SI A&P - Full Discipline Demo - Biodigital

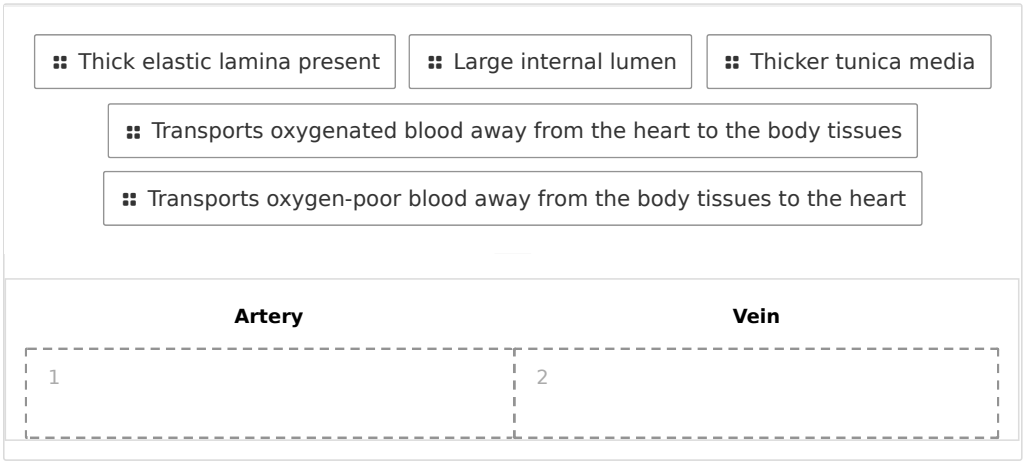
Blood Vessels and the Heart - BioDigital

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI A&P - Full Discipline Demo - Biodigital
Course	SI A&P - Full Discipline Demo - Biodigital
Instructor	Sales SI Demo

Test Your Knowledge

Classify each statement as describing an artery or describing a vein.



Correct answers:

1 Thick elastic lamina present Thicker tunica media

Transports oxygenated blood away from the heart to the body tissues

2 Large internal lumen

Transports oxygen-poor blood away from the body tissues to the heart

Sequence the structures in the order that blood flows into and out of the heart, beginning with deoxygenated blood from the body.

≡ Aorta

1 **Correct answer:** Vena cava

≡ Vena cava

2 **Correct answer:** Right atrium

≡ Right ventricle

3 **Correct answer:** Right ventricle

≡ Pulmonary veins

4 **Correct answer:** Pulmonary arteries

≡ Left ventricle

5 **Correct answer:** Pulmonary veins

≡ Left atrium

6 **Correct answer:** Left atrium

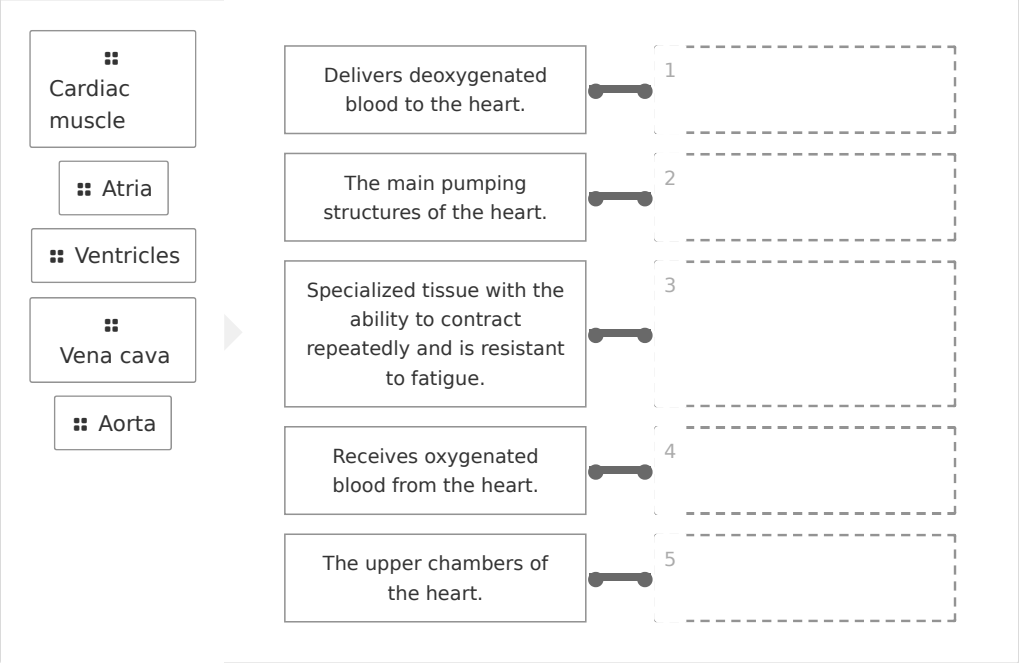
≡ Pulmonary arteries

7 **Correct answer:** Left ventricle

≡ Right atrium

8 **Correct answer:** Aorta

Match each term below with the best description.



Correct answers:

1 Vena cava 2 Ventricles 3 Cardiac muscle 4 Aorta 5 Atria

Exploration

The _____ receives the deoxygenated blood that flows into the heart from the the superior vena cava, the inferior vena cava, and the coronary sinus.

- left ventricle
- right ventricle
- left atrium
- right atrium ✔

Oxygenated blood returns to the left atrium of the heart through the _____.

- vena cava
- pulmonary arteries
- aorta
- pulmonary veins ✔

The _____ allow the passage of ions from one cardiac muscle cell to another.

- sarcomeres
- myofibrils
- nuclei
- intercalated discs ✔

Veins that are the same size as arteries have comparatively wider lumens.

- True ✔
- False

Exercise 1

What is the function of intercalated discs? How did the intercalated discs appear in the cardiac muscle slide viewed in this exercise? Reference Photo 1 in your explanation.

Intercalated discs include gap junctions that connect cardiac muscle cells together. These connections allow for the efficient movement of cardiac action potentials along the heart wall and propagate force from cell to cell. The intercalated discs appeared darker in color than the surrounding cells. In Photo 1, the intercalated discs are purple in color (because of the stain used for this slide).

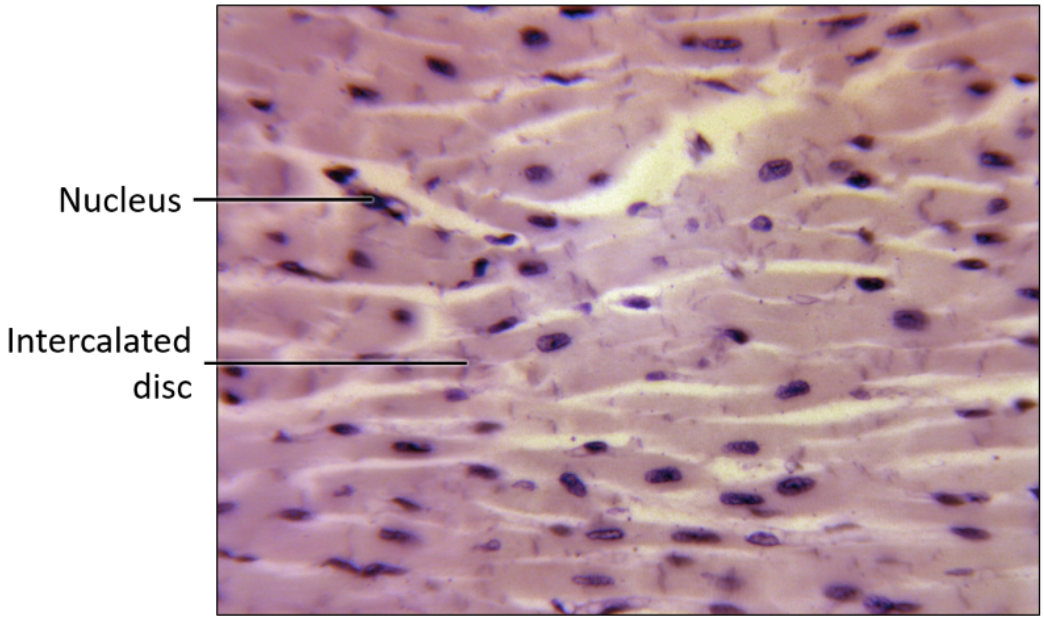
What causes striation of the cardiac muscle? Were you able to visualize the striations of the heart muscle? If your answer is no, why do you think that was the case?

The students may have difficulty visualizing the striations on the cardiac muscle due to the type of stain used or the limitations of their microscope. However, students should recognize that cardiac muscle has sarcomeres, the contractile units of the muscle. Sarcomeres consist of thin filaments called actin, thick filaments called myosin, and other specialized proteins. The sarcomere is organized into visible sections. The dark areas of the muscle fibers are where the thick myosin filaments and the thin actin filaments overlap. The lighter areas are where only the thin actin filaments are located.

List the differences that you observed between the artery and the vein cross sections. Why do those differences exist? Reference Photos 2 and 3 in your explanation.

The lumen of the vein is wider, and the walls are thinner as observed in Photo 3. This structural arrangement lowers the resistance of blood flow in the vein. The artery walls are thicker, and the lumen is smaller as observed in Photo 2. The artery wall also has more elastic components, allowing the artery to withstand higher pressures.

Photo 1: Cardiac Cells
(SAMPLE ANSWER BELOW)



Data Table 1: Microscopic Examination of Cardiac Muscle and Blood Vessels
(SAMPLE ANSWER BELOW)

Structure	Magnification	Comments
Cardiac Muscle	600X	Students will only answer here if they could not identify and label required structures
Artery	600X	Students will only answer here if they could not identify and label required structures
Vein	600X	Students will only answer here if they could not identify and label required structures

Photo 2: Artery
(SAMPLE ANSWER BELOW)

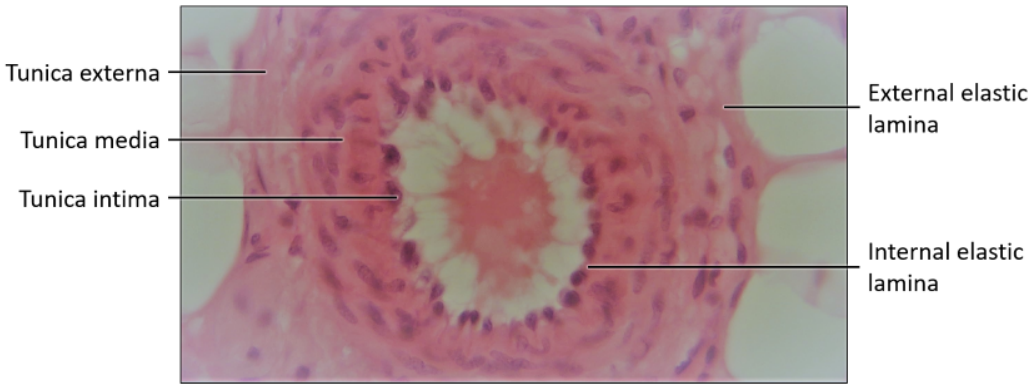
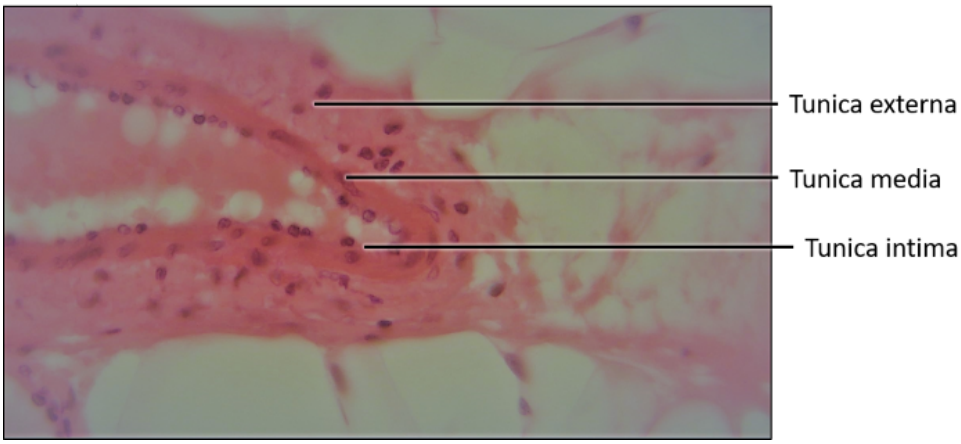


Photo 3: Vein
(SAMPLE ANSWER BELOW)



Exercise 2

What are the functions of the right pulmonary artery and the inferior vena cava that were labeled on the Virtual Model in Photo 4?

The right pulmonary artery is a branch of the pulmonary trunk that carries deoxygenated blood to the right lung. The inferior vena cava is a vein draining blood from regions below the diaphragm into the right atrium.

What are the functions of the right atrium and left ventricle that were labeled on the Virtual Model in Photo 5?

The right atrium is a cavity of the heart that receives deoxygenated blood from the venae cavae. The left ventricle is the thick-walled cavity of the heart that propels oxygen rich blood into the aorta to irrigate the body.

What are the locations and functions of each of the heart valves labeled in Photo 5?

Tricuspid valve: The tricuspid valve is located between the right atrium and the right ventricle. It prevents deoxygenated blood from backing up into the right atrium and pooling in the body.

Pulmonary semilunar valve: The pulmonary semilunar valve is located between the right ventricle and the pulmonary trunk/artery. It prevents the deoxygenated blood from flowing back into the right ventricle as the heart pumps blood to the lungs.

Bicuspid (Mitral) valve: The bicuspid valve is located between the left atrium and the left ventricle. It prevents oxygenated blood from backing up into the left atrium and pulmonary veins to the lungs.

Aortic semilunar valve: The aortic semilunar valve is located between the left ventricle and the aorta. It prevents oxygenated blood from flowing back into the left ventricle as the heart pumps blood out to the body.

Which of the four heart chambers pump deoxygenated blood away from the heart and receive oxygenated blood from the lungs? Reference the annotated image in Photo 6 in your answer.

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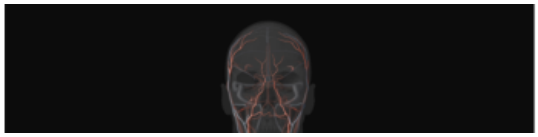
Photo 4: Virtual Model Veins and Arteries
(SAMPLE ANSWER BELOW)



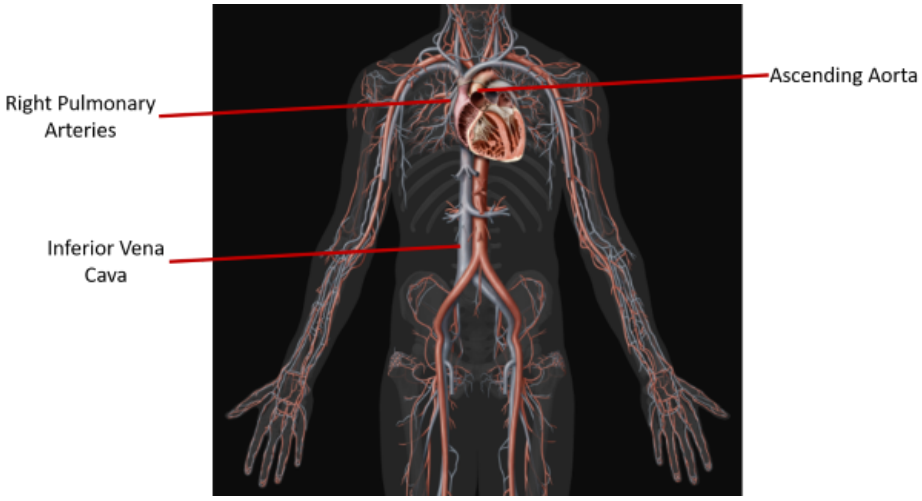
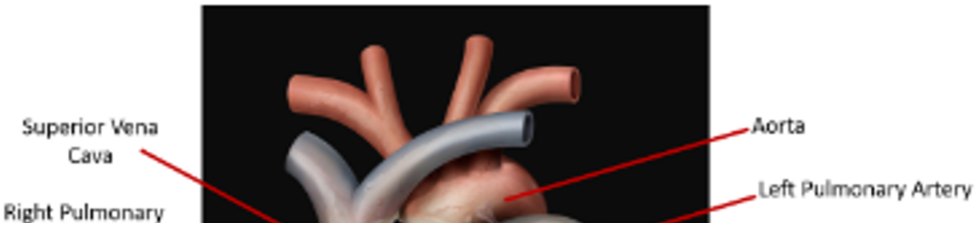


Photo 5: The Heart
(SAMPLE ANSWER BELOW)



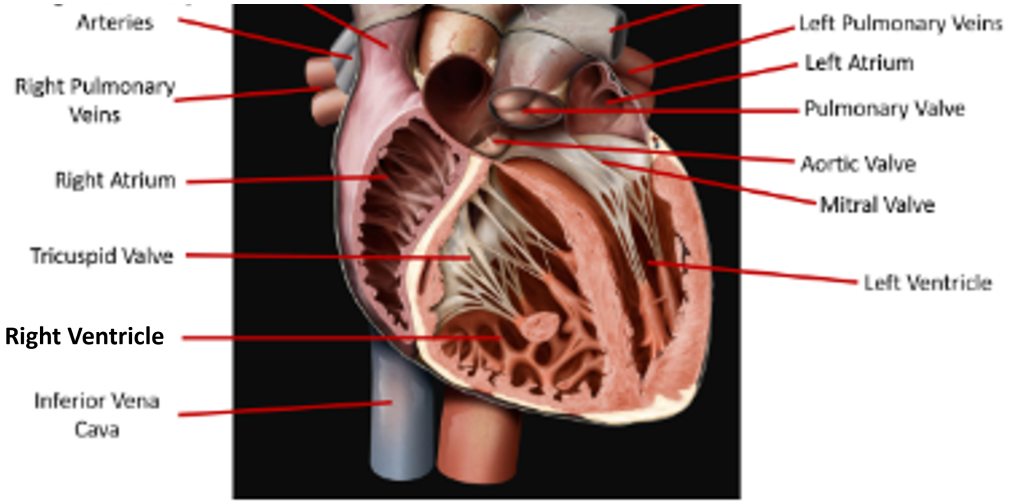
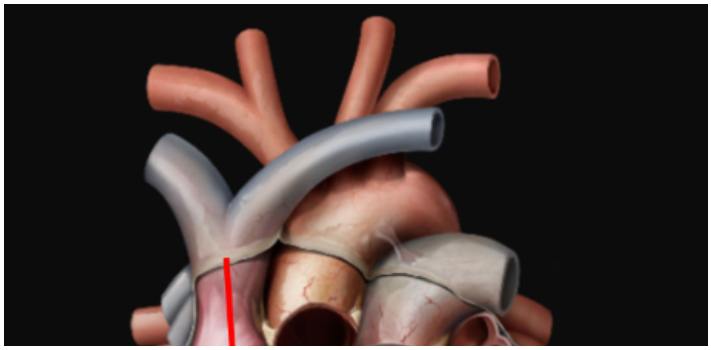
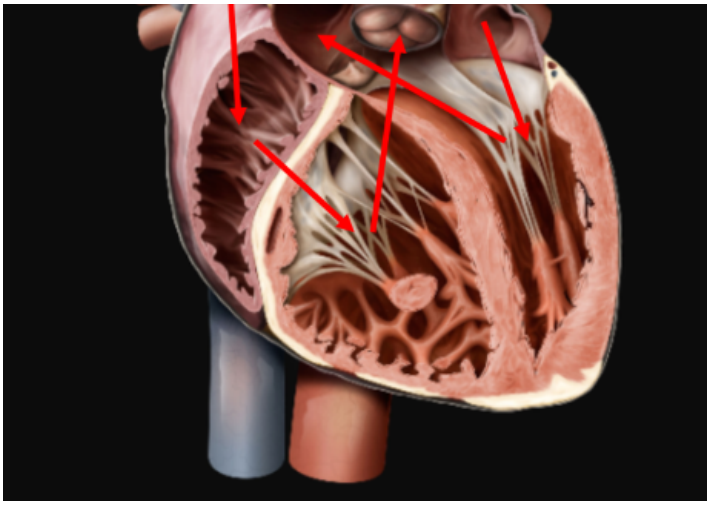


Photo 6: Blood Flow through the Heart

(SAMPLE ANSWER BELOW)





Exercise 3

How does the function of the right and left sides of the heart relate to the differences in appearance of each side? Refer to your observations recorded in Panel 1 in your explanation.

The right ventricle wall is thinner than the left ventricle wall as recorded in Panel 1. The right side of the heart only pumps deoxygenated blood to the nearby lungs, whereas the left side must be stronger to pump oxygenated blood throughout the body.

In addition to the mitral valve and the tricuspid valve, what other valves are present in the heart and what are their functions?

In addition to the mitral and tricuspid valves, the aortic valve is located where the aorta exits the left ventricle. It prevents back flow of blood from the aorta back into the left ventricle. Students may also mention the pulmonary semilunar valve which is not present on this model but prevents back flow of blood from the pulmonary trunk into the right ventricle.

Describe the location, appearance, and function of the papillary muscles. Reference Photo 9 in your answer.

The papillary muscles are located in the ventricles of the heart, connected to the atrioventricular valves by the chordae tendinea as labeled in Photo 9. They are extensions of the heart muscle and look like bumps on the wall of the ventricles.

Photo 7: Anterior External Heart
(SAMPLE ANSWER BELOW)

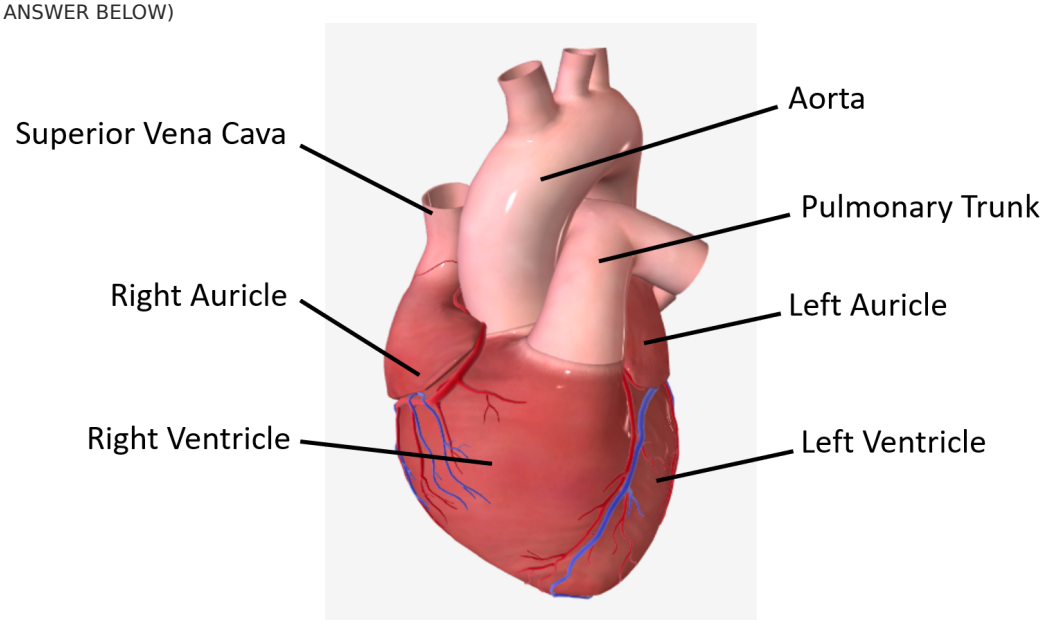
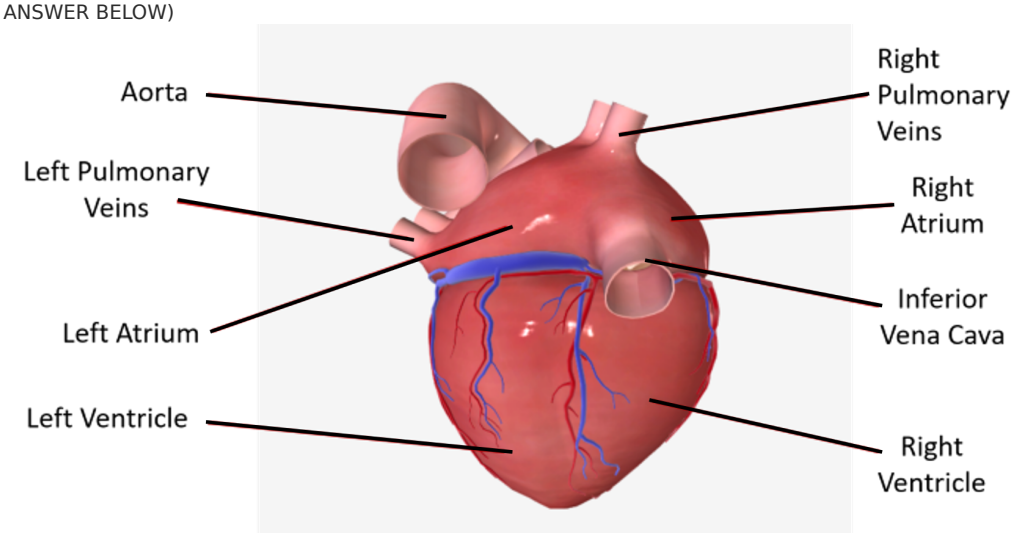


Photo 8: Posterior External Heart

(SAMPLE ANSWER BELOW)



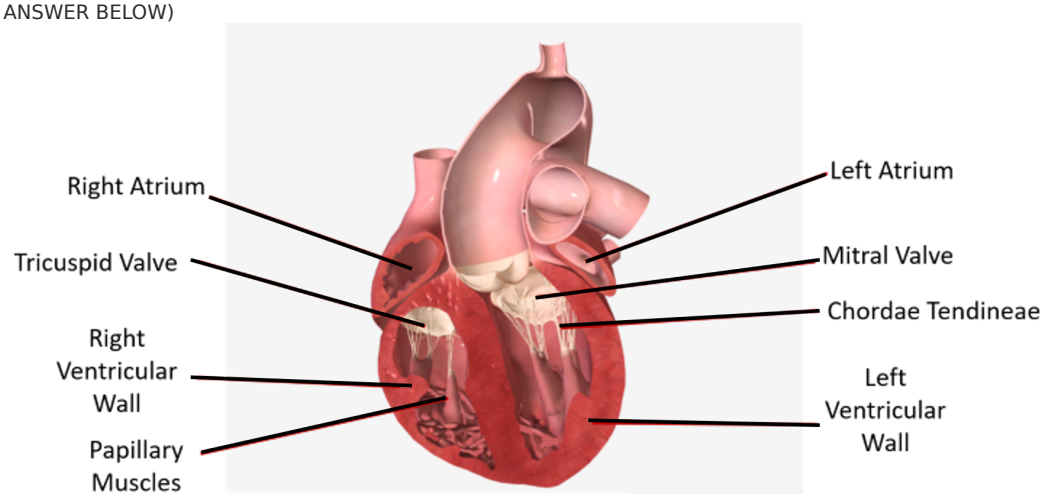
Panel 1: Comparison of Wall Thickness

(SAMPLE ANSWER BELOW)

The wall of the left ventricle is thicker than the wall of the right ventricle.

Photo 9: Internal Anatomy of the Heart

(SAMPLE ANSWER BELOW)



Exercise 4

Name the major arteries and veins that deliver and drain blood to and from the head and neck.

The major arteries going to the head and neck are the common carotid arteries. The major veins draining blood from the head and neck are the jugular veins.

List the major arteries through these pathways in a human:

a. Blood as it travels from the left ventricle to the arcuate artery of the foot.

b. Blood as it travels from the brachiocephalic trunk to the right superficial palmar arch.

a. Blood leaves the heart via the aorta. It flows down through the thoracic and abdominal aorta and then through the common iliac and external iliac arteries. It then travels through the femoral artery, the popliteal artery, the anterior tibial artery and through the dorsalis pedis artery to the arcuate artery.

b. Blood leaves the brachiocephalic trunk, travels through the right subclavian artery, axillary artery, brachial artery, and then through the radial (or ulnar) artery to the palmar arch.

List the major veins through these pathways in a human:

a. Blood as it travels from the plantar arch to the right atrium.

b. Blood as it travels from the right median cubital vein to the right atrium.

Photo 10: Major Veins
(SAMPLE ANSWER BELOW)

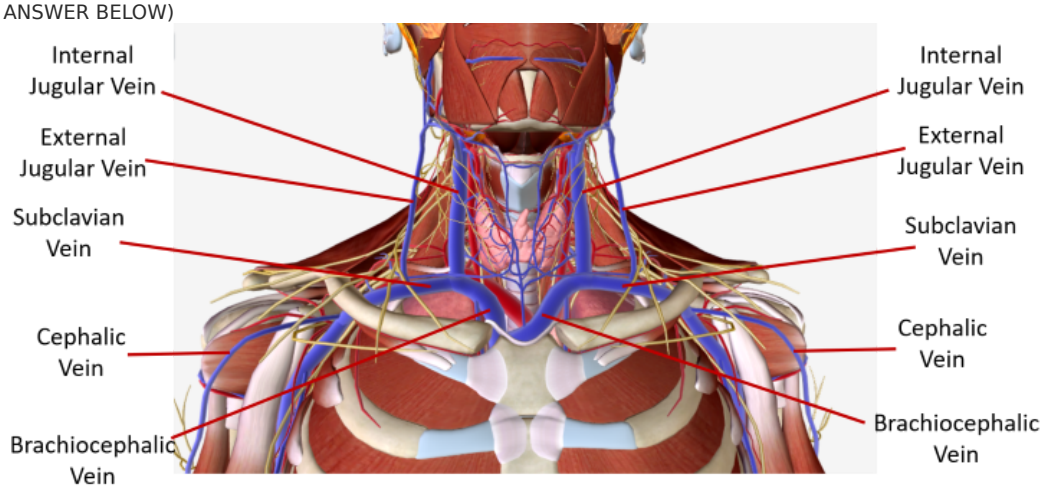
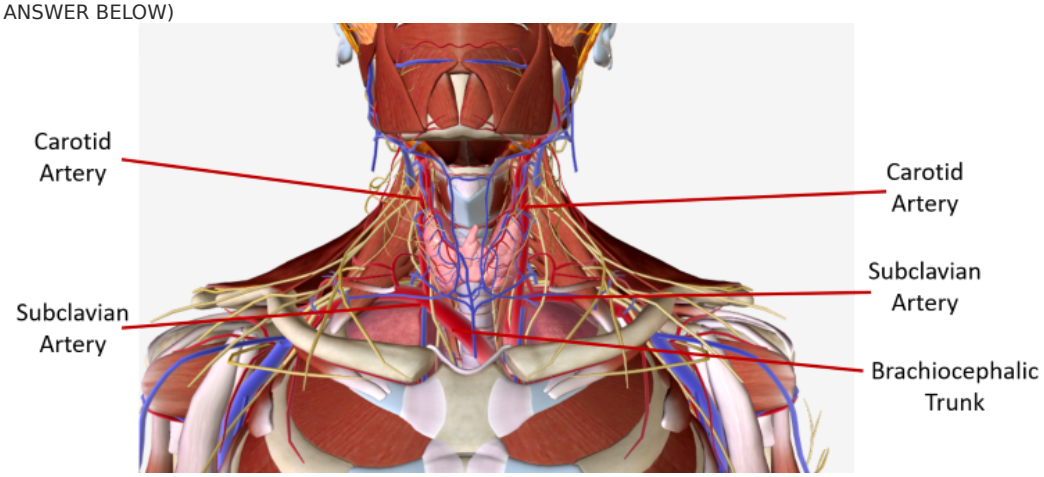


Photo 11: Major Arteries
(SAMPLE ANSWER BELOW)



Competency Review

The _____ are the primary pumping chambers of the heart.

- atria
- ventricles ✔
- aorta
- vena cava

Cardiac muscle is easily fatigued.

- True
- False ✔

Valves within the heart help maintain a unidirectional flow of blood.

- True ✔
- False

Deoxygenated blood is transported to the heart through the _____.

- aorta
- pulmonary arteries
- pulmonary veins
- vena cava ✔

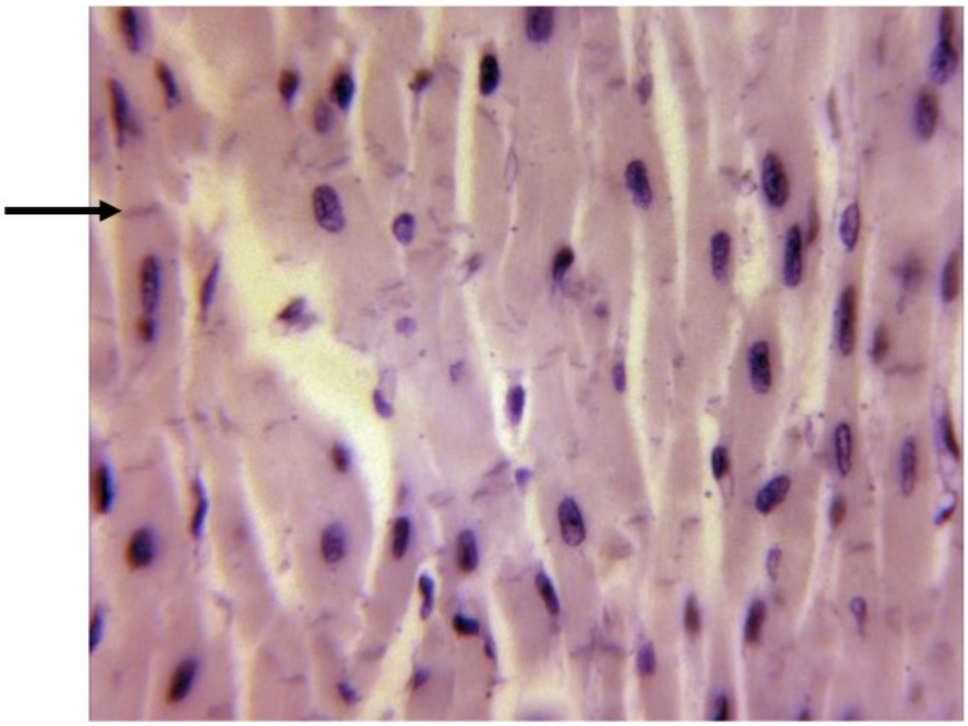
Cardiac muscle tissue is characterized by _____.

- branched cells
- cells with a single nucleus
- intercalated discs
- All of the above ✔

Arteries but not veins contain elastic lamina layers.

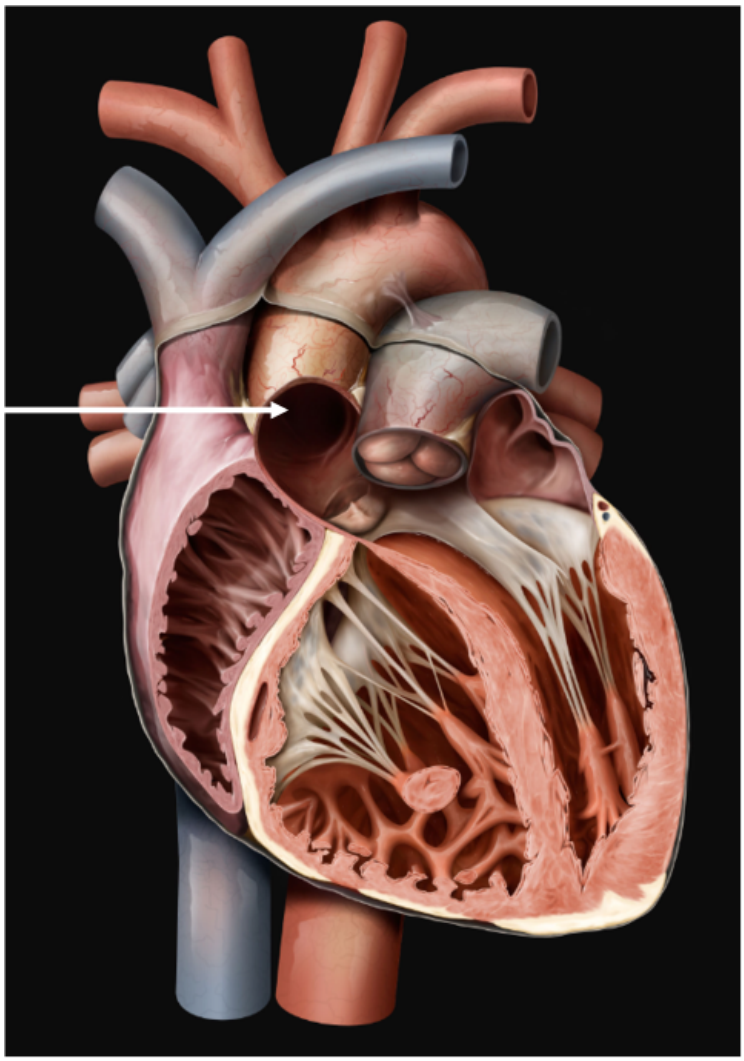
- True ✔
- False

A(n) _____ is indicated by the arrow in the image of cardiac muscle tissue below.



- lamina media
- nucleus
- intercalated disc ✔
- lumen

The ____ is indicated by the arrow in the image of the Virtual Model heart below.



- aorta ✔
- left ventricle
- right atrium
- vena cava

The walls of the right and left ventricles appear identical in a virtually dissected model heart.

- True
- False ✔

Extension Questions

A valvular insufficiency, also known as a "leaky valve," causes blood to leak backwards across the heart valve. Valvular stenosis, or stiffening, occurs when the tissues in the valve become stiffer, resulting in a narrowing of the valve.

Apply your knowledge of blood vessels and the heart to predict how a valvular insufficiency and valvular stenosis might affect heart function?

(SAMPLE ANSWER BELOW)

Both conditions would put excessive strain on the heart as it struggles to pump oxygenated blood through the body. In a valvular insufficiency, the heart would have to work harder to pump blood forward through the heart as it would be fighting the back flow of blood. In valvular stenosis, the heart would have to pump harder to force blood through the stiffer, narrowed valve.