return to resting heart rate faster than females, but it turned out females returned to resting heart rate faster. Although our sample size was small.

Conclusion

Females returned to resting heart rate faster than males. Although our sample size was small.