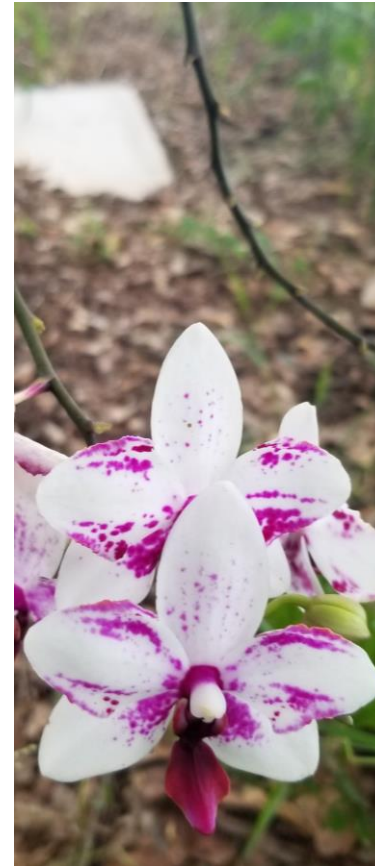


Changing of Plants Over Time

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Learning Outcomes

- Distinguish between monocot and eudicots.
- Understand the major stages in plant evolution.
- Be able to identify key characteristics of major plant groupings.

Outline

- Definitions
- Stages of plant evolution
- Major plant groups

Definitions



What is a Plant?

- A multicellular organism
- Creates sugars from sunlight
- Is made up of a shoot system and root system.



What is Botany?

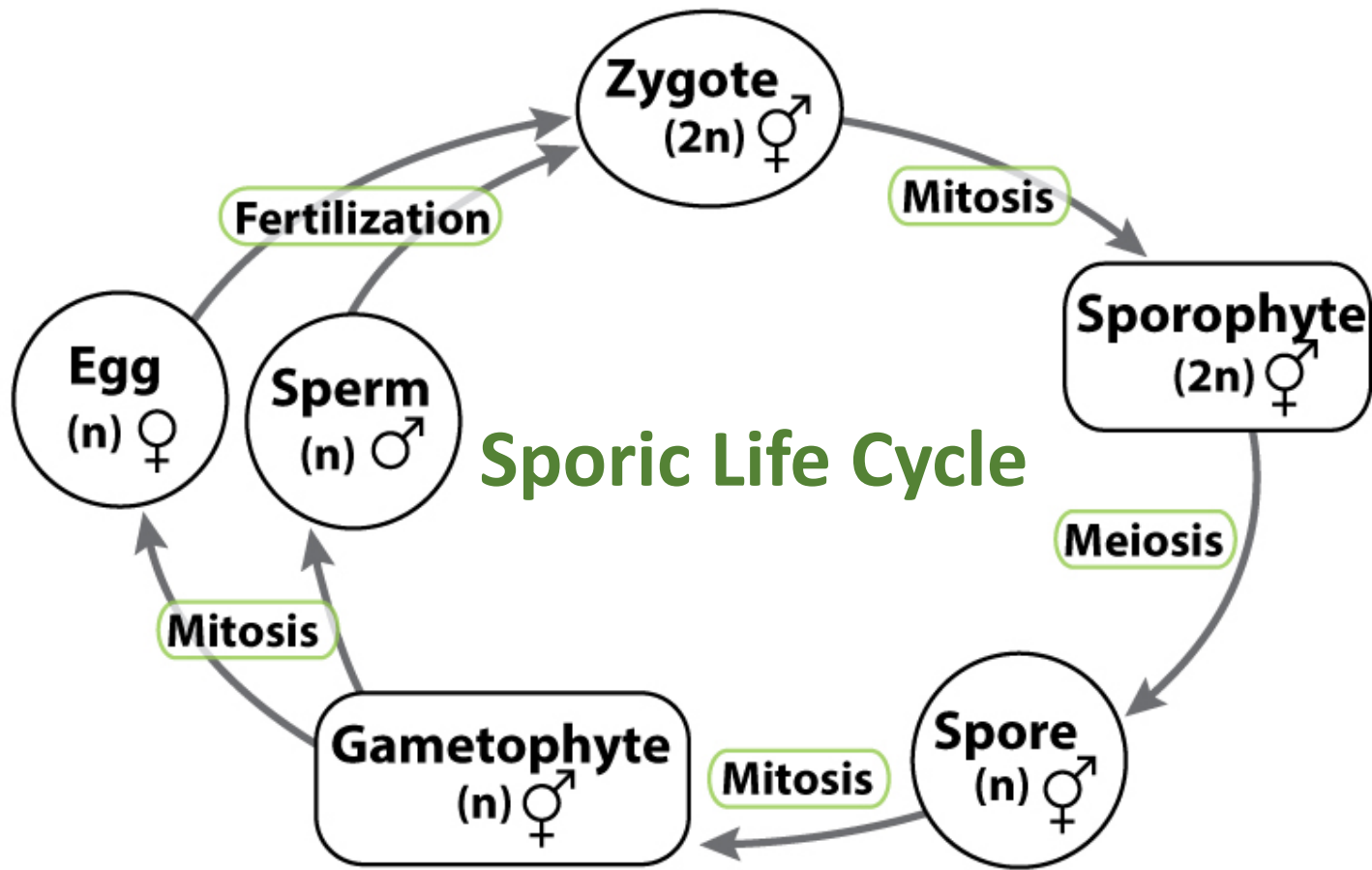
- The scientific study of plants
 - Classification/Evolution
 - Anatomy/Morphology
 - Physiology
 - Uses



What is Horticulture?

- The art and science of cultivating plants, including ornamentals, fruit, and vegetables.

Plant Evolution



1. Establishment on Land

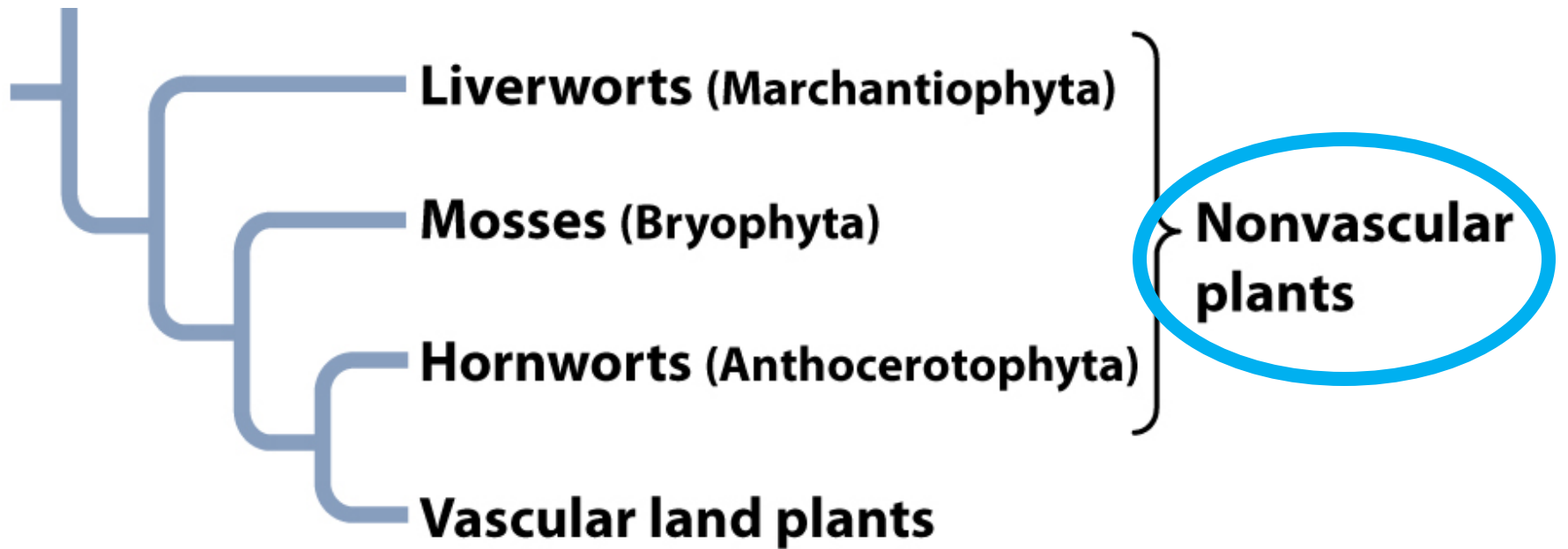
Challenges

- Dry 
- Reproduction 

Adaptations

- Grow low and close to water
- Water required for reproduction

Gametophyte life stage is dominant.



Liverworts



Mosses



Hornworts



Key Take Away

- 1st major step is land adaptation.
- Non-vascular plants took this step.



2. Vascular Tissue

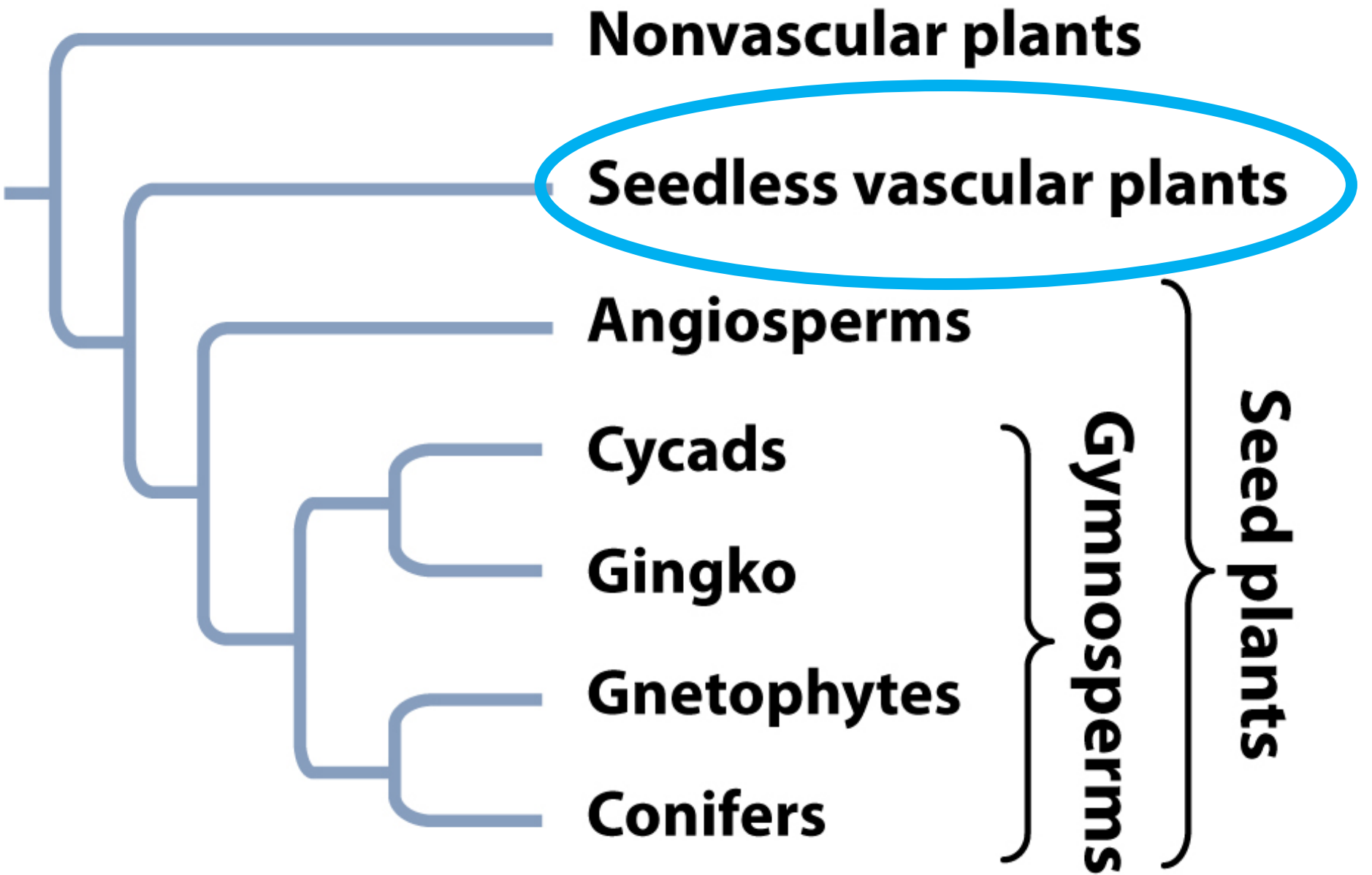
Challenges

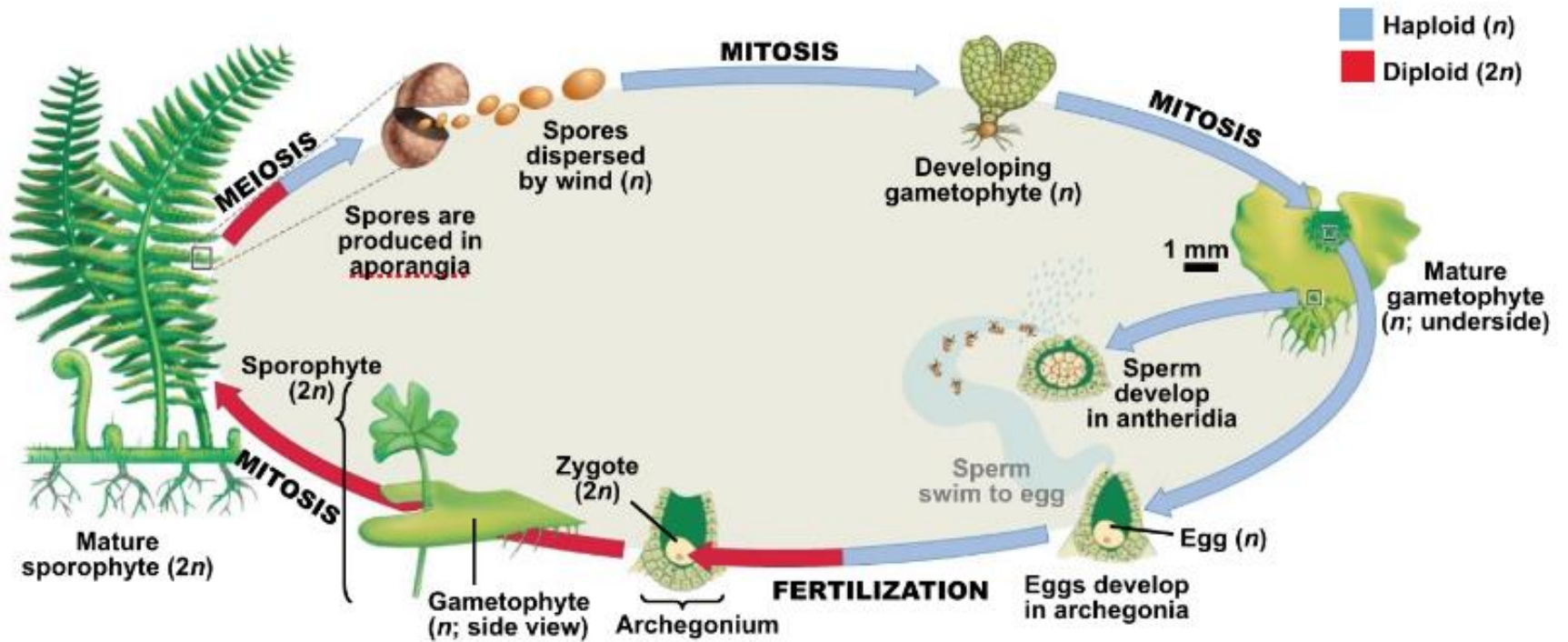
- Growing taller →
- Loosing water →
- Gas Exchange →

Adaptations

- Vascular Tissue
- Cuticle
- Stomata

Sporophyte life stage is dominant.





Division Lycophyta





Wisk Fern



Horsetails



Ferns

Division Monilophyta (a.k.a Pteridophyta):



Key Take Away

- 2nd Major step is vascular tissue
- Seedless vascular plants took this step.



3. Seeds

Challenges

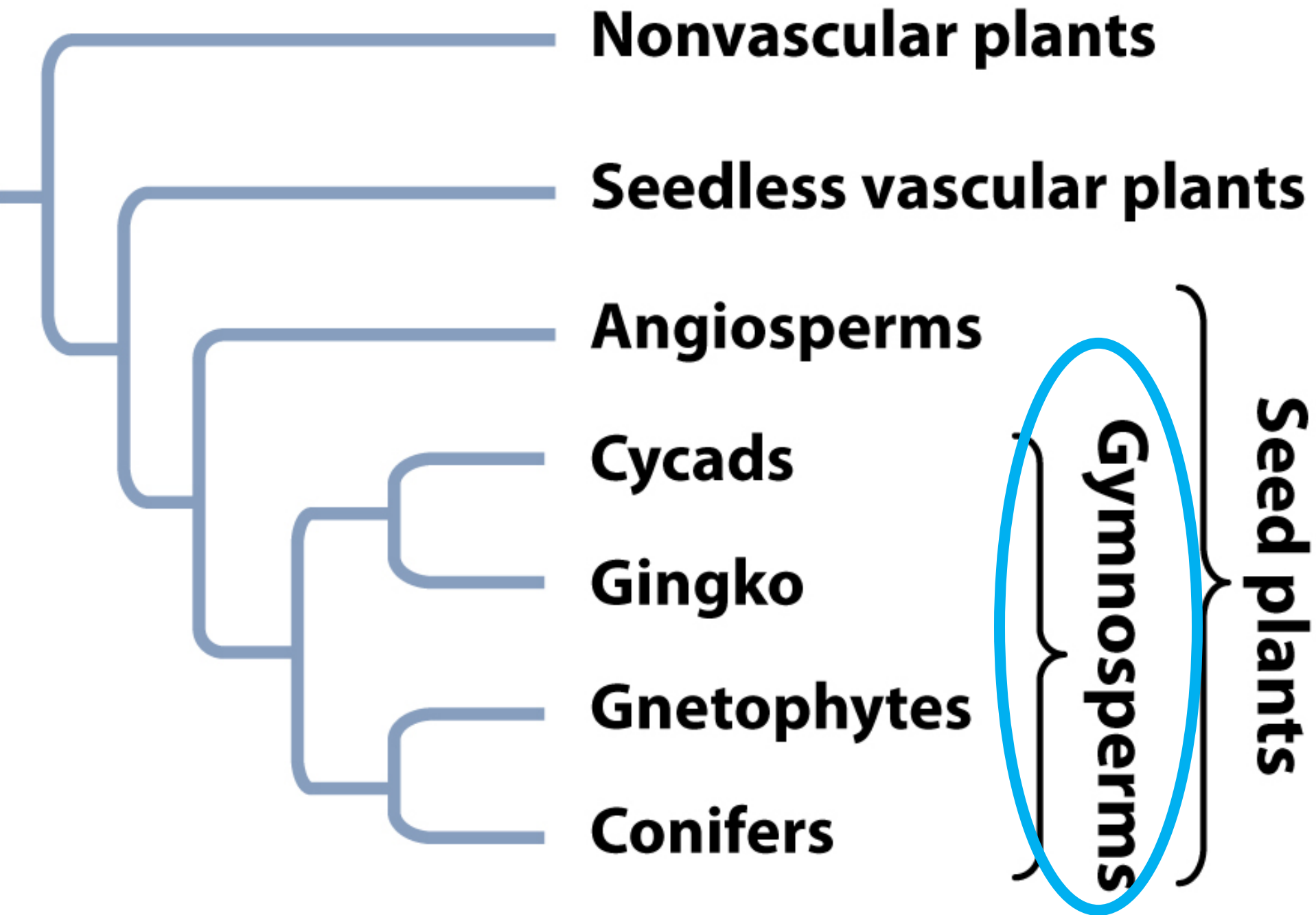
- Spores could not survive long
- Distribution
- Extra energy to produce seeds

Adaptations

- Seeds can survive a lot longer
- Seeds could move farther and survive
- Seeds germinated better than spores- worth it.

Sporophyte life stage is dominant.

‘Naked Seed’- not enclosed in ovary.



Three key features of the gymnosperm life cycle are

1. Miniaturization of their gametophytes
2. Production of seeds, a dispersible stage in the life cycle
3. The transfer of sperm to ovules by pollen.

Pinus sylvestris
(pine)

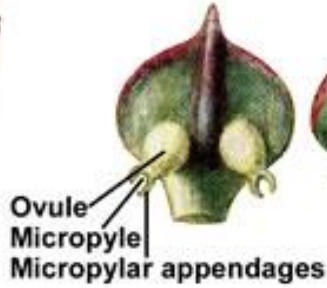
Pollen-bearing cone
(male cone) with
microsporophylls

One
year old
ovulate
cone

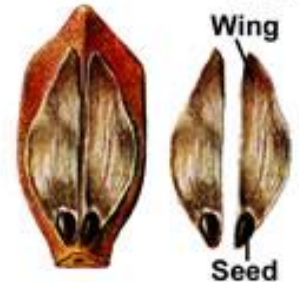
Two year old
ovulate cone



Young ovulate cone
(female cone) with
megasporophylls



Ovulate scale (megasporophyll,
ovuliferous scale) with two ovules
bottom view (left), top view (right)



Mature ovulate scale with
two winged seeds (left),
dispersed seeds (right)



From: Schmeil (1932) Leitfaden der Pflanzenkunde. Verlag von Quelle & L.Meyer, Leipzig.

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Division Cycadophyta: *Cycas* *revoluta*, king sago



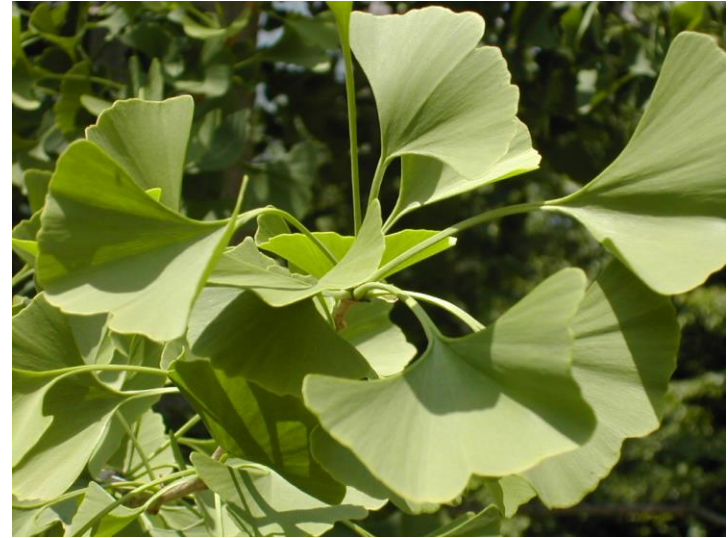
Female plant



Male plant

Division Cycadophyta: *Zamia pumila*, coontie





Division Ginkgophyta, *Ginkgo biloba*

Division Coniferophyta

- These soft wood trees are used in the timber industry.(80% of timber)
- Often used as paper pulp.
- Sap of several species of *Pinus* is used to make turpentine.



Pinaceae, *Pinus clausa*, sand pine



Pinaceae, *Pinus elliottii*, slash pine



Pinaceae, *Pinus palustris*, longleaf pine



Taxodium distichum baldcypress

Key Take Away

- 3rd Major step is seed production
- Gymnosperms took this step.
- 'Naked-Seed'
- Cycads
- Ginkgo
- Conifers

4. Flowers/Fruit

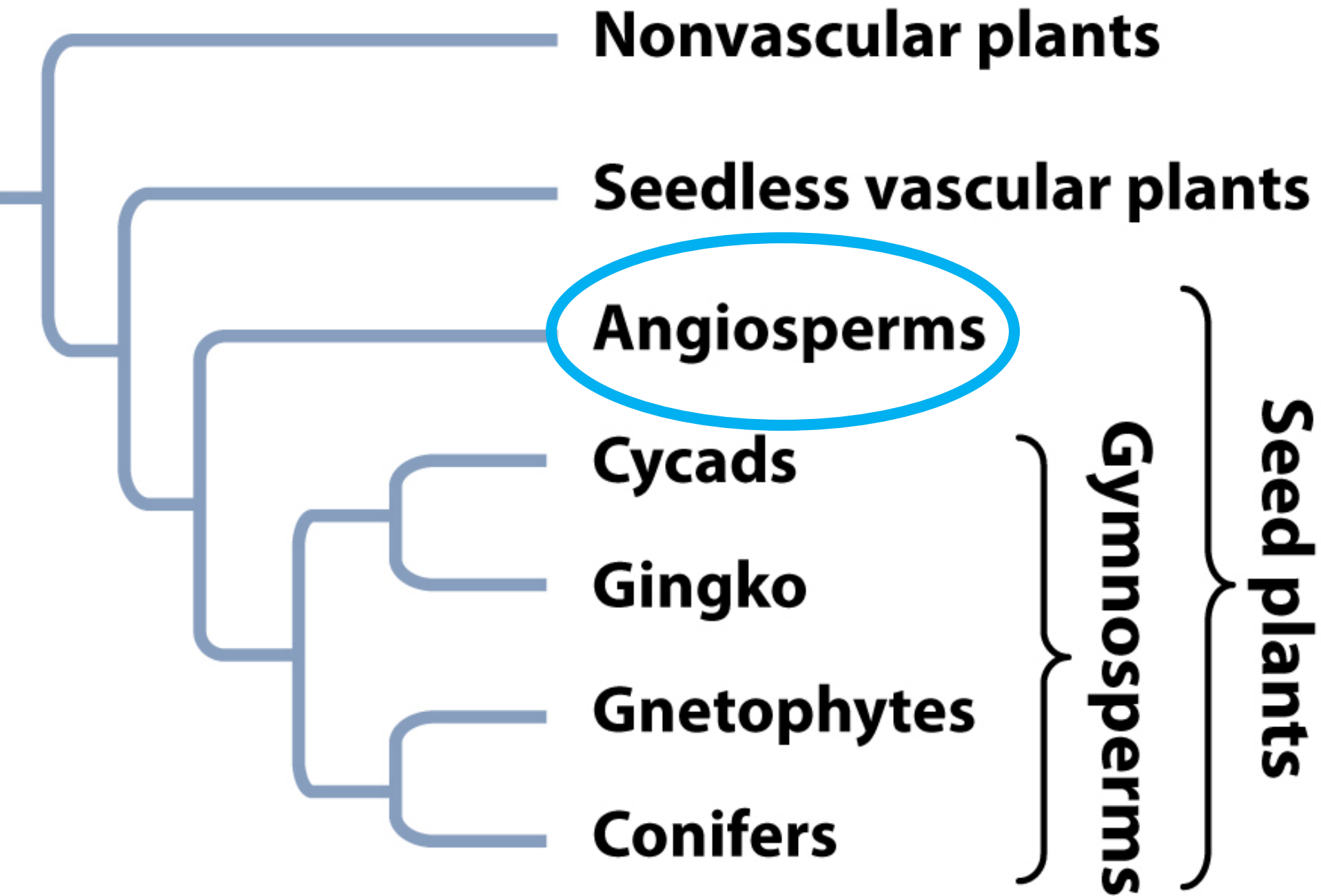
Challenges

- Pollination →
- Seed Distribution →

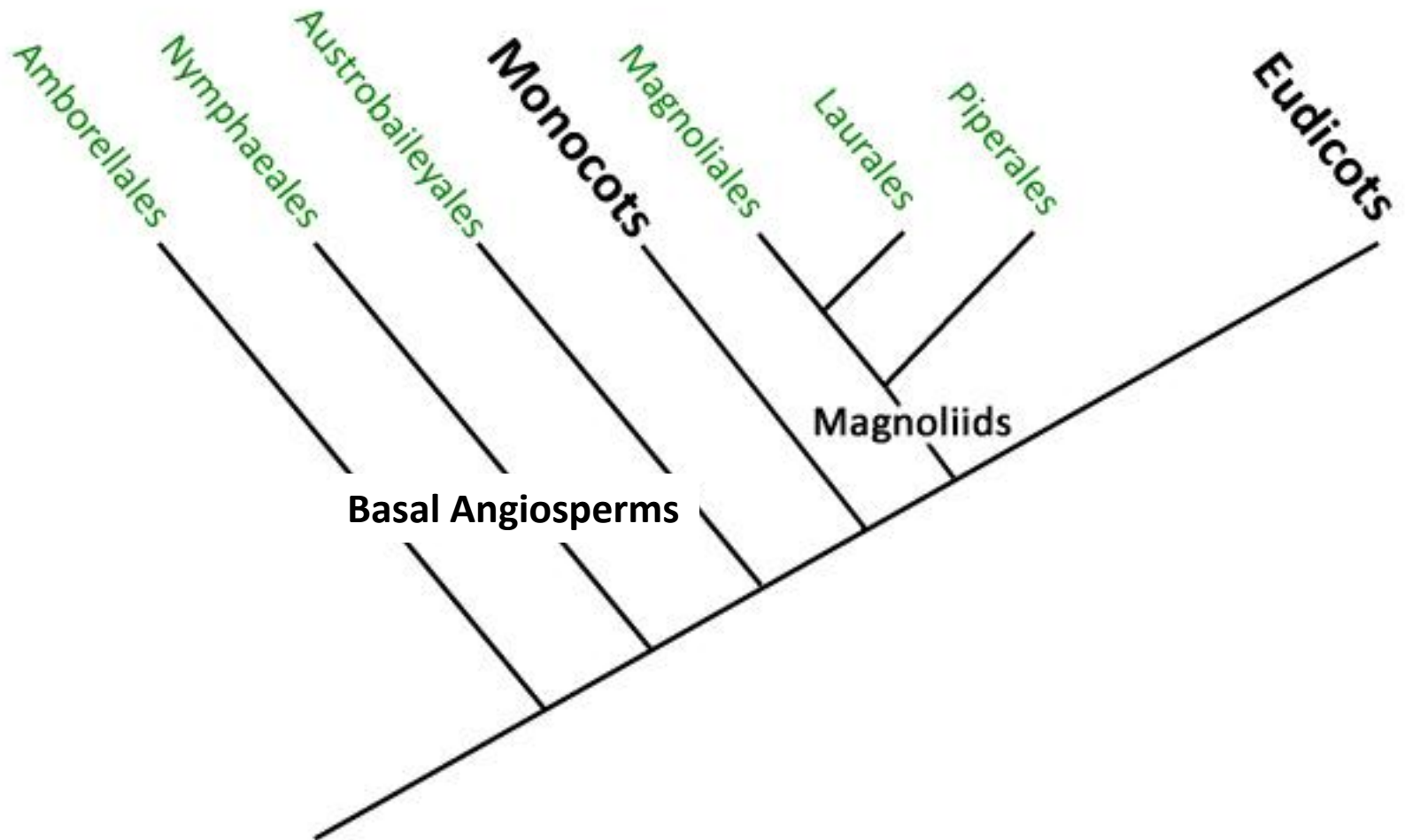
Adaptations

- Flowers with specific adaptations
- Fruit with specific adaptations

Angiosperm means “container seed.”
Seeds enclosed within an ovary (fruit)



Angiosperms



In the real world...

- **Basal Angiosperms and Magnoliids = 2%** of all angiosperms.
 - Examples: water lilies, star anise, magnolias, nutmeg, peperomias
- **Monocots = 23%** of all angiosperms.
 - Examples: grasses, orchids, bromeliads, palms
- **Eudicots (true dicots) = 75%** of all angiosperms.
 - Examples: oaks, roses, cacti, mints, asters

Basal Angiosperms



**Water lily
(*Nymphaea*
"Rene Gerard")**



Star anise (*Illicium*)



Amborella trichopoda



Magnoliids: *Magnolia grandiflora*



Members of the Piperaceae, the black pepper family


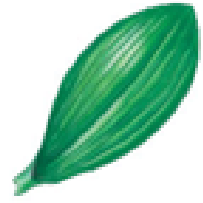
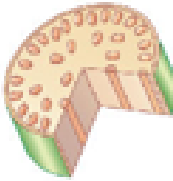






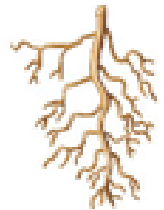

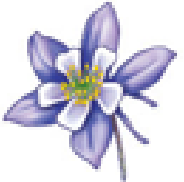
Monocots

1. Flower parts in 3's
2. One cotyledon
3. Parallel venation in leaves
4. Vascular system in scattered
5. No secondary growth

Eudicots

1. Flower parts in 4's and 5's
2. Two cotyledons
3. Net venation in leaves
4. Vascular system in a ring bundles
5. Secondary growth (they can make wood.)

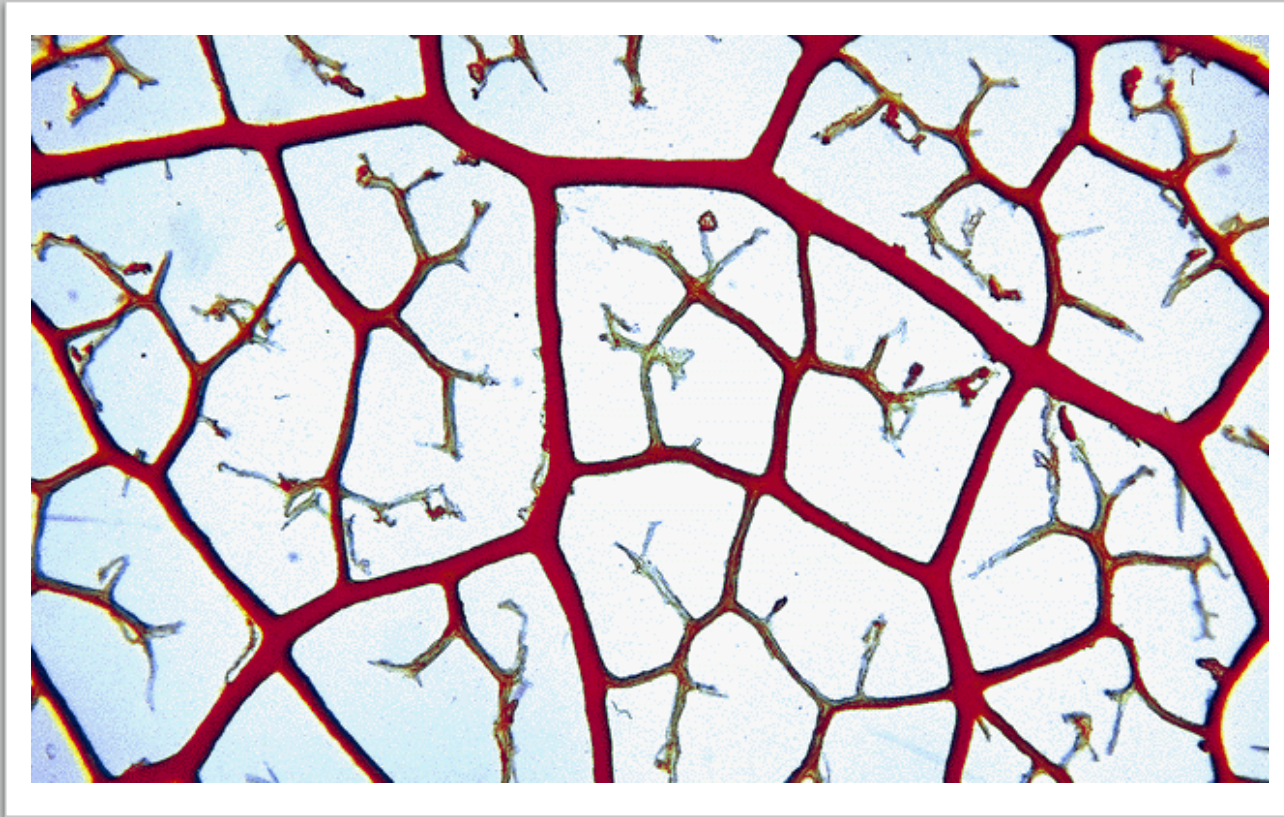
Monocot vs. Eudicot

	Embryos	Leaf venation	Stems	Roots	Pollen	Flowers
Monocot Characteristics	 One cotyledon	 Veins usually parallel	 Vascular tissue scattered	 Root system usually fibrous (no main root)	 Pollen grain with one opening	 Floral organs usually in multiples of three
Eudicot Characteristics	 Two cotyledons	 Veins usually netlike	 Vascular tissue usually arranged in ring	 Taproot (main root) usually present	 Pollen grain with three openings	 Floral organs usually in multiples of four or five



Eudicots

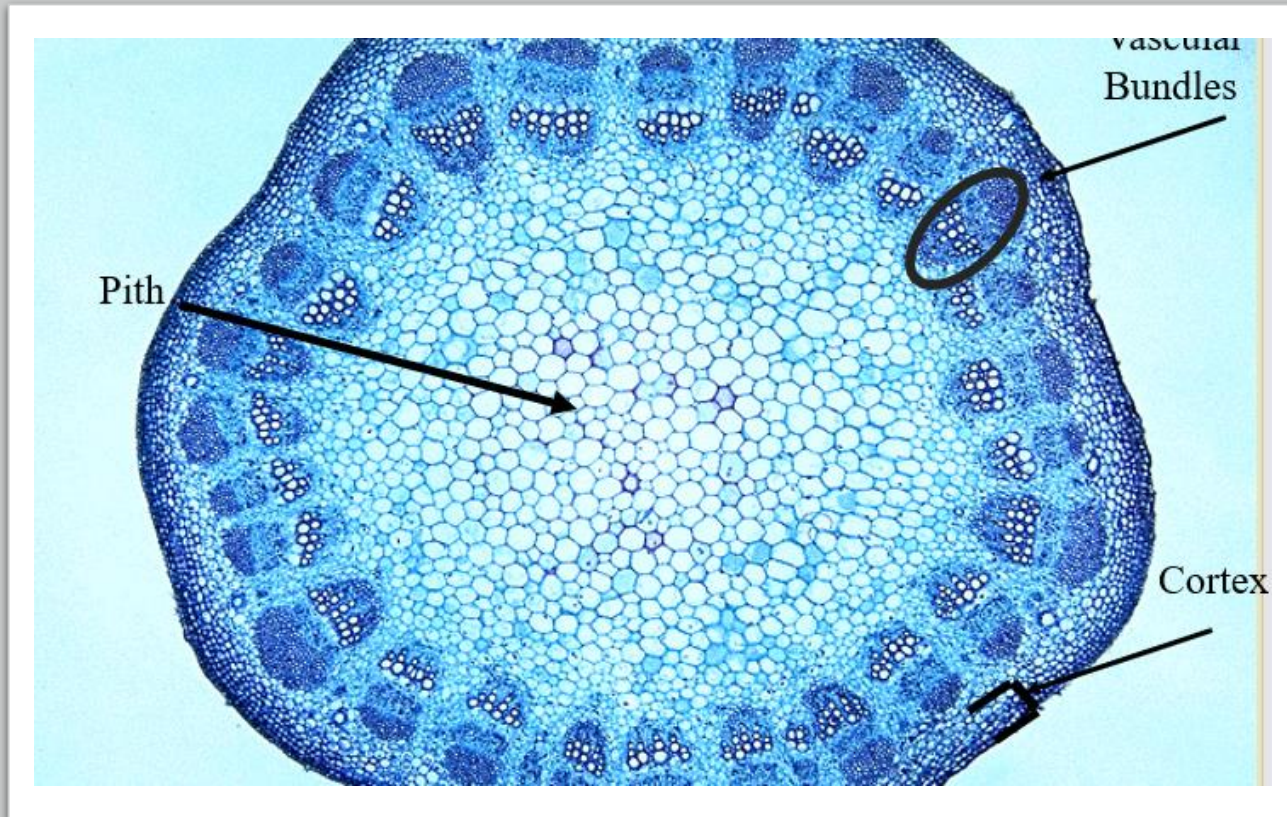
Monocots



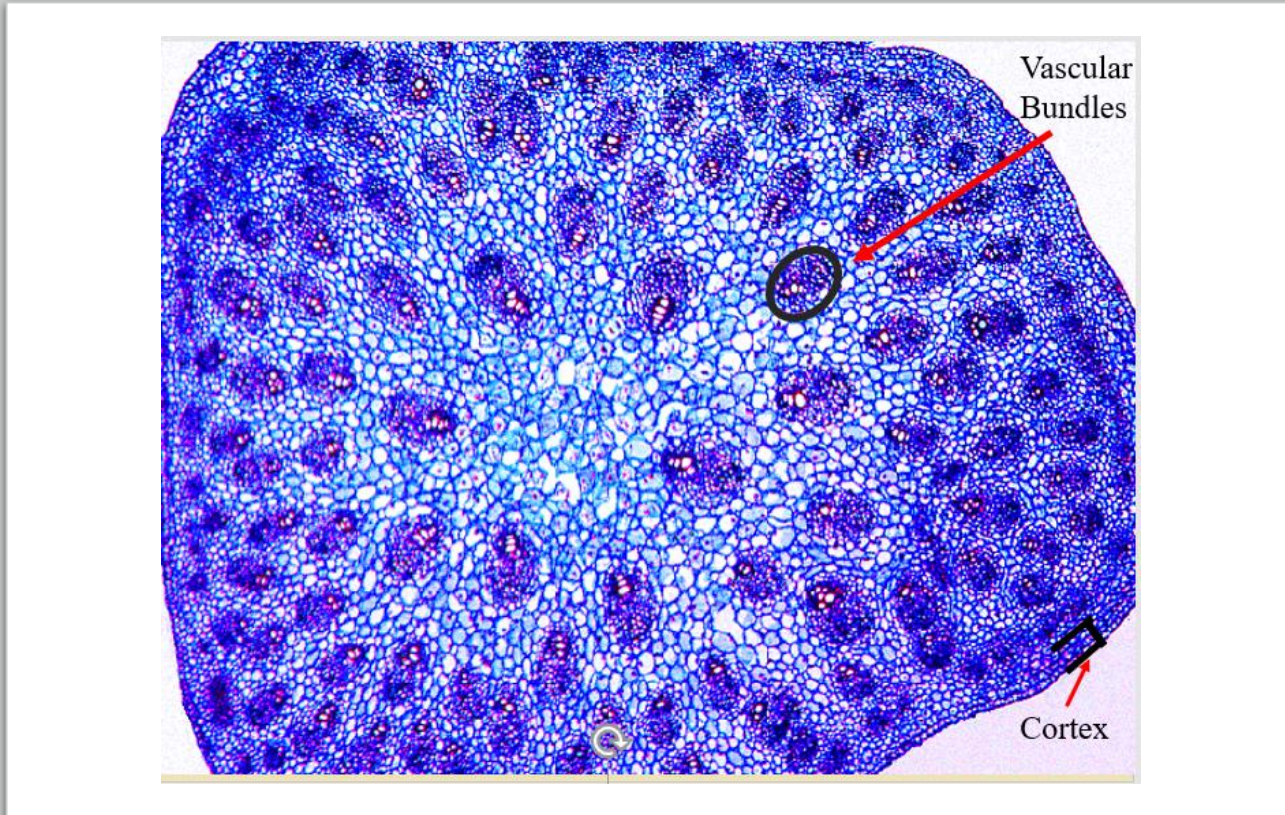
Veins in eudicot leaves form a net-like pattern.



Monocot leaves usually have parallel veins.



The vascular tissue in eudicot stems forms a ring.



Vascular bundles are scattered in monocot stems.

Key Take Away

- 4th Major step is Flower and Fruit production.
- Angiosperms took this step.
- Contains many plant groups.
- Monocot vs. Eudicot differences

You Should no be able to

- Distinguish between monocot and eudicots
- Understand the major stages in plant evolution
- Be able to identify key characteristics of major plant groupings.



Questions? |