Kingdom Plantae

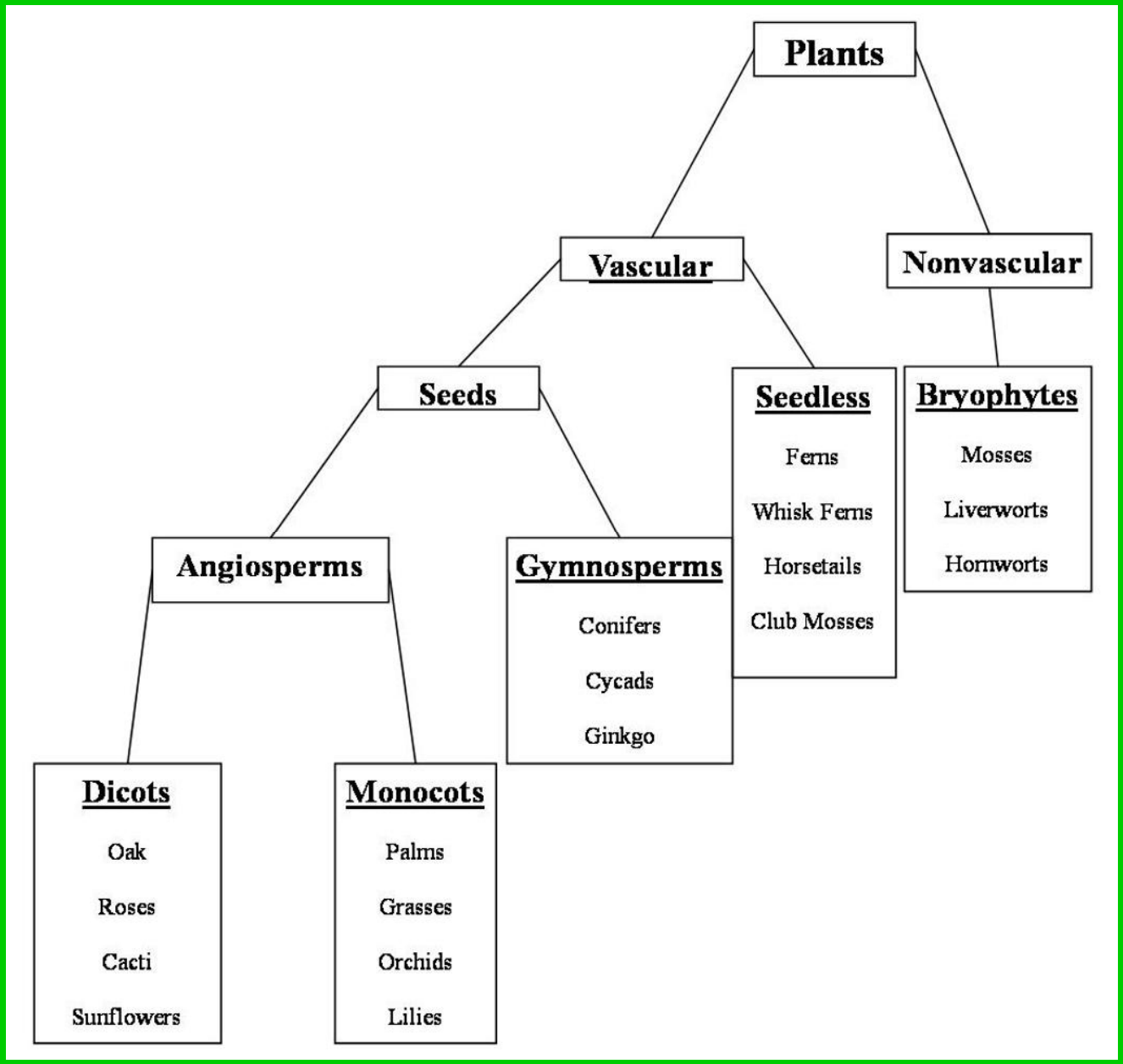
General Characteristics

- Eukaryotic cells (true nucleus, organelles)
- Multicellular.
- Photosynthetic (Autotrophs)
- Plant cells have cell walls made of **cellulose**.
  - Provides support for plant to stand upright.
  - Cells also have waxy cuticle to keep water in.

- Most have **vascular tissue**.
  - An internal system of tubes that transports water and nutrients throughout the plant.
  - Needed since the plant is no longer surrounded by water.
- Most are **sessile**—they cannot move on their own.

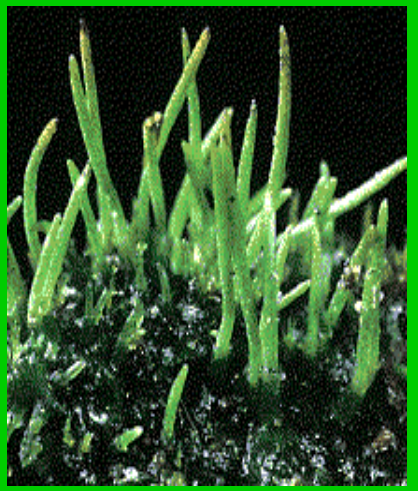
- Reproduce using **Alternation of Generations**.
  - The alternating between 2 different plant forms.
  - One form is always haploid and produces gametes. (Gametophyte)
  - One form is always diploid and produces spores. (Sporophyte)
  - One of the 2 forms is usually larger and longer lived than the other.

- Plants are separated into 2 major groups:
  - Bryophytes (nonvascular plants)
  - Tracheophytes (vascular plants)
    - Ferns (seedless)
    - Gymnosperms or cone-bearing (form naked seeds)
    - Angiosperms or flowering (seeds enclosed in fruit)


Plants
Vascular
Nonvascular
Seeds
Seedless
Ferns
Whisk Ferns
Horsetails
Club Mosses
Bryophytes
Mosses
Liverworts
Hornworts
Angiosperms
Gymnosperms
Conifers
Cycads
Ginkgo
Dicots
Oak
Roses
Cacti
Sunflowers
Monocots
Palms
Grasses
Orchids
Lilies

Bryophytes

- Nonvascular plants.
- These are considered to be the most primitive plants.
- Ex. mosses, liverworts, and hornworts.



- No vascular tissue.
- Grow mainly in shady areas that are very moist.
  - Grow close to the ground (less than 1 inch high).



  - Sperm must swim through the water to reach the egg.

- **<u>Gametophyte</u>** stage (generation) is dominant.
- Sporophytes are the long, skinny stalks that project out of the gametophyte.

- No true roots, stems, or leaves (due to lack of vascular tissues).
- Water and other substances enter the plant by **diffusion**.
- **Rhizoids** — hairlike structures that anchor the plant.

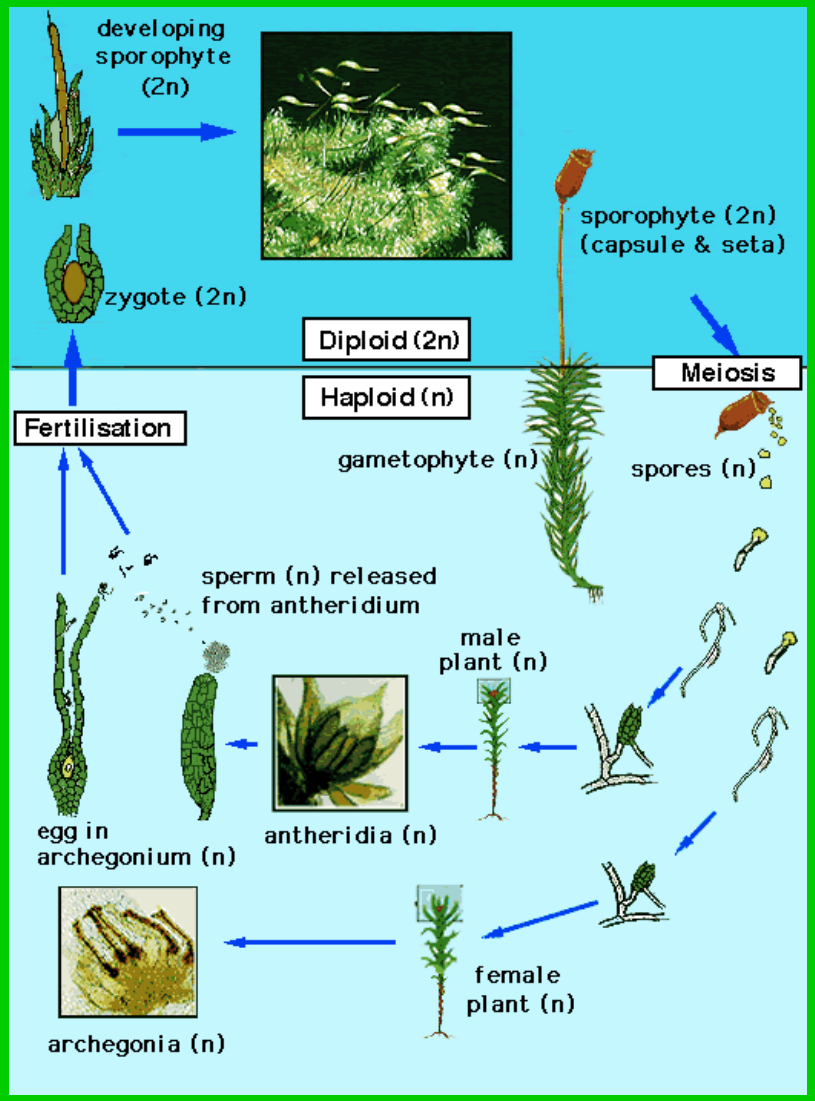
- Cushion appearance.

Importance of Mosses

- Pioneer plants
  - Prevent erosion.
  - Provide minerals to soil.
- Sphagnum moss
  - Forms peat bogs – the peat is burned as fuel.

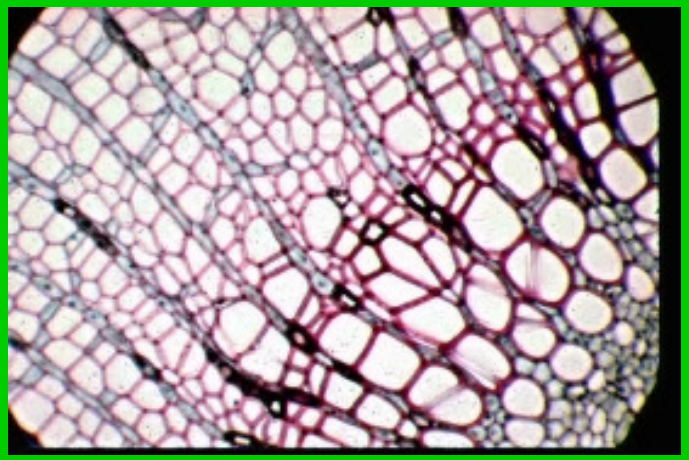
  - Used in plant nurseries as packing material.
  - They hold moisture and help the seeds of other plants to germinate and grow.

Moss Life Cycle



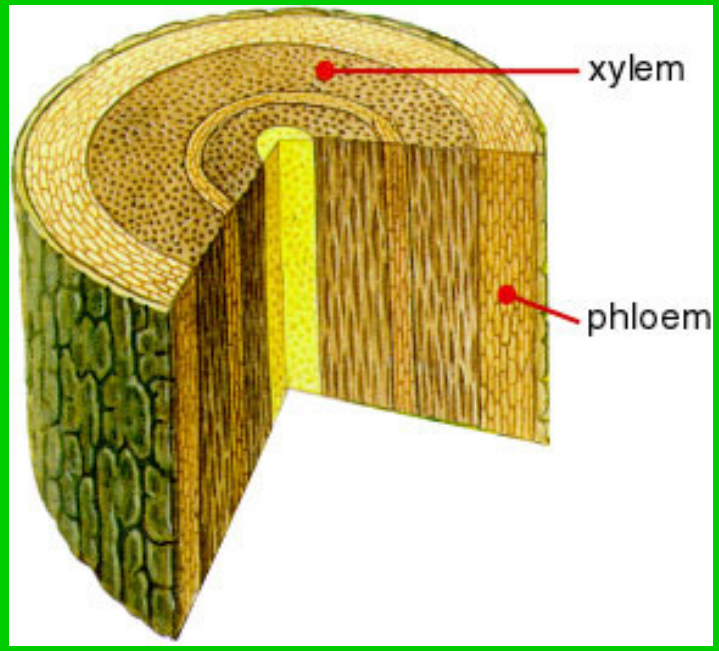
Tracheophytes

- Vascular plants
- Vascular tissue present
  - **<u>Xylem</u>**
    - Conducts water and minerals **<u>UP</u>** from the roots to the stem and leaves.



– Phloem

- Conducts dissolved food (sugars) **DOWN** from the leaves (where it was made by photosynthesis) to other parts of the plant.



- Tracheophytes are capable of growing larger than nonvascular plants due to presence of vascular tissue.
- Also capable of growing in a wide variety of environments.

2 Divisions of Vascular Plants

- A. The seedless vascular plants
  - Ex. Ferns
    - Found in a variety of environments.
    - Sporophyte generation is dominant.
    - Leaf (portion of plant seen above ground) is called a **frond**.
      - Spores can be found on the underside of the frond.
      - Spore clusters (**sori**) appear as small brown dots along the midvein of the frond leaflets.

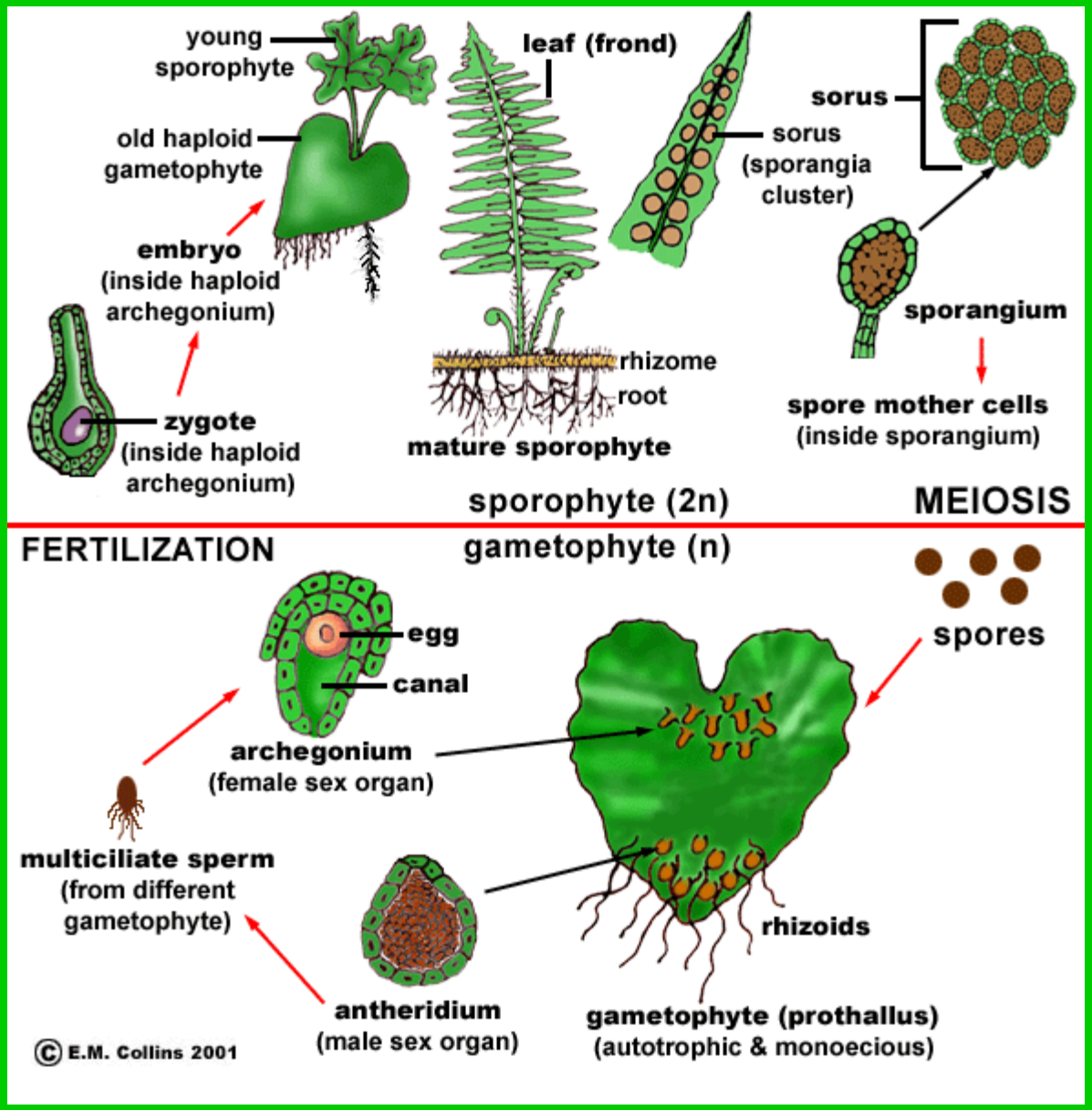
Sori with spores inside.

Sori on underside of frond.

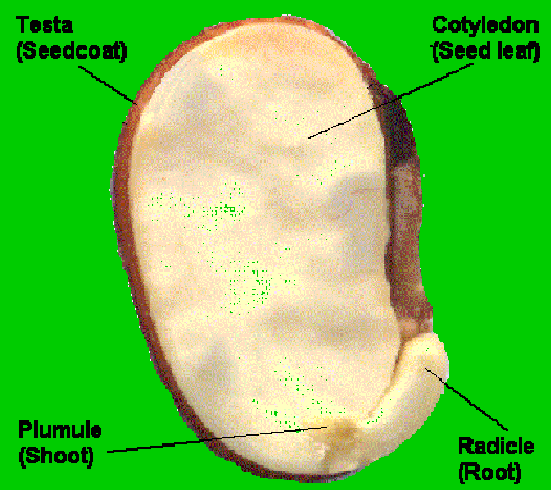
- Immature fronds are called fiddle-heads due to their curled appearance.

- Fern stems grow horizontally, underground and are called **rhizomes**.

- Roots grow from the rhizomes and extend downward.


young sporophyte
old haploid gametophyte
embryo (inside haploid archegonium)
zygote (inside haploid archegonium)
leaf (frond)
rhizome
root
mature sporophyte
sorus
sorus (sporangia cluster)
sporangium
spore mother cells (inside sporangium)
sporophyte (2n)
MEIOSIS
FERTILIZATION
gametophyte (n)
egg
canal
archegonium (female sex organ)
spores
multiciliate sperm (from different gametophyte)
antheridium (male sex organ)
rhizoids
gametophyte (prothallus) (autotrophic & monoecious)
© E.M. Collins 2001

- B. The vascular seed plants.
  - Seed
    - An embryo (young sporophyte) and a supply of food wrapped in a protective seed coat.
  - Dominant and most successful group of plants. (250,000 species)



2 Divisions of Vascular Seed Plants

- Gymnosperms
  - Seeds not enclosed in a specialized structure (naked). Seeds develop in cones.
  - Nonflowering.
  - 700 species.
  - Sex organs in cones.

Cycads

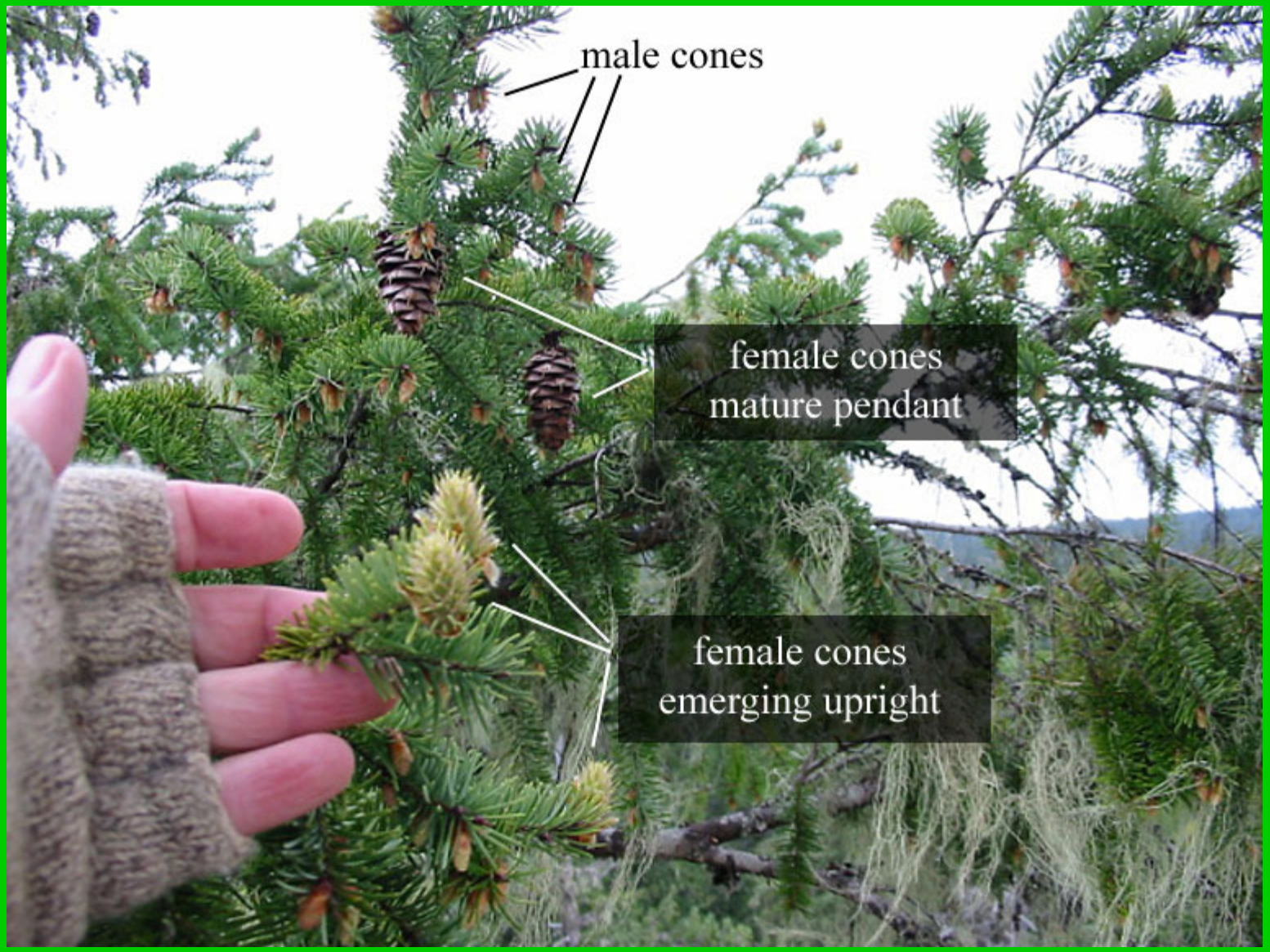
- Resemble a small palm tree.
- Leaves at top of a scaly trunk.
- Male and female parts on different trees.
- Tropical.

Ginkgo

- Ancient tree.
- Loses leaves in the fall.
- Male + female cones on different trees.
- Leaf has parallel veins.
- Female produces seeds that smell.
- Resistant to pollution + insects.

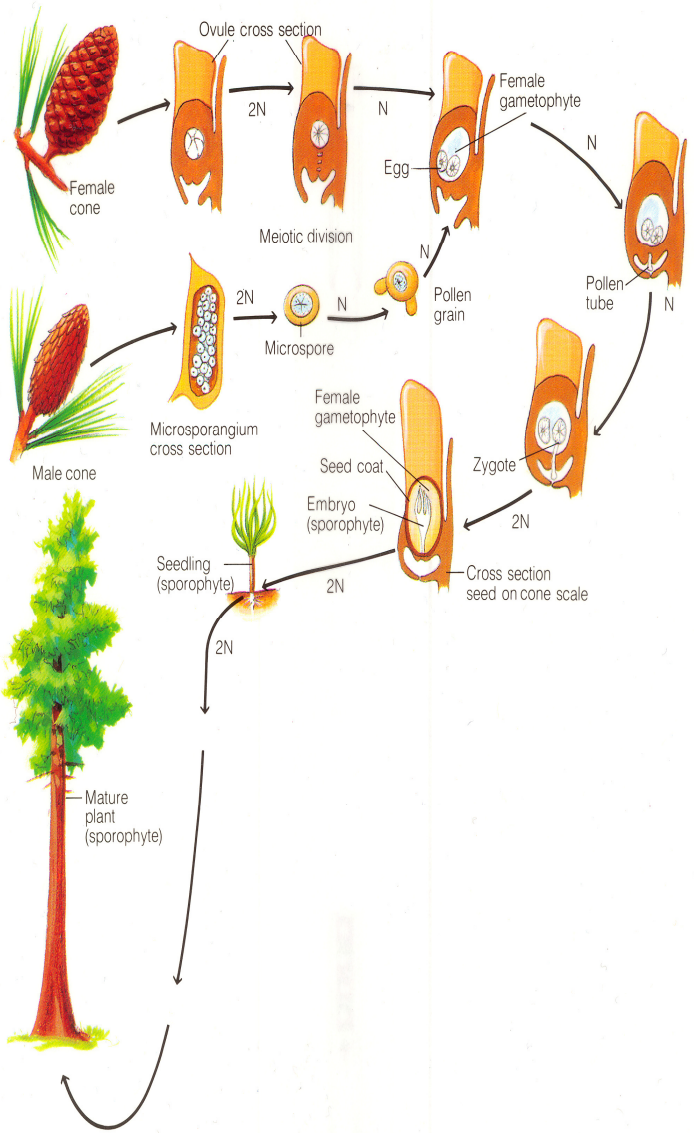
Conifers

- Largest group of gymnosperms.
- Most produce male + female cones on the same tree.
- Male cones are small and in clusters – they release pollen that looks like dust.
- Female cones become wood-like after pollination.


male cones
female cones
mature pendant
female cones
emerging upright

- Leaves in the form of needles “Evergreen” because needles remain on tree all year.
- Leaves have a very thick cuticle to prevent water loss – helps to survive winter.
- Most animals will not consume needles.
- Ex. pine, hemlock, redwood, spruce, fir, cedar, tamarack.

27. The Life Cycle of a Gymnosperm



Angiosperms

- Seed surrounded by a fruit (protects seed)
- **Flowers** produced for reproduction.
- 235,000 species, found everywhere.
- 2 forms of pollination -- the transfer of pollen (sperm) from male to female.
  - **Self-pollination** – reproductive cells are from the same plant.
  - **Cross-pollination** – reproductive cells from 2 different plants.

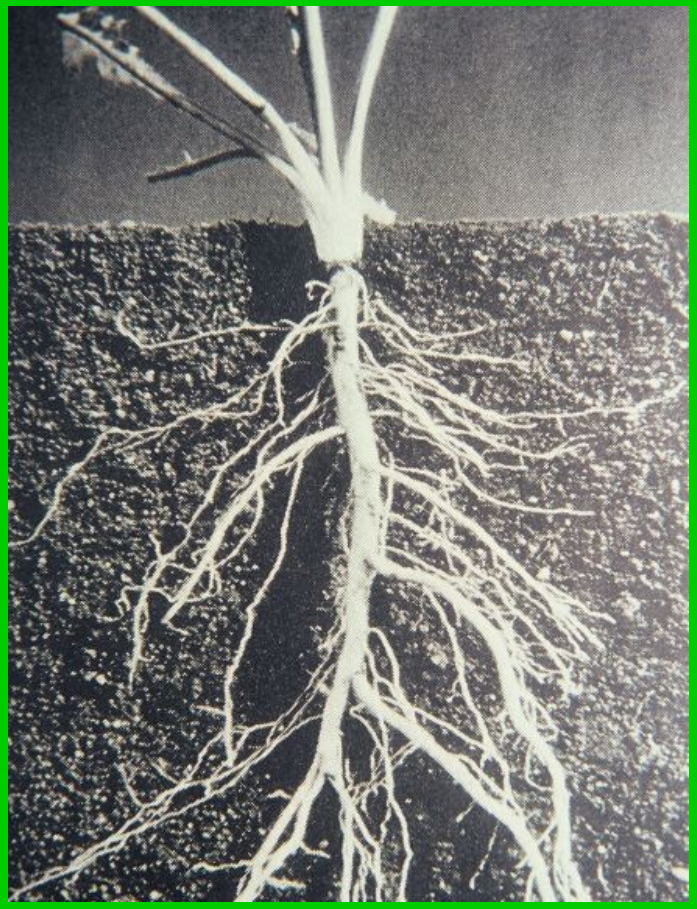
2 Groups of Angiosperms Monocots + Dicots

- Monocots
  - One seed leaf (cotyledon) on a young plant.
  - Flower parts in sets of 3.
  - Leaf veins are parallel.
  - Roots, no main root but a fibrous root system.
  - Soft stems with numerous bundles of vascular tissue scattered through the stem.
  - Bundles of xylem and phloem are separate.
  - Examples: grass, corn, lilies, irises

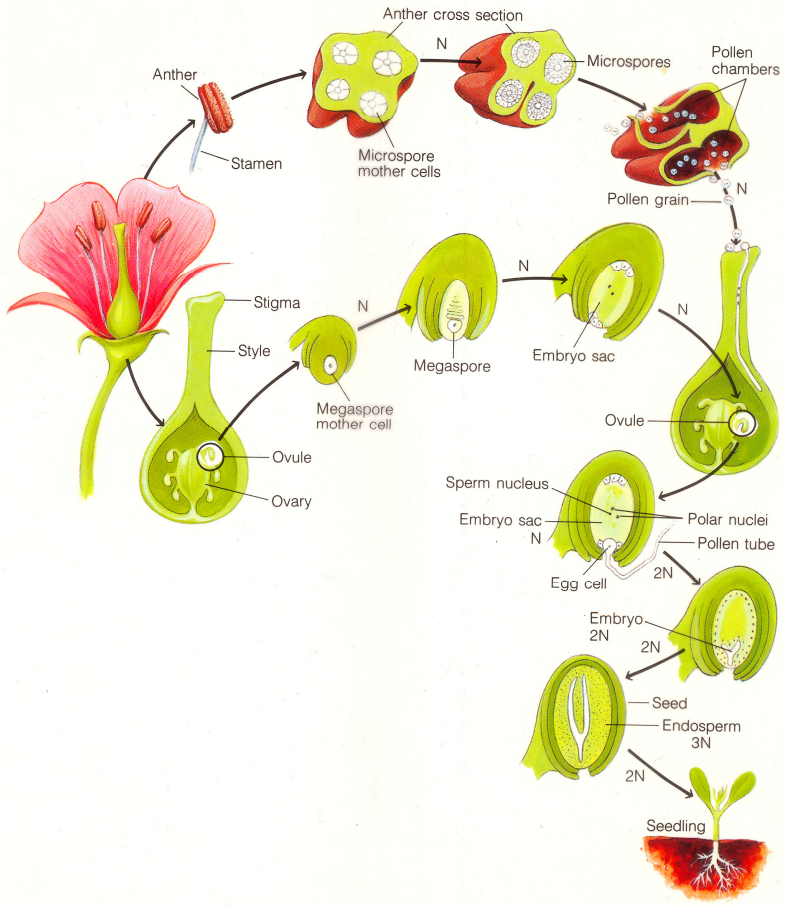
- Dicots
  - 2 seed leaves on a young plant.
  - Flower parts in sets of 4 or 5.
  - Leaf veins are branched and net-like.

- Roots; taproot present (main root) with many branching roots.
- Hard stems (wood-like) with 1 main cylinder of tissue in the stem.
- Tissues form a central bundle.
  Xylem is in the core.
  Phloem surrounds the xylem.

Ex. trees, shrubs, herbs



28. The Life Cycle of an Angiosperm



Warm-blooded Plants

The ability to maintain a constant body temperature—being warm-blooded—is a distinct advantage for modern birds and mammals. It is not a characteristic of lower animals, certainly not one expected in plants.

Surprisingly, research has shown that a common North American plant, skunk cabbage, can maintain a body temperature as much as 60 degrees higher than the immediate environment.

How is this possible? How would this serve the plant?

These are the kinds of questions such discoveries usually engender.

By conducting respiration at an incredible rate, skunk cabbage appears to be able to keep a temperature of 70° even when growing through spring snows in the Northeast.

"And now we're going to play she-loves-me, she-loves-me-not!"