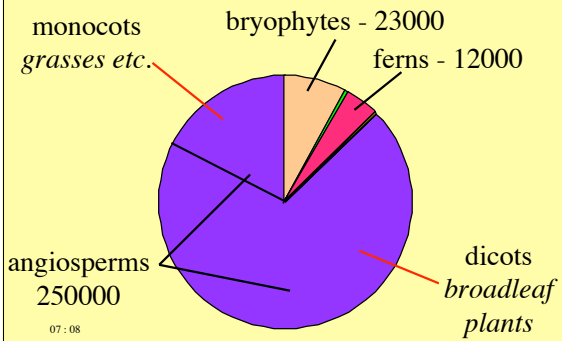
Plant Diversity - ~300,000 spp.



07 : 08

Steps in Evolutionary Development

early plants must have been low to ground
WHY?

but strong selection favoured taller stature
WHY?

taller stature aggravates problems of
gravity heating drying

general advantages of water-independence

07 : 08 3

as representatives of early plant grade
we may study **Bryophytes** - mosses & allies

small, low; no skeleton

erect only by cellulose cell-walls & turgor

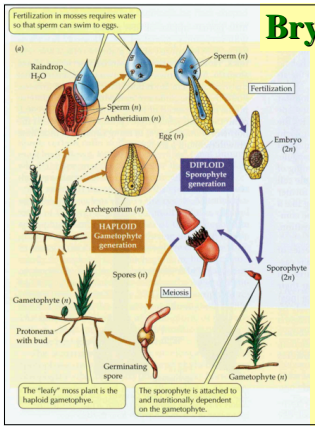
poor fluid transport, no true roots or cuticle;
nutrients & H_2O absorbed over whole body

needs free H_2O for fertilization; sperm **swims**

but can withstand extended desiccation
and temperature extremes [-100° to +100°C]

07 : 08 4

Bryophyte life cycle



the prominent plant is the **haploid gametophyte**

fertilization **water-dependent**

meiosis rapidly generates **haploid spores**

5

from LIFE by Purves, Orians, Heller & Sadava

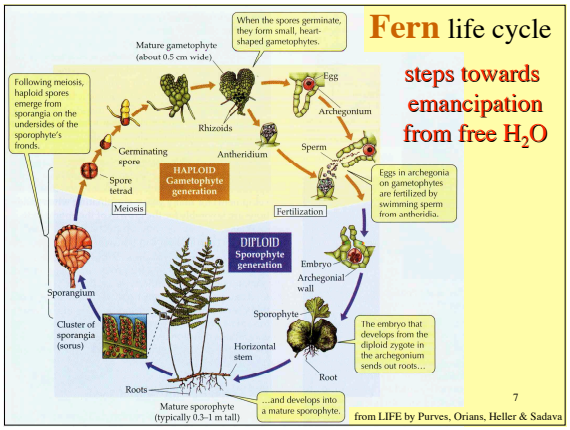
all Tracheophytes have solved problems of gravity, fluid transport and H_2O loss

have woody skeleton, xylem and phloem vessels, stomata & cuticle

but vary in development of roots and leaves & adaptation of reproductive structures

all show great reduction of haploid gametophyte generation - main "plant" becomes the diploid SPOROPHYTE

07 : 08 6



FURTHER ADAPTATIVE TRENDS

colonization of dryer uplands facilitated by greater water independence of life cycle

-> further reduction of gametophyte; cryptic & non-free-living

evolution of pollen & seeds; eventually fruits

pollen & seeds attracted animals
-> interactions with insects & other animals

07 : 08 8

GYMNOSPERMS - conifers

gametes borne on single-sex cones

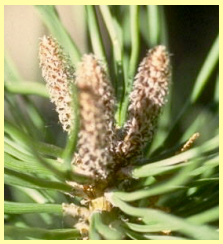
males cones release pollen

female cones have naked ovule
- no carpel, style, stigma

wind pollination only;
embryo -> naked, usually winged, seed

07 : 08 9

male cones

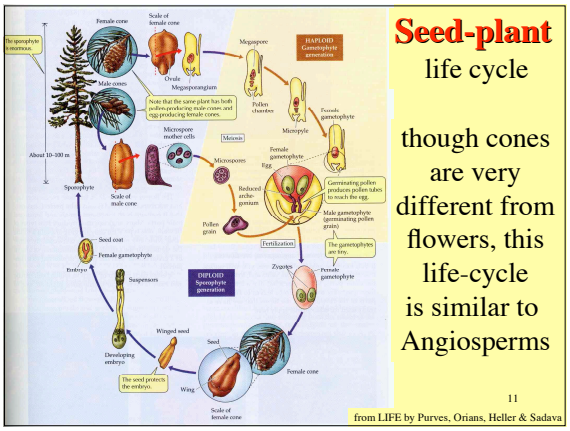


produce pollen

female cones

generate seeds

07 : 08 10



ANGIOSPERMS - flowering plants

reproductive organs in flowers; 1 or 2 sexes

sepals & petals (modified leaves) -> perianth

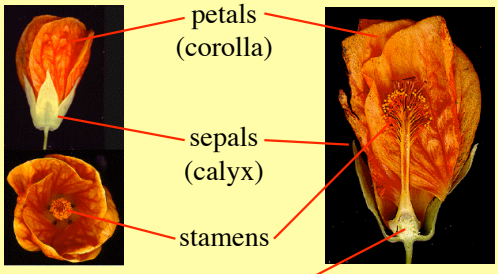
stamens -> pollen; carpels -> ovules

pollination and dispersal of seed/fruit either by wind or animal agency, in main

-> highly complex adaptive arrangements food, sex, mechanical devices

07 : 08 12

parts of a flower



07 : 08 13

plants began ~450m.y.a.;
by 350m.y.a. world covered by forests
of lycopods and allies [-> coal deposits]

Gymnosperms + Ferns dominated
the globe in MESOZOIC [dinosaurs]

at end-Cretaceous [~65m.y.a.] Angiosperms
began rapid rise; now dominate other
groups in all but boreal zone

begin interactions with rising insects
birds and mammals

07 : 08 14

three major plant-animal evolutionary interactions:

pollination

fruit/seed dispersal

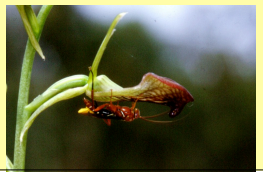
these probably involved in great success
of flowering plants and *vice versa*

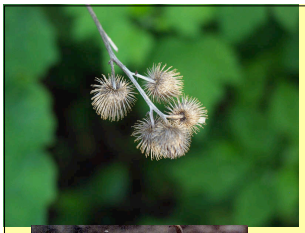
herbivory

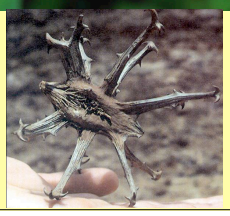
stimulated plants into biological warfare

07 : 08 15

POLLINATION







ANIMAL
SEED & FRUIT
DISPERSAL

17

HERBIVORY

plants produce an enormous and
largely unknown array of
secondary chemicals to combat herbivores

these chemicals are the basis of a growing
pharmaceutical industry

cyanide, caffeine, cocaine, mescaline,
curare, nicotine, atropine, strychnine,
morphine, quinine, codeine, digitalis,
and many, many, more…..

07 : 08 18

other biotic interactions

Nitrogen-fixing bacteria
e.g. *Rhizobium, Azotobacter*

form nodules on roots, especially legumes;
bacteria fix atmospheric N_2

roots secrete organic energy-source for bacteria

07 : 08

finally must mention a FUNDAMENTAL plant interaction with **FUNGI**

MYCORRHIZAE

a symbiosis between fungi and plant roots

some believe this symbiosis to have been crucial in plants' colonization of the land

>90% plants have mycorrhizae;
many are totally dependent on them

07 : 08 20

positive effects of mycorrhizae on pine growth

image by Laura Marx, Kenyon College

07 : 08 21

NEXT CLASS:

The Animals
- life in the fast lane

07 : 08 22

the images used in this presentation derive from these two excellent sites:

http://www.science.siu.edu/landplants/

http://www.dipbot.unict.it/sistematica/xIndex.html

07 : 08 23