
Range of Thallus Organisation in Algae

Algae are plants of simple structures. There exist a wide variety of thalli in algae, particularly in the vegetative plant body. The different forms show a definite range. The range of thallus is from the simplest, which consists of non-motile single-celled to filamentous forms with no well-organized nucleus and plastids.

There exist many unicellular motile forms which may be solitary or colonial. Some are filamentous and have two variants: unbranched and branched. Some of the plants have considered a differentiation of tissues very similar to higher plants, but they lack vascular tissues.

There are various kind of adaptations in the terrestrial forms. In the heterotrichous form, the plant body is highly developed being differentiated into the *erect* and *prostrate systems*.

In general, the varied form of the algal thallus (plant body) may be outlined as follows:

1. Unicellular

- a. ***Unicellular motile***
 - i. Rhizopodial
 - ii. Flagellated type
- b. ***Unicellular non-motile***
 - i. Coccoid type
 - ii. Spiral type

2. Multicellular

- a. ***Colonial***
 - i. *Coenobial*
 1. Motile coenobial
 2. Non-motile coenobial
 - ii. *Aggregated forms*

1. Palmelloid
2. Dendroid
3. Rhizopodial colony

- b. ***Filamentous forms***
 - i. *Unbranched*
 1. Free-floating
 2. Attached to the substratum
 3. Colonial unbranched
 - ii. *Branched*
 1. Falsely branched
 2. Truly branched
 - Simple truly branched
 - Heterotrichous truly branched
- c. ***Siphonaceous***
- d. ***Parenchymatous***

Unicellular Form of Thallus Organisation in Algae

This type of algal plant body consists of a single cell. The organisms are rounded, pear-shaped, oblong-shaped, or spherical in structure. Some unicellular algae are motile, while others are non-motile.

The unicellular algae are two types: **unicellular motile** and **unicellular non-motile**.

Unicellular Motile Forms

These are motile forms of unicellular algae. The thalli contain either flagella or rhizopodia and pseudopodia for locomotion.

The unicellular motile forms are categorized into two types: **flagellated unicellular motile** and **rhizopodial unicellular motile**.

1. Rhizopodial Unicellular Motile Form

The rhizopodial unicellular thalli have a naked protoplast without a rigid cell wall.

The plant body contains cytoplasmic projections called Pseudopodia and Rhizopodia and flagella are completely absent. The organisms show ameboid movement for their locomotion.

Examples of rhizopodial forms are Rhizochloris of Xanthophyceae and Chrysamoeba of Chrysophyceae.

2. Flagellated Unicellular Motile Form

Unicellular motile forms are found in major groups except for Phaeophyceae, Rhodophyceae, Bacillariophyceae, and Myxophyceae. The distinguishing features are the presence of a unicellular plant body bearing means of motile, i.e, flagella. The thallus is a rounded, pear-shaped, or oblong-shaped form bearing two motile flagella at the anterior region.

The most common example is Chlamydomonas, in which the biflagellate plant body is surrounded by a definite cell wall.

Both flagella may be equal in Chlorophyceae or unequal in Xanthophyceae or Dinophyceae. The number of flagella may be one as in some Chrysophyceae, to four as in some Chlorophyceae.

Examples of unicellular motile algae are Euglena (Euglenineae), Cryptomonas (Cryptophyceae), Heterochloris (Xanthophyceae), Chlamydomonas and Chlorogonium of Chlorophyceae, etc.

Unicellular Non-motile Forms

These are non-motile forms of unicellular algae without having flagella or any other locomotory organs.

The unicellular non-motile forms are divided into two types: **coccoid form** and **spiral form**.

1. Coccoid Form

The cells (plant body) are commonly small, more or less spherical without flagella, and do not exhibit any movement. Some are solitary, while others form groups and are embedded in a gelatinous material.

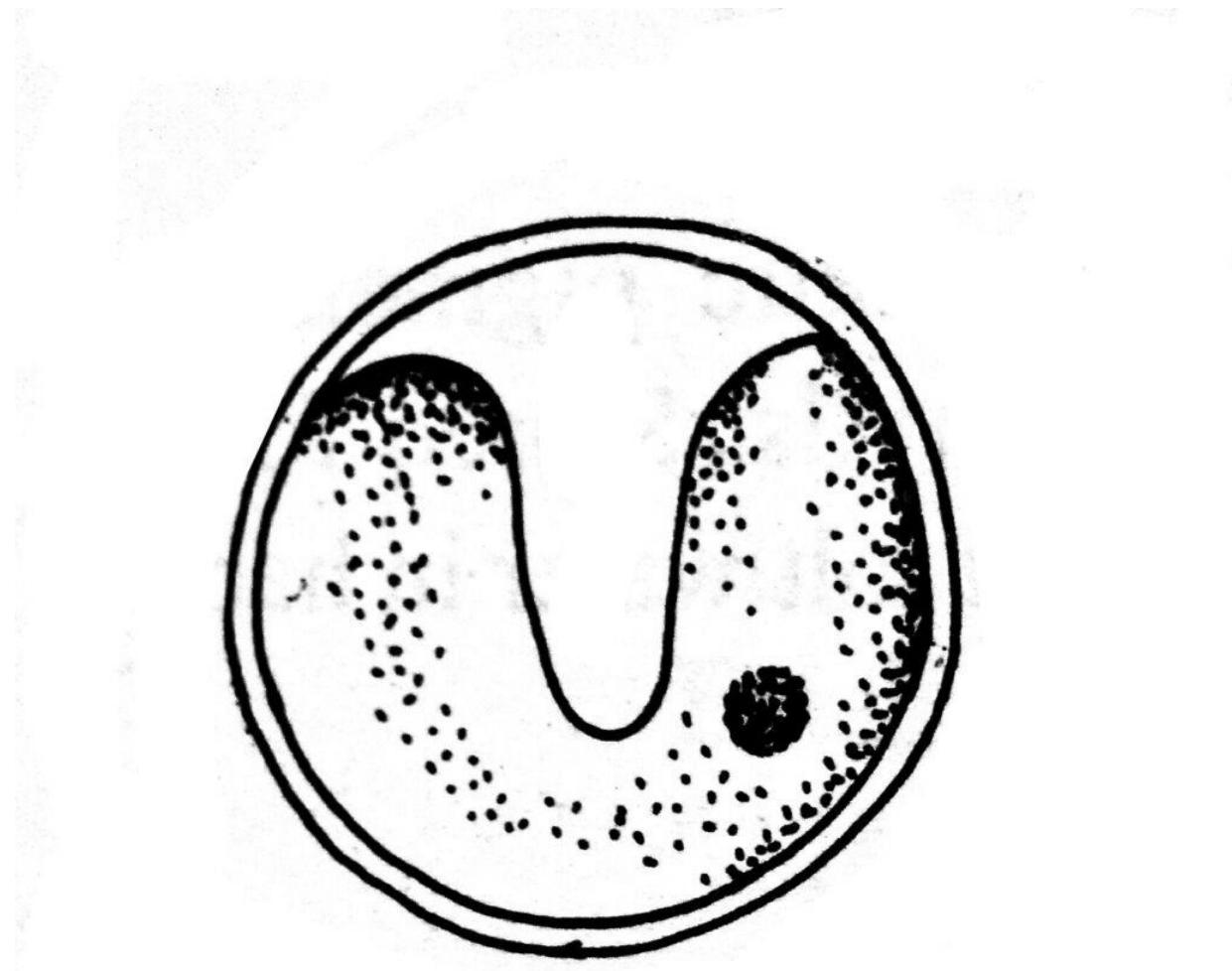


Figure: Non-motile coccoid form in Chlorella

There are also slightly elongated forms that can be differentiated by base and apex.

Unicellular non-motile thalli are found in many algal groups. Some examples of unicellular non-motile forms are Chlorococcum and Chlorella of Chlorophyceae, Porphyridium of Rhodophyceae, Charciopsis of Xanthophyceae, Gloeocapsa and Chamaesiphon of Cyanophyceae.

2. Spiral Form

These unicellular non-motile forms are filamentous algae with spiral plant bodies.

A common example of a spiral unicellular non-motile form is Spirulina.

Multicellular Form of Thallus Organisation in Algae

This type of algal thallus is formed by multi cells or aggregated unicellular algae.

The multicellular form of algae is four types: **Colonial, Filamentous, Siphonaceous, and Parenchymatous.**

Colonial Forms

The colonial thallus is the unicellular form of algae which may be compact or loosely arranged and form a colony-like structure.

There are two types of colonial algae: **Coenobium forms, and Aggregated forms.**

1. Coenobial Forms

The coenobial colony is composed of a definite number of cells arranged in a specific manner.

The coenobium colonial forms are two types: motile with flagella present and non-motile without flagella.

i. Motile Coenobial

Definite members of motile cells are embedded in a gelatinous matrix with their flagella protruded out, and sometimes held together by cytoplasmic connections.

The cells may be compact or loosely arranged, thus a colony is formed of a definite number of cells arranged in a specific manner which is known as coenobium.

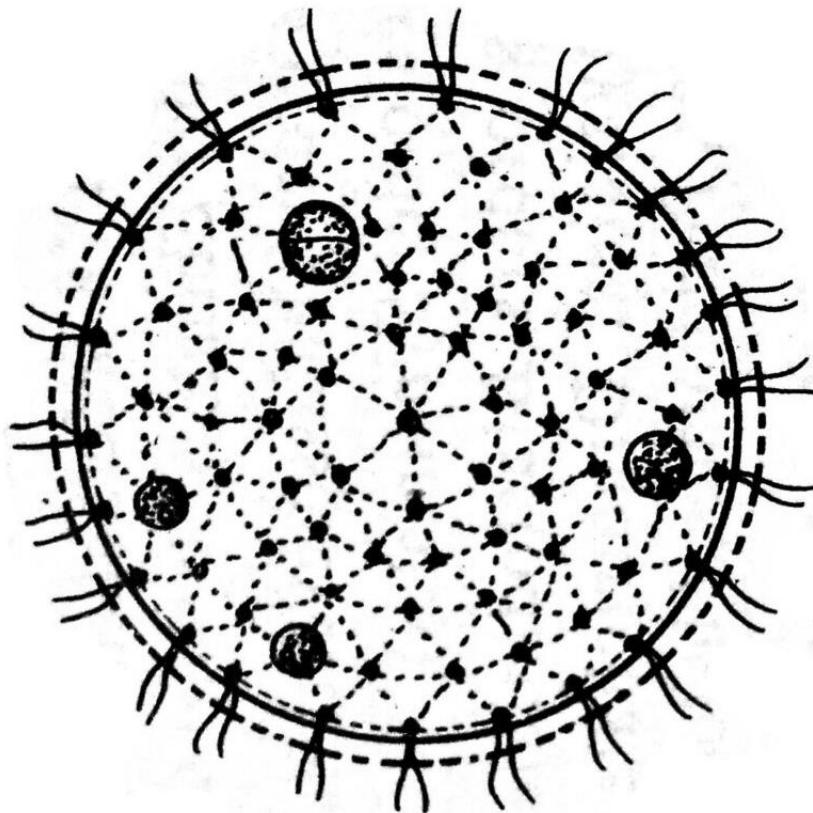


Figure: Motile coenobial form in Volvox

Some examples of coenobial forms are Volvox, Eudorina, Pandrina of Chlorophyceae, Ceratium, Gonyaulax of Dinophyceae, and Chlorodesmuus of Chrysophyceae.

ii. Non-motile Coenobial

Coenobial may be composed of non-motile cells arranged in a single layer being closely depressed to each other along the long axis or may be attached end to end forming a pentagonal or hexagonal mesh of a net.

The coenobium may also be star-shaped in appearance with a single central cell surrounded by peripheral cells of the coenobium.

The best-known example of non-flagellated multicellular coenobium form is Hydrodictyon, in which the cells of the net remain connected in the form of groups of 5 or 6 forming pentagonal or hexagonal structures.

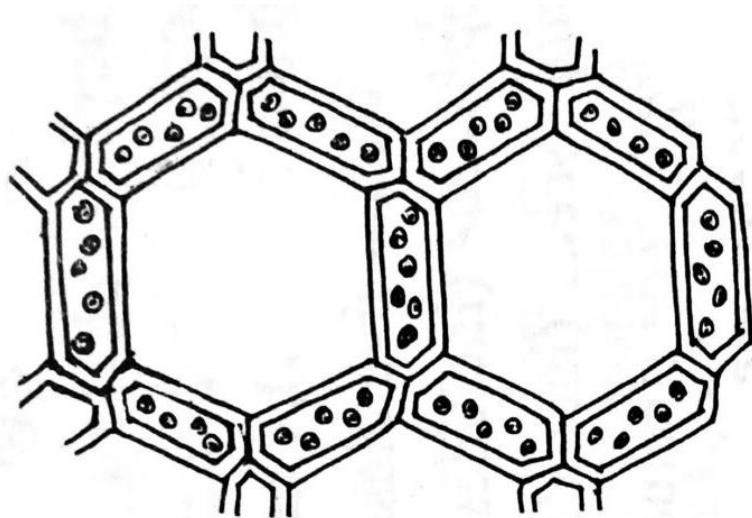


Figure: Non-motile coenobial form in *Hydrodictyon*

This habit is seen mainly in Chlorophyceae. Some other examples are Coelastrum, Scenedesmus, Pediastrum, etc.

2. Aggregated Forms

The aggregated thalli are formed by irregularly aggregated cells and are of various sizes and shapes.

Aggregated forms are divided into three types: **Palmelloid**, **Dendroid**, and **Rhizopodial colony**.

i. Palmelloid Type

It is a temporary stage formed in the alga Chlamydomonas and Chromulina of Chlorophyceae under unfavorable conditions.

During the vegetative phase, the non-motile parent cell produces several non-motile daughter cells which are embedded within a common gelatinous envelope formed by gelatinization of the parent cell wall. The daughter cells further divide forming numerous cells within the matrix which later on become motile by the formation of flagella.

The palmelloid habit is also noted in the Aphanothecae of Cyanophyceae.

ii. Dendroid Type

Dendroid means tree-like. In *Prasinocladus*, *Ecballocystis*, etc., the plant body looks like a microscopic tree.

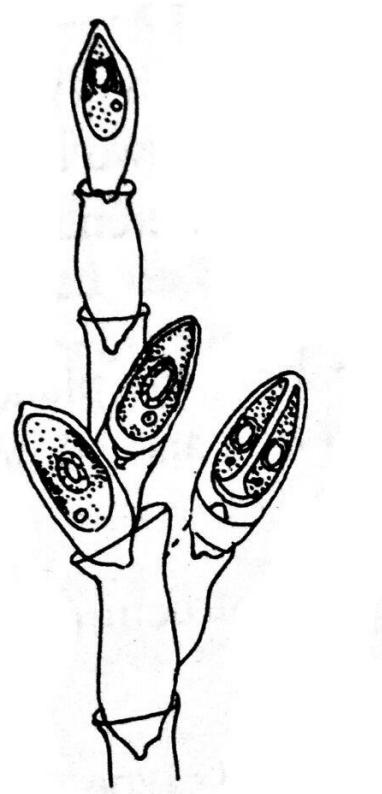


Figure: Dendroid habit of *Prasinocladus*

The mucilage is restricted in such cases usually at the base of the cells. Here the cells of the thallus are attached to each other like branching by mucilage.

iii. Rhizopodial Colony

This type of multicellular form is found in *Chrysidiastrum* of Chrysophyceae.

In the *Chrysidiastrum* thallus, the cells are united by rhizopodia to form a colony.

Filamentous Forms

In this type, the cells are arranged in a row or in several rows to make the thallus filamentous or thread-like in appearance. A filamentous plant body is formed when cells are repeatedly divided in the same plane and direction.

Filamentous forms may be Branched or Unbranched.

1. Unbranched Filaments

The filaments are not branched and are free-floating or attached to the substratum.

The unbranched filamentous forms are of three types: Free-floating, Attached to the substratum, and Colonial unbranched.

i. Free-floating

The free-floating unbranched filamentous form is found in Spirogyra of Chlorophyceae.

In this case, the filaments are not differentiated into basal and apical ends.

ii. Attached to the Substratum

These types of filaments are most common in Ulothrix and Oedogonium.

The unbranched filaments which remain attached to the substratum are differentiated into base and apex.

iii. Colonial Unbranched

This type of unbranched form is found in the Nostoc of Cyanophyceae.

In Nostoc thallus, the filaments are aggregated to form a colony.

2. Branched Filaments

A branched filament is formed when a filament occasionally starts division in a second plane.

They are three types: **Falsely branched**, **Truly branched**, and **Pseudoparenchymatous**.

i. Falsely Branched

The trichome (a single row of cells) is generally fragmented due to the degeneration of an intercalary cell, following which one or both of the intercalary cell's ends adjacent to the dead cell grow out of the parent sheath, giving the resemblance of branching.

False branching is seen in the *Scytonema* of Cyanophyceae.

ii. Truly Branched

True branching occurs when there are repeated transverse divisions on the lateral axis of the thallus.

The truly branched filamentous forms are two types: **Simple truly branched** and **Heterotrichous truly branched**.

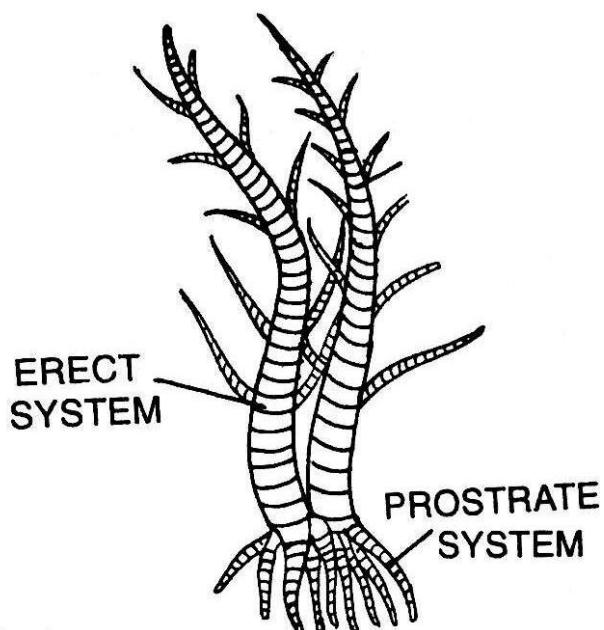
a. Simple Truly Branched

This type of filament is observed in *Cladophora*. In the *Cladophora* filament, the whole thallus is attached to the substratum (ceil, holdfast, or hapteron) with the help of a basal cell.

Simple truly branched filaments are also found in *Xanthophyceae* and *Chrysophyceae*.

b. Heterotrichous Truly Branched

In the heterotrichous filament, the whole plant body is differentiated into well-developed prostrate and erect systems.



*Figure: Heterotrichous truly branched filamentous form in *Stigeoclonium* showing erect and prostrate systems*

This most highly evolved type of plant body is found in Chlorophyceae (e.g., Fritschia, Stigeoclonium), Phaeophyceae (e.g., Ectocarpus), Rhodophyceae (e.g., Erythrotrichia), and some Chrysophyceae and Dinophyceae (e.g., Dinoclonium).

iii. Pseudoparenchymatous Forms

When one or more central or axial filaments come together with its branch fuses and form a parenchymatous structure, it's called pseudoparenchymatous thallus.

The pseudoparenchymatous form is a secondary development, the close association of cells is a result of the interweaving of filaments.

There are two types of pseudoparenchymatous thallus: the **Uniaxial type** and the **Multiaxial type**.

a. Uniaxial Type

In the uniaxial type, the thallus shows clearly the parenchymatous nature in which there is one main axis and all the others are siding branches.

Uniaxial pseudoparenchymatous types are seen in Batrachospermum, Spermatochnus (Phaeophyceae), and Polysiphonia (Rhodophyceae).

b. Multiaxial Type

The multiaxial type is seen in Chondrus, Scinaia, etc.

In this type, the plant body contains more than one axis. These axes (central and lateral) form a compact cortex.

Siphonaceous Forms

In siphonaceous form, the plant body consists of a long, hollow tube-like multinucleate structure called a coenocyte. The growth of the thallus (coenocytic filament) takes place without the usual cross-wall formation and it contains a central vacuole with chloroplasts and nuclei in the peripheral cytoplasm.

The siphonaceous forms are observed in the order siphonales (e.g., Vaucheria, Botrydium).

Parenchymatous Forms

The parenchymatous form of the plant body is a modification of the filamentous habit. The formation of a parenchymatous thallus occurs when cells of the primary filament divide into two or more planes.

The parenchymatous organization may be foliose (e.g., *Ulva*), tubular (e.g., *Enteromorpha*), or highly developed structure (e.g., *Chara*, *Fucus*, *Laminaria*, etc.).