HOW TO DEFINE LIFE?

Life (a living organisms) is a state that distinguishes organisms from non-living objects, such as non-life, and dead organisms. Living organisms are capable of growth and reproduction, some can communicate and many can adapt to their environment through changes originating internally.

Biology is a science that studies living organisms and given us data that show the unity of life. Living things are organized, they take nutrients and energy from the environment, respond to stimuli, reproduce and develop, and adapt to the environment.

PROPERTIES OF LIVING ORGANISMS:

I- LIVING ORGANISMS ARE ORGANIZED

The complex organization of living begins with the cell, the basic unit of life. These units, generally too small to be seen with the unaided eye. They are made up of molecules that contain atoms, which are the smallest units of matter that can enter into chemical combination.

Organism either composed from single cell (unicellular) or composed from many cells (multicellular). In multicellular organisms, similar cells combine to form tissue which is a series of cells that accomplish a shared function, tissues, in turn, form organs, such as the stomach and kidney. A number of organs working together compose an organ system. While organism is a complex series of various organ systems.

All organisms of one type in a particular area belong to a population. The populations interact among themselves and with the physical environment (soil, water, atmosphere …etc.) forming an ecosystem.

II-LIVING ORGANISMS AQUIRE MATERIALS AND ENERGY

Living organisms cannot maintain their organization or carry on life's activities and energy. Food provides nutrient molecules which are used as building blocks for energy. Energy is the capacity to do work and it takes work to maintain

the source of energy for nearly all life on earth is the sun and plants. Plant like organisms are able to capture solar energy and carry on photosynthesis, a process that transfer solar energy into chemical energy in the bonds of organic molecules.

Living Organisms are Composed of Chemicals: Life is formed from carbon based chemicals, i.e. organic chemicals. For example, the DNA, genes and the amino acids of the muscle proteins are all carbon based molecules. The chemicals that comprise life are basically the same between different organisms. Because these chemicals are dominated by Carbon, they are called organic chemicals. The same organic structure of DNA is common to all the life and the same can be said of many carbohydrates, lipids, and proteins.

III-LIVING ORGANISMS RESPOND:

All living organisms are able to respond to stimuli in the external environment. For example, living organisms respond to changes in light, heat, sound, chemical and mechanical contact. To detect stimuli, organisms have means for receiving information, such as eyes, ears, and taste buds.

Organisms change their behavior in response to changes in the surrounding environment. For example, an organisms may move in response to its environment (Some of them move away or toward light or chemicals. Multicellular organisms can smell meat a mile away. The ability to respond often results in movement). Responses such as this occur in definite patterns and make up the behavior of an organism. The behavior is active, not passive. Living organisms display responsiveness; nonliving things do not.

IV-LIVING ORGANISMS REPRODUCE AND DEVELOP

A living organisms has the ability to produce copies of itself by the process known as *reproduction.* These copies are made while the organism is still living. Among simple animals, reproduction is often an extension of the growth process. For example, bacteria grow and quickly reach maturity, after which they split into two organisms by the process of *asexual reproduction.* Asexual

reproduction involves only one parent, and the resulting cells are generally identical to the parent cell.

More complex organisms engage in a type of reproduction called *sexual reproduction,* in which two parents contribute to the formation of a new individual. During this process, a new combination of traits can be produced. The reproductive process begins with pairing of a sperm and an egg. This followed by many cell division results in an immature individual, which grows to form the adult, this called development.

V-LIVING ORGANISMS HAVE ADAPTATIONS

Populations of living organisms have the ability to adapt to their environment through the process of evolution. During evolution, changes occur in populations, and the organisms in the population become better able to metabolize, respond, and reproduce. They develop abilities to deal with their environment that their ancestors did not have.

Adaptations are modifications that make an organism suited to it's way of life. Most birds have for limbs proportioned for flying, but penguin has stubby, flatted wings suitable for swimming, the process by which organisms become modified over time is called natural selection.

THE CHEMISTRY OF LIFE

I. Water:

All living thing are consist of 70-90% water. Water is essential to the continuance of life because it has several properties:

1. Water is a liquid at temperatures suitable for life, it boils at $100c^0$ and freezes at 0^0C.
2. The temperature of liquid water rises and falls more slowly than that of most other liquids.
3. Water has a high heat of vaporization, therefore, splashing water on the body keeps animals cell. Converting one gram of the water to steam requires an input of 540 calories of heat energy, this properties also moderates the earth's temperature.
4. Water is universal solvent and facilitates chemical reaction both outside of and within living system.
5. Cohesive and adhesive properties of water make water serve as transport medium, like transport of water in plant.
6. Water has a high surface tension.
7. Unlike most substances, frozen water is less dense than liquid water.

II. Carbohydrates:

Carbohydrates include:

1. Monosaccharide: A simple sugar having one molecules of sugar, example glucose (C6H12O6).
2. Oligosaccharide: Contain 2-10 unites of sugars, joined together, example lactose is a disaccharide (2 unit) that contain galactose and glucose.
3. Polysaccharide: Contain a chain of sugar units, starch (in plant) and glycogen (in animal) used as energy storage, cells used sugar, especially glycols as an immediate energy source. Plant wall contain cellulose (polysaccharides).

III. Lipids:

A variety of organic compounds are classified as lipids. Many of these are insoluble in water because they lack any polar groups. The most formulaic lipids are those found in fat and oils. Fat is utilized for both in solution and energy reserves by organisms.

Phospholipids and steroids are also important lipids found in living things. For example, they are component of cell membrane.

IV. Proteins:

Proteins are composed from sequence of amino acids. Proteins are very large molecules with structural and metabolic functions. Keratin, which makes up hair and nails and collagen fibers, which support many organs, are examples of structural proteins. Many proteins performed metabolic function. Enzymes are organic catalysts that speed up the chemical reactions. Insulin is a hormone that regulate the glucose content of the blood. Protein also found in cell membranes and have a transport function.

V. Nucleic acid:

Nucleotide is a molecular complex of three types of unit molecules: phosphate, pentose sugar and nitrogen base. Nucleic acid are huge polymers of nucleotides with specific function in the cell, they are two types:

1. DNA (Deoxyribonucleic acid) is the genetic material that stores information regarding it's own replication.
2. RNA (Ribonucleic acid) conveying information from the DNA regarding the amino acid sequence in the protein to synthesis the protein.

THE CELL

All organisms, whether plants or animals or microbes, are composed of cells. Some organisms are unicellular (single cell) but most are multicellular (many cells). The cell theory stated that:

1. All organisms are made up of cells, and cell is the structural and functional unite of organs and organisms.
2. Cells are capable of self-reproduction, and cells comes only from preexisting cells.

PROKARYOTIC CELL

Bacteria are prokaryotic cells (pro = before and karyon = nucleus). Most bacteria are between 1-10 Mm in size. Prokaryote lack the nucleus inside the cell. The bacterial cells have these constant feature.

Outer boundary ---------- cell wall or Plasma membrane

Cytoplasm ---------- ribosome Enzymes

Nucleoid ---------- chromosome (DNA only)

EUKARYOTIC CELL

Eukaryotic cell (eu = true, karyon = nucleus) are larger than prokaryotic cells and have a true nucleus. A nucleus is membrane- bounded structure where DNA is enclosed. All animal and plant cells are eukaryotic.