

BIOLOGICAL DIVERSITY

EX IV LECTURE & TEXTBOOK NOTES

CHPT 30-32 LECTURE & CHPT 30, 32 TEXTBOOK (in order)

BIOLOGICAL DIVERSITY
CHAPTER 30: PLANTS (lecture)
11/10

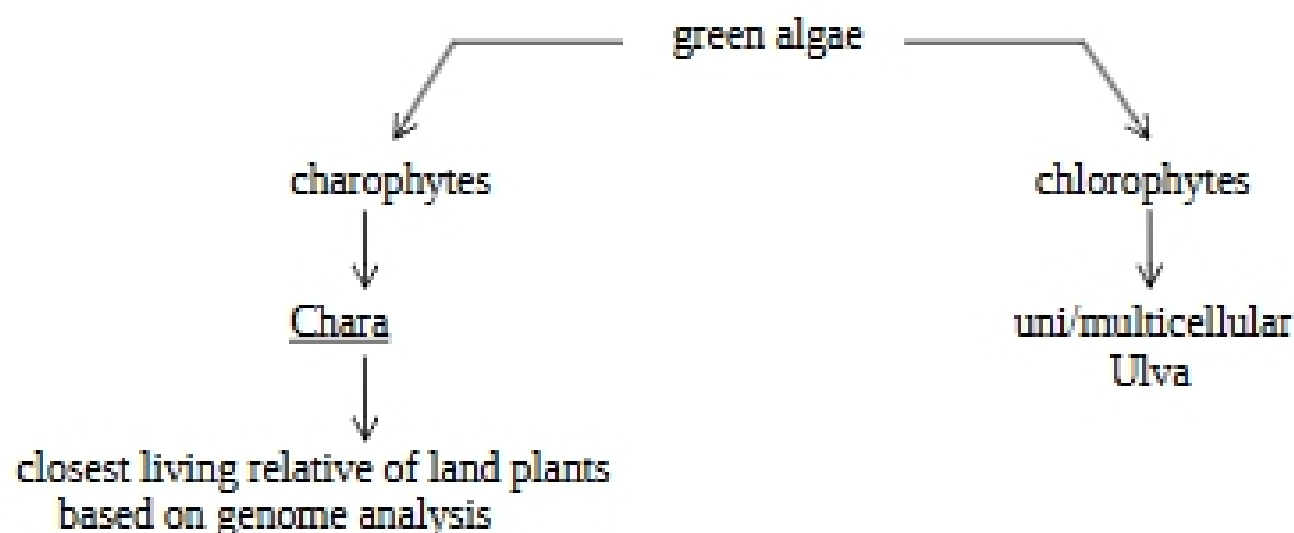
- transition between charophytes and liverworts/hornworts/mosses from water to land
 - most ancestral

What is a Plant?

- autotrophic
 - photosynthesis for carbon and energy needs
 - selective pressure has enhanced this process
 - chlorophyll
 - different types (pigments) enhance energy production
- heterotrophic/autotrophic
 - ex. venus fly traps
 - a few plants that are strictly heterotrophic
 - tend to be parasites on other plants
 - get all energy (phosphorus, carbon) from their host plants
- complex life cycles
 - alteration of generations (see below**)
 - cell walls
 - increases rigidity of cell (increase of support)
 - have ranges of cellulose and lignin (polysaccharides)
 - compose cell wall
 - multicellular
 - eukaryotic
 - chloroplasts and mitochondria

Plant Evolution

- another billion years after the oldest definite fossils for eukaryotes for land plants to emerge
 - likely derived from aquatic protists (best hypothesis out there)



Water → Land Challenges

- water to land transition was very difficult to make
 - many things selected for in aquatic organisms that would not be helpful on land
 - water has a free-floating environment
 - land has a gravity-based environment
- capturing water
 - root systems have capacity to absorb water from the environment around them
 - roots are the core of how plants capture water
 - rhizoid: how plants without roots capture water
- retaining water
 - hydrophobic/waxy coatings on the leaves/stems
 - hydrophobic: repels water from passing through/coming out of the plant
 - storage in roots
- structural stability
 - gravity
 - rigid cell walls
 - lignin
 - structural carbohydrates
 - cellulose
 - result is “woody tissues”
 - issues with how large a plant can grow driven by structural stability
 - plants were really small to begin with
 - cellulose and lignin based cell walls allowed for extended growth
- nutrient uptake
 - in water there is a viable uptake of carbon, nitrogen, and phosphorus
 - on land plants have to “look harder” for those C, N, and P nutrients
 - symbiosis relationships with nitrogen-fixing bacteria
 - roots for uptake
- facing herbivores (eating live plant tissues) and granivores (eating grains or seeds)
 - needed to evolve new ways to resolve that issue (will die without enough living tissue)
 - toxin creations (secondary compounds: compounds toxic to those ingesting them)
 - thorns, spines
 - shells (for seeds)
 - reduces drying and desiccation of those seeds
 - grasses that enhance growth when faced with herbivory
- seasonal change
 - going into an environment with extremes
 - temperatures
 - dormancy (winter)
 - extreme growth (spring)
 - goal is to adapt life cycles to alternating periods of dormancy (shutting down/plant hibernation) and rapid growth
 - abiotic factors

Basic Plant Life Cycle

- background info:
 - common to all plants as well as to multicellular green, brown, and red algae

- terminology:
 - chromosome number: number of chromosomes for an organism
 - humans have 46 chromosomes (including sex chromosomes)
 - diploid: total number of chromosomes (46 for humans)
 - represented as $2n$
 - $2n = n$ chromosomes from mom + n chromosomes from dad
 - $2n = n$ MOM egg + n DAD sperm
 - GAMETES
 - each parent provides a haploid number of chromosomes
 - $2n = \text{embryo}^*$
 - haploid: always half of the diploid number (23 for humans)
 - represented by n
 - gametes are ALWAYS haploid
 - unicellular*
 - $n = \text{gamete}^*$
 - plants have independent haploid and diploid life stages
 - haploid and diploid can live on their own
 - leads to alteration of generations
 - alternation of generations
 - haploid (n)
 - diploid ($2n$)
 - circular, loop
 - gametophyte (haploid) produces egg (n) and sperm (n)
 - fertilization is the joining of egg (n) and sperm (n)
 - $2n$ zygote
 - $2n$ embryo
 - $2n$ sporophyte (diploid)
 - sporophyte goes to sporangia
 - sporangia to spore mother cell ($2n$)
 - through meiosis, the mother cell ($2n$) goes to spores (n)
 - spore goes once again into a gametophyte
 - sporophytes are only present for a short time and is an independent life stage* (n)
 - alternations of generations gets more complicated with different groups

Earliest Land Plants (Charophytes to Bryophytes)

- bryophyta
 - likely came from charophytes
 - three subgroups:
 - mosses
 - hornworts
 - liverworts
 - do not have true roots
 - rhizoids: holds plant in place
 - anchor
 - capacity to absorb water
 - act like a sponge
 - does not go through specific vessels
 - water is drawn into plant along a single, long cell
 - no vascularization (directly proportional to blood vessels in humans)