NAME: _____ DATE: _____

PARTNER: _____

CARDIOVASCULAR AND RESPIRATORY SYSTEMS

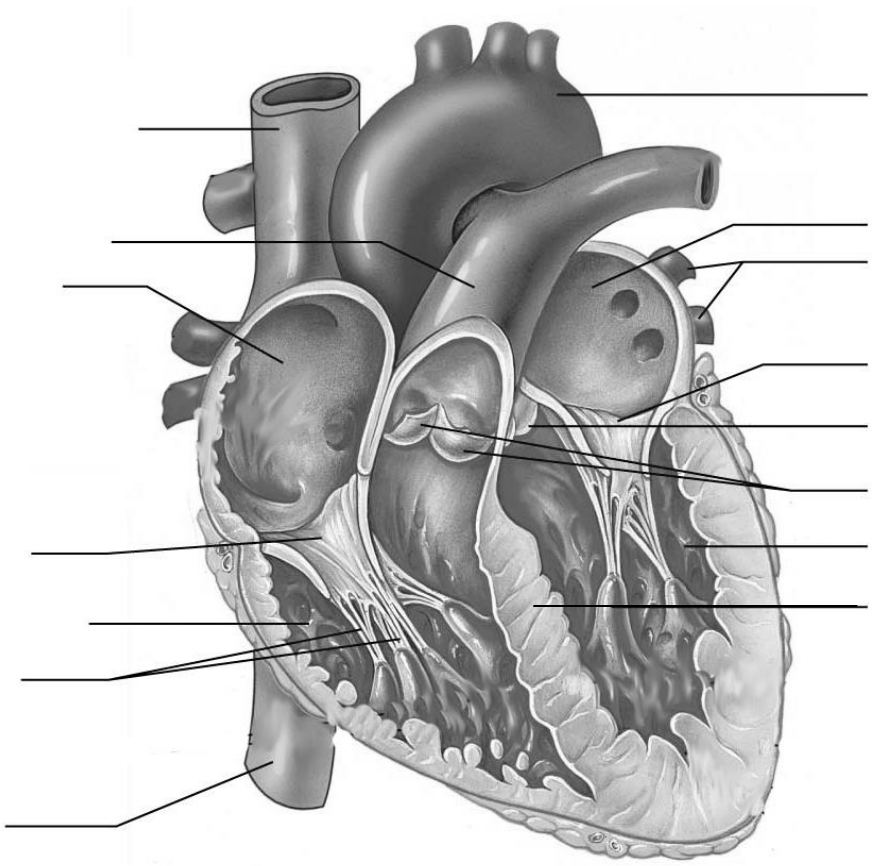
The cardiovascular and respiratory systems of animals are intricately associated to allow the delivery of oxygen (O_2) to and the removal of carbon dioxide (CO_2) from the cells of the body. In this laboratory, you will examine some of the major structures of these systems, the heart and lungs in particular, to learn more about their individual and joint functionality.

I. THE VERTEBRATE CARDIOVASCULAR SYSTEM

A. The Mammalian Heart

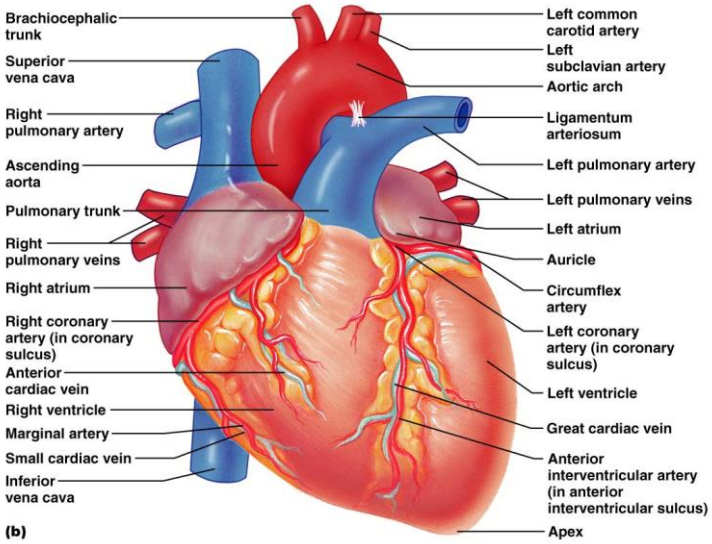
1. Use the diagram in your text to familiarize yourself with the structures of the heart and identify those listed below.

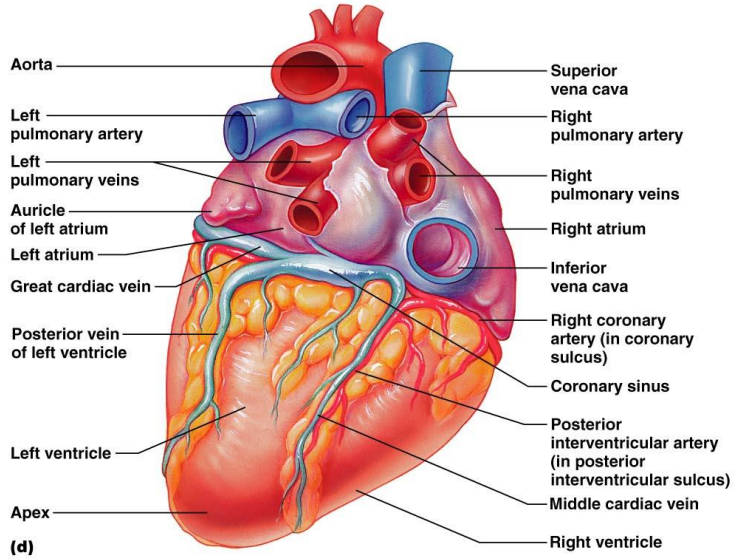
A. aorta
B. aortic semilunar valve
C. chordae tendinae
D. inferior vena cava
E. left atrioventricular valve (bicuspid)
F. left atrium
G. left ventricle
H. pulmonary artery (pulmonary trunk)
I. pulmonary semilunar valve
J. pulmonary veins
K. right atrioventricular valve (tricuspid)
L. right atrium
M. right ventricle
N. superior vena cava
O. septum



2. Obtain a preserved heart and use the previous and following diagrams to identify the structures listed below (check them off the list as you locate them).

___ aorta
___ aortic semilunar valve
___ chordae tendinae
___ coronary artery
___ inferior vena cava
___ left atrioventricular valve (bicuspid)
___ left atrium
___ left ventricle
___ papillary muscle
___ pulmonary artery (pulmonary trunk)
___ pulmonary semilunar valve
___ pulmonary veins
___ right atrioventricular valve (tricuspid)
___ right atrium
___ right ventricle
___ superior vena cava
___ septum





a. What is the function of the heart valves? _____

_____

_____

b. What is the function of the chordae tendinae? _____

_____

_____

c. You may notice that the left ventricle wall is thicker than the right ventricle wall. How might this be functionally significant? _____

_____

_____

_____

3. Using colored pens/pencils/crayons, draw arrows in the diagram from question 1 to indicate the direction of blood flow through the heart and associated vessels. Use one color (preferably red) to represent "oxygenated" blood and another (preferably blue) to represent "deoxygenated" blood (if you use other colors, be sure to indicate which color represents which degree of oxygenation).
   a. What are the pulmonary and systemic circuits?

      _____
      _____
      _____
      _____

   b. From where do the muscular walls of the heart receive their blood supply?

      _____
      _____
      _____

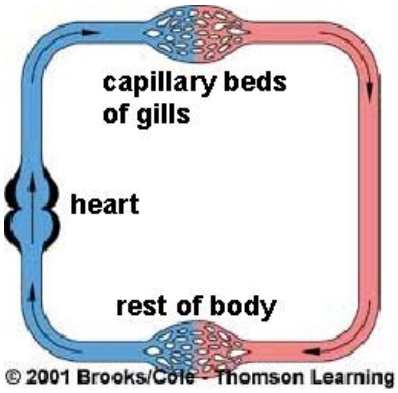
B. Vertebrate Circulation

1. Note the following diagrams of fish, amphibian/reptile and mammal/bird circulatory patterns.
   a. Identify one significant structural difference between the amphibian/reptile and mammal/bird systems. _____

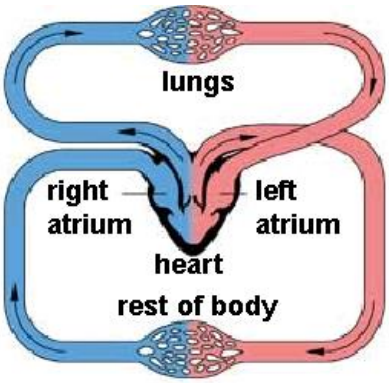
      _____
      _____

   b. Identify one significant difference between the circulation pattern of fish and the other animal systems. _____

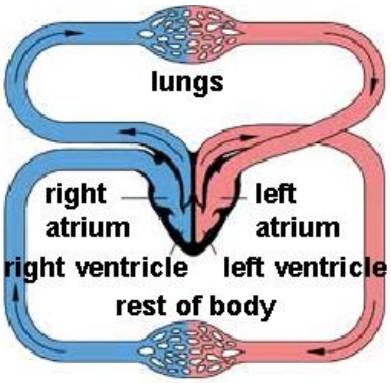
      _____
      _____



a) Fishes



b) Amphibians & Reptiles

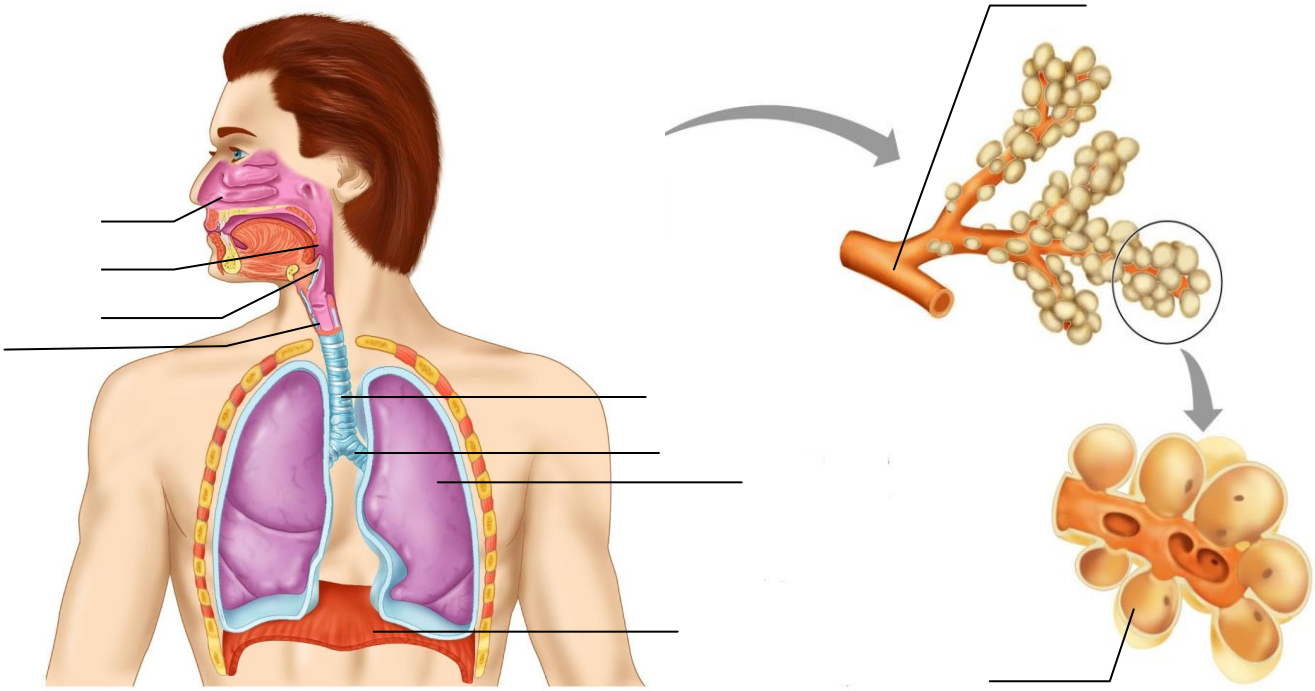


c) Mammals & Birds

II. THE VERTEBRATE RESPIRATORY SYSTEM

A. Mammalian Lungs

1. Use your text to help identify the structures in the following diagrams. Write the terms in the diagram using the list below.



1. alveolus
2. bronchus
3. bronchiole
4. diaphragm
5. epiglottis
6. larynx
7. lung
8. nasal cavity
9. pharynx
10. trachea

2. Now examine the sheep pluck on display (this consists of the heart, lungs and major vessels of these organs).
   a. Identify the trachea. What is the purpose of the rings of cartilage that surround the trachea and bronchi? _____

      _____

      _____

   b. How many lobes are present in the right lung of a human? ___ The left lung? ___. What functional purpose is served by the two lungs not being identical in size?

      _____

      _____

      _____

      _____

B. Lung Capacity

In this exercise, we will use a spirometer with a computer interface to measure selected air capacities of your lungs. Follow the procedure handout supplied with the spirometer (demonstrated by instructor).

1. Set up the spirometer (steps 1-3).
2. Inhale and exhale a few times as you would in a normal breath then begin breathing into the spirometer per instructions (steps 4-5).
3. Determine your Tidal Volume (TV) in liters (L): the volume of air inspired in a normal breath (step 6).
   a. TV = _____ L
4. Determine your Vital Capacity (VC): the total volume of air that can be expired after maximum inspiration. This is done by determining the volume between the peak of the maximum inspiration and the valley of the maximum expiration.
   a. VC = _____ L
5. Print a copy of your data to turn in with the lab (per instructor's directions).
6. Use the meter sticks provided to measure your height in meters (m): _____.
7. Enter your Vital Capacity (L) and your height (m) into the table on the board and record the total class results in the following table:

Sex	Ht (m)	VC (L)

Sex	Ht (m)	VC (L)

Sex	Ht (m)	VC (L)

8. Construct a scatter plot figure (including trendline) using Excel showing height in meters (x-axis) vs. vital capacity in liters (y-axis). Be sure to follow proper figure format (handout from lab #1). Print a copy to turn in with the lab; attach to the end after your own data printout from step 5.
   a. What generalizations can be made regarding height and vital capacity of the class?

   _____

   _____

   Is there a difference between males and females? ____ If so, how might you account for this?

   _____

   _____

III. RELATIONSHIP BETWEEN CARDIOVASCULAR AND RESPIRATORY SYSTEMS

Work in pairs and perform the following tests on your partner. However, be sure to record your own results on your data sheet. The test subject should try to remain as still and calm as possible during the test procedures.

A. Blood Pressure

1. Before starting the exercises that follow, view the computer video clip about blood pressure (blood_pressure).
   a. What happens when the cuff of the sphygmomanometer (blood pressure measurement device) is inflated? _____

      _____

   b. What is being measured when the first sounds are heard through the stethoscope?

      _____

   c. What is being measured after these sounds disappear? _____

      _____

B. Resting Pulse Rate, Blood Pressure and Breathing Rate

1. Determine your pulse rate by using either the carotid (neck) or radial (wrist) arteries or the autocuff device. If measuring manually, record your pulse rate for 20 sec and multiply by 3 to get the pulse rate per minute. Record data as beats per minutes (bpm) in the table below.
2. Determine your breathing rate by counting the number of breaths taken in 30 sec. and multiply by 2 (it may be easier for the test subject to do this on their own). Record as cycles per minute (cpm) in the table below.
3. Measure your blood pressure using the automatic pressure cuffs provided. Follow the instructions given by the instructor. Record the results in the table below.

C. Effect of Exercise on Pulse Rate, Blood Pressure and Breathing Rate

1. Perform moderate exercise (such as briskly walking, jogging or sprinting from lab to Division St. and back, doing rapid stair steps for 1 min, etc.) and then immediately repeat steps 1-3. It will work best if your partner takes your blood pressure and heart rate while you simultaneously measure your own breathing rate. Record your results in the table.

Measurement of Pulse Rate, Breathing Rate and Blood Pressure		
	Resting	After Exercise
Pulse Rate (bpm)		
Breathing Rate (cpm)		
Blood Pressure (mmHg)		

a. How were <u>each</u> of these measurements affected by exercise? _____

b. You probably observed an increase in both pulse rate and breathing rate after this activity. What is happening at the <u>cellular level</u> to make this necessary and why are both of these systems affected in a similar manner? _____