



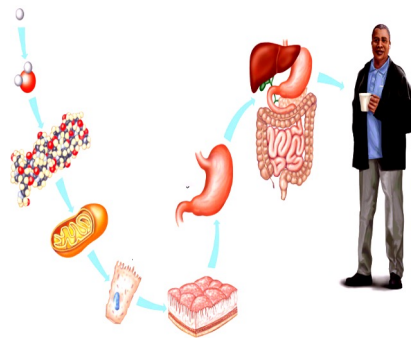
General Physiology

An Introduction to the Human Body

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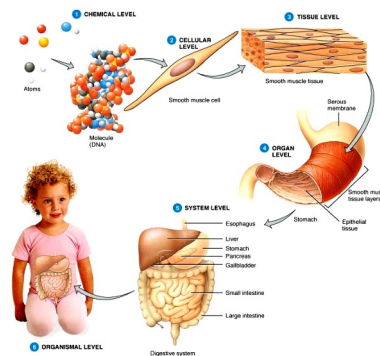
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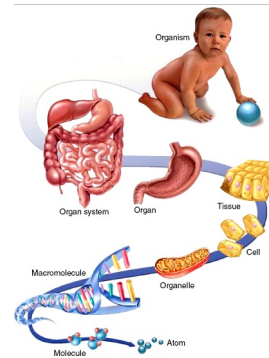
- Structural Levels Organization.
- Characteristics of the Living Human Organism.
- Basic Life Processes of Living Organisms.



Objectives:

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

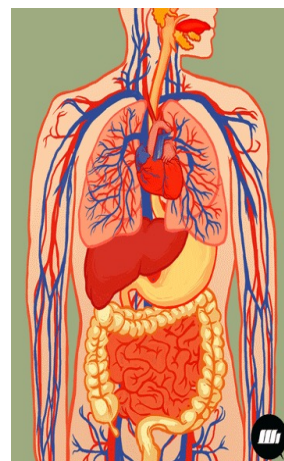
- Describe the levels of structural organization.
- List the important life processes of the human body.
- Describe Basic Life Processes of Living Organisms.



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Introduction:

- In medical studies, 2 important terms need to be learn and understand:
 - **Anatomy:** Study of structure;
 - **Physiology:** Study of function.
- Structure is always related to function because the structure determines the function.
- They are interdependent.

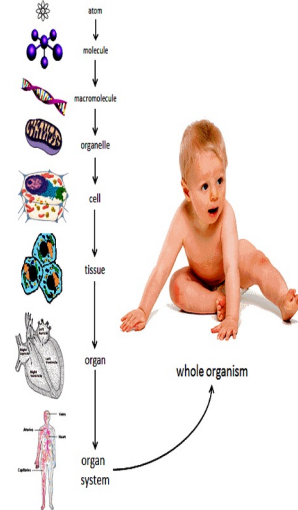


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Levels of organization:

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

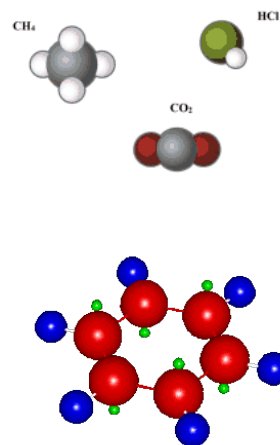
- Atoms (hydrogen, carbon)
- Molecules (water, glucose)
- Macromolecules
- Organelles
- Tissues (bone, muscle)
- Organs (heart, liver)
- Organ Systems (skeletal, renal)
- Organism (humans)



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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**.

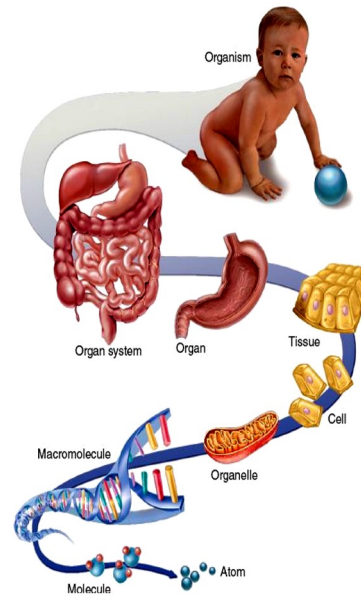


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Levels of Structural Organization and Body Systems:

- From the **smallest** to the **largest**, **SIX** 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:

▪ **Chemical level:**

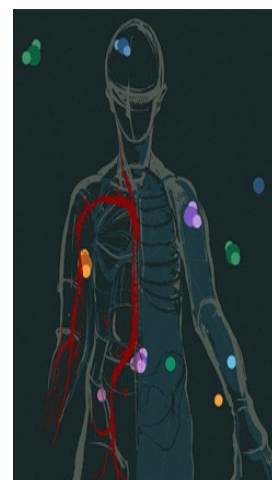
- ⊙ A very basic level can be compared to the letters of the alphabet and includes:

- **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).

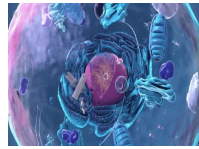
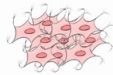


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Levels of Structural Organization and Body Systems:

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.



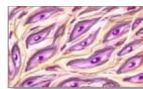
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Levels of Structural Organization and Body Systems:

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.
- ⊙ **The 4 types of tissues in our body are:**

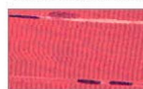
- **Epithelial tissue,**
- **Connective tissue,**
- **Muscular tissue,**
- **Nervous tissue.**



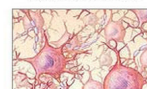
Connective tissue



Epithelial tissue



Muscle tissue



Nervous tissue

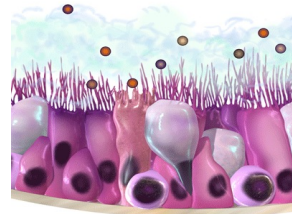
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Levels of Structural Organization and Body Systems:

■ Tissue level:

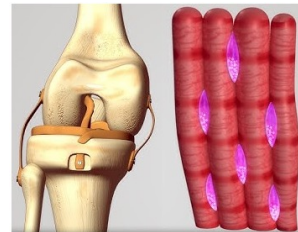
• Epithelial tissue:

- ⊙ 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.



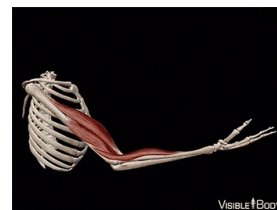
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Levels of Structural Organization and Body Systems:

■ Tissue level:

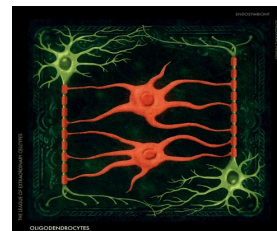
• Muscular tissue:

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



• Nervous tissue:

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

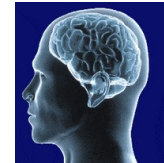
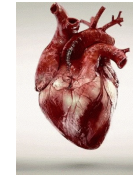
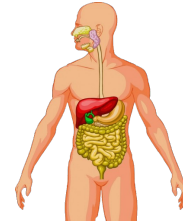


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Levels of Structural Organization and Body Systems:

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.

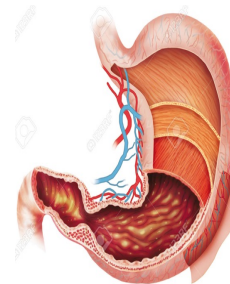


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Levels of Structural Organization and Body Systems:

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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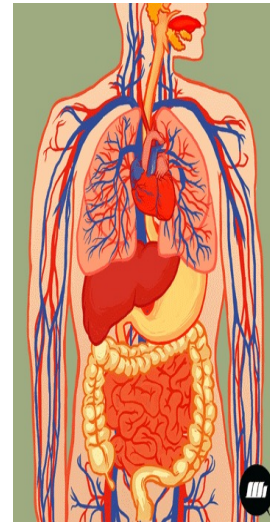
Levels of Structural Organization and Body Systems:

▪ System (organ-system) level:

- A **system** (or **chapter**, in our language analogy) consists of related organs (**paragraphs**) with a common function.

Examples:

- Digestive System:
- Respiratory System:
- Cardiovascular System:
- Urinary System:
- Endocrine System: *etc.*



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Levels of Structural Organization and Body Systems:

▪ System (organ-system) level:

- 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**.

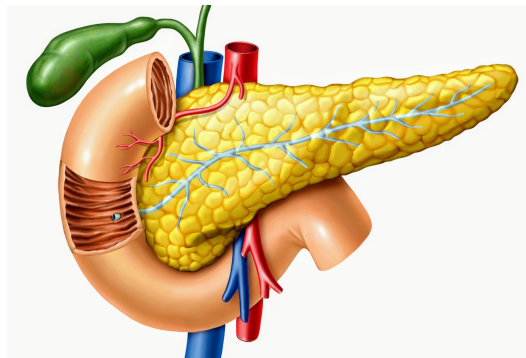


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Levels of Structural Organization and Body Systems:

■ System (organ-system) level:

- The **pancreas**: an organ is part of more than one system (**digestive system** and **endocrine system**).

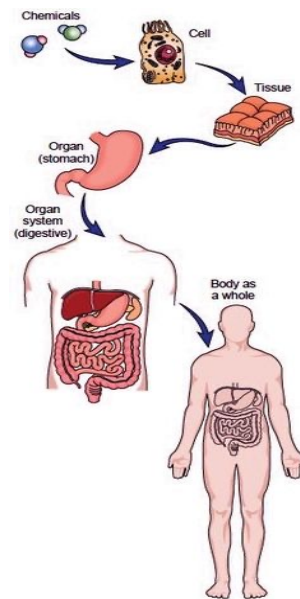


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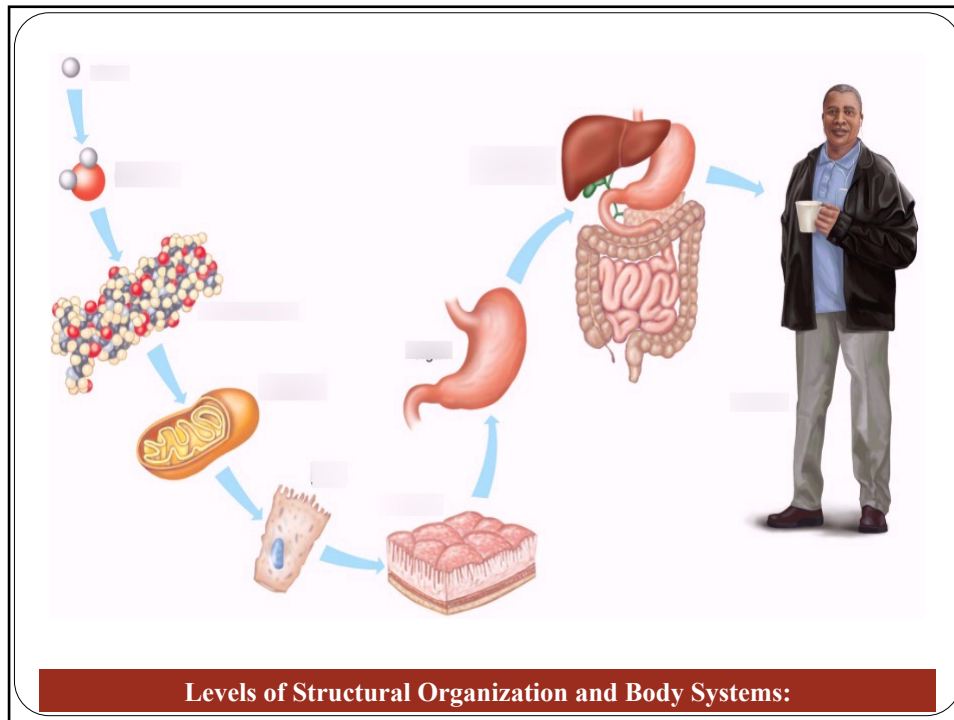
Levels of Structural Organization and Body Systems:

■ 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.
- The sum of all chemical processes that occur in the body, including:
 - ✓ **Catabolism (breaking down):**
 - ✓ **Anabolism (building up):**

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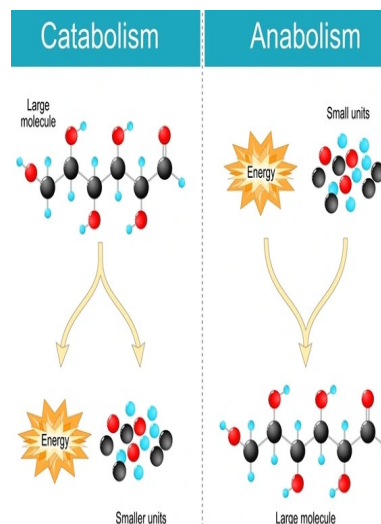
Characteristics of the Living Human Organism:

1. Metabolism:

- **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 new proteins that make up body structures such as muscles and bones.



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Characteristics of the Living Human Organism:

2. Responsiveness:

- The body's ability to detect and respond to changes in the internal or external environment (nerve impulses).
- Known as **sensitivity** or **stimulus response**.
- 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:

2. Responsiveness:

Examples of Responses:

- **Internal:**
 - ✓ **Chemoreceptors** detect blood sugar changes, initiating insulin release.
- **External:**
 - ✓ **Shivering** when cold or moving away from danger (reflexes).
- **Proprioception:**
 - ✓ **Detection** of body position.

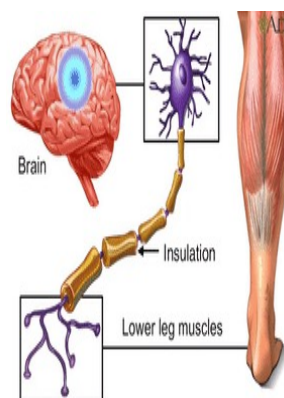


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Characteristics of the Living Human Organism:

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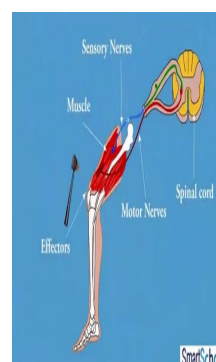
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Characteristics of the Living Human Organism:

2. Responsiveness:

Key Components of Response:

- **Stimulus:** A change in the environment, such as temperature, light, sound, or pressure.
- **Receptors:** Specialized cells, such as mechanoreceptors (touch/stretch) or chemoreceptors, that detect changes.
- **Coordination Centre:** The brain or spinal cord, which receives and processes receptor input.
- **Effectors:** Muscles and glands that bring about the response.
- **Nerve Impulses:** Electrical signals transmitted along neurons, forming the basis of the nervous system's rapid response.



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Characteristics of the Living Human Organism:

2. Responsiveness:

For example:

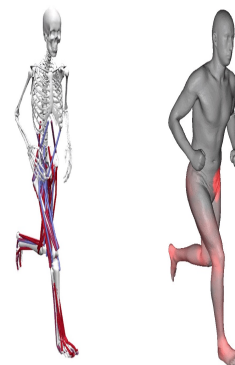
- an increase in body temperature during a **fever** represents a **change in the internal environment (within the body)**, and turning your head toward the sound of squealing brakes is a response to a change in the external environment (**outside the body**) to prepare the body for a potential threat.

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Characteristics of the Living Human Organism:

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:

- It 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.

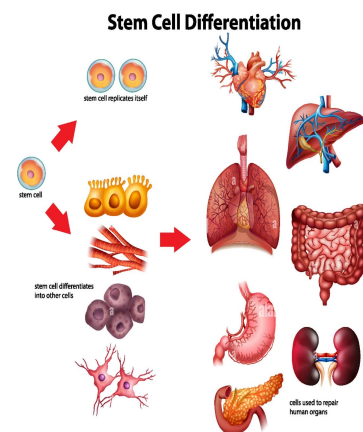


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Characteristics of the Living Human Organism:

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 and function** that differs from that of its precursor cells.

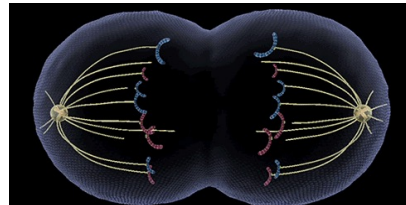


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Characteristics of the Living Human Organism:

6. Reproduction:

- Reproduction is the **production of a new individual Or**
- The formation of new cells occurs through **cell division**.
- It is the **formation of new cells** for:
 - ✓ **Tissue growth,**
 - ✓ **Repair,**
 - ✓ **Replacement.**

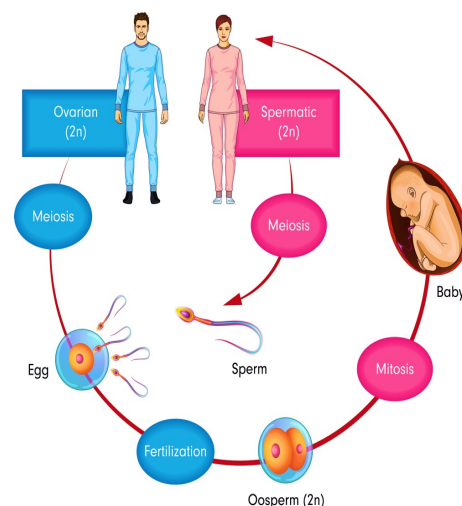


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Characteristics of the Living Human Organism:

6. Reproduction:

- The production of a **new individual (embryo)** occurs through the fertilization of an ovum (**human egg**) 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**.
- Clinically, the following signs indicate **death in the human body**:
 - **loss of the heartbeat**
 - **absence of spontaneous breathing**
 - **loss of brain functions (brain damage)**



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Questions and Comments:



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