

Young Scientist Program

Anatomy Teaching Team



"Inside the Heart: Valves"

Lesson Goals:

1. Understand the purpose of a valve in the heart.
2. Be able to name the four valves of the heart, and know where they are located
3. Understand the difference between a bicuspid and a tricuspid valve, and know what valves are each kind.
4. Know which valve closings the S1 and S2 heart sounds relate to.

As you know the heart is organized into four chambers. In order for blood to pass through the heart in the correct manner it must pass between chambers in a specific path: **right atrium → right ventricle → left atrium → left ventricle**. In order to keep blood moving in the right direction small "one-way doors", known as valves, are located in between the various chambers. There are four major valves in the heart:

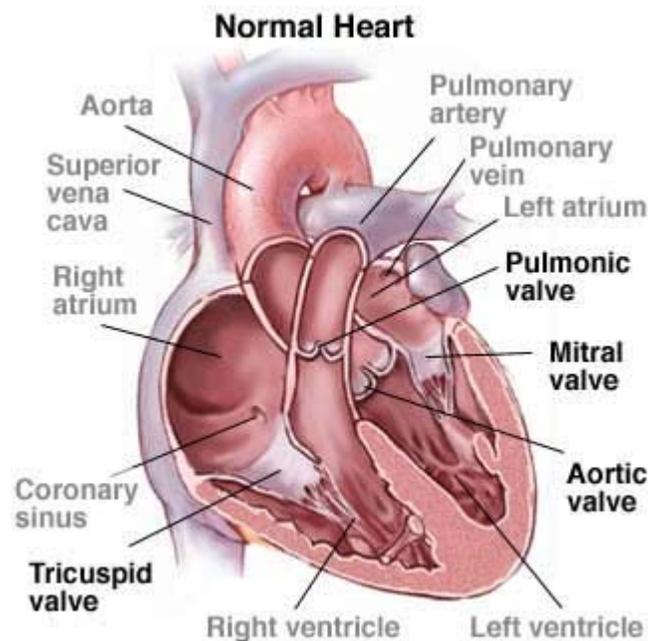
Atrioventricular Valve – Between right atrium & right ventricle

Pulmonary Valve – Between the right ventricle & pulmonary trunk

Mitral Valve – Between the left atrium & left ventricle

Aortic Valve – Between the left ventricle & aorta

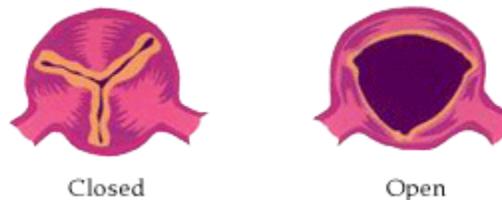
1.) Find each of the cardiac valves within your sample heart.



In general, these four valves are of two main types. The **aortic valve** and the **pulmonary valve** and both types of **semilunar valve**. They are both made up of three **valve leaflets** (the small flaps of tissue attached to the vessel wall) which come together in a triangular shape when the valve is closed. On the other hand, the **mitrial valve** and the **atrioventricular valve** are also similar, in that they both have valve leaflets that are connected to long stringy fibers known as **chordae tendinae**. These strong fibers act just like the strings in a parachute and help to keep the valve from collapsing when it is closed. These fibers are directly connected to small muscles in the ventricle walls known as **papillary muscles**, which help to pull on the **chordae tendinae** and keep the valves from collapsing. The only main difference between the **mitrial valve** and the **atrioventricular valve** is the number of leaflets they both have. The **mitrial valve** has two leaflets, and is therefore also known as the **bicuspid valve**, while the **atrioventricular valve** has three leaflets, therefore making it the **tricuspid valve**.

2.) Examine each valve in the sample heart. Notice the difference between the semilunar and the bi- / tricuspid valves.

View of Aortic Valve (Semilunar type of valve)



As a part of the physical exam, doctors can listen to a patient's chest to tell if the patient's heartbeats sound normal or abnormal. The noise that you can hear in your chest (your heartbeat) is actually made from the small leaflets of heart valves closing and hitting each other. The first sound of the heartbeat (the "lub" sound) is known to doctors as **S1**. This sound is produced by the closure of the **atrioventricular valve** and the **mitrial valve** (at the same time), and signifies that the atria are done contracting and done pushing blood into the ventricles. The second sound of the heartbeat (the "dub" sound) is known to doctors as **S2**. This sound is produced by the closure of the **aortic valve** and **pulmonary valve** (at the same time), and signifies that the ventricles are done contracting and done pushing blood out into the body. If someone has a very bad heart condition these sounds will be very different from the normal "lub-dub", and may even involve other sounds, known as **S3** and **S4**.

Listen to a normal heartbeat. Which valves are closing to produce each part of the noise? Can you tell the difference between the normal and the "bad" heartbeat of a person with a heart condition?

In many older people the valves of the heart get very stiff and rigid, and even begin to shrink. This can lead to conditions called **stenosis** (where the valve does not close all the way), or **valvular relapse** (where the valve actually collapses and flaps around like a swinging door). In these cases surgeons need to replace these valves with artificial ones made out of plastic or artificial tissue.

*Extra Credit: What would happen if the valves were not there, or they were leaky?
What effect do you think that might have on the person with a bad valve?*