**Lecture 1 (16/9/2024)**

**Algology (Phycology) — 2024**

**B.Sc. Students**

**Introduction**

The word "phycology" is derived from the Greek word *phykos*, which means “seaweed.” Algae are classified under the division Thallophyte. The thallus body never forms true roots, stems, or leaves. We define algae as a group of green, autotrophic, non-vascular thalloid plants with unicellular or multicellular, non-jacketed sex organs, and no embryo formation. They are thalloid autotrophic organisms that can synthesize their own food through photosynthesis in the presence of chlorophyll-a and sunlight. The science which study the algae is known as **Phycology or Algology**. The person who study the algae is known **Algologist or Phycologist**.

**Distinctive Characters of Algae**

1. Algae are chlorophyll-bearing thalloid plants with no differentiation into tissues ; however, some algae with true tissues (e.g., *Ulva*).
2. Some algae are motile, while others are non-motile.
3. Sex organs are generally unicellular; when multicellular, each cell is capable of reproduction.
4. Sex organs are never surrounded by a sterile jacket layer.
5. No embryo is formed after gametic fusion.
6. The thallus is nonvascular, lacking elements for the transport of fluids.
7. Sporophytic and gametophytic generations are independent when represented in the life cycle.
8. They occur in a variety of habitats, though mostly they are aquatic.
9. Reproduction in algae occurs through vegetative, asexual, and sexual modes.
10. The zygote grows into a new plant without a dormancy period.
11. They exhibit distinct alternation of generations.

**Occurrence and Distribution (Algal Habitat)**

Algae are predominantly aquatic and are found in both fresh and marine water. Some are terrestrial and can grow in damp and shaded soil surfaces. Based on their habitat, algae may be classified into the following types:

**A. Aquatic Algae**

Most algae are aquatic, found in either freshwater or marine environments. Aquatic algae may be free-floating known (**planktonic)** or attached to a substrate with the help of a holdfast known (**Benthic)**.

1. **Freshwater Algae**: These forms occur in freshwater bodies such as ponds, pools, lakes, streams, and rivers. They may be present in running water (e.g., *Cladophora*) or in stagnant water (e.g., *Chlamydomonas*).
2. **Marine Water Algae**: These algae occur in the saline waters of the sea. Most members of the classes Phaeophyceae and Rhodophyceae are found in marine environments. Marine algae are generally macroscopic, (Benthic) with large thalli, and are commonly known as "seaweeds." Example ***Ectocarpus*** . Planktonic algae, which are free-floating or swimming microscopic forms, constitute the planktons of water bodies. **These can be divided into:**
	* **Euplanktons**: Algae that are free-floating from the beginning and never attached (e.g., *Microcystis*).
	* **Tychoplanktons**: Algae that were initially attached but later become free-floating (e.g., *Cladophora*).
3. **Planktonic Algae**. Freshwater planktonic algae examples include *Chlorella* and *Volvox*, while *Fragilaria* and *Oscillatoria* are examples of marine planktonic algae. The abundant growth of planktonic algae can impart color and odor to water, a phenomenon known as **water bloom** or **(algal bloom).**

**B. Terrestrial Algae**

Many algal genera are found on or beneath the moist soil surface and are termed terrestrial algae. These algae are either found on the soil surface (***saprophytes*)** or beneath it **(*cryptophytes***). Some algae, such as certain species of *Vaucheria*, occur on the soil surface, while others, like species of *Nostoc*, have a subterranean habit and are known as **cryptophytes.**

1. **Aerophytes**: Algal forms adapted for an aerial mode of life occur on tree trunks, moist walls, and rocks. They obtain their water and carbon dioxide directly from the atmosphere .

**C. Algae in Specialized Habitats**

These algae are found in habitats other than water or soil, and are classified into several specialized types:

1. **Cryophytes**: Algae growing on mountain peaks covered with snow, known as cryophytic algae, impart attractive colors to the mountains. For instance, *Haematococcus nivalis* gives a red color to the Arctic and alpine regions.
2. **Thermophytes**: These are algae found in hot springs that can tolerate high temperatures. *Oscillatoria brevis*, for example, can survive at temperatures up to 70°C. Most thermal algae belong to the class Myxophyceae.
3. **Halophytes**: Algae found in saline water with a high salt concentration, such as *Dunaliella*.
4. **Lithophytes**: Algae growing attached to stones and rocky surfaces are known as lithophytes. Members of Cyanophyceae commonly grow on moist rocks, wet walls, and other rocky surfaces (e.g., *Nostoc*, *Rivularia*).
5. **Epiphytic Algae**: Algae that grow on other aquatic plants, such as *Oedogonium*, *Aphanochaete*, and *Bulbochaete*.
6. **Endophytic Algae**: These algae live inside higher plants, such as *Nostoc* found in the thallus of *Anthoceros*.
7. **Epizoic Algae**: Algae that grow on the shells of mollusks, turtles, and fins of fishes are called epizoic algae. *Cladophora* is found on snails and bivalve shells.
8. **Endozoic Algae**: These algae are found inside the bodies of aquatic animals. For example, *Zoochlorella* is found inside *Hydra*.
9. **Parasitic Algae**: An example of parasitic algae is *Cephaleuros virescens*, which causes red rust in tea.
10. **Symbiotic Algae**: Several members of Cyanophyceae (Cyanobacteria) grow in association with fungi, forming lichens.

**Thallus Organization**

As we know, algae are thalloid plants lacking differentiation into roots, stems, and leaves. The thallus of algae ranges from simple unicellular structures to highly organized forms with tissue differentiation, yet they lack vascular tissues. There exist various types of thallus organization in algae:

1. **Unicellular Motile Form**: Unicellular motile algae can move with the help of flagella attached to the anterior end of the body, e.g., *Chlamydomonas*.
2. **Unicellular Non-Motile Forms**: These are unicellular algae without flagella, e.g., *Chlorella*.
3. **Multicellular Colonial Forms**: Many cells come together to form colonies, which can be of the following types:
	* **Motile Coenobial Colony**: Definite numbers of motile cells are embedded in a gelatinous matrix with flagella. A colony formed of a definite number of cells arranged in a specific manner is known as a coenobium, e.g., *Volvox*.
	* **Non-Motile Coenobial Colony**: A colony with a definite number of closely attached cells without flagella, e.g., *Pediastrum*.
	* **Palmelloid Form**: Cells aggregate in a gelatinous matrix of indefinite shape, and the number of cells is not fixed as in a coenobium. In palmelloid forms, cells are embedded in a mucilaginous substance, e.g., *Tetraspora*.
	* **Dendroid Form**: A non-motile colony with an indefinite number of cells but differs from palmelloid forms in that cells are attached to the substrate, e.g., *Dinobryon*.
4. **Filamentous Form**: In filamentous thalli, cells are attached end to end in a linear fashion to form a filament. Filamentous forms may be branched, unbranched, or falsely branched.
	* **Unbranched Filament**: Simple filaments found in many algal forms, either free-living (e.g., *Spirogyra*) or attached (e.g., *Oedogonium*), or in colonial forms (e.g., *Nostoc*).
	* **Branched Filament**: Filaments with branches, e.g., *Cladophora*.
	* **False Branching**: In falsely branched filaments, the structure appears branched but is not truly branched, e.g., *Scytonema*.
5. **Siphonaceous Form**: The thallus is coenocytic, non-septate, and multinucleate, possibly with aerial and subterranean branches, e.g., *Vaucheria*, *Botrydium*.
6. **Heterotrichous Form**: This advanced type of thallus is characterized by the differentiation of the plant body into prostrate and erect systems. This form is characteristic of the orders Chaetophorales and Ectocarpales. The erect system develops from the prostrate part, e.g., *Ectocarpus*, *Stigeoclonium*.
7. **Parenchymatous Form**: Parenchymatous thallus organization is a modification of the filamentous habit. Such thalli may appear flat and leaf-like **(membraneous**) or tubular, as seen in *Ulva* and *Enteromorpha*, respectively.

**Terminology**

**Thallus**: Plant body that is not differentiated into root leaf and stem.

**Phycology**: The science which study the biology of algae. **Autotrophic**: Plant that can make their own food by the process of photosynthesis.

**Zygote**- Cell formed by union of two gametes.

**Plankton**- Free floating small plants.

**Epiphytic**- Plant which live on surface of other plants.
**Epizoic**-Organisom which living on surface of the body of an animal.