

## AP Biology Lab 10 Physiology of the Circulatory System

### Parts A and B: Blood Pressure Measurement

#### Objectives:

- To learn how to measure blood pressure.
- To measure pulse rate under different conditions: standing, reclining, after the baroreceptor reflex, and during and immediately after exercise.

\* Though the original lab involves relating blood pressure to relative fitness, we will not be calculating relative fitness in this activity. BE AWARE THAT THE EQUIPMENT IS FOR LAB USE ONLY AND IS **NOT** CALIBRATED CORRECTLY FOR ACCURATE FITNESS MEASUREMENT.

#### Pre-lab Assignment:

- Visit the Lab Bench website [http://www.phschool.com/science/biology\\_place/labbench](http://www.phschool.com/science/biology_place/labbench) and complete the activity for Lab 10-1. While reading through the web assignment, paraphrase 1-2 bullet points per paragraph and define all vocabulary.

#### Exercise 10A: Measuring Blood Pressure

##### Procedure:

1. Work in pairs. Those who are to have their blood pressure measured should be seated with both shirt sleeves rolled up.
2. Attach the cuff of the sphygmomanometer snugly around the upper arm.
3. Place the stethoscope directly below the cuff in the bend of the elbow joint.
4. Close the valve of the bulb by turning it clockwise. Pump air into the cuff until the pressure gauge reaches 180-200 mmHg.
5. Turn the valve of the bulb counterclockwise and slowly release air from the cuff. LISTEN FOR A PULSE.
6. When you first hear the heart sounds, note the pressure on the gauge. *This is the systolic pressure.*
7. Continue to slowly release air and listen until the clear thumping sound of the pulse becomes strong and then fades. When you last hear the full heart beat, note the pressure. *This is the diastolic pressure.*
8. Record the values in the attached Modified Data Sheet under measurement one.
9. Switch places with your partner. Determine your partner's first measurement and record.
10. Continue to switch places until you have three measurements per person. Calculate the average systolic and diastolic pressures.

#### Exercise 10B: A Test of Fitness

Complete the various fitness tests as described below. Use the attached Modified Data Sheet to record your results. You do **not** need to complete the fitness scores throughout the lab manual.

##### Test 1: Standing Blood Pressure Compared with Reclining Blood Pressure

1. Use the electronic sphygmomanometer to measure the change in blood pressure from reclining to a standing position.
2. Subject should recline on a lab bench or desk surfaces pushed together for **5 minutes**. At the end of this time, while reclining, measure the systolic and diastolic pressures and record in Modified Data Sheet.
3. Remain reclining for two minutes, then stand and *immediately* repeat measurements on the same subject (arms down). Record the systolic and diastolic pressures in Modified Data Sheet.

##### Test 2: Standing Pulse Rate

1. The subject should stand at ease for 2 minutes after Test 1.
2. After 2 minutes, determine the subject's pulse rate by counting the number of beats for 30 seconds and multiplying by 2. Record this rate in the Modified Data Sheet

##### Test 3: Reclining Pulse Rate

1. The subject should recline on the lab/desk top(s) for 5 minutes.
2. Determine the resting pulse rate by counting the number of beats for 30 seconds and multiplying by 2. Record in the Modified Data Sheet. The subject should remain reclining for Test 4.

**Test 4: Baroreceptor Reflex (Pulse Rate Increase from Reclining to Standing)**

1. The reclining subject should now stand up.
2. *Immediately* take the subject’s pulse by counting the number of beats for 30 seconds and multiplying by 2. Record this rate in the Modified Data Sheet.

**Test 5: Step Test – Endurance**

1. The subject should do the following: Place your right foot on an 18 inch high stool (this may also be done outside on a cement bench). Raise your body so that your left foot comes to rest by your right foot. Return your left foot to the original position. Repeat this exercise 5 times, allowing 3 seconds for each step up.
2. *Immediately* after the completion of this exercise, measure the subject’s pulse for 15 seconds and record. Measure again for 15 seconds and record. Continue taking the subject’s pulse and recording the rates at 60, 90, and 120 seconds.

**Modified Data Sheet**

**Exercise 10A: Measuring Blood Pressure**

| Measurement | 1 | 2 | 3 | Average |
|-------------|---|---|---|---------|
| Systolic    |   |   |   |         |
| Diastolic   |   |   |   |         |

**Exercise 10B: Fitness Data**

| Test                                     | Measurements   |
|--|--|
| <b>Test 1:<br/>Reclining to Standing</b> | <b>Reclining:</b> Systolic Pressure _____ mm Hg                      |
|  | Diastolic Pressure _____ mm Hg                                       |
|  | <b>Standing:</b> Systolic Pressure _____ mm Hg                       |
|  | Diastolic Pressure _____ mm Hg                                       |
| <b>Test 2:<br/>Standing Pulse Rate</b>   | _____ Beats/minute   |
| <b>Test 3:<br/>Reclining Pulse Rate</b>  | _____ Beats/minute   |
| <b>Test 4:<br/>Baroreceptor Reflex</b>   | _____ Beats/minute   |
| <b>Test 5:<br/>Step Test - Endurance</b> | Number of beats in 0-15 sec. interval _____ x 4 = _____ beats/min.   |
|  | Number of beats in 16-30 sec. interval _____ x 4 = _____ beats/min.  |
|  | Number of beats in 31-60 sec. interval _____ x 4 = _____ beats/min.  |
|  | Number of beats in 61-90 sec. interval _____ x 4 = _____ beats/min.  |
|  | Number of beats in 91-120 sec. interval _____ x 4 = _____ beats/min. |

**Conclusion Questions:**

1. What are some variables that contribute to differences in blood pressure amongst various people?
2. Explain why blood pressure **and** heart rate differ when measured in a reclining position and in a standing position.
3. Summarize the relationship between cardiac rate and physical fitness. Why is an athlete capable of delivering more oxygenated blood to his/her body? Why does an athlete need to exercise harder or longer to achieve a maximum heart rate than a person who is not as physically fit?
4. Why are standing, resting and exercising heart rates different?
5. Describe the baroreceptor reflex. Why is this reflex necessary to maintaining overall body function?
6. In Test 5, what do you notice about the heart rate/pulse at the different time intervals? Why is the time required for return of pulse rate to normal after exercise used as an indicator of relative fitness?