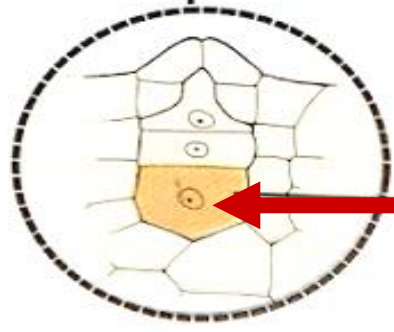
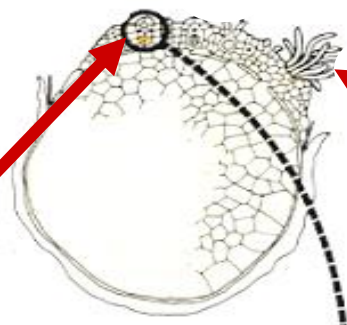
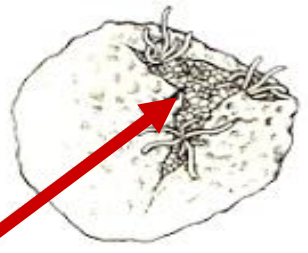
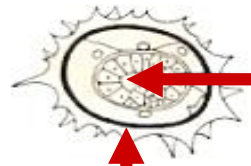
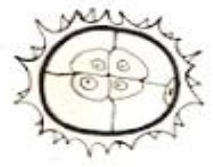


+

SP



**MICROGAMETOPHYTE**

**SPERM**

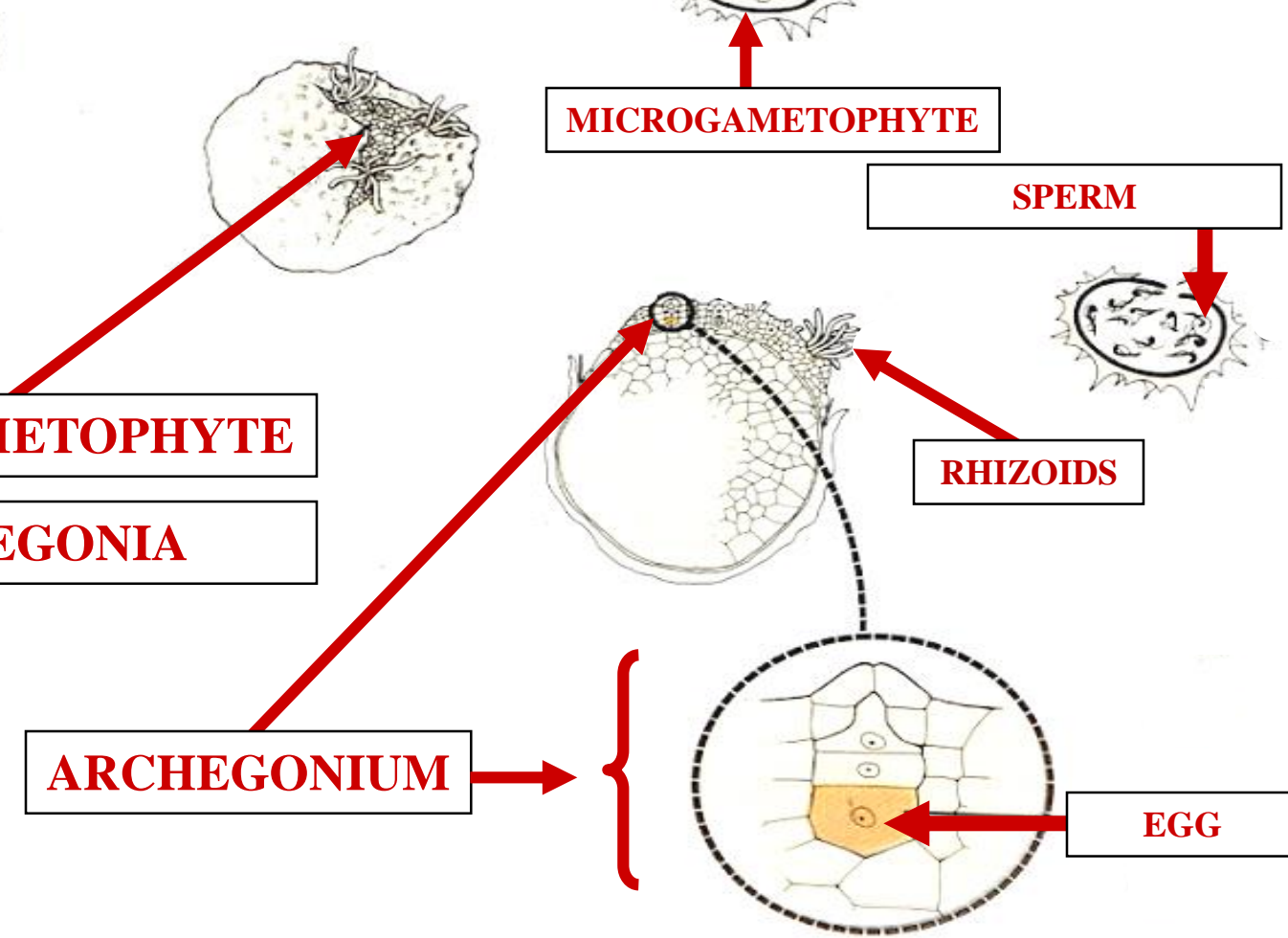
**MEGAGAMETOPHYTE**

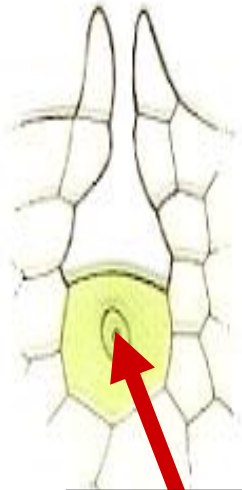
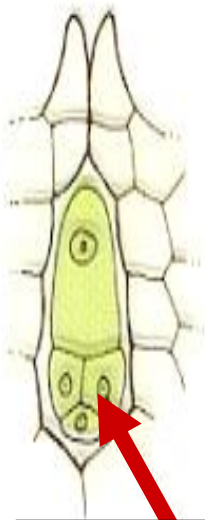
**ARCHEGONIA**

**RHIZOIDS**

**ARCHEGONIUM**

**EGG**



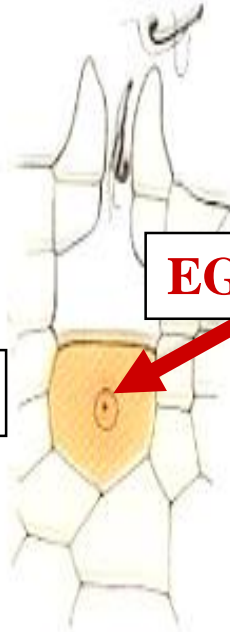
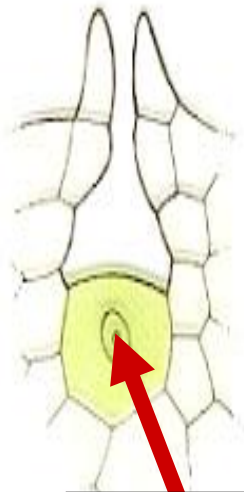
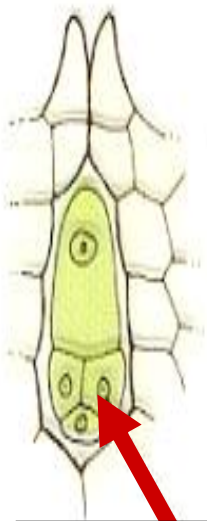


**SPERM**



**EGG**

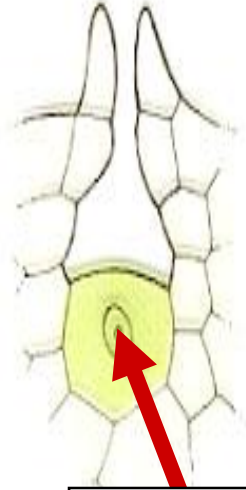
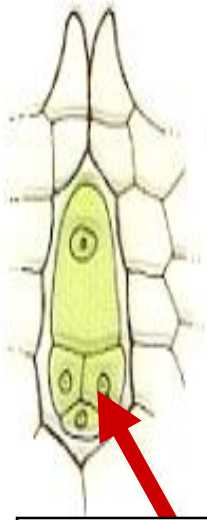




**EGG**

**SPERM**





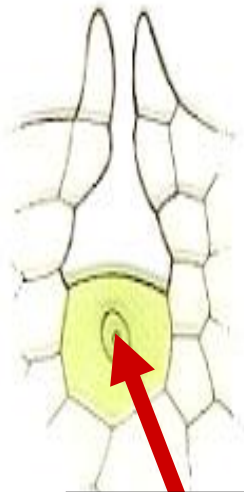
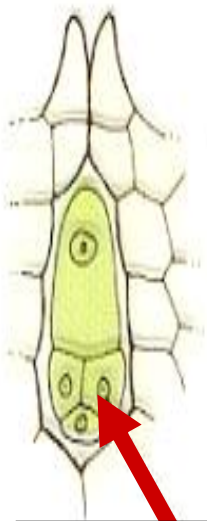
**SYNGAMY**

**SPERM**

**EGG**





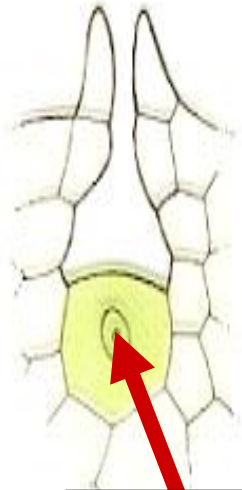
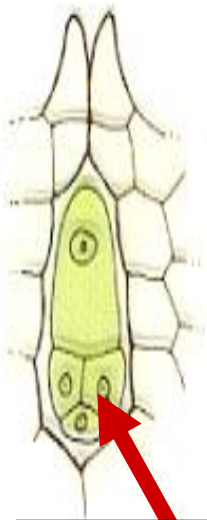


**WATER**

**SPERM**

**EGG**





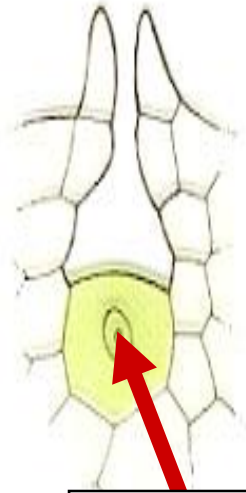
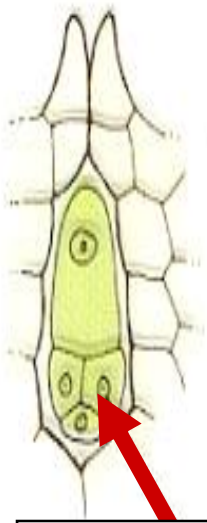
**ZYGOTE**

**SYNGAMY**

**SPERM**

**EGG**



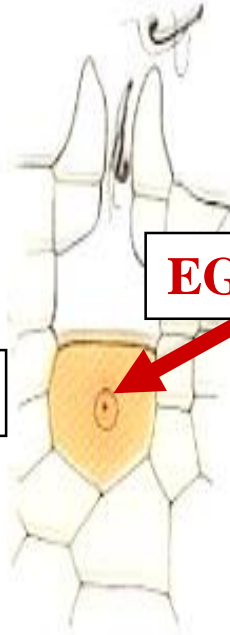


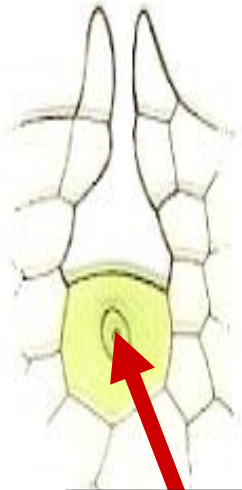
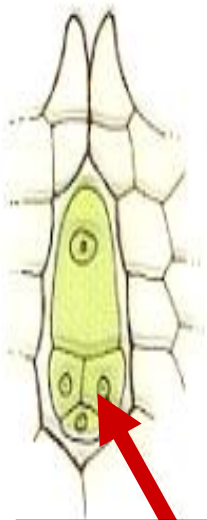
**2N**

**SYNGAMY**

**SPERM**

**EGG**





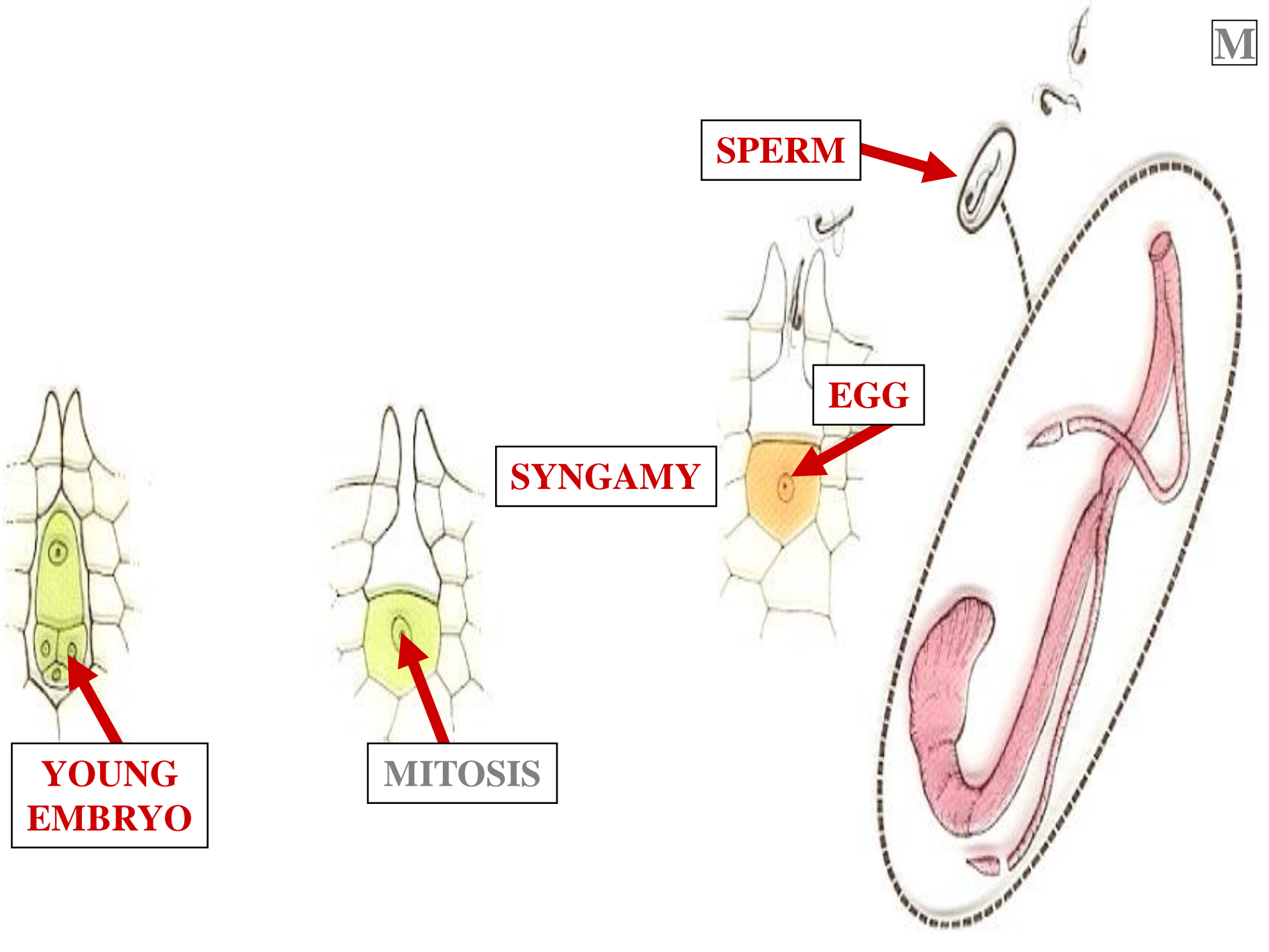
**MITOSIS**

**SYNGAMY**

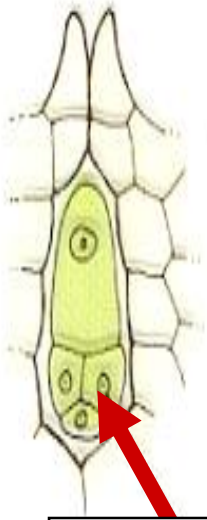
**SPERM**

**EGG**

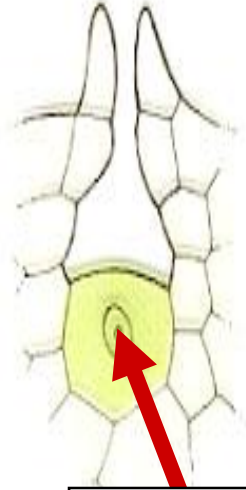








**MITOSIS**



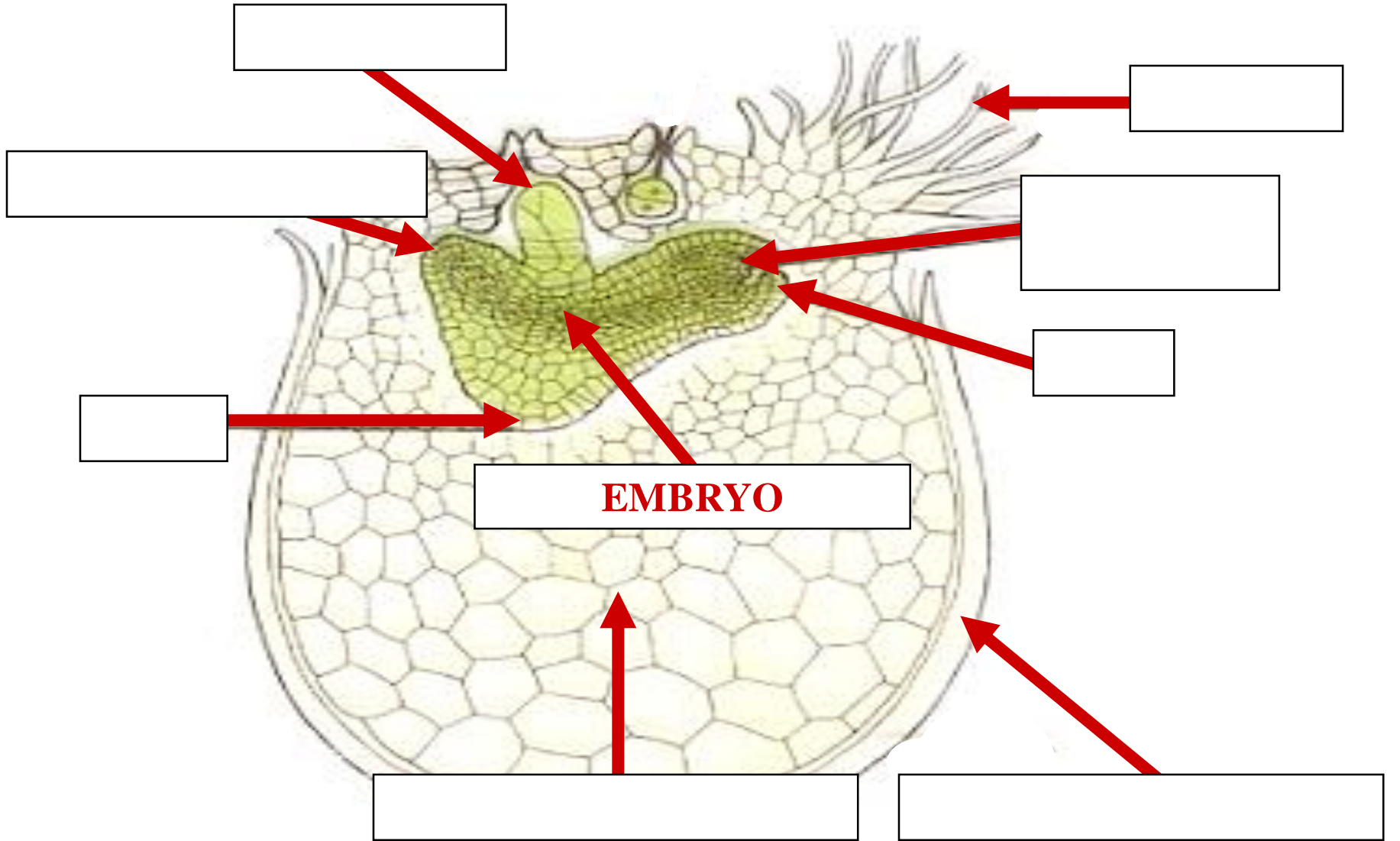
**MITOSIS**

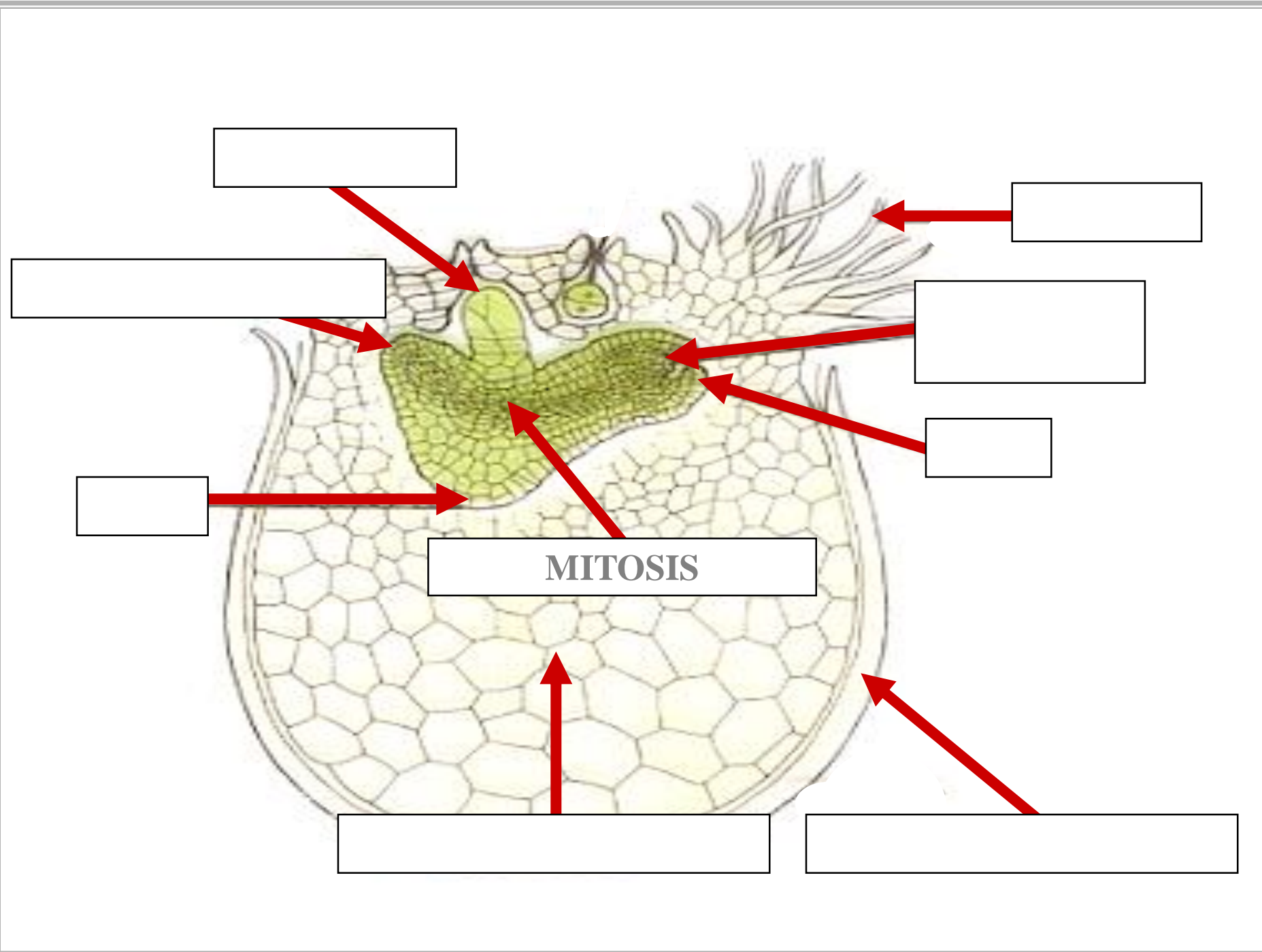
**SYNGAMY**

**SPERM**

**EGG**

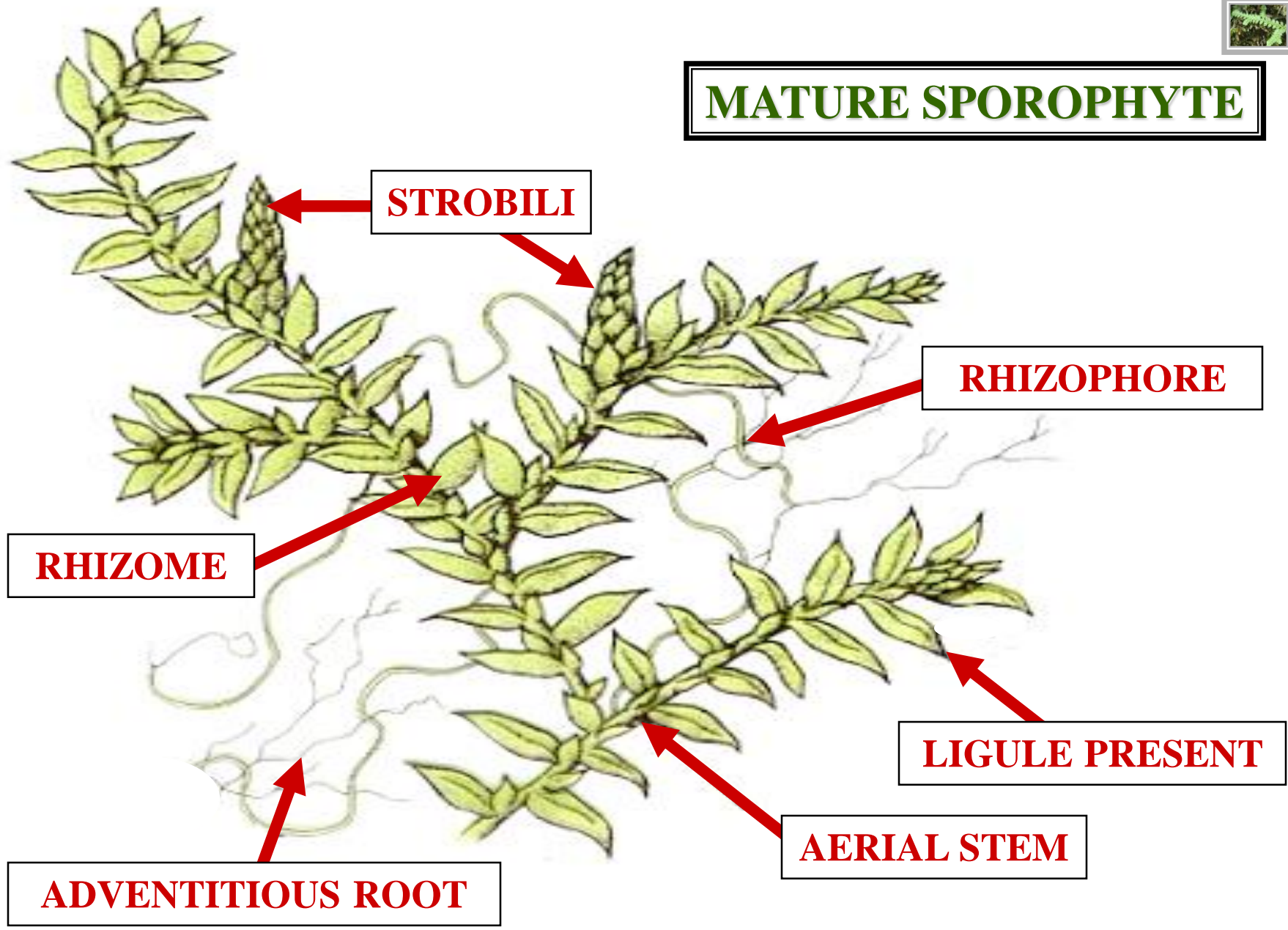








# MATURE SPOROPHYTE



**STROBILI**

**RHIZOPHORE**

**RHIZOME**

**LIGULE PRESENT**

**AERIAL STEM**

**ADVENTITIOUS ROOT**





***SELAGINELLA***



# LYCOPODIOPHYTA CLASSIFICATION



# VASCULAR PLANT EVOLUTION



# VASCULAR PLANT EVOLUTION SUMMARY

FORMAL TAXON

DEFINING CHARACTER

NON-FORMAL TAXON

→ = EVOLVED

**QUESTION**

**HOW OLD  
IS THE UNIVERSE?**

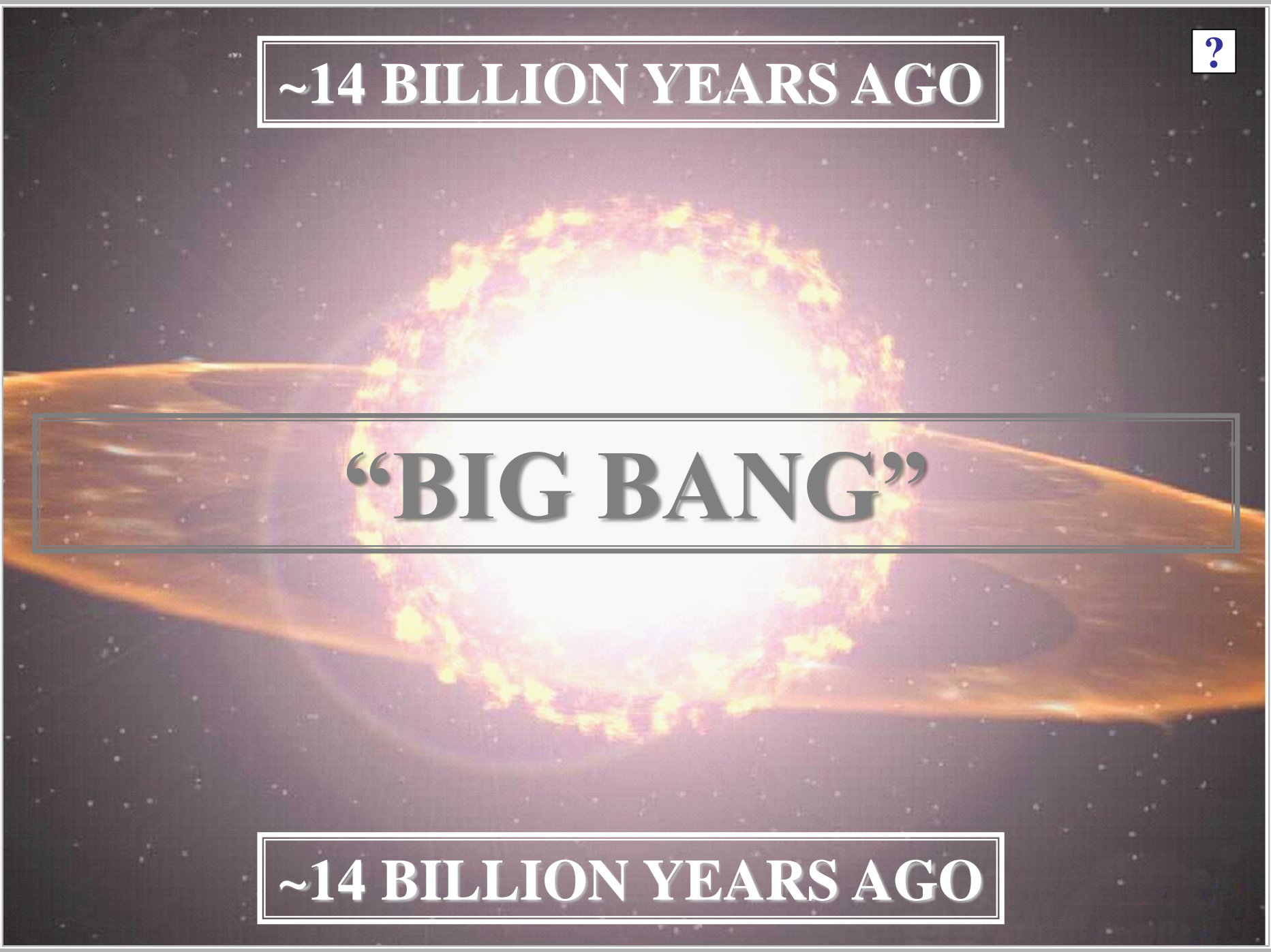
**QUESTION**



**~14 BILLION YEARS AGO**

**“BIG BANG”**

**~14 BILLION YEARS AGO**





**QUESTION**

**HOW OLD IS OUR STAR?**

**QUESTION**

**~5 BILLION YEARS AGO**

?

**SUN / STAR**

**~5 BILLION YEARS AGO**



**QUESTION**

**HOW OLD IS THE EARTH?**

**QUESTION**



**~4.5 BILLION YEARS AGO**

?

**EARTH**

**~4.5 BILLION YEARS AGO**



**QUESTION**

**HOW OLD IS LIFE?**

**QUESTION**



A black and white electron micrograph showing several rod-shaped, textured structures, likely early life forms, against a light background. The structures are elongated and have a granular, porous appearance. One large rod is oriented diagonally from the top left towards the bottom right. Other smaller rods are scattered around it.

**~3.5 BILLION YEARS AGO**



**FIRST CELLS**

**~3.5 BILLION YEARS AGO**

**1<sup>ST</sup> CELLS**

## **PROKARYOTE CELLS**

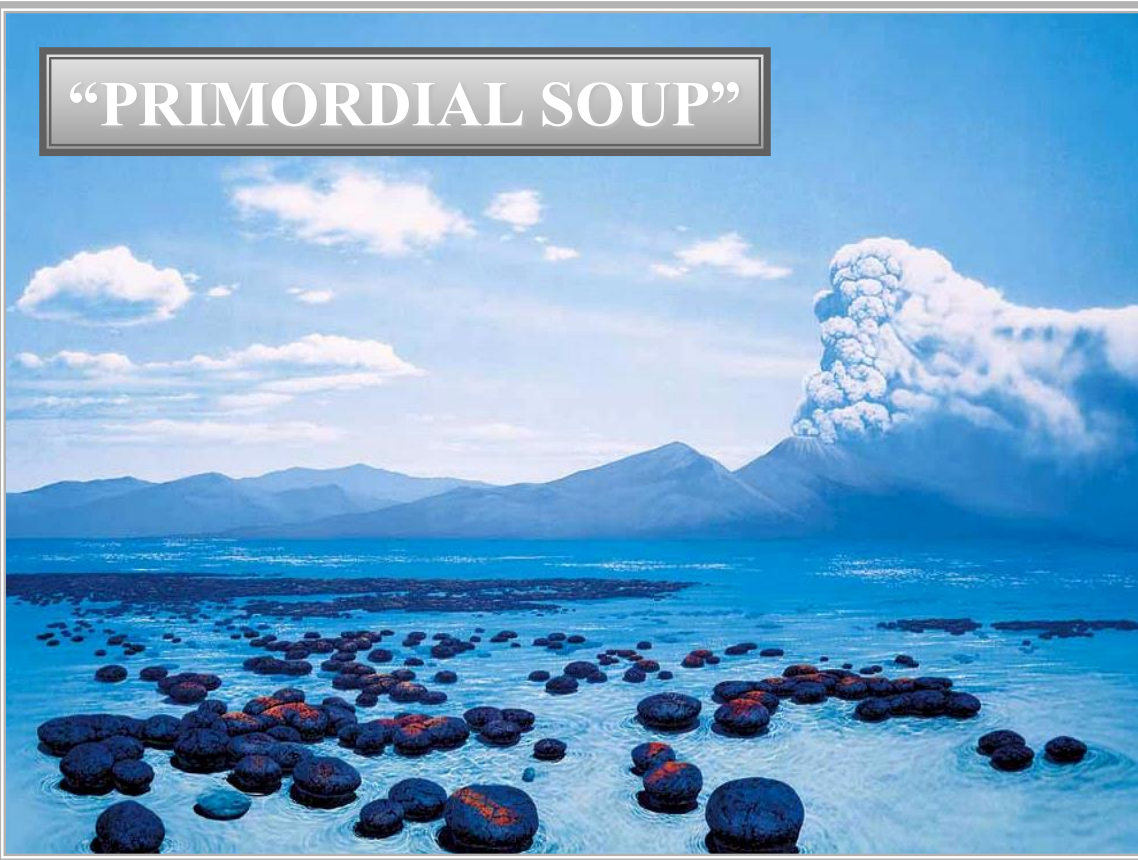
**PROKARYOTE CELLS**  
**HETEROTROPHIC**

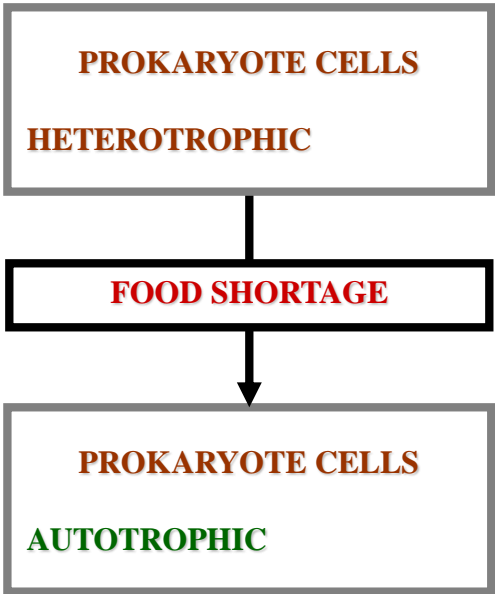


**PROKARYOTE CELLS**  
**HETEROTROPHIC**

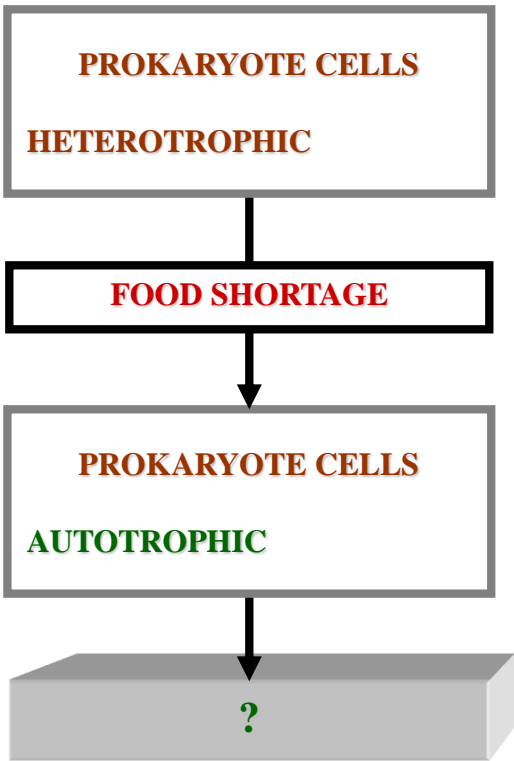
**FOOD SHORTAGE**

**“PRIMORDIAL SOUP”**









**PROKARYOTE CELLS**  
**HETEROTROPHIC**



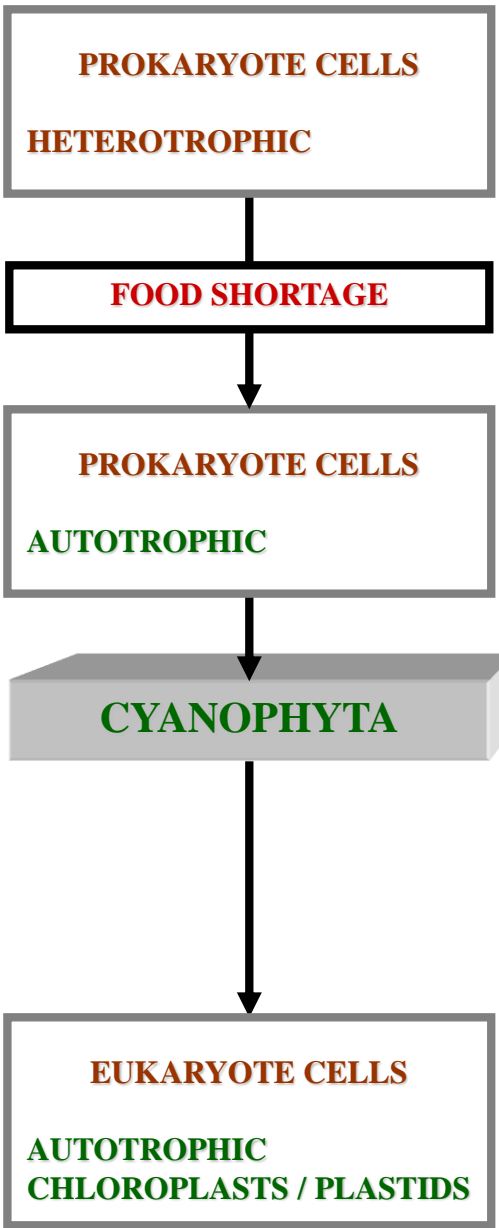
**FOOD SHORTAGE**

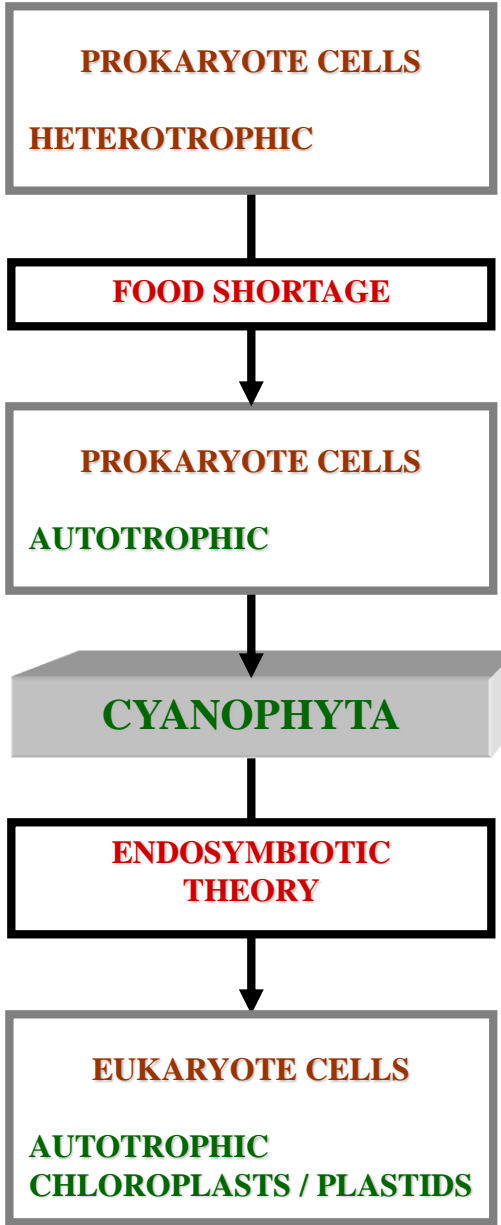


**PROKARYOTE CELLS**  
**AUTOTROPHIC**



**CYANOPHYTA**





**PROKARYOTE CELLS**  
**HETEROTROPHIC**



**FOOD SHORTAGE**



**PROKARYOTE CELLS**  
**AUTOTROPHIC**



**CYANOPHYTA**



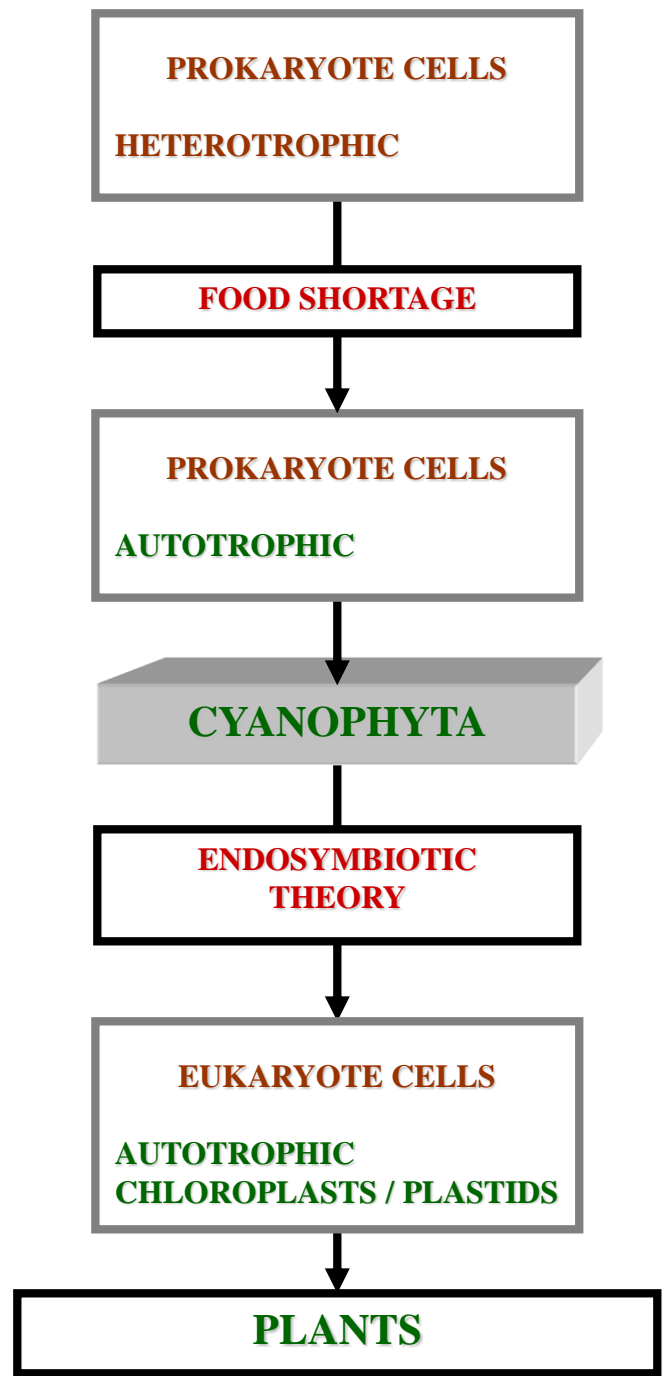
**ENDOSYMBIOTIC  
THEORY**



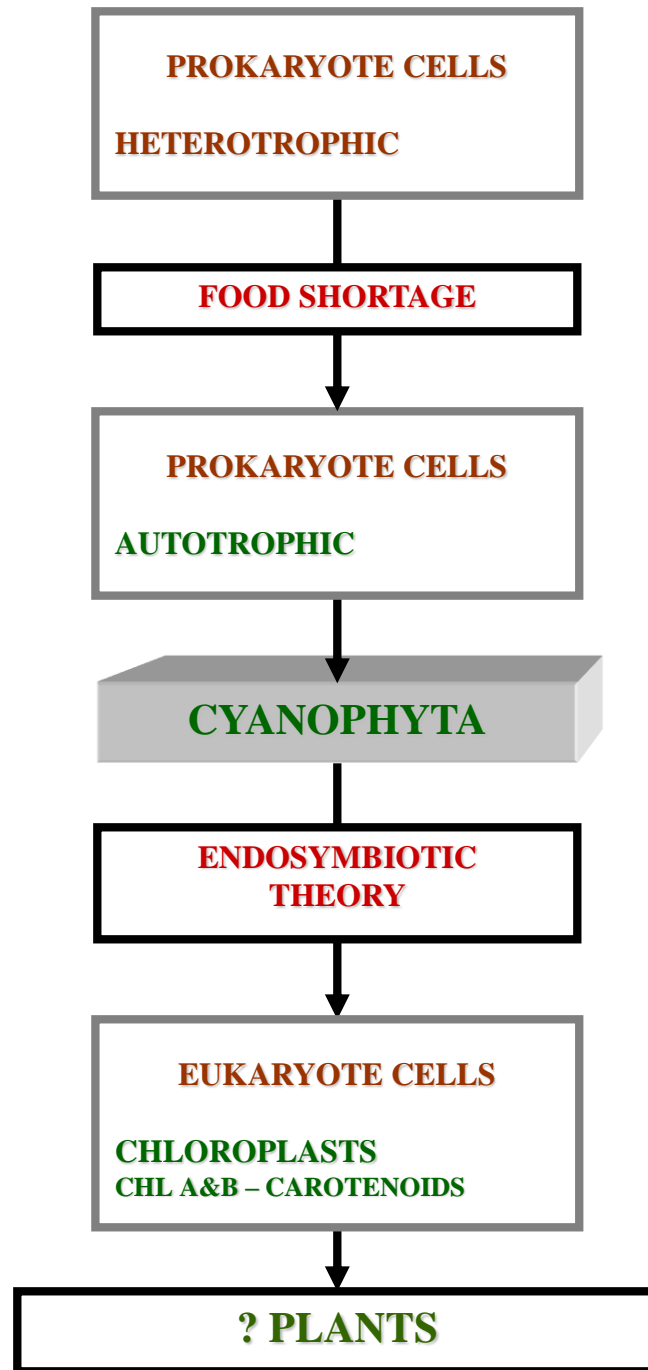
**EUKARYOTE CELLS**  
**AUTOTROPHIC**  
**CHLOROPLASTS / PLASTIDS**

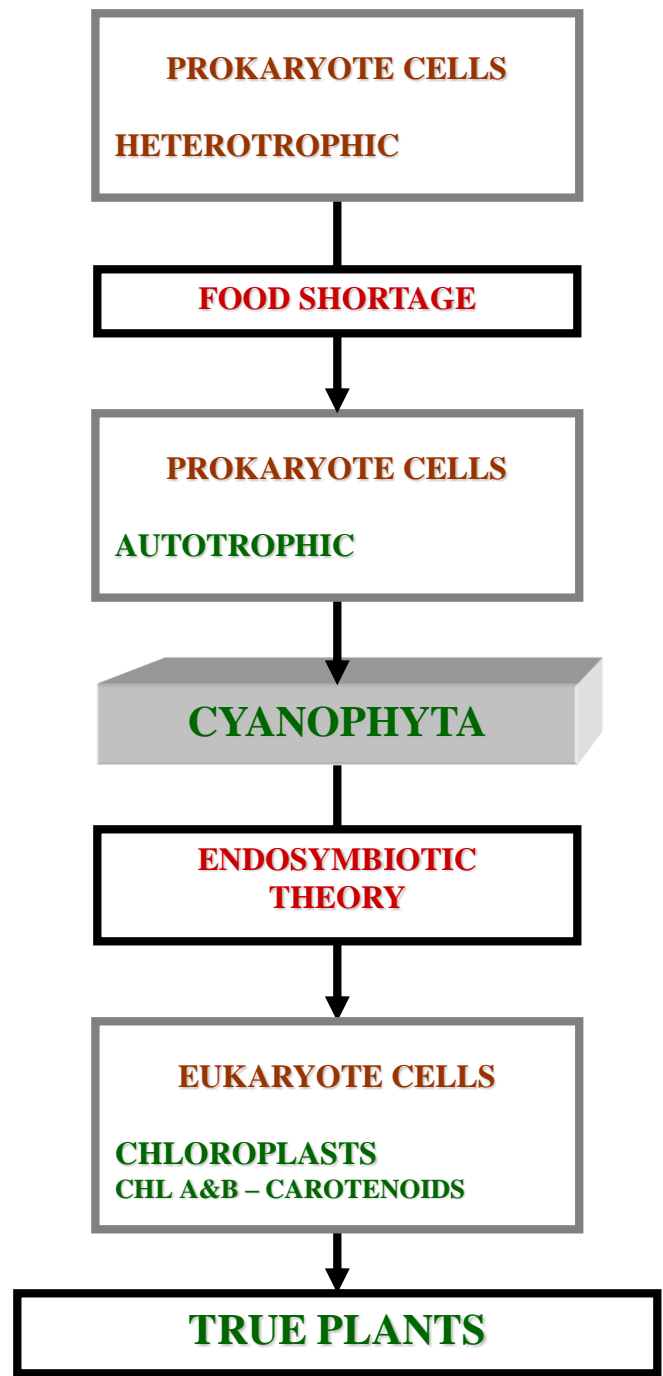


**?**









**TRUE PLANTS**

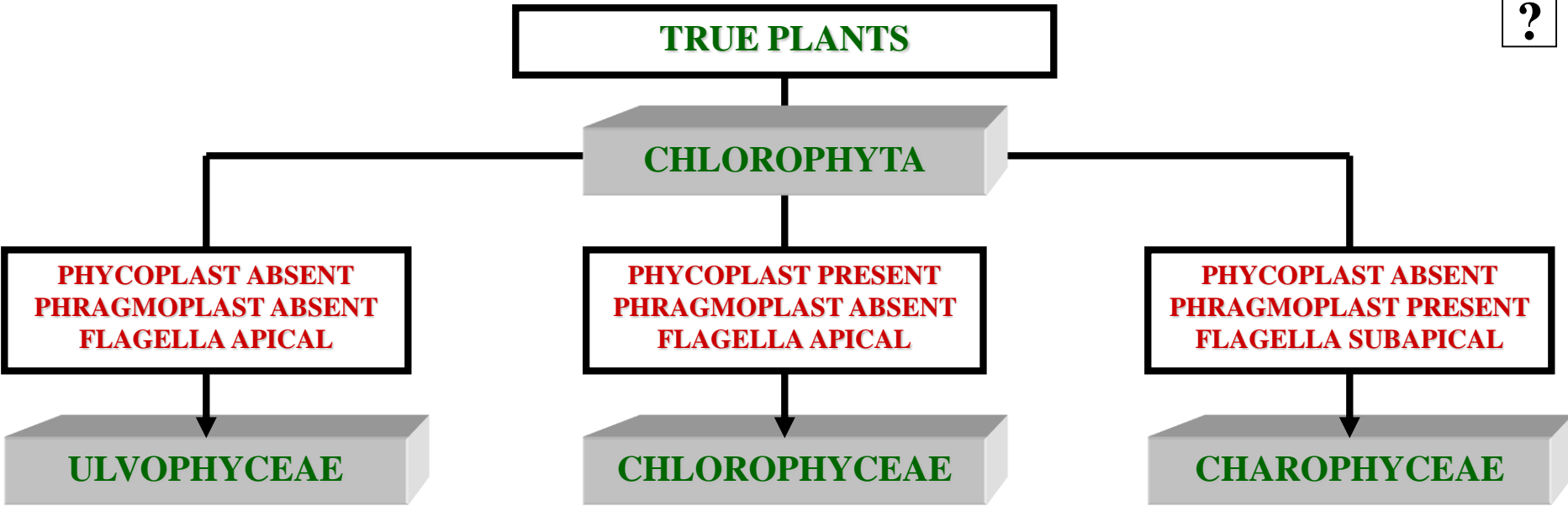
?

**TRUE PLANTS**



**CHLOROPHYTA**





**!!!ALGAE CLASS STANDARD ENDING: PHYCEAE!!!**

**TRUE PLANTS**

**CHLOROPHYTA**

**PHYCOPLAST ABSENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**ULVOPHYCEAE**

?

**PHYCOPLAST PRESENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**CHLOROPHYCEAE**

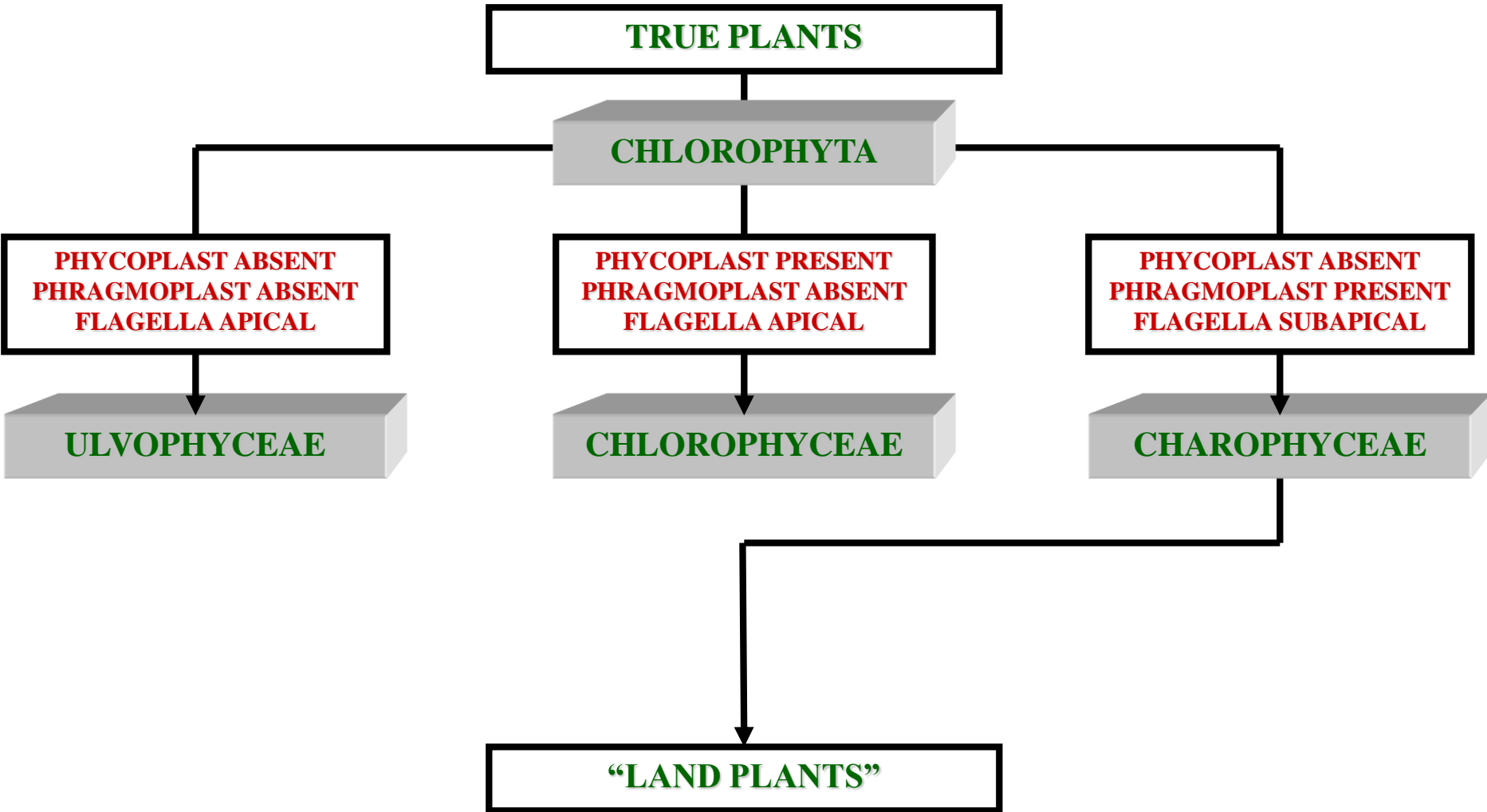
?

**PHYCOPLAST ABSENT  
PHRAGMOPLAST PRESENT  
FLAGELLA SUBAPICAL**

**CHAROPHYCEAE**

?

**“LAND PLANTS”**





**TRUE PLANTS**

**CHLOROPHYTA**

**PHYCOPLAST ABSENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**PHYCOPLAST PRESENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**PHYCOPLAST ABSENT  
PHRAGMOPLAST PRESENT  
FLAGELLA SUBAPICAL**

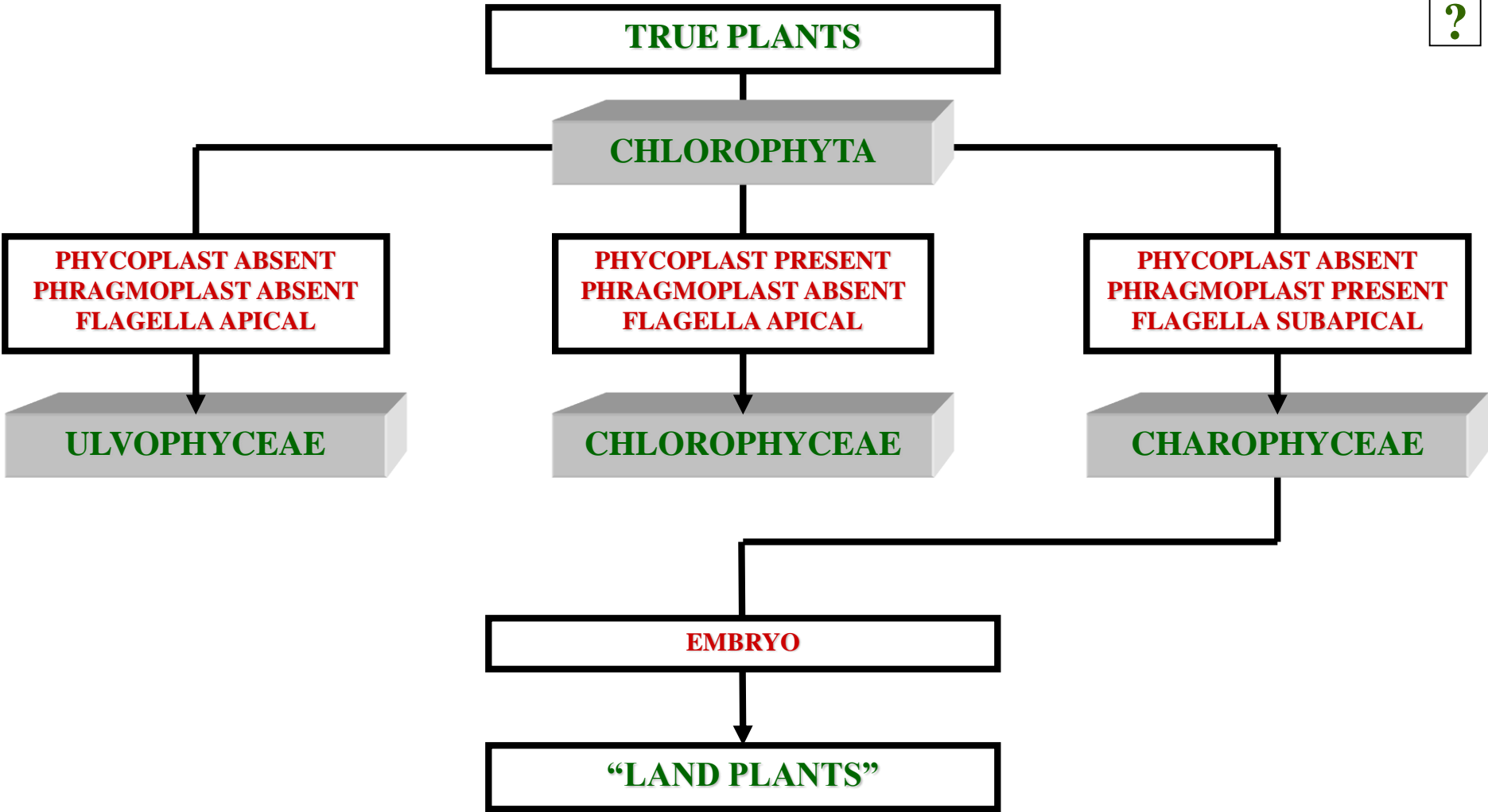
**ULVOPHYCEAE**

**CHLOROPHYCEAE**

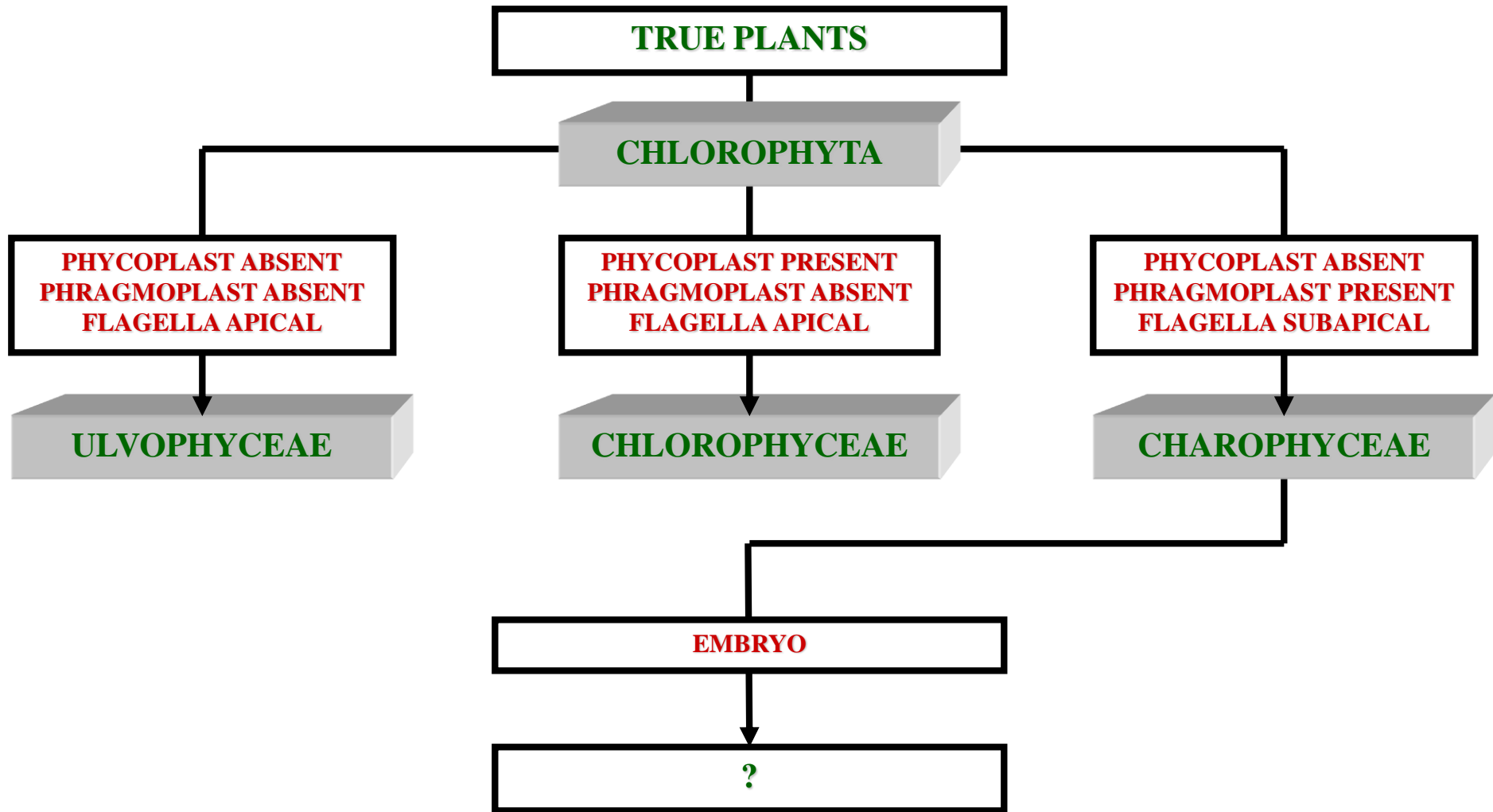
**CHAROPHYCEAE**

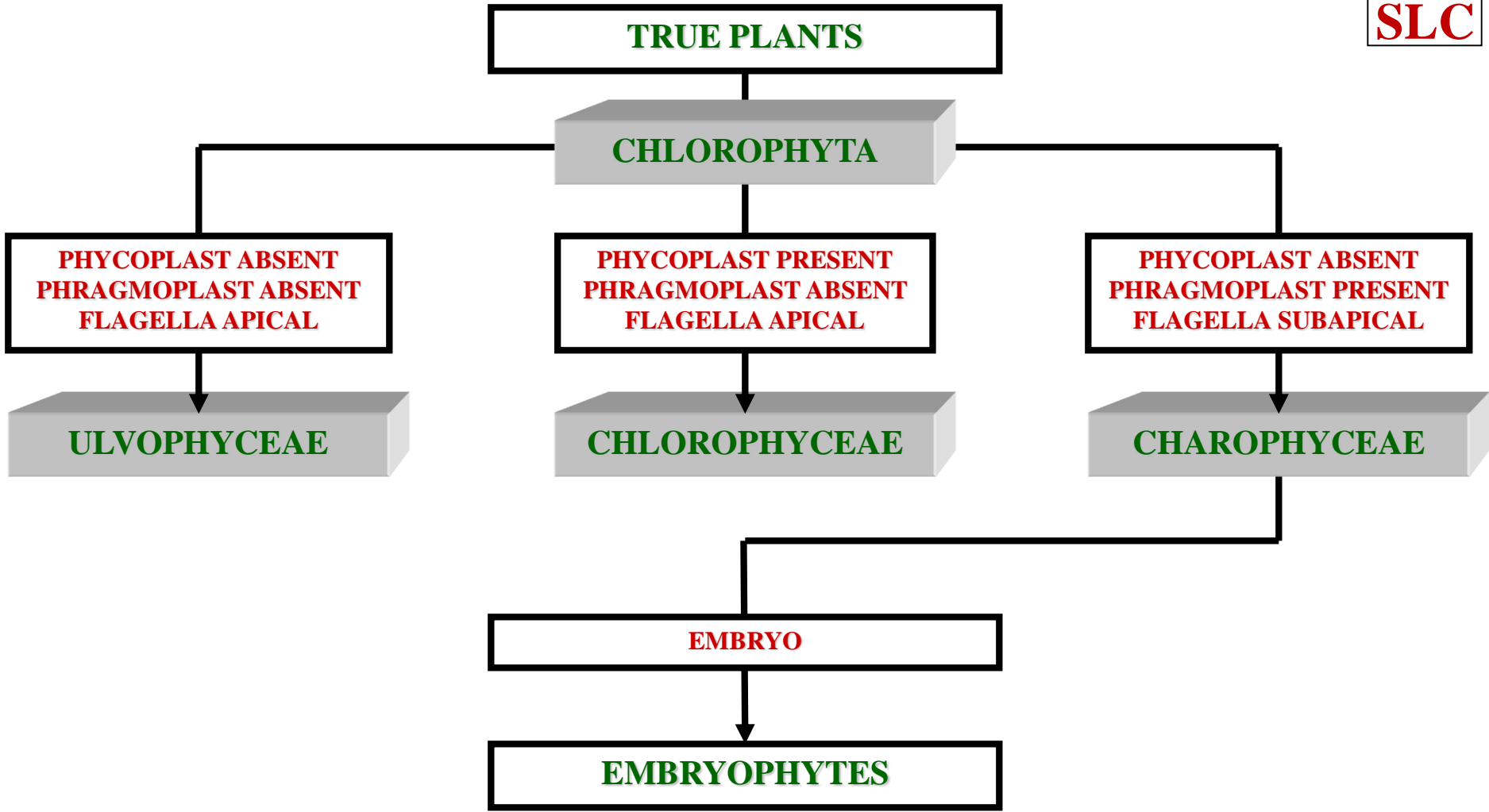
**EMBRYO**

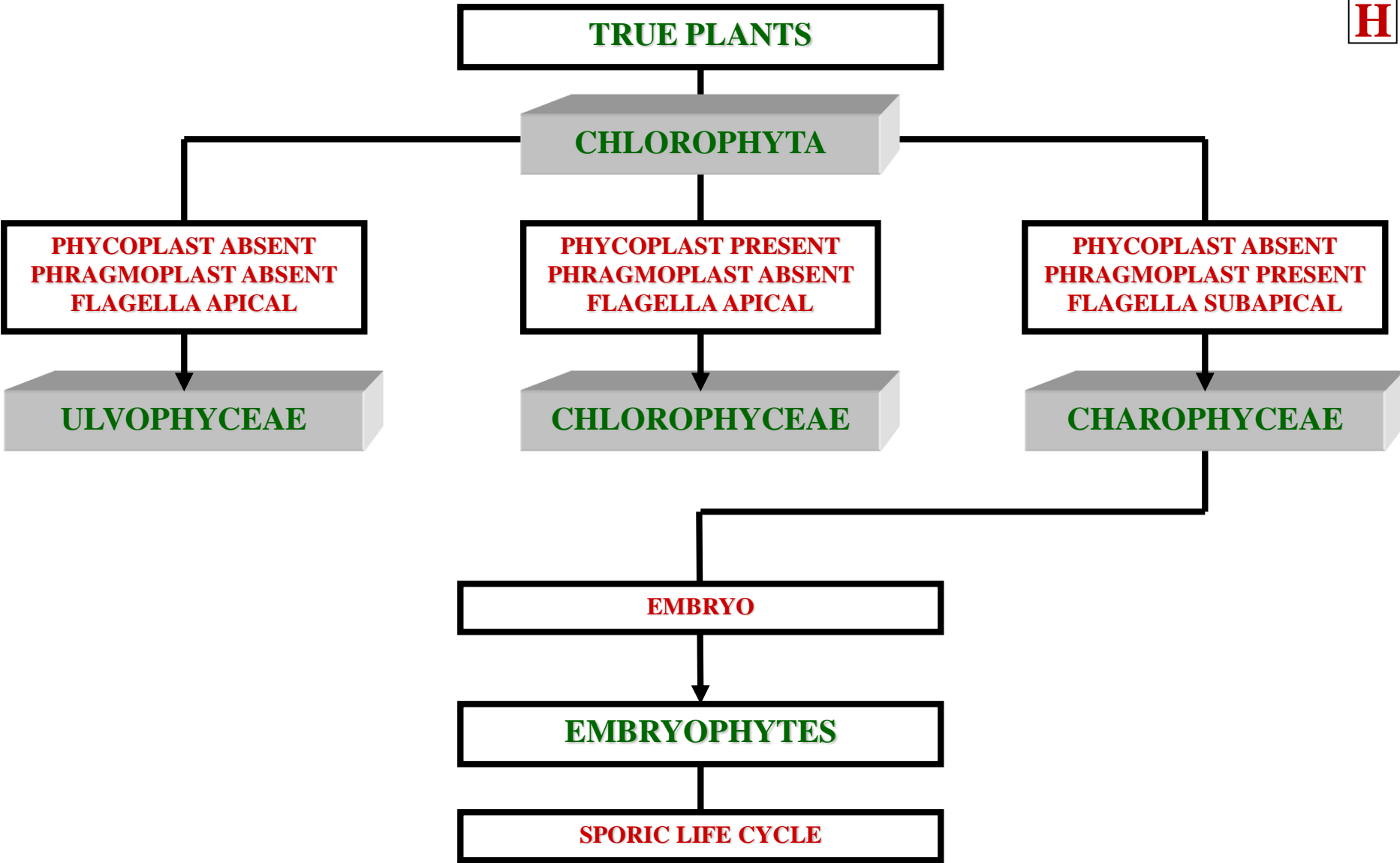
**“LAND PLANTS”**

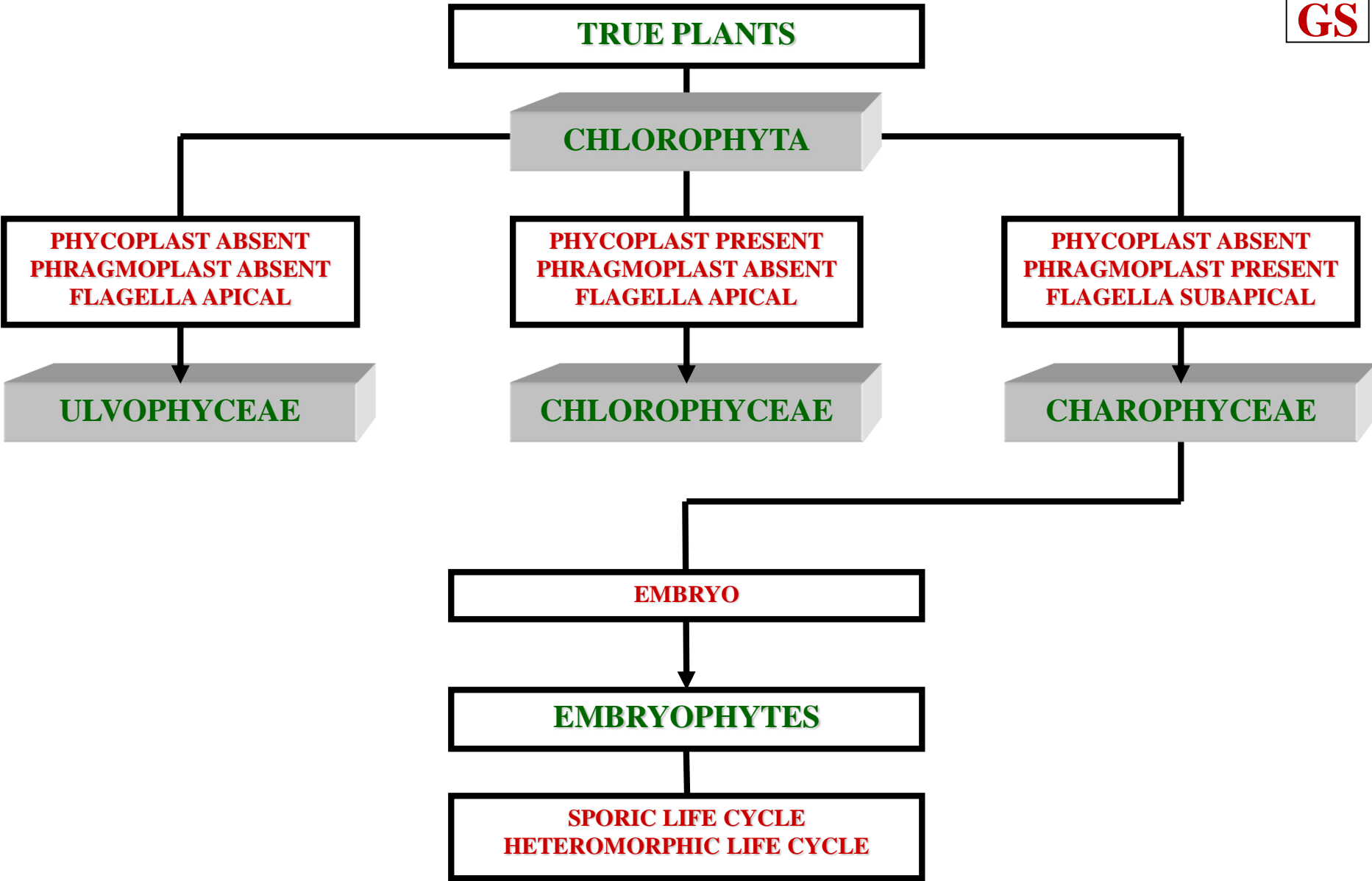


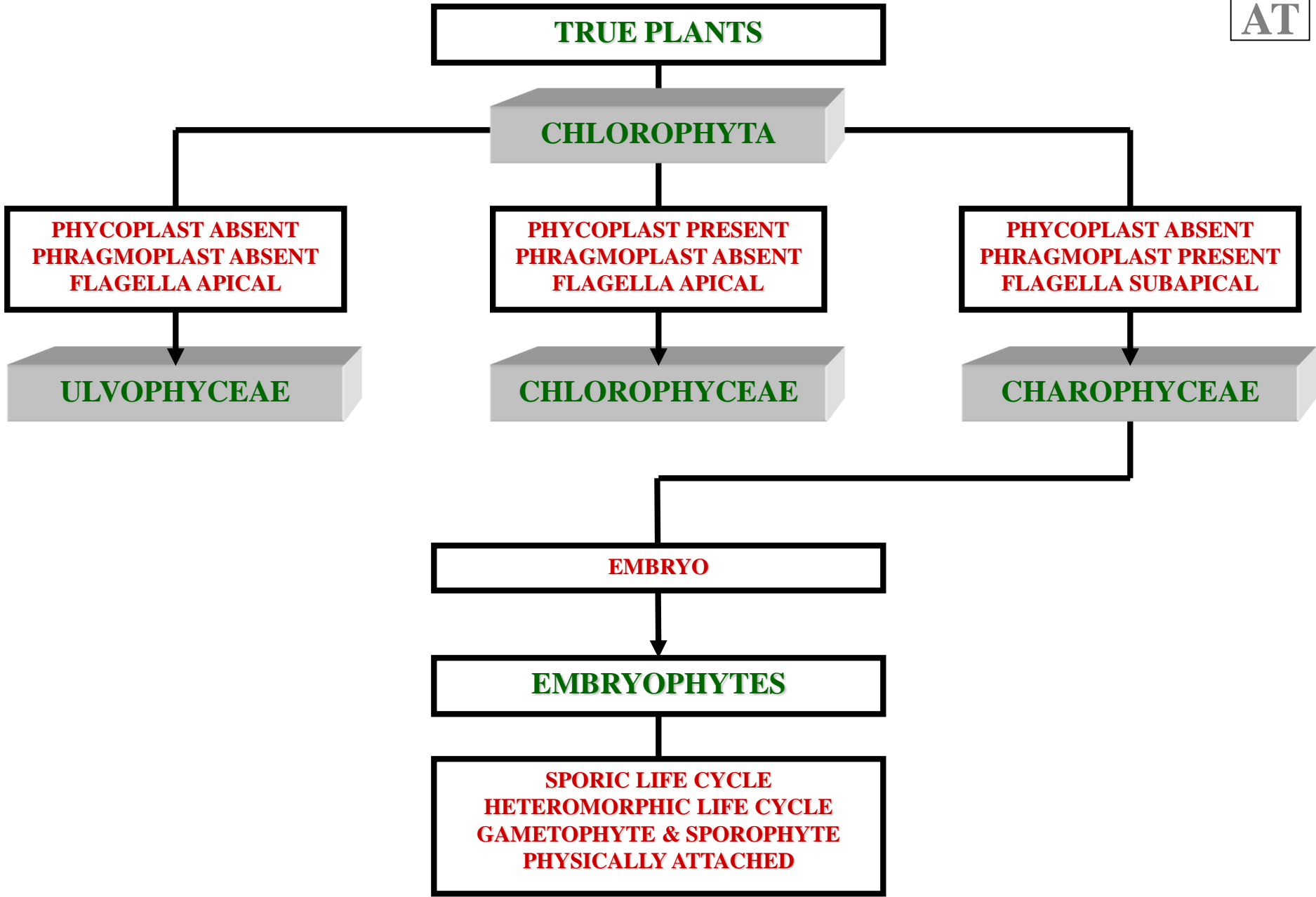














**TRUE PLANTS**

**CHLOROPHYTA**

**PHYCOPLAST ABSENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**PHYCOPLAST PRESENT  
PHRAGMOPLAST ABSENT  
FLAGELLA APICAL**

**PHYCOPLAST ABSENT  
PHRAGMOPLAST PRESENT  
FLAGELLA SUBAPICAL**

**ULVOPHYCEAE**

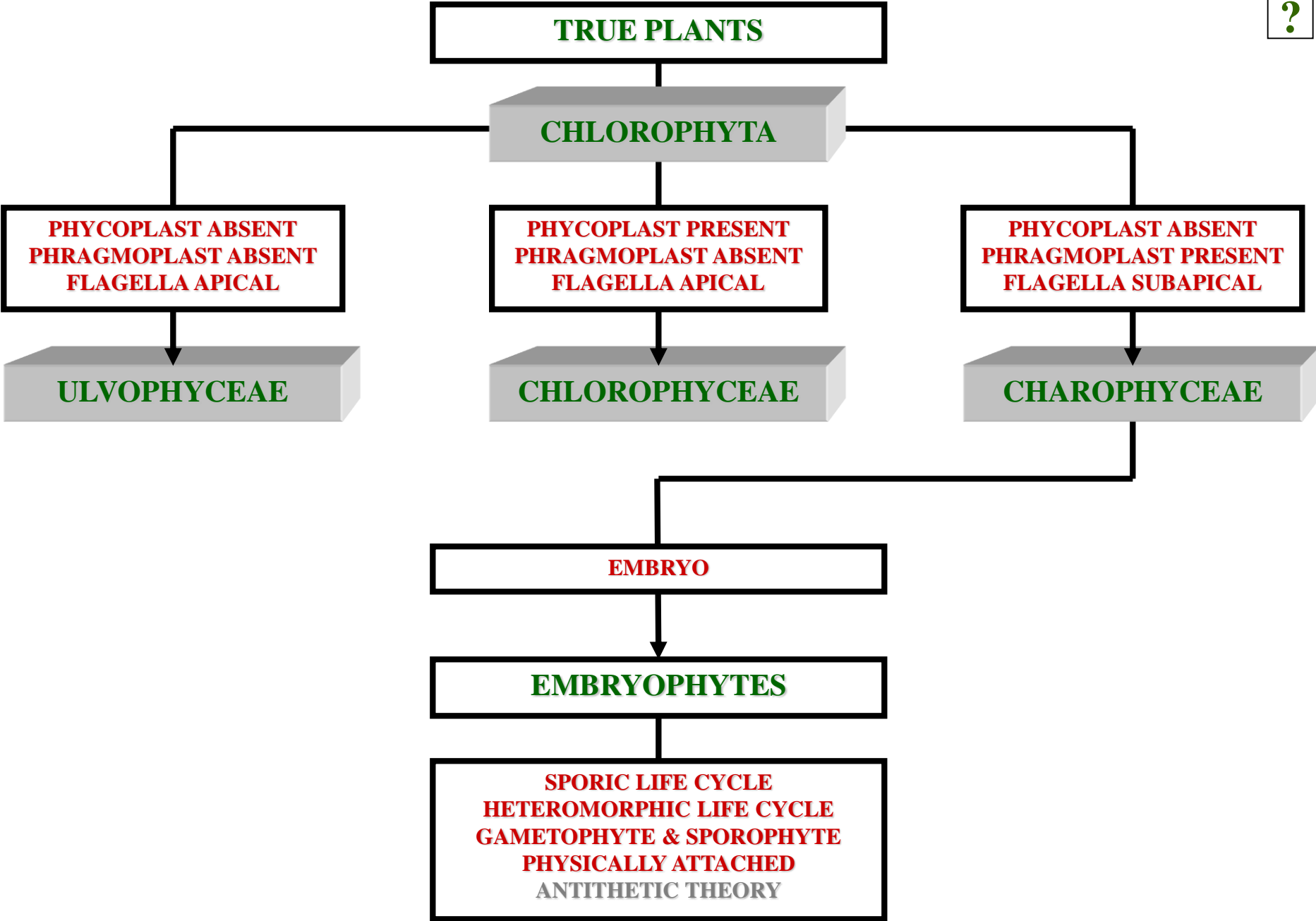
**CHLOROPHYCEAE**

**CHAROPHYCEAE**

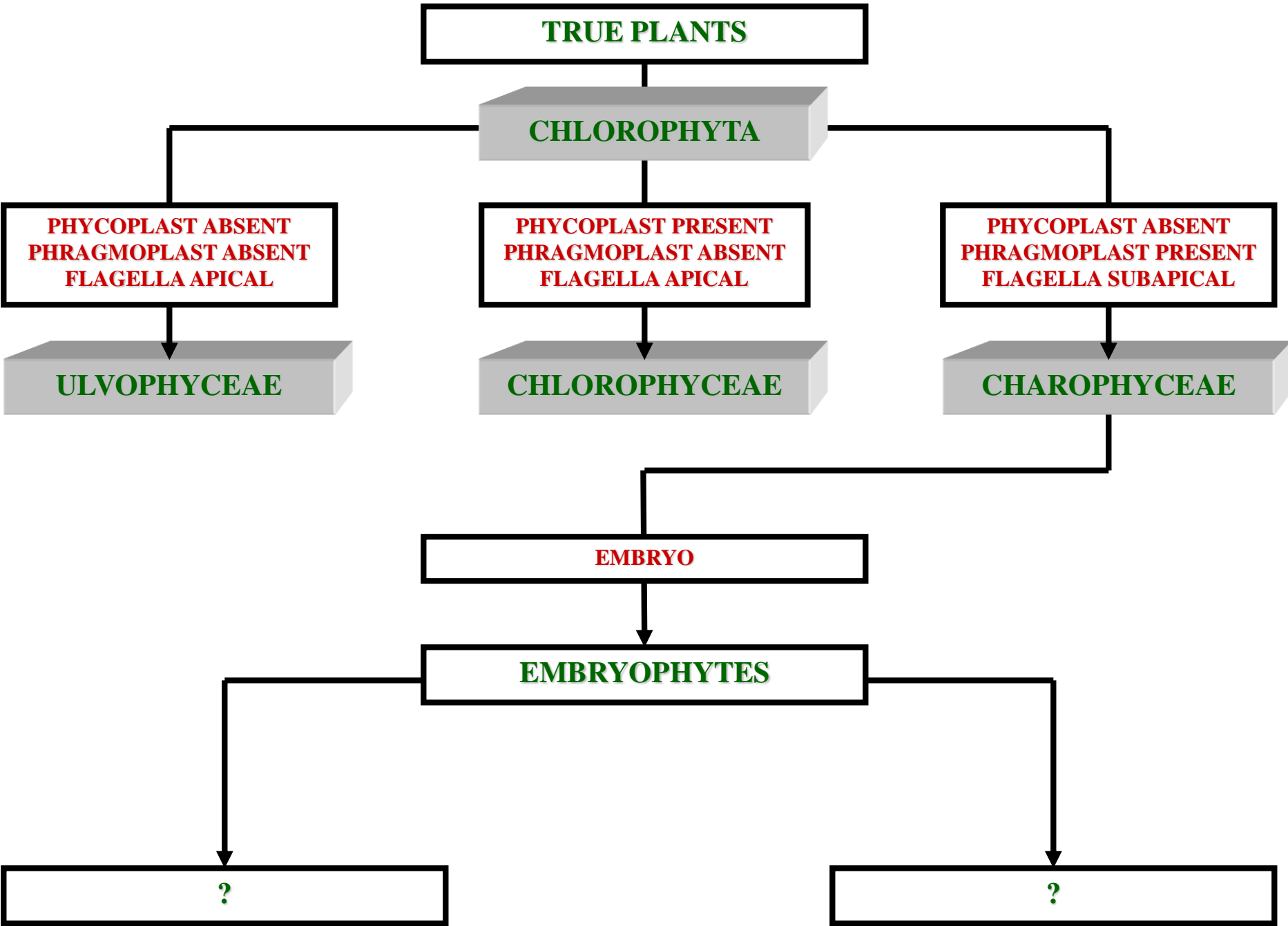
**EMBRYO**

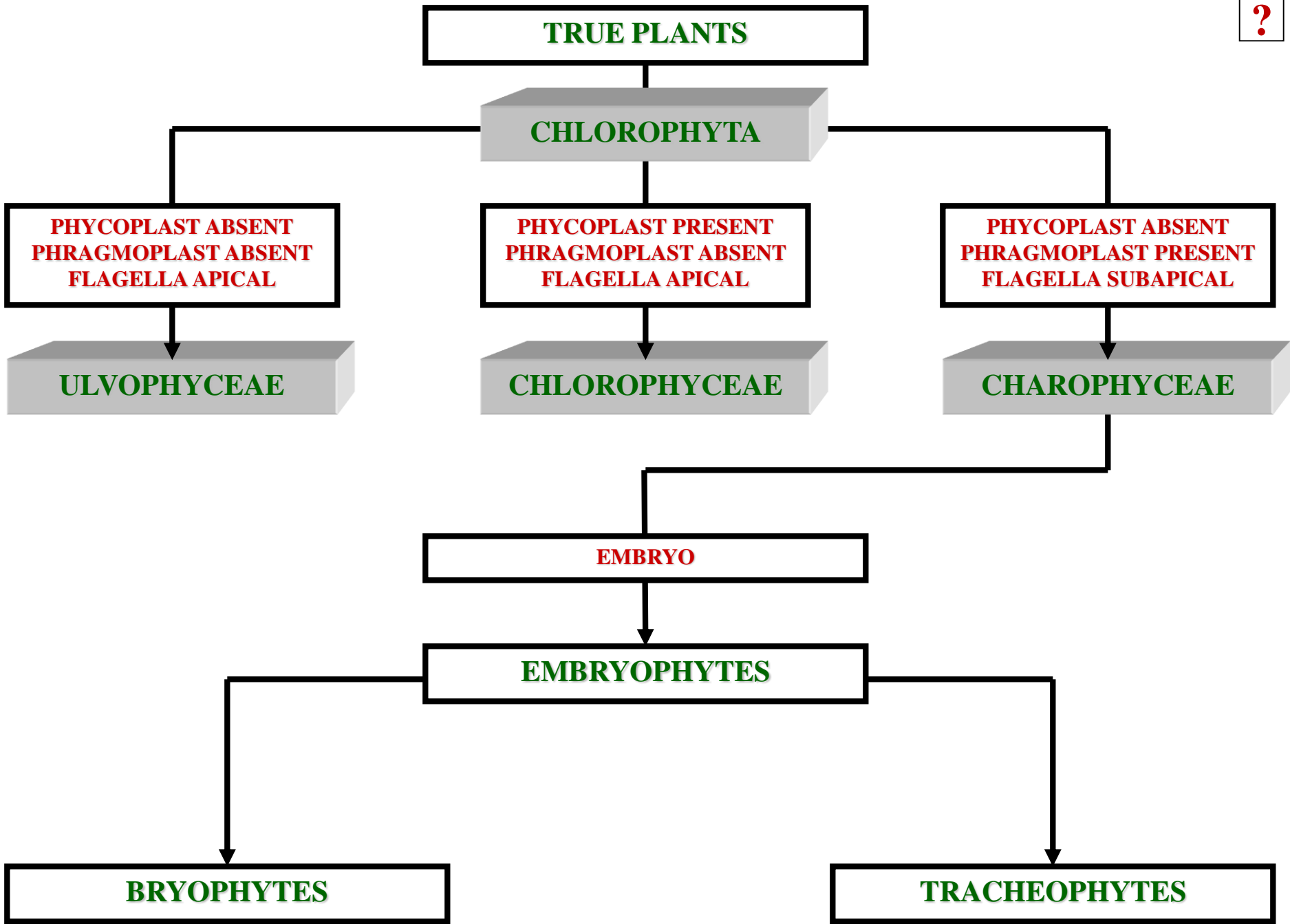
**EMBRYOPHYTES**

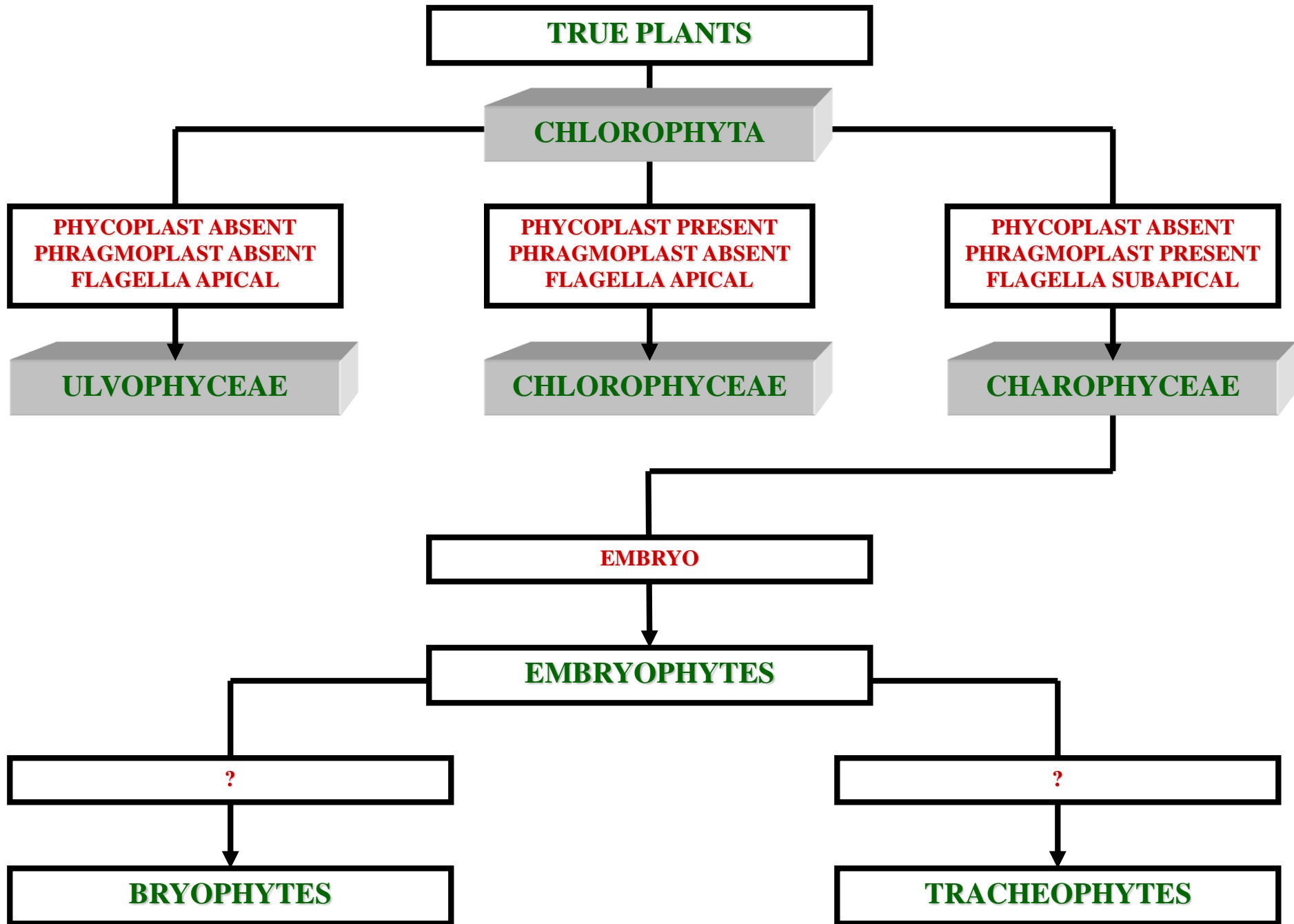
**SPORIC LIFE CYCLE  
HETEROMORPHIC LIFE CYCLE  
GAMETOPHYTE & SPOROPHYTE  
PHYSICALLY ATTACHED  
ANTITHETIC THEORY**

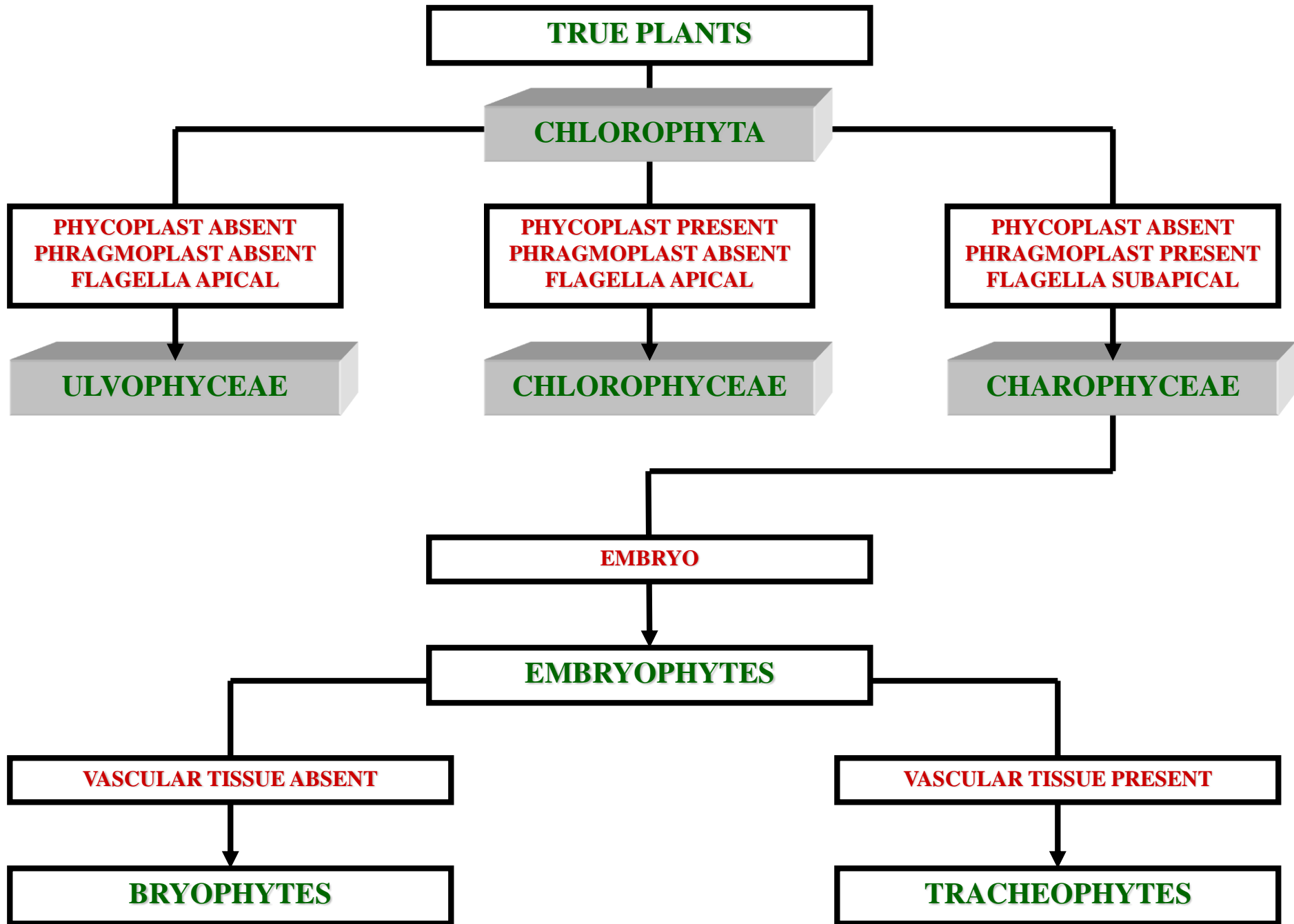










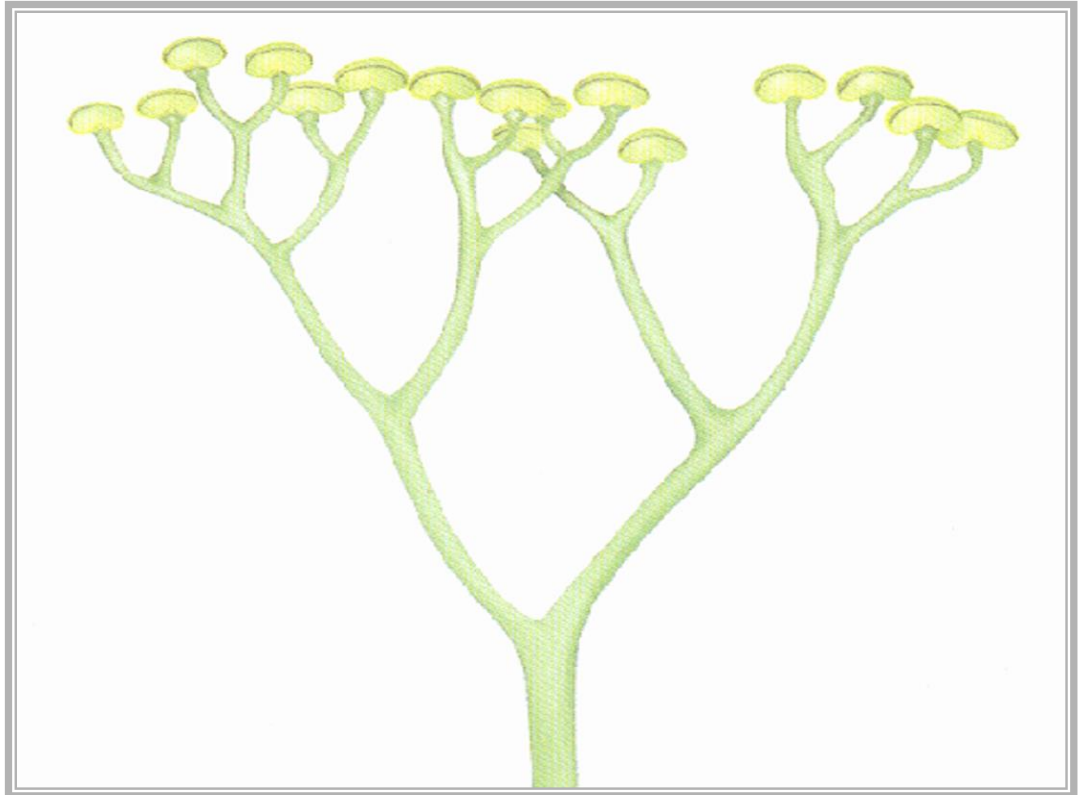


# TRACHEOPHYTES



# TRACHEOPHYTES

?

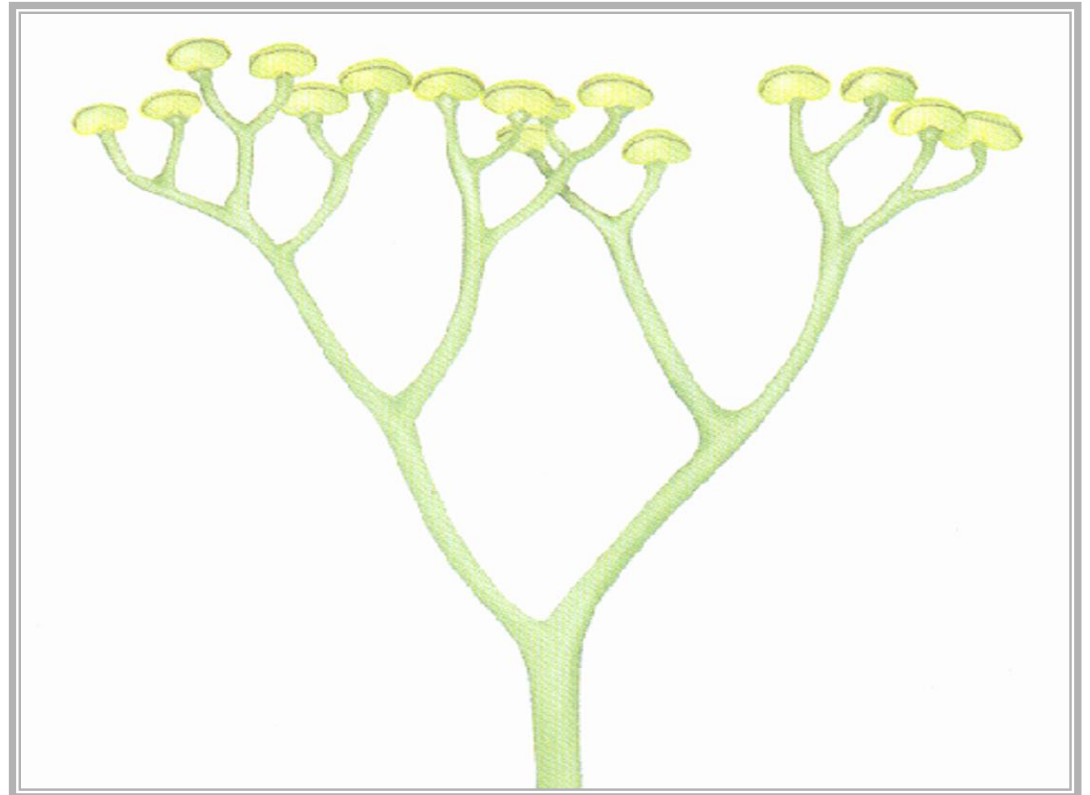




**TRACHEOPHYTES**



**RHYNIOPHYTA**



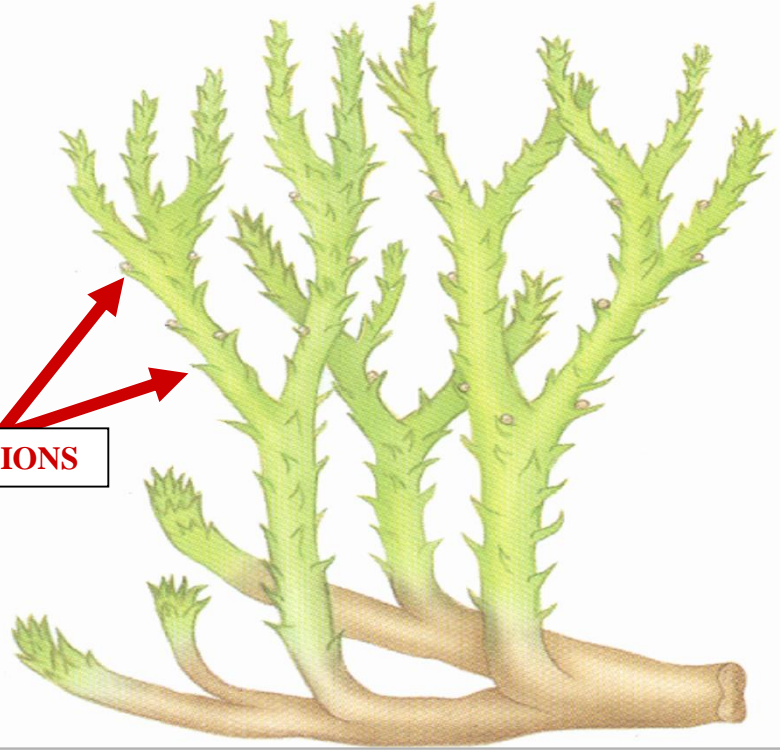
**TRACHEOPHYTES**

**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**ENATIONS**



**TRACHEOPHYTES**

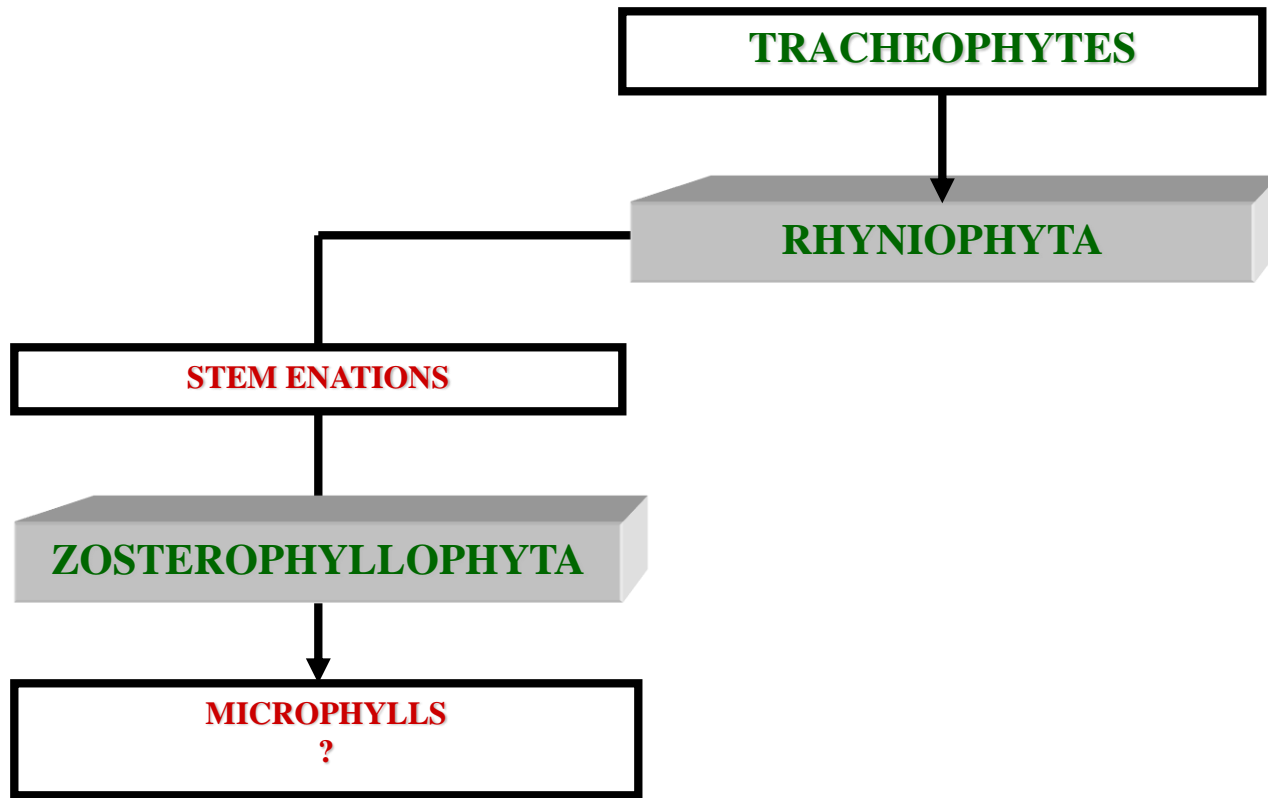
**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**MICROPHYLLS**

**?**



**TRACHEOPHYTES**

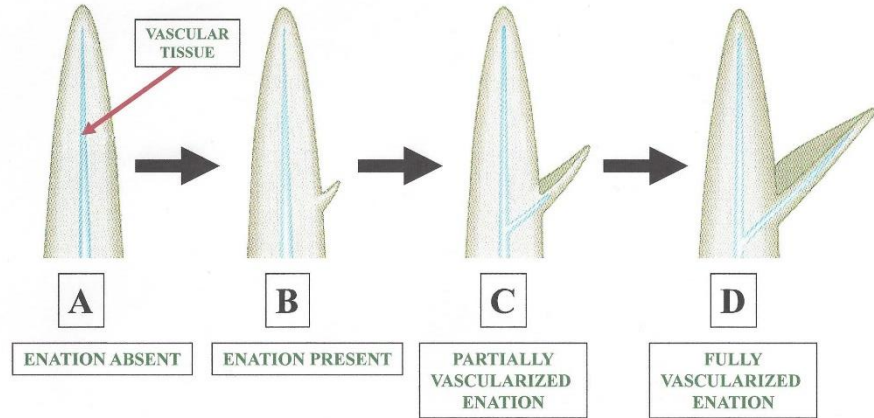
**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**MICROPHYLLS  
ENATION THEORY**

# ENATION THEORY



**MICROPHYLL**

**TRACHEOPHYTES**

**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**MICROPHYLLS  
ENATION THEORY**

**?**





**TRACHEOPHYTES**

**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**MICROPHYLLS  
ENATION THEORY**

**LYCOPODIOPHYTA**



**TRACHEOPHYTES**

**RHYNIOPHYTA**

**STEM ENATIONS**

**ZOSTEROPHYLLOPHYTA**

**MICROPHYLLS  
ENATION THEORY**

**LYCOPODIOPHYTA**

**PHYLOGENETIC  
DEAD-END**







# VASCULAR PLANT EVOLUTION



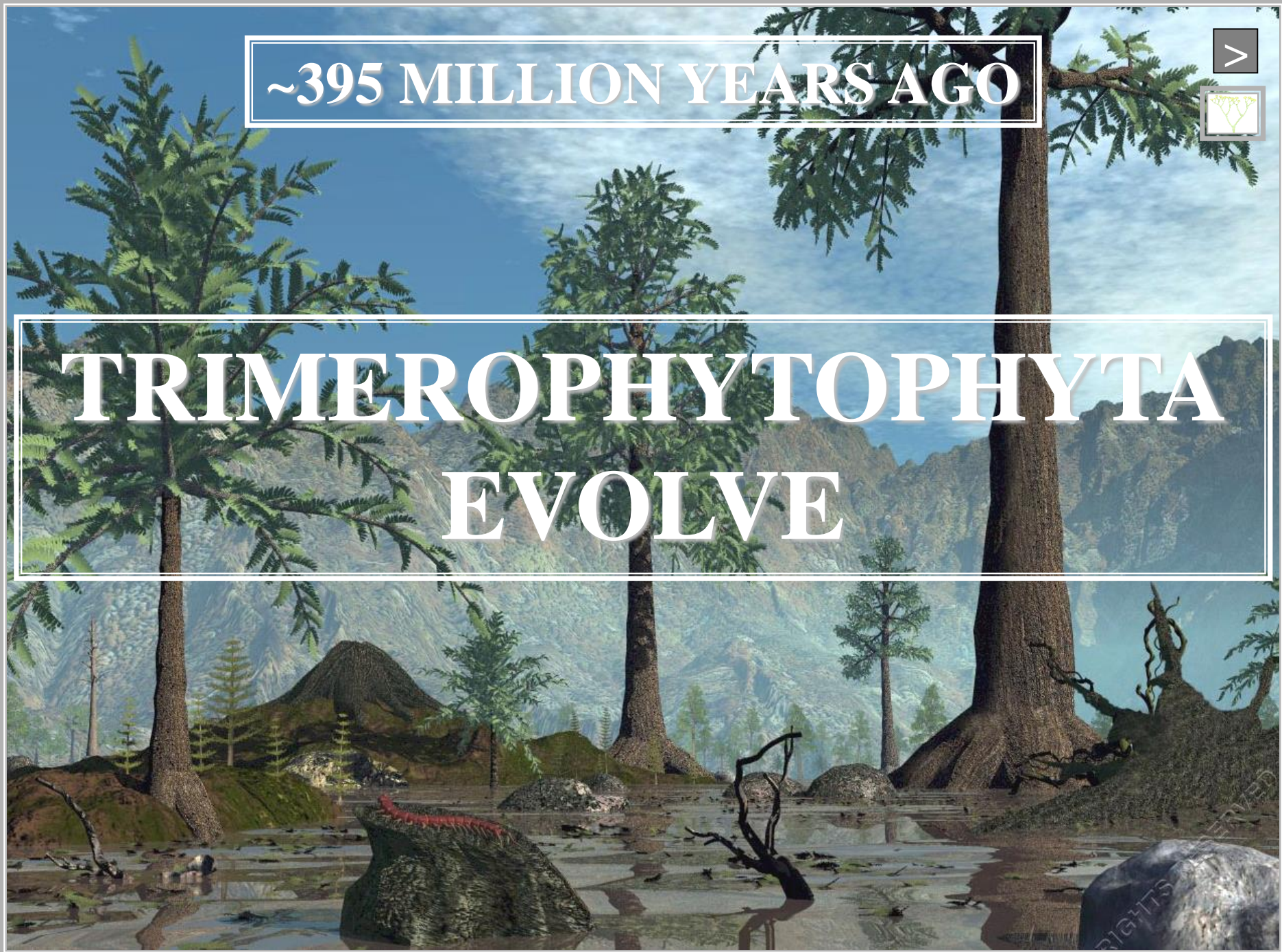
**~395**

**MILLION YEARS**

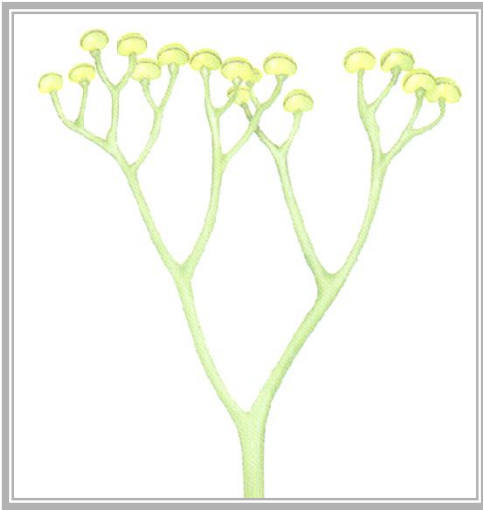
~395 MILLION YEARS AGO



# TRIMEROPHYTOPHYTA EVOLVE

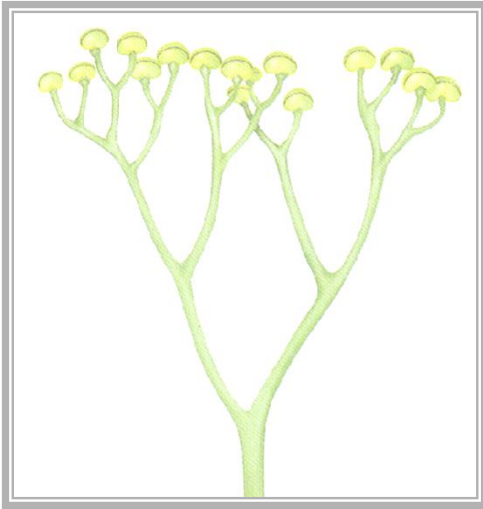


# TRIMEROPHYTE EVOLUTION



*COOKSONIA*

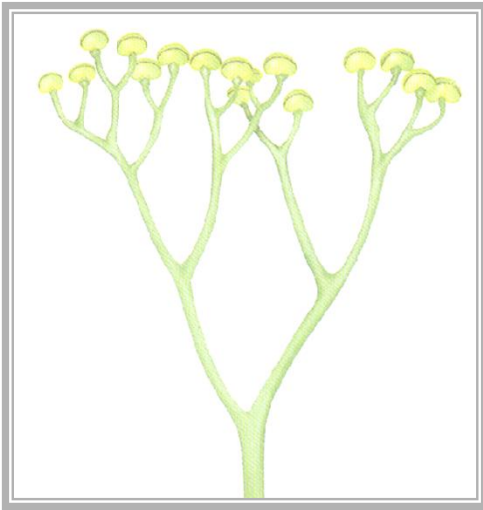
# TRIMEROPHYTE EVOLUTION



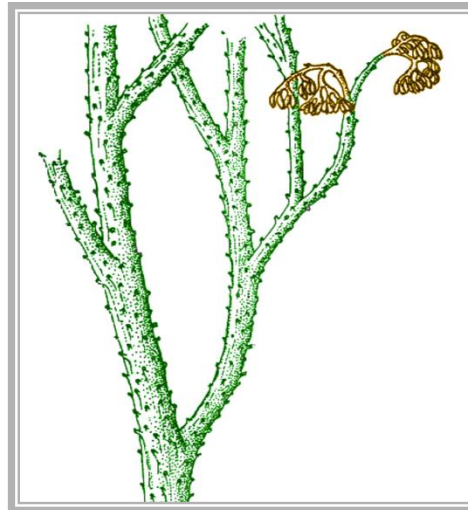
**RHYNIOPHYTE**



# TRIMEROPHYTE EVOLUTION

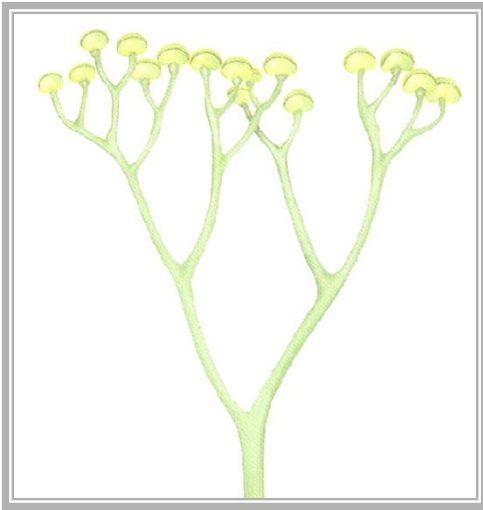


**RHYNIOPHYTE**

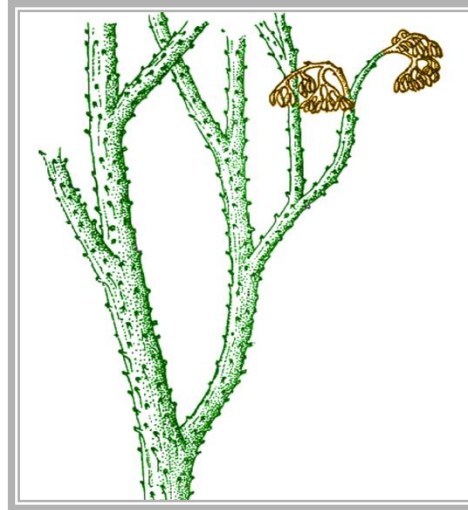


**TRIMEROPHYTON**

# TRIMEROPHYTE EVOLUTION



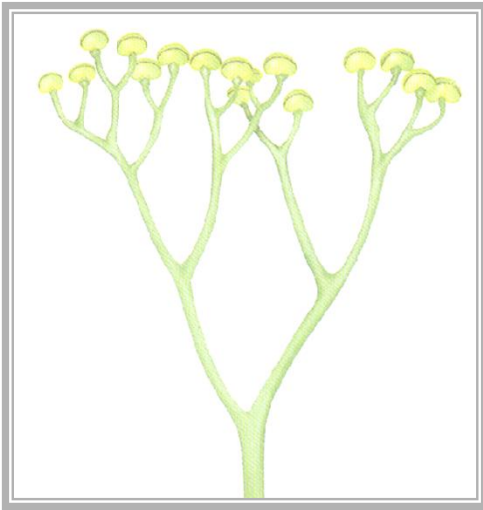
**RHYNIOPHYTE**



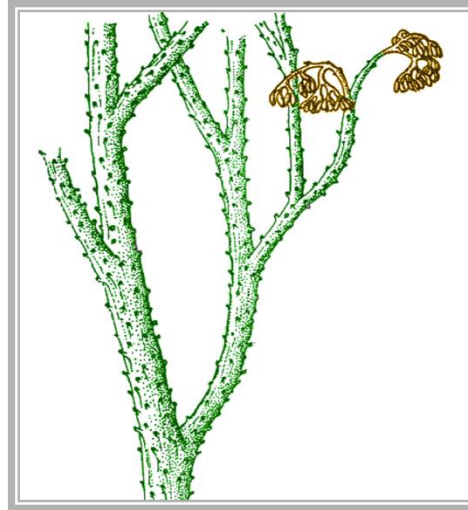
**TRIMEROPHYTE**



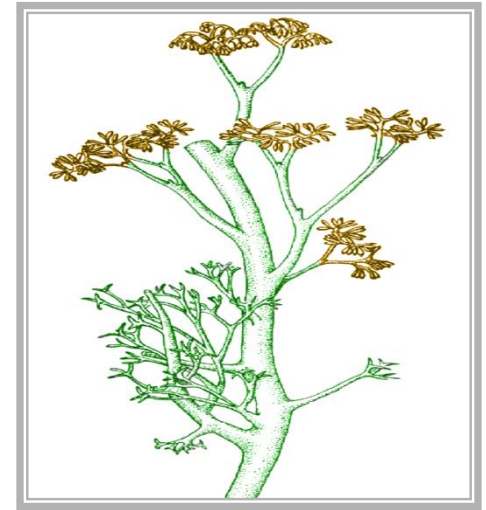
# TRIMEROPHYTE EVOLUTION



**RHYNIOPHYTE**

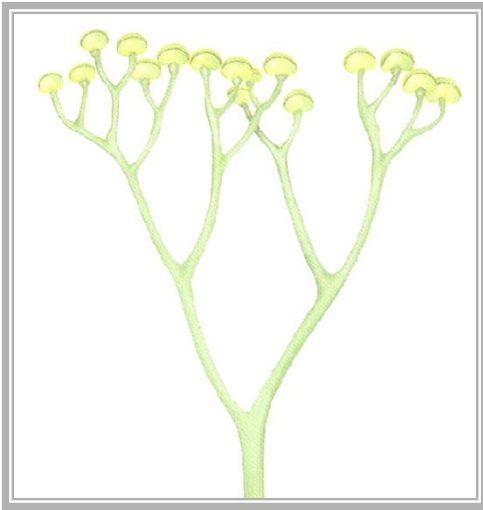


**TRIMEROPHYTE**

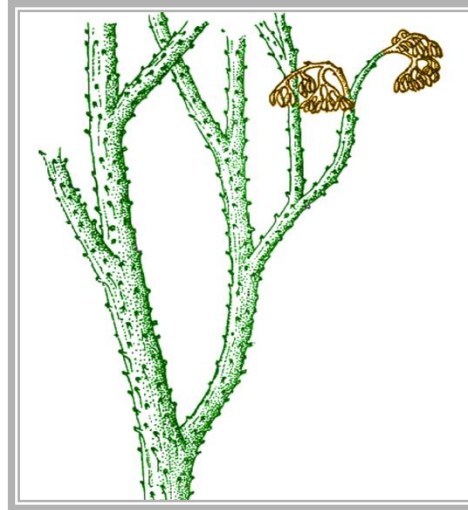


***PSILOPHYTON***

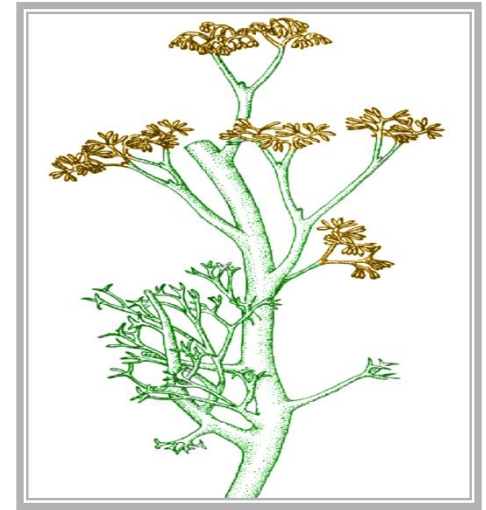
# TRIMEROPHYTE EVOLUTION



**RHYNIOPHYTE**



**TRIMEROPHYTE**



**TRIMEROPHYTE**



# PHYLUM TRIMEROPHYTYTA



**EXTINCT  
PHYLUM**

**PHYLUM**

**TRIMEROPHYTOPHYTA**

**EXTINCT  
PHYLUM**



# COMMON NAME



# TRIMEROPHYTES





# FOSSIL RECORD



**~395**

**MILLION YEARS**



~395 MILLION YEARS AGO

E

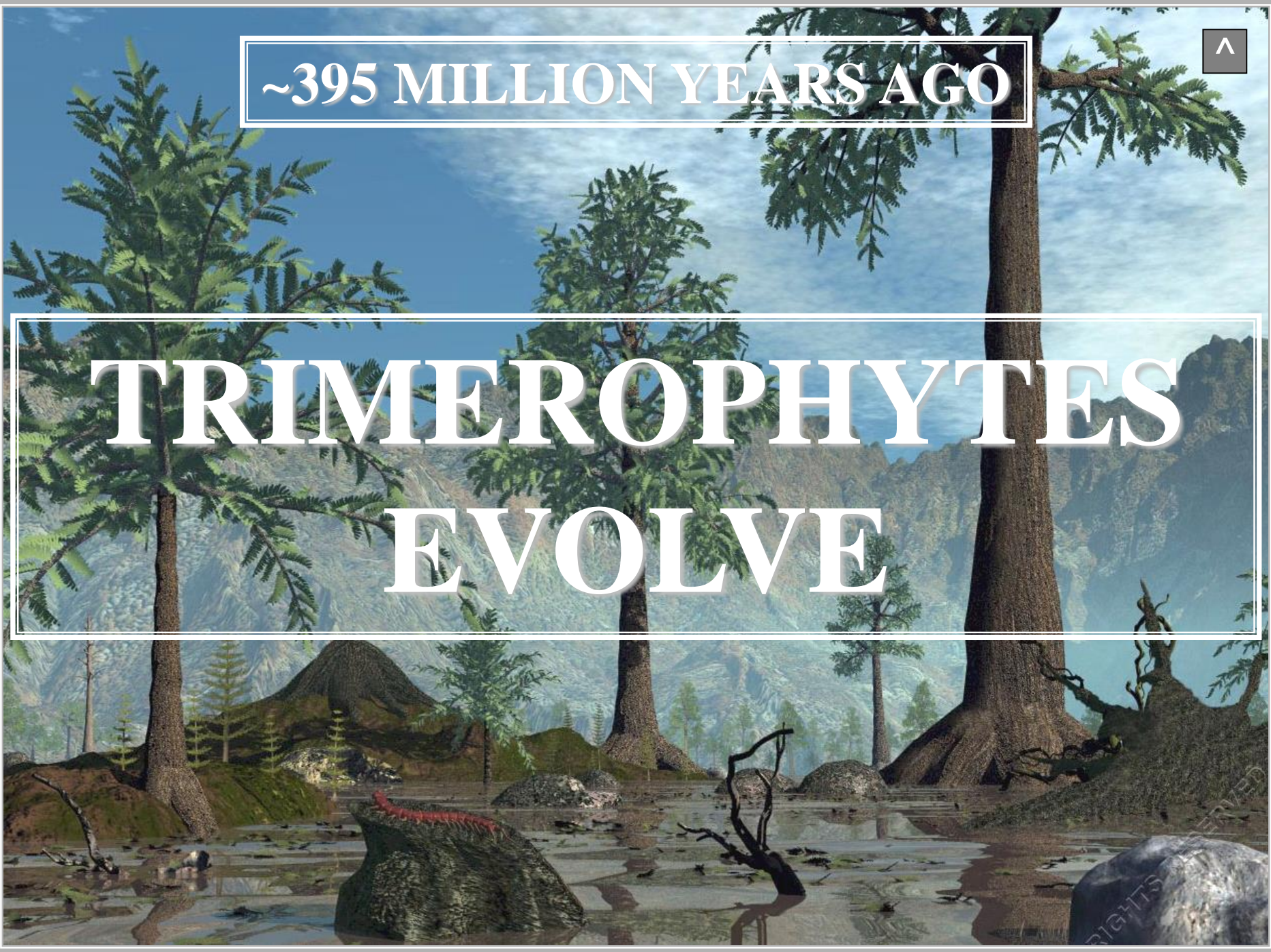
DEVONIAN





~395 MILLION YEARS AGO

# TRIMEROPHYTES EVOLVE





*~375*

**MILLION YEARS**



~375 MILLION YEARS AGO

E

DEVONIAN





~375 MILLION YEARS AGO

TRIMEROPHYTES  
EXTINCT





# GENERAL CHARACTERS

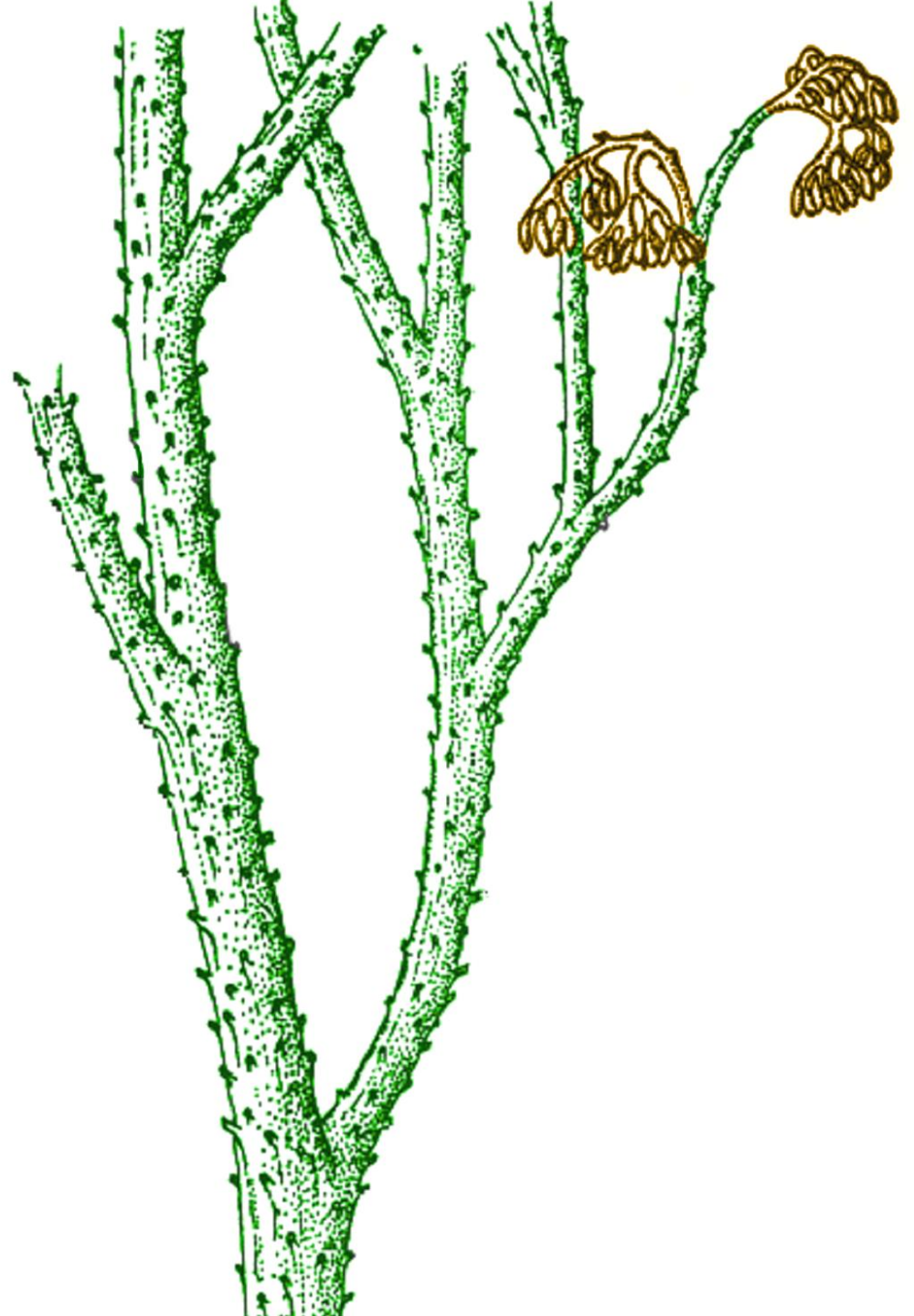


# ORGANS



# *TRIMEROPHYTON*

AB

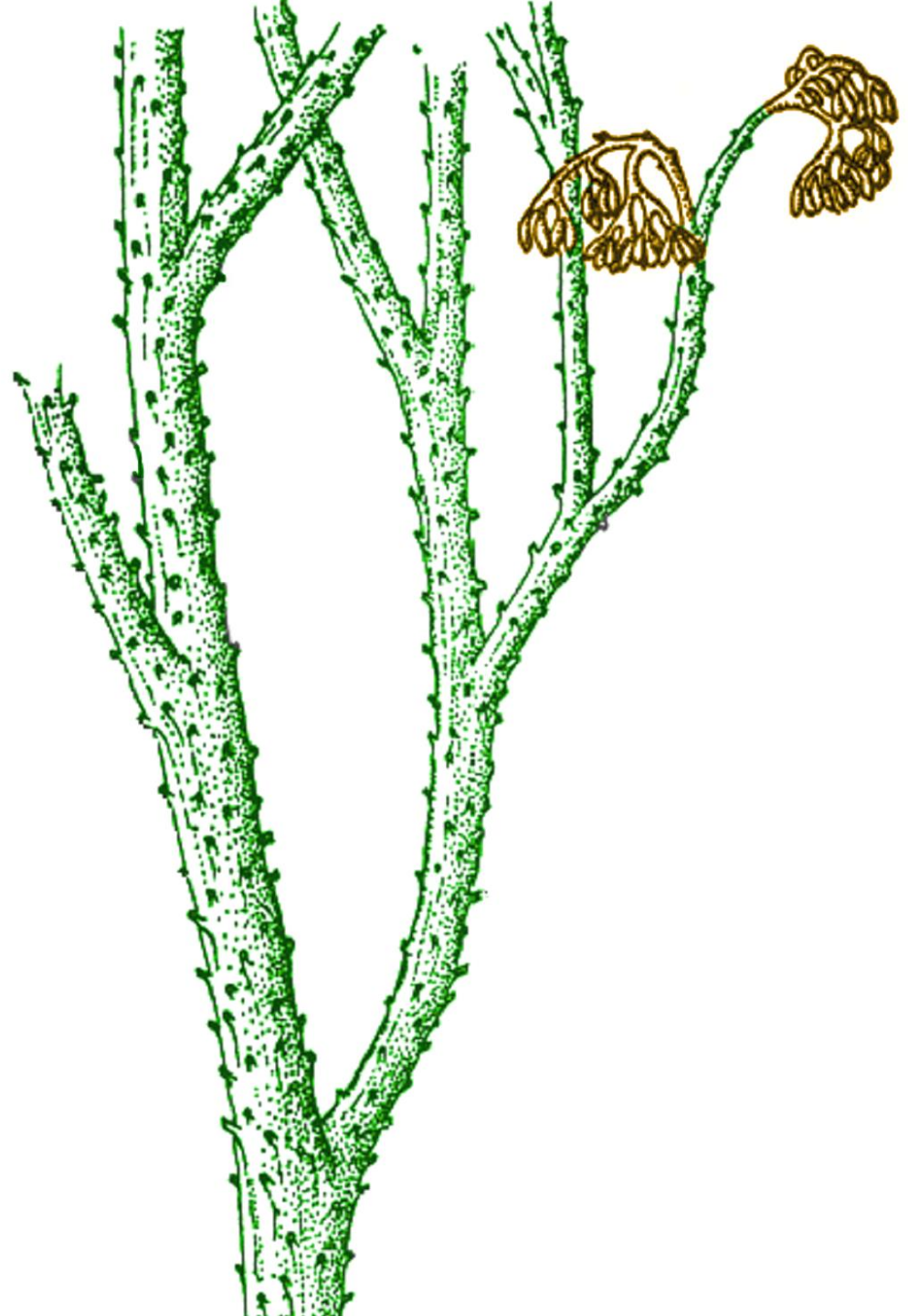




# *TRIMEROPHYTON*

**S**

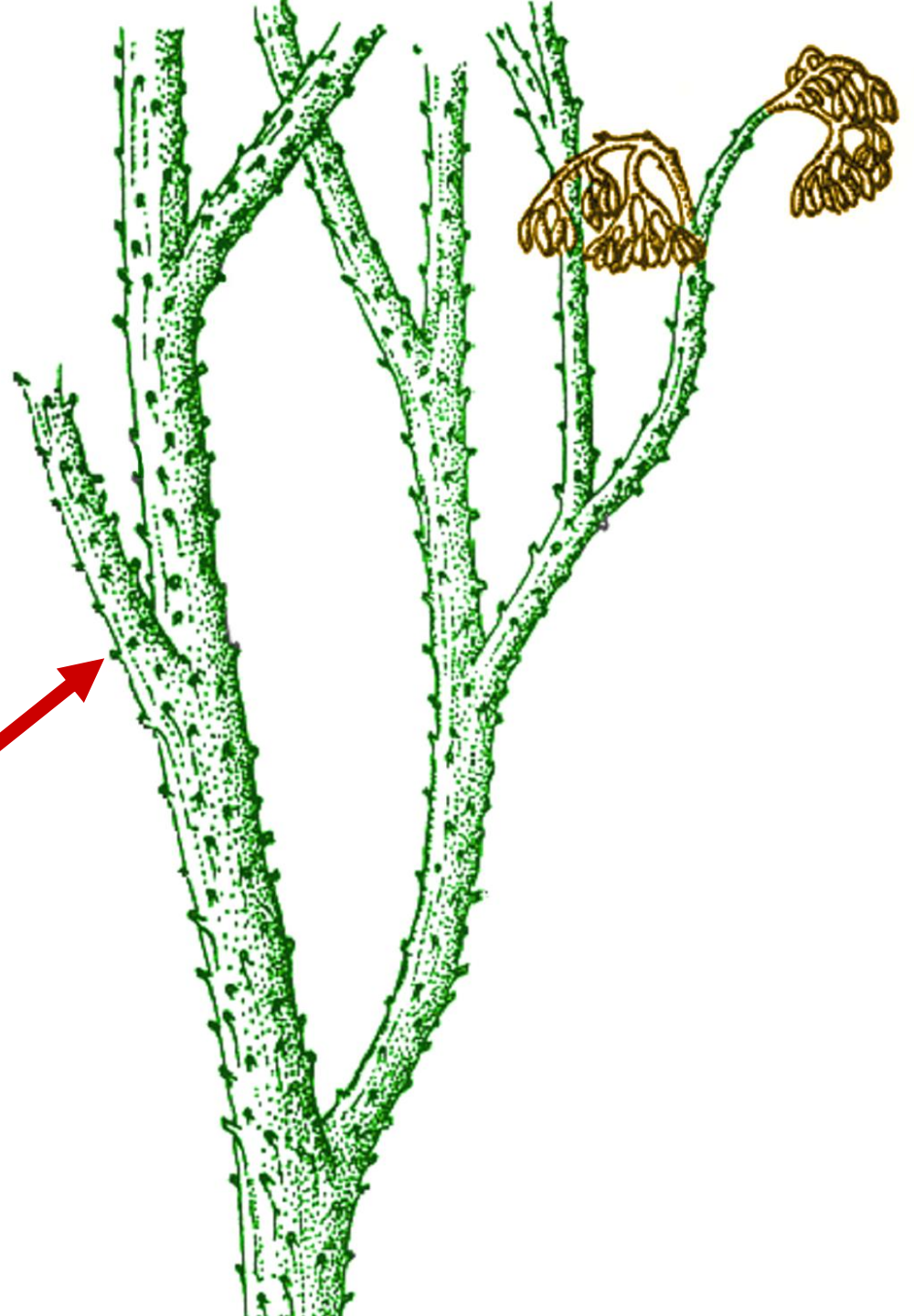
**ROOTS  
LEAVES  
ABSENT**



# *TRIMEROPHYTON*

^

**STEM**



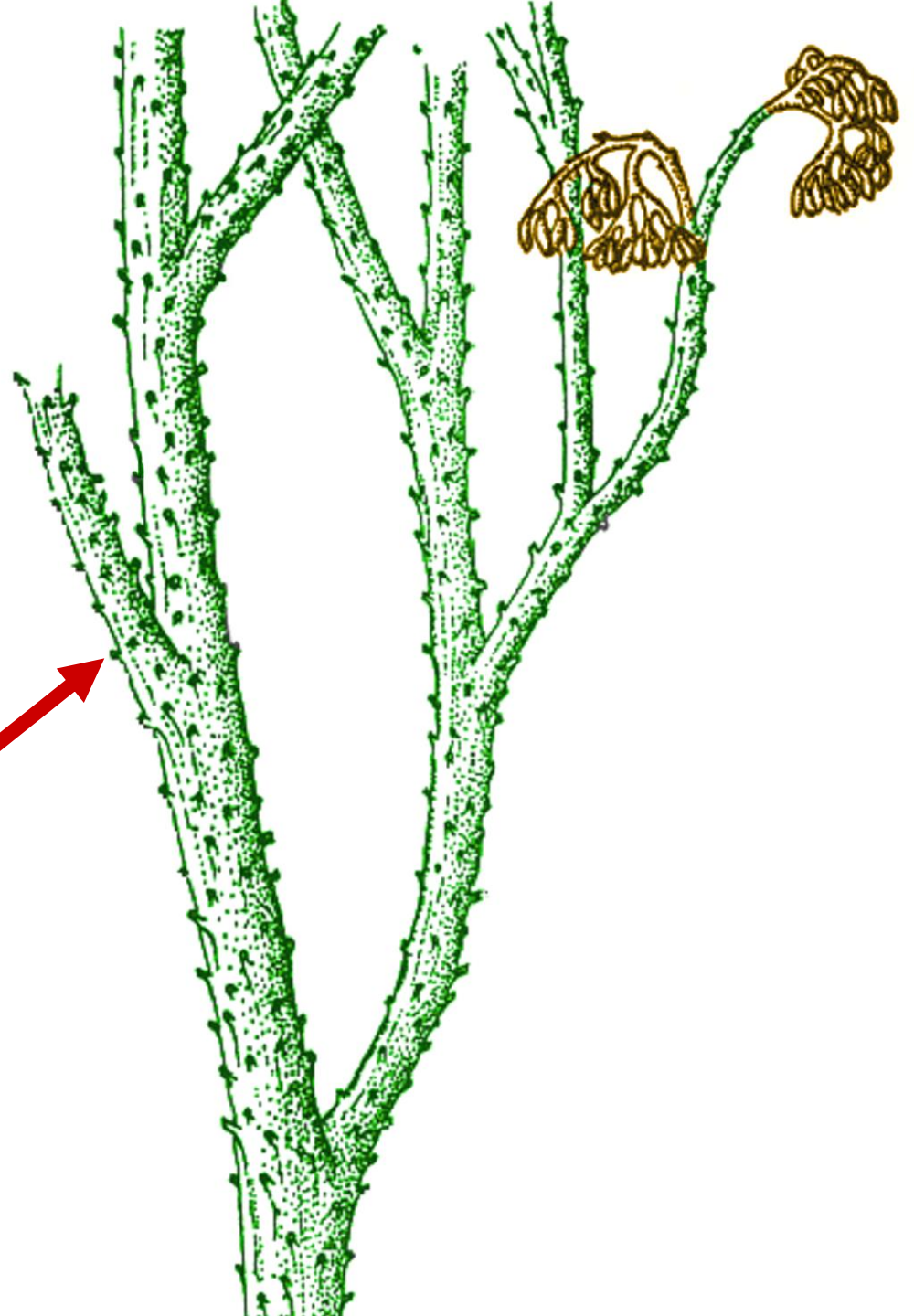


# STEM

# *TRIMEROPHYTON*

**P**

**STEM**

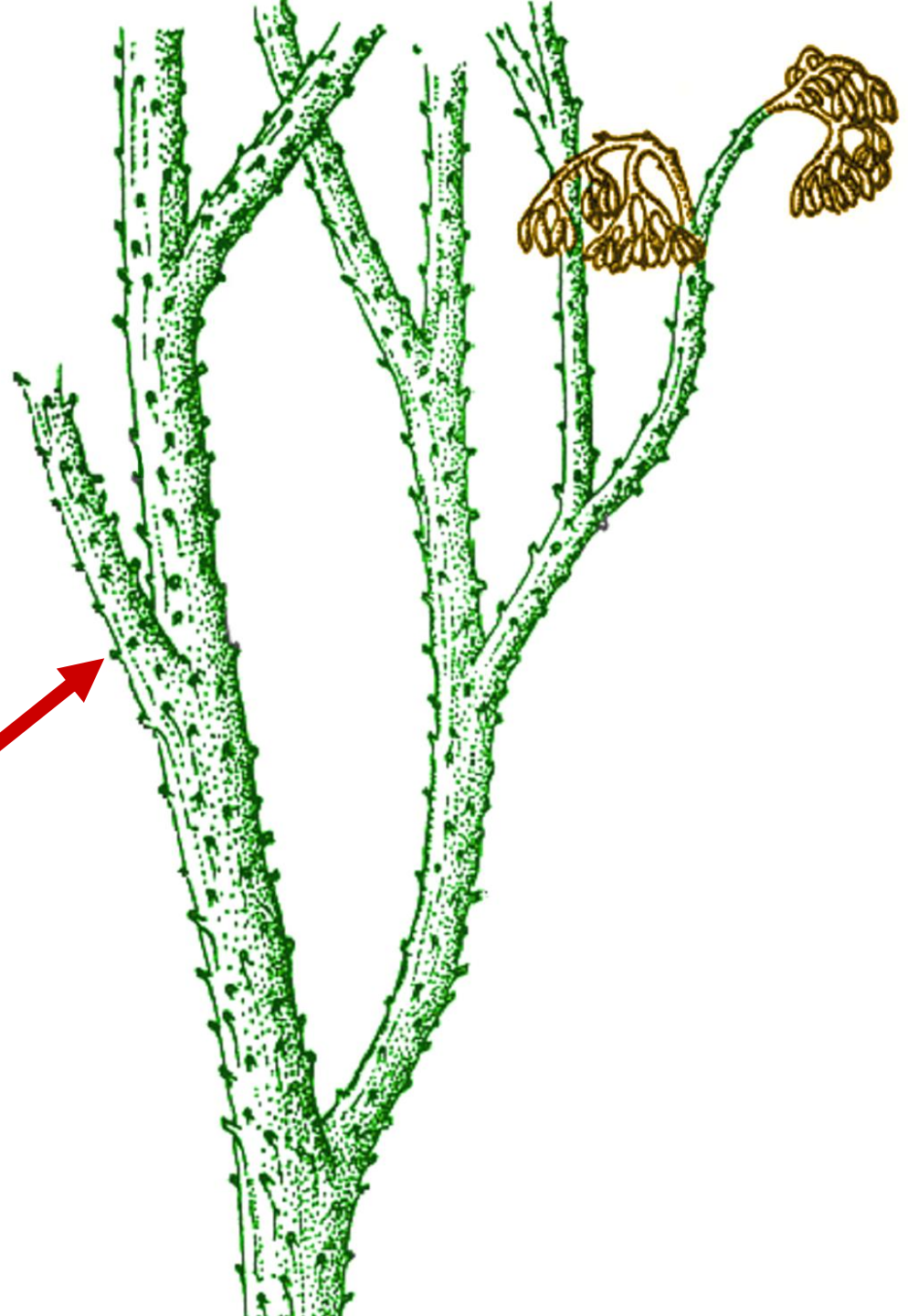


# *TRIMEROPHYTON*

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**STEM**

**PHOTOSYNTHETIC**

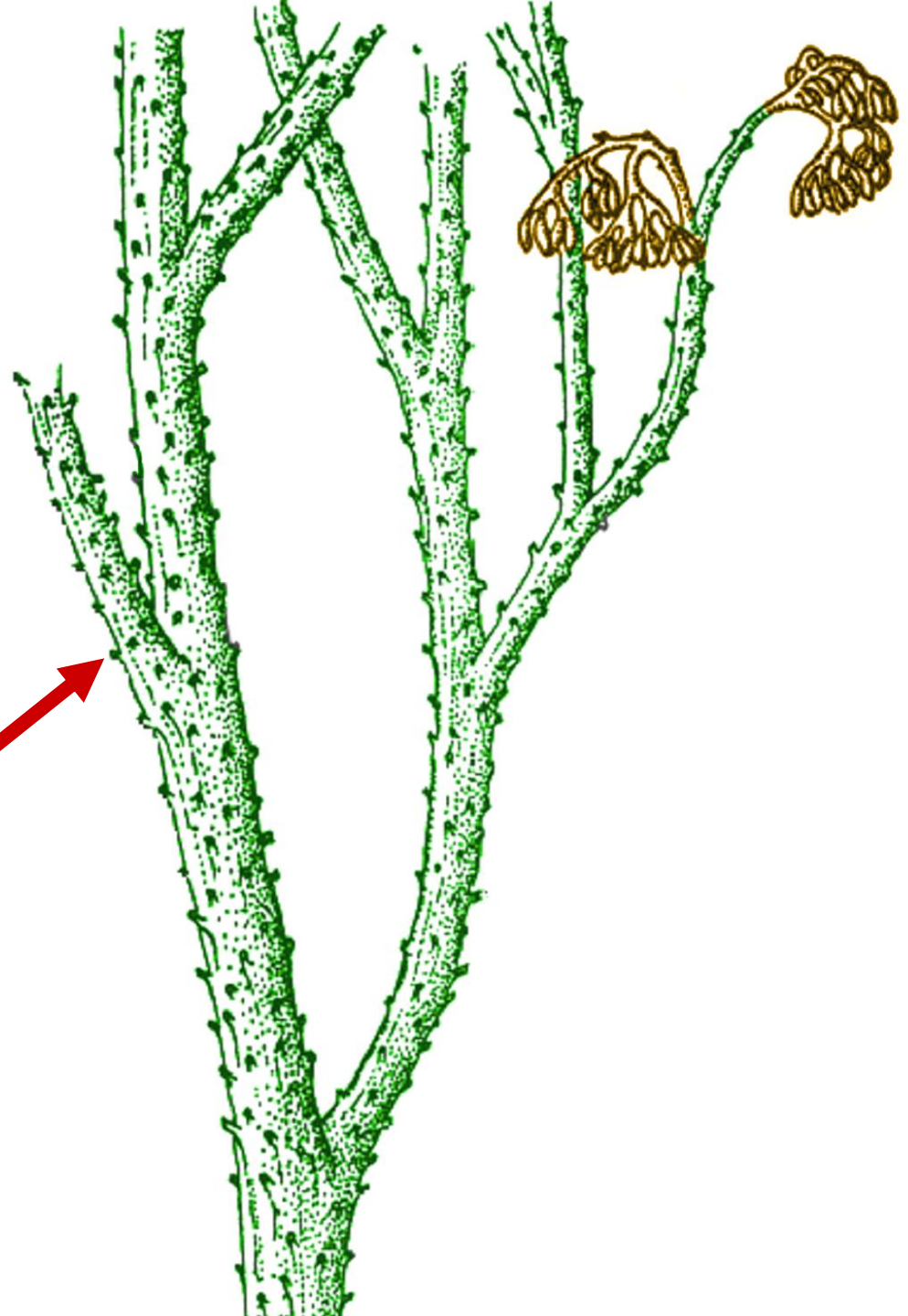




# STEM ANATOMY



# *TRIMEROPHYTON*



**STEM**

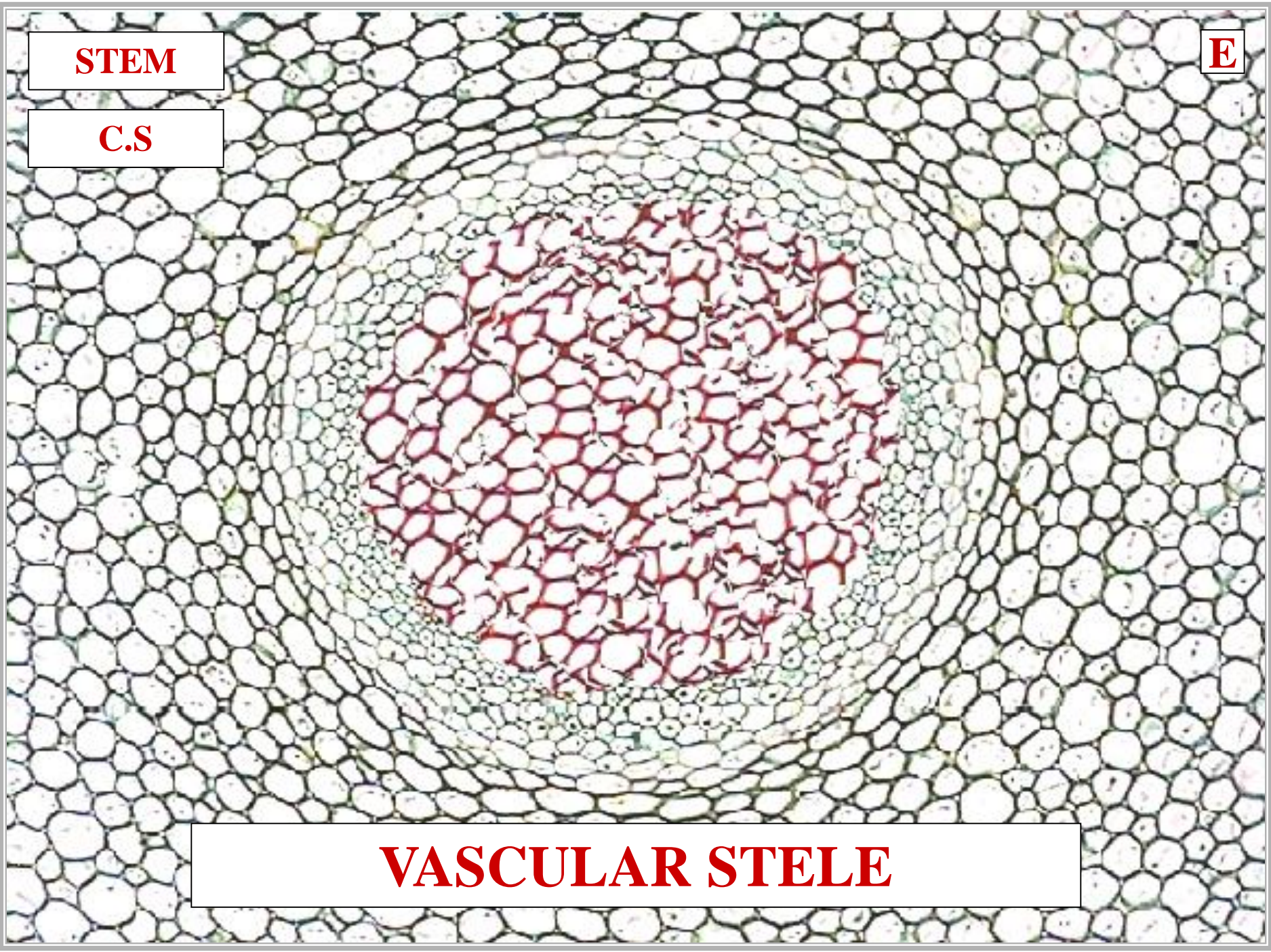


**STEM**

**C.S**

**E**

**VASCULAR STELE**



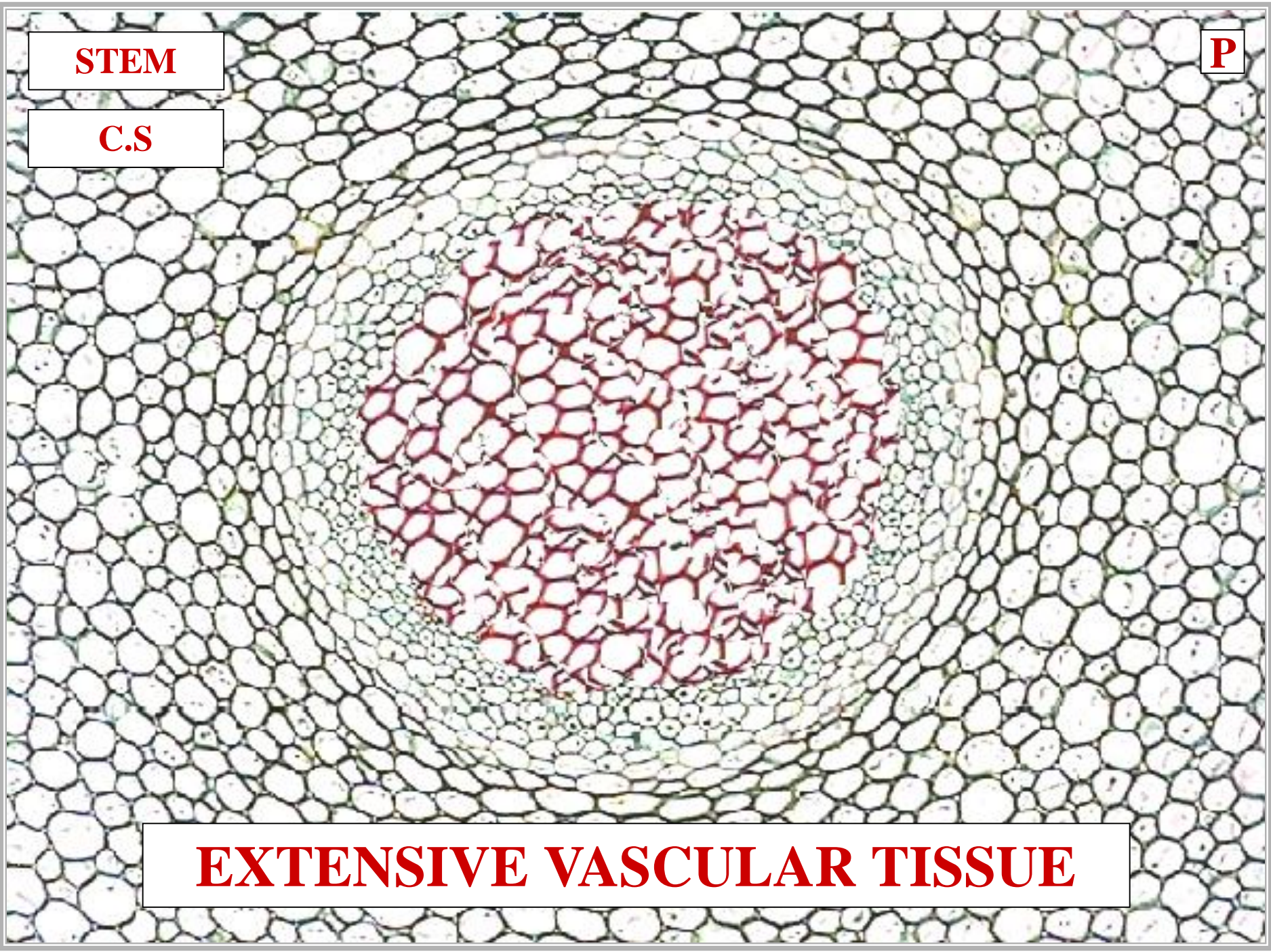


**STEM**

**C.S**

**P**

**EXTENSIVE VASCULAR TISSUE**



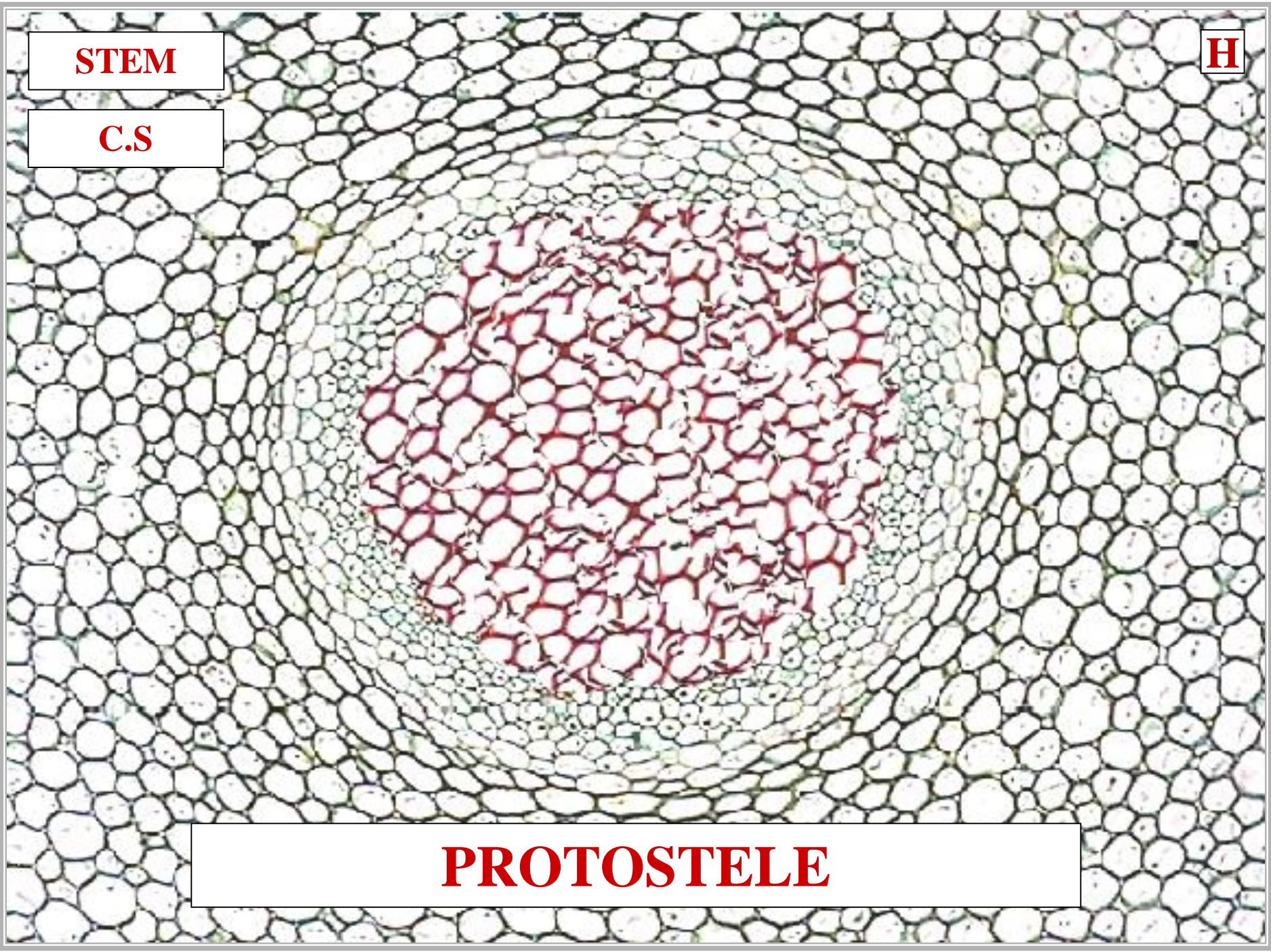


**STEM**

**C.S**

**H**

**PROTOSTELE**



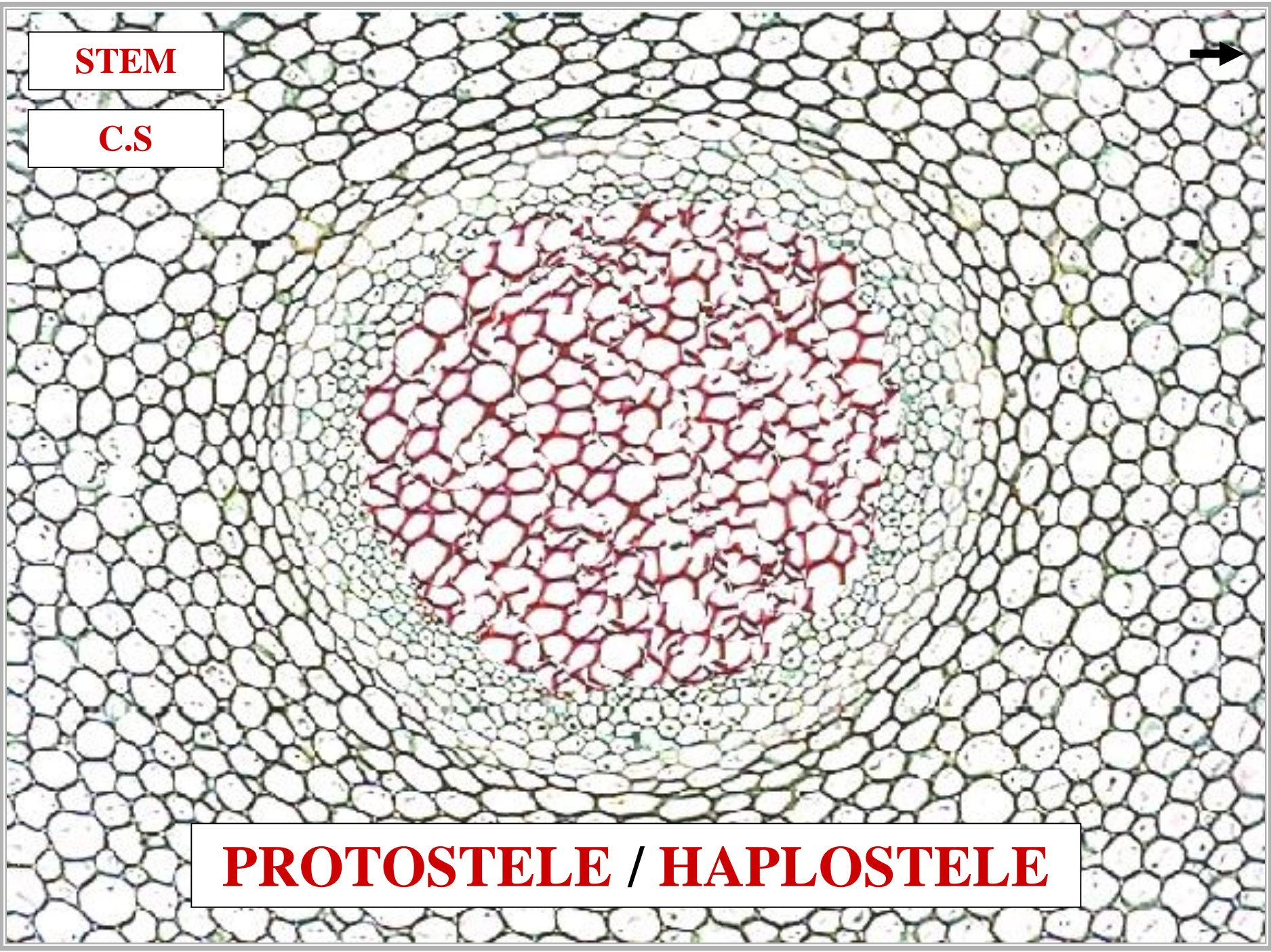


**STEM**

**C.S**



**PROTOSTELE / HAPLOSTELE**



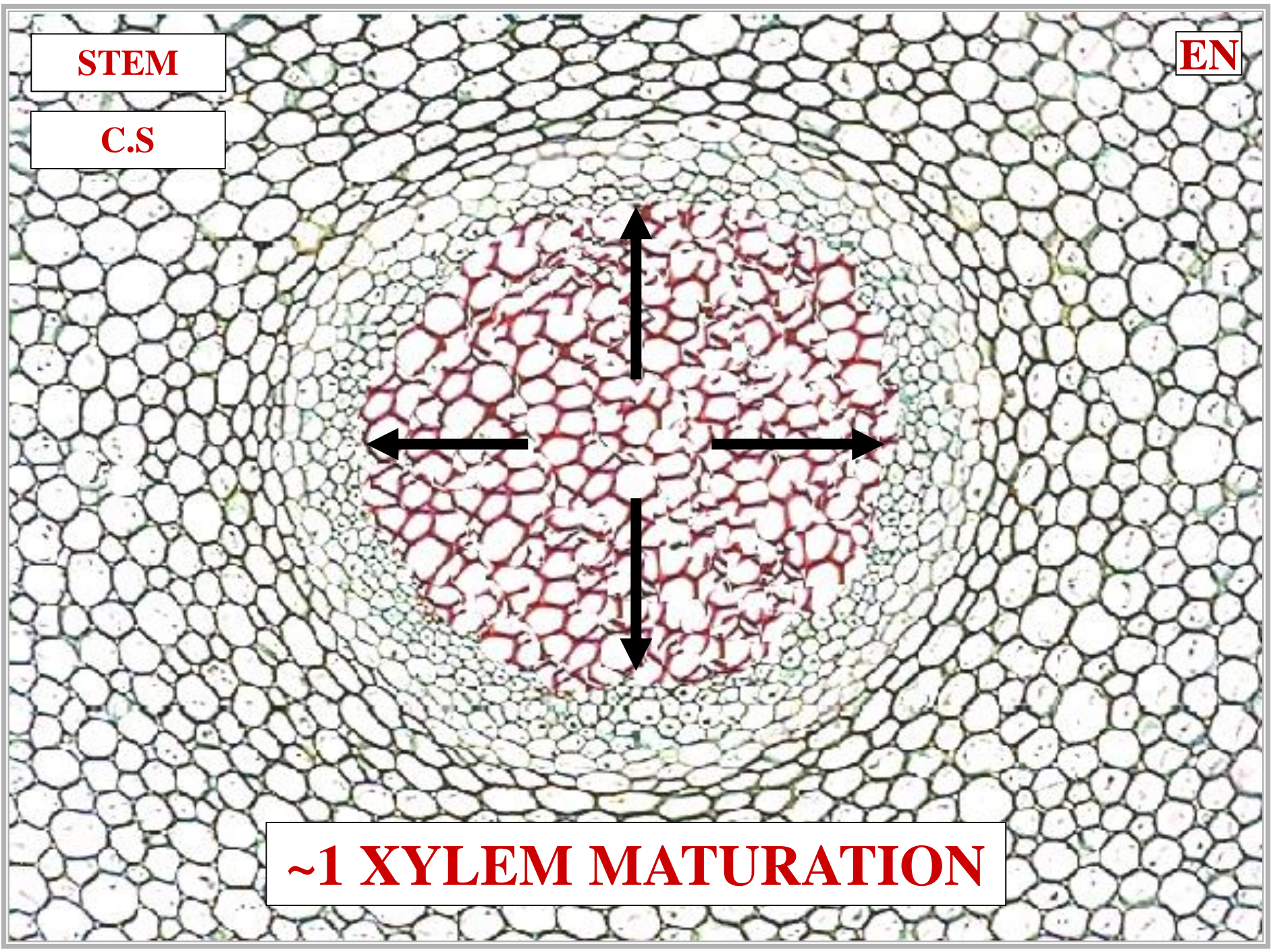


**STEM**

**C.S**

**EN**

**~1 XYLEM MATURATION**

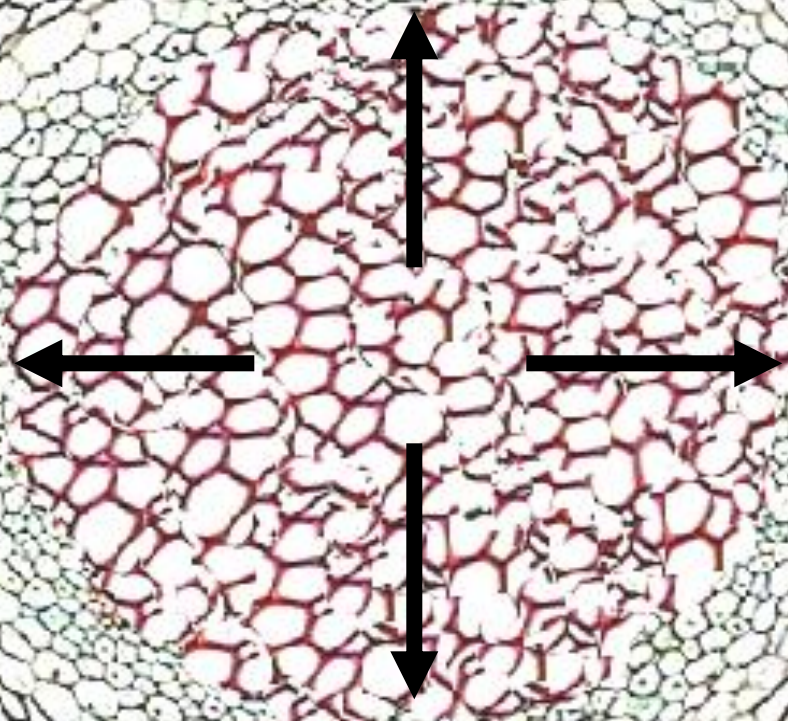




**STEM**

**C.S**

^



**ENDARCH**