Heterokontophyta II

Division: Heterokontophyta

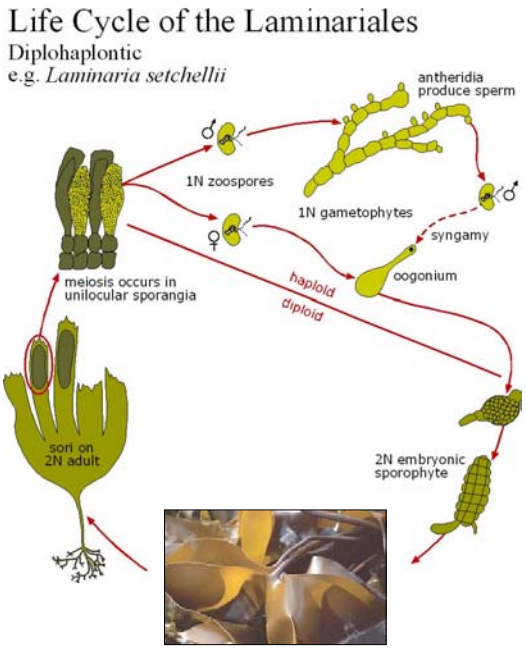
Class: Phaeophyceae

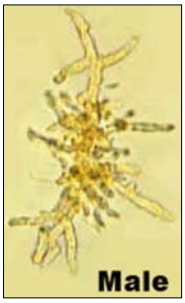
Order: Ectocarpales, Dictyotales, Scytosiphonales, Chordariales, Desmarestiales, **Laminariales**, Fucales

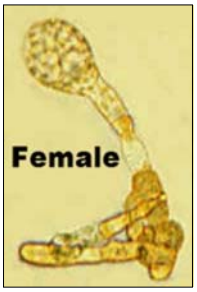
- Saxicolous
- -Sporangia always unilocular
- Most have sieve cells/elements

Order: Laminariales……

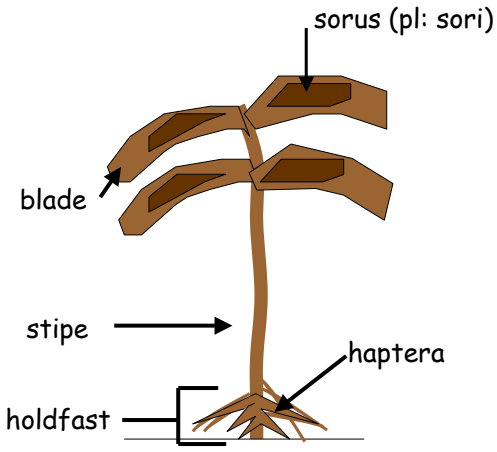
1. Life History and Reproduction
   - diplohaplontic alternation of generations
   - oogamy
2. Macrothallus Construction:
   - parenchymatous
3. Growth
   - intercalary
   - meristodermal



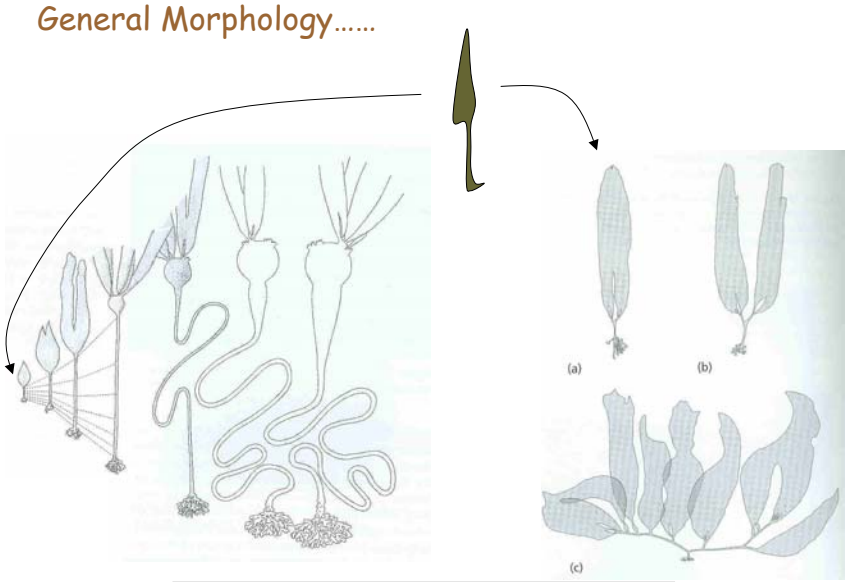




General Morphology……

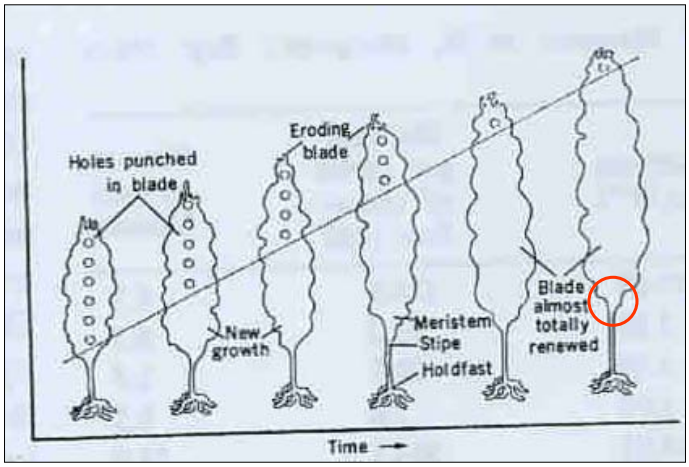


General Morphology……



All the baby kelps look the same

Growth……intercalary……



"transition zone"

- Growth in both directions away from meristem
- Usually between stipe and blade (or blade and pneumatocyst)

Growth……meristodermal……

meristoderm/outer cortex – outermost cells

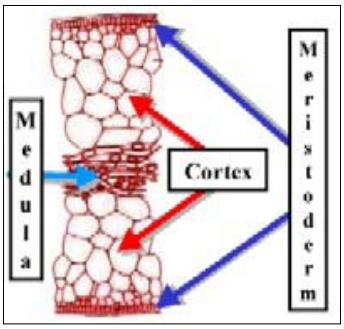
inner cortex – unpigmented cells

medulla – contains specialized cells (sieve elements)

Meristodermal growth gives thallus girth (mostly)

Periclinal vs. Anticlinal cell division:

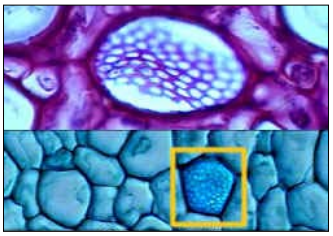
- Periclinal = cell division parallel to the plane meristoderm
- Anticlinal = cell division perpendicular to the plane of the meristoderm



Transport:

sieve elements, sieve cells, or trumpet hyphae

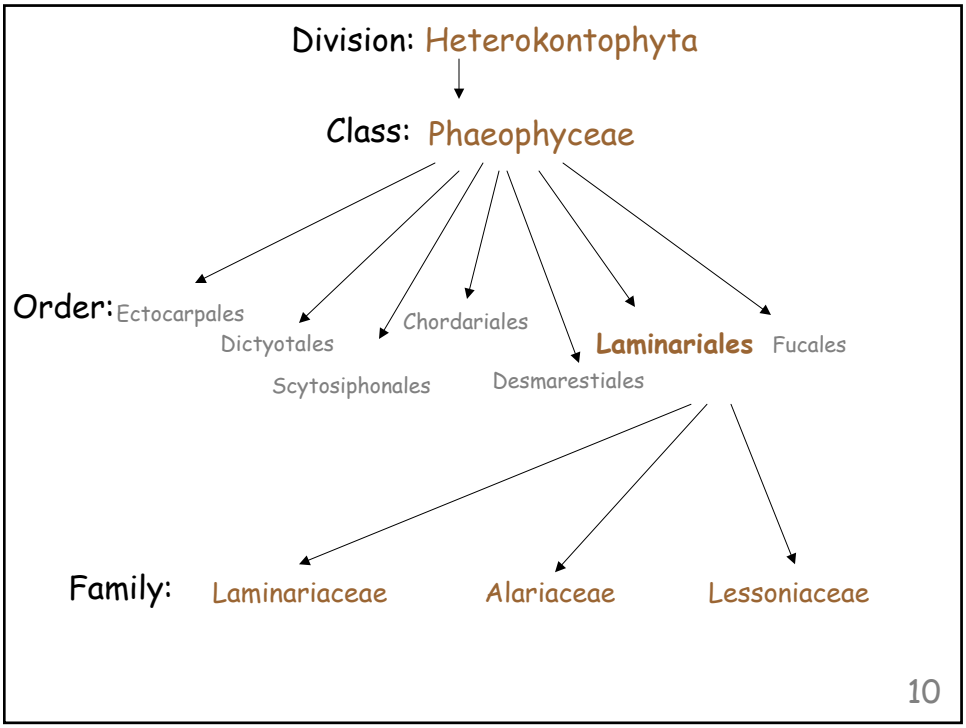
- transport photosynthetic products
- outgrowths of cortex cells that grow into the medulla
- don't divide again after formation, so they get drawn out into long thin "trumpets" during meristodermal growth
- they have sieve plates with pores between cells



Transport in Plants vs. Algae

Plants	Algae
• have water and sugar conducting cells	• only conduct sugars
•xylem → non-living	
• sieve elements → alive	•sieve elements → alive
•lack organelles	•lack organelles except mitochondria
•have companion cells	• no companion cells

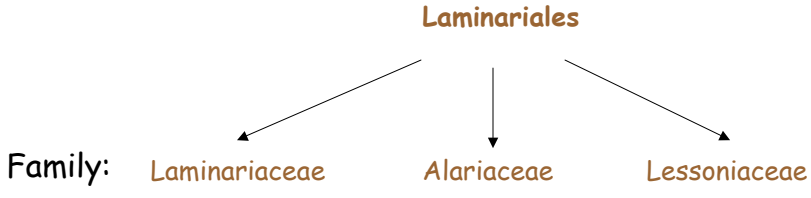
**completely independent evolutionary origins!!



Distinguishing between families……..

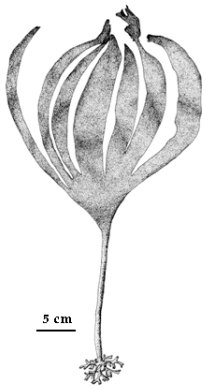
1. Blade splitting?
   - Does it occur?
   - Does it extend into the intercalary meristem?

2. Sori on main blades or sporophylls (specialized reproductive blades)



Family: Laminariaceae…….

1. Blade splits but does not extend into meristem
2. Sori on main blade



Laminaria setchelli

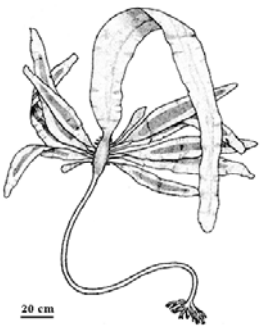
Laminaria farlowii

Laminaria sinclairii

Family: Alariaceae……

1. No blade splitting (lateral blades produced from stipe)
2. Sori produced on sporophylls

Alaria marginata

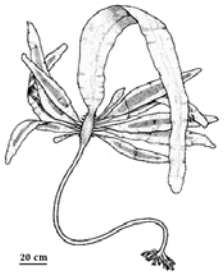


Pterogophora californica

Egregia menziesii

Pterogophora californica = the walking kelp

- understory kelp
- woody stipe, terminal vegetative blade and lateral sporophylls
- perennial – up to 25 years old!
- growth rings in stipe, just like trees
- "walking"



Egregia menziesii = feather boa kelp

- Midrib = rachis
- Sporophylls – deeper brown color; shorter and more narrow than vegitative blades and dispersed among them
- Intercalary meristem in upper portion of rachis

Family: Lessoniaceae……..

1. Blade splits and may extend into meristematic region
2. Sori on sporophylls?

Postelsia palmaeformis

Macrocystis pyrifera

Nereocystis luetkeana

Postelsia palmaeformis = the sea palm

• grows in high wave exposed habitats

•Blade surface with deep longitudinal grooves

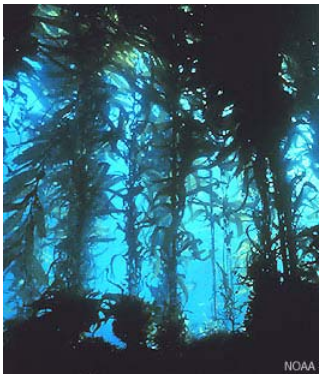
• sporangia in linear sori lining grooves

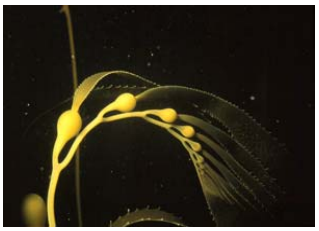
• zoospores released drip down grooves to land on:
- •Mussels
- •Bare rock
- •Below mussels

• winter storms rip out mussels which open up space for light

Macrocystis pyrifera = the giant kelp

- Major canopy kelp, up to 60 m in length
- Capable of high growth rates: 1-2 ft/day!
- Perennial, but individual blades only last ~ 2 - 6 mos
- Apical scimitar blade
- Intercalary meristem between blade and pneumatocyst





Nereocystis luetkeana = the bull kelp

- Major canopy species locally
- Haptera holdfast
- Stipe to 35 m long
- Single big pneumatocyst filled with carbon dioxide and monoxide
- Annual!!! Most growth March-Sept (~200 days to get that big… ave. of 7"/day!)
- Sori?

History of Kelp Harvest

-17th century – kelp ash – French peasants used for glazing pottery and making low quaility glass

-1811 – discovery of iodine in kelps – used to treat goiter – enlargement of the thyroid gland

- Current industrial use is for alginates

-West coast of U.S. = *Macrocystis, Nereocystis*

- Harvest regulated by CA DFG: can cut only upper 1.2 m

- Kelp beds designated by number, some are leased by harvesting companies -San Diego based firm, ISP alginates (AKA Kelco) largest in world

Division: Heterokontophyta

Class: Phaeophyceae

Order: Ectocarpales, Dictyotales, Scytosiphonales, Chordariales, Desmarestiales, Laminariales, **Fucales**

Celebrity genera: ***Fucus, Silvetia, Pelvetiopsis, Sargassum, Cystoseira***

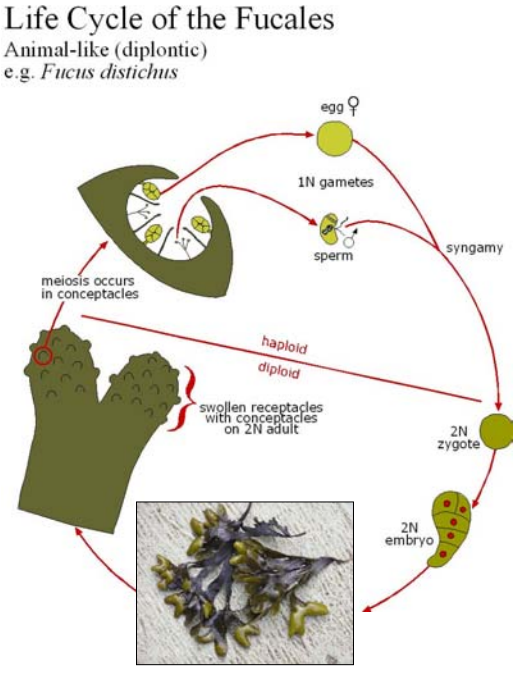
-usually saxicolus

- unattached in some cases

- unilocular gametangia

Order: Fucales……

1. Life History and Reproduction
   - diplontic ("animal-like")
   - oogamy
2. Macrothallus Construction:
   - parenchymatous
3. Growth
   - apical

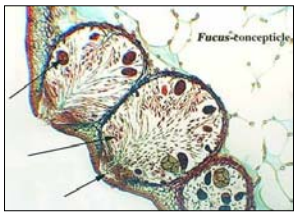


Fucus……Silvetia……Pelvetiopsis

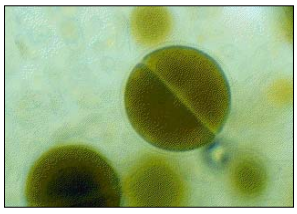
broad blade

woody stipe

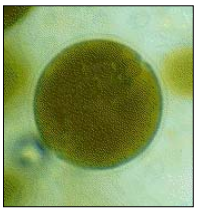
small



8 eggs per oogonia

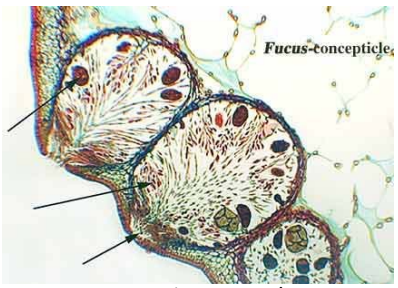


2 eggs per oogonia

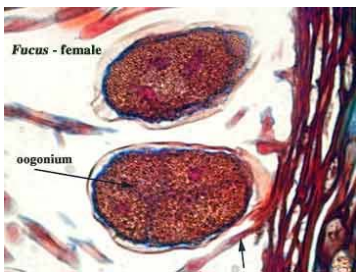


1 egg per oogonia

Receptacles



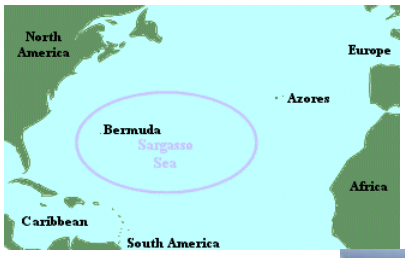
Conceptacles



Oogonia/Antheridia

Sargassum.....

Sargasso Sea in the Atlantic



=Unattached *Sargassum* sp

©Henry Genthe

Cystoseira

Sargassum