Chapter: Human Physiology

Subject: Biology | IB MYP Class 10 Sciences (Group 4)

Introduction

Human physiology is the study of the functioning of the human body and its systems. It explains how our organs work together to sustain life, maintain balance (homeostasis), and respond to internal and external stimuli. Understanding human physiology equips learners with knowledge of their own biology and helps in making informed decisions about health, nutrition, and lifestyle. In the MYP framework, this unit also encourages inquiry, critical thinking, and a systems approach to life science.

Learning Objectives

By the end of this chapter, students will be able to:

- Describe the main organ systems in the human body and their primary functions.
- Explain the processes involved in digestion, circulation, respiration, excretion, and nervous coordination.
- Understand how these systems interact to maintain homeostasis.
- Apply knowledge to real-life contexts such as health, disease prevention, and medicine.

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1. Organization of the Human Body

The human body is organized into levels:

- **Cells → Tissues → Organs → Organ systems → Organism**

Key Organ Systems:

1. **Digestive system**
2. **Circulatory system**
3. **Respiratory system**
4. **Excretory system**
5. **Nervous system**

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2. Digestive System

Function:

To break down food into nutrients that the body can absorb and use for energy, growth, and repair.

Major Organs:

- **Mouth**: Mechanical and chemical digestion begins here.
- **Esophagus**: Transports food to stomach via peristalsis.
- **Stomach**: Churns food, secretes acid and enzymes.
- **Small intestine**: Most digestion and absorption occurs here.
- **Large intestine**: Absorbs water and forms feces.
- **Liver, Gallbladder, Pancreas**: Secrete digestive enzymes and bile.

Enzymes and Digestion:

- **Amylase**: Breaks down carbohydrates.
- **Protease**: Breaks down proteins.
- **Lipase**: Breaks down fats.

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3. Circulatory System

Function:

To transport nutrients, gases, hormones, and waste products throughout the body.

Components:

- **Heart**: Pumps blood.
- **Blood vessels**:
  - **Arteries**: Carry oxygenated blood away from the heart.
  - **Veins**: Return deoxygenated blood to the heart.
  - **Capillaries**: Facilitate exchange of gases and nutrients.
- **Blood**: Contains red blood cells (RBCs), white blood cells (WBCs), platelets, and plasma.

Double Circulation:

- **Pulmonary circuit**: Between heart and lungs.
- **Systemic circuit**: Between heart and body.

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4. Respiratory System

Function:

To provide oxygen to the body and remove carbon dioxide.

Major Organs:

- **Nasal cavity**: Warms and filters air.
- **Trachea and bronchi**: Conduct air to lungs.
- **Lungs**: Main site of gas exchange.
- **Alveoli**: Tiny sacs where O_2 and CO_2 are exchanged with capillaries.

Process:

- **Inhalation**: Diaphragm contracts, lungs expand.
- **Exhalation**: Diaphragm relaxes, air is expelled.

Gas Exchange:

Occurs in alveoli via diffusion:

- Oxygen moves into blood.
- Carbon dioxide moves into alveoli to be exhaled.

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5. Excretory System

Function:

To remove metabolic wastes and maintain internal balance of water and salts.

Main Organs:

- **Kidneys**: Filter blood to produce urine.
- **Ureters**: Carry urine to bladder.
- **Bladder**: Stores urine.
- **Urethra**: Releases urine from the body.

Processes in the Kidney:

- **Filtration**
- **Reabsorption**
- **Secretion**
- **Excretion**

Importance:

Maintains homeostasis of water, salts, and pH.

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6. Nervous System

Function:

To detect, process, and respond to stimuli.

Divisions:

- **Central Nervous System (CNS)**: Brain and spinal cord.
- **Peripheral Nervous System (PNS)**: Nerves connecting CNS to the rest of the body.

Neuron Structure:

- **Cell body**, **dendrites**, **axon**, **myelin sheath**, **axon terminal**

Types of Neurons:

- **Sensory neurons**: Detect stimuli.
- **Motor neurons**: Control muscles.
- **Interneurons**: Relay messages within CNS.

Reflex Arc:

- Automatic response to stimuli involving sensory input, spinal processing, and motor output.

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7. Integration and Homeostasis

All organ systems work together to maintain a stable internal environment, known as **homeostasis**.
Examples:

- **Temperature regulation** by the nervous and circulatory systems.
- **Blood glucose regulation** by the digestive and endocrine systems.
- **Oxygen levels** regulated by respiratory and circulatory systems.

Disruption in one system can affect others, leading to diseases or disorders.

ATL (Approaches to Learning) Skills Integration

- **Critical Thinking**: Analyzing how systems interact and affect overall health.
- **Communication**: Explaining physiological processes using appropriate scientific vocabulary.
- **Research**: Investigating medical technologies (e.g., dialysis, pacemakers).
- **Self-management**: Making health-related decisions based on understanding of bodily systems.

Global Context: Identities and Relationships

Understanding how our bodies function helps us build a healthy relationship with ourselves and others. This knowledge empowers us to advocate for our own health and make responsible choices related to nutrition, exercise, and medical care.

Summary

Human physiology examines how the body's systems—digestive, circulatory, respiratory, excretory, and nervous—work individually and together to keep the body functioning and in balance. Key processes such as digestion, respiration, circulation, excretion, and neural communication are central to life. An integrated understanding of physiology supports health literacy, enables critical inquiry into diseases and treatments, and nurtures a sense of respect for human biology.