Biology

Biology is the science of life or living matter in all its forms and phenomena.

Biology is divided into botany (Botany = plant), which means the science of plants, and zoology (Zoology = animal) the science on of animal. Each one of these two major fields were divided into subdivisions like:

1. Anatomy
2. Cytology
3. Ecology
4. Embryology
5. Histology
6. Physiology
7. Pathology
8. Genetics
9. Parasitology
10. Evolution

What is life?

Living organisms can in most cases be differentiated from non-living things by certain characteristics, the most important of which are the following:

1. Nutrition and growth 2. The nutrition means taking food through the process called ingestion.

Anabolism → Catabolism
2- Movement is one of the most easily observed activities of most living things is motion.

3- Irritability is an inherent property of all protoplasm.

4- Extraction means the elimination of the useless substances from the body.

5- Respiration means provision (or) gaining of O₂ and the removal of CO₂.

6- Reproduction is the ability of an organism by itself (or) in cooperation with another to produce new organism.

7- Adaptation is the capability of living things to survive within new environment (or) condition which may be in response to a change in temperature (or) light (or) may be resulting from genetic differences to produce new varieties which lead to evolution.
cells

cell is the basic unit of life and all things are composed of cells.

Most gene are found within a single ch. within nucleoid, and Ribosomes. These primitive cells are called Prokaryotic cells, like bacteria and blue-green algae, while Eukaryotic cells contain true nuclei and variety of other cell organelles like plant and animals.

Size of Cells
The cells vary in size according to their location and function in the organism. Most of the animal and plant cells are in size of 10-100 μ (Micron = 0.001 millimeter). RBCs of man are 7.5 μ in diameter, bacteria (1 μ).

Shape of Cells: The primary cells develop gradually to show great differentiation with different shapes according to the function. Muscle cells are spindle, nerve cell are irregular, kidney cells are cuboidal, RBCs are.

Bacterial Cells:
Bacteria are prokaryotic cells. Most bacteria are between 1-10 μ in size, therefore, they are just visible with the light microscope. The cell contains Peptidoglycan, a complex molecule built up with chains of a unique amino disaccharides joined by peptide chains. In some bacteria-
cell wall is further surrounded by a capsule and/or gelatinous sheath called a slim layer. Motile bacteria usually have long, very thin appendages called flagella (sing. flagellum).

A membrane called the plasma membrane regulates the movement of molecules into and out of the cytoplasm, the interior of the cell. Cytoplasm in a prokaryotic cell consists of cytosol, a semifluid medium and thousands of ribosomes (small bodies that coordinate the synthesis of proteins). In prokaryotes, most genes are found within a single circular loop of DNA located within the nucleoid.

- The chemistry of organic molecules -

   The most common elements in living things are carbon, hydrogen, nitrogen, and oxygen, which consist 95% of your body weight.

Carbon skeletons and functional groups:

Carbon has four electrons in its outer shell, and this allows it to bond with as many as 4 other atoms. The ability of carbon to bond to itself results in carbon chains of various lengths and shaps long chains containing 50 (or more) carbon atoms.

Molecules composed only of C and H are hydrophobic. But the addition of a functional group like –OH (or) – CO makes the molecule polar and able to interact with other polar molecules. In particular, polar molecules are hydrophilic.
the blood of animals and fructose is frequently found in fruits. These sugars are isomers of each other. They both have the molecular formula C₆H₁₂O₆, but they differ in structure (Fig. 1).

A disaccharide contains 2 mono- that have joined by condensation. Lactose is a disaccharide that contains galactose and glucose and is found in milk. Maltose (composed of 2 g. molecules) is a disaccharide of interest because it is found in our digestive tract as a result of starch digestion (Fig. 2).

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\begin{align*}
\text{C₆H₁₂O₆} & \quad \text{+} \quad \text{C₆H₁₂O₆} & \quad \text{C₁₂H₂₂O₁₁} \\
\text{glucose} & \quad \text{glucose} & \quad \text{maltose}
\end{align*}
\]

(Fig. 2)

- Polysaccharides are long polymers of mono- formed by condensation synthesis. The most common polysaccharides are starch, glycogen, and cellulose, which are chains of g. molecules. Chitin is a polysaccharide that contains modified g. molecules.

- Starch and glycogen. The structures of starch and glycogen differ only slightly. Glycogen is characterized by many branches which are side chains of g. that go off from the main chain. Starch has fewer branches.
Isomers:
Iso also contribute to the diversity of organic molecules. Iso are molecules that have identical molecular formulas but they are different molecules because the atoms in each are arranged differently. For example 2-

\[
\begin{align*}
\text{Glyceraldehyde} & : \quad \text{H}_2\text{C}-\text{O}-\text{H} \\
\text{Dihydroxyacetone} & : \quad \text{H}_2\text{C}=\text{C}-\text{C}-\text{H} \quad \text{H}_2\text{O} \quad \text{H}_2\text{O}
\end{align*}
\]

1. Carbohydrates:
The formula means (or) represent Carbohydrate that bear many hydroxyl groups exist.

\[
\begin{align*}
\text{Glucose} & : \quad \text{CH}_2\text{OH} \\
\text{Fructose} & : \quad \text{CH}_2\text{OH}
\end{align*}
\]

Carbohydrates include monosaccharides (one sugar), disaccharides (two sugar bonded together) and polysaccharides (many sugars bonded together). Sugars and some polysaccharides (starch and glycogen) serve as energy storage compounds. Monosaccharides are simple sugars with a carbon backbone of 3-7 atoms. The best known sugars are those that have 6 C (hexoses). Glucose is in
Cellulose and chitin.
Cellulose contains glucose molecules that are joined together differently than they are in starch and glycogen. The orientation of the bond between the glucose molecules in cellulose causes the polymers to be straight and fibrous, making cellulose suitable as a structural compound.

Chitin, which is found in the exoskeleton of crabs and related animals like insects, is also a polymer of glucose. The linkage between the glucose molecules is like that found in cellulose, therefore chitin is not digestible by humans.

2- Lipids contain H2C and O but are different in ratio and arrangement than in carbohydrates. Many of these are insoluble in water because they lack any polar groups. The most familiar lipids are those found in fats and oils. Fat is utilized for both insulation and energy reserves by organisms.

Fats and oils.
Fats and oils contain two types of unit molecules: fatty acids and glycerol. Each fatty acid consists of a long hydrocarbon chain with a carboxyl (acid) group at one end. Because the carboxyl group is a polar group, fatty acids are soluble in water. Most of the fatty acids in cells contain 16 to 18 carbon atoms per molecule. Fatty acids are either saturated or unsaturated. Saturated have no double bonds between the carbon atoms. Unsaturated fatty acids have double bonds in the carbon chain wherever the number of hydrogens is less than two per carbon atom.
Glycerol is a compound with 3 hydroxyl (-OH) groups which are polar, therefore, glycerol is soluble in water.

Waxes in waxes, a long-chain fatty acid bonds with a long-chain alcohol. They are solid at normal temperatures because they have a high melting point, they are also waterproof and resistant to degradation. In many plants, waxes form a protective cuticle (covering) that retards the loss of water for all exposed parts. In animals, waxes are involved in skin. In humans, wax is produced by glands in the outer ear and

Fatty acid

Long-chain alcohol
phospholipids, one fatty acid replaced by phosphate group (PO4) like lecithin and cephalin. phospholipids have polar head and nonpolar tail they arrange themselves in double layer in presence of water.

\[ \text{phospholipid symbol} \]

Steroids are lipids have different structure from natural fats. they are bile salts which are synthesized and secreted by mammalian liver.

\[ \text{cholesterol} \]

The most abundant steroid in human is cholesterol which present in all body cells (especially nervous tissue).

Proteins

A protein is composed of one or more polypeptides, which are polymers of amino acids. Proteins are made up of C, H, O and N. Many proteins also contain sulphur and phosphorus. They are tissue builders, tissue repairs. Proteins are constructed of monomer called amino acids. there are 22 amino acids. The amino acids are linked together by peptide bond to form polypeptides. Albumin composed of 50 amino acids, hemoglobin of 574 amino acids.
- Nucleic acids— are polymers of nucleotides with very specific functions in cells. DNA (deoxyribonucleic acid) is the genetic material that stores information regarding its own replication and the order in which amino acids are to be joined to make a protein. RNA (ribonucleic acid) is another type of nucleic acid. An RNA molecule called messenger RNA (mRNA) is an intermediary in the process of protein synthesis. Some of nucleotides have independent metabolic functions in cells. For example, some are components of coenzymes which facilitate enzymatic reactions. ATP (adenosine triphosphate) is a nucleotide that supplies energy for synthetic reactions and for various other energy-requiring processes in cells.