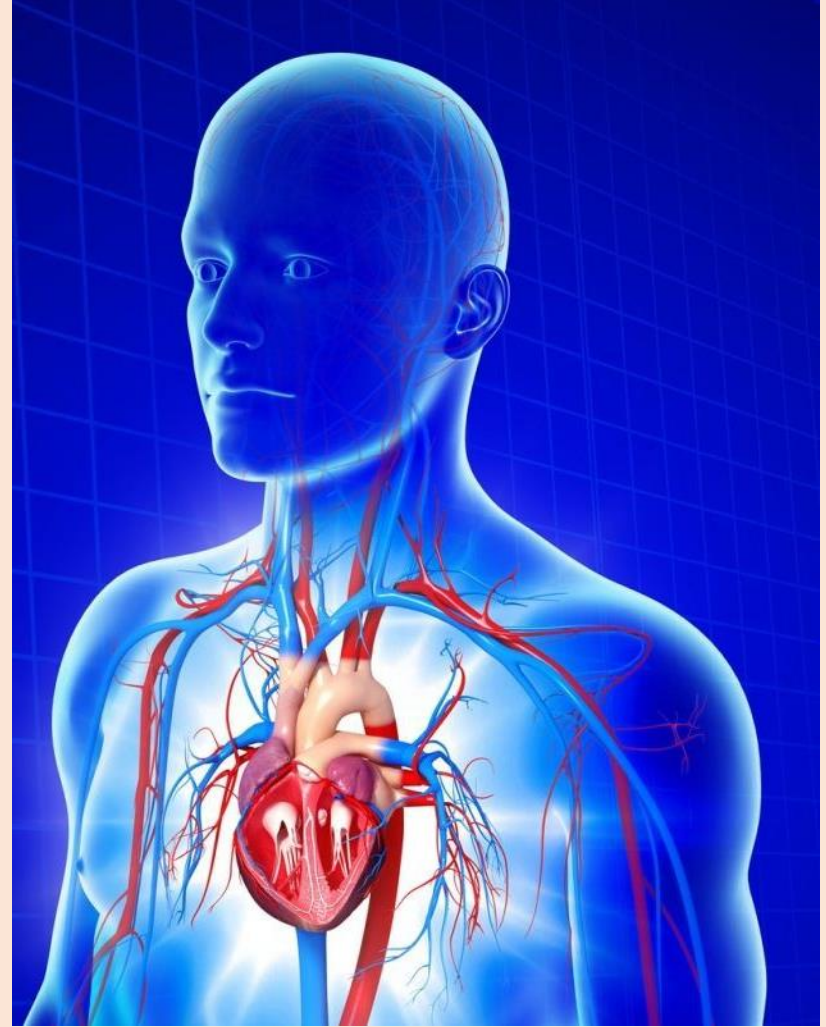


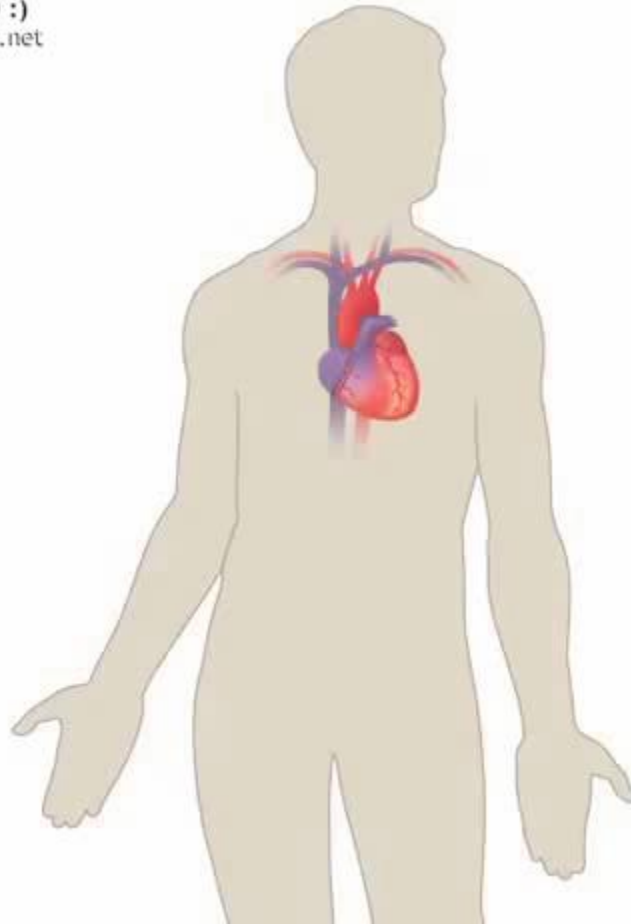
# How the Heart Works



CSUS Cardiovascular Wellness Program

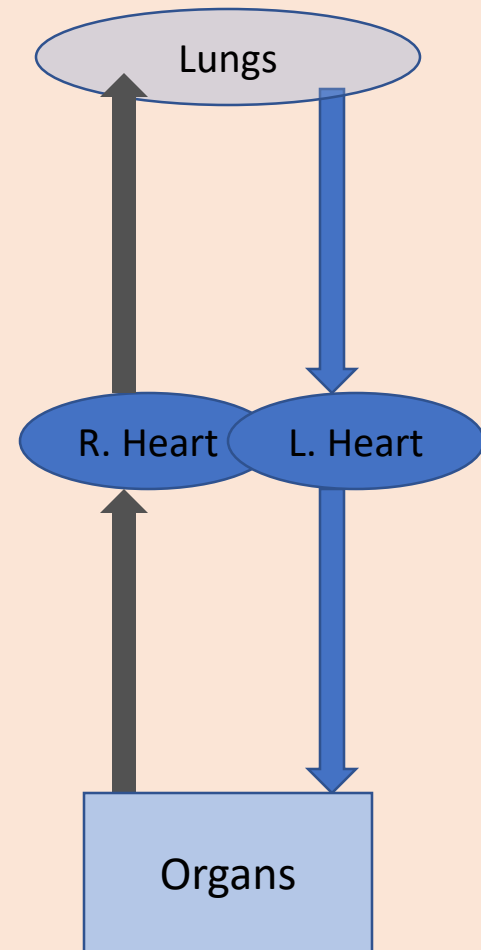
# Heart Video

UNREGISTERED :)  
downloadhelper.net

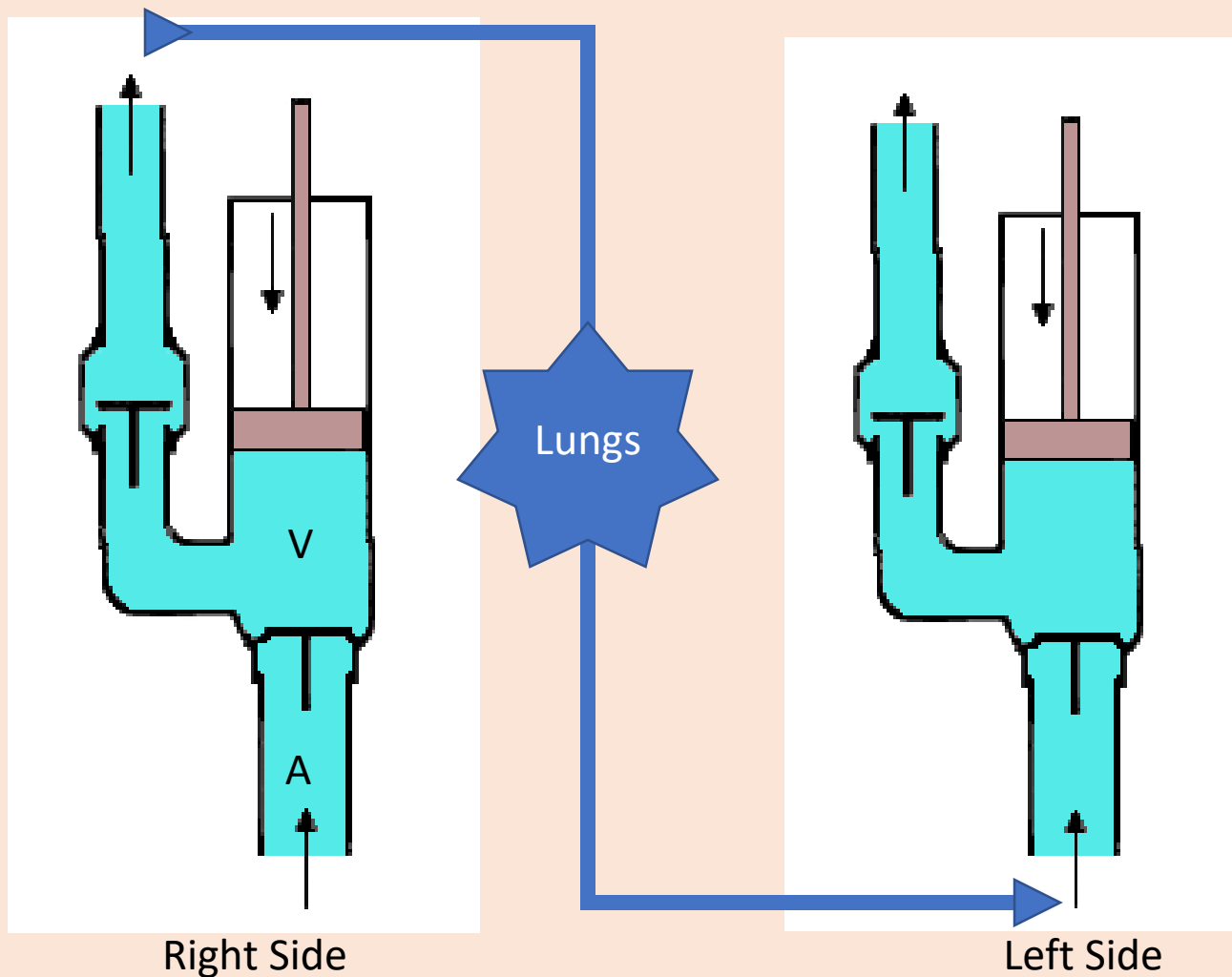


# Summarizing What We Have Seen.....

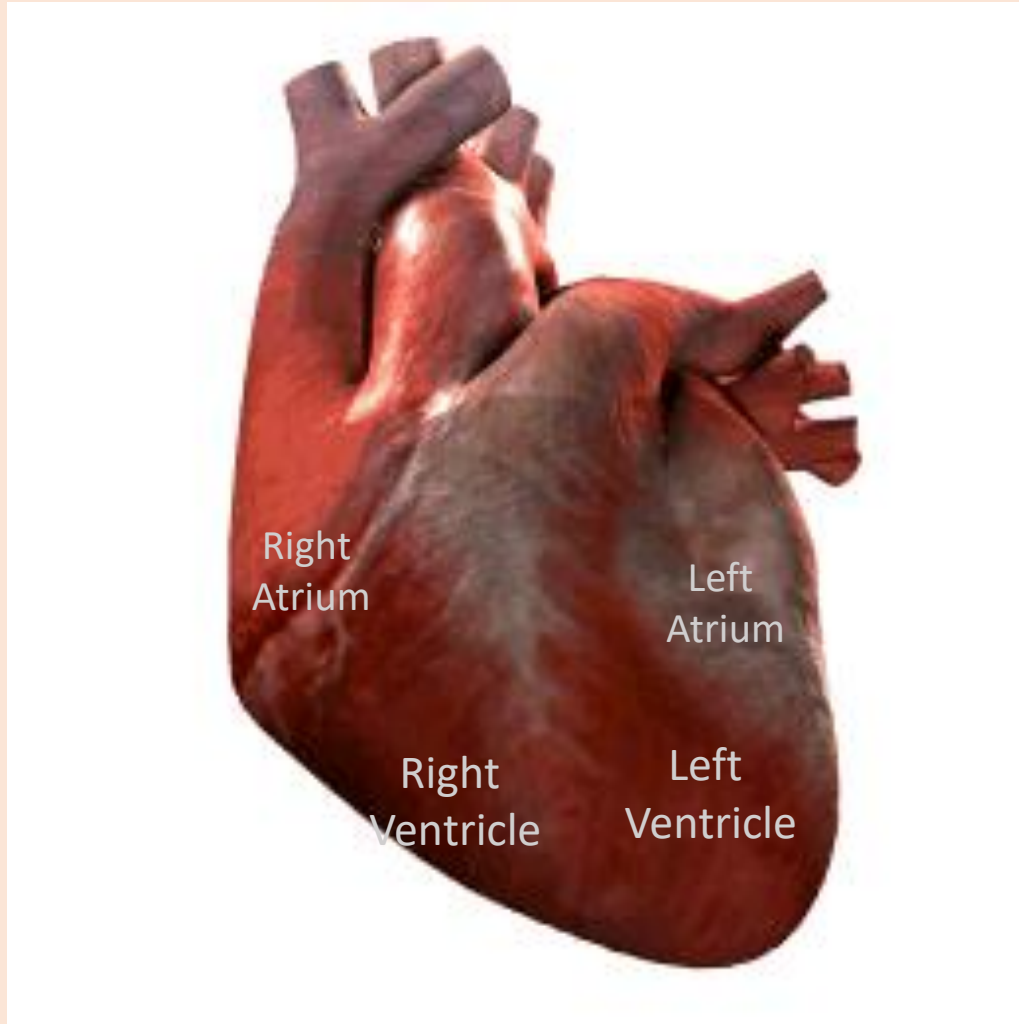
- ♥ The heart is a pump that circulates blood.
- ♥ It moves oxygenated blood to the organs where the oxygen is exchanged for carbon dioxide.  
**Remember! The heart is an organ that functions in the same way.**
- ♥ It moves the blood containing carbon dioxide to the lung where it is scrubbed and carbon dioxide is replaced by oxygen.
- ♥ Finally this clean blood (with oxygen) comes back to the heart which pushes it back to the organs.



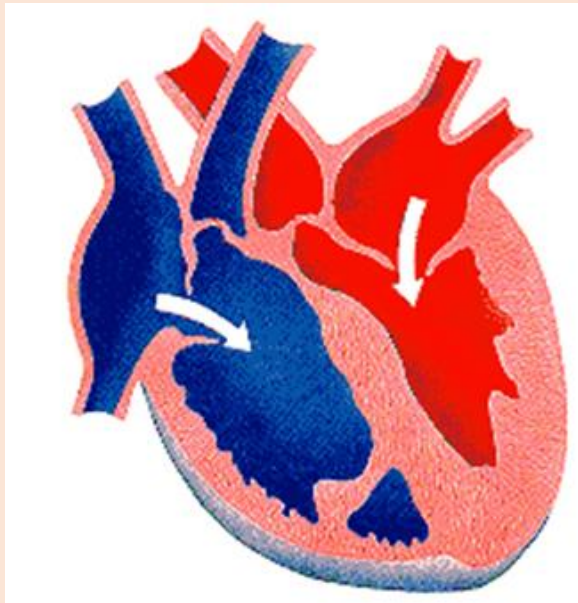
# The Heart Must Work Like 2 Pumps



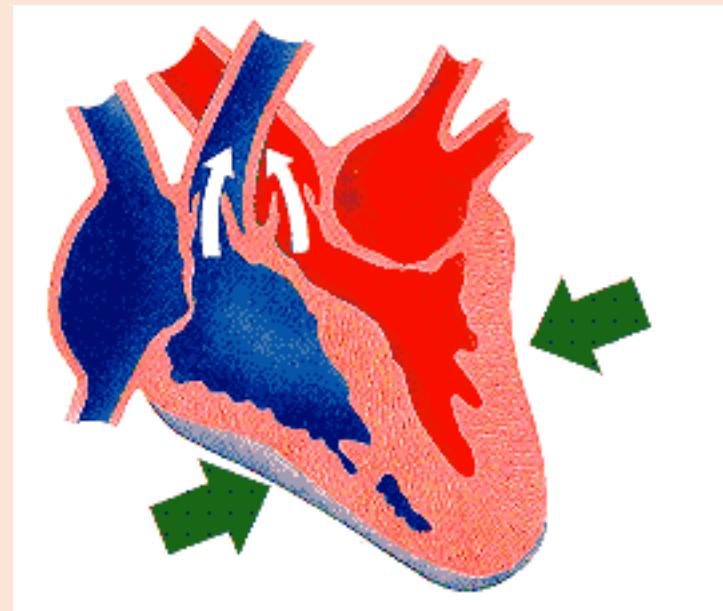
# The Heart



# Phases of Contraction

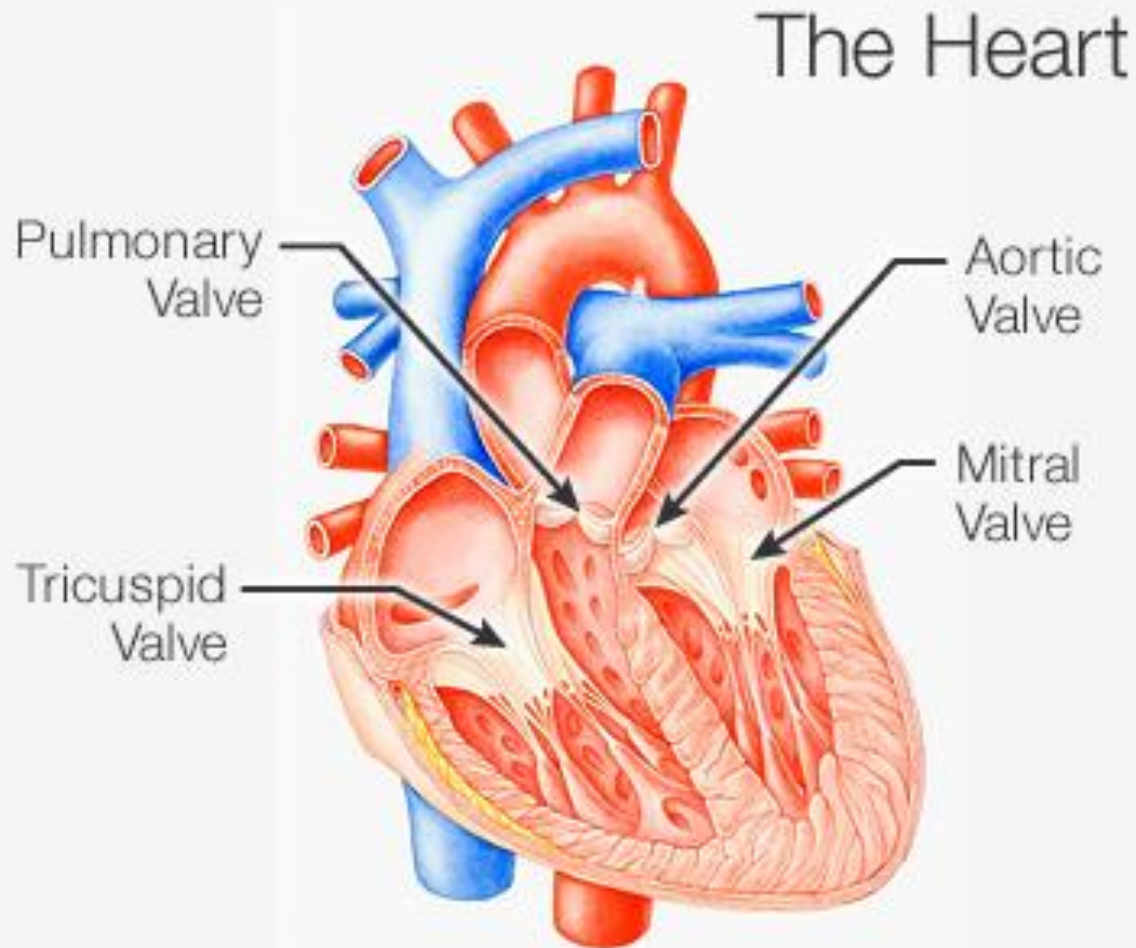


Relaxed state ("Diastole")

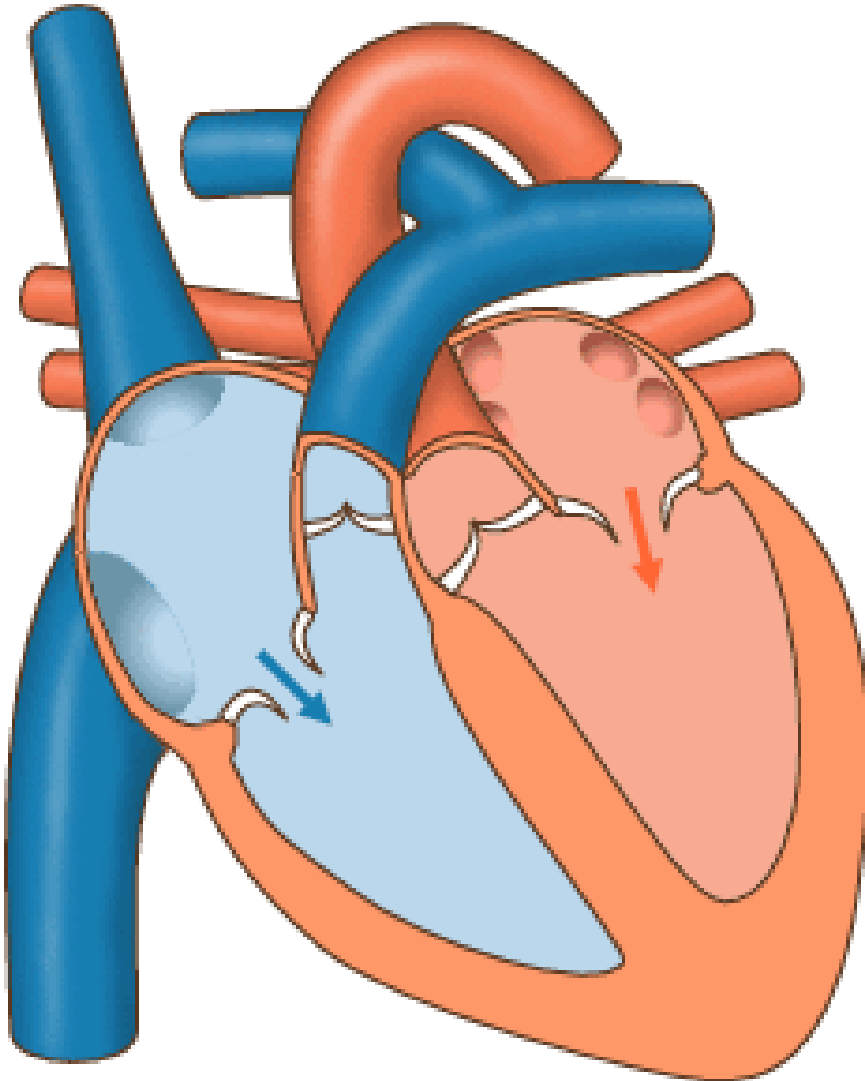


Contracted state ("Systole")

# Heart Valves



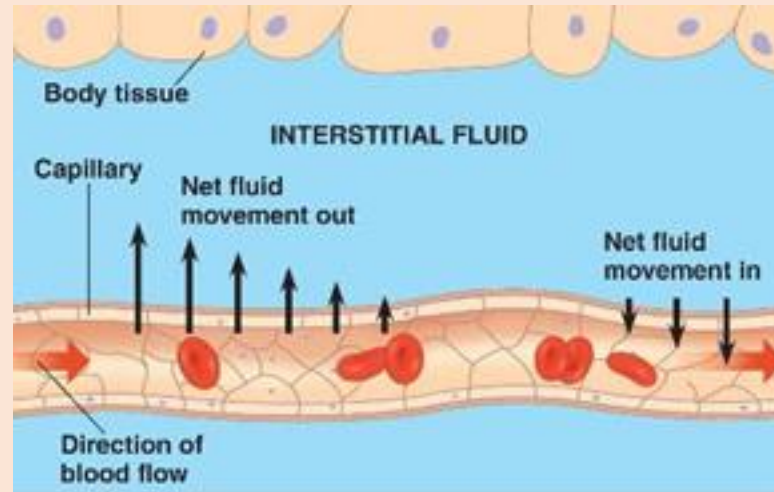
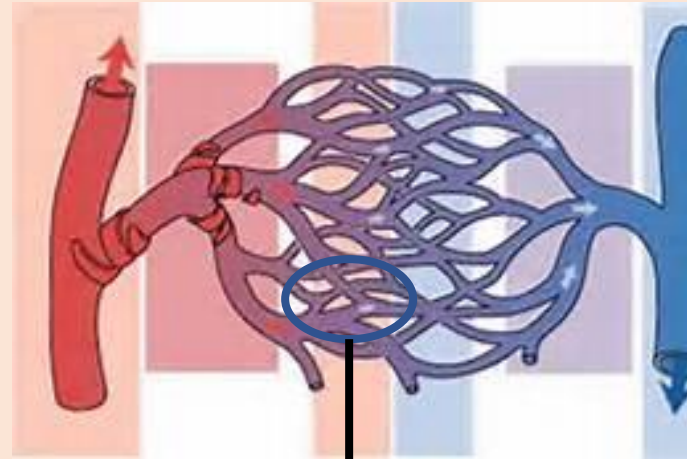
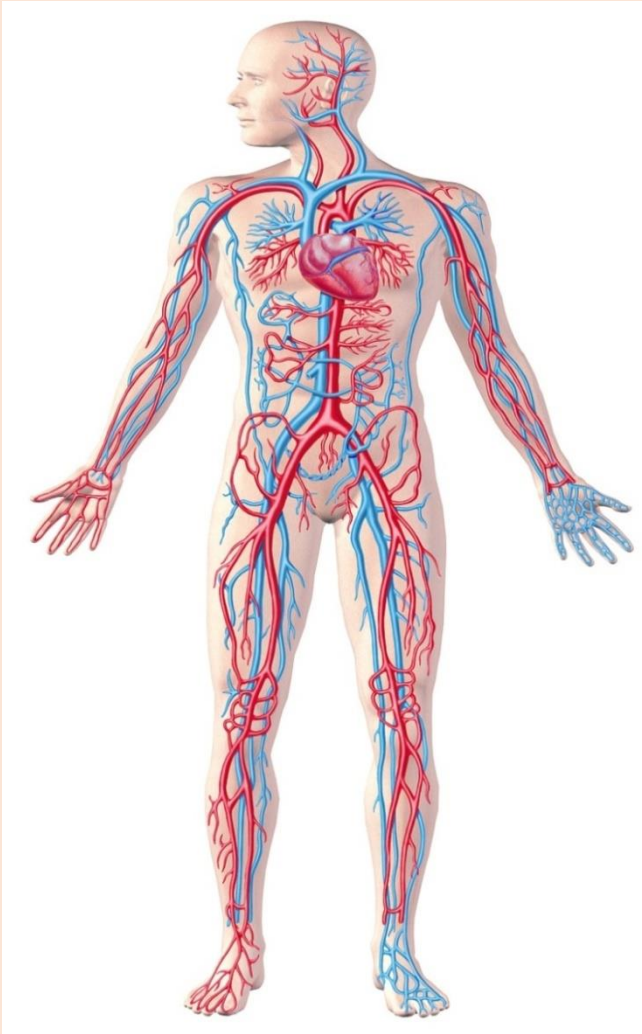
# Heart Valves



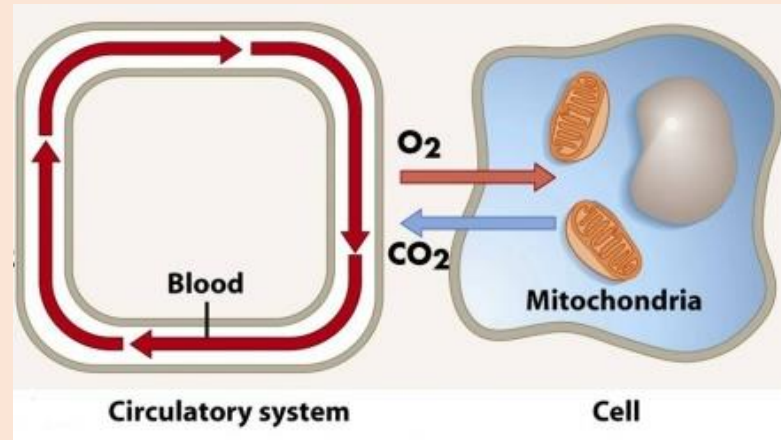
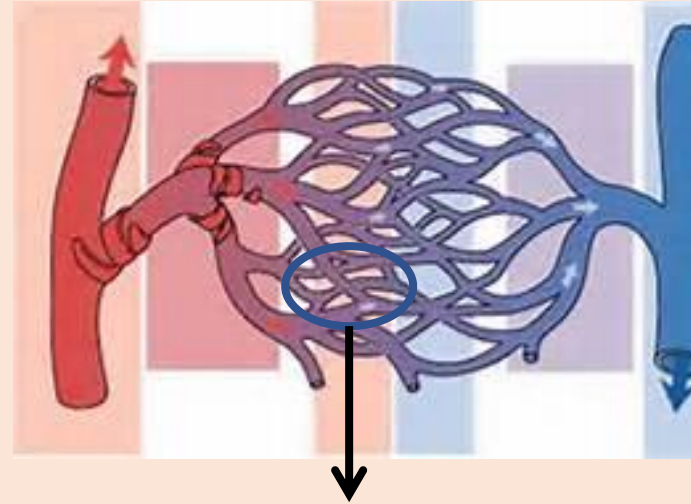
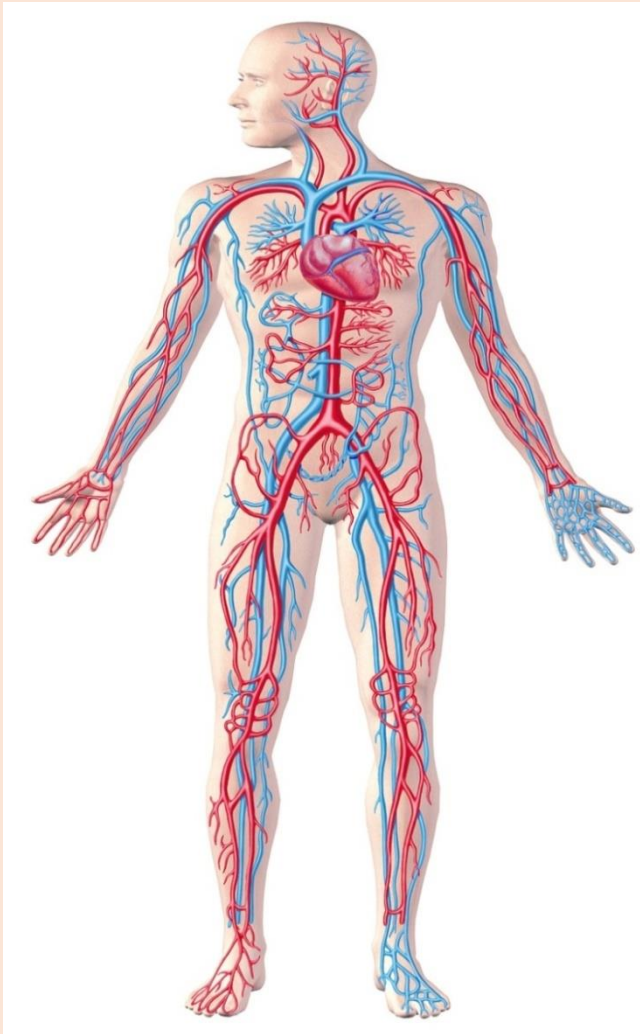
Valves



# What Happens In The Organs (1)

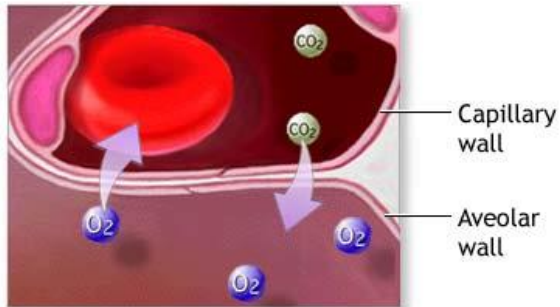


# What Happens in the Organs (2)



# What Happens In The Lungs

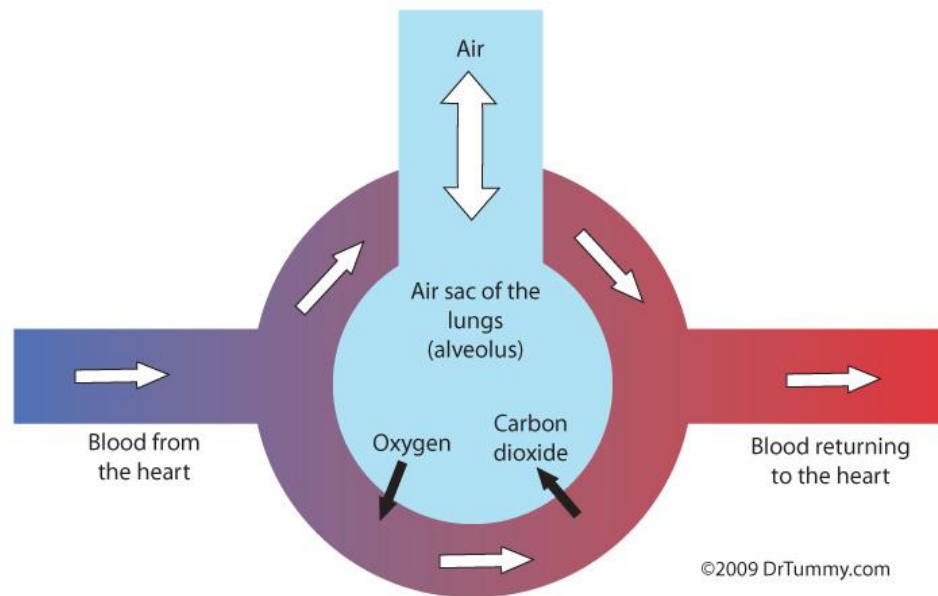
Carbon dioxide diffuses from the bloodstream to alveolus



Oxygen molecules diffuse from the alveolus to the bloodstream and attach to red blood cells

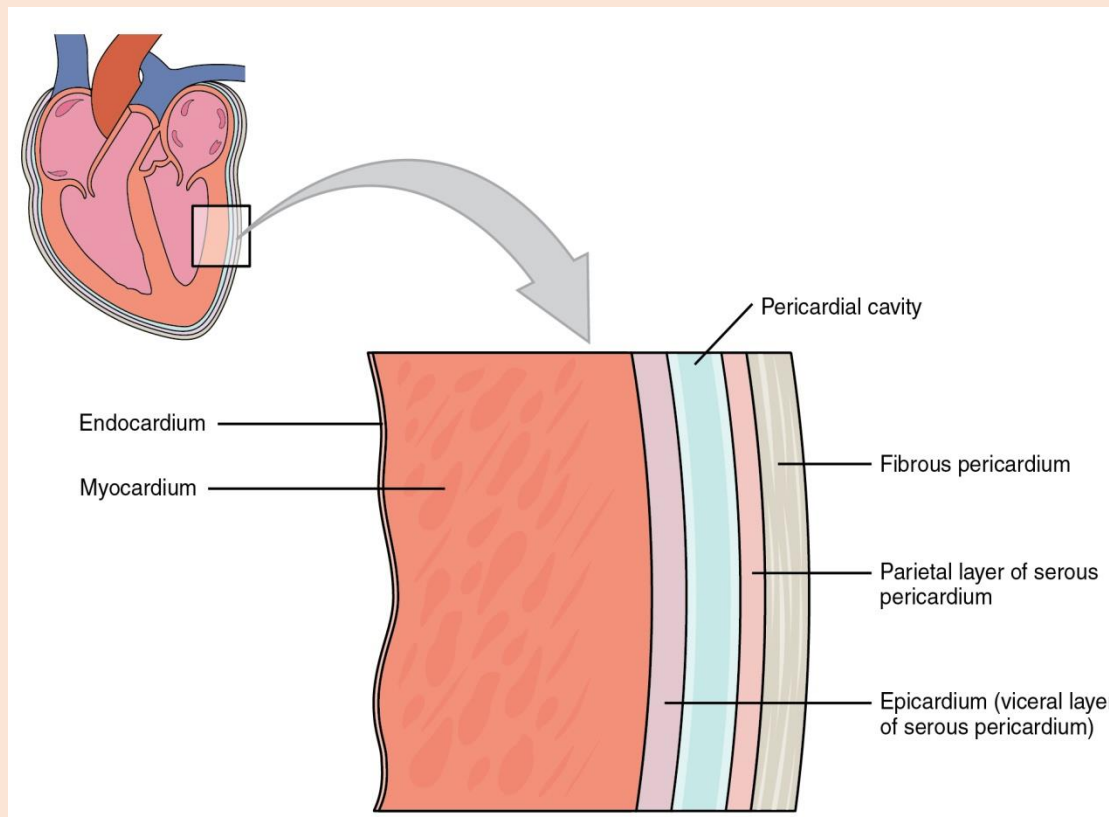
ADAM.

## Gas Exchange in the Lungs

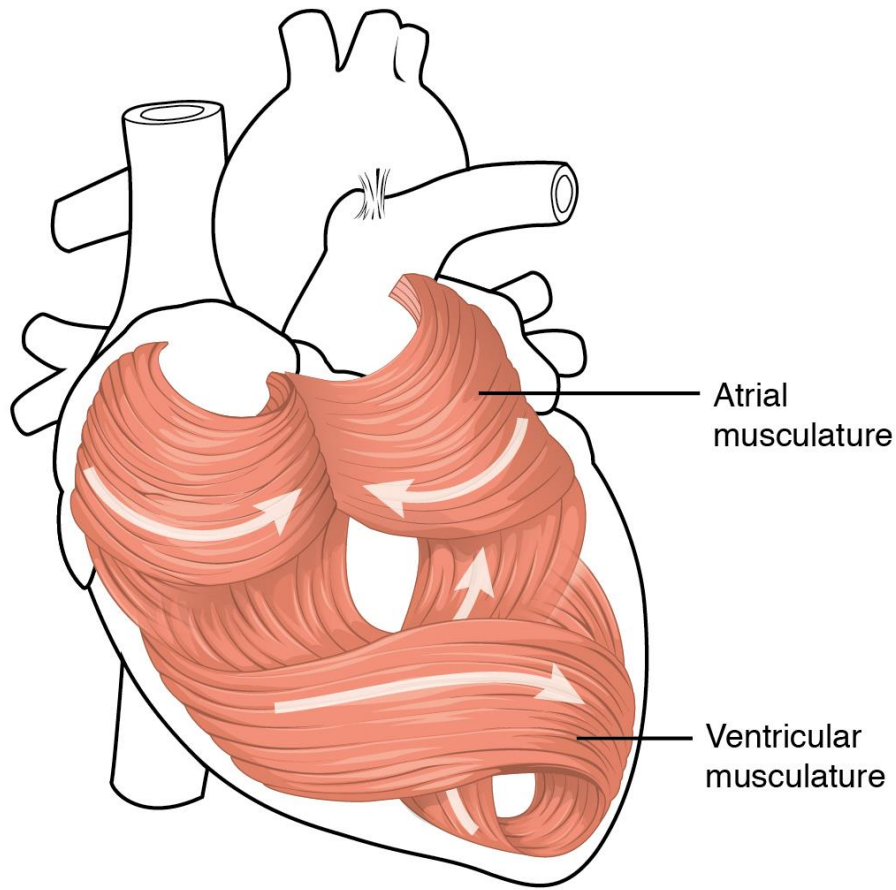


# Is the Heart a Muscle?

The heart wall is made up of three layers: the inner **endocardium**, middle **myocardium** and outer **epicardium**. These are surrounded by a double-membraned sac called the **pericardium**.



# Is the Heart a Muscle?



“Myocardium” is the cardiac muscle—a layer of striated muscle tissues surrounded by a framework of collagen. The myocardium is also supplied with blood vessels, and nerve fibers by way of the epicardium.

Cardiac muscle tissue has **autorhythmicity** - a unique ability to initiate a cardiac action potential—spreading the impulse rapidly from cell to cell to trigger the contraction of the entire heart. This autorhythmicity is still modulated by the endocrine and nervous systems.



# Types of Muscle Cells

**Skeletal muscle**



**Smooth muscle**



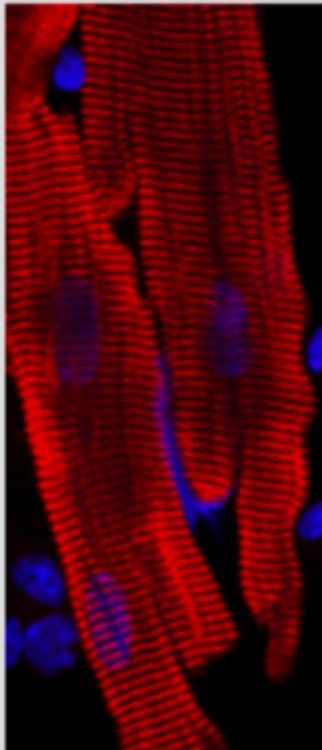
**Cardiac muscle**



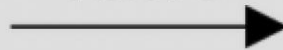
# Types of Cardiac Muscle Cells

There are two types of cardiac muscle cell: 1) **Cardiomyocytes** contract easily, make up the bulk (99%) of cells in the atria and ventricles. These contractile cells respond to impulses of from the 2) **pacemaker** cells.

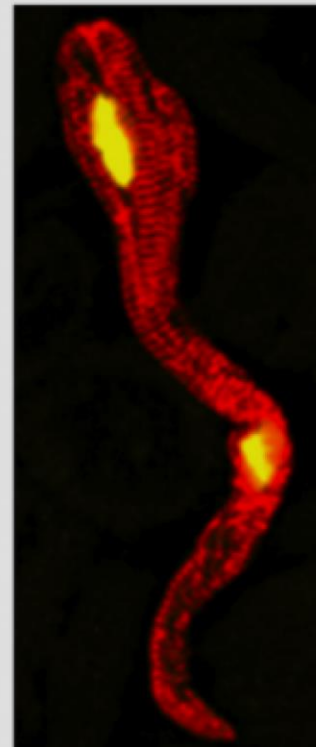
Cardiac myocytes



Tbx18

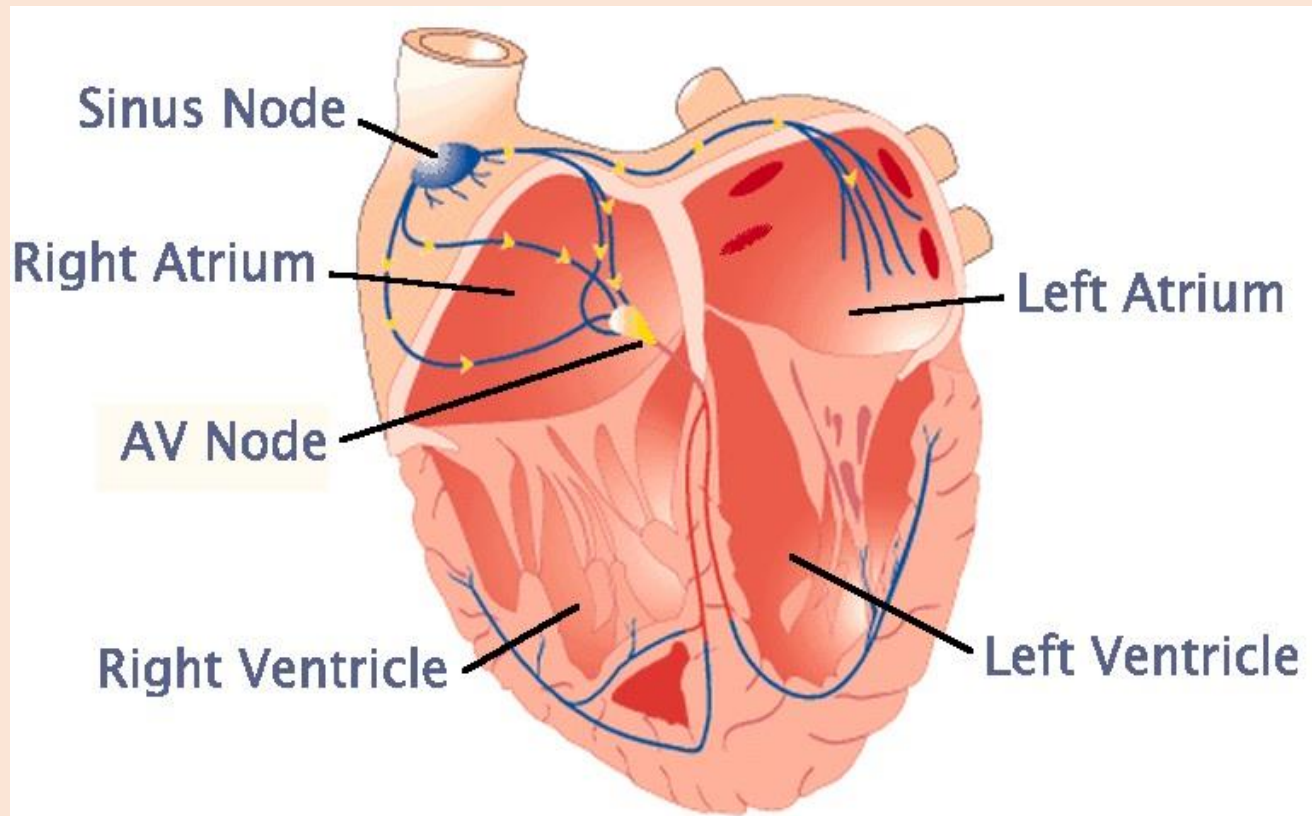


Pacemaker cell



# Pacemaker Cells

**Pacemaker** cells comprise just 1% of myocytes and form the conduction system of the heart. They are generally much smaller than the contractile cells and have limited contractibility. Their function is similar in many respects to neurons.

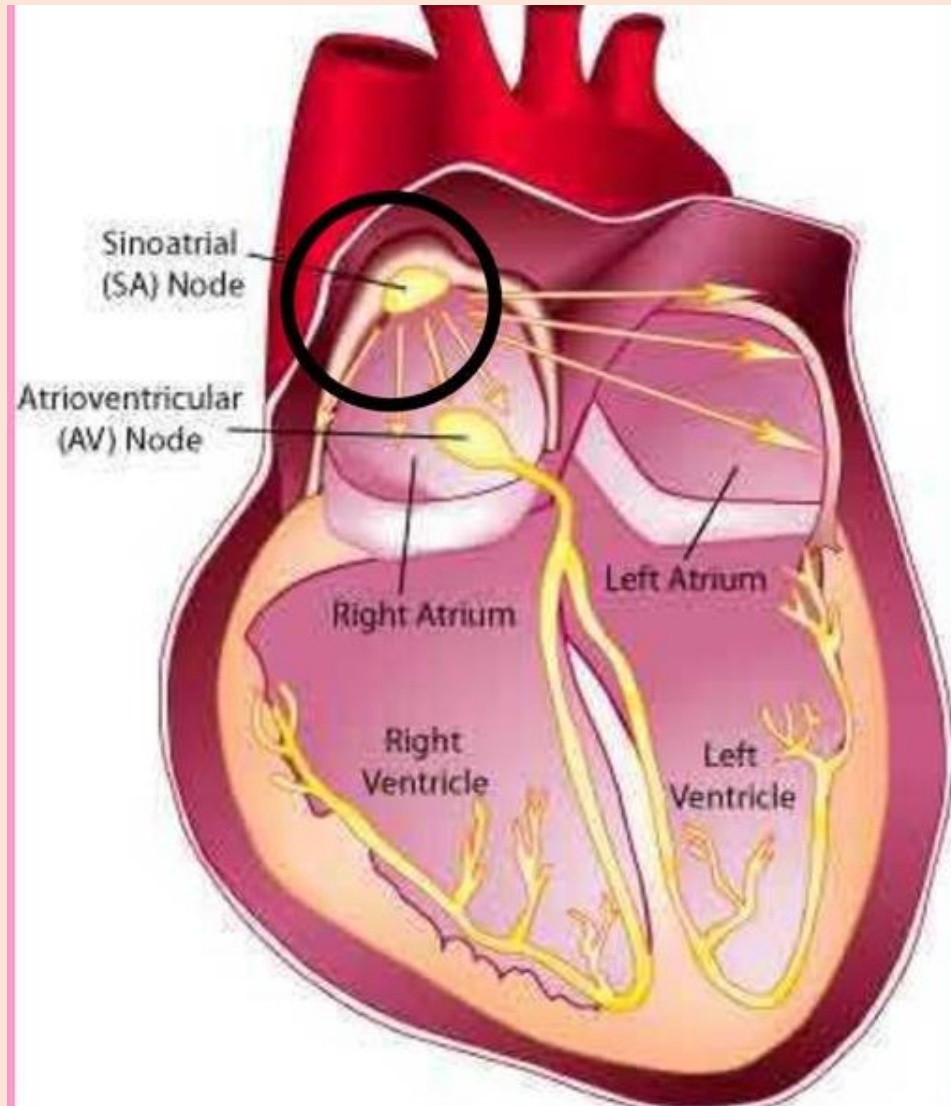




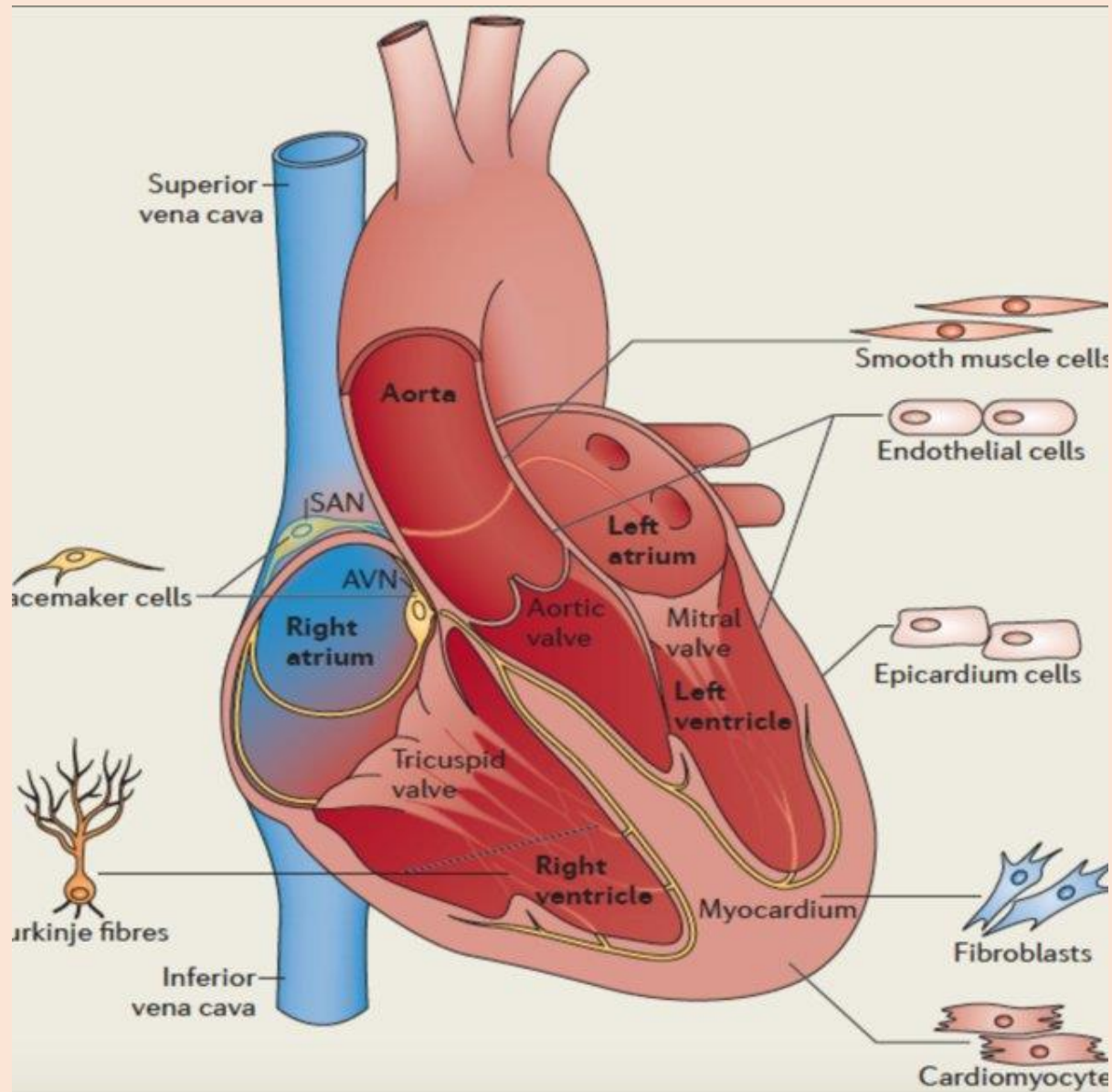
# What Makes the Heart Beat?

A normal heart beat is triggered by a small pulse of electric current initiated in the SA Node. This tiny electric shock spreads downward and cause the heart muscle to contract.

If the whole heart muscle contracted at the same time, there would be no pumping effect. The electrical activity starts at the top, spreads down and then up again, enabling the heart to contract and pump blood in a rhythmic fashion.

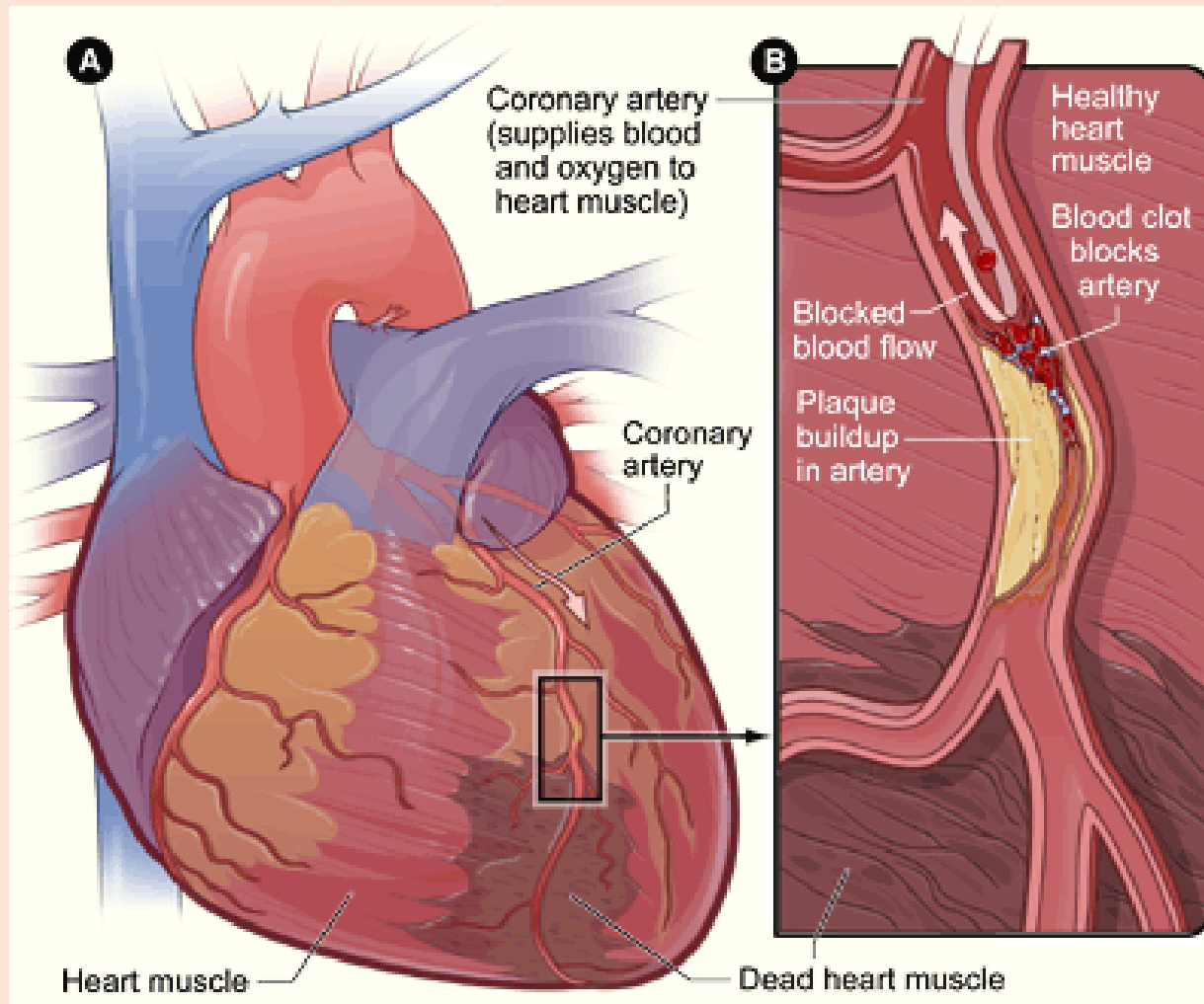


# Types of Cardiac Cells



# The Heart is a Very Special Muscle

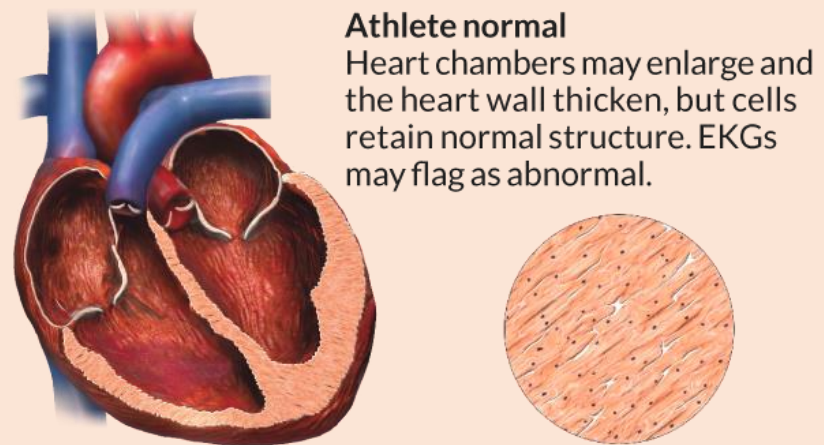
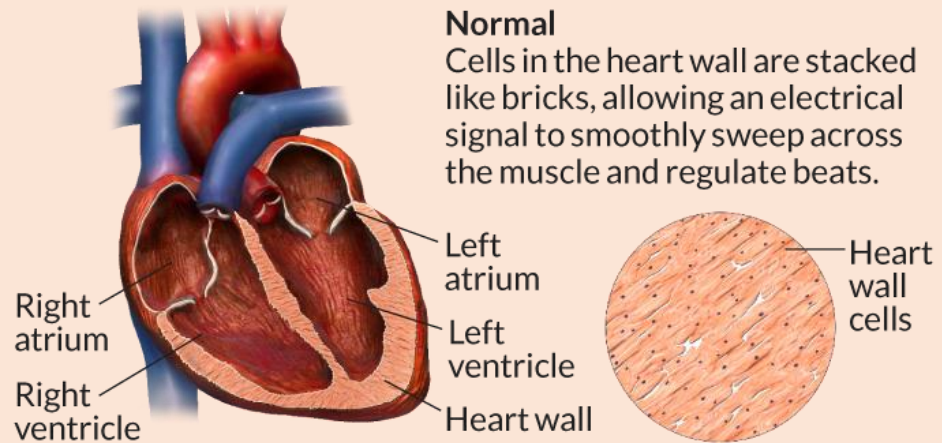
A heart attack implies some of the heart muscle (myocardium) has died (infarcted) .



# Cardiac Hypertrophy

As with skeletal muscles the heart can increase in size and efficiency with exercise

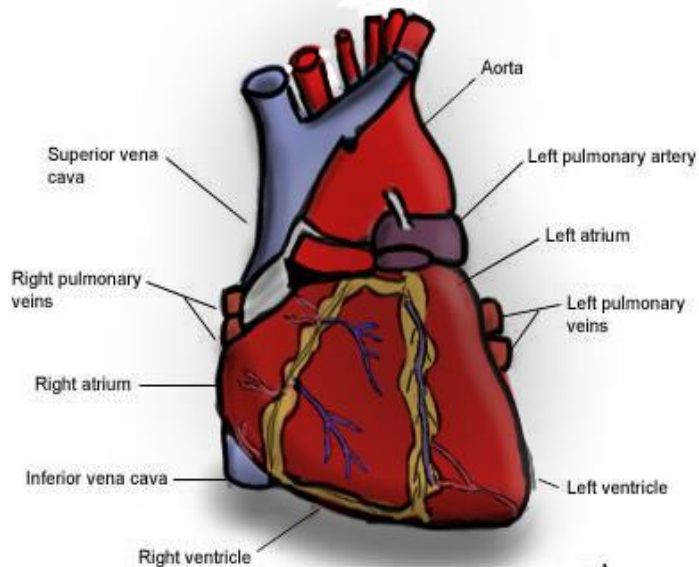
Endurance athletes (such as [marathon runners](#)) may have a heart that has [increased in size](#) by up to 40%.



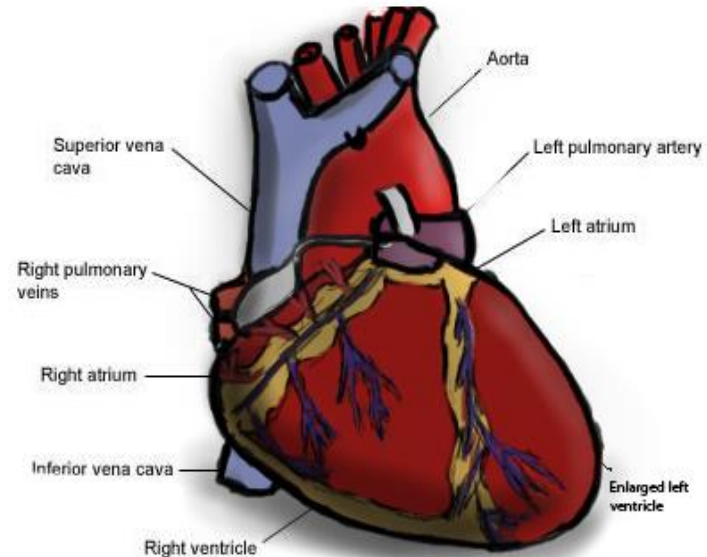
# Cardiac Hypertrophy

Hearts overworked by pumping against elevated pressures also “hypertrophy” and enlarge.

## Normal Heart

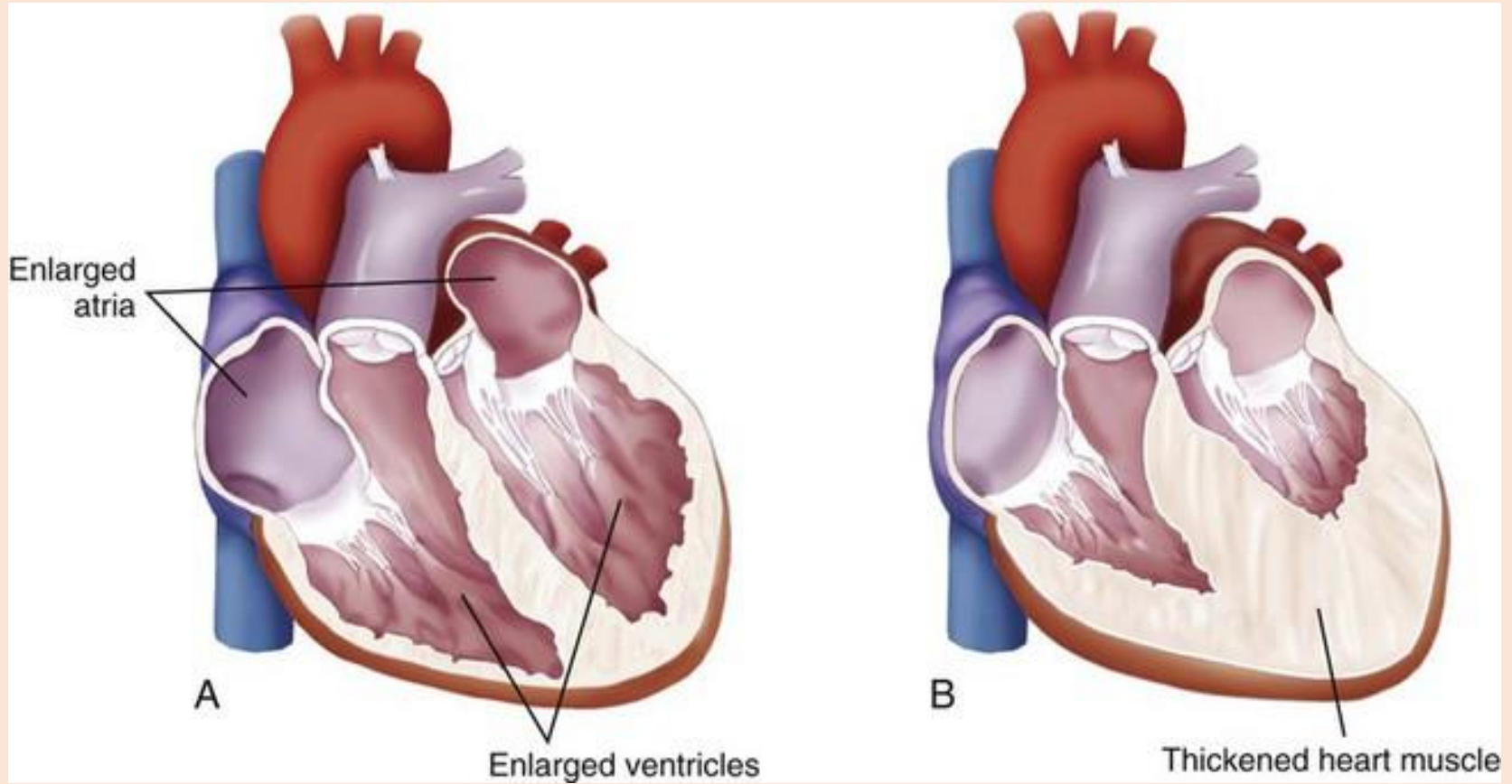


## Enlarged Heart

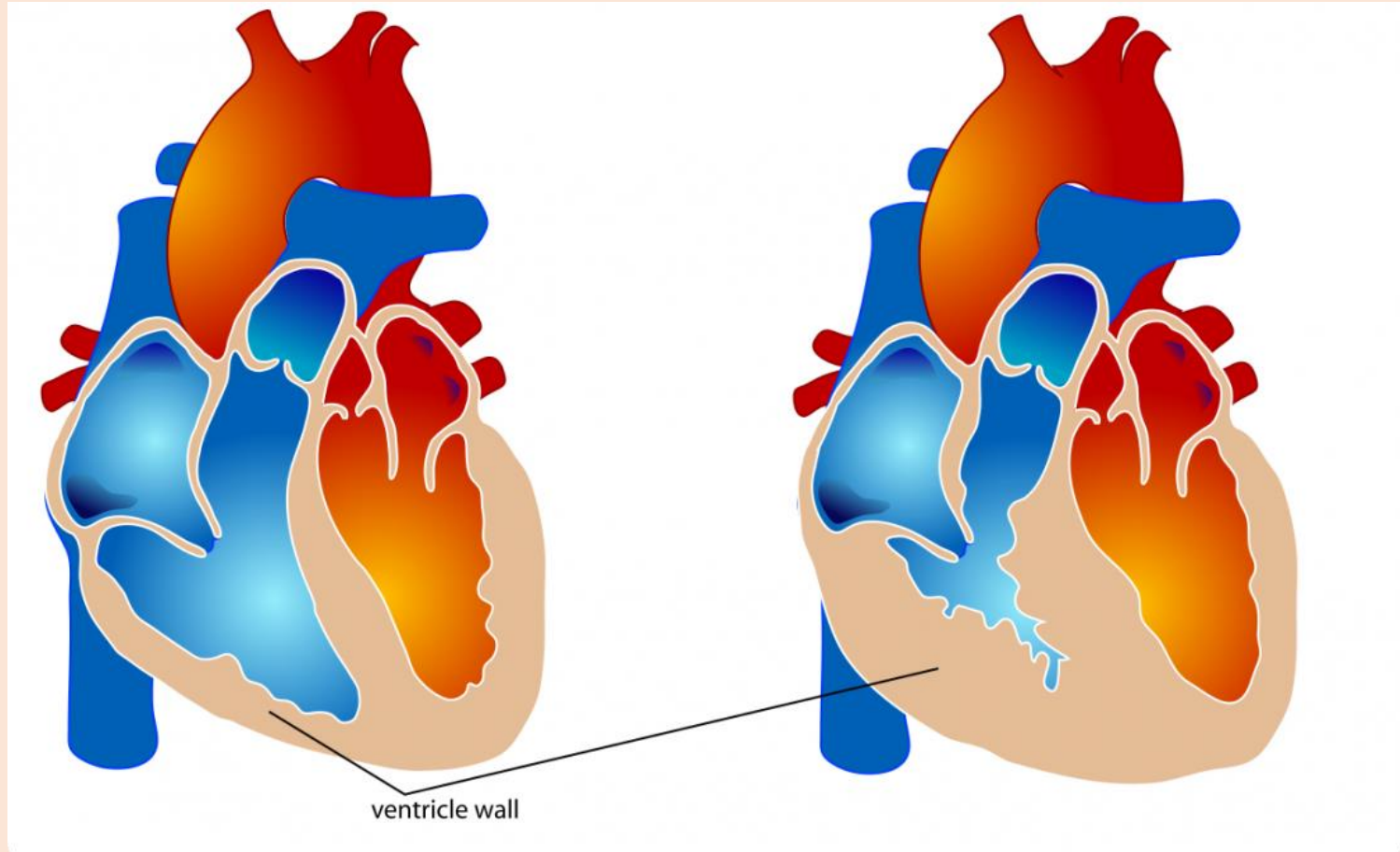




# LV Hypertrophy



# RV Hypertrophy

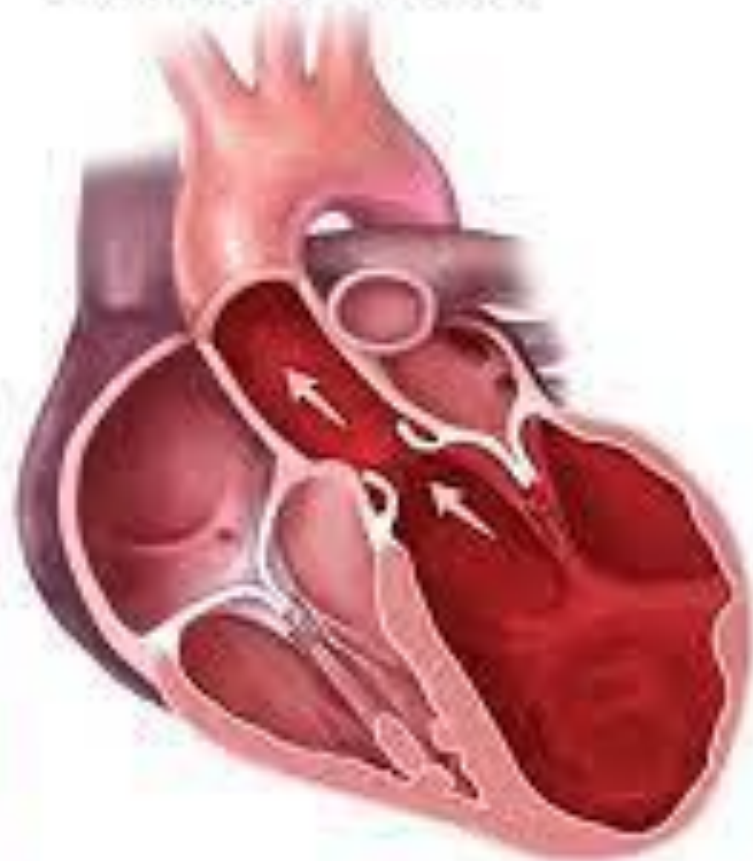


# Dilated Cardiomyopathy

Normal

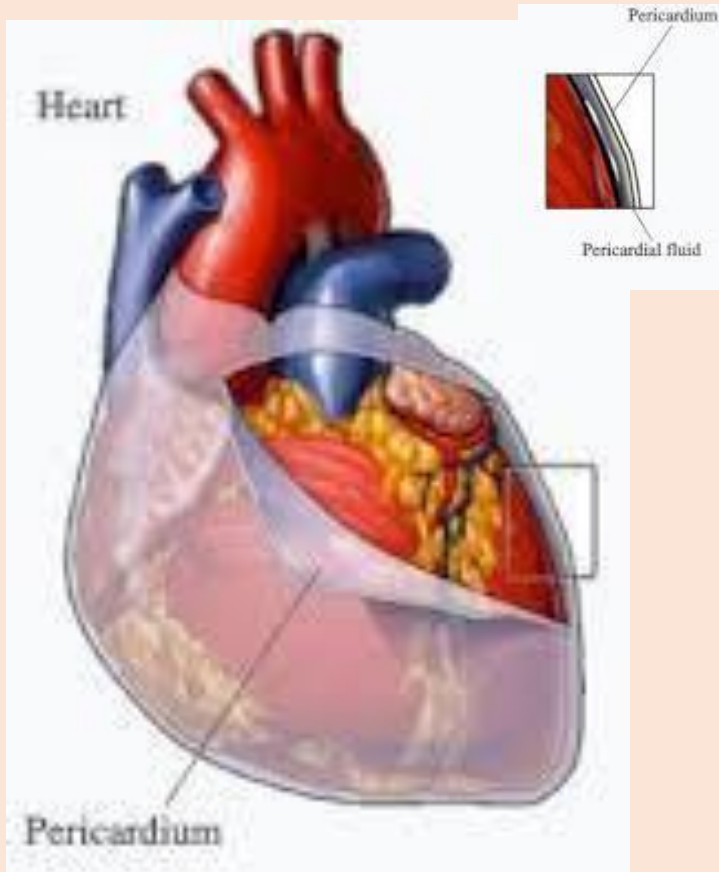


Dilated Cardiomyopathy





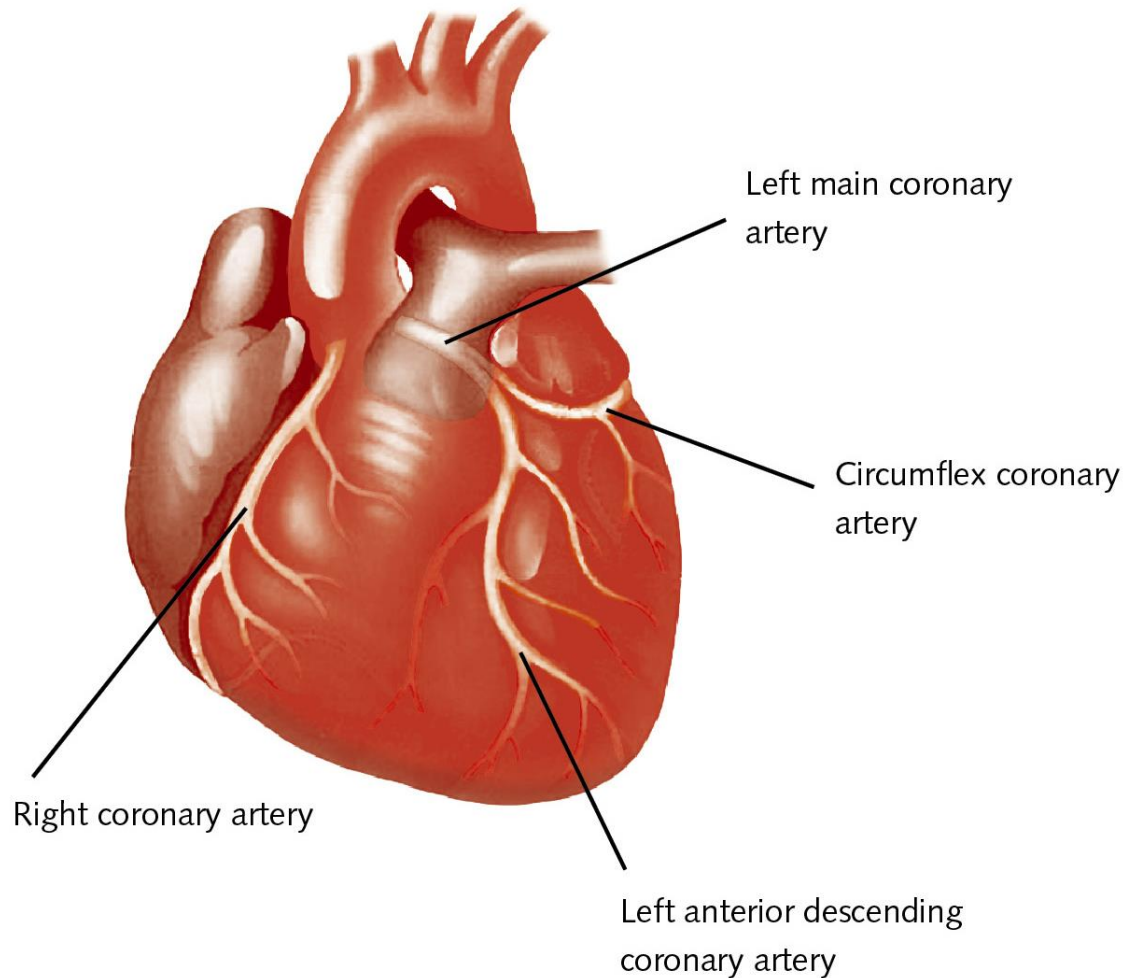
# Heart Covering



The **pericardium** is a double-walled sac containing the [heart](#) and the roots of the [great vessels](#). The pericardial sac has two layers, a serous layer and a fibrous layer. It encloses the pericardial cavity which contains [pericardial fluid](#).

The pericardium fixes the heart to the [mediastinum](#), gives protection against infection, and provides the lubrication for the heart.

# Coronary Arteries



SUPERIOR VENA CAVAL  
BRANCH (NODAL ARTERY)

ANTERIOR R. ATRIAL  
BRANCH OF  
R. CORONARY  
ARTERY

RIGHT  
CORONARY  
ARTERY

ANTERIOR  
CARDIAC  
VEINS

SMALL  
CARDIAC VEIN

STERNOCOSTAL  
ASPECT

L. CORONARY ARTERY

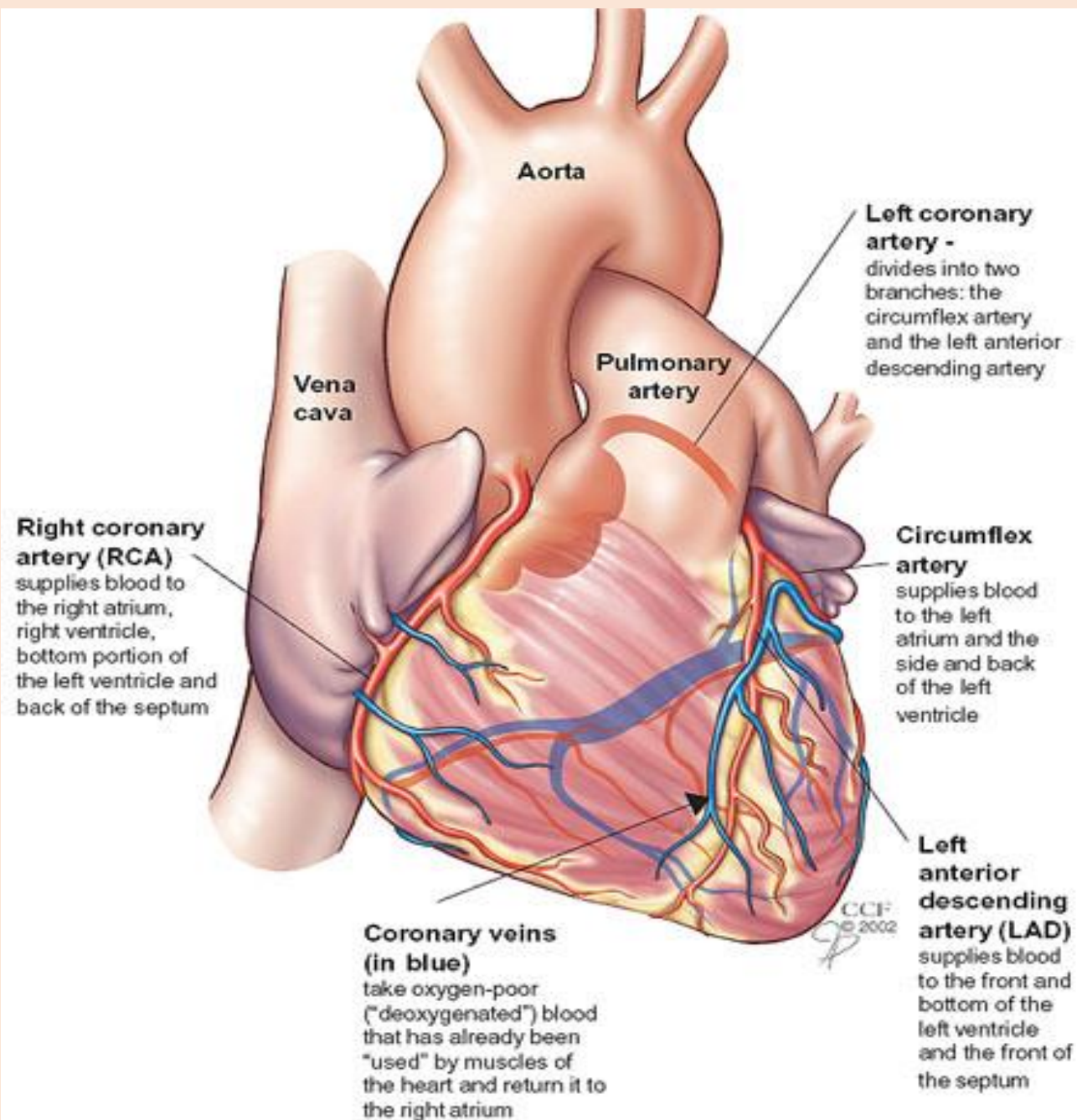
CIRCUMFLEX BRANCH OF  
L. CORONARY ARTERY

GREAT CARDIAC VEIN

ANTERIOR  
INTERVENTRICULAR  
(ANTERIOR DESCENDING)  
BRANCH OF L.  
CORONARY ARTERY

*F. Netter*  
M.D.  
© CIBA





# So What Could Possibly Go Wrong?



Diseases of Heart Muscle

Diseases of Valves

Diseases of Arteries

Diseases of Coverings

Diseases of Conduction

Compromises  
Function