**SL IB Biology II Lab: Circulatory & Respiratory Systems**

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**OBJECTIVES:**

1. Understand the main function(s) of respiratory and circulatory systems.
2. Learn the major components of each system.
3. Examine how these systems and their components differ across taxa and their respective environments.

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**Procedure 1: Measuring pulse rate**

1. Find your pulse by placing your second and third fingers on the side of your inner wrist that is closest to the thumb (the radial artery passes into the hand there).
2. Press down slightly and count your pulse (the number of beats you feel) for 15 seconds. Record your results in Table 1.
3. Multiply this value by 4 to get your pulse rate in beats/minute. Record your results in the “Pulse Rate” column of Table 1.
4. Repeat steps 1-3 three times.
5. Average your results for the three trails and record this value in Table 1.

**Table 1:**

|  |  |  |
| --- | --- | --- |
| **Sampling time** | **Beats in 15 seconds** | **Pulse Rate (beats/min)** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| AVERAGE |  |  |

1. Measure your pulse at the common carotid artery (on either side of your neck):

**Pulse Rate = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_beats/min**

**Procedure 2. Measuring the effect of exercise on respiratory and circulatory systems**

In this exercise you will measure the effect of exercise on pulse rate, blood pressure and tidal volume. As in previous procedures, you will work in pairs. You will need to measure every parameter three times and log your results in Tables 2 and 3. Review the instructions for measuring tidal volume below.

**Procedure:**

1. Measure the resting pulse rate, blood pressure and tidal volume of your partner. Record these values in the appropriate columns of Table 4 – Student 1.
2. As your lab mate is breathing normally, before exercise, observe how many times his/her chest rises in 15 seconds.
   1. Multiply this number by 4 to get respiratory rate/minute.
   2. Record this number below
      1. Student 1:
      2. Student 2 :
3. Exercise for exactly 5.0 minutes. You can do jumping jacks, run in place or do push-ups.
4. Immediately after the 5.0 minutes, measure pulse rate, blood pressure and tidal volume again (3 times). Take an average of each parameter and log the results in the appropriate Table.
5. After 5 minutes of exercise, count how many times his/her chest rises in 15 minutes.
   1. Multiply this number by 4 to get respiratory rate/minute.
   2. Record this number below
      1. **Student 1:**
      2. **Student 2 :**

**Measuring tidal volume**

**Tidal volume** is defined as the amount of air a person at rest normally takes in during a single normal breath. A spirometer (Fig. 7) is an apparatus that measures the volume of air inspired and expired by the lungs. It can also measure **vital capacity**, which is the maximum amount of air that can be expired after a maximum inspiration. A person’s vital capacity is a good measure of his/her overall respiratory efficiency and health. Diseases such as asthma, emphysema, tuberculosis and cancer can severely decrease a person’s vital capacity.

1. Insert the sterilized mouthpiece into the spirometer and seal your mouth around the mouthpiece.
2. Inhale and exhale **three times** through your mouth only.
   * You will need to do this before and after exercise
3. Read the reading off of the dial and record the tidal volume (volume is measured as cubic centimeter, cc) in the appropriate Table.

**Table 2: Student 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name**  **\_\_\_\_\_\_\_\_\_\_** | **Initial pulse rate**  **(beats/min)** | **Pulse rate after exercise**  **(beats/min)** | **Initial**  **Respiratory rate**  **(breaths/min)** | **Respiratory rate after exercise**  **(breaths/min)** | **Initial tidal volume**  **(cc)** | **Tidal volume after exercise**  **(cc)** |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| **Average** |  |  |  |  |  |  |

**Table 3: Student 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Initial pulse rate**  **(beats/min)** | **Pulse rate after exercise**  **(beats/min)** | **Initial blood pressure**  **(mm Hg)** | **Blood pressure after exercise (mmHg)** | **Initial tidal volume (cc)** | **Tidal volume after exercise** |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| **Average** |  |  |  |  |  |  |

**Questions:**

1. How does exercise affect pulse rate and tidal volume?
2. Explain what happens to the circulatory system during exercise. Include the major organs involved in your explanation.
   * 1. Why does increased physical activity increase heart rate?
     2. Why is heart rate lower in an individual who does aerobic exercise regularly?
     3. From your study of the circulatory system, how would you describe a "fit" individual
3. Explain what happens to the respiratory system during exercise. Include the major organs involved.
4. Plot the relationship between pulse rate and tidal volume both before and after exercise.
5. Explain the relationship between the circulatory and respiratory systems.
6. How and why does heart rate change with body position?