

S

+



***SELAGINELLA***

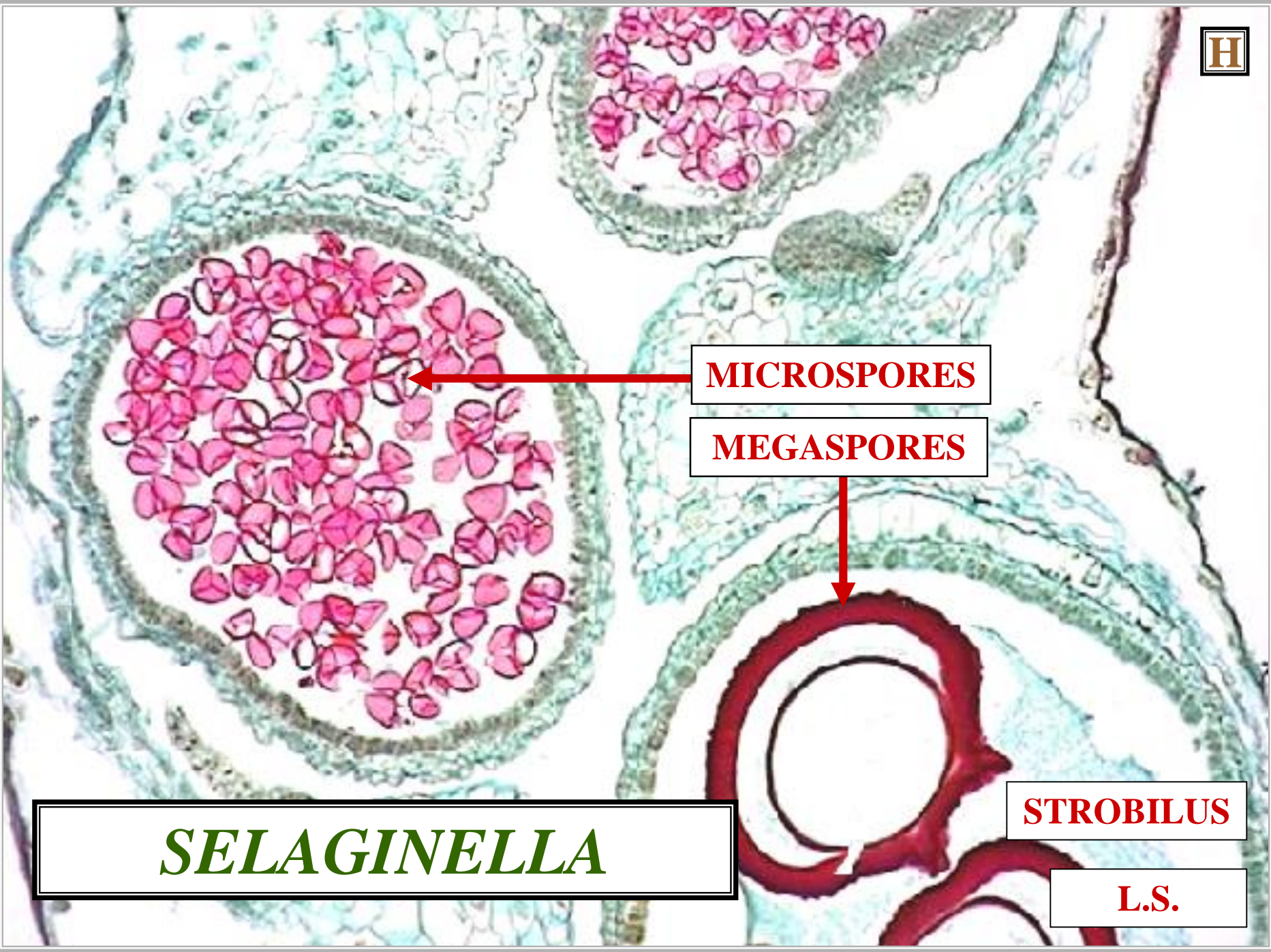


**STROBILUS**



***SELAGINELLA***





**MICROSPORES**

**MEGASPORES**

**STROBILUS**

***SELAGINELLA***

**L.S.**

S

S

MICROSPORES

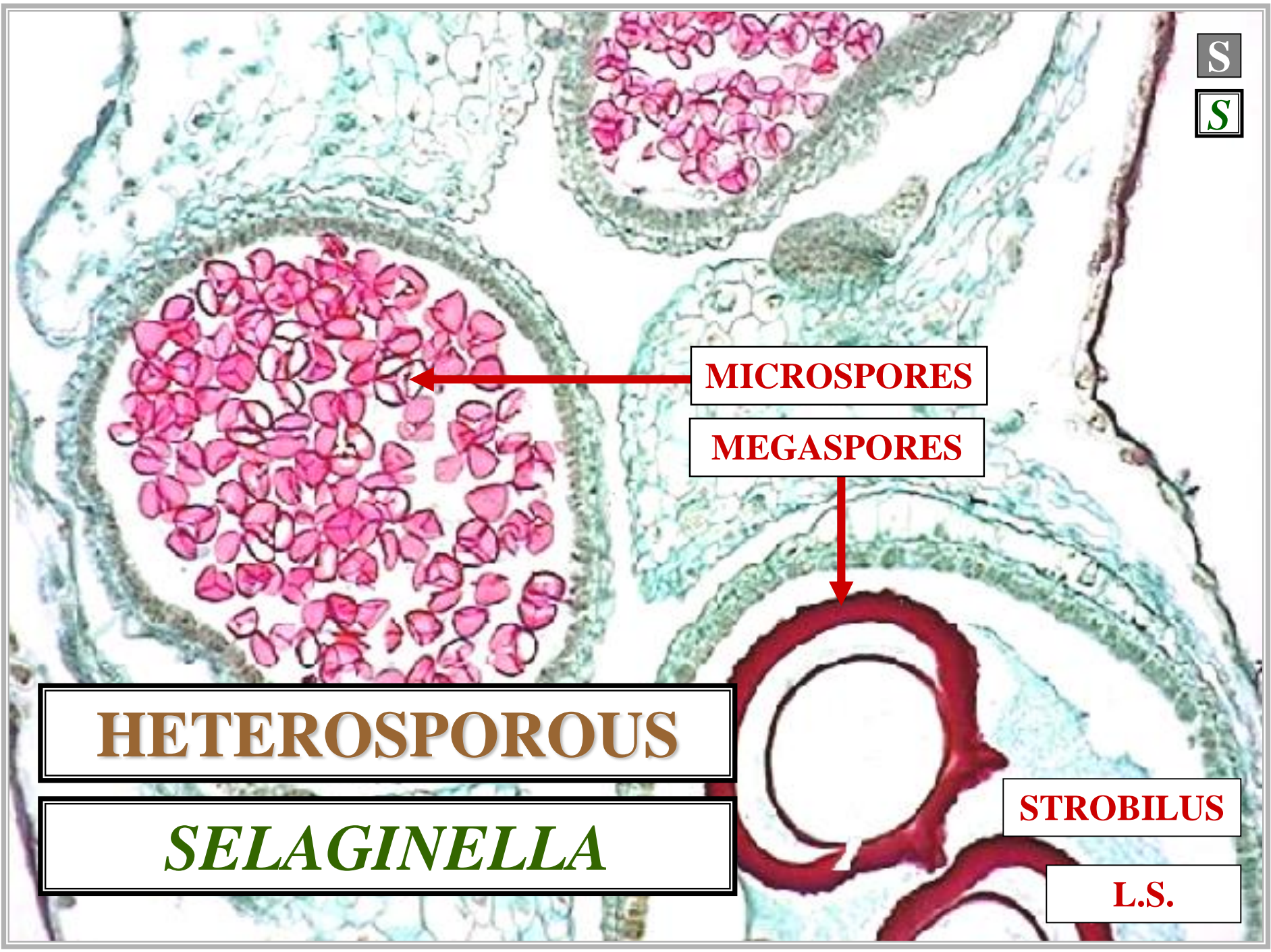
MEGASPORES

HETEROSPOROUS

*SELAGINELLA*

STROBILUS

L.S.

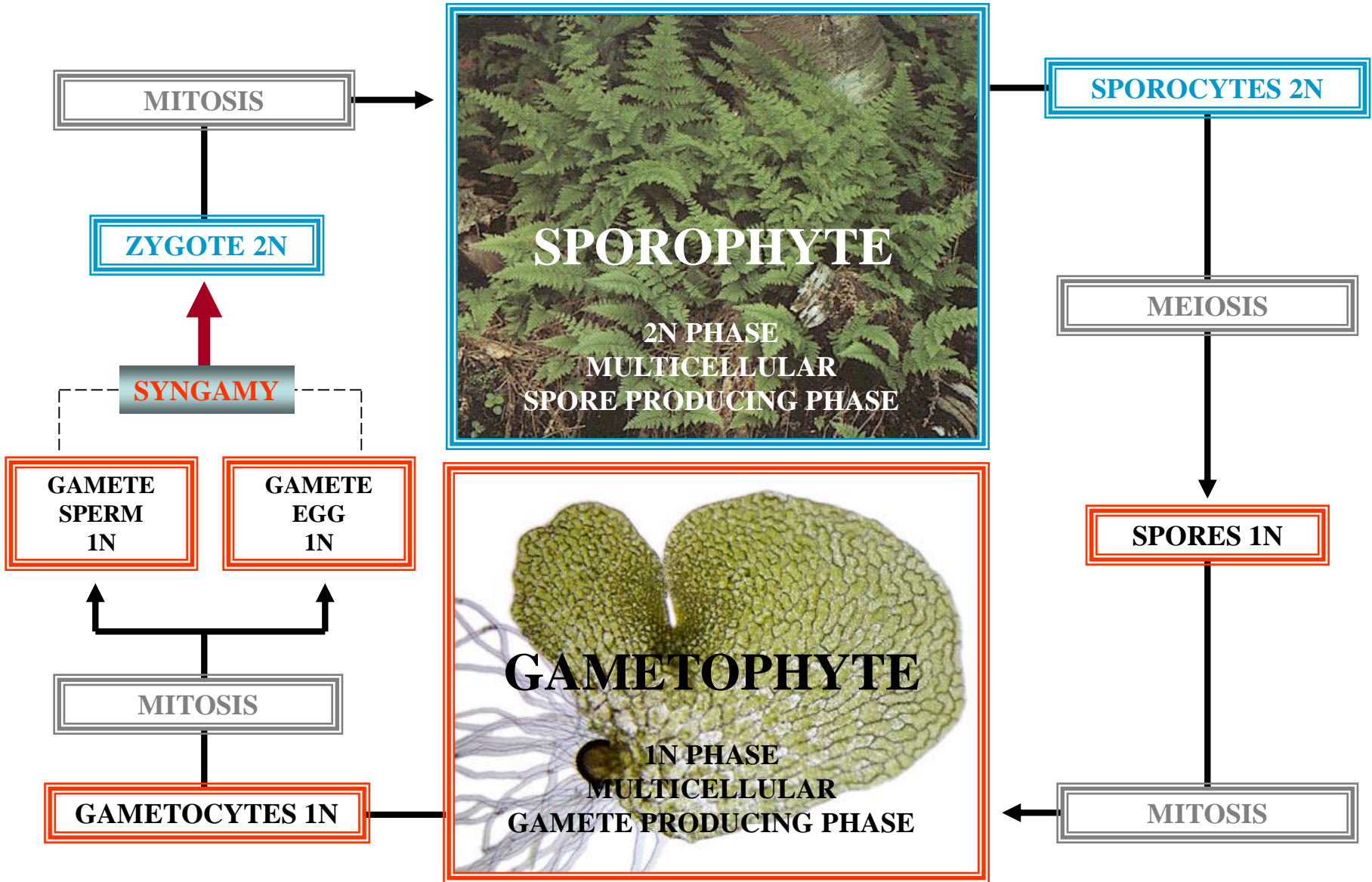




**HETEROSPOROUS**

***SELAGINELLA***

# PTERIDOPHYTE LIFE CYCLE



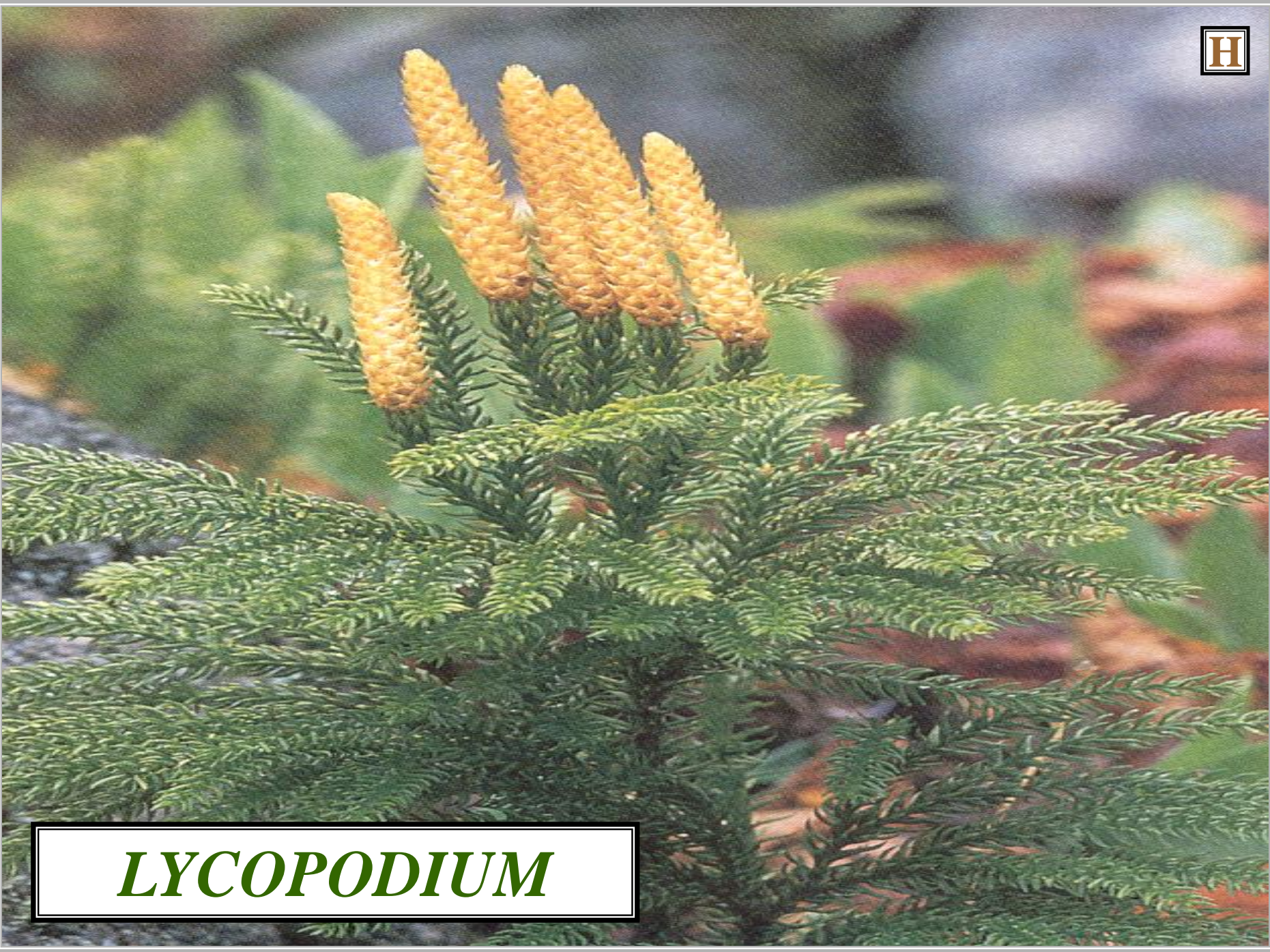


# GAMETOPHYTE CHARACTERS



# GROWTH HABIT





***LYCOPODIUM***



S

+

**HOMOSPOROUS**

***LYCOPODIUM***

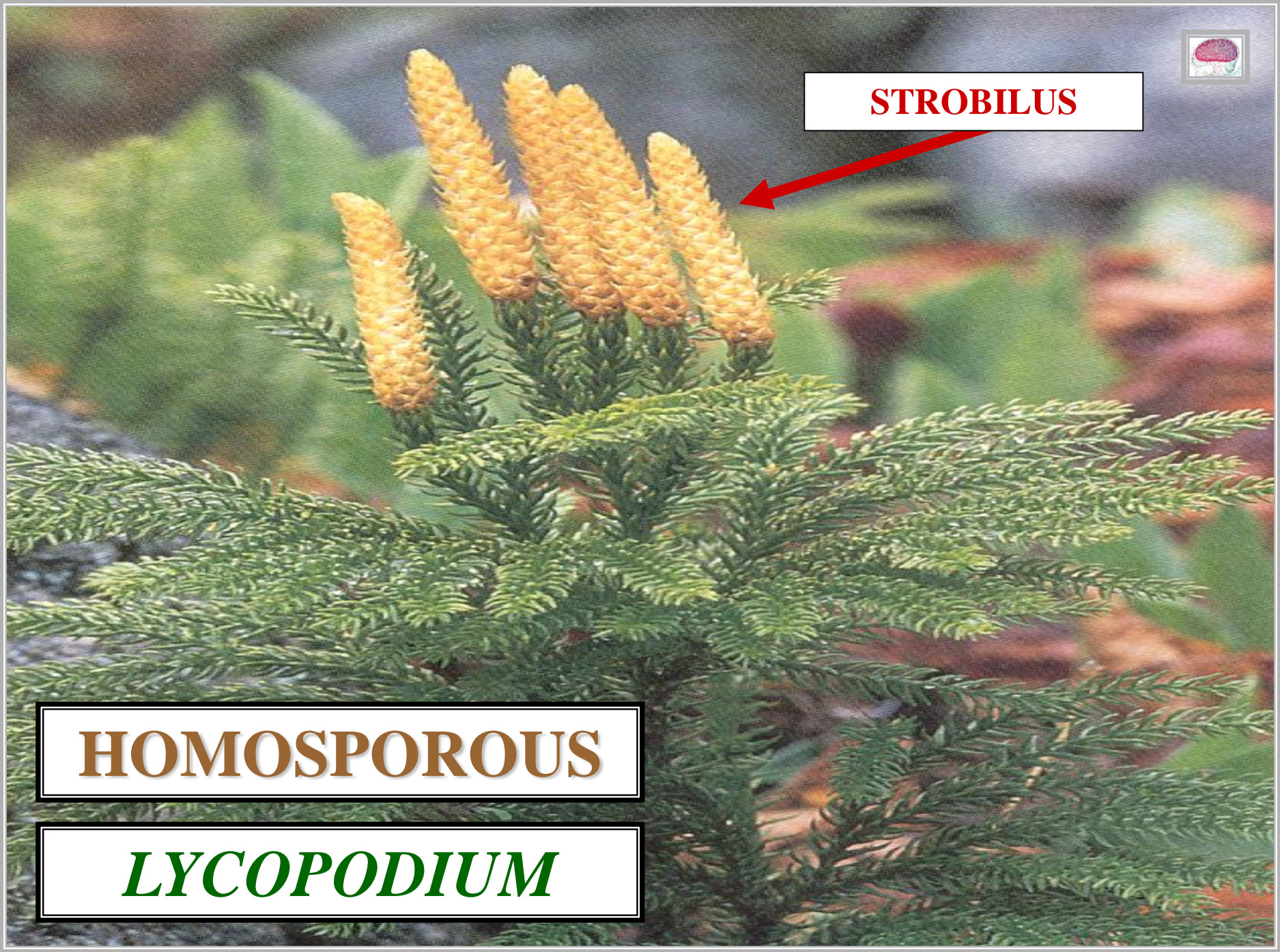


**STROBILUS**



**HOMOSPOROUS**

***LYCOPODIUM***



I

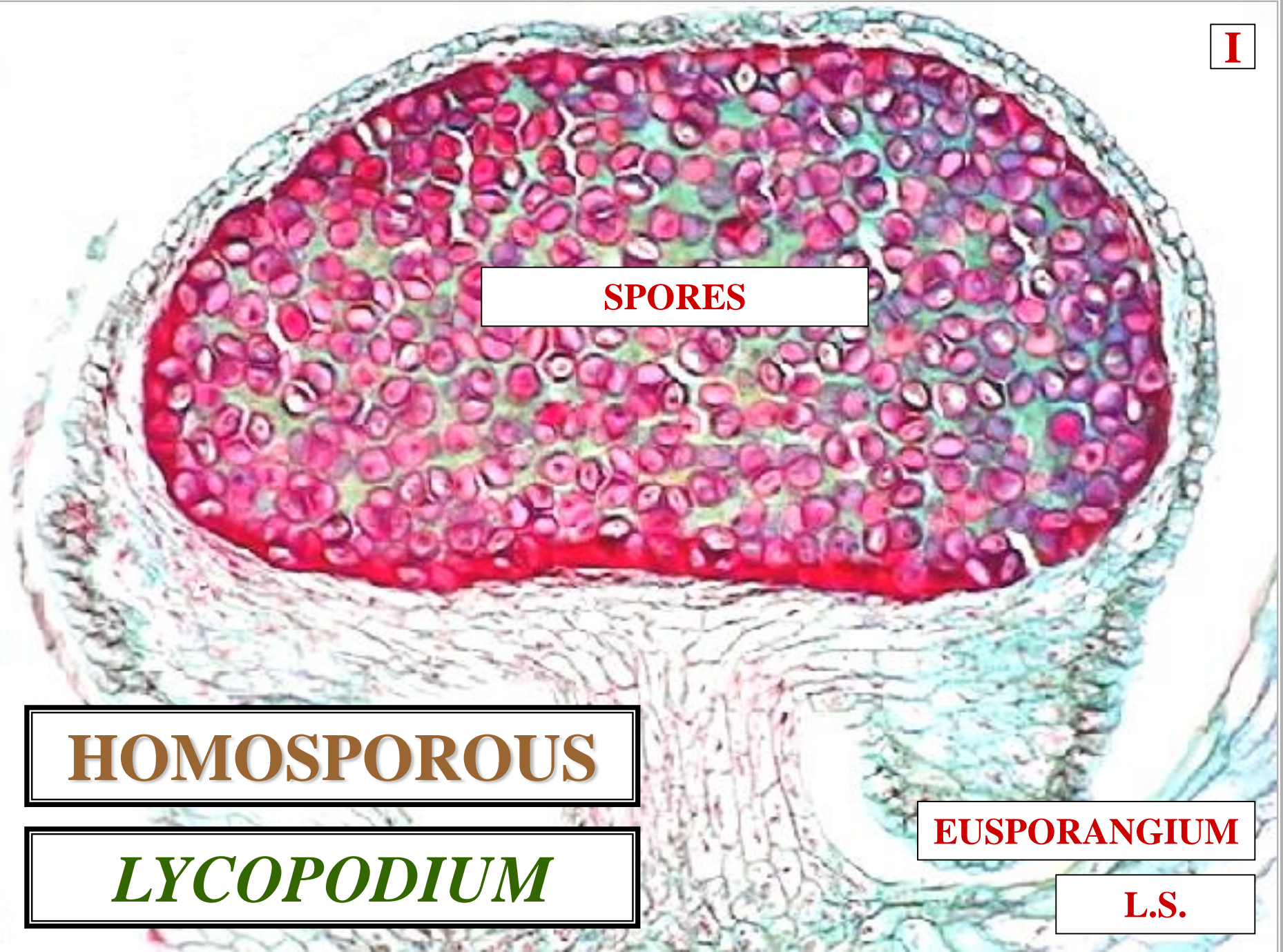
**SPORES**

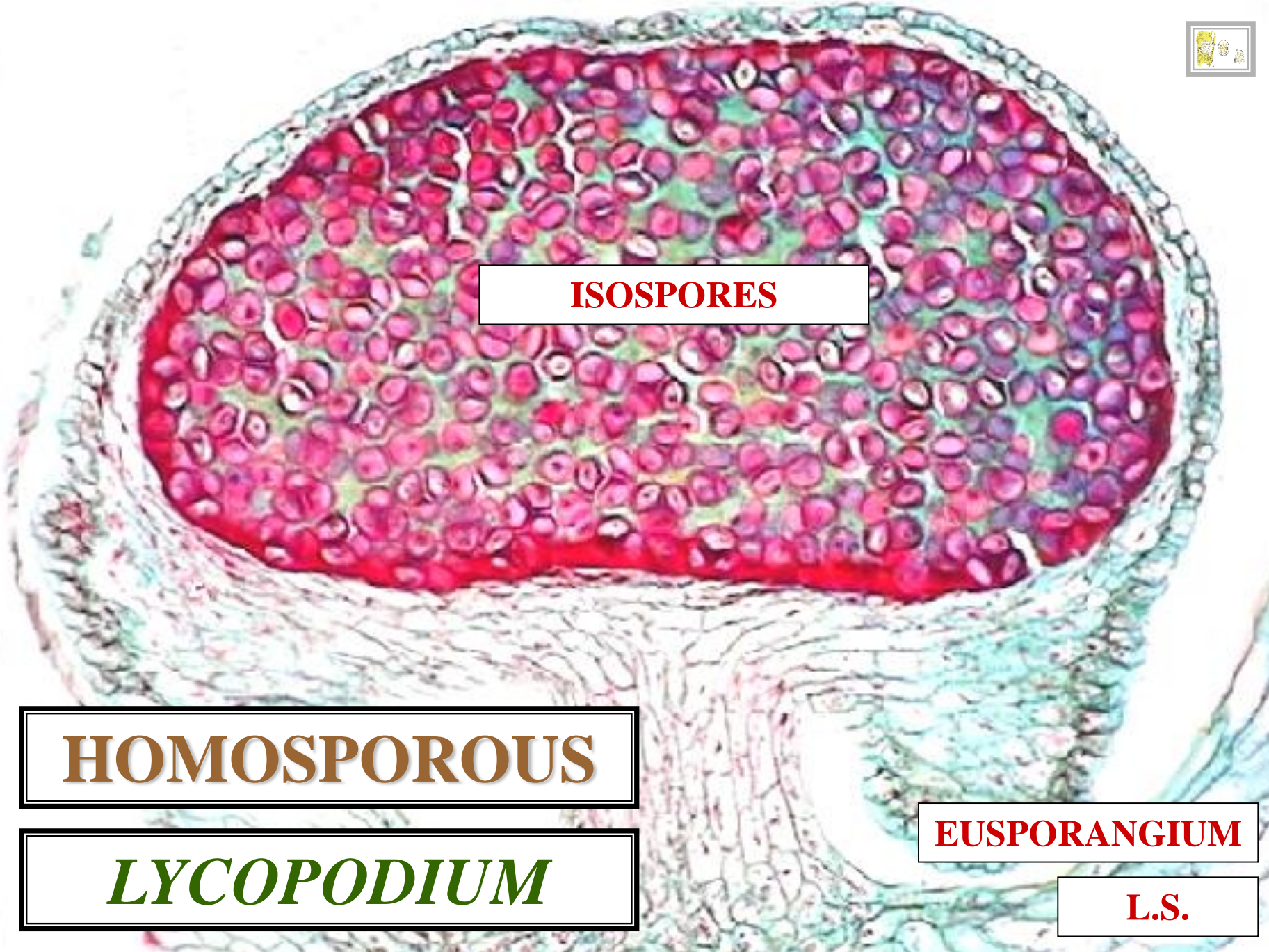
**HOMOSPOROUS**

***LYCOPODIUM***

**EUSPORANGIUM**

**L.S.**





**ISOSPORES**

**HOMOSPOROUS**

***LYCOPODIUM***

**EUSPORANGIUM**

**L.S.**

**SPOROPHYTE  
STROBILUS**

# *LYCOPODIUM*

M

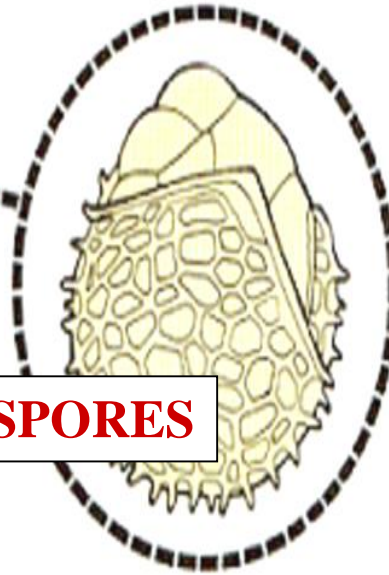
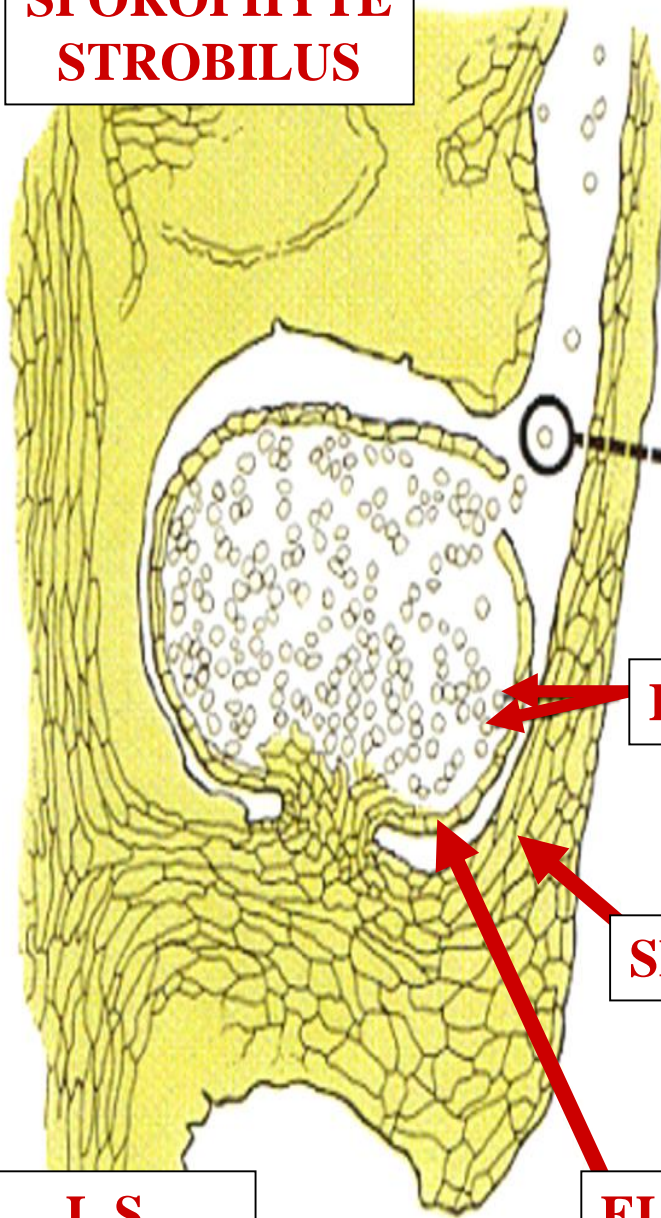
**ISOSPORE**

**ISOSPORES**

**SPOROPHYLL**

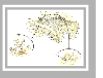
**L.S.**

**EUSPORANGIUM**



**SPOROPHYTE  
STROBILUS**

# *LYCOPODIUM*



**G**

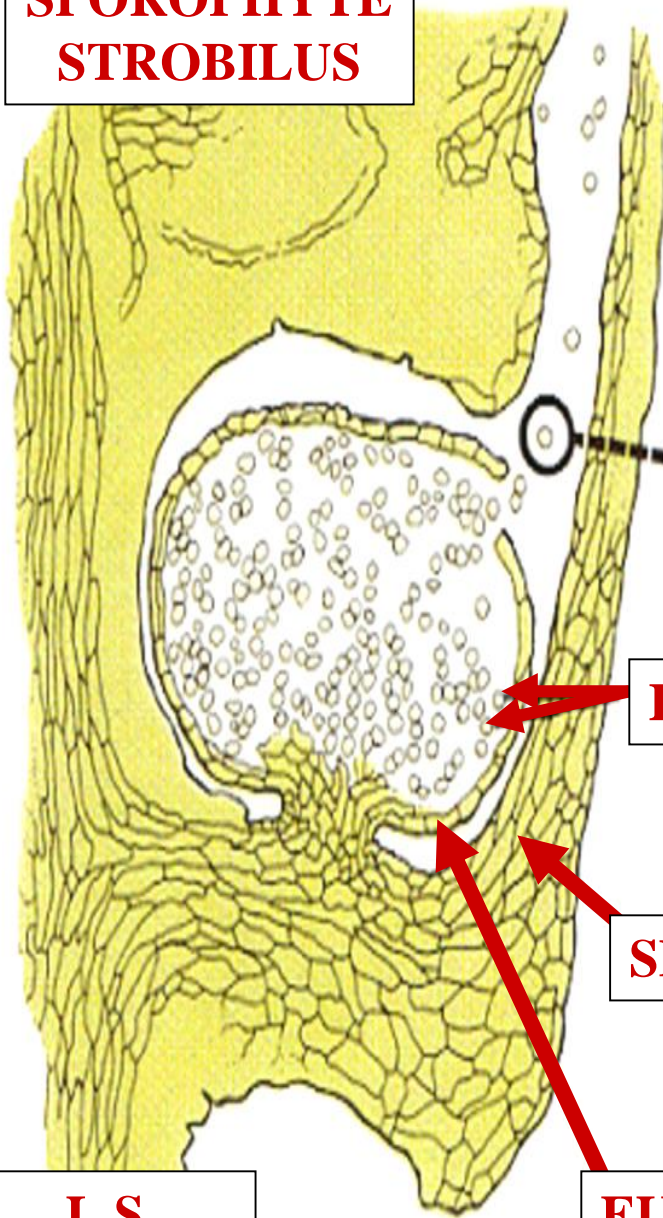
**MITOSIS**

**ISOSPORES**

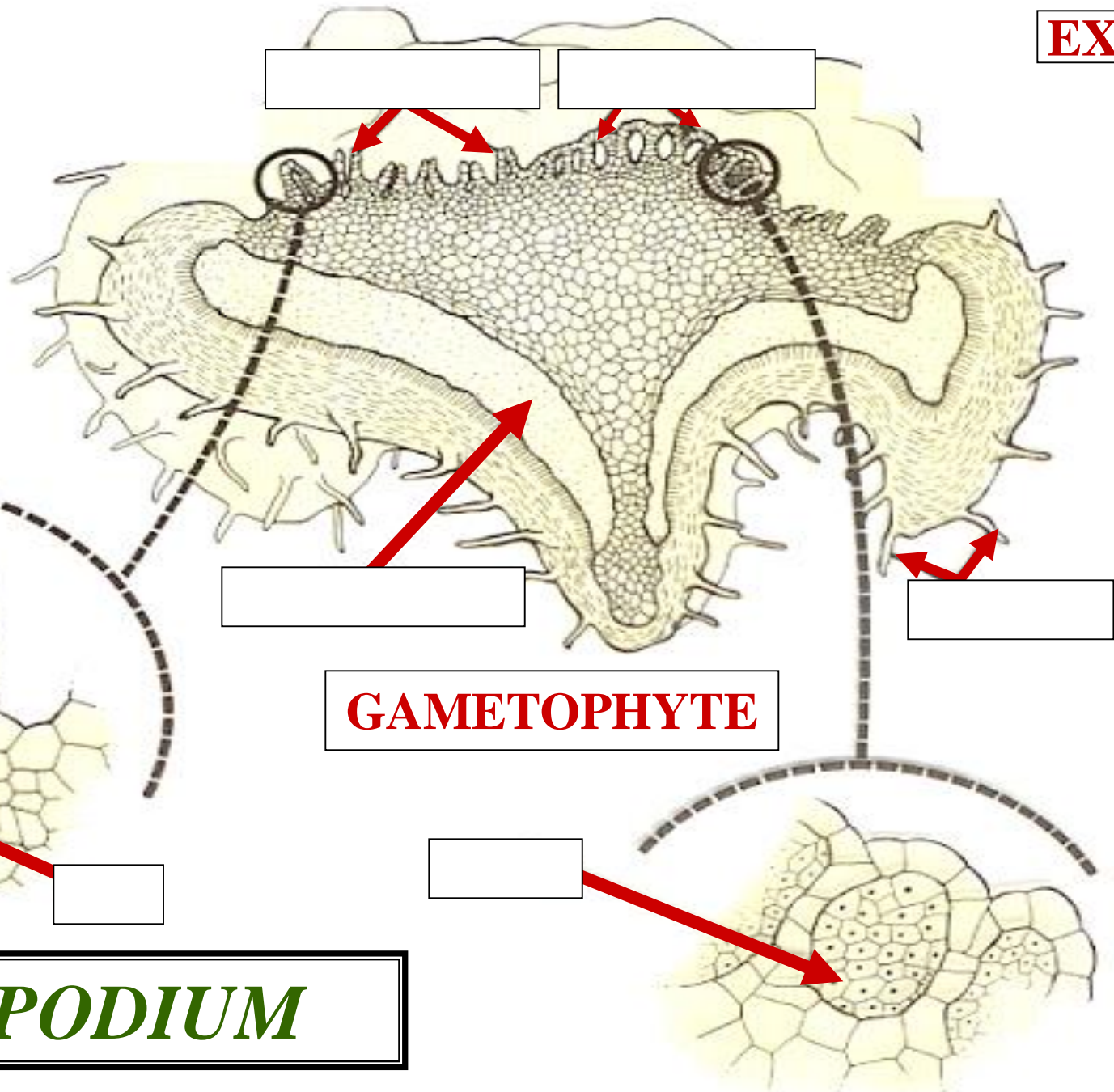
**SPOROPHYLL**

**L.S.**

**EUSPORANGIUM**



**EX**

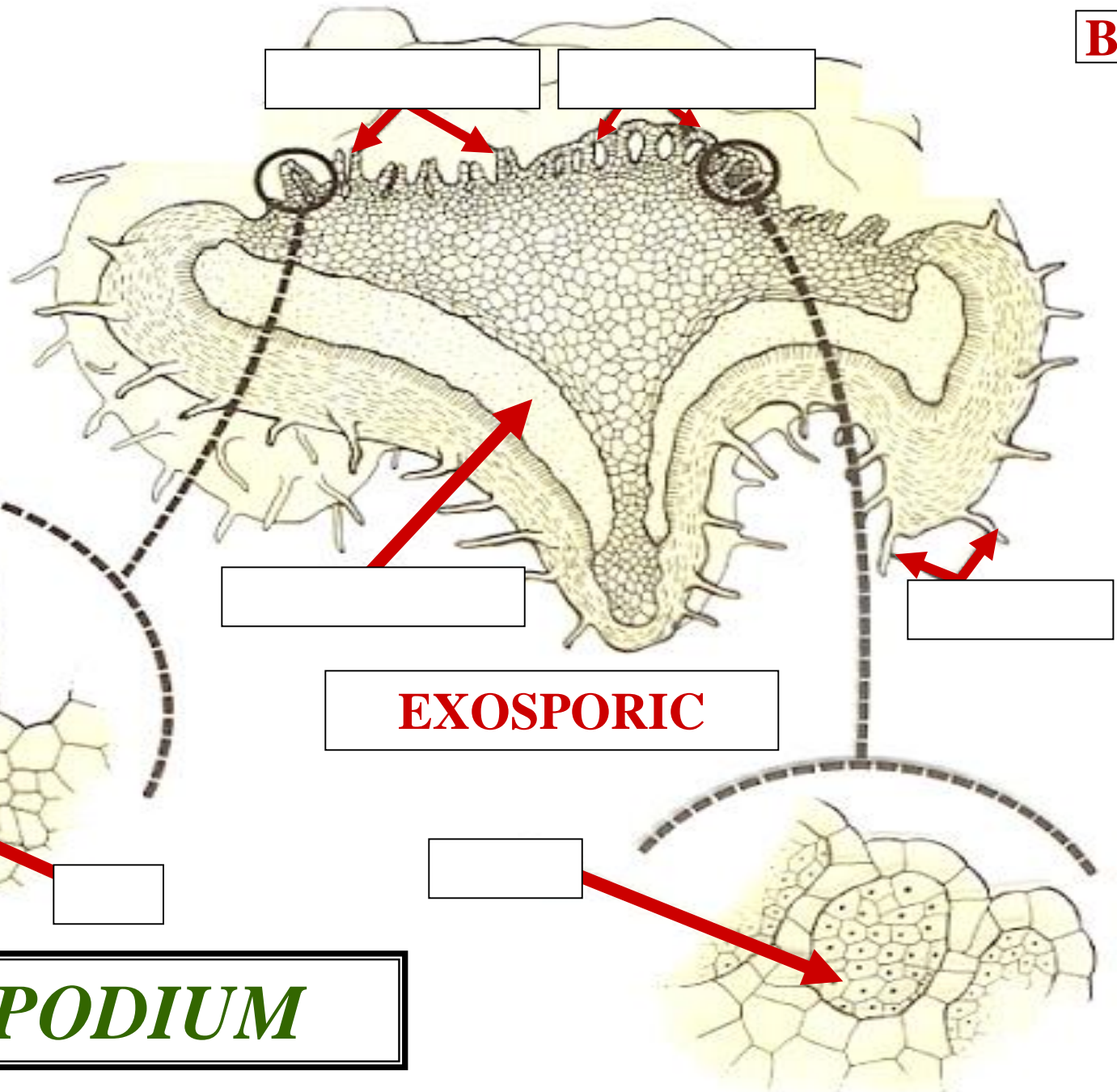


**GAMETOPHYTE**

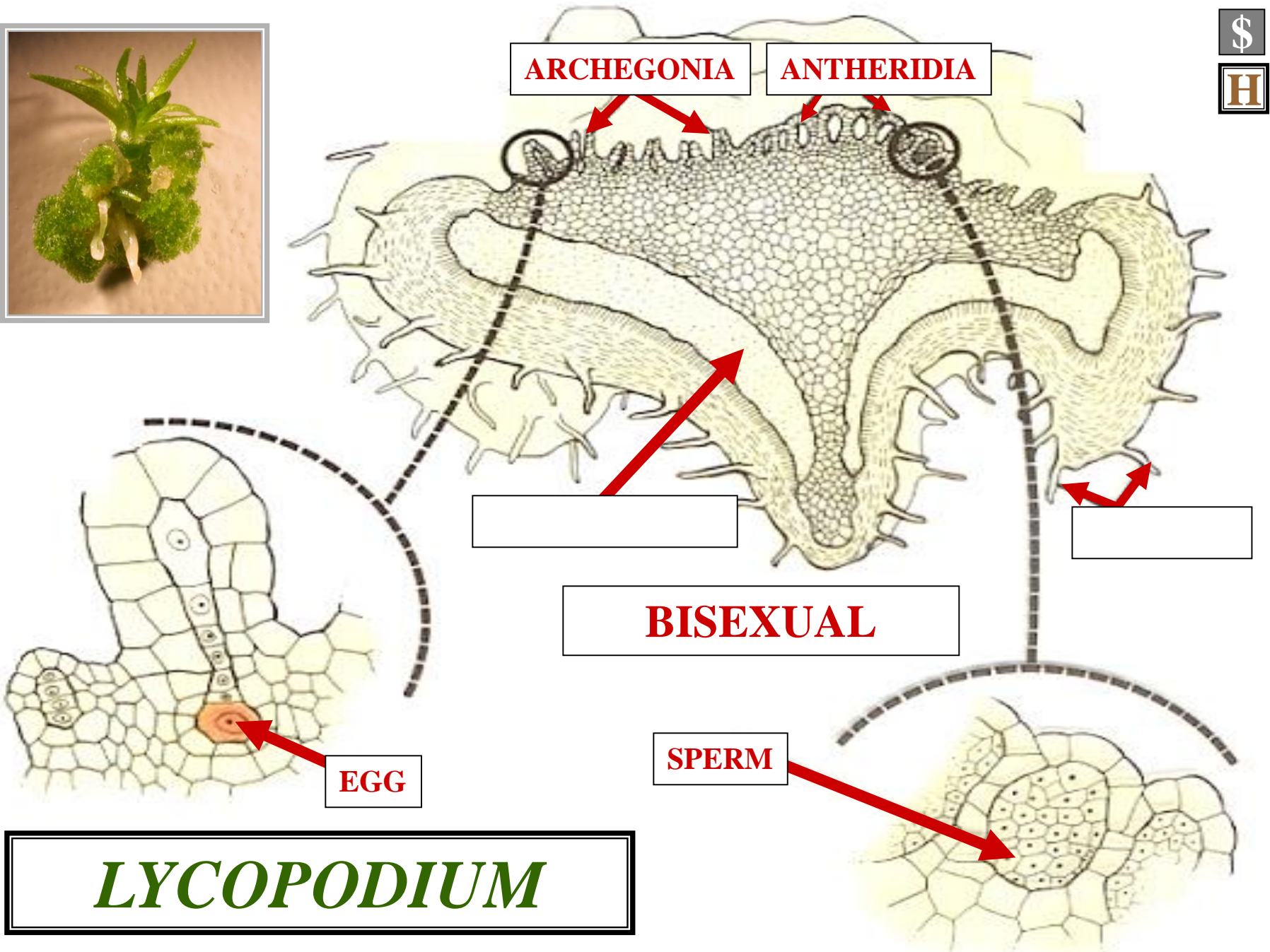
***LYCOPODIUM***



**B**

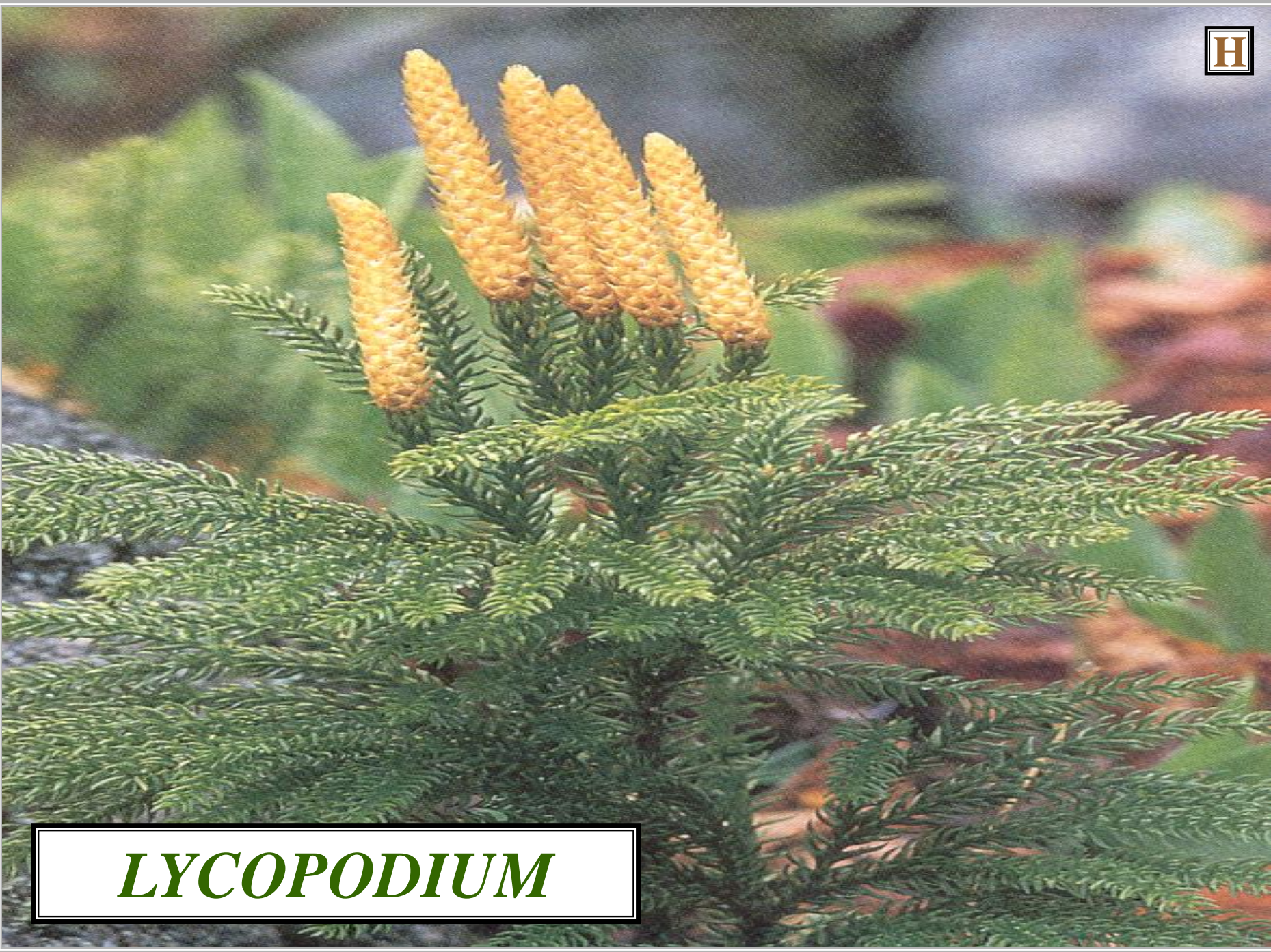


***LYCOPODIUM***





# TRACHEOPHYTE HOMOSPOROUS LIFE CYCLE SUMMARY



***LYCOPODIUM***

**HOMOSPOROUS**

***LYCOPODIUM***

**EX**

**ISOSPORES**

***LYCOPODIUM***

**EXOSPORIC GAMETOPHYTE**

*LYCOPODIUM*

**BISEXUAL GAMETOPHYTE**

***LYCOPODIUM***





# GAMETOPHYTE CHARACTERS



# GROWTH HABIT



***SELAGINELLA***



S

+



**HETEROSPOROUS**

***SELAGINELLA***

?



**STROBILUS**

**HETEROSPOROUS**

***SELAGINELLA***

?



**HETEROSPOROUS**

***SELAGINELLA***



**L.S.**

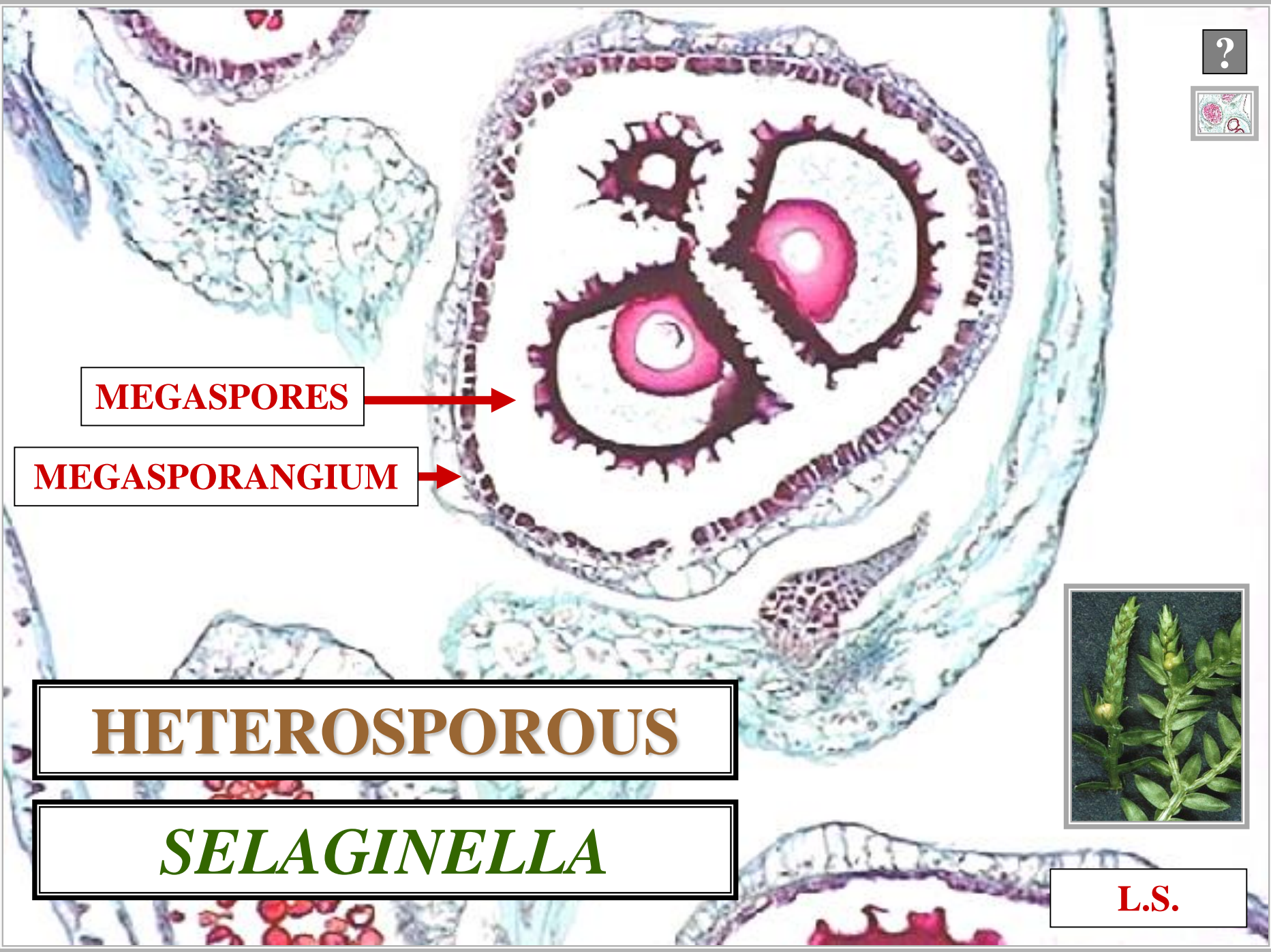
MEGASPORANGIUM →

**HETEROSPOROUS**

***SELAGINELLA***



L.S.



**MEGASPORES** →

**MEGASPORANGIUM** →

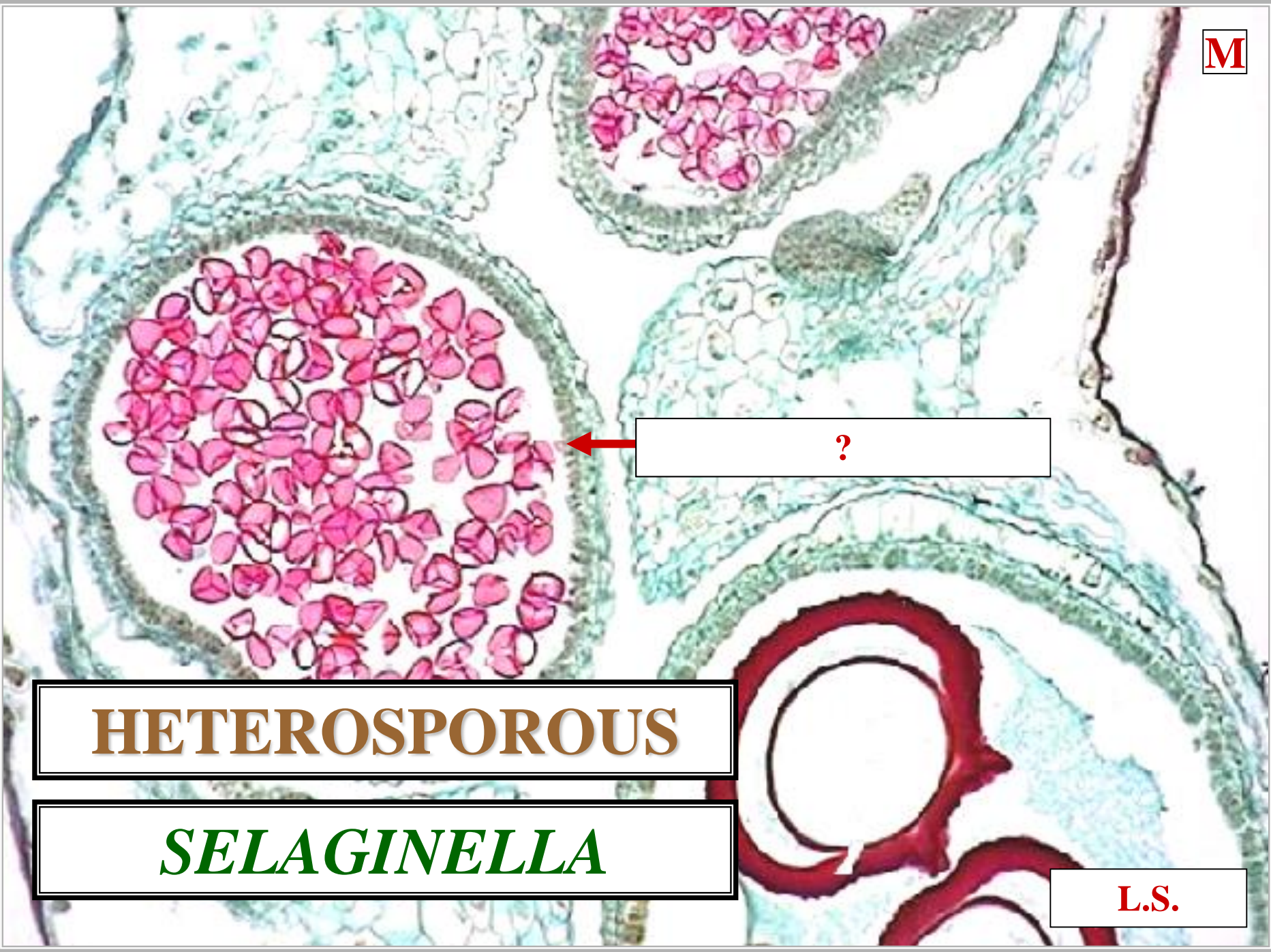
**HETEROSPOROUS**

***SELAGINELLA***



**L.S.**



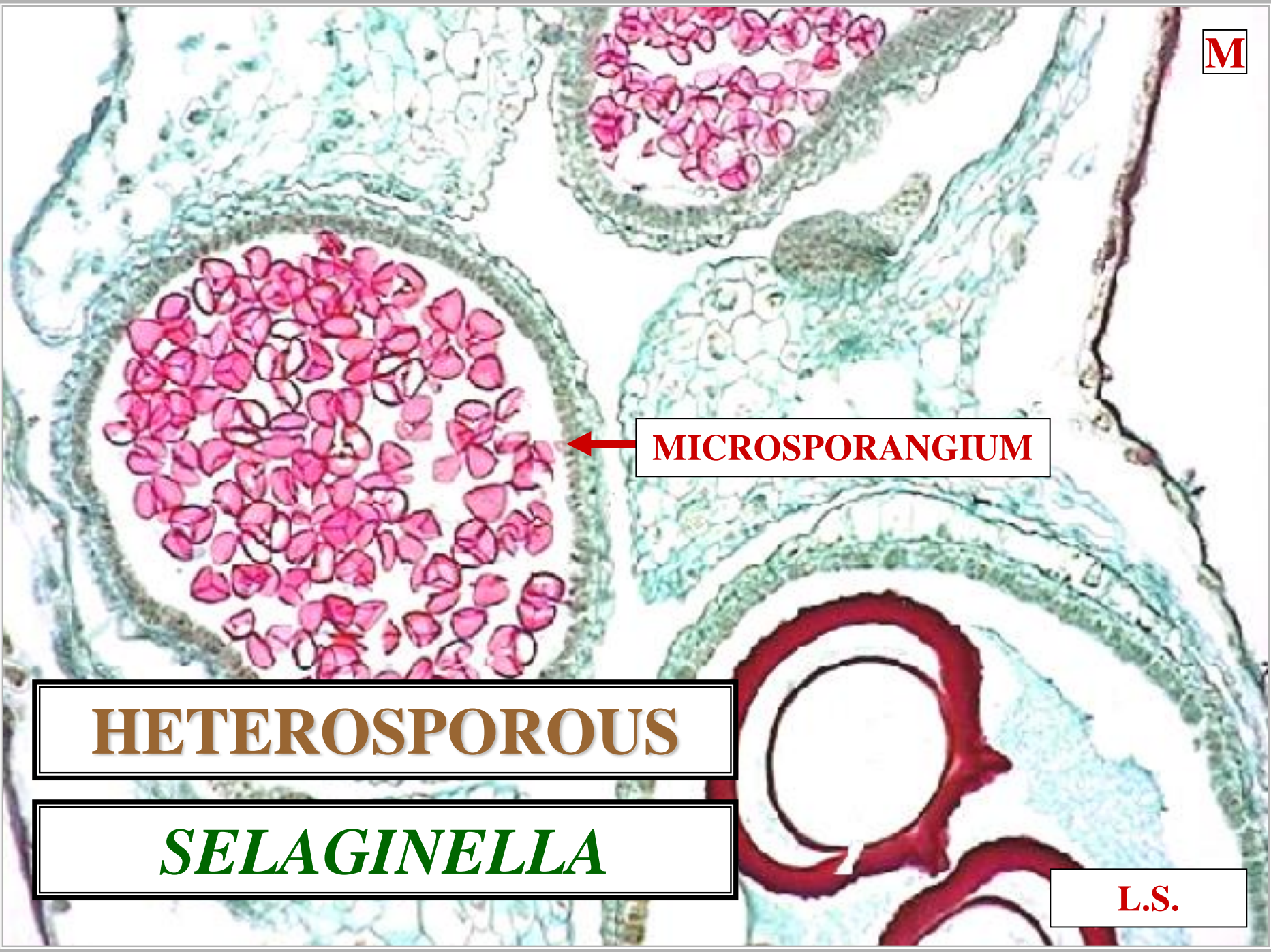


?

**HETEROSPOROUS**

***SELAGINELLA***

**L.S.**

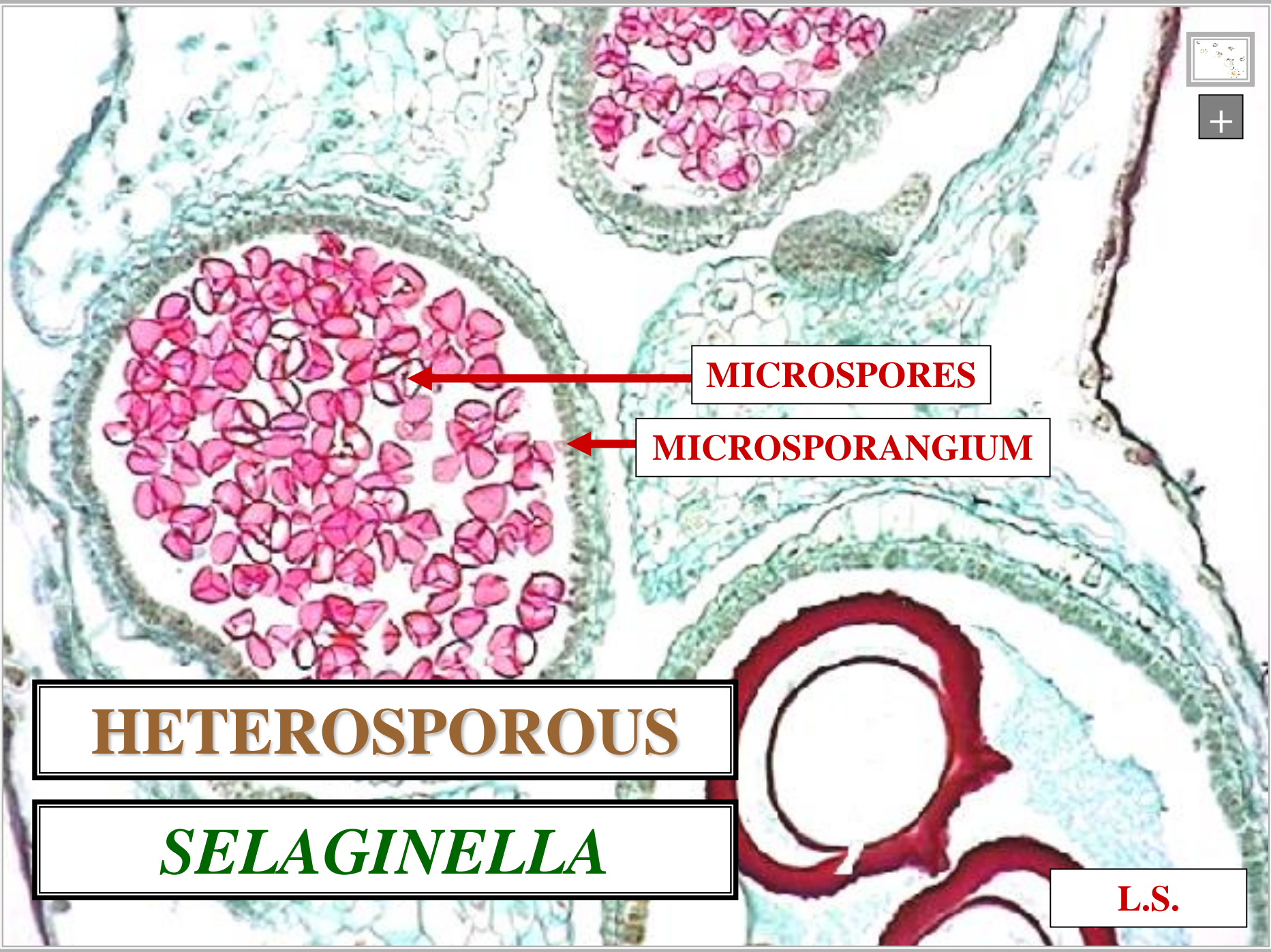


← MICROSPORANGIUM

**HETEROSPOROUS**

***SELAGINELLA***

L.S.



**MICROSPORES**

**MICROSPORANGIUM**

**HETEROSPOROUS**

***SELAGINELLA***

**L.S.**

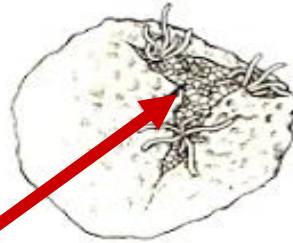
# SELAGINELLA



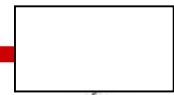
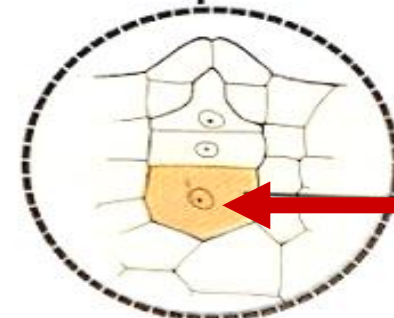
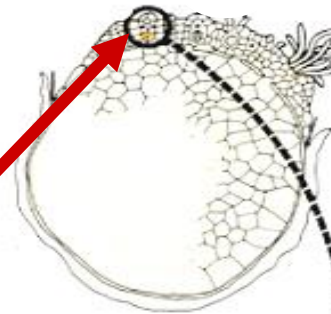
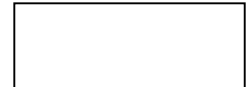
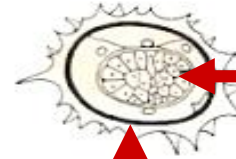
**MICROSPORE**



**MEGASPORE**



M

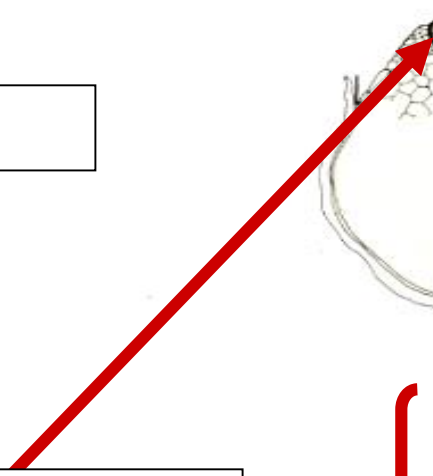
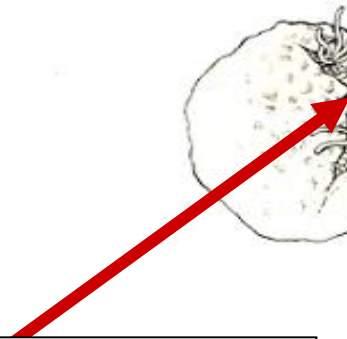
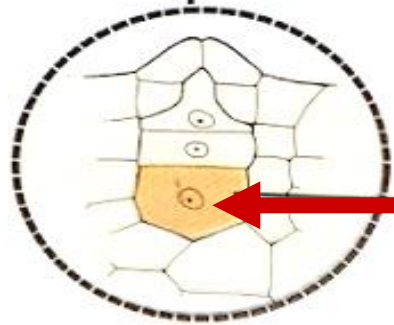
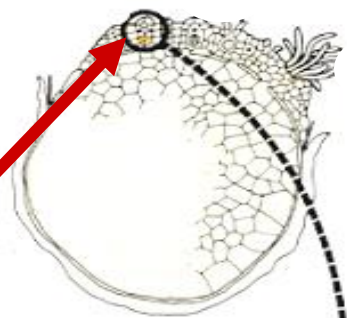
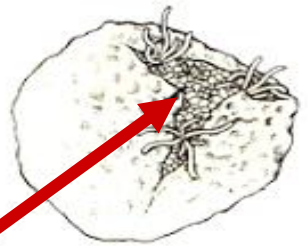
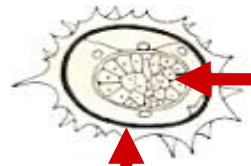
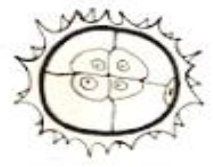
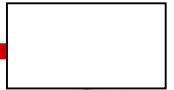


# SELAGINELLA

G

MITOSIS

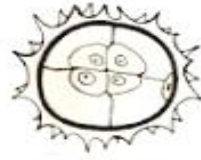
MITOSIS



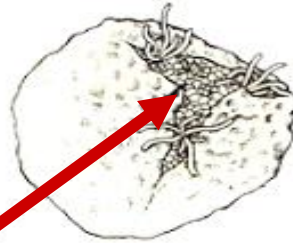
# SELAGINELLA



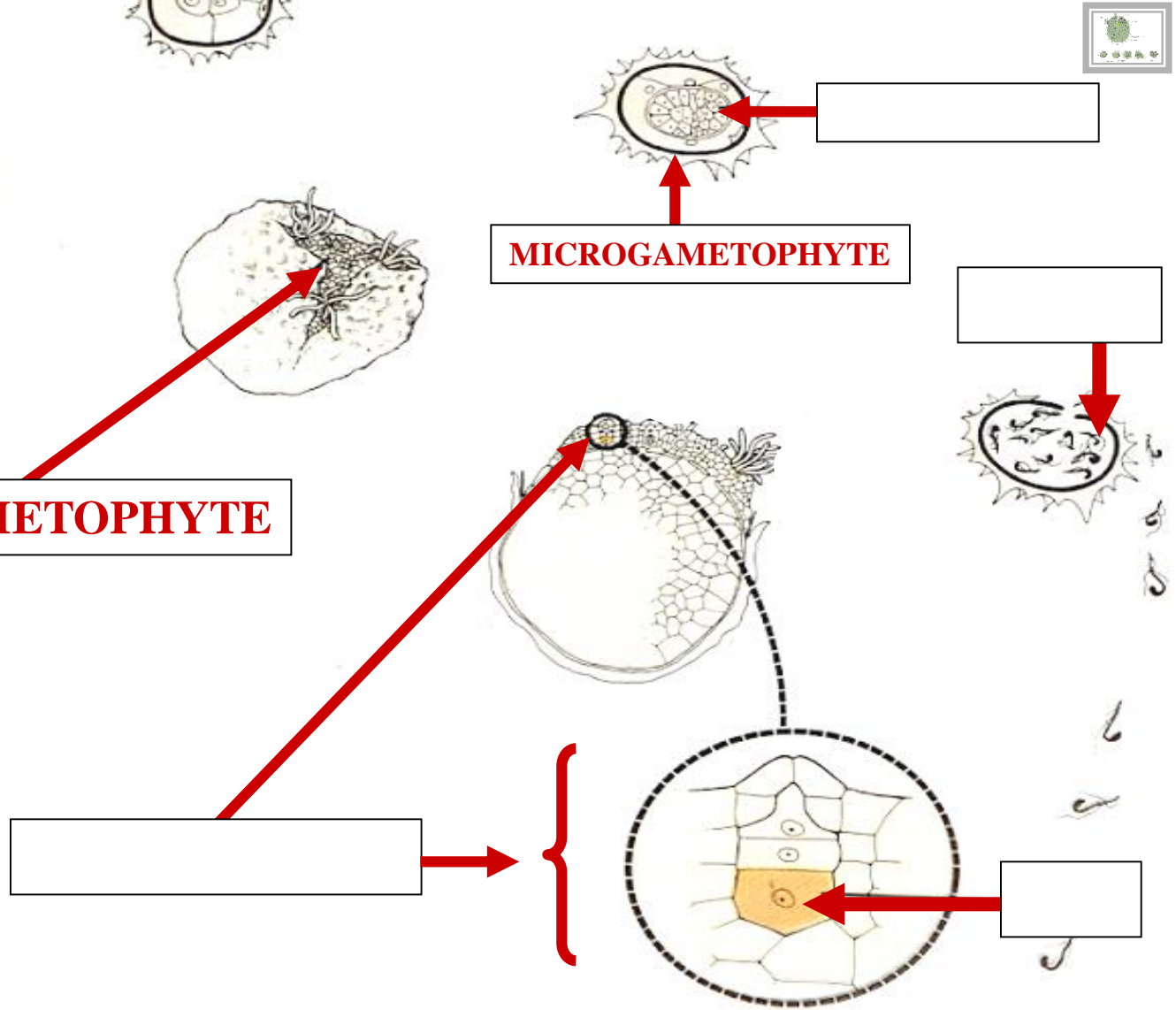
**MICROSPORE**



**MEGASPORE**



**MEGAGAMETOPHYTE**



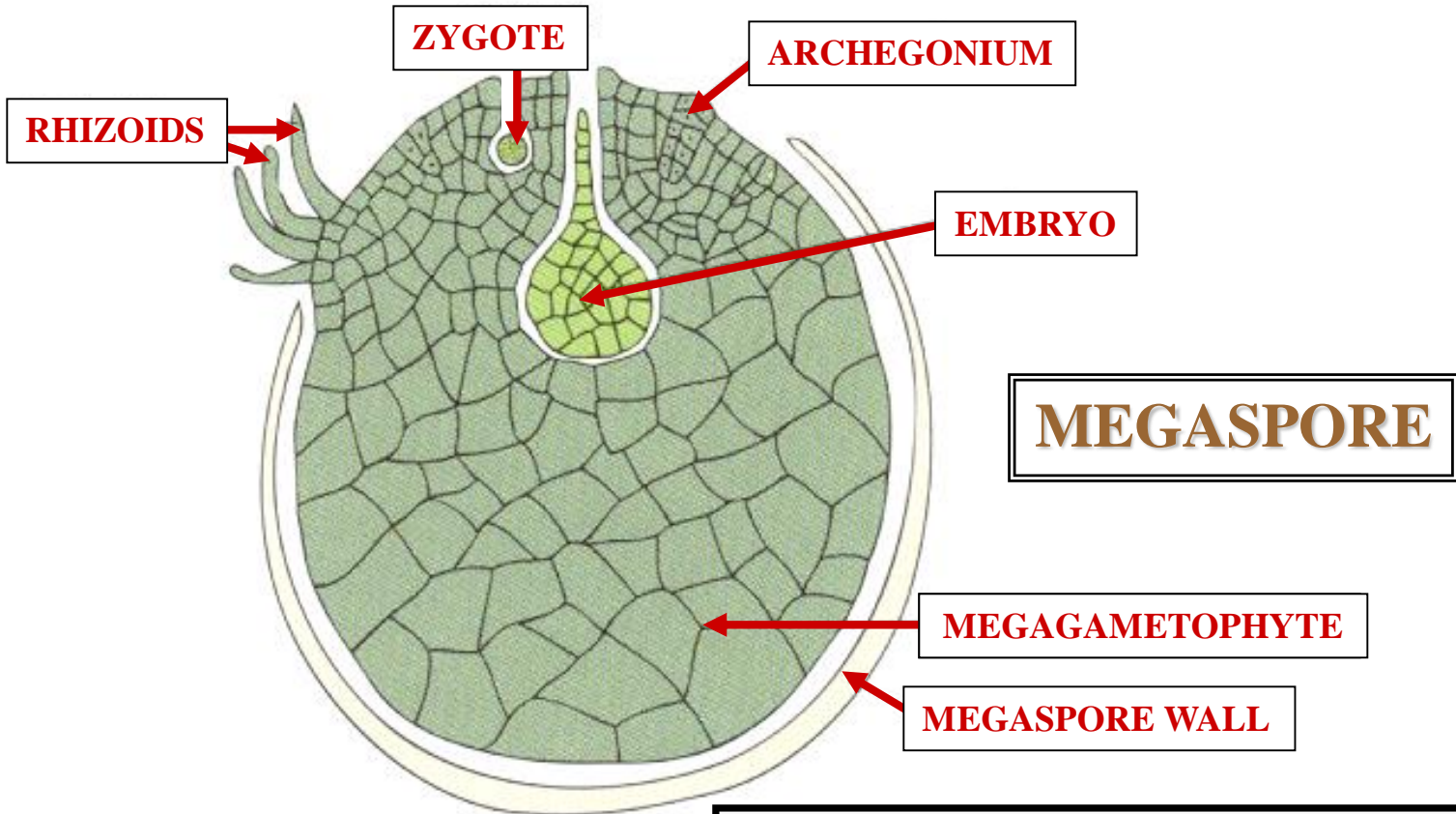
**MICROGAMETOPHYTE**

[ ]

[ ]

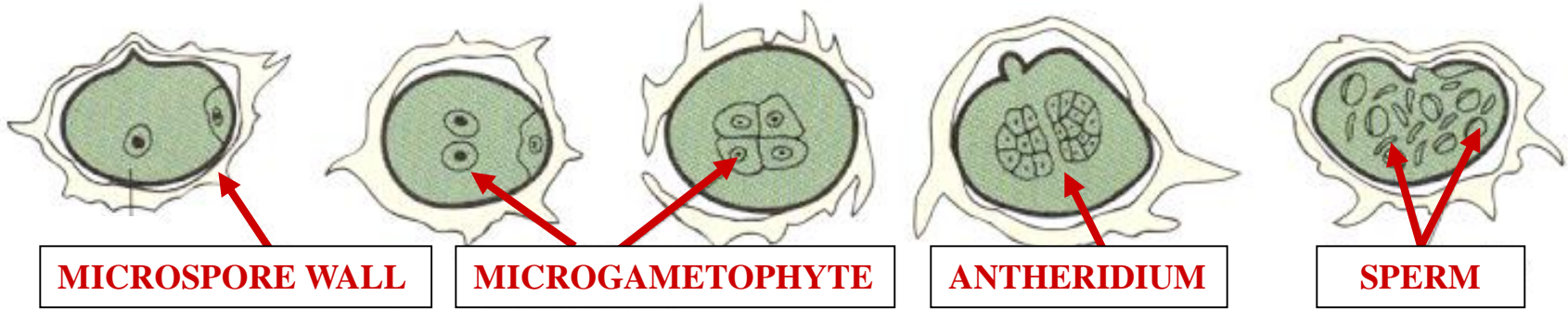
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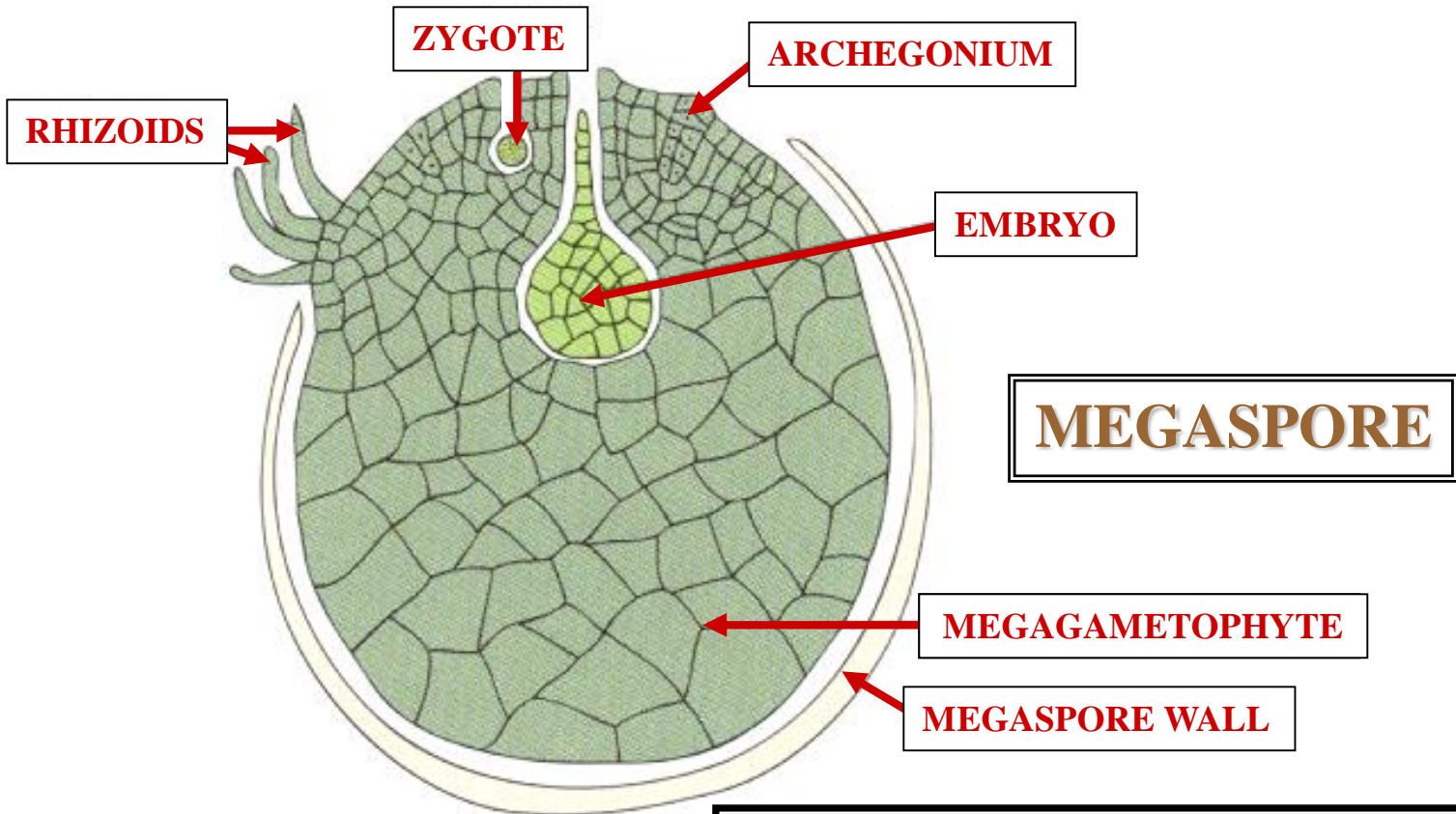
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**MICROSPORE**

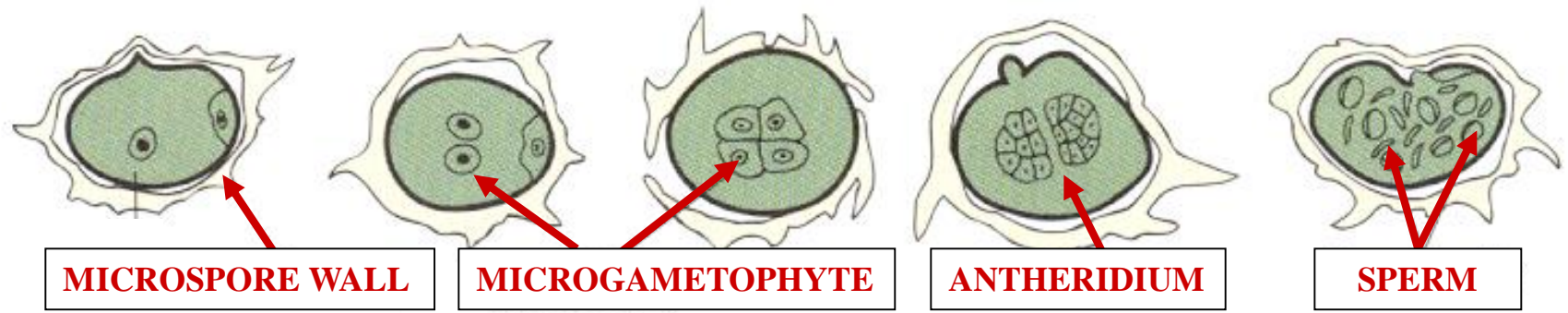
**GAMETOPHYTES**



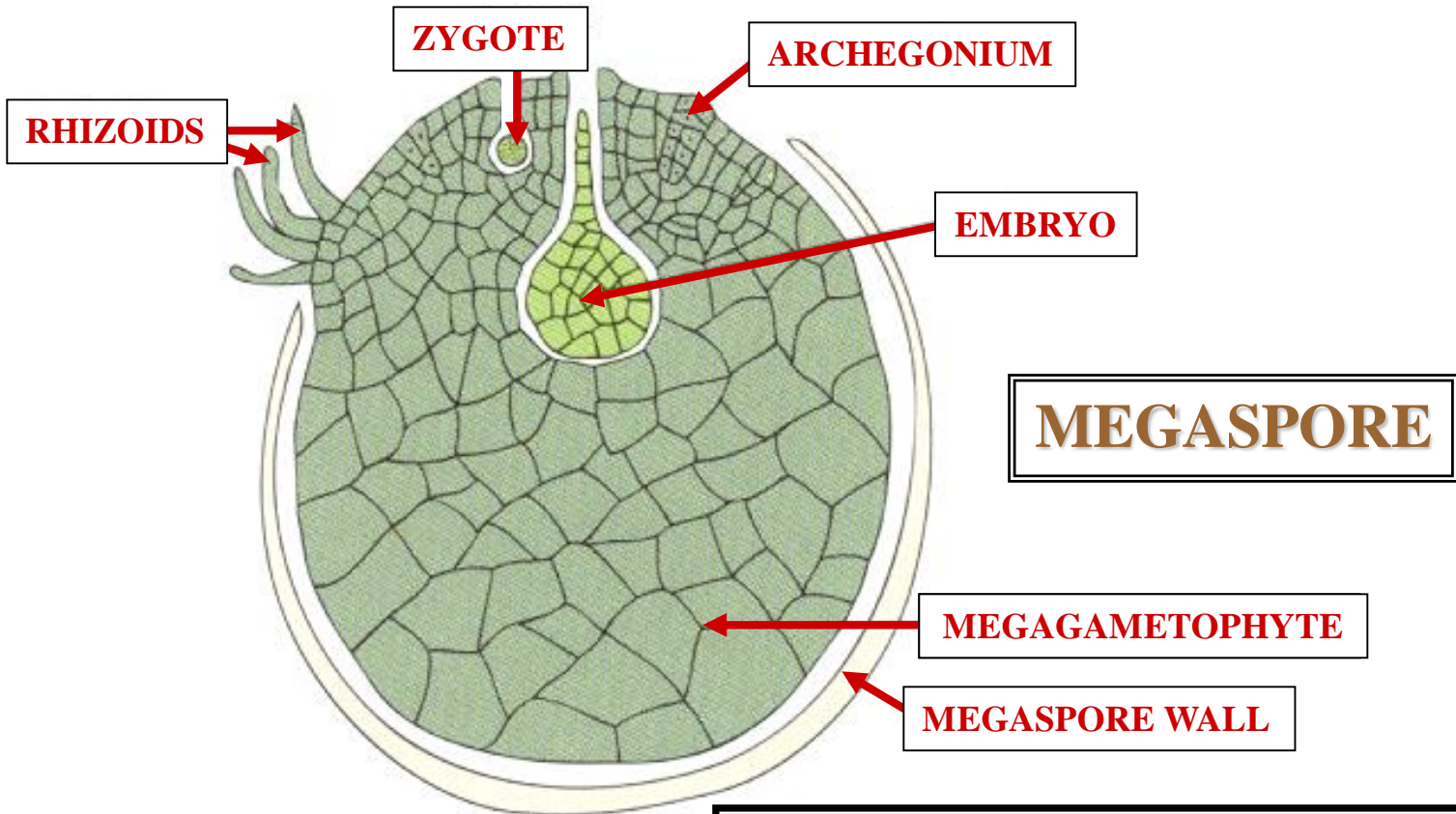


**MICROSPORE**

**ENDOSPORIC**

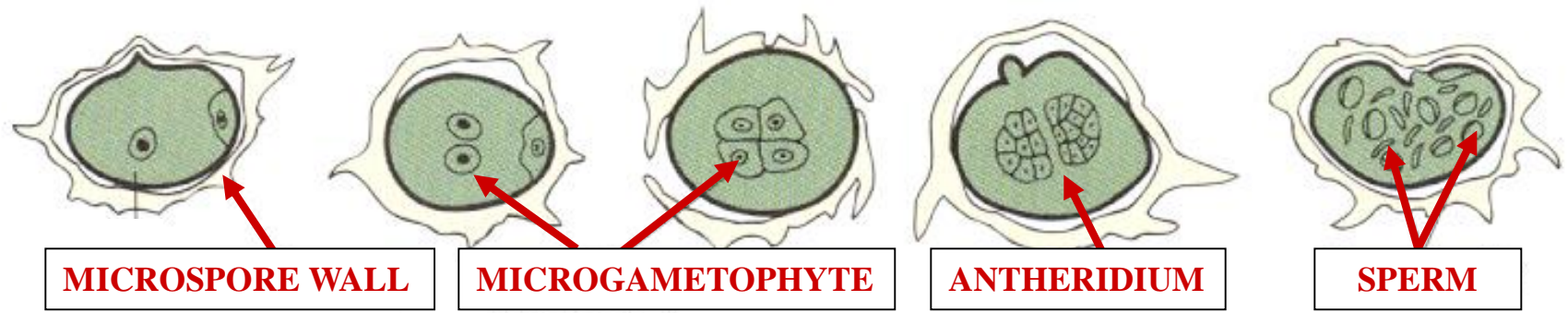






**MICROSPORE**

**UNISEXUAL**





# **TRACHEOPHYTE HETEROSPOROUS LIFE CYCLE SUMMARY**



***SELAGINELLA***

**HETEROSPOROUS**

***SELAGINELLA***

**MICROSPORES & MEGASPORES**

***SELAGINELLA***

**ENDOSPORIC GAMETOPHYTE**

***SELAGINELLA***



**UNISEXUAL GAMETOPHYTE**

***SELAGINELLA***



**B**

# SPERM



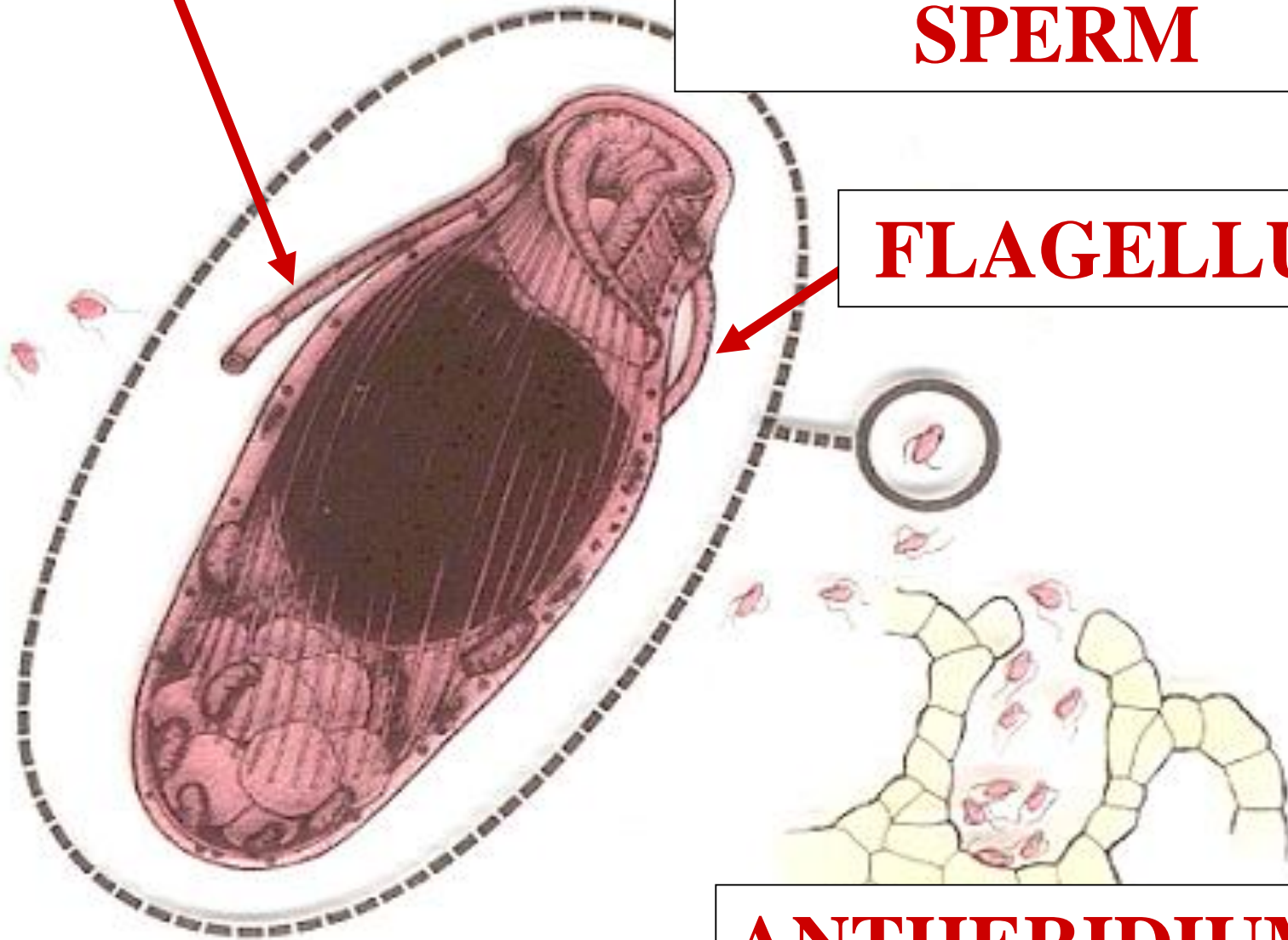
**FLAGELLUM**

**BIFLAGELLATED  
SPERM**

**M**

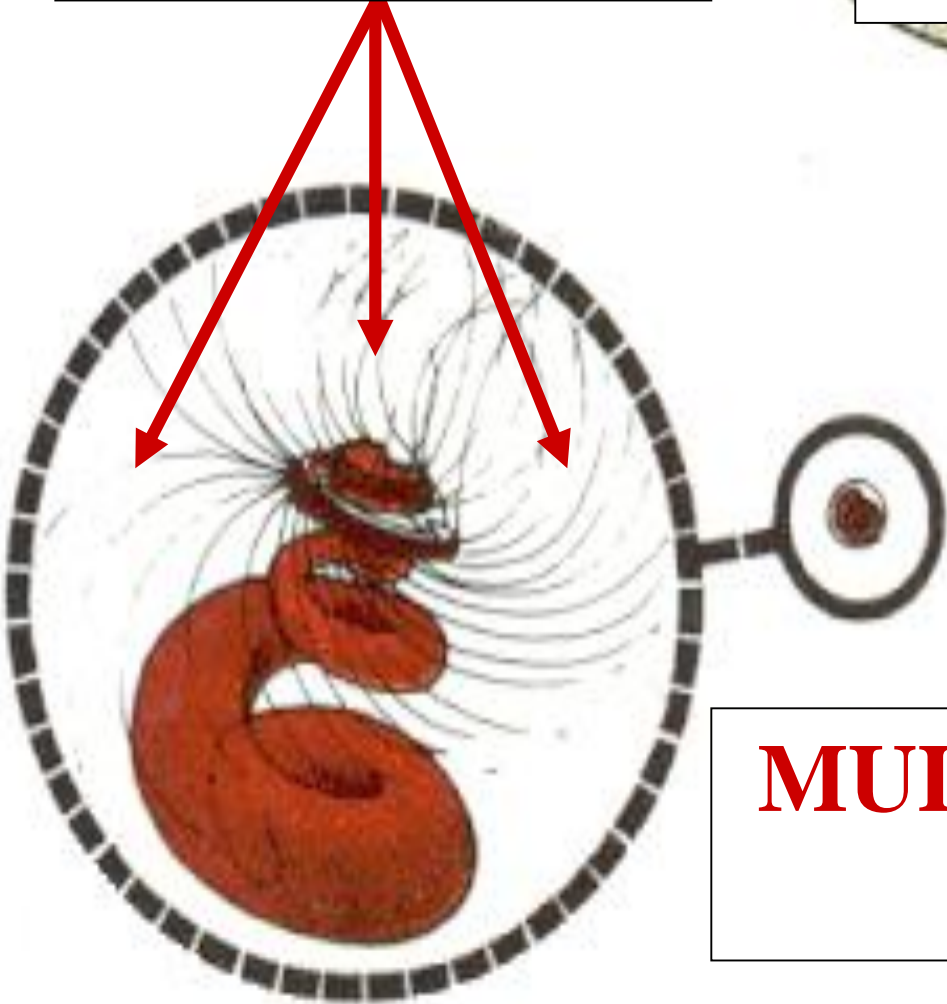
**FLAGELLUM**

**ANTHERIDIUM**

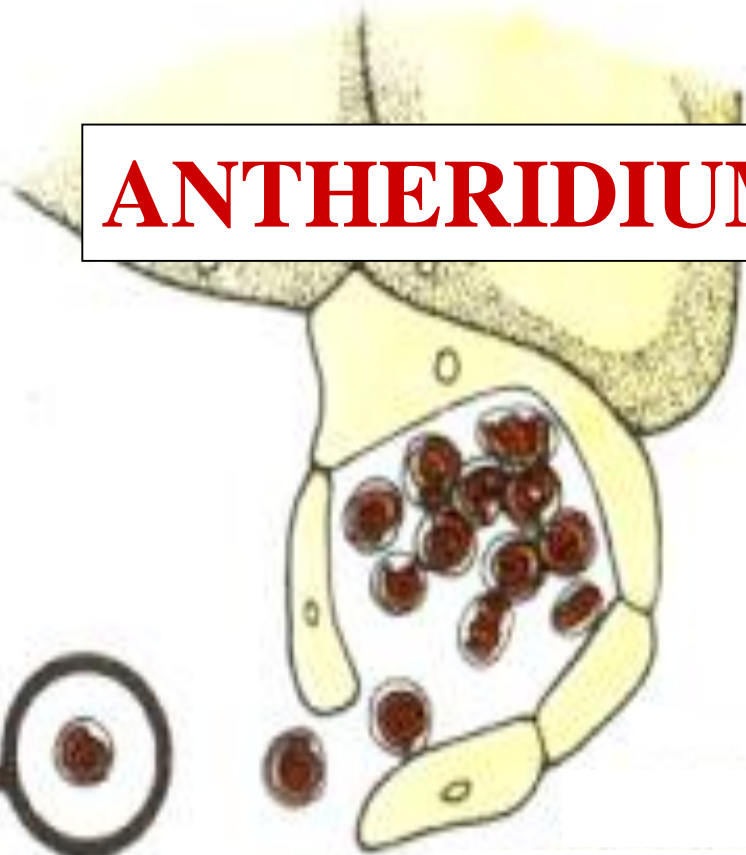


**MULTIPLE  
FLAGELLA**

**ANTHERIDIUM**



**MULTIFLAGELLATED  
SPERM**





# SYNGAMY

# PTERIDOPHYTES

ANTHERIDIUM

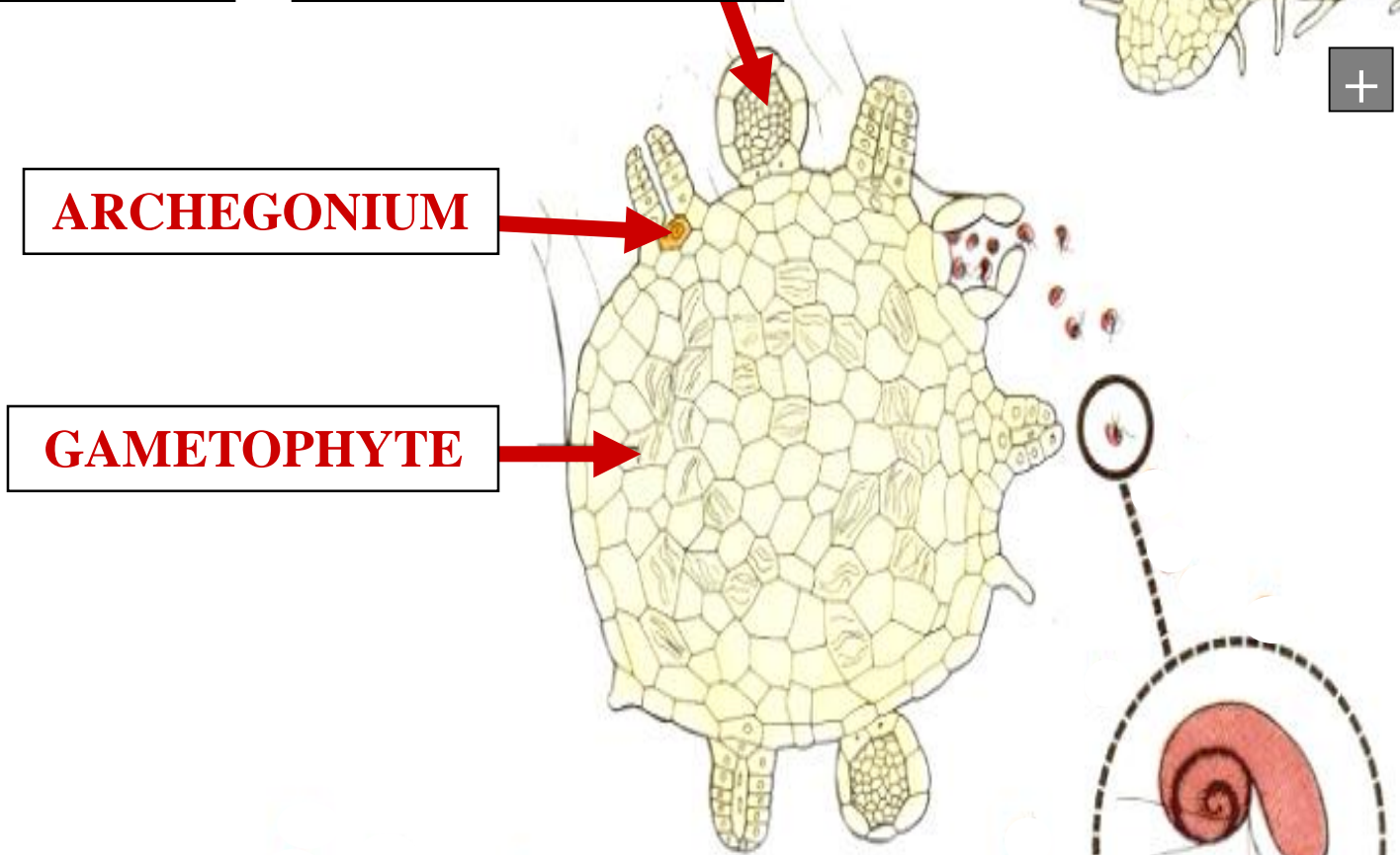
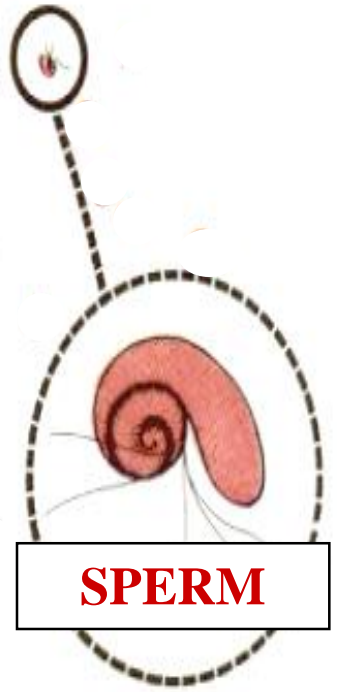
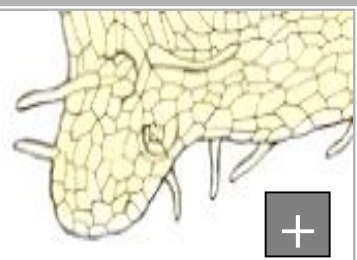
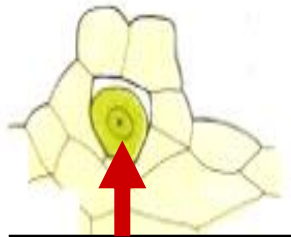
ARCHEGONIUM

GAMETOPHYTE

SPERM

EGG

FLAGELLATED SPERM



# PTERIDOPHYTES

ANTHERIDIUM

ARCHEGONIUM

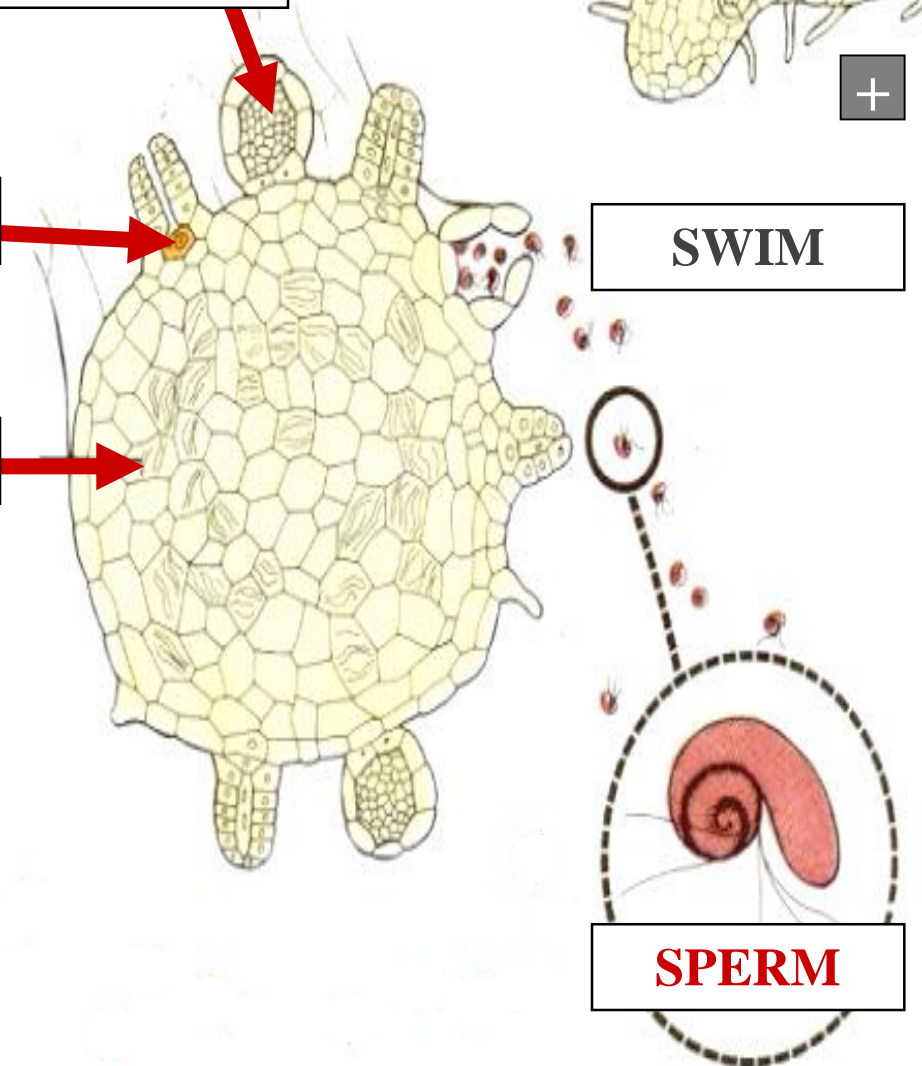
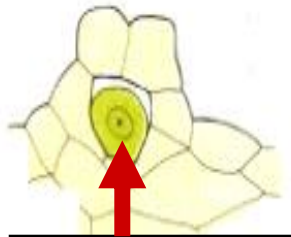
GAMETOPHYTE

SWIM

SPERM

EGG

FLAGELLATED SPERM



# PTERIDOPHYTES

ANTHERIDIUM

ARCHEGONIUM

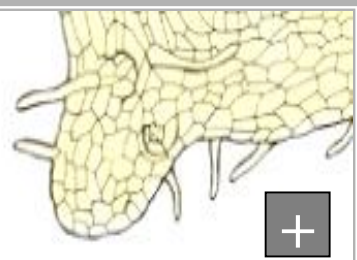
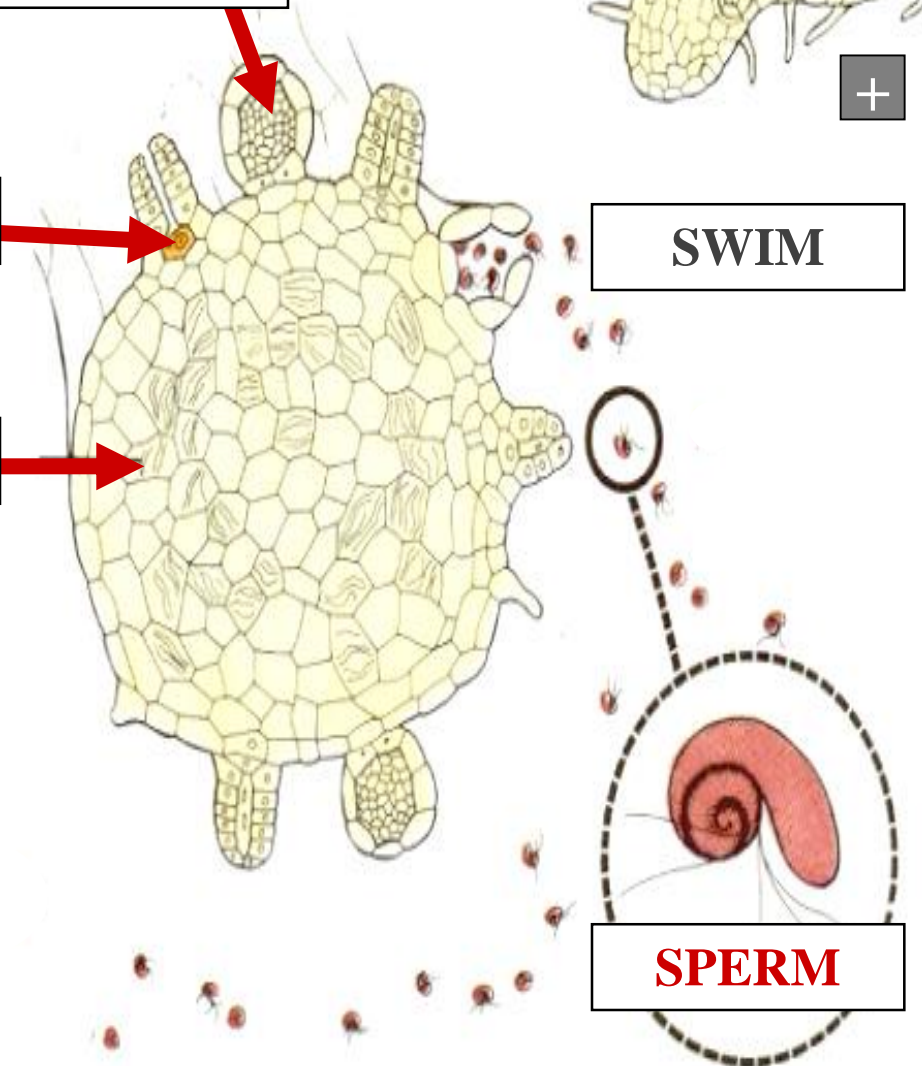
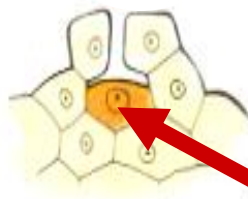
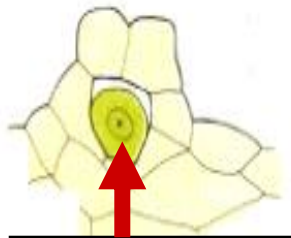
GAMETOPHYTE

SWIM

SPERM

EGG

FLAGELLATED SPERM



# PTERIDOPHYTES

ANTHERIDIUM

ARCHEGONIUM

GAMETOPHYTE

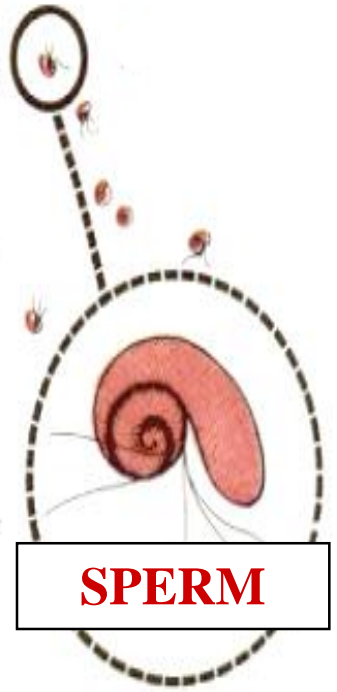
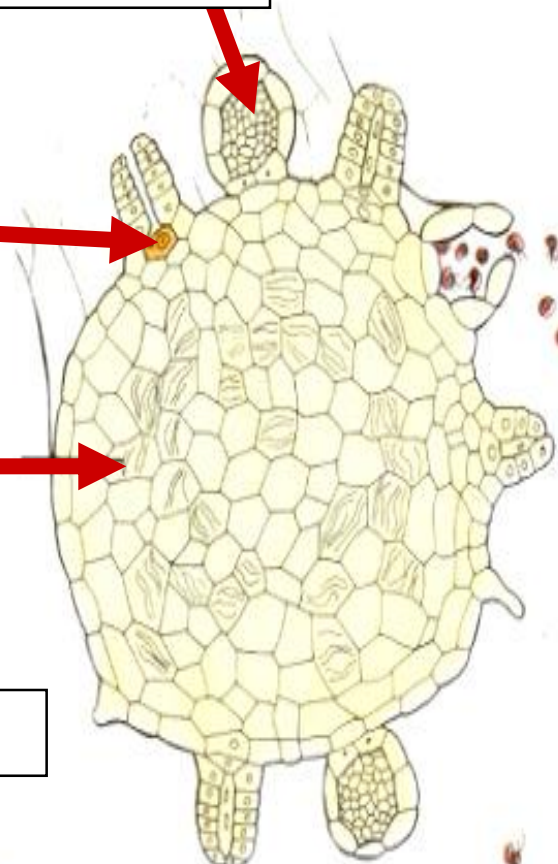
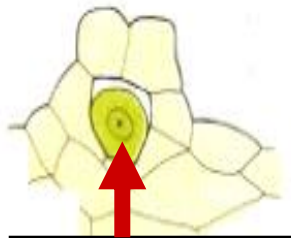
SWIM

SWIM

SPERM

EGG

FLAGELLATED SPERM



# PTERIDOPHYTES

ANTHERIDIUM

ARCHEGONIUM

GAMETOPHYTE

SWIM

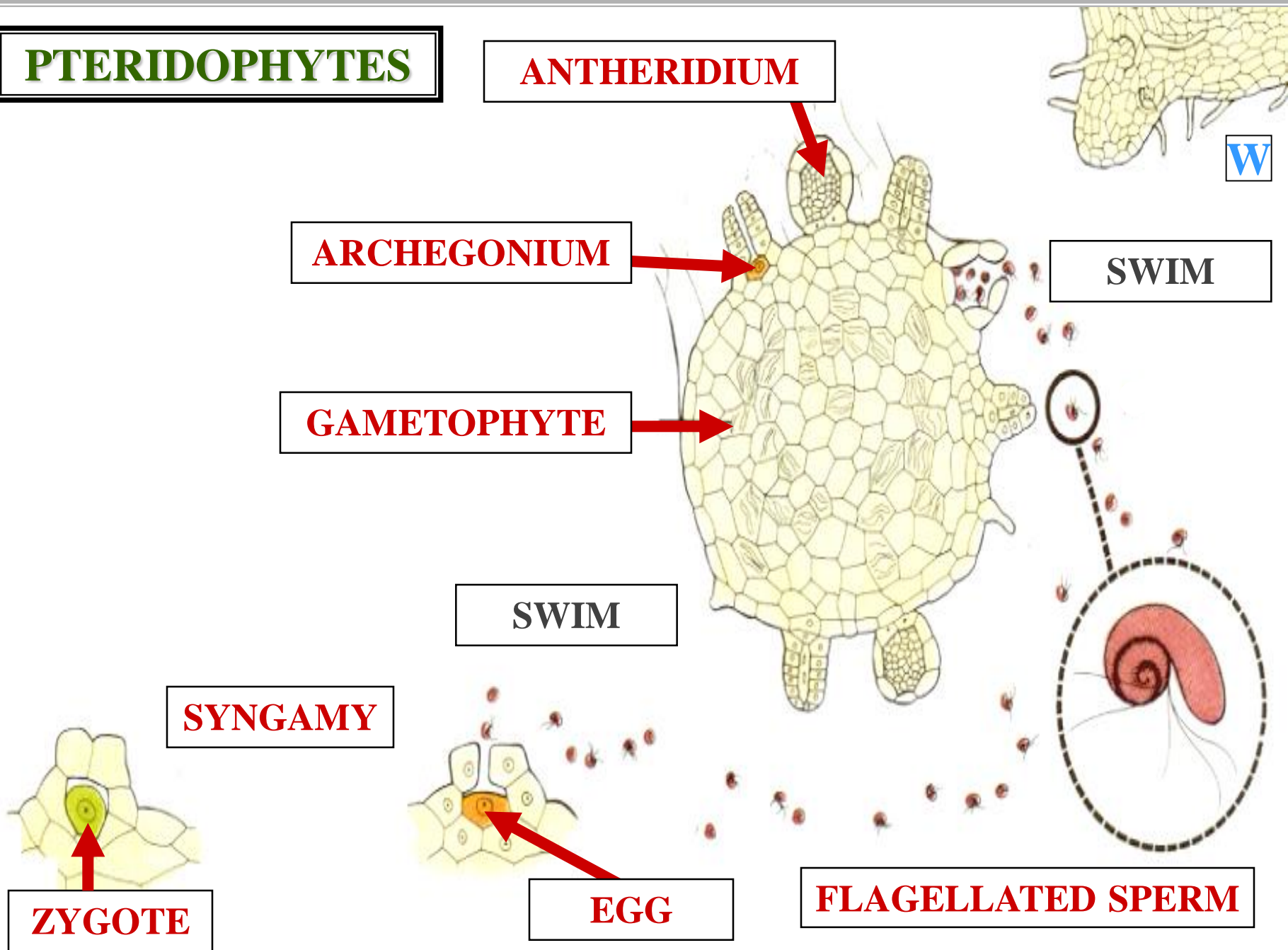
SYNGAMY

ZYGOTE

EGG

FLAGELLATED SPERM

SWIM





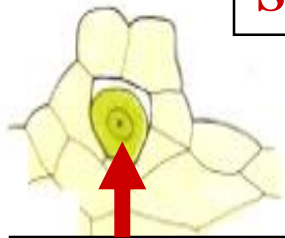
# PTERIDOPHYTES

S



## SYNGAMY REQUIRES WATER

SWIM



ZYGOTE

SYNGAMY

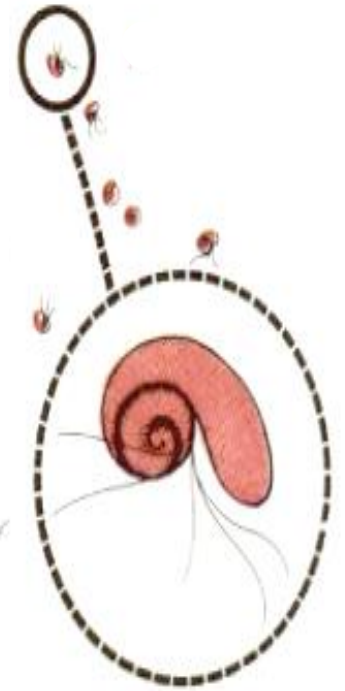


EGG

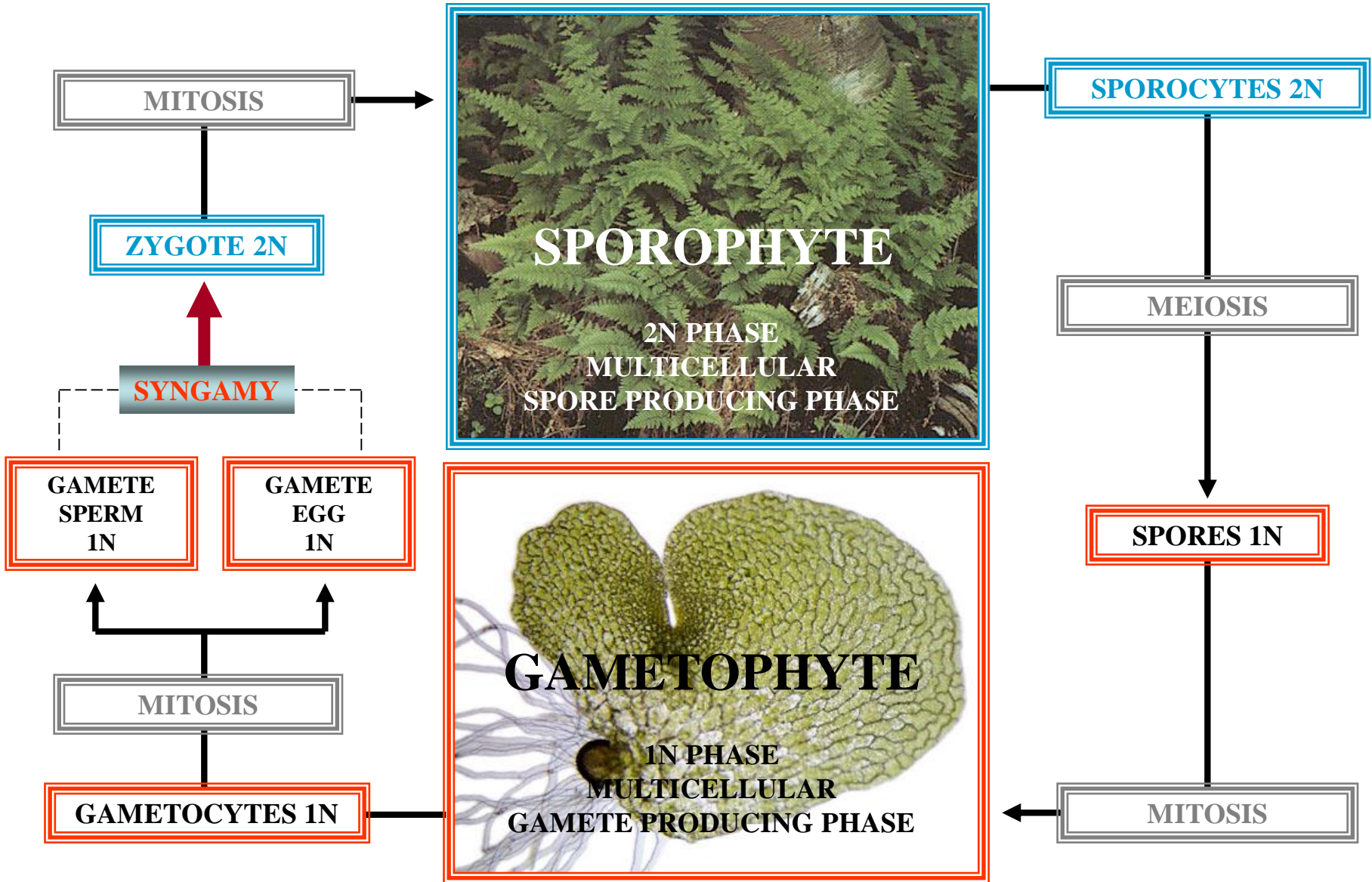
SWIM



FLAGELLATED SPERM



# PTERIDOPHYTE LIFE CYCLE





# VASCULAR PLANT EVOLUTION



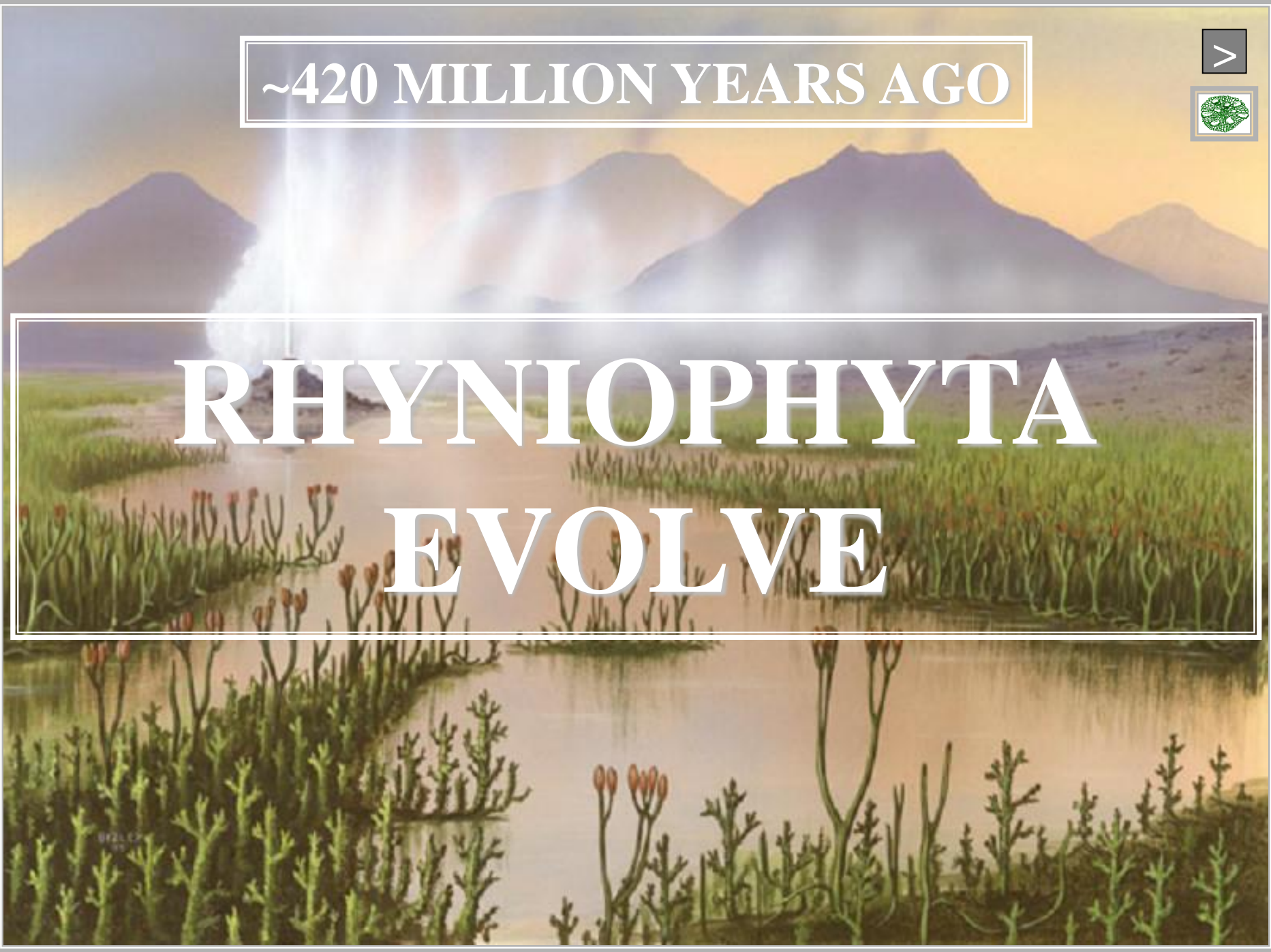
**~420**

**MILLION YEARS**

~420 MILLION YEARS AGO



# RHYNIOPHYTA EVOLVE



# RHYNIOPHYTE EVOLUTION



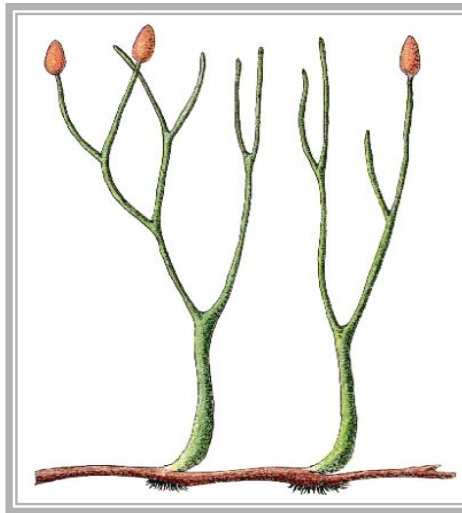
*PARKA*

# RHYNIOPHYTE EVOLUTION



**CHAROPHYTE**

# RHYNIOPHYTE EVOLUTION

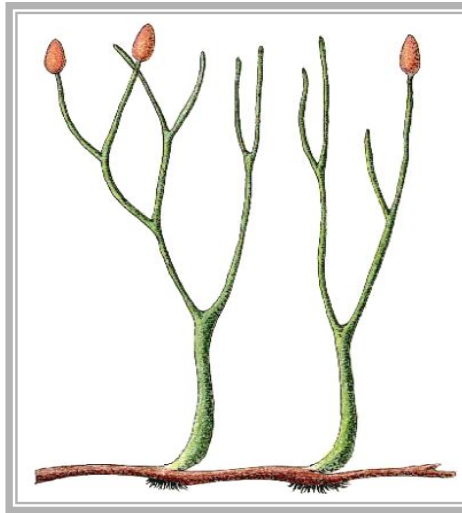


**CHAROPHYTE**

**AGLAOPHYTON**



# RHYNIOPHYTE EVOLUTION



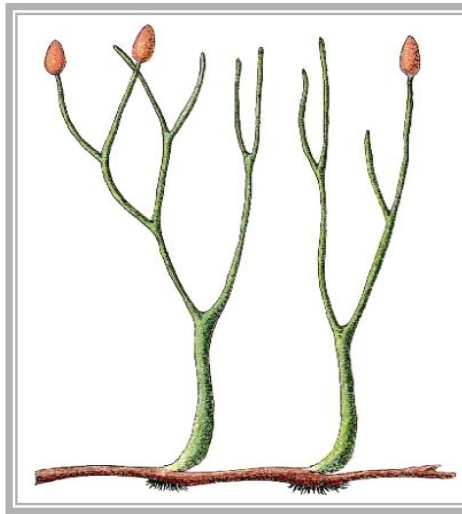
**CHAROPHYTE**

**PROEMBRYOPHYTE**

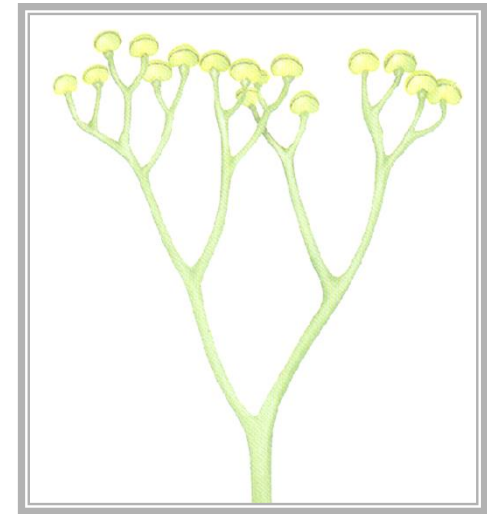
# RHYNIOPHYTE EVOLUTION



**CHAROPHYTE**



**PROEMBRYOPHYTE**

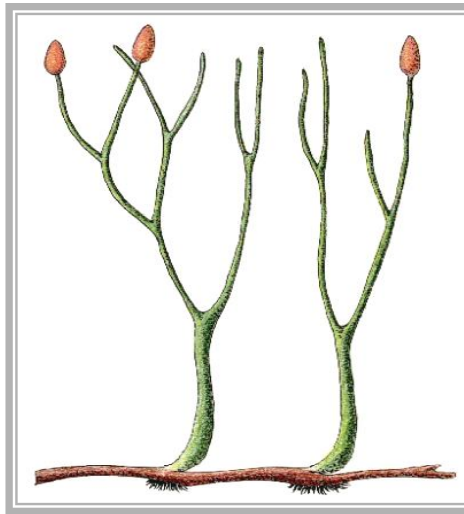


**EMBRYOPHYTE**

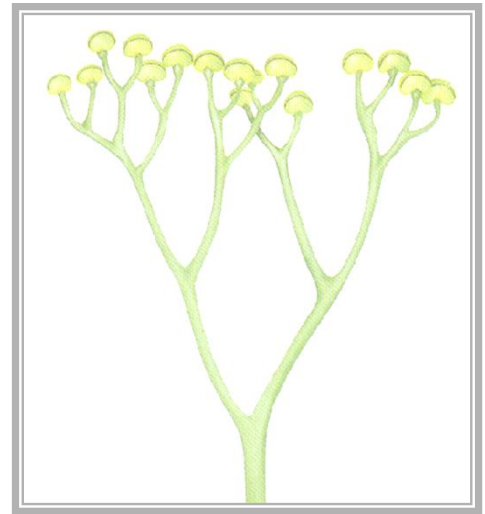
# RHYNIOPHYTE EVOLUTION



**CHAROPHYTE**



**PROEMBRYOPHYTE**



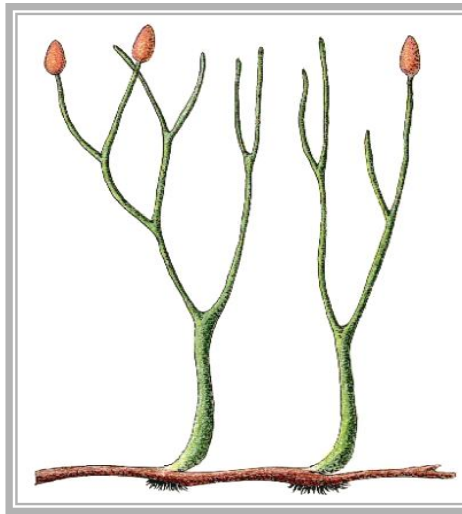
**TRACHEOPHYTE**



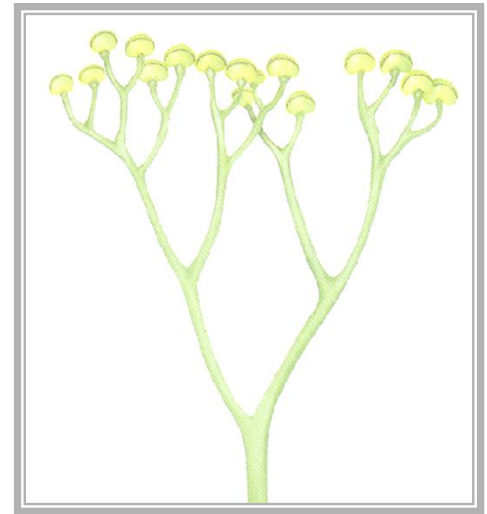
# RHYNIOPHYTE EVOLUTION



**CHAROPHYTE**



**PROEMBRYOPHYTE**



**RHYNIOPHYTE**



# PHYLUM RHYNIOPHYTA



EXTINCT  
PHYLUM

PHYLUM  
RHYNIOPHYTA

EXTINCT  
PHYLUM

# VILLAGE OF RHYNIE

^



# ABERDEEN, SCOTLAND



# COMMON NAME





# **RHYNIOPHYTES**



# FOSSIL RECORD

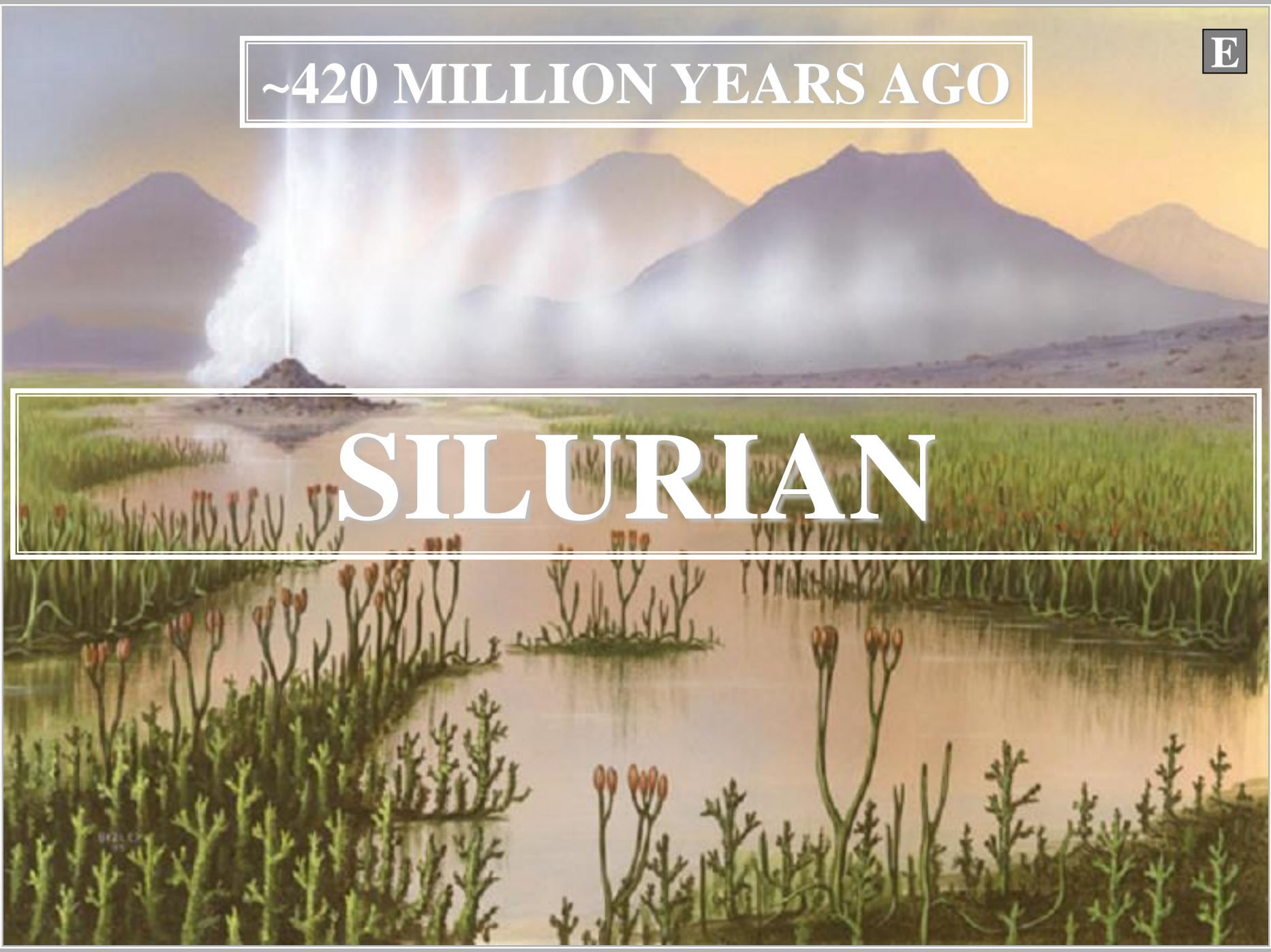


**~420**

**MILLION YEARS**

~420 MILLION YEARS AGO

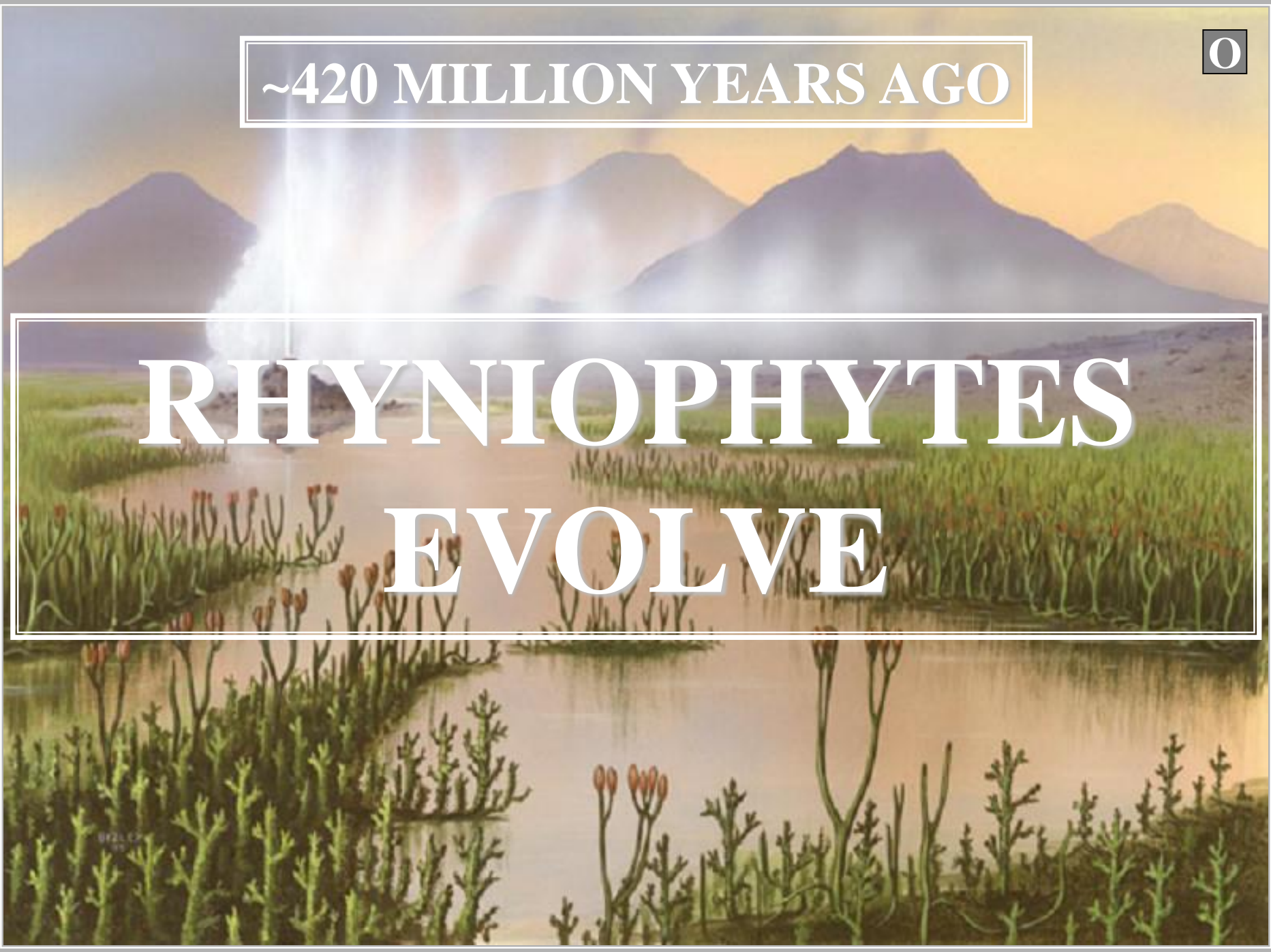
SILURIAN



~420 MILLION YEARS AGO

0

# RHYNIOPHYTES EVOLVE



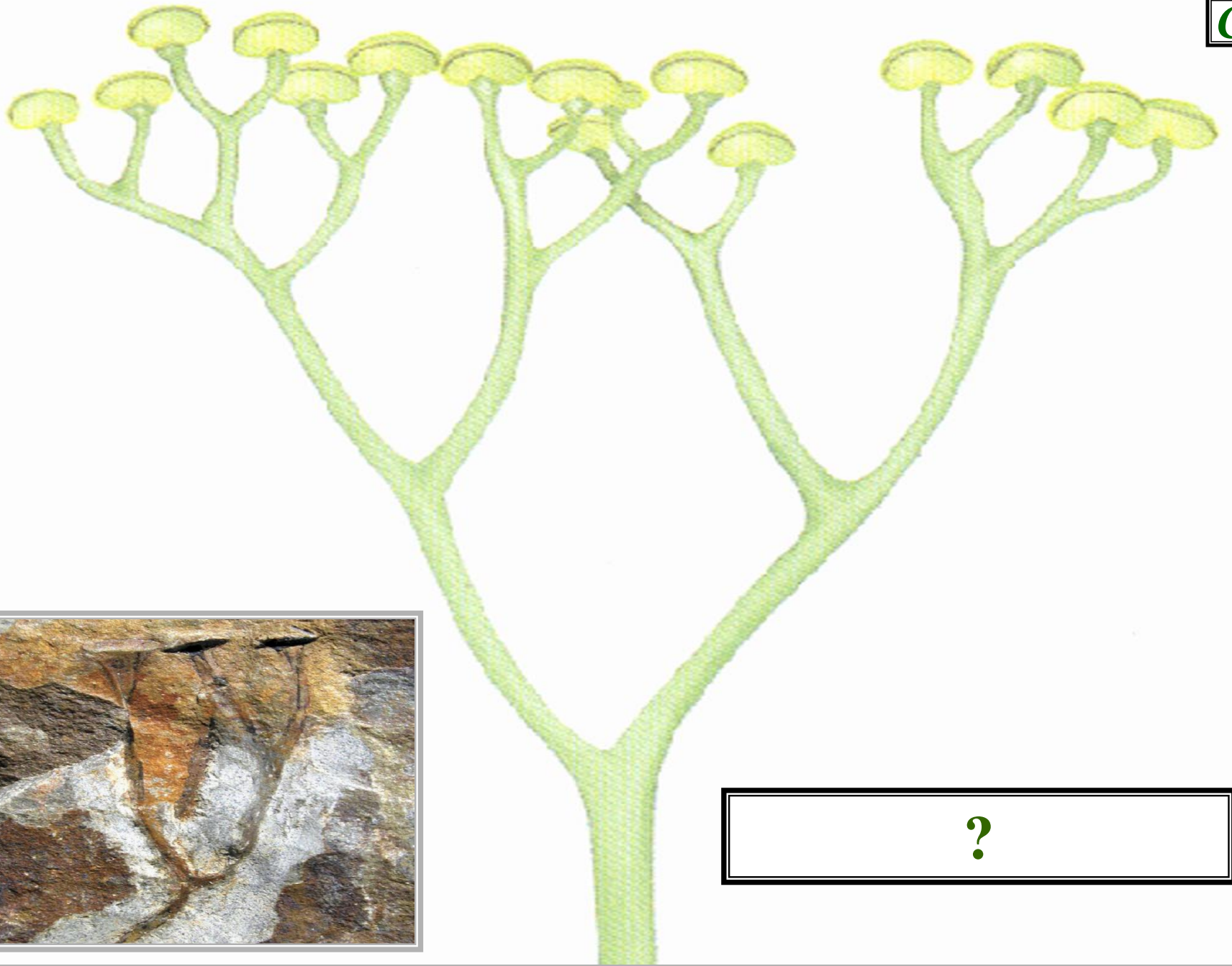
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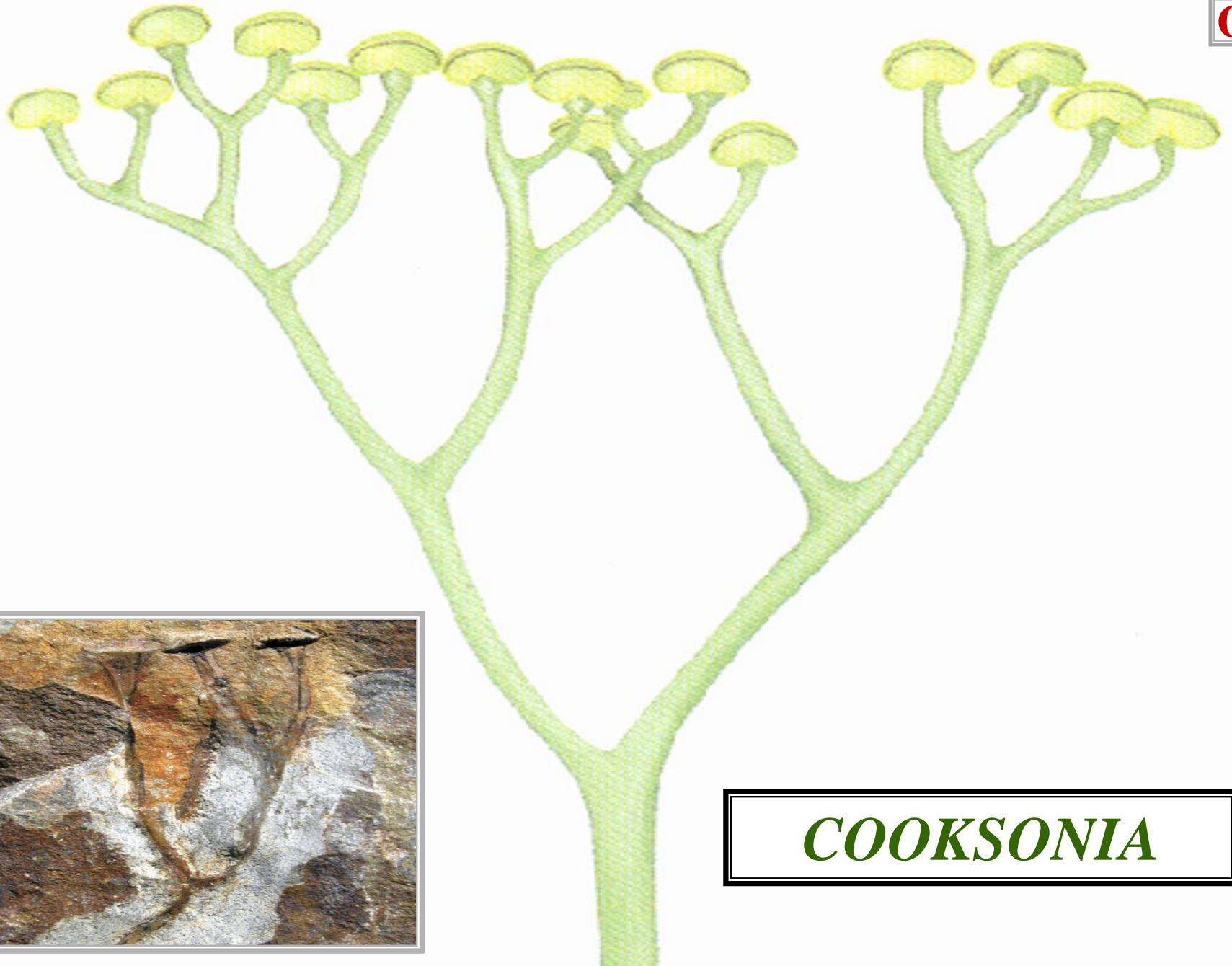
RHYNIOPHYTES  
OLDEST  
TRACHEOPHYTES

9/23/17

C

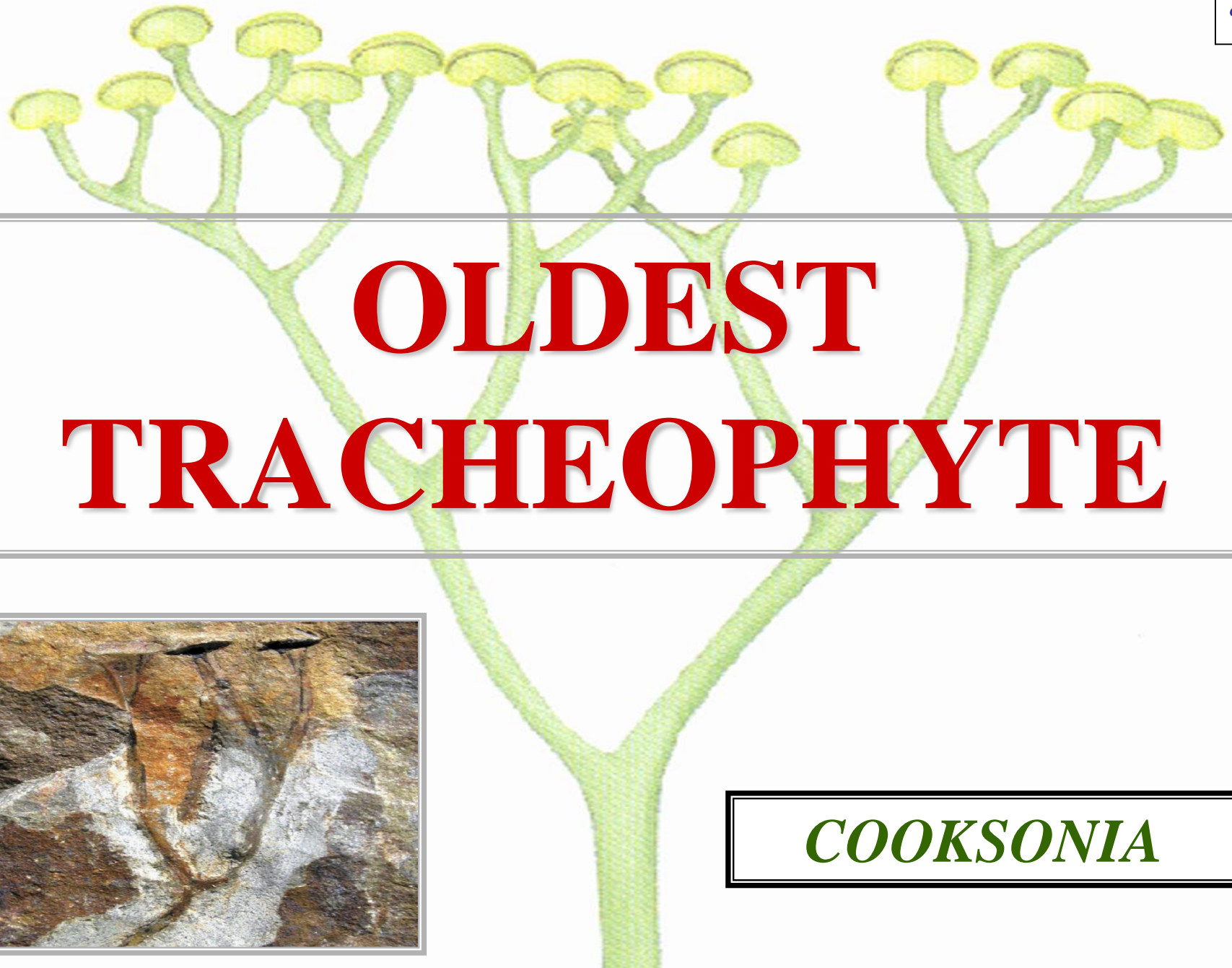


?



***COOKSONIA***





# OLDEST TRACHEOPHYTE



*COOKSONIA*



# QUESTION

HOW DO BOTANISTS  
KNOW *COOKSONIA*  
IS A TRACHEOPHYTE?

# QUESTION



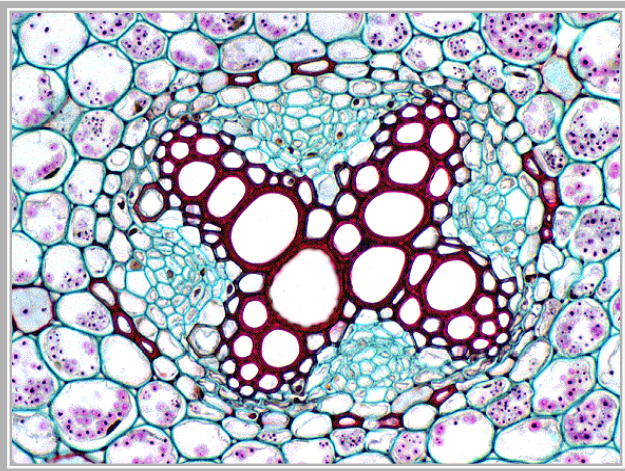
# OLDEST TRACHEOPHYTE



*COOKSONIA*



# VASCULAR TISSUE

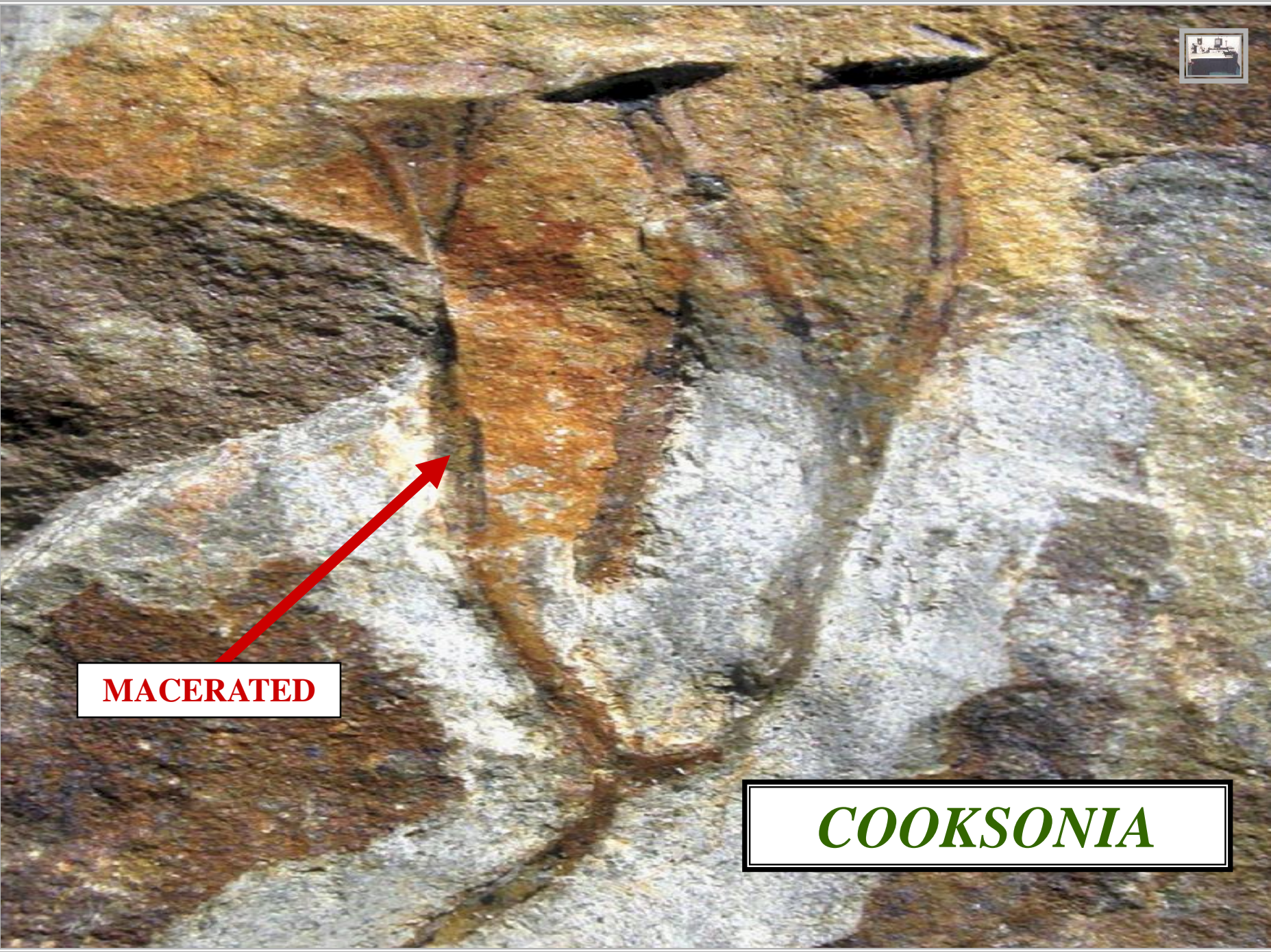


*COOKSONIA*



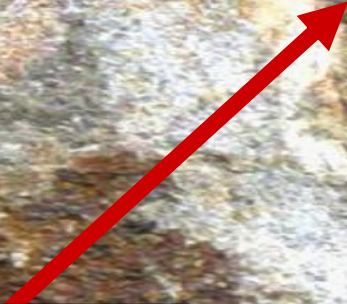
**STEM**

***COOKSONIA***

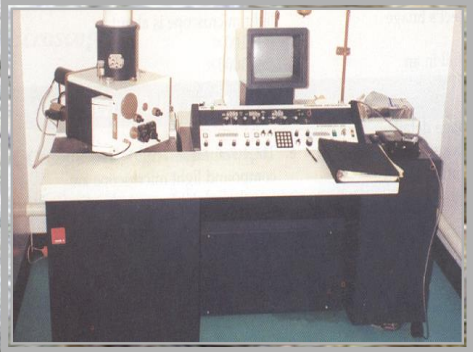


**MACERATED**

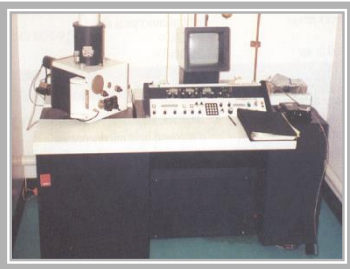
***COOKSONIA***



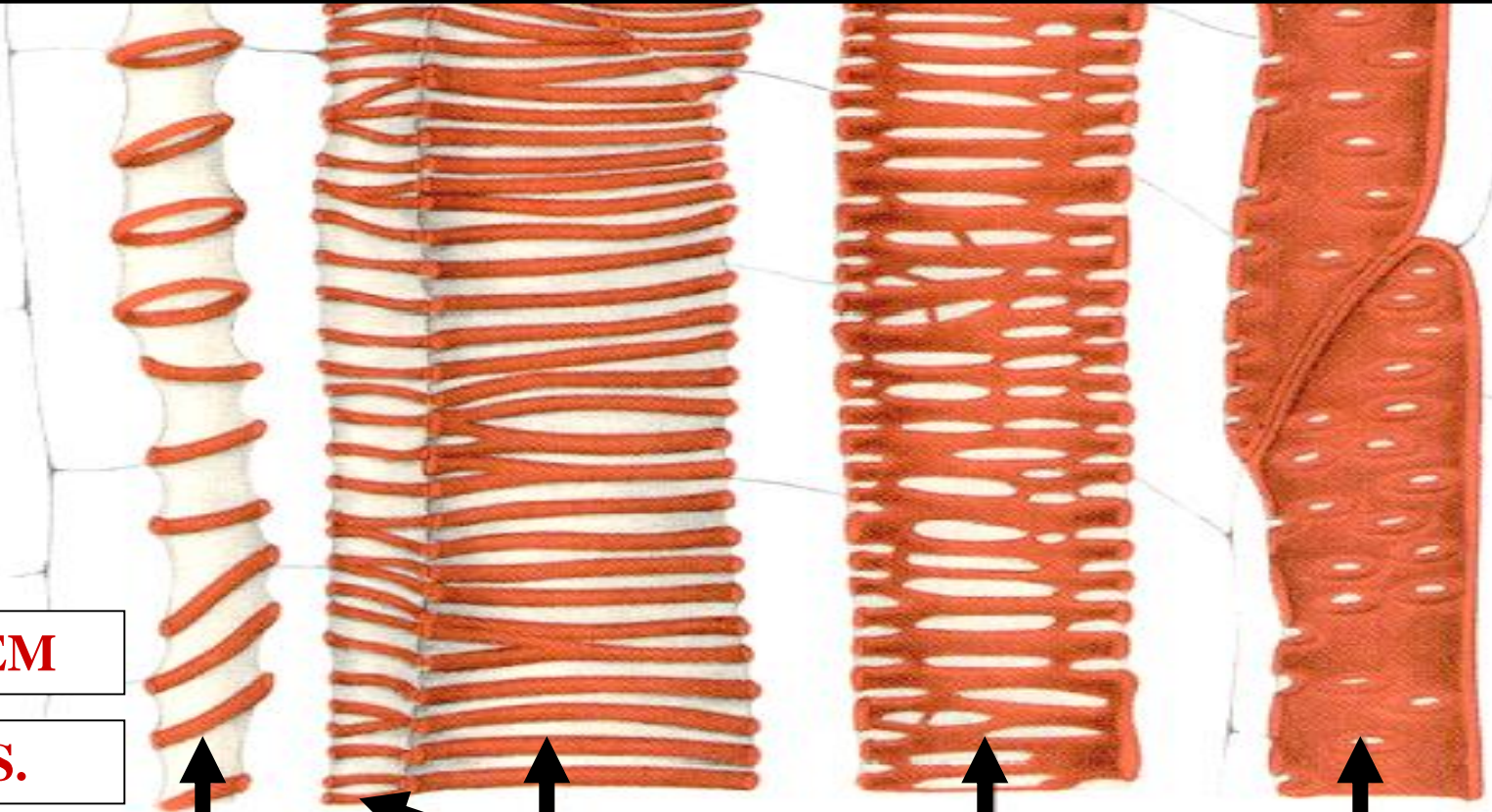
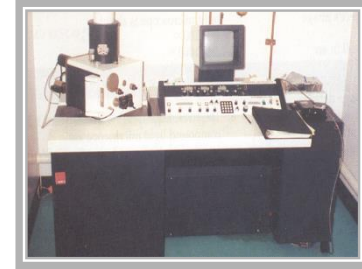
**MACERATED**



***COOKSONIA***



# SECONDARY CELL WALL DEPOSITION

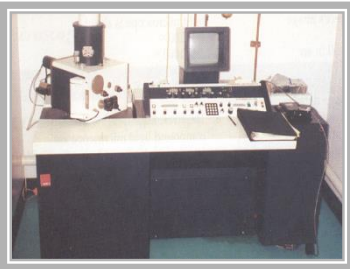


STEM

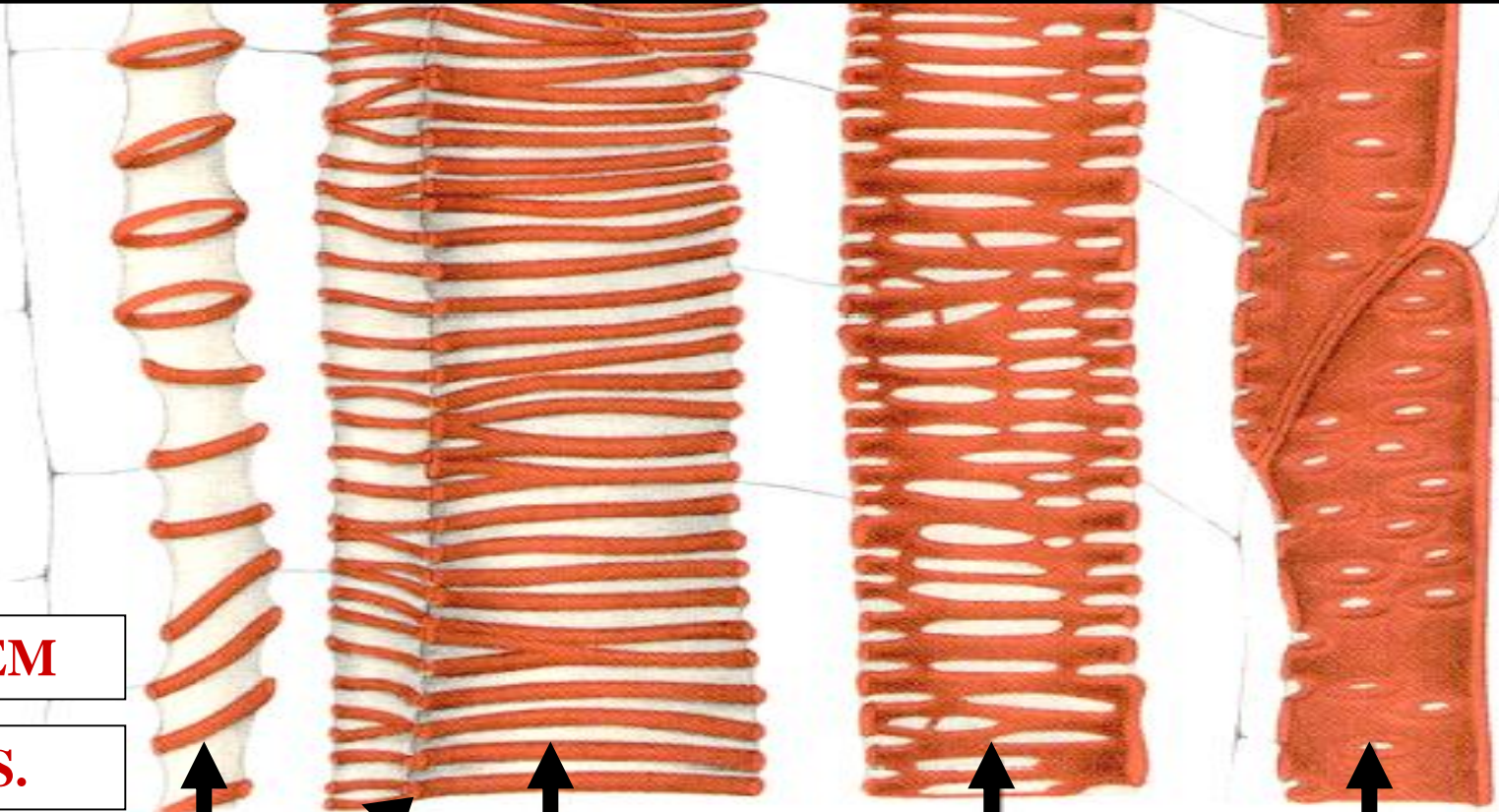
L.S.







# SECONDARY CELL WALL DEPOSITION



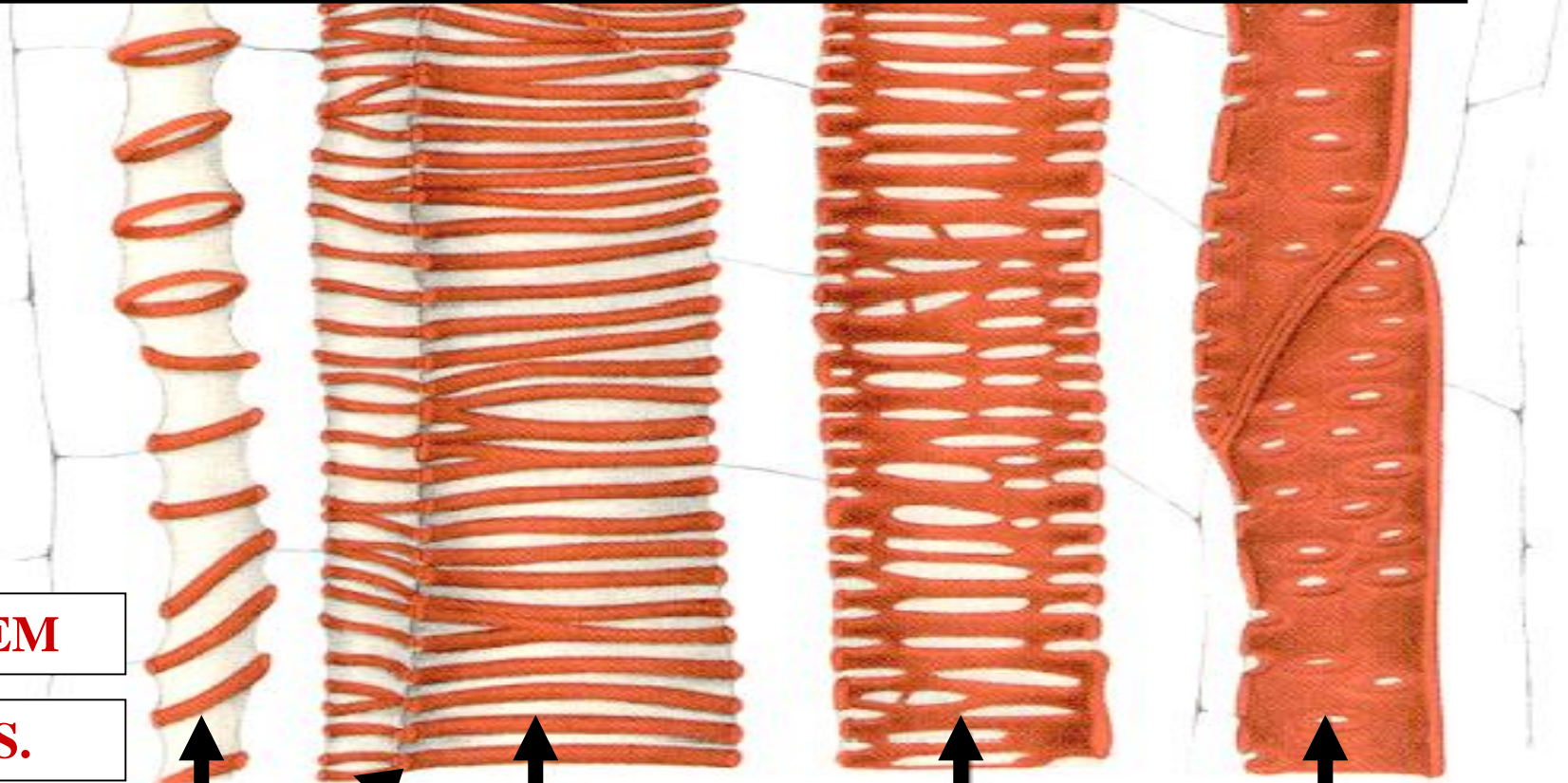
STEM

L.S.

ANNULAR



# SECONDARY CELL WALL DEPOSITION



STEM

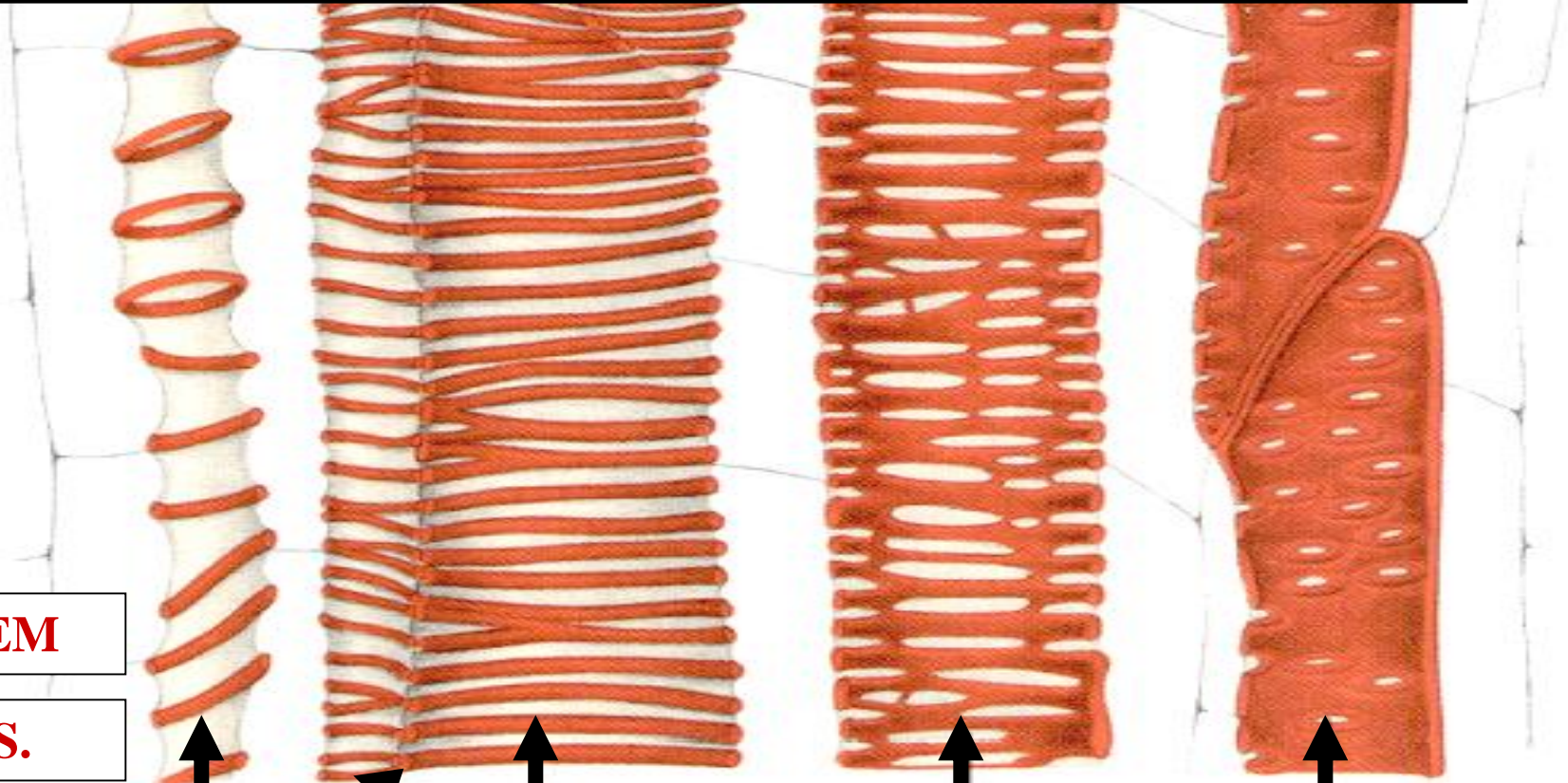
L.S.

ANNULAR

HELICAL



# SECONDARY CELL WALL DEPOSITION



STEM

L.S.

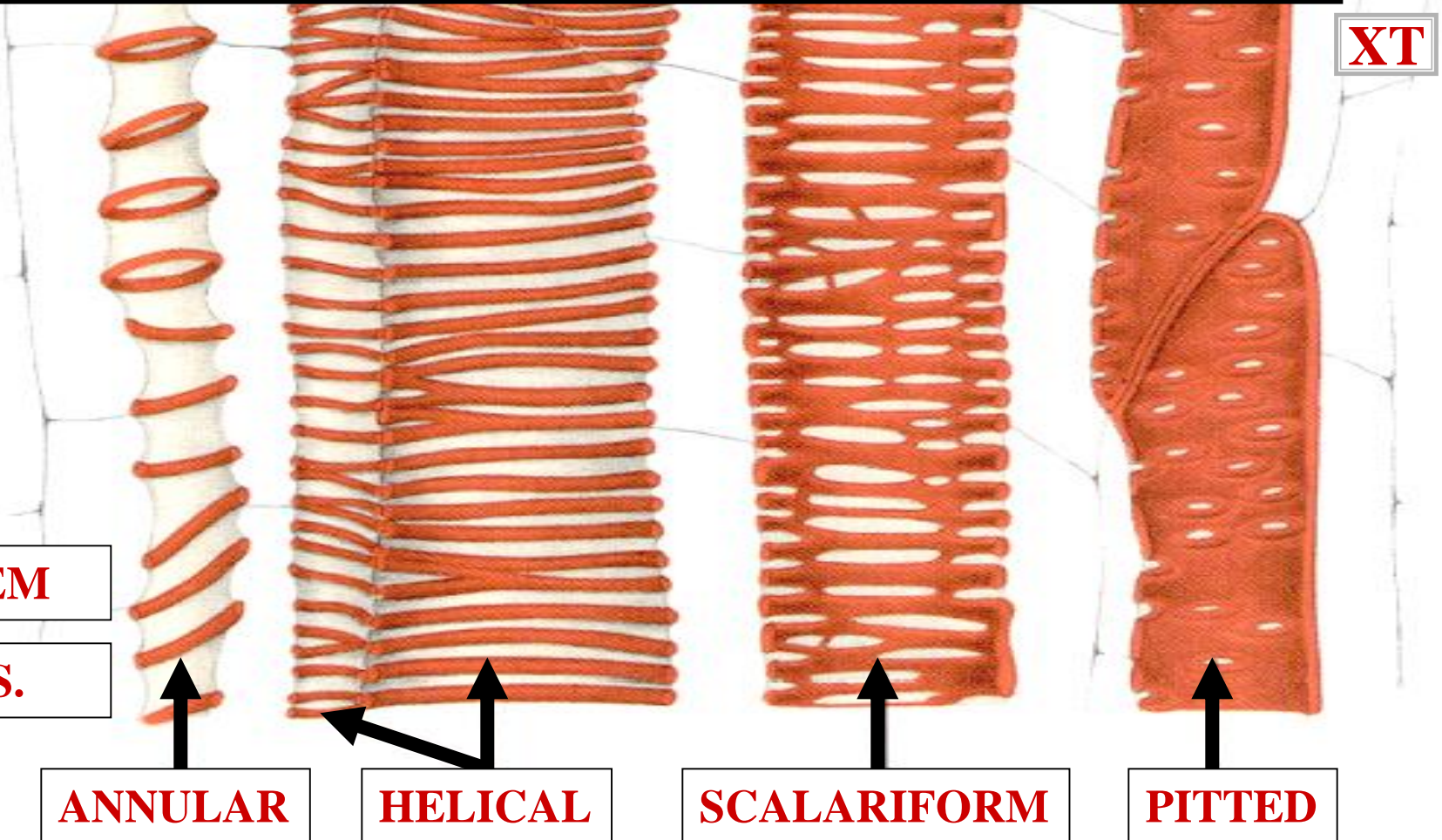
ANNULAR

HELICAL

SCALARIFORM

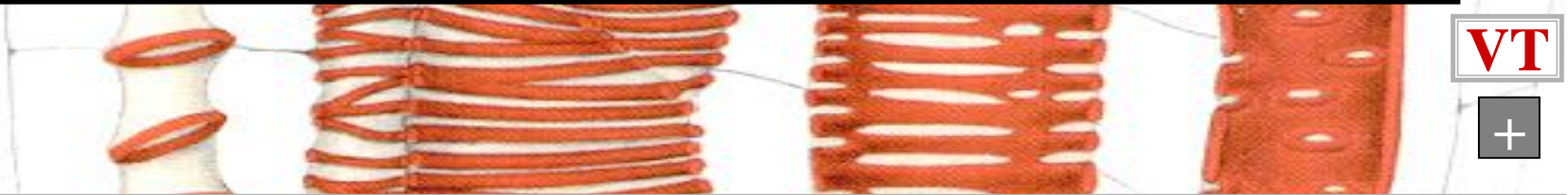


# SECONDARY CELL WALL DEPOSITION





# SECONDARY CELL WALL DEPOSITION



VT

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# XYLEM TISSUE

STEM

L.S.

ANNULAR

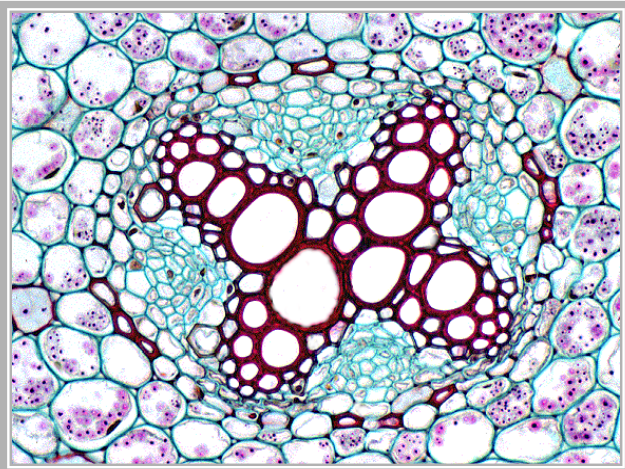
HELICAL

SCALARIFORM

PITTED



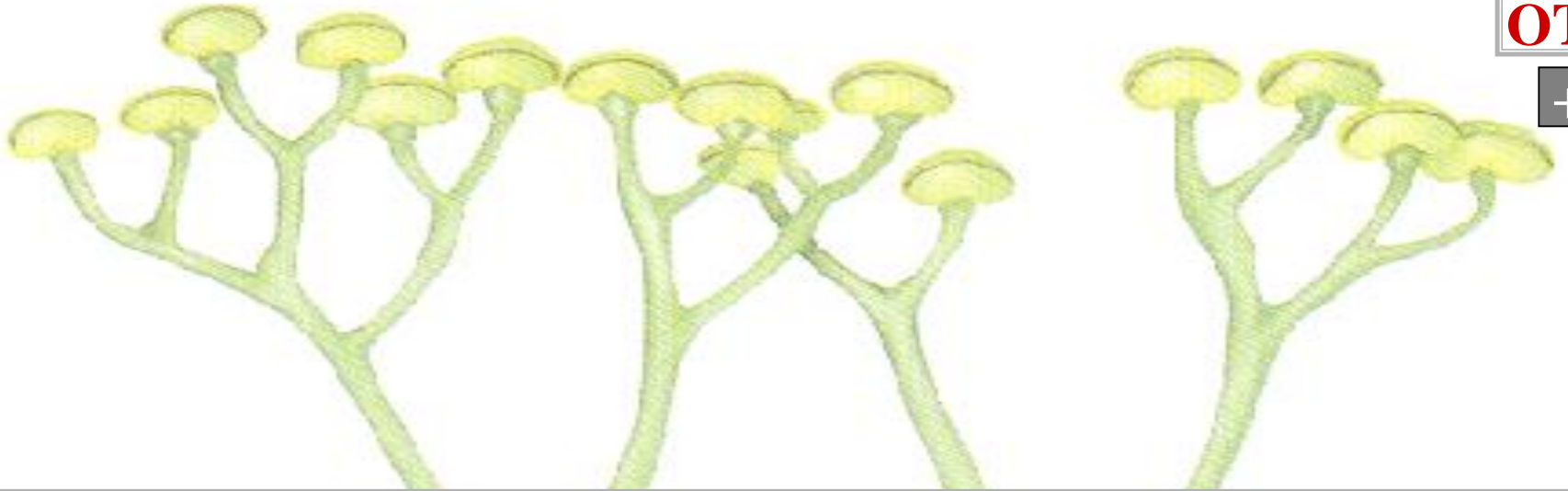
# VASCULAR TISSUE



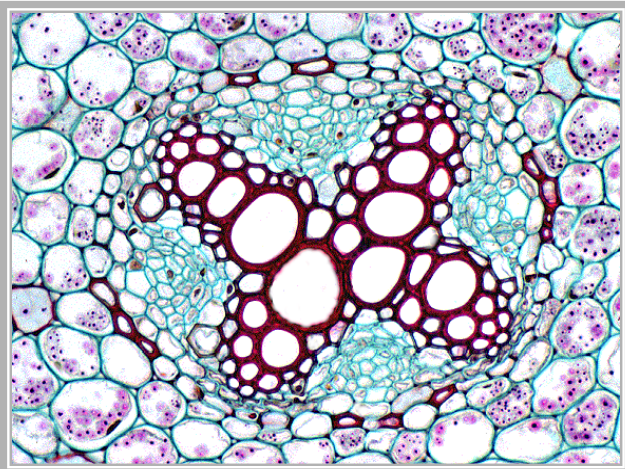
*COOKSONIA*

OT

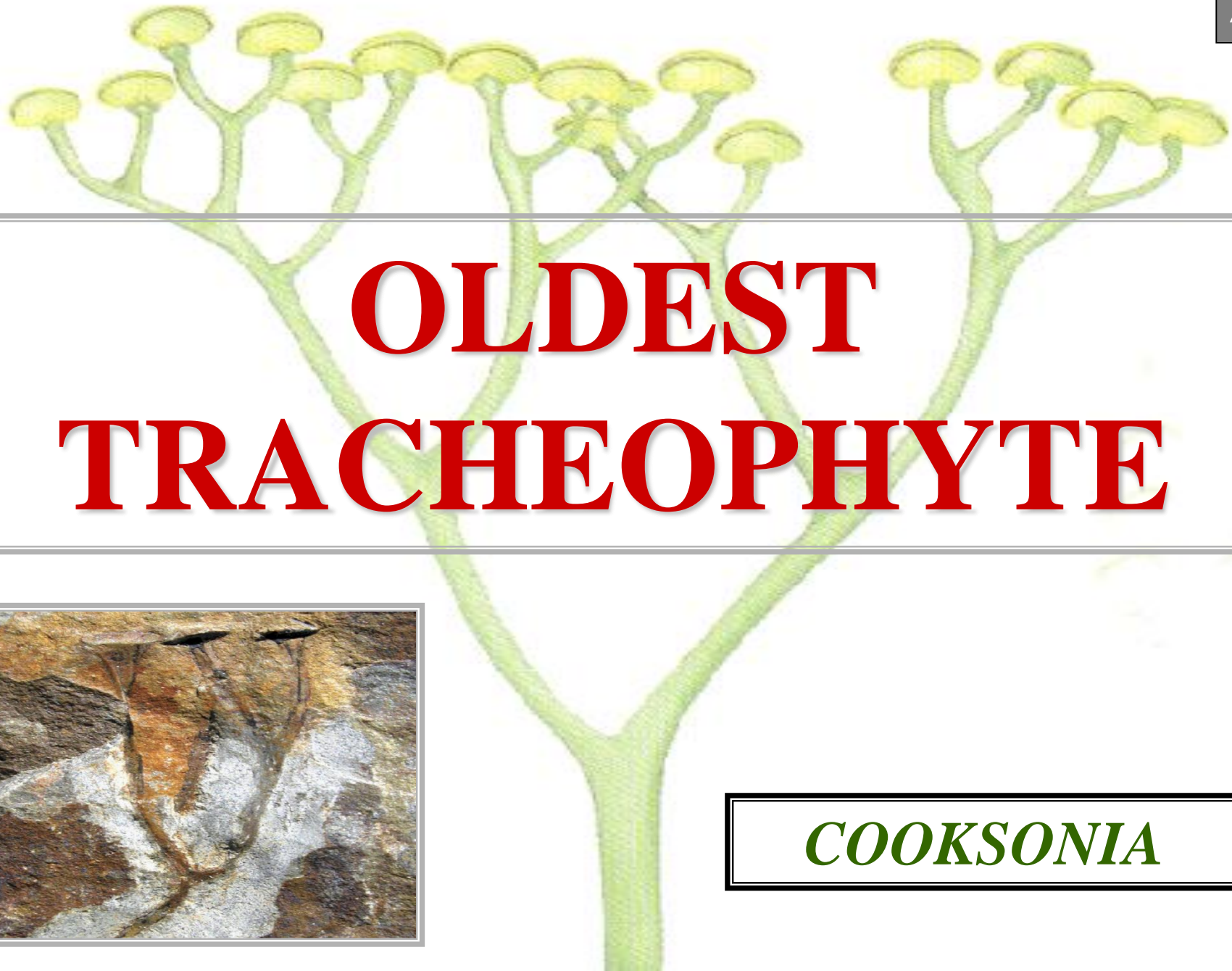
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# TRACHEOPHYTE



*COOKSONIA*



# OLDEST TRACHEOPHYTE



*COOKSONIA*





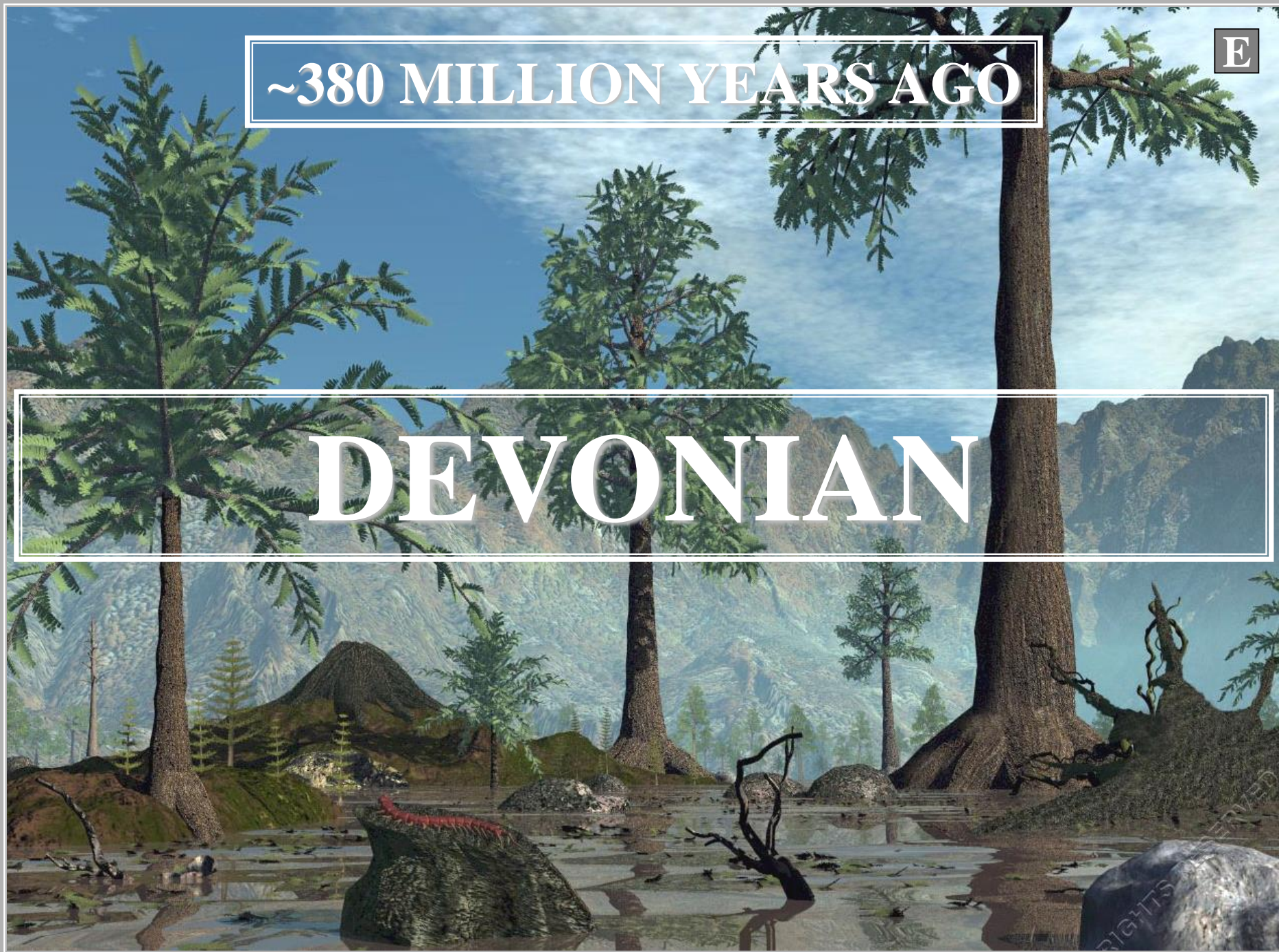
**~380**

**MILLION YEARS**

~380 MILLION YEARS AGO

E

DEVONIAN



~380 MILLION YEARS AGO

# RHYNIOPHYTES EXTINCT





# GENERAL CHARACTERS