

Young Scientist Program Anatomy Teaching Team



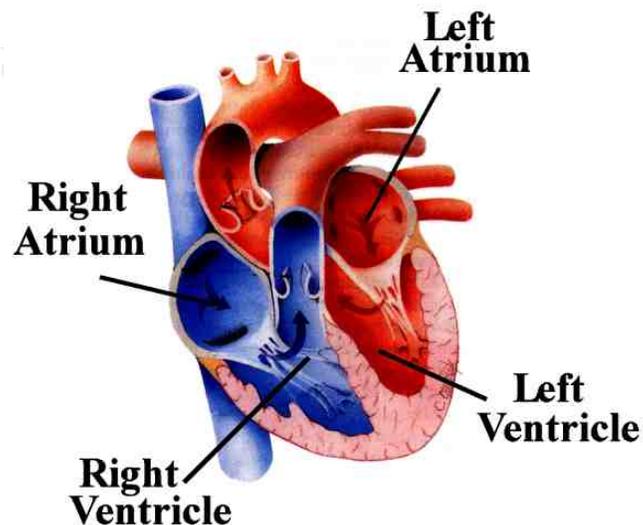
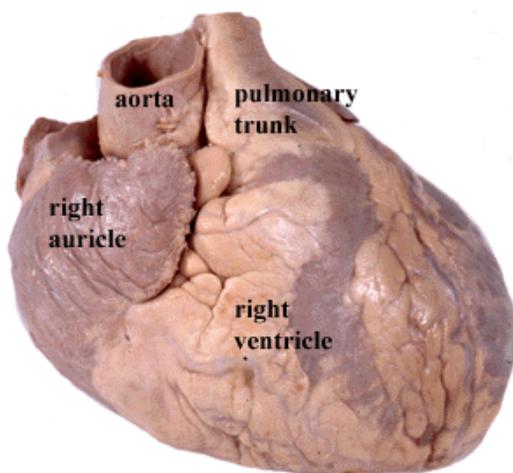
“The Architecture and Function of the Heart”

Lesson Goals:

1. Be able to name the four chambers of the heart, and understand which chambers pump blood away from the heart to the lungs and body.
2. Understand the differences in function between the right and left sides of the heart.
3. Know the difference between arteries and veins.
4. Be able to trace the path that blood takes from the body to the heart and back out to the body.

The heart is a very important organ. Essentially, the heart is a large, thick muscle which serves to pump blood around the body. Therefore, the heart is responsible for delivering nutrients to other organs, transporting oxygen (O₂) and carbon dioxide (CO₂) to and from the lungs and body, and generally keeping all of the cells in your body alive. Over millions of years the mammalian human heart has developed into a very sophisticated type of pump made up of four chambers: the **right atrium**, the **right ventricle**, the **left atrium**, and the **left ventricle**. The ventricles do the work pumping blood away from the heart, therefore the muscular walls of the ventricles are very thick (just like how a weightlifter’s arm or leg muscles are very big and thick). On the other hand, the *atria* collect blood coming in from around the body and pump it into the ventricles to be sent out away from the body. Since this is more of a “wimpy” job the muscular walls of the atria are not very thick.

Find the four chambers in your sample heart.



The right and the left side of the heart have two different functions. The right side of the heart collects “used” deoxygenated blood coming from the body in the **right atrium** and pumps this used deoxygenated blood into the lungs via the **right ventricle**. In the lungs the blood gets oxygenated and then gets collected again in the **left atrium**, which pushes the blood into the **left ventricle**, where the “fresh” oxygenated blood is pumped out into the body. Therefore, blood takes a very specific path through the heart, which you can follow.

- a. First “used” blood coming into the heart from the rest of the body enters the **right atrium** through two large veins known as the **superior vena cava** and the **inferior vena cava**.

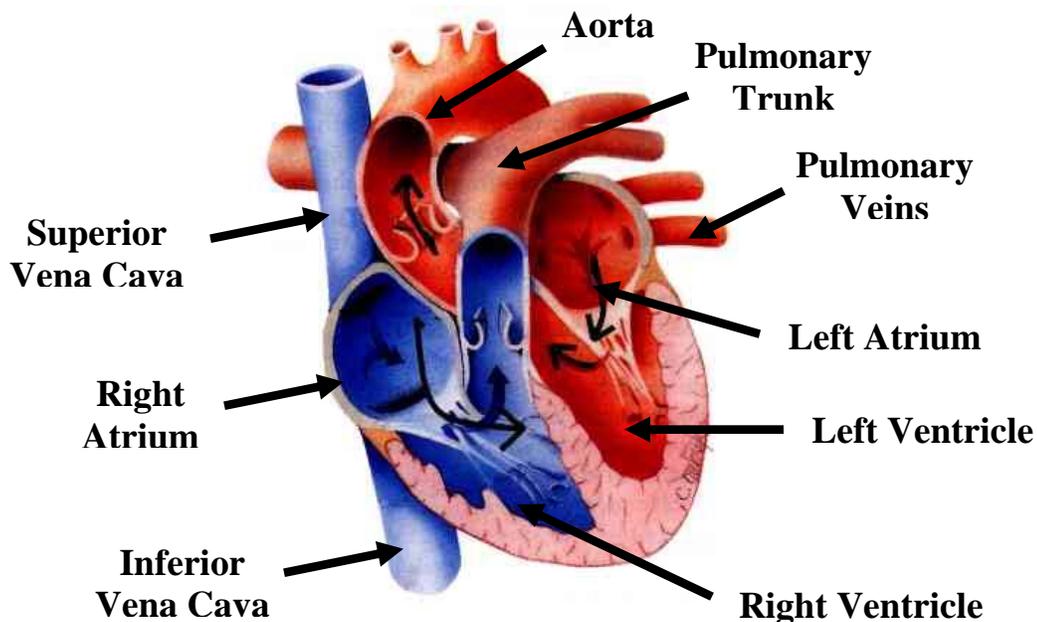
Which one of these veins do you think brings “used” blood from the brain to the heart? How about “used” blood from the legs?

- b. The “used” blood is then pumped by the **right atrium** into the **right ventricle** through a small opening containing connecting the two.
- c. The **right ventricle** then contracts and pump the blood to the lungs through a large artery called the **pulmonary trunk**, which comes out of the top of the heart and splits into two branches to go to both lungs.
- d. After going through the lungs, the “fresh” oxygenated blood flows into the **left atrium** through four veins (two from each lung) known as the **pulmonary veins**.

What is the difference between arteries and veins? Arteries bring blood away from the heart (usually oxygenated, but not always in the case of the pulmonary artery), and veins bring blood to the heart (usually deoxygenated, but not always in the case of the pulmonary veins).

- e. The “fresh” blood is then collected and pumped into the **left ventricle**, which then pumps the blood out into the rest of the body through the largest artery in body, known as the **aorta**.

Trace the path of blood from where it enters the heart (as it comes from the body) to where it exits the heart (as it goes out into the body).



Extra Credit: If you look closely at the thickness of the walls of the left and right ventricles you will notice that the wall of the left ventricle is much thicker than the wall of the right ventricle. Why do you think this is? What does this tell you about path that the blood takes after coming out of the right ventricle versus the left ventricle?

Embryological differences in the human heart:

During early development, the fetus does not use the lungs to exchange O₂ and CO₂. Instead, gas exchange is carried out from mother to baby at the placenta. As a result of this, there are differences in the circulation during in utero development. Because oxygenated blood is delivered from the placenta to the inferior vena cava, this blood enters the right side of the heart. In order to deliver oxygenated blood to the body instead of to the lungs, most of the blood must bypass the pulmonary circulation. It does this through the **foramen ovale**, which conducts blood from the right to the left atrium, and through the **ductus arteriosus**, which shunts blood from the pulmonary artery to the aorta. Shortly after birth when the baby starts breathing through his or her own lungs, these two pathways close, and the route blood takes becomes like that discussed previously. Remnants of the **foramen ovale** and the **ductus arteriosus** can be seen in adult heart as the **fossa ovalis** and the **ligamentum arteriosum**, respectively.