

**MARATTIOPSISIDA  
CHARACTERS**

**TERRESTRIAL**

**MARATTIOPSISIDA  
CHARACTERS**

**MARATTIOPSISIDA  
CHARACTERS**

**TERRESTRIAL  
FROND CIRCINATE**

**MARATTIOPSISIDA  
CHARACTERS**

**MARATTIOPSISIDA  
CHARACTERS**

**TERRESTRIAL  
FROND CIRCINATE  
EUSPORANGIATE**

**MARATTIOPSISIDA  
CHARACTERS**

**MARATTIOPSIDA  
CHARACTERS**

**TERRESTRIAL  
FROND CIRCINATE  
EUSPORANGIATE  
SYNANGIATE**

**MARATTIOPSIDA  
CHARACTERS**

**MARATTIOPSIDA**  
**CHARACTERS**



**TERRESTRIAL**  
**FROND CIRCINATE**  
**EUSPORANGIATE**  
**SYNANGIATE**  
**HOMOSPOROUS**

**MARATTIOPSIDA**  
**CHARACTERS**



# MARATTIOPSISIDA FOSSIL RECORD

**~340**

**MILLION YEARS**



~340 MILLION YEARS AGO

E

# CARBONIFEROUS MISSISSIPPIAN

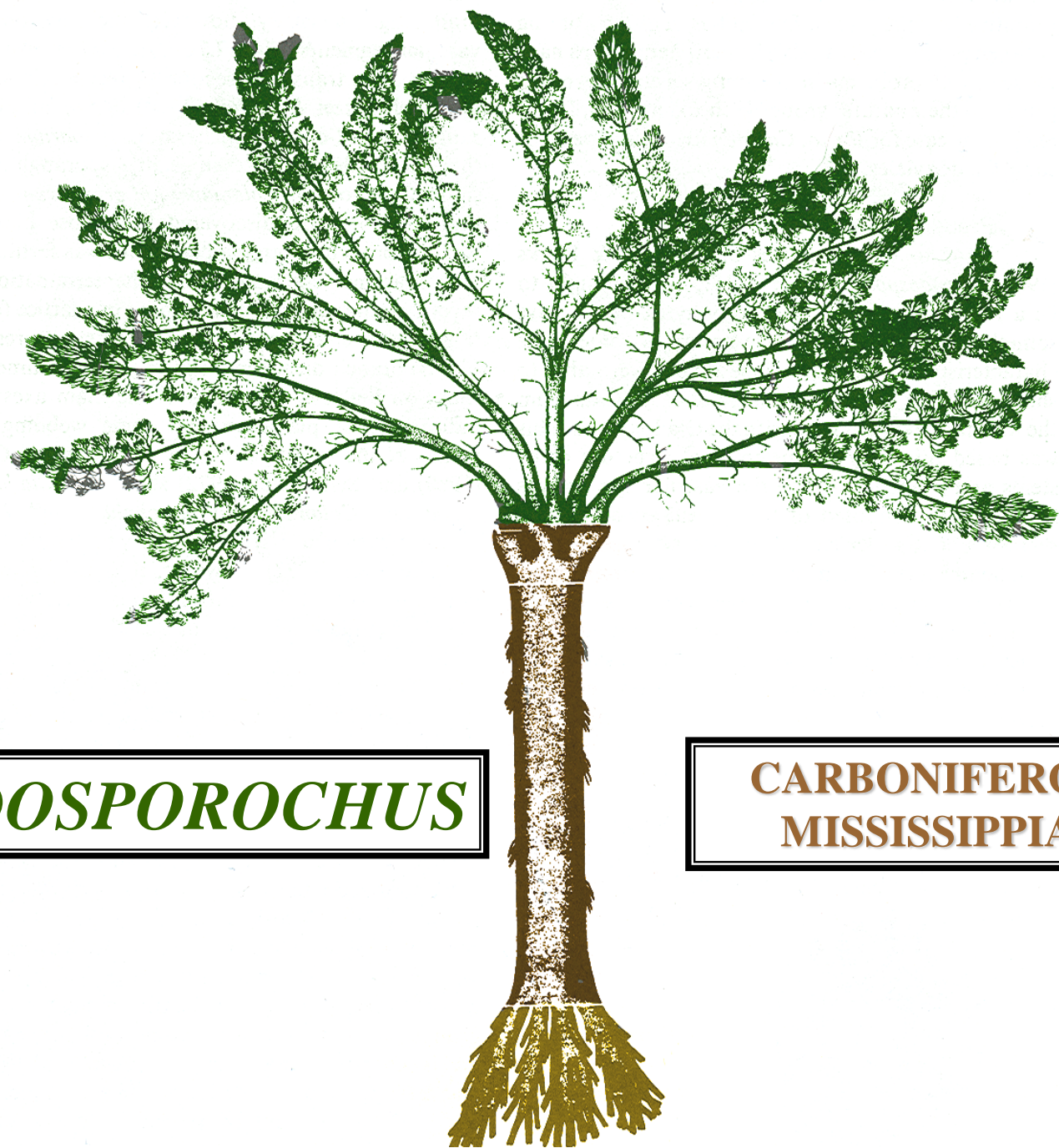


~340 MILLION YEARS AGO



P

# MARATTIOPSIDA EVOLVE



***PSEUDOSPOROCHUS***

**CARBONIFEROUS  
MISSISSIPPIAN**

**~300  
MILLION YEARS**



~300 MILLION YEARS AGO

Z

# CARBONIFEROUS

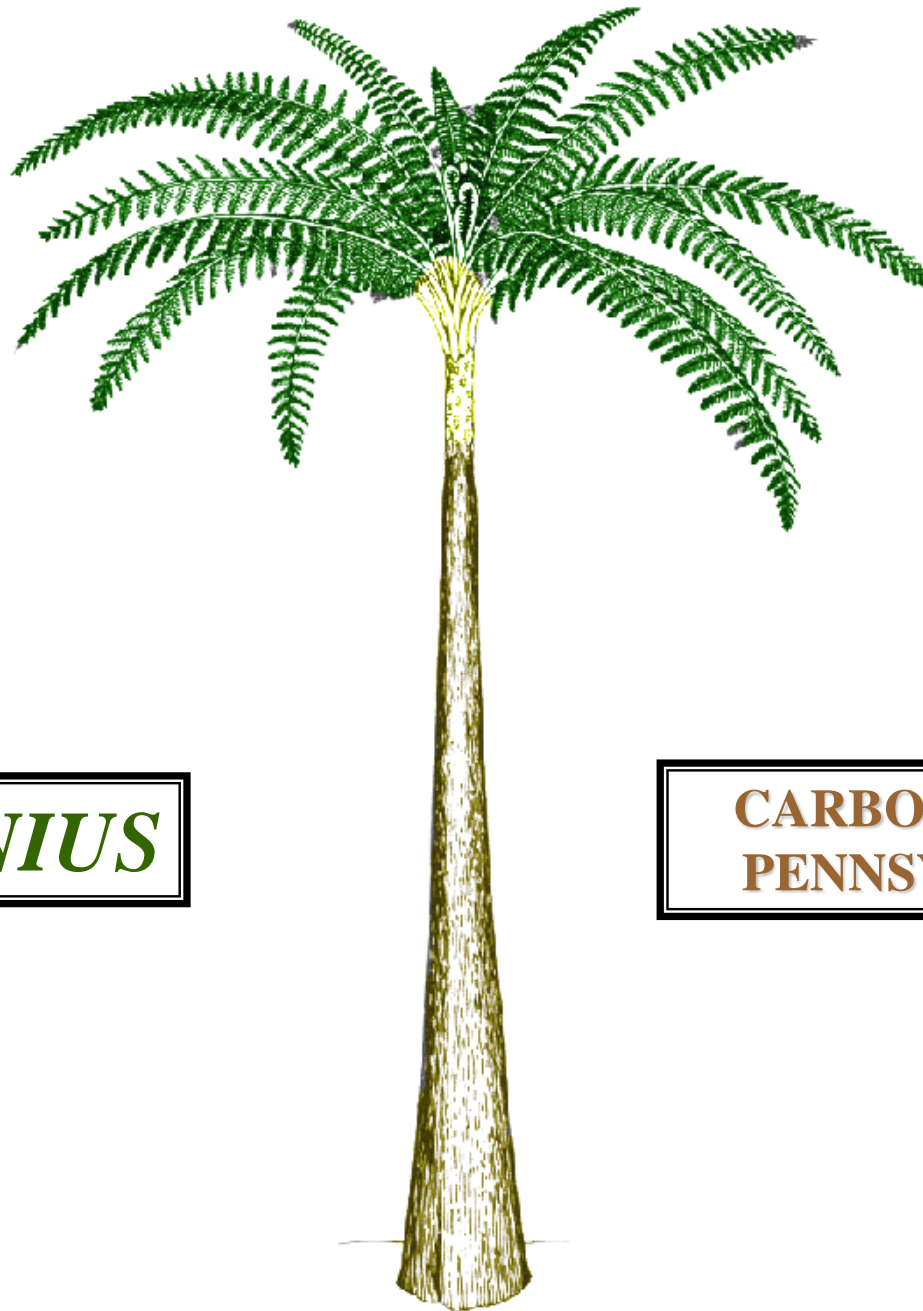
## PENNSYLVANIAN

~300 MILLION YEARS AGO



P

# MARATTIOPSIS ZENITH



*PSARONIUS*

CARBONIFEROUS  
PENNSYLVANIAN

# PHYLOGENETIC RELATIONSHIP

# MARATTIOPSIDA

## EVOLUTION



*IBYKA*

**CLADOXYLPHYTE**

**FERN**

**EXTINCT**



# MARATTIOPSIDA EVOLUTION



*IBYKA*

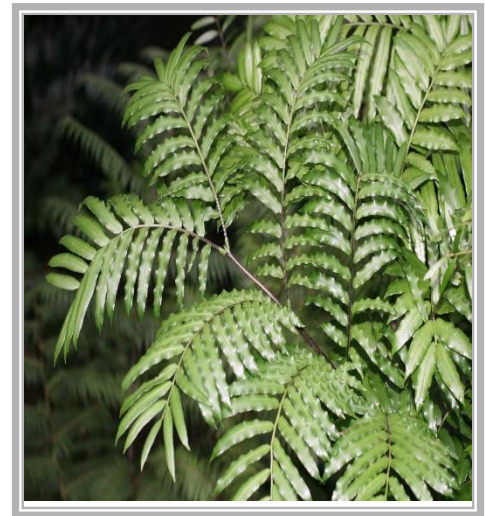
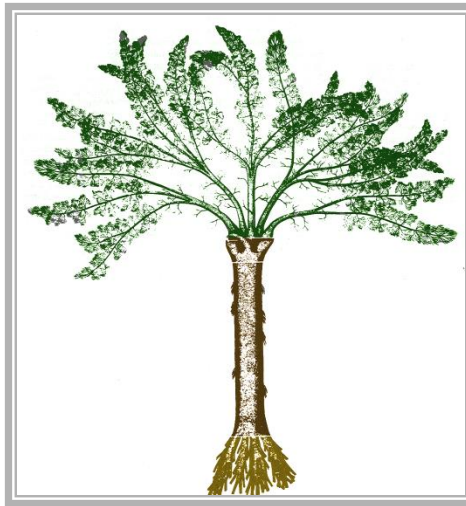
CLADOXYLPHYTE  
FERN  
EXTINCT



*PSEUDOSPOROCHUS*

MARATTIOPSIDA  
FERN  
EXTINCT

# MARATTIOPSIDA EVOLUTION



*IBYKA*

**CLADOXYLPHYTE  
FERN  
EXTINCT**

*PSEUDOSPOROCHUS*

**MARATTIOPSIDA  
FERN  
EXTINCT**

*MARATTIA*

**MARATTIOPSIDA  
FERN  
EXTANT**



# MARATTIOPSISIDA ORDER

**EXTANT  
ORDER**

**MARATTIALES**

**EXTANT  
ORDER**

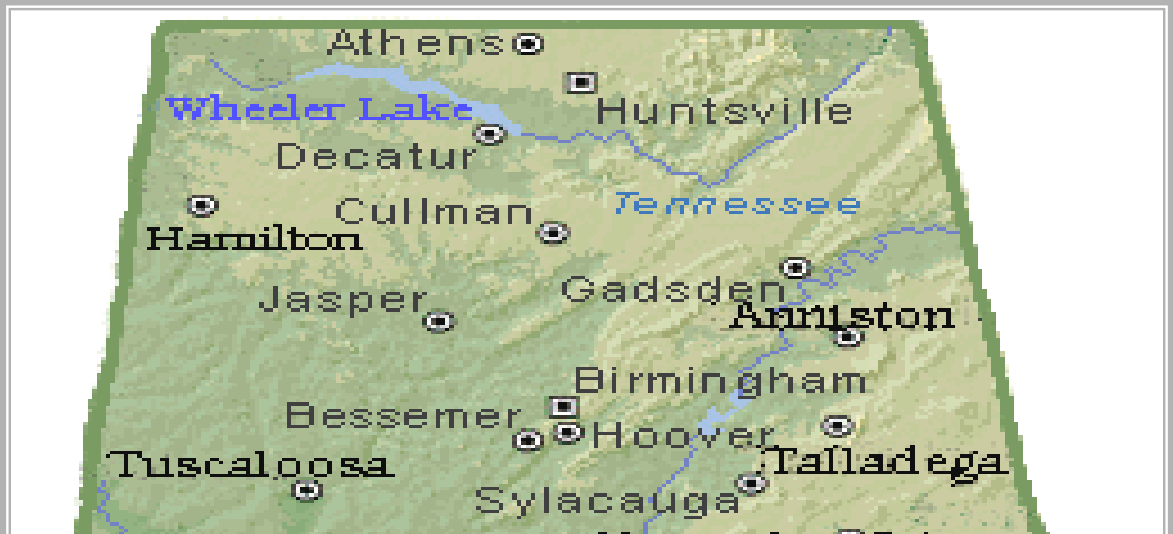


# DIVERSITY



**~200 SPECIES**

**EARTH**



**0 SPECIES**





# REPRESENTATIVE GENERA





***ANGIOPTERIS***



***MARATTIA***



# DISTRIBUTION



**TROPICAL**

**EARTH**



# HABITAT



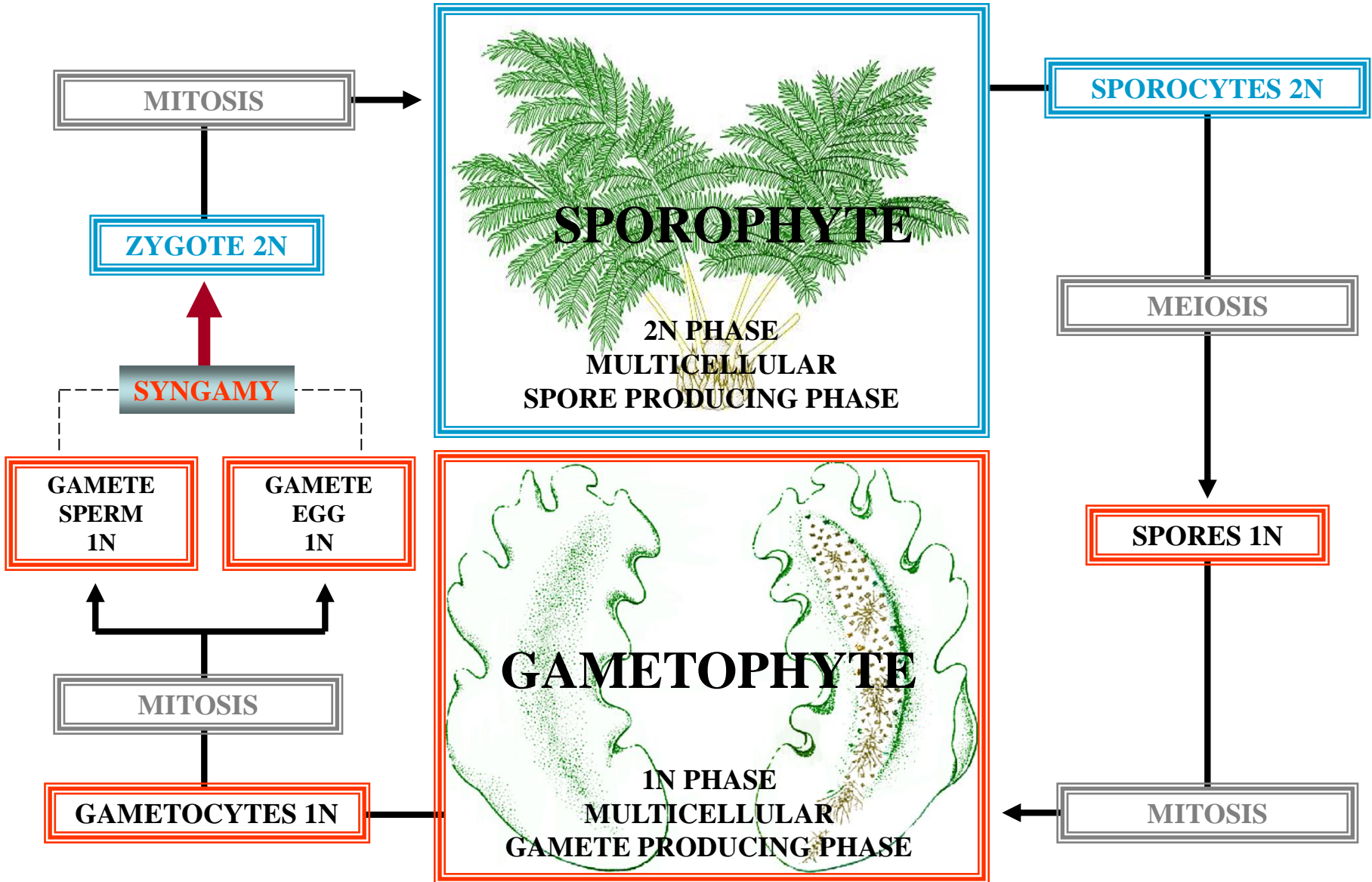
# TROPICAL RAINFOREST



# GENERAL CHARACTERS

# MARATTIALES

## LIFE CYCLE

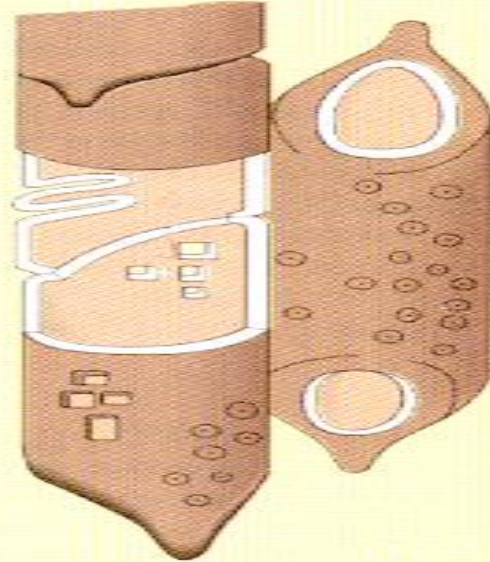
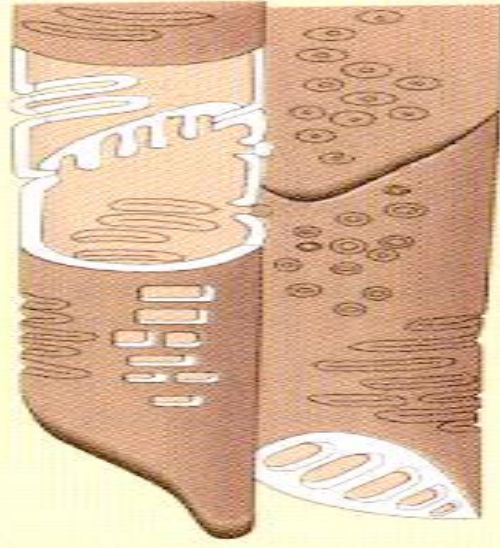
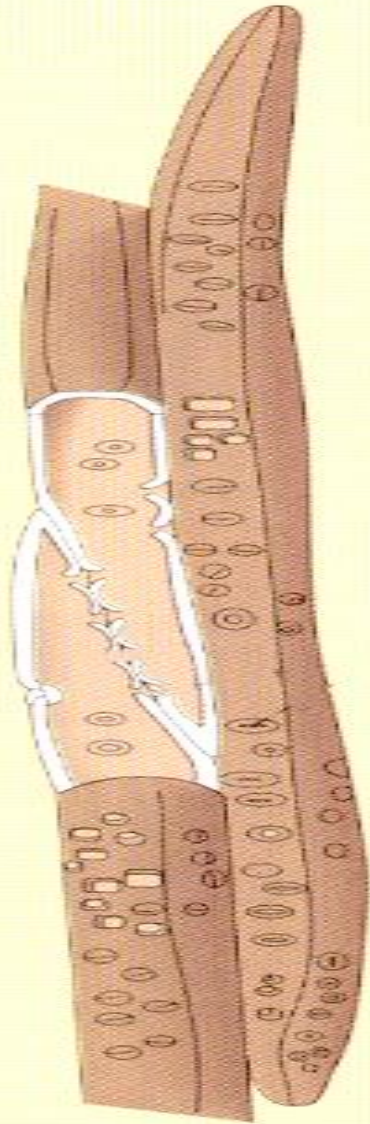


# **SPOROPHYTE CHARACTERS**

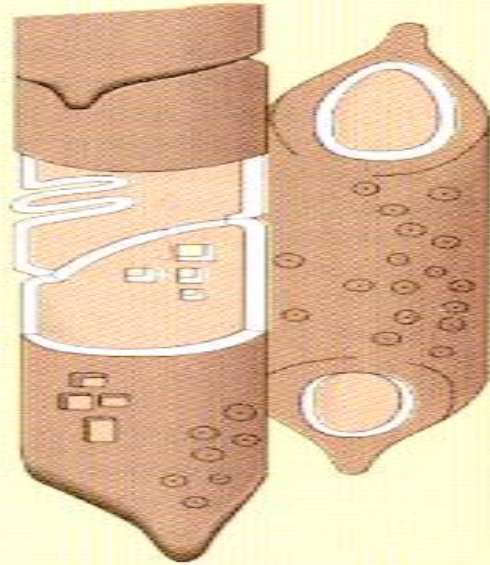
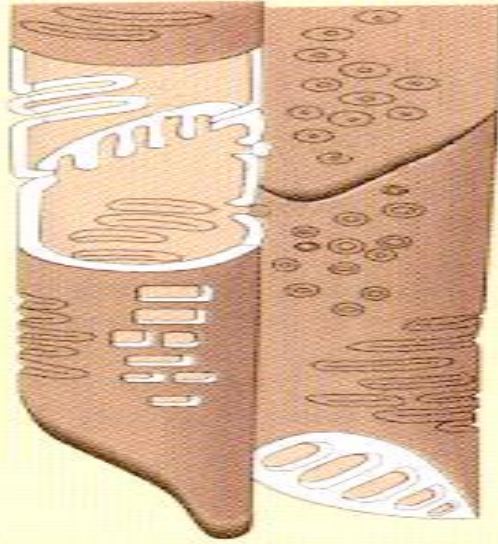
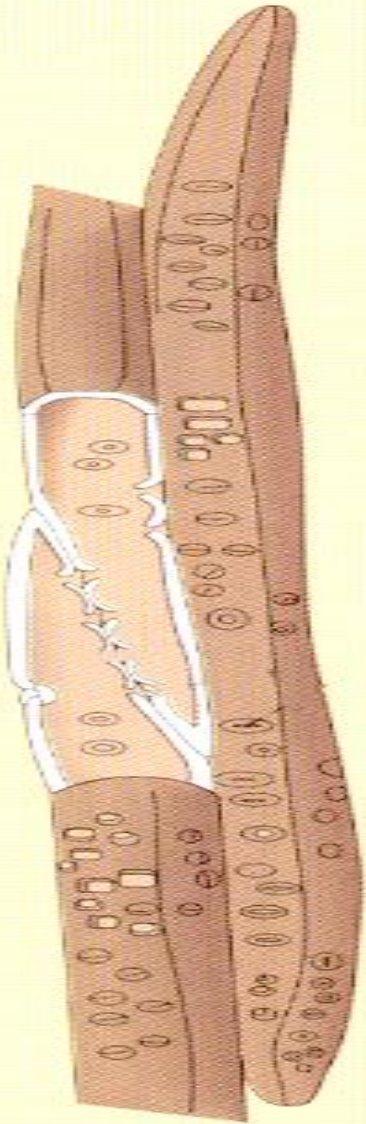




# XYLEM



**XYLEM CELLS**



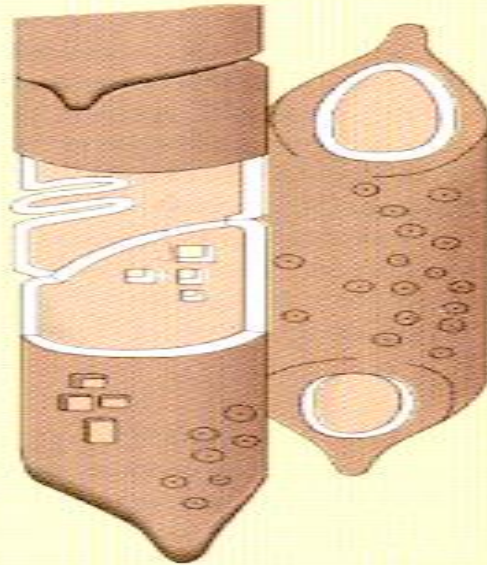
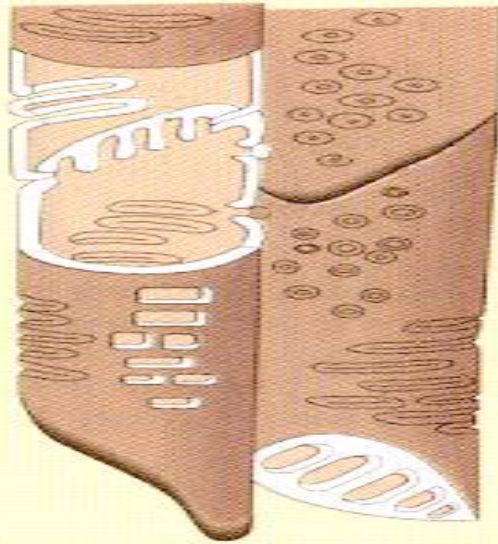
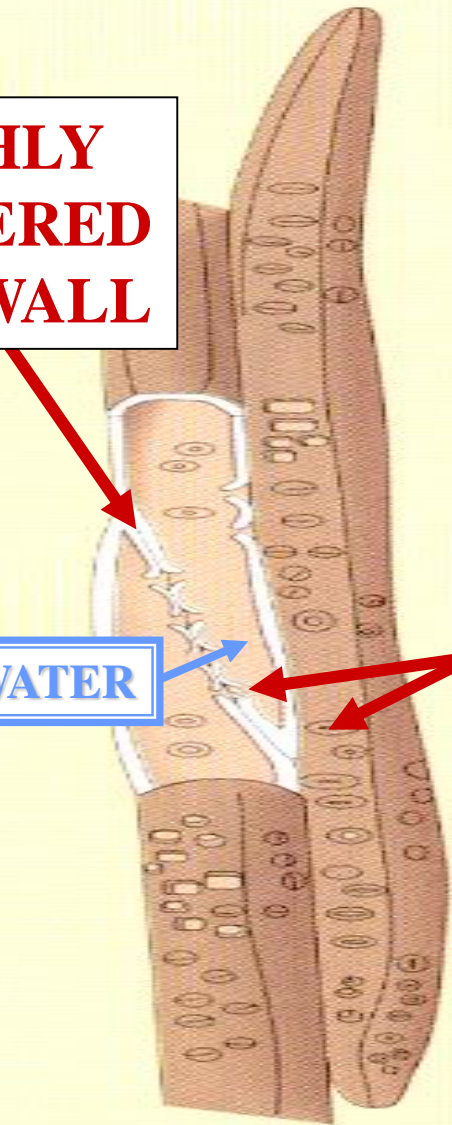
**TRACHEARY ELEMENTS**

**HIGHLY  
TAPPED  
END WALL**

**WATER**

**PITS**

**?**

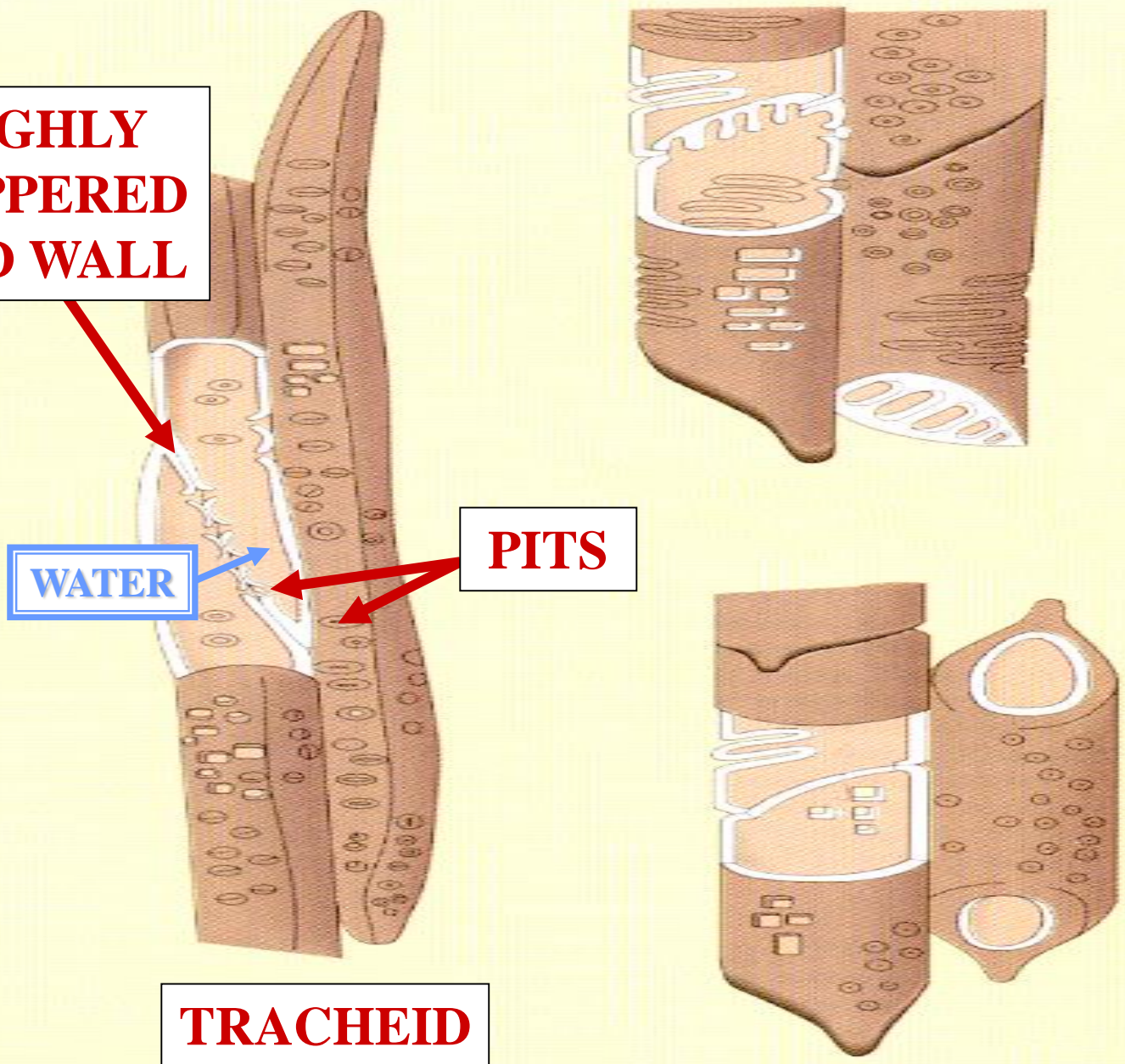


**HIGHLY  
TAPPED  
END WALL**

**WATER**

**PITS**

**TRACHEID**



**HIGHLY  
TAPPED  
END WALL**

**LESS  
TAPPED  
END WALL**

?

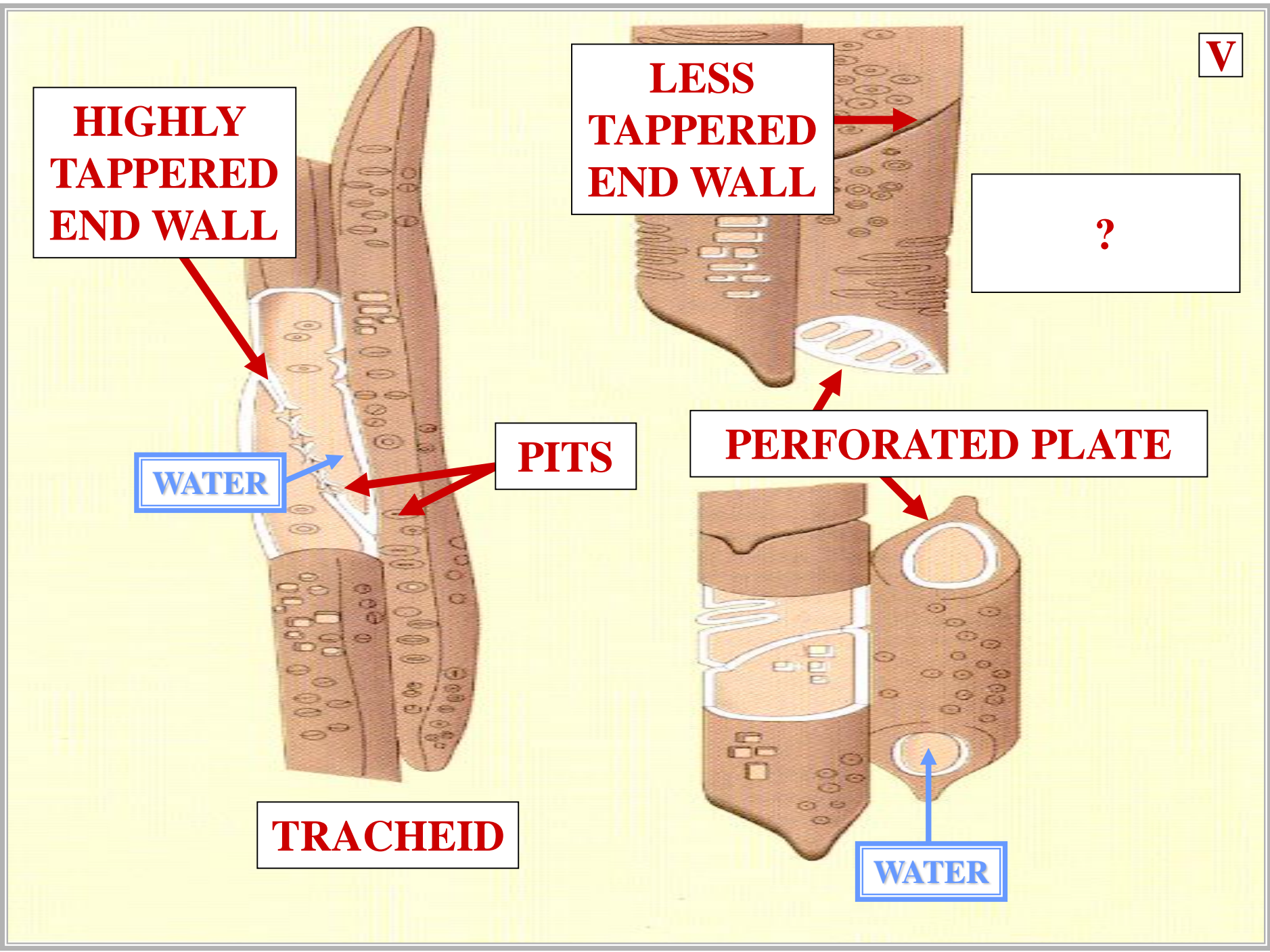
**WATER**

**PITS**

**PERFORATED PLATE**

**TRACHEID**

**WATER**





**T**

**HIGHLY  
TAPPED  
END WALL**

**LESS  
TAPPED  
END WALL**

**VESSEL  
MEMBER**

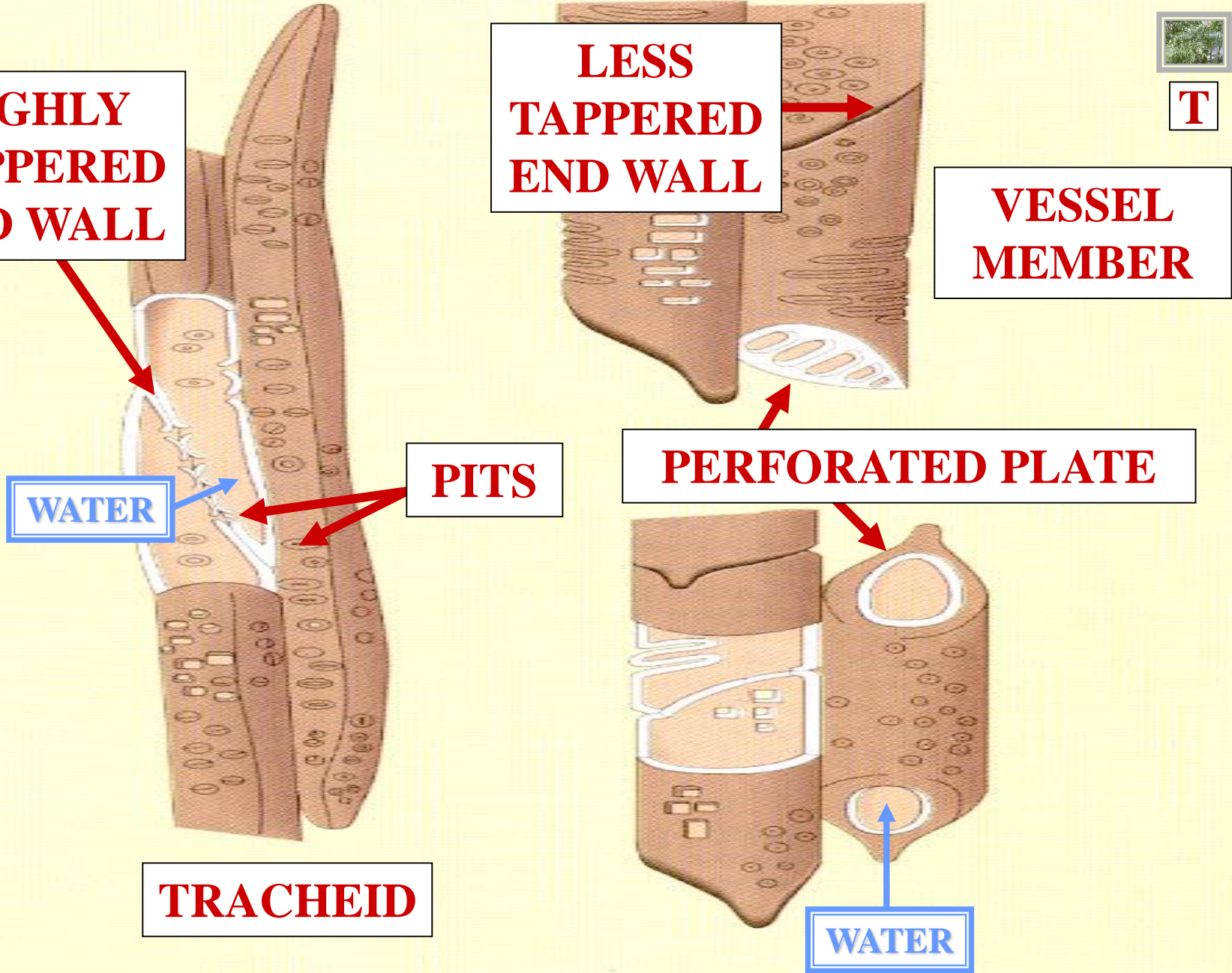
**WATER**

**PITS**

**PERFORATED PLATE**

**TRACHEID**

**WATER**





**TRACHEIDS**

***ANGIOPTERIS***



**TRACHEIDS**

***MARATTIA***





**STEM**



# STEM ANATOMY

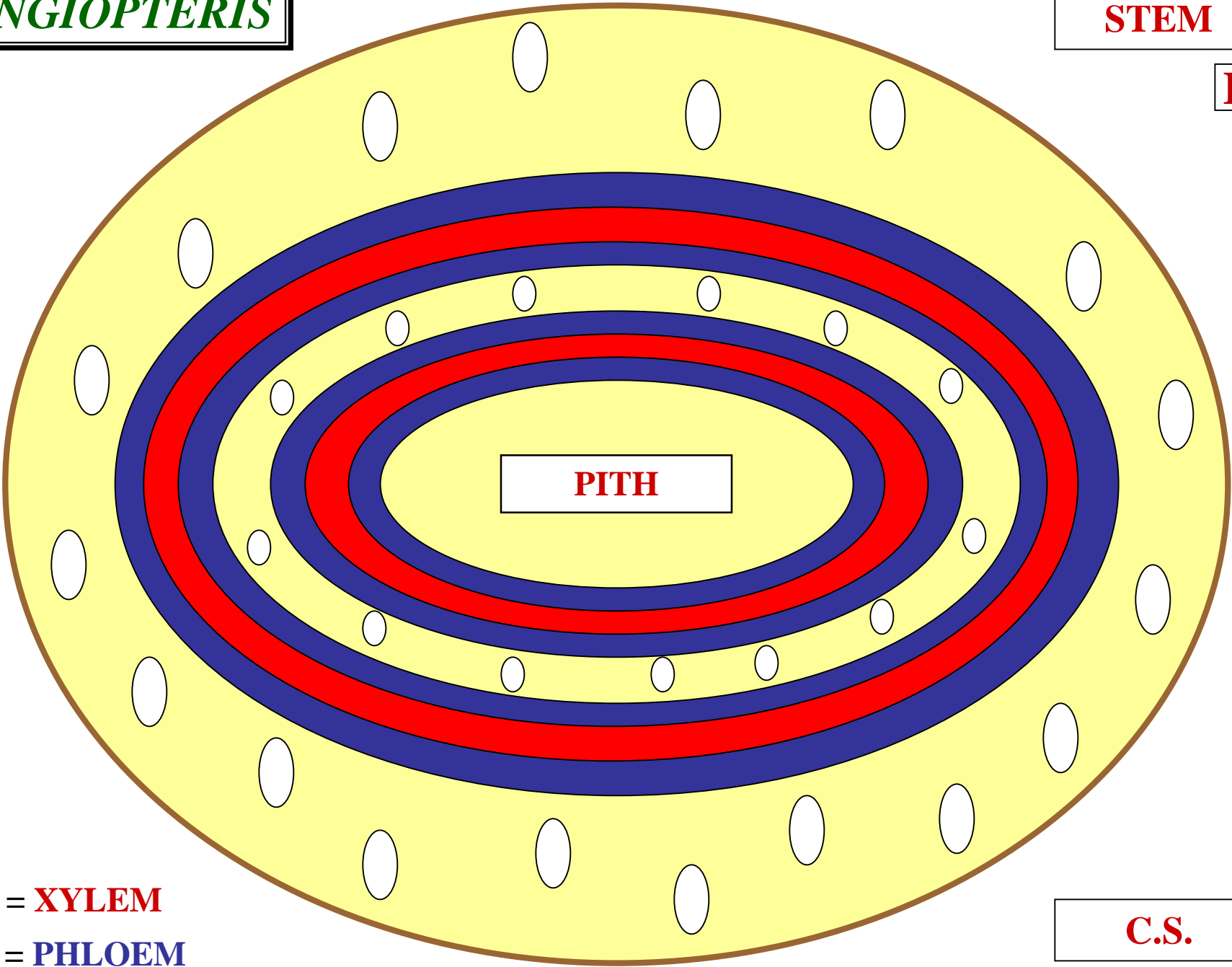


*ANGIOPTERIS*

**ANGIOPTERIS**

**STEM**

**E**



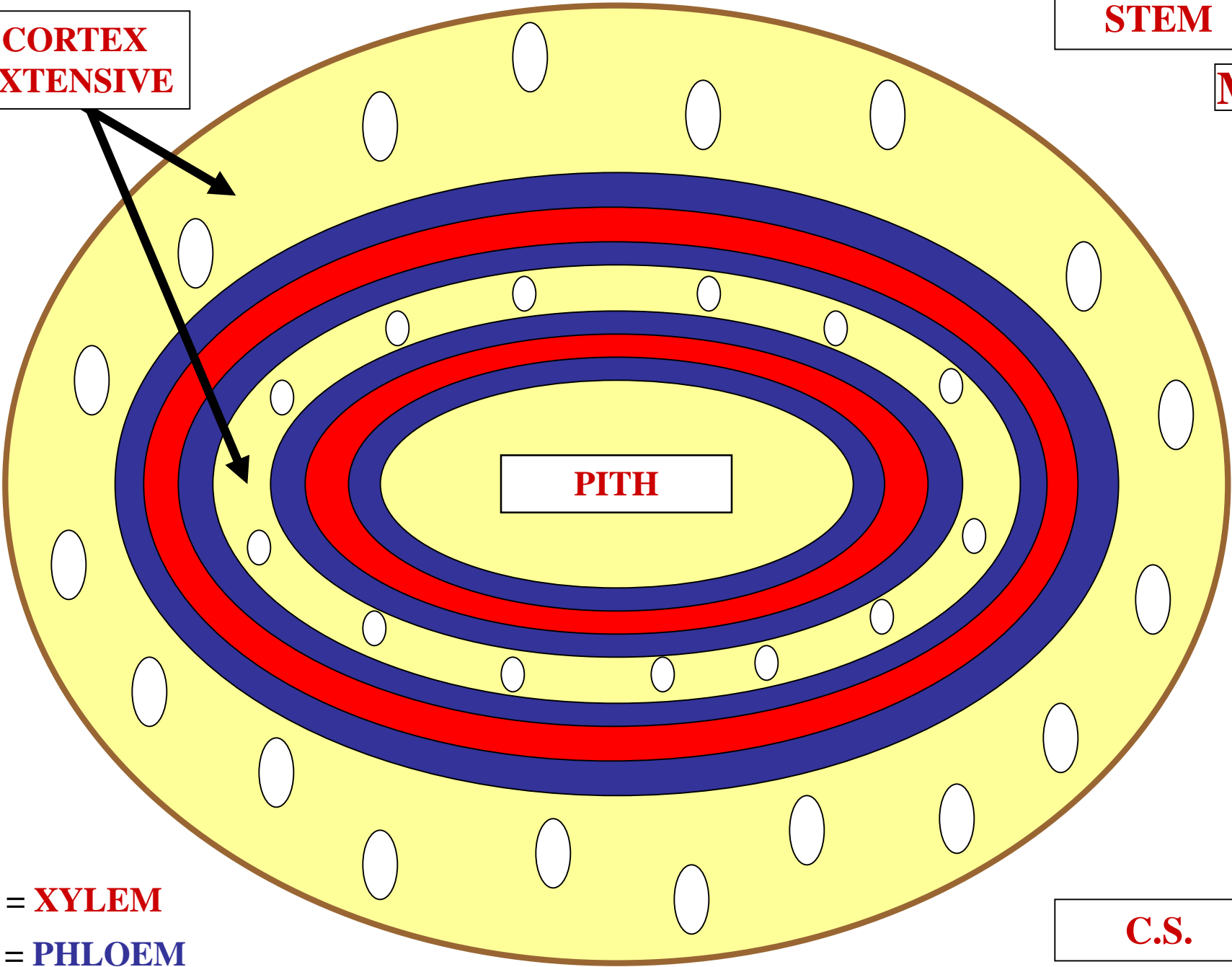
**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**C.S.**

**CORTEX  
EXTENSIVE**

**STEM**

**M**



**PITH**

**[Red Square] = XYLEM**  
**[Blue Square] = PHLOEM**

**C.S.**

**MUCILAGE  
CANALS**

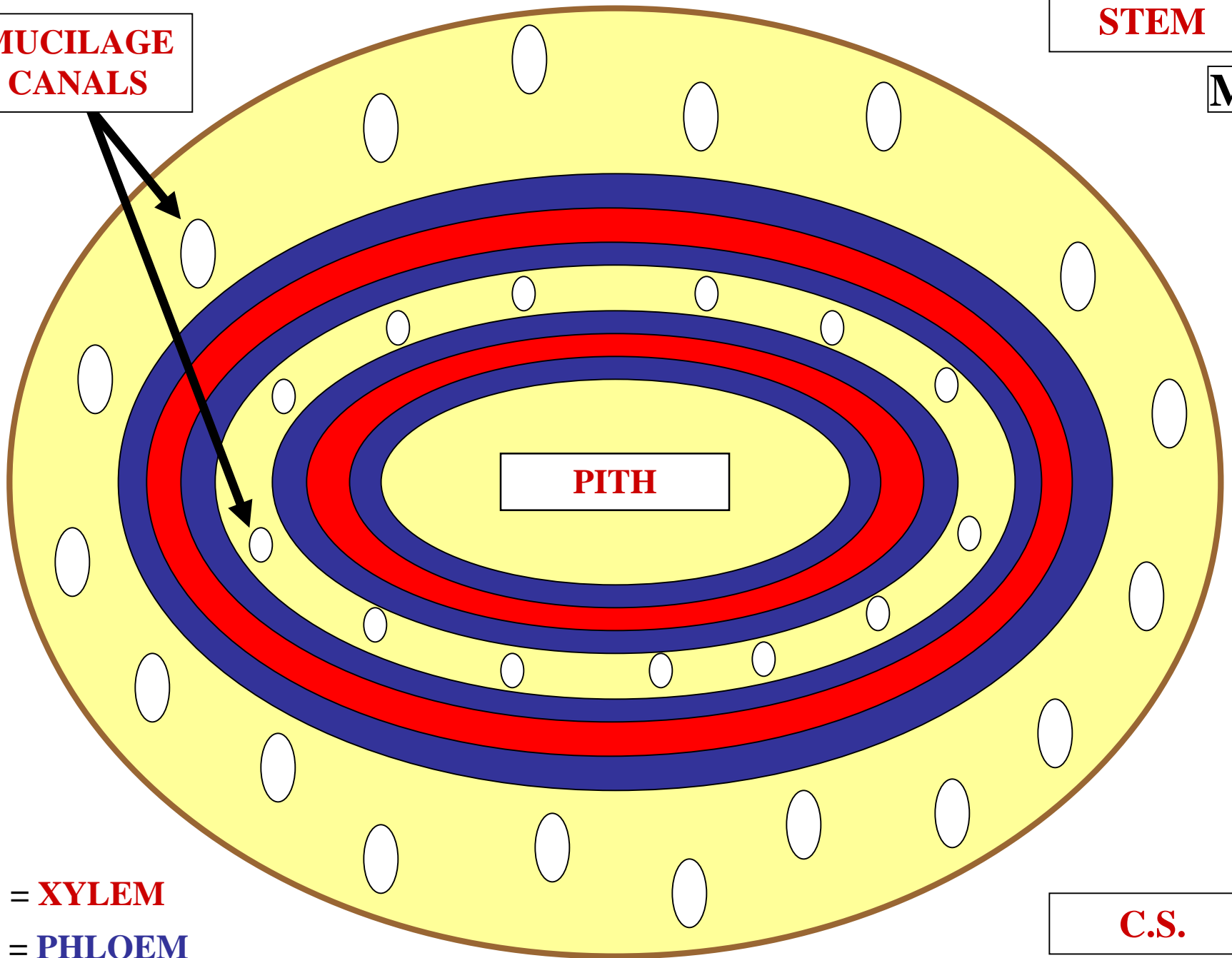
**STEM**

**M**

**PITH**

**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**C.S.**



# MUCILAGE CANAL

**MARATTIALES**  
**MUCILAGE CANAL**

**CANAL WITH**  
**MUCILAGE**

**MARATTILAE**  
**MUCILAGE CANAL**



**MUCILAGE**

**MARATTIALES**  
**MUCILAGE**



**GUM-LIKE**  
**CARBOHYDRATE**

**MARATTILAE**  
**MUCILAGE**



**MARATTIALES**

**MUCILAGE**

**GUM-LIKE**

**CARBOHYDRATE**

**---**

**INHIBITS HERBIVORES**

**MARATTILAE**

**MUCILAGE**

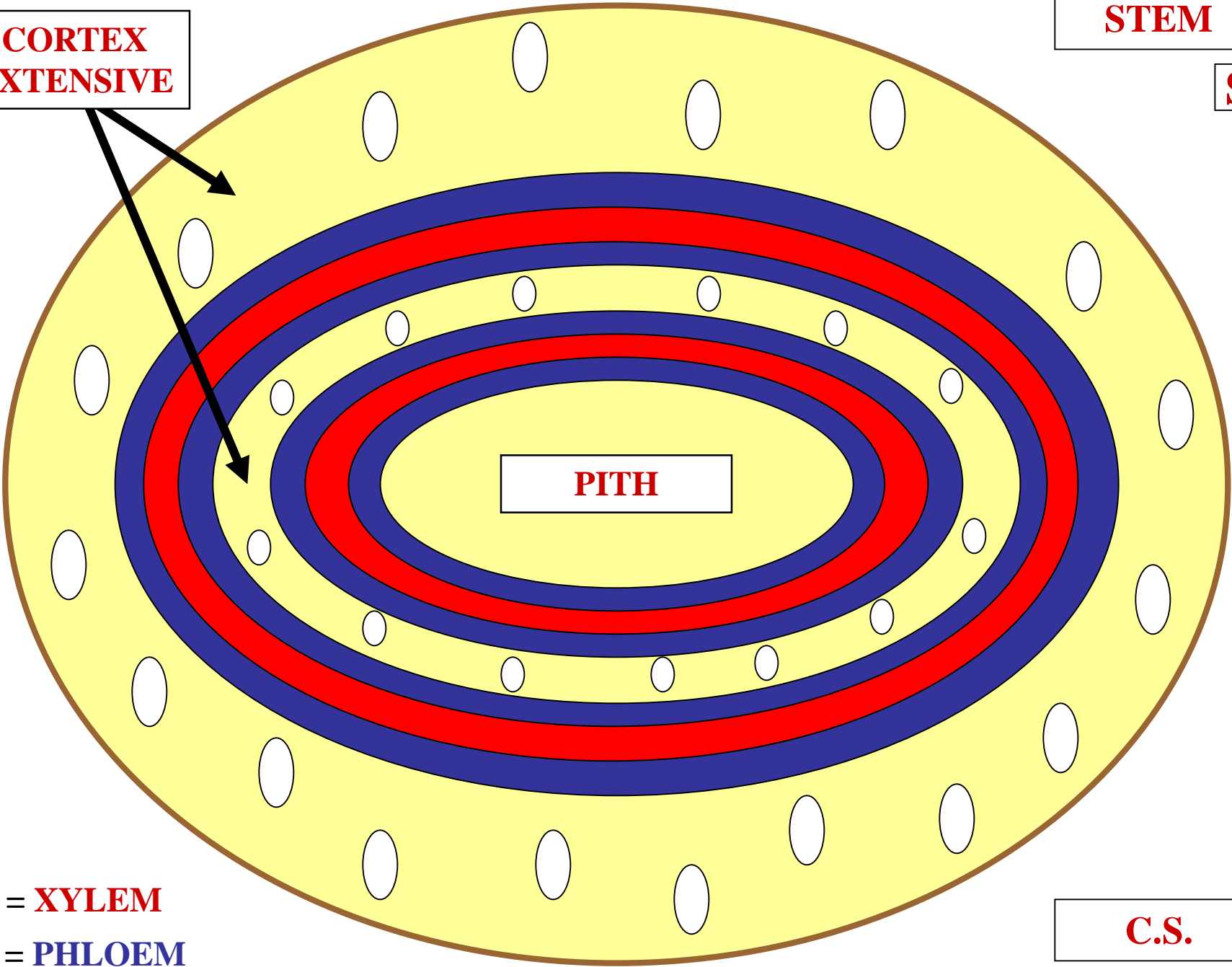


# STEM STELE

**CORTEX  
EXTENSIVE**

**STEM**

**S**



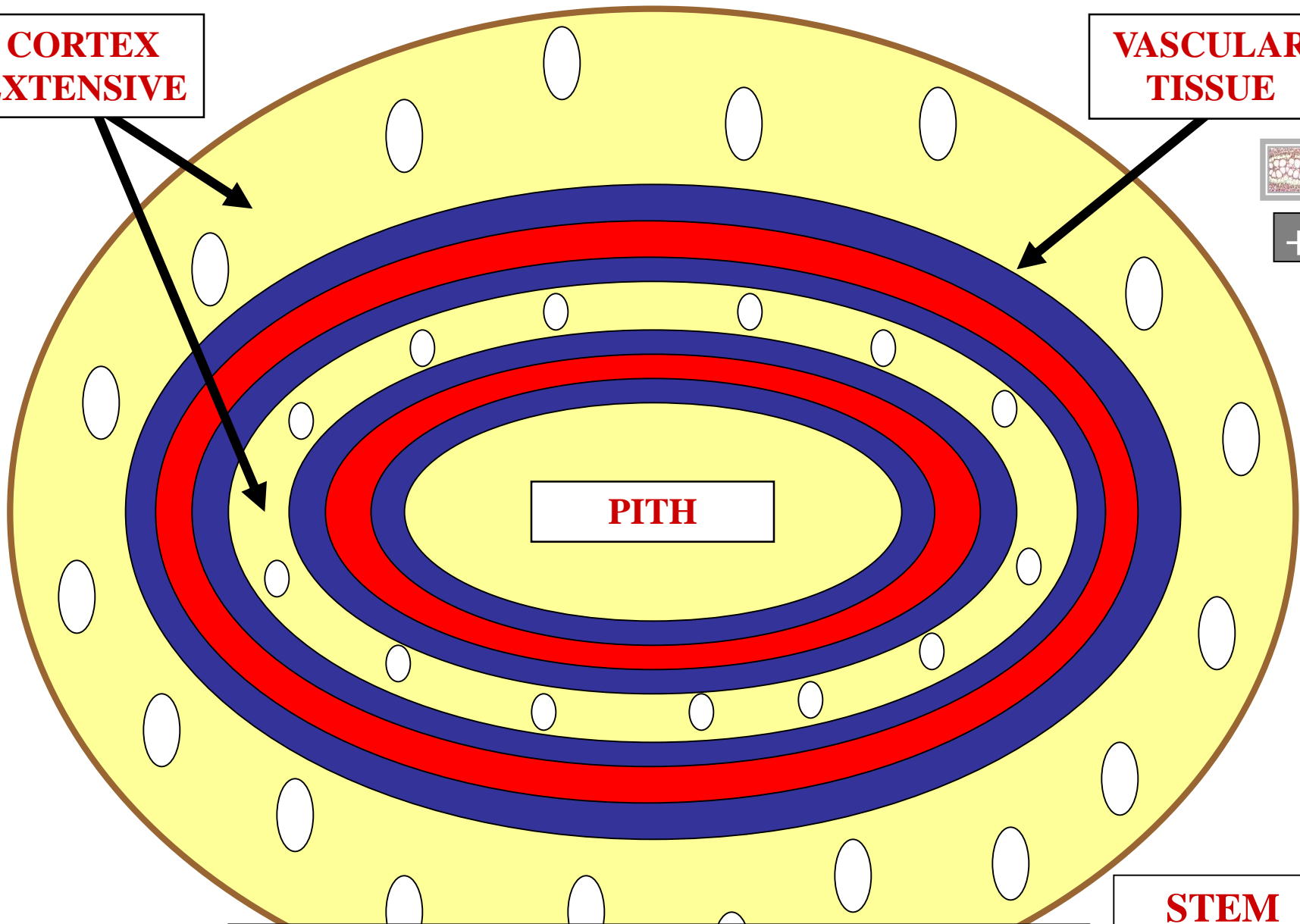
**PITH**

**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**C.S.**

**CORTEX  
EXTENSIVE**

**VASCULAR  
TISSUE**



**PITH**

**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**SIPHONOSTELE**

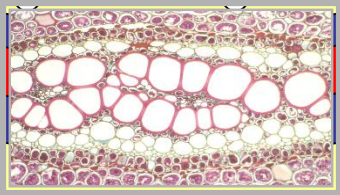
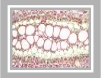
**STEM**

**C.S.**

**CORTEX  
EXTENSIVE**

**VASCULAR  
TISSUE**

**PITH**

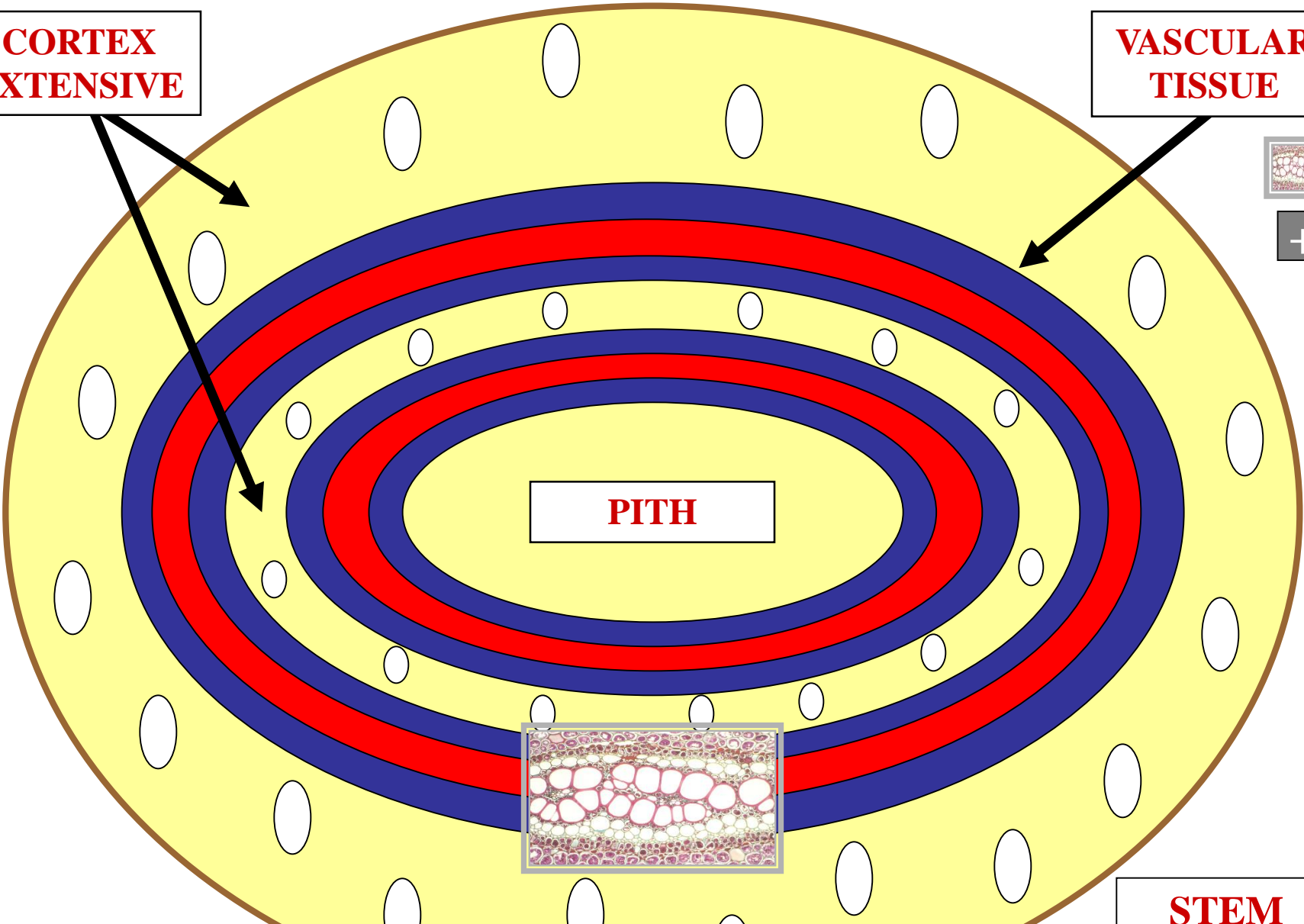


**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**SIPHONOSTELE**

**STEM**

**C.S.**



**A**

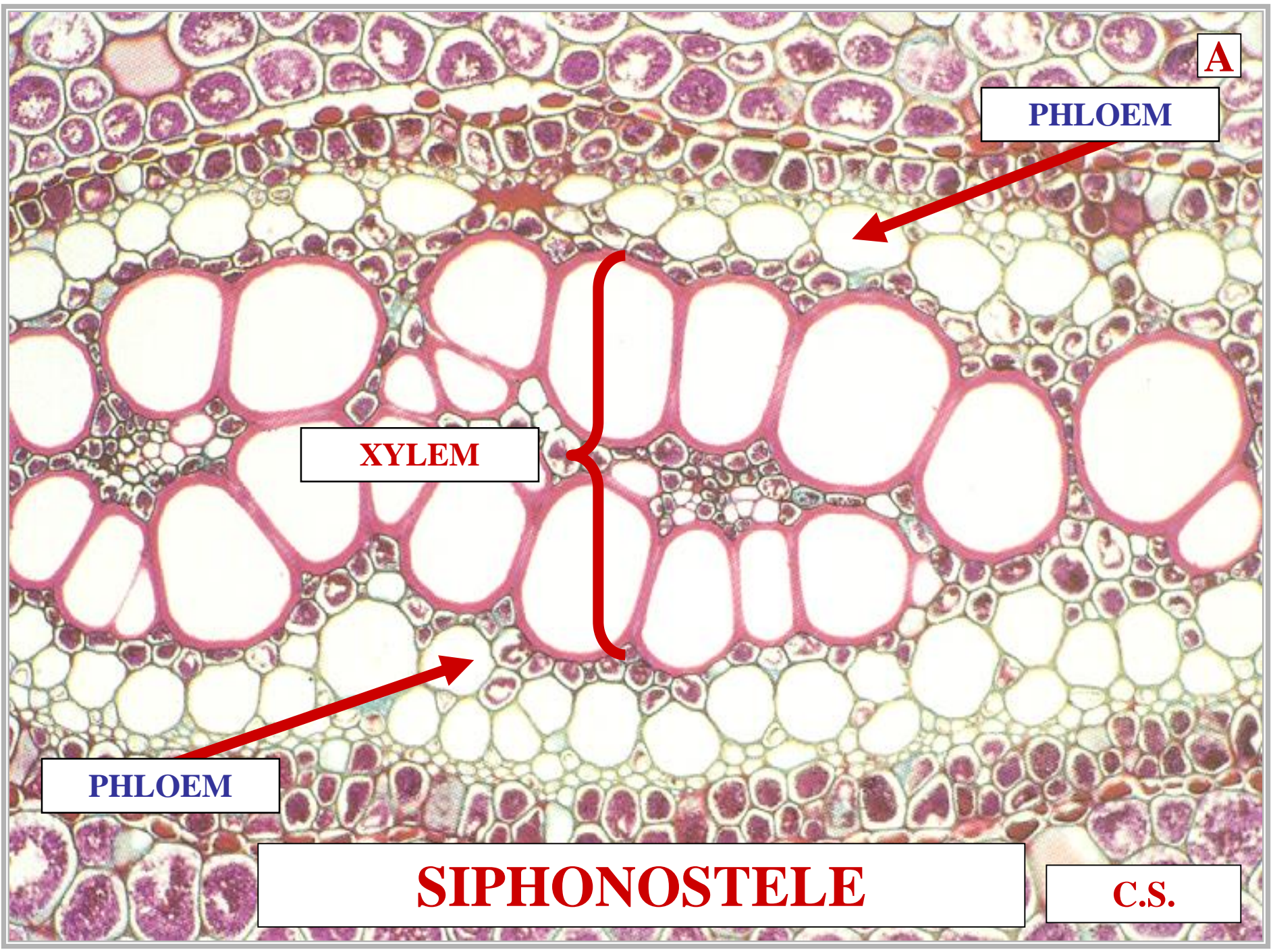
**PHLOEM**

**XYLEM**

**PHLOEM**

**SIPHONOSTELE**

**C.S.**





**CORTEX  
EXTENSIVE**

**VASCULAR  
TISSUE**

**P**

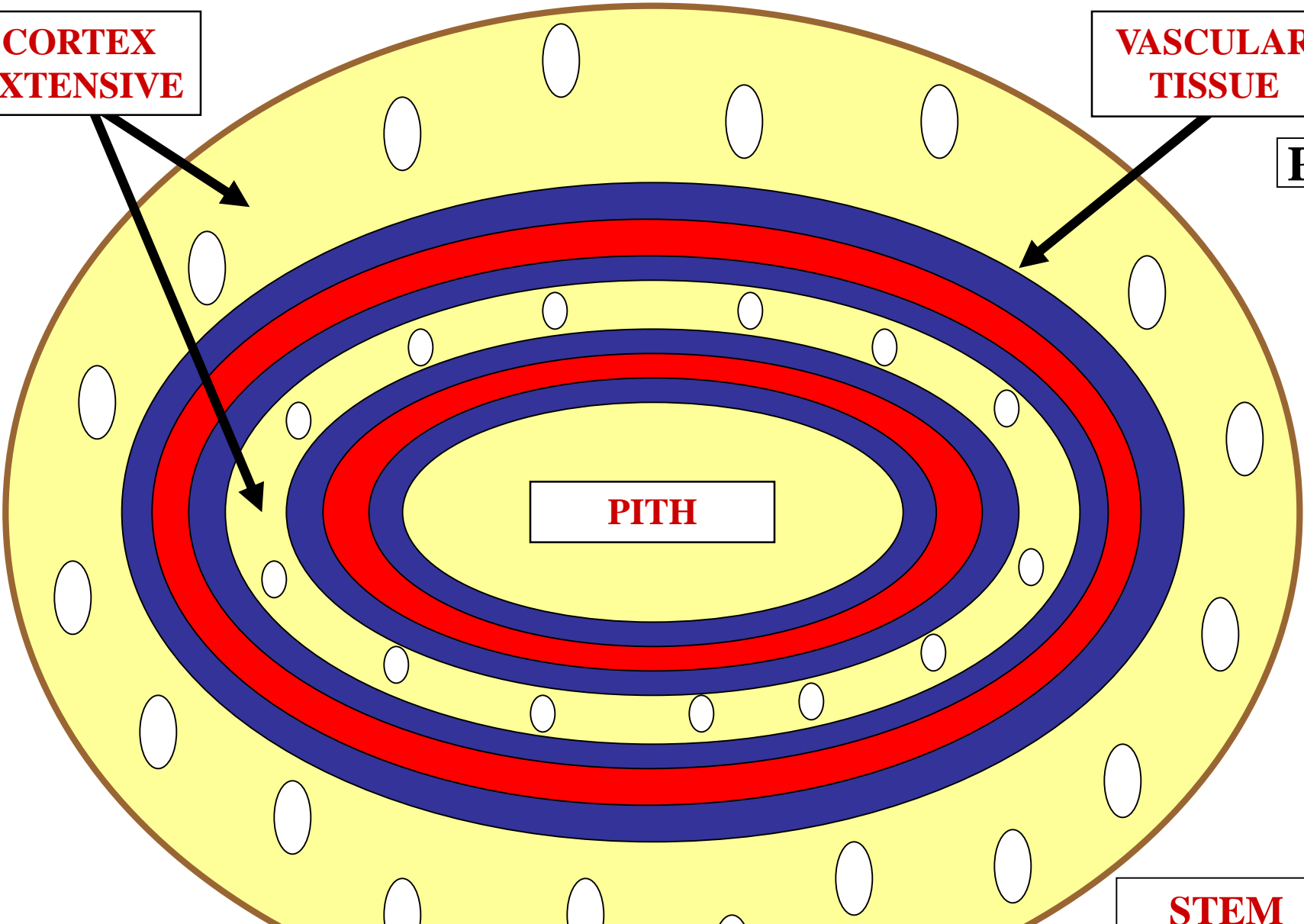
**PITH**

**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**AMPHIPHLOIC**

**STEM**

**C.S.**



# **POLYCENTRIC STELE**

**MARATTIALES**  
**POLYCENTRIC STELE**

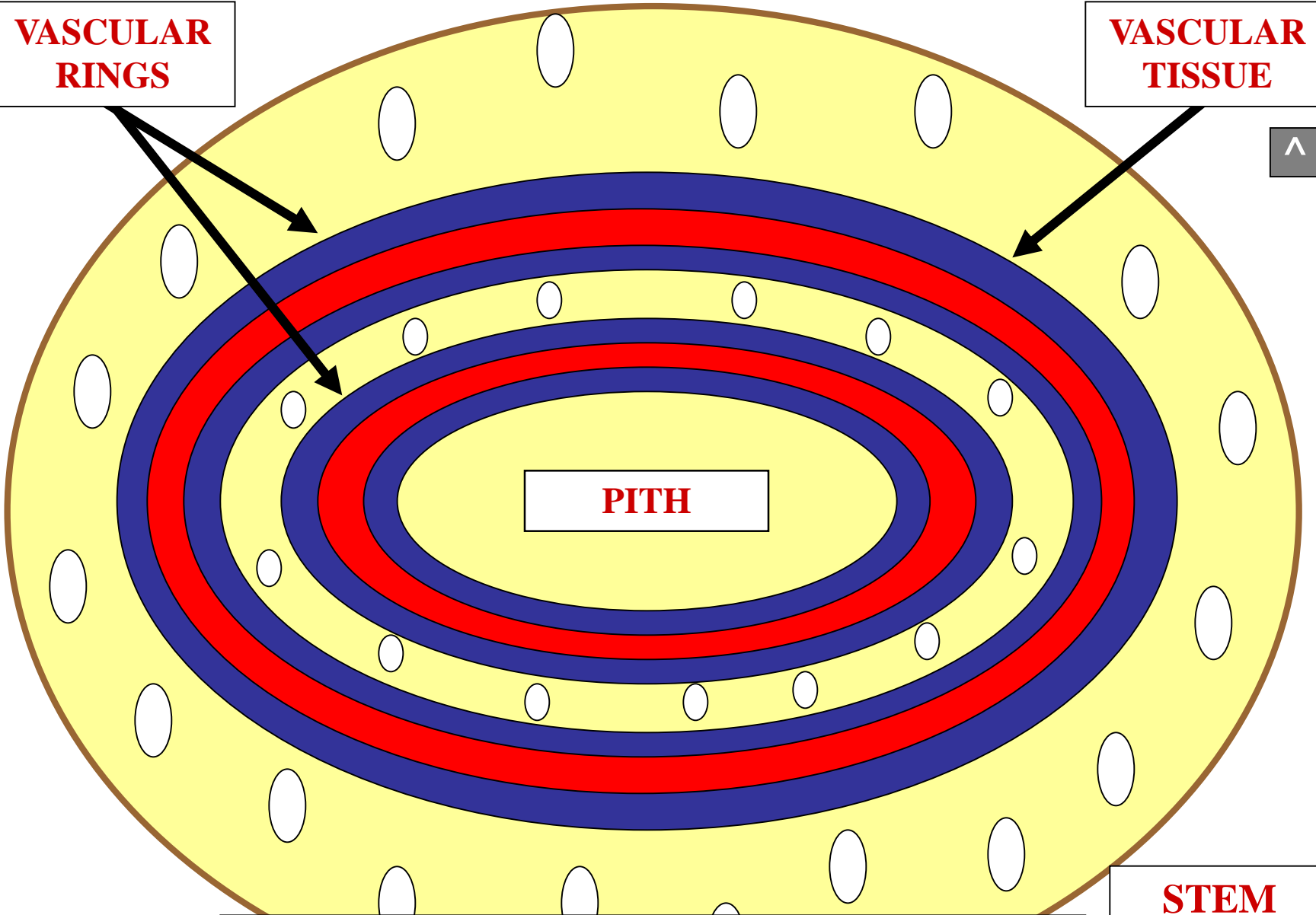


**+1 VASCULAR RING**

**MARATTILAE**  
**POLYCENTRIC STELE**

**VASCULAR RINGS**

**VASCULAR TISSUE**



**[Red Box] = XYLEM**  
**[Blue Box] = PHLOEM**

**POLYCENTRIC**

**STEM**  
**C.S.**



**R**

# **RHIZOME**

S

*ANGIOPTERIS*

**RHIZOME  
VERTICAL  
GROWTH**



**B**

***ANGIOPTERIS***

**RHIZOME  
SHORT STOUT  
FLESHY**





**ANGIOPTERIS**

**RHIZOME  
BRANCHING  
ABSENT**







**FROND**



**F**

+

# PHYLLOTAXY

1

*ANGIOPTERIS*

FROND



A

*ANGIOPTERIS*

ONE FROND  
PER NODE





***ANGIOPTERIS***

**ALTERNATE  
PHYLLOTAXY**





# VERNATION

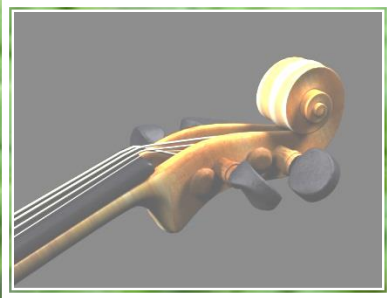


**F**

***ANGIOPTERIS***



**“FIDDLEHEAD”**



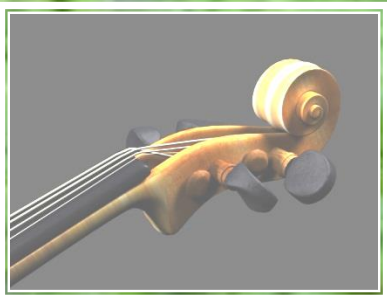


CV



**“FIDDLEHEAD”**

**CROZIER**

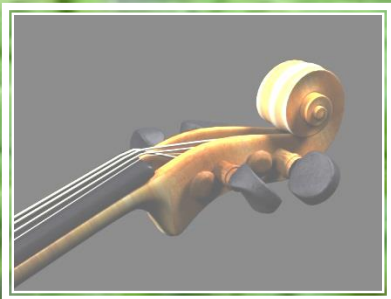




**“FIDDLEHEAD”**

**CROZIER**

**CIRCINATE VERNATION**





**F**

# MORPHOLOGY

**FROND  
PINNAE  
PRESENT**

***ANGIOPTERIS***





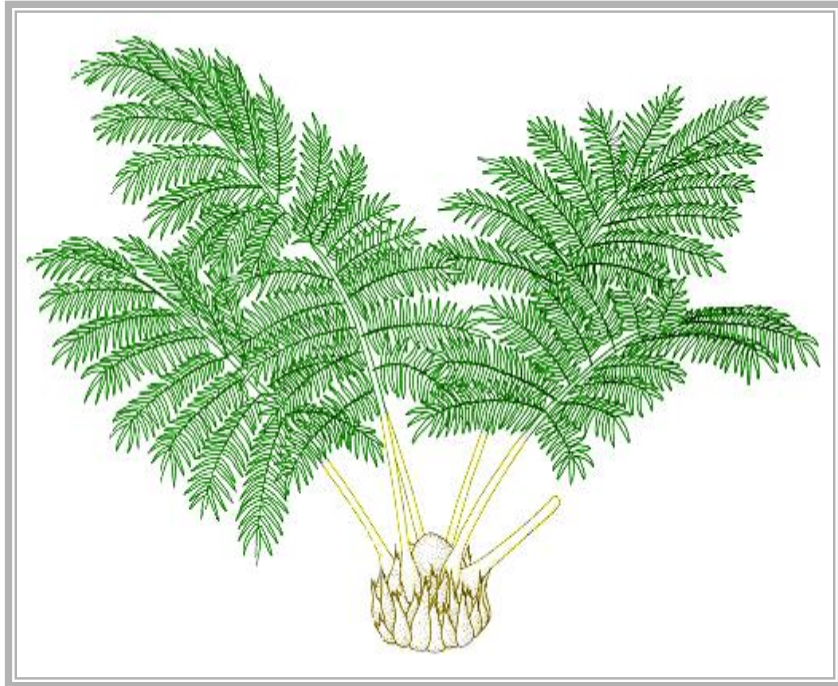
**VERY LARGE  
COMPOUND  
FROND**

***ANGIOPTERIS***



# ANGIOPTERIS

A

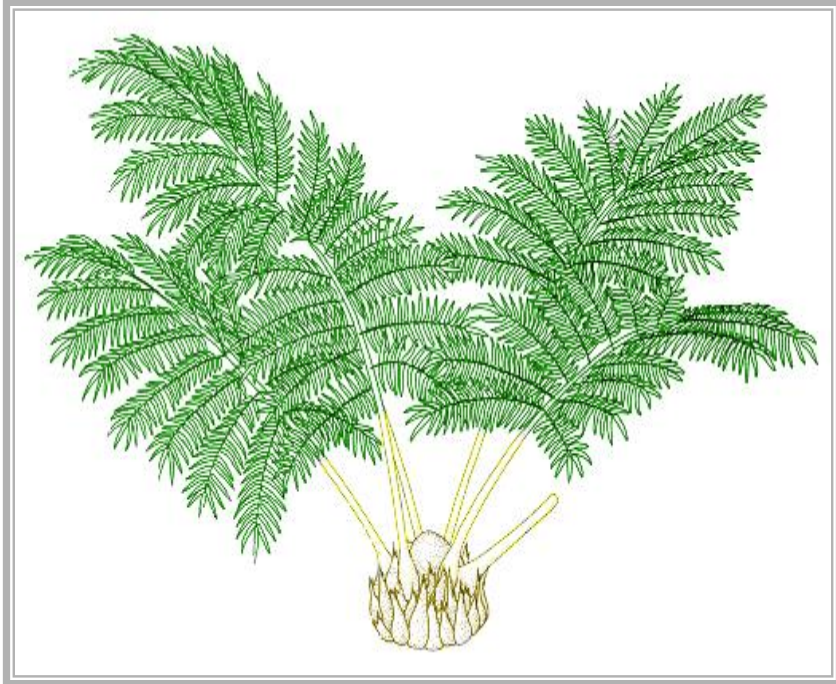


**RHIZOME  
VERTICAL  
GROWTH**

**PERSISTENT  
STIPES**

# ANGIOPTERIS

^



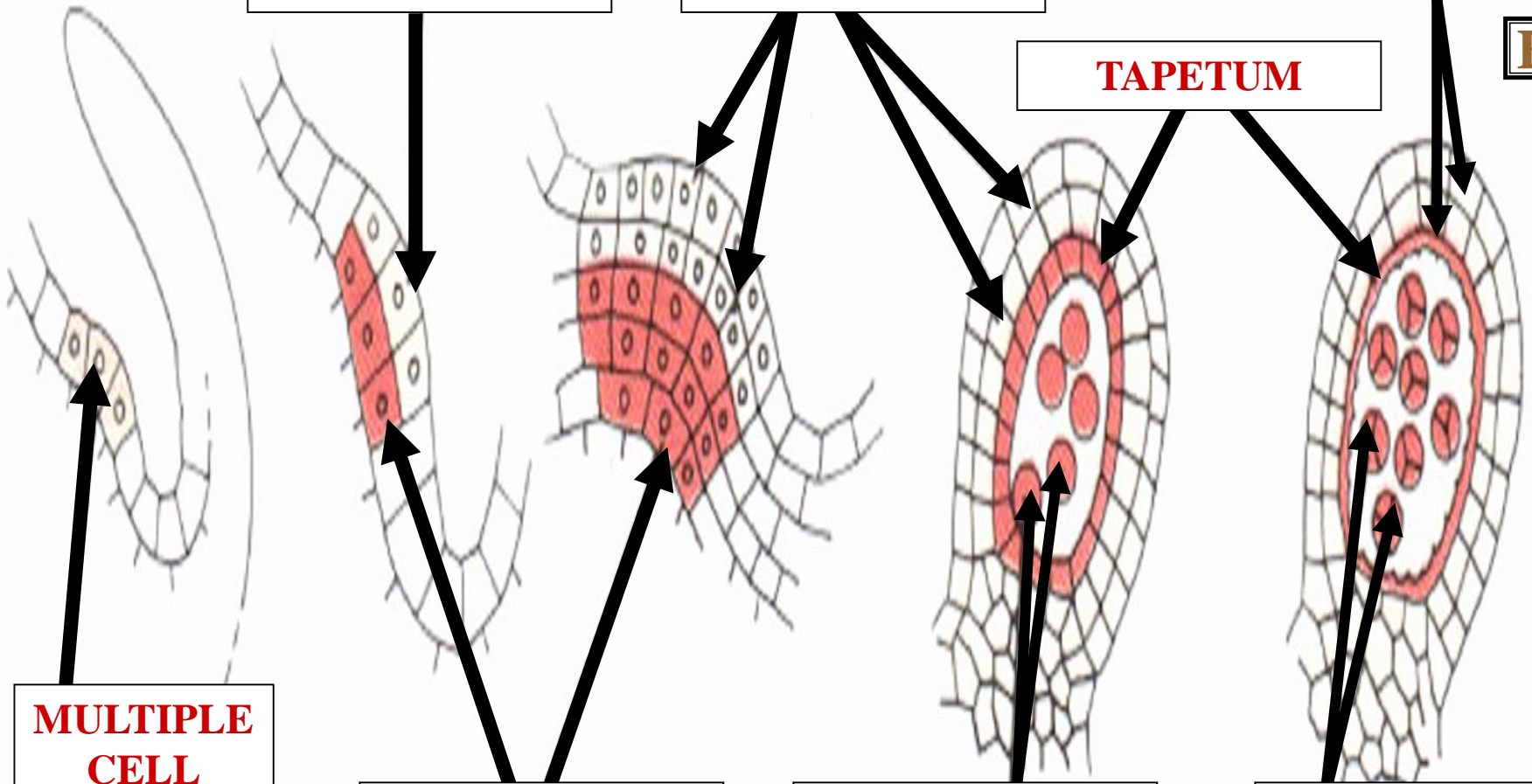
**RHIZOME  
VERTICAL  
GROWTH**

**ARMOR-LIKE  
APPEARANCE**



# SPORANGIUM





**WALL CELLS**

**WALL CELLS**

**LARGE SIZE**

**THICK WALL**

**E**

**TAPETUM**

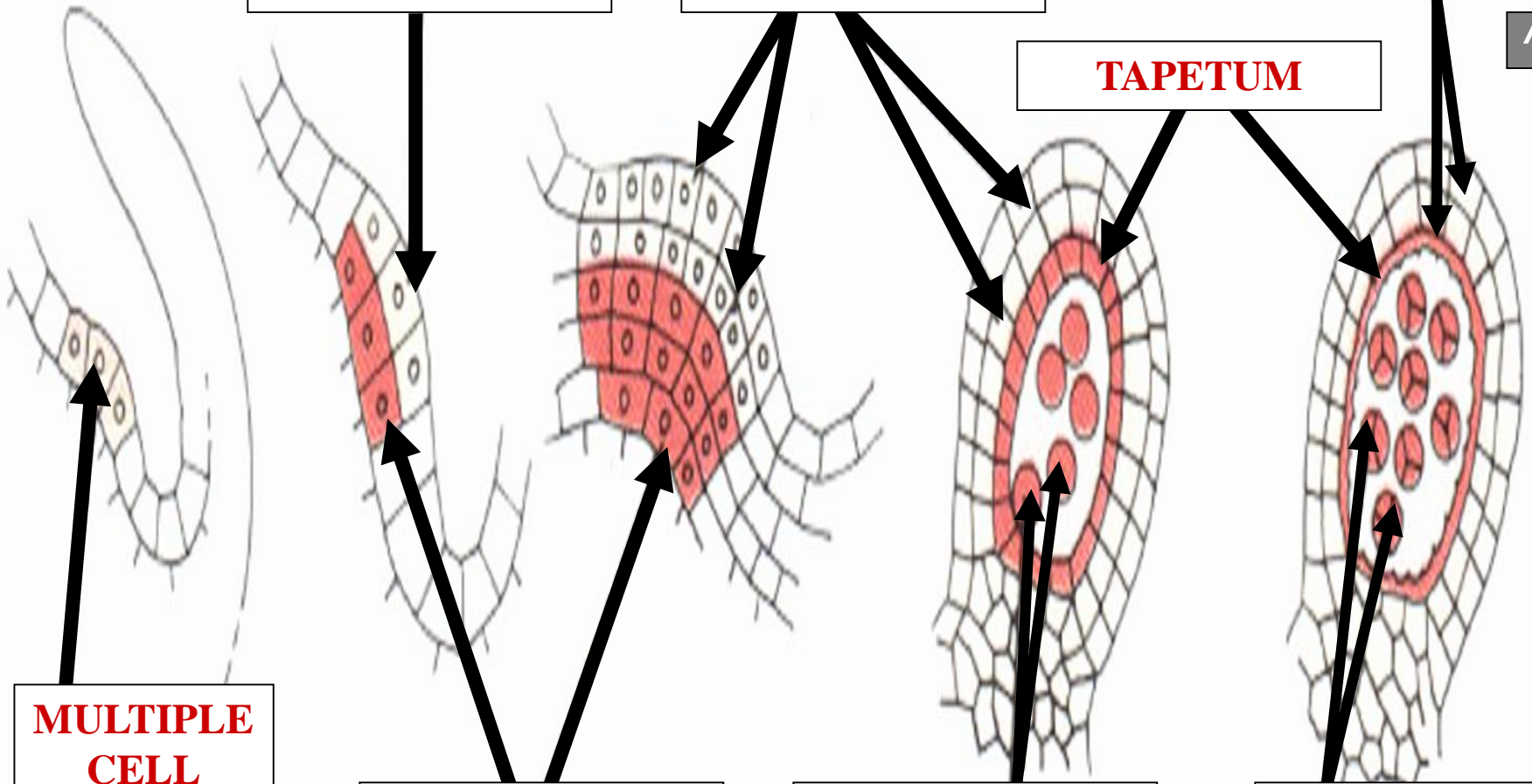
**MULTIPLE  
CELL  
INITIALS**

**SPOROCYTES**

**SPOROCYTES**

**NUMEROUS  
SPORES**

**L.S.**



**WALL CELLS**

**WALL CELLS**

**LARGE SIZE**

**THICK WALL**

**TAPETUM**

**MULTIPLE  
CELL  
INITIALS**

**SPOROCYTES**

**SPOROCYTES**

**NUMEROUS  
SPORES**

**EUSPORANGIUM**

**L.S.**



# SPORANGIUM POSITION

F

**SPORANGIA**



A

**FOLIAR**



**ABAXIAL**

**A**



**ABAXIAL**

**MARATTIOPSIDA**  
**SPORANGIUM POSITION**  
**ABAXIAL**

**LOWER SPOROPHYLL SURFACE**

**MARATTIOPSIDA**  
**SPORANGIUM POSITION**  
**ABAXIAL**



# SYNANGIATE

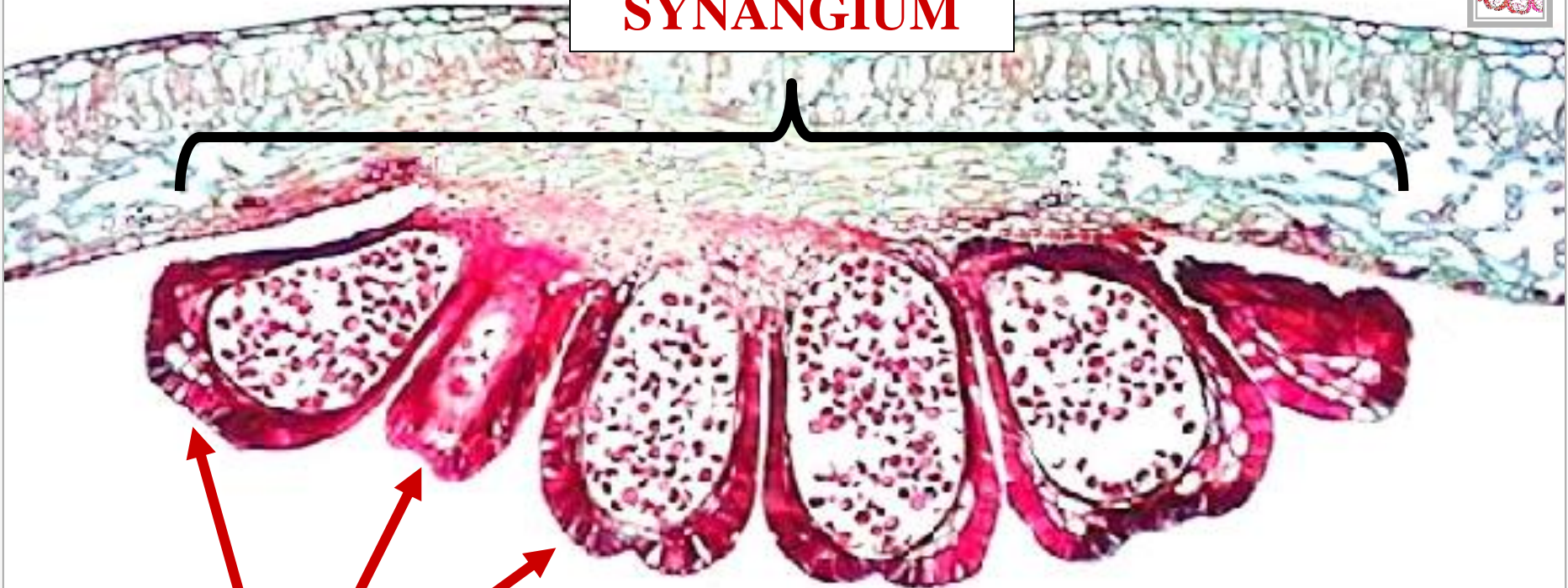


**ANGIOPTERIS**

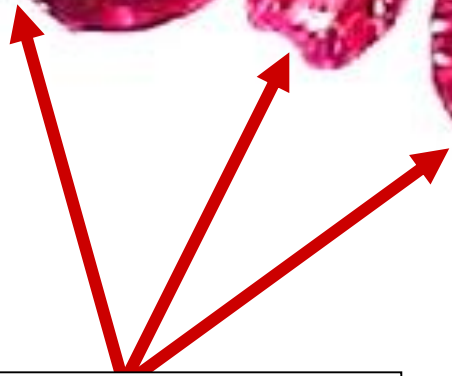
**L.S.**

**PF**

**SYNANGIUM**



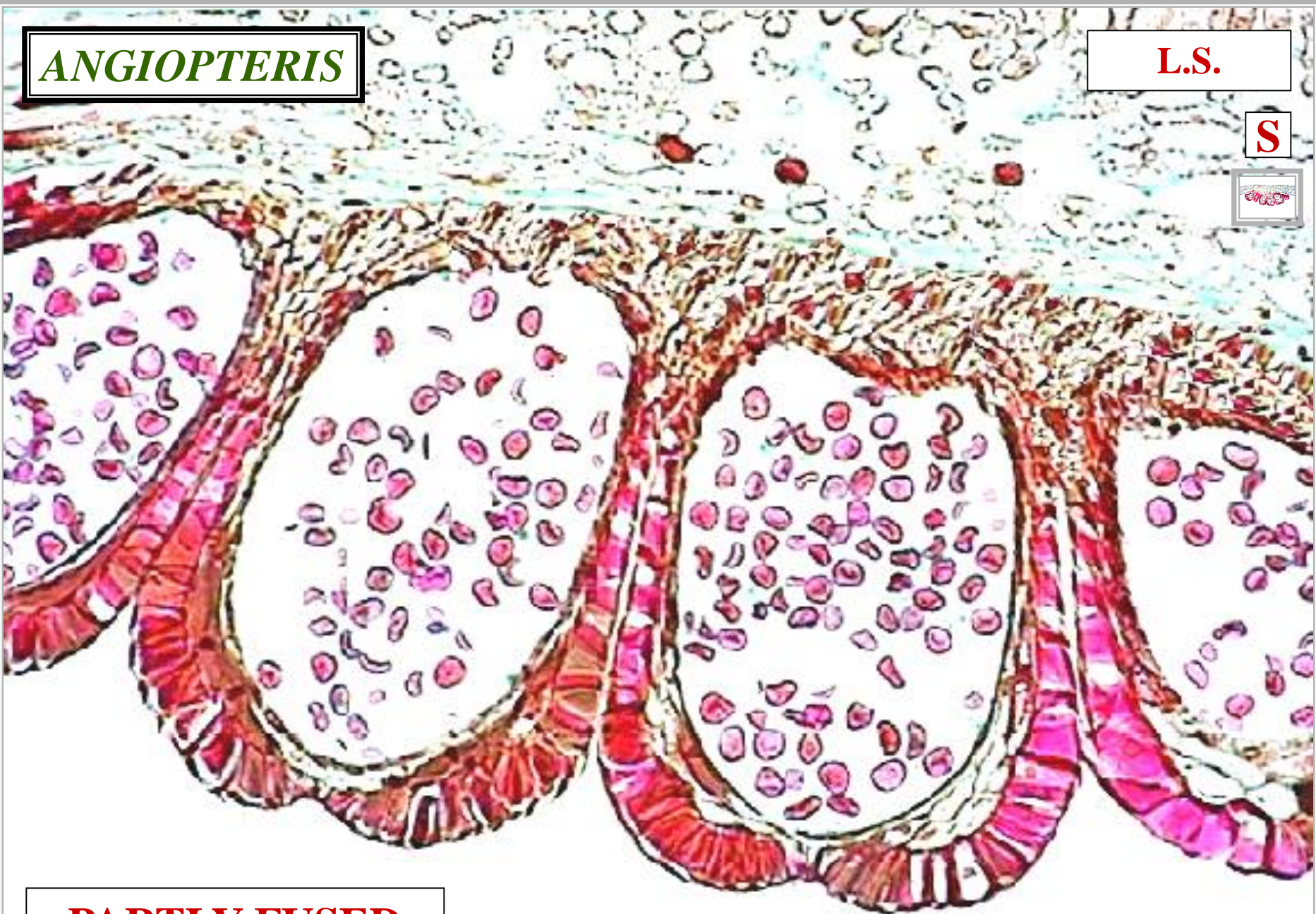
**EUSPORANGIA**



**ANGIOPTERIS**

**L.S.**

**S**



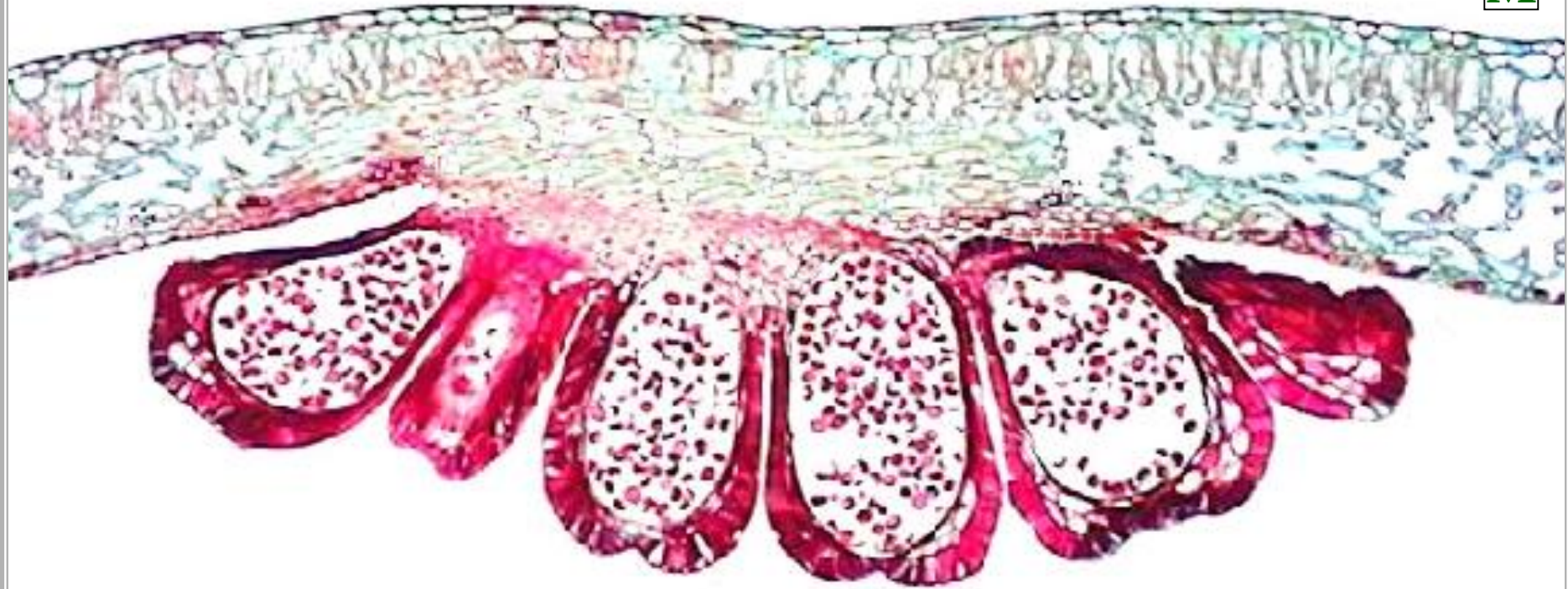
**PARTLY FUSED**

**ANGIOPTERIS**

**L.S.**

^

**M**



**PARTLY FUSED SYNANGIUM**



**MARATTIA**

**L.S.**

**T**



**EUSPORANGIA**



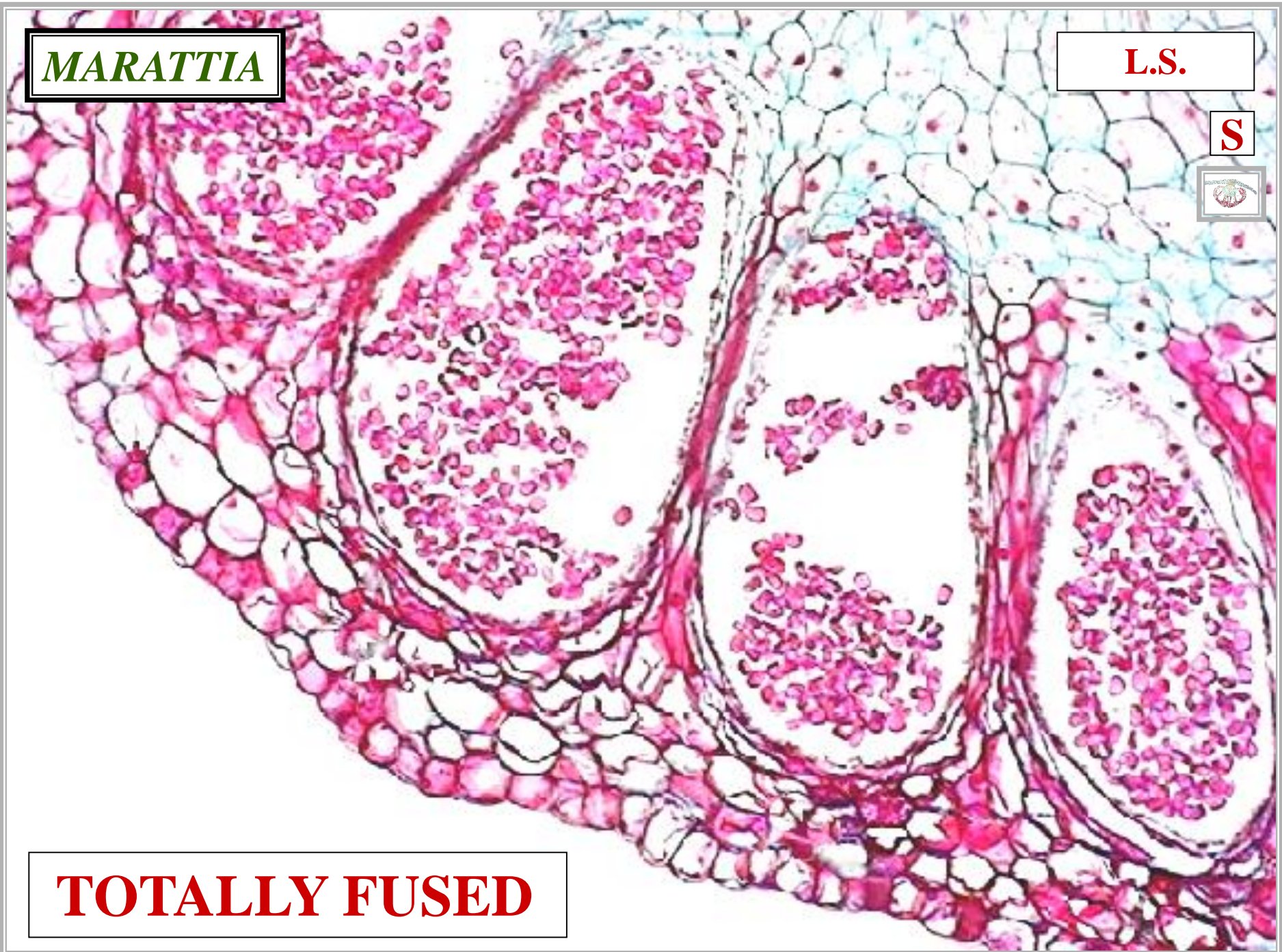
**MARATTIA**

**L.S.**

**S**



**TOTALLY FUSED**



**MARATTIA**

**L.S.**



**TOTALLY FUSED SYNANGIUM**





# SPORE HABIT



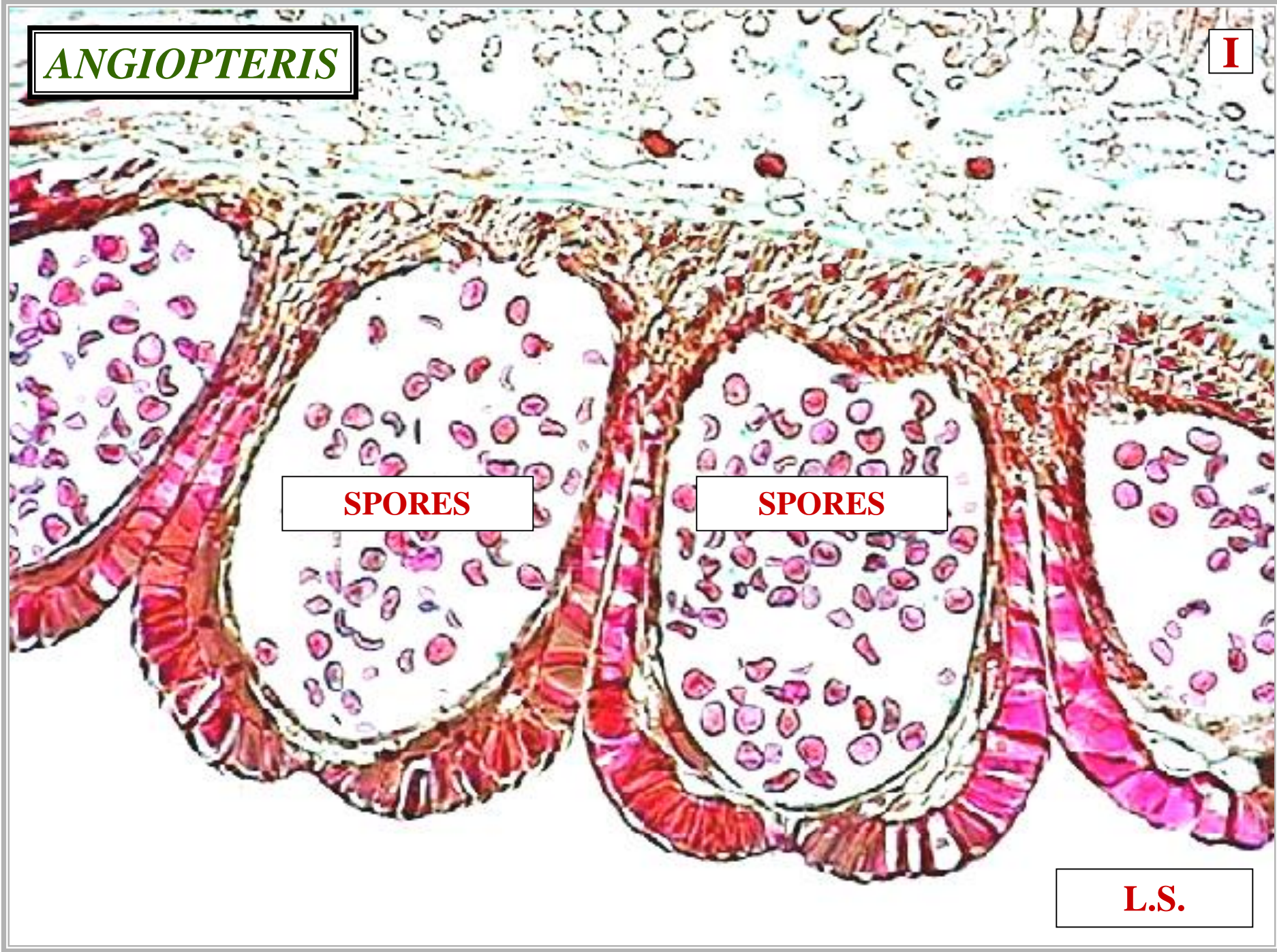
**ANGIOPTERIS**

**I**

**SPORES**

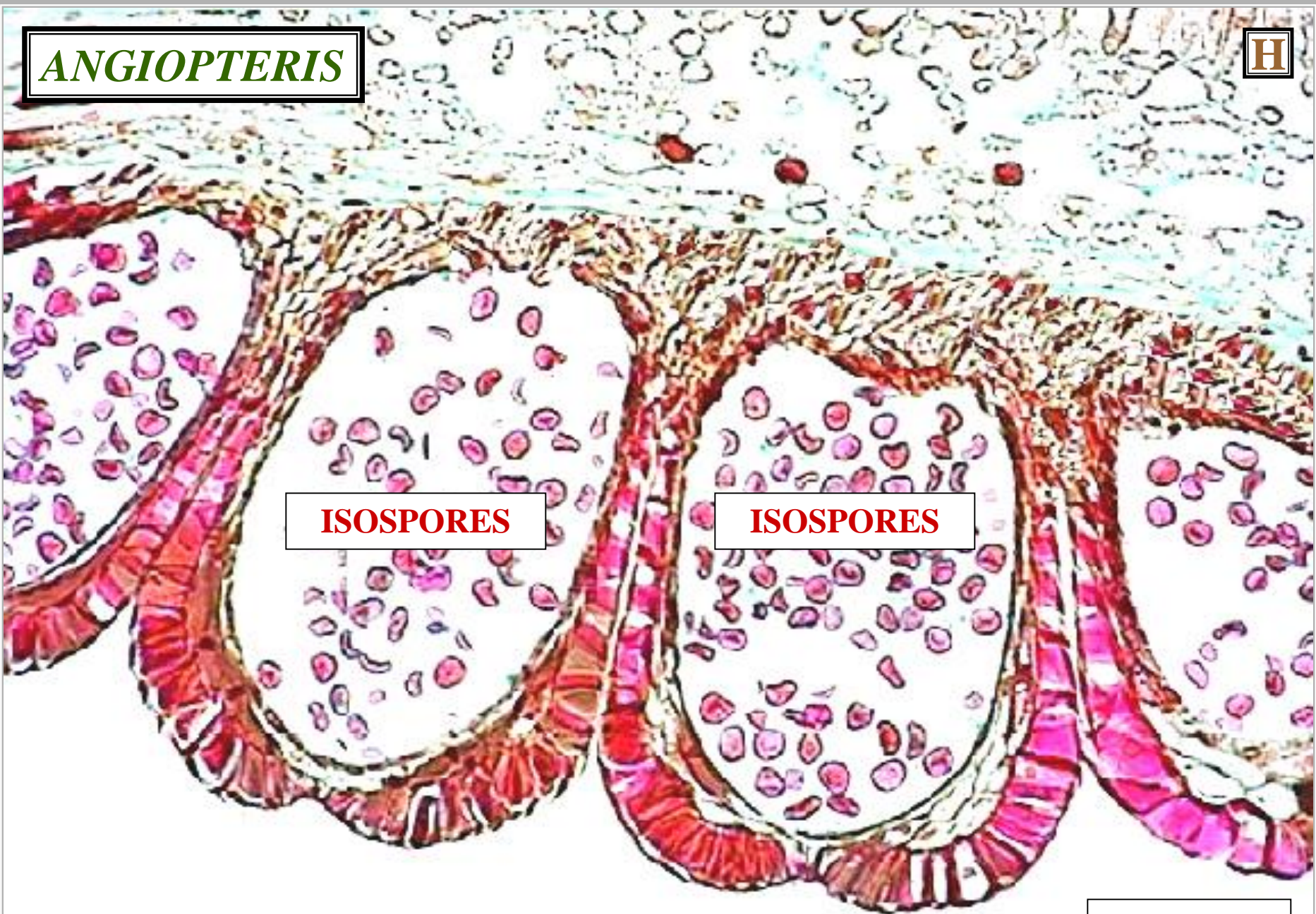
**SPORES**

**L.S.**



**ANGIOPTERIS**

**H**

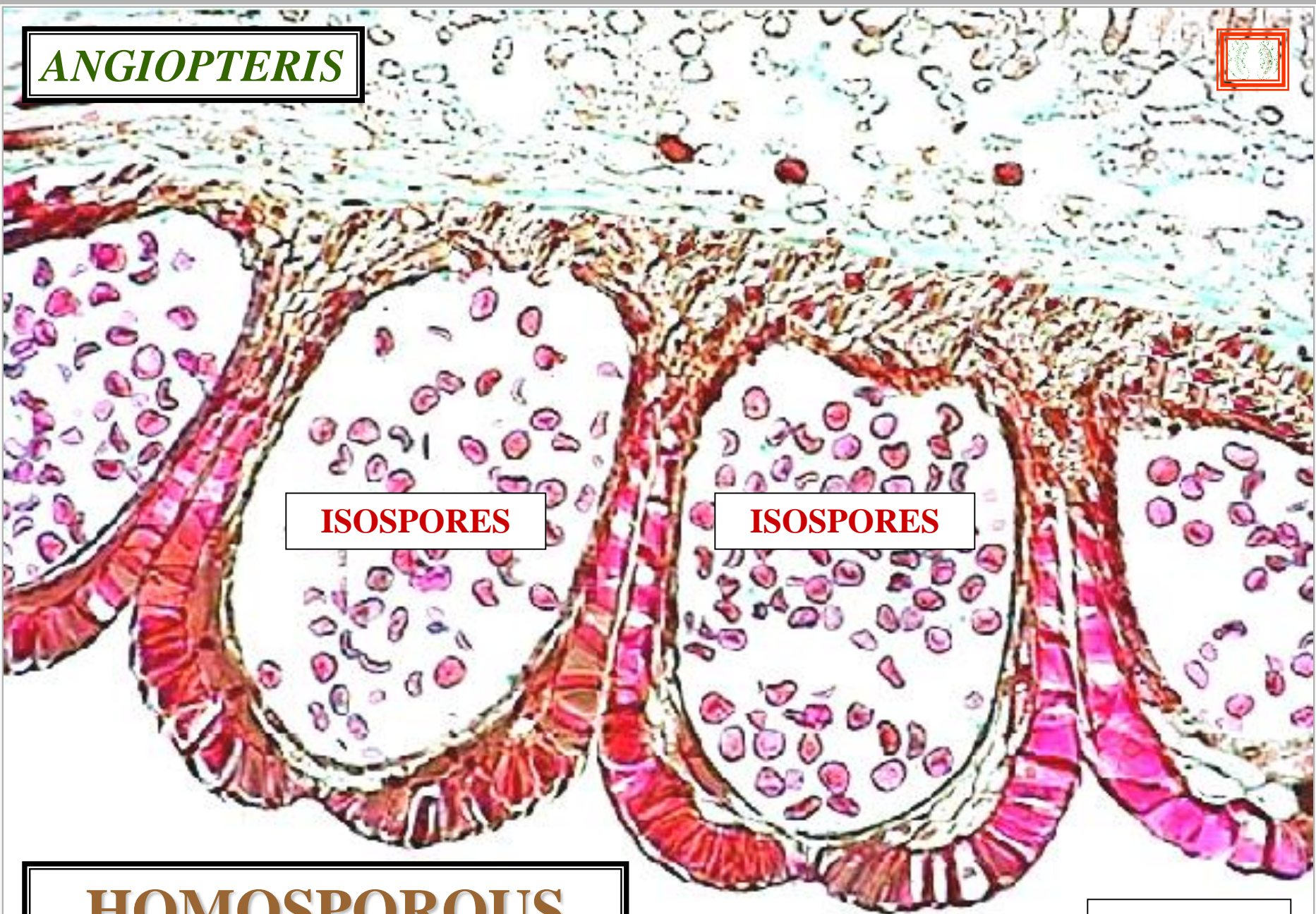


**ISOSPORES**

**ISOSPORES**

**L.S.**

**ANGIOPTERIS**



**ISOSPORES**

**ISOSPORES**

**HOMOSPOROUS**

**L.S.**

# MARATTIALES LIFE CYCLE

