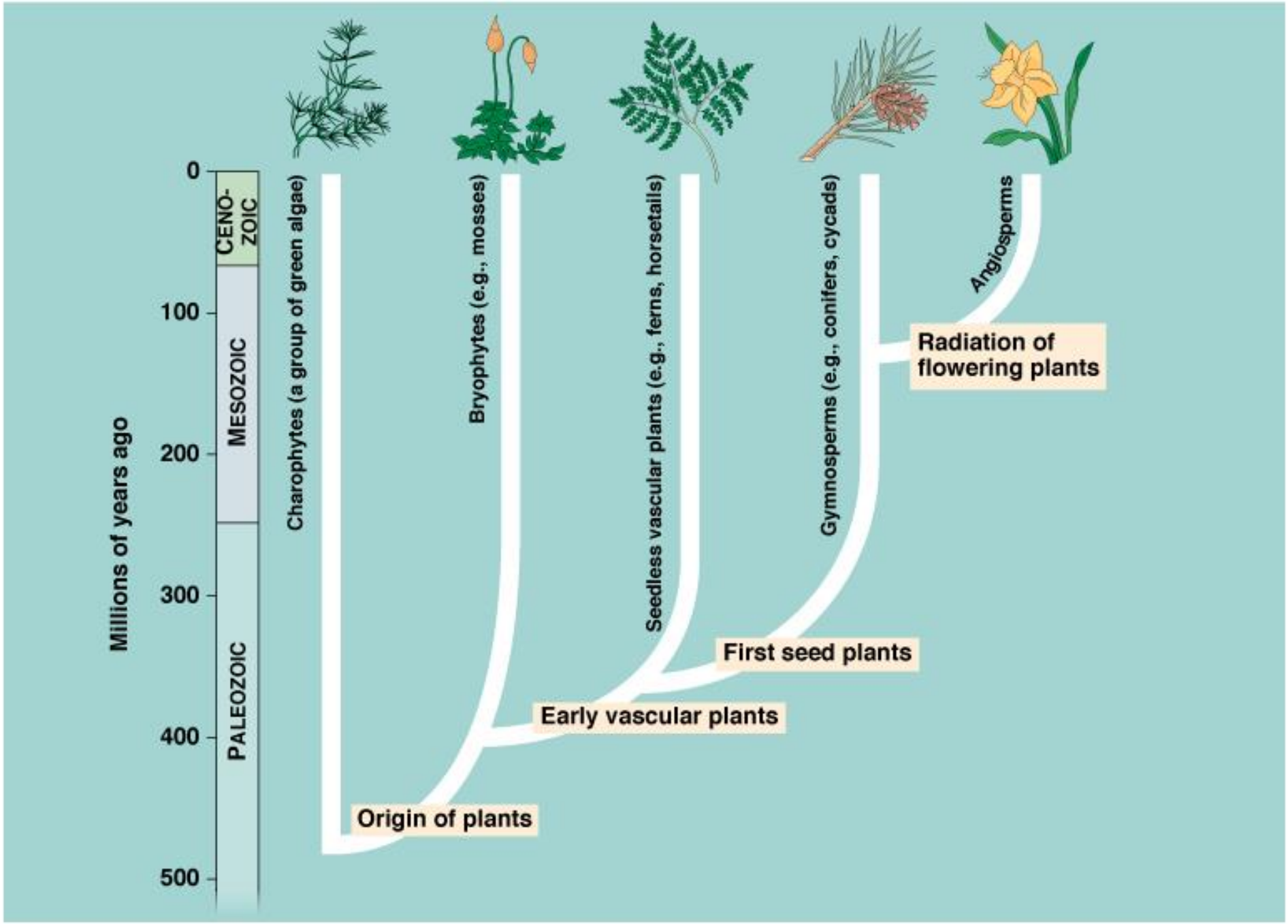
Kingdom Plantae



Algae

CHAPTER 20; BASED ON TB

Characteristics of Algae (20-1)

Key Characteristics

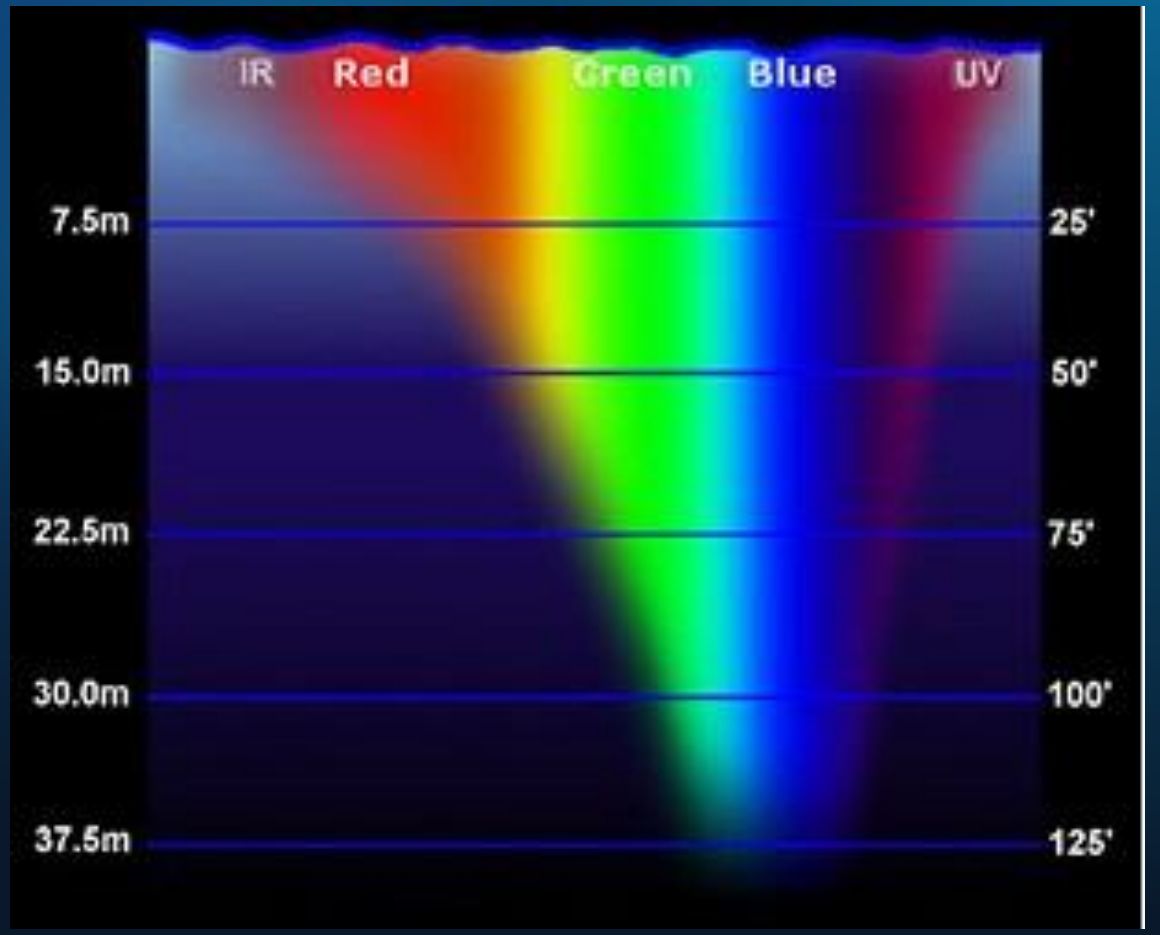
- Photosynthetic, have chlorophyll *a* (and sometimes other photosynthetic pigments)
- Eukaryotic
- Unicellular or multicellular
- Aquatic
- Classification debated; no clear definition on what ‘algae’ are

Adaptations for Aquatic Living

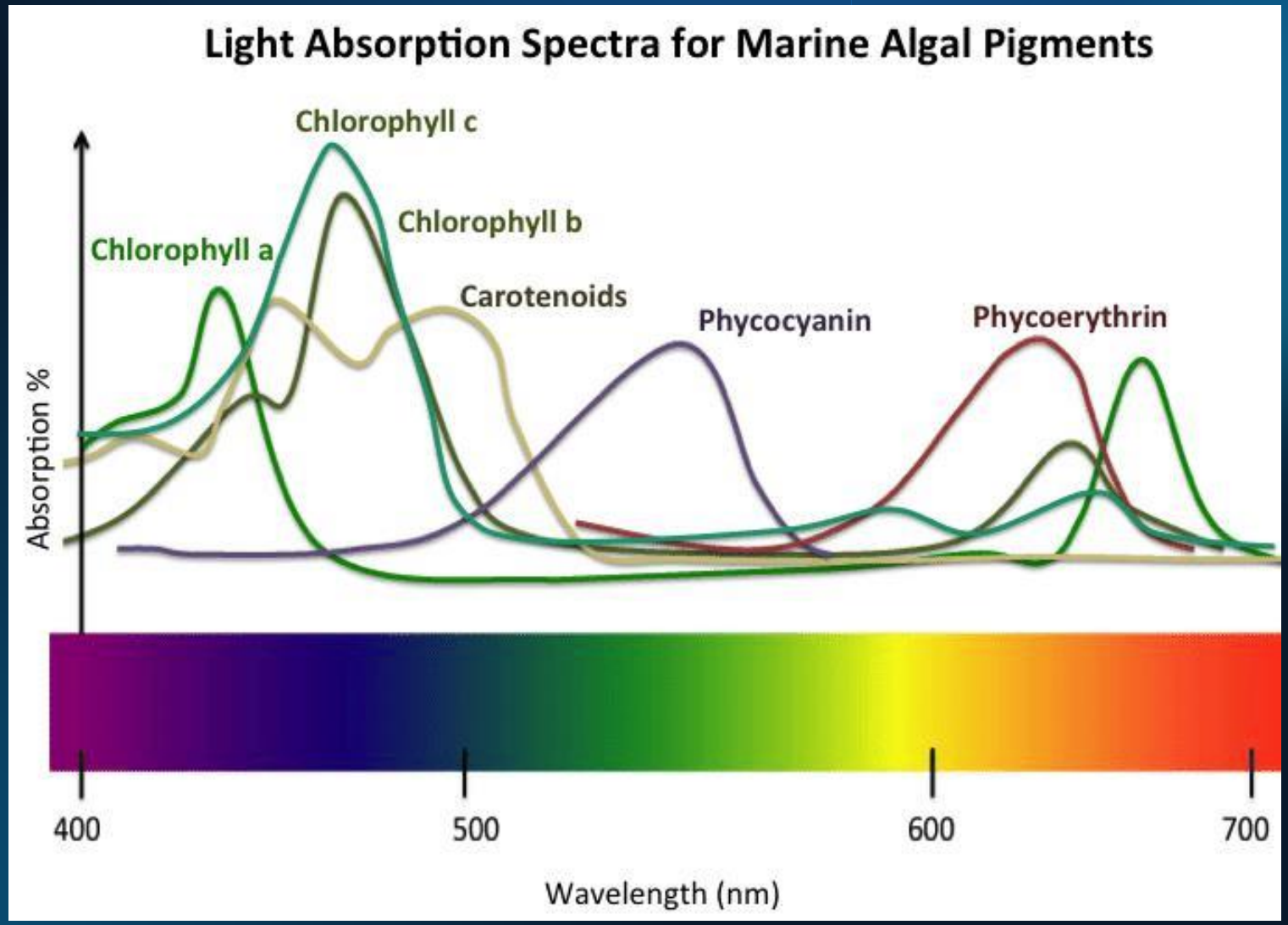
- Thin leaf-like structures; exchange gases and nutrients directly with surroundings
- No vascular system to transport water
- No stem structure (water provides sufficient support)

Chlorophyll and Accessory Pigments

- All algae have chlorophyll *a*, which uses red and violet light (scarce underwater)
- Algae often use different forms of chlorophyll (*b*, *c*, *d*) and/or **accessory pigments** to use other wavelengths of light



Chlorophyll and Accessory Pigments



Absorption spectra for various photosynthetic pigments.

E.g. chlorophyll *a* uses violet and red light; phycocyanin uses green light.

Note: if a colour is absorbed, that algae will ***not*** appear that colour. Most plants are green because chlorophyll *a* absorbs the least green light.

Groups of Algae (20-2)

Groups of Algae Intro

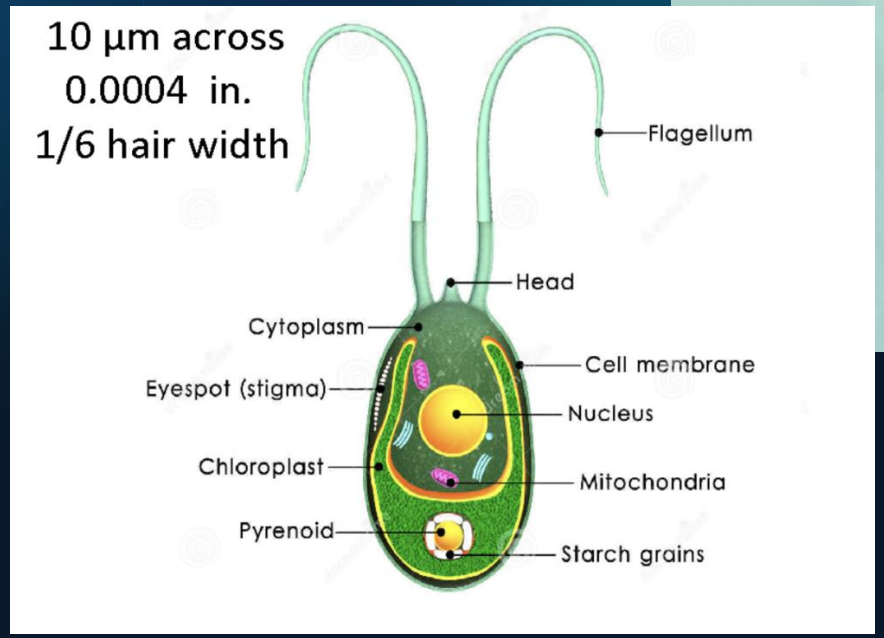
- Chlorophyta (green algae)
- Phaeophyta (brown algae)
- Rhodophyta (red algae

Chlorophyta (green algae)

- Have chlorophylls *a* and *b*
- Colour: green
- Store food as starch
- Habitat: moist terrestrial, freshwater, ocean
- Solitary or colonies

Chlamydomonas

- Single-celled green algae
- Two flagella
- Eyespot: senses light and dark
- Single large chloroplast



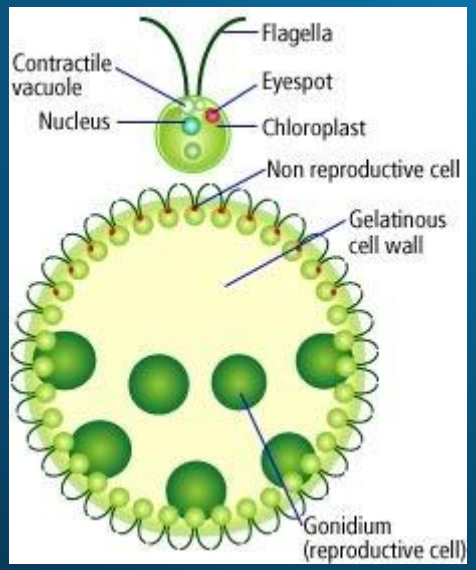
Colonial Green Algae

- **Colony:** group of cells joined together that live together, though each individual cell functions independently

Colonial Green Algae

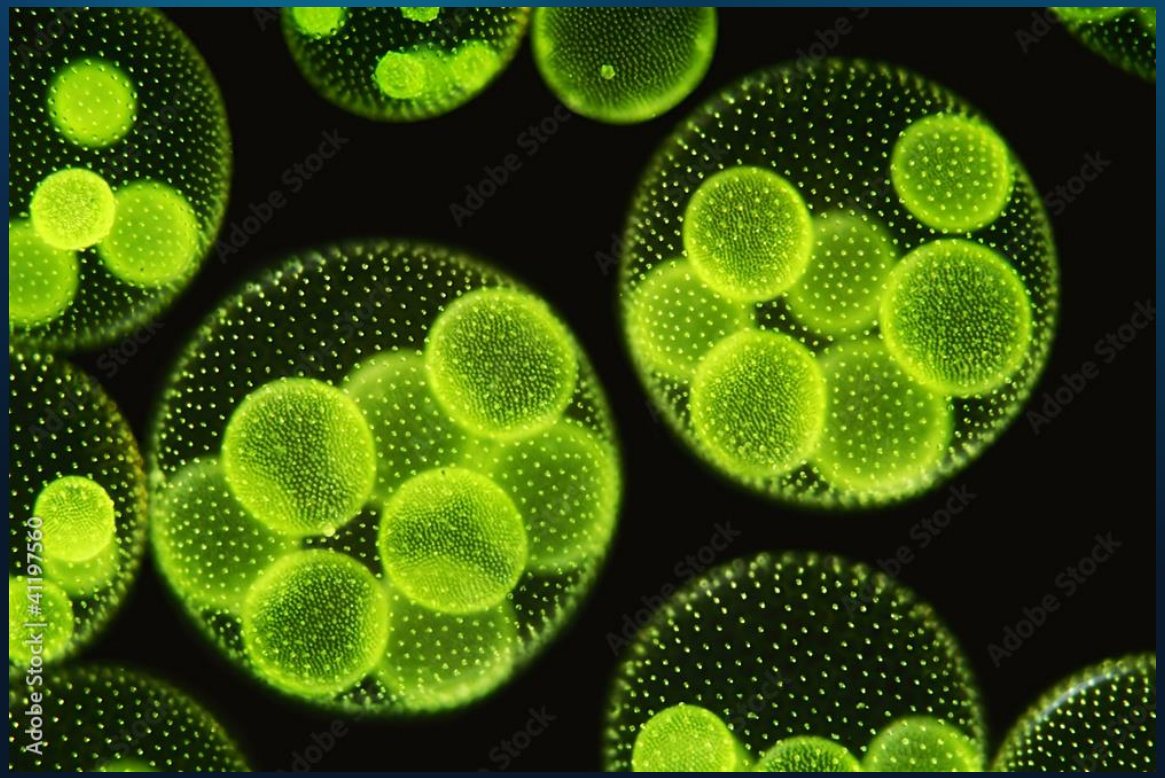
***Gonium*:** colonial alga made of 4-32 cells; if colony splits up, each cell can form its own colony

Colonial Green Algae



***Volvox*:** colonial alga made of 500-50,000 cells

- Cells connected by strands of cytoplasm, can communicate (essential for coordinated locomotion)
- Some specialized cells; some produce gametes only



Threadlike Green Algae

- Long threadlike colonies called **filaments**
- Some species exhibit cell specialization

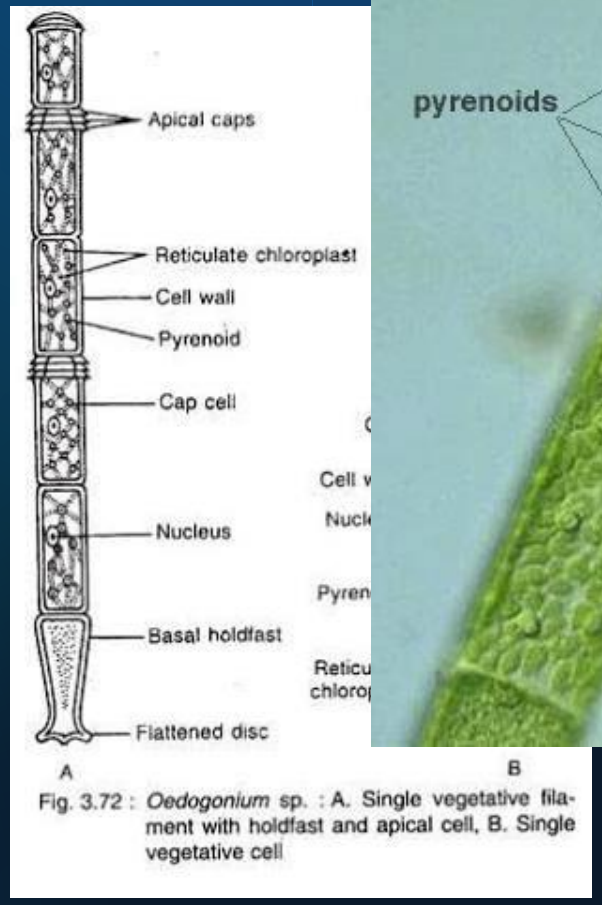
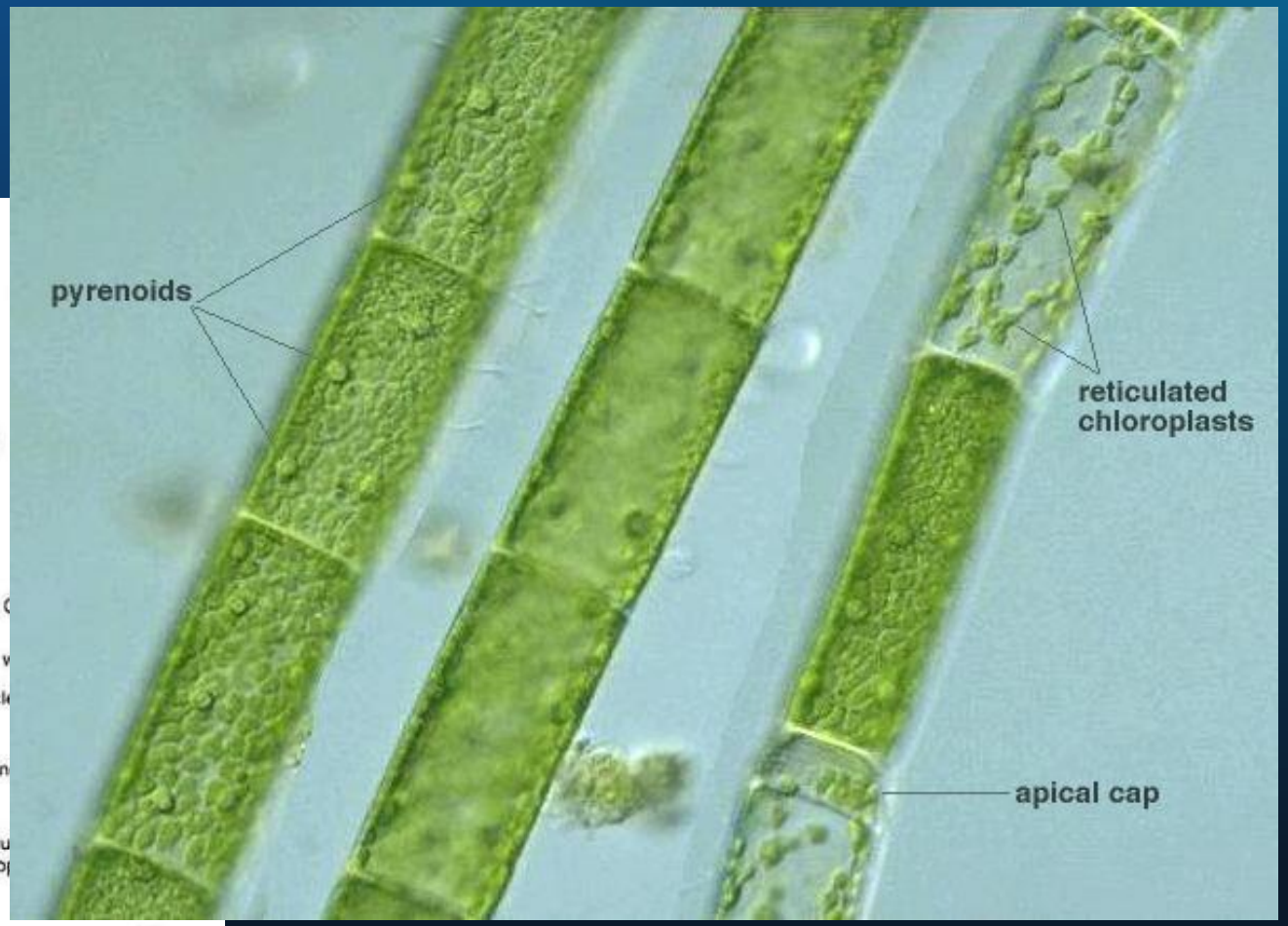


Fig. 3.72 : *Oedogonium* sp. : A. Single vegetative filament with holdfast and apical cell, B. Single vegetative cell



Discussion

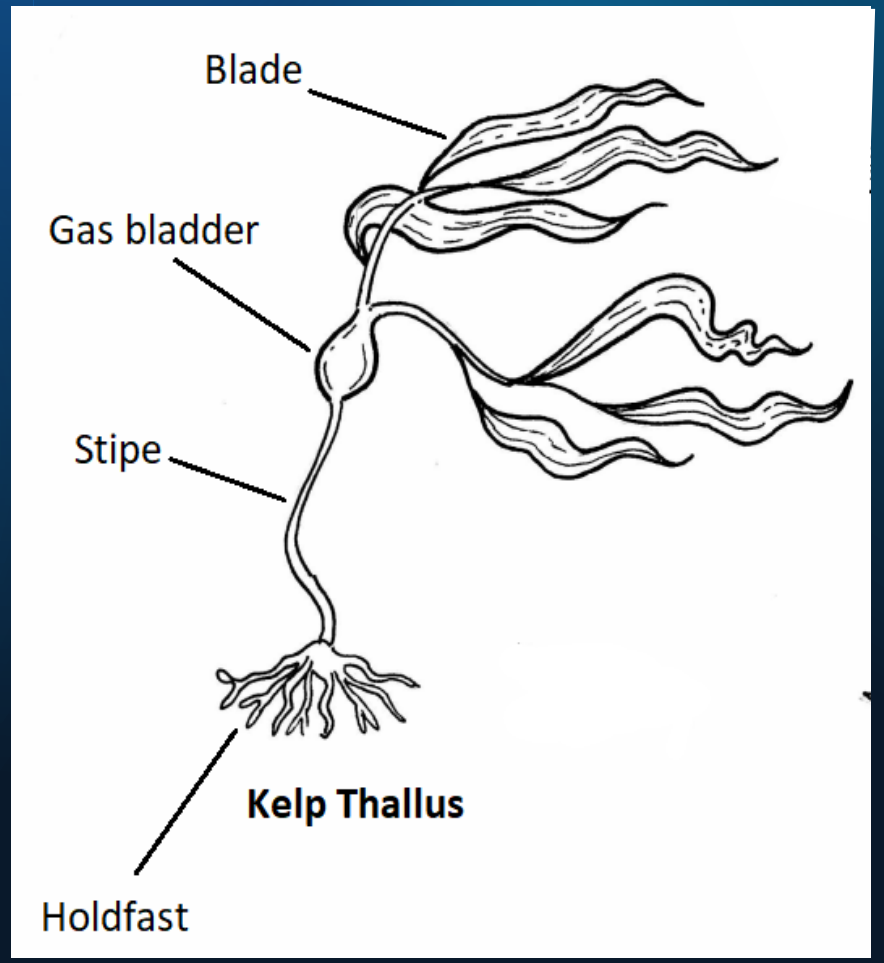
Algae are a diverse group with unicellular and multicellular members. Why are colonial and threadlike (filamentous) algae so important in helping us understand the evolution of multicellularity as a strategy for living things?

Brown Algae (Phaeophyta)

- “Seaweeds”
- Chlorophylls *a* and *c*, accessory pigment fucoxanthin
- Colour: brown
- Store food as starch and oil
- Habitat: cool shallow coastal waters, arctic areas
- Can grow to very large in size (60 meters!), with complex structures

Brown Algae: *Fucus* Anatomy

- **Blade:** used for photosynthesis
- **Gas bladder:** filled with gas for flotation
- **Holdfast:** anchors algae down to rock or other substrate



Brown Algae: Importance (ecology)

Kelp forests are an important source of food and habitat for many species

Brown Algae: Importance (economic)

- Alginic acid harvested from brown algae and used for various purposes (stabilizing ice cream and cosmetics, batteries, pharmaceuticals)
- Fertilizer
- Eaten as “seaweed” in some cultures

Rhodophyta (Red Algae)

- Chlorophyll *a* (and sometimes *d*), accessory pigment phycobilin (absorbs blue light)
- Colours: pink, red, purple, or black
- Live at greater depths than other algae (up to 170m)
- Store food as starch
- E.g. *Porphyra* (Japanese *nori* – sushi)

Where Algae Fit into the World (20-4)

Where Algae Fit Into the World

- Unicellular algae – food for most aquatic life
- Habitat for other animals (e.g. kelp)
- Photosynthesis (50-75% of all oxygen production)
- Food industry (food source, ingredient for ice cream, soup, cosmetics)
- Pharmaceuticals
- Industrial uses (plastic, paints, baking ingredients, agar to grow bacteria, etc.)

Reproduction in Algae (20-3)

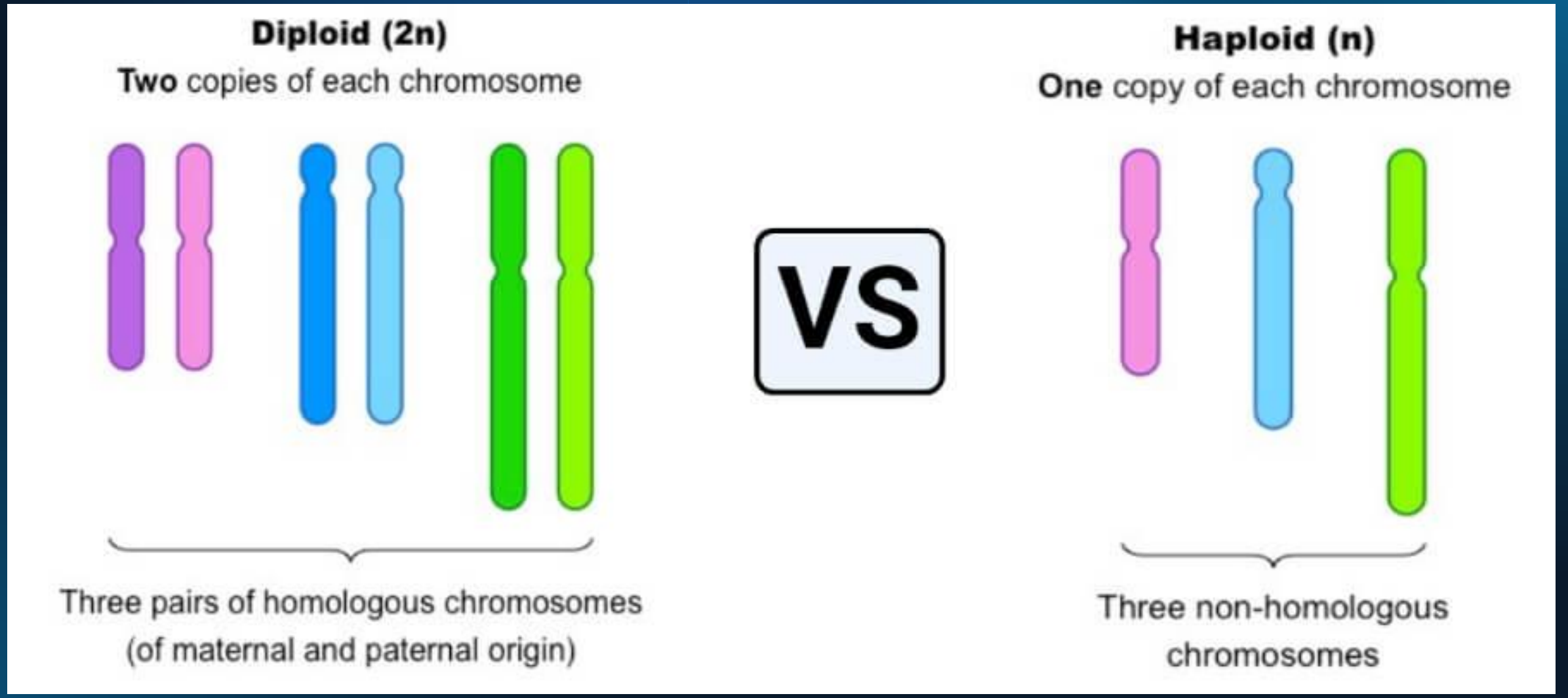
Introduction

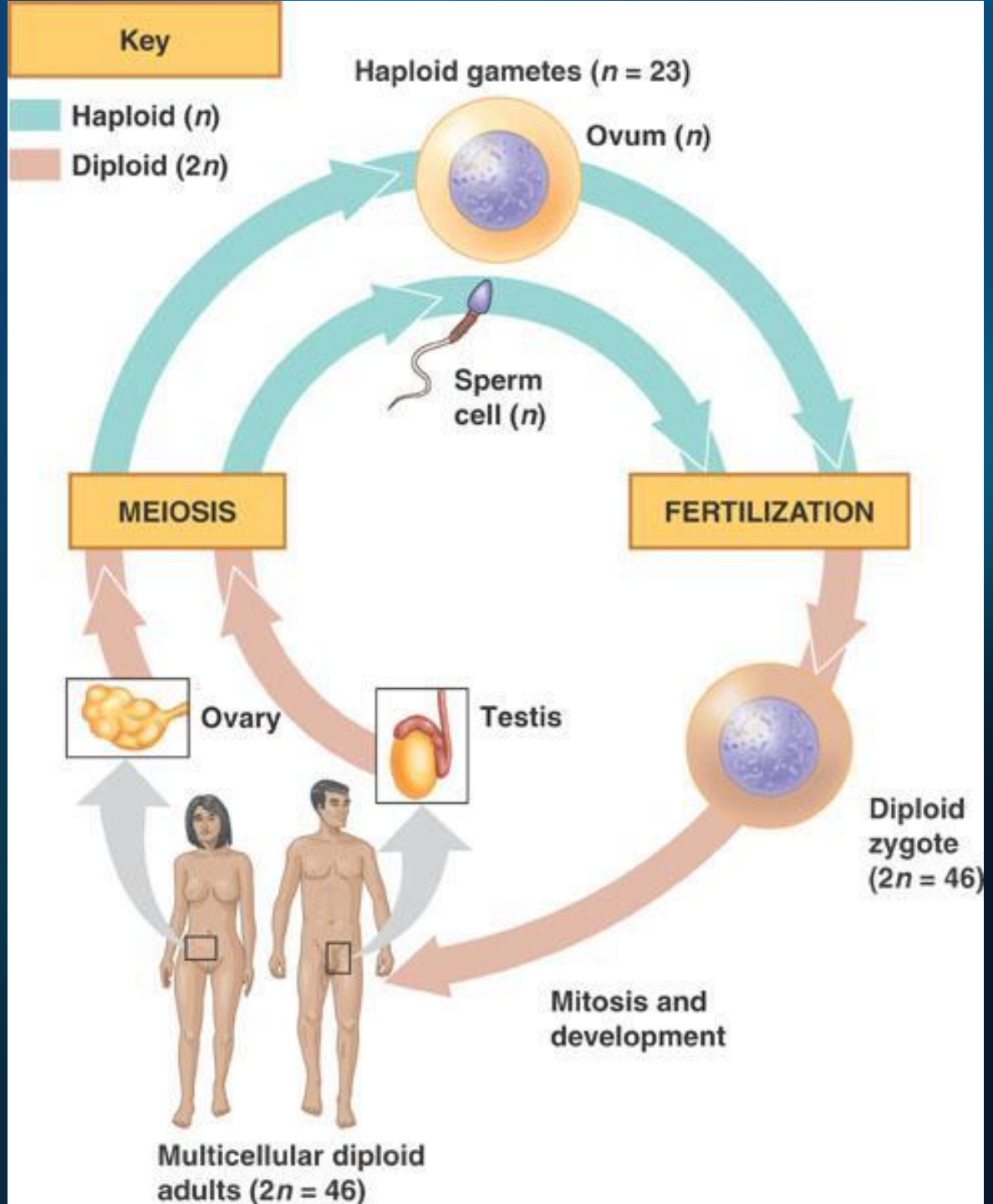
Draw the “life cycle of a human”. Include the following words:

- Meiosis
- Mitosis
- Sperm
- Egg
- Zygote
- Baby

Review the concept of ploidy with your teacher. Now, add “haploid” and “diploid” to your diagram.

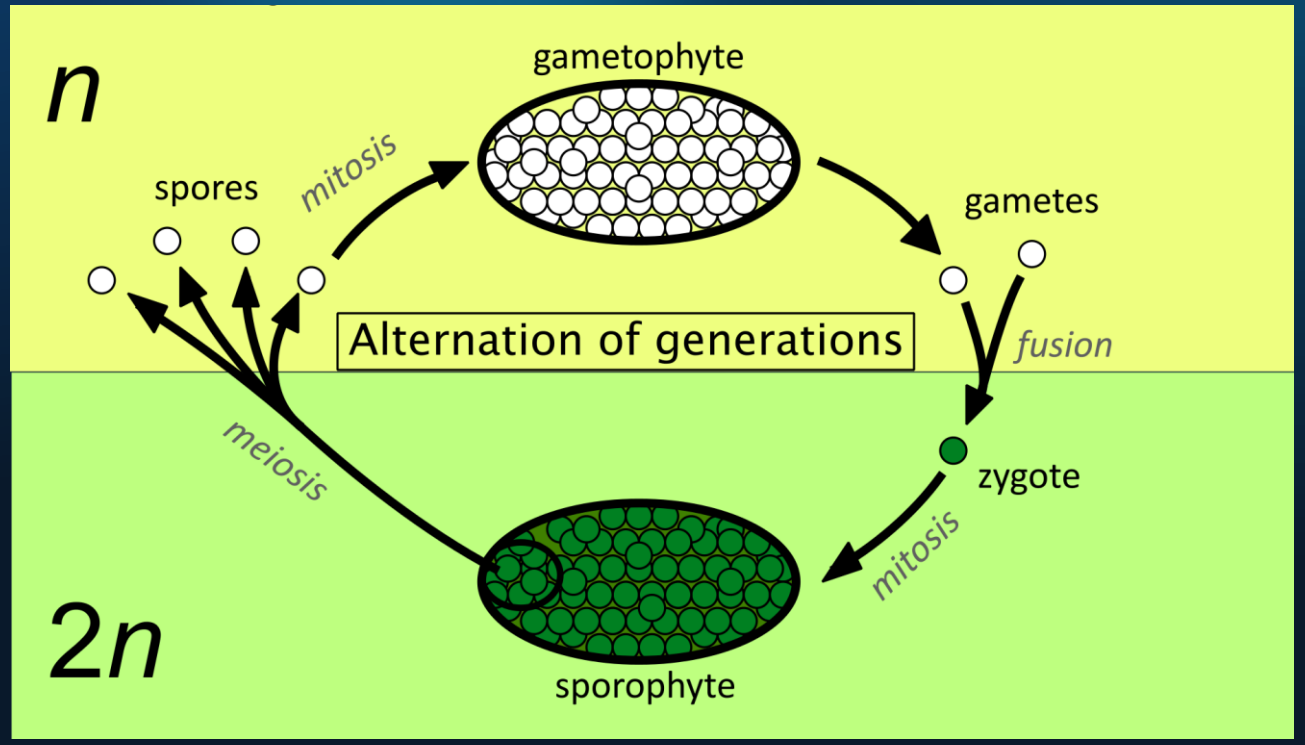
Review: Reproduction Concepts



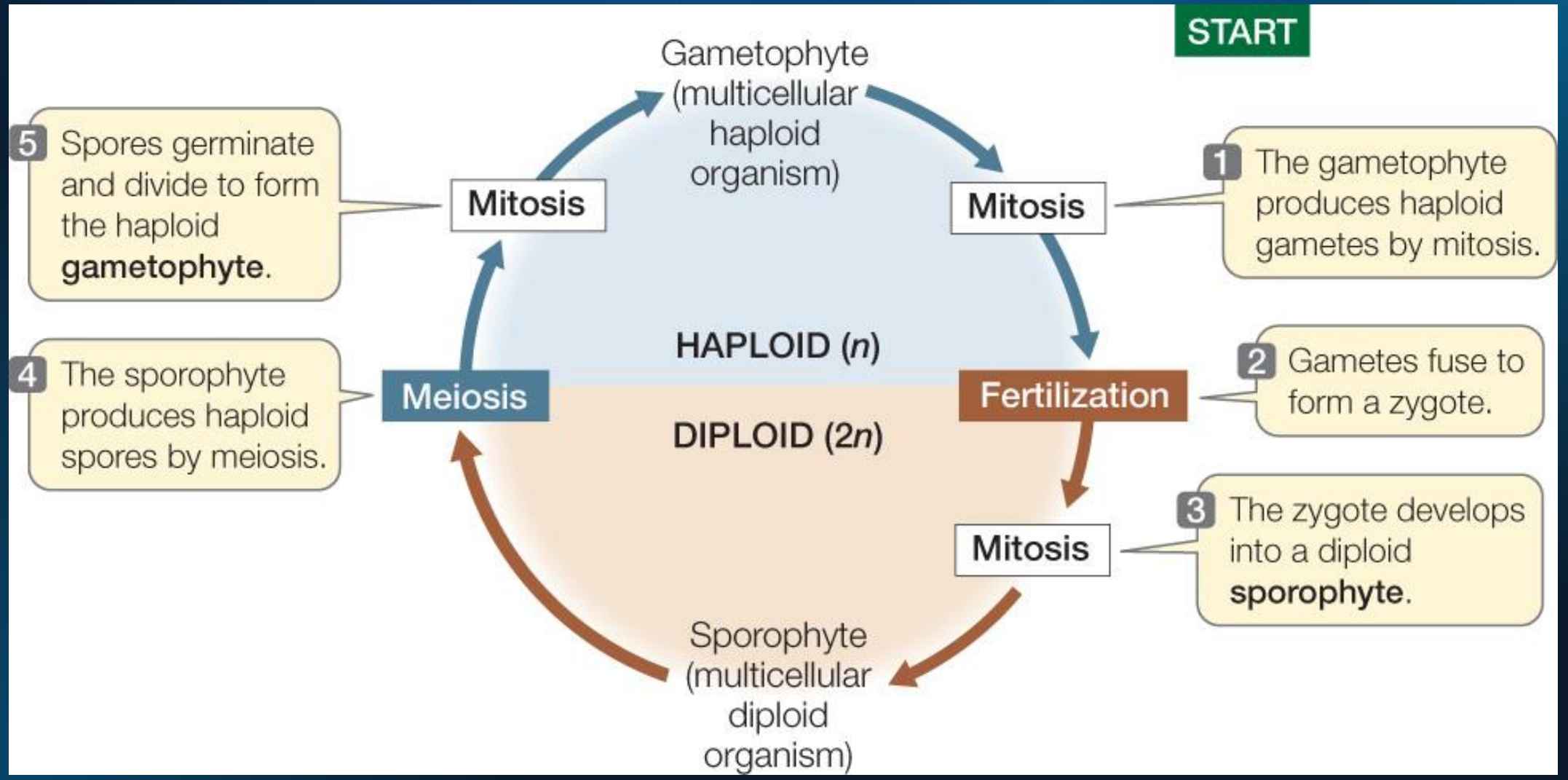

Key
Haploid (n)
Diploid (2n)
Haploid gametes (n = 23)
Ovum (n)
Sperm cell (n)
MEIOSIS
FERTILIZATION
Ovary
Testis
Diploid zygote (2n = 46)
Mitosis and development
Multicellular diploid adults (2n = 46)

Alternation of Generations

- Kingdom Plantae
- Life cycle alternates between two distinct forms:
  - Haploid (*n*) **gametophyte** generation, creates haploid gametes through mitosis
  - Diploid (2*n*) **sporophyte** generation, creates haploid spores through meiosis



Alternation of Generations

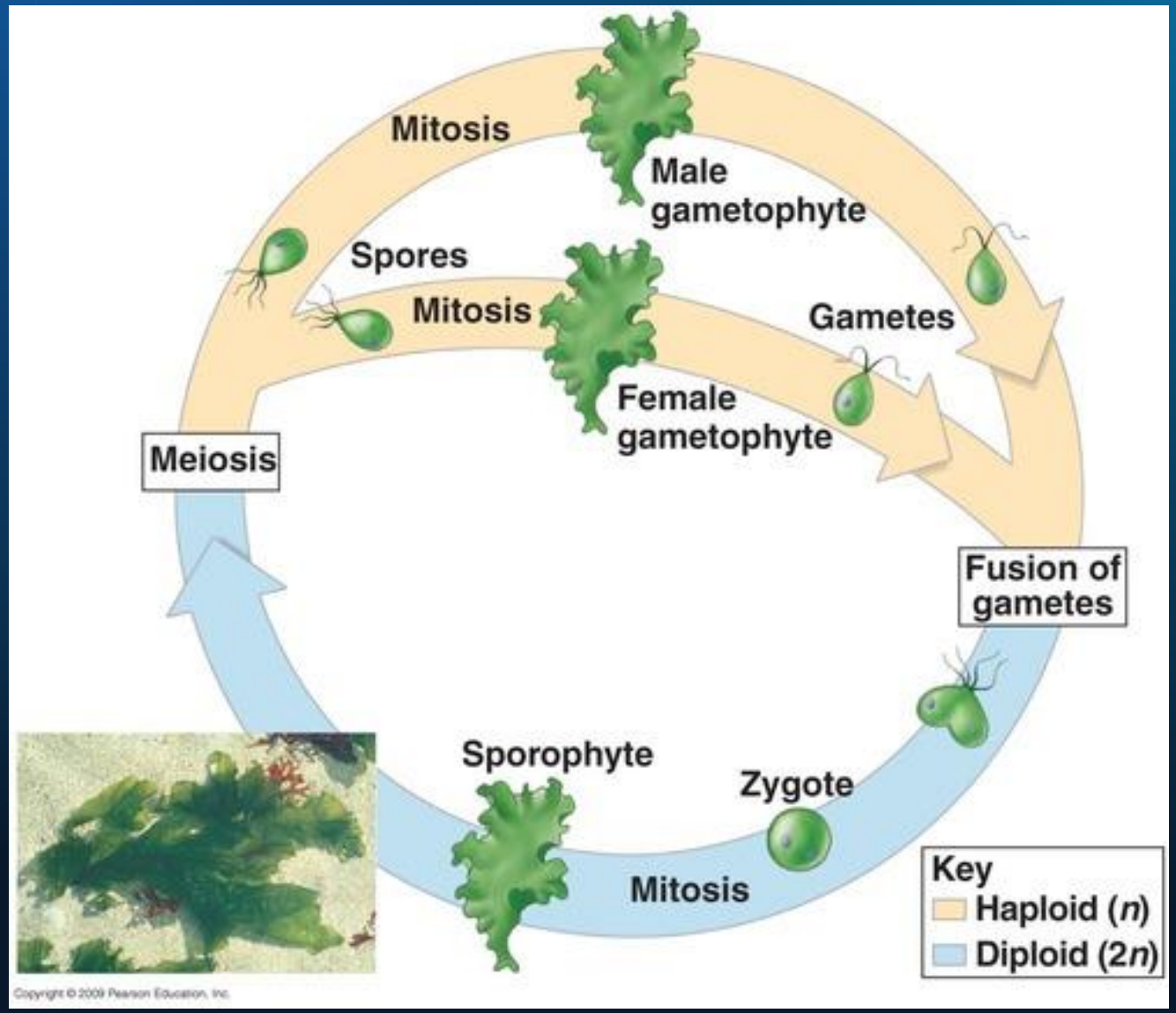


Discussion Questions

1. How does reproduction in Kingdom Plantae differ from reproduction in Kingdom Animalia? (Note: humans are animals.) Which steps/stages are similar? Which steps/stages are unique to Plantae?
2. Imagine you are a plant (diploid sporophyte generation).
   a) How would your family tree look? Include your theoretical children in this family tree.
   b) If asked the question "Who do you look the most like: mom or dad?" how would you respond as a plant? Explain your answer.

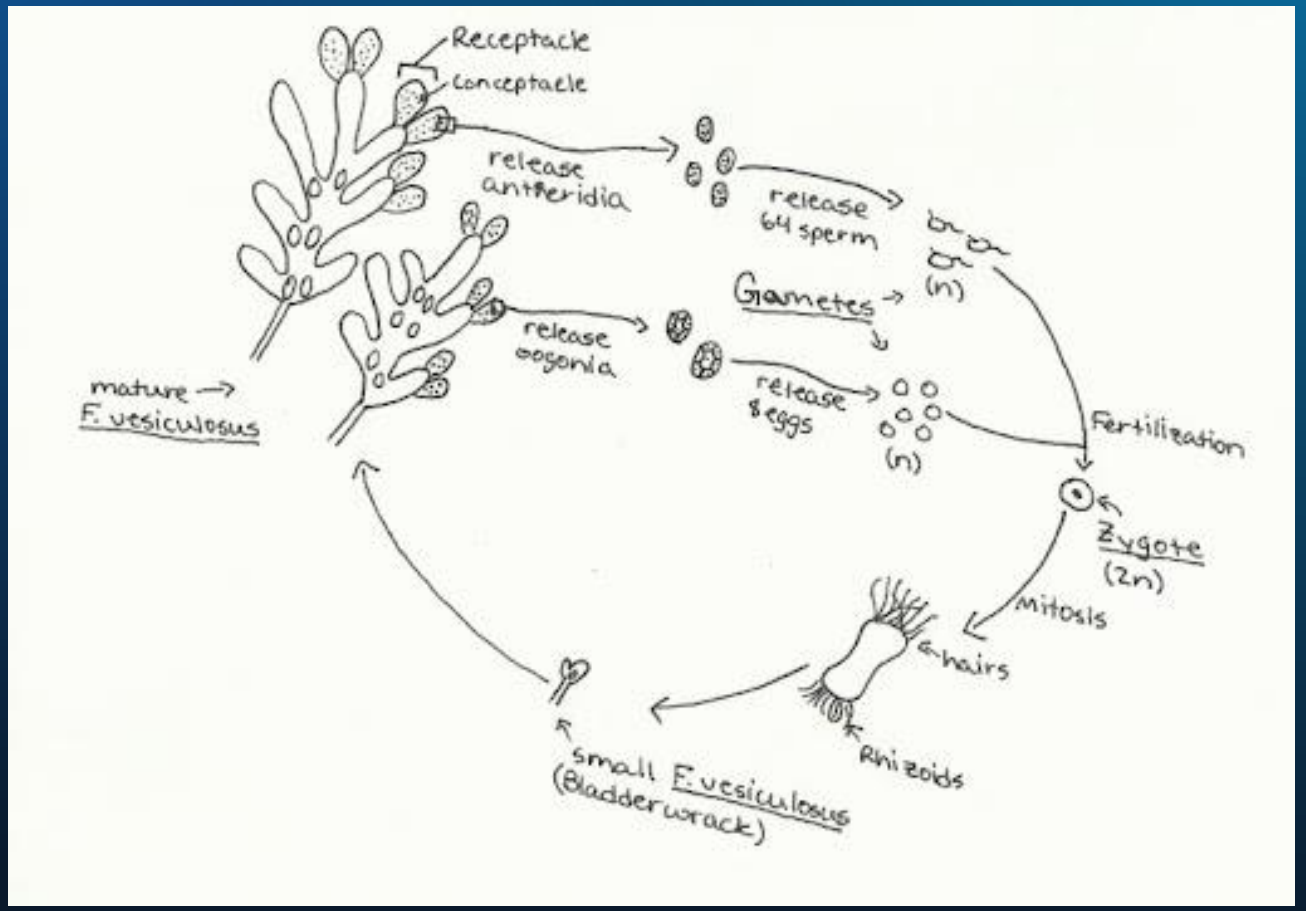
Ulva

- Diploid sporophyte and haploid gametophyte generations are both multicellular and look almost identical
- No dormant stage



Fucus

- Multicellular diploid sporophyte
- Unicellular haploid gametophyte (on the tips of the *Fucus* blades) produces eggs or sperm



Life cycle of *Fucus* spp. Note: a single diploid sporophyte will produce both male and female gametophytes.