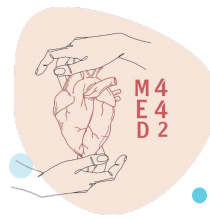
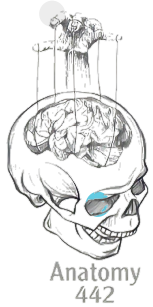


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Cardiovascular system

Lecture 5

Color index:

Main text

• Red: important

Pink: in girls slides only

Blue: in boys slides only

Green: Doctors notes

Grey: Extra info





Objectives



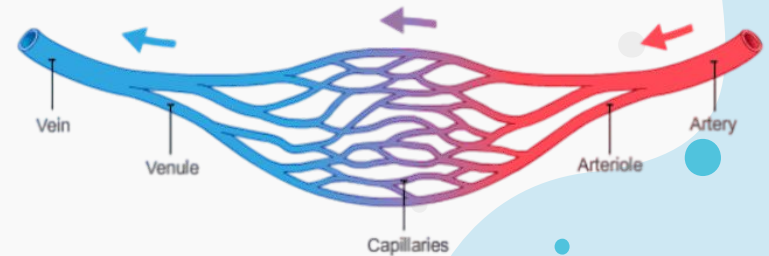
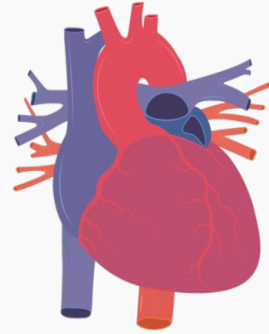
By the end of this session, students should be able to:

- 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.

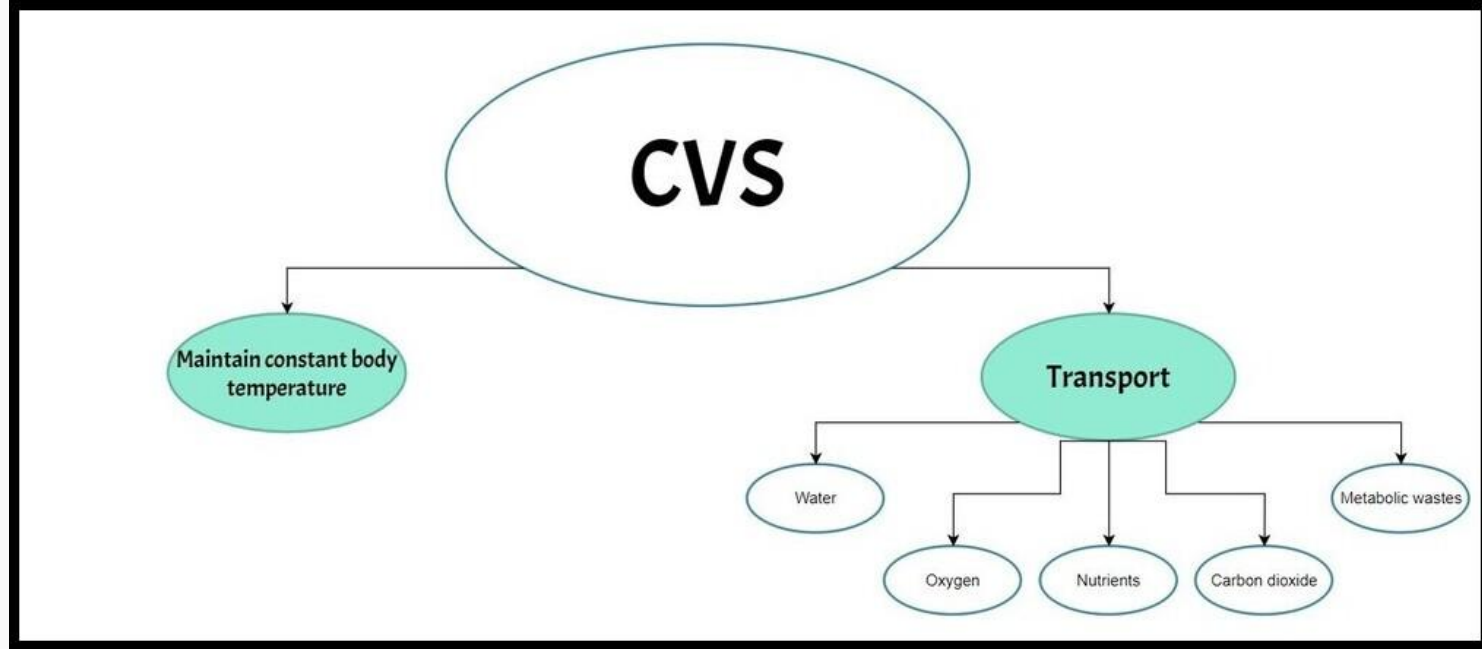
What is the cardiovascular system comprised of?

The cardiovascular system (CVS) is composed of:

- The heart
- The vessels
 - Arteries
 - Carry blood away from the heart
 - Capillaries
 - Thin vessels between arteries and veins
 - Take part in gas exchange
 - Veins
 - Carry blood to the heart



Functions of CVS



- CVS uses blood as a transport vehicle
- Transport is vital for homeostasis
- The heart provides the force to move the blood



The Heart

Definition (التعريف): hollow, cone shaped muscular pump responsible for circulation. The force that moves the blood is provided by the heart

Features:

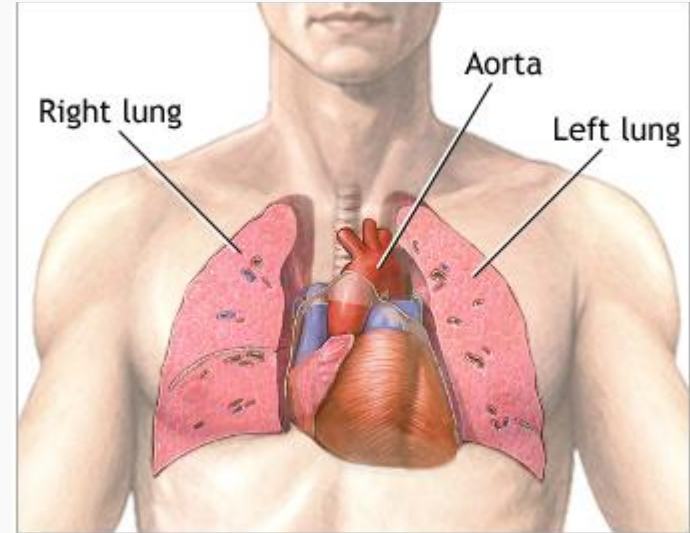
- If a person makes a fist, their fist will match their heart's size
- Apex and base
- Two surfaces
 - Sternocostal surface.
 - Near the sternum and intercostal muscles of the ribcage
 - Diaphragmatic surface.
 - Near the sternum and intercostal muscles of the ribcage
- Three borders
 - Right border
 - Left border
 - Inferior border

The heart

Position/location



- Obliquely in the thorax
- More precisely located in the middle mediastinum between the pleural sacs
 - Pleural sacs are what contain the lungs
- $\frac{2}{3}$ of the heart lies to the left of the median plane while the other $\frac{1}{3}$ lies to the right of the median plane
- The heart is enclosed by a double membrane called the pericardium
 - One layer is tough
 - The other layer is soft

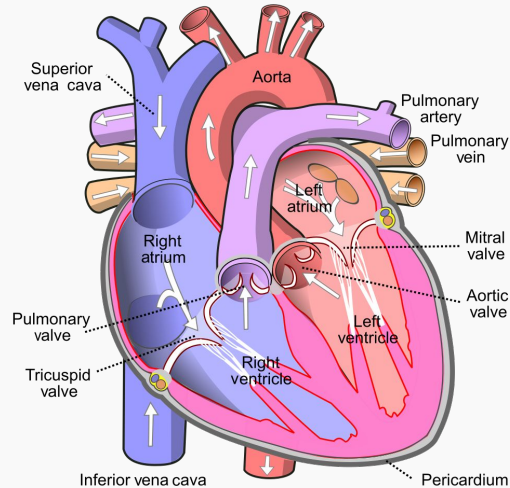


The heart chambers

The heart is divided into 4 chambers. 2 atria and 2 ventricles

Atria

- Superior in position
- Receiving chambers
- Thin walls
- Upper part of the atrium is called auricle
- Blood first comes to the heart from the right atrium which receives the venous blood.
- The Left atrium receives blood coming back from the lungs to the heart (the arterial blood).



Ventricles

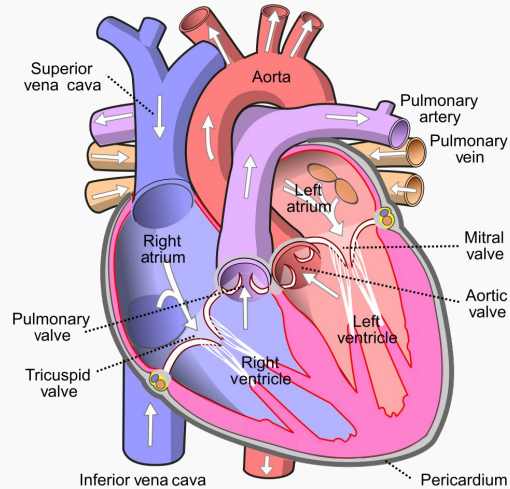
- Inferior in position
- Chambers that pump blood out of the heart
- Have thick walls
- Contraction of the ventricles propels blood out of the heart into circulation
- The left ventricle forms the apex of the heart

The heart valves.

Total of 4 valves

Atrioventricular valves

- Allow blood to flow in one direction from atria to ventricles
- Tricuspid valve
 - Between Right atrium and ventricle
- Bicuspid (**mitral**) valve
 - Between left atrium and ventricle

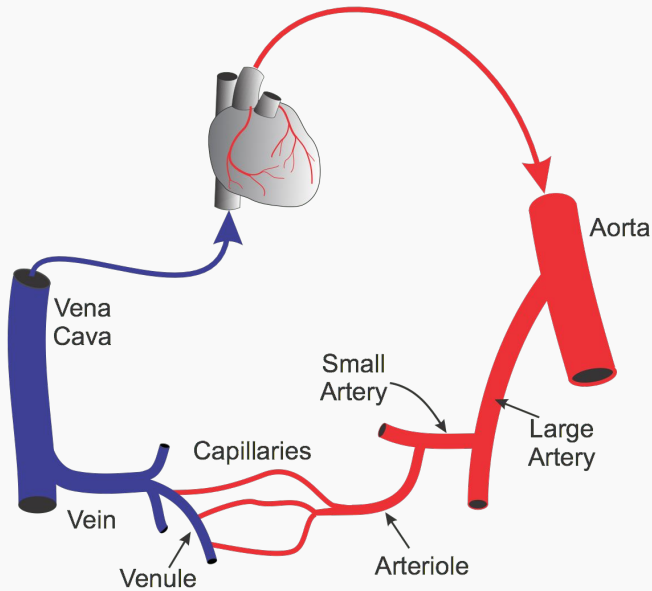


Semilunar

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

Blood vessels

Blood vessels can be split into three types



Arteries

- Thick walled
- **Lack valves**
- Smallest arteries are called arterioles

Veins

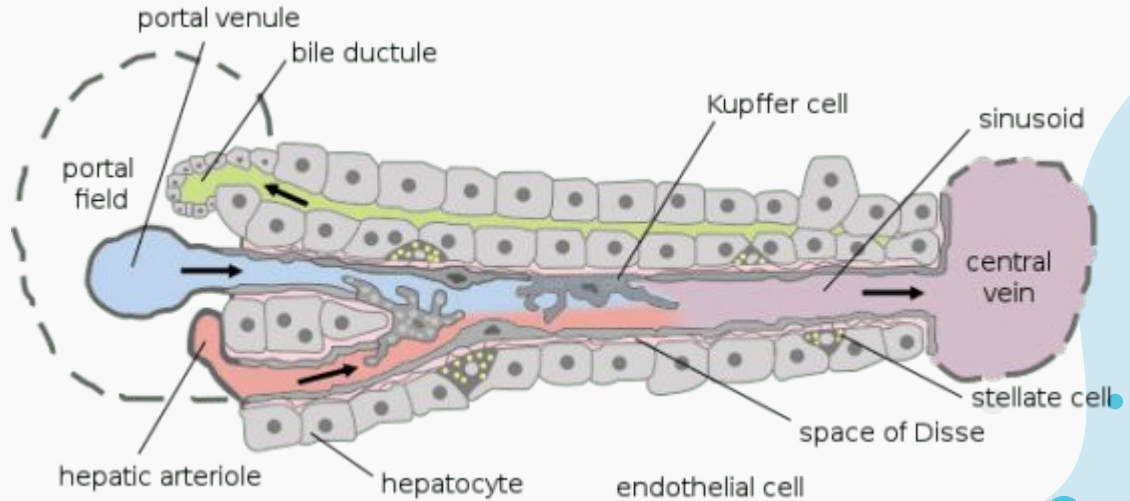
- Thin walled
- Many contain valves
- Smallest veins are known as venules

Capillaries

- microscopic vessels
- Connect arterioles to venules
- Site of exchange between tissue and blood
- Wall consists of only endothelium
- **Some tissues lack capillaries**
 - Hyaline cartilage
 - Cornea of the eye
- Special kind of capillary next slide

Sinusoids

- Wide capillaries with discontinuous endothelium and irregular cross diameter
- Numerous in the following:
 - Liver
 - Spleen
 - Bone marrow
 - Pituitary gland



Anastomosis

A circulatory anastomosis is a connection between two blood vessels.

1. Arterio-arterial anastomosis

2. Veno-venous anastomosis

3. Arterio-venous anastomosis

Actual
Potential

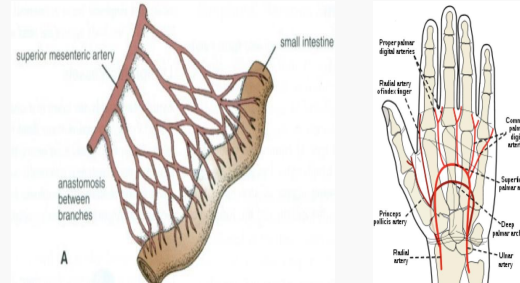
Arteries

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

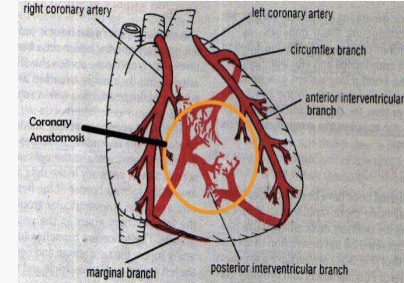
1. Arterial Anastomoses

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

Actual



Potential



End Arteries

No precapillary anastomosis between adjacent arteries, interruption of arterial blood flow- INFARCTION / GANGRENE

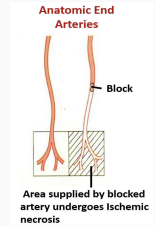
Examples : Liver, spleen, kidney, retina

Anatomic End arteries:

Vessels whose terminal branches **do not anastomose** with branches of arteries supplying adjacent areas

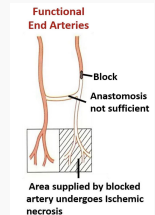
Example: Central artery of Retina > Blindness

Branches of cerebral arteries in the brain > infarct/ stroke



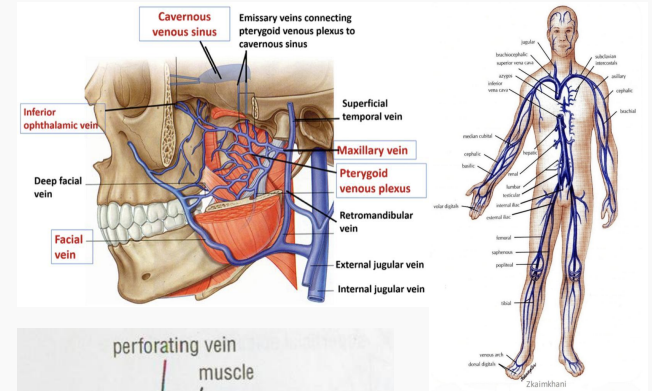
Functional End arteries:

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



Veins

- They transport blood back to the heart.
Carry **deoxygenated** blood except 4 Pulmonary veins opening in the left atrium carry **oxygenated** blood
- The smaller venules (**tributaries**) unite to form larger veins which commonly join with one another to form **Venous Plexuses**

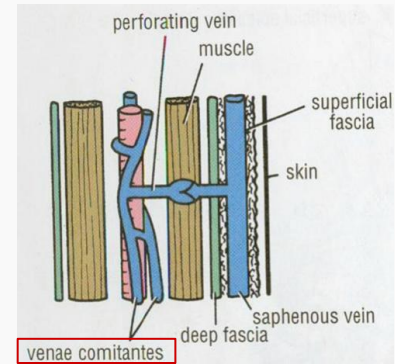


Vein types:

1- Venae comitantes

Deep veins accompany medium sized deep arteries, usually two.

2- Superficial Veins



Anastomosis

A circulatory anastomosis is a connection between two blood vessels.

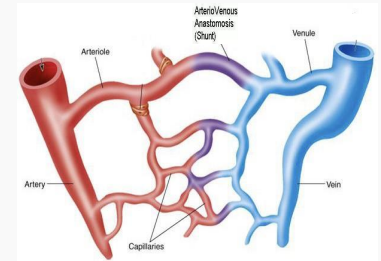
1. Arterio-arterial
anastomosis

2. Veno-venous
anastomosis

3. Arterio-venous
anastomosis

3. Arterio-Venous Anastomosis:

- 1 | Direct connections between the arteries and veins without the intervention of capillaries.
- 2 | EXAMPLE: **Tips of the Fingers and Toes.**
- 3 | May have a role in temperature regulation



Blood circulation

Cardiopulmonary

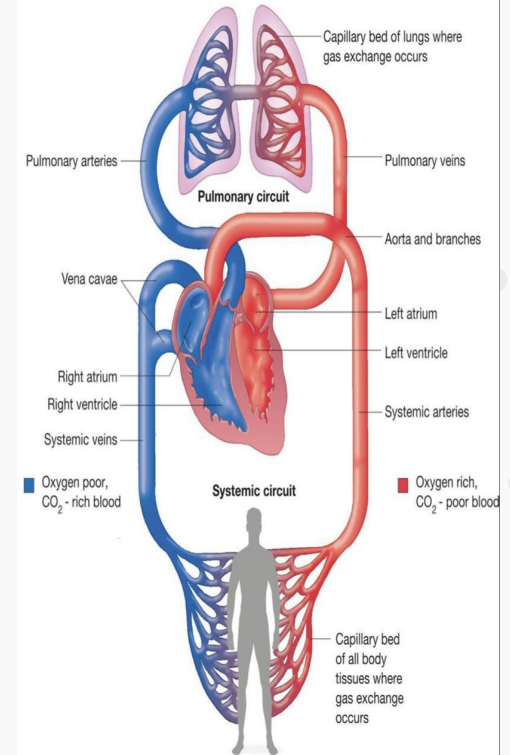
Takes place between the **heart** and **lungs**.

- The **right side** of the heart (right atrium/ ventricle) receives oxygen Poor blood (**Deoxygenated blood**)
- This blood is pumped from the **heart** through the **Pulmonary Trunk** to the **lungs**.
- **Gas exchange** takes place in the lungs.
- It **returns** to the **left side** of the heart (left atrium/ventricle) through **4 pulmonary veins**.

Systemic

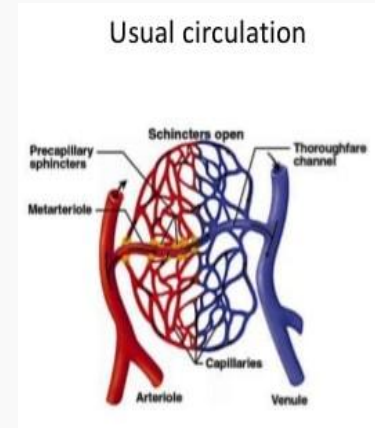
Takes place between the **heart** and each **cell of the body**

- This blood is pumped from the **left ventricle** to all **body tissues** through the **aorta and its systemic arteries** which ultimately terminates in capillaries.
- Oxygen poor blood circulates from the **tissues** to the **capillaries, venules & veins** back to the right atrium through the **Systemic Veins**.



Portal circulation

- It is a system of vessels interposed between **Two Capillary Beds**
- It takes place in the **liver** and some **endocrine glands** (Pituitary gland)



They pass to the **Portal Vein** which enters the liver and breaks up into veins of diminishing size

Venous blood enter **2nd capillary bed** then to smaller veins that leave the liver through **hepatic veins**.

01

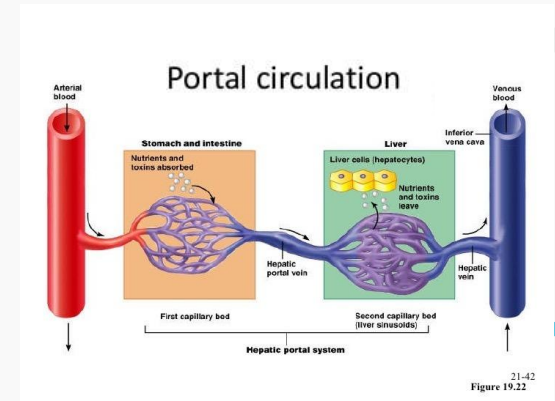
02

03

04

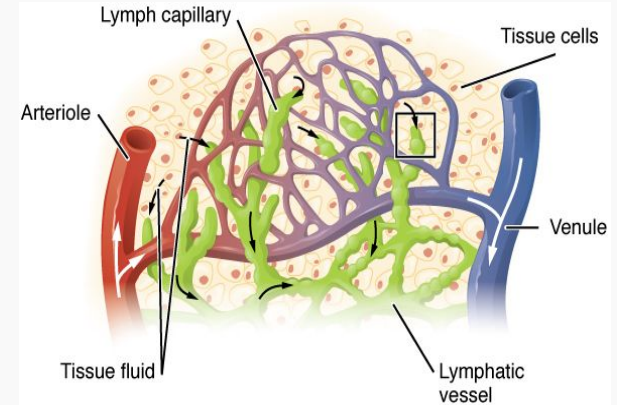
Veins leaving the gastrointestinal tract **do not** go directly to the heart.

The diminishing veins ultimately join capillary like vessels **Sinusoids (first capillary bed)**



Lymphatics

- 1 Not all blood entering a part returns by the way of veins
- 2 Much of it becomes **tissue fluid (lymph)** Returns by the way of vessels called **LYMPHATIC VESSELS**
- 3 **Lymph** is a clear to white fluid made of White blood cells especially **lymphocytes**
- 4 The lymphatic system is unique, in that it is a **one-way** system that returns lymph fluid via vessels to the **cvs**
- 5 Lymph vessel have **more** valves than veins
- 6 In general superficial lymphatics follow veins while deep lymphatics follow arteries



Summary

- ❖ The cardiovascular system is a **transporting system**.
- ❖ It is composed of the **heart** and **blood vessels**.
- ❖ The heart is **cone shaped**, covered by pericardium and composed of **four chambers**.
- ❖ The blood vessels are the **arteries, veins** and **capillaries**
- ❖ **Arteries** transport the blood **from the heart**.
- ❖ The terminal branches of the arteries can anastomose with each other freely or be **anatomic** or **functional** end arteries
- ❖ **Veins** transport blood **back to the heart**.
- ❖ Capillaries **connect** the arteries to the veins.
- ❖ Sinusoids are **special type of capillaries**
- ❖ The portal system is composed of **two sets of capillaries**.
- ❖ It is found in the **liver & pituitary gland**.

MCQs:

1-Membrane that encloses the heart

A- Pleural cavity

B- Pericardium

C-Mediastinum

D- Semilunar

2- Chambers that deliver blood away from the heart

A- Right ventricle

B- Left ventricle

C- Both A&B

D- none

3-Which one of the following is a tricuspid valve?

A- Right Atrioventricular

B- Aortic valve

C-Pulmonary valve

D- Left atrioventricular

4-Direct connections between the arteries and veins without the intervention of capillaries

A- Veno-Venous Anastomosis

B- Arterio-Venous Anastomosis

C- Arterio-Arterial Anastomosis

D-Anatomic End Arteries

5- A Clear to white fluid made of white blood cells is ?

A-Capillaries

B-Right Ventricle

C-Lymph

D- Semilunar

6- Where does the portal circulation takes place ?

A-Pleural sac

B-Spleen

C- GIT tract

D-liver

D-6
C-5
B-4
A-3
C-2
B-1

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Anatomy
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