

Heart Anatomy

Objectives

- Describe the gross external properties of the heart, including location, size and shape
- List the layers of tissue that comprise the wall of the heart and the pericardium
- Identify the internal structure of the heart and the arrangement of the four chambers
- Identify the four heart valves, describing the function of each
- Identify the great vessels of the heart and describe their relationship to the chambers they serve
- Describe the differences between the pulmonary circuit and the systemic circuit
- Trace the pathway of blood through the pulmonary circuit and systemic circuit
- Identify the vessels of coronary circulation

Introduction

In the previous lab, you learned about the basic organization of the **circulatory system**, focusing on the fluid tissue of that system known as blood. In this lab, we narrow our focus to the muscular pump of the system, the heart. We will also look at the vessels that deliver blood directly into or carry blood immediately out of the heart. When studying only the heart and blood vessels it is common to refer to them as the **cardiovascular system**. While many might use the terms circulatory system and cardiovascular system interchangeably, we want you to be more accurate in differentiating between the two. It would be correct to say that the circulatory system consists of the blood and the cardiovascular system (heart and vessels) that moves and distributes the blood throughout the body.

In the cardiovascular system, there are two major categories of large vessels: arteries and veins. Generally, arteries transport freshly oxygenated blood from the heart to the body's tissues and veins transport deoxygenated blood from those tissues back to the heart. The exceptions to the pattern are the vessels of the pulmonary circuit (the pulmonary arteries and pulmonary veins).

In a later lab you will learn about more types of vessels than these, but for now, know that these are the major types.

Location, Size, and Shape of the Heart

[\[Section 19.1.1: Location of the Heart\]](#)

[\[Section 19.1.2: Shape and Size of the Heart\]](#)

[\[Figure 19.2: Position of the Heart in the Thorax\]](#)

Ventral body cavity, thoracic cavity, mediastinum.

Inferior mediastinum contains pericardial cavity.

Base, apex, cardiac notch.

Be sure you know the dimensions of the heart (in cm) and its mass (in grams); and describe the differences in these values between males and females

Layers of the Heart

[\[Section 19.1.4.1: Membranes\]](#)

[\[Section 19.1.4.3: Layer\]](#)

[\[Figure 19.5: Pericardial Membranes and Layers of the Heart Wall\]](#)

[\[Figure 19.8: Differences in Ventricular Muscle Thickness\]](#)

The pericardium is the serous membrane of the heart

- Two layers (parietal and visceral)
 - Outer parietal
 - attaches heart to mediastinum
 - has fibrous tissue so heart doesn't over-expand
 - Inner visceral layer (epicardium)
 - lines surface of the heart
- Space between= pericardial cavity
 - Filled with serous fluid (reduces friction)
- Both layers have mesothelium which produces serous fluid

The heart wall has 3 layers

- Epicardium
 - same as visceral pericardium
- Myocardium
 - most of heart wall, composed of cardiac muscle tissue (which is made of uninucleated cardiac muscle cells)
- Endocardium
 - thin layer of endothelial tissue that lines the heart chambers

Internal Structure of the Heart

[\[Section 19.1.5: Internal Structure of the Heart\]](#)

[\[Figure 19.9: Internal Structures of the Heart\]](#)

[\[Figure 19.11: Chordae Tendineae and Papillary Muscles\]](#)

[\[Figure 19.12: Heart Valves\]](#)

[\[Figure 19.13: Blood Flow from the Left Atrium to the Left Ventricle\]](#)

[\[Figure 19.14: Blood Flow from the Left Ventricle into the Great Vessels\]](#)

Septa

- Interatrial septum, fossa ovalis, interventricular septum

Right Atrium

- Coronary sinus, pectinate muscles

Right Ventricle

- Papillary muscles, chordae tendineae, trabeculae carneae

Left Atrium

Left Ventricle

Valves

- Right AV (tricuspid), pulmonary semilunar valve, left AV (bicuspid or mitral), aortic semilunar valve

Circulation Through the Heart

[\[Section 19.1.3: Chambers and Circulation through the Heart\]](#)

[\[Figure 19.4: Dual System of the Human Blood Circulation\]](#)

Blood enters the right atrium by way of the superior vena cava & the inferior vena cava

From the right atrium, the blood flows through the tricuspid AV valve into the right ventricle.

After the ventricle contracts, the blood flows through the pulmonary semilunar valve and into the pulmonary arteries.

The pulmonary arteries deliver the blood to the lungs where it is enriched and exits by the pulmonary veins.

The oxygenated blood is delivered to the left atrium, where it then is pushed through the bicuspid (or mitral) AV valve into the left ventricle.

From here the blood is pushed through the systemic semilunar valve, and the aorta and then out into the body.

Coronary Circulation

[\[Section 19.1.6: Coronary Circulation\]](#)

[\[Figure 19.15: Coronary Circulation\]](#)

- Left coronary artery, circumflex artery, anterior interventricular artery (aka, LAD)
- Right coronary artery, marginal arteries, posterior interventricular artery (aka, PDA)

Veins remove waste and metabolic by-products from the myocardium

- Great cardiac vein, small cardiac vein, middle cardiac vein, posterior cardiac vein
- Coronary sinus (all coronary veins merge into this)
 - Located in posterior region of coronary sulcus
 - Empties deoxygenated blood from myocardium into right atrium

Heart Dissection

Follow your TA to the lab where you will find a dissection guide. Follow the instructions on the guide to dissect a sheep heart. Identify all structures studied above. Notice the dimensions of the sheep heart. What are the differences between this heart and the dimensions of your heart as described in your text?

Lab exercise – Anatomy of the Heart Activities:

Heart Muscle Histology Review

Exterior of the Heart

Interior of the Heart

Dissection of the Sheep Heart

Also see Cardiac Muscle, to review cardiac muscle histology

Learning Objectives

- Describe the location of the human heart
- Name and located the major anatomical areas and structures of the heart on a chart, model, diagram or preserved specimen (see the Structures of Importance)
- Trace the pathway of blood through the heart
- Compare the pulmonary and systemic circuits
- Describe the features and operation of the atrioventricular and semilunar valves
- Describe the blood supply to the heart (see the table)
- Compare and contrast cardiac tissue histology with skeletal and smooth muscle

Structures of Importance

External structures	Internal structures
Great vessels (if visible): aorta, superior vena cava, inferior vena cava, pulmonary trunk	Right and left atria
Right and left atria	Right and left ventricles
Right and left ventricles	Right and left atrioventricular valves (mitral and tricuspid valves)
Pulmonary veins	Aortic and pulmonary semilunar valves
Pericardium (visceral and fibrous, if visible)	Interventricular septum
	Papillary muscles and trabeculae carneae
	Chordae tendineae
Coronary arteries	Coronary veins
Right coronary artery	Coronary sinus
Marginal artery / right marginal artery	Great cardiac vein
Left coronary artery	Middle cardiac vein
Anterior interventricular artery	
Circumflex artery	
Posterior interventricular artery	
Heart microanatomy (see Wise, pp. 59-60)	
Cardiac muscle cells / nuclei / striations	
Intercalated disks	

TABLE 1: STRUCTURE OF THE HEART		
Term/Structure	Definition/Location	Notes
Mediastinum		
Pericardium		
Veins		
Arteries		
Pericardial Sac (parietal pericardium)		
Pericardial Cavity		
Serous Fluid		
Epicardium (Visceral Pericardium)		
Myocardium		

CBIO 2210L - Heart Structure

Cardia Muscle		
Endocardium		
Exterior of the Heart		
Apex		
Base		
Aorta		
Pulmonary Trunk		
Left Ventricle		
Interventricular Groove (sulcus)		
Coronary Arteries		

CBIO 2210L - Heart Structure

Cardiac Veins		
Auricles		
Atrioventricular Sulcus (groove)		
Coronary Sinus		
Superior Vena Cava		
Inferior Vena Cava		
Pulmonary Veins		
Pulmonary Trunk		
Pulmonary Arteries		
Ligamentum Arteriosum		

CBIO 2210L - Heart Structure

Ascending Aorta		
Left Coronary artery		
Anterior interventricular artery		
Circumflex Artery		
Right Coronary Artery		
Posterior interventricular artery		
Right Marginal Artery		
Great Cardiac Vein		
Small Cardiac Vein		
Interior of the Heart		

CBIO 2210L - Heart Structure

Right Ventricle		
Interventricular Septum		
Right Atrium		
Interatrial Septum		
Fossa Ovalis		
Foramen ovale		
Pectinate Muscles		
Right Atrioventricular valve (tricuspid valve)		
Chordae tendineae		
Papillary Muscles		

CBIO 2210L - Heart Structure

Trabeculae Carneae		
Pulmonary Semilunar Valve		
Bicuspid Valve		
Left Atrioventricular Valve (Mitral Valve)		
Aortic Semilunar Valve		

1. The heart is located between the lungs in an area known as the:
2. What is the outer (superficial) layer of the pericardium?
3. What is the innermost layer of the heart wall called?
4. Name the depression between the two ventricles seen on the anterior surface of the heart.
5. Are auricles extensions of the atria or the ventricles?

CBIO 2210L - Heart Structure

6. What three vessels take blood to the right atrium?
7. Where do the great cardiac vein and the small cardiac vein take blood?
8. Is the apex of the heart superior or inferior to other parts of the heart?
9. What blood vessels nourish the heart tissue?
10. What structure separates the left atrium from the right atrium?
11. The bicuspid valve is located between what two chambers of the heart?
12. What is the function of the aortic semilunar valve?
13. Name the structure found between the left atrioventricular valve and the papillary muscle.
14. What is another name for the tricuspid valve?
15. What is the cell type that makes up most of the myocardium?
16. The walls of the left ventricle are thicker than those of the right ventricle. What explanation can you give for this?

CBIO 2210L - Heart Structure

17. How does cardiac muscle resemble skeletal muscle?
18. In terms of function, how is cardiac muscle different from skeletal muscle?
19. What is the function of the semilunar valves?
20. Trace the flow of blood through the heart.
21. Label the following illustration using the terms provided.