





# Ways of Gathering Knowledge

How to we give credence to one over another? What is a more holistic way to walk with knowledge?

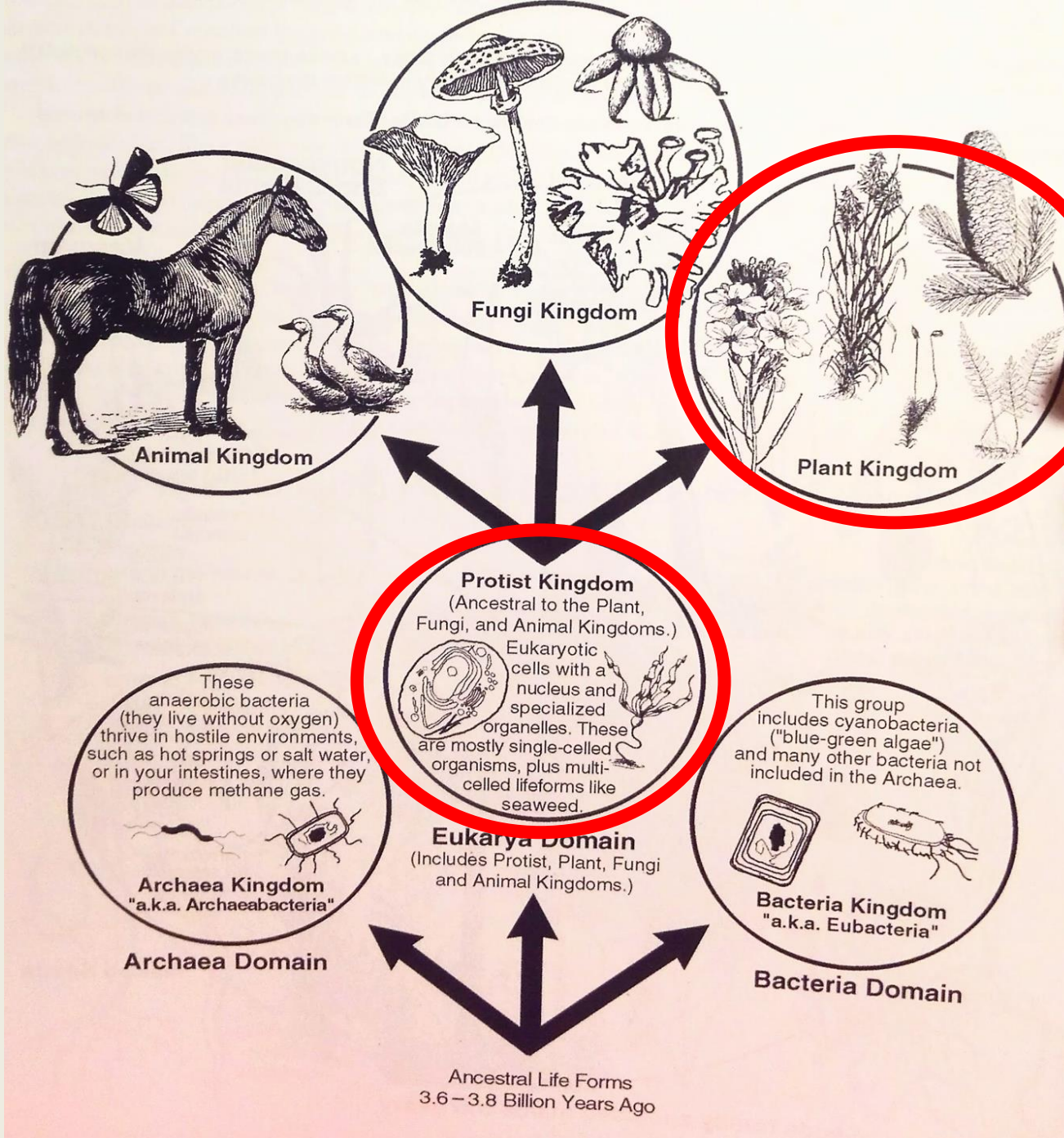


### 3 Domains:

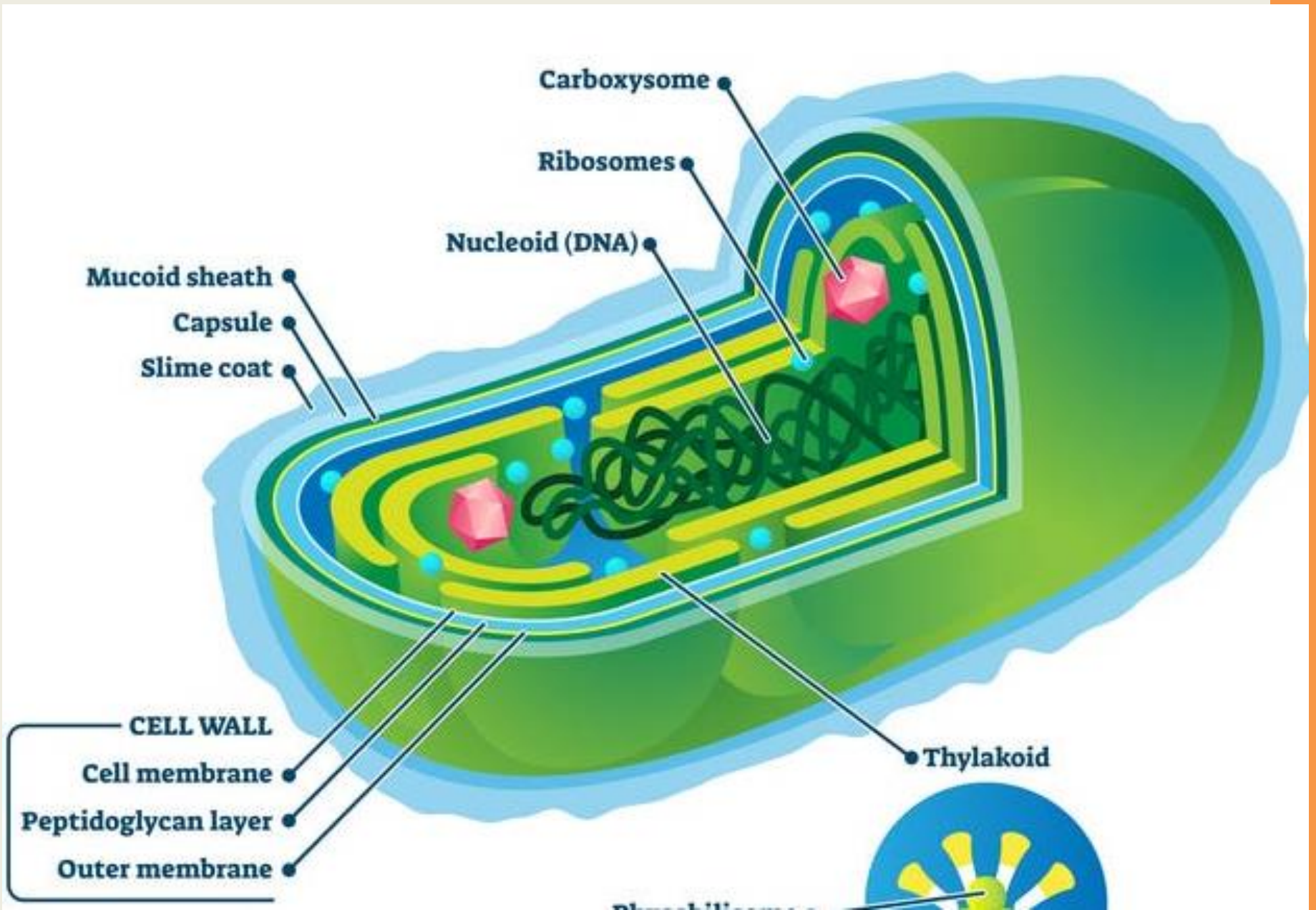
*Archea*  
*Eukaraya*  
*Bacteria*

### 6 Kingdoms:

*Animal*  
*Fungi*  
*Protist*  
*Bacteria*  
*Acrchea*

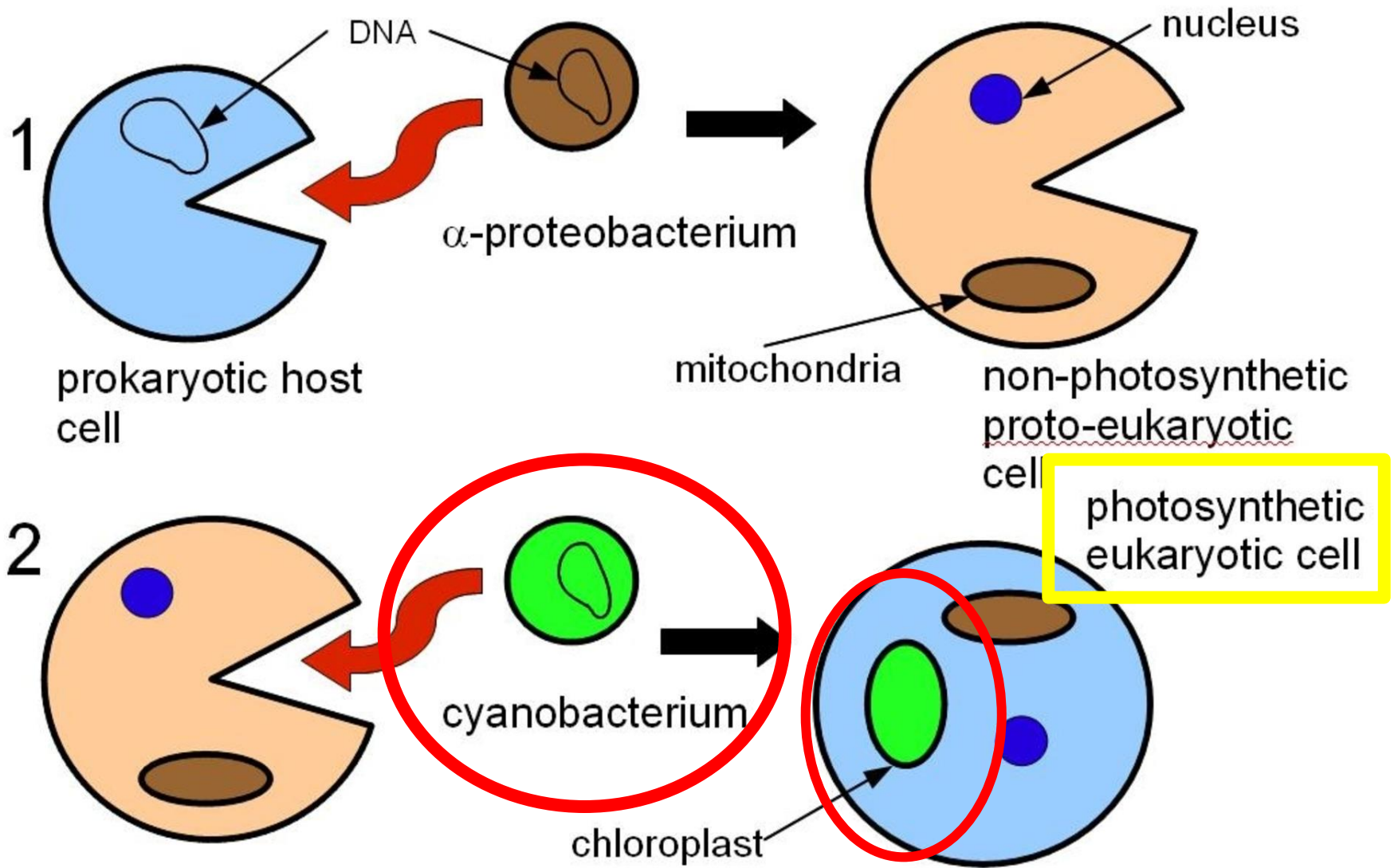


# CYNOBACTERIA-BACTERIA THAT PHOTOSYNTHESIZE





# Two endosymbiotic events c.2.7 bya





# WHERE DID PLANTS COME FROM?

**Cyanobacteria**: Bacteria that contained blue/green algae (2.7 billion years ago)

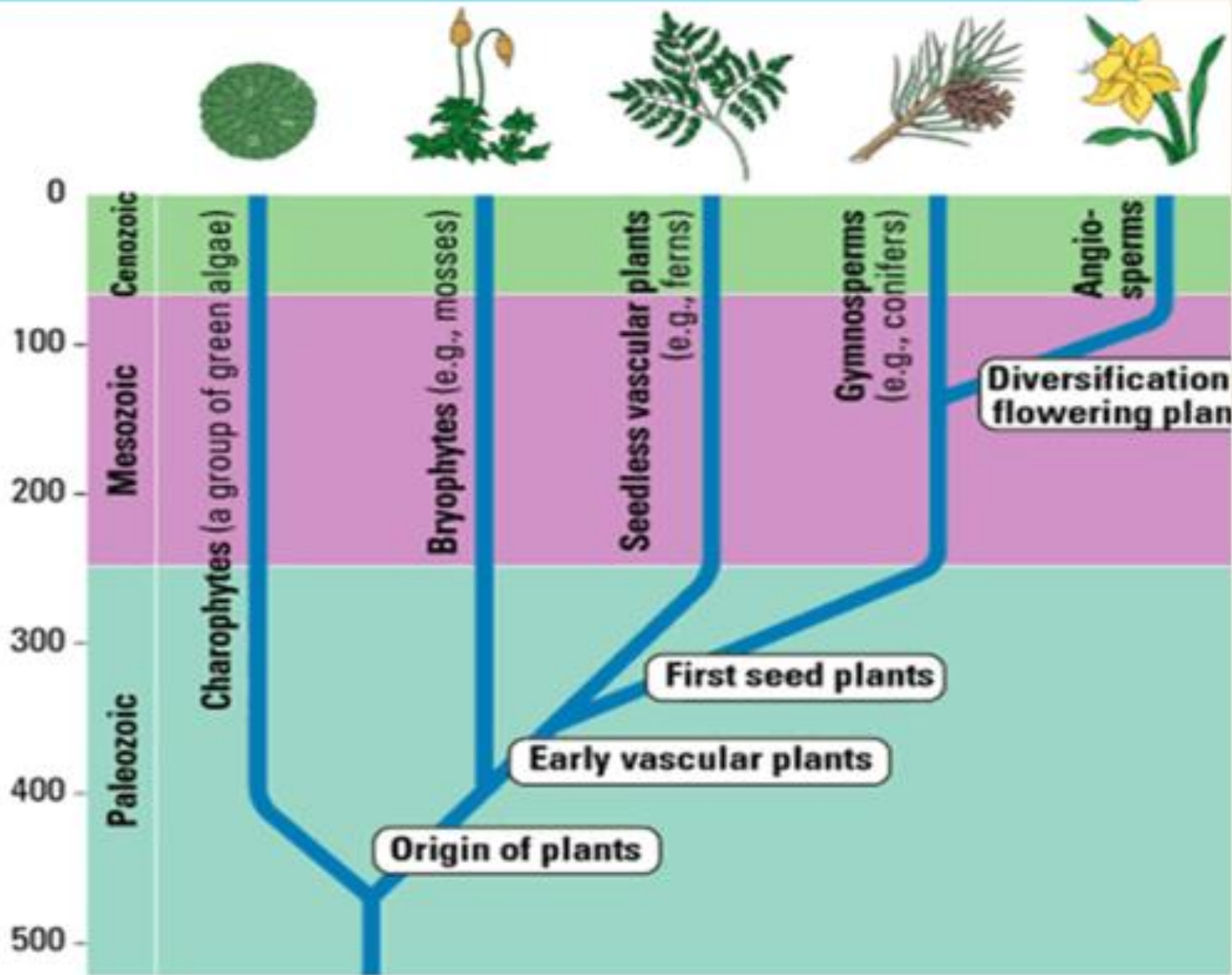
Proto plants came up on to land and formed **symbiotic relationship with fungi**

(470 m.y.a) because they could offer digest forms of rock and minerals; the algae provided glucose (sugar).

***90% of plants have fungal associations via mycorrhizae with plants***



# EVOLUTION, STRUCTURE AND COMPLEXITY





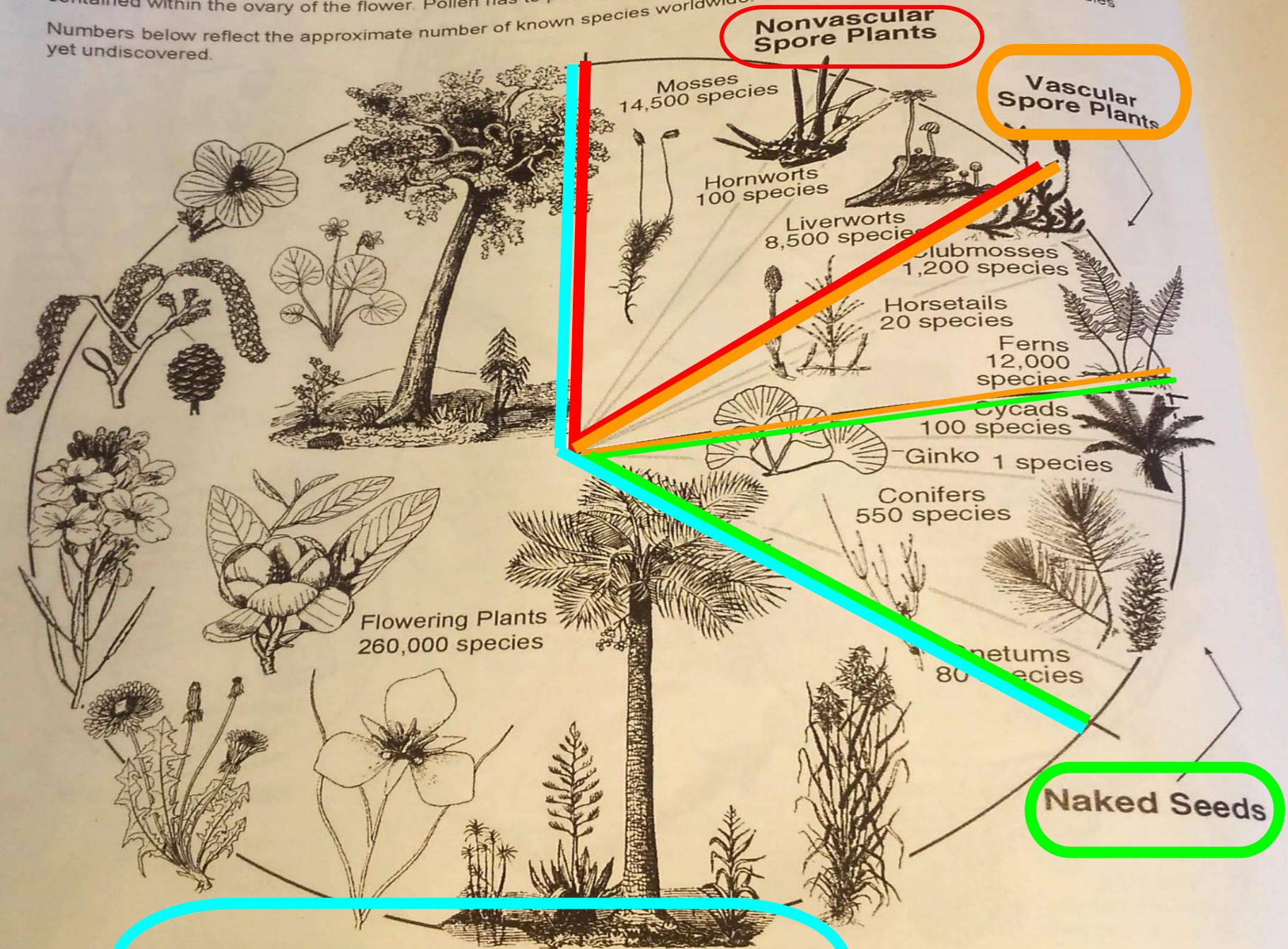
# EVOLUTION, STRUCTURE AND COMPLEXITY (Elpel)

Botany in a Day Tutorial

			EVOLUTIONARY EVENT
ERA	PERIOD	MIL YEARS	
Cenozoic	Quaternary	0-1.65	Modern humans.
	Tert./Neogene	1.65-23	Human ancestors, horses, dogs, asters, pinks.
	Tert./Paleogene	23-65	Primates, deer, grasses, lilies, roses, peas, grapes.
Mesozoic	Cretaceous	65-143	Flowering plants spread. Broad-leaf trees, palms.
	Jurassic	143-213	First flowering plants. First birds.
	Triassic	213-248	First dinosaurs and mammals.
Paleozoic	Permian	248-290	Modern insects like dragonflies and beetles appear.
	Pennsylvanian	290-323	Coal age— First cycads, ginkos, primitive conifers.
	Mississippian	323-362	Coal age— First winged insects. Reptiles.
	Devonian	362-408	Ferns, horsetails, club mosses. First amphibians.
	Silurian	408-440	Vascular plants, first millipedes. Fish with jaws.
	Ordovician	440-510	First fish. Plant/fungus symbiosis begins on land.
	Cambrian	510-570	Marine life: invertebrates, shells, predators.
Neo-Proterozoic		570-900	First multi-celled life, and first oceanic herbivores.
Meso-Proterozoic		900-1,600	Atmosphere oxygenated. First bisexual reproduction.
Paleo-Proterozoic		1,600-2,500	First Eukaryotic cells with nucleus and organelles.
Archean Eon		2,500-3,800	First simple bacteria & blue-green algae cells.
Hadean Eon		3,800-4,500	Earth's Crust and Oceans Form. No Life.



Angiosperms of flowering plants. Pollen has to penetrate  
Numbers below reflect the approximate number of known species worldwide. There may  
yet undiscovered.



**Nonvascular Spore Plants**

**Vascular Spore Plants**

**Naked Seeds**

**Seeds totally enclosed inside the ovary**

Mosses  
14,500 species

Hornworts  
100 species

Liverworts  
8,500 species

Clubmosses  
1,200 species

Horsetails  
20 species

Ferns  
12,000 species

Cycads  
100 species

Ginkgo  
1 species

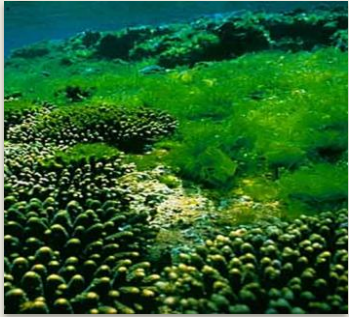
Conifers  
550 species

Gymnperms  
80 species

Flowering Plants  
260,000 species



# 4 Divisions we are working with....



**ALGAE**  
(Thallophyta)



**MOSSES,  
LIVERWORTS,  
HORNWORTS**  
(Bryophyta)



**FERNS**  
(Pterophyta)



**GYMNOSPERMS**  
(CONIFERS)



**ANGIOSPERMS-**  
**Flowering Plants**



# ALGAE



- **NON VASCULAR:** Lack true roots or stems and structures for transporting water
- **ANCESTORS OF ALL PLANTS!**
- **STRUCTURALLY SIMPLE**
- **NEEDS TO BE AROUND OR IN H<sub>2</sub>O for REPRODUCTIVE CYCLES**
- **EXAMPLES: SEAWEED, BLUE GREEN SLIME**

# Mosses, Liverworts & Hornworts



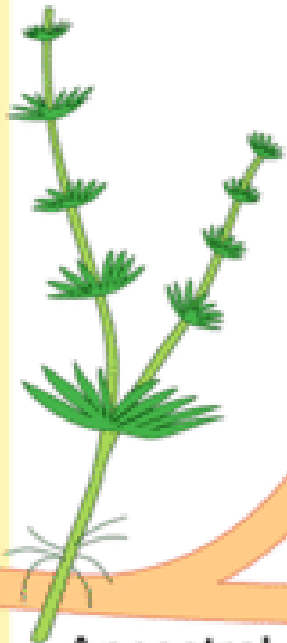
- **NON VASCULAR**
- **REPRODUCE THROUGH SPORES- GEMMAE CUP...SO COOL!!**
- **HAVE A BIT MORE STRUCTURE THAN ALGAE>>>>>>>LESS DEPENDANT ON H2O**
- **CHLOROPHYLL HANGS OUT WHEN ITS DRY**
- **Lots here in the rainforest!**



**First Vascular Plants:** Means they have **water (Xylem)** and **nutrient (Phloem)** conducting tissues!

**Nonvascular**

Mosses,  
liverworts,  
hornworts



Ancestral  
green alga

**Vascular**

Nonseed



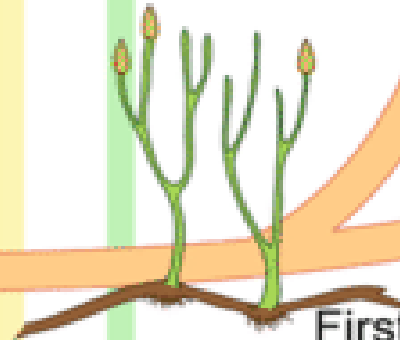
Ferns

Seed

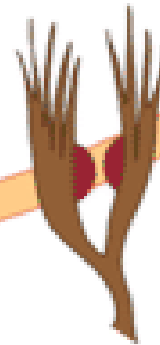


Flowering  
plants

Conifers



First vascular  
plants



First seed  
plants

# FERNS AND ALLIES

(CLUBMOSES, HORSETAILS)



## Vascular systems!

Allows more specialization of structure so we get.....

**ROOTS!**

**BARK!!**

**LEAVES!!!**

**BRANCHES!!!!**

Allows plants to stand upright & utilize sunlight

- STILL USE SPORES FOR REPRODUCTION

- STILL DEPENDENT ON H<sub>2</sub>O FOR SPORES TO GERMINATE



# GYMNOSPERMS-CONIFERS

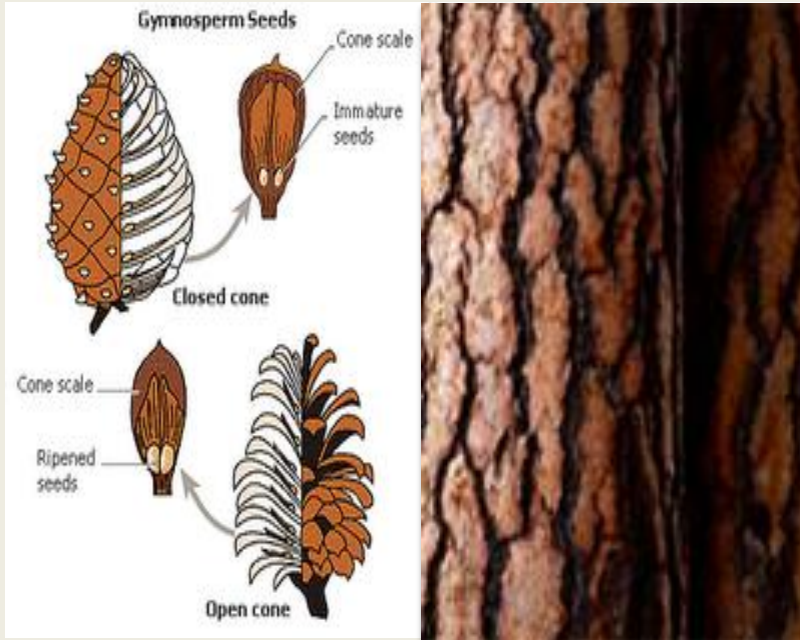
- VASCULAR

- NAKED = “GYMNO” +  
SEED= “SPERM”

- CONES WITH SEEDS!

- WIND POLLINATED (brrrr....naked!)

- CONIFERS!

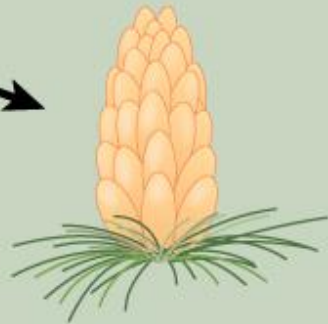




Sporophyte (2n)  
(mature tree)



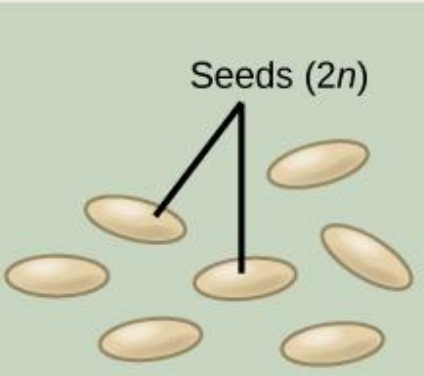
Female cones grow in the upper branches where they may be fertilized by pollen blown on the wind from the male cones.



Male cones grow in the lower branches.

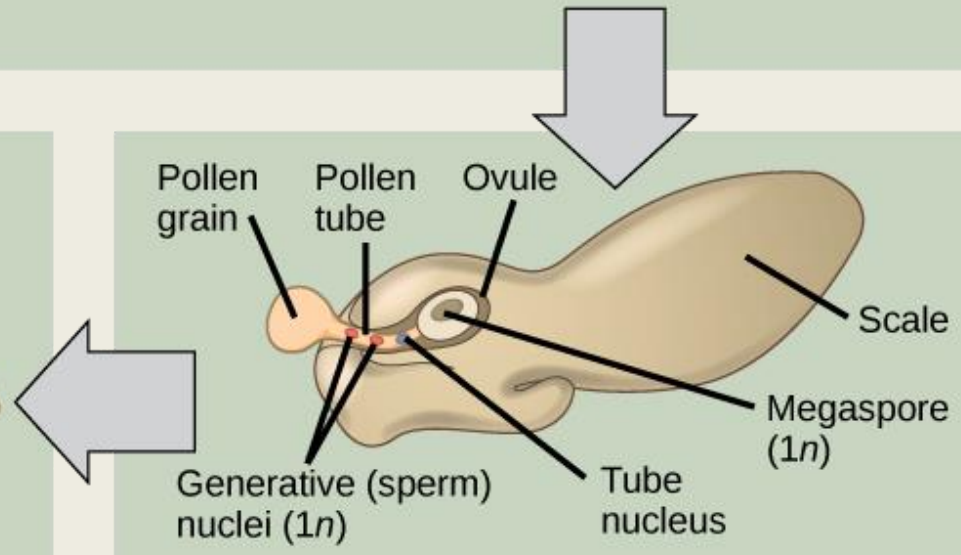


Female cone



Seeds (2n)

Seeds are dispersed and grow into mature trees.

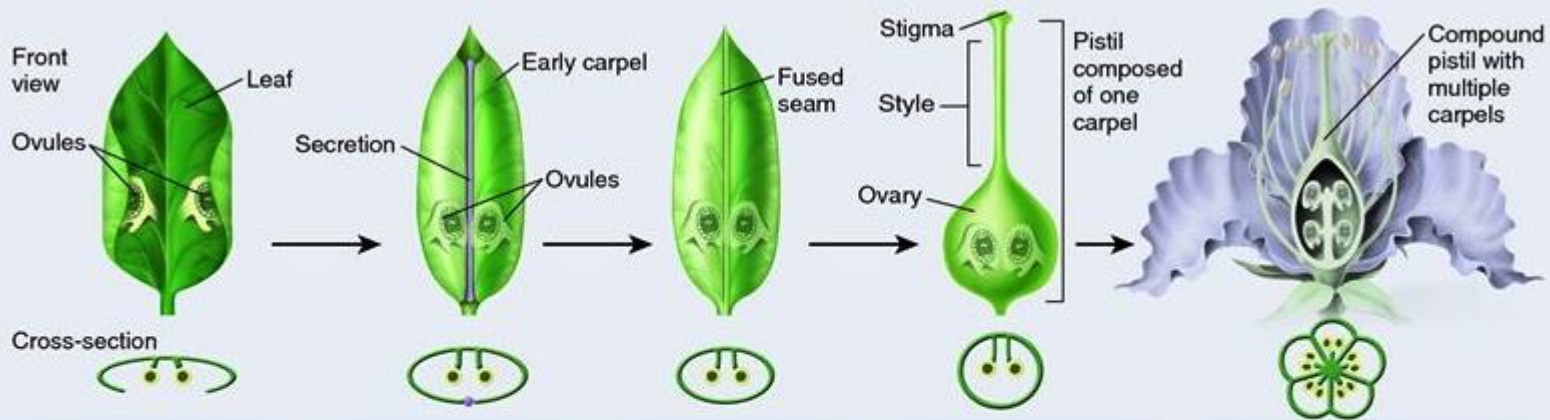


A pollen tube forms, allowing the pollen to migrate toward the female gametophyte. Upon fertilization, a diploid zygote forms.



Male cone





1 Carpels evolved from leaflike structures whose edges folded over ovules, protecting them.

2 Early carpels folded over ovules, with the seam closed by sticky secretions.

3 Later carpels were completely closed into a tube, by fusion of tissue.

4 Carpels developed specialized regions (stigma, style, and ovary) to form a pistil.

5 In many modern flowers, several to many carpels are fused to form a compound pistil.

# ANGIOSPERM-FLOWERING PLANTS

- **VASCULAR**
- **“ANGIO”= COVERED**
- **“SPERM”=SEED**  
(Ginko story)

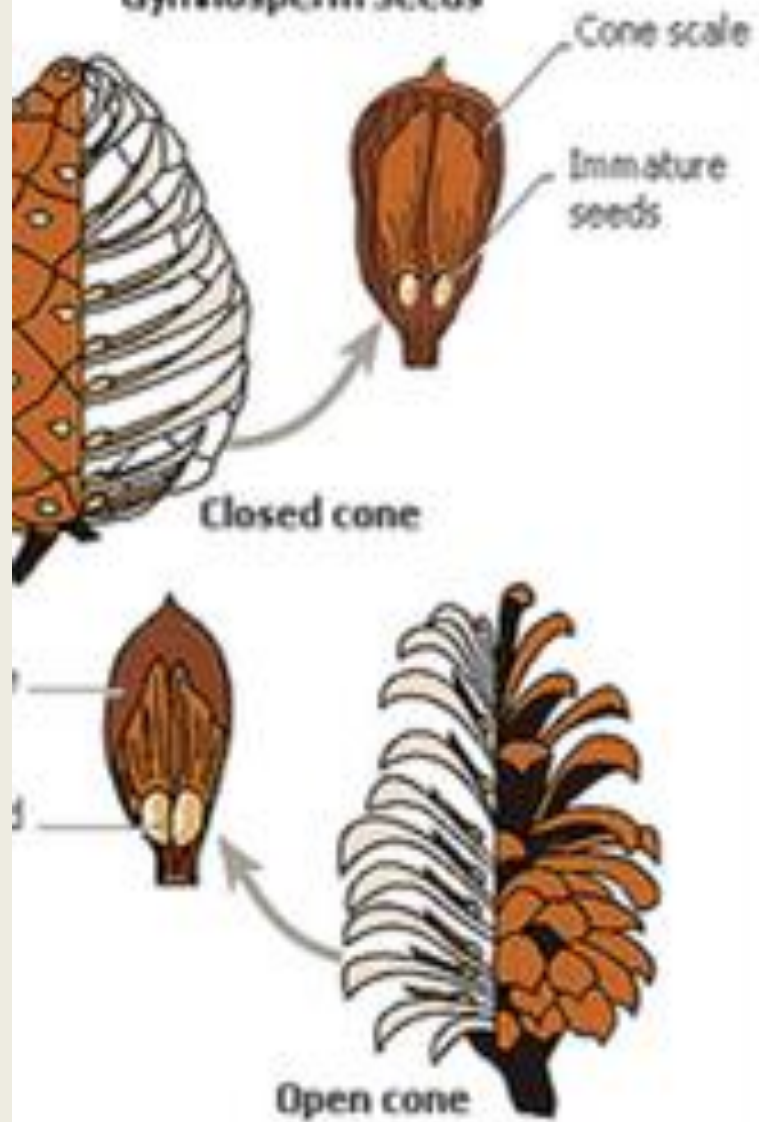
## FLOWERS AND THEIR STRUCTURES!

- Petals!*
- Pollinators*
- Fruit*

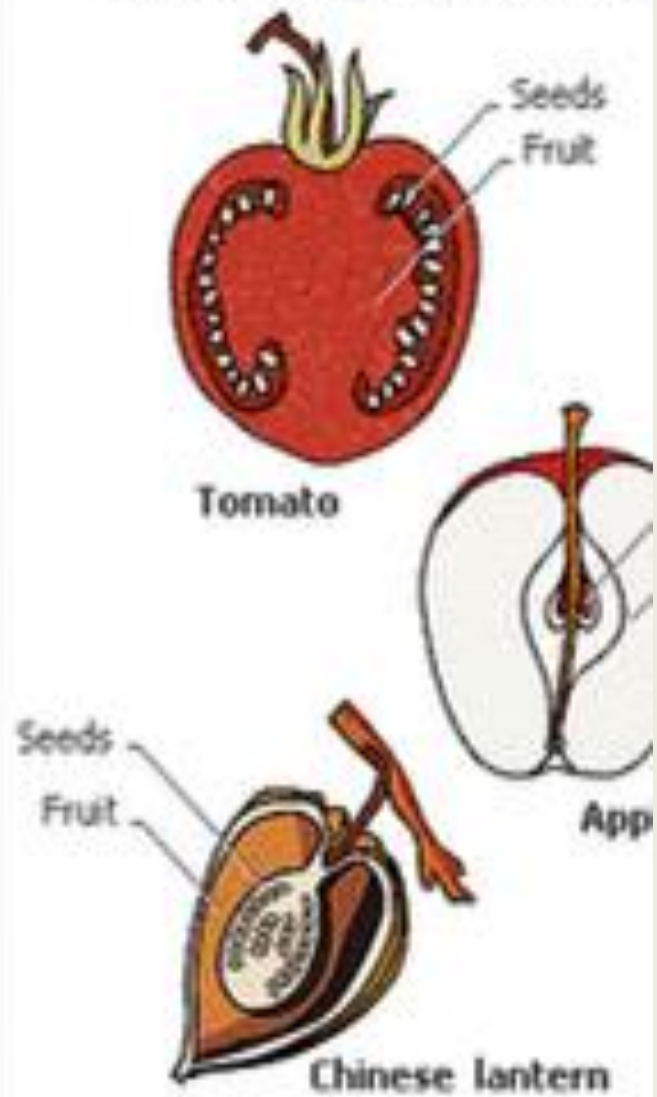




### Gymnosperm Seeds



### Angiosperm Seeds and Fruits



Stamen

Anther  
Filament

Stigma

Style

Ovary

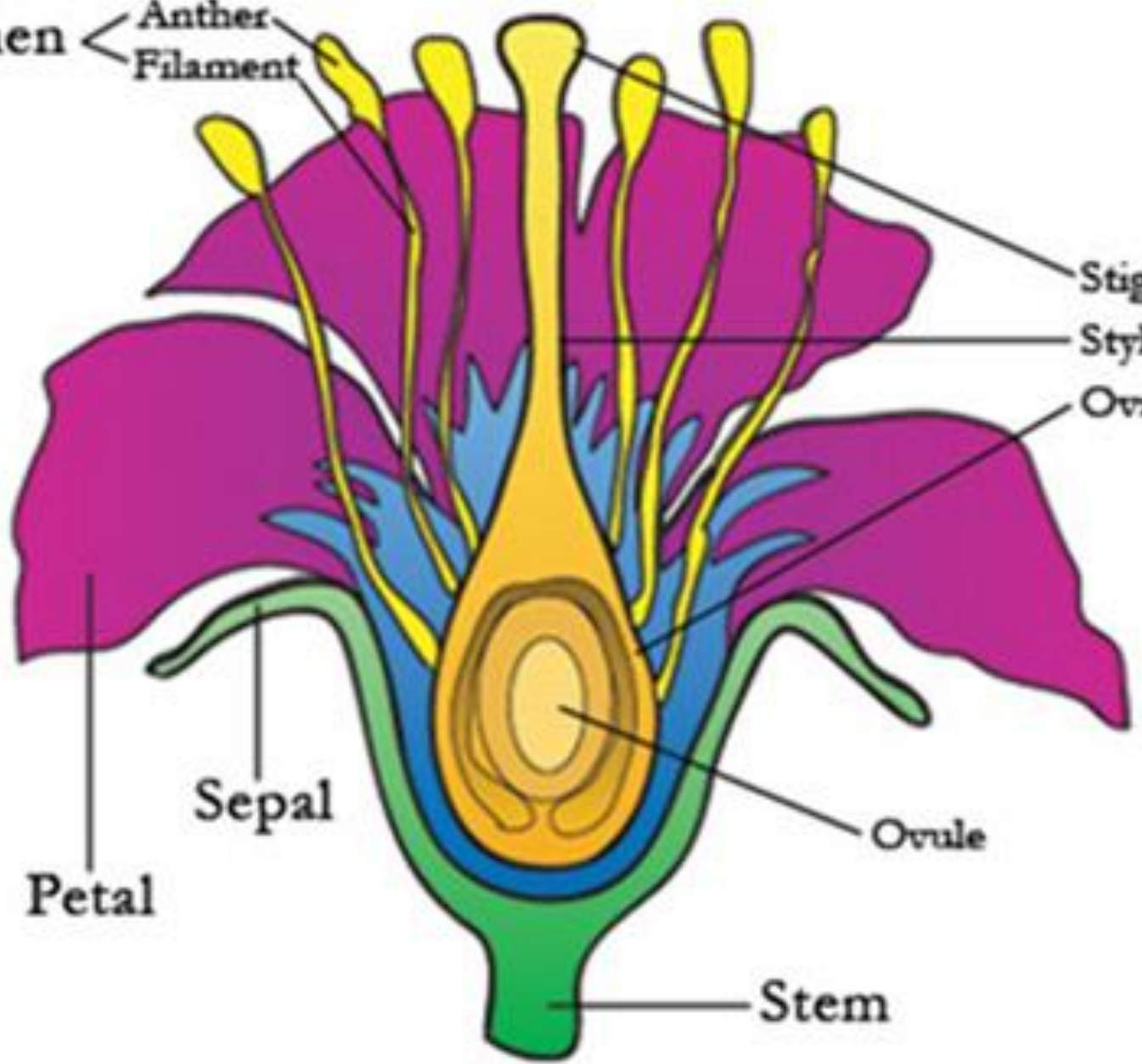
Pistil

Sepal

Petal

Ovule

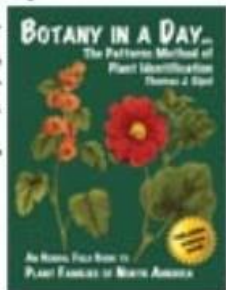
Stem







Wall Flower

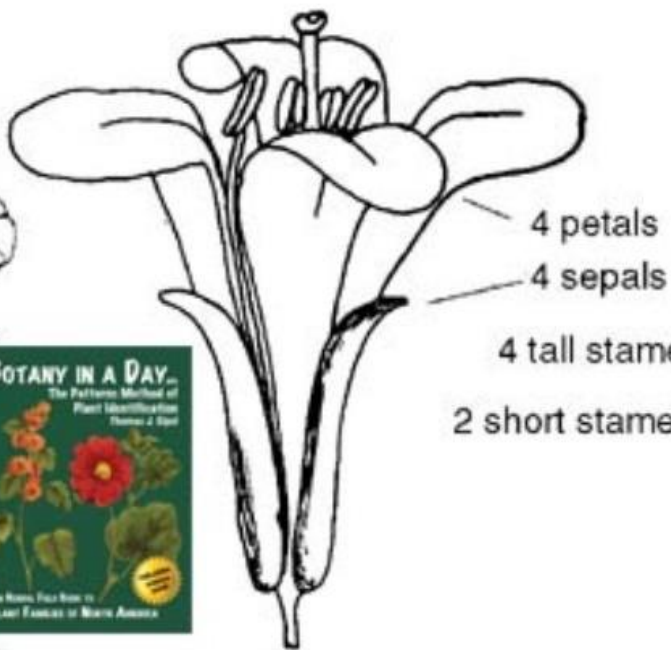


**BOTANY IN A DAY**  
The Pattern Method of  
Plant Identification  
Thomas A. Steyer

An Online Free Book to  
Plant Families of North America

## Patterns of the Mustard Family

Mustard seed pods come in many shapes and sizes, but always occur on the plant in the same radial pattern around the stalk, a "raceme".

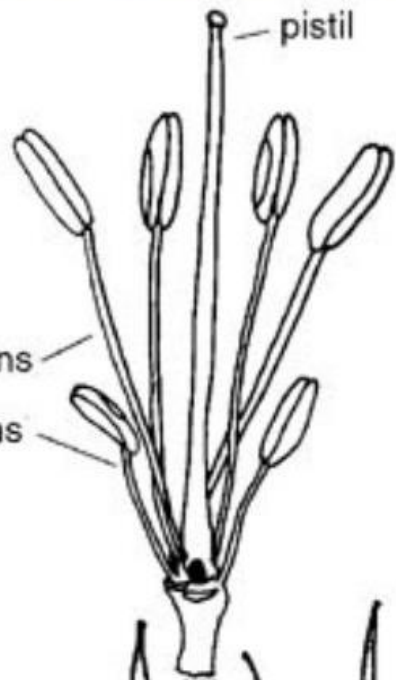


4 petals

4 sepals

4 tall stamens

2 short stamens

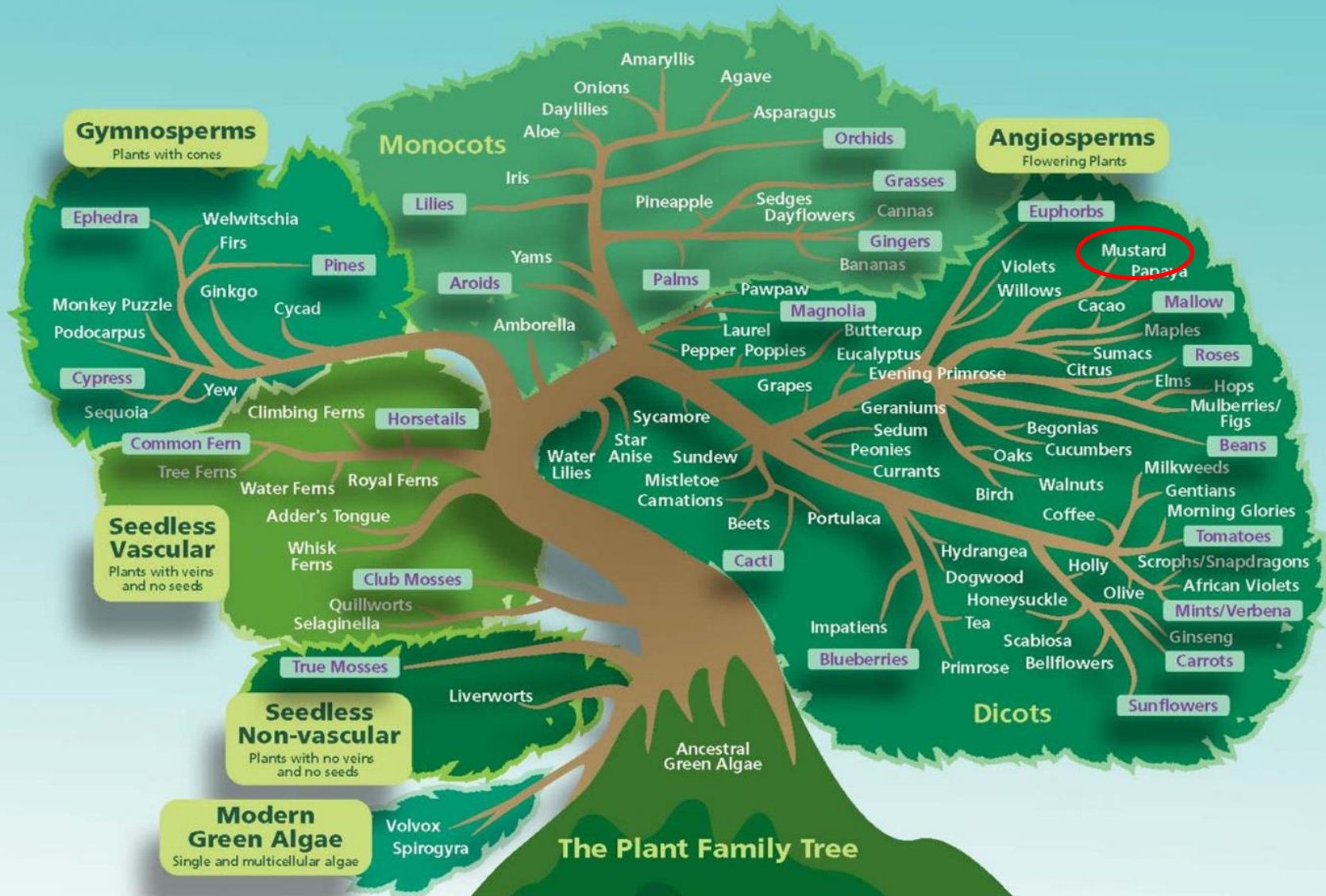


pistil



The seed pods split open from both sides to expose a clear membrane in the middle.





# The Plant Family Tree