# Transport in Humans

## Importance of the Circulatory System

The circulatory system is crucial for transporting essential substances such as oxygen, nutrients, and hormones to cells while removing waste products like carbon dioxide and metabolic by-products. This system ensures that cells receive the necessary components to generate energy and function properly.

## Role of the Kidneys in Transportation

The kidneys are essential for filtering blood and removing waste, which is then excreted as urine. By working in coordination with the circulatory system, the kidneys maintain homeostasis and overall health.

## Basic Requirement for Life Processes

All living organisms require food, water, and oxygen for survival. These substances must reach every cell to facilitate various biological functions such as respiration and digestion. Waste products generated in these processes need to be removed efficiently to prevent toxicity.

## Historical Perspective on Circulatory System

**17th Century:** William Harvey revolutionized medical science by demonstrating that blood circulates in a closed loop, propelled by the heart.

**17th and 18th Centuries:** Marcello Malpighi and Stephen Hales contributed to the understanding of fluid transport in plants, laying the foundation for vascular physiology.

## Human Circulatory System

**The circulatory system consists of:**

**Blood:** A fluid connective tissue that transports essential substances.

**Blood Vessels:** Networks of tubes that carry blood.

**Heart:** A muscular organ responsible for pumping blood throughout the body.

## Components of Blood

**White Blood Cells (WBCs):** Also known as leucocytes, they protect the body by fighting infections.

**Red Blood Cells (RBCs):** Also called erythrocytes, they contain hemoglobin, which binds oxygen for transport.

**Hemoglobin:** A red pigment that forms oxyhemoglobin when combined with oxygen, facilitating oxygen transport.

### Heart Structure and Function

**The heart has four chambers:**

- Right Atrium
- Right Ventricle
- Left Atrium
- Left Ventricle

### Blood Flow Pathway:

#### Deoxygenated Blood:

Body → Right Atrium → Right Ventricle → Pulmonary Artery → Lungs

#### Oxygenated Blood:

Lungs → Pulmonary Vein → Left Atrium → Left Ventricle → Aorta → Body

### Heartbeat and Heart Sounds

**Lub Sound (S1):** Produced by the closing of cuspid valves at the start of ventricular contraction.

**Dub Sound (S2):** Occurs when semilunar valves close, marking the end of contraction.

#### Phases of Heartbeat:

- Atrial Systole: Atria contract, pushing blood into ventricles.
- **Ventricular Systole:** Ventricles contract, pumping blood into arteries.
- **Diastole:** The heart relaxes, refilling the atria and ventricles with blood.

### Blood Circulation Diagram

- **Pulmonary circulation:** Heart → Lungs → Heart
- **Systemic circulation:** Heart → Body → Heart

## Excretion in Humans

Metabolic processes generate harmful by-products that must be removed. Excretion is the process of eliminating these wastes.

## Human Excretory System

**Kidneys:** Filter blood and produce urine.

**Ureters:** Transport urine from the kidneys to the bladder.

**Urinary Bladder:** Stores urine before excretion.

**Urethra:** Expels urine from the body.

## Composition of Urine

**Urine consists of:**

- 95% Water
- 2.5% Urea
- 2.5% Other Wastes

## Types of Excretory Waste Based on Organism Type

i. **Ammonotelic Animals:** Excrete ammonia (e.g., fish, amphibians).

ii. **Ureotelic Animals:** Excrete urea (e.g., mammals, including humans).

iii. **Uricotelic Animals:** Excrete uric acid (e.g., reptiles, birds).

**Other waste elimination methods:**

- **Sweating:** Removes excess salts and small amounts of waste.
- **Respiration:** Eliminates carbon dioxide via the lungs.

## Key Facts & Activities

The human body contains approximately 4—5 liters of blood.

The average lifespan of an RBC is 120 days.

The heart beats approximately 72 times per minute.