DISCUSSION ON ALGAE

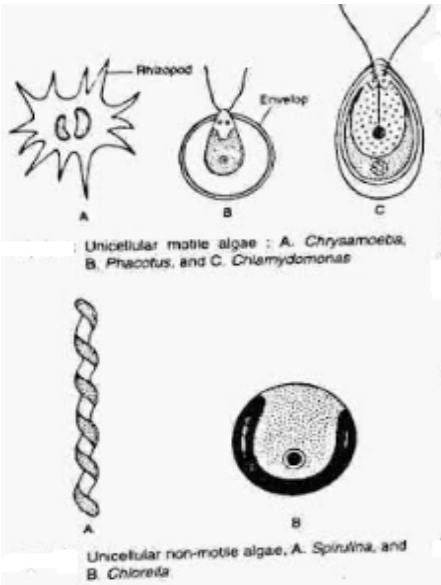
1. Discuss about the thallus organisation found in algae.

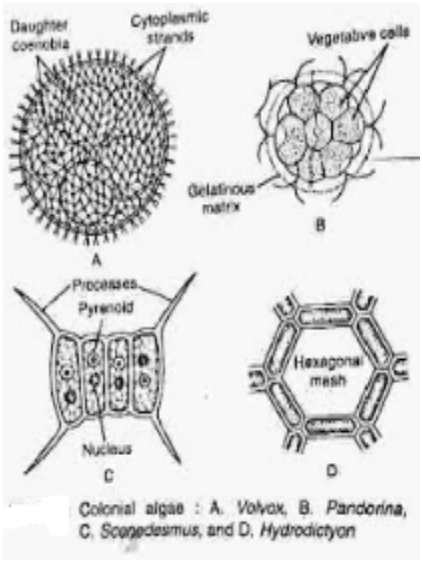
The plant body in algae is always a thallus. It is not differentiated in root, stem and leaves. Algaes are ranges in size from minute unicellular (less than 1μ in diameter in some planktons) to very large highly differentiated multicellular forms e.g., some sea-weeds.

Their forms may be colonial (loose or integrated by inter-connections of protoplasmic strands), filamentous (branched or un-branched), septate (branched or un-branched), non-septate or branched, multinucleate siphonaceous tube where the nuclear divisions occur without usual septa formation. Structural and cellular organizations are important characters in the classification of algae and in establishing the inter-relationship among them. Similarities of some morphological structures are seen among various classes of algae. The unicellular types which are seen in all groups of algae except the brown algae are considered to be the basic type from which, through evolution, other types of thalli developed.

A. Unicellular algae
    a. Motile
        i. Rhizopodial (lack rigid cell wall and have cytoplasmic projections that help them in amoeboid movement. *Chysamoeba* -Chrysophyceae)
        ii. Flagellated (flagella resemble as locomotion varying in number and type. *Phacota* and *Chlamydomonas* -Chlorophyceae)
    b. Non-motile
        i. Spiral filamentous (like spiral filament. Spirulina -Cyanophyceae)

ii. Coccoidal (coccoid unicellular algae. Chlorella -Chlorophyceae)





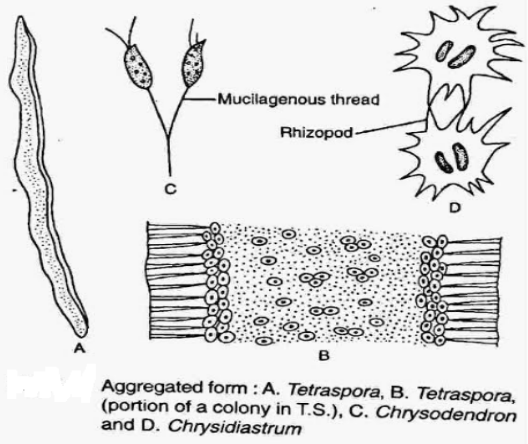
B. Multicellular algae

1. Colonial (The colonial habit is achieved by loose aggregation of cells within a common mucilaginous investment. Cells are connected each other by cytoplasmic threads.)
   a. Coenobium (colony has a definite number of cells with a definite shape and arrangement)
      i. Motile (flagellated. e.g. *Volvox, Pandorina*)
      ii. Non-motile (non flagellated. e.g. *Scenedesmus, Hydrodictyon*)
   b. Aggregated form (cells are aggregated irregularly showing a colonial mass of various size and shape)

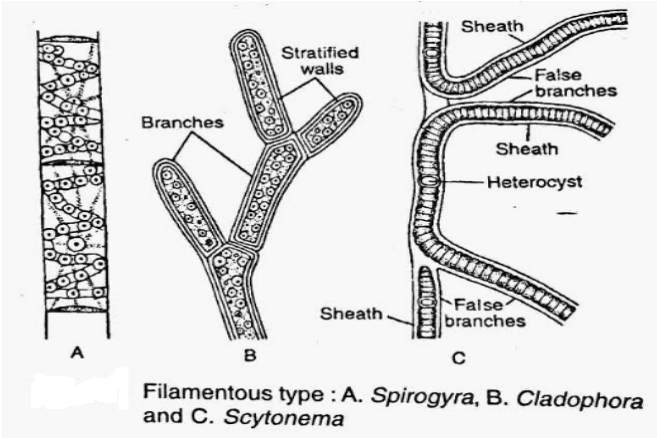
i. Palmelloid (in this type the non motile cells remain embedded in an amorphous gelatinous or mucillginous matrix. Each and every cell of the organization is independent and can perform all the functions as an individual. e.g. *Tetraspora* -Chlorophyceae)

ii. Dendroid (in this type the number, shape and size of the cell is variable. They look like microscopic trees. e.g. Chrysodendron -Chrysophyceae)

iii. Rhizopodial (in this type the cells are united through rhizopodia. Chrysidiastrum -Chrysophyceae)



Aggregated form : A. *Tetraspora*, B. *Tetraspora*, (portion of a colony in T.S.), C. *Chrysodendron* and D. *Chrysidiastrum*



Filamentous type : A. *Spirogyra*, B. *Cladophora* and C. *Scytonema*

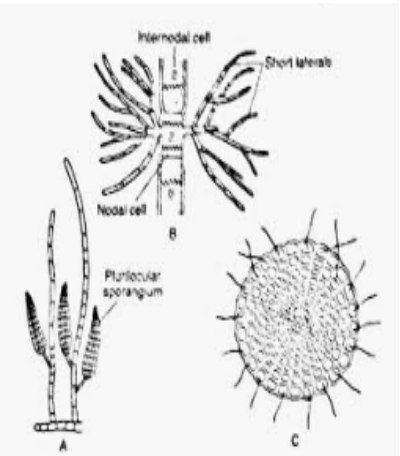
2. Filamentous

a. Unbranched filaments (free-floating unbranched filaments are not differentiated into basal and apical ends but the unbranched filaments that remain attached to the substratum are differentiated into base and apex)

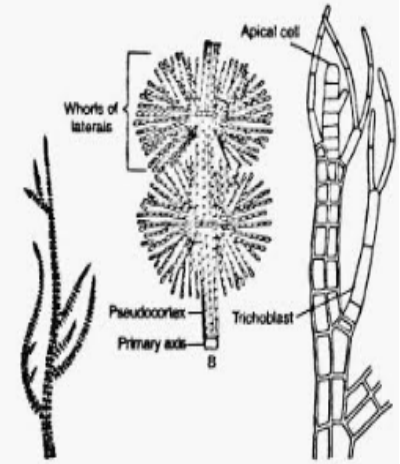
b. Branched filaments

i. Falsely branched (the trichomes of blue green algae may break either due to death or decay of the intercalary cells. The broken ends emerge out of the mucilaginous sheath in the form of branch. e.g. Scytonema)

ii. Truly branched (when a cell in the filament starts division in a second plane, true branch is formed)



Branched filament showing heterotrichous habit : A. *Ectocarpus*, B. *Draparnaldiopsis*, and C. *Coleochaete*

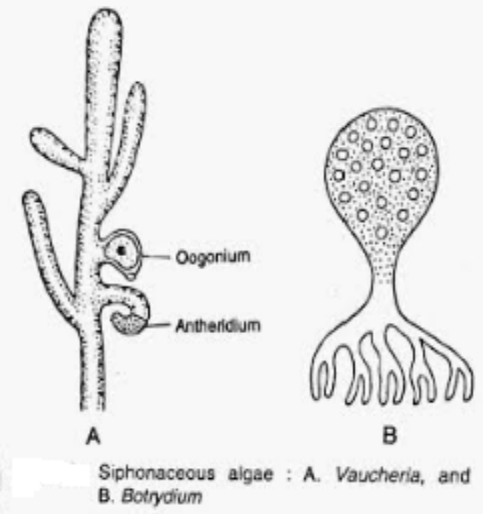


Pseudoparenchymatous habit : A. *Batrachospermum*, B. *Batrachospermum* (portion of the plant body), and C. *Polysiphonia*

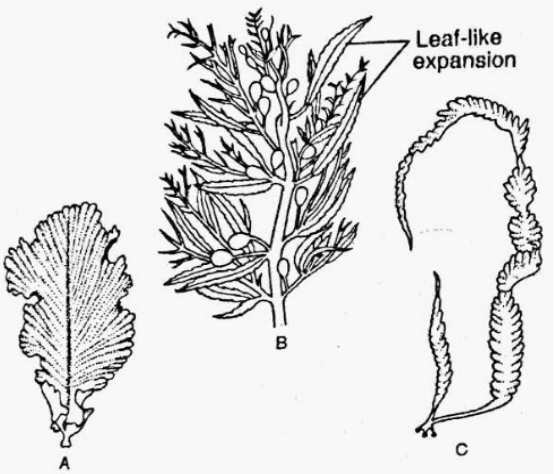
- **Simple filament** (the whole thallus remain attached to the substratum by a basal cell and the branches may arise from any cell of the filament except the basal cell. e.g. Cladophora)
- **Heterotrichous** habit (the whole thallus is differentiated into prostrate and erect system. Both the prostrate and erect systems may be well-developed. e.g. *Ectocarpus.* Progressive elimination of the prostrate system is observed in *Draparnaldiopsis* or of the erect system as in *Coleochaete*.)
- **Pseudoparenchymatous** habit (if one or more central or axial filaments together with their branches fuse to form a parechymatous structure, it is called pseudoparenchymatous thallus)
  - **Uniaxial** (it is formed by the branches of a single filament. e.g. *Batrachospermum*)
  - **Multiaxial** (more than one filament involved. e.g. *Polysiphonia*)

3. Siphonaceous forms (thallus is aseptate and multinucleate. It may be simple bramnched – *Vaucheria* or may be very elaborate with clear division of labour, differentiated into aerial and subterranean portions – *Botrydium*)

4. Parenchymatous forms (cells of a filament divide in multidirectional planes. It may be foliose and flat –*Ulva* or tubular –*Enteromorpha* or Complex –S*argassum*. Growth of the parenchymatous thalli may be diffused and intercalary –*Laminaria* or trichothallic –*Porphyra* or apical –*Fucus*)



Siphonaceous algae : A. *Vaucheria*, and B. *Botrydium*



Parenchymatous algae : A. *Ulva*, B. *Sargassum*, and C. *Laminaria*

2. Write about the economic importance of Algae.

The economic importance of algae is very diverse. Some of the algae are used as food and fodder, in agriculture, industry, medicine, purification of water, aviation and as a source of petroleum and natural gas.

A brief account of the uses of algae is given below:

(a) Algae Used as Food:

The red, brown and green algae, growing along the coasts of the Pacific Ocean, are now extensively used as food. Ulva a green alga, commonly known as 'sea lettuce', is taken by man as a vegetable. Caulerpa racemosa, another green alga, is cultivated by the Philippinase for food. Chlorella, a green alga, contains vitamins A and B, which has food value equivalent to lemon juice. The Japanese take chlorella powder along with green tea. Some of the brown algae, like Laminaria, Sargassum, Fucus etc., are taken as food by man, particularly by the Chinese and by the Japanese. Americans are fond of **"seatron"**, which is a preparation made from the bladders and stalks of Nereocystis, brown algae.

The red algae, like Porphyra, Chondrus, crispus, etc., are used in the preparation of soups, desserts and puddings. The people of the Western Europe, particularly of France and Denmark, like to take "blankmanges" delicious food, which is prepared by boiling an alga, like Chondrous, with milk and then mixed with fruit's juice and scented with vanilla. It has been observed that about 25%of marine algae are included within the food menu by the Japanese.

(b) Algae Used as Fodder:

The blue green algae as well as green algae and a few red algae form the food for various fishes and aquatic animals. Some of the marine algae are used as fodder for Cattle by the Americans, French and Danish people. The people living in the American Pacific coasts use pieces of sea weeds from which kelp is prepared for poultry. For these purpose small industries for cultivation of Archophyllum, Fucus, Laminaria, etc., have been raised. Pelvetia, a brown sea weed, increases the milk-content of the cattle and sometimes its butter and fat. A few red algae, like Rhodymenia, are taken by the cattle. Sargassum is a good cattle food.

(c) Algae Used in Agriculture:

Some blue green algae, like Nostoc, Anabaena etc., increases the fertility of soil by nitrogen fixation, thus thereby helping the production of crops. The people of France, Ceylon, etc., use a few marine algae as fertilisers. Chlorella is used to purify the soil. It liberates oxygen by photosynthesis which decomposes the rotten substances. The brown algae, like Pelargophycus, Macracystis, Nereocystis, etc. furnish us with potash, which is used as manure.

(d) Algae Used in Industry:

Algae is used in different kind of industry are described here**.**

(i) Agar Industry: Agar is a transparent substance obtained from the red algae, like Gelidium, Gracillaria, etc. It is solid at normal temperature but becomes liquid above 95°C. Agar has diverse uses. Agar is used for the preparation of culture media for fungi and bacteria in the laboratory as well as a sizing material in the textile industry, as a laxative, and as a solidifying agent in the preparation of desserts.

(ii) Algin Industry: Algin is a gelatinous or jelley like substance obtained from the cell-wall of some red algae. It is used in different commercial purposes, like the preparation of shampoos, cosmetics, hair dressings, shaving creams and other articles of toilet, shoe polishes, lubricating jellies, ice-creams and desserts. It is also used in paints and rubber industry.

(iii) Kelp Industry: The ash left behind, after burning the brown algae, like Laminaria, Sargassum, etc., is known as kelp. It chiefly contains potassium and iodine. Formerly, these algae were used for the production of the ingredients but it has been discarded at present.

(iv) Diatomaceous Earth Industry: The diatomaceous earth is a kind of earth deposited at the bottom of the sea, after the death and decay of Diatoms. The largest diatomaceous earth deposit has been discovered in Santamaria oil-fields in California. The uses of diatomaceous earth are-much varied, viz., as a filtering material, as a substance used in insulation of boilers, blast furnaces, etc., as a cementing material, as a mild abrassive in metal polishes and tooth-pastes, as an absorbent for liquid nitroglycerine (the explosive material of the dynamite), as a material for painting the ship to protect it against the attack of sea-barnacles.

(e) Algae Used in Medicine: A large number of medicines are obtained from algae. The brown algae like Laminaria, Sargassum, etc., are good sources of iodine. These algae also yield medicines for treatment of goitre and gland diseases. Antibiotics are also prepared from some of these algae. Chloranthus, an antibiotic is obtained from Chlorella. The red algae like Gelidium, Gracillaria, etc., yield agar, which is a laxative and used in the preparation of medicinal pills and ointments.

(f) Algae Used in the Purification of Water: The green algae play an important role in the purification of water in which they grow. They utilise the carbon dioxide released by the various animals during their respiration and give off oxygen during photosynthesis and thus the water is purified.

(g) Algae Used in Aviation: The aviator prior to their flight store lumps of algae, such as Chlorella, in the craft along with Oxygen-cylinders. The oxygen of the cylinders are utilised by the aviators when the plane rises to high altitude where the air is much rarefied. In case, there be

a shortage or stoppage of oxygen supply from the cylinders the algae give off necessary oxygen for carrying on respiration.

(h) Algae as a Source of Petroleum and Gas: The minute marine algae about the solar energy store it up as a potential energy inside their body. When these algae are taken by the marine animals it gets in their body and is stored up as such. After the death of these animals their dead bodies are deposited in heaps at the bottom of the sea. Subsequently the dead bodies are decomposed by bacteria in absence of oxygen and being subjected to a great hydrostatic pressure of sea water. Their organic substances containing the energy are gradually converted into oil and gas. These are utilised by man for various purposes.

References:

1. https://www.botanylibrary.com/algae/economic-importance-of-algae-botany/14607
2. https://www.biologydiscussion.com/algae/thallus-organisation-in-algae-botany/53555
3. Hait G, Bhattacharya K, Ghosh A k. A Textbook of Botany (vol.1). New Central Book Agency (P) Ltd. 2017; ISBN:81-7381-547-x

(All the information is collected from above references and will be used only for teaching and learning purposes**)**