Part Ⅰ Botany

Environment Department/ Collage of Science / Basrah University

Lecture (1)

Important definitions

Biology: The study of living organisms is called "Biology"

Botany: the science related to plants is called "Botany"

Zoology: The science related to animals called "Zoology "

Scope of Botany:

The subject of Botany deals with the study of plants from any points of view. This science investigates the internal and external structures of all kinds of plants from simplest to the most complex form.

Botany is the study of plants. What is a plant? The answer is not as simple as you might think. Most familiar plants:

1- Are green, contain chlorophyll, and manufacture their food through the process of photosynthesis.
2- Are immobile and rooted to the ground.
3- Have neither a nervous system nor an excretory system.
4- Have a cell wall composed largely of cellulose.
5- Can continue to grow almost indefinitely by cell division.

The importance of green plants

Green plants purify the atmosphere by absorbing carbon dioxide gas from it and releasing from their bodies (by breaking-down of water)an almost equal volume of pure oxygen into it; and they prepare food such as starch, the chief constituent of rice, wheat, potato, etc. from carbon dioxide obtained from the air and water and inorganic salts obtained from the soil.

Uses of plant. Importance of the forests: Forest plays the following roles:

1. Forests provide natural habitat and food for wild life.
2. Forests provide wood which is used as a fuel and also as raw material for use in various industries such as pulp and paper etc..
3. Forests purify the atmosphere, supplying oxygen gas during photosynthesis.
4. Forests tree-roots bind the soil to prevent soil erosion and also help in retaining water in the soil.
5. Forests cool the atmosphere giving off water vapor during transpiration
6. Forests reduce earth's temperature by absorbing carbon dioxide from the atmosphere.
7. Forests influence the local rain fall.

Branches of Botany

a. **Morphology:** This deals with the study of forms and features of different plant organs such as roots, stems, leaves, flowers seeds and fruits.
b. **Histology:** (*Histos*, tissue) The study of details structure of tissues making up the different organs of plants, as revealed by the microscope.
c. **Physiology:** (*Physis*, nature of life). This is deals with various functions that the plants perform.
d. **Ecology:** (*Oikos*, home): This deals with relationship between the living organisms (plant and animals) and their environment which include all the conditions surroundingthem .
e. **Taxonomy** (*Taxon*= a group, *nomos*= to name): This deals with the description and identification of plant and their classification into various groups.
f. **Economic Botany:** This deals with various uses of plants and their products.

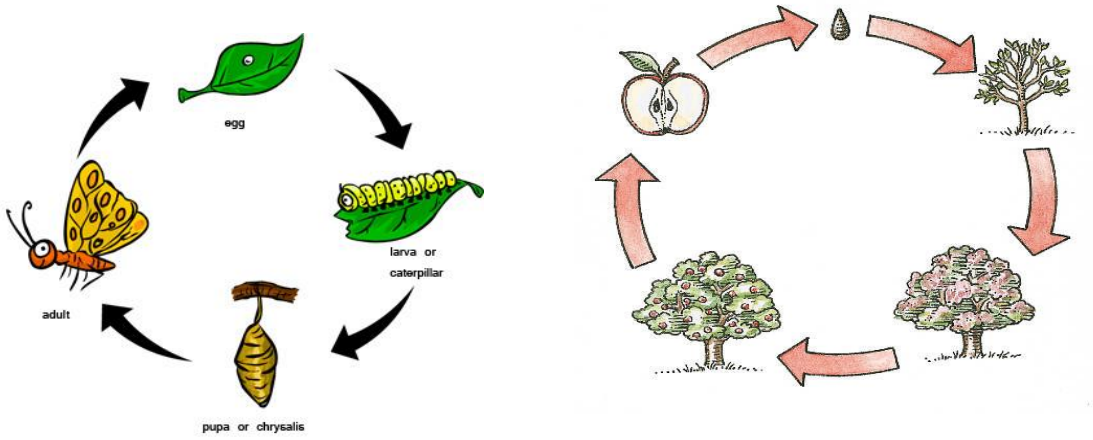
What is the life

We do not know what life really is? It is something mysterious and we are not in a position to define the life. The origin of life is equally mysterious.

Life was created on the earth by Divine Power. This view, strong though for several centuries, had a background in all religions but had no experimental basis. However, life has unique characteristics that distinguish it from non-living matter .However, certain characteristic by which they can be distinguished from the non living. These are:

1- **Life cycle**
2- **Protoplasm**.
3- **Cellular Structure**
4- **Respiration**
5- **Reproduction**
6- **Metabolism**
7- **Nutrition**
8- **Growth**
9- **Movement**
10- **Organization**

1- **Life Cycle:** All living object follow a definite life cycle of birth, growth, reproduction, old age and death. The animal or the plant is born, and gradually it grows into characteristic form and size. In due course it reproduce to maintain the continuity of the species and also multiply in number. Ultimately the organism attains old age and dies (see Fig-1)



(A) Animal life cycle **(B) Plant life cycle**

Fig-1 The life cycle of living object

2- **Protoplasm:** Life cannot exist without protoplasm. It is the actual living substance in both plants and animals.(1) Protoplasm can be defined as the physical basis of life. It performs all vital functions; it shows various kinds of movement and is sensitive to all kinds of stimuli such as light, temperature, chemical substances, electrical shock, etc. Protoplasm is a very delicate and complicate substance. Or it can be define as (2) the colourless material comprising the living part of a cell, including the cytoplasm, nucleus, and other organelles

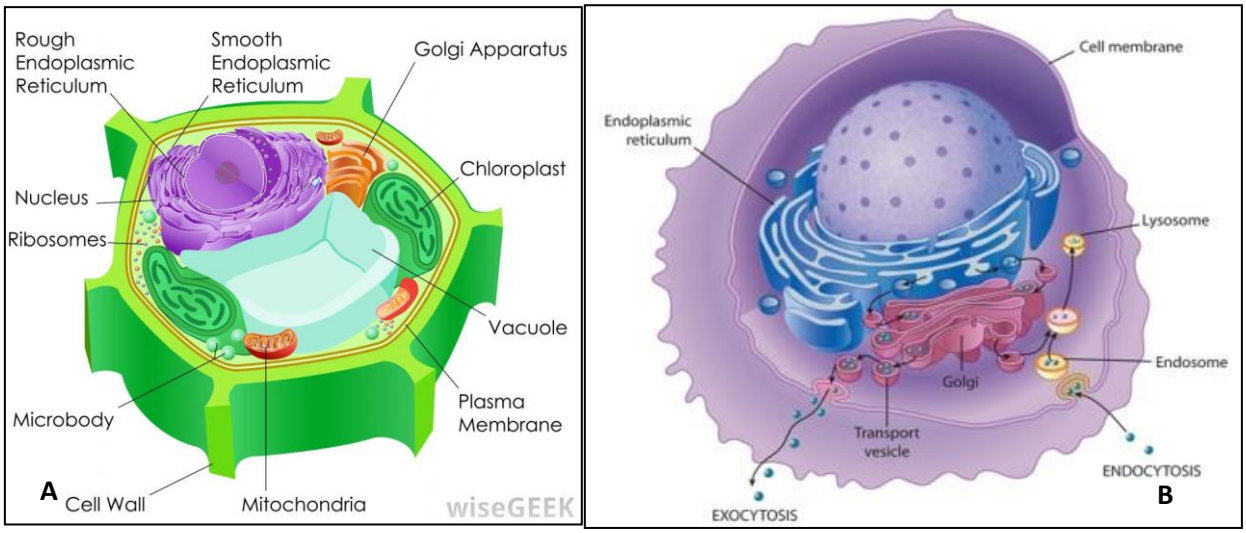


Fig-2 Cellular strcture Animal Cell (A) (B) Plant Cell

3- **Cellular Structure:** The whole body of the plant or animal is composed of cells. A cell is a unit mass of protoplasm, with nucleus in it, surrounded by a distinct cell-wall in the case of a plant and only a thin delicate membrane (plasma membrane) in the case of an animal (See Fig-2 A & B). The cellular structure as described above, is the characteristic feature of every living organism.

4- **Respiration:** Respiration is the sign of life. all living beings plants and animals respire continuously day and night, and for this process they take in oxygen gas from the atmosphere and give out an almost equal volume of carbon dioxide gas. By this process the energy stored up in the food and the other materials is released and used by the protoplasm for it activity.

6- **Reproduction:** Living beings- animals and plants- possess the power of reproduction, i.e. of giving rise new young ones like themselves. Non-living objects have no such power. They may mechanically break down into a number of irregular parts; but living objects reproduce according to certain principles. there are two forms of reproduction sexual and a sexual reproduction(see Fig-3 A &B)

Fig-3(A) Asexual reproduction in plants (B) Flowers are the sexual organ of flowering plants

General difference between Asexual and sexual reproduction

Asexual Reproduction	Sexual reproduction
• **Identical offspring are genetically identical to the parents**	• Produce non-identical offspring
• **Never uses more than one parent**	• Use two parent
• **Not adapt to new enviroment**	• Can adapt to new environment

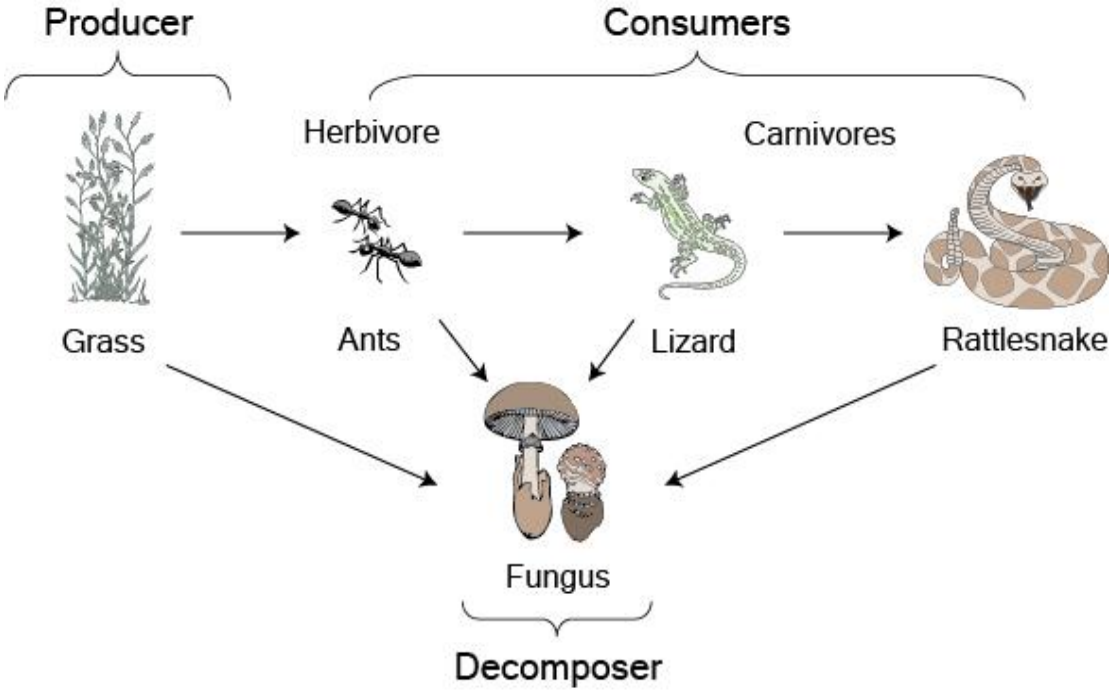
7- Metabolism:(1) Metabolism is a phenomenon of life. It includes both constructive(build up) or and destructive (break down) changes that are constantly going on in the living body. Or it defined as (2)the chemical reactions within the cells that maintain the life.Constructive changes

lead to the formation of the food substances and the construction of the protoplasm while destructive changes result in their breakdown, ending in the formation of variety of chemical substances. Organism in the ecosystem can be grouped by how can get energy in to three groups , Producer, Consumer and Decomposer.

a. Producer : Also Called (Autotrophs), producer are get their food and energy from the sun light (Plants). They make their food through a process called Photosynthesis.

b. Consumer: Also called (Heterotrophs), they are the organism which obtained their energy by eating other organisms, e.g. cow eat grass.

c. Decomposer: Decomposer is also called (Heterotrophs organism), they



take their food or nutrients from dead bodies or dead parts of animals. EX. worms, insects, fungi, bacteria etc. **(See Fig-4)**

Fig- 4 the diagram showed the three groups of organism in the ecosystem (Producer, Consumer and Decmoposer)

8- Nutrition: A living organism requires to be supplied with food. Food furnishes the necessary materials for nutrition and growth, and is a source of energy.

9- **Growth:** All living objects grow. Some non-living bodies may also grow, as does crystal. But there is difference in the mode of growth between two. the non-living objects is external, i.e. new particles are deposited on the external surface of their body from the outside and as a result they grow, while in living objects, the growth is internal, i.e. it proceeds from within, new particles being secreted by the protoplasm in the interior of their body. Further, in living bodies the growth is the result of a series of complicated processes, both constructive and destructive.

10- Movements: Movements are commonly regarded as a sign of life. Movements in most plants are, however restricted, as they are fixed to the ground, while most animals move freely. Movements in plants and animals may be spontaneous [movement of an organism or of an organ of plant or animal of it own accord (without any external influence)], or induced (is the movement of living organisms or of their organs in response to external stimuli.

11- Organization: Scientist have recognized that the life can be organized into several different levels of functions and complexity :

a. Species : Are different kinds of organism found on the earth.
b. Population: Is two or more members of the same type of organism, or species, living in same place at the same time.
c. Community: Refers to all the populations in a specific area or region at certain time.
d. Ecosystem: Includes both the living and non living components of an area.
e. Biosphere: The part of the planet that can support life, and all of the organism that live there.

Biological levels of organization:(see Fig-5)

b. Atom
c. Molecule
d. Organelle
e. Cell
f. Tissue
g. Organ
h. Body System

h- Multi cellular organism (different kinds of organisam found on the earth= species)

(Lecture 2)

What are the three domains of life:

When the scientist first started to classify life, everything was designated as either an animal or plant. But as new forms of life were discovered and our knowledge of life on earth grew, new groups (categories), called kingdoms, were added. There are eventually came to be five kingdoms in all Animalia, Plantae, Fungi, Protista and Bacteria

In 1990, **Three-domain system** was developed by *Carl Woese*, an American microbiologist and physicist. The **three- domain**

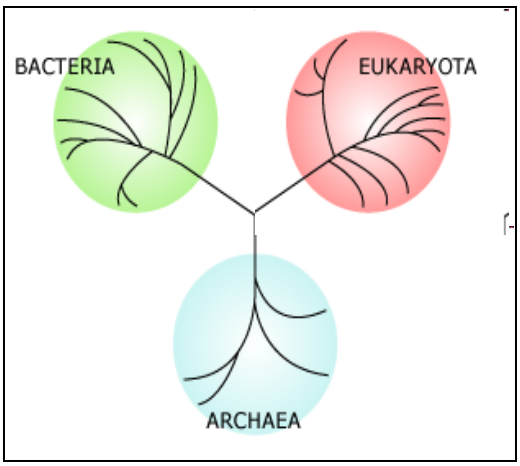
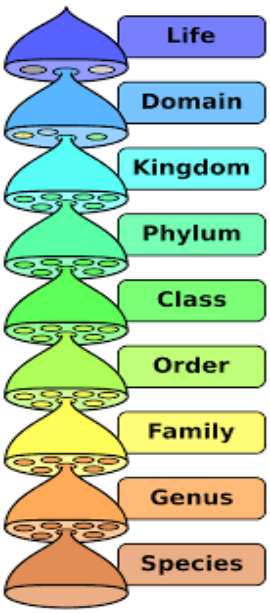


Fig- 5 biological level of organization

system divides cellular life forms into archaea, bacteria. Eukaryotedomains and each domain can be further divided into kingdoms, phyla, classes. However, Archaea and Bacteria were both grouped together in one categorycalled prokaryotes, although each group had its own kingdom.



Biologist use several levels to describe and classify organisms. Below the hierarchical system of biological classifications with eight major taxonomic ranks (Fig-6).

Note: Domain is the highest taxonomic rank of organism in three domain system of taxonomy designed by*Carl Woese.*

Relationship between domains and kingdoms

Fig-6 The hierarchical system of biological classifications

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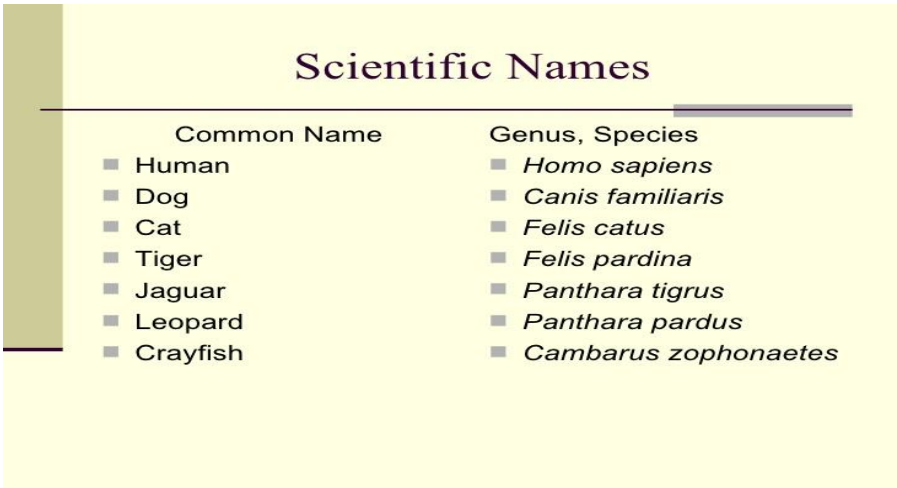
Domain Bacteria	Arachaea	Eukaryota			
Kingdom Bacteria	Archaea	Protista	Plantae	Fungi	Animalia
Unicellular	Unicellular	Most unicellular	Multicellular	Most multicellular	Multicellular
Cells lack nuclei and membrane-bounded organelles	Cells lack nuclei and membrane-bounded organelles	Cells with nuclei and membrane-bounded organelles	Cells with nuclei and membrane-bounded organelles	Cells with nuclei and membrane-bounded organelles	Cells with nuclei and membrane bounded organelles
Distinctive cell wall	Distinctive cell wall	Some have cell wall	Cell wall of cellulose	Cell wall of chitin	No cell wall
Some autotrophs Some heterotrophs	Some autotrophs Some heterotrophs	Some autotrophs Some heterotrophs	Autotrophs (Usually)	Heterotrophs (by absorption)	Heterotrophs (by digestion)
			Complex organ system	Tissue	Complex organ system
Escherichia coli	Acidiphilium sp.	Closterium sp.	Phoenix dactylifera	Agaricus bisporus	Plusiotis sp.

Domain- Bacteria	Domain- Archaea	Domain- Eukarya
Size= 1-10 micrometers (µm)	**Size= 1-10 micrometers (µm)**	**Size= 10-100 micrometers (µm)**
Cell wall of peptidoglycan	**Cell wall of various molecules like (protein, pseudopeptidoglycan)**	**Cell wall of cellulose or chitin**
No introns presence	**Some introns presence**	**Iintrons presence**
Membrane based on fatty acid	**Membrane based on non-fatty acid (Isoprenes)**	**Membrane based on fatty acids**
No membrane-bounded organelles	**No membrane bounded organelles**	**Membrane- bounded organelles**
4-subunit RNA polymerase	**Many- subunit RNA polymerase**	**Many-subunit RNA polymerase**

The cells of the Prokaryotes, on the other hand, lack this nuclear membrane. Instead, the DNA is part of protein-nucleic acid structure called nucleoid. Bacteria are all prokaryotes.

How scientist use names to help classify the organism

When Linnaeus grouped organism into kingdoms, he also developing the naming system called binomial nomenclature.



Binomial nomenclature gives organism a tow word scientific name, genus name and species name.

Genus: is a group of similar species

Species: group of organisms with similar traits and are able toto produce fertile offspring

Common name: organism is commonly called. Common name were confusing because the names varied among different regions and languages. They can also be misleading. Here are some common names: Spider, sun flower sea horse etc.

How to write the scientific name:

As we mentioned above, organism scientific name consist of two words, there are genius name and species name. It is proper to capitalize the first letter of the genus name, while, species name must be written in small letters. Additionally, the entire terms must be written in italic font, or underlined the whole termed (genus name and species name) when italics font not available.