**1st Lecture Phycology 1**

**Assistant professor Janan Jabbar Toma 2nd class 2024**

**Definition of the Algae:**

The term algae are derived from (Latin word-sea= weeds). The algae comprise of a large heterogeneous assemblage of micro and macro flowerless plants which are diverse in habitat. It is an important group of Thallophyta (Gr. Thalls (a sprout) and phyton (a green plant). The science of algal study is called Phycology (Gr. Seaweeds or phyco=green plant, logos= science

**The Differences between Higher Plants and Algae:**

1. Sexual reproduction never occurs without water.
2. In unicellular algae, the organisms themselves may act as gametes.
3. In multicellular algae the gametes may produce in special containers called gametangia as in Oedogonium, or in unicellular and multicellular gametangia called plurilocular or unilocular sporangia as in Fucus or male and female conceptales as in Ectocarpus.
4. Some of them are free-living prokaryotes or prokaryota organisms that have no nucleolus or nucleus sheath or cellular organization.
5. Some algae produce flagellated spores (motile spores) or a flagellated one (non-motile spores).
6. The algal body is thallus (gametophyte) which is not differentiated into roots, stems, leaves and is without vascular tissues. The Photosynthetic portion of the algae is a thallus, while the attached portion to the substrate comprises hair-like rhizoids. Therefore, old classification put algal flora into a grouping known as the Thallophyta.
7. For most algae, sperm and eggs (male and female gametes) fusion in the water and the zygote develops into a new plant without any protection organ. While in higher plants, the zygote develops into an embryo remaining within the parent female plant. For these reason old classification systems, term all other plant groups Embryophytes.

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**General Characteristics:**

1. Gametophyte or thallus (1n=1chromosome) is the dominant phase of the life cycle which is without roots, stems, and leaves.
2. The plants are mostly aquatic. Therefore, sexual reproduction (fertilization and zygote formation) never occurs without water.
3. A Zygote is sporophyte (2n=2 chromosomes) subdominant.
4. A Zygote is without jackets (sterile organs or protects organs).
5. Most algae are photosynthetic organisms possessing chlorophyll-a, -b, -c and -d, with alpha & beta carotene, leutin, violaxanthin, zeanithin and other accessory pigments.
6. The algal cell wall is commonly in three layers made of cellulose, pectin, and chitin.
7. Mainly reserve food material is of starch type.
8. Zoospores or antherozoids and gametes are motile and flagellated.
9. Male and female organs called antheridia (plural) antheridium (singular) and Oogonia (plural) and Oogonium (singular).
10. All types of sexual reproduction occur among algae (isogamous, anisogeous, and Oogomous).
11. Asexual reproduction occurs by vegetative parts, spore's formation as zoospore, aplanospore, endospore, exospores, auxospore, carpospores, androspore and other spores in addition to cysts, heterosystis, and akinetes.

**Algal Habitats**

Algae are abundant and ancient organisms that can be found in virtually every ecosystem in the biosphere. It is the main component of aquatic ecosystems like springs, streams, rivers, ponds, and lakes because they reflect the health of their environment through their abundance, distribution, and productivity.

The habitats of algae may be as follows: Planktonic: for (phytoplankton) or tychoplanktonic, the later is named as:

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Benthose (in the U.S.A.), Periphyton (in the UK), Auffwuches (in German language) all referred to as living underwater on the substrates as benthic that are divided into **epilithic** that attached to the rocks, **epipelic** attached to the muds or moist soil and **epiphytic** attached to the dead or/and living plant organs.

 Algae are living in **aquatic** and **terrestrial**, **sublittoral**, **intertidal** habitats. Some of them are found living on **moist soils** and **rocks** in the water of streams like some species of ***Nostoc*** ***muscarm***and***N microspica***found from Ahmad Iwa in Sulaimaniyah, Gally Zanta in Ikri district in Duhok and around Bekhal and Jundian spring in Erbil province.

**Edaphic**: living on the soil surface as terrestrial ***e.g. N. muscarum*** found near the main road between Bekhal spring and Ruwandiz town, Erbil province.

**\*The habitats may be as follows:**

**Endedaphic**: living inside soil like ***Chroococcum***

**Epidaphic**: living in moist soil like ***Chroococcus***

**Epilithic**: living on rock surface like diatoms

**Endolithic**: living on rock penetration like diatoms

**Hydrolithic**: living in the lower surface of rocks like ***Hydrarus foetidus*** found near Joman-Azadi Bridge, Haji Omaran, and Erbil province

**Chasmolithic**: living in rock fissures as diatoms

**Endophytic**: living within another plant e.g. ***Nostoc***in ***Anthoceros***and ***Anabaena*** in ***Azola*** moss plant.

**Epizoic** attached to the animals as ***Chlorella***living on ***Hydra.***

**\*According to the lakes, the algal habitats divided into:-**

Autotrophic algae: Living in water rich in nutrients

Oligotrophic algae: Living in a water medium in nutrients

Distrophic algae: Living in water poor in nutrients

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**\*According to water types algae are divided into:**

1. Freshwater algae 2. Brackish water algae 3. Salty water algae such as ***Ulva*** and ***Enteromorpha*** 4. Some algae living in sulfur springs as ***Formedium* sp**. ***Gleocapsa*** **sp**.

**Algal Classification:**

 More recently algal flora has been classified on the basis of chlorophylls content. While, algae have traditionally been classified (Bold and Wynne, 1985) on the basis:

**Pigments color**

**Chlorophyll types**

**Flagella apparatuses**

**Cell wall compositions**

**Storage foods**

**Cell organizations**

**Habitats**

**Plastids**

**Evolution and phylogeny**

Therefore, algae with other green plants or with other organisms beastly classified in 1883 (Van den Hoek, *et.al*. 1997).

However, the position of algae and with respect to evolution represented as follows:

Sub Kingdome monera (prokaryota)

Bacteria (Shizomycophyta)

Cyanophyta (Cyanobacteria)

Sub Kingdome protesta or eukryota

 Protozoa

 Algae (Thallophyta)

 Myxomycetes

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Subkingdom Plantae:

 Bryophyte

 Pteridophyta

 Trachyeophyta

 Phanerogamy

 Gymnosperm

 Angeosperm

Monocotyledonous

Dicotyledonous

Sub Kingdome (Animalia)

The classical classification of algae divided into 6-7 categories for example:

Division or (phylum): Thallophyte

Classes (Class): Chlorophyceae

(Order) : Volvocales

(Family): Chlamydomonaceae

Genus ***Chlamyomonas***

Species ***Chlamydomonas***sp

Variety and forms

**Algal occurrence and classification:**

Algae can be aquatic or subaerial when they are exposed to the atmosphere rather than being submerged in water. Aquatic algae are found almost anywhere from freshwater spring to salty lakes.

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**Algal Forms (Bold and Wynne, 1985):**

**Unicellular Algae:**

 Unicellular forms of algae are also called cellular algae. They function or act as complete organisms. Unicellular forms are common groups of algae except for Rhodoohyceae, Phaeophyceae and Charophyceae. The unicells may be motile or non-motile. The motile unicells are either **rhizopodial** or **flagellated**.

The **rhizopodial** forms lack rigid cells and have cytoplasmic projections that help in amoeboid movement e.g. ***Chrysomoeba*** from(Chrysophyceae) and ***Rhizochloris*** from Xanthphyceae.

The **flagellated** unicells resemble the gametes and zoospores. The flagella are the organ of locomotion varying in number, type, length, and position. The flagellated cells are found in many groups of algae, e.g., ***Carteria***and ***Chlamydomonas* of** Chlorophyceae and ***Euglena*** of Euglenophyceae… etc.

 1. Unicellular motile algae: **Chlamydomonas** and **Euglena**(Figure 1).

 2. Unicellular non-motile algae: ***Tetraedron*, *Protococcas*. *Chlorella*,**

***Chroococcum*** (Figure 2).

The non-motile cells may be filament or colonial as found in Cyanophyceae. The coccoid unicellular algae are the simplest forms of algae found in Cyanophyceae and in Chlorophyceae, e.g. ***Gleocapsa*** and ***Oocystis.***(Figure 3)



**Figure 1: Unicellular motile algal forms**

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**Figure 2: Nonmotile unicellular algae**



**Figure 3: Non-motile colonial algal forms**