Lab: Blood **Organ System:** Cardiovascular	Student _____ Lab #: _____ Date _____

Objectives:

1. Identify and learn the major functions of formed elements in blood using laboratory models, microscope slide, or photos.
2. Describe their ABO and Rh blood groups.
3. List the antigens found on RBCs for each of the ABO and Rh blood types.
4. Determine the ABO and Rh blood group of an unknown and explain the principles behind the procedure.
5. Explain the basis of a transfusion reaction when receiving incompatible or mismatched blood.
6. Understand the importance of the Rh factor during pregnancy and the physiological basis of Hemolytic Disease of the Newborn.

Materials:

- Textbook
- Microscopes, lens cleaner and lens paper
- Prepared blood slides (Wright-stained blood smear)
- Platelets, red blood, and white blood cell models and charts
- Ward's simulated ABO and Rh blood typing kit
- Toothpicks

Pre-class Activity: Practice Blood Typing

1) Go to http://www.nobelprize.org/educational/medicine/bloodtypinggame/ to practice blood typing prior to coming to lab.
2) Find out your blood type if you can.

Activity 1: Pre-class activity—*carry out all steps below prior to your lab time!*

1. Using the terms provided in activity 2 **label** the models in Figs. 1&2. Refer to Chapter 9 in your Essentials textbook.
2. Next, **answer** questions I-III in activity 2 using your Lecture notes and / or Essentials textbook.
3. Lastly**, read** pages 349-352 in your Essentials textbook to fill out **Tables 1 and 2** and **understand Activities 3 & 4 before lecture and lab**!

Your instructor will provide you with a stamp here upon your completion of the tasks above.

_____ 

Activity 2: Study Formed Elements (Cells and Platelets) of Blood

I. Use the terms below to review Figure 1 as you examine the lab models:

- Red blood cell (erythrocyte)
- Neutrophyl
- Eosinophyl
- Basophyl
- Nucleus

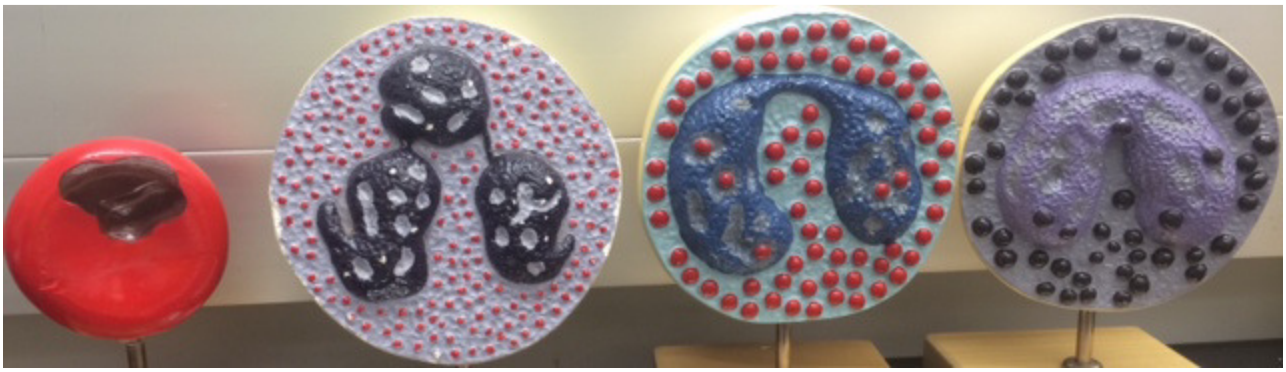


Fig. 1

1. Name the cell that lacks a nucleus in Fig. 1 _____
2. What is the function of the cell lacking the nucleus in Fig. 1?
   _____
   _____
3. An abnormal value showing high numbers of Neutrophils in a blood test could be an indication of _____.

Critical **Thinking!**

II. Use the terms below to label Figure 2 as you examine the lab models:

- Lymphocyte
- Monocyte
- Platelet

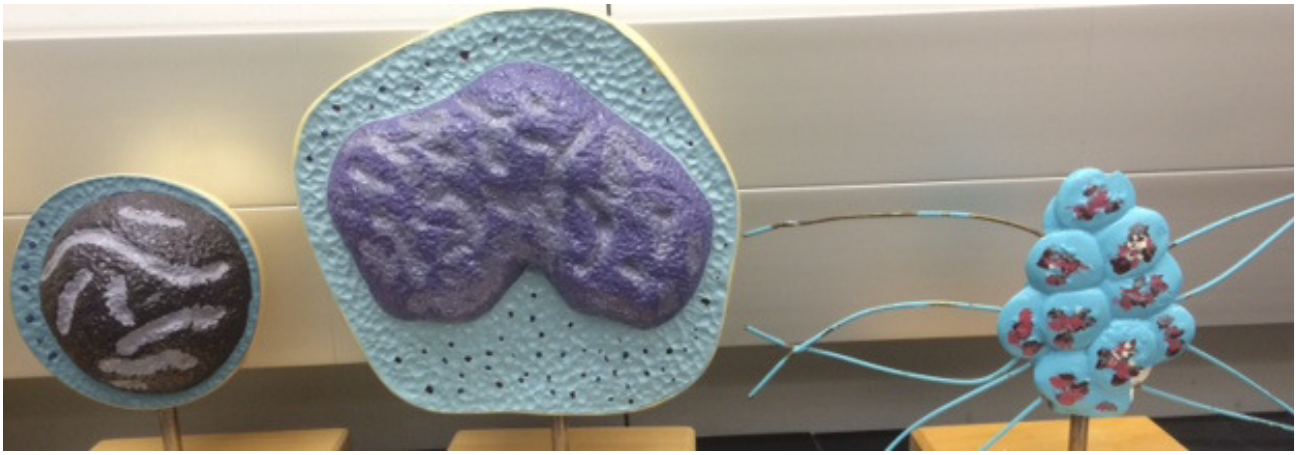


Fig. 2

III. Microscope study

1. Obtain a prepared Wright-stained blood smear slide from the side counter and use the microscope to examine it at low power (10x).
2. Notice the numerous pink dots (**red blood cells** or **erythrocytes**) seen under this power.
3. Under the same power notice the purple dots (**white blood cells** or **leukocytes**) present in low numbers relative to the **erythrocytes**.
4. Switch to a total magnification of 400x.

5. Observe the physical differences between the erythrocytes and leukocytes.

- How are erythrocytes structurally different from leukocytes? _____
- What large organelle is present in all leukocytes yet absent in erythrocytes? _____
- Why do you suppose the slide you are looking at shows so few leukocytes or white blood cells? _____ _____

6. Attempt to find platelets; these are not cells, but fragments of a unique multinucleated cell. Call your instructor to help if you cannot find them!
7. Locate a neutrophil and lymphocyte.

_____

Activity 3: ABO and Rh Blood Groups Table

Read pages 349-352 to answer the questions below and fill out Table 1

1) What are antigens? _____
_____
_____

2) What are antibodies, what is their function, and how are they related to antigens?
_____
_____
_____
_____
_____
_____

When an individual is told their blood type is B, this means that they have type B antigens on their erythrocyte plasma membrane. Someone with type A blood has type A antigens, and someone with type AB has both type A and B antigens on their cell membrane surface. However, your current instructor has type O blood, therefore, what antigens are present on her erythrocytes? _____

Complete the chart below for each ABO blood type listed using your text: Table 1.

Blood type	Draw Antigen(s)	List Antibody(s) in Plasma	Might Safely Receive Blood From Which Blood Type(s)?	Might Safely Donate Blood to Which Blood Type(s)?
A				
B				
AB				
O				

Answer the following scenario as a group:

1) Let's say somehow you receive a blood transfusion, but your nurse did not pay attention and gave you the wrong blood type and Rh. What will be the most "devastating" from this unforgivable mistake?

_____
_____
_____
_____

Another surface antigen is known as the **Rh blood groups**. When you are informed of your blood type, you might be told that you are A+ or A-. This means that if you are A+, you must have the A antigen and the Rh+ antigen on the plasma membrane of your erythrocytes. However, if you are A-, you have the A antigen on the plasma membrane of your erythrocytes, but lack the Rh+ antigens. Here is the problem, when we are Rh- and receive Rh+ antigens our immune system will begin to produce anti-Rh+ antibodies in order to attack the foreign antigens. Upon receiving a new blood transfusion containing the Rh+ antigens, the antibodies remaining in our circulation will cause hemolysis of the donor's erythrocytes.

Complete the chart below for each Rh blood type listed using your text:
Table 2.

Blood Type	Draw Antigen on RBC Membrane	List Antibody in Plasma	Might Safely Receive Blood From Which Rh Blood Type(s)?	Might Safely Donate Blood to Which Rh Blood Type(s)?
Rh+				
Rh-				

Activity 4: Typing for ABO and Rh Blood Groups

Obtained from "instructions for the *"Wards's simulated ABO blood typing lab activity."*

You will be performing the blood typing test carried out in clinical laboratories with simulated blood and antibodies. When an **antibody** and **antigen** bind (such as those in the ABO and Rh mismatched blood transfusions), agglutination will occur as antigens and antibodies form a "complex" due to both molecules becoming "stuck" to each other. In turn you will be able to visualize this agglutination reaction letting you know the blood antigens present and the blood type of the individual. In other words, the antigens present in the membrane of their red blood cells!

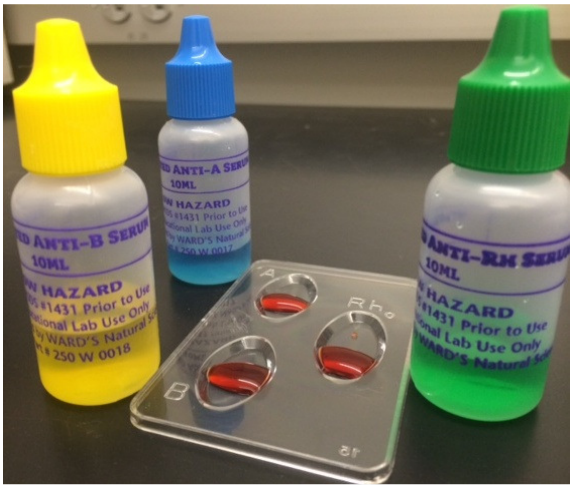


Fig. 3 Anti-A, Anti-B, and Anti-Rh Sera

As a clinical team, carefully follow the procedures outlined below to determine the proper blood type for the following 4 patients.

1. Take 4 paper towels and label each with the following patient information:
   Tray #1: Mr. Smith
   Tray #2: Mr. Jones
   Tray #3: Mr. Green
   Tray #4: Ms. Brown

2. Pick up 4 small plastic trays with wells. Notice each well is labeled A, B, and Rh.

3. Gather a container with Anti-A, Anti-B, and Anti-Rh sera (Figure 3).

4. Gather a container with simulated blood labeled Mr. Smith, Mr. Jones, Mr. Green, and Ms. Brown.

5. Gather a container with toothpicks. ***You will be using 3 toothpicks per tray ensuring not to cross contaminate your samples.***

6. Assign each member in your group the task to determine the blood type of a particular individual.

7. Place four drops of Mr. Smith's blood in each of the A, B, and Rh wells of Tray #1.
8. Place four drops of Mr. Jone's blood in each of the A, B, and Rh wells of Tray #2.

9. Place four drops of Mr. Green's blood in each of the A, B, and Rh wells of Tray #3.

10. Place four drops of Ms. Brown's blood in each of the A, B, and Rh wells of Tray #4.

11. Place four drops of the simulated anti-A serum in each A well on the four Trays.

12. Place four drops of the simulated anti-B serum in each B well on the four Trays.

13. Place four drops of the simulated anti-Rh serum in each Rh well on the four slides.

14. Gather 3 toothpicks for each tray. Gently stir (to avoid splattering) each well with a separate clean toothpick for 60 seconds by keeping track of time. As you stir, make sure to not scratch the plastic tray to reuse it!

15. As a clinical team, observe one tray at a time to come to a **consensus** of the blood type for each individual.

16. Record your observations in Table 3 using a **+ (positive sign)** to indicate **agglutination** or a **– (negative sign)** to indicate **no agglutination**. The **+** sign will indicate the **presence of antigens** on the cell membrane of erythrocytes, while a **–** sign will indicate the **absence of antigens** on the cell membrane of the red blood cells of your patient.

17. To ensure an accurate reading of agglutination or no agglutination reactions, place each tray over a cluster of words on this laboratory to see if you can read the text. If you **cannot read the text**, you have a confirmation that the test is **+ for agglutination**. In some cases you may still be able to read, but in viewing the well's surface more carefully (at an angle) you will notice **multiple fibers** floating which is **another indication** of a **positive agglutination reaction**.

Agglutination

No Agglutination

18. Clean trays by using some soap and water after you have confirmed with your instructor that you obtained the correct results.

19. Put all material away in an organized manner.

Agglutination Reactions

Table 3.

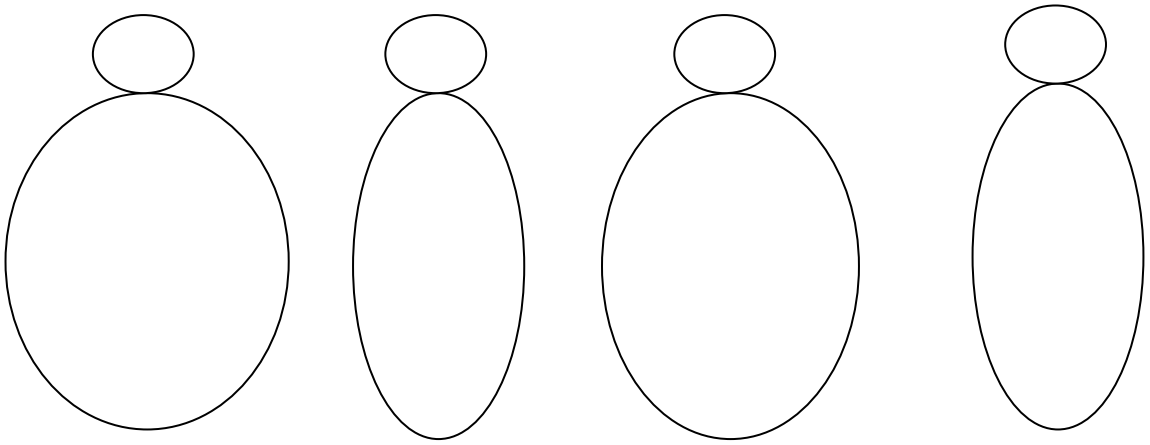
	Agglutination with Anti-A Serum	Agglutination with Anti-B Serum	Agglutination with Anti-Rh Serum	Blood Type
Tray #1 Mr. Smith				
Tray #2 Mr. Jones				
Tray #3 Mr. Green				
Tray #4 Ms. Brown				

1. Are any of the patients a universal donor? Explain.

2. Are any of the patients a universal recipient? Explain.

Activity 5: Understanding Hemolytic Disease of the Newborn

1. Pay close attention to the explanation during lecture (or lab) and copy the diagrams your instructor is demonstrating on the board to answer the questions below.

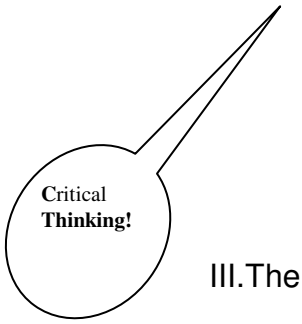


I. An **Rh- negative woman** has no anti-Rh antigens. What will happen to her when she becomes pregnant with a fetus that has **Rh+ antigens**?

_____
_____

II. What will happen to the same woman as she becomes pregnant a second time with another fetus that has **Rh+ antigens**? What will happen to the fetus during this second pregnancy? (Be detailed and complete with your explanation)

_____
_____
_____
_____



III. The same woman becomes pregnant with another fetus (3rd) that is Rh-. What will happen to this fetus?

_____
_____

Lab: Anatomy of the Heart **Organ System:** Cardiovascular	Student _____ Lab #: _____ Date _____

Objectives:

1. Using skeletal landmarks, describe the position of the heart in the thoracic cavity.
2. Identify external heart anatomy including the great vessels from the prospective of a chest cavity opened for surgery.
3. Identify internal heart anatomy and describe blood flow through these heart structures.
4. Diagram the pulmonary and systemic circuits using flow charts.
5. Describe the anatomical structures involved in medical conditions affecting the heart, such as myocardial infarction, heart murmur, mitral valve prolapse, coronary artery bypass graft surgery, heart transplant, aortic stenosis and valve replacement.

Materials:

- Heart, lung, torso models
- Slice-man (Cross sectional model)
- Heart bypass model

Pre-class activity: Go to the video and information links to answer all the questions under #'s **1 & 2 (next page)** below **prior to lab**. Your ***accurate*** completion of this pre-class activity will earn you 1 extra credit point towards your grade.

Display this and the next page at the beginning of lab for your instructor to sign here: _____

1. **C.A.B.G surgery** video link: http://www.youtube.com/watch?v=RZhPZc1Uhws

   I. To what device is the heart connected to during the **C.A.B.G** procedure once the heart is cooled and stopped?
   _____

   II. What is the purpose in connecting the heart to the device mentioned in question I?
   _____

   _____

   III. Name the blood vessel typically used for a heart by-pass.
   _____

2. Traditional **C.A.B.G** procedure along with the newest procedures involving heart bypass surgery information link: http://www.webmd.com/heart-disease/guide/heart-disease-bypass-surgery?page=2

   I. Name two conditions that would make you (or a loved one) an ideal candidate for "Off pump Heart Bypass Surgery."
      a. _____
      b. _____

Critical Thinking!

Activity 1: Position and Location of the Heart.
Use your Essentials textbook and members of your clinical team to answer the questions below. Refer to figures 1 and 2 to review relevant structures.

1. Through what bone would you cut lengthwise to reach the heart? _____

2. What cavity would you immediately reach upon cutting through the bone above? _____(***Be specific***)

3. Name the double-walled sac in which the heart is enclosed:_____ (not shown in Figs. 1 or 2)

4. State the two terms used to describe the layer immediately over the heart surface. (It is part of the heart wall). _____, or _____ (not shown in Figs. 1 or 2)

5. The most inferior and narrow pointed end of the heart is known as the ____; whereas the _____ is the posterior flattened aspect from which the great vessels emerge.

6. Use a directional term to describe the location of the heart in relation to the lungs_____

Fig. 1 Anterior view of Torso Model (Coronal Plane)

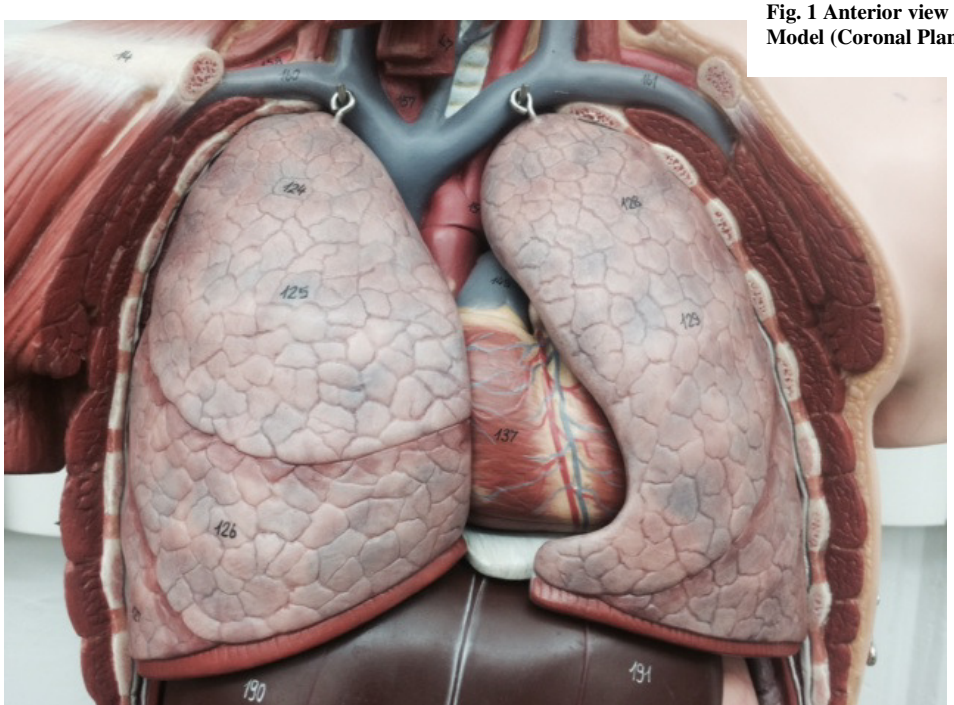
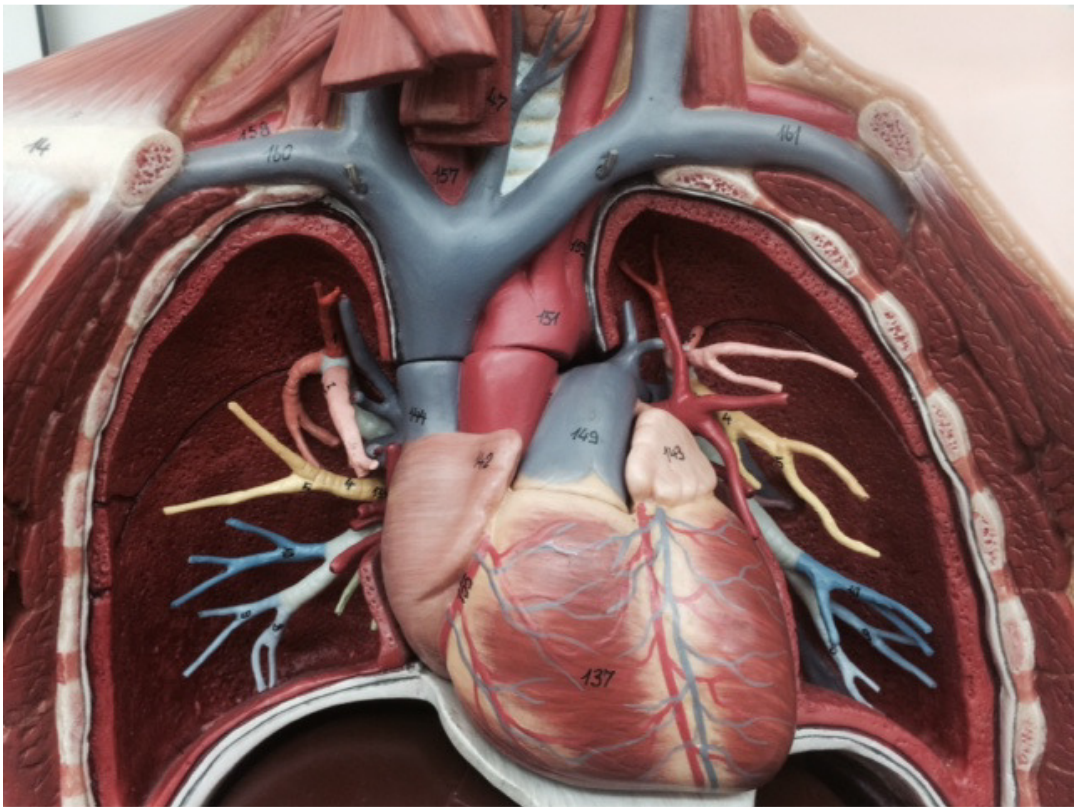


Fig. 2 Anterior view of Torso Model (Coronal Plane through Lungs)



Activity 2: External Anatomy of the Heart

1. While observing the heart model in the lab, refer to your Essentials textbook to identify, label and learn the following great vessels in figures 3 and 4.

a. Superior vena cava
b. Inferior vena cava
c. Pulmonary trunk
d. Left and right pulmonary arteries
e. Left and right pulmonary veins
f. Aorta

Fig. 3 Anterior view of Heart Model

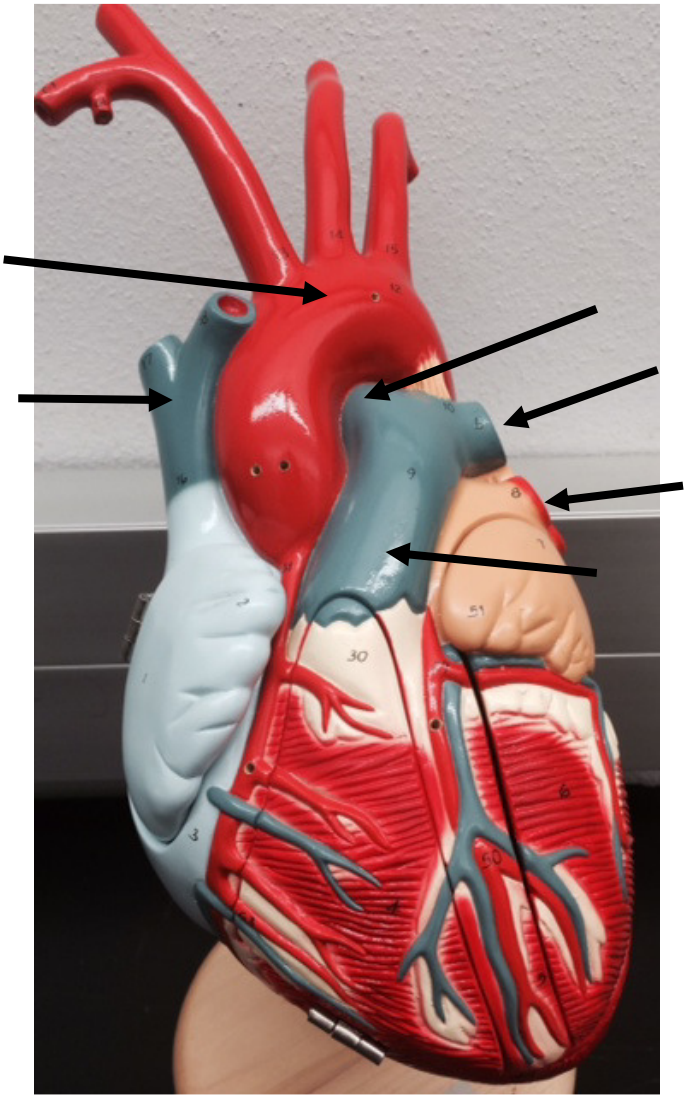
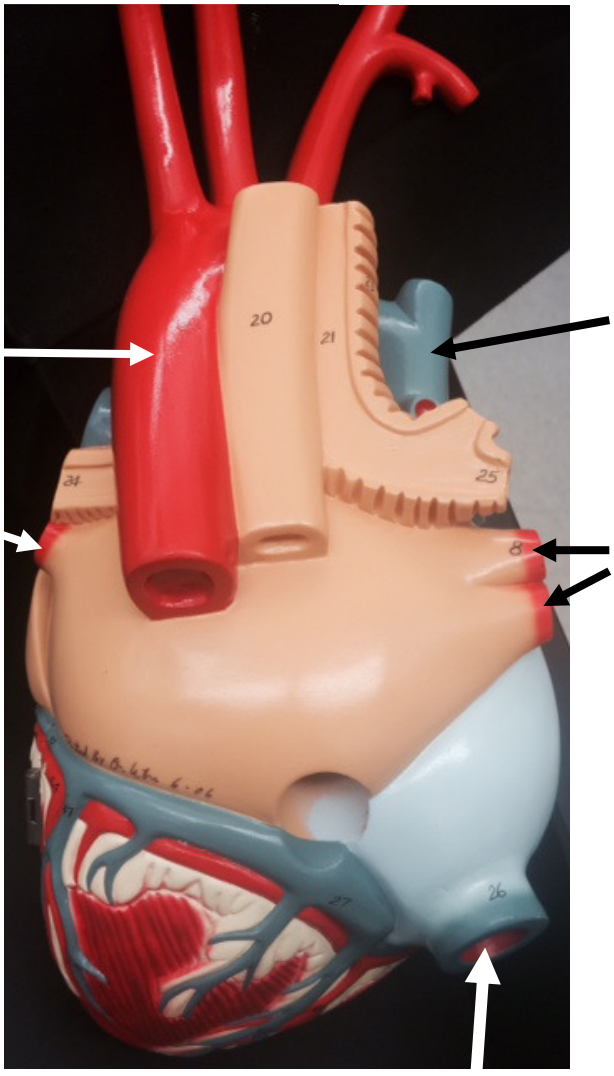


Fig. 4 Posterior view of Heart Model



2. Make a **flow chart** to demonstrate the **pulmonary circuit** by using the blood vessels on the previous page **(a-f)** in the space provided. Begin with blood leaving the heart, including the right and left lungs in your flow chart.

Critical Thinking!

3. Make a **flow chart** to demonstrate the **systemic circuit** by using the blood vessels above on the previous page **(a-f)** in the space provided. Begin with blood leaving the heart.

Critical Thinking!

Activity 3: Internal Anatomy of the Heart

1. While observing the heart model in the lab, refer to your Essentials textbook to identify, label and learn the following structures in figure 5.

a. Right atrium
   - Interatrial septum
   - Fossa ovalis*

b. Tricuspid valve
   - Chordae tendineae

c. Right ventricle
   - Pulmonary semilunar valve

d. Interventricular septum

e. Left atrium
   - R. & L Pulmonary veins (entry points)

f. Bicuspid or Mitral valve
   - Chordae tendineae

g. Left ventricle
   - Aortic semilunar valve

Find in lab model.

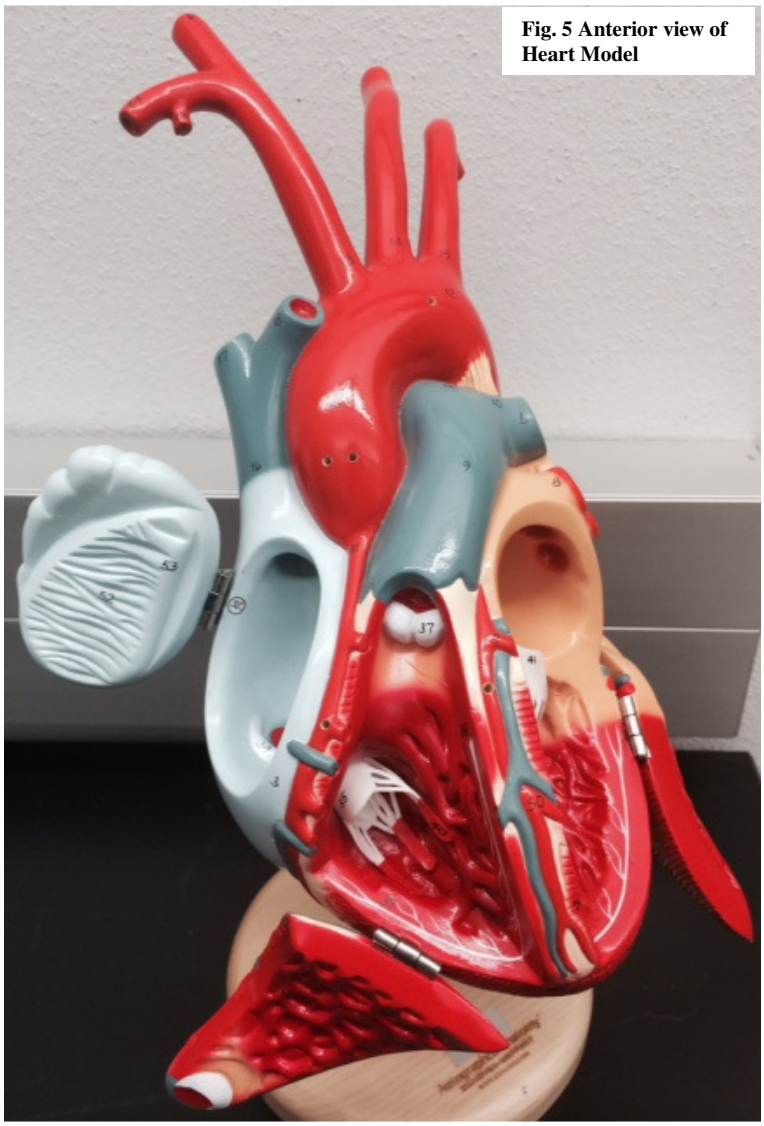
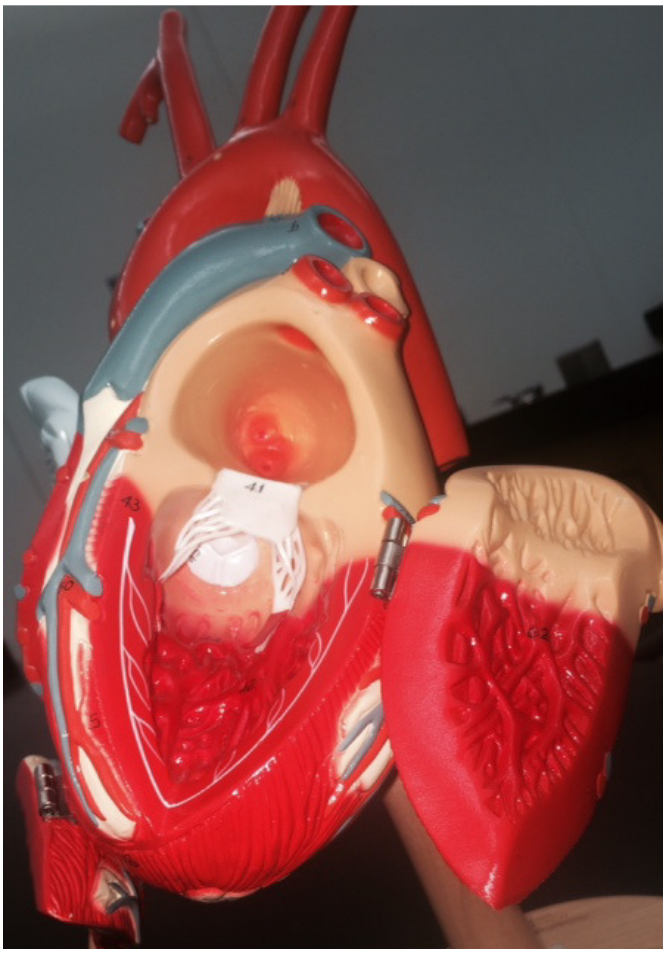


Fig. 5 Anterior view of Heart Model

2. Identify and label the two chambers, two valves and the “entry points” of the right pulmonary veins, and the left pulmonary veins in Fig. 6.

   When done call upon your instructor to sign here _____

Fig. 6 Left side of Heart Model



What are heart murmurs due to? _____

Homeostatic imbalances
(Describe each using your Essentials textbook and Lecture notes):

Mitral valve prolapse:

Aortic stenosis:

Myocardial infarction:

Valve replacement:

Activity 4: Cardiac Circulation (blood supplied to the heart)
Ask yourself the following questions:

- Is your heart muscle contracting right now? _____
- Was your heart muscle contracting yesterday? _____
- For how many years has your heart muscle been contracting? _____
- A human heart contracts approximately 70 beats per minute.
- In the space below calculate how many times your heart has contracted:

Our heart constantly requires delivery of oxygen and removal of waste since it contracts 24 hours every single day! In turn, several blood vessels provide our heart with the nutrients it needs and removes unwanted wastes. ***Note: our heart does not acquire any nourishment from the blood filling out its chambers!!!***

While observing the heart model in the lab, refer to your Essentials textbook to identify, label and learn the following structures in figures 6 and 7.

a. Left coronary artery
b. Circumflex artery
c. Anterior interventricular arteries or LAD (left anterior descending branch of the left coronary artery)
d. Right coronary artery
e. Marginal artery
f. Cardiac veins
g. Coronary sinus

Fig. 7 Anterior view of Heart Model

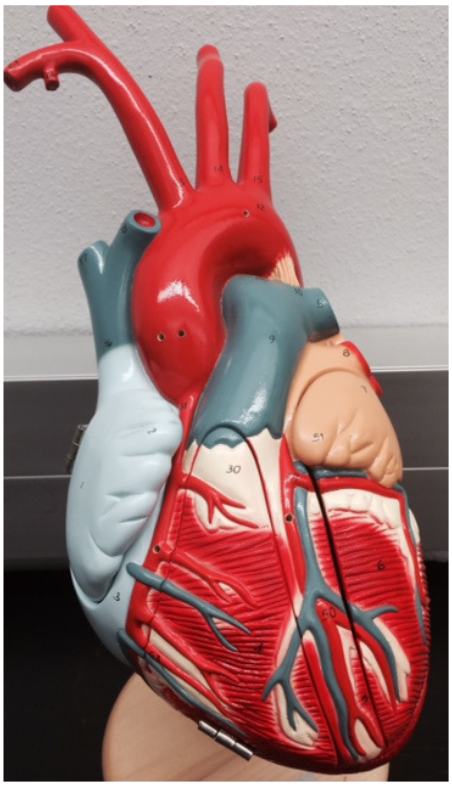


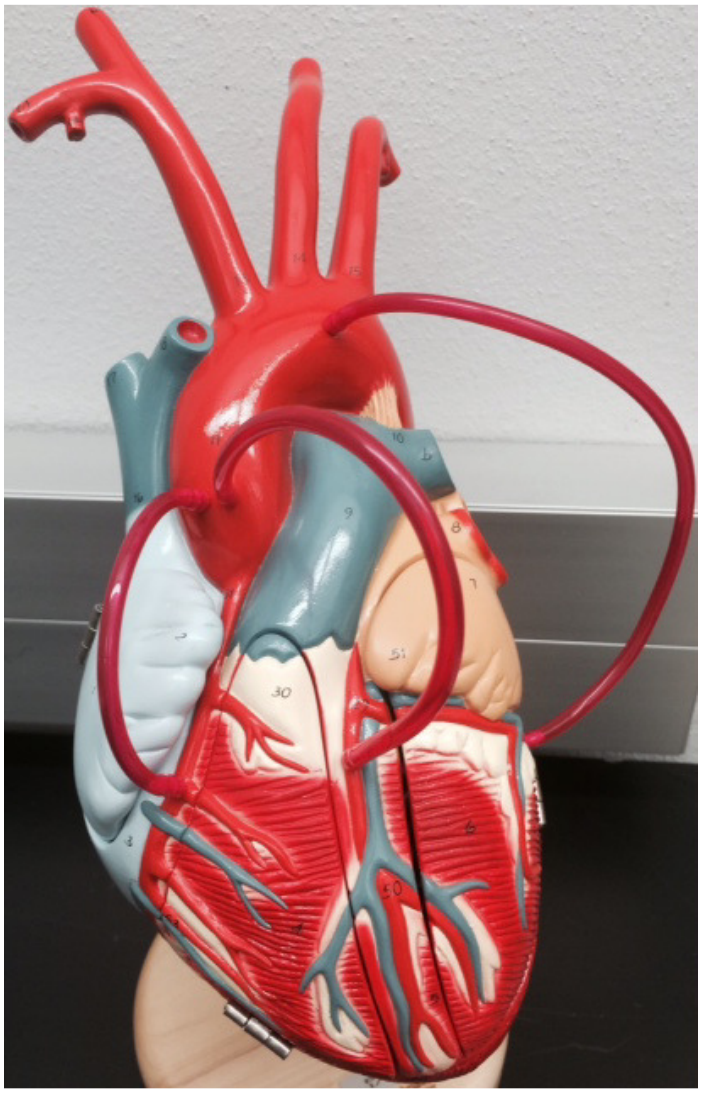
Fig. 8 Posterior view of Heart Model

Coronary Artery Bypass Graft Surgery (C.A.B.G. procedure)

1. Figure 10 demonstrates an example of a triple heart bypass because three grafts have been performed. Use your Essentials textbook to label the three blood vessels that have been bypassed in the figure below.

2. Demonstrate the **C.A.B.G** procedure on the circumflex artery using the heart model, when done, call your instructor. Your instructor will sign here if you are correct _____

Fig. 10 Heart showing Triple heart bypass

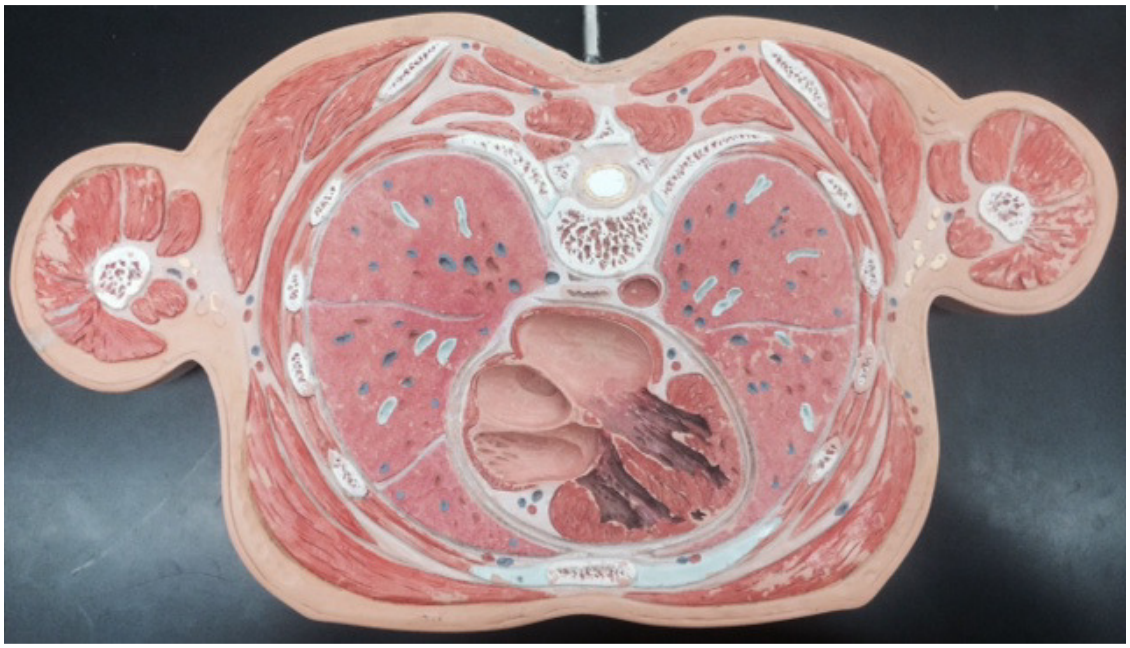


Activity 5: Transverse view of the Heart

While observing slice-man in the lab, refer to your Essentials textbook to identify, label, and learn the following structures in figure 11.

a. Right and Left lungs
b. Sternum
c. Mediastinum
d. Heart
e. Esophagus
f. Descending aorta
g. Parietal pericardium
h. Pericardial space (cavity)
i. Left ventricle
j. Right ventricle
k. Interventricular septum

Fig. 11 Transverse view of the Heart



Lab: BLOOD VESSELS **Organ System:** Cardiovascular	Student _____ Lab #: _____ Date _____

Objectives:

7. Identify and compare differences in vessel construction from microscope slides or photos. Refer to lecture notes.
8. Find a carotid pulse point on your own body.
9. Identify and diagram the course of the major arteries of the body.
10. Identify and diagram the course of the major veins of the body.

Materials:

- Bust, torso, muscular arm and forearm, muscular leg and thigh, heart, and full body flat board with vessels models.
- Posters (if available)

Activity 1: The Aorta and Major Arteries

Use your Essentials textbook as reference! *It is important to note that arteries are delivering nutrients and oxygen to every cell in our body (part of systemic circulation)!!!!*

1. Identify, label, and learn the blood vessels below using the torso model and fig. 1.
   figure 1.

- **Aorta**
  - Ascending aorta
    - R. and L. Coronary artery
  - Aortic arch
    - Brachiocephalic trunk
      - R. common carotid artery
      - R. subclavian artery
    - L. common carotid artery
    - L. subclavian
  - Descending aorta
    - Thoracic aorta (pierces diaphragm)
    - Abdominal aorta
      - Celiac trunk
        - L. gastric artery (flat board)
        - Splenic artery (flat board)
        - Common hepatic artery (flat board)
    - R. and L. renal artery
    - R. and L. common iliac artery
      - R. and L. internal iliac artery
      - R. and L. external iliac artery

Use for fig. 2

Use for fig. 1*

*Include the ascending aorta when labeling fig. 1

2. Use a heart model and **Figure 2** to identify, label and learn the first 10 blood vessels on page 1. Notice that the **aortic arch** branches into the **brachiocephalic trunk** to then branch into the **right common carotid** and **right subclavian arteries**. Next, the **aortic arch** branches into the **left common carotid** and **left subclavian arteries**.

Critical Thinking!

- Do the right and left common carotid arteries branch from the same blood vessel?
  _____ !!!!!

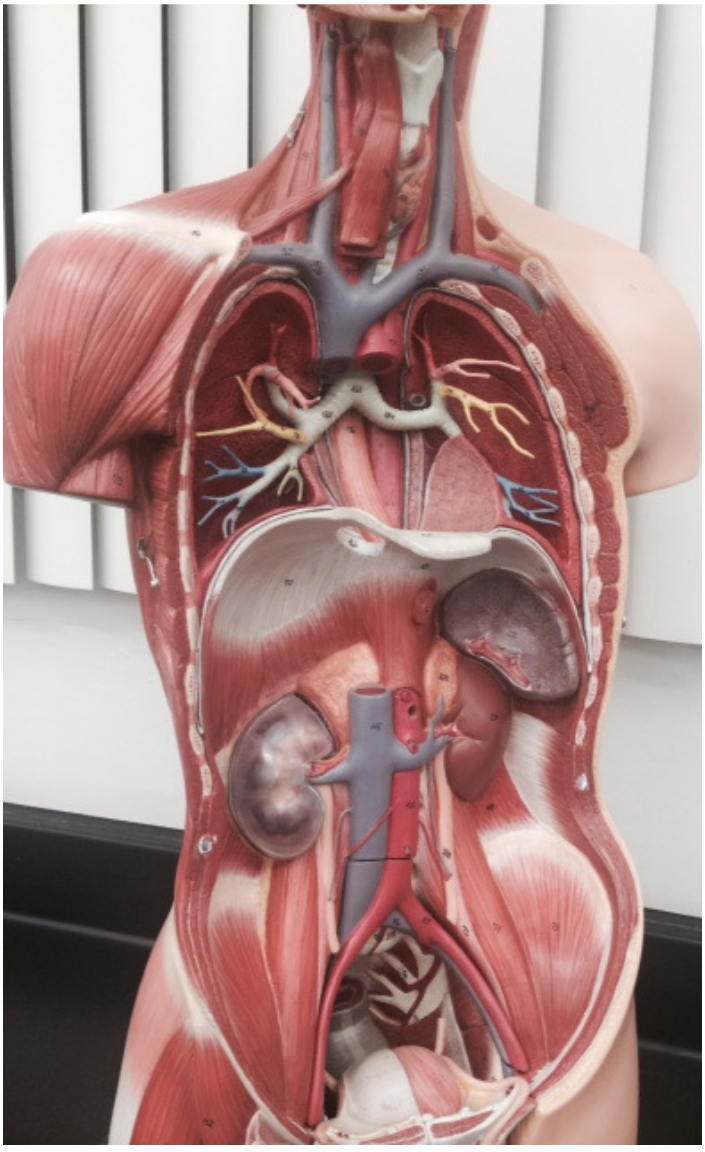


Fig. 1 Anterior view of Torso Model (Coronal Plane through Lungs and Cavities)

Fig. 2 Superior view of Heart Model with Major Branching Arteries

3. Use the flat board model (**Figure 3**) to identify, label and learn the blood vessels on page 1. This model will allow you to find the **celiac trunk** which then branches into the **left gastric**, **splenic**, and **hepatic arteries**.

    - What organs do the **gastric**, **splenic** and **hepatic arteries** supply blood to?

      _____

Critical Thinking!

Fig. 3 Flat board model (Coronal plane displaying Arteries and Veins)

Activity 2: Major Arteries of the Head and Neck

1. Use the transparent skull model to identify, label, and learn the blood vessels below using **figure 4**.

Note: Both arteries are pulse points.

- ❖ R. and L. common carotid artery
- ❖ R. and L. vertebral artery

2. Check your own pulse

To check your pulse over your carotid artery, place your index and middle fingers on your neck to the side of your trachea (windpipe). When you feel your pulse, look at your watch and count the number of beats in 10 seconds. Multiply this number by 6 to get your heart rate per minute.
http://www.mayoclinic.org/healthy-living/fitness/multimedia/checking-pulse-over-the-carotid-artery/img-20006075

My own pulse rate _____

Call your instructor to sign here _____

Fig. 4 Transparent skull Model showing the Right and Left Common Carotid Arteries

Activity 3: Arteries Supplying the Upper Limbs
Use your Essentials textbook as reference!
Use the muscular arm and forearm model to identify and learn the blood vessels below as you label **figures 5** and **6**.
Note: in order to find the blood vessels in the list below, you must remove some of the superficial muscles from the models.

The arteries of the upper limb branch from the right and left subclavian arteries

- R. and L. axillary artery
  - R. and L. brachial artery
    - R. and L. radial artery (pulse point)
    - R. and L. ulnar artery
      - Branches of both the radial and ulnar arteries
        - Deep and superficial palmar arches
        - Digital arteries

Fig. 5 Right Arm and Forearm

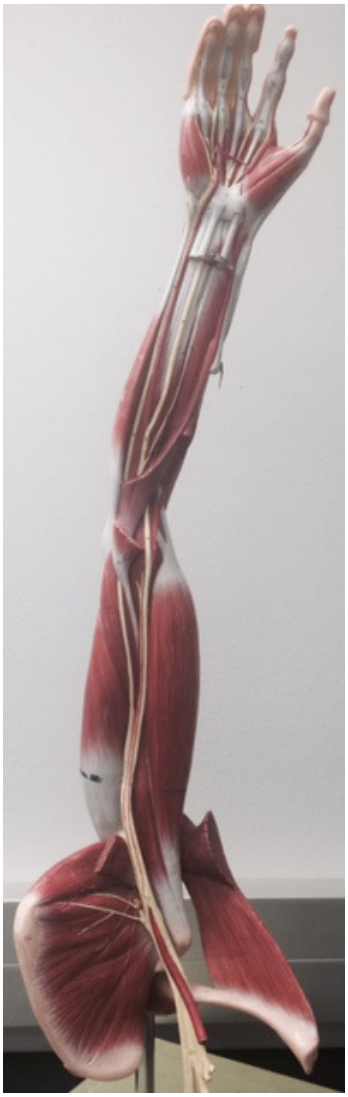


Fig. 6 Left Arm and Forearm

Activity 4: Arteries Supplying the Lower Limbs
Use your Essentials textbook as reference!
Use the muscular leg and thigh model to identify and learn the blood vessels below as you label **figures 7** and **8**. In order to find the blood vessels in the list below, you must remove some of the superficial muscles from the model.

Note: The arteries of the lower limb branch from the right and left external iliac arteries

- R. and L. femoral artery (pulse point after leaving pelvis)
  - R. and L. popliteal artery (pulse point)
    - R. and L. anterior tibial artery
      - Arcuate artery
    - R. and L. posterior tibial artery

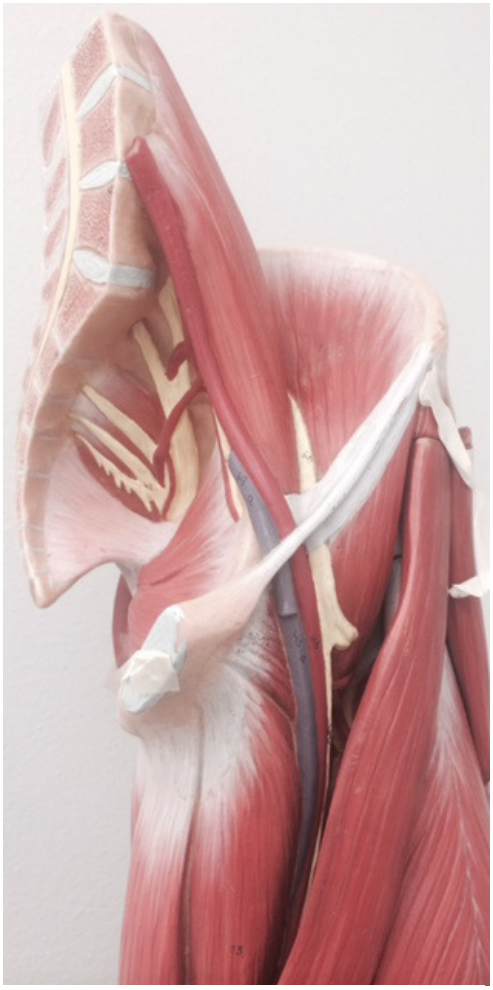


Fig. 7 Left Upper Thigh close up (note Femoral artery)

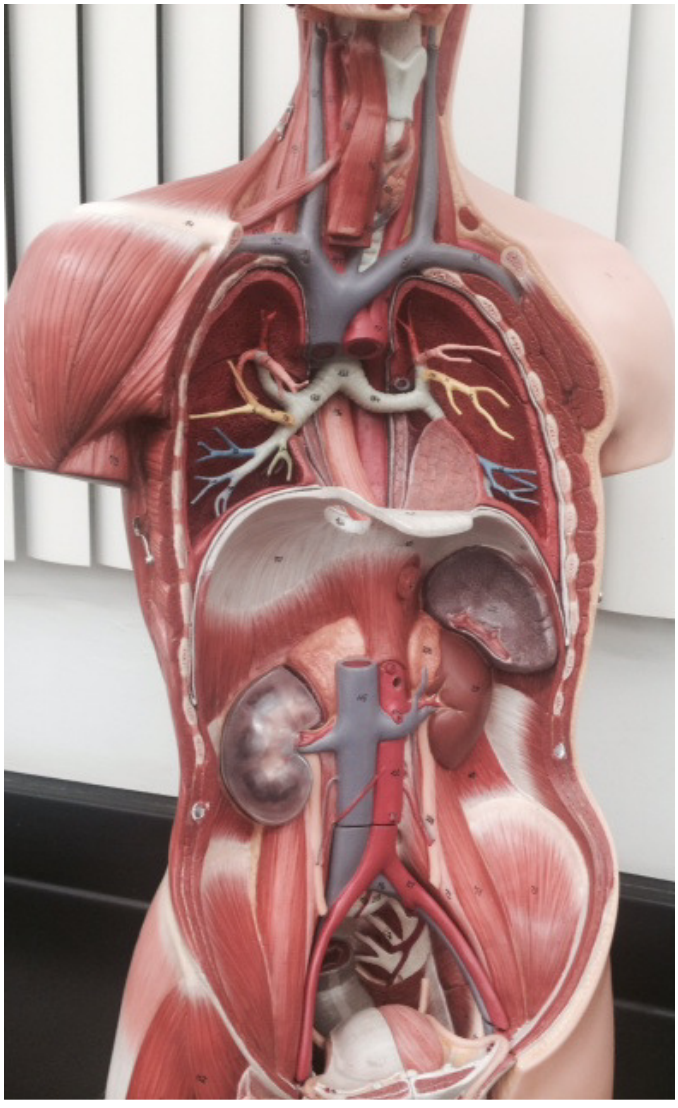
Fig. 8 Left Thigh and Leg

Activity 5: Major Veins of the Systemic Circulation and their Branches
It is important to note that all veins return blood to the heart in order to enter pulmonary circulation. This, in turn, will enable blood to **acquire oxygen (O_2)** from the lungs and **dispose of carbon dioxide (CO_2)**.
Use the torso model to identify, label, and learn the blood vessels below in **figure 9**.

- **Superior vena cava**
  - R. and L. brachiocephalic vein
  - R. and L. Internal jugular vein
  - R. and L. subclavian vein

- **Inferior vena cava**
  - R. and L. renal vein
  - Hepatic vein
  - R. and L. common iliac vein
  - R. and L. internal iliac vein
  - R. and L. external iliac vein

Fig. 9 Anterior view of Torso Model (Coronal Plane through Lungs and Cavities)



Activity 6: Veins Draining the Upper Limbs
Use the muscular arm and forearm model to identify, label, and learn the blood vessels below in **figures 5** and **6**.
Note: In order to find the blood vessels in the list below, you must remove some of the superficial muscles from the models. Notice how easy it is to learn the veins. IF you learn the arteries, you automatically are learning many of the veins!!!!

The veins of the upper limb branch from the right and left subclavian veins.

- **Deep veins draining the upper limbs:**
- R. and L. axillary vein
  - R. and L. brachial vein
    - R. and L. radial vein
    - R. and L. ulnar vein
      - Branches of both the radial vein and ulnar vein
        - R. and L. palmar arches
        - R. and L. digital veins

Superficial veins draining the forearm:
- R. and L. cephalic vein (lateral) (empties into axillary vein)
- R. and L. basilic vein (medial) (empties into brachial vein)
- R. and L. median cubital vein – joins both basilic and cephalic veins at the anterior aspect of the elbow. The median cubital vein is used for blood removal to run blood testing procedures.

Activity 7: Veins Draining the Lower Limbs
Use the muscular leg and thigh model to identify, label, and learn the blood vessels below in **figures 5** and **6**.
Note: In order to find the blood vessels in the list below, you must remove some of the superficial muscles from the models.

Note: The veins of the lower limb branch from the right and left external iliac veins

- R. and L. great saphenous vein
- R. and L. popliteal vein
- R. and L. femoral vein
- R. and L. anterior tibial vein
- R. and L. dorsal venous arch
- R. and L. posterior tibial vein
- R. and L. plantar arch

} Not seen in most models