

College of Biomedical Engineering

Biology

First Stage

Lecture one

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Biology: Is the natural science that involves the study of life and living organisms, including their function, development and evolution. physical and chemical structure, in general, biology recognizes the cell as the basic unit of life, genes as the basic unit of heredity.

All living things share in common certain biological phenomena—for example, various means of reproduction, cell division, and the transmission of genetic material. There are a range of functions that are essential for something to be considered an organism. These include movement, respiration, sensitivity, growth, reproduction, and release of wastes and the consumption of food.

Life process	Explanation
Movement	All living things move in some way. This may be obvious, such as animals that are able to walk, or less obvious, such as plants that have parts that move to track the movement of the sun.
Respiration	Respiration is a chemical reaction that happens within cells to release energy from food.
Sensitivity	The ability to detect changes in the surrounding environment.

Growth	All living things grow.
Reproduction	The ability to reproduce and pass genetic information onto their offspring.
Excretion	Getting rid of waste.
Nutrition	The intake and use of nutrients. This occurs in very different ways in different kinds of living things.

Most biological study is built on the foundations of five universally recognized truths.

These are:

1. Cells are the basic unit of life.

2. Genes are the basic units for passing traits from parent to offspring.

3. Evolution by natural selection is the process that has led to the great diversity of species on Earth.

4. Living organisms maintain the environment within their cells and bodies.

5. Living organisms have the ability to acquire and transform energy.

Characteristics of life: All organisms; Grow, Respire, Interact, Move, Need Nutrients, excrete (Waste), Reproduce, Death.

- Living things are sensitive, meaning they are able to respond to stimuli.
- Living things are able to grow, develop, and reproduce.
- Living things are able to adapt over time by the process of natural selection.

- All known living things use the hereditary molecule, DNA.

- Internal functions are coordinated and regulated so that the internal environment of a living thing is relatively constant, referred to as homeostasis.

Levels of Organization of Living Things

Life is organized at different levels, from molecules to entire ecosystems. These levels help in understanding the complexity of biological systems.

1. **Molecular Level**:
    - Life begins at the molecular level, where the building blocks of life (such as proteins, lipids, carbohydrates, and nucleic acids) interact to form the structure and function of cells.
    - DNA, the genetic material, is a critical molecule that carries instructions for life's processes.
2. **Cellular Level**:
    - The cell is the basic unit of life. Cells can be **prokaryotic** (lacking a nucleus, e.g., bacteria) or **eukaryotic** (containing a nucleus, e.g., plant and animal cells).
    - Within cells, various organelles (such as the nucleus, mitochondria, and ribosomes) perform specific functions.
3. **Tissue Level**:
    - Tissues are groups of similar cells working together to perform a particular function. For example:
        - **Epithelial tissue** forms protective layers.
        - **Muscle tissue** enables movement.
        - **Nervous tissue** transmits signals.
        - **Connective tissue** supports and binds structures.

4. **Organ Level**:
    - Organs are made up of different types of tissues working together to perform a specific function. For example:
        - The **heart** (made of muscle, connective, and nervous tissues) pumps blood.
        - The **stomach** (involved in digestion) contains muscle tissue for churning food and epithelial tissue for secretion.
5. **Organ System Level**:
    - Organ systems are groups of organs that work together to carry out a major life function. Examples include:
        - The **digestive system**, which includes the stomach, intestines, liver, and pancreas, responsible for breaking down and absorbing food.
        - The **circulatory system**, including the heart, blood, and blood vessels, responsible for transporting nutrients and gases.
6. **Organism Level**:
    - An organism is an individual living entity that consists of multiple organ systems working together. Humans, plants, animals, and bacteria are examples of organisms.
7. **Population Level**:
    - A population refers to a group of individuals of the same species living and interacting in a specific area. Populations evolve over time as they adapt to their environment.
8. **Community Level**:
    - A community consists of all the different populations of organisms that live in the same area and interact with each other, such as all the plants, animals, and microorganisms in a forest.

9. **Ecosystem Level**:
    - An ecosystem includes all living organisms in a particular area, along with the non-living components (e.g., water, soil, air), interacting as a system. This includes both the biotic (living) and abiotic (non-living) factors.
10. **Biosphere Level**:
    - The biosphere is the highest level of biological organization and includes all ecosystems on Earth. It is the global sum of all ecosystems where life exists.