

INTRODUCTION OF CARDIOVASCULAR SYSTEM (CVS)

Foundation block - Anatomy - Lecture 5



Objectives

By the end of this session, student should be able to:

- ❖ Identify the components of the cardiovascular system.
- ❖ Describe the Heart as regards (position, chambers and valves).
- ❖ Describe the Blood vessels (Arteries, Veins and Capillaries).
- ❖ Describe the Portal System.
- ❖ Describe the Sinusoids.
- ❖ Describe the Functional and Anatomical end arteries.
- ❖ Describe the Arteriovenous Anastomosis.

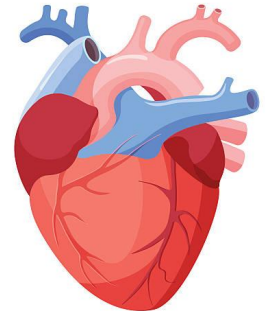
Color guide :

Only in boys slides in **Green**

Only in girls slides in **Purple**

important and doctors note in **Red**

Extra information in **Blue**

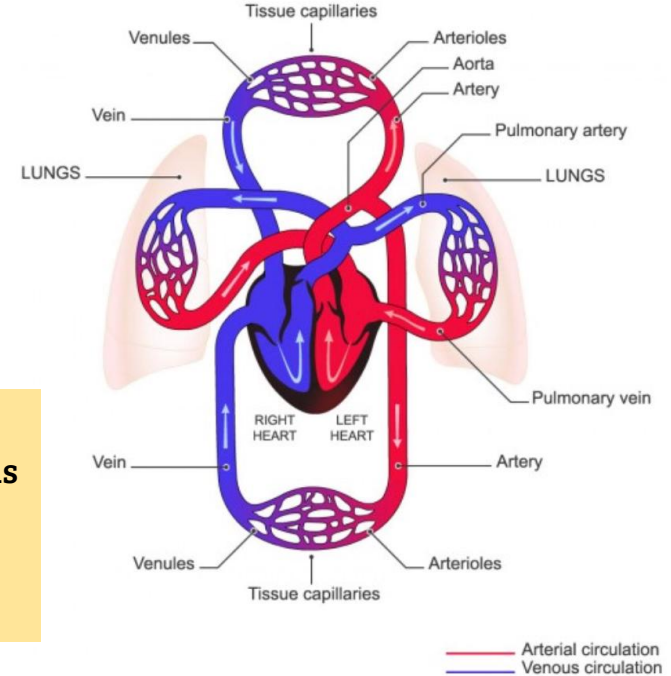


The Cardiovascular System

CVS is comprised of :

- Pump : **Heart** » pumps blood throughout the body .
- Network of tubules : **Blood vessels**

Boys slides



Arteries

The blood vessels that take blood away from the heart.

Veins

The Blood vessels that return blood to the heart.

Capillaries

Very small vessels that lie between the arteries and veins.

Functions of the CVS :

- It is a transportation system which uses the blood as the transport vehicle
 - Transports ≫ water, oxygen, nutrients and hormones **to cells**.
 - Transports ≫ wastes, including carbon dioxide, **away from the cells**.
 - Helps - maintain correct body temperature.
 - The force to move the blood around the body is provided by ≫ the **beating Heart**.
- (vital for body **homeostasis**)

The heart

Is a hollow, cone shaped muscular pump that keeps circulation going on.

Is a muscular pump responsible for circulation

It is the size of hand's fist of the same person.

It Has:

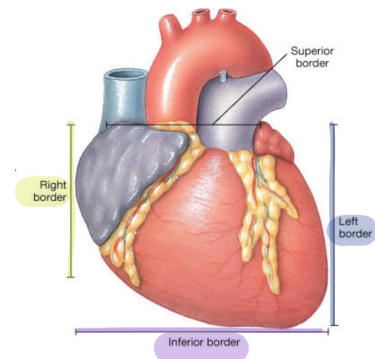
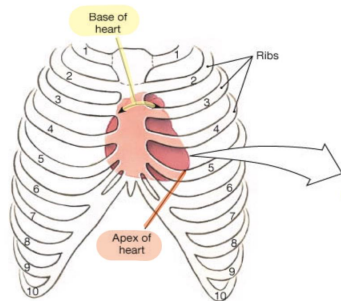
- Apex (قمة)
- Base

Borders:

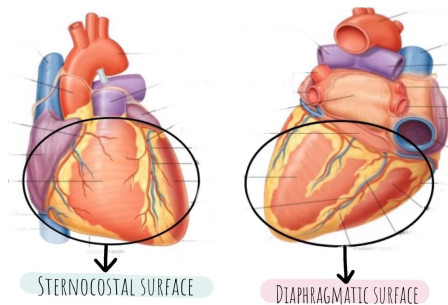
- Right, Left, Inferior

Two Surfaces:

- Diaphragmatic (inferior formed)
- Sternocostal (anterior formed)



Extra note :sternocostal surface of the heart is directed anteriorly, superiorly and slightly to the left. It is formed by the left, right, superior and inferior borders of the heart

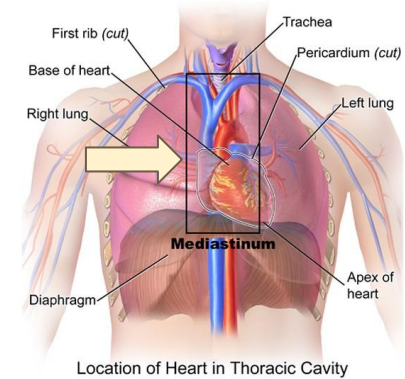


Location of the Heart

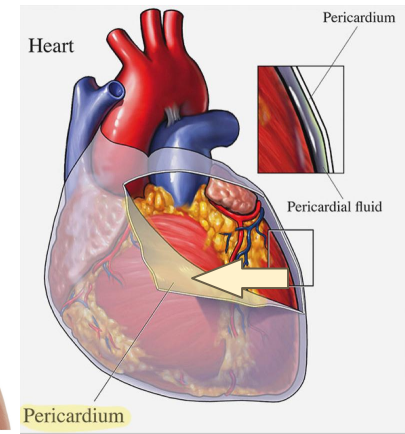
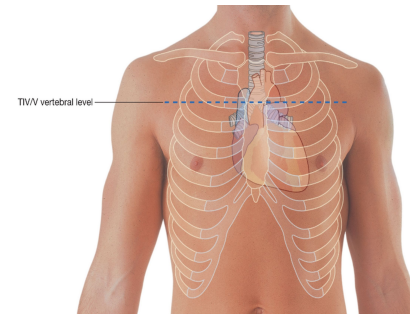
It lies in a centrally located partition in the thoracic cavity Known as the **Middle Mediastinum** (الْمَنْصِيفُ الْأَوْسَطُ) between the two pleural sacs.

Lies obliquely in the thorax between the two pleural sacs. "More specifically within a centrally located partition Known as the **Middle Mediastinum (MEDIA-STI-NUM)**

- **2/3** of the heart lies to the **left of median plane**.
- Enclosed by a **double** sac of **serous** membrane (**Pericardium**).



Location of Heart in Thoracic Cavity



Chambers of the Heart

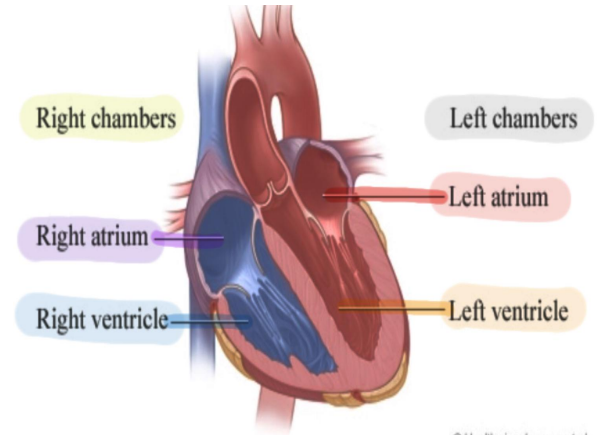
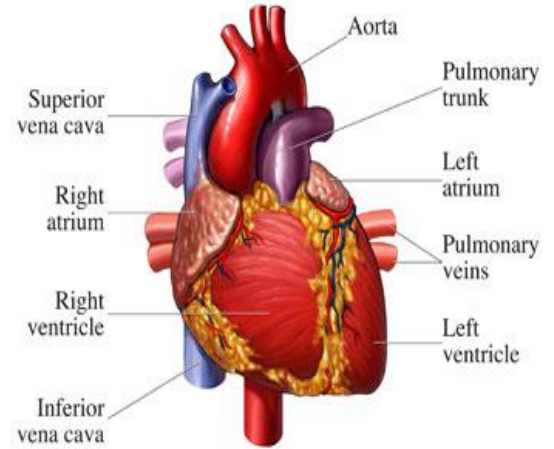
4 CHAMBERS , Two Atria (Right & Left) and Two Ventricles (Right & Left)

Atria:

- **Superior** in position.
- They are the **receiving** chambers.
- They have **thin** walls.
- The **upper** part of each atrium is the **Auricle** (**أذينة**)
- The **Right Atrium** is the first chamber **receives** the **venous** blood **entering** to the heart.
- The **Left Atrium** receives **arterial** blood **coming** from the **lungs**

Ventricles:

- Are **inferior** chambers.
- Are **discharging** chambers (**Actual Pump**).
- have **thick** walls.
- Their contraction propels blood **out** of the **heart** **into** the **circulation**.
- The **left ventricle** forms the **APEX** of the heart.

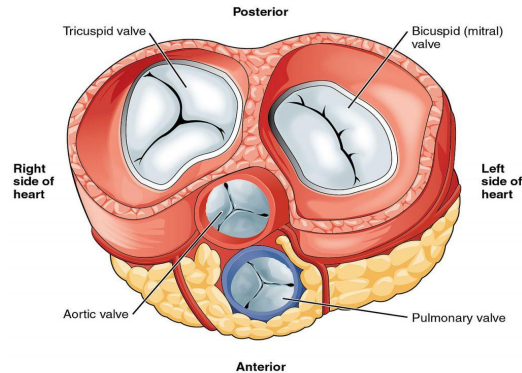
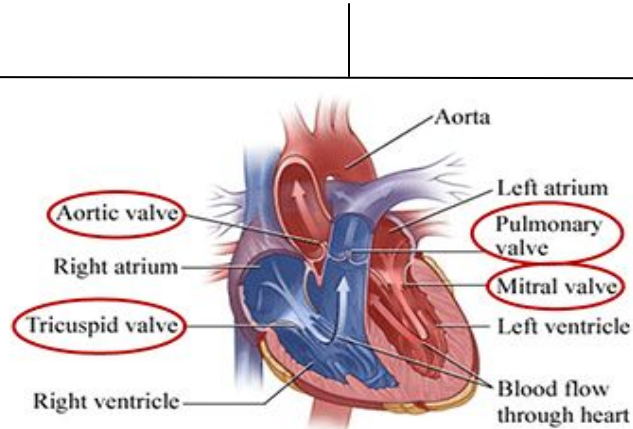
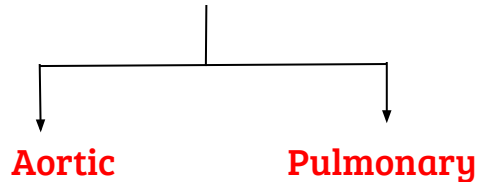


Valves of the heart

The heart has four valves

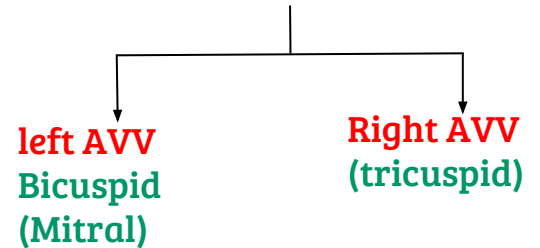
Two Semilunar

- Found **between** the right and left ventricles and the great arteries leaving the heart (**aorta** and **pulmonary trunk** respectively).
- They allow the flow of blood **from** the ventricles to these arteries.



Two Atrioventricular

- **Between** atria and ventricles.
- they allow the blood to flow in one direction from the atria to the ventricles.



Blood vessels

Arteries

- **Thick** walled, **do not** have valves.
- The smallest arteries are **arterioles**

Veins

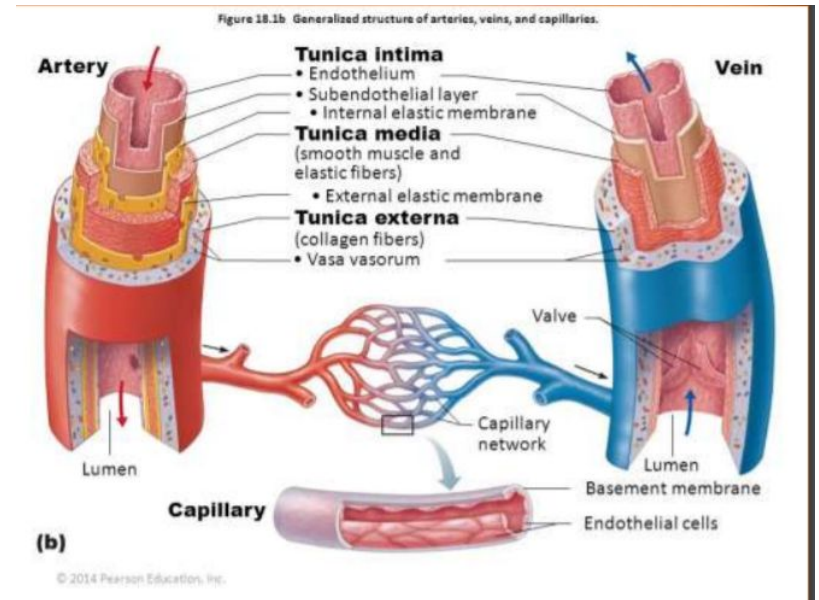
- **Thin** walled.
- Many of them possess **Valves**.
- The smallest veins are **venules**

Capillaries

- The **smallest** blood vessels (microscopic).
- Form a **network** between the arterioles and venules.
- Site of **exchange** between tissue and blood.
- Wall only consist of **endothelium**

e.g. Tissue with no capillaries; Cornea of eye and Hyaline cartilage

Sinusoids: wide capillaries with discontinuous endothelium Numerous in LIVER, SPLEEN, BONE MARROW, Pituitary gland

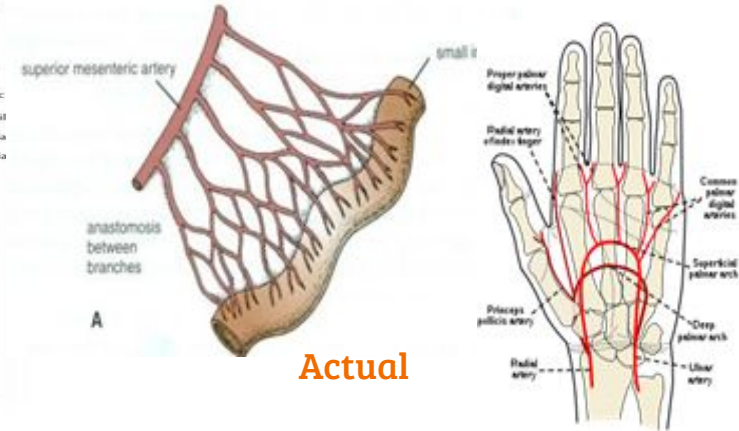
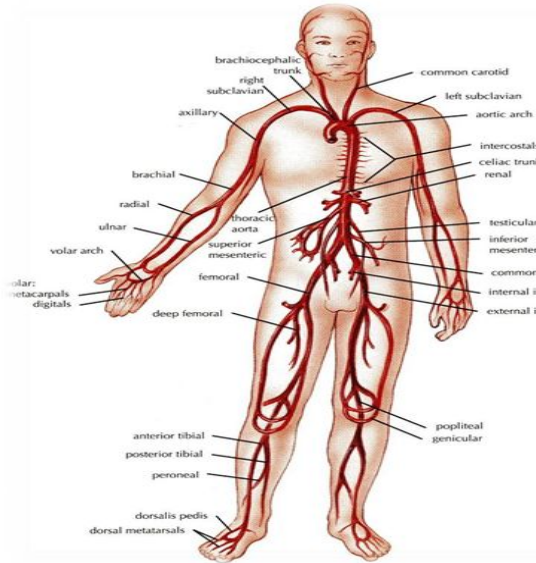


Blood vessels

Arteries

Arteries

Transport blood from the heart and distribute it to the various tissues of the body through their branches.



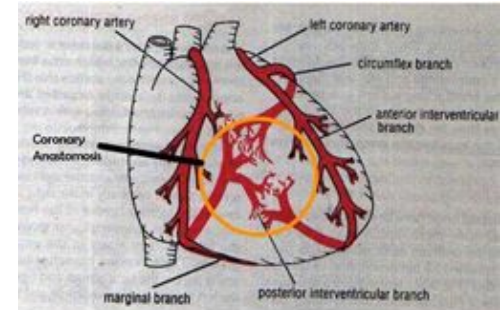
Arterial anastomoses

It is a connection between **two** arteries, i.e. arteries meet END to END (arterio-arterial anastomosis)

-Actual

-Potential

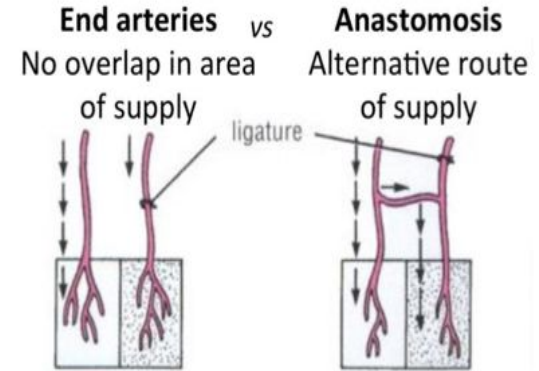
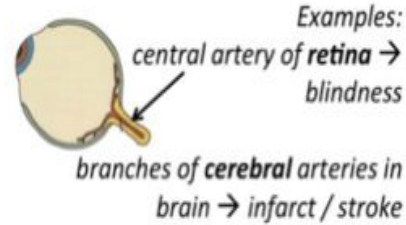
it is the joining of terminal branches of the arteries (intestinal arteries)



potential

End Arteries

No precapillary anastomosis between adjacent arteries, interruption of arterial blood flow-
INFARCTION / GANGRENR
e.g. liver, spleen, kidney, retina.

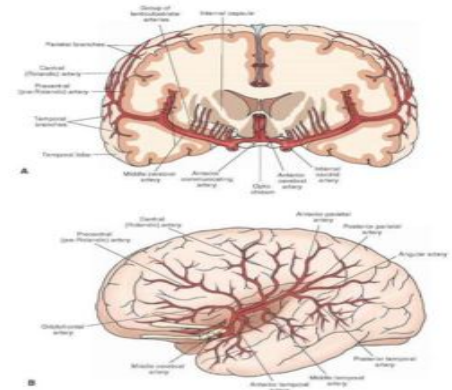


Anatomic End arteries.

Vessels whose terminal branches do not anastomose with branches of arteries supplying adjacent areas (Central artery of Retina).

Functional End arteries.

The terminal branches do anastomose with those of adjacent arteries but the anastomosis is insufficient to keep the tissue alive if one of the arteries is occluded.



Functional End arteries

Veins

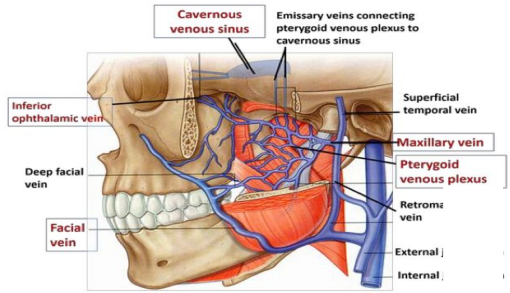
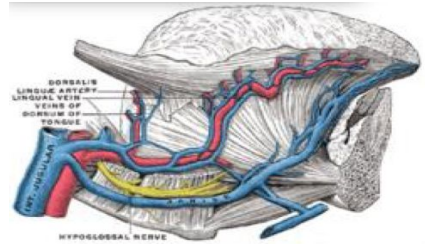
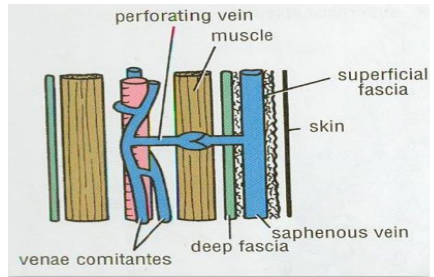
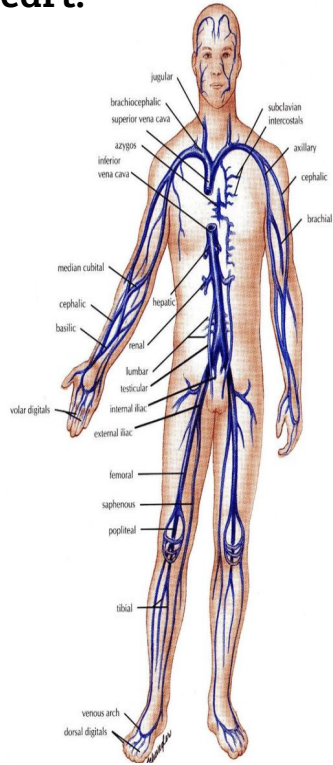
They transport blood **back** to the heart.

Smaller venules (**Tributaries**) unite to form larger veins which commonly join with one another to form **Venous Plexuses**.

Note: we have 2 type of veins
 1) Deep veins (venae comitantes)
 2) surfacial veins

Deep veins (venae comitantes)

Deep veins accompany medium sized deep arteries, usually two.



Arteriovenous Anastomosis

Direct connections between the arteries and veins **without** The intervention of capillaries.

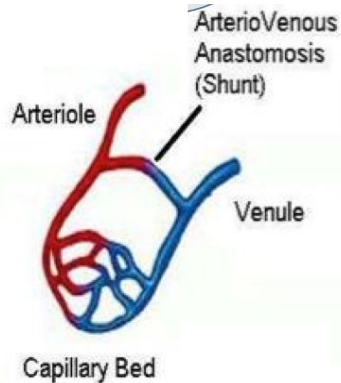
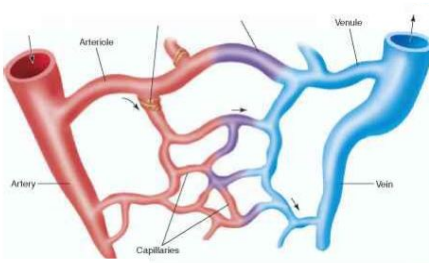
Found in: Tips of the Fingers and Toes.

May have a role in temperature regulation

Note: We have two type to connect between vein and artery

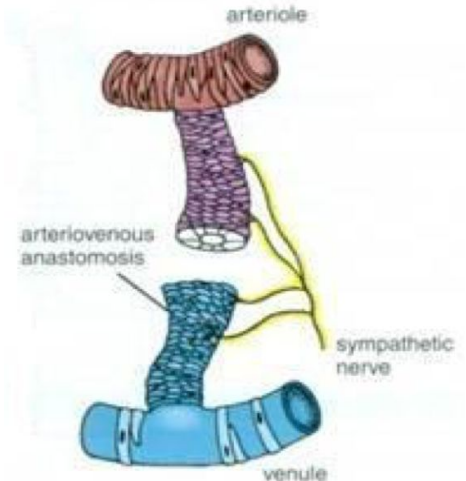
1)capillaries

2)ARTERIOVENOUS ANASTOMOSIS



A circulatory anastomosis is a connection between two blood vessels.

1. Arterio-arterial anastomosis.
2. Veno-venous anastomosis.
3. Arterio-venous anastomosis



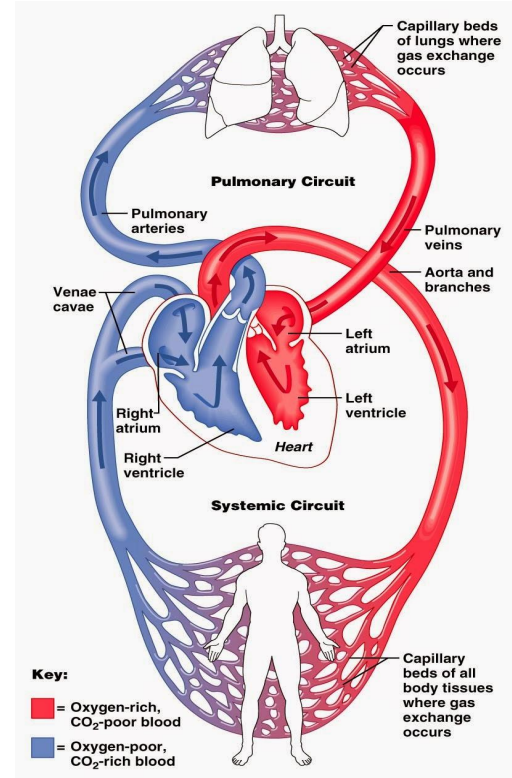
Blood Circulation

CARDIOPULMONARY

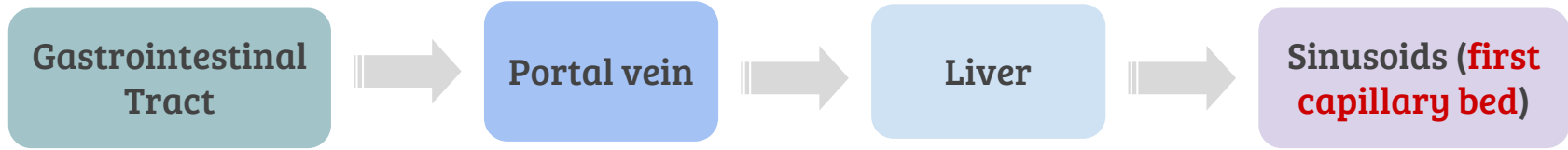
- Between the **Heart** and the **Lungs**
- The **right side** of the heart (the **right atrium & ventricle**) receive **Deoxygenated blood**
- Blood is pumped to the **lungs** through the **pulmonary Artery**
- Gas exchange takes place in the **lungs**
- It returns to the **left side** of the heart through **4 pulmonary veins**. **(Two for each lung)**

SYSTEMIC

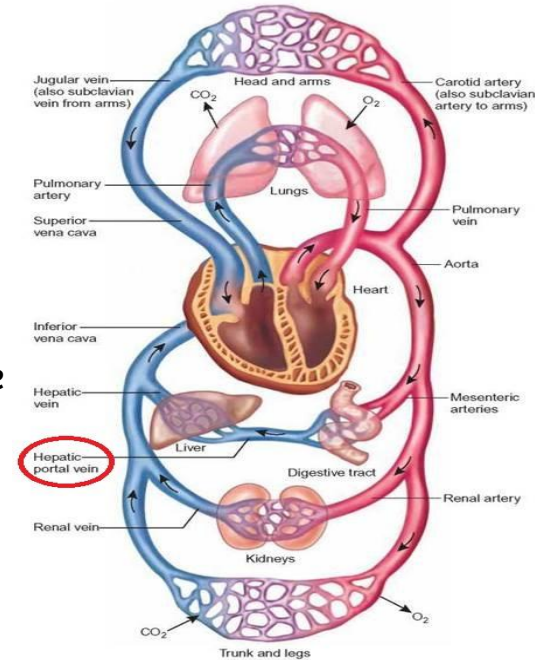
- Between the **Heart** and the **Body**
- The **left side** of the heart (**left atrium & ventricle**) receive the **Oxygenated blood from** the **lungs**
- Blood is pumped from the **left ventricle** to all body tissues through the **Aorta** and its **systemic arteries**
- The blood ultimately terminates in **capillaries**
- **Deoxygenated blood** circulates from the **tissues** to the **capillaries, venules & veins** back to the **right atrium** of the heart through the **systemic veins**



Portal circulation



- It is a system of vessels interposed between Two Capillary Beds.
- Takes place in the **liver** and some **endocrine glands (pituitary gland)**.
- Veins leaving the gastrointestinal tract do not go direct to the heart.
- They pass to the **Portal Vein**.
- **Portal Venous System** occurs when a capillary bed pools into another capillary bed through veins, without first going through the heart.
- This vein **enters the liver** and breaks up again into veins of diminishing size which ultimately join capillary like vessels (**Sinusoids**) : first capillary bed (more explain in next slide)
- Venous blood enter 2nd capillary bed then to smaller veins that leave the liver through the hepatic vein..



Portal circulation

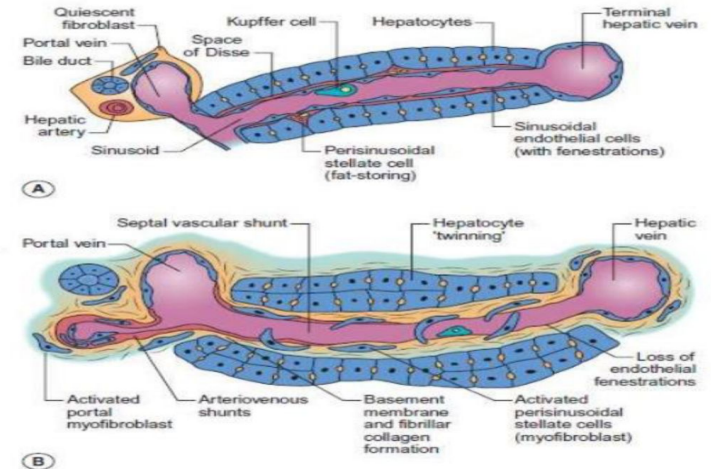
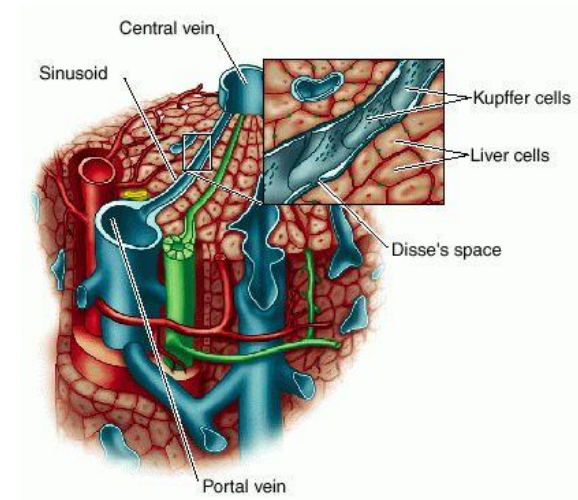
Sinusoids: Are thin walled blood vessels like capillaries. Wider with irregular cross diameter. Wide capillaries with discontinuous endothelium.

Found in : liver, spleen, bone marrow, pituitary gland

Why doesn't the blood go straight to the heart?

Because it contains food with Venous blood (food can't go to the heart).

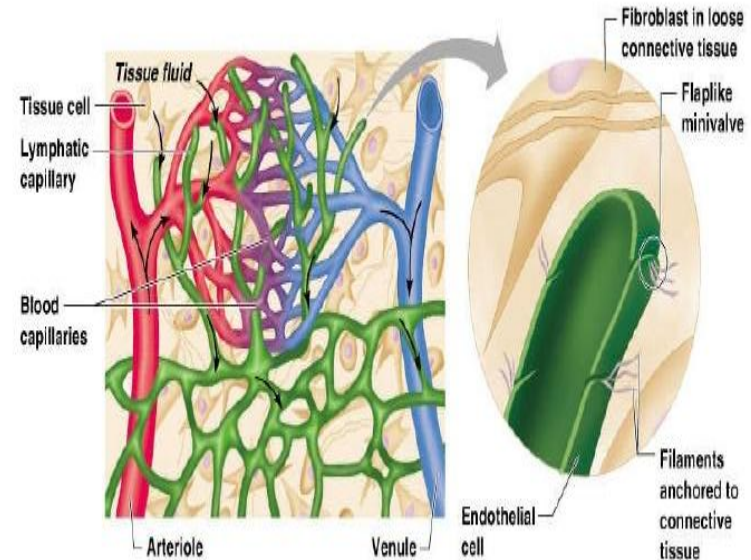
Note: The sinusoids will get rid of the food by giving it to the liver cells which are surrounded by them .



Lymphatics

- **Not** all the blood entering a part returns by the way of veins
- Much of it becomes **TISSUE FLUID (Lymph)** returns by the way of vessels called **Lymphatic vessels**
- **Lymph** is a clear-to-white fluid made of: White blood cells, especially **lymphocytes**.
- The **lymphatic system** is unique, in that it is a 1-way system that returns lymph fluid via vessels to the cardiovascular system.
- Lymph vessel have **more valves** than **veins**.
- In general **superficial** lymphatics follow **veins**, while **deep** lymphatics follow **arteries**

Lymphatic Vessels



Quiz

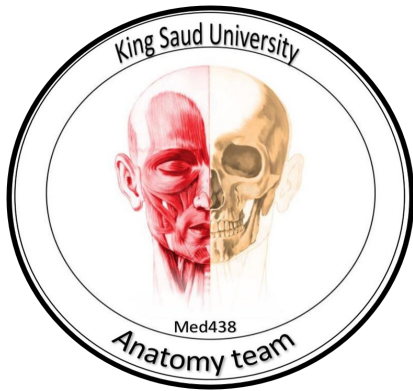
(True or False)

Here is a useful video for you :
<https://youtu.be/UMTDmP81mG4>

1. The cardiovascular system is a transporting system.
2. The cardiovascular system is composed of the heart only.
3. The heart is spinel shaped, covered by pericardium and composed of four chambers.
4. The blood vessels include the arteries, veins and capillaries.
5. Arteries transport the blood to the heart.
6. The terminal branches of the arteries can anastomose with each other freely or be anatomic or functional end arteries.
7. Veins transport blood back to the heart.
8. Aorta are smallest vessels; connecting the arteries to the veins.
9. Sinusoids are special type of arteries.
10. The portal system is composed of two sets of capillaries and found in the liver & thyroid gland

Answers : 1-T 2-F(and blood vessels) 3-F(cone shape) 4-T 5-F(from) 6-T 7-T 8-F(Capillaries) 9-F(Capillaries) 10-F(pituitary gland)

**A special thanks to the 436
anatomy team, who inspired
our work.**



Good luck to you all

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