SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIAC TECHNOLOGY

COURSE NAME : Applied Physiology Relevant to Cardiac Technology

UNIT : Overview and functions of Cardiovascular System

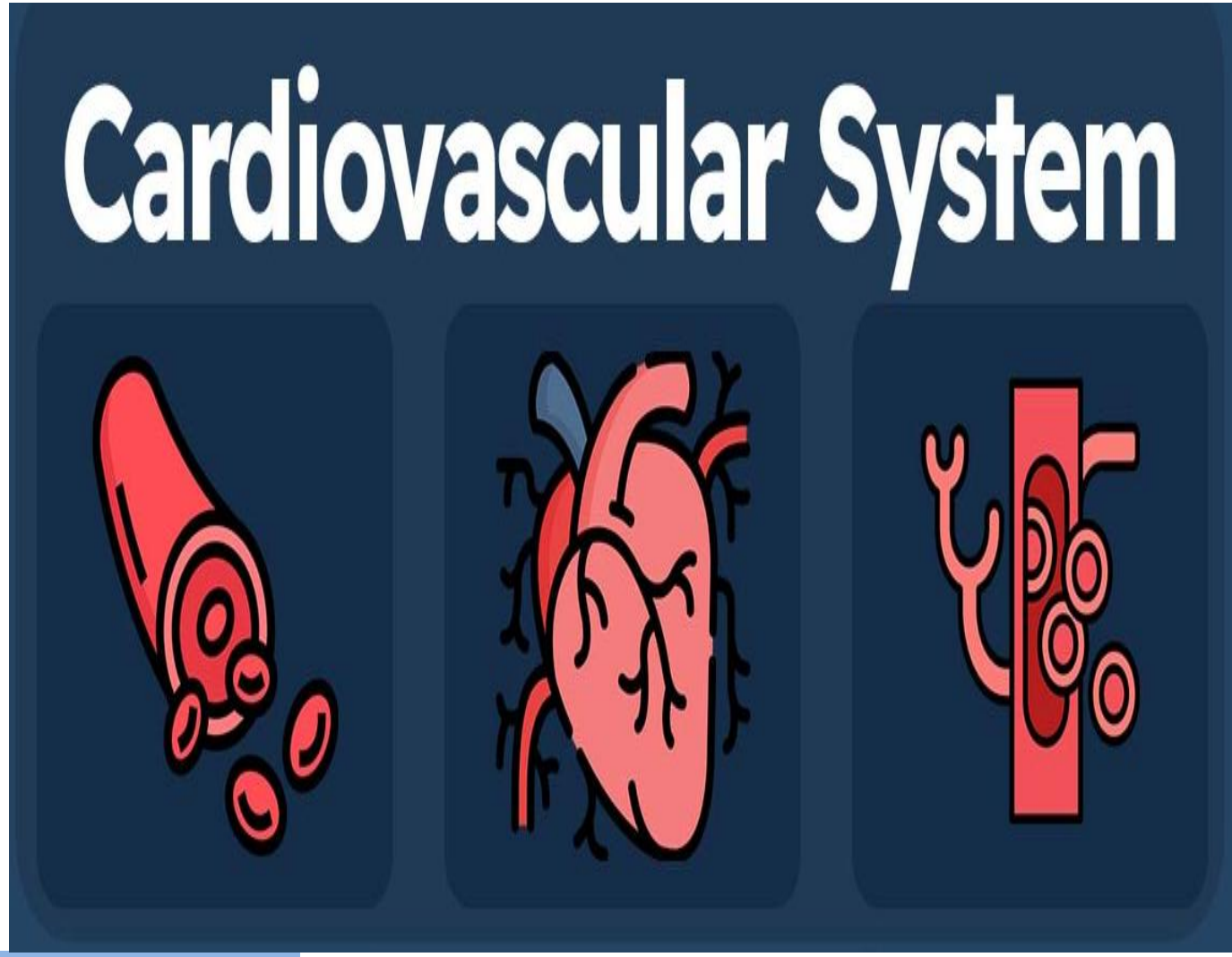
TOPIC : Components – Heart ,Blood & Blood Vessels

FACULTY NAME: Kavipriya S

EMPATHIZE – Understanding the Clinical and Learning Need

Purpose of this Concept:

- To understand how the **heart**, **blood**, and **blood vessels** work together as an **integrated transport system**.
- The cardiovascular system ensures **oxygen and nutrient delivery**, **waste removal**, and **homeostasis**.



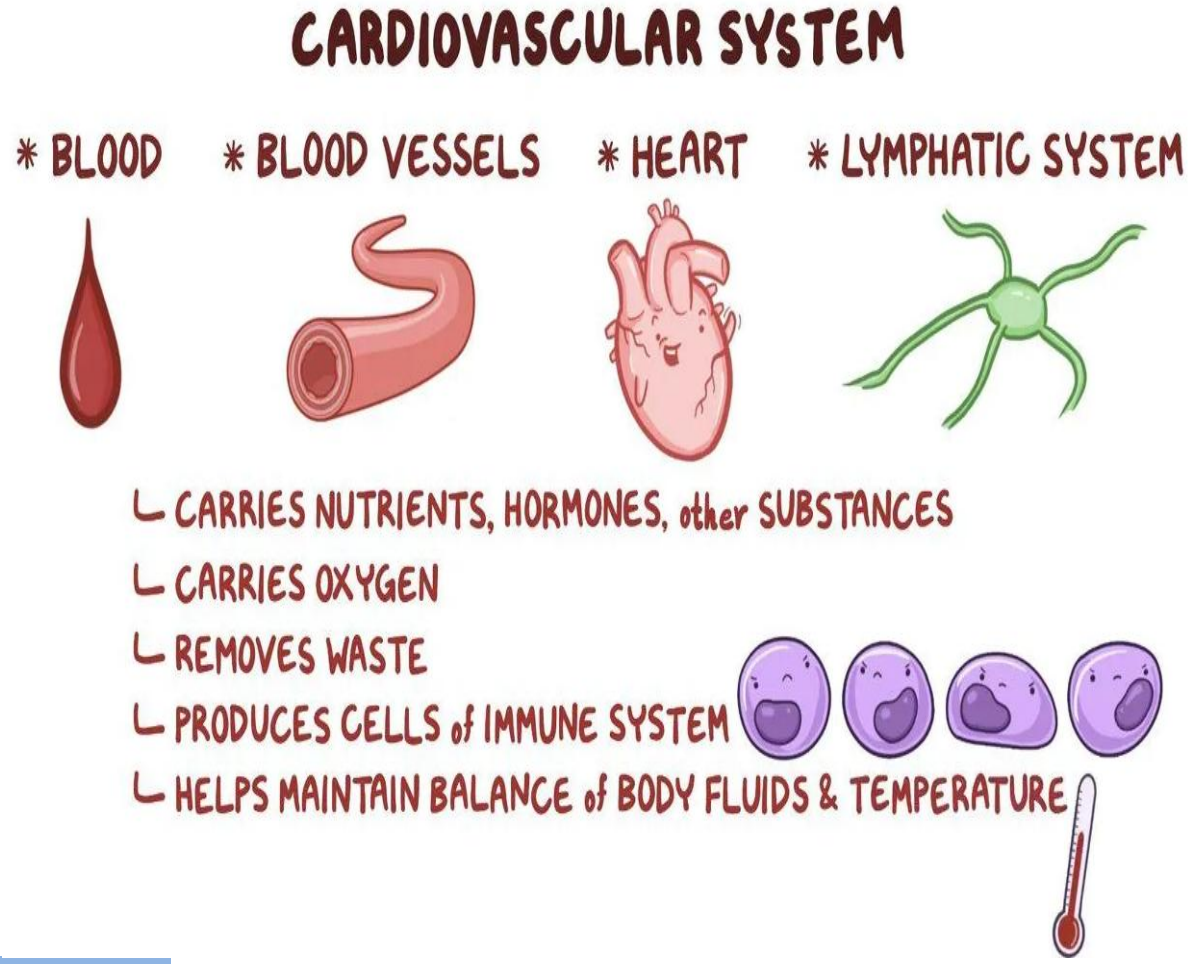
💡 DEFINE – Identifying the Core Concept

The **Cardiovascular System** consists of three main components:

1.Heart – muscular pump that propels blood.

2.Blood – circulating fluid carrying nutrients, gases, and hormones.

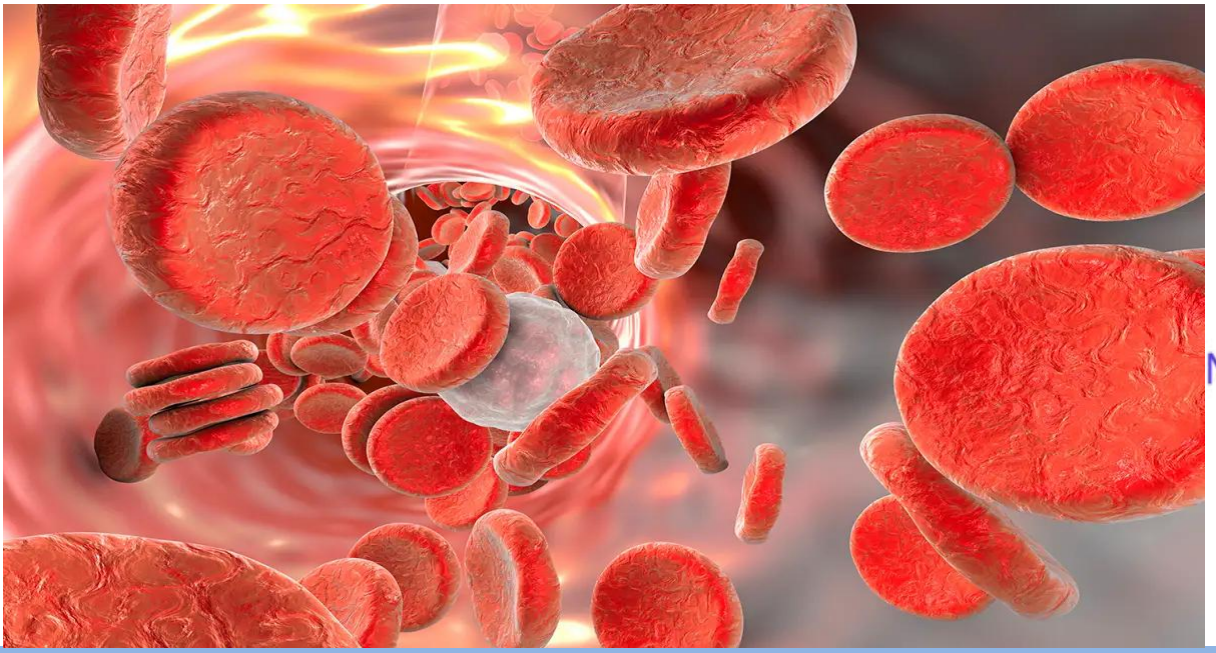
3.Blood Vessels – tubular network that distributes and collects blood throughout the body.

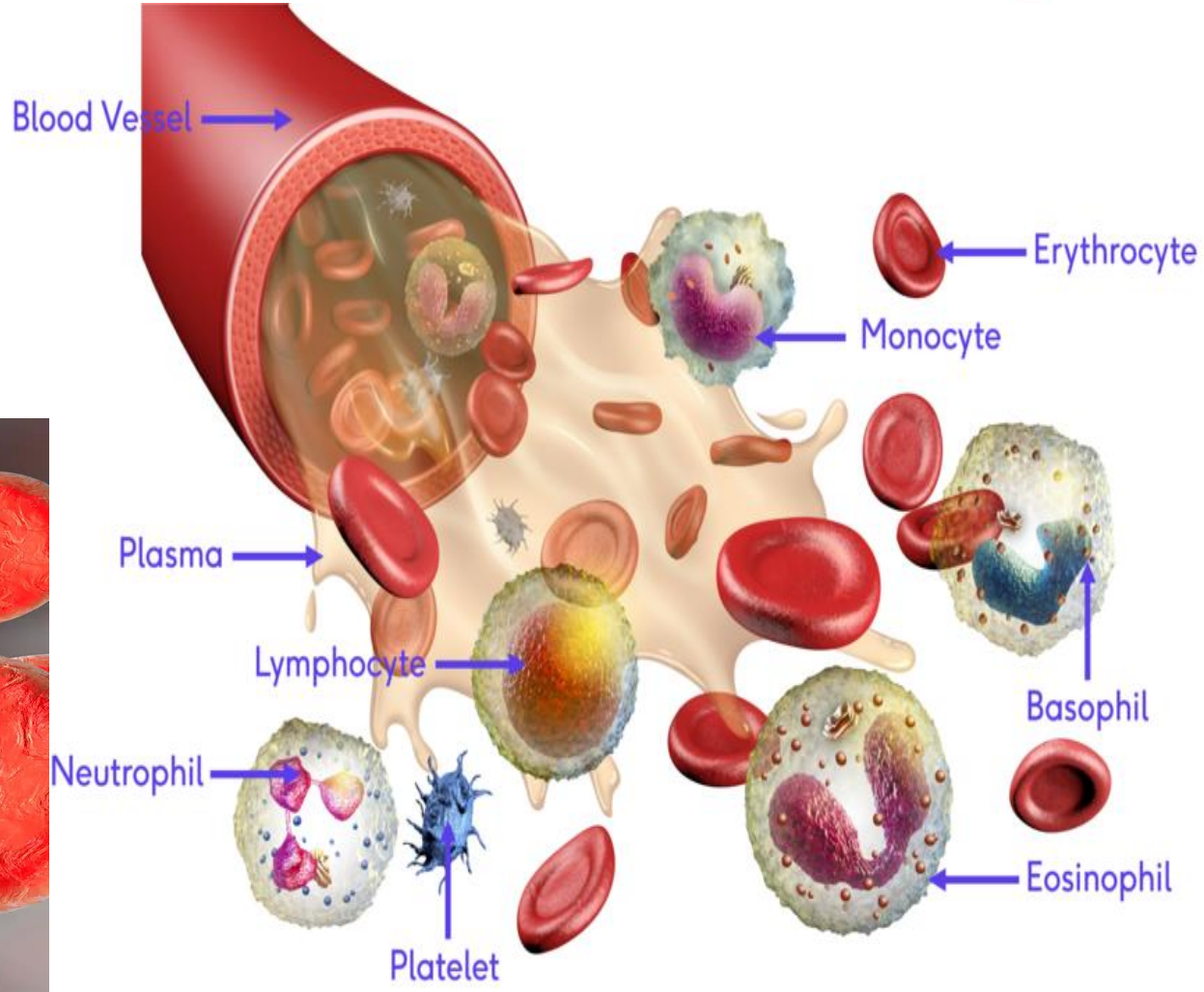


💡 2. DEFINE — Identifying the Core Concept

Overall Function:

- To **transport**, **regulate**, and **protect** body tissues through continuous blood circulation.



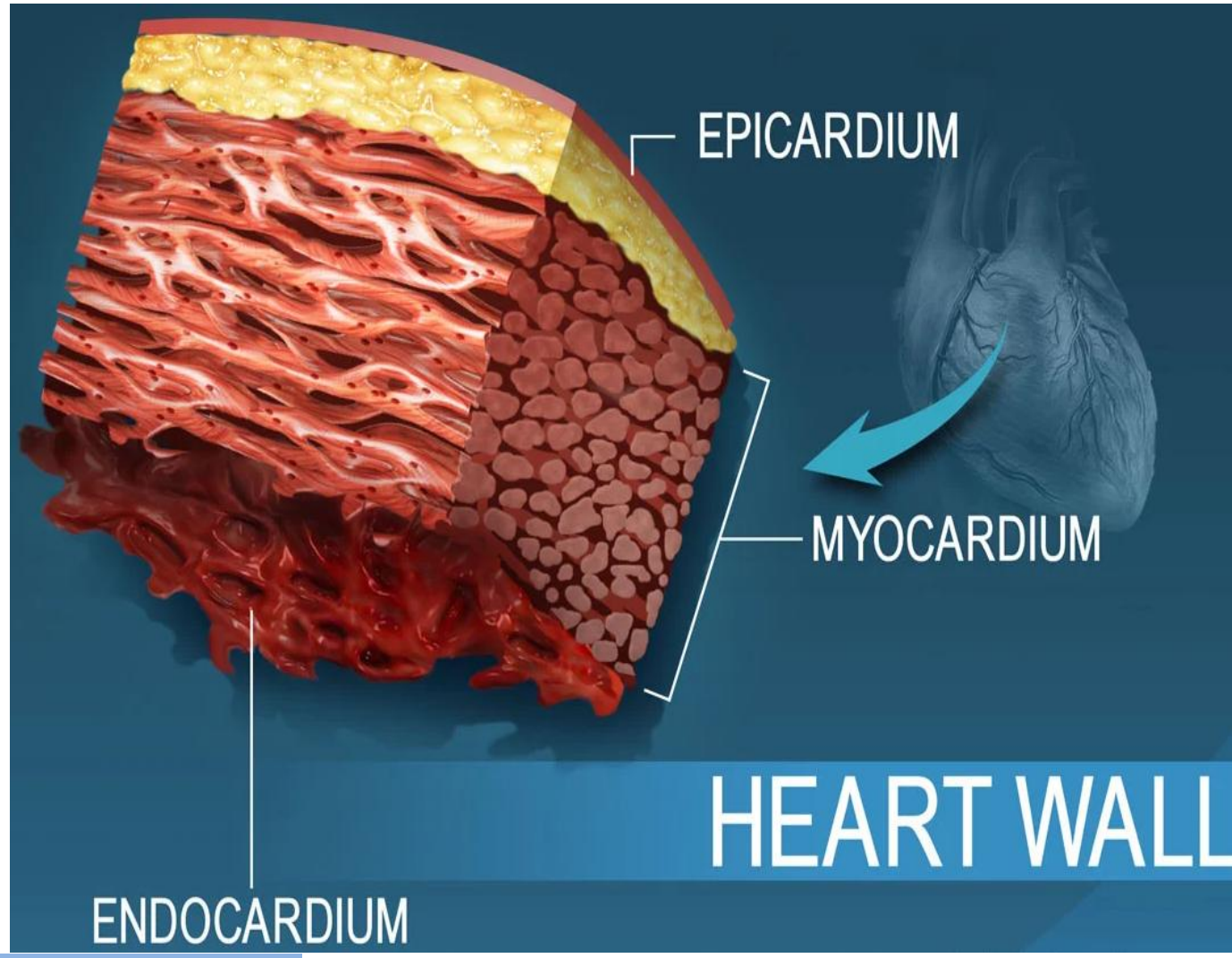


🧠 3. IDEATE — Concept Development

❤️ A. The Heart

Structure:

- Hollow, **four-chambered muscular organ** (~300 g in adults).
- Located in **mediastinum**, slightly left of the midline.
- Covered by **pericardium** (fibrous + serous layer).



🧠 IDEATE — Concept Formation & Theory

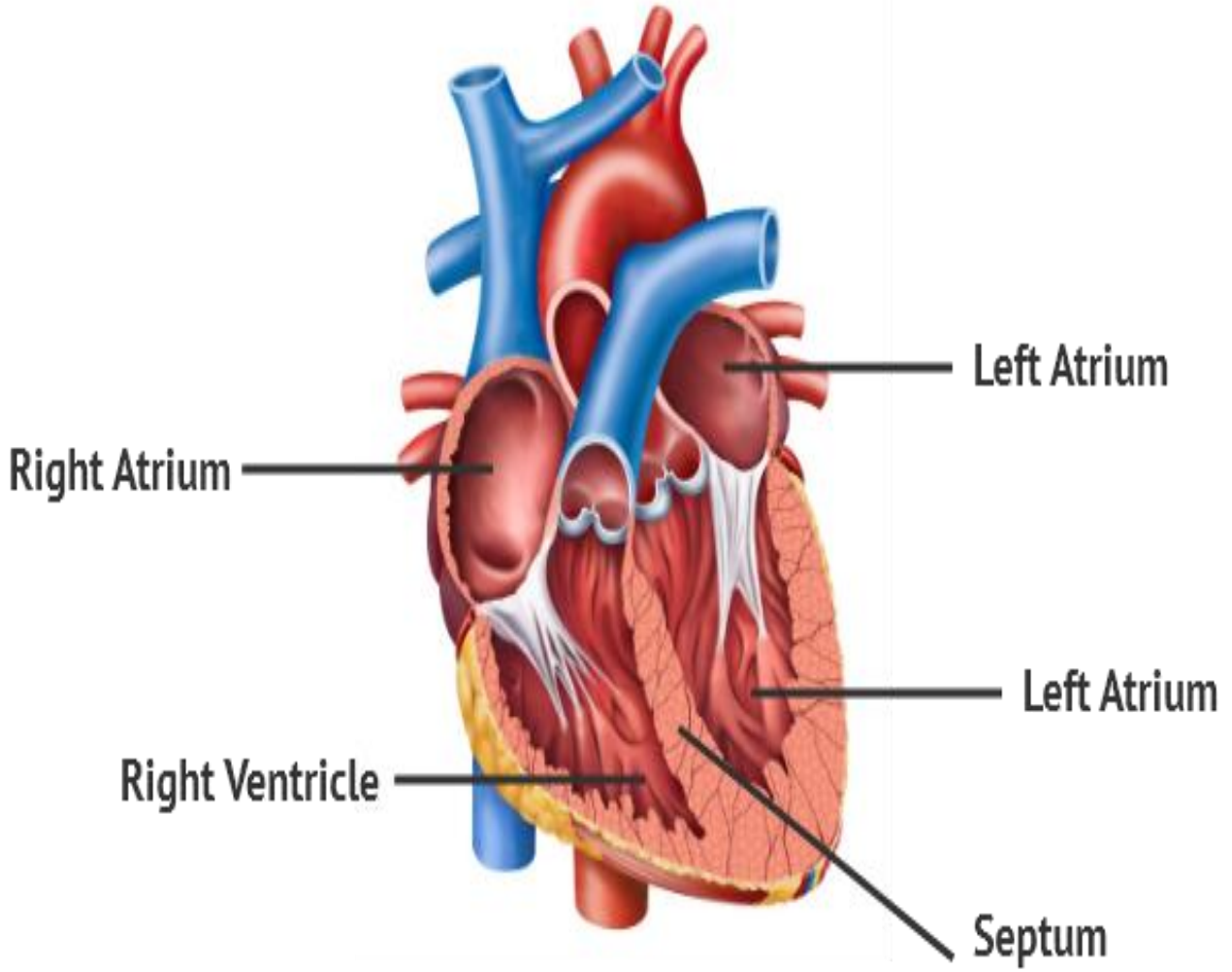
Chambers:

Right Atrium (RA): Receives deoxygenated blood from body via superior & inferior vena cava.

Right Ventricle (RV): Pumps blood to lungs via pulmonary artery.

Left Atrium (LA): Receives oxygenated blood from lungs via pulmonary veins.

Left Ventricle (LV): Pumps blood to the entire body via aorta.



🧠 IDEATE — Concept Formation & Theory

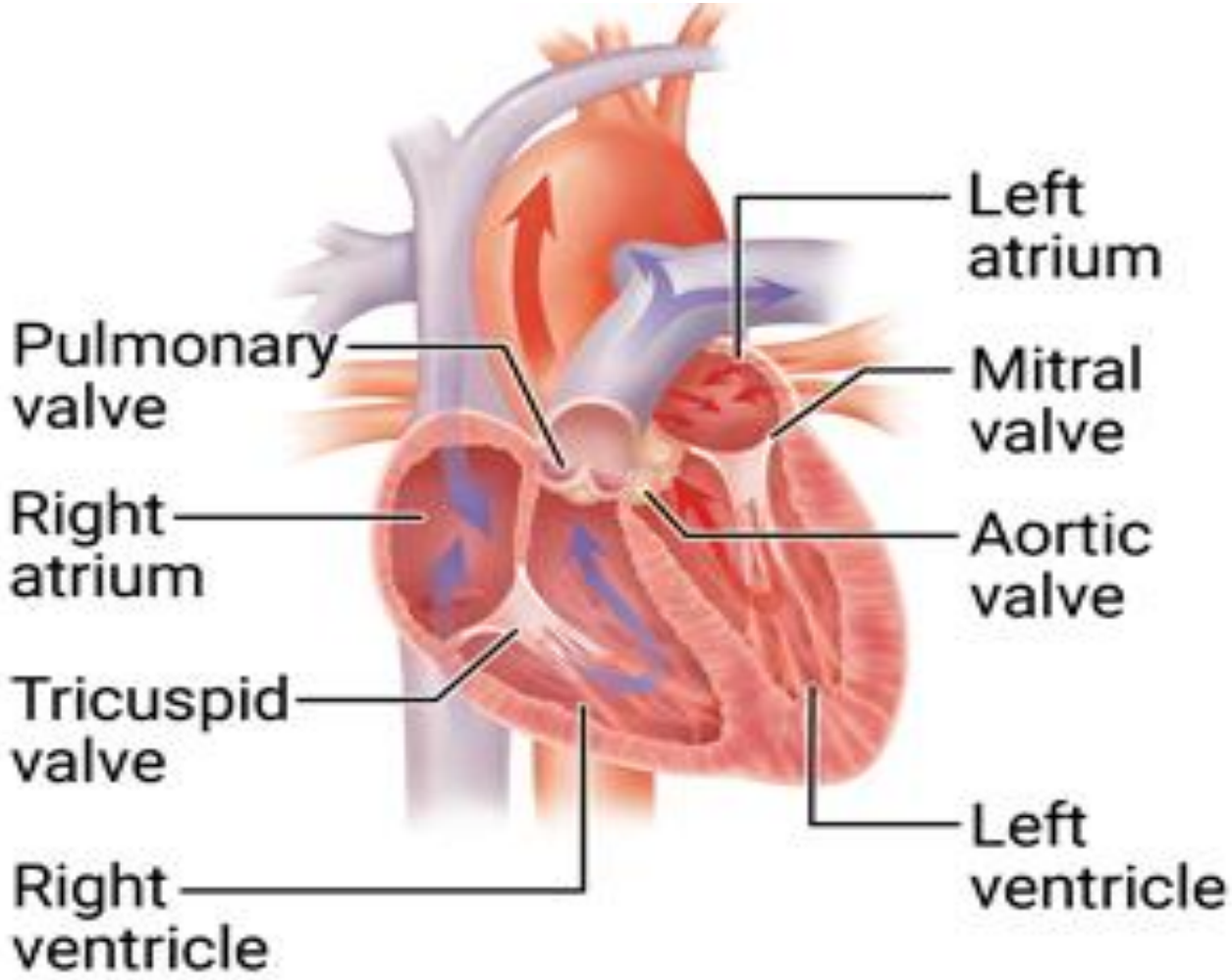
Valves:

Atrioventricular Valves:

- Right side – *Tricuspid valve*
- Left side – *Mitral (bicuspid) valve*

Semilunar Valves:

- *Pulmonary valve* (RV → Pulmonary artery)
- *Aortic valve* (LV → Aorta)



Circulatory Pathways

- **Pulmonary circulation:** RV → Lungs → LA
- **Systemic circulation:** LV → Body → RA

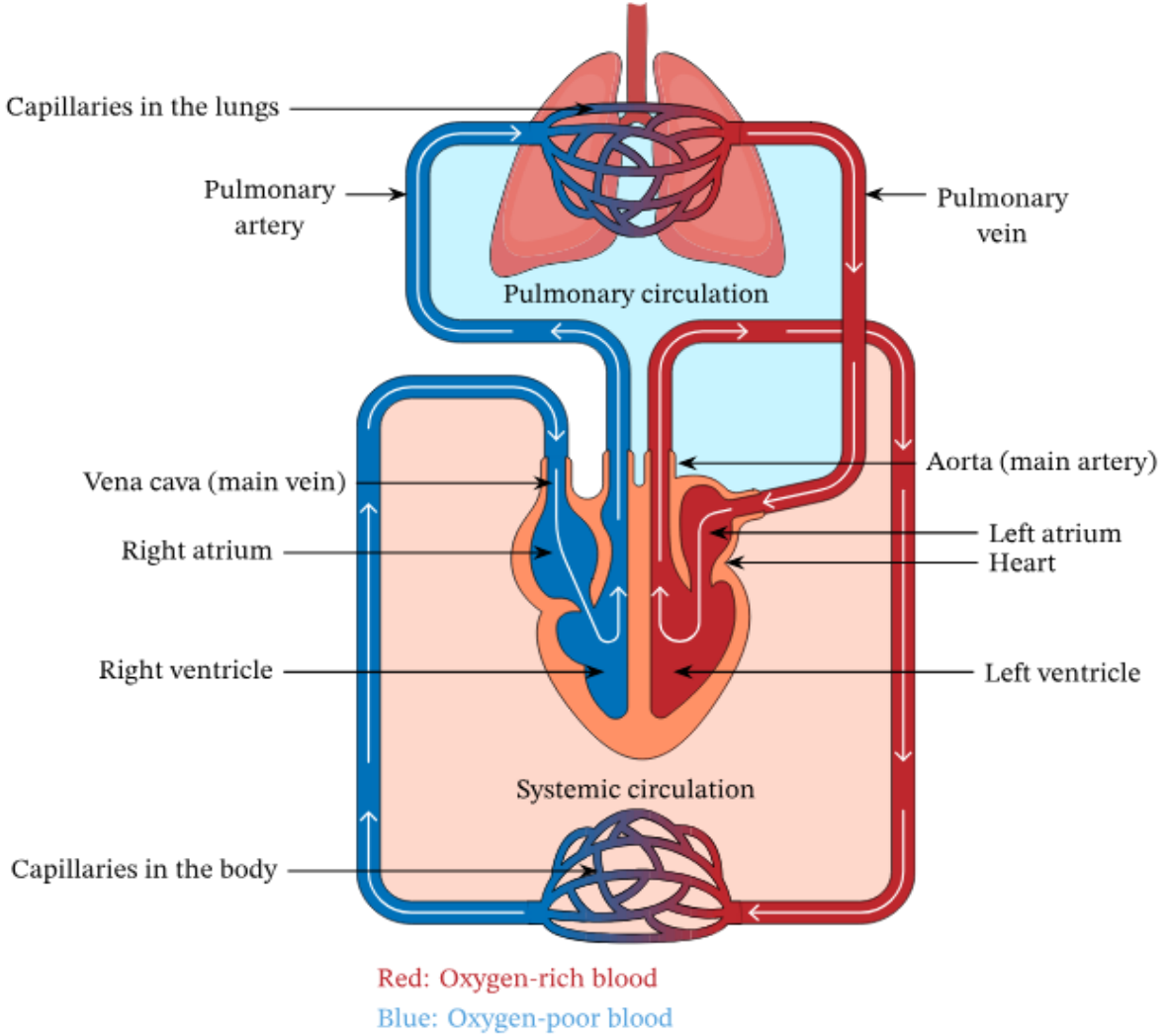
Heart Wall Layers:

1.Endocardium – inner smooth lining.

2.Myocardium – muscular middle layer

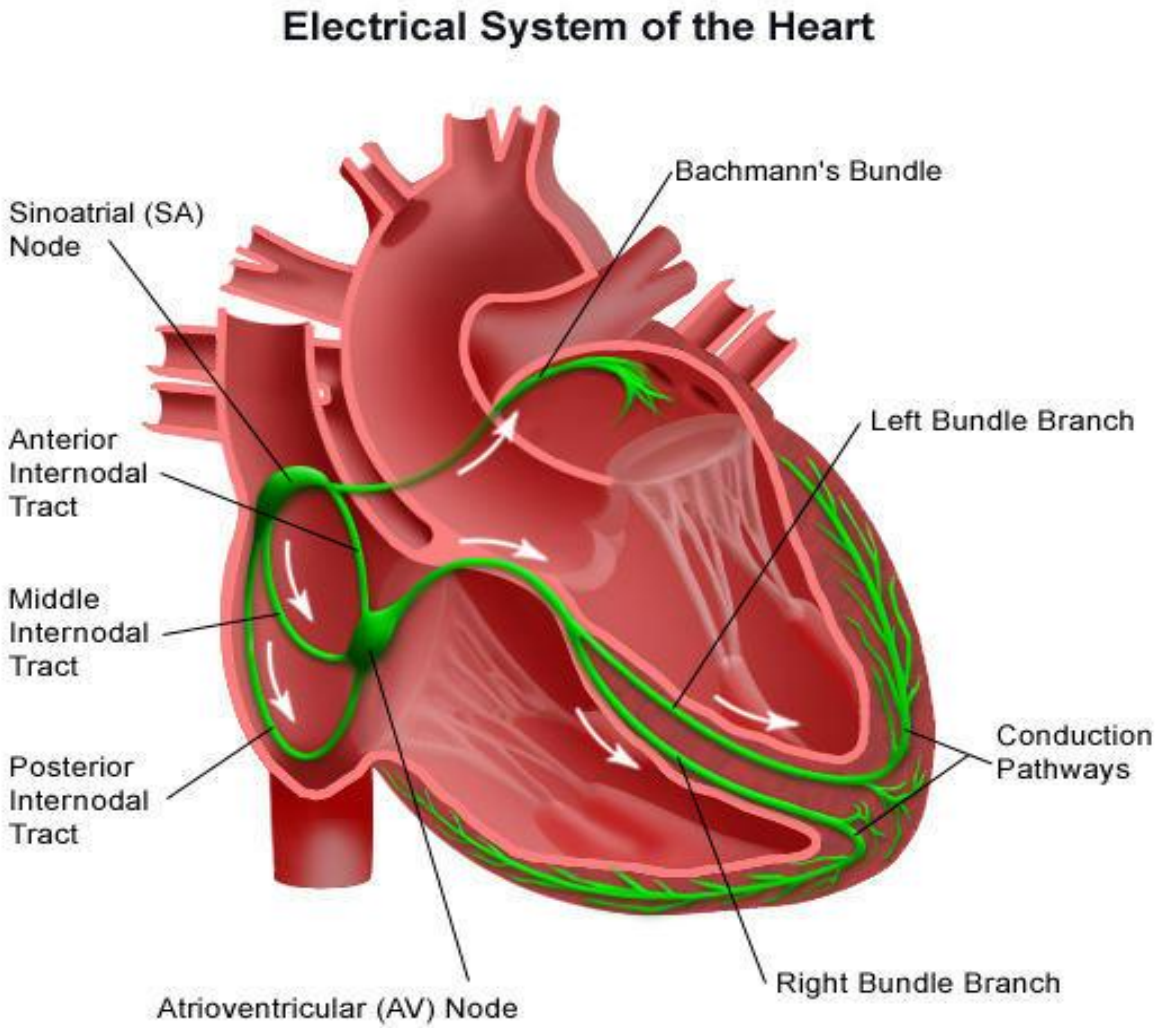
(thickest in LV).

3.Epicardium – outer protective layer.



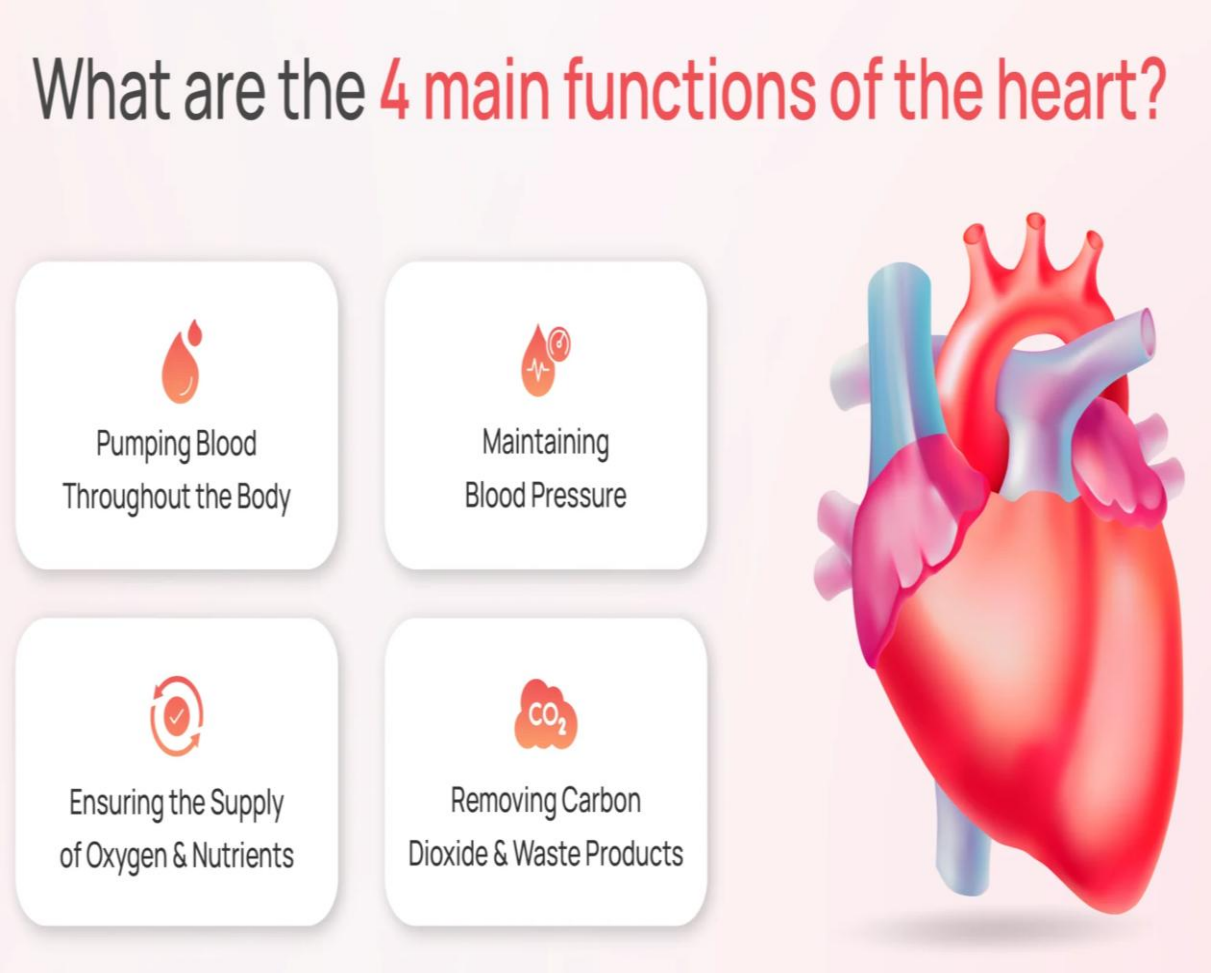
Conducting System

- **SA Node → AV Node → Bundle of His → Purkinje Fibers**
- Responsible for **rhythmic contraction** and **synchronous pumping**.



Physiological Functions

1. Generates **pressure gradient** for blood flow.
2. Maintains **unidirectional flow** via valves.
3. Regulates **cardiac output (CO = HR × SV)**.
4. Responds to **autonomic and hormonal control**.



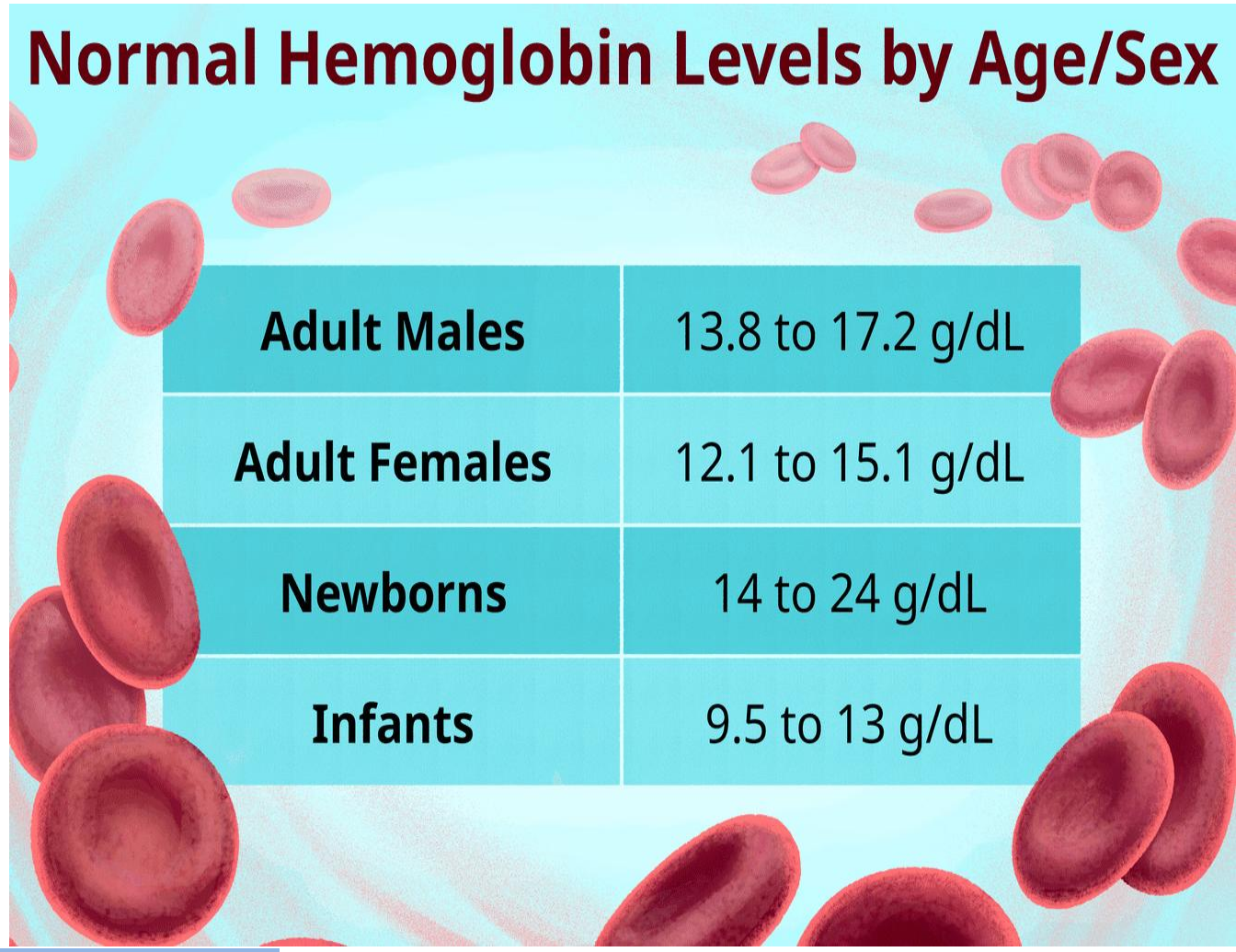
B. The Blood

Definition:

A **fluid connective tissue** that transports essential substances to and from tissues.

Volume:

- **Adults:** ~5–6 L (males), ~4–5 L (females)
- **Pediatrics:** ~80–85 mL/kg body weight



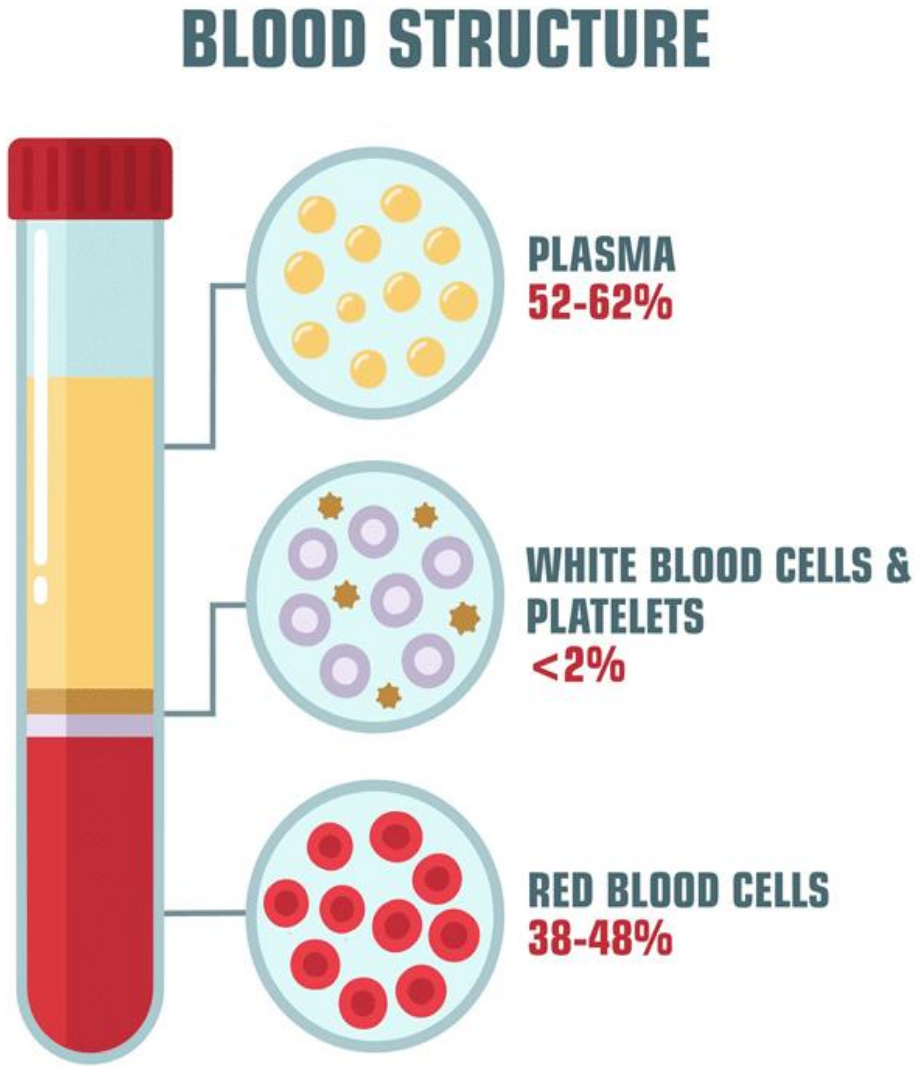
Composition

1.Plasma (55%) – straw-colored fluid.

- Components: 90% water, 7% plasma proteins (albumin, globulin, fibrinogen), 3% solutes (ions, nutrients, hormones).

2.Formed Elements (45%)

- **Red Blood Cells (Erythrocytes):**
  - Contain **hemoglobin** for O_2 transport.
  - Lifespan: ~120 days.
- **White Blood Cells (Leukocytes):**
  - Defend against infection (neutrophils, lymphocytes, monocytes, etc.).
- **Platelets (Thrombocytes):**
  - Help in clot formation and tissue repair.



Functions of Blood

– **Transport:** O_2, CO_2, nutrients, hormones, wastes.

– **Regulation:** pH, temperature, fluid balance.

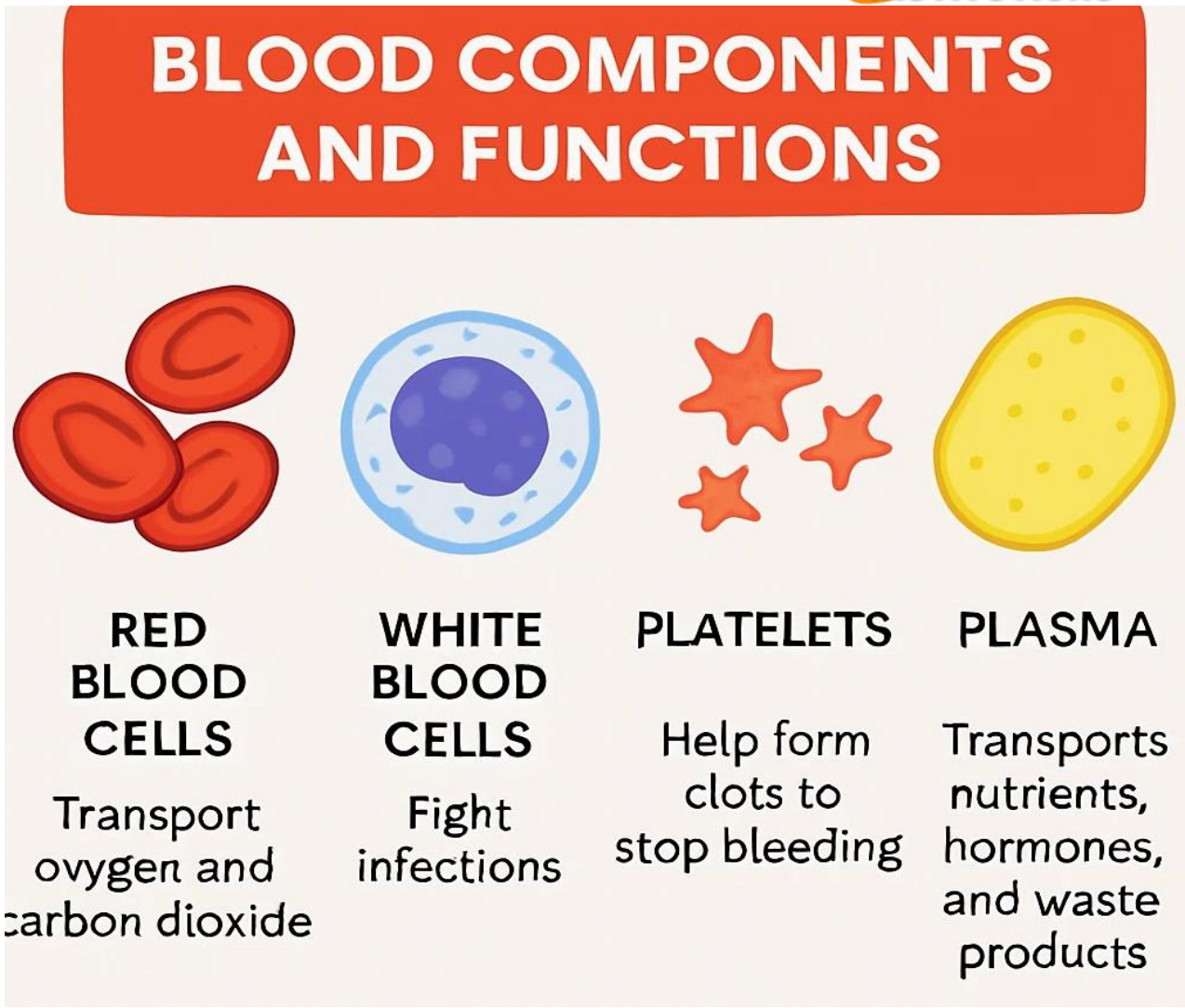
– **Protection:** Immune defense and clotting.

Clinical relevance:

– **Anemia:** ↓RBCs or Hb → fatigue.

– **Leukemia:** ↑abnormal WBCs → immune dysfunction.

– **Thrombocytopenia:** ↓platelets → bleeding risk.



Blood Vessels 🩸➡️🩸

Definition: Tubular structures that transport blood to and from the heart.

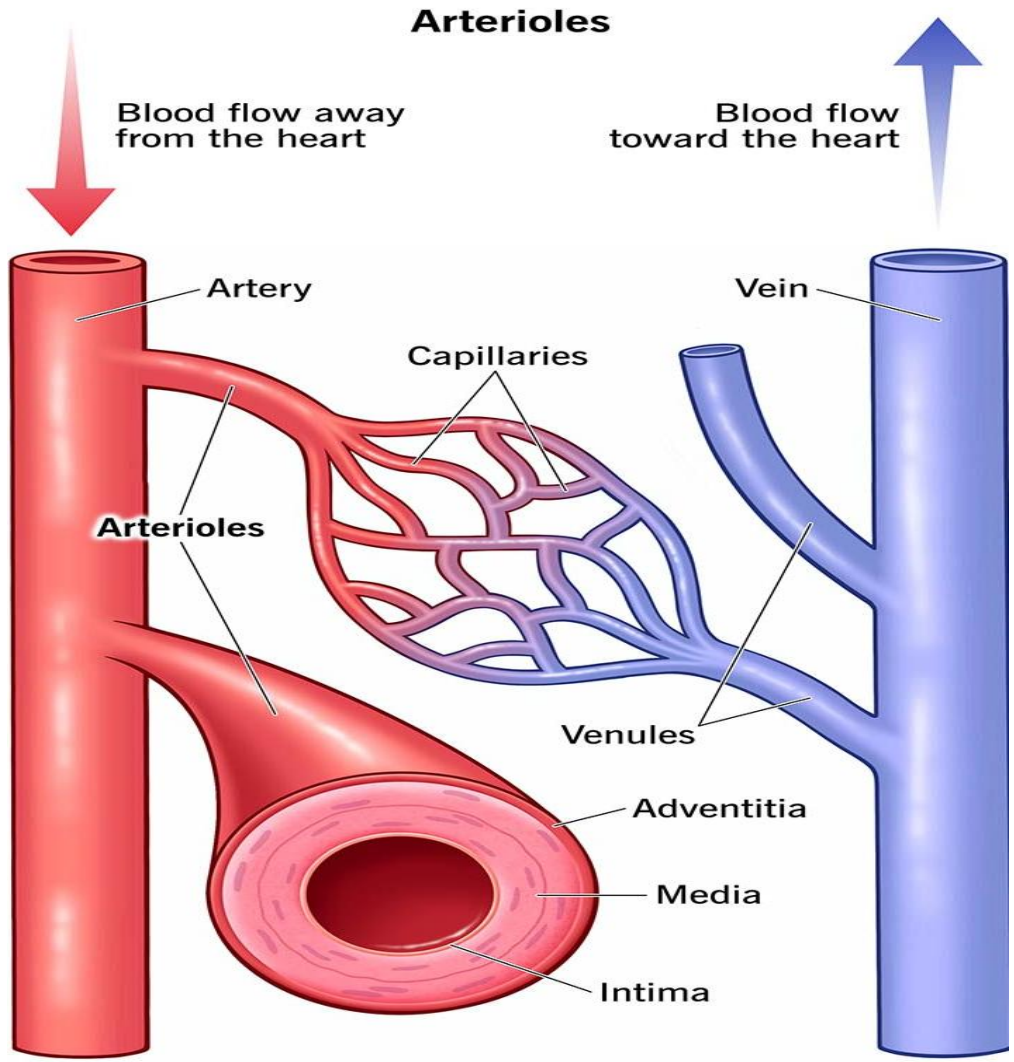
Types:

Arteries:

- Carry blood *away* from the heart (usually oxygenated).
- Thick muscular walls, high pressure.
- Example: Aorta, Coronary arteries.

Arterioles:

- ❖ Smaller arteries controlling blood flow into capillaries.
- ❖ Main site of **resistance** and **BP regulation**.

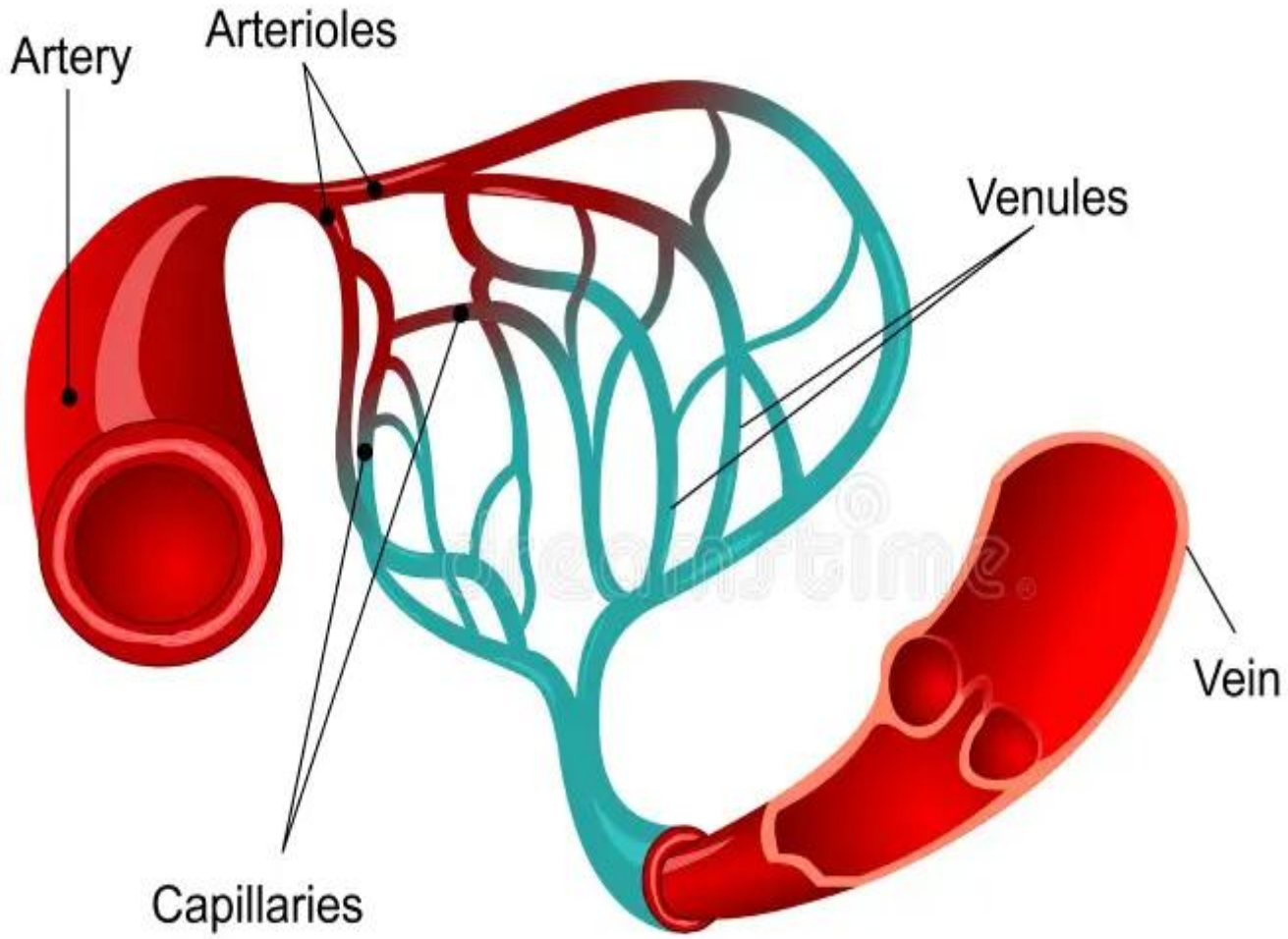


Capillaries:

1. Microscopic thin-walled vessels.
2. Site of **exchange** (gases, nutrients, wastes).
3. Found in tissues and organs.

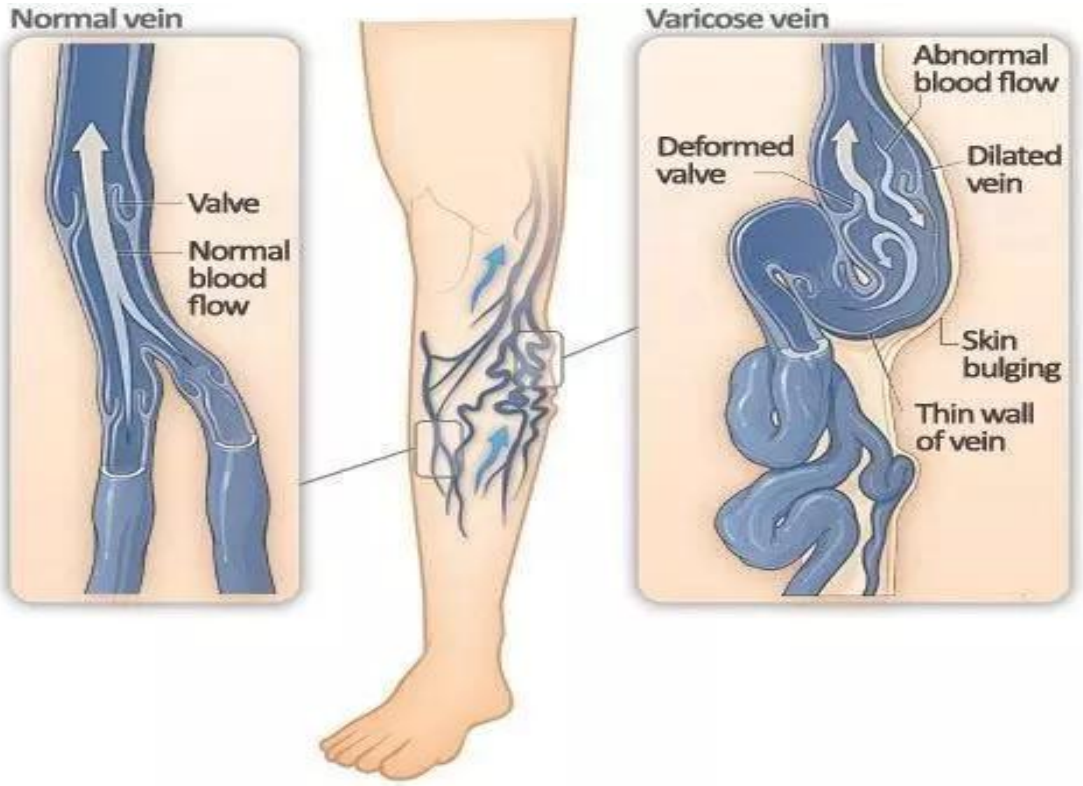
Venules and Veins:

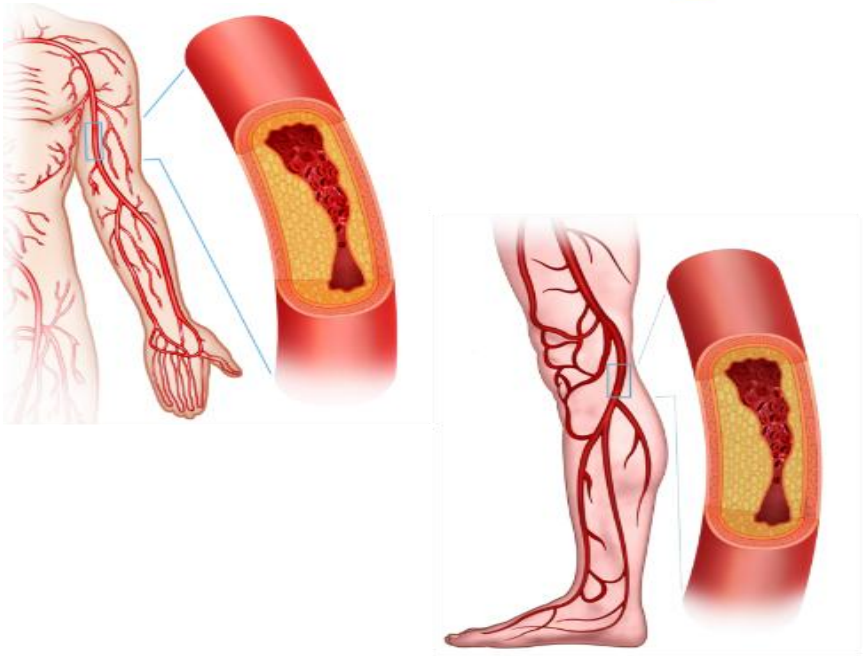
1. Carry blood *toward* the heart (usually deoxygenated).
2. Contain **valves** to prevent backflow.
3. Thin walls, low pressure system.

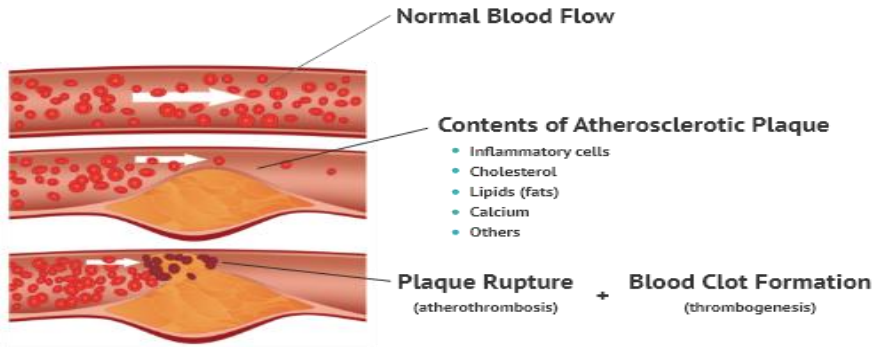


Clinical Relevance

- Arteriosclerosis → hardening of arteries → hypertension.
- Varicose veins → faulty valves → pooling of blood.







💡 IDEATE — System Integration & Function

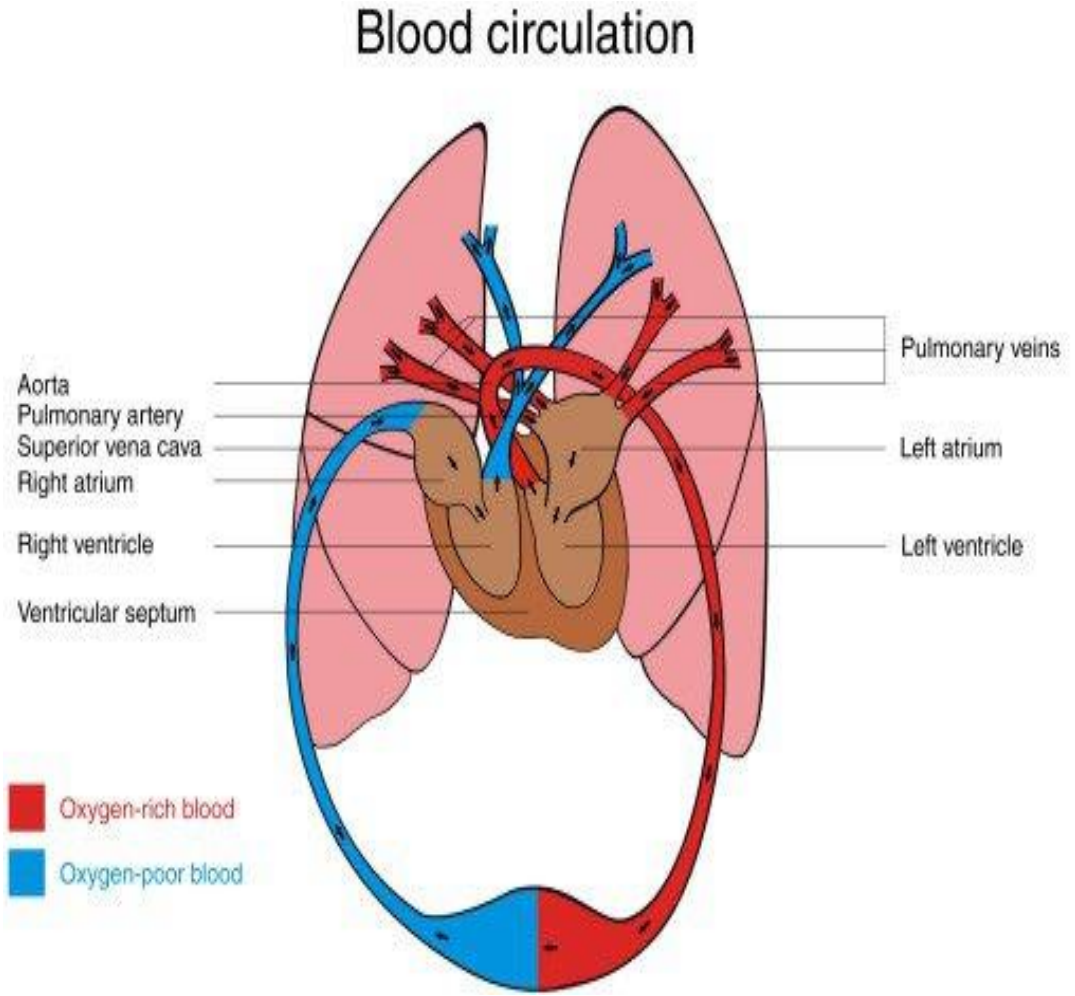
Heart + Blood + Vessels = Closed circulatory system working in synchrony.

Pathway:

– LV → Aorta → Arteries → Capillaries → Veins → RA → RV → Lungs → LA → LV.

Key Concepts:

- ❑ **Systemic circulation:** LV → body → RA.
- ❑ **Pulmonary circulation:** RV → lungs → LA.
- ❑ **Coronary circulation:** Heart's own blood supply.



Clinical Tools & Investigations:

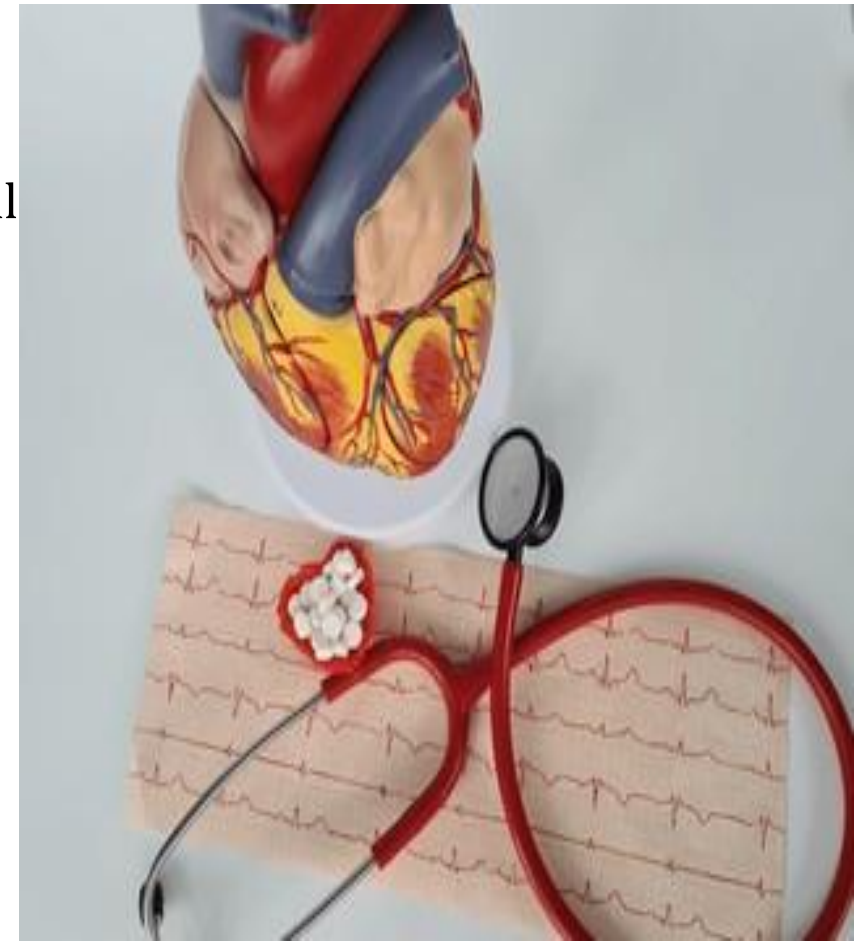
ECG: Assesses electrical function of heart.

Echocardiography: Checks valve, wall motion, ejection fraction.

Blood tests: Evaluate components (Hb, WBC, platelets).

Doppler studies: Assess blood vessel flow & resistance.

Cardiac catheterization: Measures pressure and flow in vessels.



Interventions:

1. Blood transfusion (for anemia).
2. Angioplasty (for blocked arteries).
3. Valve repair/replacement (for structural issues).

Summary

Component	Structure	Function	Clinical Importance
Heart	4 chambers, valves, conduction system	Pumps blood	Heart failure, valve disease
Blood	Plasma + formed elements	Transport, regulation, defense	Anemia, infection, bleeding
Blood Vessels	Arteries, veins, capillaries	Distribute & collect blood	Hypertension, atherosclerosis

REFERENCE BOOKS

- **Guyton & Hall**, *Textbook of Medical Physiology* (14th Edition)
- **Sembulingam & Sembulingam**, *Essentials of Medical Physiology*
- **John R. Hampton**, *The ECG Made Easy*
- **Chatterjee & Price**, *Clinical Electrocardiography: Simplified Approach*
- **Goldberger**, *Clinical Electrocardiography: A Simplified Approach*