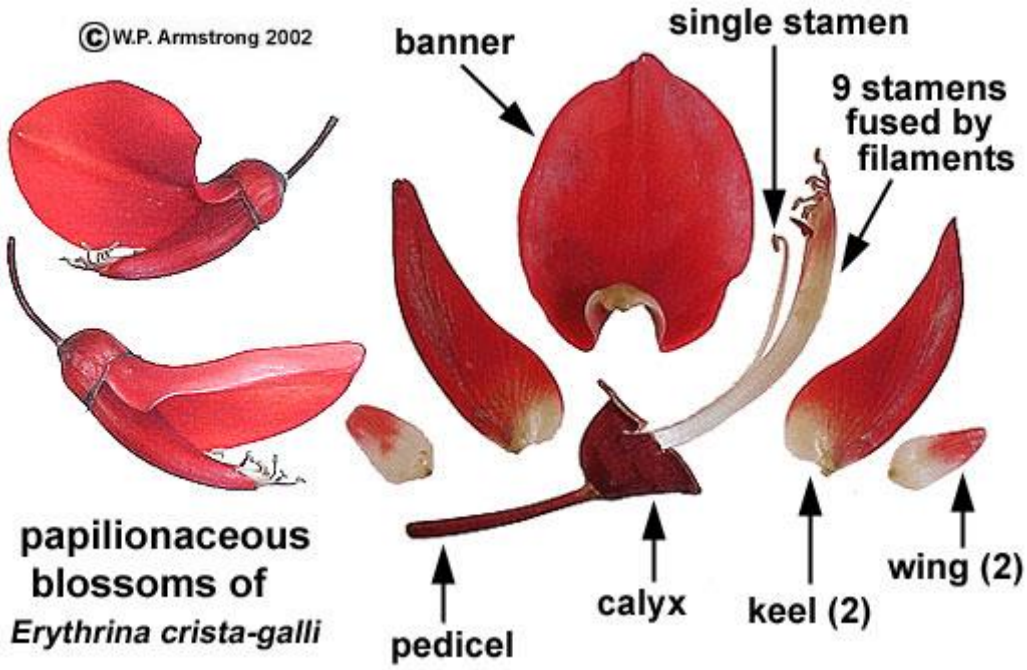
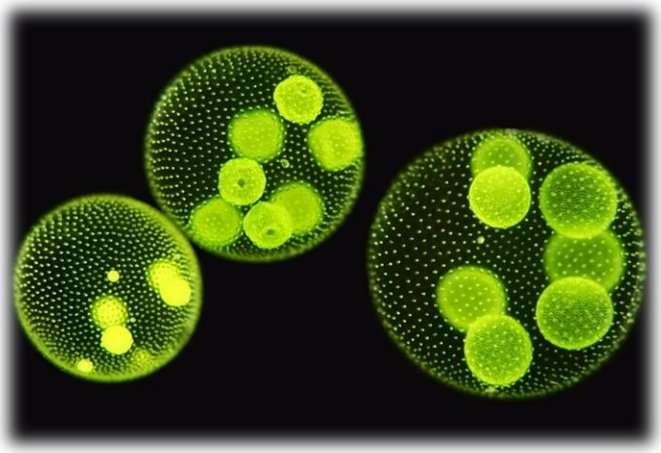




TOPIC NOTES FOR BIOL3711: PLANT AND ALGAL DIVERSITY

Completed in 2018

Contents

Summary Table of main Algal and Plant groups

Group	Species #	Cell covering	chloroplast	Photosynthetic pigments	flagella	Energy Reserve	Reproduction	Ecology
Cyanobacteria (Blue-Green Algae)	7,500	Polysaccharide protein	None	Chlorophyll a Phycocyanin phycoerythrin	None	Cyanophycean Starch	Vegetative Endospores Exospores Hormgonia Akinete	N2 fixation, High pH and temperature resistance Releases toxicants
Chlorophyta (green algae)	7,000	Cellulose Pectin	Yes	Chlorophylls a & b B-carotene	None, or 2 or more of equal lengths	Starch	Sexual or asexual	Most in freshwater, but some in marine.
Dinophyta (dinoflagellates)	2,100	Theca (cellulose)	yes	Chlorophylls a & c B-carotene xanthophylls	Transverse longitudinal	Starch	Sexual or asexual	Red tides
Cryptophyta (cryptomonads)	200	periplast	yes	Chlorophylls a & c Phycocyanin Phycoerythrin	2, unequal	starch	asexual	Enriched freshwater
Euglenophyta (euglenoids)	800	Pellicle	yes	Chlorophylls a & b B-carotene	1-2	paramylon	Only asexual	Autotrophic or heterotrophic
Bacillariophyta (diatoms)	5,600	Silicon Epitheca Hypotheca Raphe	yes	Chlorophylls a & c Fucoxanthin diatoxanthin	none	Leucosin Oil	Sexual, asexual and auxospores	Euplanktonic, meroplanktonic & benthic Silicon
Chrysophyta (golden algae)	200	Naked or with a lorica	yes	Chlorophylls a & c Fucoxanthin	1 or 2, equal or unequal	Leucosin Oil	Mainly asexual, statospores	Prefer cold water, rarely occurs in high pH or phosphate
Xanthohpyta (yellow algae)	600	"H" shape cellulose	yes	Chlorophylls a & c B-carotene	Rare	Leucosin Oil	Asexual, aplanospores, zoospores	Mainly in unpolluted freshwater
Phaeophyta (brown algae)	1500 - 2000	Cellulose	yes	Chlorophylls a & c B-carotene Fucoxanthin	Only reproductive flagellates	Laminarian	Sporophytes, gametophytes	Benthic
Rodophyta (red algae)	4000	cellulose	yes	Chlorophylls a Phycocyanin Phycoerythrin	none	Floridean starch	Very diverse	Marin, in tropical areas
Plantae (true plants)	400,000	cellulose	yes	Chlorophylls a & b	None	Starch	Sexual or asexual Sporophytes, gametophytes	Mostly terrestrial, but some aquatic.

WK1: General Algal Biology – (Professor Jian Qin)

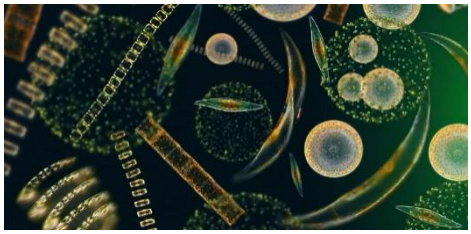
Alga (singular) or algae (plural) refers to a diverse group of simple plant-like organisms that may be unicellular or multicellular. The shared characteristics of this group include a photosynthetic system utilising chlorophyll *a*, and that all algae are eukaryotic except blue-green algae. Algae exist in all aquatic ecosystems including freshwater, saltwater and brackish water. Some are also adapted to survive in semi-moist environments e.g. soil, bark, snow, etc. while others are capable of being spread via the wind or migratory birds. Algae can range in size from μm to more than 50m in the case of kelps. Different structural features of algae include:

- Flagellated solidary cells with the number and position of flagellum varying. (A)
- Flagellated colonial cells which may be arranged in a flat plate or sphere. (D)
- Non-flagellated cells which may be singular (B) or colonial (E)
- Filaments are a structure that may be branched or unbranched and are formed by cells arranged end-to-end with a common cross wall shared by adjacent cells. (J)
- Parenchymatous thalli refers to cell organisation that is three dimensional to produce a solid mass as opposed to linear filaments. (N)

Algae include organisms across two different taxonomic kingdoms:

Kingdom: *Monera*
Phylum: *Cyanophyta* – (blue-green algae/cyanobacteria)
- ➔ This group is prokaryotic and therefore lack membrane-enclosed nucleus.

Kingdom: *Protista*
Phylum: *Chlorophyta* – (green algae)
Bacillariophyta – (diatoms)
Chrysophyta – (golden algae)
Xanthophyta – (yellow algae)
Euglenophyta – (euglenoids)
Dinophyta – (dinoflagellates)
Cryptophyta – (cryptomonads)
Phaeophyta – (brown algae)
Rhodophyta – (red algae)



Planktonic algae: algae that drift on the surface layer of water.

- ➢ Phytoplankton: free-floating algae without swimming capacity. When these algae proliferate they may cause an algal bloom which decreases the clearness of the water and is associated with a change in water colour.

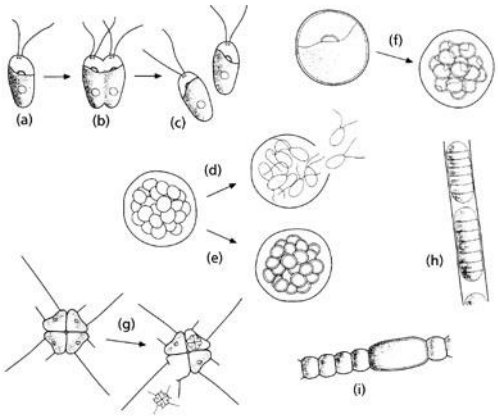
Benthic algae: algae that grow on the surface of submerged substrates.

- ➢ Epilithic algae: living on stone
- ➢ Epipelic algae: attached to mud or sand
- ➢ Epiphytic algae: attached to plants (or other algae)
- ➢ Epizoic algae: attached to animals

Subaerial algae: living in a terrestrial environment with a relatively moist environment.

Within the algal group, reproduction across species can be sexual, asexual or both. Sexual reproduction allows for more genetic variation to occur in the offspring but can be more costly due to the wastage of gametes that fail to reproduce. Asexual reproduction is less costly and allows for rapid population growth but results in less variation.

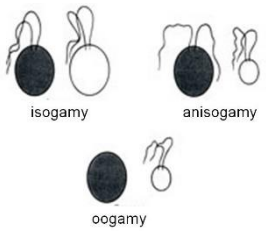
Asexual forms of algal reproduction:



- Binary division: each dividing daughter cell receives a copy of the single parental chromosome (A)
- Zoospore: a motile flagellated spore that is formed inside the parental cell wall. These spores are collectively referred as swarm spores. (D)
- Autospore: a non-flagellated spore which is the miniature of its parent cell. (E, F)
- Fragmentation (hormogonium): the formation of new individuals from segments by breaking up parental ones. (H)
- Autocolony: a newly produced colony with the same form as the parent colony. (G)
- Akinete: an algal cell with thickened and often enlarged walls to withstand dry and other conditions hostile to development. (I)

Sexual forms of algal reproduction:

- Gametes: the cells released from the sexually reproductive parents, often these take the form of male and female cells.
- Zygote: the cell formed by the union of two gametes. These cells may develop immediately into a new individual or can be delayed via dormancy.
    - Isogamy: having two compatible flagellated gametes with similar sizes.
    - Anisogamy: having two flagellated gametes with different sizes.
    - Oogamy: having small motile male gametes (sperm) and large non-motile female gametes (eggs).



Algal Utility:

1. They serve as the basal element of the food chain, providing the basis of the food web in marine and freshwater ecosystems.
2. Human food; with some large algae being utilised as a food stable.
3. Industrial materials; they can be used as a thickener, to produce agar and in salt extraction.
4. Medicine such as vitamins, antibiotics and anti-cancers.
5. Environmental controls such as the sequestration of nutrients and heavy metals.
6. Biofuel