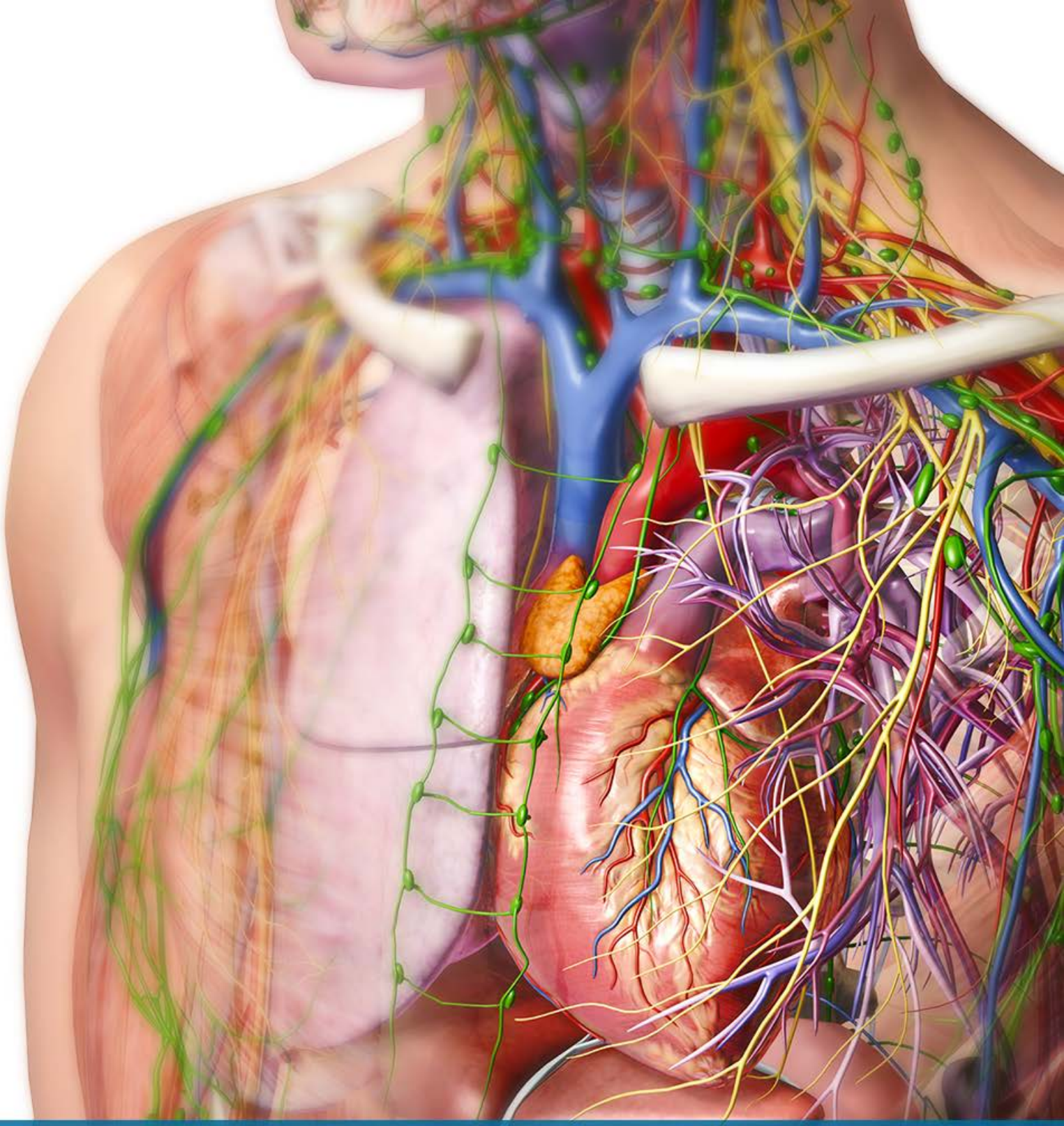


VISIBLE BODY®

The Human Heart

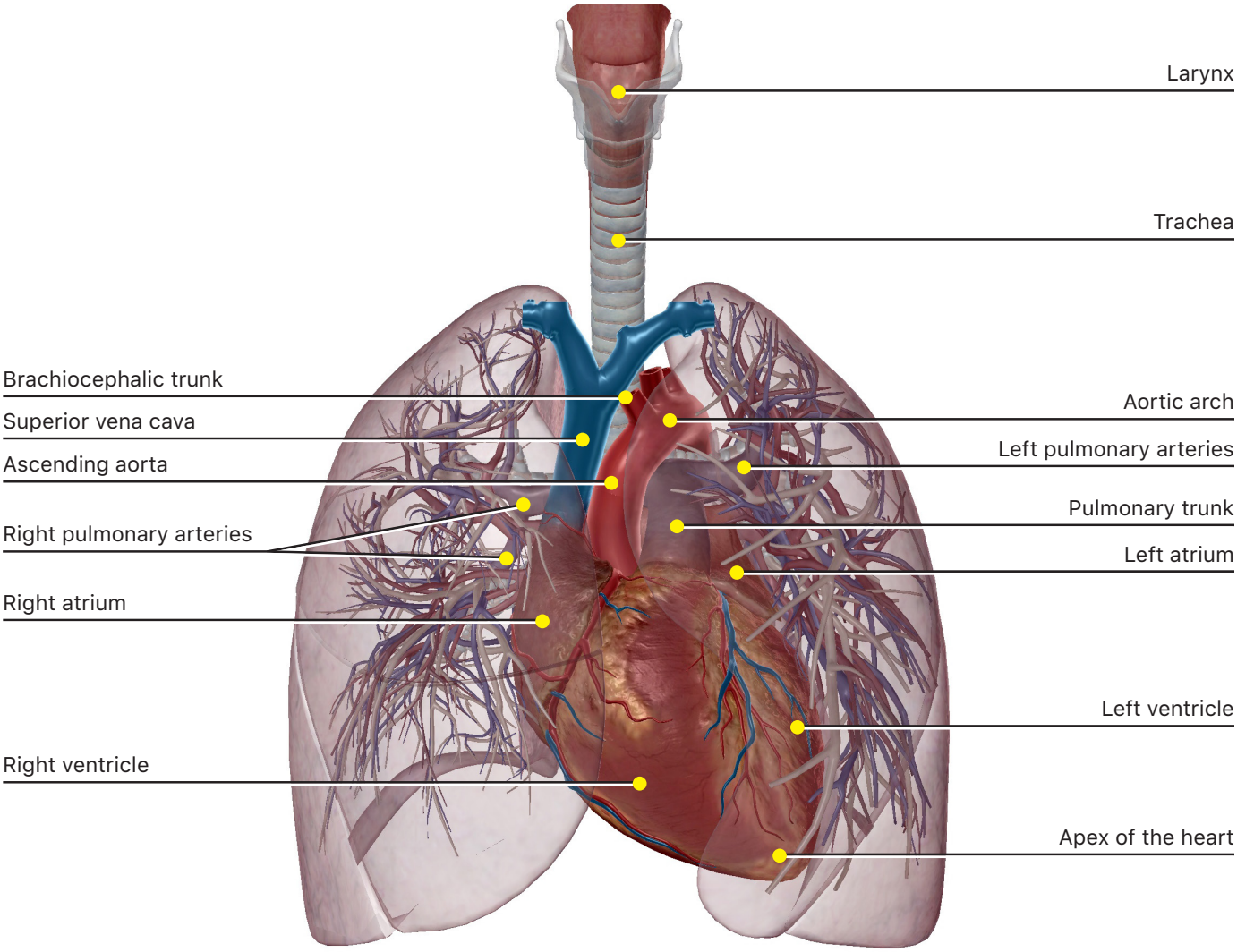
A circulatory system lab activity using Visible Body Suite

Molli Crenshaw, Instructor of Biology, TCU

A. LOCATION OF THE HEART

Open Visible Body Suite. Search for and select the Circulatory System View "Location of Heart." Make the following observations, and note you are responsible for the bolded terms:

Location of the Heart (Anterior View)

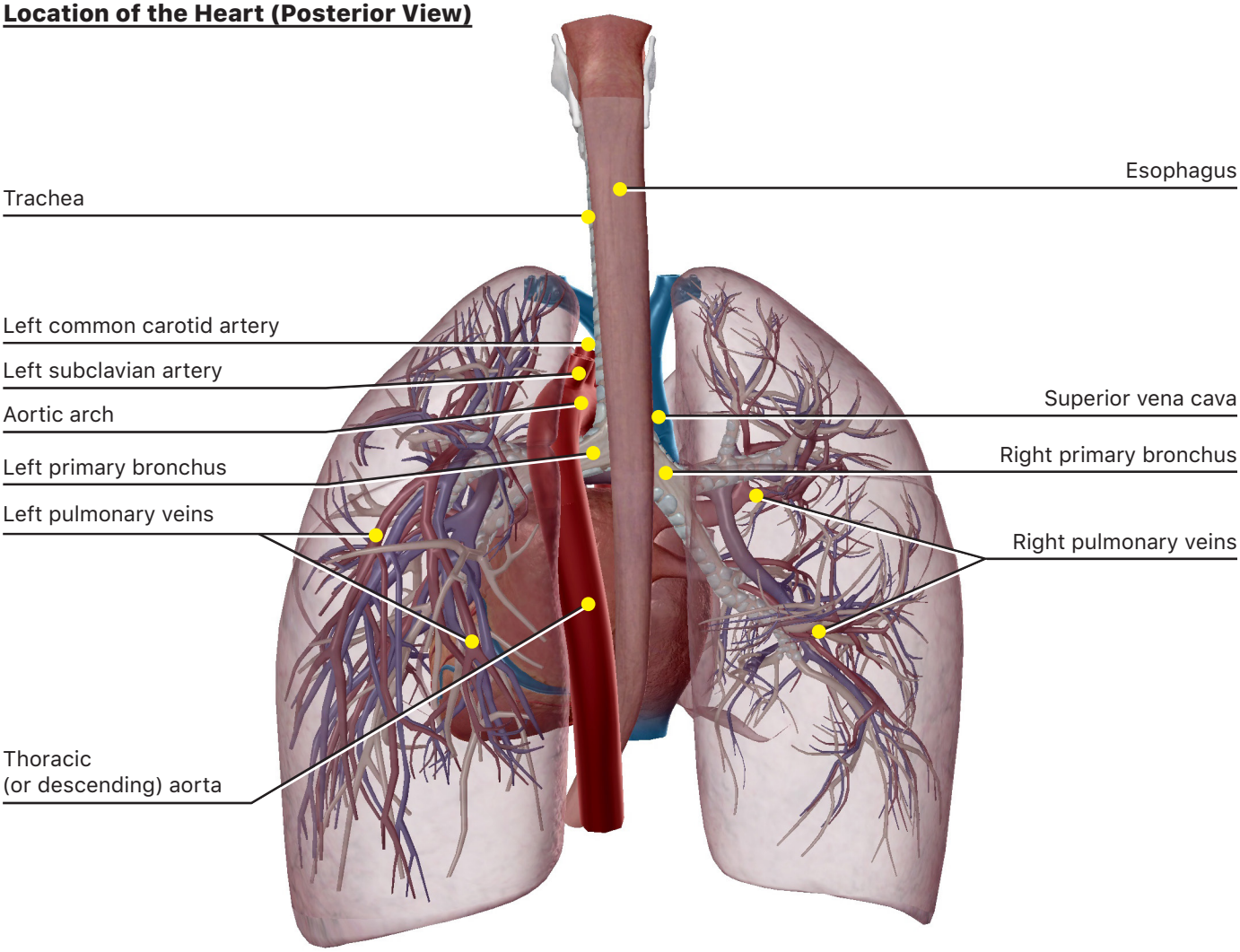


1. What is a basic description of the heart's function?

2. What is the approximate size and weight of the heart?

3. By rotating the image and highlighting the visible bones, make a list of the bones which form the protective thoracic cage around the heart:

Location of the Heart (Posterior View)



4. What is the function of the thoracic cage in regard to the heart?

5. What is the location of the heart in reference to the right and left lungs?

6. Which lung experiences the greatest displacement due to the location of the heart? Highlight this lung and read its description. What is this "indentation" of the heart called?

7. In the Systems Tray on the left side of the screen, deselect the skeletal system to hide the thoracic cage. Then, rotate the model to see the trachea and esophagus. What is the placement of the heart in regard to the trachea and esophagus?

8. Hide the lungs by deselecting the respiratory system icon on the left-hand side of the screen. You should now be able to see the vessels associated with the "pulmonary circuit" of blood flow. Select any part of the **pulmonary trunk**, and use its description to answer the following questions:

a. The flow of blood from the heart to the lungs, then back to the heart is known as the **pulmonary circuit**. What does this indicate about the oxygen content of blood in these vessels?

b. The pulmonary trunk supports pulmonary circulation by carrying _____ blood from the _____ of the heart into the lungs for _____.

c. At the aortic arch, the pulmonary trunk divides into the _____.

d. The pulmonary arteries and the pulmonary trunk are the only arteries in the adult body to carry _____ blood.

e. Identify the **pulmonary valve**.

9. Select any part of the **pulmonary arteries** and read the description to answer the following questions:

a. What color is used to distinguish the pulmonary arteries?

b. The _____ pulmonary artery is longer and larger than the _____ pulmonary artery.

c. In the lungs, pulmonary arteries branch into arterioles and then into networks of _____.

d. What happens to the oxygen content of the blood as it passes through these pulmonary capillaries?

e. Be sure to distinguish between the right and the left pulmonary arteries before moving on.

10. Select any part of the **pulmonary veins** and read the description to answer the following questions:

a. What color is used to distinguish the pulmonary veins? What does this indicate about the oxygen content of blood in these vessels?

b. These veins return _____ blood from the lungs to the _____ atrium of the heart for distribution via _____ circulation to the rest of the body.

c. How many pulmonary veins empty blood into the heart?

d. Do they have valves like most other veins?

e. Be sure to distinguish between the right and the left pulmonary veins before moving on.

11. Select any part of the **aorta** and read the description to answer the following questions:

a. The flow of blood from the heart to the tissues of the body, then back to the heart is known as the **systemic circuit**.

b. The aorta is the largest _____ in the body.

c. The aorta receives blood from the _____ ventricle through the _____ valve.

d. What two arteries branch off of the initial part of the aorta, known as the **ascending aorta**?

e. Where does the **aortic arch** begin?

f. Name the three branches off of the aortic arch:

g. At which point does the aortic arch become the **descending aorta**?

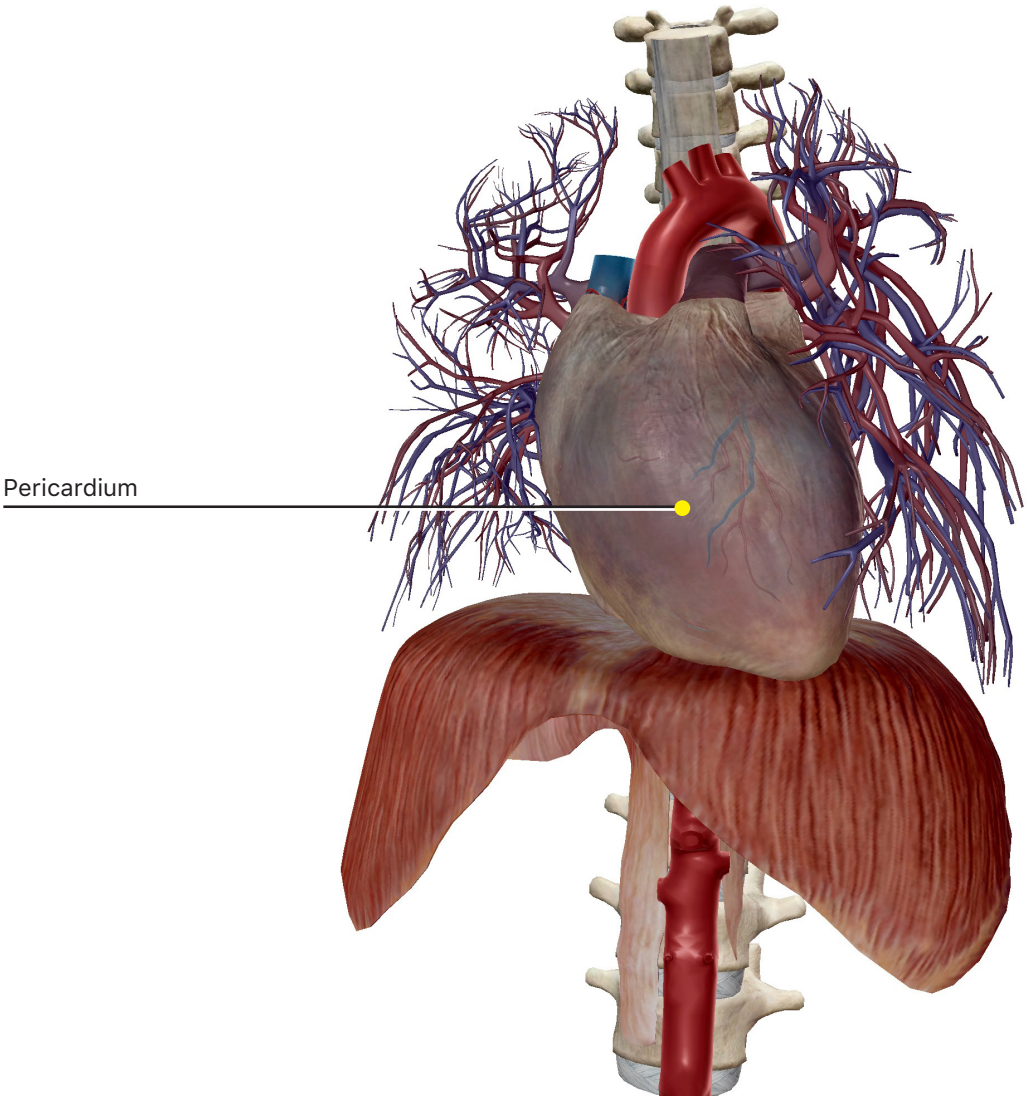
h. Highlight the aortic arch, and click the “pathologies” icon. Summarize the condition known as an **aortic aneurysm**.

TIME TO PRACTICE!
SEARCH FOR AND TAKE THE FOLLOWING CIRCULATORY SYSTEM QUIZ:
PULMONARY CIRCULATION

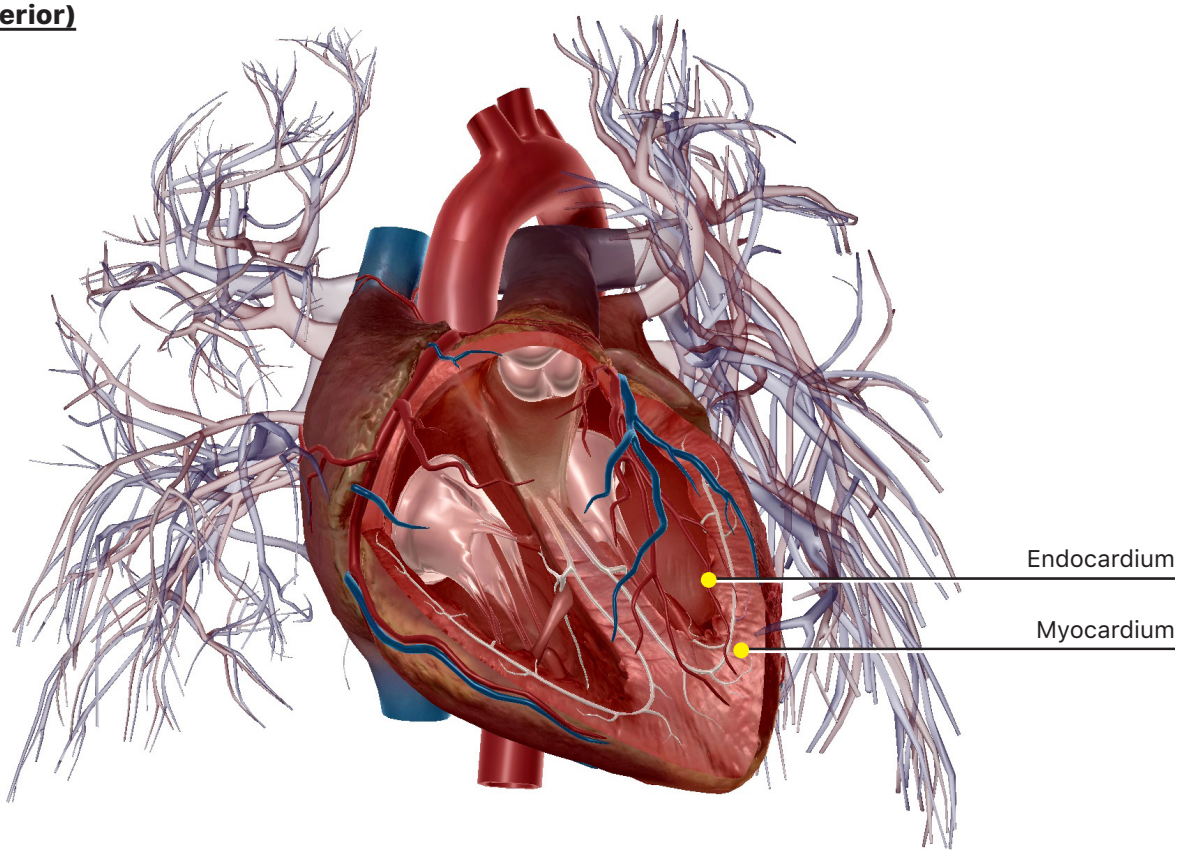
B. HEART WALL AND PERICARDIUM

Search for and select "Pericardium" from the Structures list. Use the book icon in the content box to read its description and then, answer the following questions.

Heart Wall (Exterior)



Heart Wall (Interior)



1. What is the outer layer of the **pericardium** called? What is its function?

2. Just deep to the **fibrous pericardium** is the **serous pericardium**. There are two layers of serous pericardium that surround the heart:

   a. The _____ layer of the serous pericardium lines the inside of the fibrous pericardium.

   b. The _____ layer of the serous pericardium covers the heart and the great vessels. It forms the outermost part of the heart wall known as the _____.

   c. What is the fluid-filled space between these visceral and parietal layers called? What is its function?

3. Highlight the **pericardium**, and click the "pathologies" icon. What pathologies are associated with the pericardium?

4. “Hide” the pericardium to reveal the surface of the heart wall, and read the description.

a. List the two ways the **outermost layer** of the heart is described:

b. What is the **middle layer** of the heart wall?

i. What is the function of this layer?

ii. This layer is most likely comprised of which type of muscle tissue?

iii. According to the reading, what triggers the contractions of the heart?

iv. “Hide” the surface of the heart to reveal the thickness of the **myocardium**.

v. Highlight the **myocardium**, and click the “pathologies” icon. What is **cardiomyopathy**, and what complications are associated with it?

c. What is the **inner layer** of the heart wall? (Answer can be found in the description of myocardium.)

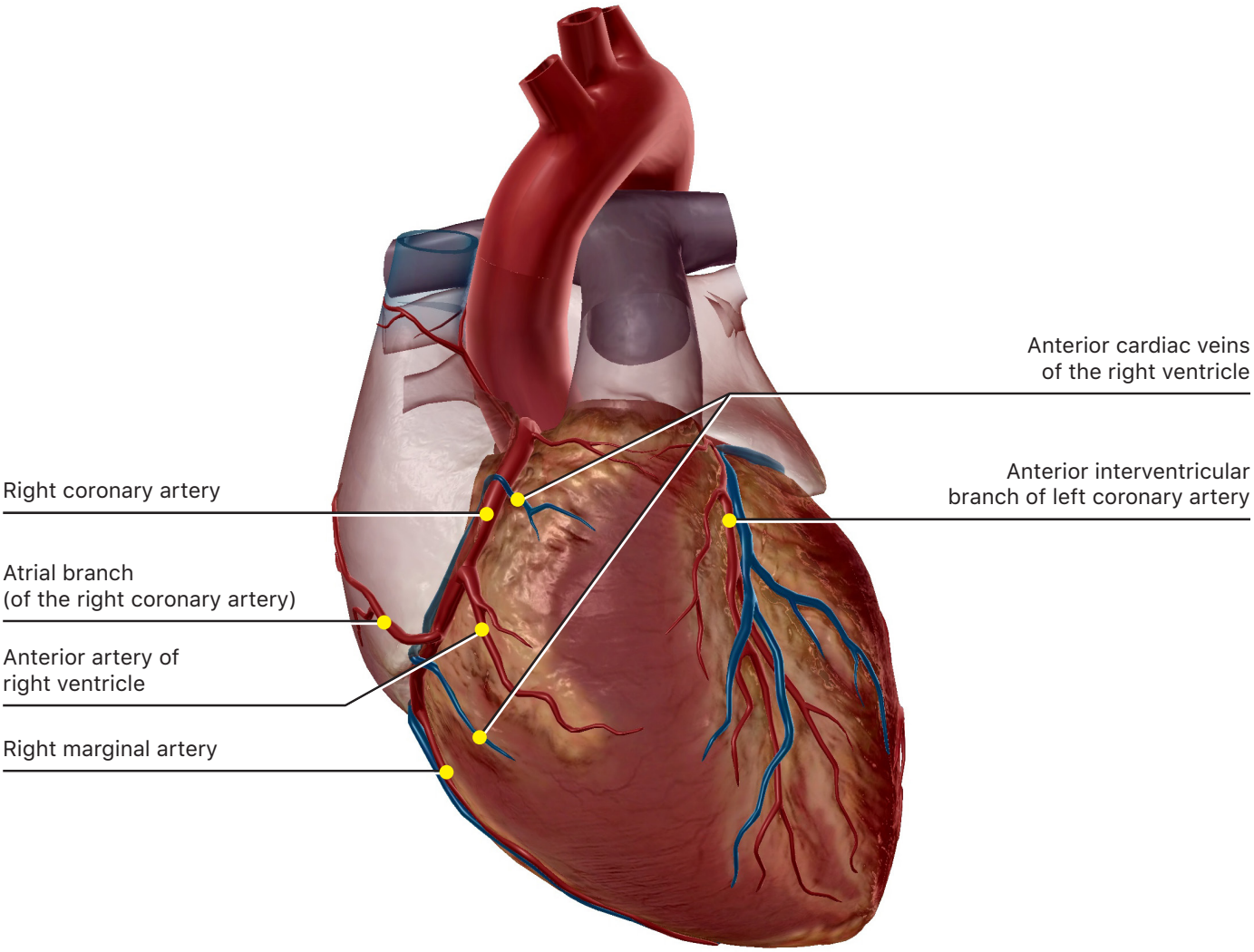
i. What types of tissue form this layer?

d. In the space below, make a simple sketch to show the layering of the heart wall. You can use the “radius blast” icon to restore the more superficial layers of the heart for review.

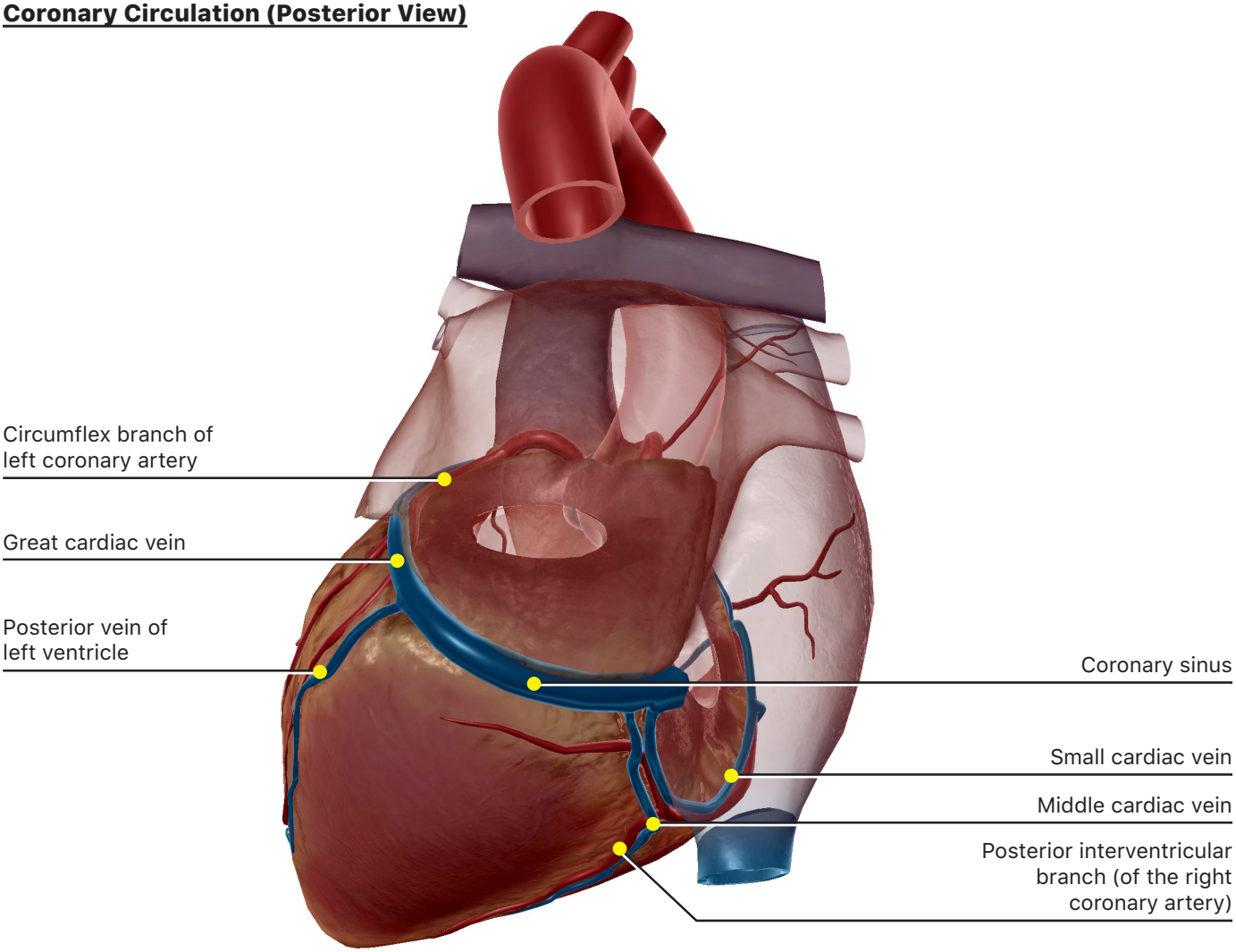
C. CORONARY CIRCULATION

Search for and select "Coronary vessels" from the Structures list. Use the book icon in the content box to read the description and then, answer the following questions.

Coronary Circulation (Anterior View)



Coronary Circulation (Posterior View)



1. According to the description provided, what is the function of **coronary arteries**?

2. According to the description provided, what is the function of **coronary veins**?

3. Select and fade both **atria** of the heart to give you a better view of the coronary circulation.

4. Follow the directions below to study the **coronary arteries**. After reading the initial description, be sure to rotate the heart and identify all coronary arteries listed below:

a. Select the right coronary artery. This artery and its branches supply blood to the _____ and the _____. It extends from the _____ and runs to the right of the _____. The first large branch off the right coronary artery is the right marginal artery which supplies branches to the right ventricle. As it reaches the posterior longitudinal sulcus, it branches into the _____, which extends to the apex of the heart.

b. Also be sure to identify the anterior artery of the right ventricle and the atrial branch.

c. Select the left coronary artery. *Note: You may need to hide or fade the left atrium to see the left coronary artery.* The **left coronary artery** and its branches supply blood to the _____ and the _____. The left coronary artery is _____ than the right coronary artery, and arise from the _____. The left coronary artery divides into the **anterior interventricular branch** and the **circumflex branch**.

d. What does the term "interventricular" indicate about a vessel's location?

e. Highlight the **right coronary artery**, and click the "pathologies" icon.

i. What is **atherosclerosis**? What complications can arise from this condition?

ii. What is the cause of most **heart attacks**?

5. Identify the following coronary veins:

a. **Great cardiac vein**

b. **Posterior vein of the left ventricle**

c. **Anterior cardiac veins of the right ventricle**

d. **Small cardiac vein**

e. **Middle cardiac (posterior interventricular) vein**

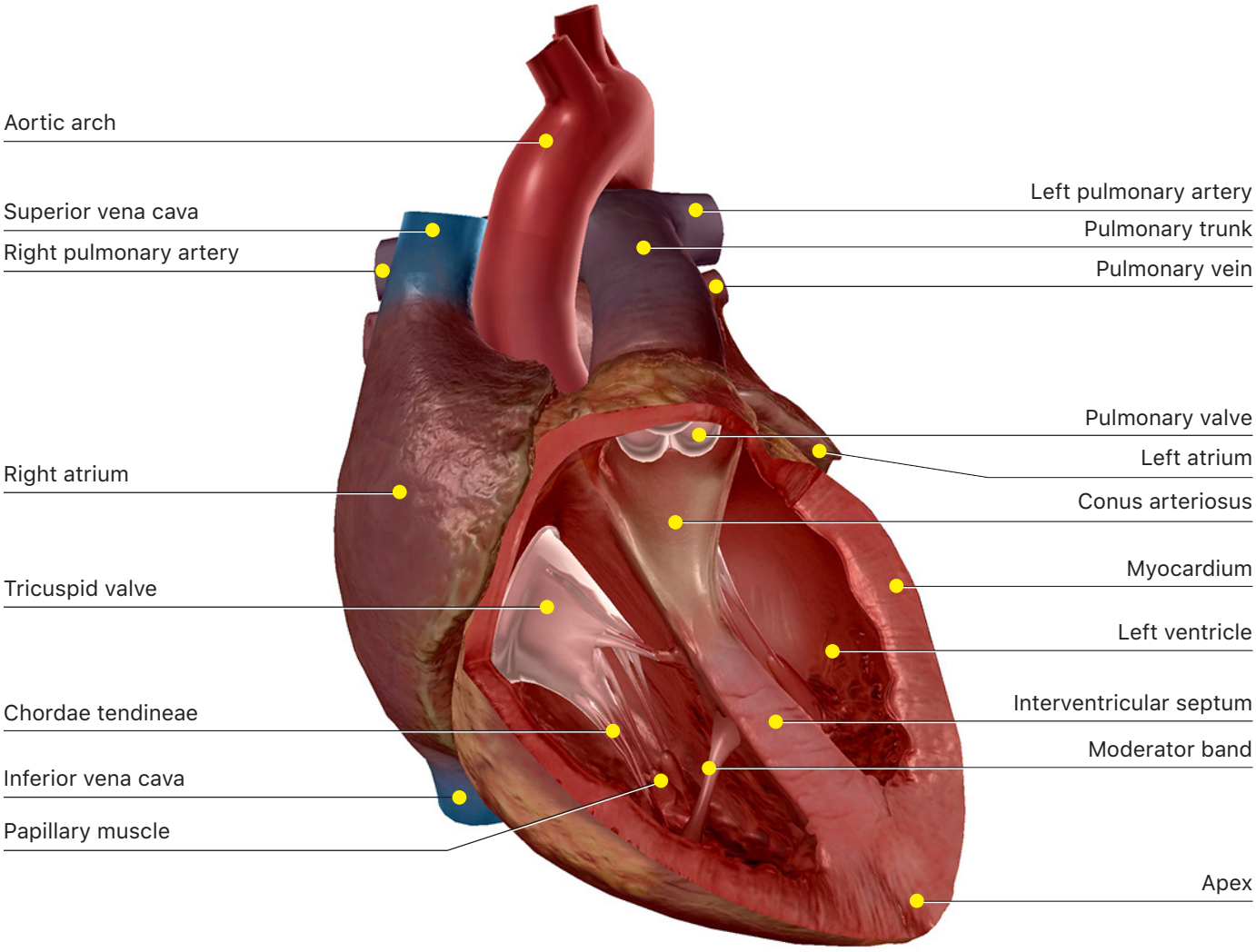
f. The **coronary sinus** is a convergence of veins which drains _____ blood directly into the _____. What structure prevents regurgitation of blood back into the sinus during the contraction of the atrium?

TIME TO PRACTICE!
SEARCH FOR AND TAKE THE FOLLOWING CIRCULATORY SYSTEM QUIZ:
CORONARY CIRCULATION

D. CHAMBERS OF THE HEART

Open the Circulatory System View "Heart Section."

Heart Internal Anatomy



1. Select the **right atrium** and read its description. This chamber receives _____ blood from which three structures:

   a. Blood from the right atrium will empty into the _____.

   b. The right atrium is _____ than the left atrium, and its walls are somewhat _____ than the left atrium.

2. Select the **left atrium** and read its description. This chamber receives _____ blood from the _____.

a. Blood from the left atrium will empty into the _____.

b. What is the purpose of the **atrial septum**?

c. Identify the **pectinate muscles** within the right atrium.

3. Select the **right ventricle** and read its description. The right ventricle receives blood from the _____ through the _____ valve, and is responsible for pumping deoxygenated blood into the _____ through the _____ valve.

a. While exploring the right ventricle, identify the conical pouch known as the **conus arteriosus**. This pouch gives rise to which two structures?

b. Identify the **interventricular septum**. It is a division between which two structures?

c. Identify the **moderator band** and describe its location.

4. Select the **left ventricle** and read its description. The left ventricle receives blood from the _____ (see previous questions) and is responsible for pumping oxygenated blood into the _____ through the _____ valve (to be identified below).

5. Which ventricle has the thickest walls? Why do you think this is important?

6. Which ventricle forms the **apex** of the heart?

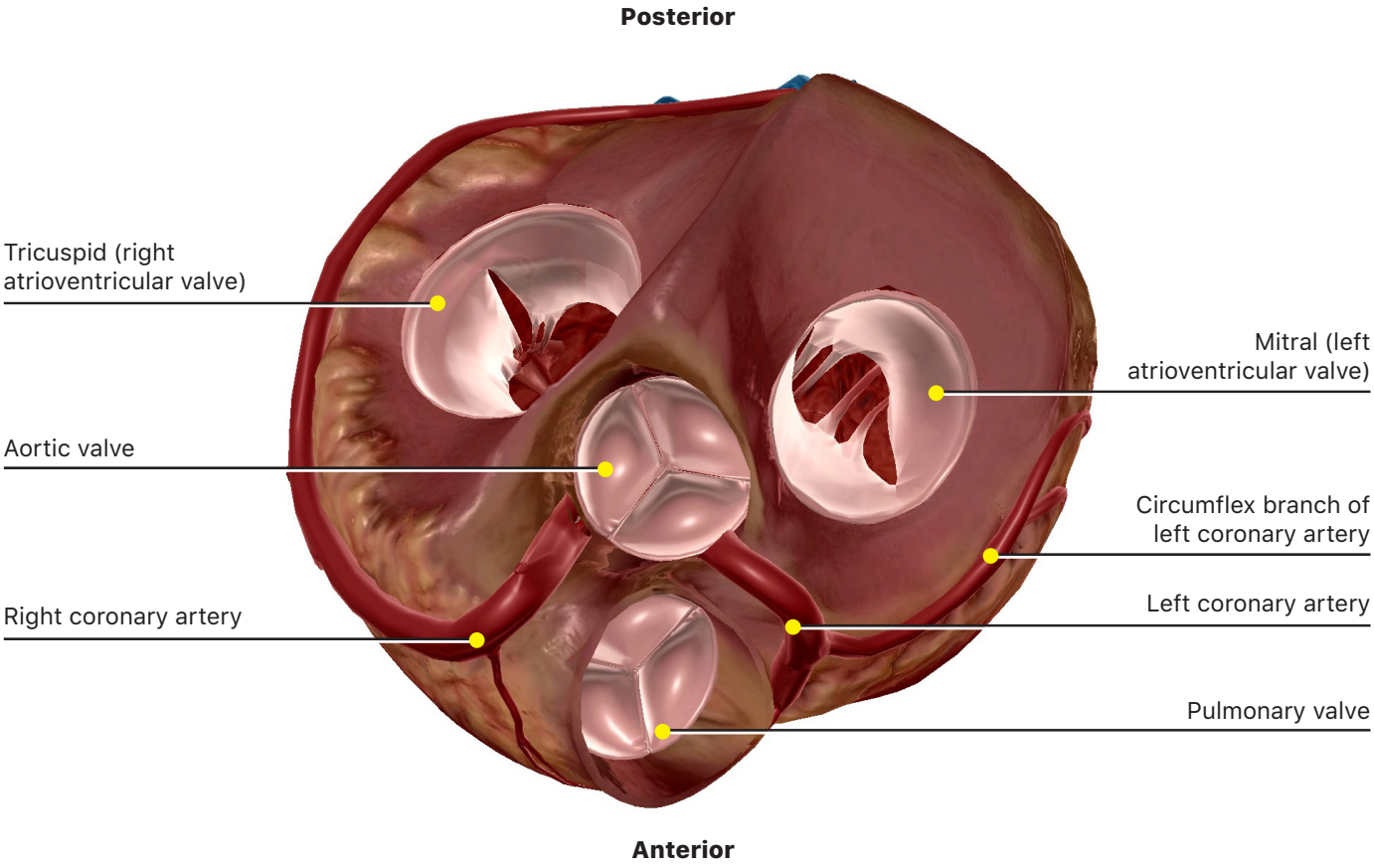
7. What are **trabeculae carneae**?

TIME TO PRACTICE!
SEARCH FOR AND TAKE THE FOLLOWING CIRCULATORY SYSTEM QUIZ:
HEART CHAMBERS

E. HEART VALVES

Search for and select "Heart valves" from the Structures list. Use the book icon in the content box to read the description. Summarize the function of the heart valves in the space below:

Heart Valves



1. Identify the **right atrioventricular (AV) valve**.

    a. What is the alternate name for this valve? What does this name signify?

    b. Blood passes through the right AV valve as it moves from the _____ to the _____.

    c. When the right atrium contracts, these valves will be open/closed (circle one).

d. When the right ventricle contracts, these valves will _____, preventing _____.

e. What is the oxygen quality of blood passing through this valve?

f. Identify the **chordae tendineae** of this valve. These fibers connect the cusps of the valve to the _____ muscles on the ventricle walls. What is the function of these chordae tendineae?

g. Identify the **papillary muscles** in the right ventricle.

2. Identify the **left atrioventricular (AV) valve**.

a. What are the alternate names for this valve? What do they signify?

b. Blood passes through the left AV Valve as it moves from the _____ to the _____.

c. When the left atrium contracts, these valves will be open/closed (circle one).

d. When the left ventricle contracts, these valves will _____, preventing _____.

e. What is the oxygen quality of blood passing through this valve?

f. Identify the **chordae tendineae** and the **papillary muscles** associated with this valve.

3. Identify the **pulmonary valve**.

a. How many cusps does this valve have?

b. Blood passes through the **pulmonary valve** as it moves from the _____ to the _____.

c. When the right ventricle contracts, these valves will open/close (circle one).

d. What causes this valve to close at the end of ventricular systole (contraction)?

e. What is the oxygen quality of blood passing through this valve?

4. Identify the **aortic valve**.

a. How many cusps does this valve have? How do these cusps compare with those of the pulmonary valve?

b. Blood passes through the **aortic valve** as it moves from the _____ to the _____.

c. When the right ventricle contracts, these valves will open/close (circle one).

d. What causes this valve to close at the end of ventricular systole (contraction)?

e. What is the oxygen quality of blood passing through this valve?

5. Highlight any one of the four heart valves, and click the “pathologies” icon.

   a. What is **regurgitation**, and what can cause this condition?

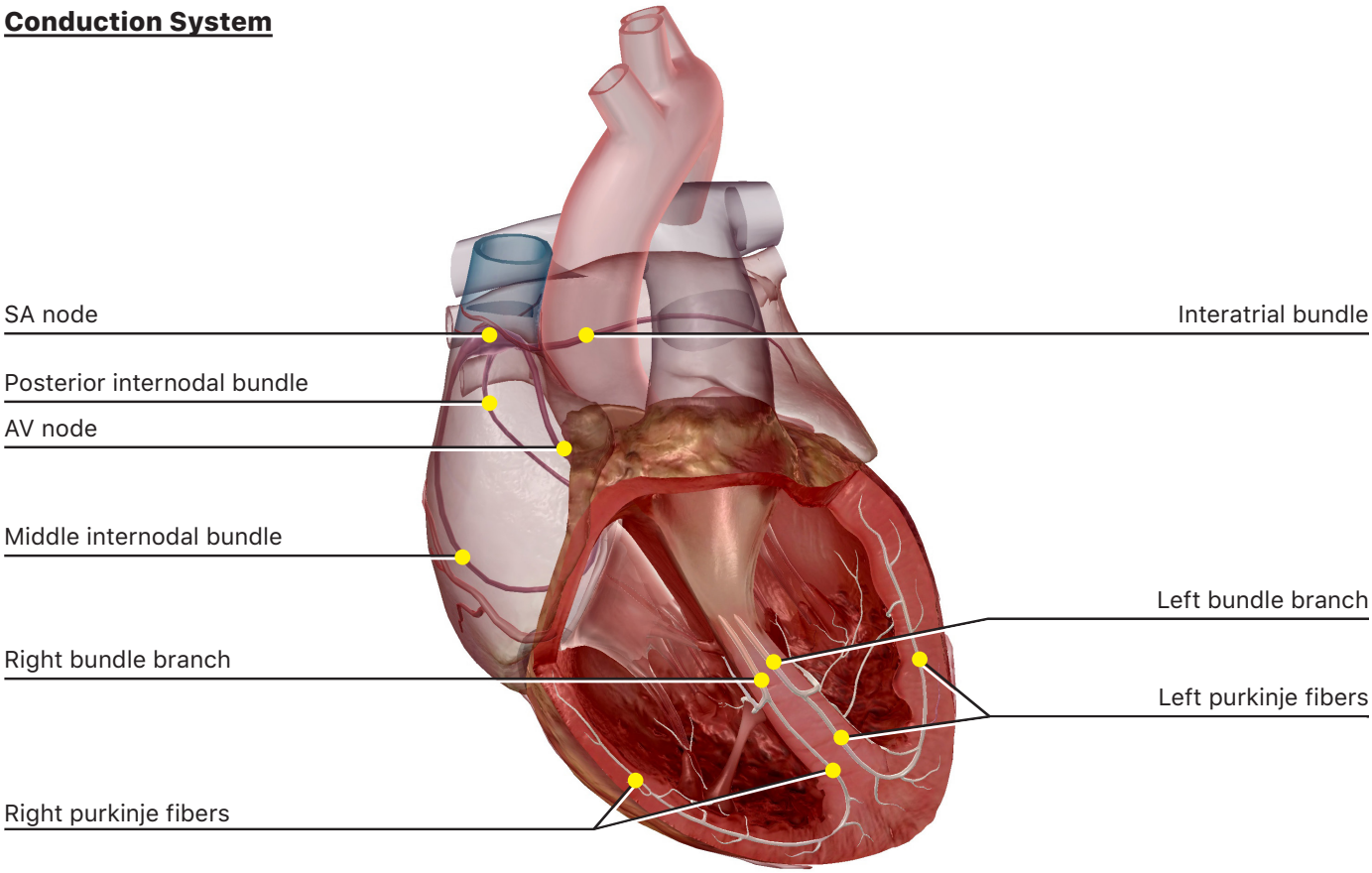
   b. What is **stenosis**?

TIME TO PRACTICE!
SEARCH FOR AND TAKE THE FOLLOWING CIRCULATORY SYSTEM QUIZ:
HEART VALVES

F. CONDUCTION SYSTEM

Search for and select "Conduction system" in the Structures list. Use the book icon in the content box to read its description and then, answer the following questions.

Conduction System



1. The conduction system of the heart is controlled by the _____ nervous system.

2. List the five steps of each electrical impulse as written in the description:

3. Each electrical impulse of the conduction system takes approximately _____ to complete this cycle.

4. Identify the **sinoatrial node** (SA node) node by "hiding" the right atrium (if not otherwise hidden). The SA node is situated on the anterior border of the opening of the _____. An electrical impulse that starts at the sinoatrial node travels through the _____ bundle to the left atrium, and into the internodal fibers toward the _____ node.

5. Identify the **atrioventricular node** (AV node) by hiding the right ventricle.
The AV node is located near the orifice of the _____ in the right atrium. Between the start of the impulse at the sinoatrial node and the pause at the atrioventricular node the right and left atria _____. After the pause, the electricle impulse continues into the _____.

6. Select the **atrioventricular bundle (bundle of His)**. The bundle extends from the atrioventricular node into the lower part of the _____. The bundle divides into _____.

7. Select and read about the **right and left bundle branches**. At the bundle branch, the pathway of an electrical impulse diverges toward _____. In the lower parts of the ventricles, each bundle branch differentiates into numerous strands that end in the _____ and _____. An electrical impulse travels through each bundle branch into the ventricles by stimulation from the _____ fibers.

8. Identify the **purkinje fibers**. What is their function?

9. Highlight the **right atrium**, and click the "pathologies" icon.

    a. What is **atrial fibrillation**?

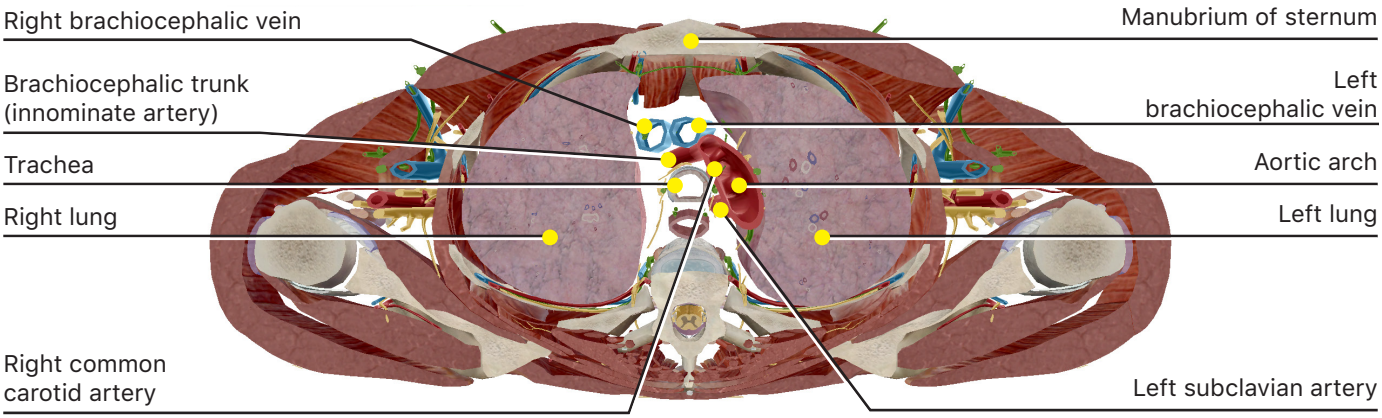
b. What term describes an **arrhythmia** in which the heart beats too fast?

TIME TO PRACTICE!
SEARCH FOR AND TAKE THE FOLLOWING CIRCULATORY SYSTEM QUIZ:
HEART CONDUCTION

G. VIEW OF A THORACIC CROSS SECTION

Search for and select the Cross Section "Thorax (T03-T04)." Use this view to answer the following questions.

Cross section (Inferior view)



1. Using this inferior view of the thorax, identify the following structures:

    a. Esophagus

    b. Trachea

    c. Left lung

    d. Right lung

    e. Manubrium of the sternum

    f. T04 vertebra

    g. Aortic arch

2. Flip the image to look at this cross section in a superior view. Identify the following structures:

    a. Esophagus

    b. Trachea

    c. Left lung

    d. Right lung

    e. Manubrium of the sternum

    f. T03 vertebra

g. Aortic arch

h. Brachiocephalic trunk

i. Left common carotid artery

j. Left subclavian artery

3. Use the right-hand arrow in the content box to progress to the next Cross Section "Thorax (T04-T05)." Make sure you are looking at the superior view, and identify the following structures:

a. Esophagus

b. Trachea

c. Left lung

d. Right lung

e. Manubrium of the sternum

f. T04 vertebra

g. Superior vena cava

h. Aortic arch

4. Flip the image to look at this cross section in an inferior view. Identify the following structures:

a. Esophagus

b. Tracheal cartilages

c. Left lung

d. Right lung

e. T05 vertebra

f. Base of the aorta (ascending aorta)

g. Aortic arch

h. Superior vena cava

i. Pulmonary trunk

j. Left pulmonary arteries

k. Right pulmonary arteries

5. Use the right-hand arrow in the content box to progress to the next Cross Section “Thorax (T05-T08).” Make sure you are looking at the superior view, and identify the following structures:

a. Esophagus

b. Left lung

c. Right lung

d. Right and left atria (fade the lungs in order to see them)

e. Thymus

f. Right and left primary bronchus (leading into the lungs)

g. Left pulmonary arteries

h. Right pulmonary ateries

i. Pulmonary trunk

j. Base of the aorta (ascending aorta)

k. Superior vena cava

l. Pericardium

6. Flip the image to look at this cross section in an inferior view. Identify the following structures:

a. Left lung

b. Right lung

c. Esophagus

d. Descending (thoracic) aorta

e. Right atrium

f. Sinoatrial node

g. Right atrioventricular (tricuspid) valve

h. Right ventricle

i. Pulmonary valve

j. Interventricular septum

k. Left ventricle

l. Left atrioventricular (mitral, bicuspid) valve

m. Aortic valve

n. Left atrium (fade the left ventricle to see from the inferior view)

7. Use the right-hand arrow in the content box to progress to the next Cross Section "Thorax (T08-T11)." Make sure you are looking at the superior view, and identify the following structures:

a. Left lung

b. Right lung

c. Esophagus

d. Descending (thoracic) aorta

e. Right atrium

f. Inferior vena cava

g. Left atrium

h. Coronary sinus (fade the left and right atria to see from the superior view)

i. Right ventricle

j. Left ventricle

k. Right atrioventricular (tricuspid) valve

l. Chordae tendineae of right AV valve (those of the left AV valve are also visible)

m. Papillary muscles of both ventricles

n. Moderator band

o. Interventricular septum

p. Bundle branches of cardiac conduction system (fade the interventricular septum to see from superior view)

8. Flip the image to look at this cross section in an inferior view. Identify the following structures:

a. Liver

b. Inferior vena cava (fade the lobes of the liver for best view)

c. Descending (abdominal) aorta

d. Stomach

e. Diaphragm

H. PUTTING IT ALL TOGETHER:

Use the answers to the questions throughout this exercise to summarize the cycle of blood flow through the heart.

1. While the right atrium is relaxed, it will fill with _____ blood from which three structures associated with the systemic circuit?

2. As the right atrium contracts, it will propel this blood through the open _____ valve and into the _____ (heart chamber). As this heart chamber fills, rising pressure will cause the right AV valve to open/close (circle one), while the pulmonary valve will open/close (circle one).

3. Blood passing through the open pulmonary valve will enter the _____ and pass through the right and left _____ arteries on its way to the lungs.

4. Gas exchange will occur in the lungs, allowing _____ blood to return to the heart. This cycle of circulation is known as _____ circulation.

5. Blood will return to the heart through the right and left _____ veins.

6. These pulmonary veins will empty _____ blood into the right atrium/left atrium (circle one).

7. As the left atrium contracts, blood will be propelled through the open _____ valve and into the _____ (heart chamber). As this heart chamber fills, rising pressure will cause the left AV valve to open/close (circle one), while the aortic valve will open/close (circle one).

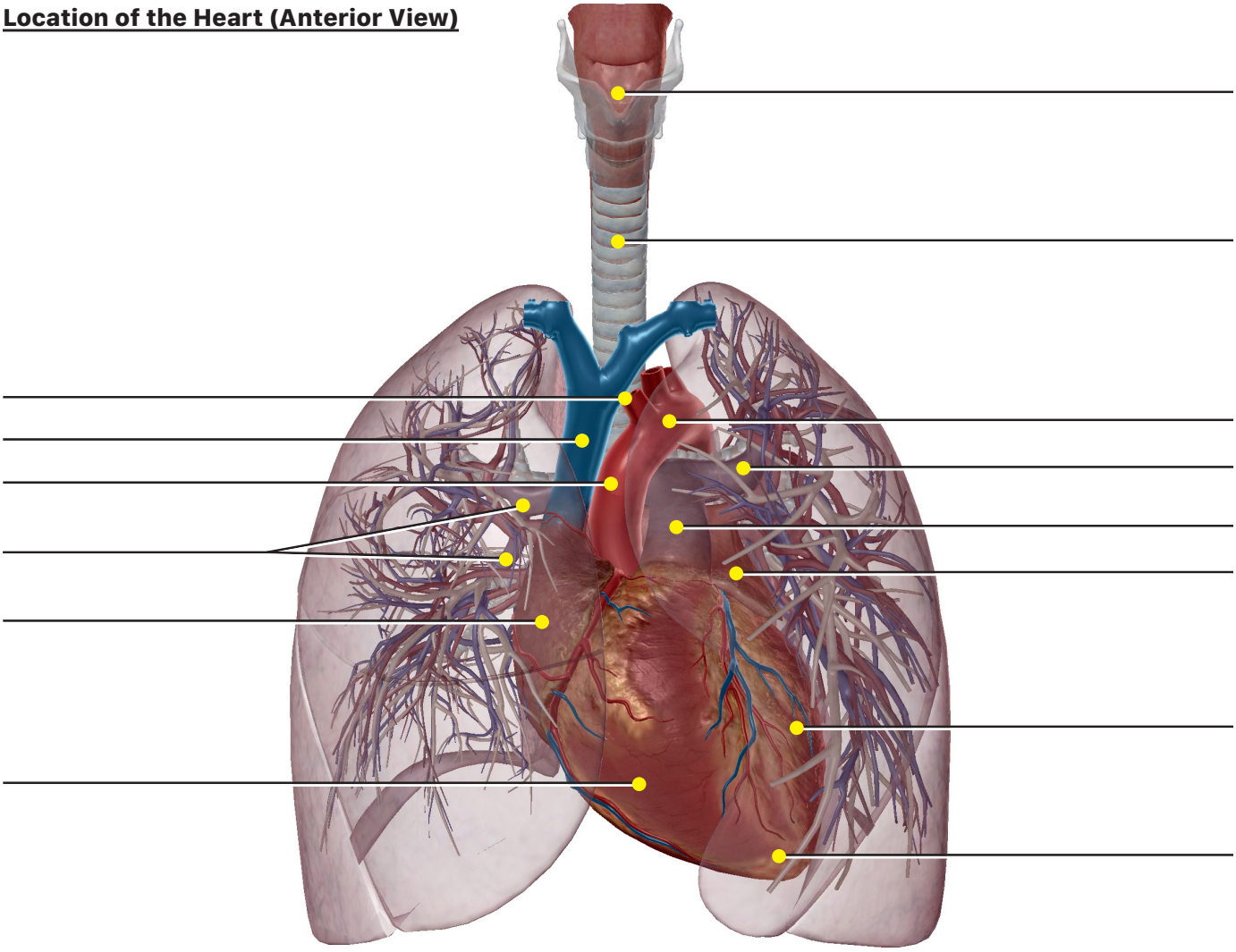
8. Blood passing through the open aortic valve will enter the _____ on its way to supplying body tissues. This is the beginning of what is known as _____ circulation.

VISIBLE BODY®

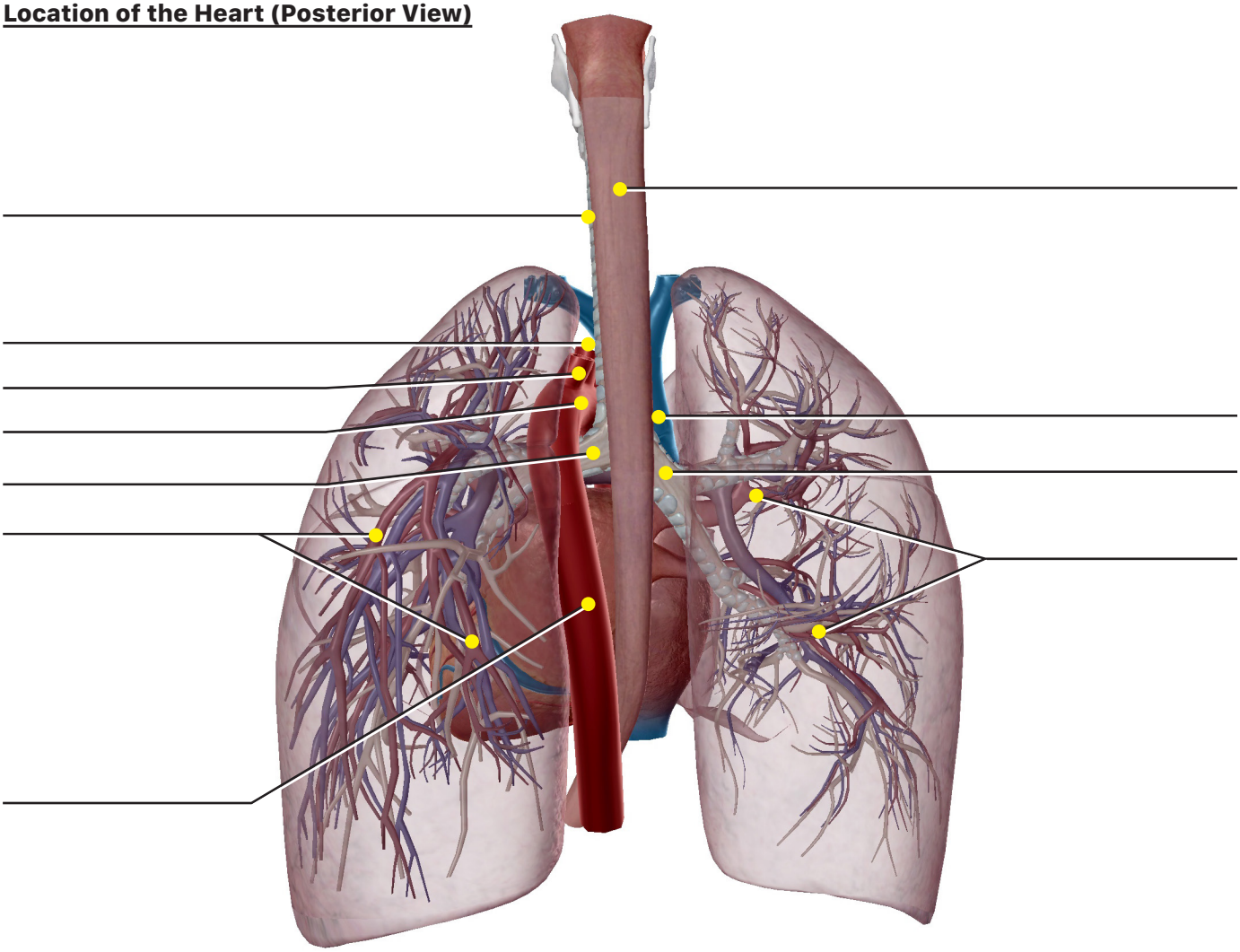
Student Practice

Label the structures in the following figures.

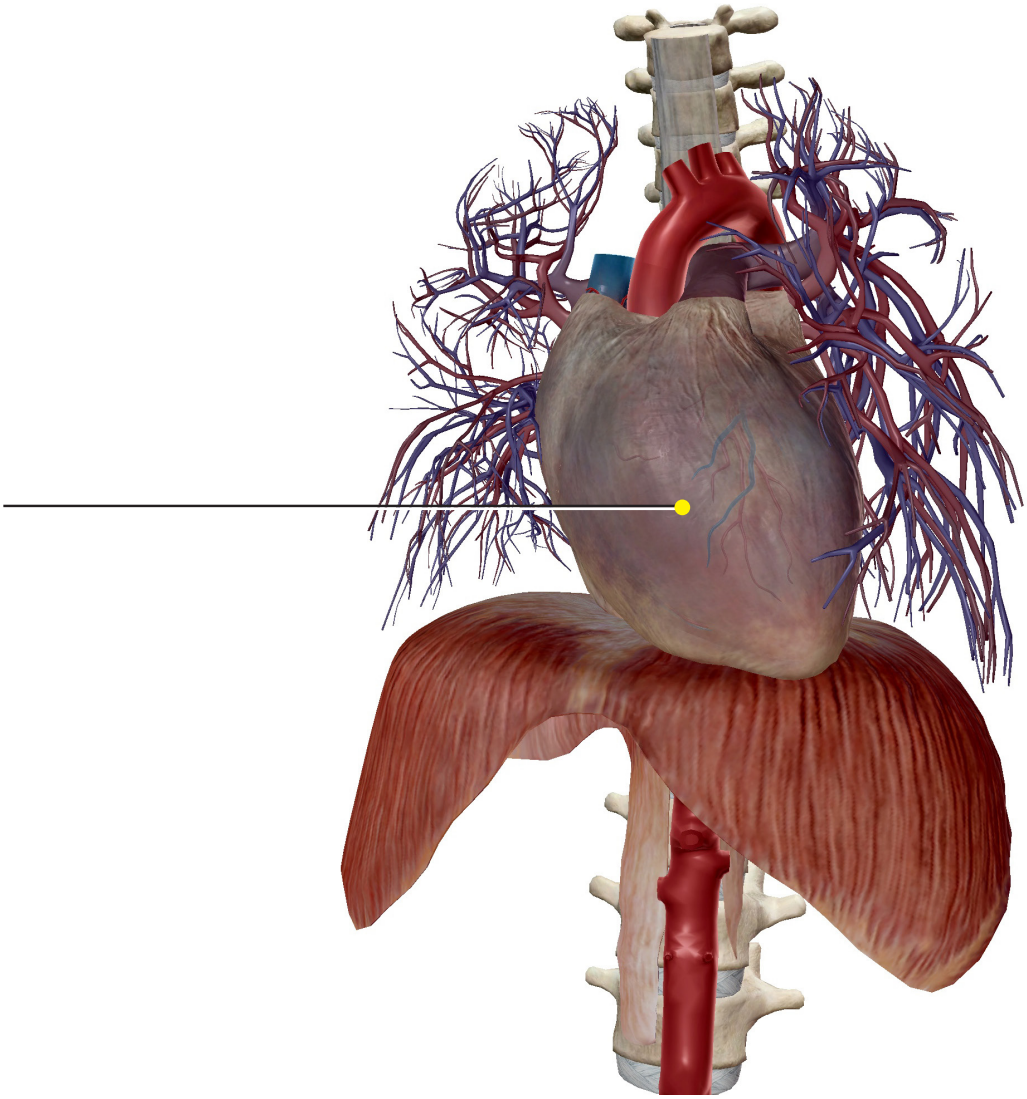
Location of the Heart (Anterior View)



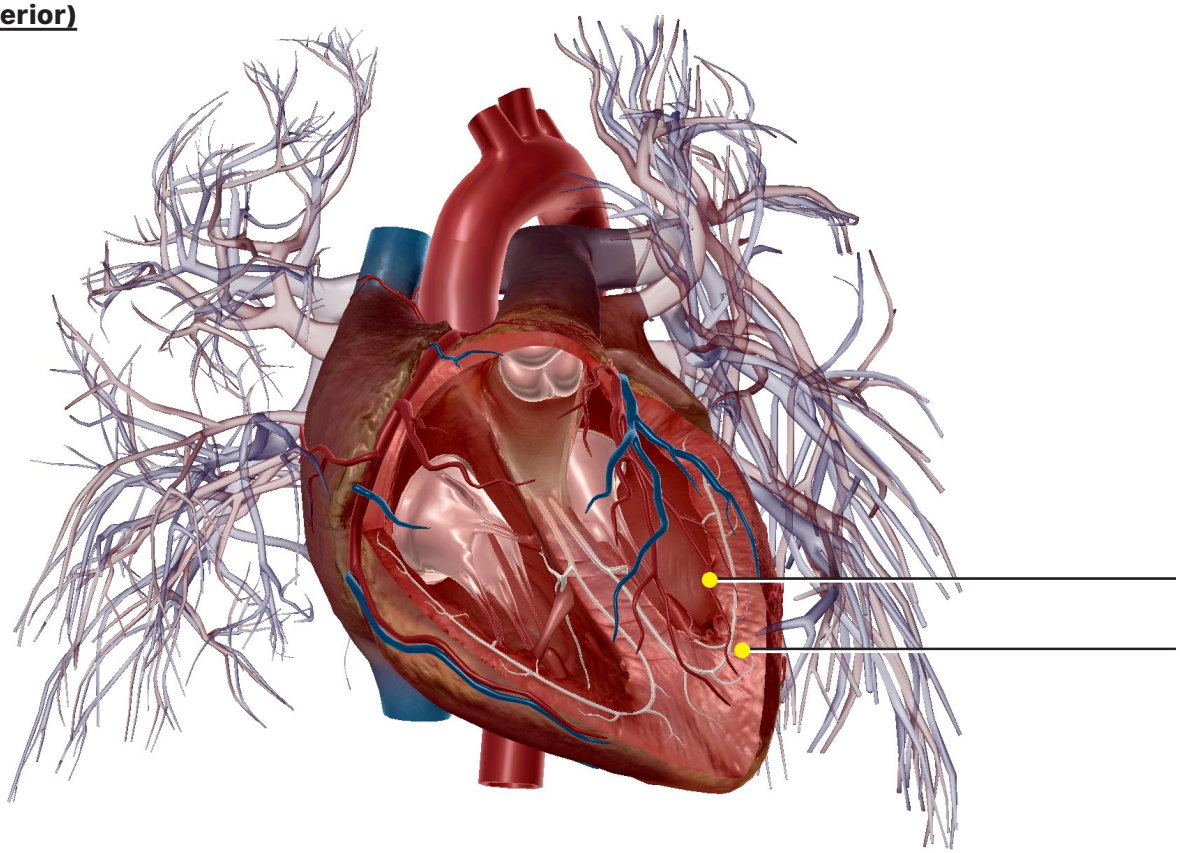
Location of the Heart (Posterior View)



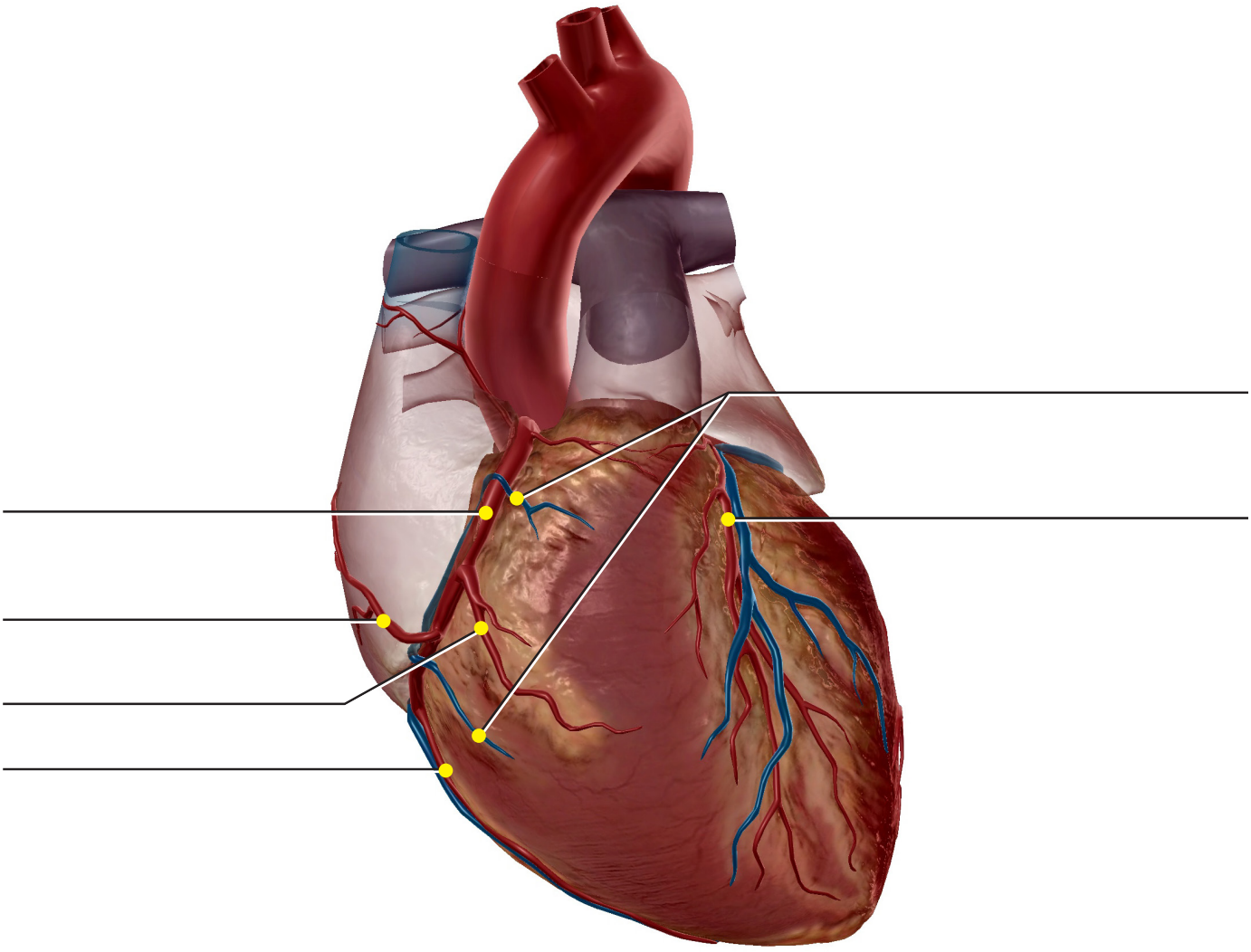
Heart Wall (Exterior)



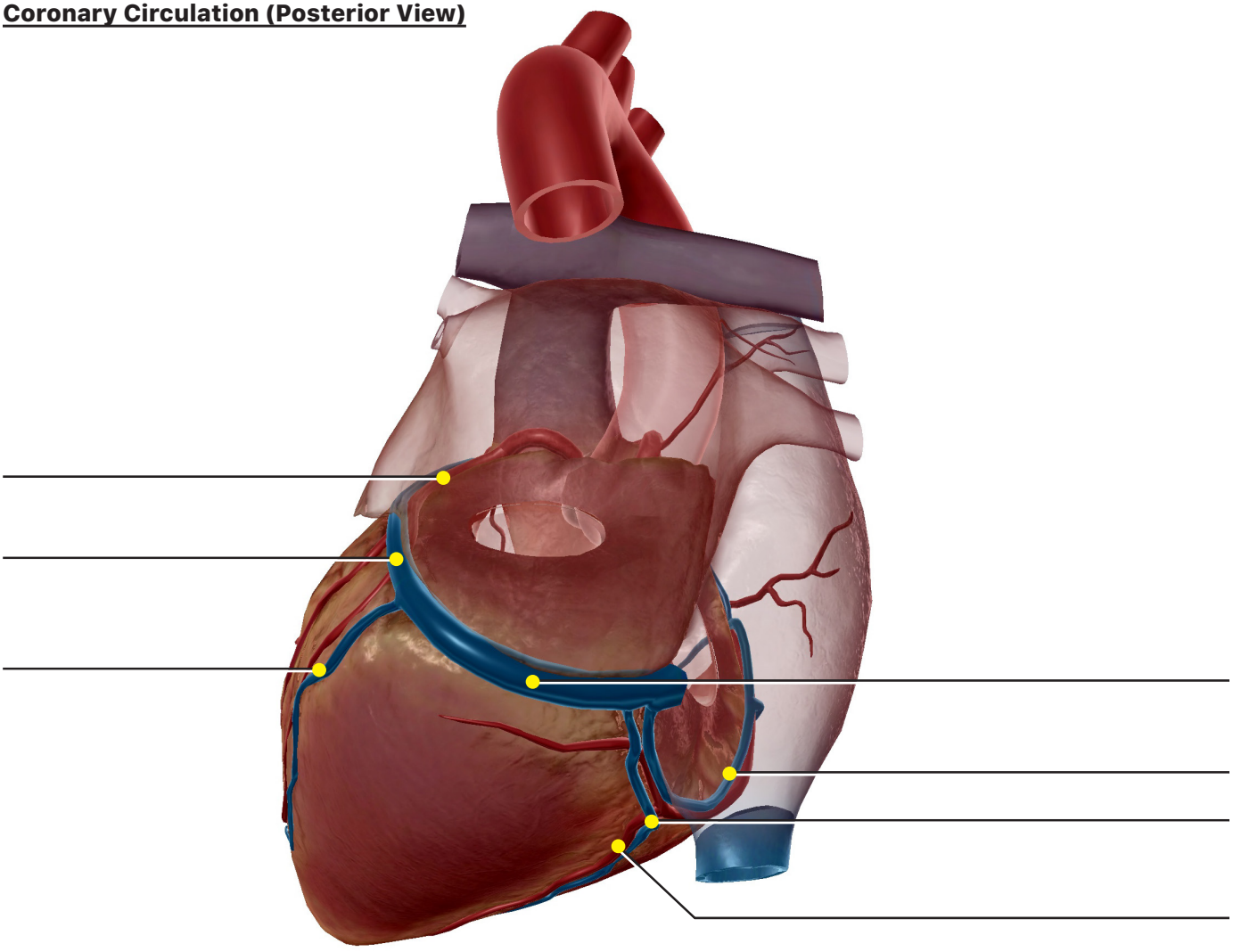
Heart Wall (Interior)



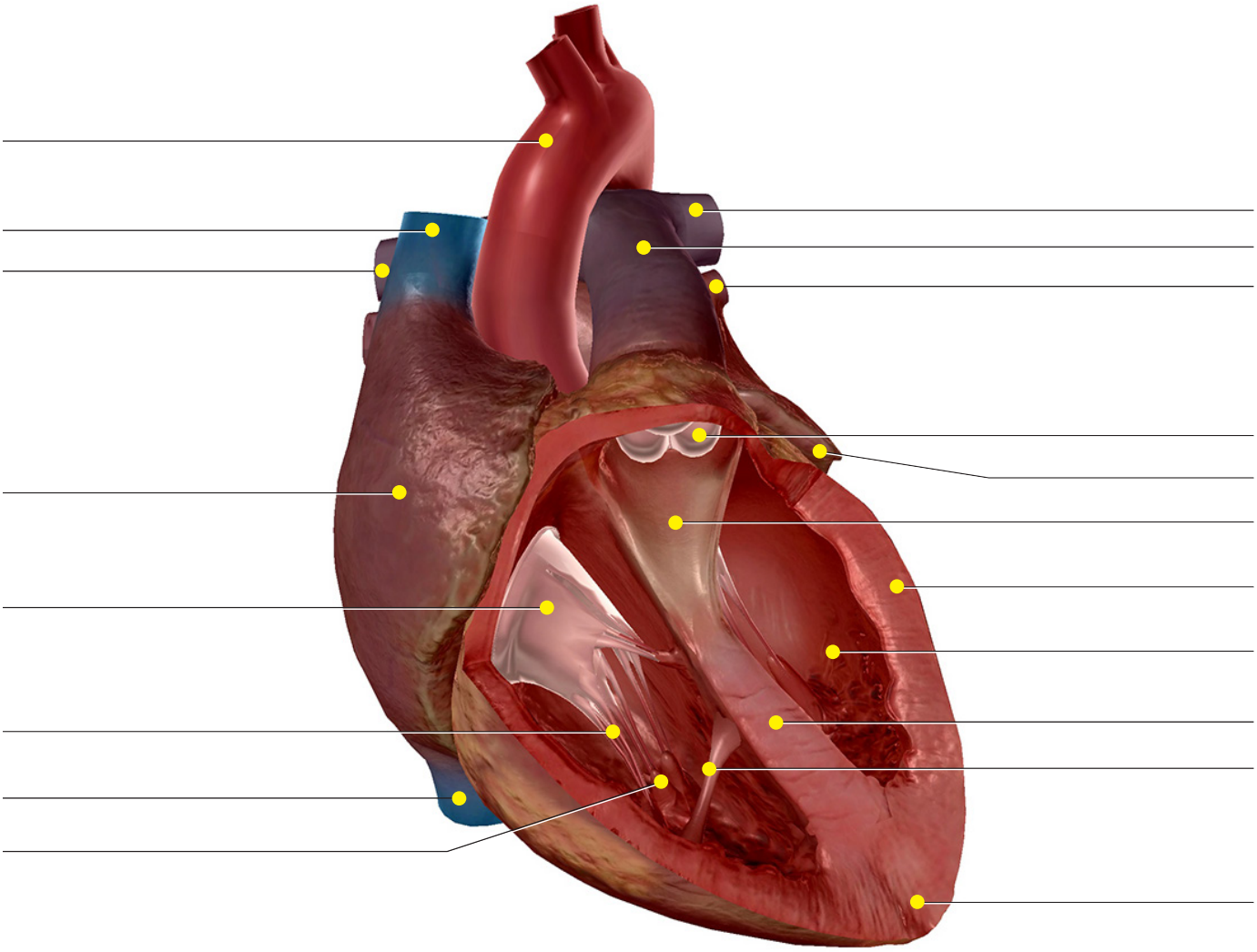
Coronary Circulation (Anterior View)



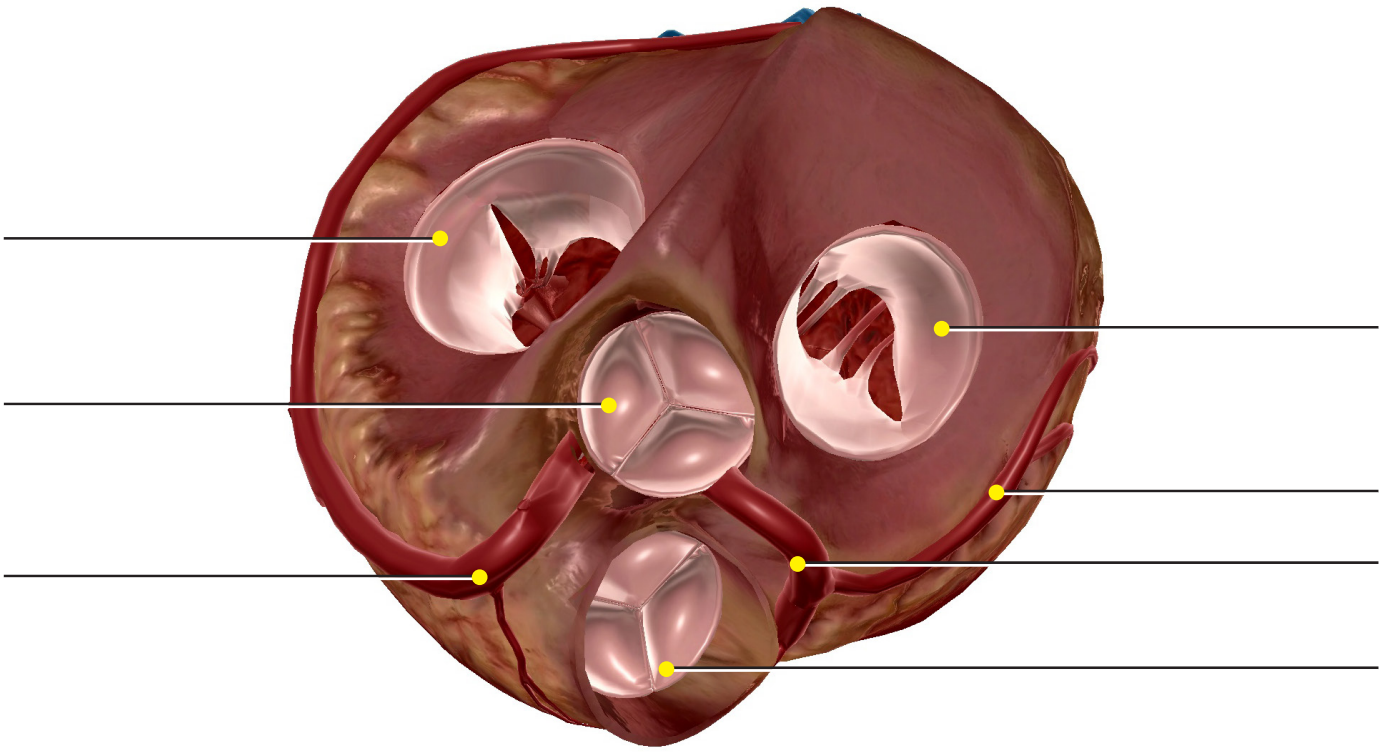
Coronary Circulation (Posterior View)



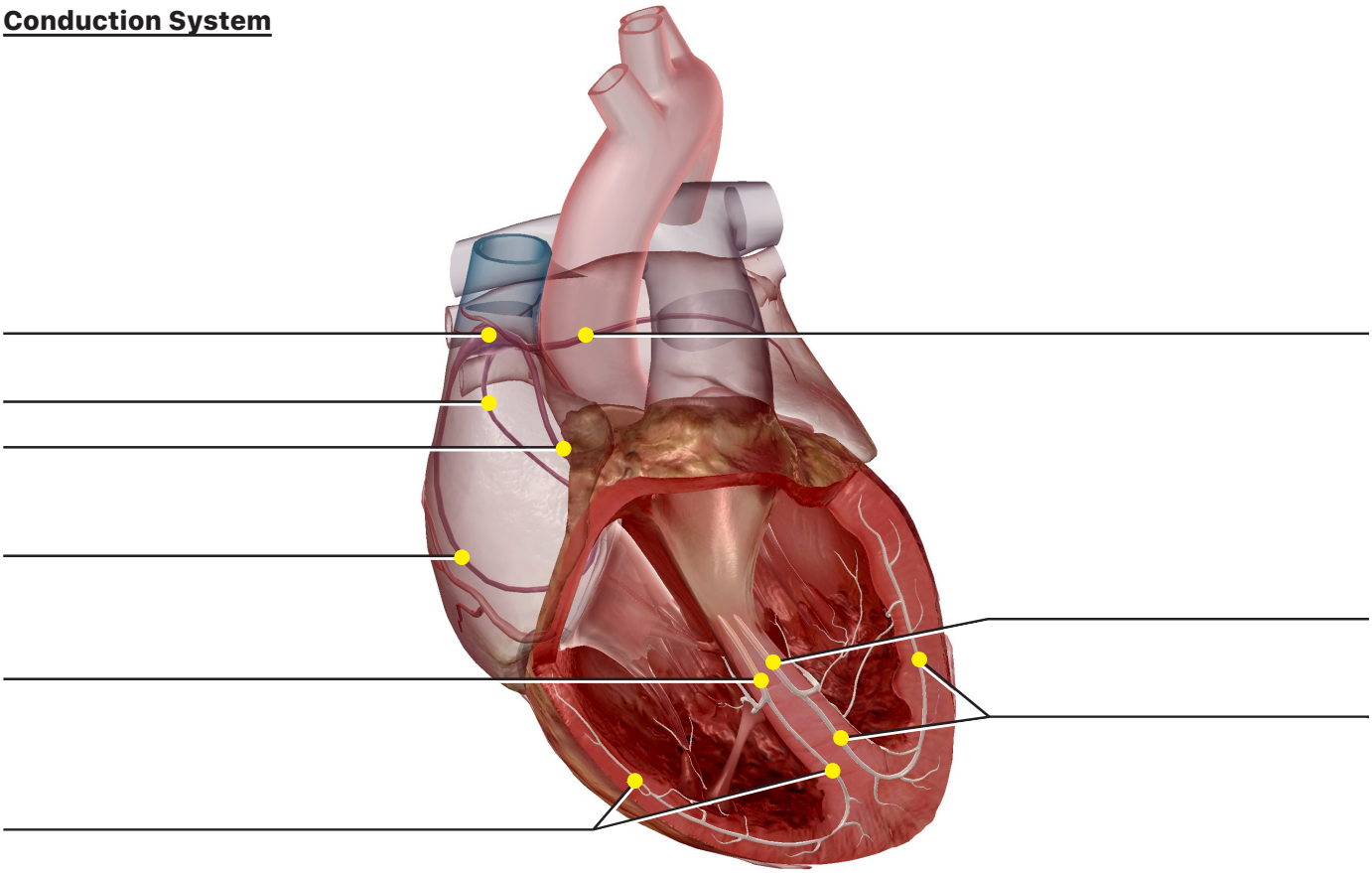
Heart Internal Anatomy



Heart Valves



Conduction System



Cross section (Inferior view)