

THE GREEN ALGAE

Chlorophyta

A rare infection worldwide producing skin ulcers, apple jelly–look, particularly in poor regions

It is becoming common

Even found in US with most cases are from the SE including Alabama!

No particular race, or sex, or age, even cows, cats, dogs are victims

Usually found in individuals with compromised immunological system, i.e., AIDS

Can be fatal

Most disinfectants? No effect

Antibacterials? No effects

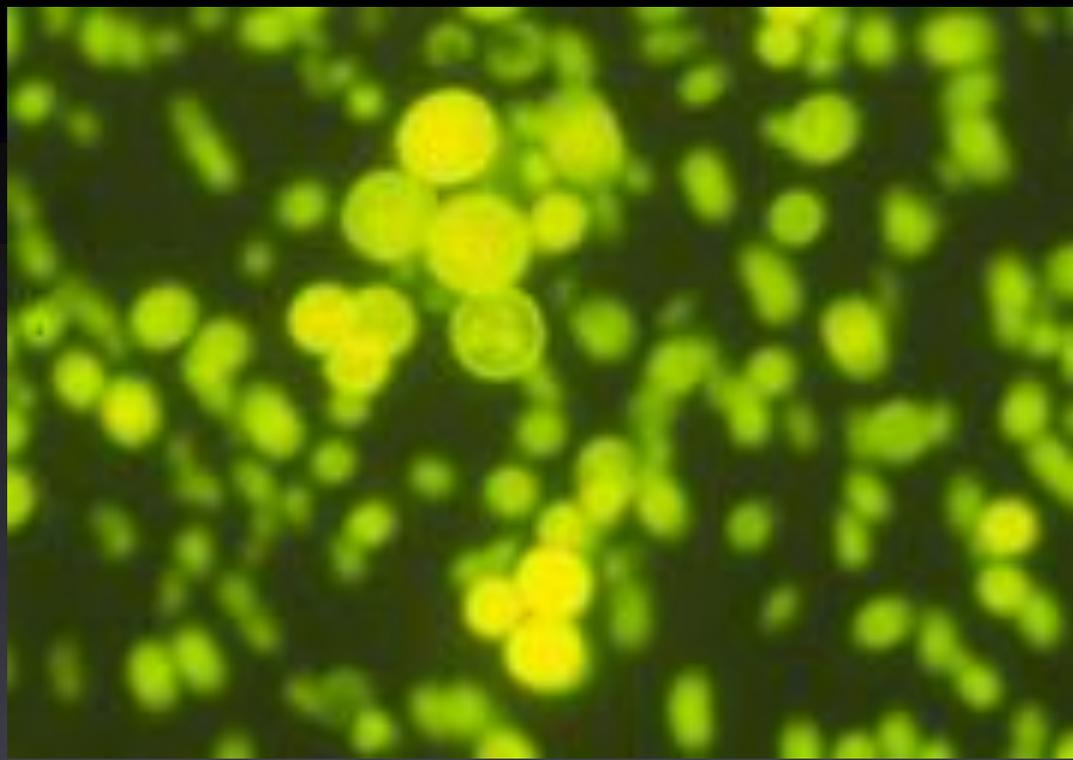
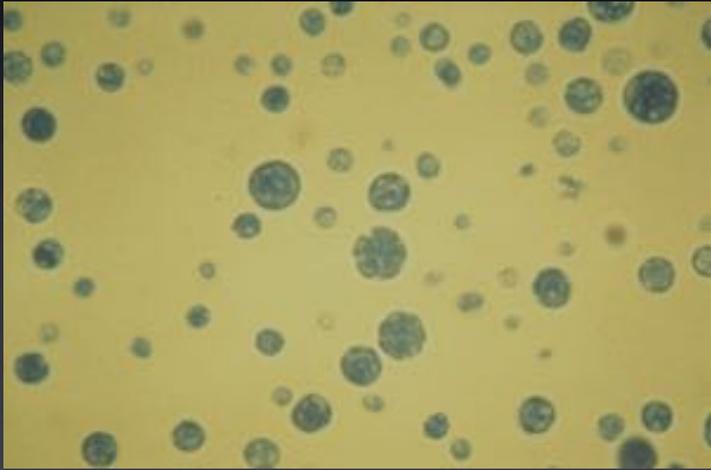
Antivirals? No effects

Antifungals? No effects



Causative organism?

A green alga!!!



An achlorophyllous green algae

Genus *Prototheca* related to the common *Chlorella*

Ubiquitous alga

Protothecosis

Common treatment: surgical excision

Eukaryotic algae @ 17,000 species

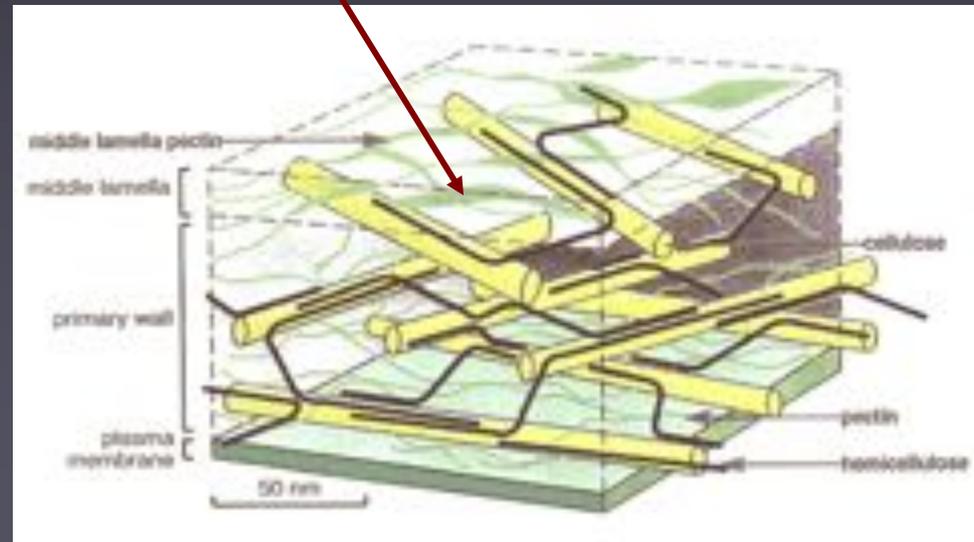
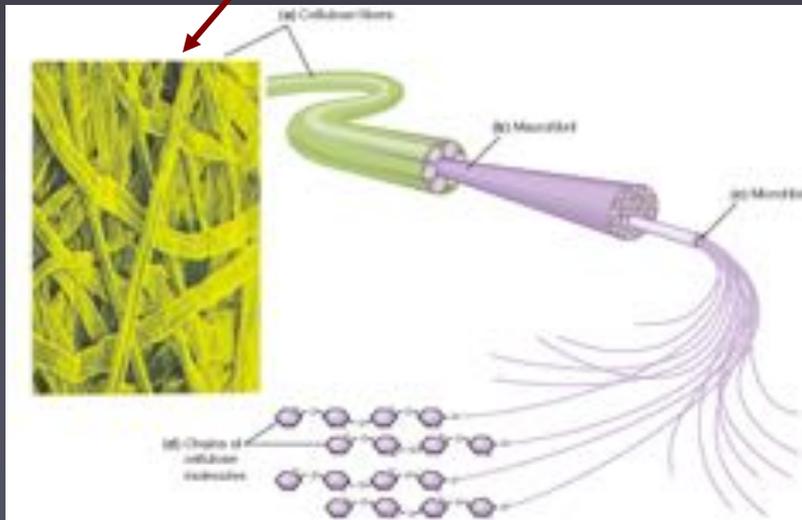
Progenitors of the higher plants or seed plants

Predominantly freshwater forms, common in marine and subaerial habitats. Rare pathogens are also known

Cell walls: Cellulose. (Scales, calcified or naked)

Fibers of Cellulose

A matrix of several polymers:
pectin, hemicellulose, etc.



Pigments of Chlorophyta

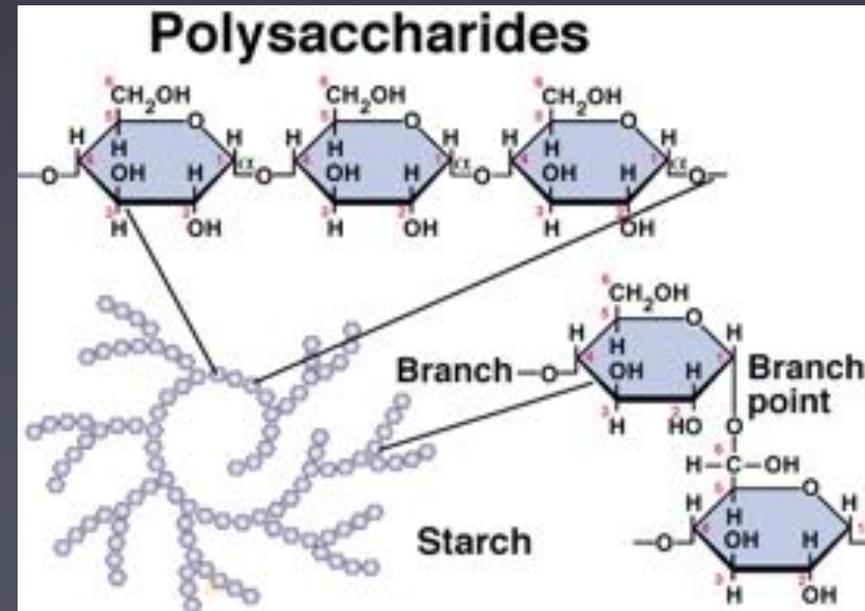
Pigments are located in chloroplasts within thylakoids occurring singly or in stacks of variable number:

- A. Chlorophylls *a* & *b*
- B. Carotenes: α and β -carotenes
- C. Xanthophylls: luteine, zeaxanthine, neoxanthine, violaxanthine



Storage Products:

1. True starch (IKI positive)
(α -1,4 linked polyglucans)
inside the chloroplast
2. Lipids



The pyrenoid

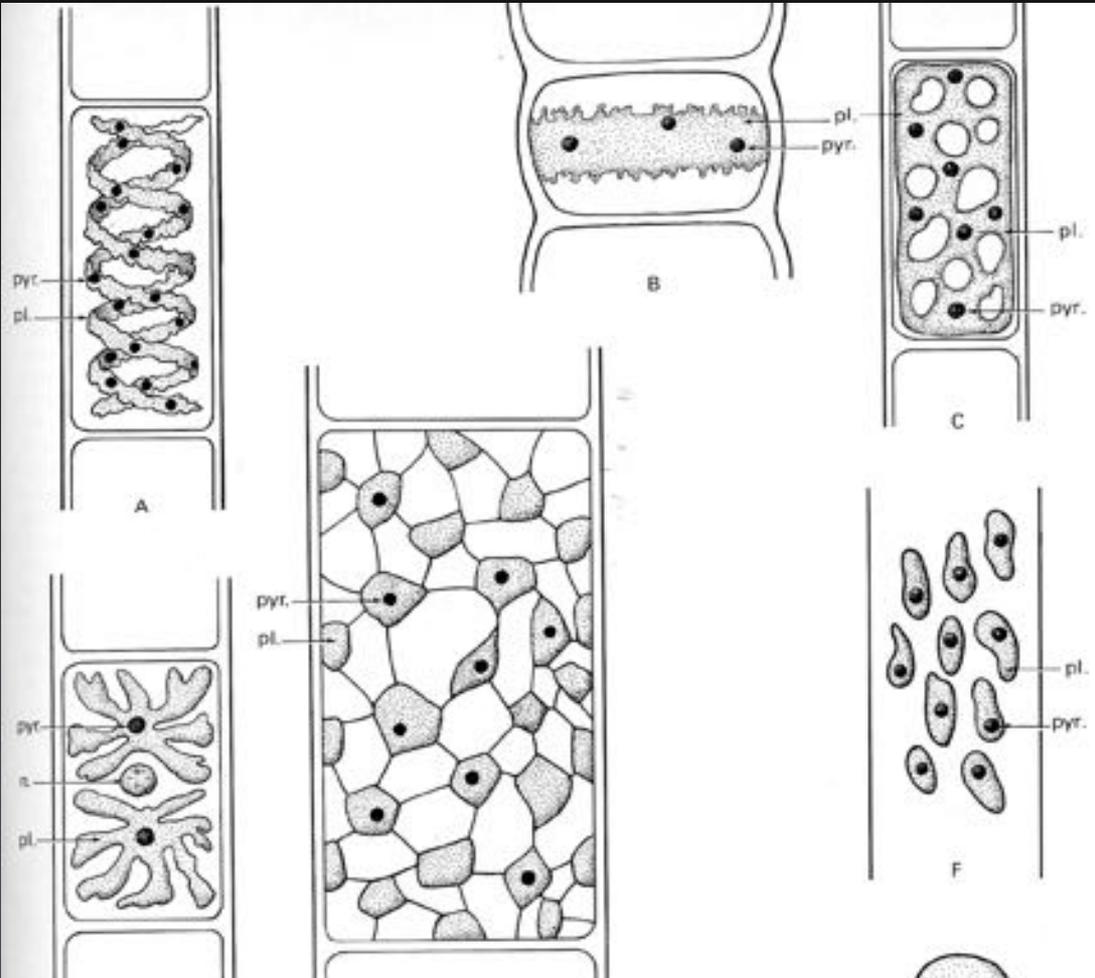
1. Where is it found?
Inside chloroplasts
2. Of what is it made?
RuBisCo
3. Of what is it reminiscent?
Carboxysomes
(polyhedral bodies)
4. What does it do?
primary site of starch
production in those
algae which have them



Chloroplast types

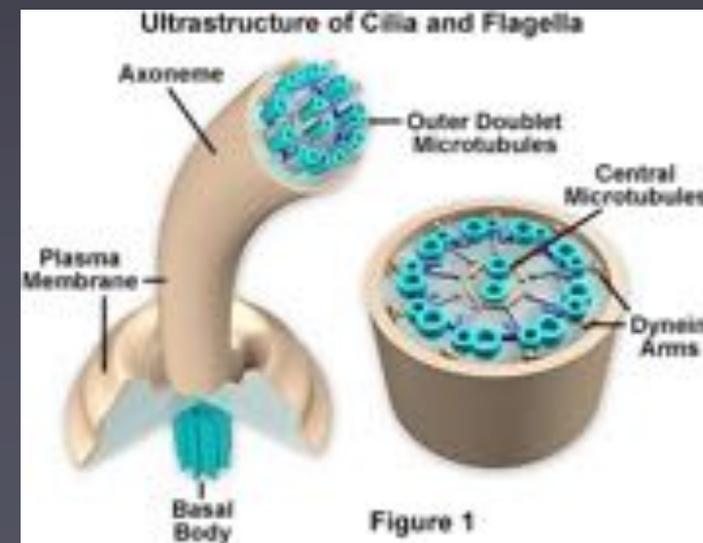
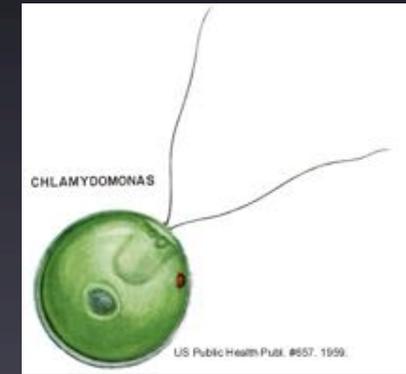
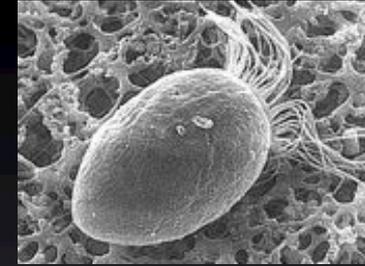
Chloroplast shapes

- Parietal spiral *Spirogyra*
- Parietal ring *Ulothrix*
- Parietal perforated *Acrosiphonia*
- Reticulated w/pyrenoids *Cladophora*
- Axile stellate w/ pyrenoids *Zygnema*
- Discoid *Bryopsis*

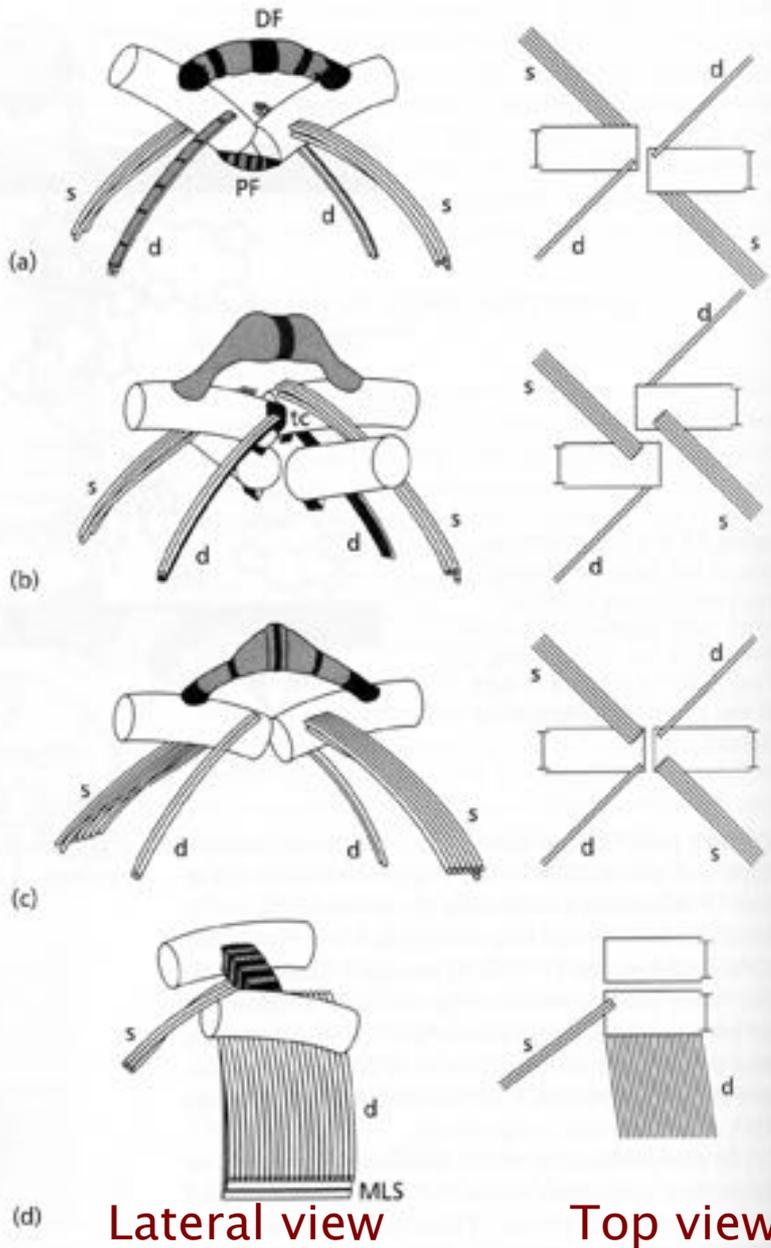


Flagellar apparatus in Chlorophyta

- a) 1, 2, 4, 8, or more (multiples of two)
stephanokont (e.g. *Oedogonium*)
- b) generally **isokont** (with exceptions)
iso=equal kont=oar
simple or whiplash (**acronematic**)
acro=tip nema=thread
heterokont (unequal flagella)
some **pleuronematic** (e.g. *Haematococcus*)
pleuro=multiple nema=thread
- c) generally anteriorly inserted (**acrokont**)
- d) Laterally inserted (**pleurokont**)
- e) “9+2” axonemes!!!



Flagellar apparatus in Chlorophyta



Consisting of:

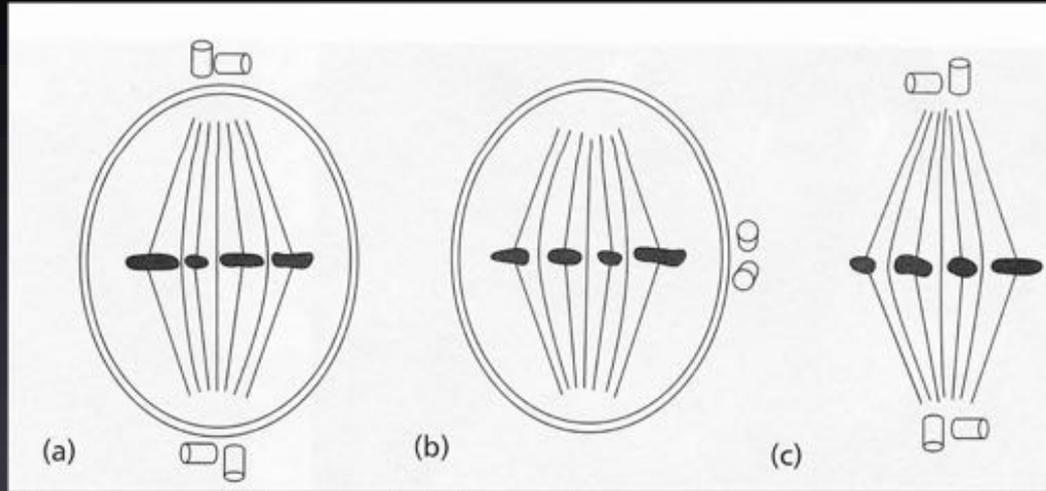
1. Flagella
2. 2–4 basal bodies
3. Microtubular roots (s, d)
4. Connecting fibers (DF, PF)

Four Types according to the BB position:

- CW Clockwise
- CCW Counterclockwise
- DO Directly opposite
- Parallel with MLS Parallel with Multilayer structures

Cell Division in Chlorophyta

Karyokinesis (mitosis, nuclear division)
Cytokinesis (cell division)

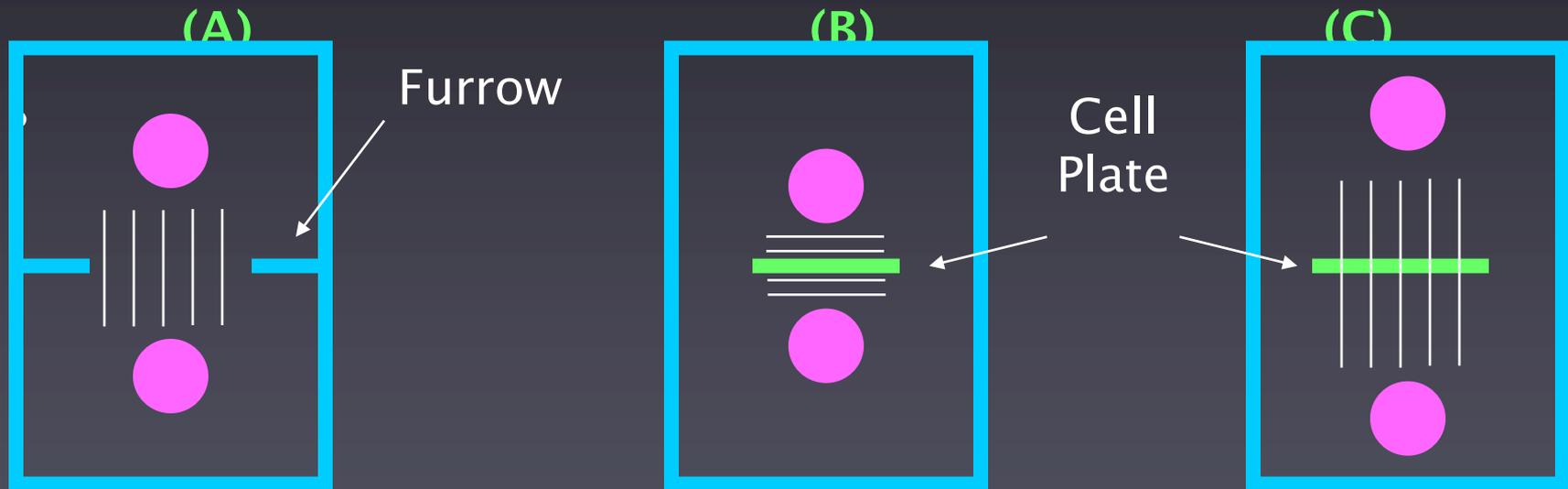


Karyokinesis (mitosis, nuclear division)

- **Closed mitosis:** the nuclear envelope persists during nuclear division, with centrioles located at the spindle poles (in Ulvophyceans and Chlorophyceans)
- **Metacentric spindle:** Centrioles located near the metaphase plate (in Trebouxiophyceans)
- **Open mitosis:** The nuclear envelope disappears during nuclear division (in Charophyceans and vascular plants)

Cytokinesis in green algae

- By simple infurrowing (A)
- Phycoplast (B): daughter nuclei remain close together and microtubules are oriented parallel to the plane of cell division (in Chlorophyceans)



- Phragmoplast (C): daughter nuclei move to opposite ends of the parent cell, microtubules are oriented perpendicular to the plane of cell division (in Charophyceans and vascular plants)

Reproduction and Life–History in Chlorophyta

Several types, depending on where the meiosis take place!

1. If the life cycle is spent in the haploid state, with meiosis during zygote germination: **ZYGOTIC MEIOSIS**

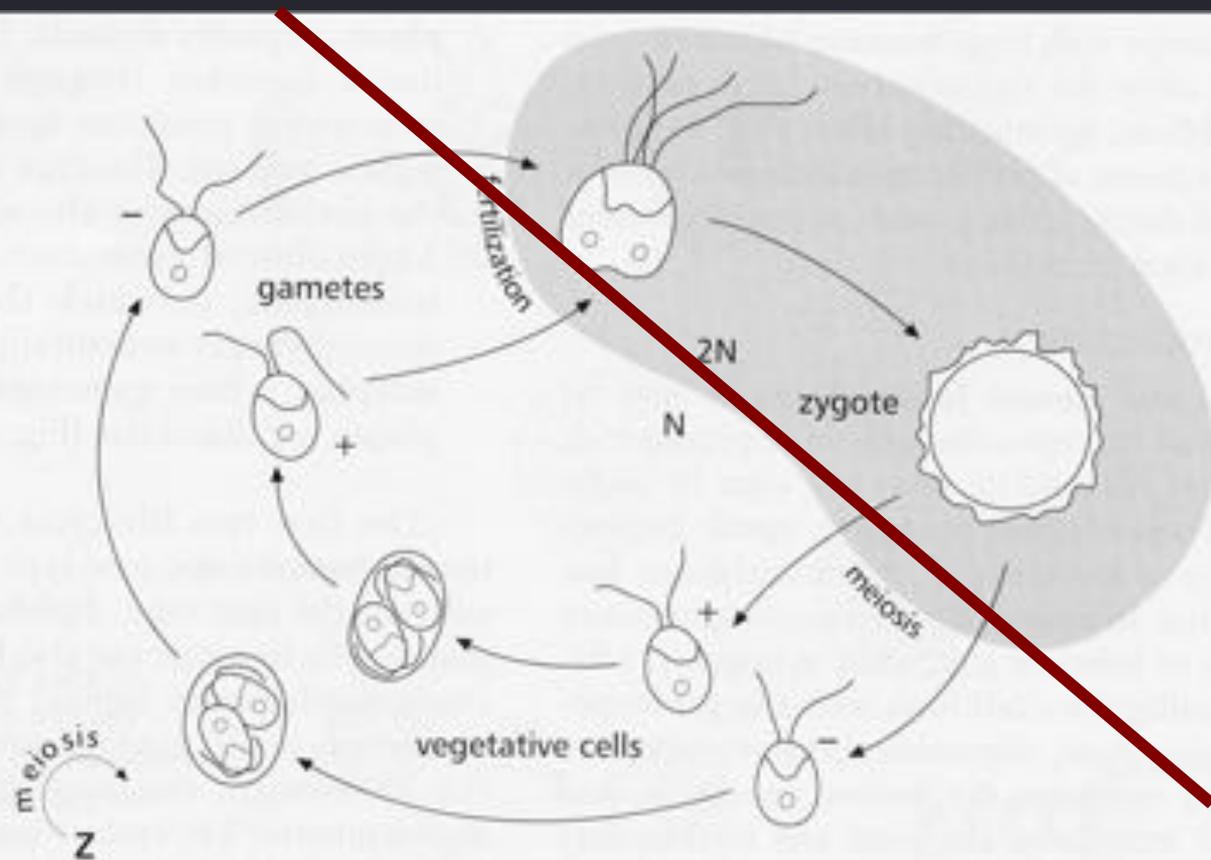


Figure 1–22 Zygotic meiosis in the green unicellular flagellate *Chlamydomonas*.

Several types, depending on where the meiosis take place!

1. ZYGOTIC MEIOSIS

2. The vegetative phase is diploid, meiosis during gametogenesis: **GAMETIC MEIOSIS**

Male



Female

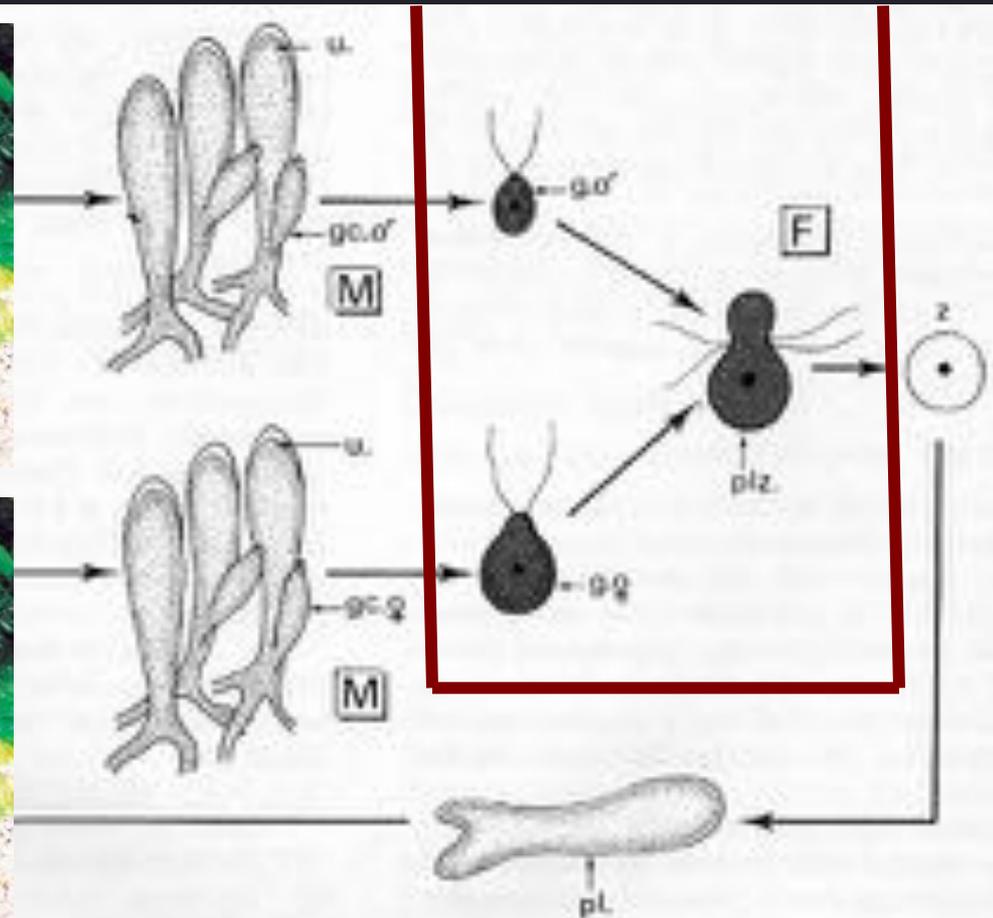


Fig. 70 Reproduction sexuelle et cycle schématique du développement d'un *Codium diolus*.

Several types, depending on where the meiosis take place!

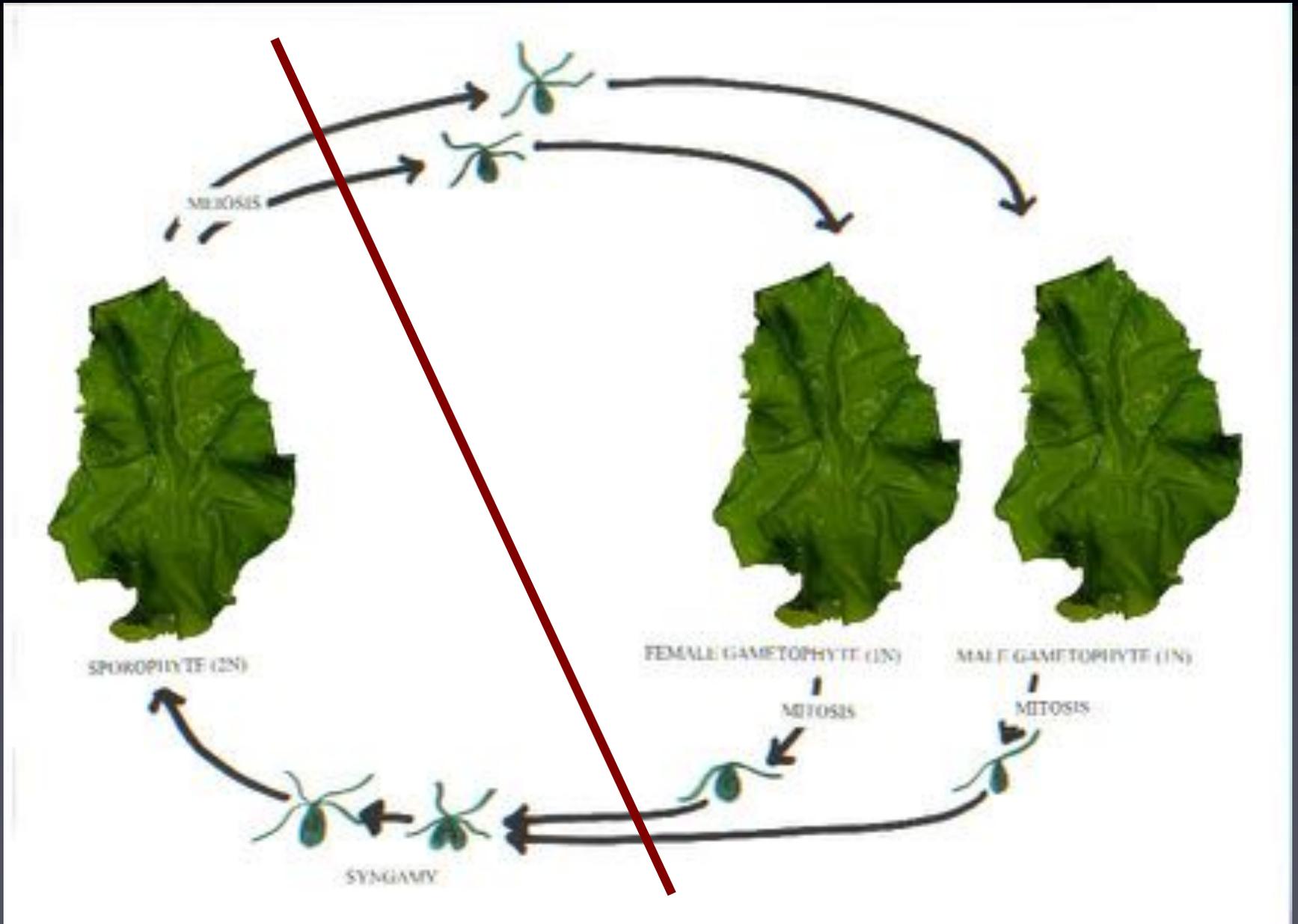
1. **ZYGOTIC MEIOSIS**

2. **GAMETIC MEIOSIS**

3. Two or three phases occur (gametophyte usually haploid; sporophyte typically diploid); meiosis during sporogenesis: **SPORIC MEIOSIS.**

With alternation of generations, either **isomorphic** or **heteromorphic.**

SPORIC MEIOSIS, ISOMORPHIC: *Ulva*



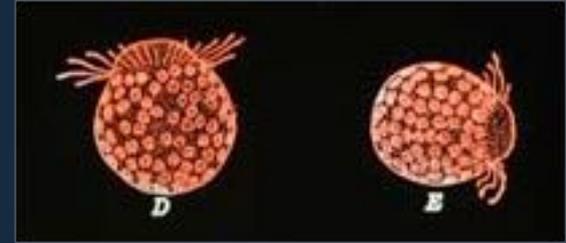
SPORIC MEIOSIS, HETEROMORPHIC: *Derbesia*



Derbesia "phase"



Meiosis



Male



Halicystis "phase"

Female



Phylogeny of Chlorophyta: Major Classes

VIRIDIPLANTAE (CHLOROBIONTA, GREEN PLANTS)

CHLOROPHYTA

STREPTOPHYTA

Chlorophycean lineage

Charophycean lineage

CHLOROPHYCEAE



TREBOUXIOPHYCEAE



LAND PLANTS



ULVOPHYCEAE



CHAROPHYCEAE

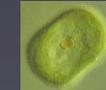
Chlorokybales
Klebsormidiales
Coleochaetales
Zygnematales
Charales



PRASINOPHYTES
PRASINOPHYTES
PRASINOPHYTES
PRASINOPHYTES



Chaetosphaeridium /
Mesostigma
(PRASINOPHYTES)



ANCESTRAL
GREEN
FLAGELLATE

PRASINOPHYTES

VIRIDIPLANTAE (CHLOROBIONTA, GREEN PLANTS)

CHLOROPHYTA

STREPTOPHYTA

Chlorophycean lineage

Charophycean lineage

CHLOROPHYCEAE



TREBOUXIOPHYCEAE



LAND PLANTS



ULVOPHYCEAE

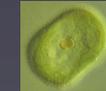


CHAROPHYCEAE

- Chlorokybales
- Klebsormidiales
- Coleochaetales
- Zygnematales
- Charales



*Chaetosphaeridium /
Mesostigma*
(PRASINOPHYTES)



PRASINOPHYTES
PRASINOPHYTES
PRASINOPHYTES
PRASINOPHYTES

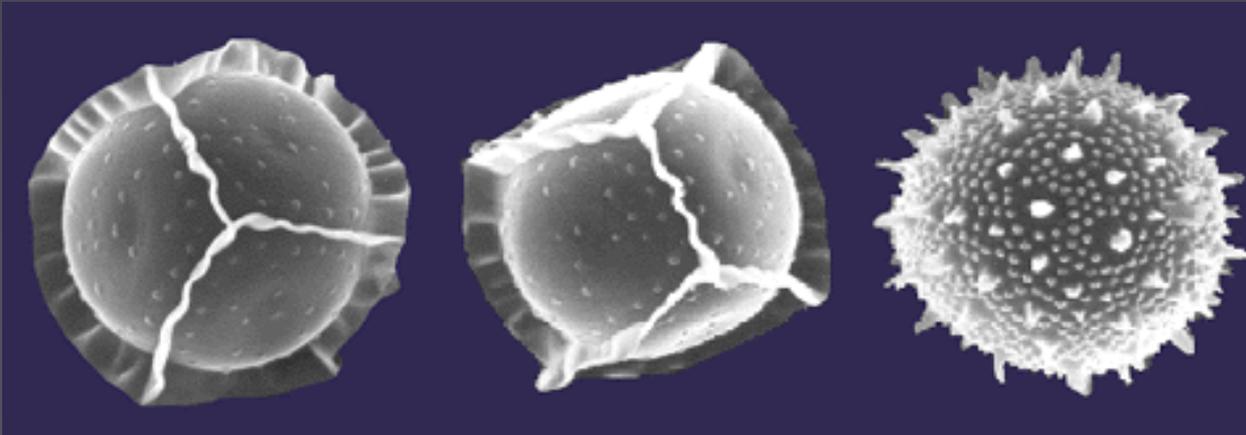
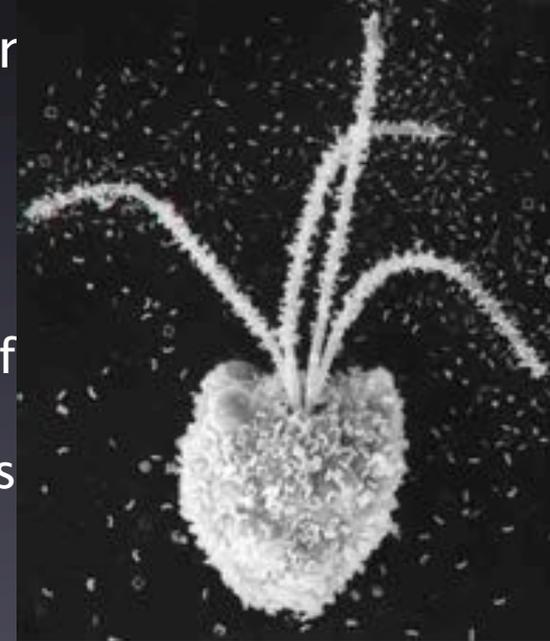


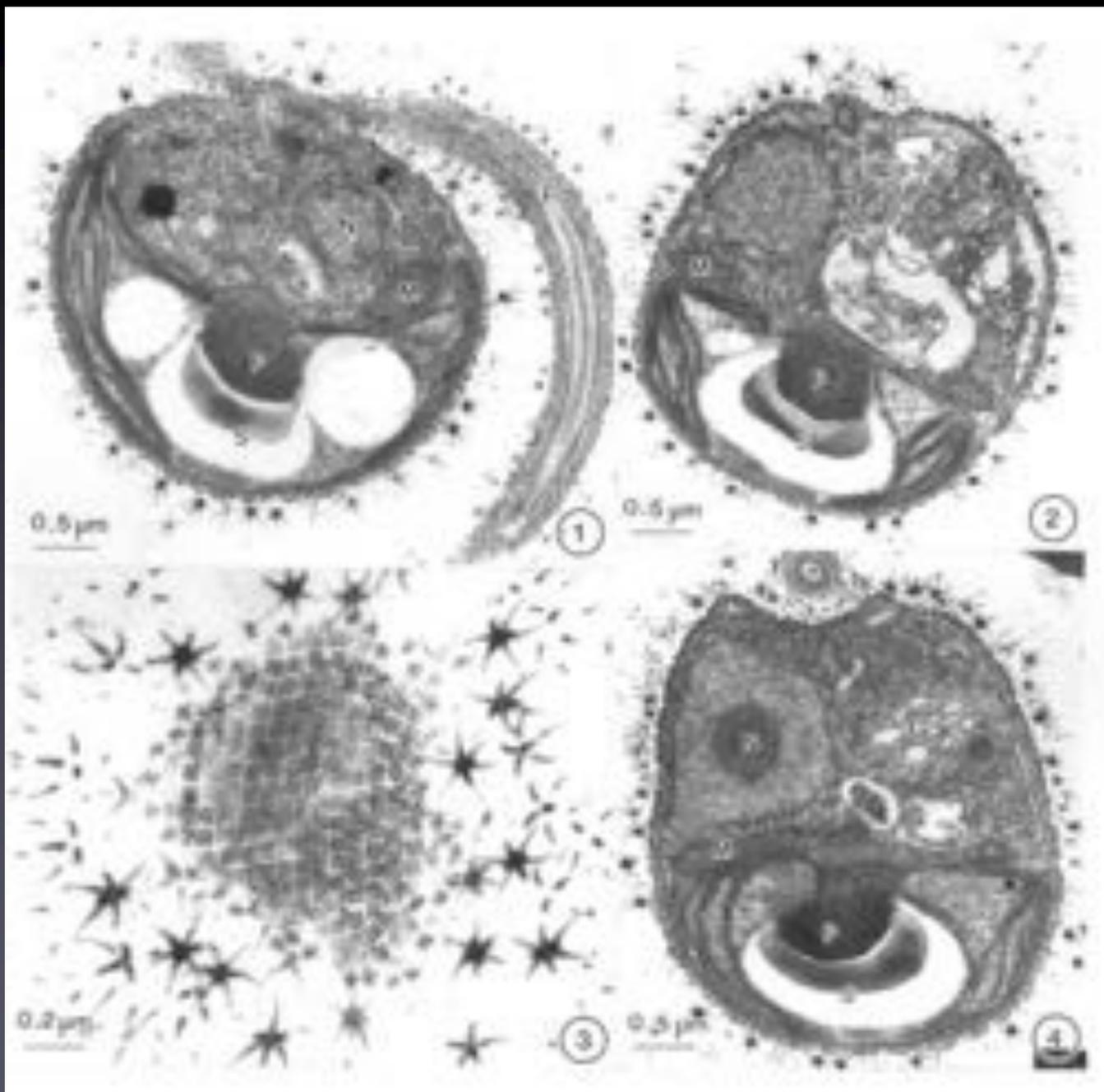
ANCESTRAL
GREEN
FLAGELLATE

The early divergents
chlorophytes!!!

The Prasinophytes – Essential Information

1. Also known as Micromonadophycean
2. Unicellular motile cells (few palmelloid)
3. Marine, brackish, freshwater; abundant in ocean
4. Prasinoxanthine and siphonoxanthine
5. Surface organic scales:
 - Golgi-derived
 - Fuse to form a theca
 - Flagella scales different from scales on cell surface
6. Open or close mitosis with a furrowing cytokinesis
7. Flagellar apparatus diverse with parallel basal bodies
8. In the fossil record (**phycoma** = asexual cyst)



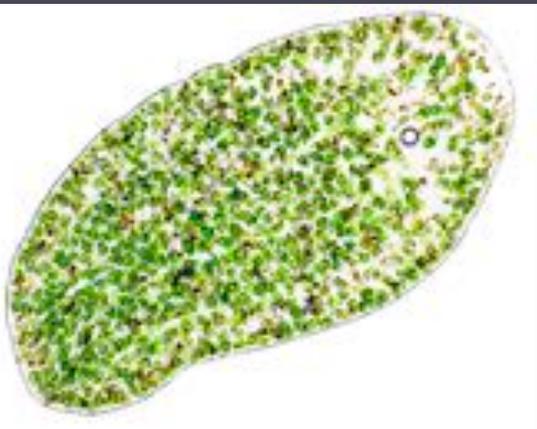


Examples of Prasinophytes



Tetraselmis (Prasinocladus)

Convoluta roscoffensis a green flatworm



Tetraselmis convolutae
Endosymbiont prasinophyte!

<http://www.youtube.com/watch?v=TIItU3rT1PIs>



Prasinophytes are widely cultured in aquaculture facilities for finfish and shellfish because their high lipid content is yummy!

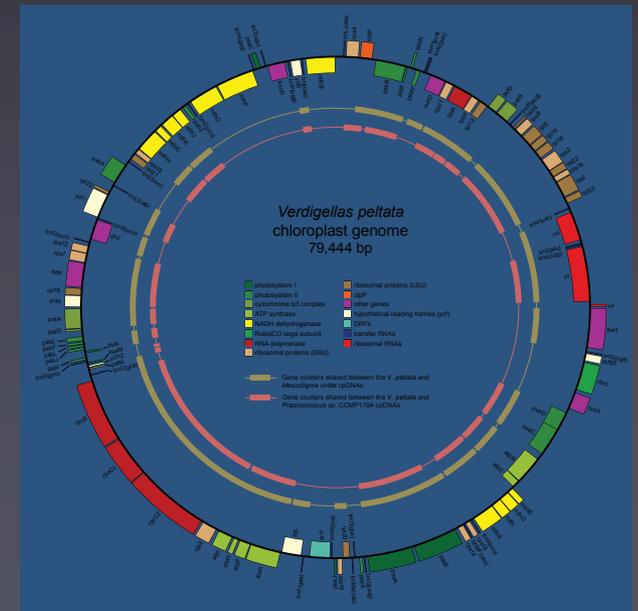
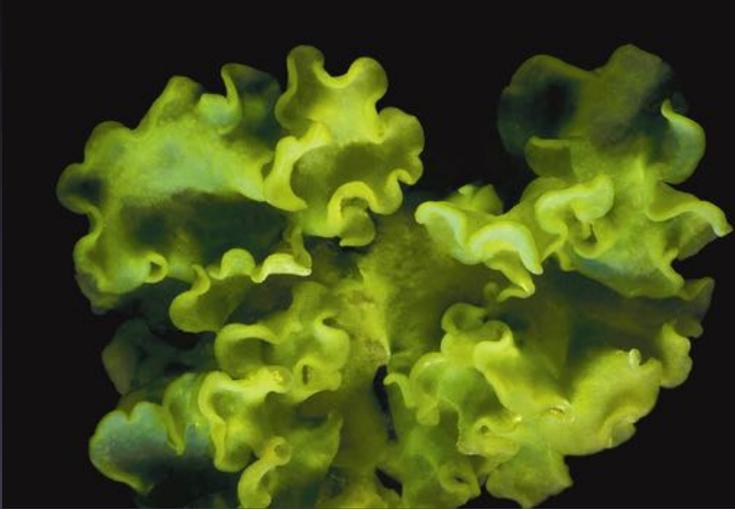


Instant Algae!!!



New prasinophytes group discovered last year by us!

PALMOPHYLLOPHYCEAE



VIRIDIPLANTAE (CHLOROBIONTA, GREEN PLANTS)

CHLOROPHYTA

STREPTOPHYTA

Chlorophycean lineage

Charophycean lineage

CHLOROPHYCEAE



TREBOUXIOPHYCEAE



LAND PLANTS



ULVOPHYCEAE



CHAROPHYCEAE

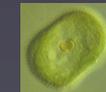
Chlorokybales
Klebsormidiales
Coleochaetales
Zygnematales
Charales



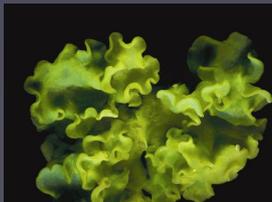
PRASINOPHYTES



Chaetosphaeridium /
Mesostigma
(PRASINOPHYTES)



PALMOPHYLLOPHYCEAE



ANCESTRAL
GREEN
FLAGELLATE

Activity: Concept Mapping

Terms:

Male Gamete (sperm)

Spores

Female Gamete (egg)

Male Gametophyte

Zygote

Female Gametophyte

Sporophyte

Processes:

Sporogenesis

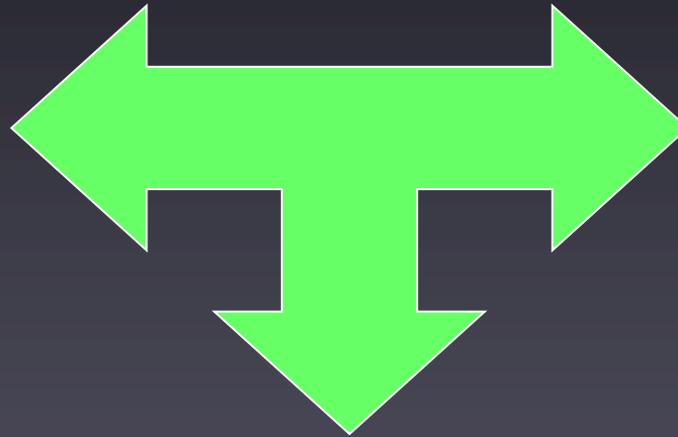
Fertilization

Meiosis

Germination

Gametogenesis

Germination



Condition:

Haploid 1N

Diploid 2N