Cardiovascular system

Objectives:

1. Identify the components of the cardiovascular system.
2. Describe the Heart in regard to (position, chambers and valves).
3. Describe the Blood vessels (Arteries, Veins and Capillaries).
4. Describe the Portal System.
5. Describe the Functional and Anatomical end arteries.
6. Describe the Arteriovenous Anastomosis.
7. Describe the component of the blood and its function.
8. Describe the Sinusoids.

The Cardiovascular System

Consist of :

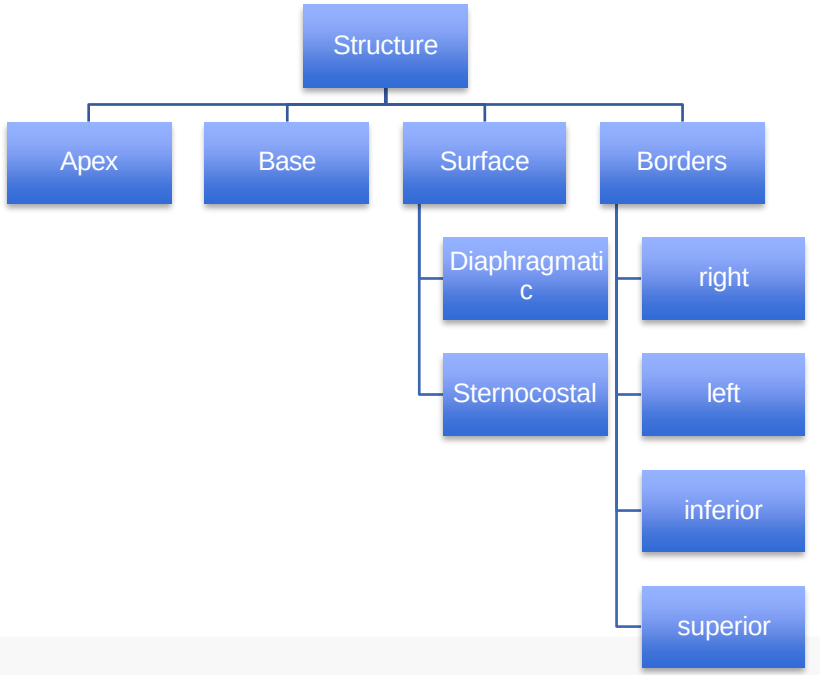
1. Heart: pumps blood throughout the body .
2. Blood vessels: a network of tubules.
3. Blood

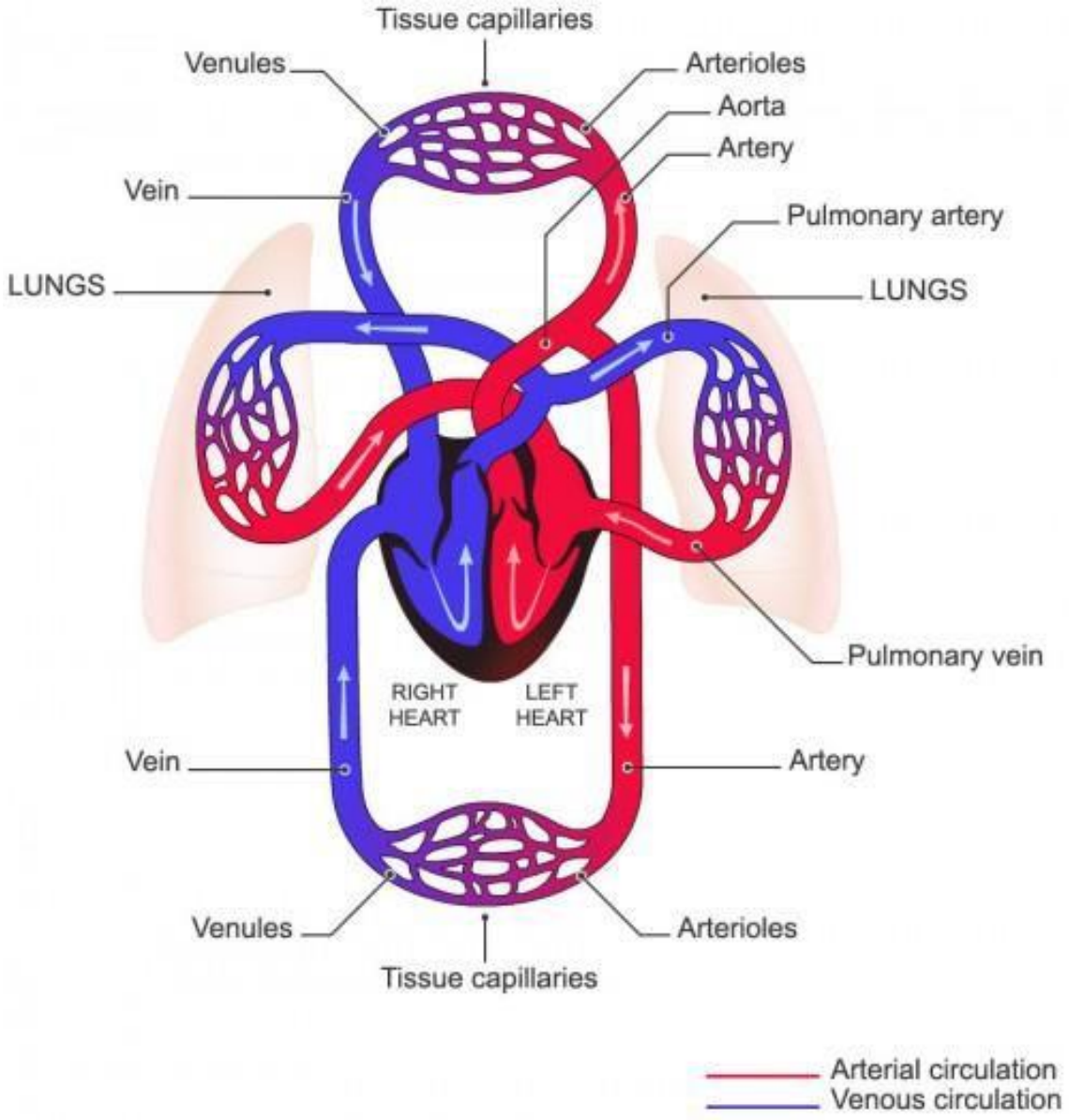
Functions:

1. It is a transportation system which uses the blood as the transport vehicle .
2. It carries oxygen , nutrients, cell wastes, hormones and many other substances vital for body homeostasis.
3. It provides forces to move the blood around the body .

Structure of the heart:

- It is a hollow, cone shaped muscular pump that keeps circulation going on
- It is the size of the hand's fist of the same person.
- It has : Apex , base surface and borders




Tissue capillaries
Venules
Arterioles
Aorta
Artery
Vein
Pulmonary artery
LUNGS
LUNGS
Pulmonary vein
RIGHT HEART
LEFT HEART
Vein
Artery
Venules
Arterioles
Tissue capillaries
Arterial circulation
Venous circulation

Location of the heart

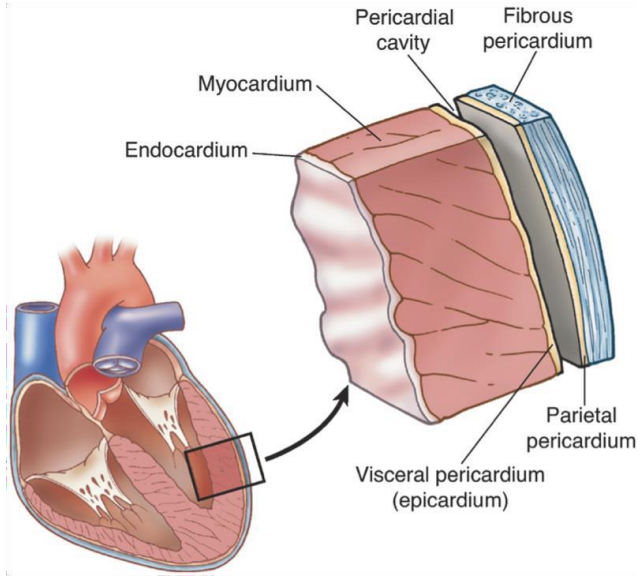
It is located in the thoracic cavity in a place known as the Middle Mediastinum between the two pleural sacs.

oEnclosed by a double sac of serous membrane (Pericardium).

o2/3 of the heart lies to the left of median plane.

oThe outer wall of the heart is made up of three layers:

- Epicardium
- Myocardium (muscle of the heart)
- Endocardium



Chambers of the heart

Atria:

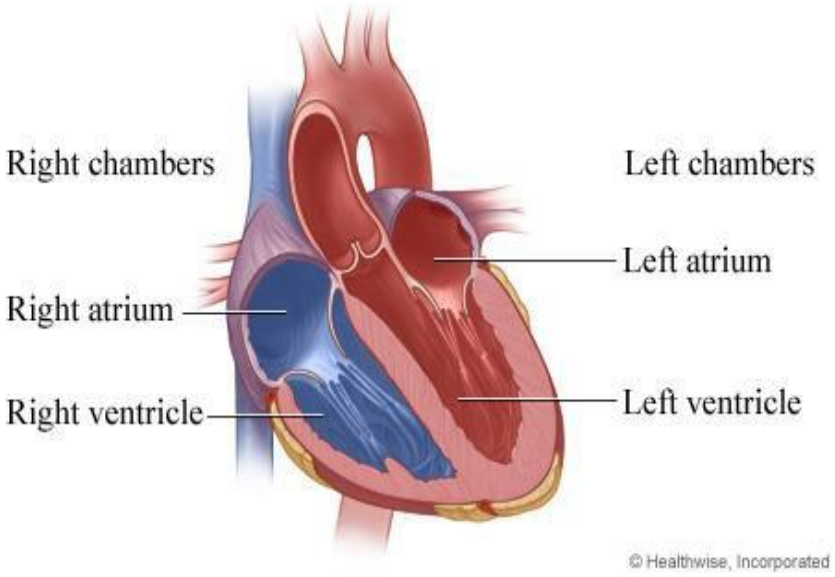
•They are two (Right & Left).

•Superior in position.

•They are the receiving chambers.

•They have thin walls.

•
The upper part of each atrium
•is the Auricle.



•The Right Atrium receives the venous blood coming to the heart.

•The Left Atrium receives arterial blood coming from the lungs.

VENTRICLES:

•The inferior chambers.

•They are two (right & left).

•They have thick walls.

•They are the discharging chambers (actual pumps).

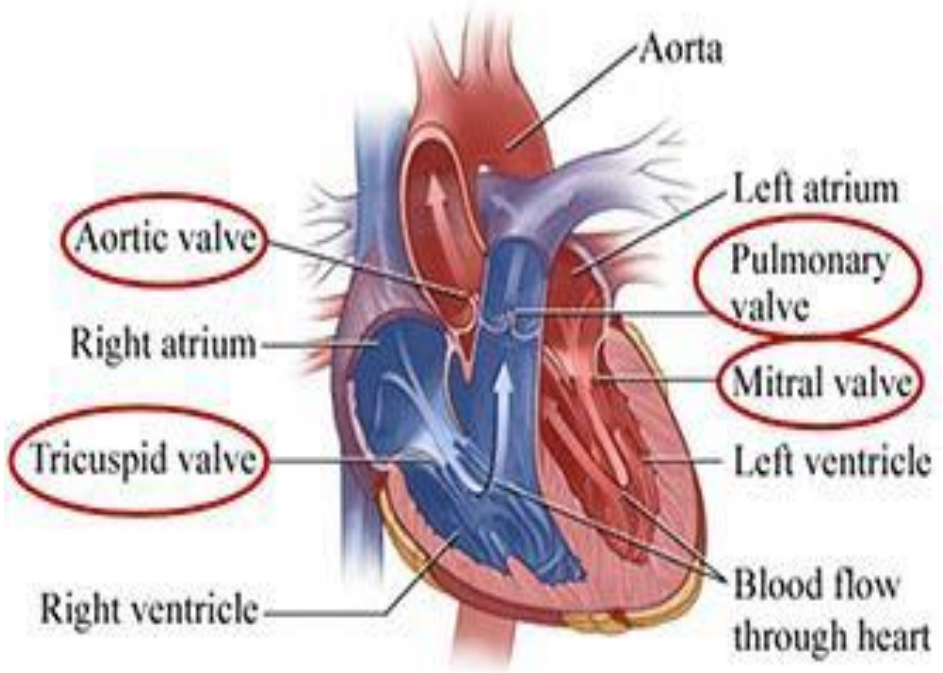
• Their contraction propels blood out of the heart into the circulation.

•The left ventricle forms the apex of the heart.

Valves of the heart

The heart has FOUR VALVES:

- **Two Atrio-Ventricular valves.**
- **One Aortic Semilunar valve.**
- **One Pulmonary Semilunar valve**



ATRIOVENTRICULAR VALVES:

- Location: between atria & ventricles.
- Function: they allow the blood to flow in one direction from the atria to the ventricles.
- 1-Right AVV (Tricuspid).
- 2-Left AVV (Bicuspid/Mitral).

SEMILUNAR VALVES (AORTIC & PULMONARY):

- Location: between the right and left ventricles and the great arteries leaving the heart (Aorta & Pulmonary trunk).
- Function: they allow the flow of blood from the ventricles to arteries.

BLOOD CIRCULATION

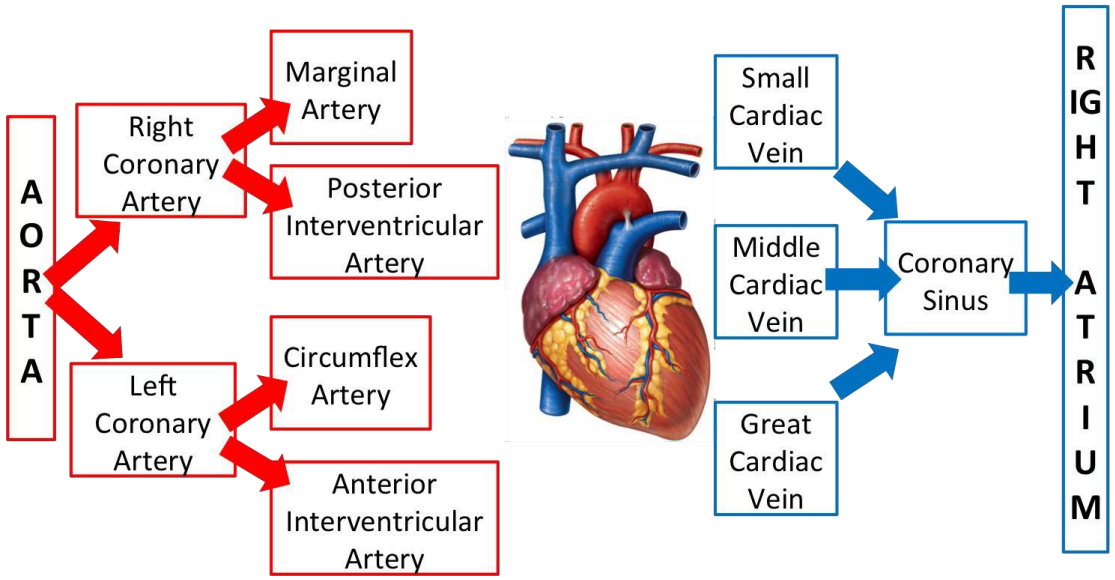
CARDIO PULMONARY	SYSTEMIC
BETWEEN THE HEART AND THE LUNGS	BETWEEN THE HEART AND THE BODY
The right side of the heart (the right atrium & ventricle) receive deoxygenated blood	The left side of the heart (left atrium & ventricle) receive the oxygenated blood from the lungs
Blood is pumped to the lungs through the pulmonary Artery	Blood is pumped from the left ventricle to all body tissues through the Aorta and its systemic arteries
Gas exchange takes place in the lungs	The blood ultimately terminates in capillaries
It returns to the left side of the heart through 4 pulmonary veins	Deoxygenated blood circulates from the tissues to the capillaries, venules & veins back to the right atrium of the heart through the systemic veins

CORONARY CIRCULATION

- The heart has its own blood vessels that provide the myocardium with the oxygen and nutrients necessary to be able to pump blood to the body.
- The left and right coronary arteries branch off from the aorta and provide blood to the left and right sides of the heart.
- The coronary sinus is a vein on the posterior side of the heart that returns deoxygenated blood from the myocardium to the vena cava.
- Great, middle and small coronary veins drain into coronary sinus.
- Coronary sinus drains into right atrium.

For extra explanation visit this link:
https://www.youtube.com/watch?v=xSnFf62GDBI

Coronary Circulation



Why do Arteries have thick walls?

Arteries have much **thicker walls** than other blood vessels in order to withstand the higher blood pressure that propels oxygenated blood away from the heart

Blood vessels

Veins

- The smallest veins are Venules
- Thin walled
- Many of them posses valves

Arteries

- The smallest arteries are arterioles
- Thick walled and do not have valves

Capillaries

- Connect arterioles and venules
- Help enable the exchange of water , oxygen and nutrients between blood and the tissues

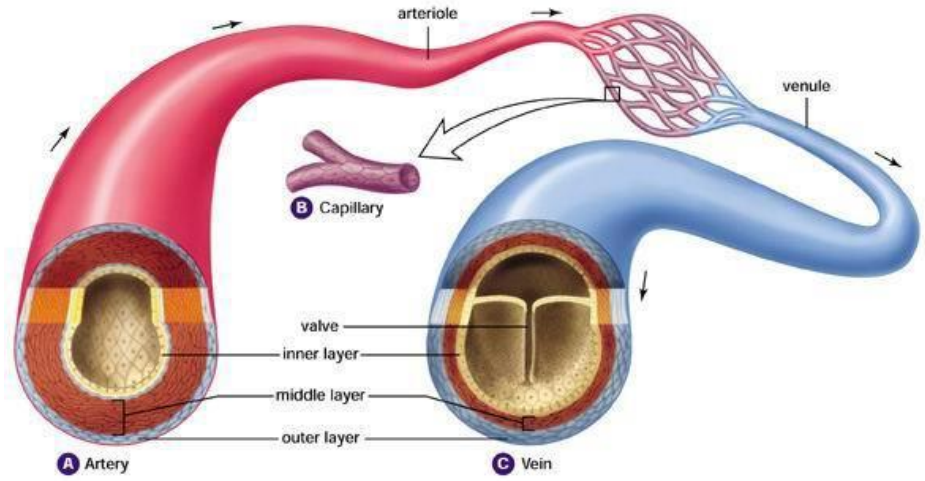


Figure 9.12. Sections through an artery, capillary, and vein. At any given moment, about 30% of the blood in your systemic circulation will be found in the arteries, 5% in the capillaries, and 65% in the veins.

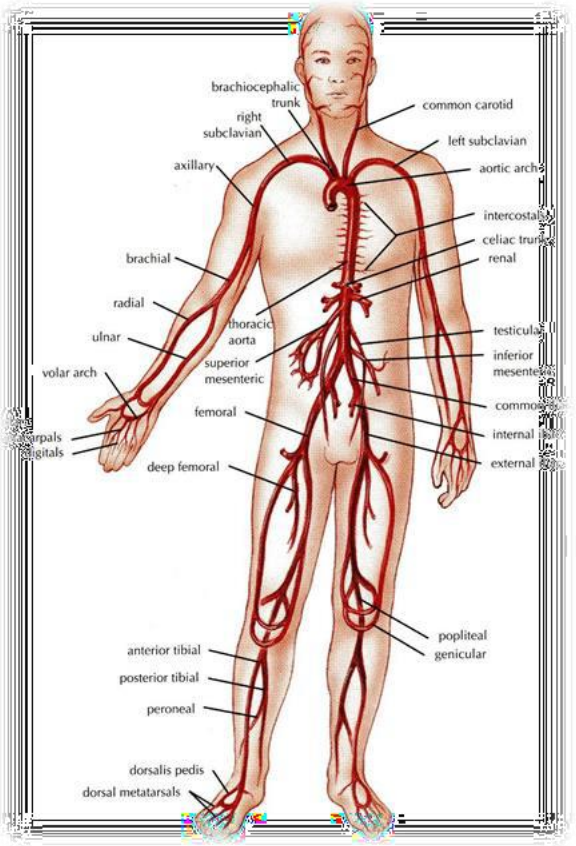
Arteries

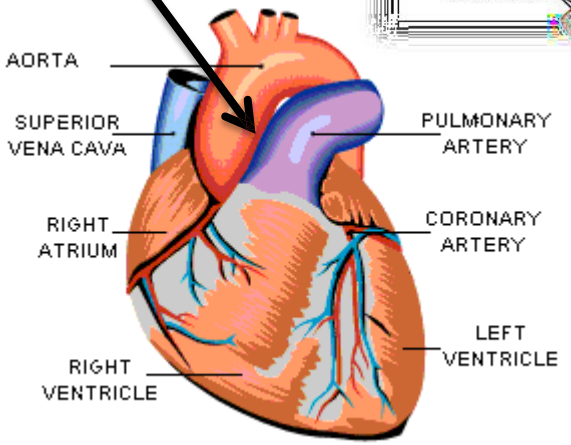
- They transport blood from the heart and distribute it to the various tissues of the body through their branches.
- Carry oxygenated blood away from the heart.
  - TWO EXCEPTIONS:
    - The pulmonary arteries.

Carries deoxygenated blood from the heart to the lungs.

    - The umbilical arteries.

Supplies deoxygenated blood from the fetus to the placenta in the umbilical cord.





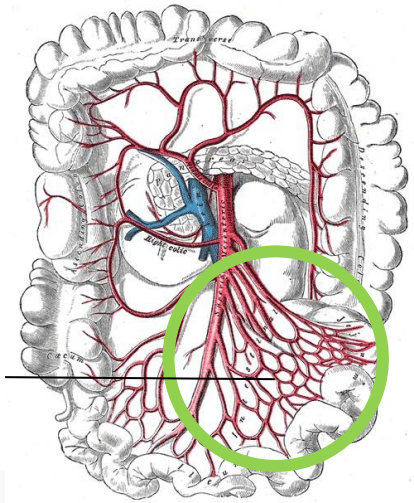
Anastomosis

Anastomosis: the connection between two structures (arteries, veins, or an artery and a vein)

Arterial anastomosis: is the joining of terminal branches of the arteries.

Function: It serves as a backup route if one of the branches is cut off(or blocked), allowing the blood to flow through other branches.

e.g. abdominal anastomosis (see picture)
intestinal arteries

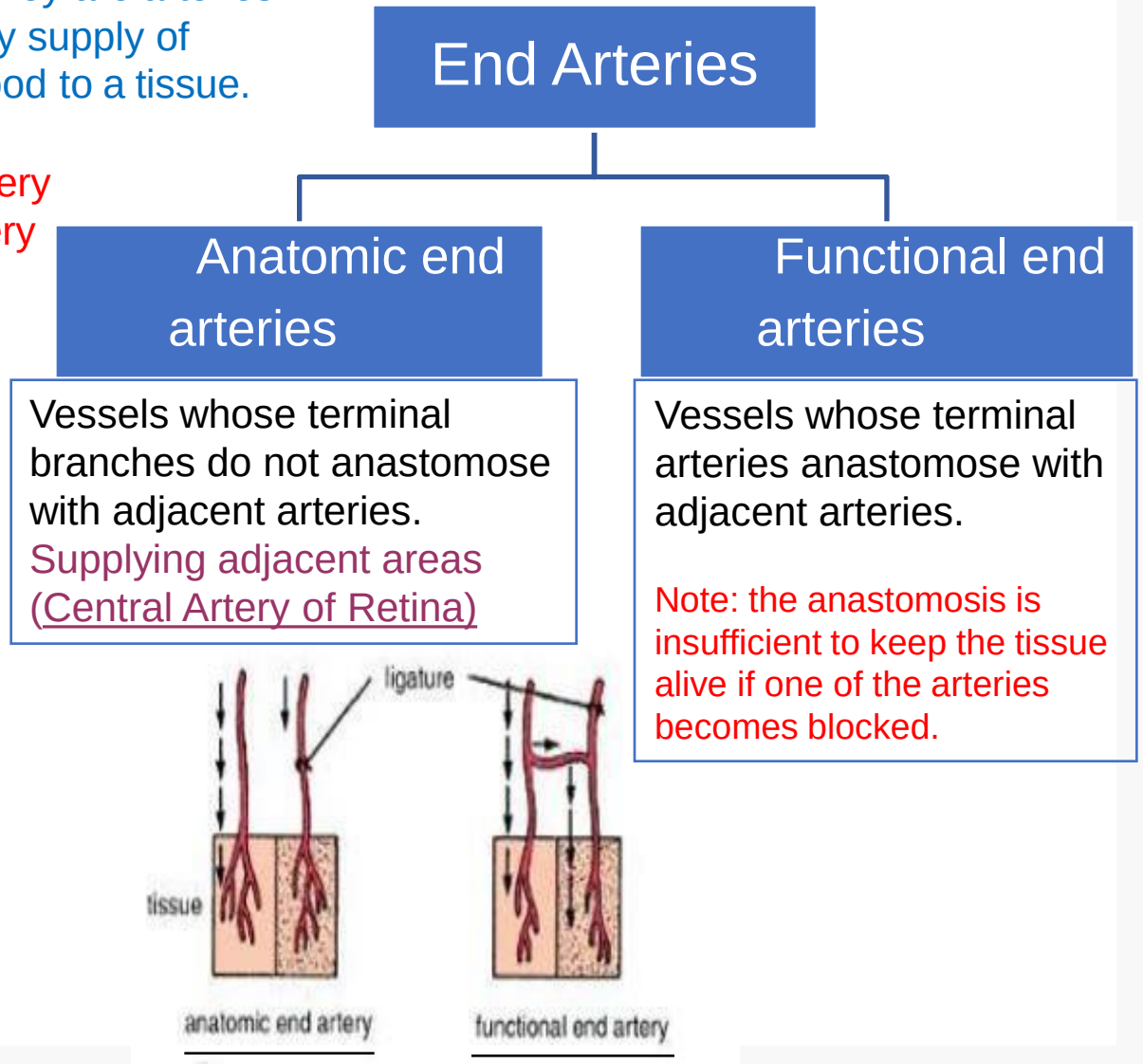


Arterial anastomosis

End Arteries

End Arteries: They are arteries that are the only supply of oxygenated blood to a tissue.

e.g. Splenic artery
Renal artery



Veins

- They transport blood back to the heart.
- The smaller venules (Tributries) unite to form larger veins which commonly join with one another to form Venous Plexuses.
- Carry deoxygenated blood towards the heart in all situations except two:

Pulmonary vein: carries the oxygenated blood from the lungs back to the heart (left atrium)

Umbilical vein: Carries the oxygenated blood from the placenta towards the fetus

Note: Veins do not branch they only unite.

Deep Veins (Venae Comitantes)

•They are two veins that accompany medium sized deep arteries.

•They are found in close to arteries so that the pulsations of the artery aid venous return.

•Venae comitantes are usually found with smaller arteries, especially those in the limbs**. Larger arteries do not have venae comitantes. They usually have a single, similarly sized vein.**

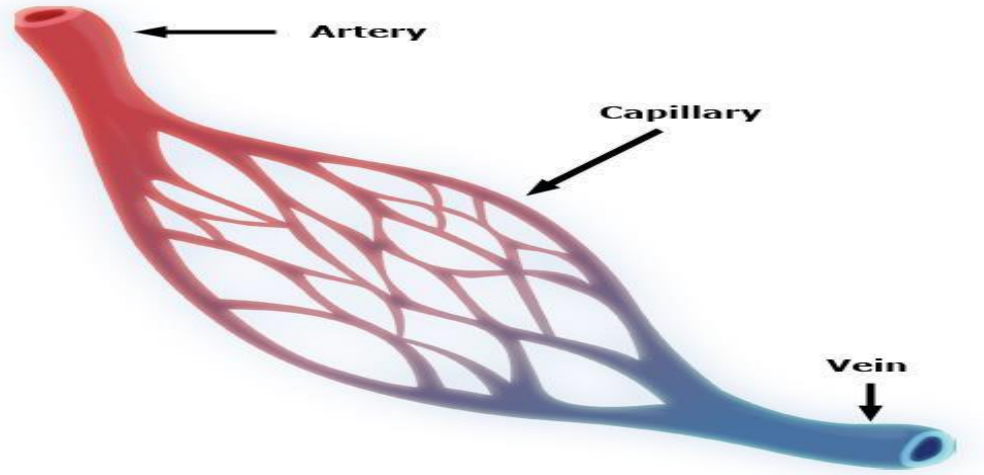
CAPILLARIES

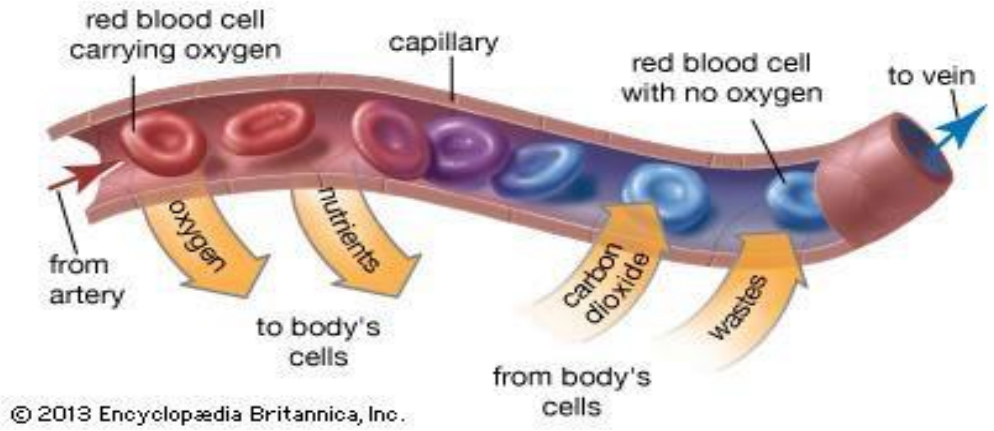
- Microscopic vessels in the form of a network.

Function:

- They connect the Arterioles to the Venules.

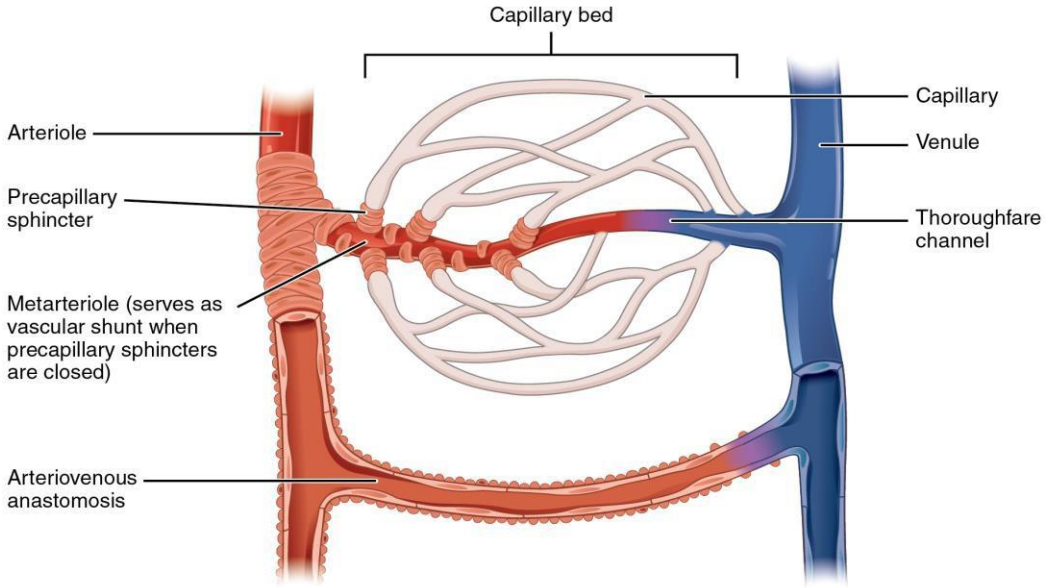
- They help to enable the exchange of water, oxygen and many. other nutrients between blood and the tissues.





ARTERIOVENOUS ANASTOMOSIS

- Direct connections between the arteries and veins without the intervention of capillaries.
- Found in tips of the fingers and toes.



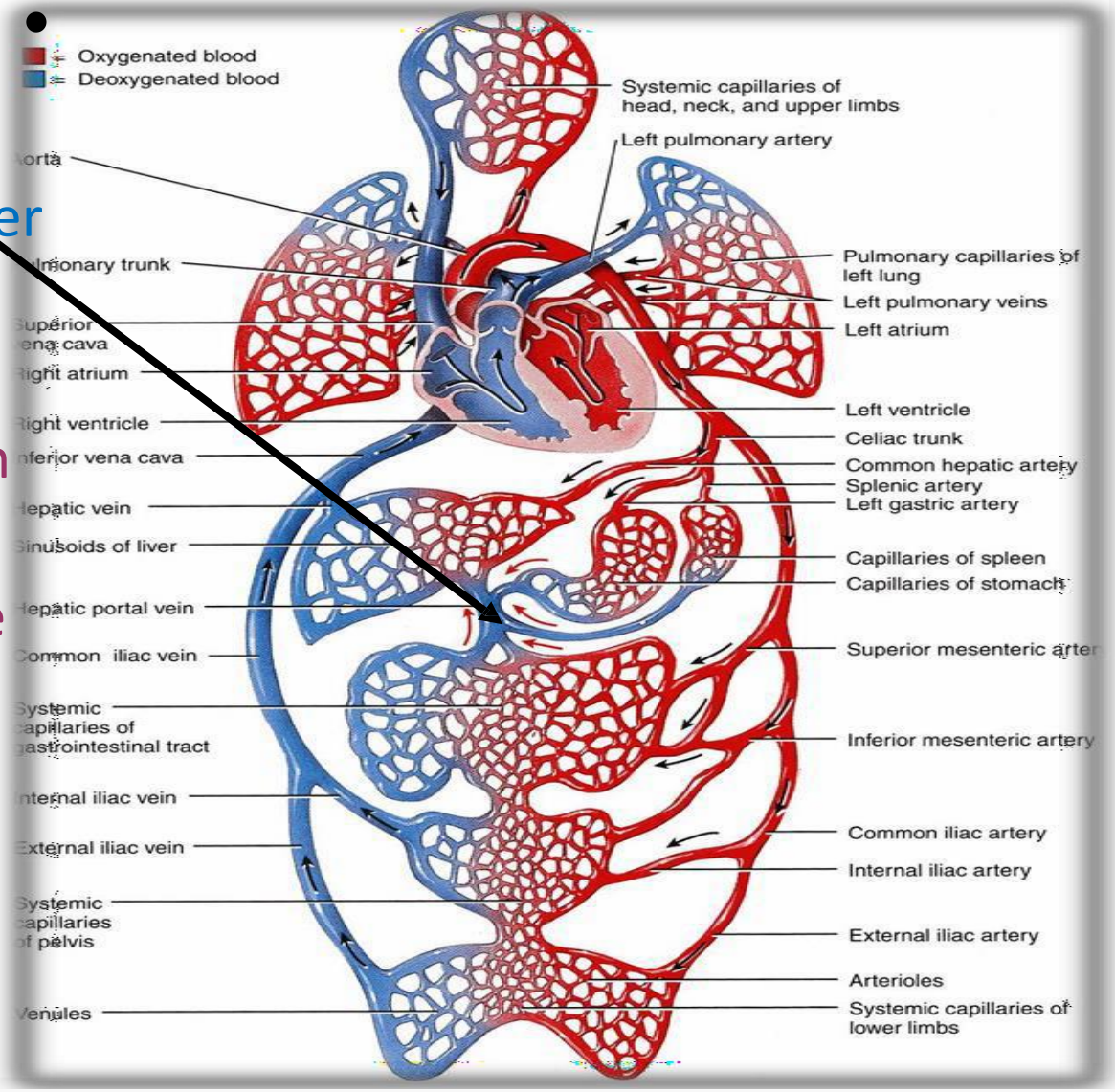
Portal circulation

Portal Venous System occurs when a capillary bed pools into another capillary bed through veins, without first going through the heart.

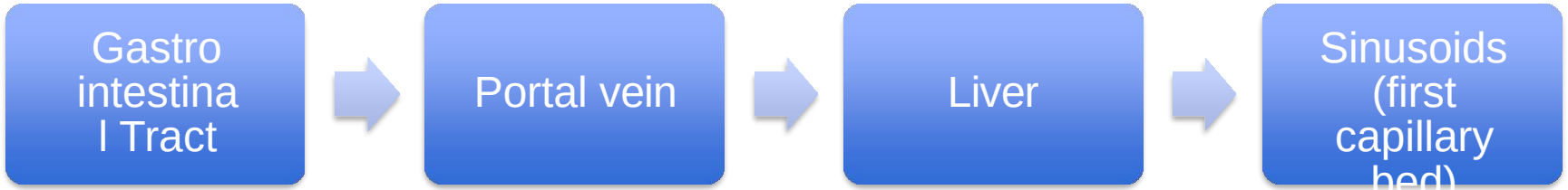
It is a system of vessels interposed between Two Capillary Beds.

Takes place in the liver and some endocrine glands (pituitary gland).

The purpose of **hepatic** portal **circulation** is to deliver blood from some parts of the gastrointestinal tract to the liver. In other words, blood is drained from the digestive organs (and the spleen, gall bladder, and pancreas) and the blood is then delivered to the liver.



Portal Circulation



- Veins leaving the gastrointestinal tract do not go direct to the heart.
- They pass to the Portal Vein.
- This vein enters the liver and breaks up again into veins of diminishing size which ultimately join capillary like vessels (Sinusoids).
- Venous blood enter 2nd capillary bed then to smaller veins that leave the liver through the hepatic vein.

Sinusoids are:
Thin walled blood vessels like capillaries. Wider with irregular cross diameter.
Found in : liver, spleen, bone marrow, pituitary gland .

The sinusoids will get rid of the food by giving it to the liver cells which are surrounded by them .

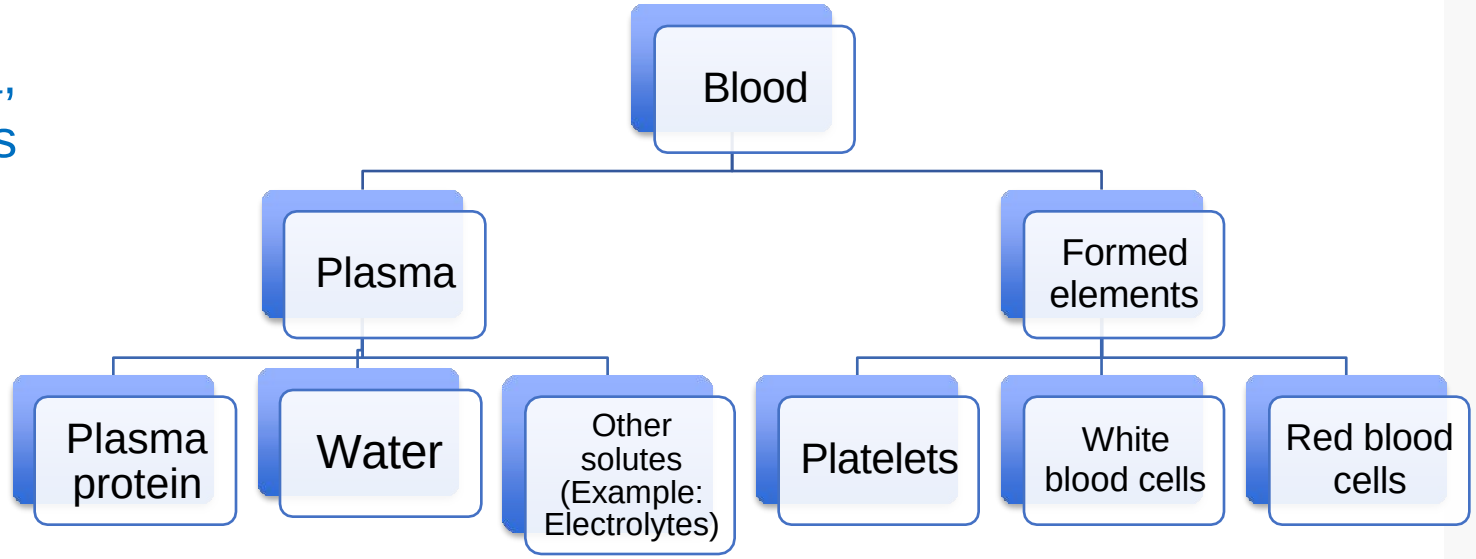
Why doesn't the blood go straight to the heart? Because it contains food with Venus blood (food can't go to the heart).

Structure and function of the heart

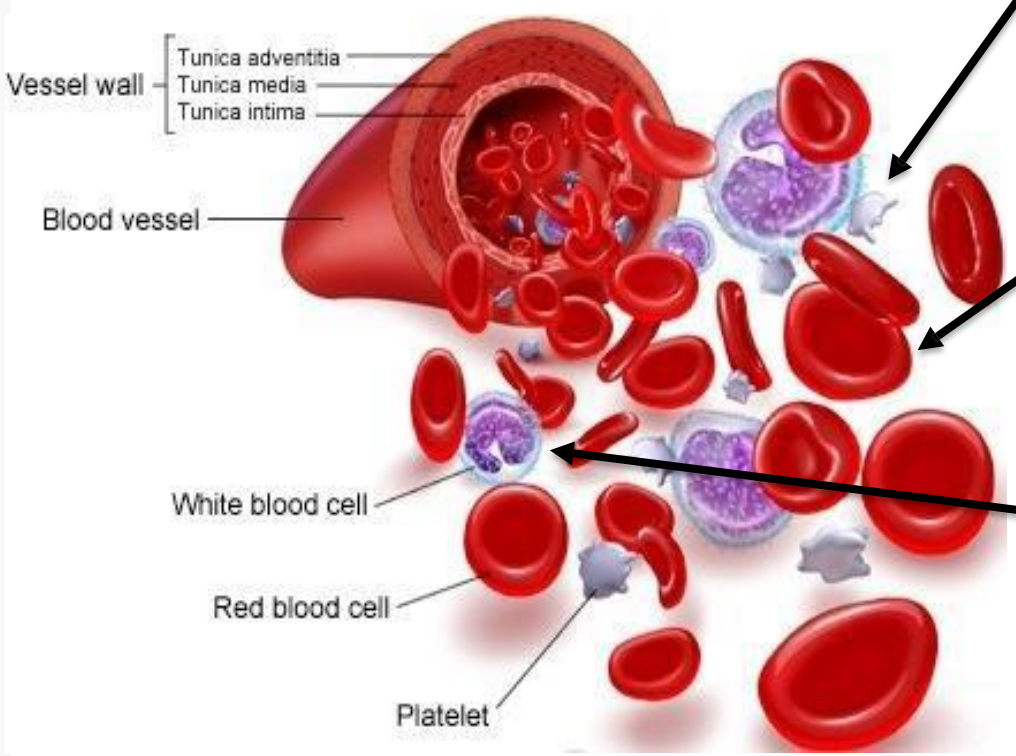
Structure	Function
Septum	Prevents mixing of oxygenated and deoxygenated blood
Aorta	Carries oxygenated blood
Pulmonary artery	Carries deoxygenated blood to the lung
Pulmonary vein	Carries oxygenated blood from the lung to the heart
Superior vena cava	Returns deoxygenated blood from head and arms to heart
Inferior vena cava	Returns deoxygenated blood from lower limbs and organs to heart

BLOOBLOOD

- Blood is the actual carrier of the oxygen and nutrients into arteries.
- Blood is made mostly of plasma, which is a yellowish liquid that is 90% water.
- Plasma contains also salts, glucose and other substances.
- Most important, plasma contains proteins that carry important nutrients to the body's cells and strengthen the body's immune system.
- Blood has main 3 types of blood cells that circulate with the plasma.



TYPES OF BLOOD CELLS



PLATELETS:

Helping the blood to clot. Clotting stops the blood from flowing out of the body when a vein or artery is broken. Platelets are also called thrombocytes.

RED BLOOD CELLS

Carry oxygen. A healthy adult has about 35 trillion of them. Red blood cells are also called erythrocytes.

WHITE BLOOD CELLS

These cells, which come in many shapes and sizes, are vital to the immune system against infections. When the body is fighting off infection, they increase. White blood cells are also called leukocytes.

Cardiovascular Diseases

HEART ATTACK

Occurs when blood flow to a part of the heart is blocked by a blood clot. If this clot cuts off the blood flow completely, the part of the heart muscle supplied by that artery begins to die. Most people survive their first heart attack and return to their normal lives to enjoy many more years of productive activity.

ISCHEMIC STROKE

Happens when a blood vessel that feeds the brain gets blocked, usually from a blood clot. When the blood supply to a part of the brain is shut off, brain cells will die.

HEMORRHAGIC STROKE

Occurs when a blood vessel within the brain bursts. The most likely cause is uncontrolled hypertension.

HEART FAILURE

It means the heart isn't pumping blood as well as it should. The heart keeps working, but the body's need for blood and oxygen isn't being met.

ARRHYTHMIA

This is an abnormal rhythm of the heart.

The heart can beat too slow, too fast or

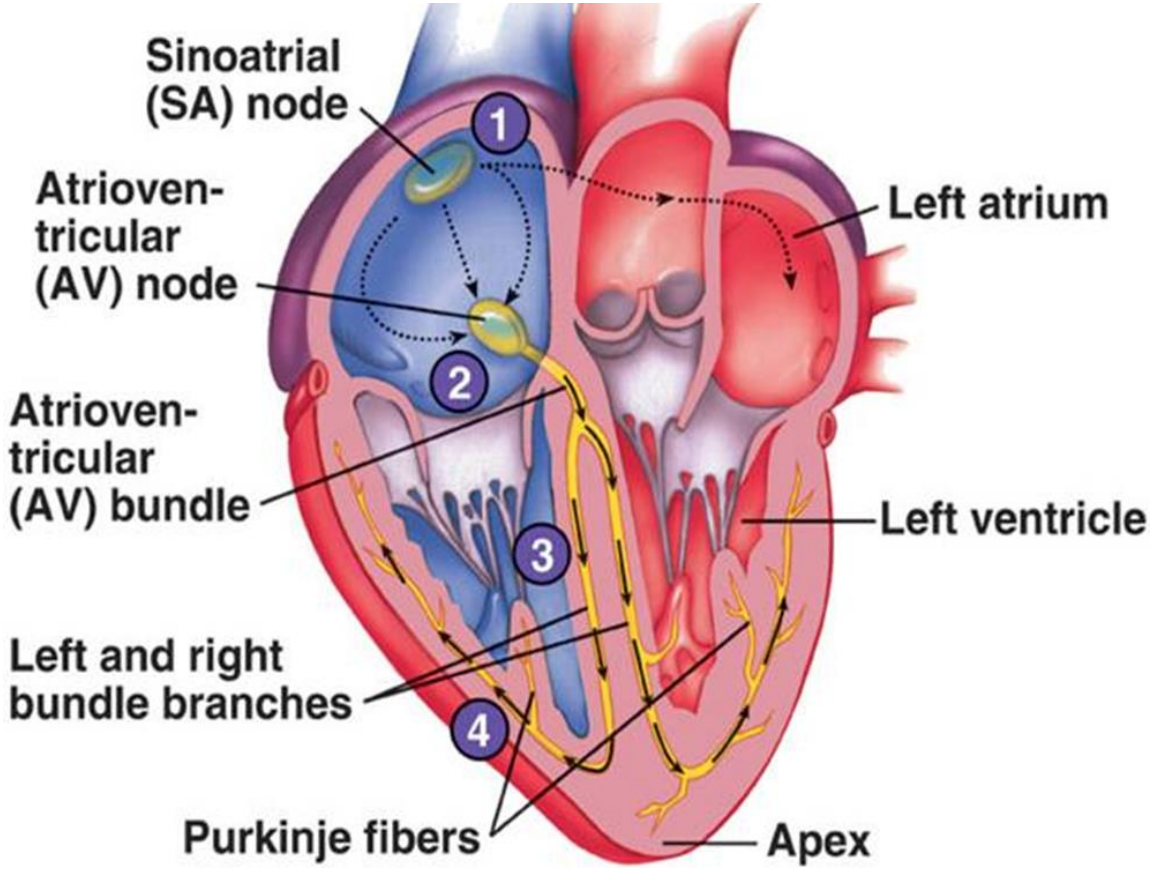
HEART VALVE PROBLEMS

When heart valves don't open enough to allow the blood to flow through as it should.

COMPONENTS OF CONDUCTIVE SYSTEM

- SA node
- Inter-nodal pathways
- A-V node
- A-V bundle
- Right bundle branch
- Left bundle branch
- Purkinje fibers

COMPONENTS OF CONDUCTIVE SYSTEM

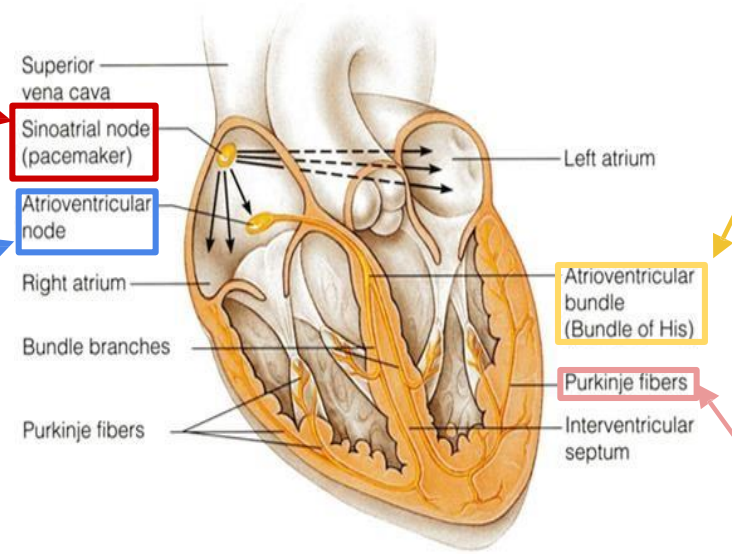


Conduction system of the heart

- The **beating of the heart** is regulated by the **intrinsic conduction (nodal) system.**
- Its function is to ensure that the chambers of the heart contract in the proper rhythm and sequence

The **main center** is the **sinoatrial (SA) node**, located in the right atrium

The **atrioventricular (AV) node** is located at the junction of the atria and the ventricles

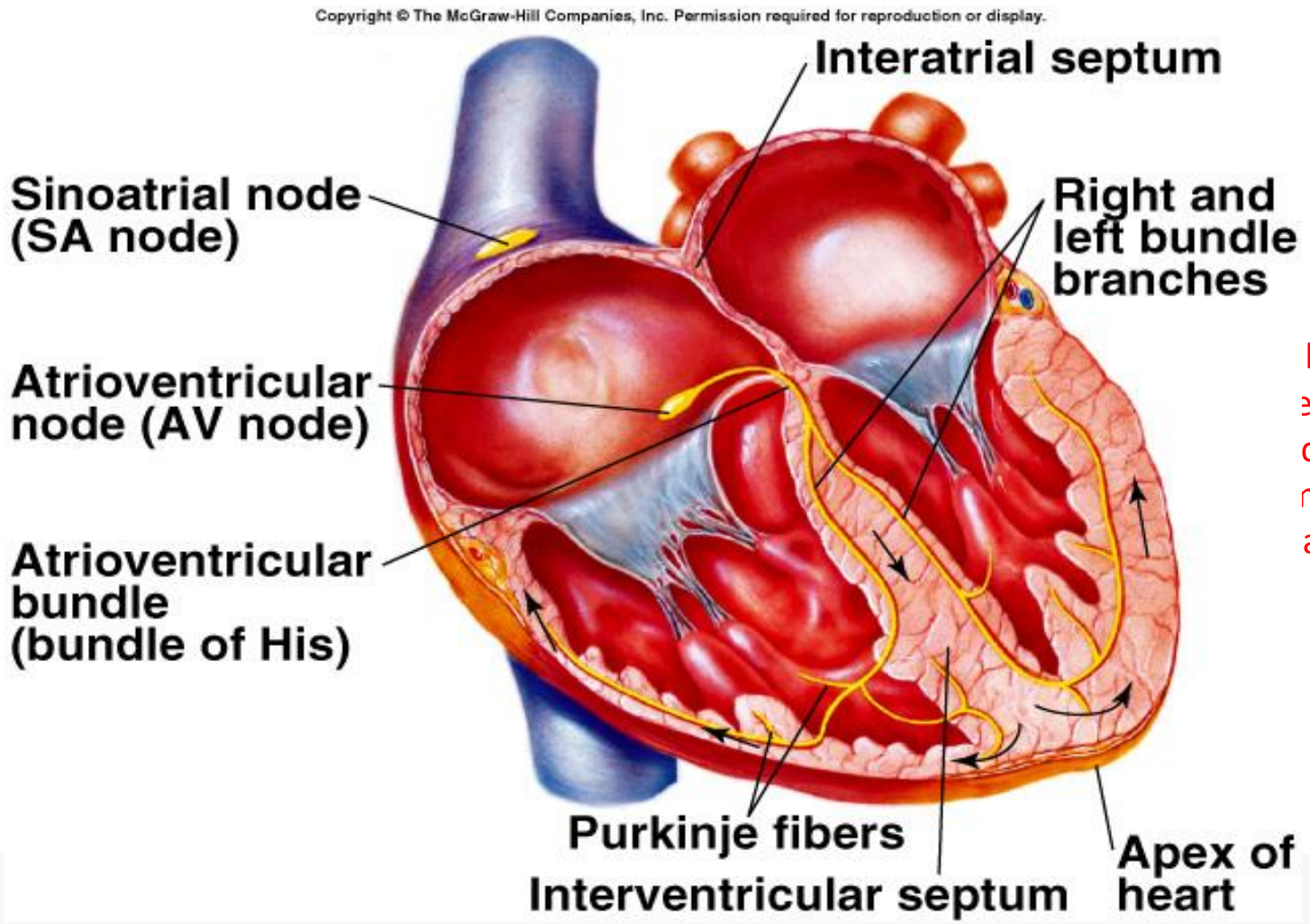


atrioventricular (AV) bundle (bundle of His) is located in the interventricular septum

Purkinje fibers are located inside the walls of the ventricles

The SA node is called the **pacemaker** of the heart, because it generates the impulse.

Conducting Tissues of the Heart



has a special system
enerating rhythmical
cal impulses to cause
nical contraction of
art muscle.

Conducting Tissues of the Heart

Sequence of excitation

Sinus-Atrial node (SA node)

↓

Atria

↓

Atrial-ventricular node (AV node)

↓

Ventricles

↓

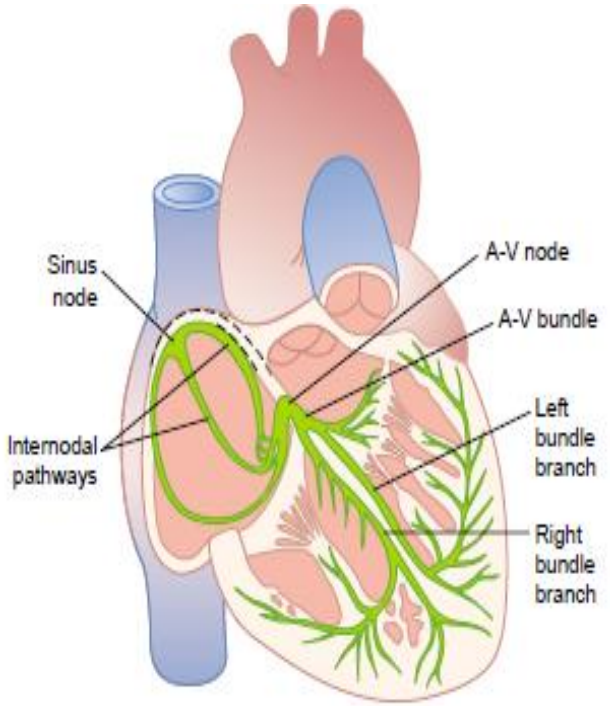
bundle branch of His

↓

Right and left bundle branch of His

↓

Purkinji fibers



SA node

SA node is the pacemaker of the heart.

It is located in the superior wall of the right atrium

Responsible for contraction of the heart.

AV node

**The AV node is located in the posterior wall
right atrium immediately behind the tricuspi
valve.**

Right and Left Bundle Branches

- **Bundle of His splits into two branches which are called right and left bundle branches that lie on the respective sides of the ventricular septum.**

- **From the time the cardiac impulse enters the bundle branches until it reaches the terminations of Purkinje fibers**

Purkinje fibers

- **Purkinje fibers are very large fibers.**

THANK YOU