Eukaryotic Algae

I. General Characteristics
II. Reproduction and Life History Patterns
III. Photosynthetic Pigments
IV. Chloroplast types
V. Major Polysaccharide Reserves
VI. Flagellated stages and Flagella types

Characteristics Of Eukaryotic Algae
- true nucleus
- well developed organelles
  - mitochondria
  - chloroplasts - surrounded by 2 or 3+ membranes
- more complex reproductive cycles
  - asexual reproductive spores
  - sexual reproduction

Reproduction

Asexual
1. mitosis (cell division)
2. zoospores (flagellated)
3. Fragmentation (filaments)

Sexual Reproduction

Two steps in sexual reproduction:
1. meiosis (reduction division)
2. syngamy (fusion of sex cells)

Zygote - diploid cell resulting from gamete fusion

Three Basic Life History patterns:
- differ in when and where meiosis occurs

Haplontic (zygote)  Diplohaplontic (sporophyte)
Diplontic (2n thallus)

Sexual (production of gametes)

Gametes - types:
- isogamous (gametes identical, flagellated)
- anisogamous (gametes differ in size, flagellated)
- oogamous (flagellated sperm and non-flagellated egg)

Haplontic life History

- vegetative phase is haploid (thallus)
- zygote only diploid cell
- meiosis occurs in zygote (zygotic meiosis)
meiosis occurs in diploid thallus (gametic meiosis)

Diplontic Life History
- vegetative phase in diploid (2n)
- meiosis occurs in diploid thallus (gametic meiosis)
- gametes are only haploid stage

Diplohaplontic Life History
- meiosis in (2n) thallus sporophyte (sporic meiosis)
- gametes produced by mitosis
- zoospores grow into (n) thallus (gametophyte)

Alternation of Generations
Some General Distinguishing Features

photosynthetic pigments
  Chl a - all have
  Chl b – Green, some Cyanobacteria
  Chl c₁, c₂, c₃ - found in Brown Algae (Ochrophyta), Dinophyta, Cryptophyta & Haptophyta
carotenoids - excess energy dissipation? Xanthophyll cycle

Carotenoids cont.

cia. 60 different carotenoids
  major carotenoids:
  • β-carotene – major yellow pigment in ochrophytes
  • fucoxanthin e.g. Browns
  • peridinin e.g. Dinoflagellates
  • siphonoxanthin e.g. Greens (light absorption in deep water?)
**More photosynthetic pigments**

**phycobilins (Phycobiliproteins)**

**Cyanobacteria and Red Algae (Rhodophyta)**

- phycobiliproteins are a phycobilin (pigment) and associated protein
- water soluble
- organized in phycobilisomes
  1. Phycoerythrin
  2. Phycoerythrocyanin
  3. Phycocyanin
  4. Allophycocyanin

**chloroplast structure**

**number**

- varies (one in *Chlamydomonas* to many)

**shape**

- disk shaped (most)
- stellate (*Zygnema*)
- spiral (*Spirogyra*)
- reticulate (*Microspora*)

**position**

- parietal
- axial
- central

**chloroplast origin**

1° endosymbiont

- Red algae
- Metaphytes
- Chlorophytes

2° endosymbiont

- Rhodophytes
- Chromophytes

- Cryptophytes
- Rhodophytes

**Polysaccharide Reserves**

polysaccharide reserves - glucose chains (Glucans), side branching varies between groups and species

- two basic groups

  - α-1,4 linked glucose
  - β-1,3 linked glucose
Some Storage Products

\[ \alpha-1,4 \text{ linked glucose} \]
- Starch
- Cyanophytan starch (glycogen)
- Floridean starch

\[ \beta-1,3 \text{ linked glucose} \]
- paramylon
- chrysolaminaran
- lipids

Flagellar Appendages
- smooth (fine hairs) “whiplash”
- tinsel (stiff hairs - mastigonemes)

Flagellated Cell Types
- isokontous – flagella identical in shape and structure
- heterokontous - (two unequal length flagella usually one smooth one tinsel)

Flagella

9+2 organization (eukaryotic, however no prokaryotic algae are flagellated)
- no flagellated cells in the Rhodophyta
- number of flagella
- position (anterior, posterior, transverse)