

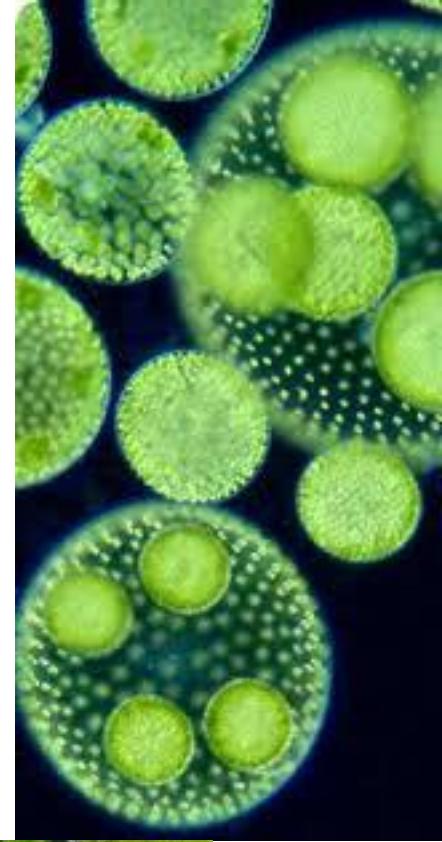
The background of the slide is a photograph of a lush green forest. Sunlight filters through the dense canopy of leaves and branches, creating bright highlights and deep shadows. The overall atmosphere is vibrant and natural.

# Week 4: Volvox

Theme: Autotrophic Eukaryotes

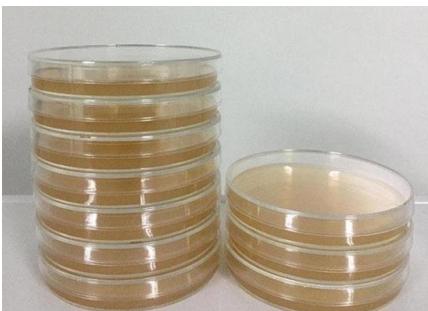
# ‘Algae’

- Very diverse; all are photosynthetic, can be marine or freshwater, and can be multicellular, unicellular, or colonial
  - “Algae” is a paraphyletic group (therefore not a taxonomic group) like protists, you’ll see why
- Different alga can have one of the three types of lifecycles:
  - gametic, zygotic, sporic
- All have chlorophyll a (like cyanobacteria and plants)
  - vary in secondary pigments



# Importance in Daily Lives

- Consumed as food by humans and other organisms (Very necessary)
  - Used in agriculture
- Produce oxygen
- Algal blooms can be indicators of water pollution, and be harmful
- Agar-Agar plates are made of algae (refer to antibiotic resistance plates)



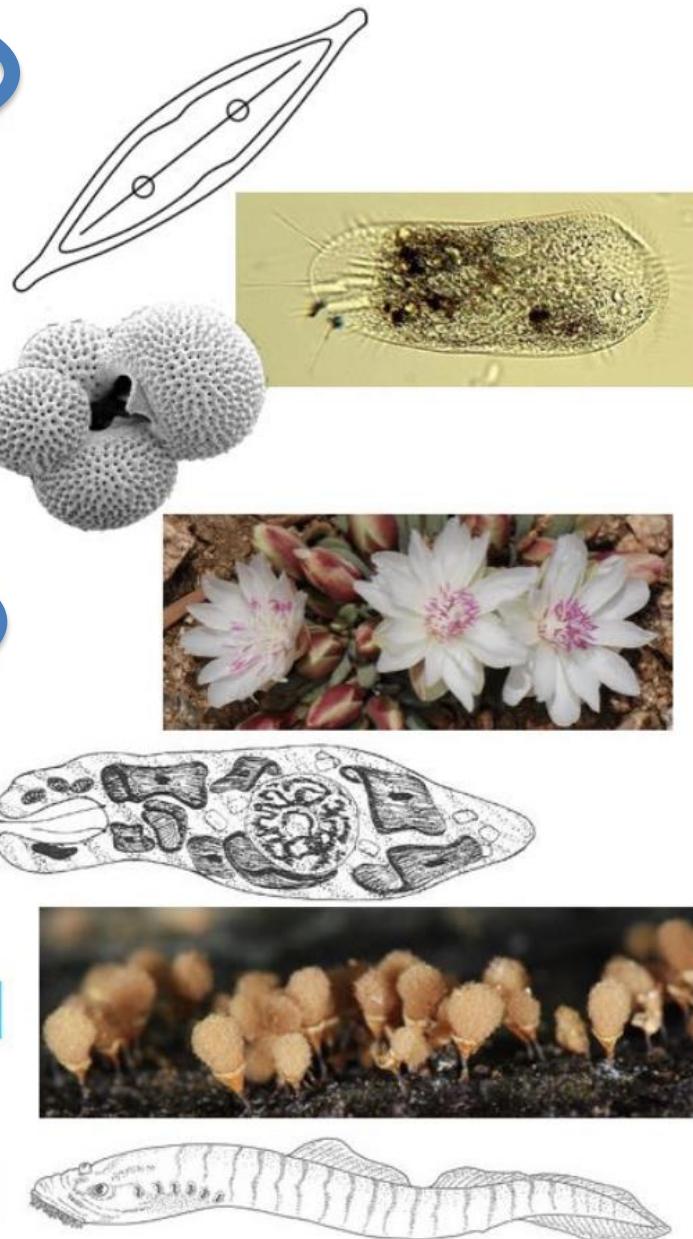
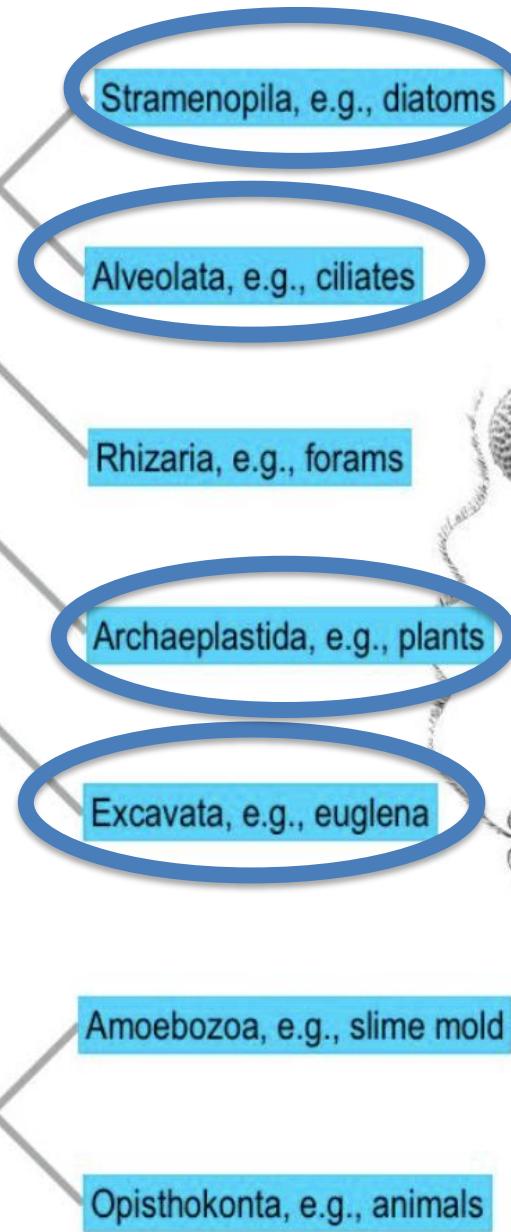
# Seven Eukaryotic Lineages

Note how there is no formal “algae” group and all the algae come from different lineages.

Domain:  
Eukarya



Common Ancestor Here!



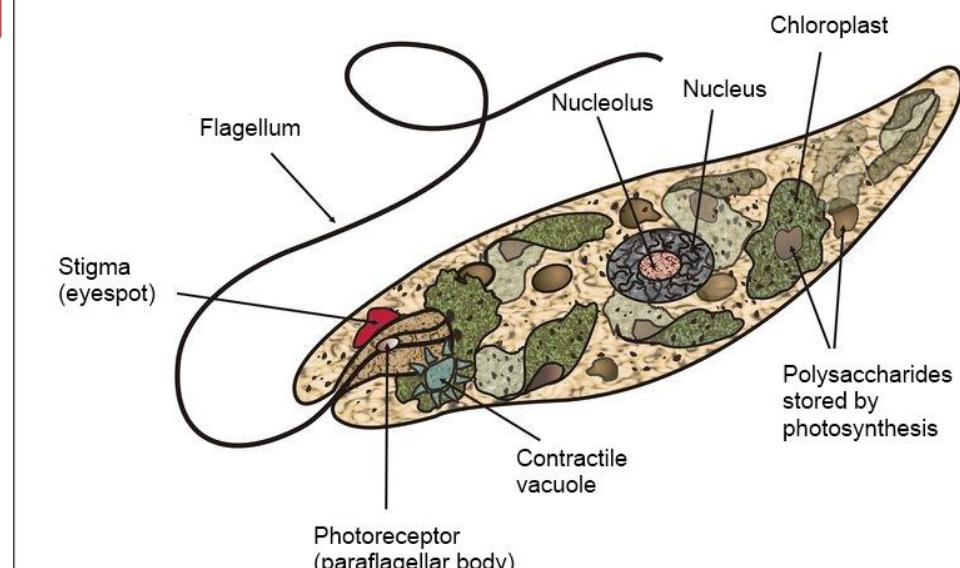
# Observation Period-Checklist

## ❑ Organisms to look at

- ❑ Dinoflagellates (*Gymnodinium*, *Prorocentrum*,  
*Amphidinium*)
- ❑ Diatoms
- ❑ *Euglena*
- ❑ Chlorophyta (*Chlamydomonas*, *Gonium*, *Pandorina*,  
*Volvox*)
- ❑ Rhodophyta (*Callithamnion*)
- ❑ Chlorophyta
- ❑ Phaeophyta
- ❑ *Fucus*
- ❑ *Porphyra* (foliaceous)
- ❑ *Corallina* (jointed coralline)

# Lineage Excavata: Phylum Euglenida

Same lineage as Trichonympha, Trichomonas, Trypanosoma



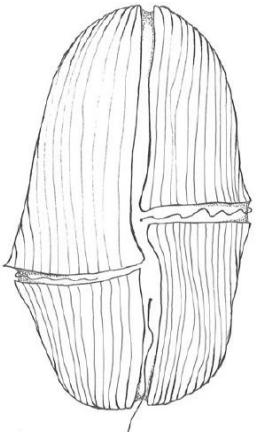
## Characteristics:

- Unicellular
- All lack mitochondria
- No cell wall
- All are asexual.
- Store sugars from photosynthesis as **paramylon**
- 1-3 flagella
- Can lose chlorophyll and live a heterotrophic life in dark conditions
- Lack cell wall, maintains **shape** with **pellicle**

Take note of these:

- **Stigma**-eyespot (detects light)
- **Pyrenoids**-stores carbohydrates
- **Paramylon** granule- stores glucose
- **Flagellum**

# Lineage Alveolata: Phylum Dinoflagellata



What was in Alveolata last week?  
Ciliates, *Plasmodium vivax*



## Characteristics:

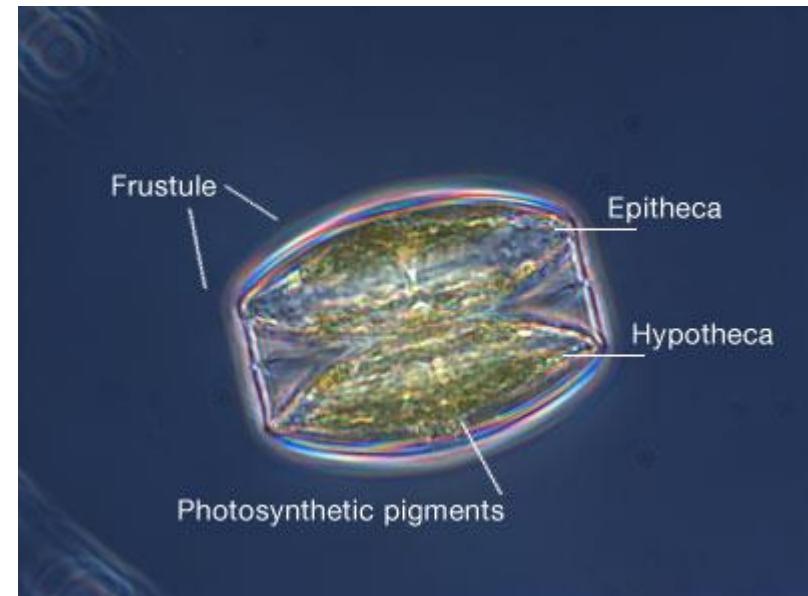
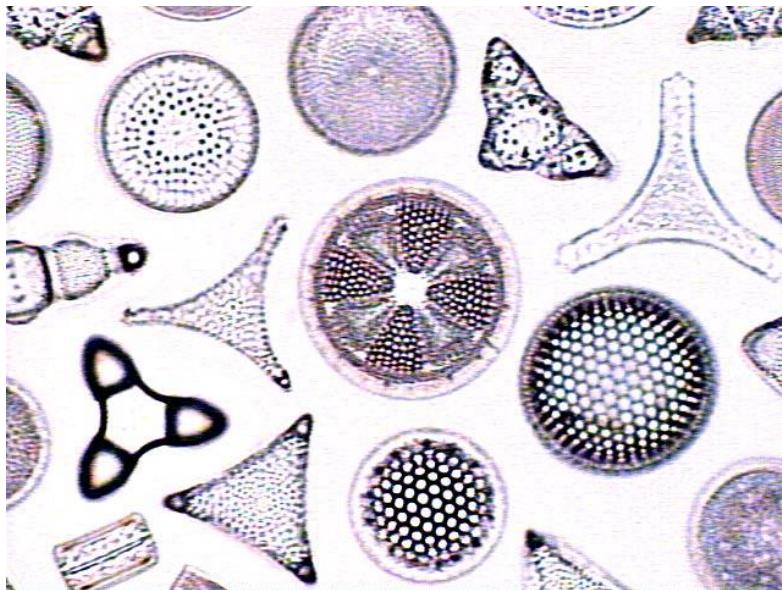
- They can be autotrophic, heterotrophic, and parasitic
- They can be phytoplankton, so they photosynthesize
- Most are unicellular
- They have armor, or protective plates and some have flagella/cilia. (refer to illustration)
- Store sugars as **starch**
- This group includes Zooxanthellae - the endosymbionts of corals

These are known for their **bioluminescence** and red tides

When observing Dinoflagellates, you look for:

- Protective plates
- flagella

# Lineage Stramenopila: Phylum Bacillariophyta (Diatoms)



## Characteristics:

- **Frustules:** cell walls of silica
  - Epivalve (top), hypovalve (bottom)
- Either radially (centric) or bilaterally (pennate) symmetrical
- Photoautotrophs (they have both Chlorophyll a & c)
- Move by secreting mucus through groove along frustule (**Raphe**)
- Really cool asexual reproduction! (in fact there's a quiz question on this)
- Common, fossilize well – have many uses!

Look for:  
• Valves  
• Raphe

# Lineage Archaeplastida: Phylum Rhodophyta

(Called Red Algae)

- Multicellular or unicellular colonies
- Chlorophyll a, phycobilins (red color), carotenoids (like what can be found in carrots!)
  - **Phycobilins** allow for absorption of green and blue-green light → can live deeper in the ocean
- Store sugars as **starch**

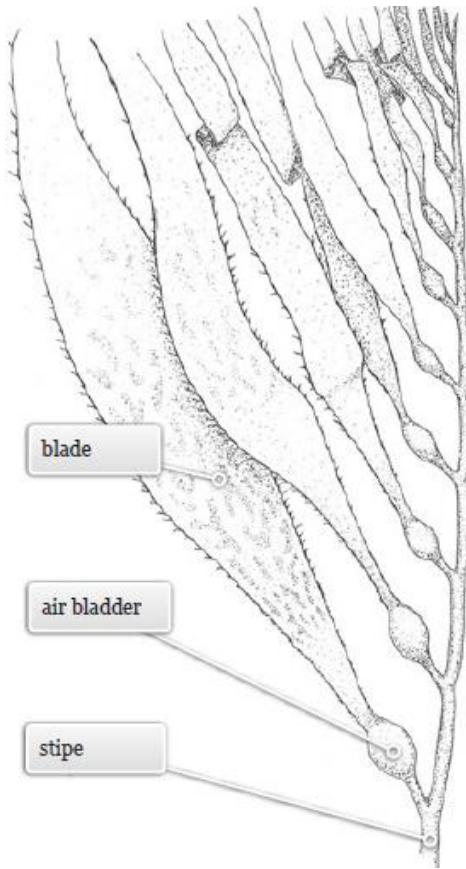


Characterize morphology:

- Microscopic filamentous
- Filamentous, branched
- Encrusting coralline
- Jointed coralline
- Foliaceous

# Lineage Stramenopila: Phylum Phaeophyta

(The Kelps and brown algae)



Anatomy of Kelp

Note: *Laminaria*,  
*Fucus*, *Sargassum* are  
part of this phylum.

Take note of:

- Color, texture
- Identify blade, air bladder, stipe, hold fast



Famously known for the Kelp Forests off the coast of California

## Characteristics:

- Majority are macroalgae (multicellular)
- Chlorophyll a & c, carotenoids Attaches to rocks via root-like appendages called the **holdfast**
- Alginates found in ice cream!
- **Air bladder** provides buoyancy and keeps the kelp standing straight in the water

# Lineage Archaeplastida: Phylum ‘Chlorophyta’

Note: *Spirogyra*, *Ulva*, *Codium*, *Chlamydomonas*, *Volvox* are part of this phylum.



## Characteristics:

- A large group referred to as green algae and the precursor to land plants
- Chlorophyll a & b, carotenoids
- Store sugars as **starch** in **pyrenoids**
- Unicellular, Multicellular, or Colonial

## Chlamydomonas

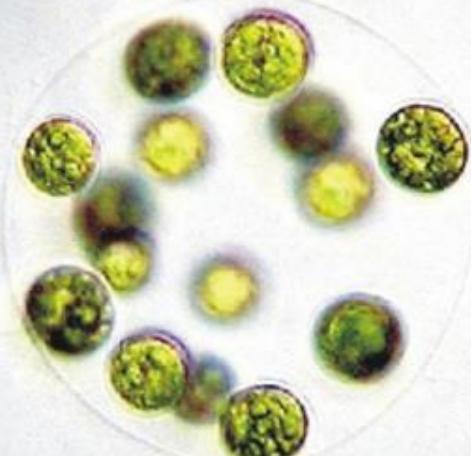


Flickr: Proyecto Agua

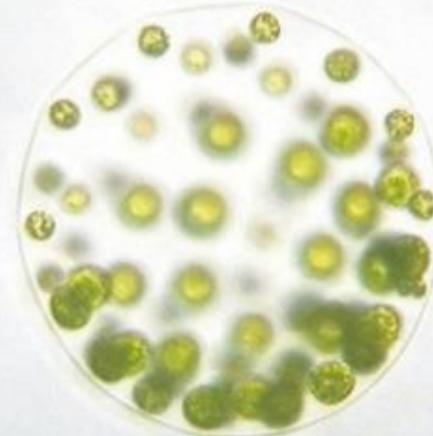
## A Gonium



## B Eudorina



## C Pleodorina



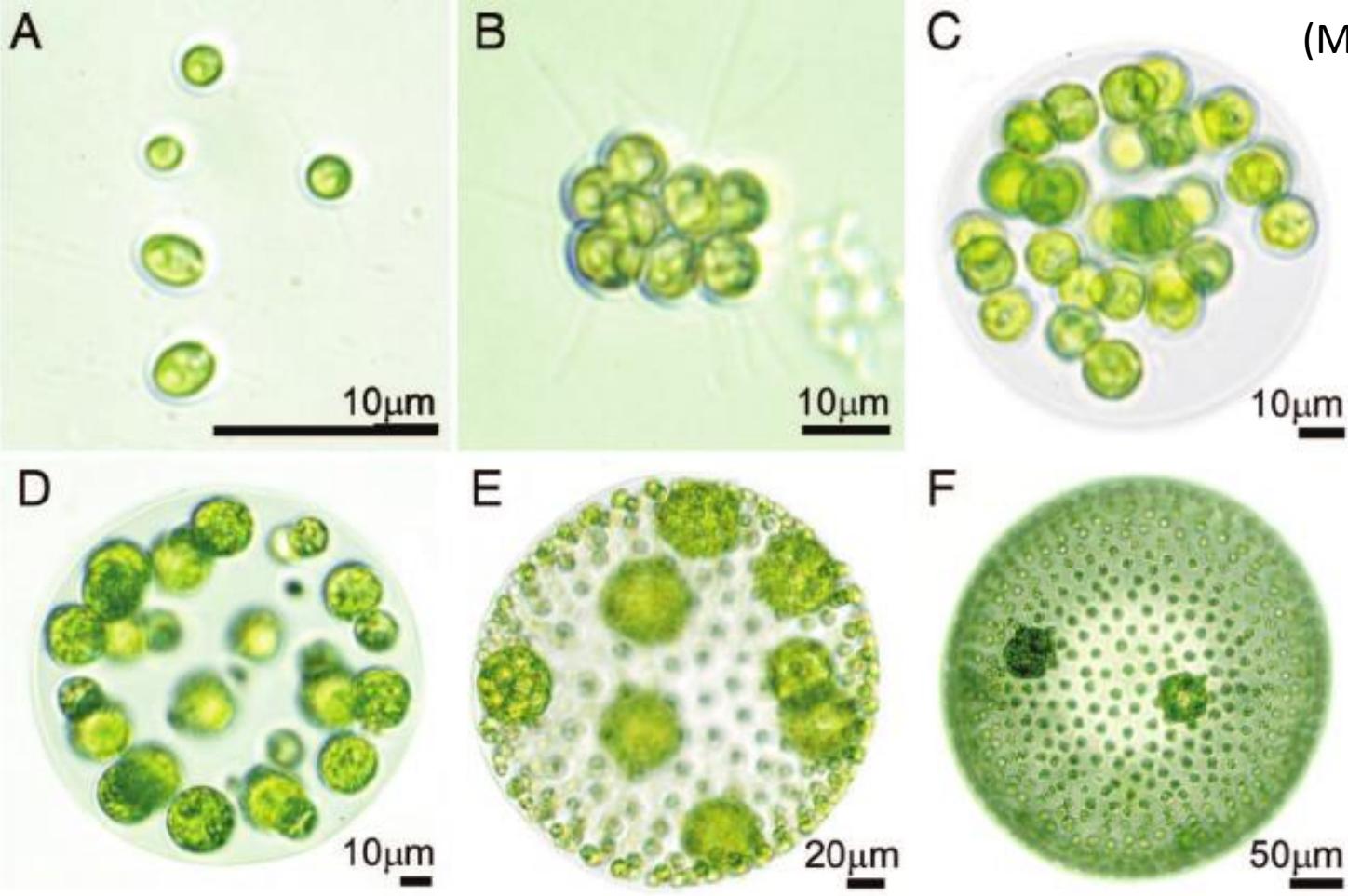
## D Volvox



Take note of:

- Chlamydomonas*: flagella, chloroplast, eyespot
- Gonium*: # of cells in colony, shape
- Volvox*: movement (it spins! It's super cute). Video on Canvas.

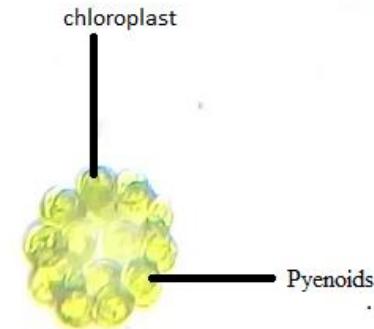
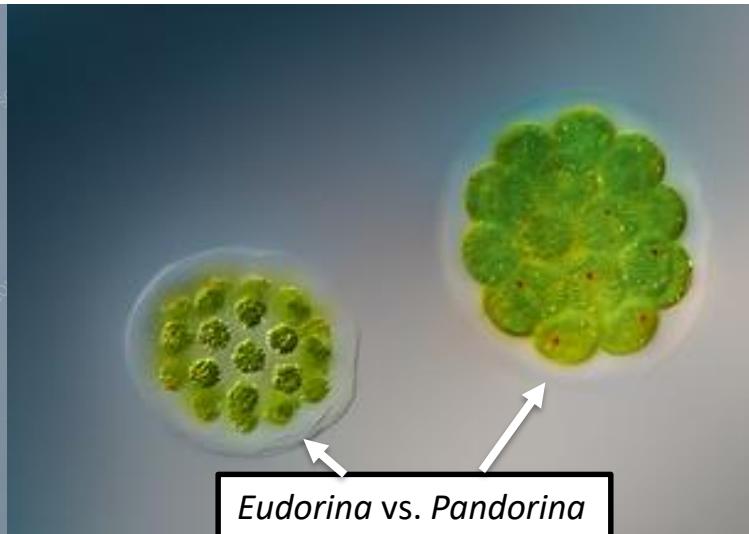
Wikimedia: Aurora M. Nedelcu



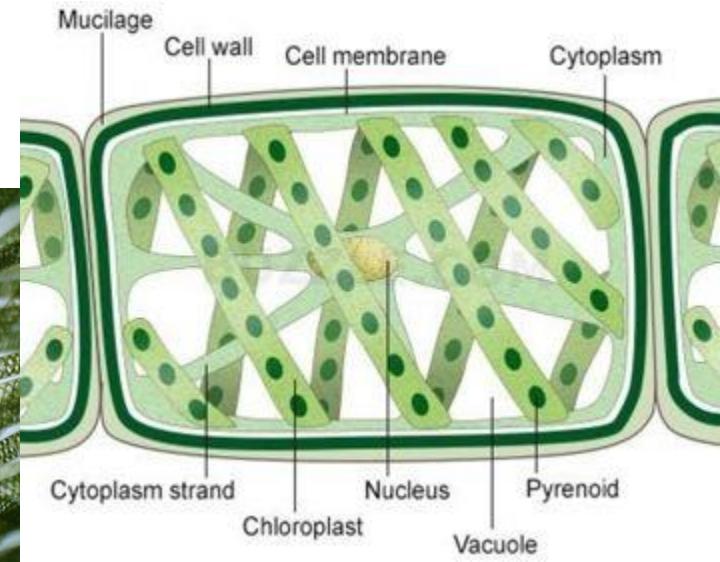
( A ) *Chlamydomonas* ( B ) *Gonium* ( C ) *Eudorina*  
( D ) *Pleodorina* ( E ) and ( F ) *Volvox*

(Michod 2007)

## *Pandorina*: motion of colonies, shape



## *Spirogyra*: cell walls, chloroplasts



Observe the different morphologies  
across the different Phyla

*Ulva*  
(*'Chlorophyta'*)



*Codium*  
(*'Chlorophyta'*)



*Mastocarpus*  
(Rhodophyta)



*Porphyra*  
(Rhodophyta)



Feather Boa  
(Phaeophyta)



*Fucus*  
(Phaeophyta)



# Lifecycles- Define these terms!

- Haploid
- Diploid
- Gametes
- Fertilization
- Zygote
- Meiosis
- Mitosis
- Syngamy
- Isogamous



Tip: Write it out or draw out the terms and the life cycles – you will memorize it all better!

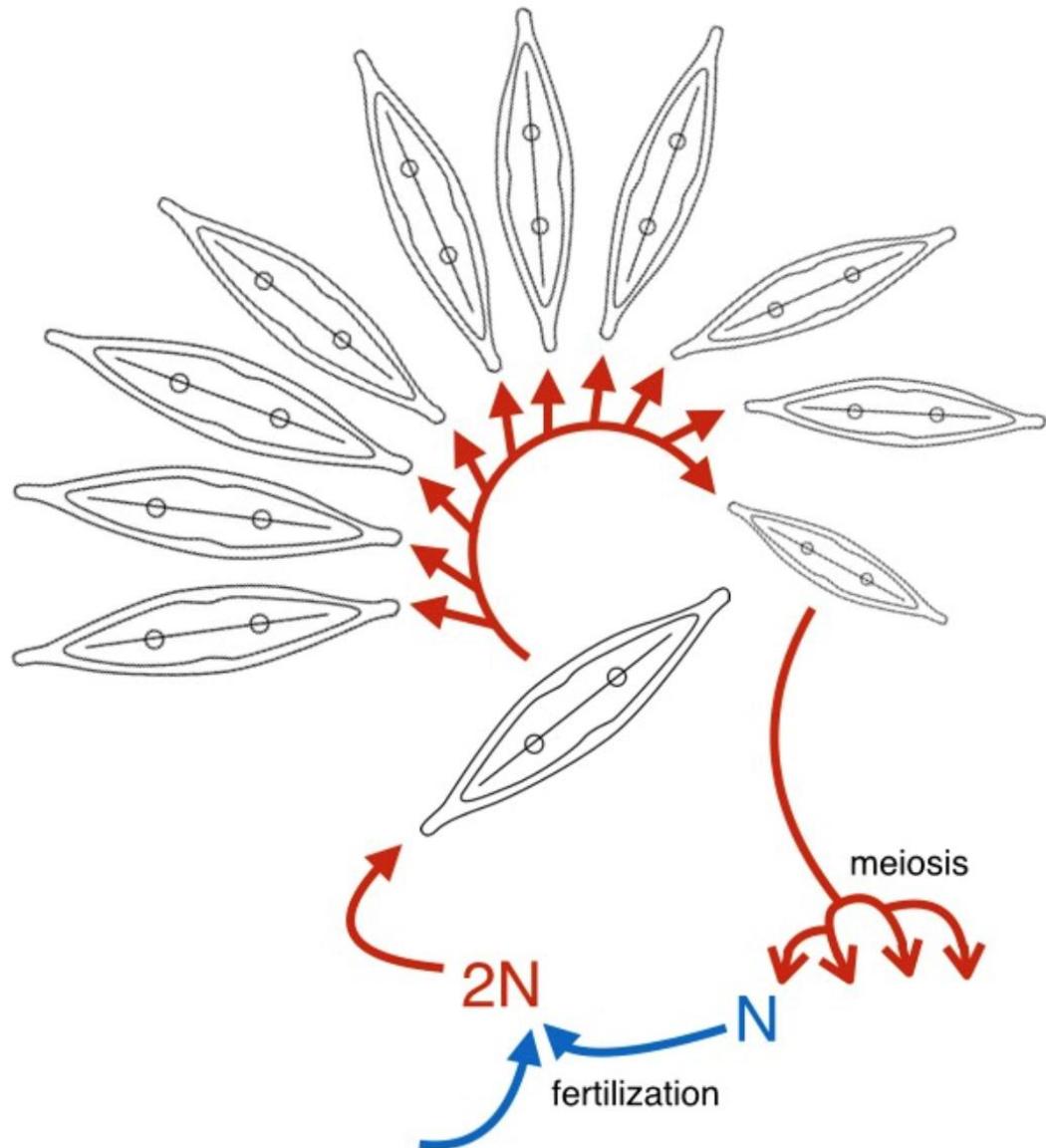
# Gametic Lifecycle

## Gametic

(e.g. Watermolds, *Fucus*, diatoms)

Diploid ( $2N$ ) Parents produce  
gametes ( $N$ ) by meiosis

Syngamy!



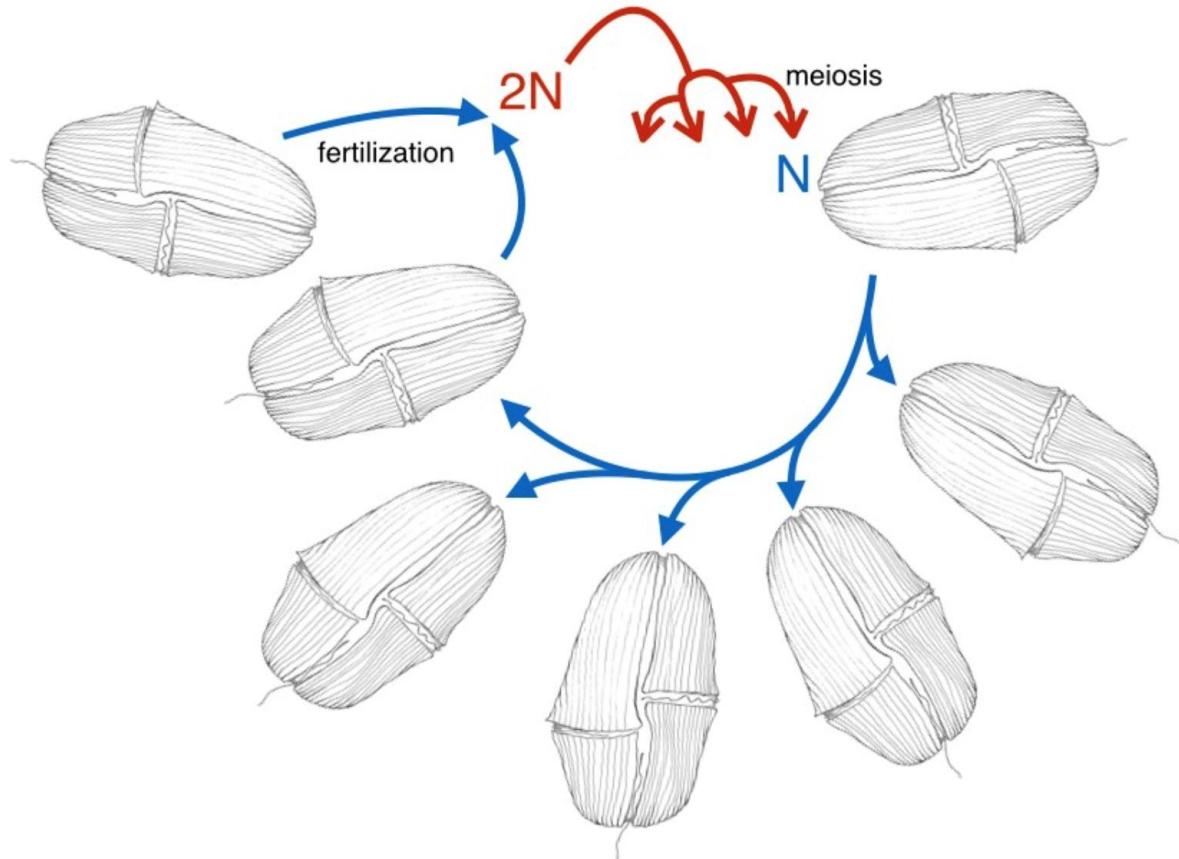
# Zygotic Lifecycle

## Zygotic

Dinoflagellates, also common amongst fungi

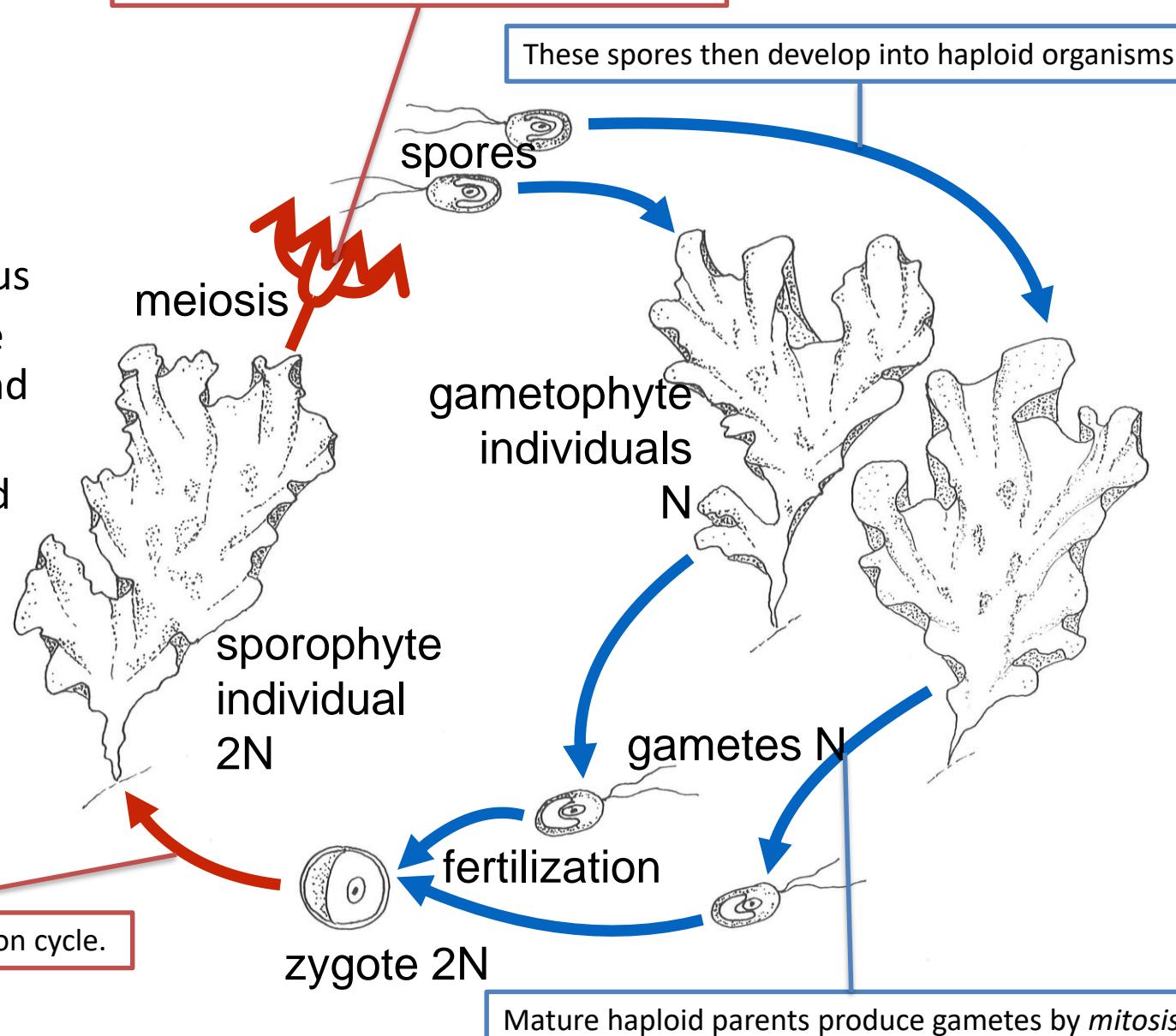
Parents/cells( $N$ ) produce gametes by meiosis( $N$ )

Zygote ( $2N$ ) undergoes meiosis



# Sporic Lifecycle

**Sporic**  
Isomorphic & Isogamous  
Generations alternate  
between haploid and  
diploid phase  
Define *sporophyte* and  
*gametophyte*



In conclusion, Eukaryotic life cycles can be confusing and involve a lot of terms

- If the diagrams or descriptions don't help, here is a website that might help you:

[Description of Eukaryotic Lifecycles](#)

- The link to the webpage is also on canvas. We test you on this so take the time to understand it!

# Intermediate Disturbance Hypothesis

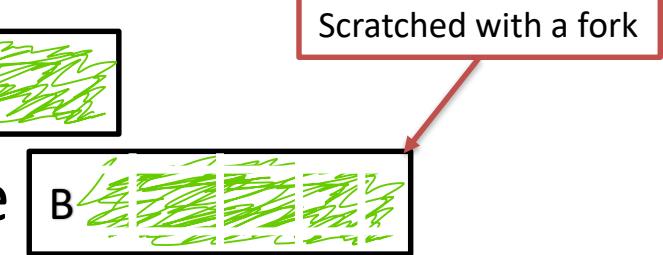
## Lab Report

- **Intermediate disturbance hypothesis:** species richness (number of species) will be highest when ecological disturbance is intermediate
- Three different communities of algae and protozoans underwent different experimental treatments:

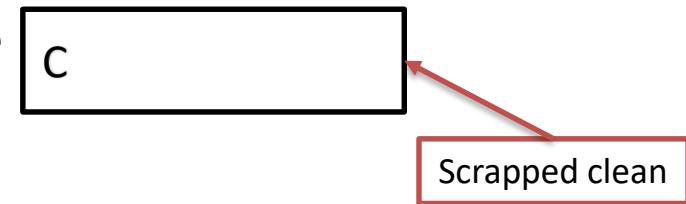
– A: No Disturbance



– B: Intermediate Disturbance



– C: Extreme/Severe Disturbance



# Intermediate Disturbance Hypothesis

## Lab Report

- Read the prompt on canvas to get started on your lab report
- Watch the video if you want context on how the experiment was conducted

**Most importantly! Don't forget to do  
your discussion and quiz!**