Algae

Giant kelp (Macrocystis pyrifera). Source: NOAA; Credit: Claire Fackler.

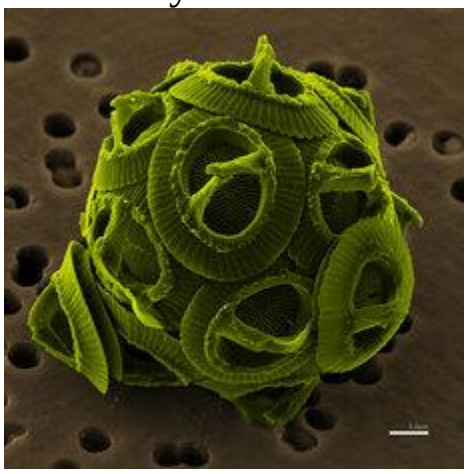
Introduction

Algae comprise a diverse group of typically autotrophic organisms, ranging from unicellular to multicellular forms. The largest and most complex marine forms are generally termed seaweeds. Algae convert solar energy to biomass using photosynthesis, like plants, although they lack the many distinct organs found in most terrestrial vegetation.

Algae lack most of the structures that are associated with terrestrial flora, such as phyllids (leaves) and rhizoids in non-vascular plants; furthermore, they are without leaves, roots, and certain other organs that are found in vascular plants. Many are autotrophic although some groups contain species that are mixotrophic, deriving energy both from photosynthesis and uptake of organic carbon either by osmotrophy, myzotrophy, or phagotrophy. Some unicellular taxa rely solely on external energy sources and have limited or no photosynthetic apparatus.

Virtually all algae have photosynthetic apparatuses derived ultimately from the Cyanobacteria. They respire oxygen as a by-product of photosynthesis, unlike such other photosynthetic bacteria as purple and green sulfur bacteria. Fossilized filamentous algae from the Vindhya Basin (in India) have been dated back to as far as 1.6 to 1.7 billion years before present.

Taxonomy



False-color scanning electron micrograph of the unicellular coccolithophore,*Gephyrocapsa oceanica*. Source: Neon ja/Richard Bartz

Algae are Eukaryotes that engage in photosynthesis within membrane-bound organelles called chloroplasts. Chloroplasts contain circular DNA and are similar in structure to Cyanobacteria, ostensibly representing reduced cyanobacterial endosymbionts. The chloroplast character differs among the lines of Algae, reflecting various endosymbiotic events.

Previously, Cyanobacteria were included in Algae (as blue-green algae), but such major differences as the lack of membrane-bound organelles, the presence of a single circular chromosome, the presence of peptidoglycan in the cell walls, and ribosomes differing in size and content from Eukaryotes.[1] Rather than in chloroplasts, they conduct photosynthesis on specialized infolded cytoplasmic membranes called thylakoid membranes. They have, therefore, divergent morphology from Algae, even though they occupy similar ecological niches.

W.H.Harvey (1811-1866) was the first to divide the Algae into four divisions based on pigmentation. This is the first instance of a biochemical criterion in plant systematics. Harvey's four divisions were: Red Algae (Rhodophyta), Brown Algae (Heteromontophyta), Green Algae (Chlorophyta) and Diatomaceae.[2]

Current taxonomy is driven by molecular biology and can be divided as follows:

- Charophyta (Subset of green algae, which may have flagellate cells and sexual reproduction)
- Chromista (Algae with chlorophyllic elements: include brown algae, water moulds and many diatoms)
- Chrysophyta (Golden algae)
- Chlorophyta (Subset of green algae, having motility and chlorophylls)
- Craspedophyta
- Cryptophycophyta (Subset of algae with flattened shape and two flagellae in motile stage)

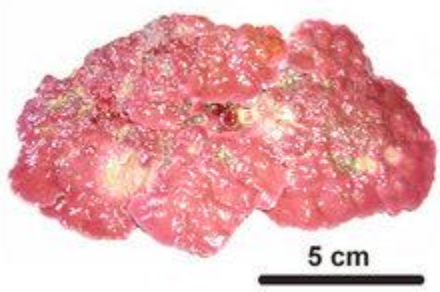
- Euglenophycota
- Haptophyta (Subset of algae with motile stage organism having two unequal flagellae)
- Phaeophyta (Brown algae: Includes kelps, having four membranes around chloroplasts)
- Prasinophyta (Marine green algae: Have a single chlorplast and mitochondrium)
- Pyrrophycophyta
- Rhodophyta (Red algae: Seaweeds lacking flagellae)
- Xanthophyta (Yellow green algae whose chloroplasts lack fucoxanthin)

Brown algae

Giant Kelp juvenile, with a bottom holdfast. Source: Steinhart Aquarium, San Francisco, California

Brown algae, also known as Phaeophyceae, are comprised chiefly by marine multicellular Algae, including many seaweeds of the colder Northern Hemisphere waters. They play a key role in marine environments both as food, and for the habitats they create, with their intricate and sometimes large architecture. For example, some members of the kelp genus*Macrocystis* may attain lengths of up to 60 meters, and form prominent mostly submerged kelp forests; along a portion of the Pacific coast ofCalifornia, these kelp forests form an intrinsic element of the habitat of the endangered Southern sea otter. Another example of a brown alga is the genus*Sargassum*, that creates unique habitats in the tropical waters of the Sargasso Sea. Many brown algae such as members of the order Fucales are found commonly along rocky seashores. Some brown algae are used as food by humans, and for food additives, and even in sound reducing building materials. Some brown algae species, for example *Ascophyllum nodosum*, have such great commercial importance that they are subjects of extensive scientific investigation.[3]

Coralline algae



Lythophyllum cabiochae, an example of a non-geniculate coralline. Source: Amélie Charnoz

Coralline algae are calcifying red algae that have a hard skeleton resulting from the precipitation of calcium carbonate within the cell walls.[4] Coralline algae are abundant and widespread in coastal areasthroughout the world, from polar regions to the tropics. They are found not only near the water surface, but also to depths of more than 100 meters; some occur under intense illumination, while others with very dim lighting. Coralline algae belong to the family Corallinaceae and are divided into two general types based on their morphology:[5]*geniculate corallines* and *non-geniculate corallines*.

References

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