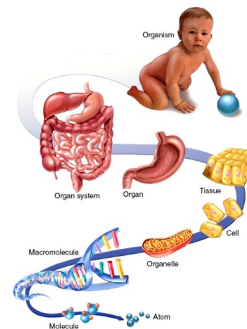




Human Physiology An Introduction to the Human Body

By
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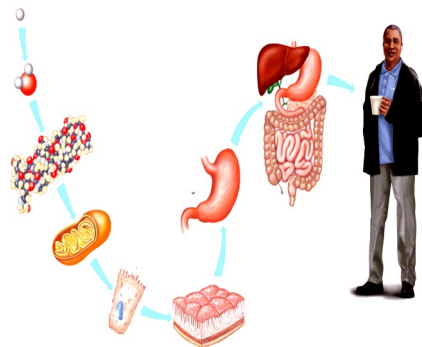
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Contents:

- Levels of Structural Organization.
- Characteristics of the Living Human Organism.
- Basic Life Processes.

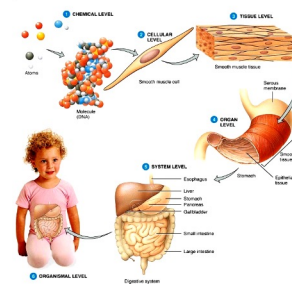


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Objectives:

Upon completion of this lecture, you will be able to:

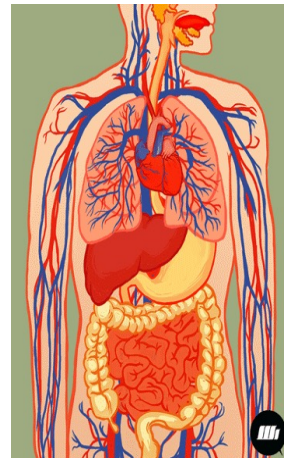
1. Describe the body's 6 levels of structural organization.
2. Enumerate the important life processes of the human body.
3. Describe the processes that distinguish living organisms from nonliving things.



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Introduction:

- Two important terms need to learn and understand:
 - **Anatomy:** the study of structure;
 - **Physiology:** the study of function.
- Structure is always related to function because the structure determines the function.
- The two are interdependent.

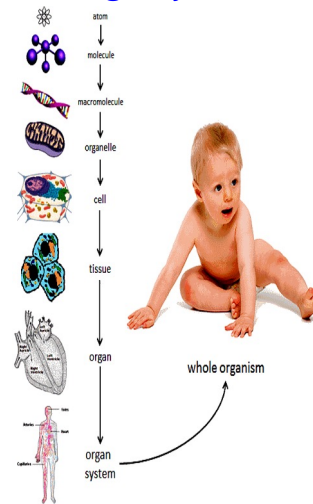


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Levels of organization:

- The body is a very complex organism, consists of many components, and organized in the following way:

- The atoms (hydrogen, carbon)
- The molecules (water, glucose)
- The macromolecules
- The organelles
- The tissues (bone, muscle)
- The organs (heart, liver)
- The organ systems (skeletal, renal)
- The organism (humans)



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Levels of Structural Organization and Body Systems:

- The levels of organization of a language are: **letters, words, sentences, paragraphs**, and so on, can be compared to the levels of organization of the human body.
- Exploration of the human body will extend from **atoms** and **molecules** to the **whole person**.

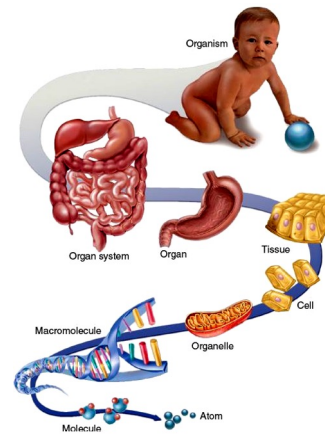


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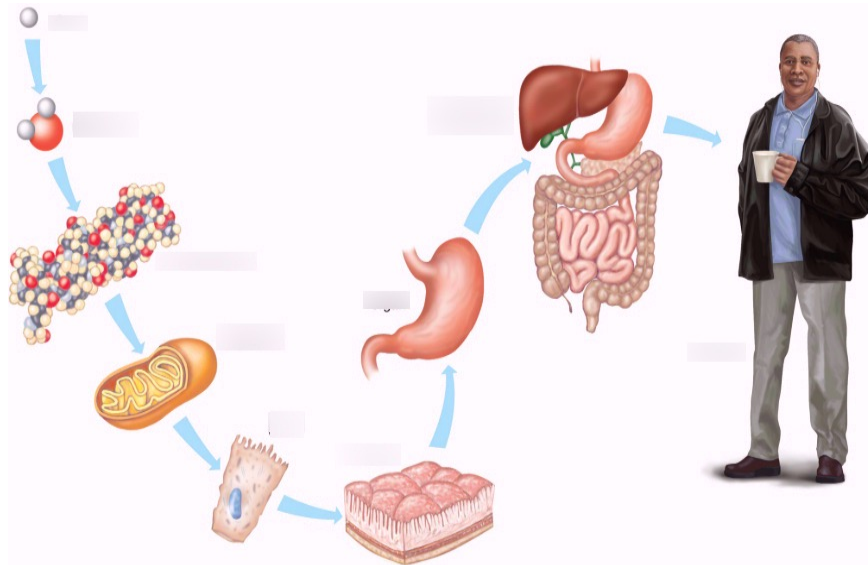
Levels of Structural Organization and Body Systems:

- From the smallest to the largest, 6 levels of organization will help us to understand **anatomy** and **physiology**: they are, the:

- Chemical,
- Cellular,
- Tissue,
- Organ,
- System, and
- Organism.



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Levels of Structural Organization and Body Systems:

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Levels of Structural Organization and Body Systems:

■ Chemical level:

- ⊙ A very basic level can be compared to the letters of the alphabet and includes:

• Atoms:

- ⊙ the smallest units of matter that participate in chemical reactions, C, H, O, N, P, Ca, S are essential for maintaining life.

• Molecules:

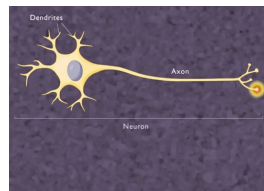
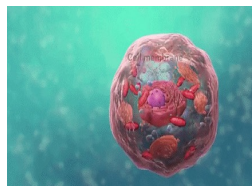
- ⊙ two or more atoms joined together. DNA, (the genetic material), and glucose (blood sugar).

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Levels of Structural Organization and Body Systems:

■ Cellular level:

- ⊙ Molecules combine to form cells, **the basic structural and functional units of an organism** that are composed of chemicals.
- ⊙ Just as words are the smallest elements of language that make sense, **cells are the smallest living units in the human body.**
- ⊙ Examples: muscle cells, nerve cells, and bone cells.



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Levels of Structural Organization and Body Systems:

■ Tissue level:

- ⊙ Tissues **are groups of cells** and the materials surrounding them that work together to perform a particular function.
- ⊙ Similar to the way words are put together to form sentences.
- ⊙ There are 4 types of tissues in our body:
 - Epithelial tissue,
 - Connective tissue,
 - Muscular tissue,
 - Nervous tissue.

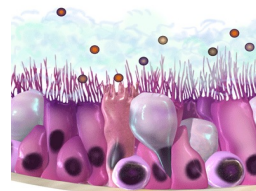
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Levels of Structural Organization and Body Systems:

■ Tissue level:

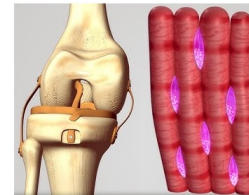
• Epithelial tissue:

- ⊙ covers body surfaces, lines hollow organs and cavities, and forms glands.



• Connective tissue:

- ⊙ connects, supports, and protects body organs while distributing blood vessels to other tissues.



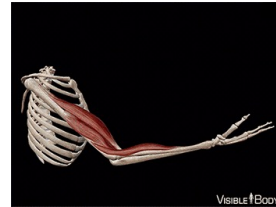
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Levels of Structural Organization and Body Systems:

■ Tissue level:

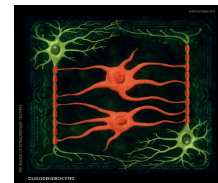
• Muscular tissue:

- ⊙ contracts to make body parts move and generates heat.



• Nervous tissue:

- ⊙ carries information from one part of the body to another through nerve impulses.

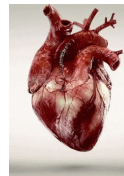
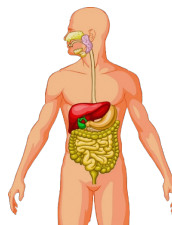


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Levels of Structural Organization and Body Systems:

■ Organ level:

- At the organ level, **different types of tissues** are joined together.
- Similar to the relationship between **sentences** and **paragraphs**, organs are structures that are composed of two or more different types of tissues; they have specific functions and usually have recognizable shapes.
- **Examples:**
 - stomach,
 - skin,
 - heart,
 - liver,
 - brain.... etc.



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Levels of Structural Organization and Body Systems:

■ Organ level:

- The stomach's outer covering layer: **epithelial tissue and connective tissue** that reduces friction when the stomach moves and rubs against other organs.
- Underneath are three layers of a type of muscular tissue called **smooth muscle tissue**, which contracts to churn and mix food and then push it into the next digestive organ, the small intestine.
- The innermost lining layer: **epithelial tissue** that produces fluid and chemicals responsible for digestion in the stomach.



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Levels of Structural Organization and Body Systems:

■ System (organ-system) level:

- A **system** (or **chapter**, in our language analogy) consists of related organs (**paragraphs**) with a common function.
- The **digestive system** (breaks down and absorbs food). Its organs include the **mouth**, **salivary glands**, **pharynx** (throat), **esophagus** (food tube), **stomach**, **small intestine**, **large intestine**, **liver**, **gallbladder**, and **pancreas**.
- The **pancreas**: an organ is part of more than one system (digestive system and endocrine system).

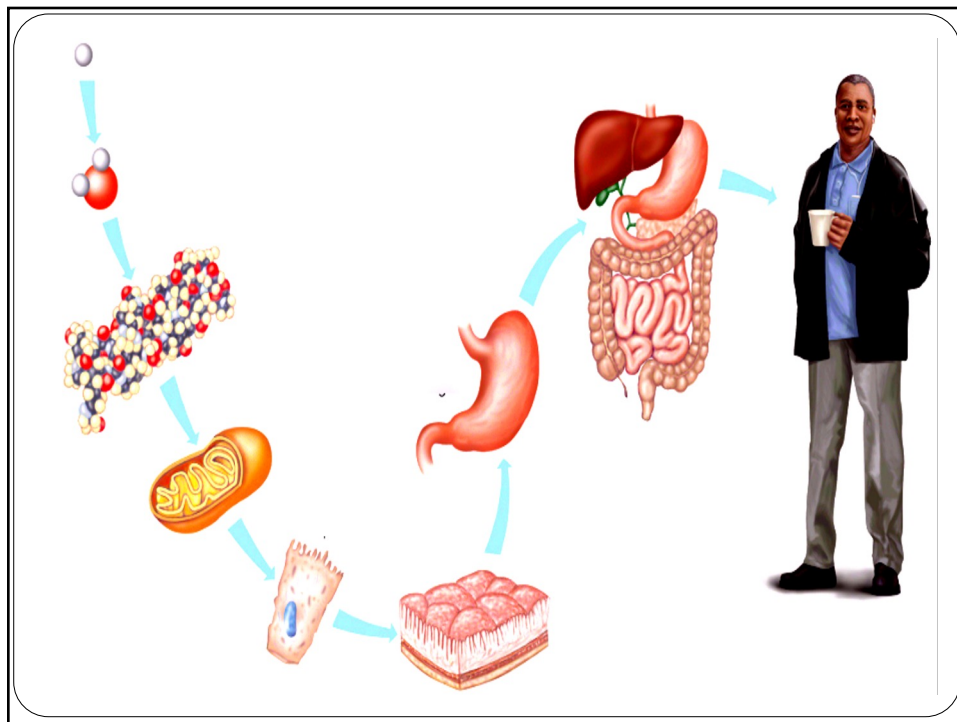
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Levels of Structural Organization and Body Systems:

- **Organismal level:**
- An **organism**, any living individual, can be compared to a **book** in our analogy.
- All the parts of the human body functioning together constitute the **total organism**.



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Characteristics of the Living Human Organism:

- **Basic Life Processes:** Certain processes distinguish organisms (living things) from nonliving things.
- **Following are the six most important life processes of the human body:**
 1. **Metabolism**
 2. **Responsiveness**
 3. **Movement**
 4. **Growth**
 5. **Differentiation**
 6. **Reproduction**

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Characteristics of the Living Human Organism:

1. **Metabolism:**

- The sum of all chemical processes that occur in the body.
- **Catabolism**, the breakdown of complex chemical substances into simpler components.
- **Anabolism**, the building up of complex chemical substances from smaller, simpler components.

For example:

- digestive processes catabolize proteins in food into amino acids.
- These amino acids are then used to anabolize (build) new proteins that make up body structures such as muscles and bones.

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Characteristics of the Living Human Organism:

2. Responsiveness:

- is the body's ability to detect and respond to changes.
- **For example:**
- an increase in body temperature during a fever represents a change in the internal environment (within the body), and turning your head toward the sound of squealing brakes is a response to a change in the external environment (outside the body) to prepare the body for a potential threat.

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Characteristics of the Living Human Organism:

2. Responsiveness:

- Different cells in the body respond to environmental changes in characteristic ways.
- **Nerve cells** respond by generating electrical signals known as nerve impulses (action potentials).
- **Muscle cells** respond by **contracting**, which generates force to move body parts.

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Characteristics of the Living Human Organism:

3. Movement:

- It includes motion of the whole body, individual organs, single cells, and even tiny structures inside cells.
- **For example:**
- the coordinated action of leg muscles moves your whole body from one place to another when you walk or run.
- When a body tissue is damaged or infected, certain white blood cells move from the bloodstream into the affected tissue to help clean up and repair the area.

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Characteristics of the Living Human Organism:

4. Growth:

- is an increase in body size that results from an increase in the size of existing cells, an increase in the number of cells, or both. In addition, a tissue sometimes increases in size because the amount of material between cells increases.
- In a growing bone, for example, mineral deposits accumulate between bone cells, causing the bone to grow in length and width.

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Characteristics of the Living Human Organism:

5. Differentiation:

- is the development of a cell from an unspecialized to a specialized state. **Such precursor cells**, which can divide and give rise to cells that undergo differentiation, are known as **stem cells**.
- each type of cell in the body has a specialized structure or function that differs from that of its precursor (**ancestor**) cells.
- **For example**, Through differentiation, a single fertilized **human egg** (ovum) develops into an **embryo**, and then into a **fetus**, an **infant**, a **child**, and finally an **adult**.

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Characteristics of the Living Human Organism:

6. Reproduction:

- Is the formation of new cells for tissue growth, repair, or replacement.
- Or is the **production of a new individual**.
- The formation of new cells occurs through cell division. The production of a new individual occurs through the fertilization of an ovum by a sperm cell to form a zygote, followed by repeated cell divisions and the differentiation of these cells.

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Characteristics of the Living Human Organism:

- When any one of the life processes ceases to occur properly, the result is death of cells and tissues, which may lead to death of the organism.
- **For example:**
- Clinically, loss of the heartbeat, absence of spontaneous breathing, and loss of brain functions indicate **death in the human body**.

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Questions and Comments:



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