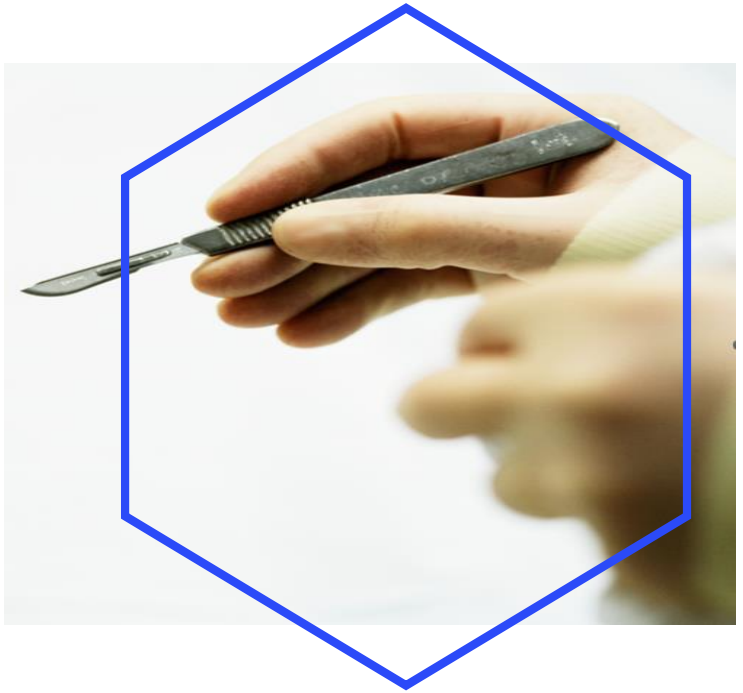
Journey Through the Heart

Objectives

- **Measure systolic and diastolic blood pressure.**
- **Dissect a Carolina's Perfect Solution® sheep heart.**
- **Trace blood flow through the mammalian heart.**
- **Relate heart structure and function to blood pressure.**



Building Toward 3-Dimensional Learning

Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and using models • Develop and use a model based on evidence to illustrate the relationships between systems.	LS 1: From molecules to organisms: Structures and processes • Multicellular organisms have a hierarchical structural organization.	Structure and function • The shape and structure of objects determine their functions and properties.[1]

- **Next Generation Dissections**

1. NGSS Lead States, *Next Generation Science Standards: For States, By States* (Washington, DC: The National Academies Press, 2013), retrieved from www.nextgenscience.org or ngss.nsta.org

Workshop “Organ”ization

Procedure:

1. Take blood pressure measurements
2. Dissect the sheep heart
3. Tie it all together

Blood Pressure

- Force of blood exerted on blood vessel walls
- Typically measured in the brachial artery in millimeters of mercury (mmHG)
- Systolic pressure:
  - Max. pressure
  - Left ventricle contracts
  - Avg.: 120 mmHG
- Diastolic pressure:
  - Min. pressure
  - Left ventricle relaxes
  - Avg.: 80 mmHG
- Korotkoff sounds (🔊: systolic; 🔇: diastolic)

Remember: BP is dynamic - it changes daily, seasonally, and as we age.

Activity 1: Blood Pressure

$$BP = \frac{\text{Systolic Pressure}}{\text{Diastolic Pressure}}$$

1. Wrap the cuff around your upper left arm, about 1” above the elbow.
2. Align the cuff’s artery mark ⌽ with your brachial artery on the inside of your arm. *The tube should be toward lower arm!*
3. Tighten the cuff.
4. Lay your arm on the table, palm up, so cuff is the same height as your heart.
5. Press the power button. Wait for 3 beeps and the inflation indicator to begin flashing ▲ before proceeding!
6. Squeeze the bulb to inflate the cuff to 30 mmHG above your normal BP (160-180 mmHG).
7. Stop and wait.
8. Record your BP.

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Carolina's Perfect Solution® Specimens

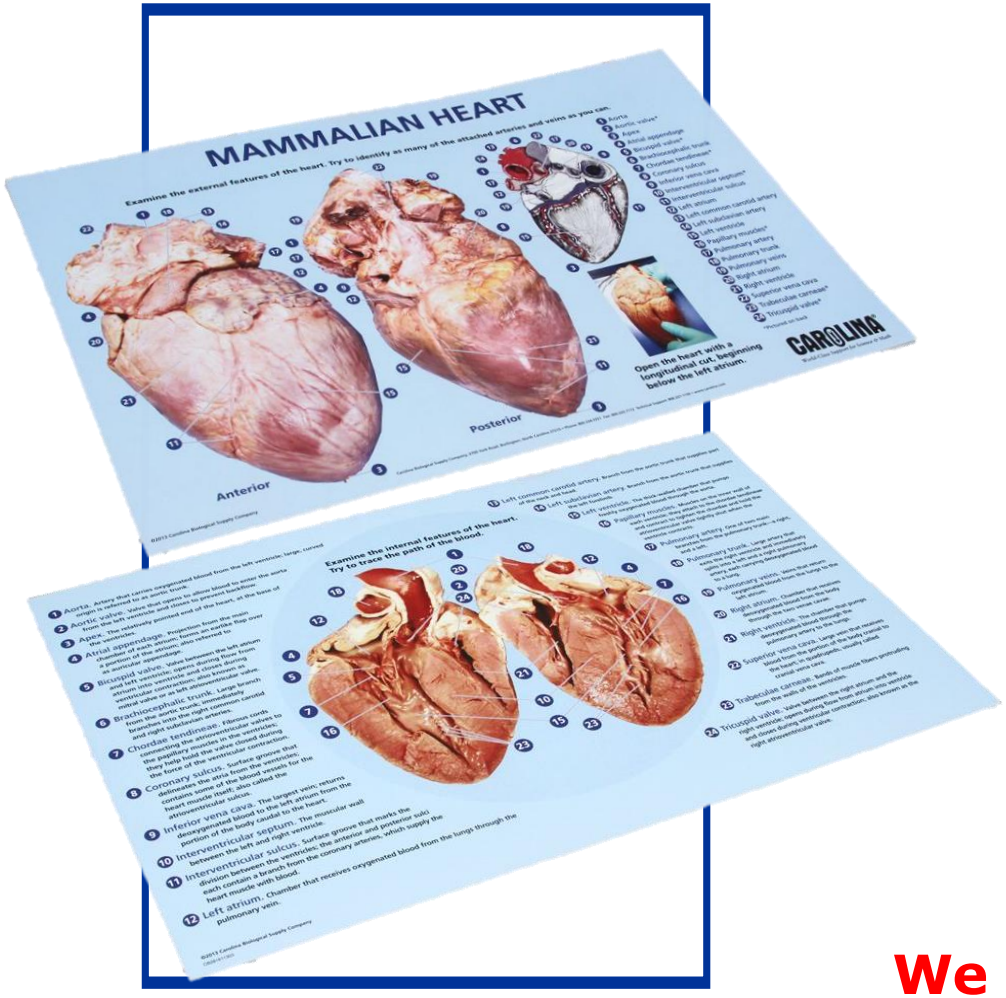
Quality

- Superior preservation
- Superior tissue color and texture

Safety

- No dangerous off-gassing
- No formalin odor

Carolina® Dissection Mats



- **Clear, concise dissection instructions**
- **Detailed, color photographs**
- **Labeled internal and external structures with definitions**
- **Cost-effective**
- **Reusable—wipe clean**

PLEASE DO NOT TAKE!
We need these for the other workshops.

Dissection Preparation Tips

- **Organize your dissection area:**
  - Take out your dissection tray
  - Put blue absorbent pad under the dissection tray
  - Lay out your instruments
    - Coffee Stirrers
    - Scalpel
- **Use appropriate personal protective equipment:**
  Apron, gloves, goggles

Safety Issues

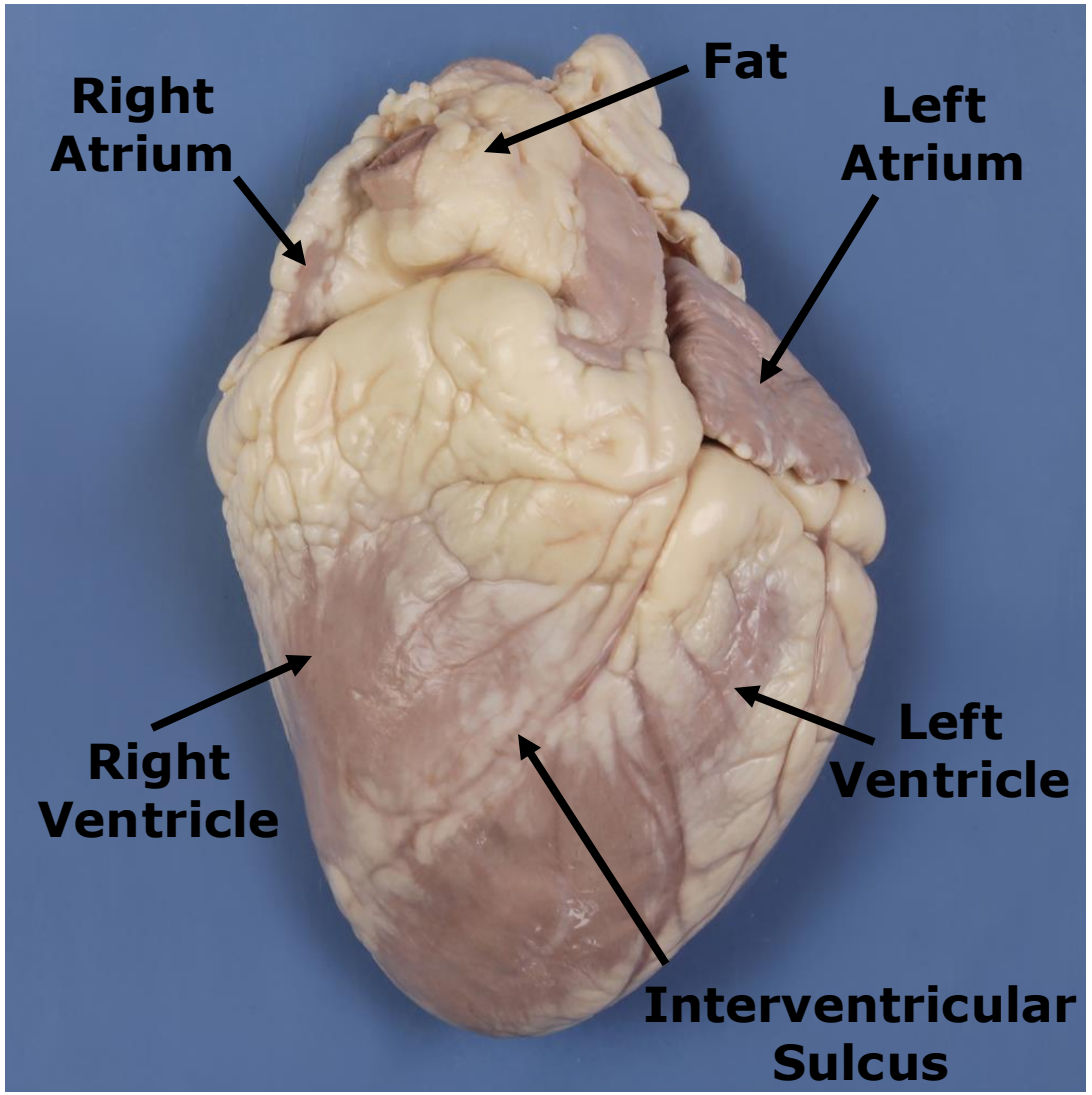
- **Personal protective equipment**
  Gloves, goggles, and lab aprons
- **Dissection tools**
  Be diligent with sharp tools

Safety Tip
If you are not using an instrument, set it down!

Teacher Tip

1. At the anterior of the specimen, locate an area where there is excess plastic.
2. Force any fluid out of the area to prevent spills.
3. Cut a small hole in the excess plastic. This will allow the fluid to drain to the bottom of the bag.
4. Continue to cut around the anterior of the specimen until you can easily remove the specimen from bag.
5. Keep bag upright until we collect fluid and bag.

Sheep Heart: External Anatomy



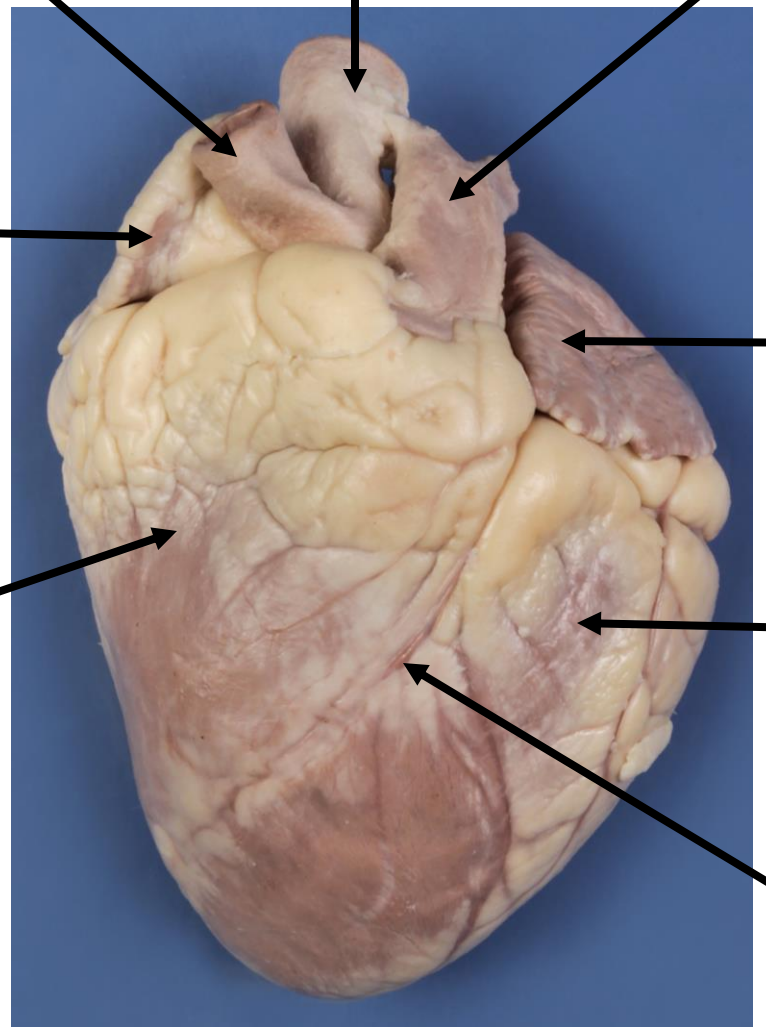
Anterior Surface

1. **Correctly orient the heart.**
   Hint: Find the interventricular sulcus first, then each atria.

2. **Locate all structures on the anterior and posterior surfaces.**

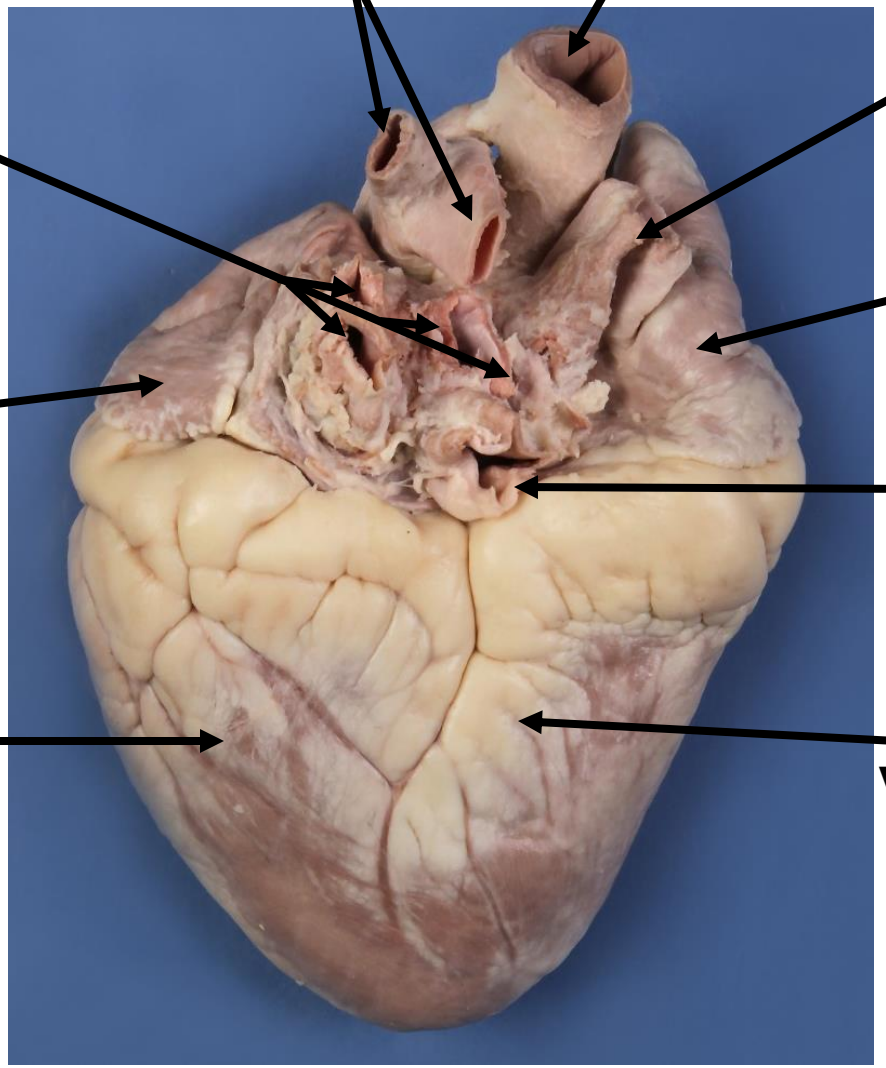
3. **As needed, trim the fat from the around the blood vessels with scissors.**

Sheep Heart: External Anatomy



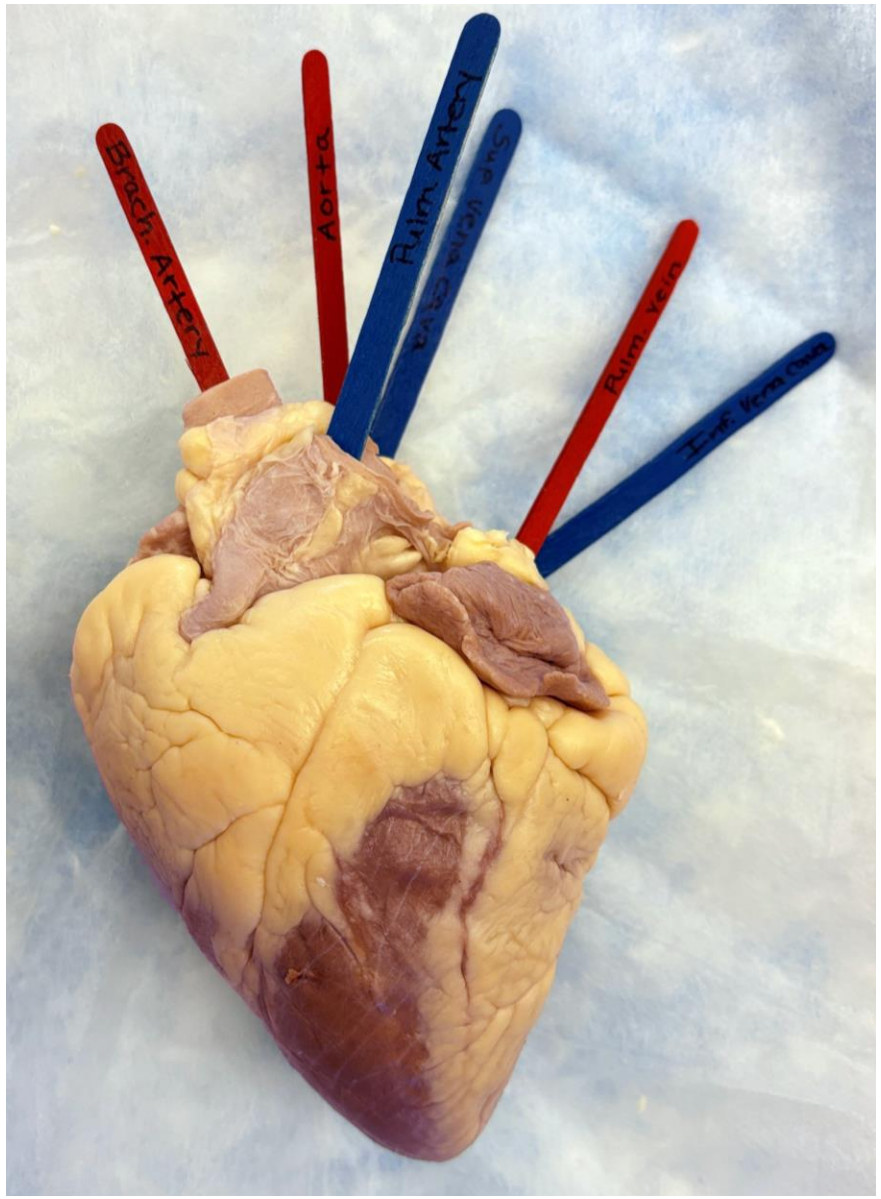
Anterior Surface

Sheep Heart: External Anatomy



Posterior Surface

Activity 2: Blood Flow

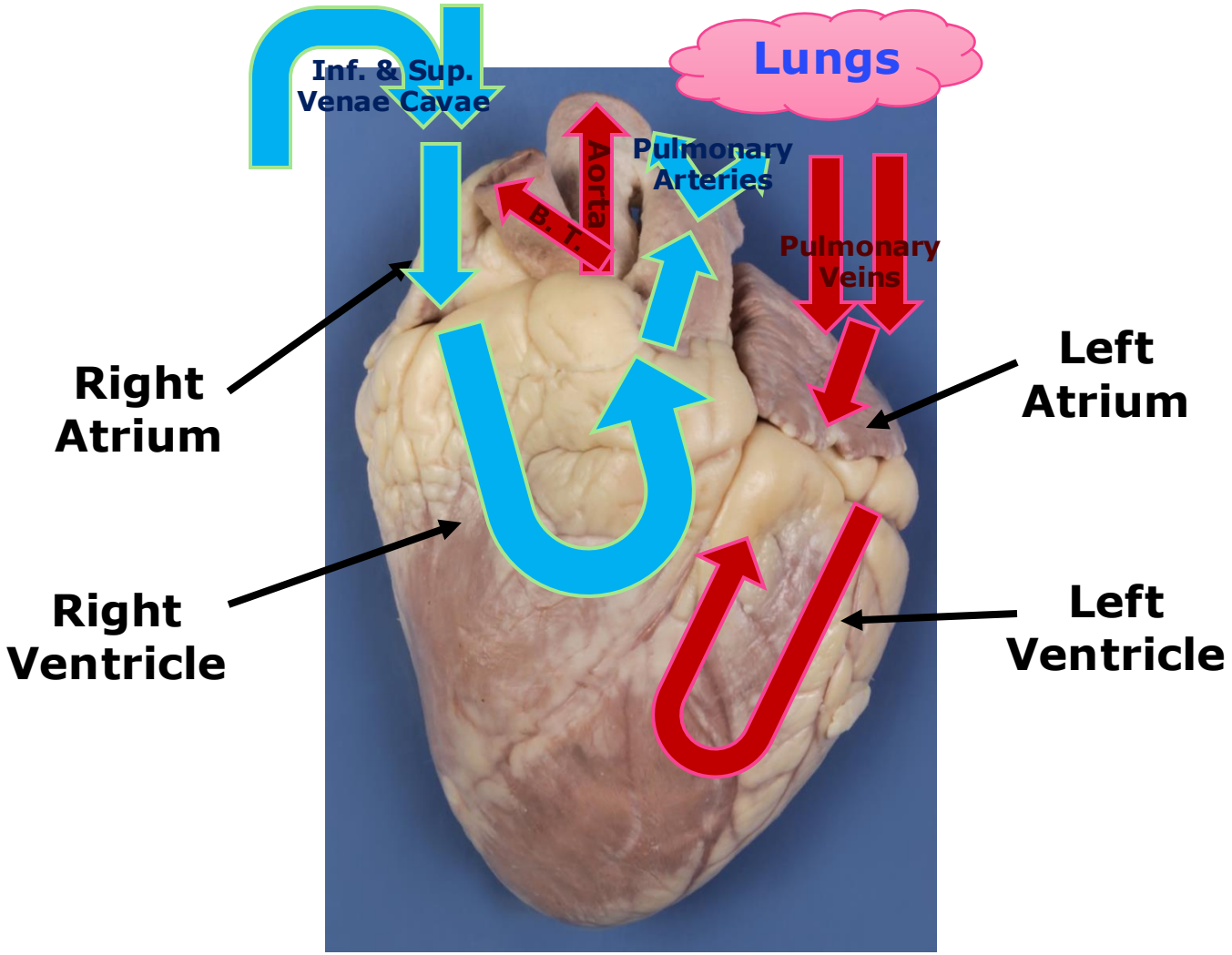


1. **Locate the major blood vessels.**
2. **Trace blood flow into and out of the heart:**
   a. **Insert a blue stirrer into vessels transporting deoxygenated blood.**
   b. **Insert a red stirrer into vessels transporting oxygenated blood.**

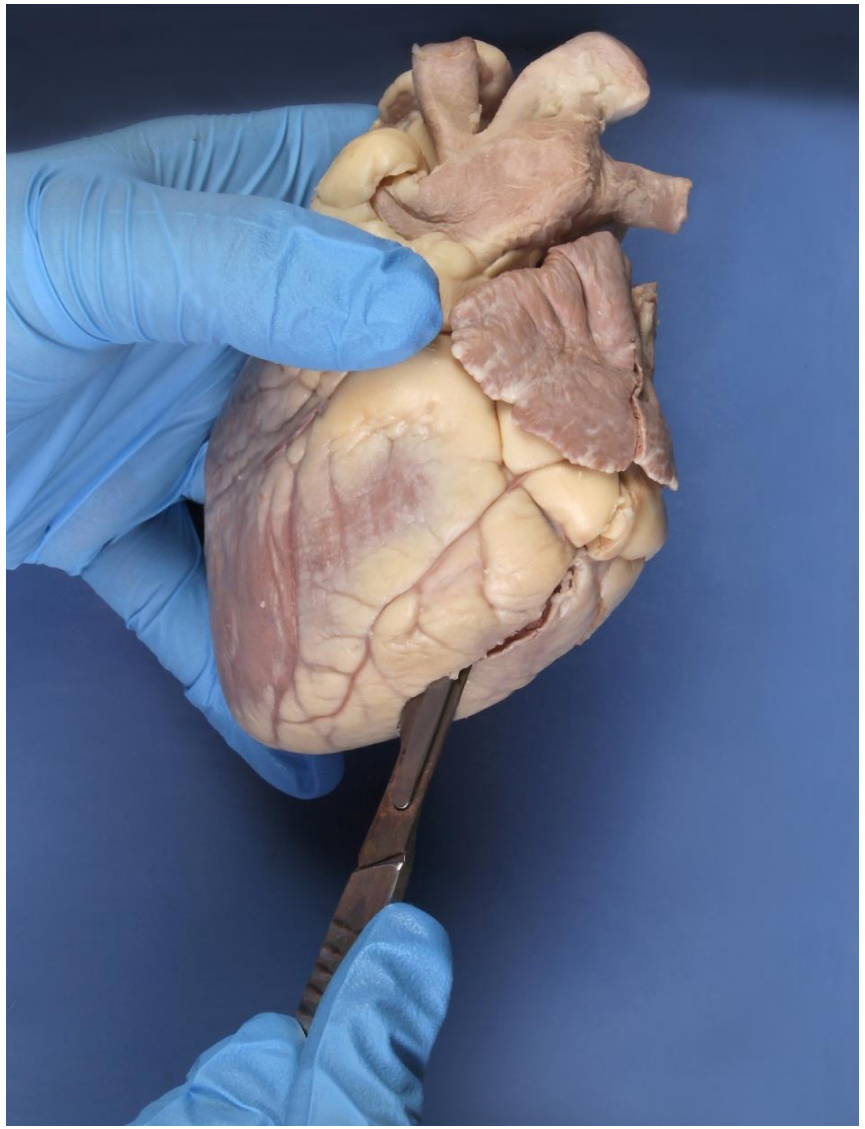
- ♥ Aorta
- ♥ Pulmonary arteries
- ♥ Pulmonary veins
- ♥ Superior vena cava
- ♥ Inferior vena cava
- ♥ Brachiocephalic artery

IMPORTANT: For the pulmonary arteries and veins, only use 1 stirrer each.

Trace Blood Flow Through the Heart

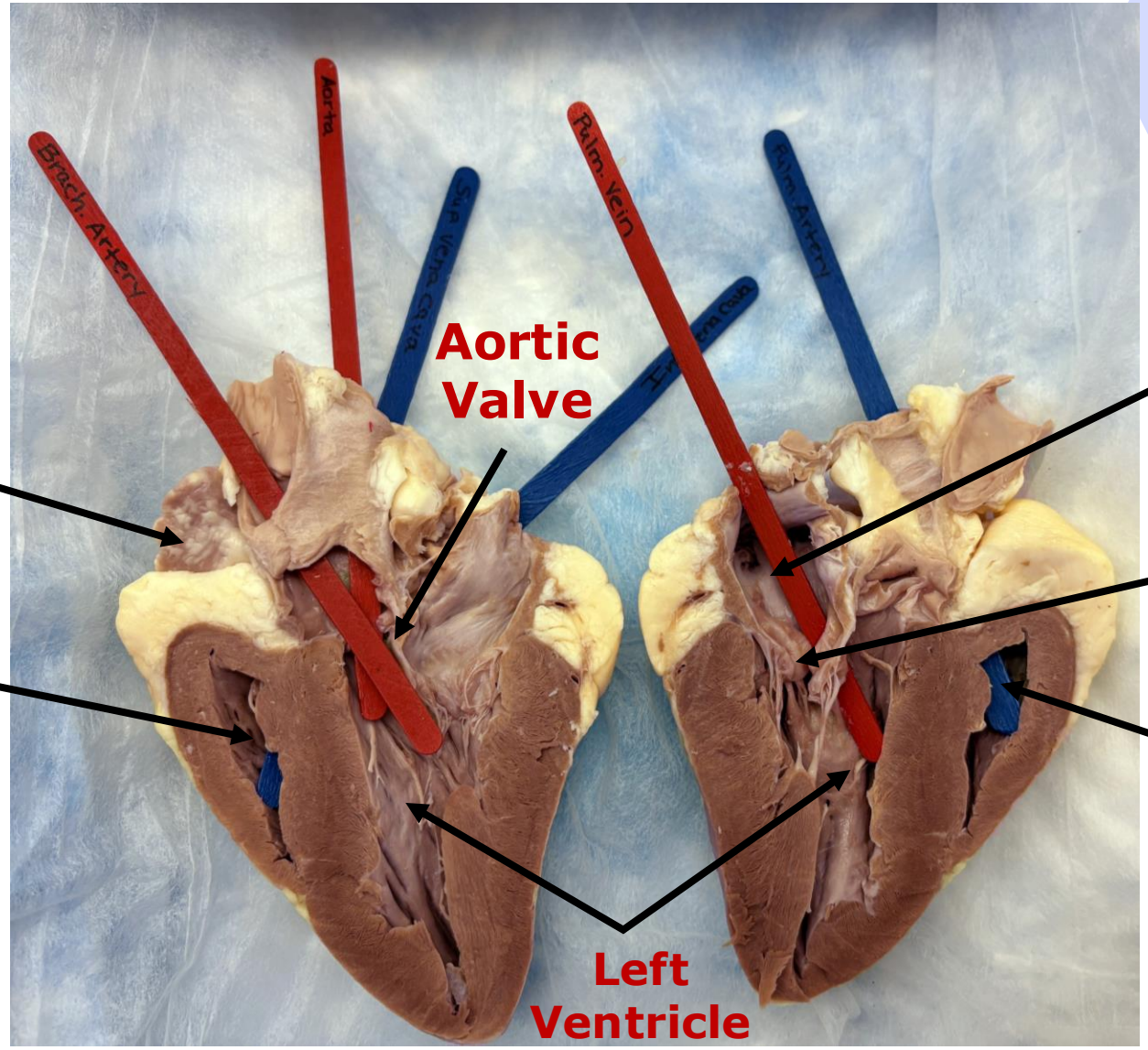


A Knife in the Heart!



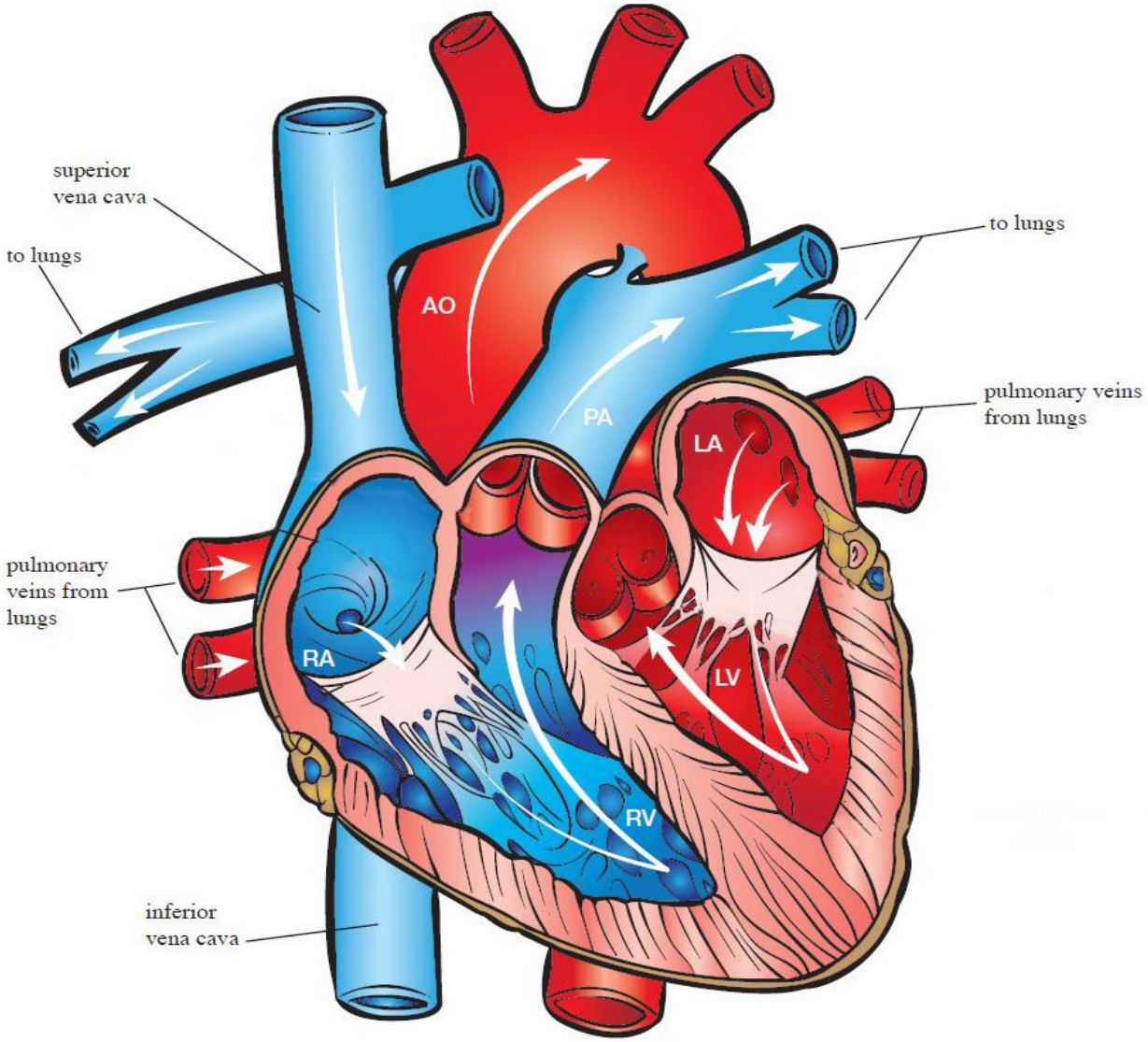
Cut the heart in half, across the atria and ventricles, as shown.

Sheep Heart Internal Anatomy



Tricuspid and pulmonary valves not pictured

Blood Flow



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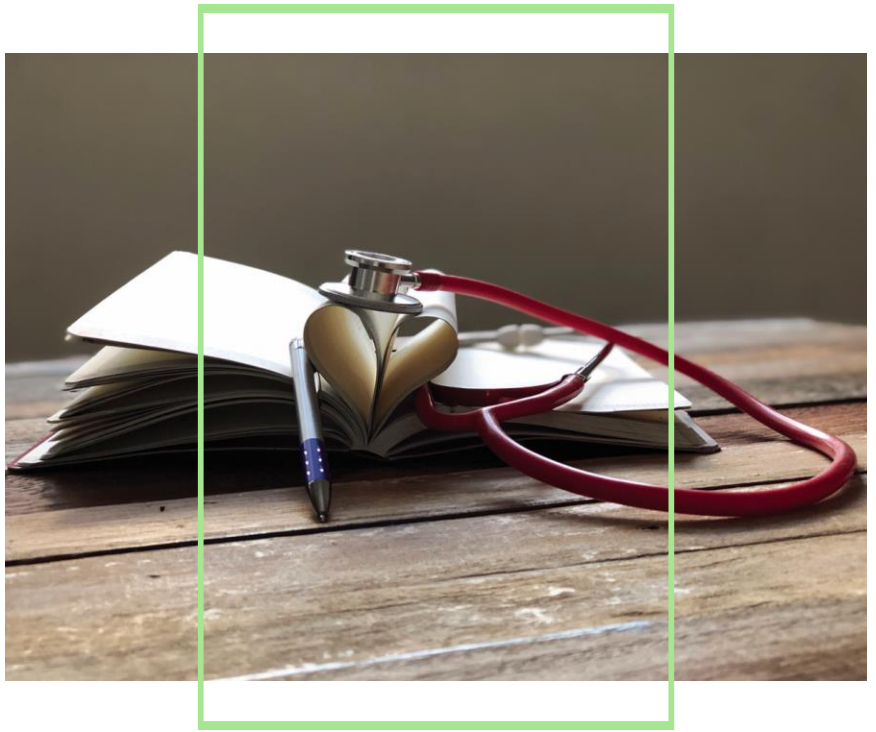


What We Know So Far

- Systole – relaxation or contraction?
- Diastole – relaxation or contraction?

- Blood pressure is measured in (arteries or veins)?

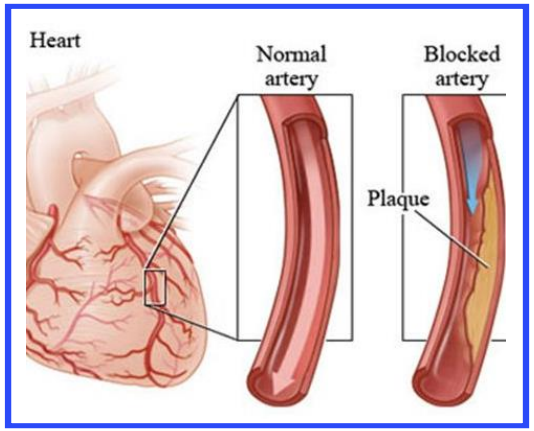
- Pressure is created as blood moves through the heart, with the greatest pressure resulting from the (chamber).

- Blood leaves the heart through the (vessel) after being pumped by the (chamber).

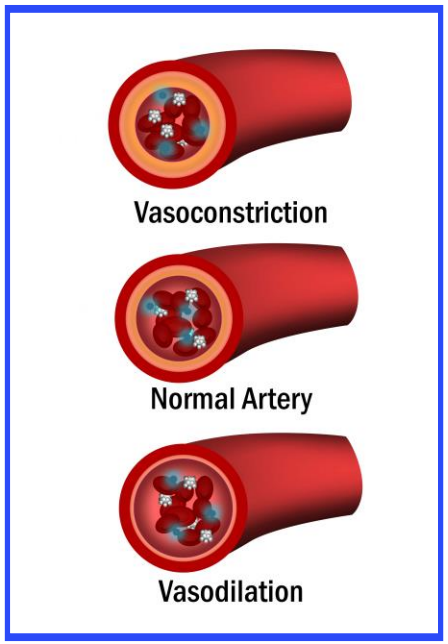
From here, have students discuss different variables that could impact blood pressure.

Main Factors Affecting Blood Pressure

1. Cardiac output
   a. Amount of blood flow through the heart (L/min)
   b. ↑ C.O. = ↑ in BP



2. Compliance
   a. Ability of vessels to expand
   b. ↓ C = ↑ in BP



3. Resistance
   a. Opposition to blood flow through vessels
   b. ↑ R = ↑ in BP
   c. Related to:
      a. Blood viscosity (thickness): ↑ = ↑ in BP
      b. Blood vessel length: ↑ = ↑ in BP
      c. Blood vessel diameter: ↓ = ↑ in BP

4. Blood Volume
   a. Amount of blood in the body
   b. ↑ = ↑ in BP

Cleanup Instructions

- **KEEP GLOVES ON!**
- **Separate trash from animal material/waste**
- **Carolina Employees will be walking around to collect ONLY animal waste.**
- **All other trash goes in trash bags.**
- **Wipe out pans, clean tools, and wipe off tables.**