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# **Anatomy and Physiology I**

**1<sup>st</sup> Year, 1<sup>st</sup> Semester, 2025-2026**

**Lecture (1):**

**Basic scientific principles of anatomy and physiology**

## Outlines:

- Connection between anatomy and physiology
- Gross and microscopic anatomy
- Intracellular and Extracellular fluid
- Electrolytes

**What is Anatomy?**

**What is Physiology?**



- **Anatomy**

It is the science that studies the structure of the body.

- Human beings are arguably the most complex organisms on this planet.
- Imagine **billions of microscopic parts**, each with its own identity, working together in an organized manner for the benefit of the total being.
- The human body is a single structure but it is made up of billions of smaller structures of four major kinds:

- **Cells**

Cells have long been recognized as the simplest units of living matter that can maintain life and reproduce themselves. The human body, which is made up of numerous cells, begins as a single, newly fertilized cell.

- **Tissues**

Tissues are somewhat more complex units than cells. By definition, a tissue is an organization of a great many similar cells with varying amounts and kinds of nonliving, intercellular substance between them.

- **Organs**

Organs are more complex units than tissues. An organ is an organization of several different kinds of tissues so arranged that together they can perform a special function. For example, the stomach is an organization of muscle, connective, epithelial, and nervous tissues. Muscle and connective tissues form its wall, epithelial and connective tissues form its lining, and nervous tissue extends throughout both its wall and its lining.

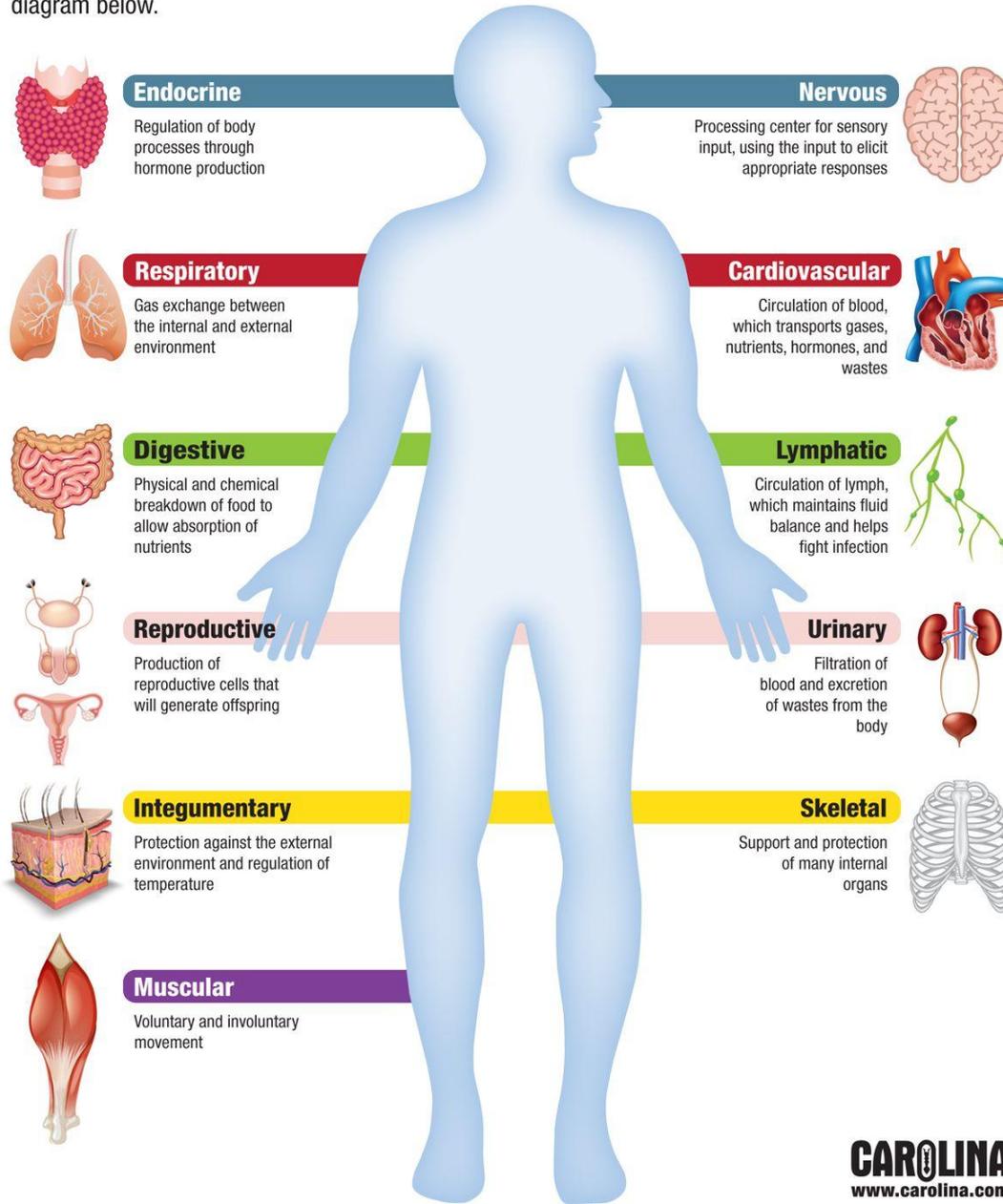
## ➤ **Systems:**

Systems are the most complex of the component units of the human body. A system is an organization of varying numbers and kinds of organs so arranged that together they can perform complex functions for the body. Ten major systems compose the human body:

- Integumentary
- Skeletal
- Muscular
- Nervous
- Endocrine
- Cardiovascular
- Lymphatic
- Respiratory
- Digestive
- Urinary
- Reproductive

# Human Body Systems

There are 11 main systems that keep our bodies functioning. Learn the primary roles of each in the diagram below.



- ✓ **Physiology** is the study of the characteristics and mechanisms of the human body.
- ✓ Cells are the basic unit of life and approximately **100 trillion cells make up the typical human**, each specially adapted to perform one or a few particular functions.
- ✓ **Nearly 25 trillion** red blood cells function by transporting oxygen from the lungs to all tissues in the body. All cells have some basic commonalities.
- ✓ Almost all cells **have the ability to reproduce** further similar cells.

# Connection between anatomy and physiology

## How Anatomy and Physiology Work Together?

### ➤ **Structure Dictates Function:**

The form of a structure is perfectly suited for its job (e.g., long axon of a neuron to send signals far away).

❖ **Function Requires Structure:** Conversely, functions like nerve impulses or muscle contractions rely on specific cellular and tissue structures to occur.

□ **Interdependence:** Anatomy identifies the heart's valves, while a physiology studies how those valves regulate blood flow.

### ✓ **Interconnectedness:**

All systems (nervous, circulatory, digestive, etc.) work together to keep the organism alive.

# Gross and Microscopic Anatomy

## **Gross anatomy**

It is the study of large body structures (like organs, bones, muscles) visible to the naked eye.

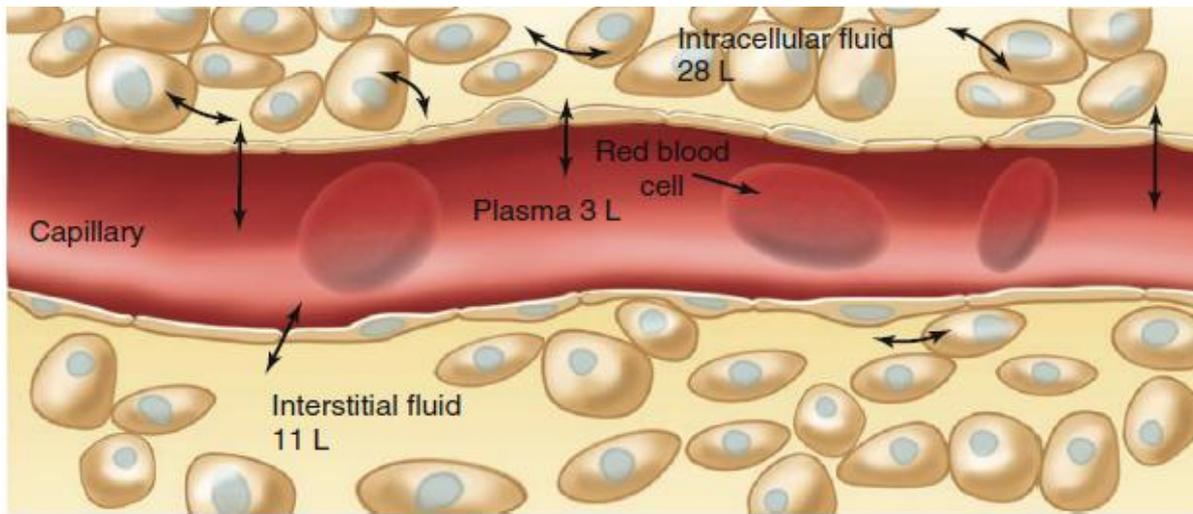
## **Microscopic anatomy (histology)**

It involves examining body parts through dissection (on cadavers) or medical imaging (like X-rays, MRI) to understand their relationships, locations, and functions.

## Body Fluid Compartments

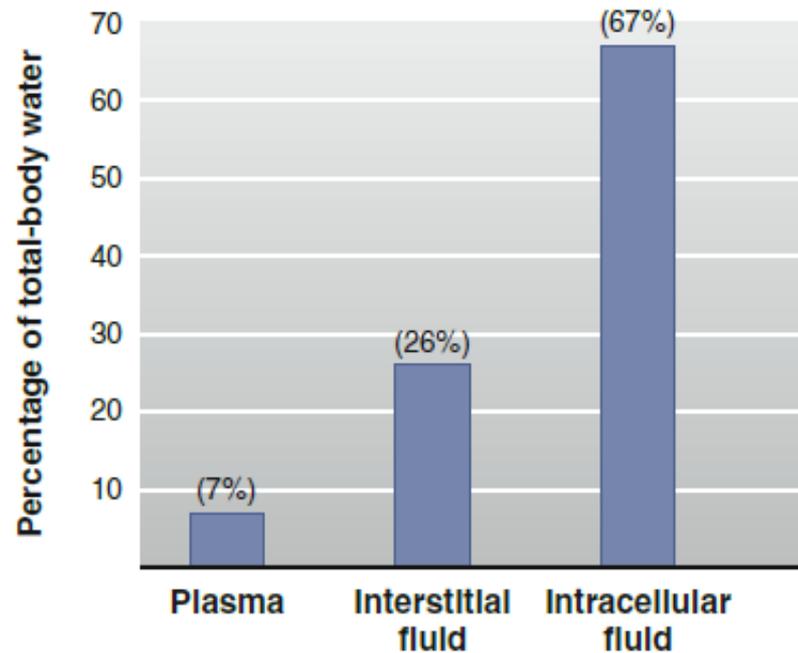
- Another useful way to think about how the body is organized is to consider body fluid compartments.
- When we refer to “**body fluid**,” we are referring to a watery solution of dissolved substances such as oxygen, nutrients, and wastes. This solution is present within and around all cells of the body, and within blood vessels, and is known as the internal environment.
- Body fluids exist in two major compartments, **intracellular fluid** and **extracellular fluid**.

- **Intracellular fluid** is the fluid contained within all the cells of the body and accounts for about **67% of all the fluid in the body**.
- Collectively, the fluid present in the blood and in the spaces surrounding cells is called **extracellular fluid**, that is, all the fluid that is outside of cells. Of this, only about **20%–25% is in the fluid portion of blood**, which is called the **plasma**, in which the various blood cells are suspended. The remaining **75%–80% of the extracellular fluid**, which lies around and between cells, is known as the **interstitial fluid**. The space containing interstitial fluid is called the **interstitium**.
- Therefore, **the total volume of extracellular fluid is the sum of the plasma and interstitial fluid volumes**.

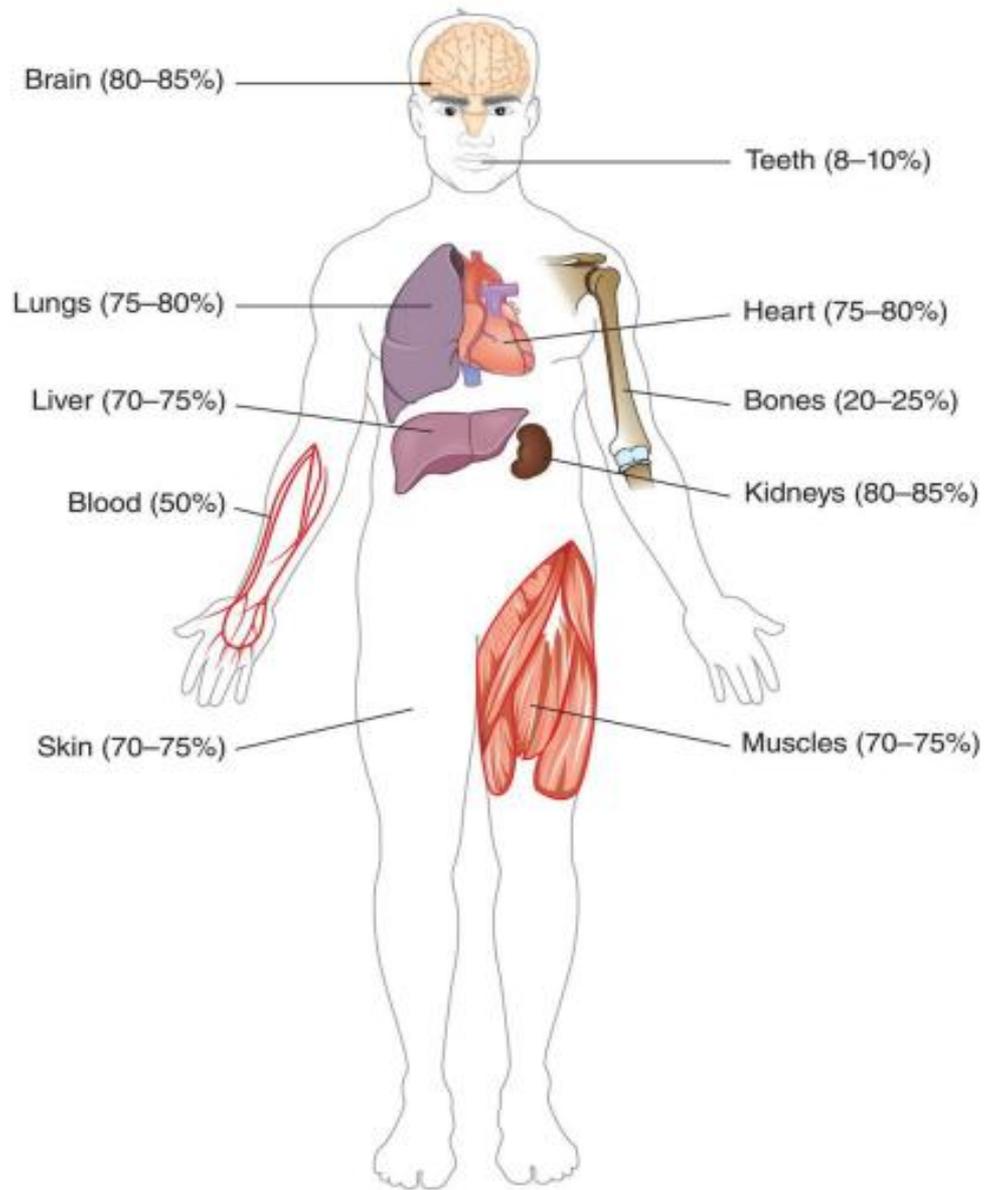


(a)

**Fluid compartments of the body. Volumes are for a typical 70-kilogram (kg) (154-pound) person.** (a) The bidirectional arrows indicate that fluid can move between any two adjacent compartments. Total-body water is about 42 liters (L), which makes up about 55%-60% of body weight. (b) The approximate percentage of total-body water normally found in each compartment.



(b)



## Body water content

## Electrolytes

- **Ions** that have a net **positive charge** are called **cations**, and those that have a net **negative charge** are called **anions**.
- Because of their charge, ions are able to conduct electricity when dissolved in water; consequently, the ionic forms of mineral elements are collectively referred to as **electrolytes**.
- This is extremely important in physiology, because electrolytes are used to **carry electrical charge** across cell membranes; in this way, they serve as the **source of electrical current** in certain cells.

## Ionic Forms of Elements Most Frequently Encountered in the Body

Chemical Atom	Symbol	Ion	Chemical Symbol	Electrons Gained or Lost
Hydrogen	H	Hydrogen ion	H <sup>+</sup>	1 lost
Sodium	Na	Sodium ion	Na <sup>+</sup>	1 lost
Potassium	K	Potassium ion	K <sup>+</sup>	1 lost
Chlorine	Cl	Chloride ion	Cl <sup>-</sup>	1 gained
Magnesium	Mg	Magnesium ion	Mg <sup>2+</sup>	2 lost
Calcium	Ca	Calcium ion	Ca <sup>2+</sup>	2 lost

*Thank you*

