Bio-fluidics
Part 1

Circulatory system, Components

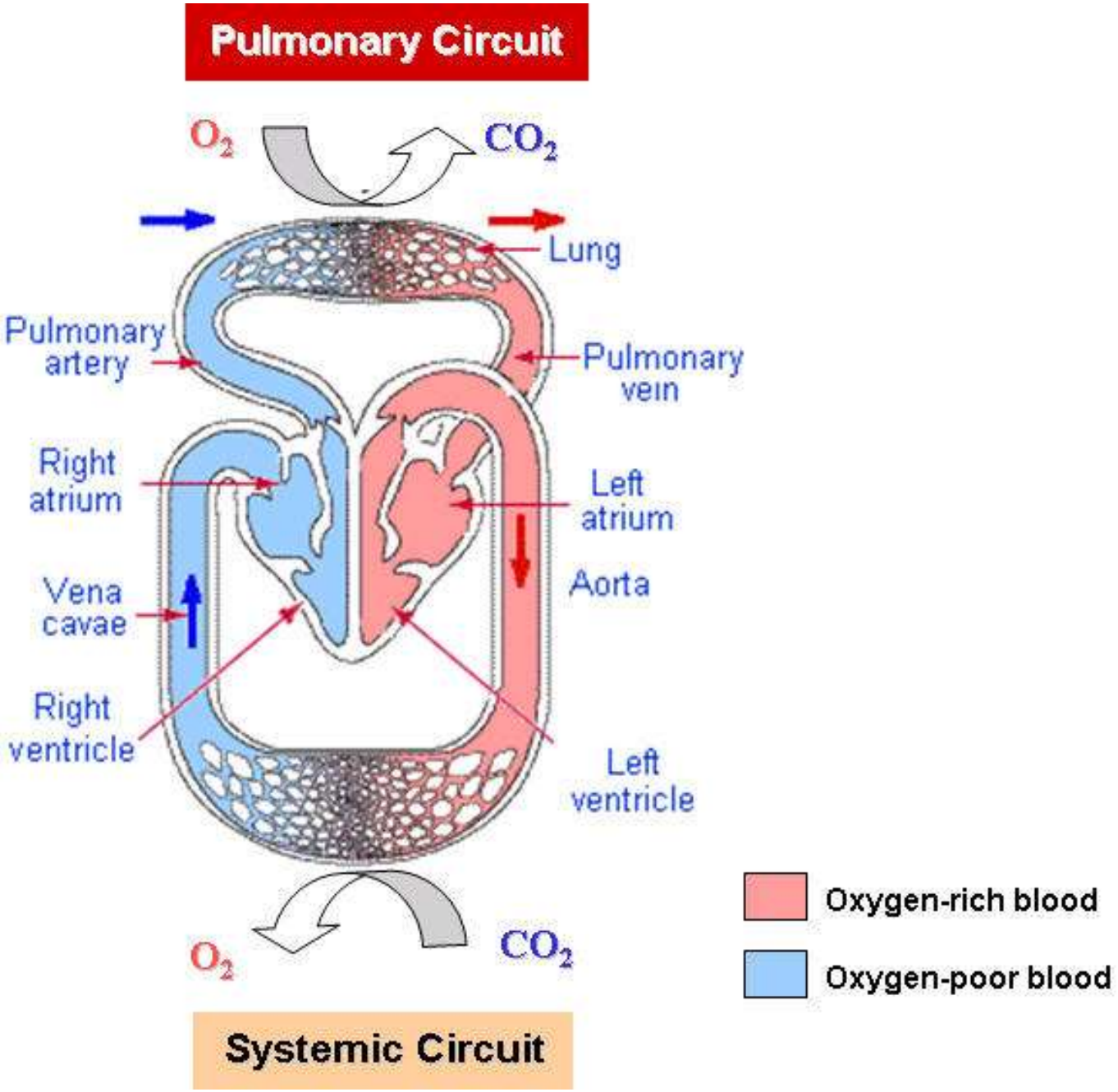
Circulatory system

- System that passes nutrients, gases, hormones and blood cells to and from cells in the body
  - to help fight diseases,
  - stabilize body temperature and pH,
  - to maintain homeostasis.

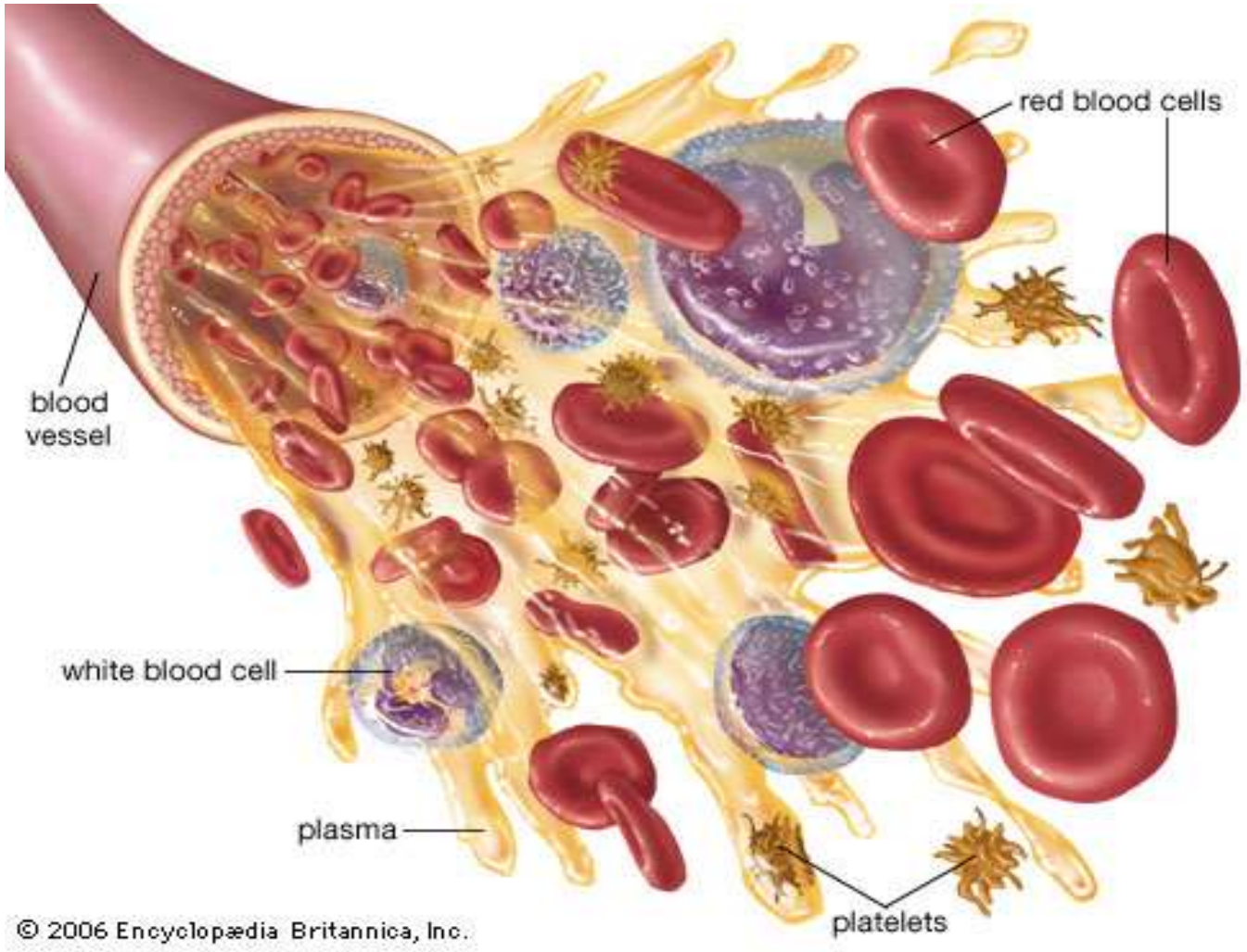
Components

- The main components:
  - heart,
  - blood,
  - blood vessels.

- The heart is the strongest muscle of our body.
- It is responsible for moving the blood throughout the circulatory system.
- The heart acts like a giant mechanical pump, pushing blood like clockwork.


Pulmonary Circuit
O_2
CO_2
Lung
Pulmonary artery
Pulmonary vein
Right atrium
Left atrium
Aorta
Vena cavae
Right ventricle
Left ventricle
O_2
CO_2
Systemic Circuit
Oxygen-rich blood
Oxygen-poor blood

- The muscle of the heart (or more specifically, the heart's muscular middle layer) is called the **myocardium**. (*Myo-* refers to muscle.)
- There are three main types of blood vessels :
  - arteries : the vessels that lead blood AWAY from the heart
  - veins : the vessels that lead blood back TOWARD the heart
  - capillaries : the microscopic vessels that connect arteries and veins; they serve as the place where gasses (oxygen, carbon dioxide, etc.) and nutrients are exchanged.


red blood cells
blood vessel
white blood cell
plasma
platelets
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Types of circulation

- Systemic circulation**:** starts with oxygenated blood in the aorta, ends with deoxygenated blood in the vena cava; the part of the loop that provides most of the body with its blood
- Pulmonary circulation*:* the relatively short part of the loop that starts with deoxygenated blood in the pulmonary artery and ends with oxygenated blood in the pulmonary vein; the part of the loop responsible for "refilling" the blood with oxygen in the lungs

Blood

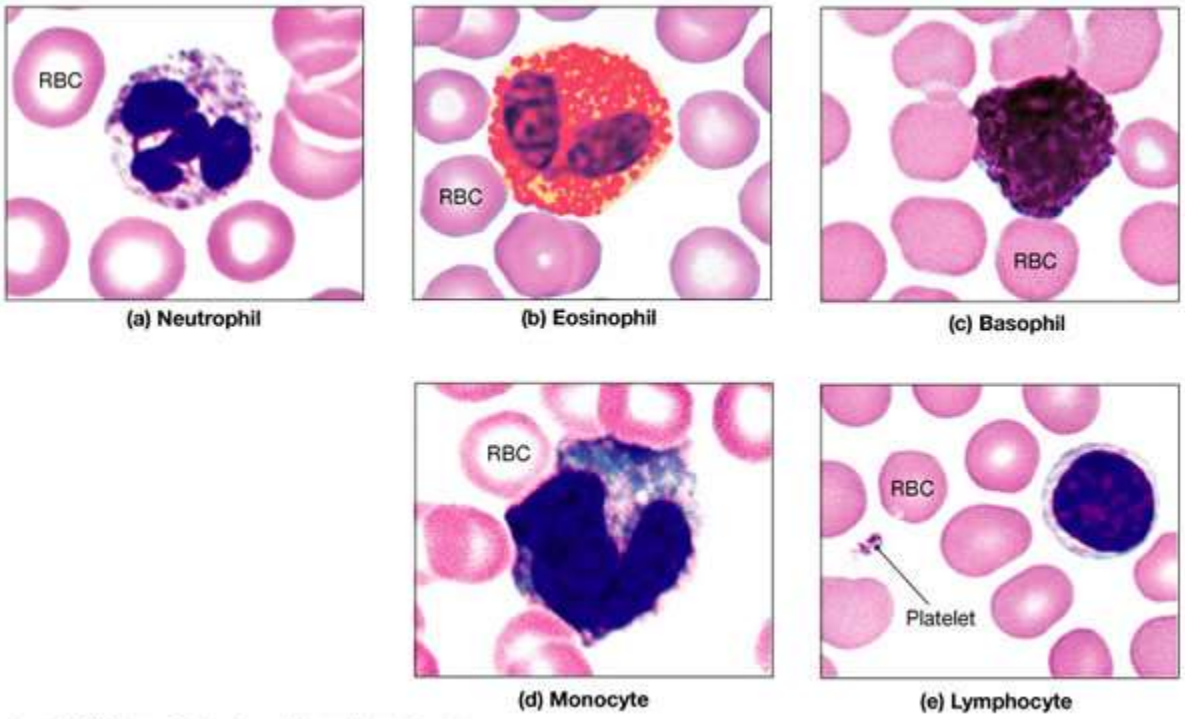
- Body contains approximately 4 to 5 liters of blood, making up about 8% of the body's weight
- Functions :
  - Transporting nutrients, oxygen, and hormones
  - Removing metabolic wastes and carbon dioxide
  - Providing immunity through antibodies
  - Maintaining body temperature and electrolyte balance
  - Clotting to prevent bleeding from a wound

Red Blood Cells (Erythrocytes)

- Contain hemoglobin
- live only 90 to 120 days
- New cells are manufactured by the red marrow or myeloid tissue in bones
- The liver and spleen remove dead red blood cells

Five Types of WBCs

- Neutrophils
- Basophils
- Eosinophils
- Lymphocytes
- Monocytes

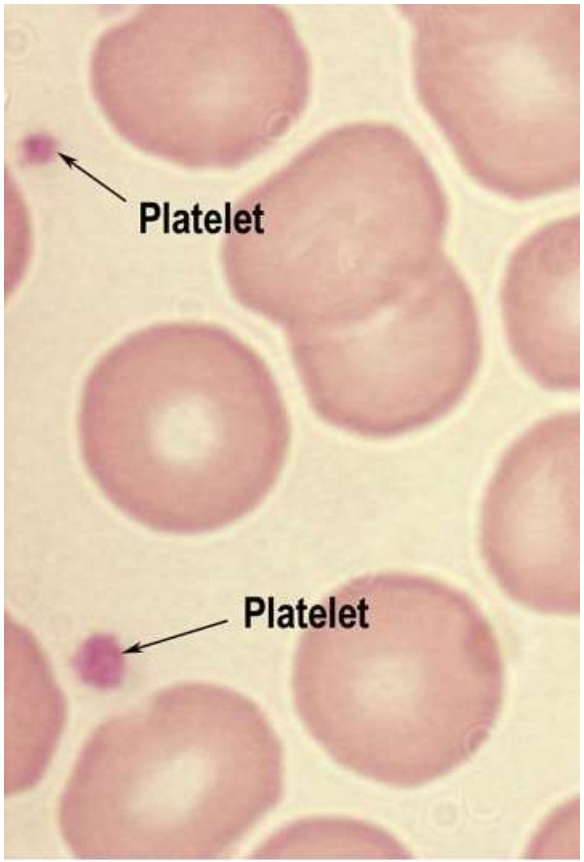


White Blood Cells (Leukocytes)

- White blood cells remove foreign particles, fight infection, and help prevent disease
- White blood cells are larger

Platelets (Thrombocytes)

- Platelets can form a plug to seal small vessels by themselves or start the clotting process
- Produced in red bone marrow
- Live about 5 to 9 days



Plasma

- A pale yellow liquid that remains when elements are removed from blood
- Whole blood is 55% plasma
- Plasma is 90% water and approximately 10% proteins
- It contains
  - nutrients, electrolytes, oxygen, enzymes,
    hormones, and wastes
- Helps fight infection and assists in the clotting (coagulation) of blood