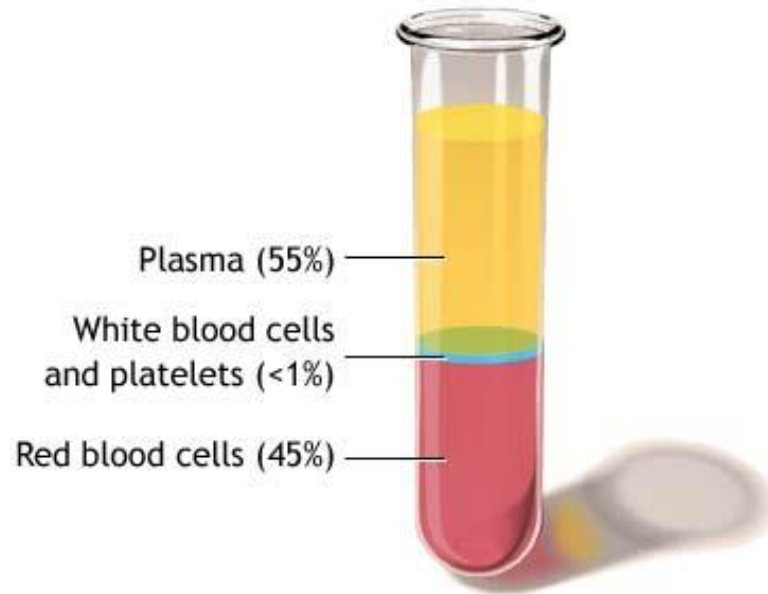


Blood



# Blood Introduction

- Blood is a **collection of cells** that have been specialized to perform a set of tasks within an organism.
- For this reason, doctors and scientists consider blood a **tissue** and not a fluid.

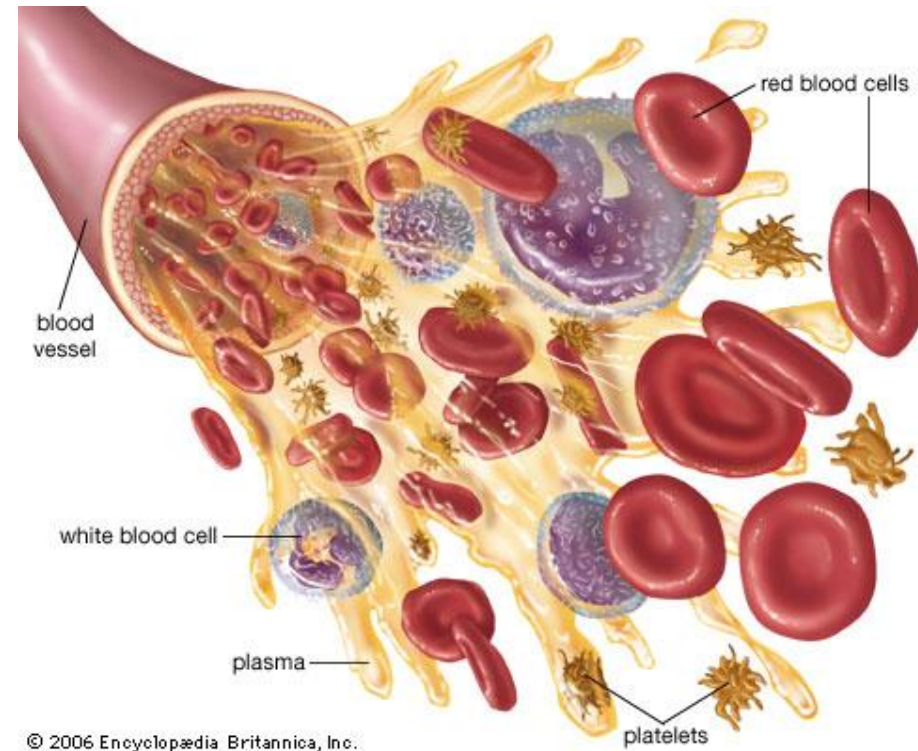


Blood consists of two distinct elements:

- 1. Plasma:** the fluid portion of the blood (55% of blood)
- 2. Cells:** the solid portion of blood (45% of blood)

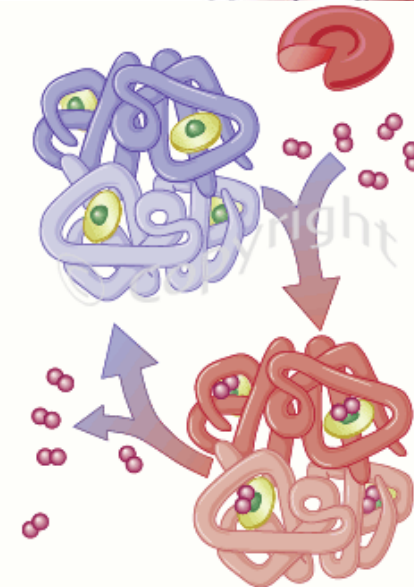
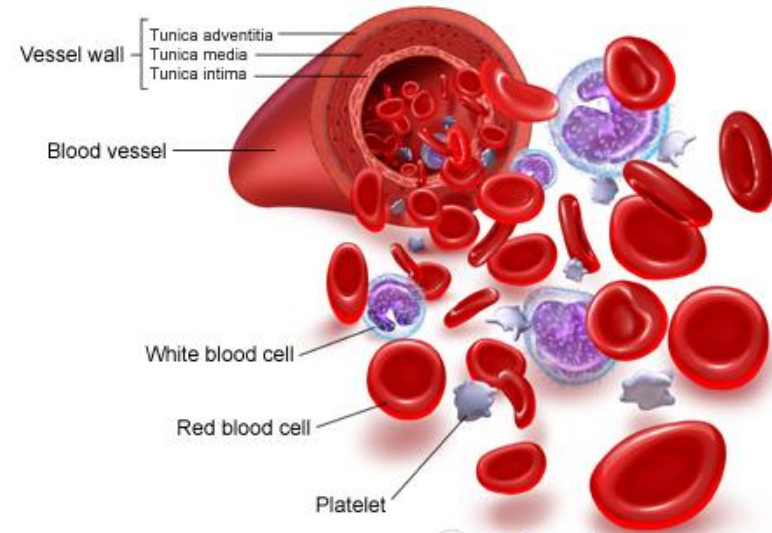
# Plasma

- **Fluid portion** of the blood that carries blood cells.
- Made up of **90% water**, the other 10% made up of blood proteins, glucose, vitamins, minerals, dissolved gases, waste products of cell metabolism.
- Also **transports CO<sub>2</sub>**.



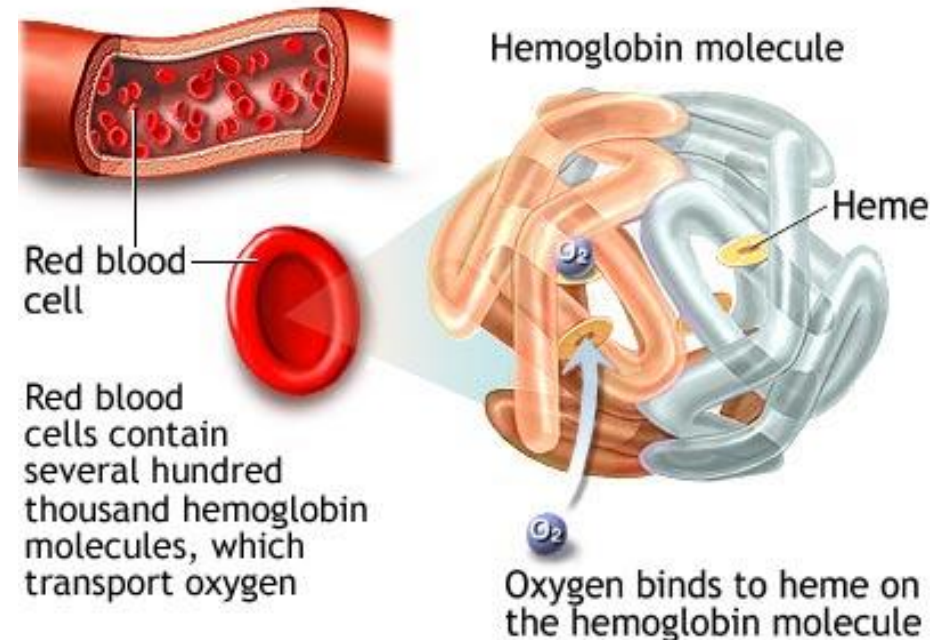
# Red Blood Cells

- **Erythrocytes**
- Make up 44% of blood.
- Specialized for **transport of O<sub>2</sub>**. Without them plasma could only carry 2% of the oxygen that normally travels through our bodies.
- Shape: **biconcave disk** to increase surface area.
- **No nucleus**, lifespan of 120 days, constantly reproduced.
- Males ~ 5.5 billion RBC/mL blood; Females ~ 4.5 billion.



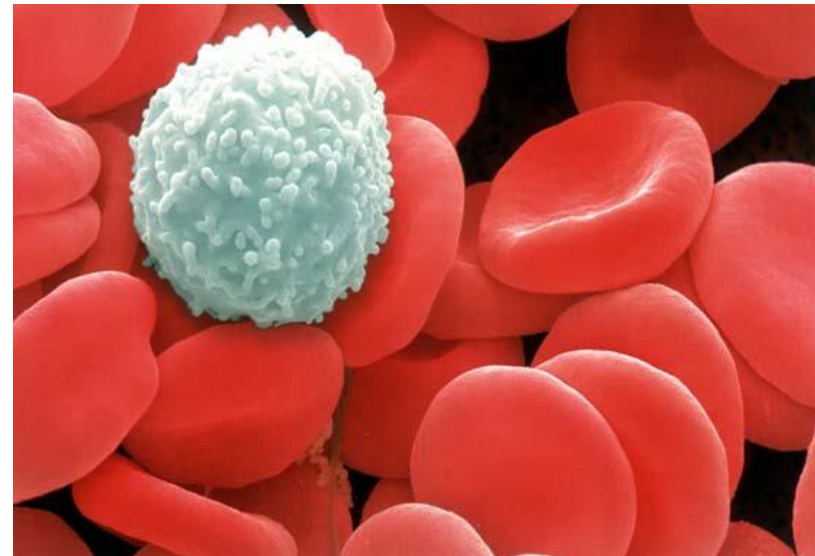
# Red Blood Cells

- Packed with 280 million molecules of **hemoglobin**, an iron-containing molecule that binds with oxygen.
- **Hemoglobin** has 4 globular protein molecules (globin) and 1 iron molecule (protein)
  - High affinity for oxygen
  - Hemoglobin + oxygen  
hemoglobin
- RBC lose their **nucleus** when they enter the blood stream in order to carry more hemoglobin.



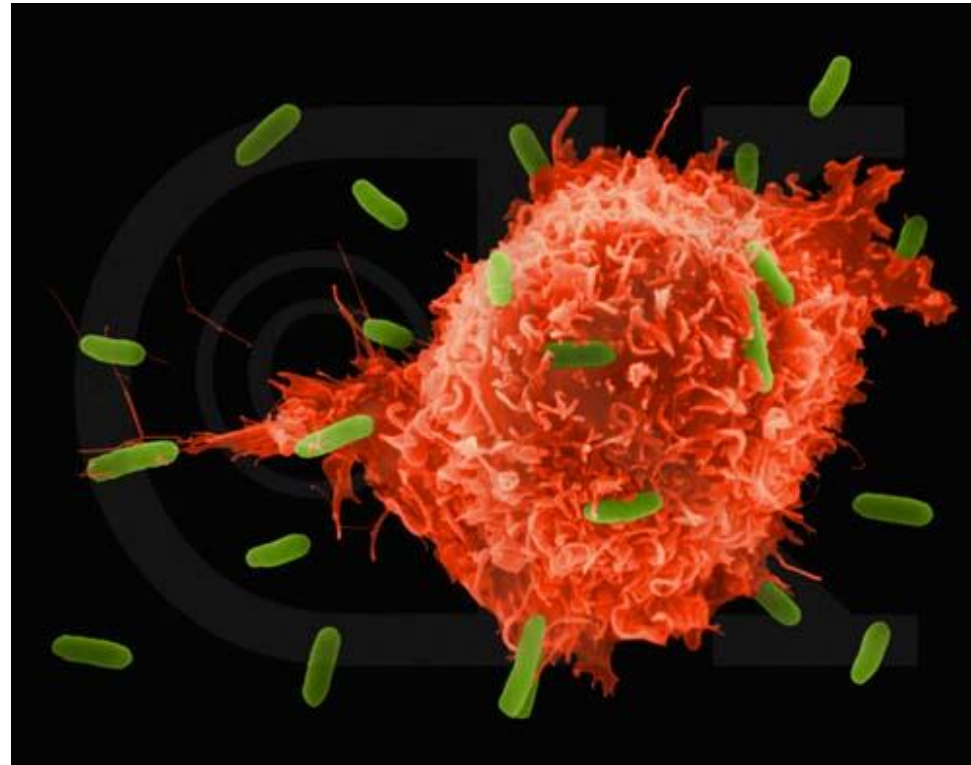
# White Blood Cells

- Make up about **1% of blood's volume**.
- Produced in **bone marrow**.
- White blood cells contain nuclei and appear colourless.
- They play many roles in **fighting off infection** and **protecting the body from pathogens**.
  - The number of WBC may increase by double when you are fighting off an infection.
  - **Pus**: fragments of remaining protein of the WBC and the invader.



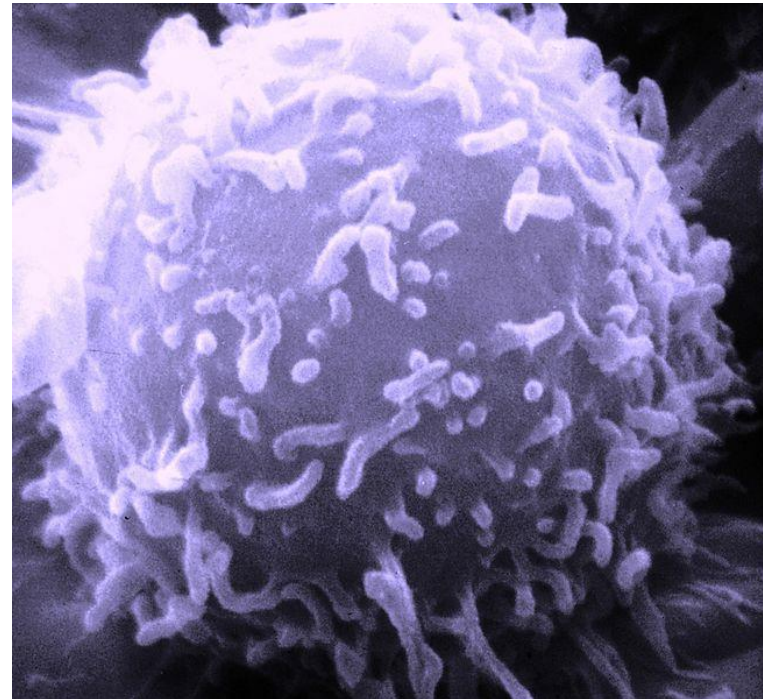
# Leukocytes and Lymphocytes

- Two of the most important disease-fighting white blood cells are **leukocytes** and **lymphocytes**.
- **Leukocytes** (macrophages) engulf and digest pathogens.
  - Innate immune response (generalized response of the body to infection).
  - Can pass through the wall of the capillaries.



# Leukocytes and Lymphocytes

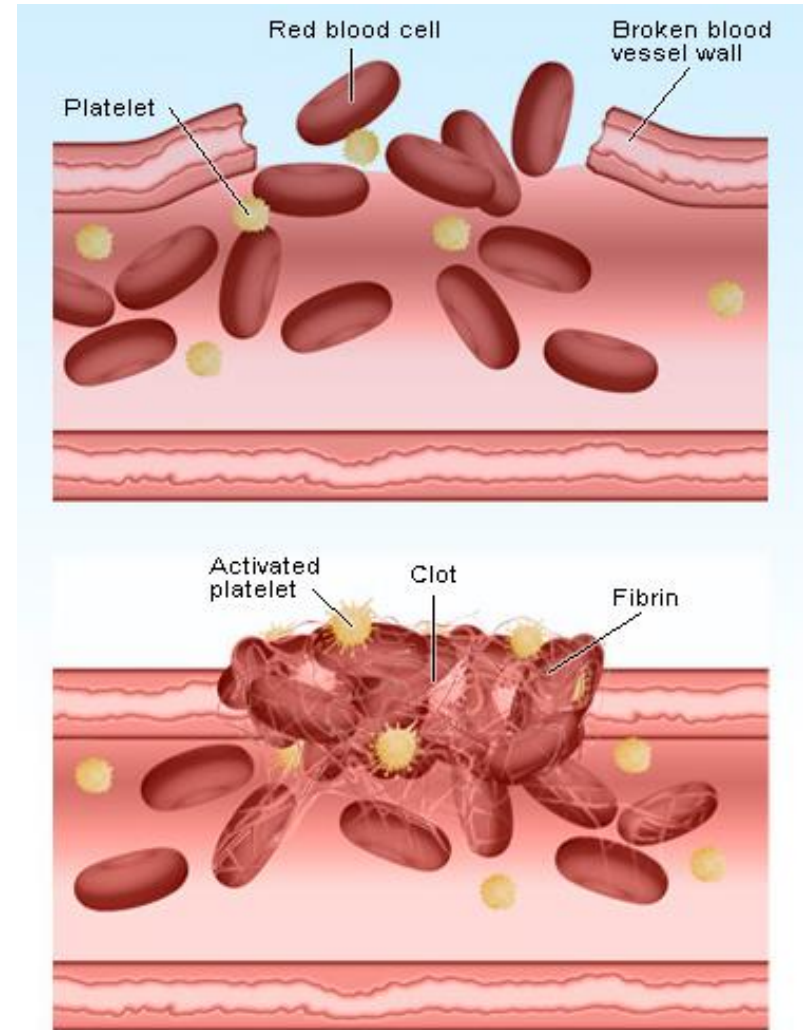
- **Lymphocytes**
  - Acquired immune response (specific immune response).
  - Recognize and remember specific pathogens and fend them off if they attack again.





# Platelets

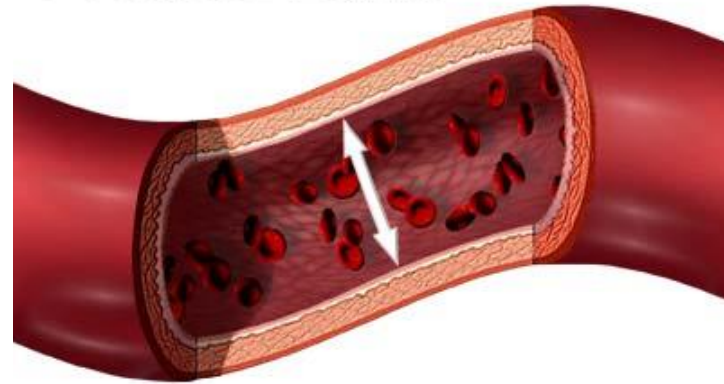
- Are **not cells**.
- Fragments of larger cells that broke apart in the bone marrow.
- They contain no nucleus and break down relatively quickly.
- They **help the blood to clot** and protect the body from excessive blood loss after an injury.



# Blood Pressure

- Force of the blood on the walls of the arteries.
- Normal BP 120/80 mm Hg; decreases as you move away from the heart.
- **Stroke Volume**: volume of blood leaving heart (L)
- **Heart Rate**: number of beats (contractions) per minute (bpm)

Blood pressure is the measurement of force applied to artery walls



# Blood Pressure

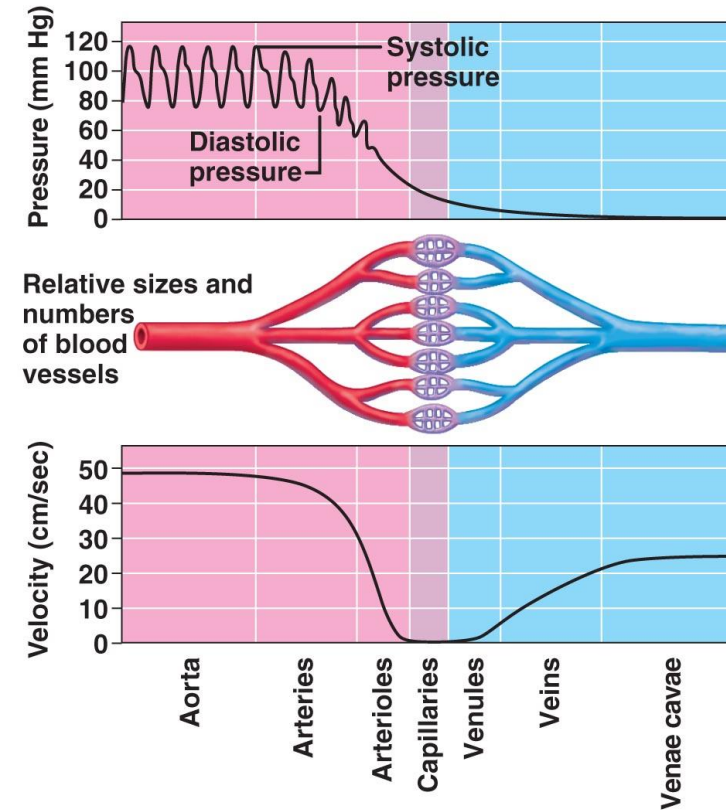
Two factors determine BP:

**1. Cardiac Output (CO):** amount of blood pumped from the heart each minute = Heart Rate (HR) x Stroke Volume (SV)

- $\uparrow$  CO =  $\uparrow$  BP
- increase CO by  $\uparrow$ HR or  $\uparrow$  Stroke Volume (stronger heart)

**2. Arteriolar resistance:** diameter of the arteriole determines the amount of blood flow

- $\uparrow$  diameter =  $\downarrow$  BP



# Blood Pressure Regulation

- Diameter of blood vessels regulated by the **medulla oblongata**.
- **Vasoconstriction**: nerve impulses cause muscle to contract, reducing diameter of vessel, reduces flow to tissue, increases pressure
- **Vasodilation**: nerve impulses cause muscles to relax, increasing diameter of vessel, increases flow to tissue, decreases pressure

