



Human Anatomy and Physiology

Anatomy = the study of the structure of body parts

Physiology = the study of how those parts function and work together to sustain life

Together, Human Anatomy and Physiology (A&P) explain **how the human body is built and how it works**, from the cellular level to whole-body systems.



Levels of Organization (Before Organ Systems)

The human body is organized into several levels:

1. **Chemical level** – Atoms and molecules (e.g., water, proteins, DNA)
 2. **Cellular level** – Basic units of life (e.g., muscle cells, nerve cells)
 3. **Tissue level** – Groups of similar cells with a common function (e.g., muscle tissue)
 4. **Organ level** – Two or more types of tissue (e.g., heart, lungs)
 5. **Organ system level** – Groups of organs that work together (e.g., circulatory system)
 6. **Organism level** – The complete human being
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1. Cardiovascular System

Main Structures:

- **Heart** – pumps blood
- **Blood vessels** – arteries, veins, capillaries
- **Blood** – carries oxygen, nutrients, hormones, and wastes

Function:

- Transport oxygen and nutrients to tissues
 - Remove carbon dioxide and metabolic wastes
 - Maintain blood pressure and circulation
 - Assist in immune response (white blood cells)
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2. Nervous System

Main Structures:

- **Brain** – control center
- **Spinal cord** – pathway for signals
- **Nerves** – transmit signals to/from body
- **Neurons** – specialized cells for communication

Function:

- Receive and interpret sensory information
 - Control voluntary and involuntary actions
 - Maintain homeostasis via rapid signaling
 - Enable thought, emotion, and memory
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3. Respiratory System

Main Structures:

- **Nasal cavity**

- **Trachea**
- **Bronchi and bronchioles**
- **Lungs** (including **alveoli**)

Function:

- Exchange gases: bring in oxygen, remove carbon dioxide
 - Maintain blood pH balance
 - Enable vocalization (via larynx)
 - Protect against airborne pathogens (via mucus and cilia)
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4. Digestive System

Main Structures:

- **Mouth, esophagus, stomach**
- **Small and large intestines**
- **Liver, pancreas, gallbladder**
- **Rectum and anus**

Function:

- Ingest and break down food (mechanical and chemical digestion)
 - Absorb nutrients into the bloodstream
 - Eliminate undigested food and waste
 - Produce enzymes and digestive juices (from accessory organs)
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Other Major Organ Systems (Briefly)

Musculoskeletal System

- **Bones, muscles, joints**
- Supports body, enables movement, protects organs

Endocrine System

- **Hormone-producing glands (e.g., pituitary, thyroid)**
- Regulates metabolism, growth, reproduction

Immune/Lymphatic System

- **Lymph nodes, white blood cells, spleen**
- Protects against disease-causing agents

Reproductive System

- **Male:** testes, penis
- **Female:** ovaries, uterus, vagina
- Produces gametes and supports reproduction

Urinary (Excretory) System

- **Kidneys, ureters, bladder, urethra**
- Filters blood, maintains water/electrolyte balance, excretes waste

Integumentary System

- **Skin, hair, nails**

- Protects body, regulates temperature, sensory reception

Homeostasis: A Key Concept in Physiology

All systems work together to maintain **homeostasis**, or stable internal conditions. For example:

- The **nervous** and **endocrine** systems control body temperature, blood sugar, and pH.
 - The **respiratory** and **circulatory** systems regulate oxygen and CO₂ levels.
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Summary Table of Major Organ Systems

System	Key Organs	Primary Function
Cardiovascular	Heart, blood vessels	Transport of blood, nutrients, gases, waste
Nervous	Brain, spinal cord, nerves	Fast communication and control
Respiratory	Lungs, trachea, bronchi	Gas exchange
Digestive	Stomach, intestines, liver	Nutrient breakdown and absorption
Musculoskeletal	Bones, muscles	Movement, structure, protection
Endocrine	Glands (pituitary, thyroid)	Hormone production and regulation
Immune/Lymphatic	Lymph nodes, white blood cells	Defense against infection
Reproductive	Testes, ovaries	Reproduction
Urinary	Kidneys, bladder	Waste elimination and fluid balance
Integumentary	Skin, hair, nails	Protection and temperature regulation