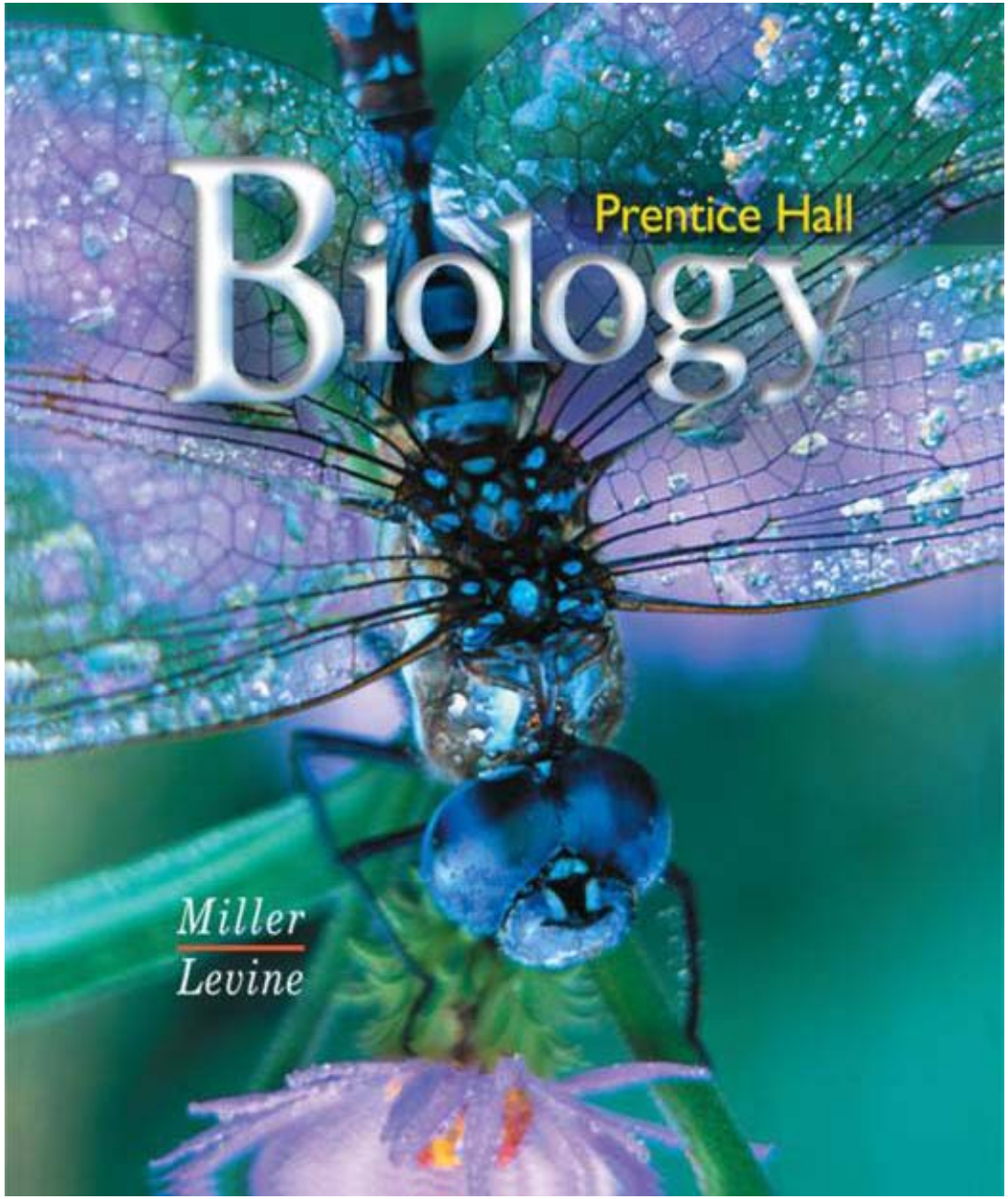
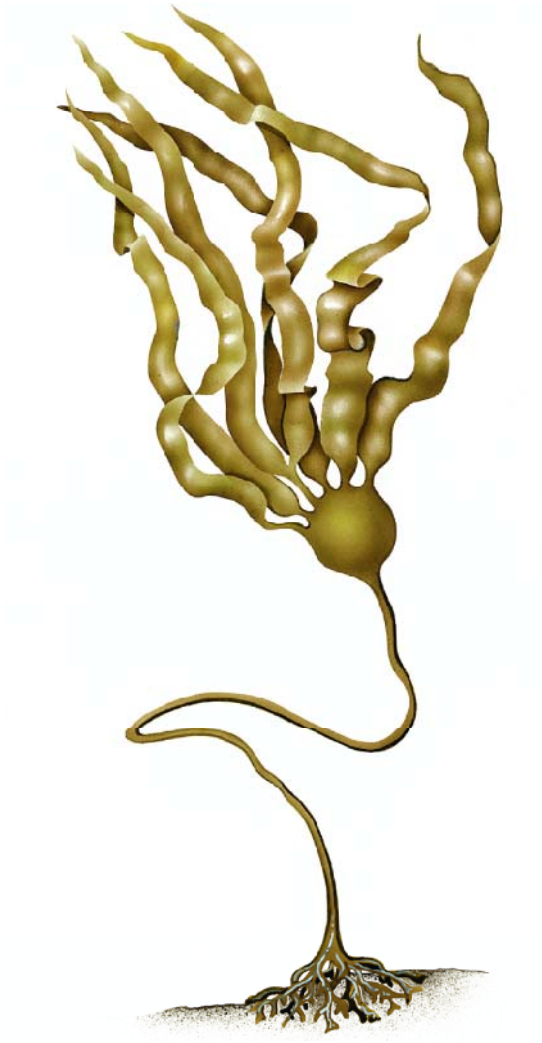


20-4 Plantlike Protists: Red, Brown, and Green Algae



Plantlike Protists: Red, Brown and Green Algae

- Most of these algae are **multicellular**, like plants.
- Their reproductive cycles are sometimes very similar to those of plants.
- Many have **cell walls** and **photosynthetic pigments** identical to plants.
- Many have highly **specialized tissues**.

20-4 Plantlike Protists: Red, Brown, and Green Algae

The three phyla of algae that are **largely multicellular** are:

- **red algae**
- **brown algae**
- **green algae**

The most important difference among these phyla involved their **photosynthetic pigments**

Red Algae (Rhodophyta, means "red plants")

• Red algae are able to live at **great depths** (up to 250m) due to their efficiency in harvesting light energy.

• Red algae contain **chlorophyll *a*** and reddish accessory pigments called **phycobilins**.

• **Phycobilins** absorb blue light, enabling red algae to live deep in the ocean.

• They are red, green, purple, reddish black, depending upon the other pigments they contain.

Red Algae

- Most species are multicellular
- All species have complex life cycles
- They lack flagella and centrioles

Red Algae

- They help in maintaining the equilibrium of the coral ecosystem, providing nutrients from photosynthesis that nourish coral animals.

- Coralline red algae provide much of the calcium carbonate that helps to stabilize the growing coral reef.

Brown Algae (Phaephyta, means “dusky plants”)

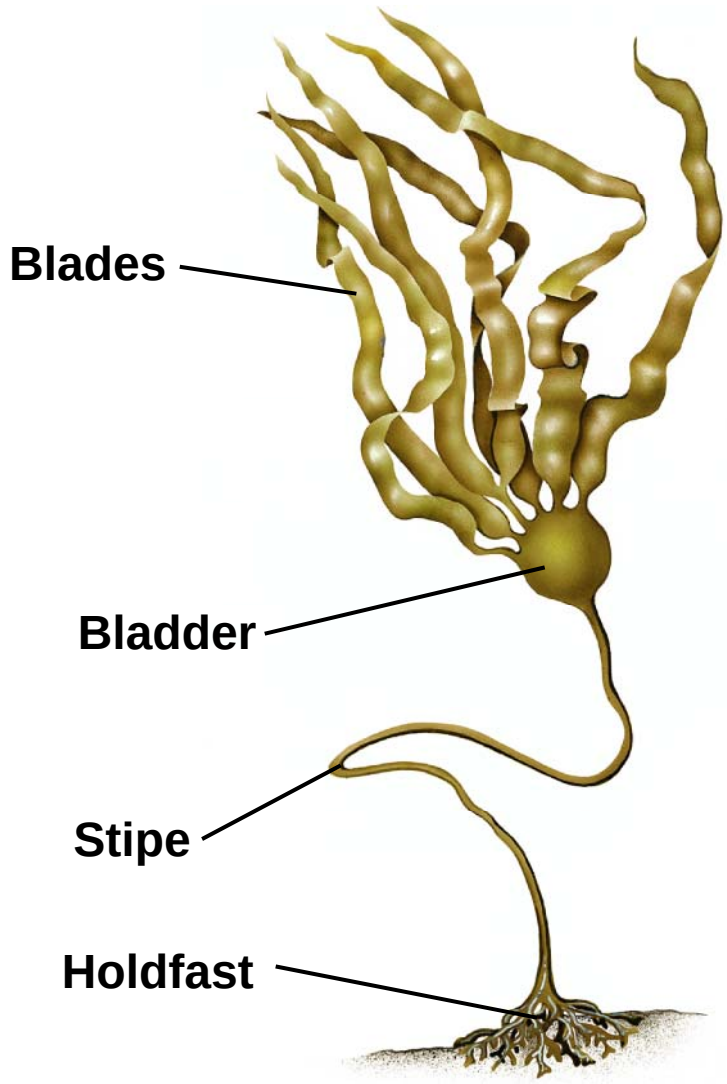
- Brown algae contain **chlorophyll *a* and *c***, as well as a brown accessory pigment, **fucoxanthin**.
- These pigments give the algae a dark, yellow-brown color.
- Largest and most complex of the algae
- All are multicellular and most are marine, commonly found in cool, shallow coastal waters of temperate or arctic areas.

Brown Algae

- The largest known alga is a giant kelp, that can grow up to 60 meters in length.
- *Sargassum* forms huge floating mats on many kilometers
- *Fucus*, a rock seaweed, is one of the most common brown algae

Brown Alga Structure

- The **holdfast** attaches the alga to rocks.
- Flattened stemlike structure is called a **stipe.**
- Leaflike structures are called **blades**
- Gas-filled **bladders** keep the alga afloat and upright.

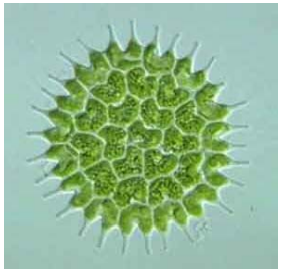


Green Algae (Chlorophyta, means "green plants")

- Green algae share many characteristics with plants, including their photosynthetic pigments and cell wall composition.

- Scientists hypothesize that the ancestors of modern land plants looked like certain species of living green algae.

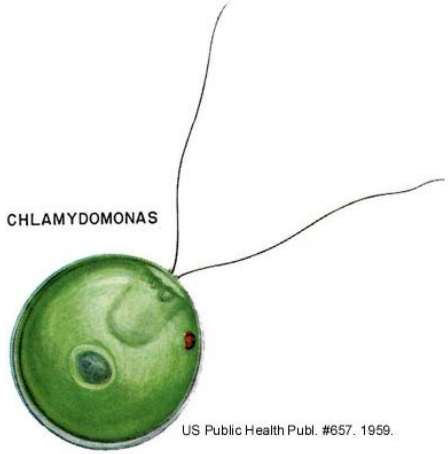
Green Algae (Chlorophyta, means "green plants")



- **Cellulose** in their cell walls
- **Chlorophyll a and b**
- Store food in the form of **starch**, like land plants
- Green algae live in fresh and salt water, and moist land areas.
- Many species live **most** of their lives **as single** cells.
- Others form colonies, groups of similar cells that are joined together but show few specialized structures.
- A few are multicellular and have specialized structures.

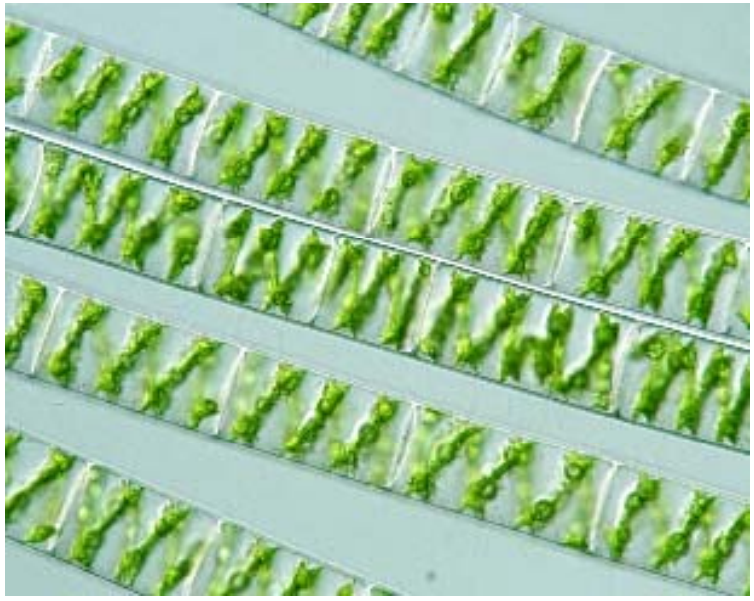
Example of an Unicellular Green Algae

- *Chlamydomonas*
  - a typical single-celled green algae
  - grows in ponds, ditches, and wet soil.
  - egg-shaped
  - **2 flagella**
  - a **single** large cup-shaped **chloroplast**
  - **2 small contractile vacuoles**



Examples of a Colonial Green Algae

- *Spirogyra*
  - Freshwater
  - Forms long threadlike colonies called **filaments**



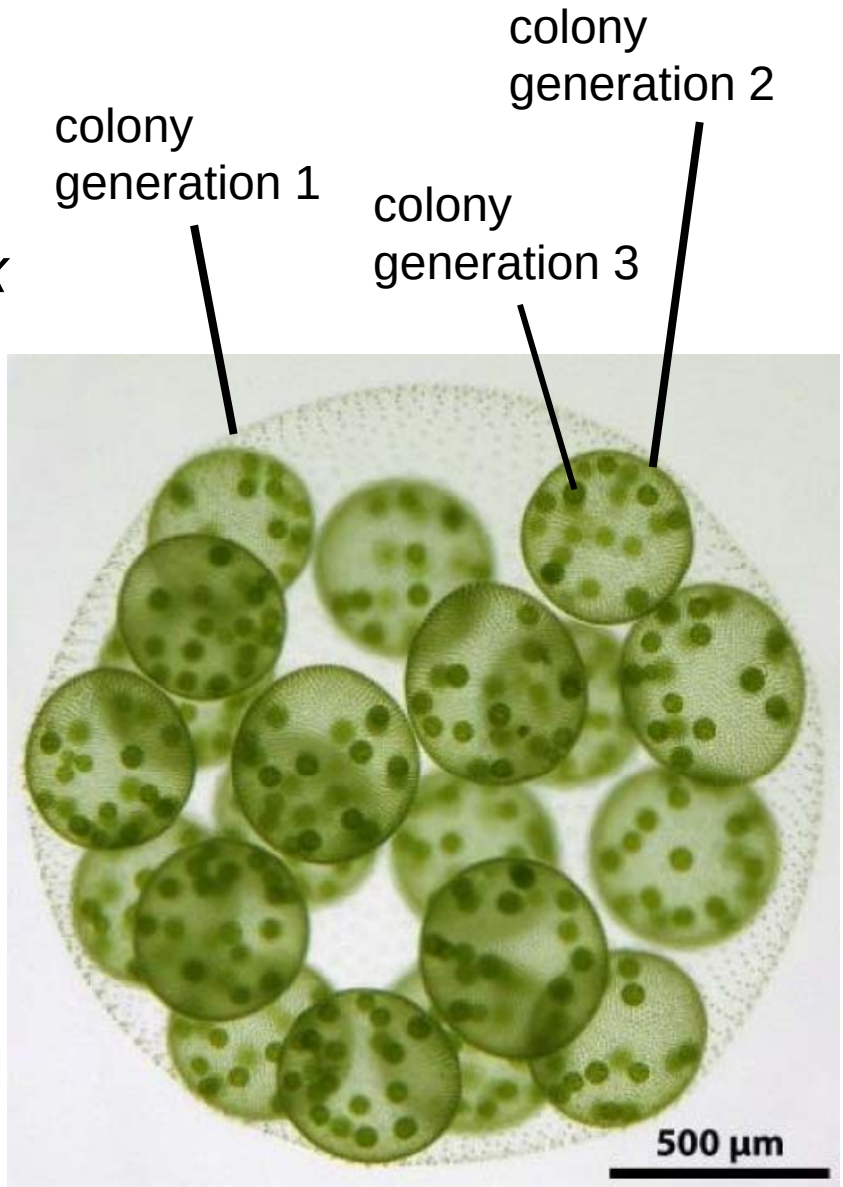
Examples of a Colonial Green Algae

- *Volvox*
  - More elaborated colonies
  - Hollow spheres of 500 to 50,000 cells
  - Cells are connected by strands of cytoplasm. Enables cells them to coordinate movement. Cells on the side of the colony "pull" with their flagella, and the cells on the other side of the colony have to "push".

Examples of a Colonial Green Algae

- *Volvox*

- Although most cells in a *Volvox* colony are identical, a few gamete-producing cells are specialized for reproduction. Because it shows some cell specialization, *Volvox* strabbles the fence between colonial and multicellular life.
- Daugther colonies are generated insite the mother colony



Examples of a Multicellular Green Algae

- *Ulva*, or "sea lettuce"
  - Bright-green marine algae
  - Commonly found along rocky sea coasts
  - *Ulva* is a **true multicellular** organism, containing several specialized cell types.
  - Only two cells thick, but tough enough to survive the pounding of waves on the shores where it lives
  - A group of cells at its base forms **holdfasts** that attach *Ulva* to the rocks.

Reproduction in Green Algae

• The life cycles of many algae include both a **diploid and a haploid** generation.

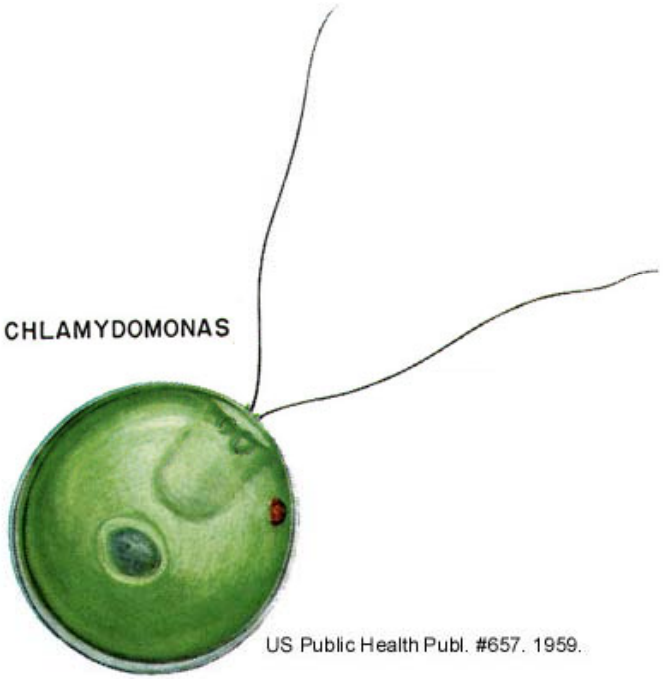
• Many algae switch back and forth between haploid and diploid stages during their life cycles, in a process known as **alternation of generations.**

• Many alga also shift between sexual and asexual reproduction.

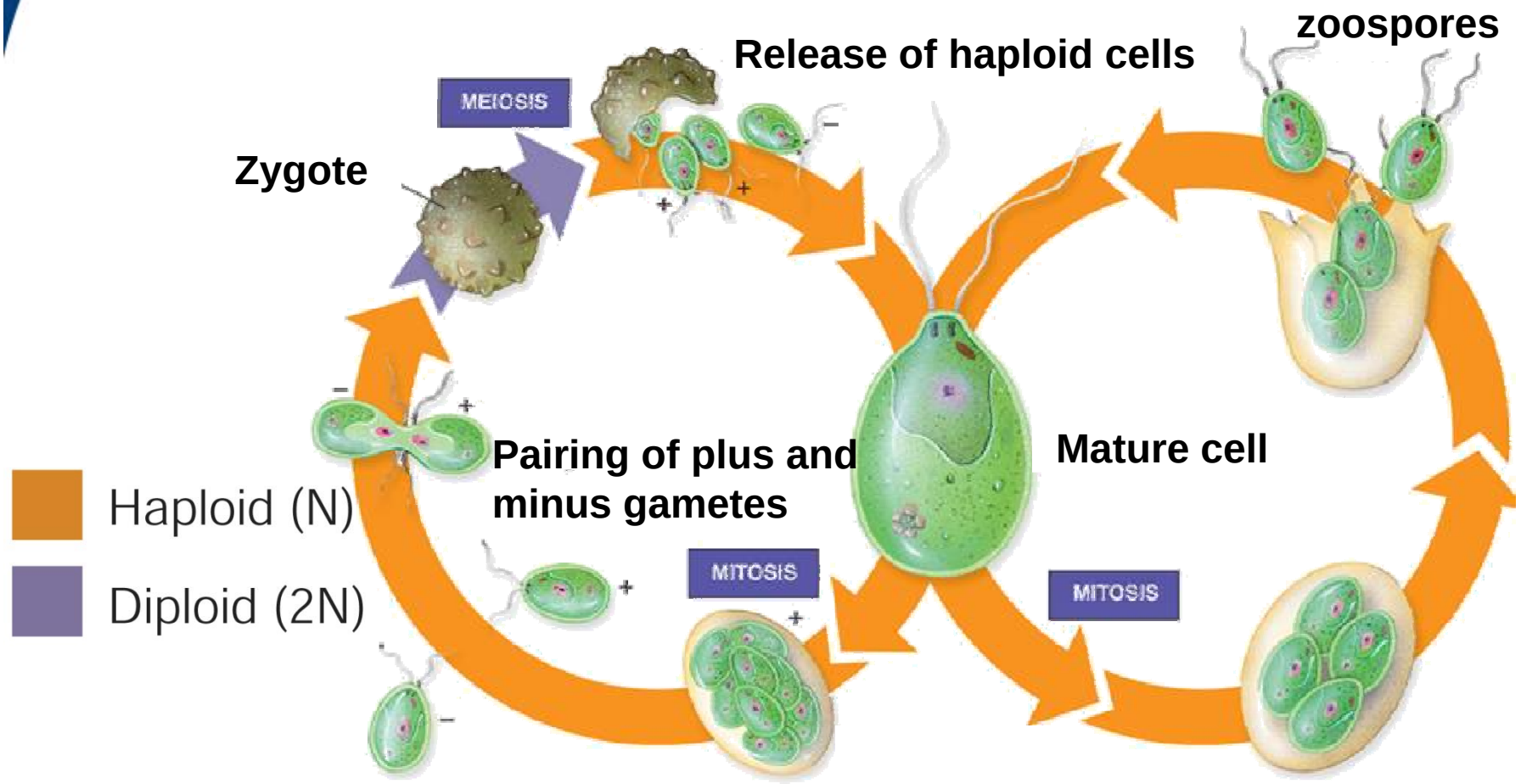
Reminder: Diploid cells have 2 sets of chromosomes, haploid cells have a single set.

Reproduction in *Chlamydomonas*

The unicellular *Chlamydomonas* spends most of its life in the haploid stage.

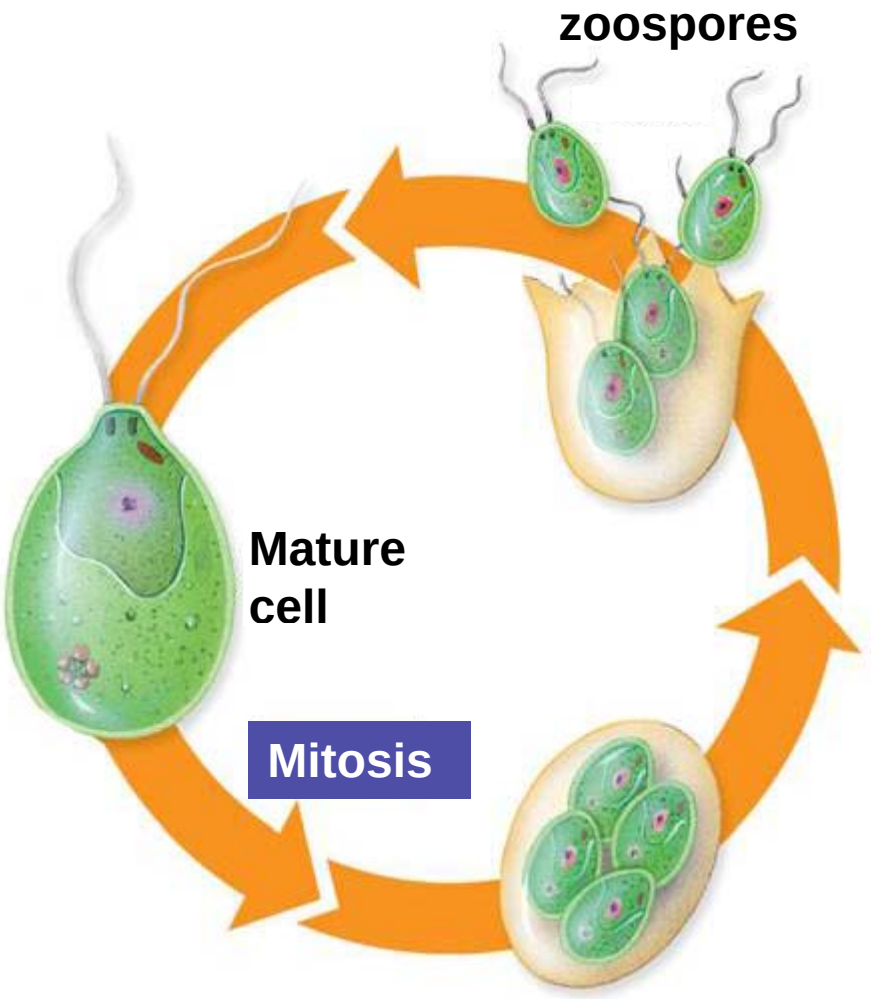


Reproduction in *Chlamydomonas*



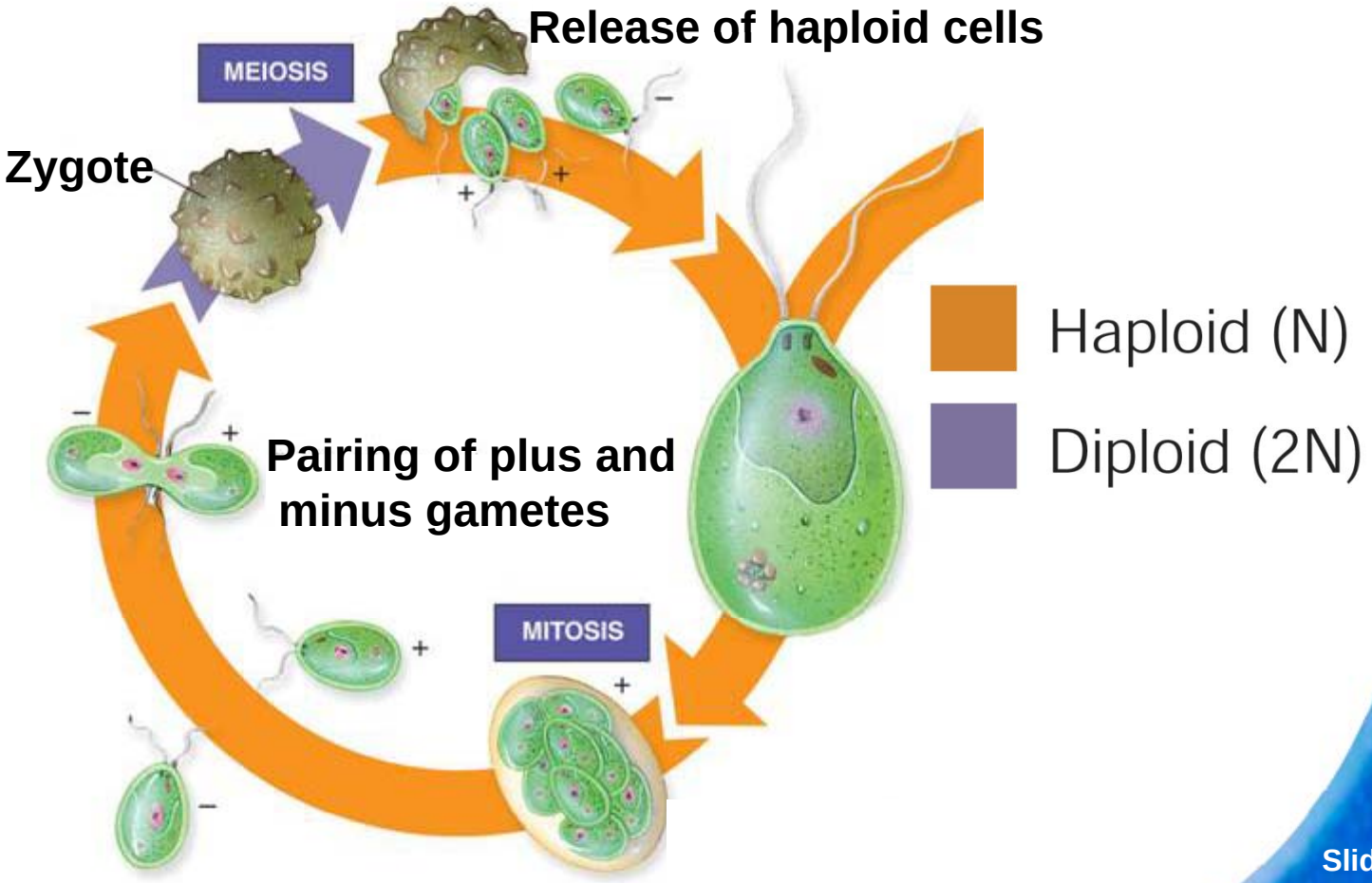
Asexual Reproduction in *Chlamydomonas*

In suitable living conditions, this haploid cell reproduces asexually, producing cells called **zoospores** by mitosis.



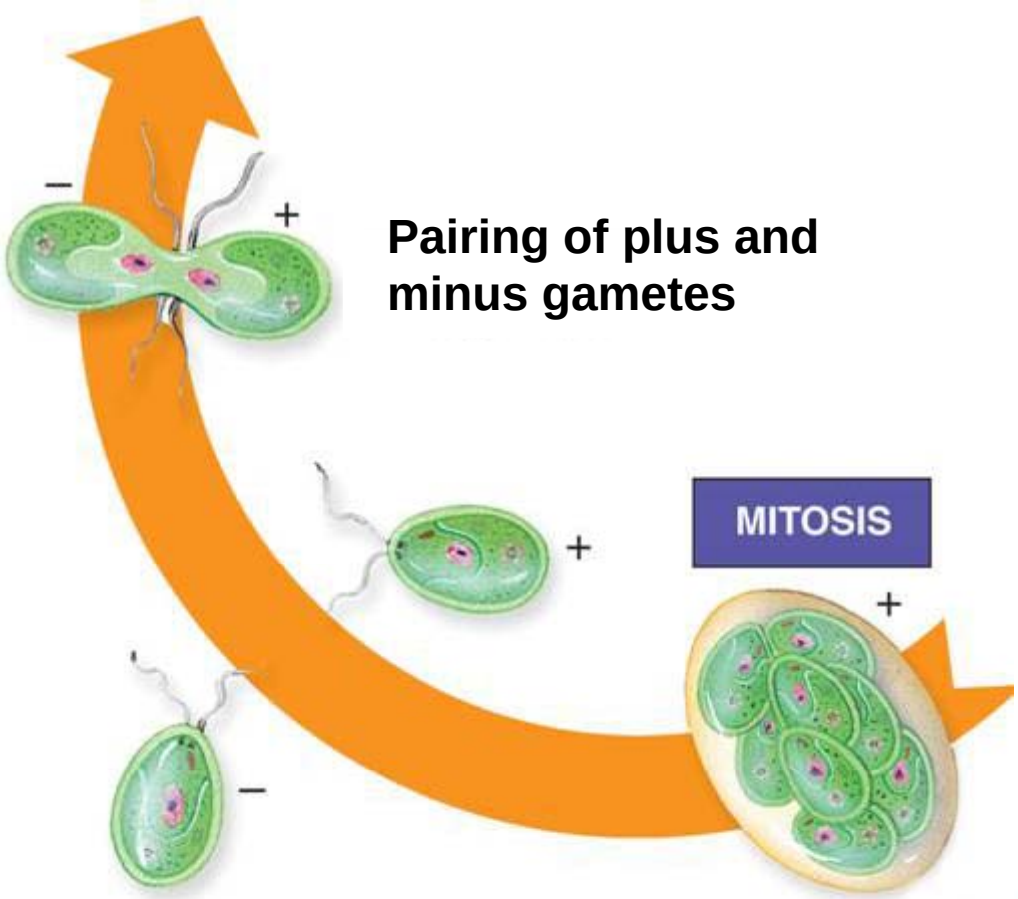
If conditions become unfavorable, *Chlamydomonas* can also reproduce sexually.

Sexual Reproduction in *Chlamydomonas*

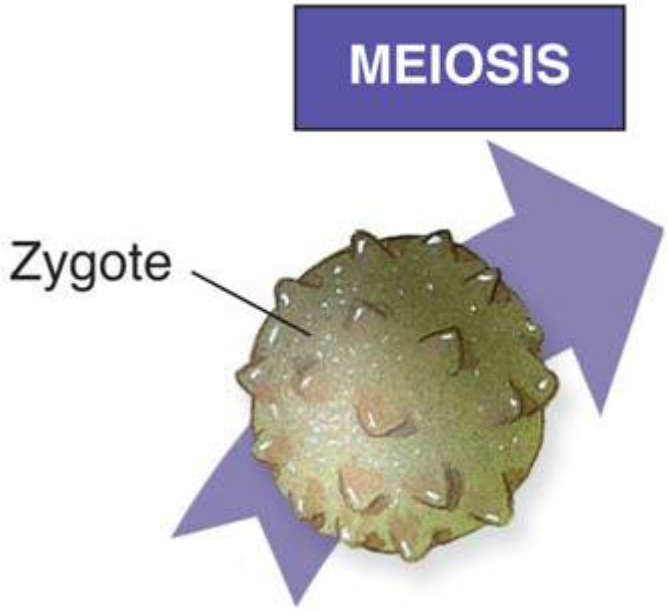


Haploid cells undergo mitosis, but release **gametes** instead of zoospores.

The zoospores are of two opposite mating types—plus (+) and minus (-).

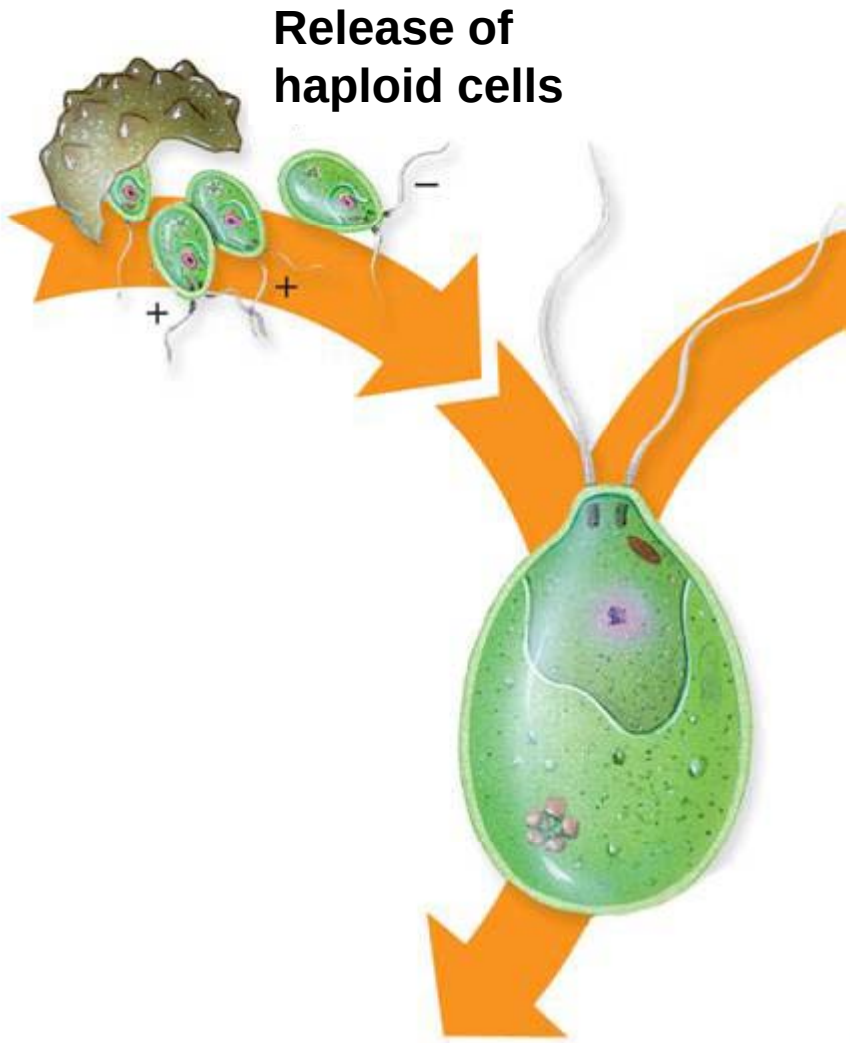


The plus and minus gametes form pairs and fuse, forming a diploid zygote.



The zygote grows a thick protective wall. Within this protective wall, *Chlamydomonas* can survive conditions that otherwise would kill it.

When conditions again become favorable, the zygote grows, divides by meiosis, and produces four haploid cells.

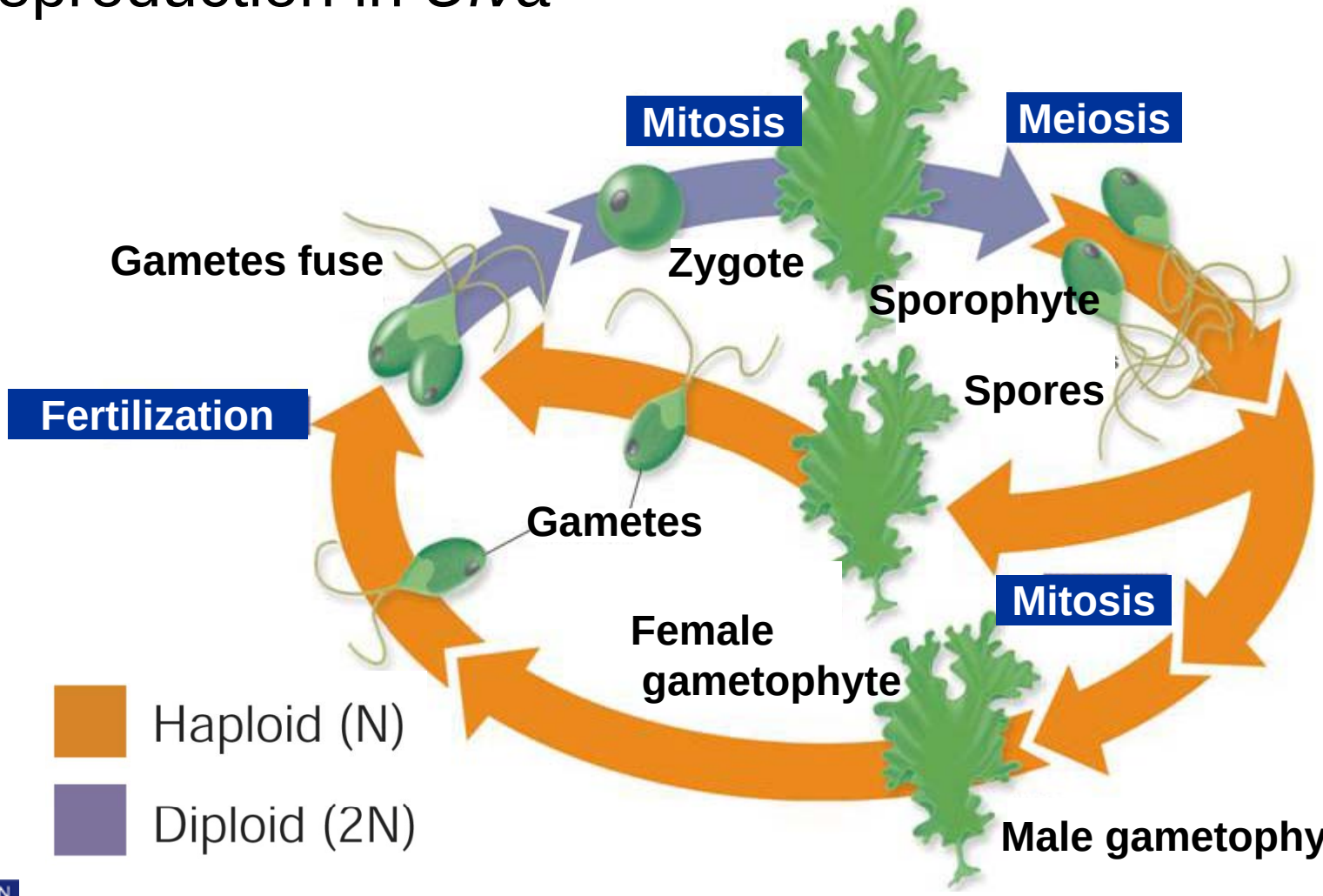


Reproduction in *Ulva*

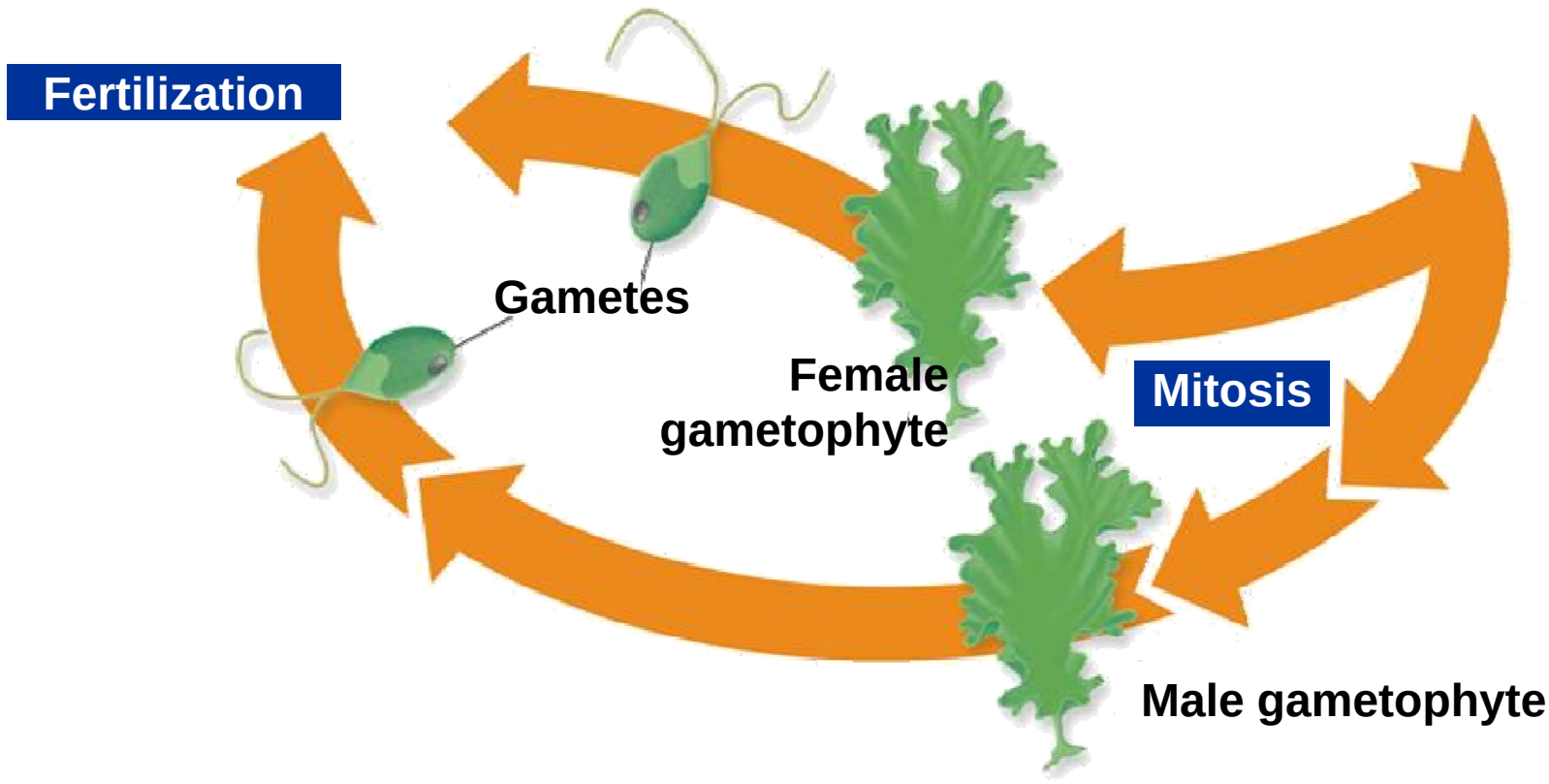
The life cycle of the green alga *Ulva* involves alternation of generations.

Ulva are **gametophytes**, or gamete-producing plants.

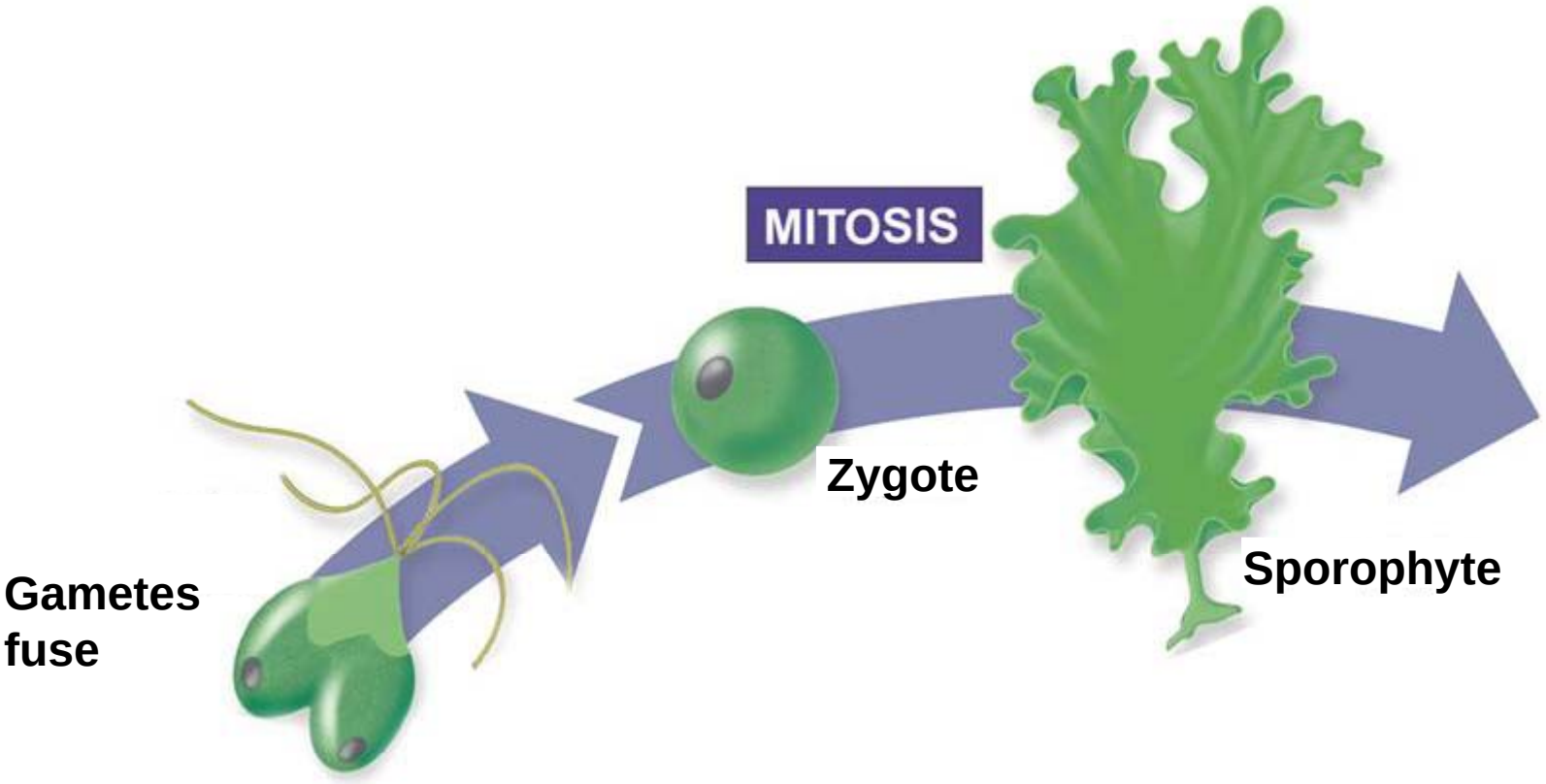
Reproduction in *Ulva*



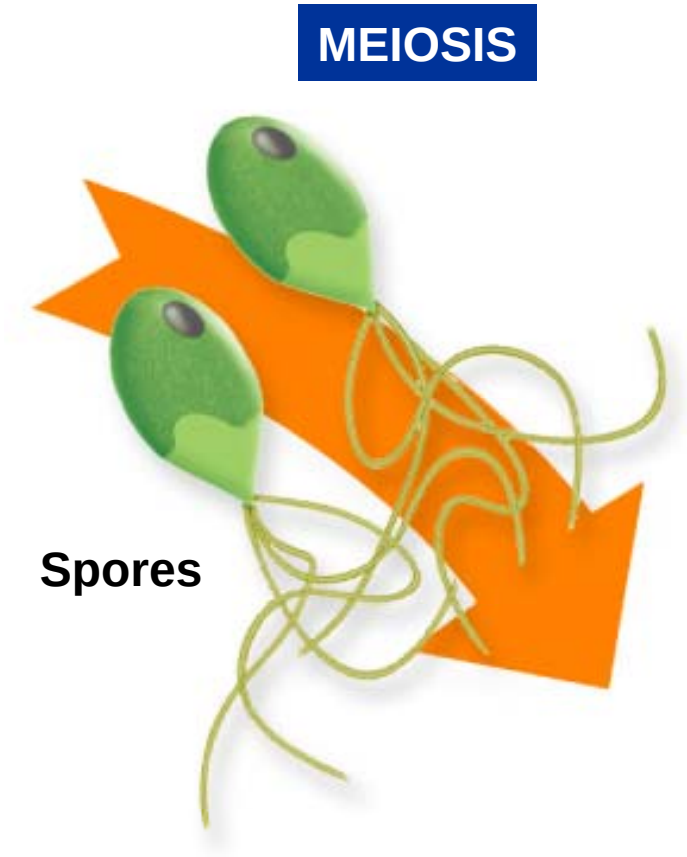
The haploid phase of *Ulva* produces male and female gametes.



When male and female gametes fuse, they produce a diploid zygote cell, which grows into a diploid multicellular *Ulva*.

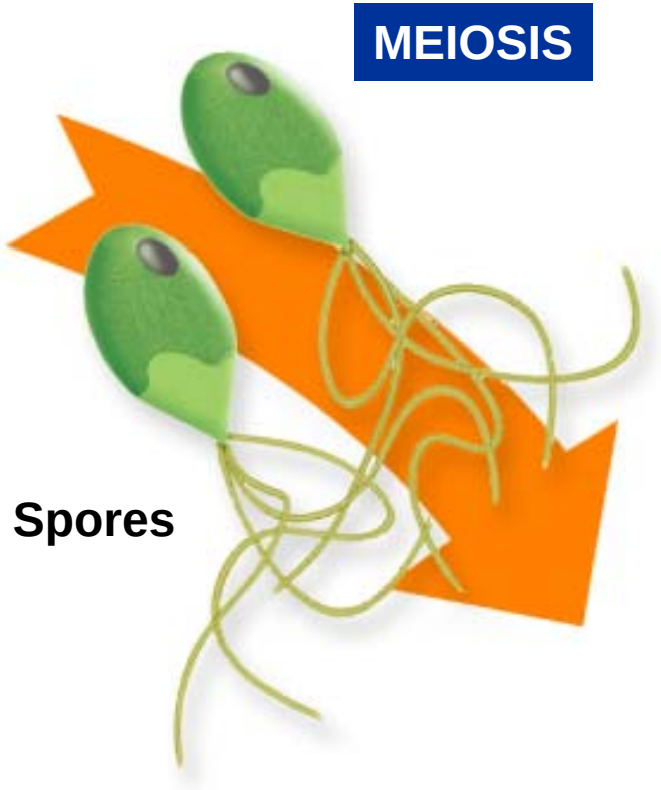


The diploid *Ulva* undergoes meiosis to produce haploid reproductive cells called **spores**.



Each spore can grow into a new individual without fusing with another cell.

Because the diploid *Ulva* produces spores it is known as a **sporophyte**, or spore-producing organism.



Ecology of Algae

Algae produce half of Earth's oxygen through photosynthesis.

Algae is found in sushi, ice cream, and other foods.

Chemicals from algae are used to make plastics, waxes, transistors, deodorants, paints, lubricants, and artificial wood.

Agar thickens nutrient mixtures in scientific labs.