

THE UNIVERSITY OF THE GAMBIA

COURSE: SCI 101 GENERAL SCIENCE (BIOLOGY COMPONENT)

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BIOLOGY

The study of living things

Levels of biological organization

1. **The biosphere:** the biosphere includes most regions of land, water bodies and the atmosphere.
2. **The ecosystem:** An ecosystem consists of all the living things in a particular area, along with all the non-living components of the environment with which life interacts, example, soil, water, the atmospheric gases and light, etc. all of earth's ecosystems combined to make up the biosphere.
3. **Communities:** The entire array of organisms inhabiting a particular ecosystem is called a biological community. Examples include plants, animals, fungi and other microorganisms.
4. **Population:** it consists of all the individuals of a species living within a specified area.
5. **Organisms:** individual living things are called organisms.
6. **Organ and organ systems:** an organ carries out a particular function in the body. Stems and roots are the major organs of the plants. Human organs includes the brain, the heart, and the kidney. The organs of humans, other complex animals and plants are organized into organ systems, each a team of organs that cooperate in a specific function.
7. **Tissues:** a group of similar cells
8. **Cells:** life's fundamental unit of structure and function.

The cell

- a. **Definition:** - It is the structural and functional unit of a living organism. It was discovered by Robert Hooke in 1665.
- b. **Classification of living things Based on the number of cells**
- Unicellular or a cellular organisms: having only one cell e.g. Amoeba, euglena etc.
 - Multicellular organism: more than one cell e.g. man, mango etc.

Structure of plant and animal cell

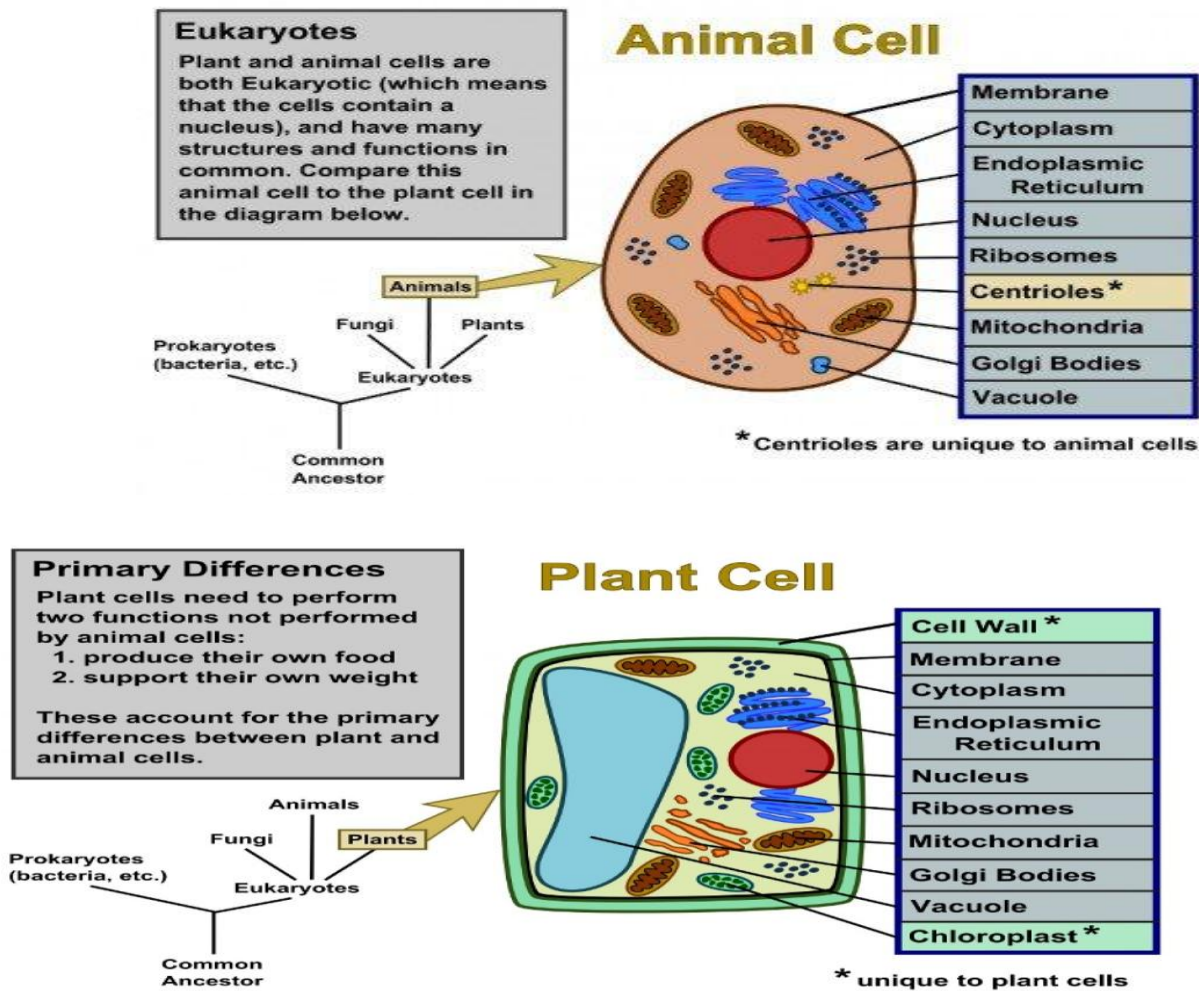


Fig 1.0

Cells contain structures called organelles. They are the functional components that make up cells.

Functions of the organelles

1. **Cell wall:** - It is the outer layer of the plant cell and it contains cellulose. It protects and supports the cell.
2. **Cell membrane (plasma membrane):** - It regulates what passes into and out of cells and also protect the cells.
3. **Endoplasmic reticulum:** - They are network of internal membrane. Within the cytoplasm is an extensive network of membranes called ER. They produce enormous varieties of molecules.
 - Rough ER: gets its name from the bound ribosomes that dot the outside of the ER. The ribosomes produce proteins that are packaged into vesicles which are later exported or secreted by the cell.
 - Smooth ER: it lacks ribosomes. It produces lipid molecules.
4. **Nucleus:** - It is a spherical structure which controls all the activities of the cell and stores the DNA.
5. **Nucleolus:** - It produces the ribosome for protein synthesis.
6. **Golgi bodies:** Some products that are made in the ER travel to the Golgi apparatus, an organelle that modifies, stores and routes proteins and other chemical products to their next destination.
7. **Lysosomes:** - They are sites for respiratory enzymes.
8. **Ribosome:** They are responsible for protein synthesis.
9. **Mitochondria:** - They are sausage like structures which is known as the power house of the cell.
10. **Chloroplasts:** - They contain chlorophyll which aid photosynthesis in green plants.
11. **Chromosomes:** - Long thread like structure which contains the DNA
12. **Centrioles:** - They are important in cell division.
13. **Cytoplasm:** It's the transparent liquid in which all other organelles are suspended.
14. **Vacuoles:** they are large membrane bound sacs. Many store undigested nutrients, one type called the contractile vacuole is found in some single –celled freshwater organisms and pumps out excess water that diffuse into the cell.
Many plants have a central vacuole that stores chemicals such as salts and contribute to plant growth by absorbing water and causing cells to expand. Central vacuoles may contain poisons against plant-eating animals.

Similarities and difference between plant cell and animal cell

Similarities: - Both plant and animal cells have

- | | | | |
|--------------|-------------------|---------|---------------|
| (a) Ribosome | (b) cell membrane | (c) E R | (d) Cytoplasm |
| (e) Nucleus | (f) Mitochondria | | |

Differences

Plant cell	Animal cell
Chloroplast present	Chloroplast absent
Cell wall present	Cell wall absent
Large vacuole present	Small vacuole present
Absence of centriole	Centriole present
No flexible cell membrane	Has flexible cell membrane

TYPES OF CELLS

1. ANIMAL CELLS

- a. Sperm cell b. egg cells c. nerve cells d. muscle cell e. WBC f. RBC

2. PLANT CELLS

- a. Root tip cells b. leaf epidermal cells

Movement of materials in and out of cells

1. **DIFFUSION**; it is the process by which molecules or ions move from a region of higher concentration to a region of lower concentration until they are evenly distributed.

Factors affecting diffusion

- a. State of matter
- b. Molecular size
- c. Difference in concentration
- d. Temperature

Examples in plants

- i. CO_2 and O_2 moves through the stomata in and out of leaves
- ii. water vapour moves out of leaves

Examples in Animals

- i. Exchange of O_2 and nutrients from mother to fetus
- ii. Exchange of gas in cellular organisms

2. **OSMOSIS**: It is the movement of water molecules from a region of dilute or a weaker solution to a region of concentrated higher or stronger solution through a semi permeable membrane

Examples in plants

- Absorption of soil water by root hair
- Movement of H₂O from cell to cell within a plant

Examples in animals

- Re- absorption of water in the kidney
- Osmoregulation in unicellular

3. Active Transport

It is the movement of dissolved substance from a region of lower concentration to a region of higher concentration using energy from the cell

Examples

- a. Movement of substances into the blood
- b. Movement of ions into the root hairs

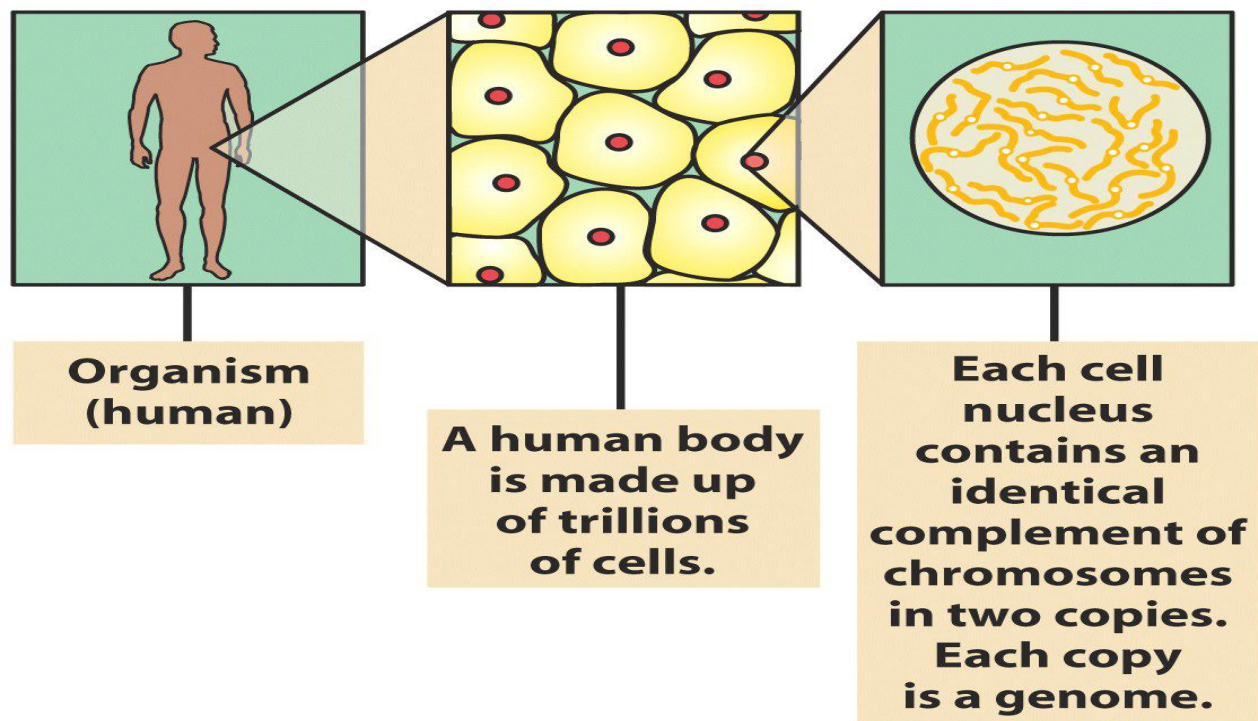
Cell growth: cells multiply through a process called cell division.

CELL DIVISION

Cells contains chromosomes (fig 1.1).

- Chromosomes are made of DNA which carries the genetic information of an organism.
- Each contains genes in a linear order.
- Human body cells contain 46 chromosomes in 23 pairs – one of each pair inherited from each parent
- Chromosome pairs 1 – 22 are called autosomes.
- The 23rd pair are called sex chromosomes:
XX is female, XY is male.

Fig 1.1.



There are two types of cell division namely mitosis and meiosis

- Mitosis:** this type of cell division occurs in somatic cells or body cells.

New cells

Each daughter cell receives chromosomes that are identical to those in the original nucleus (diploid cells)

b. Meiosis

It occurs in our gametes or sex cells

Daughter cells

- ❖ It results into four haploid daughter cells

Why is it that members of a particular family look alike?

Genetics

The first people who noticed that like produced like used the knowledge to improve crops and to select for desirable characteristics in domesticated animals.

Definition: It is the scientific study of heredity and variation.

Hereditary or inheritance: it refers to the transmission and expression of characters or traits from parents to offsprings.

Variation: it is the difference that exists between parents and offspring as well as the offspring.

Define the following:

1. Gene
2. Chromosome
3. Traits
4. Gametes
5. Hereditary
6. Phenotype
7. Genotype
8. Dominant gene
9. Recessive gene
10. Homozygous
11. Heterozygous
12. Hybrid
13. Allele

Mendel's first law (Segregation of genes)

The law states that pair of homologous chromosome separates during meiosis and end up in different gametes.

Mendel's second law of independent assortment:-

States that each pair behaves as a separate unit and it is inherited independently of each other.

Monohybrid inheritance

1. Tall and short plants
2. Red flowers cross with white flowers
3. Sex linked: inheritance of blood group.

Mutation

- an alteration or change in the genetic material
- In clinical use usually = “harmful”
- Inherited
- From exposure to mutagenic agents but more arise spontaneously through errors in DNA replication / repair
- More likely to be recognised if effects are detrimental
- Alterations in genes or chromosomes alter the protein produced and can hence cause disease

Where does a cell get its energy?

Food

What is food: - It is any substance which after consumption, digestion and absorption by the body, produces energy, promotes growth and repair worn out tissues.

Classes of food

There are seven different classes of food namely:

- | | | | |
|---------------------|-------------|---------------------------|--------------|
| a. Carbohydrates | b. proteins | c. fats and oils (lipids) | |
| d. mineral elements | e. vitamins | f. water | g. roughages |

Carbohydrates: - They contain carbon, hydrogen and oxygen. They can be converted to fats into the body.

Classes or types of carbohydrates

1. Monosaccharides: - They are known as simple sugars because they cannot be broken down into simpler carbohydrates. E.g. galactose (milk sugar), glucose (blood sugar) and fructose (fruit sugar) in nectar, fruits and honey.
2. Disaccharides: - They usually contain two monosaccharide units. E.g. Sucrose in sugar cane, lactose in milk and maltose found in grains (malt).
3. Polysaccharides: - These consist of several monosaccharide sugars joined together by chemical bonds. E.g. starch, cellulose, glycogen, and chitin.

Uses of carbohydrates

- i. They serve as a useful source of energy e.g. Glucose.
- ii. They store food e.g. Starch in plants and glycogen in animals.
- iii. They help in forming plants structure e.g. Cellulose.

Proteins: they are extremely complex compounds of carbon, hydrogen, oxygen, nitrogen, Sulphur and usually phosphorus e.g. Egg, meat, fish, milk. They are also organizing camp composed of one or more chains of amino acids.

Classes of proteins

- a. Animal protein: can be obtained from animals e.g. Meat, egg etc.
- b. Plant protein: can be obtained from plants e.g. Ground nut, beans etc.
- c. fibrous proteins: they are often strong and water insoluble: such as any keratin (hair and nail) collagen (Connective tissues) myosin (muscles)
- a. Globular protein: e.g. enzyme, hemoglobin, insulin, antibodies.

Fats and Oils

They are organic compounds that are also insoluble in water.

Classes of lipids or fats

- a. *Triglycerides*: they serve as energy reservoirs in vertebrates animals e.g. Fats, butter
- b. *Phospholipids*: they are the main components of cell membrane e.g. Lecithin.
- c. *Waxes*: they are components of water repelling and lubricating secretion e.g. Chitin.
- d. *Steroids*: they are components cell membrane and precursors of many other molecules e.g. Cholesterol.

Function

- i. They serve as energy storage
- ii. They form key components of cell membrane
- iii. They help to conserve water in plants
- iv. They are components of animal cell membrane
- v. Fats cushion internal organs such as heart, liver, kidneys.