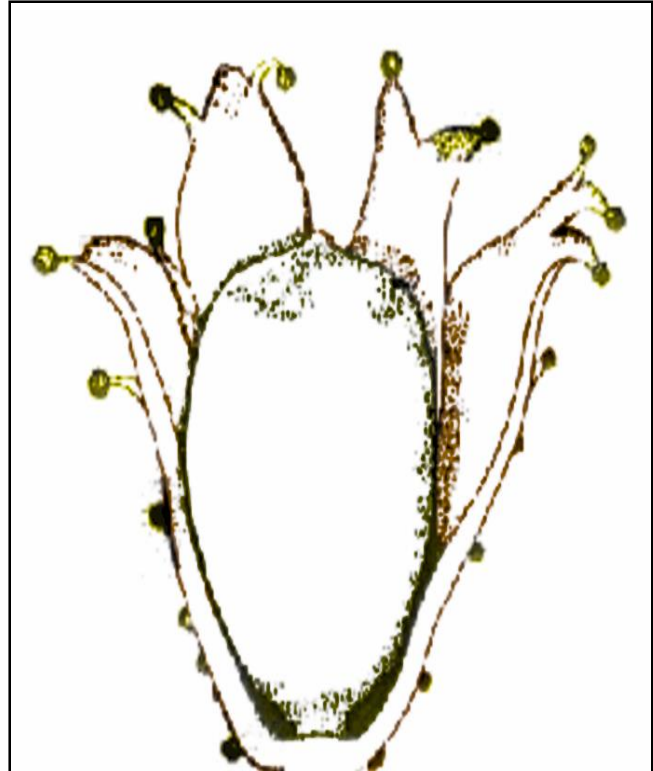
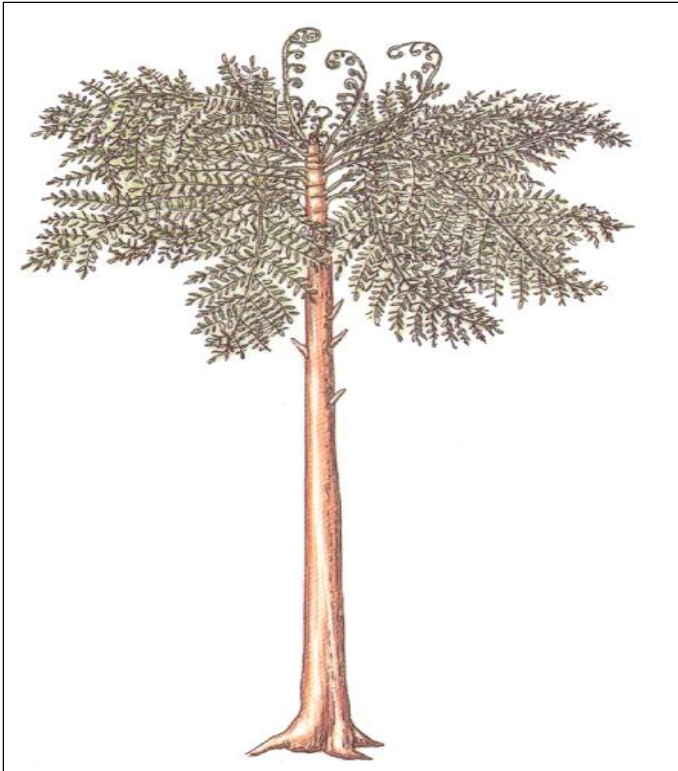


**FOSSIL BEDS**



**FOUND SAME FOSSIL BEDS**

***LYGINOPTERIS***

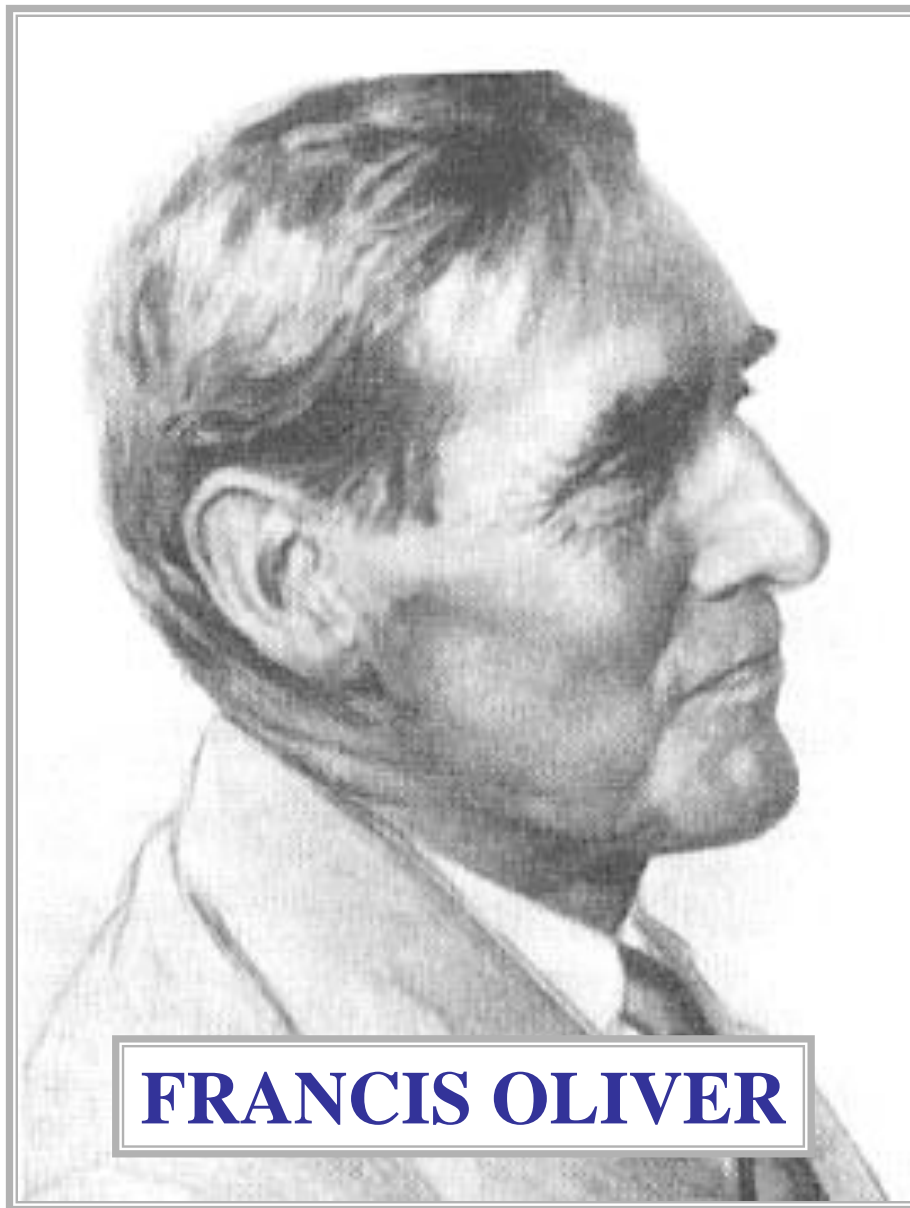
**PROGYMNOSPERM**

***LAGENOSTOMA***

**GYMNOSPERM**



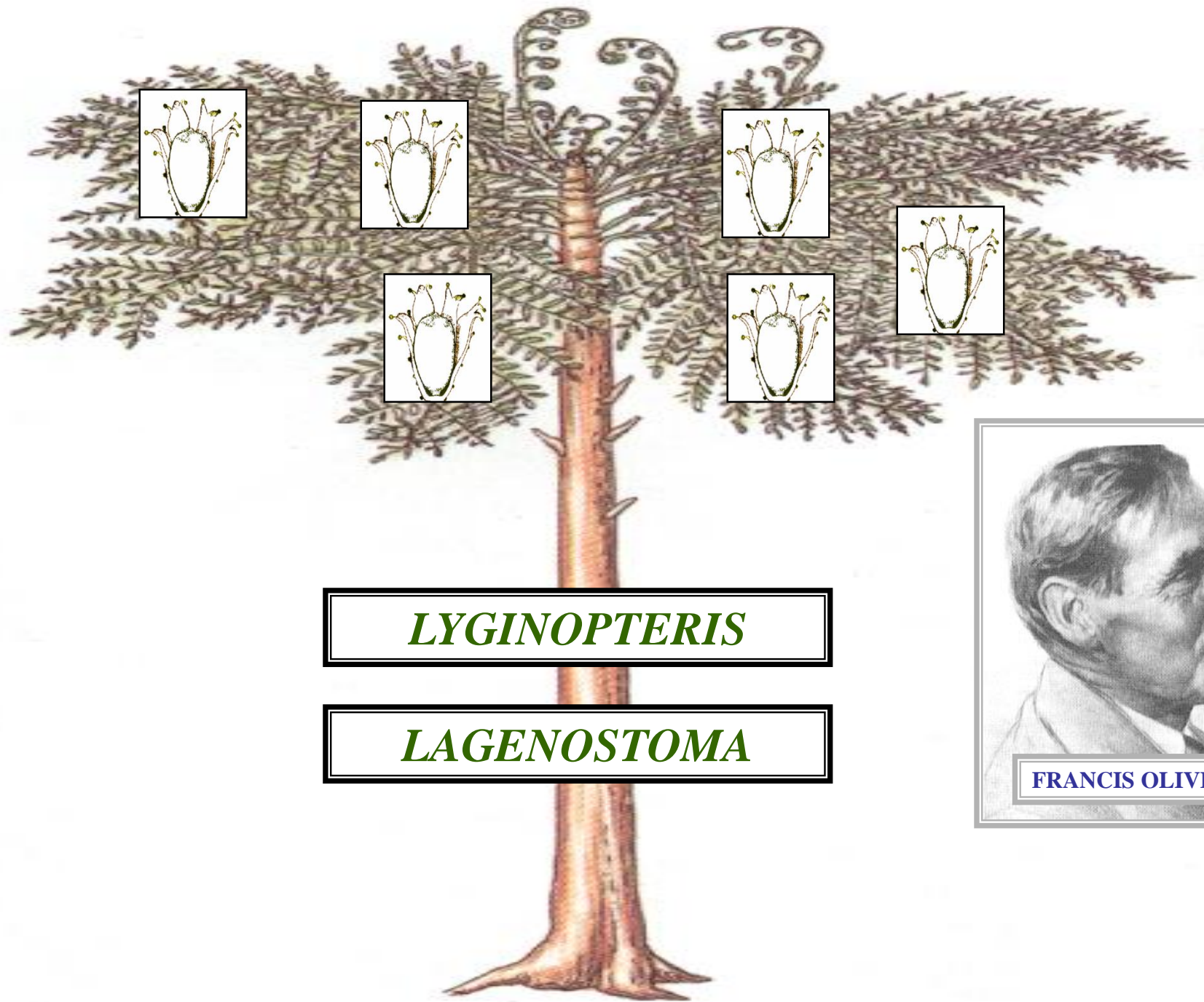
**DURING 1904**



**FRANCIS OLIVER**

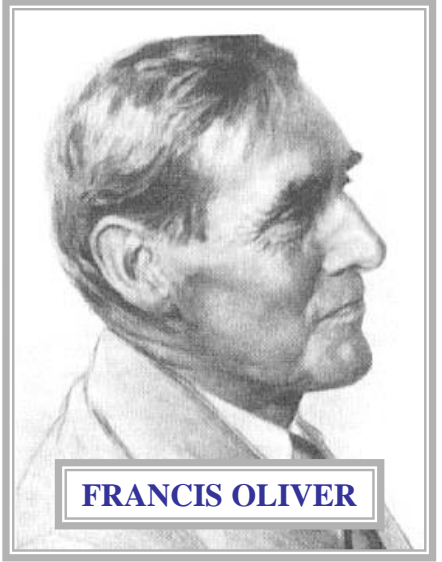
**PALEOBOTANIST**



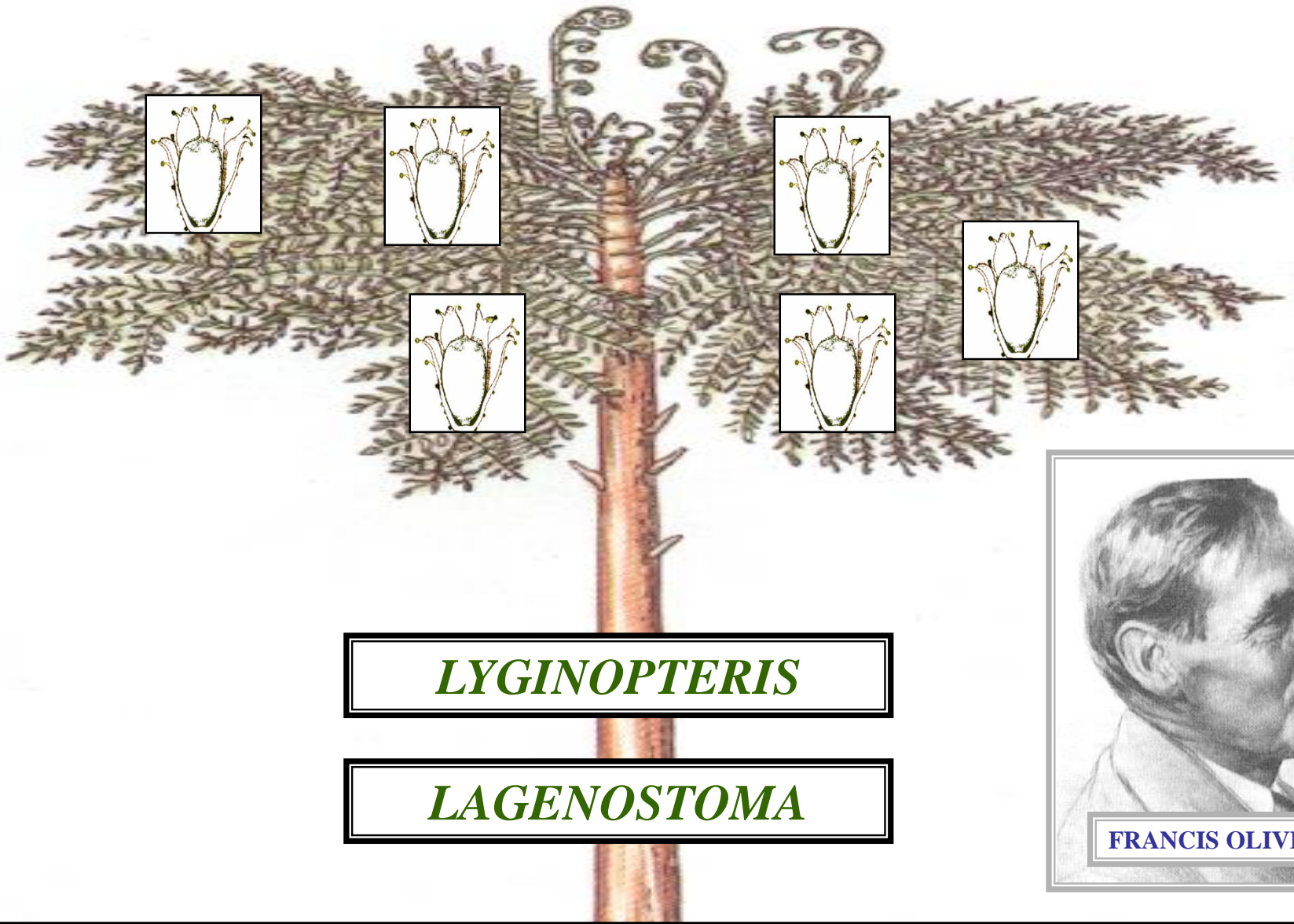


*LYGINOPTERIS*

*LAGENOSTOMA*

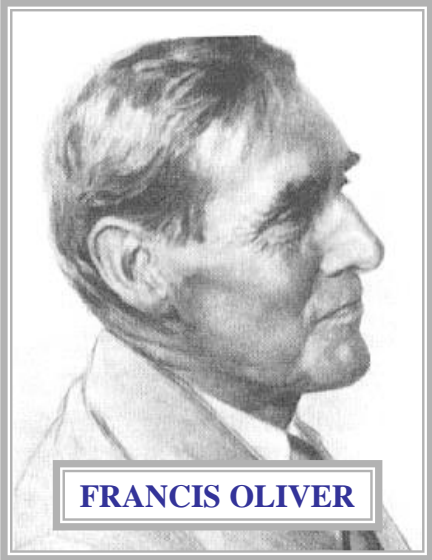


FRANCIS OLIVER



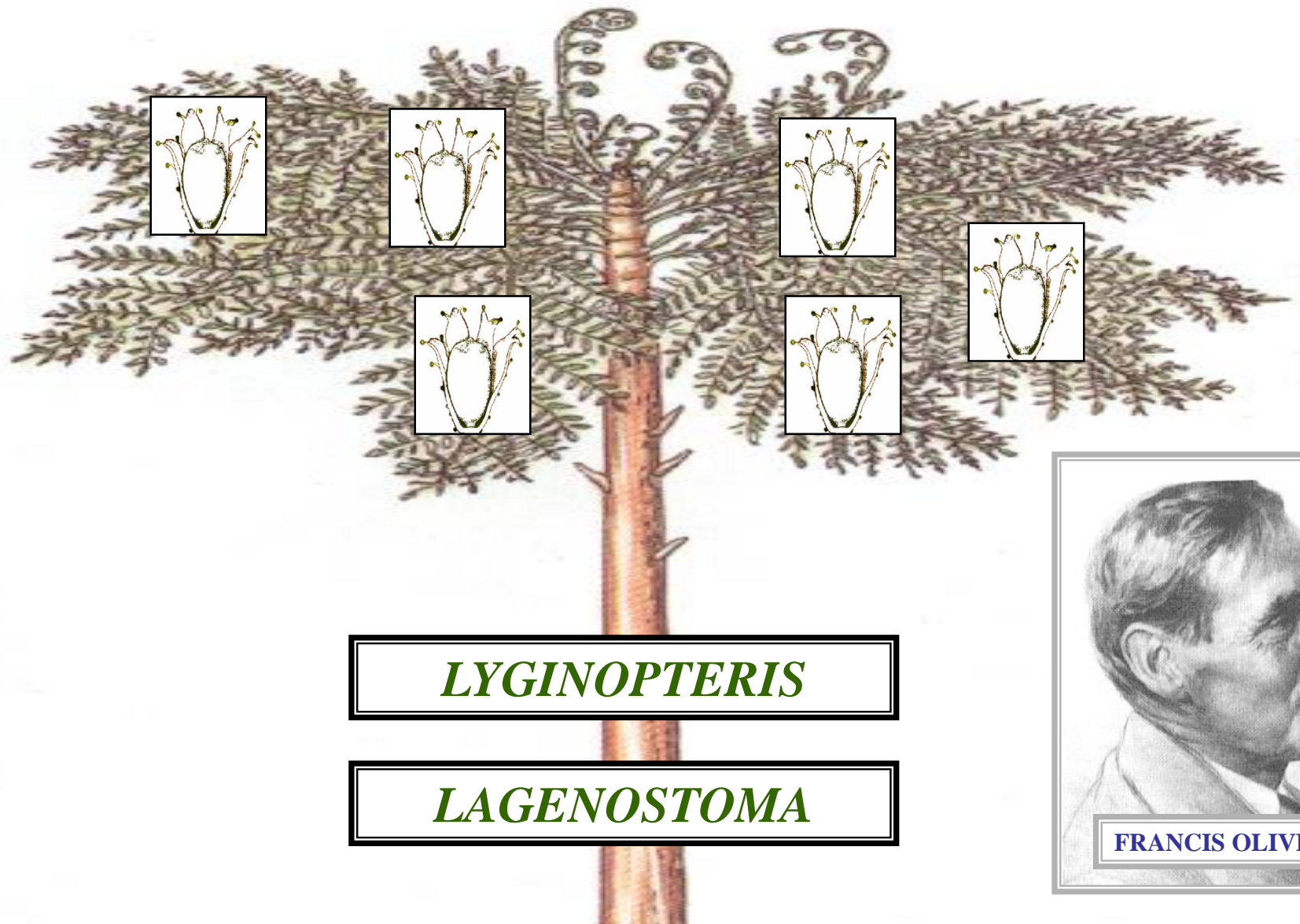
*LYGINOPTERIS*

*LAGENOSTOMA*



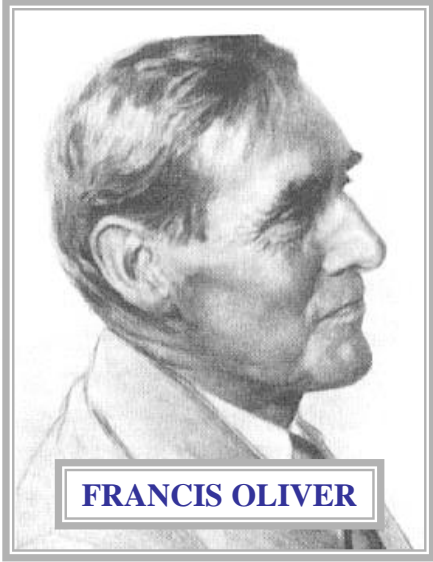
FRANCIS OLIVER

*LYGINOPTERIS & LAGENOSTOMA*  
**PHYSICALLY ATTACHED**



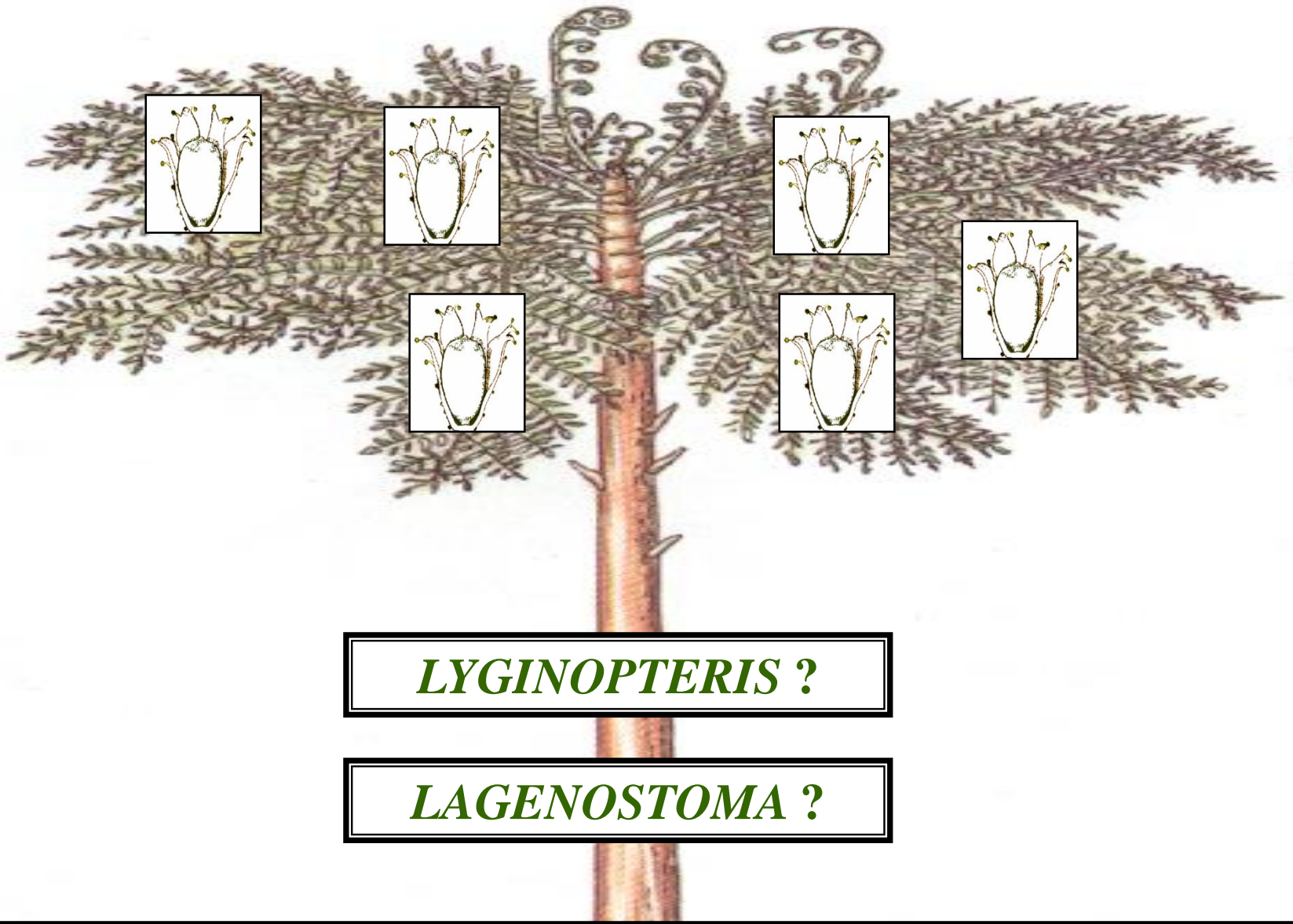
*LYGINOPTERIS*

*LAGENOSTOMA*



FRANCIS OLIVER

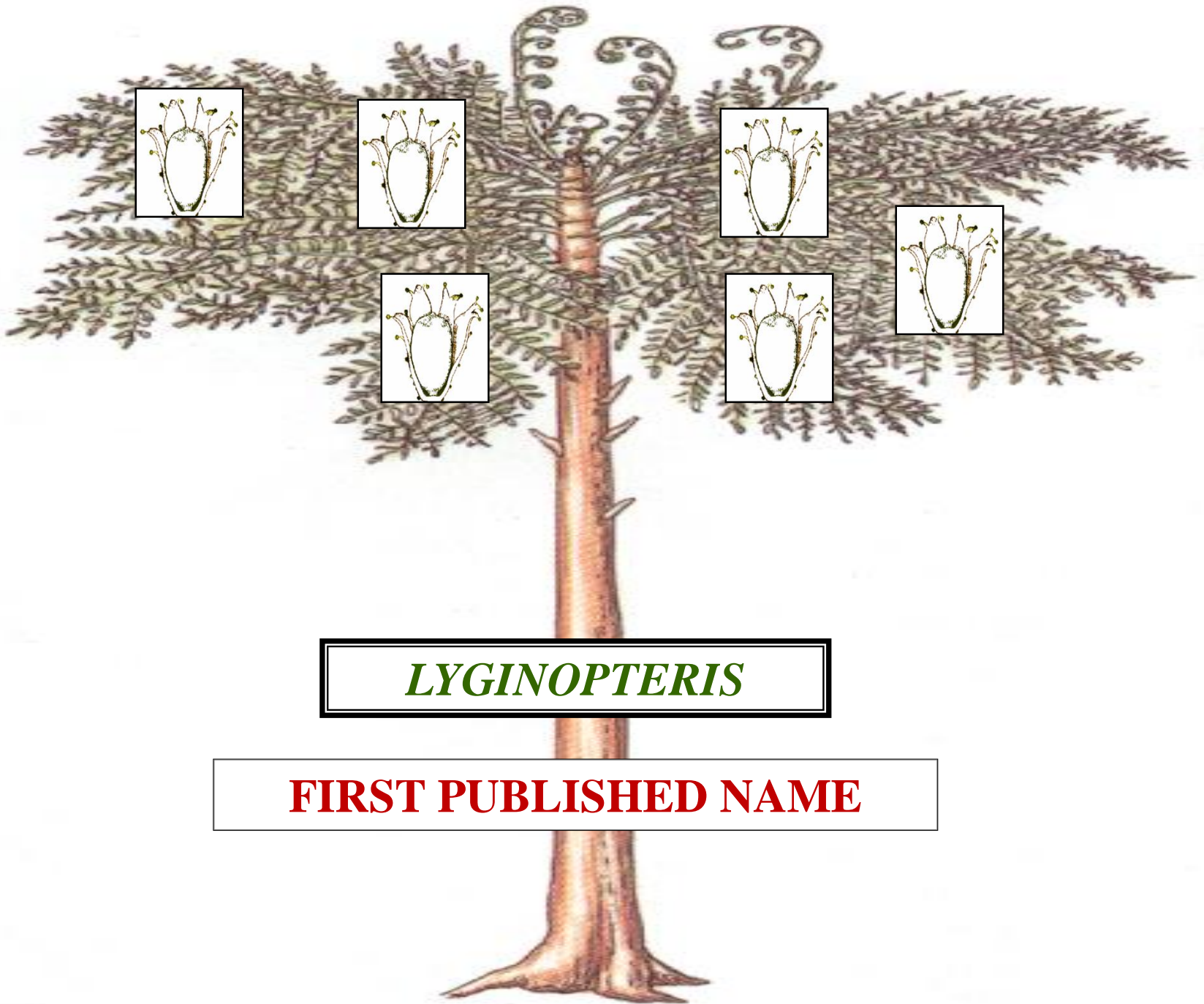
*LYGINOPTERIS & LAGENOSTOMA*  
**SAME PLANT**



*LYGINOPTERIS ?*

*LAGENOSTOMA ?*

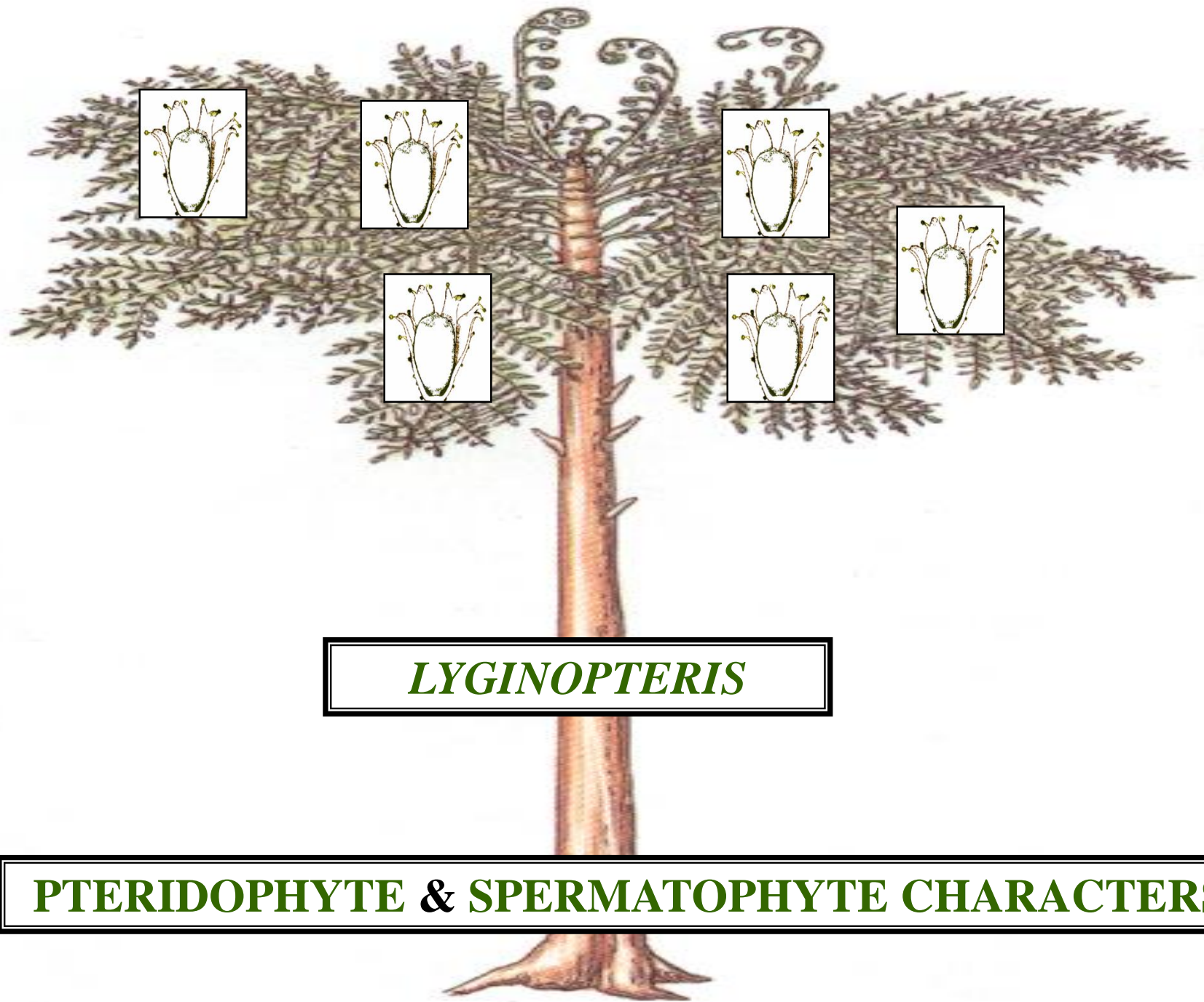
*LYGINOPTERIS & LAGENOSTOMA*  
**SAME PLANT**



*LYGINOPTERIS*

**FIRST PUBLISHED NAME**





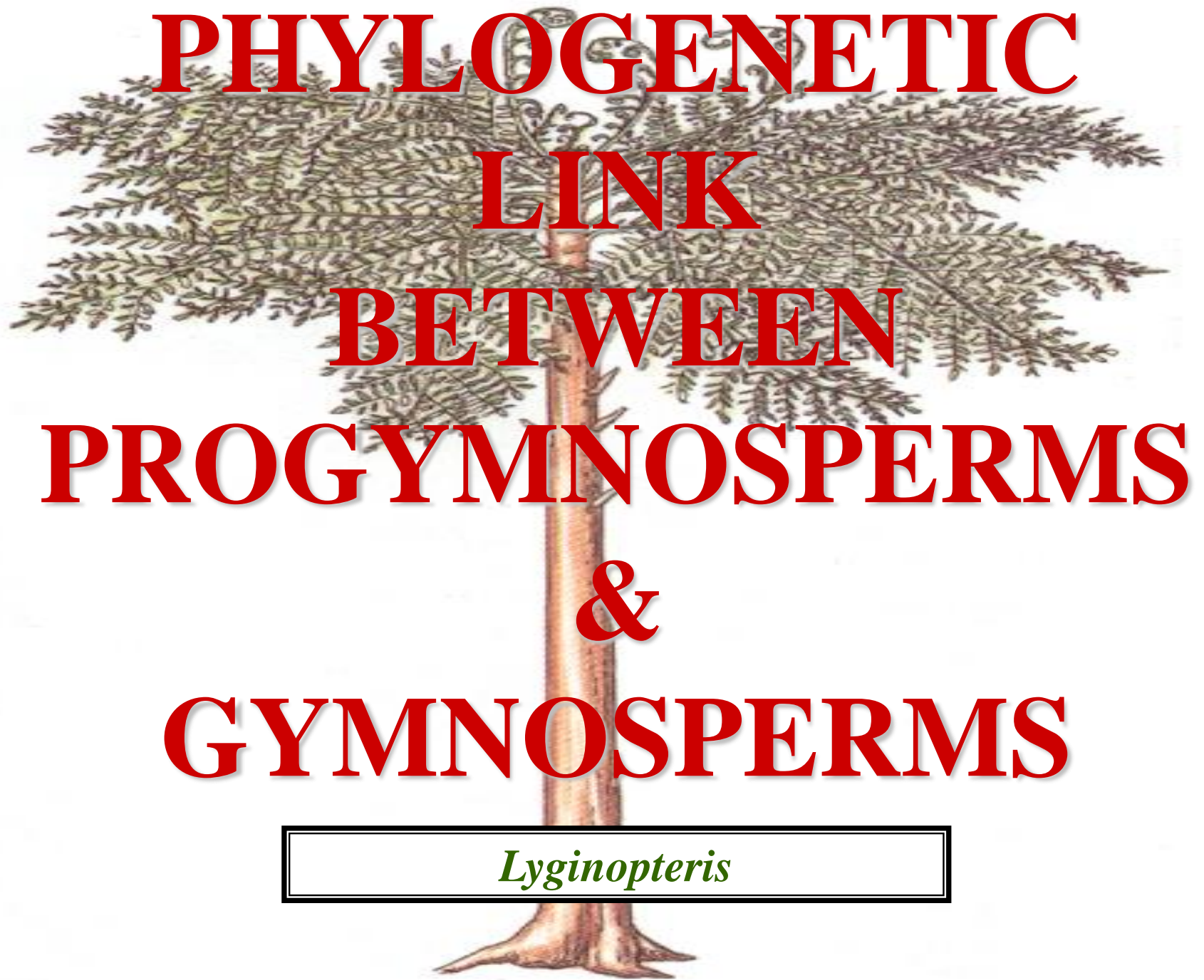
*LYGINOPTERIS*

**PTERIDOPHYTE & SPERMATOPHYTE CHARACTERS**



**PHYLOGENETIC  
LINK  
BETWEEN  
PTERIDOPHYTES  
&  
SPERMATOPHYTES**

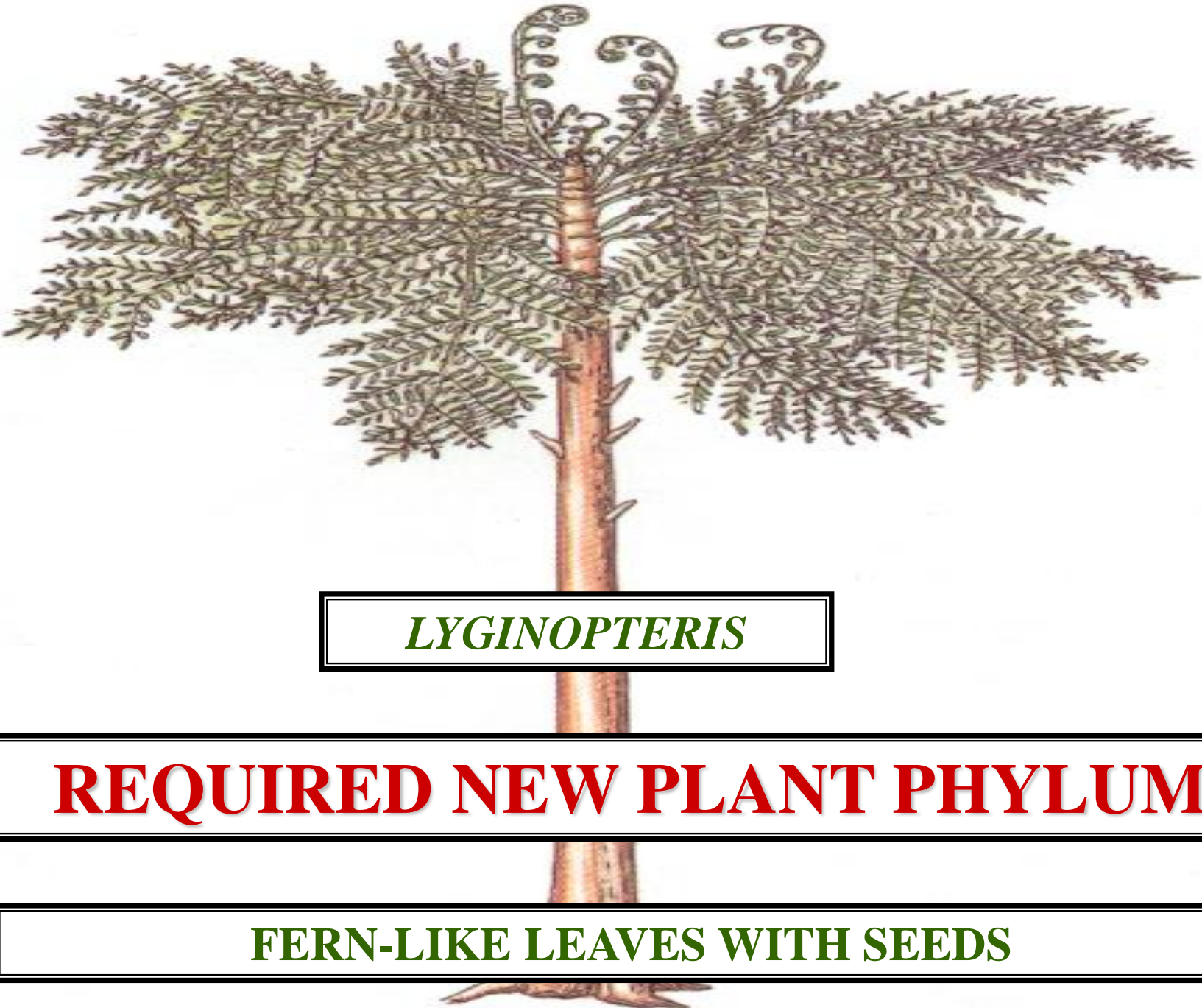
*Lyginopteris*



**PHYLOGENETIC  
LINK  
BETWEEN  
PROGYMNOSPERMS  
&  
GYMNOSPERMS**

*Lyginopteris*

# OLIVER'S DISCOVERY CONSEQUENCES



*LYGINOPTERIS*

**REQUIRED NEW PLANT PHYLUM**

**FERN-LIKE LEAVES WITH SEEDS**

A detailed illustration of a tree with a thick, brown trunk and a dense canopy of small, fern-like leaves. A large, prominent frond with a spiral pattern is visible at the top of the tree. The tree is centered in the background of the slide.

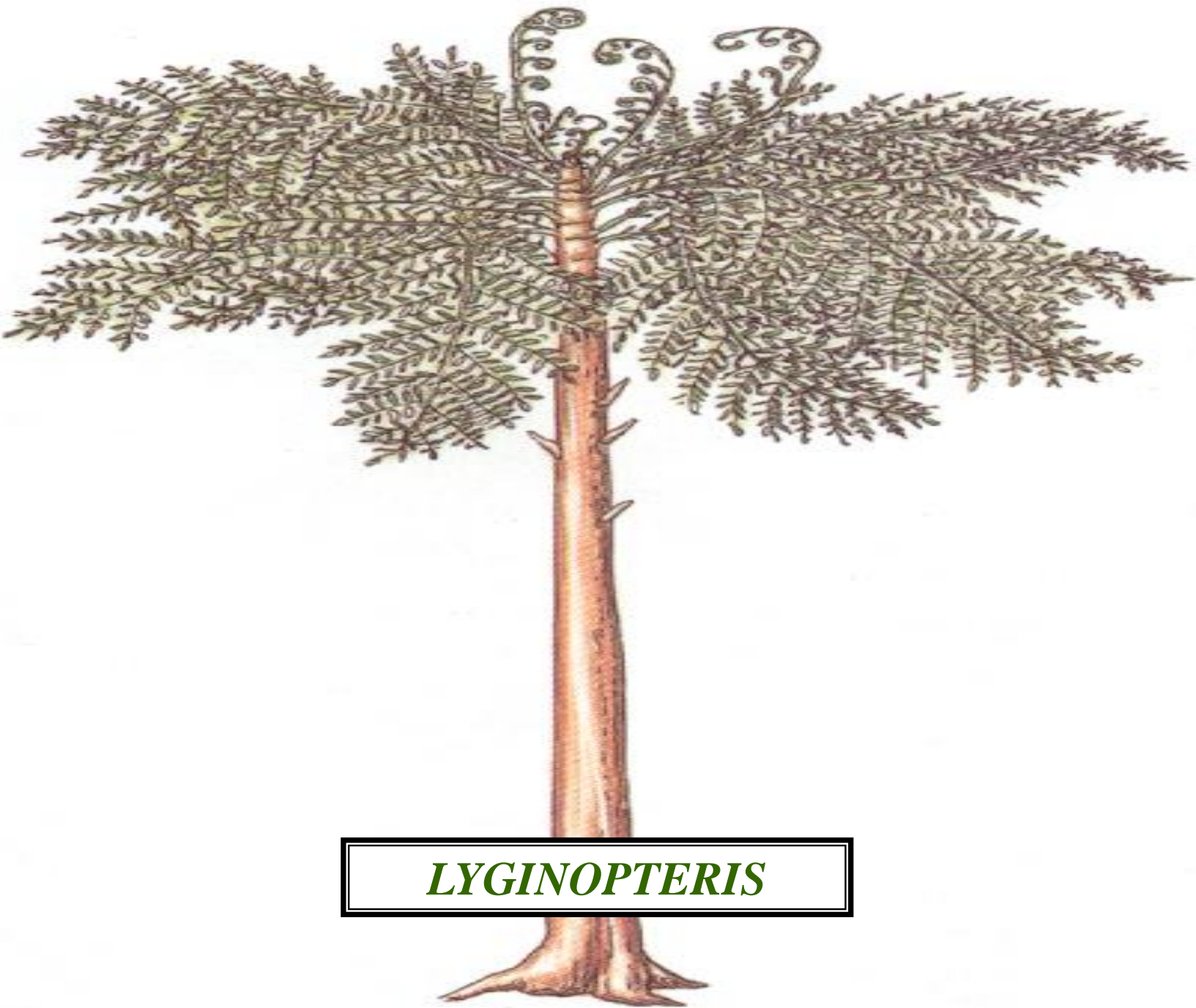
# PHYLUM PTERIDOSPERMOPHYTA

*LYGINOPTERIS*

**REQUIRED NEW PLANT PHYLUM**

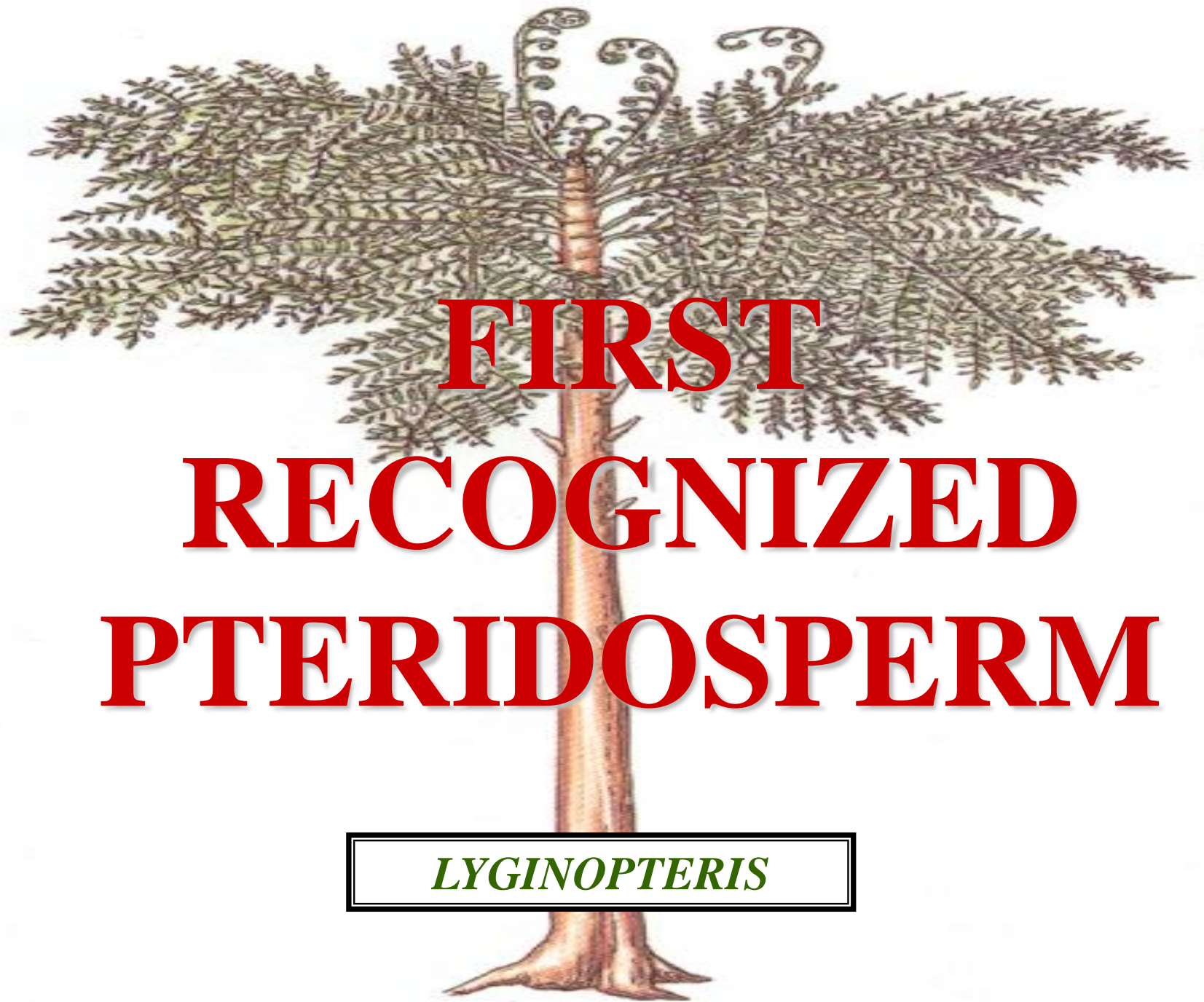
**FERN-LIKE LEAVES WITH SEEDS**

# REPRESENTATIVE GENUS



*LYGINOPTERIS*





**FIRST  
RECOGNIZED  
PTERIDOSPERM**

*LYGINOPTERIS*

# PHYLOGENETIC RELATIONSHIP



**TRACHEOPHYTES**

**RHYNIOPHYTA**

**STEM ENATIONS**

**COMPLEX TELOMES**

**ZOSTEROPHYLLOPHYTA**

**TRIMEROPHYTOPHYTA**

**MICROPHYLLS  
ENATION THEORY**

**MEGAPHYLLS  
TELOME THEORY**

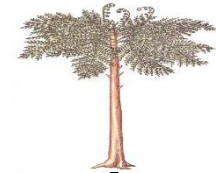
**LYCOPODIOPHYTA**

**PTERIDOPHYTA**

**PROGYMNOSPERMOPHYTA**

**PHYLOGENETIC  
DEAD-END**

**PHYLOGENETIC  
DEAD-END**



**PTERIDOSPERMOPHYTA**



**PTERIDOPHYTES  
EVOLVE ALL OTHER  
SPERMATOPHYTES**



**~280**

**MILLION YEARS**

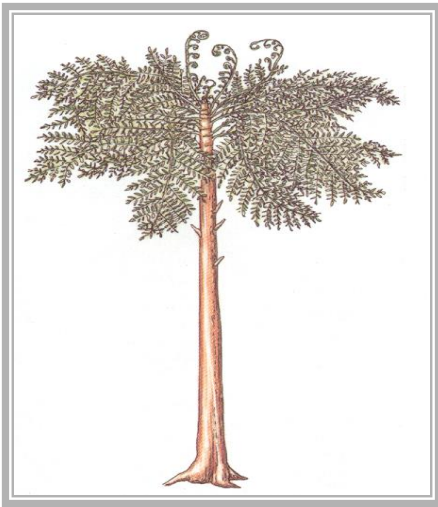
~280 MILLION YEARS AGO



# CYCADOPHYTA EVOLVE

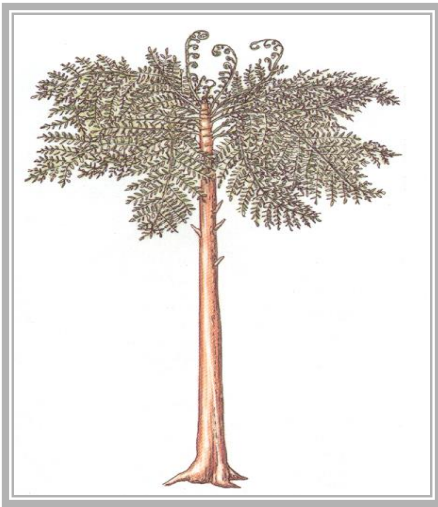


# CYCADOPHYTA EVOLUTION



*LYGINOPTERIS*

# CYCADOPHYTA EVOLUTION

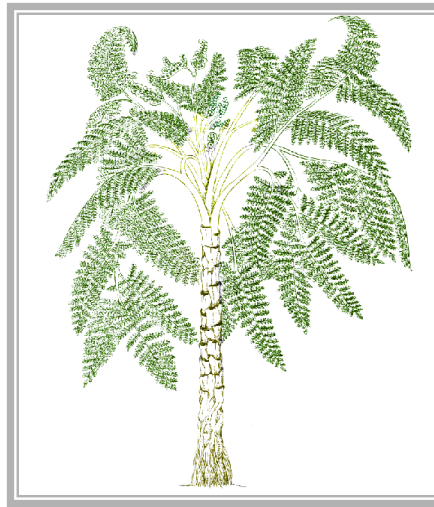
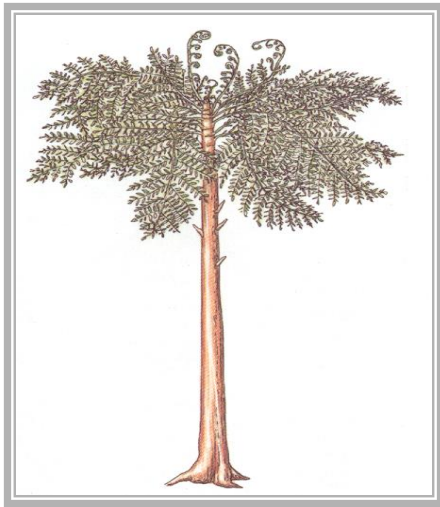


**PTERIDOSPERM**

**GYMNOSPERM**



# CYCADOPHYTA EVOLUTION

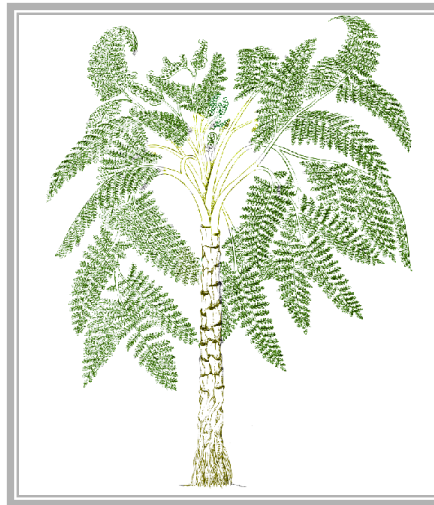
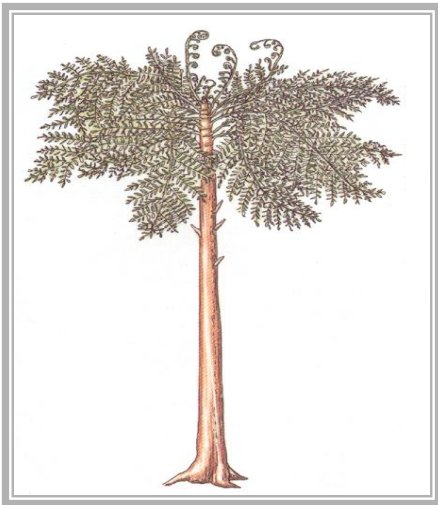


**PTERIDOSPERM**

***MEDULLOSA***

**GYMNOSPERM**

# CYCADOPHYTA EVOLUTION



**PTERIDOSPERM**

**PTERIDOSPERM**

**GYMNOSPERM**

**GYMNOSPERM**

# CYCADOPHYTA EVOLUTION



**PTERIDOSPERM**

**PTERIDOSPERM**

**CYCADOPHYTA**

**GYMNOSPERM**

**GYMNOSPERM**

**EXTANT  
PHYLUM**

**CYCADOPHYTA**

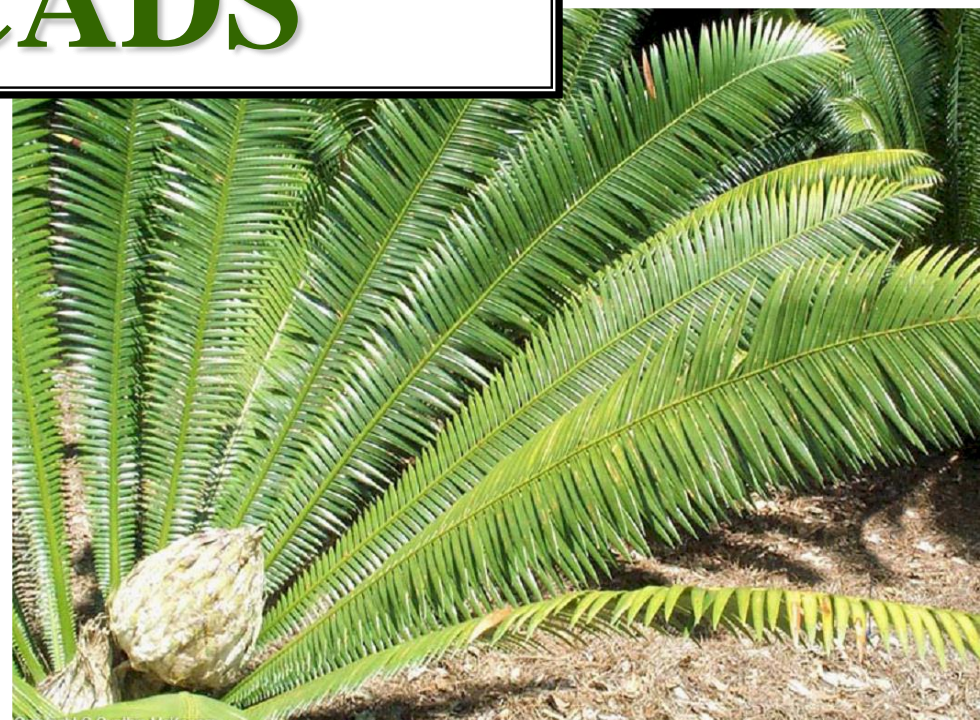
**EXTANT  
PHYLUM**



# COMMON NAME



# CYCADS





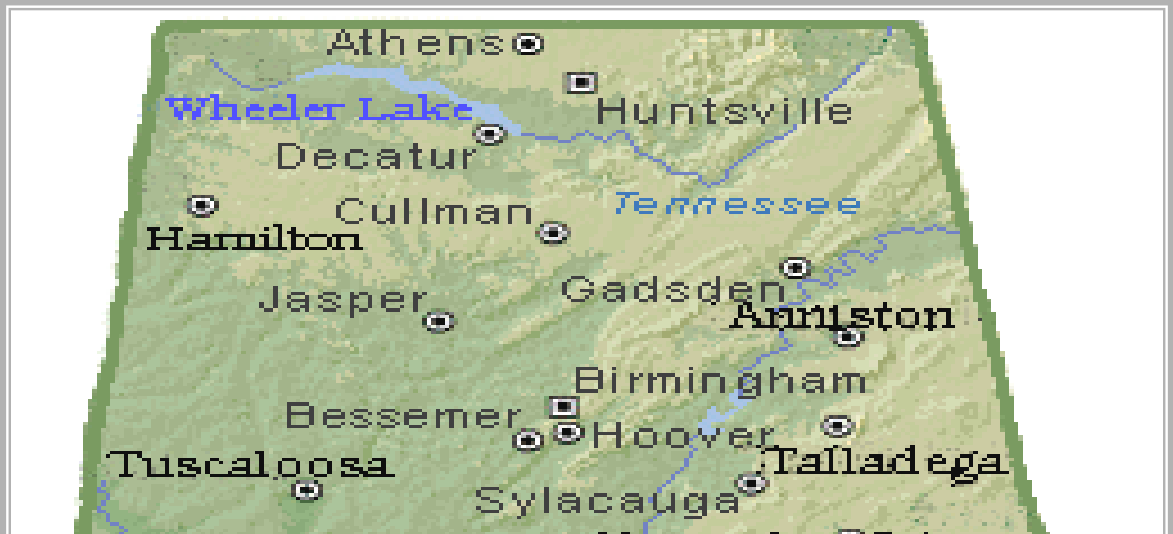
# DIVERSITY



**~125 SPECIES**

**EARTH**





**0 SPECIES**





**CYCADOPHYTA**  
**VERY MINOR**  
**COMPONENT**  
**EXTANT FLORA**

**EARTH**



S

# DISTRIBUTION

T

**SUBTROPICAL**

**EARTH**



# TROPICAL

EARTH

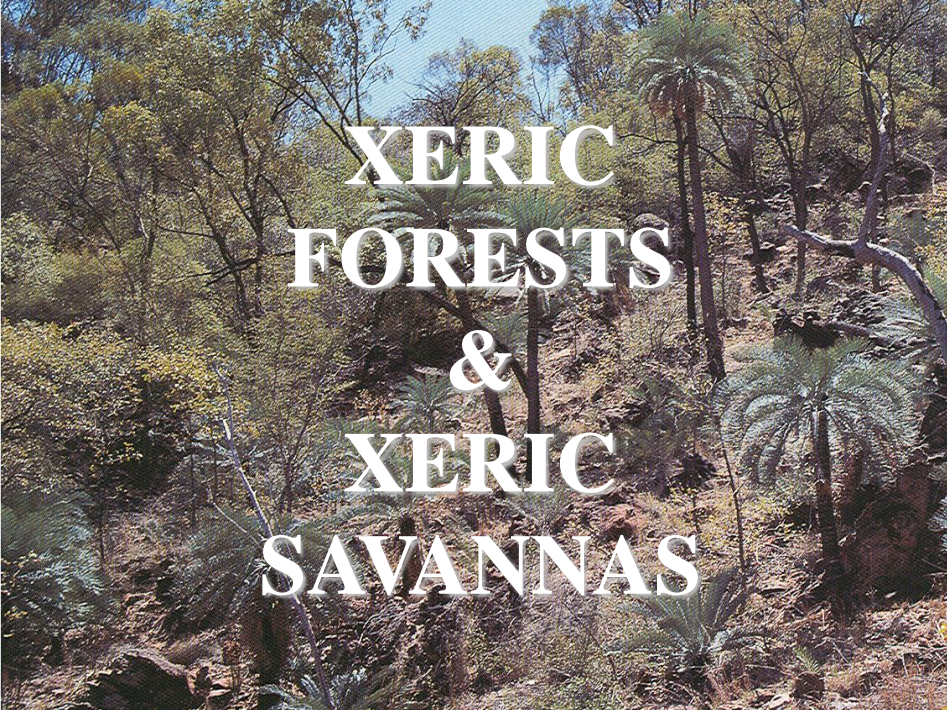
A close-up photograph of a Zamia integrifolia plant, showing its thick, green, lanceolate leaves and a central, upright, cylindrical inflorescence (strobilus) covered in small, light-colored flowers. The plant is set against a background of more foliage and soil.

**INDIGENOUS FLORIDA**

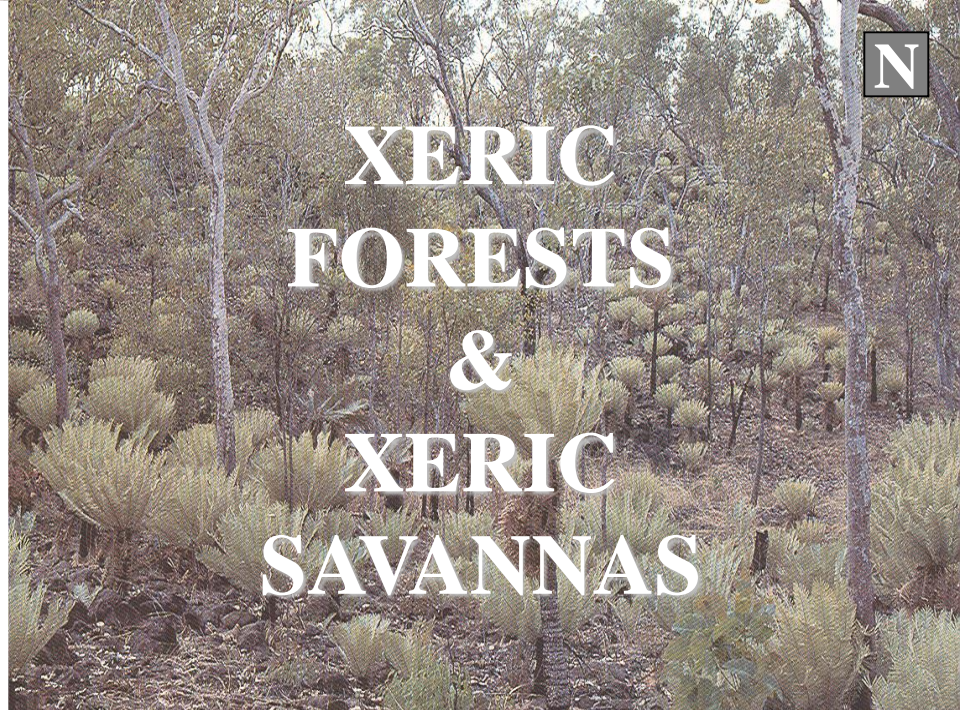
***ZAMIA INTEGRIFOLIA***



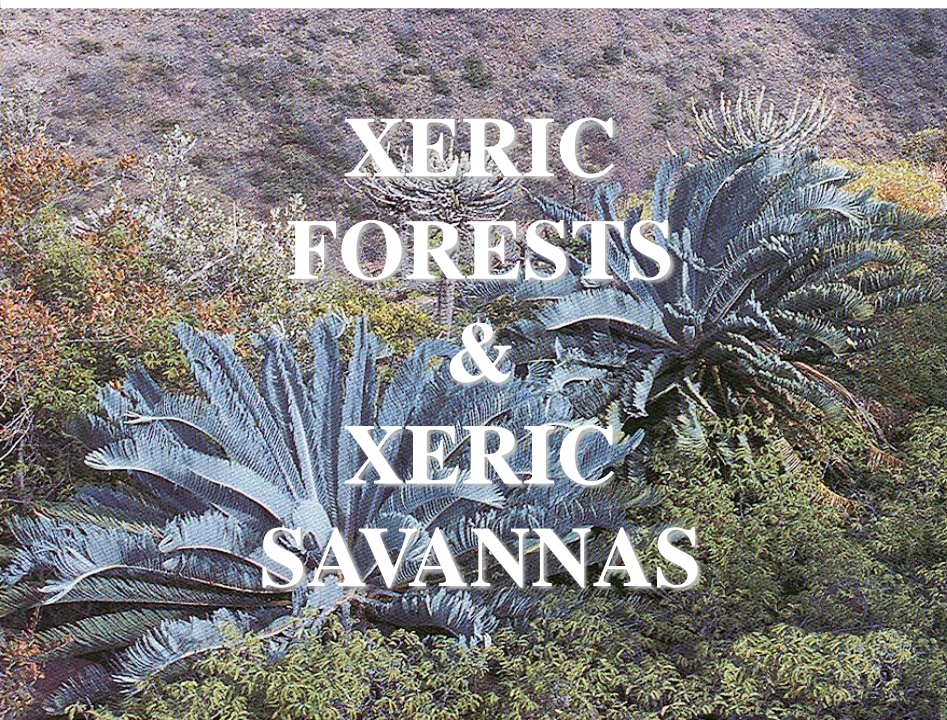
# HABITAT



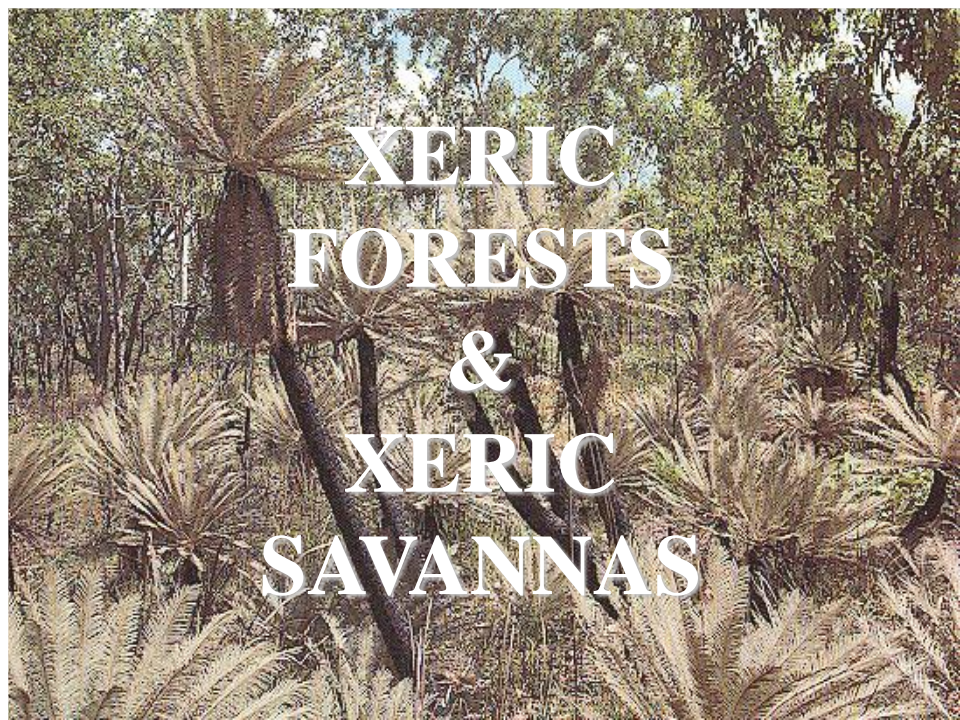
**XERIC  
FORESTS  
&  
XERIC  
SAVANNAS**



**XERIC  
FORESTS  
&  
XERIC  
SAVANNAS**

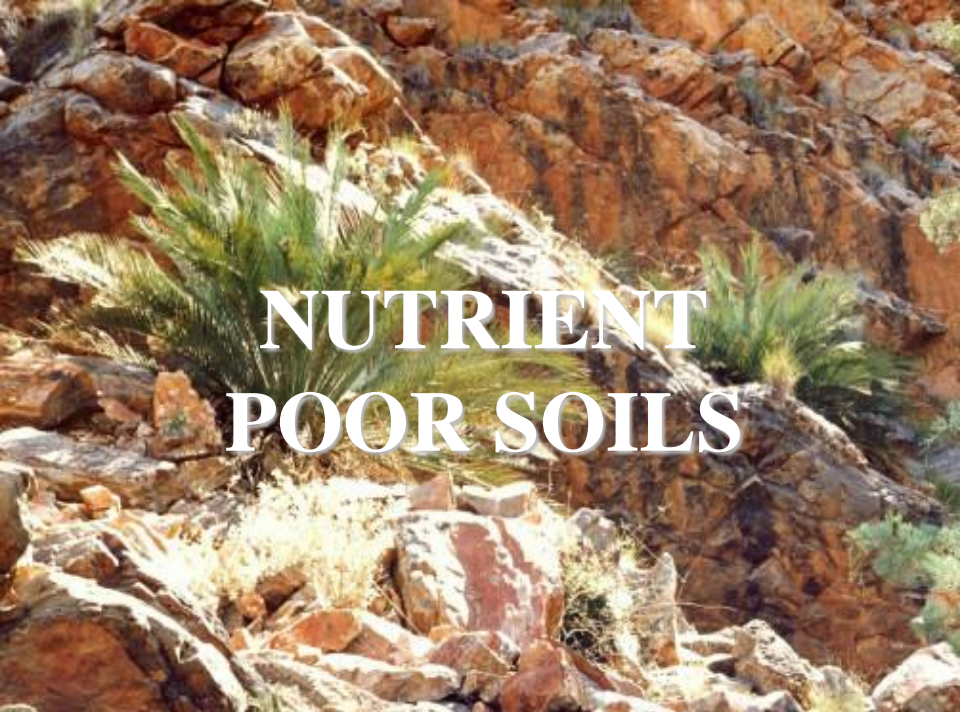


**XERIC  
FORESTS  
&  
XERIC  
SAVANNAS**



**XERIC  
FORESTS  
&  
XERIC  
SAVANNAS**

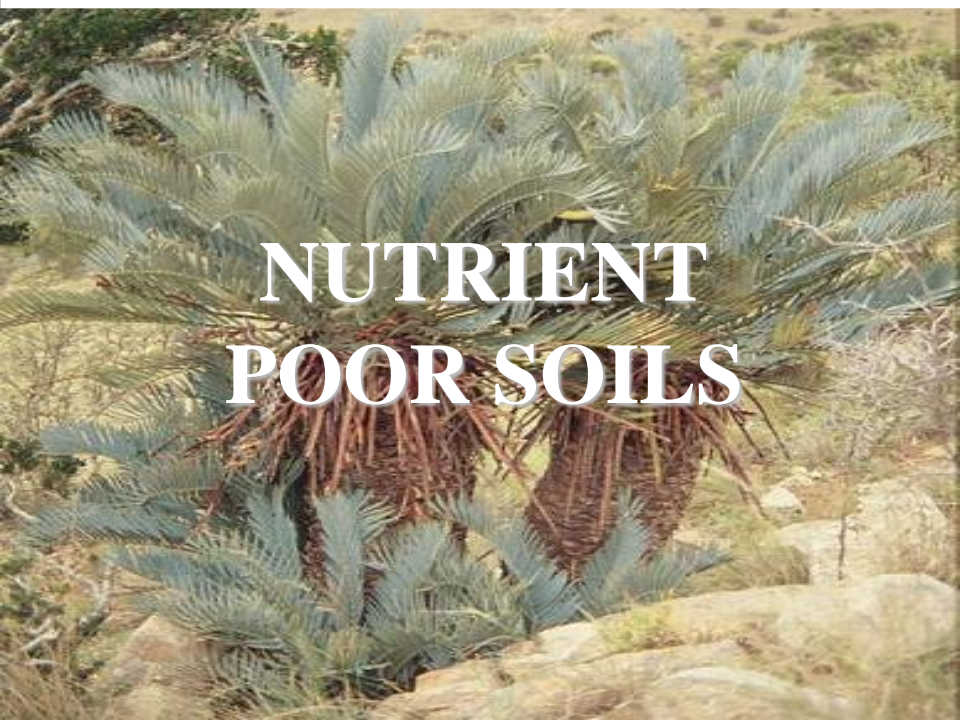




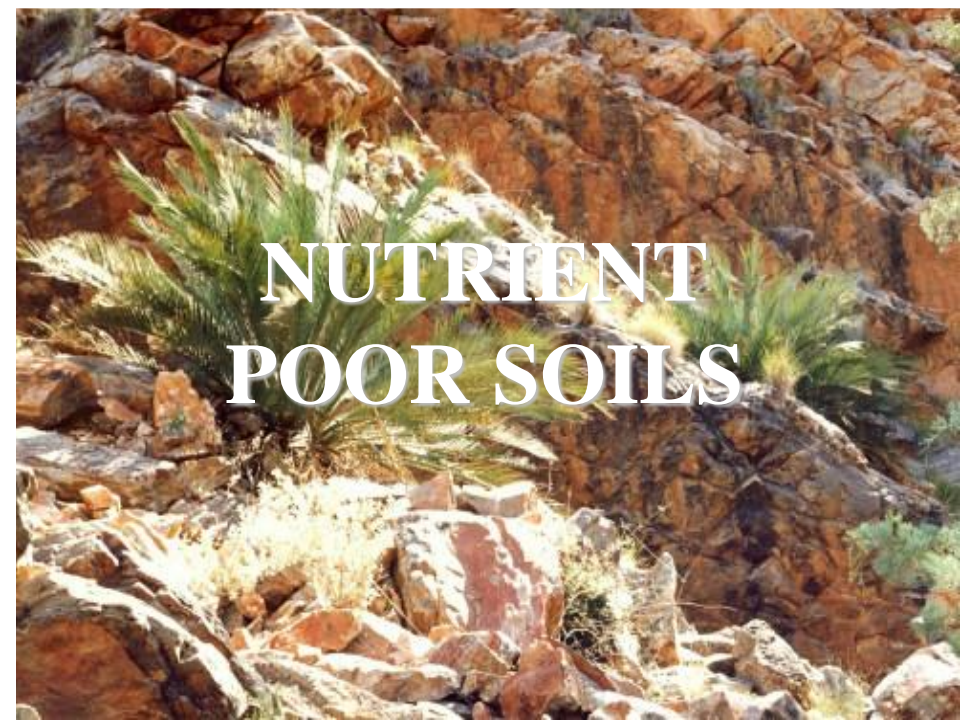
**NUTRIENT  
POOR SOILS**



**NUTRIENT  
POOR SOILS**



**NUTRIENT  
POOR SOILS**

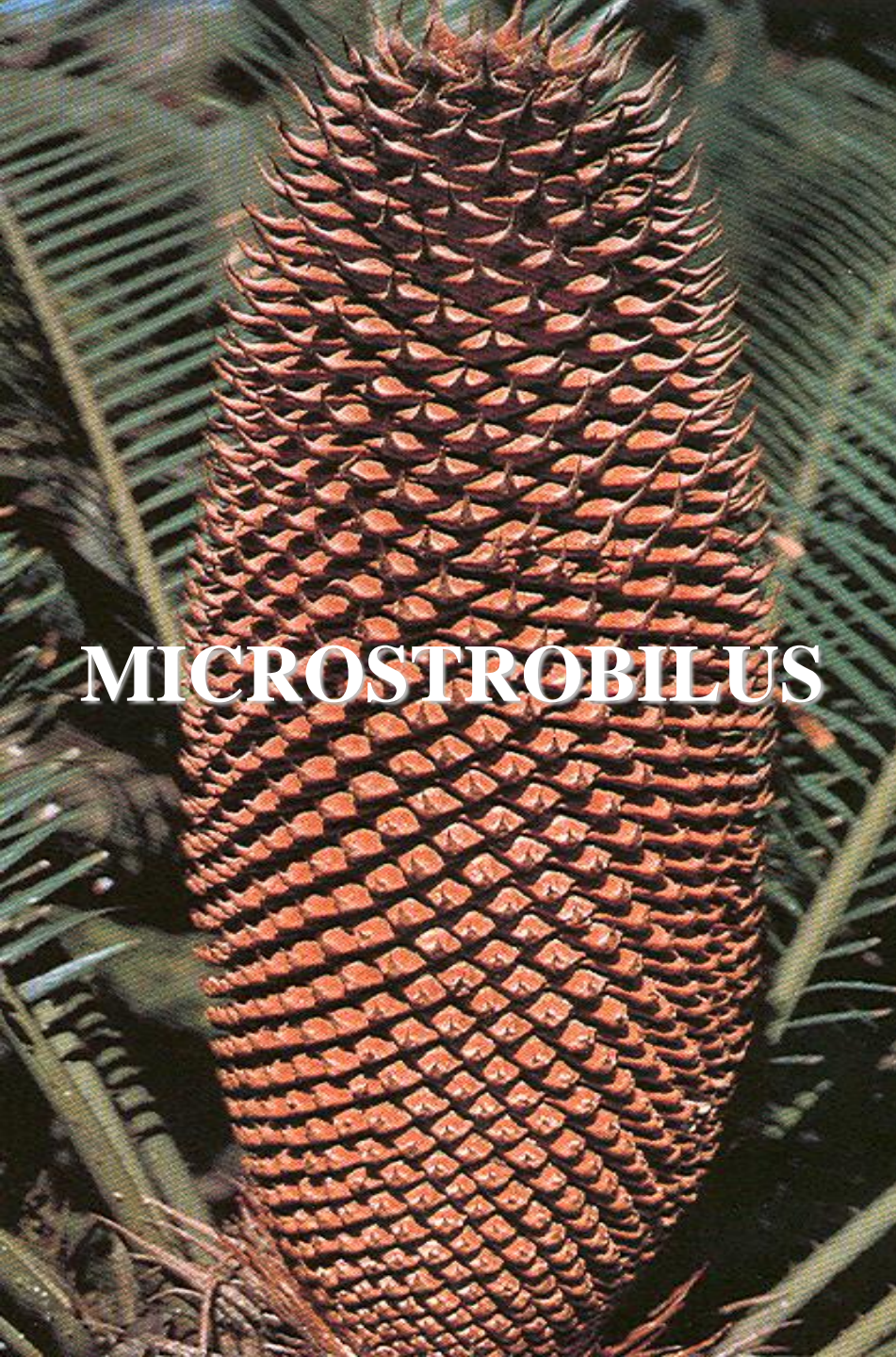


**NUTRIENT  
POOR SOILS**



# ECONOMIC IMPORTANCE





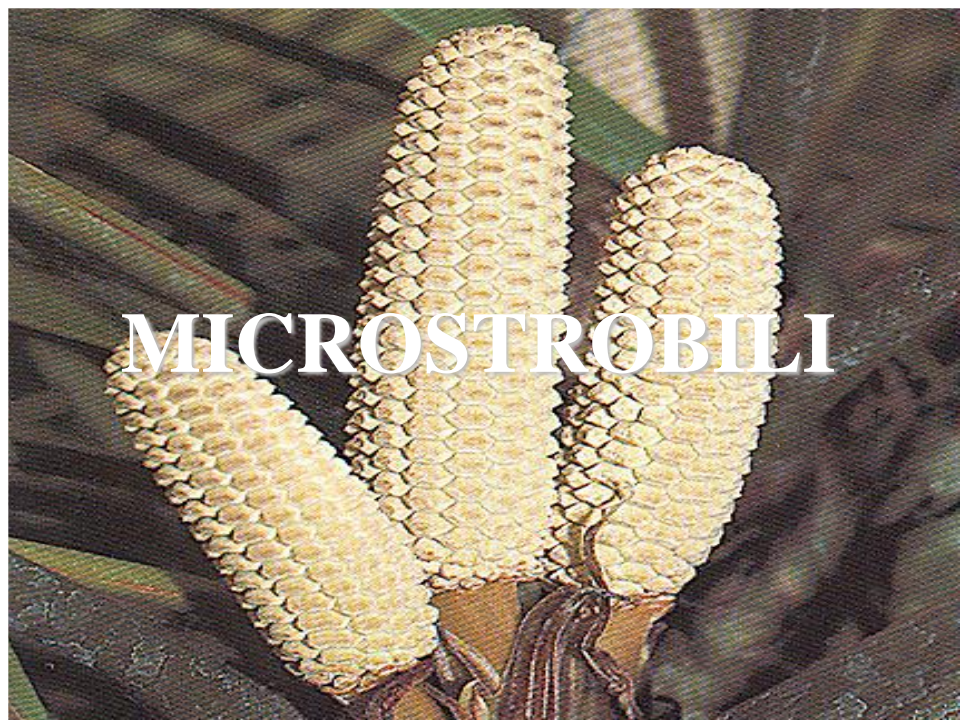
**MICROSTROBILUS**



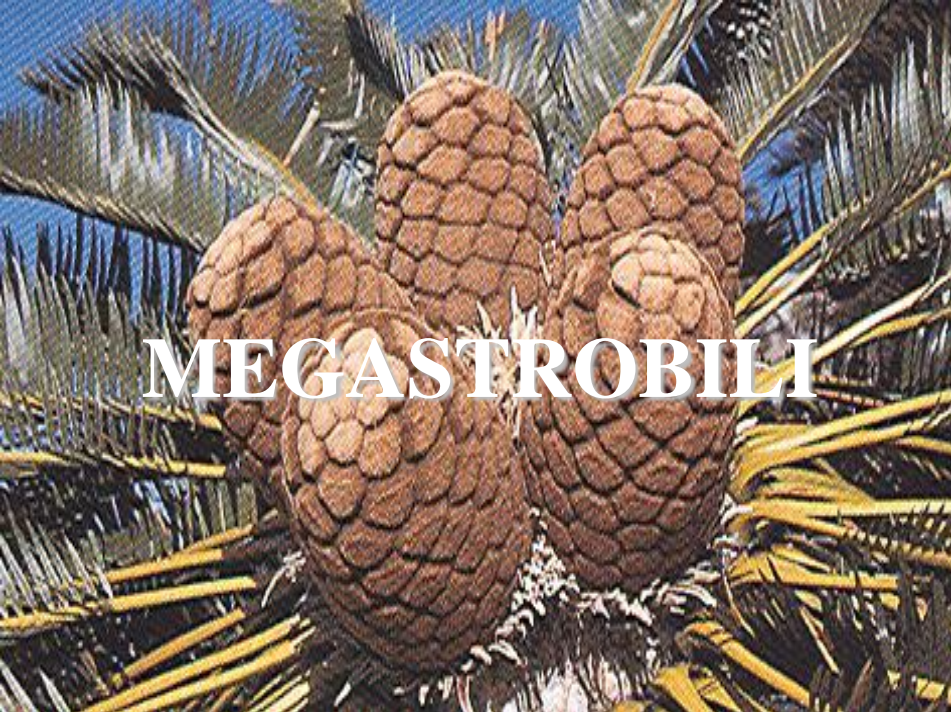
**MICROSTROBILI**



**M**



**MICROSTROBILI**



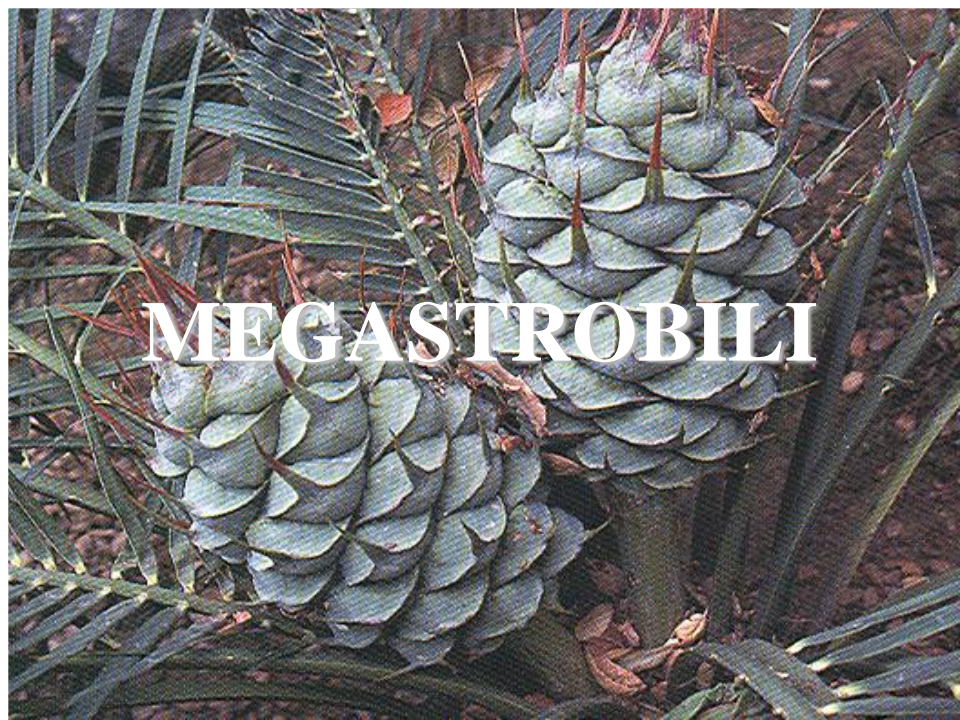
MEGASTROBILI



MEGASTROBILI



MEGASTROBILI



MEGASTROBILI

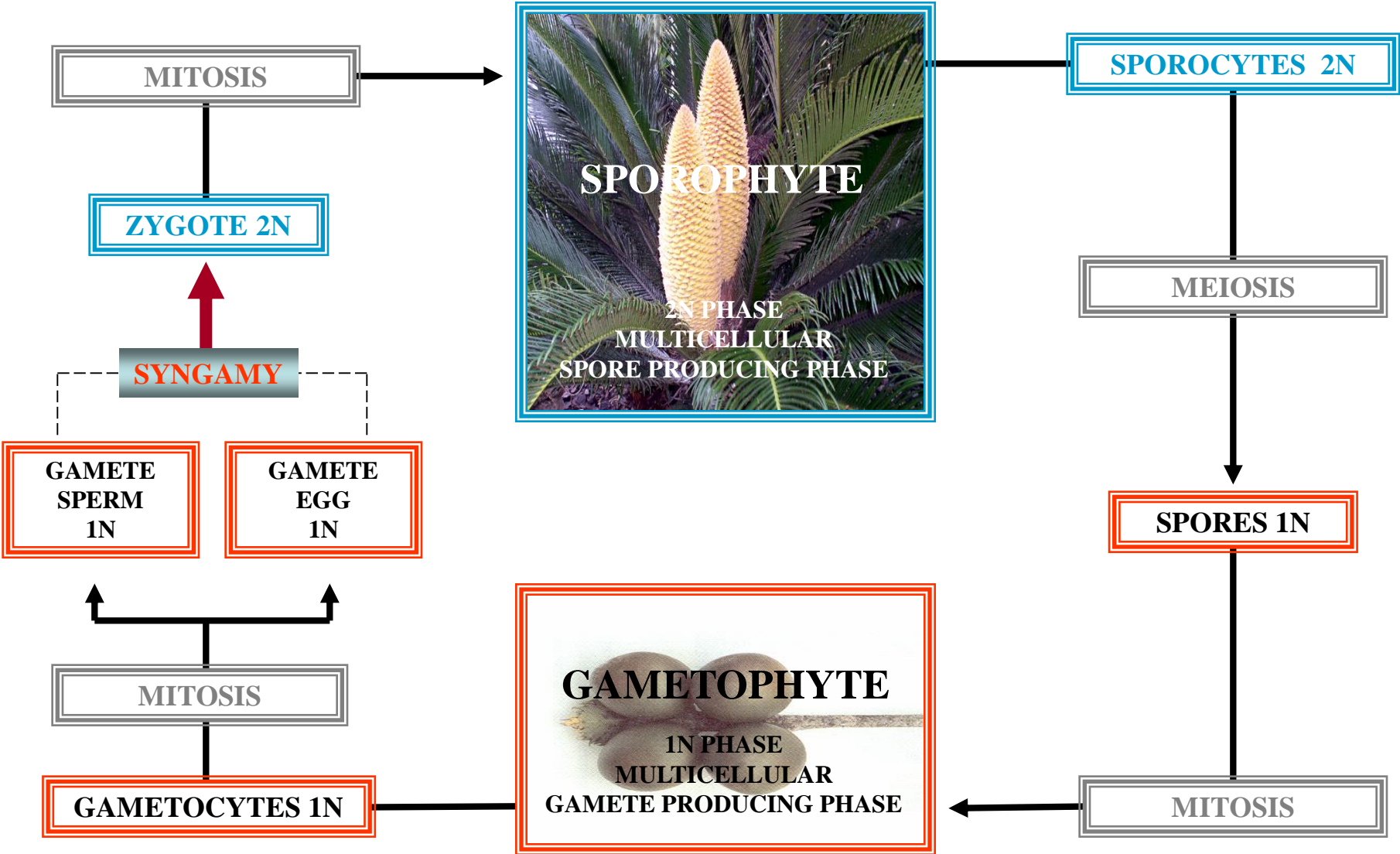


# GENERAL CHARACTERS



# CYCADOPHYTA

## LIFE CYCLE





# SPOROPHYTE CHARACTERS



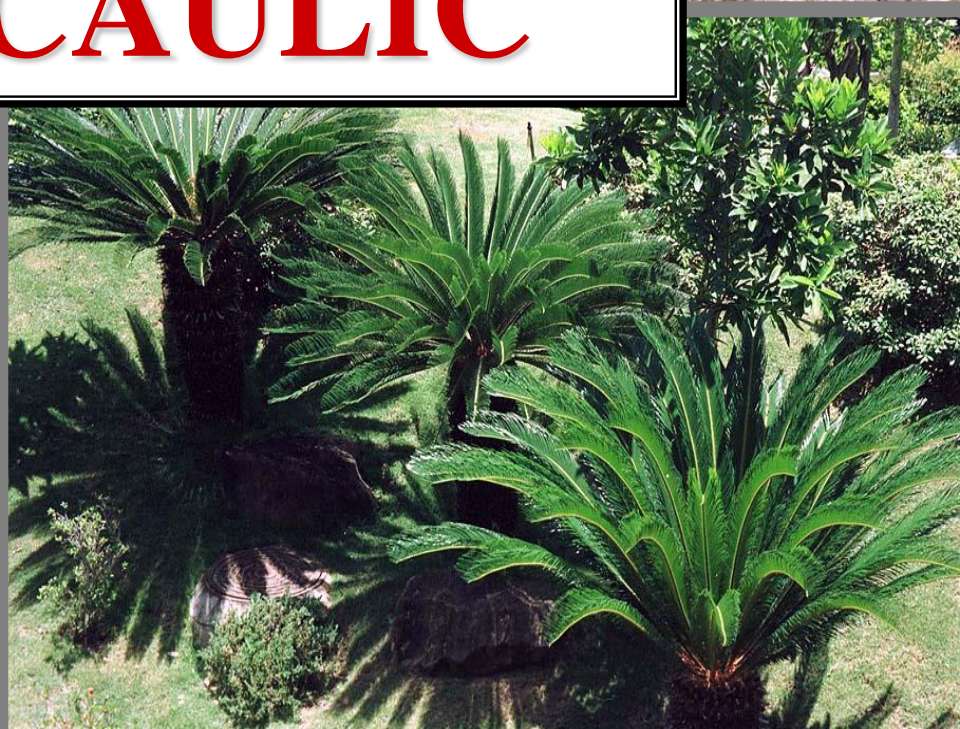


# GROWTH FORM



P

# PACHYCAULIC



**PACHYCAULIC**

**CYCADOPHYTA  
PACHYCAULIC**

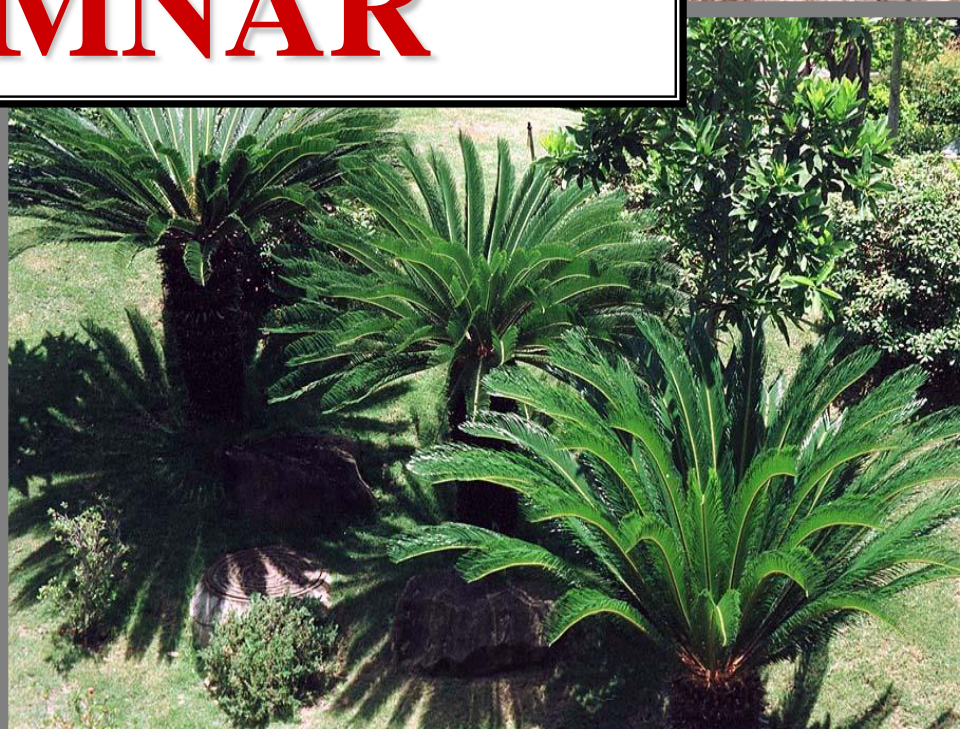


**COLUMNAR  
“PALM-LIKE”**

**CYCADOPHYTA  
PACHYCAULIC**



# COLUMNAR





**“PALM-LIKE”**





**STEM**



# STEM STELE

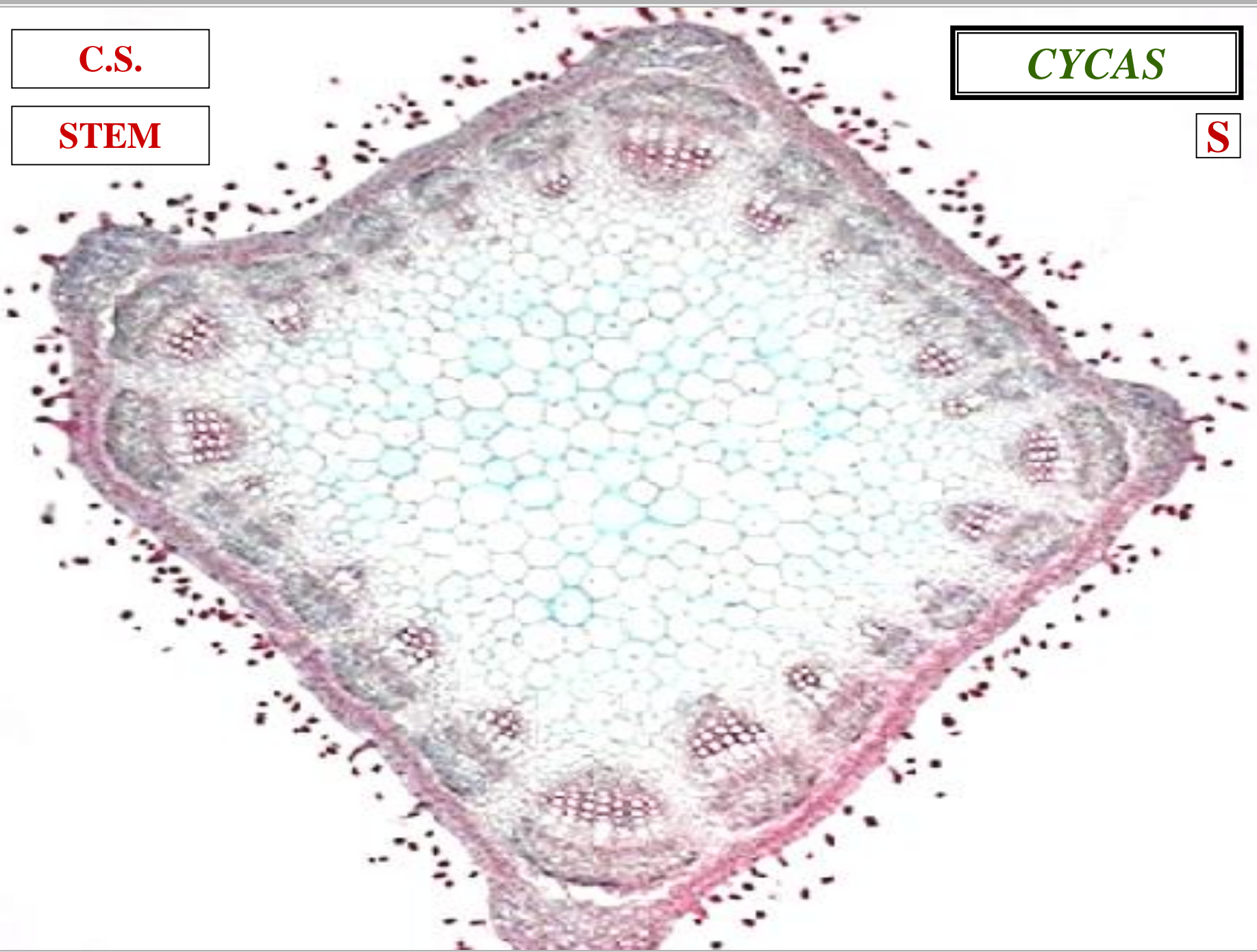


**C.S.**

**STEM**

**CYCAS**

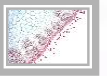
**S**



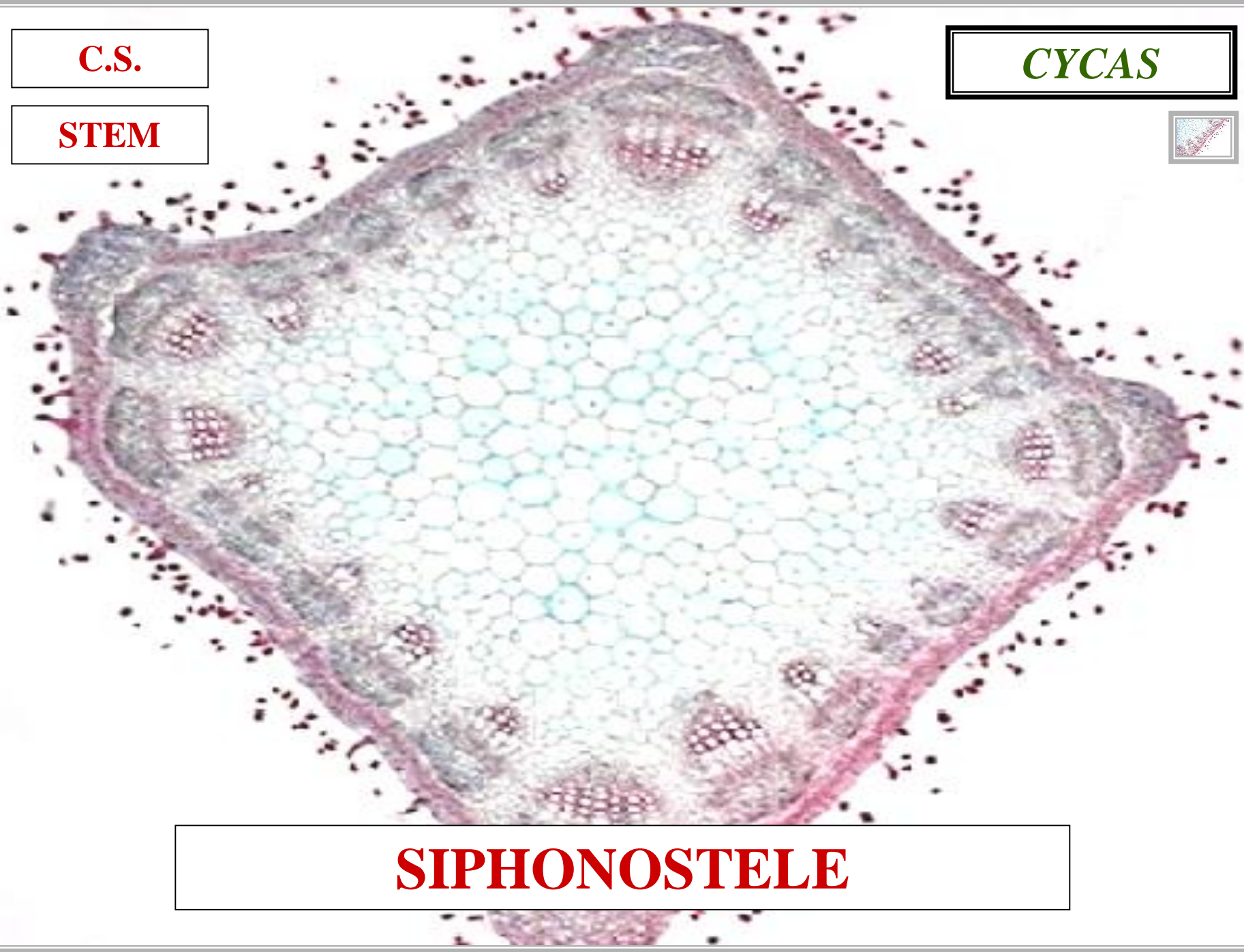
**C.S.**

**STEM**

**CYCAS**



**SIPHONOSTELE**



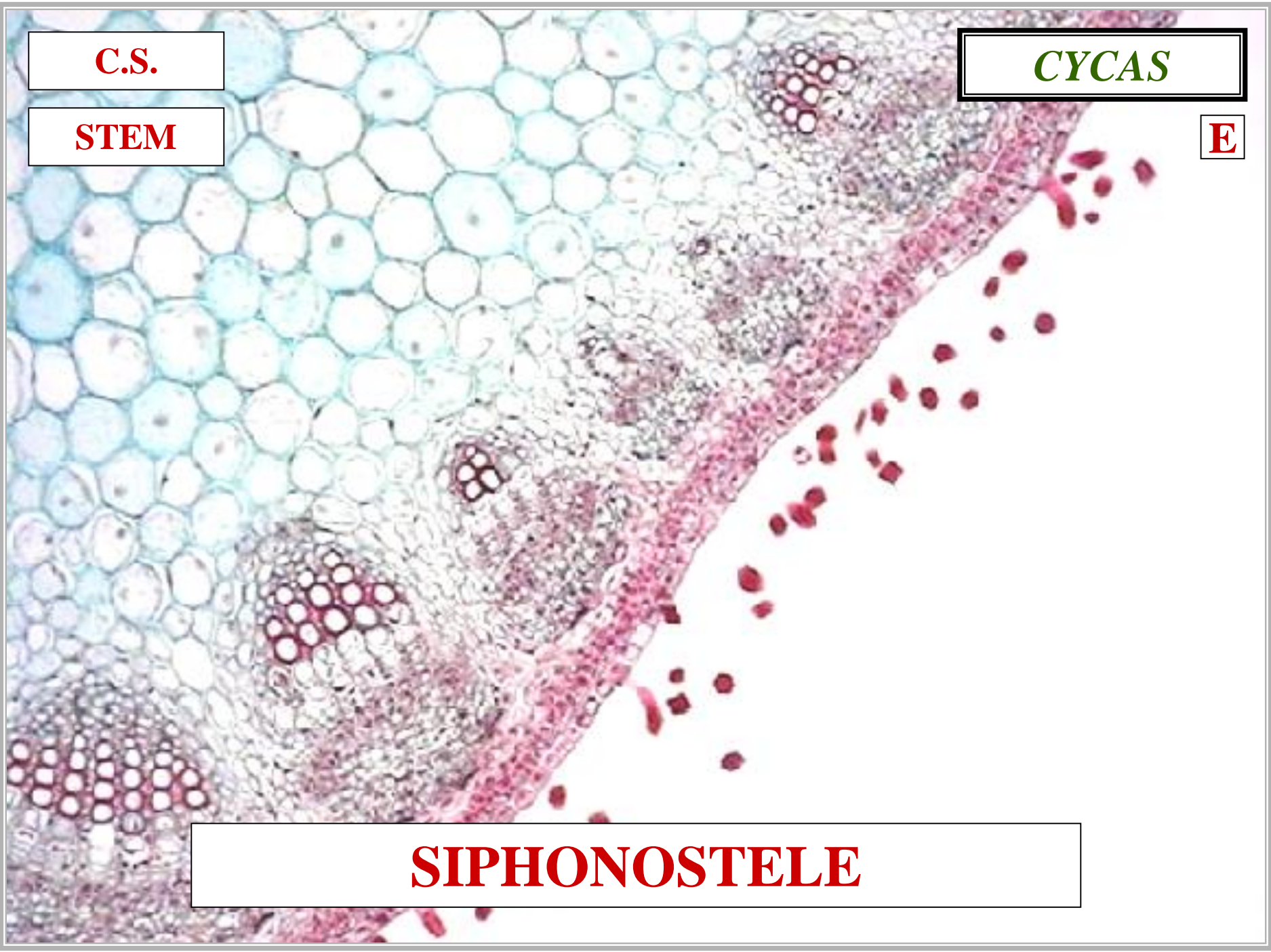
**C.S.**

**STEM**

***CYCAS***

**E**

**SIPHONOSTELE**



**C.S.**

**STEM**

**CYCAS**

**V**

**SIPHONOSTELE / EUSTELE**



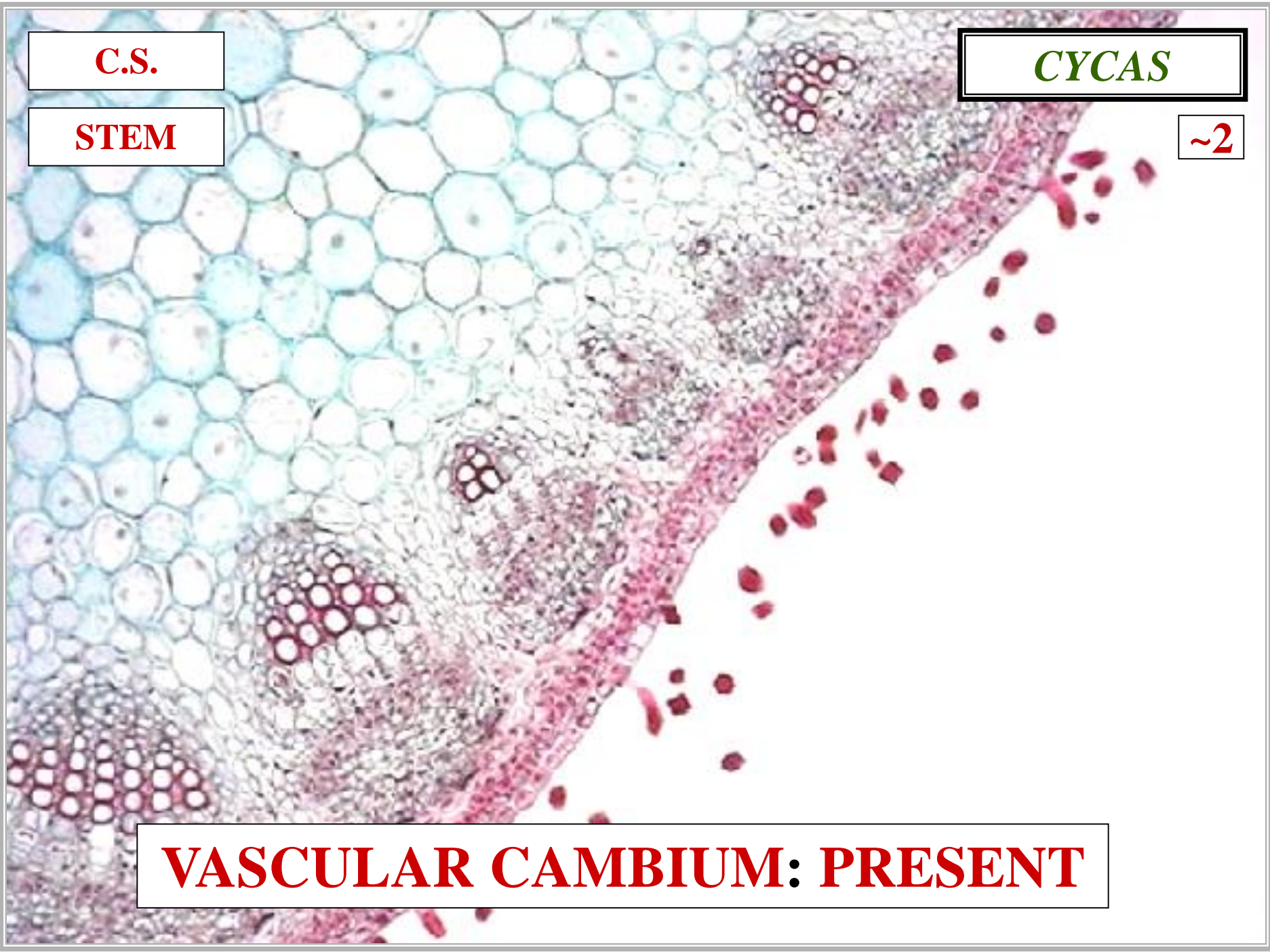
**C.S.**

**STEM**

***CYCAS***

**~2**

**VASCULAR CAMBIUM: PRESENT**



**C.S.**

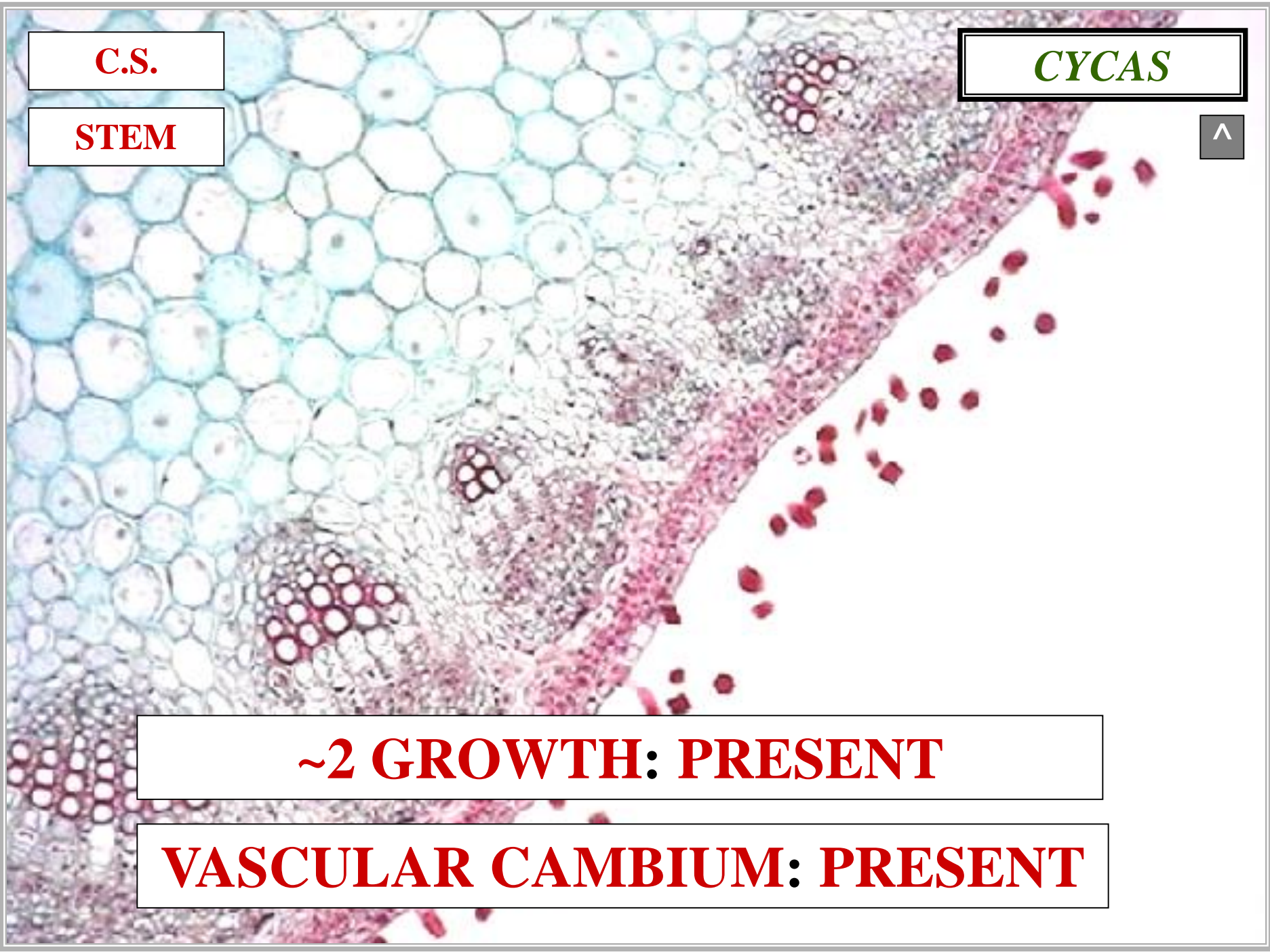
**STEM**

**CYCAS**



**~2 GROWTH: PRESENT**

**VASCULAR CAMBIUM: PRESENT**





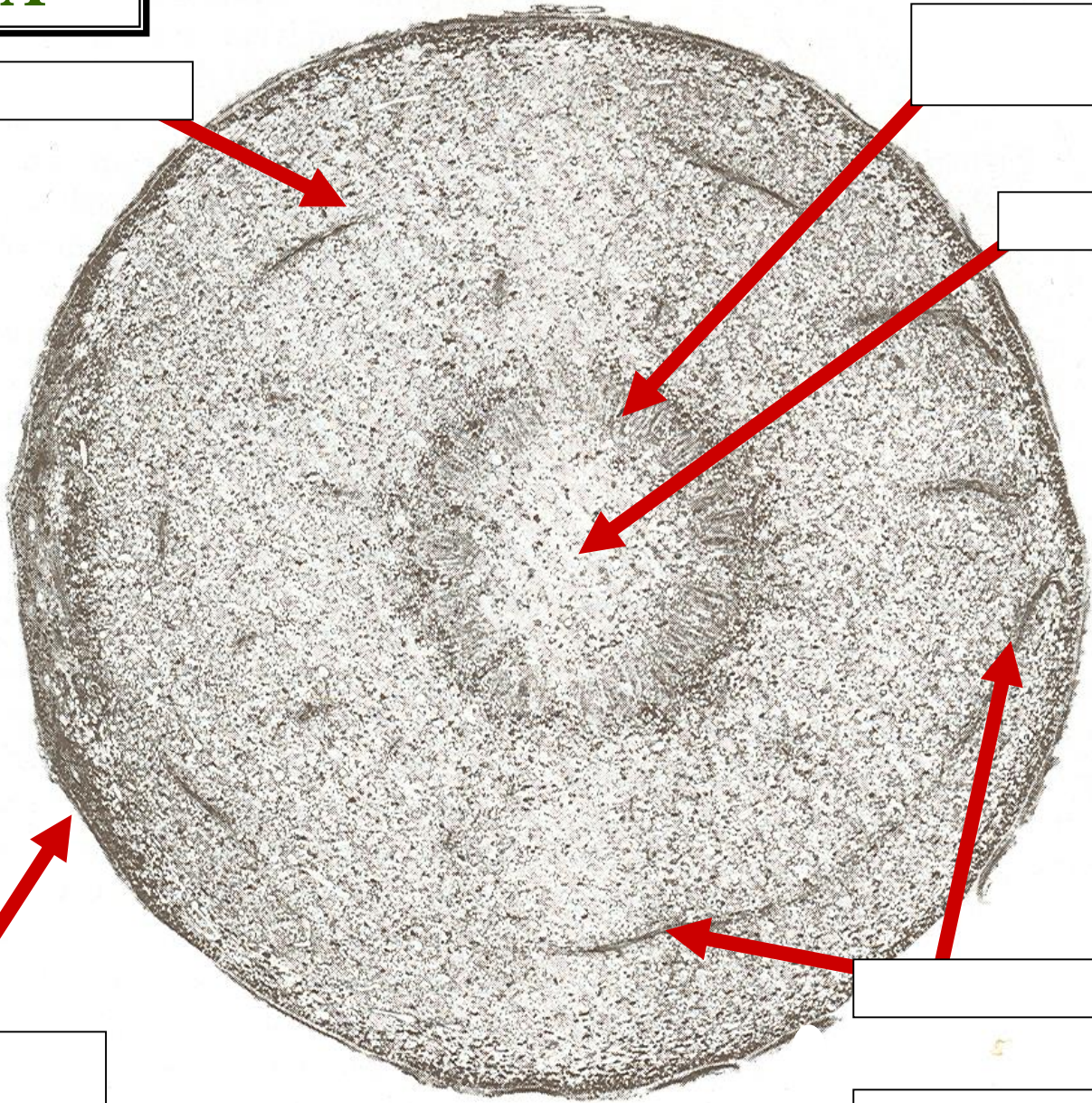
**STEM  
SECONDARY  
GROWTH  
ANATOMY**

# ZAMIA

[ ]

[ ]

[ ]



[ ? ]

[ ]

**STEM**

**C.S.**



# ZAMIA

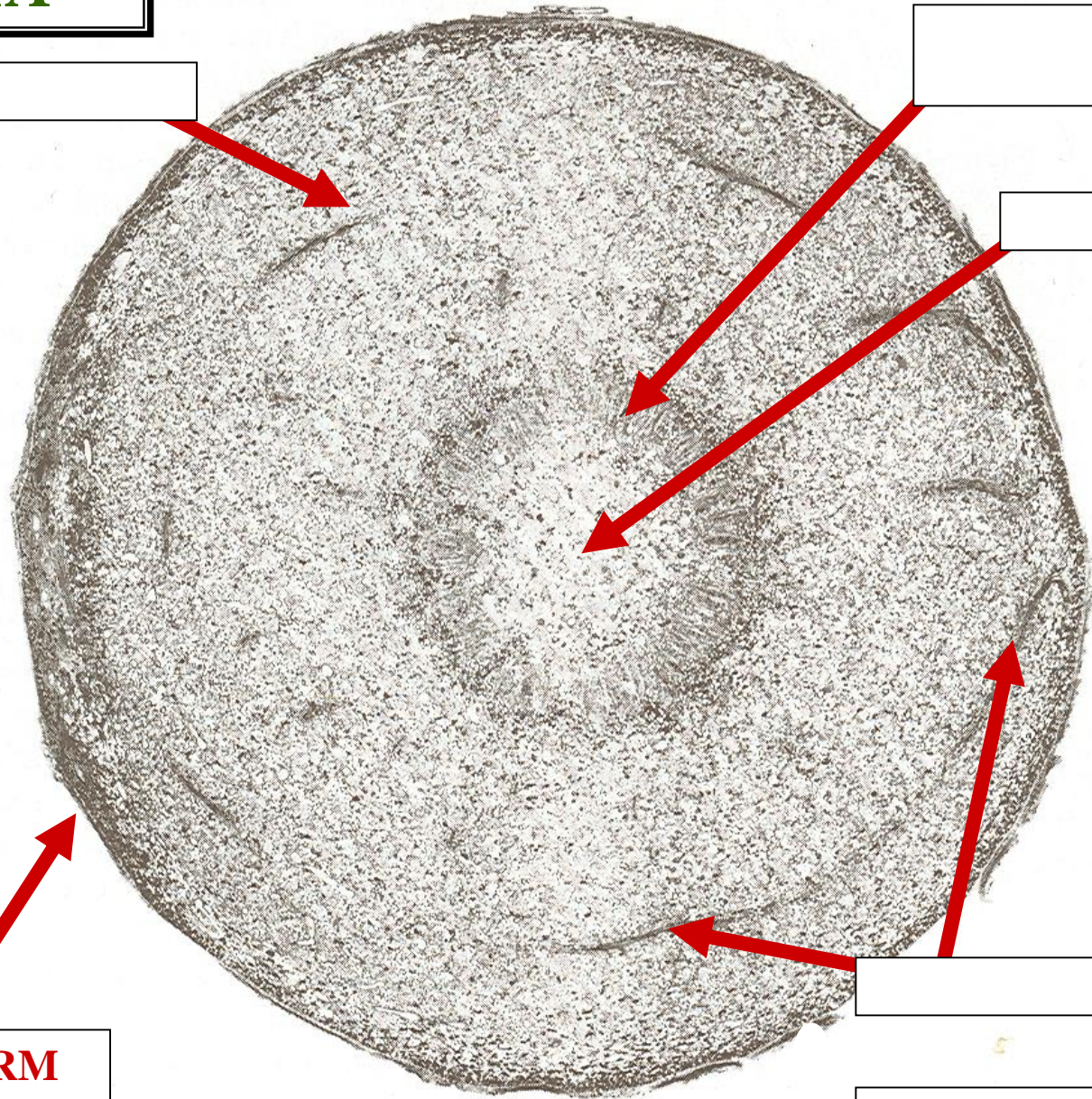
?



[Empty box]

[Empty box]

[Empty box]



**PERIDERM**

[Empty box]

**STEM**

**C.S.**

# ZAMIA

C

?



**STEM**

**C.S.**

**ZAMIA**

?

**CORTEX**



**STEM**

**C.S.**

**ZAMIA**

**M**

**?**

**CORTEX**



**STEM**

**C.S.**

**ZAMIA**

?

**MUCILAG  
CANAL**

**CORTEX**



**STEM**

**C.S.**

**ZAMIA**

**V**

**MUCILAG  
CANAL**

**CORTEX**

**?**



**STEM**

**C.S.**

**ZAMIA**

?

**MUCILAG  
CANAL**

**CORTEX**

**VASCULAR  
CAMBIUM**



**STEM**

**C.S.**

**B**

**ZAMIA**

**?**

**MUCILAG  
CANAL**

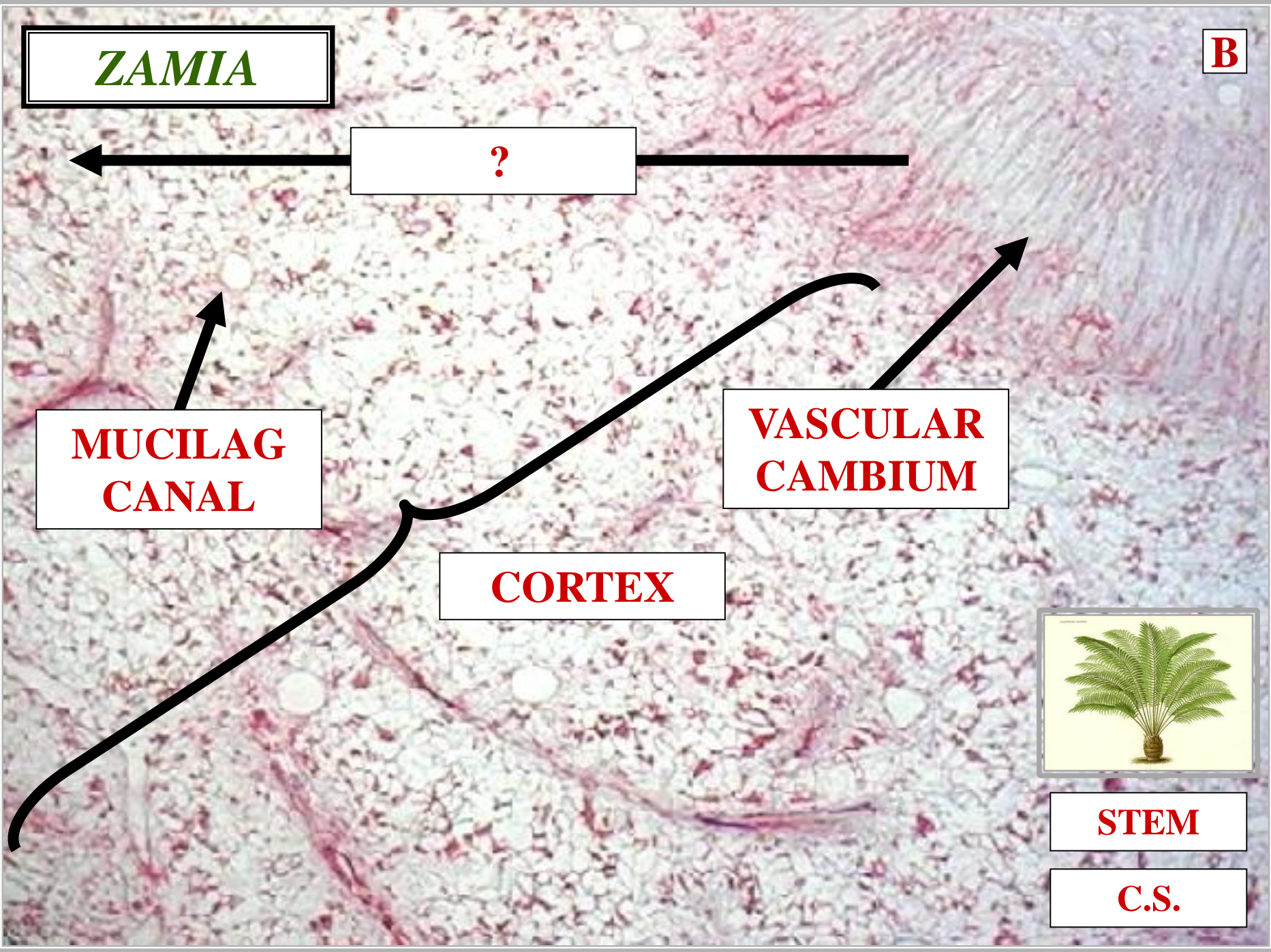
**VASCULAR  
CAMBIUM**

**CORTEX**



**STEM**

**C.S.**





?

**ZAMIA**

**BARK**

**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

**CORTEX**



**STEM**

**C.S.**

**ZAMIA**

**?**

**P**

**MUCILAG  
CANAL**

**CORTEX**

**VASCULAR  
CAMBIUM**



**STEM**

**C.S.**

**ZAMIA**

**~2 PHLOEM**

?

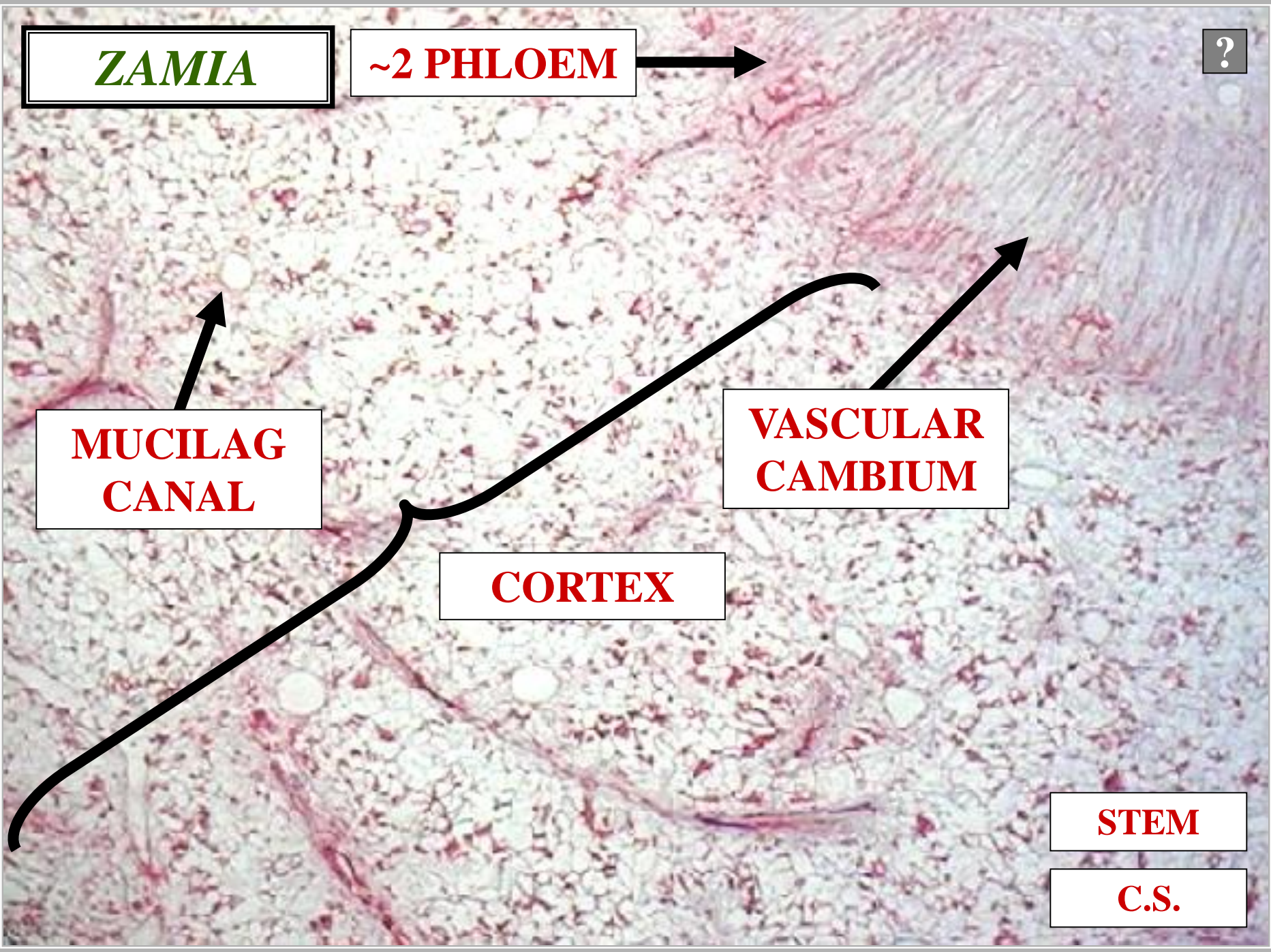
**MUCILAG  
CANAL**

**CORTEX**

**VASCULAR  
CAMBIUM**

**STEM**

**C.S.**



**ZAMIA**

**~2 PHLOEM**

**W**

**?**

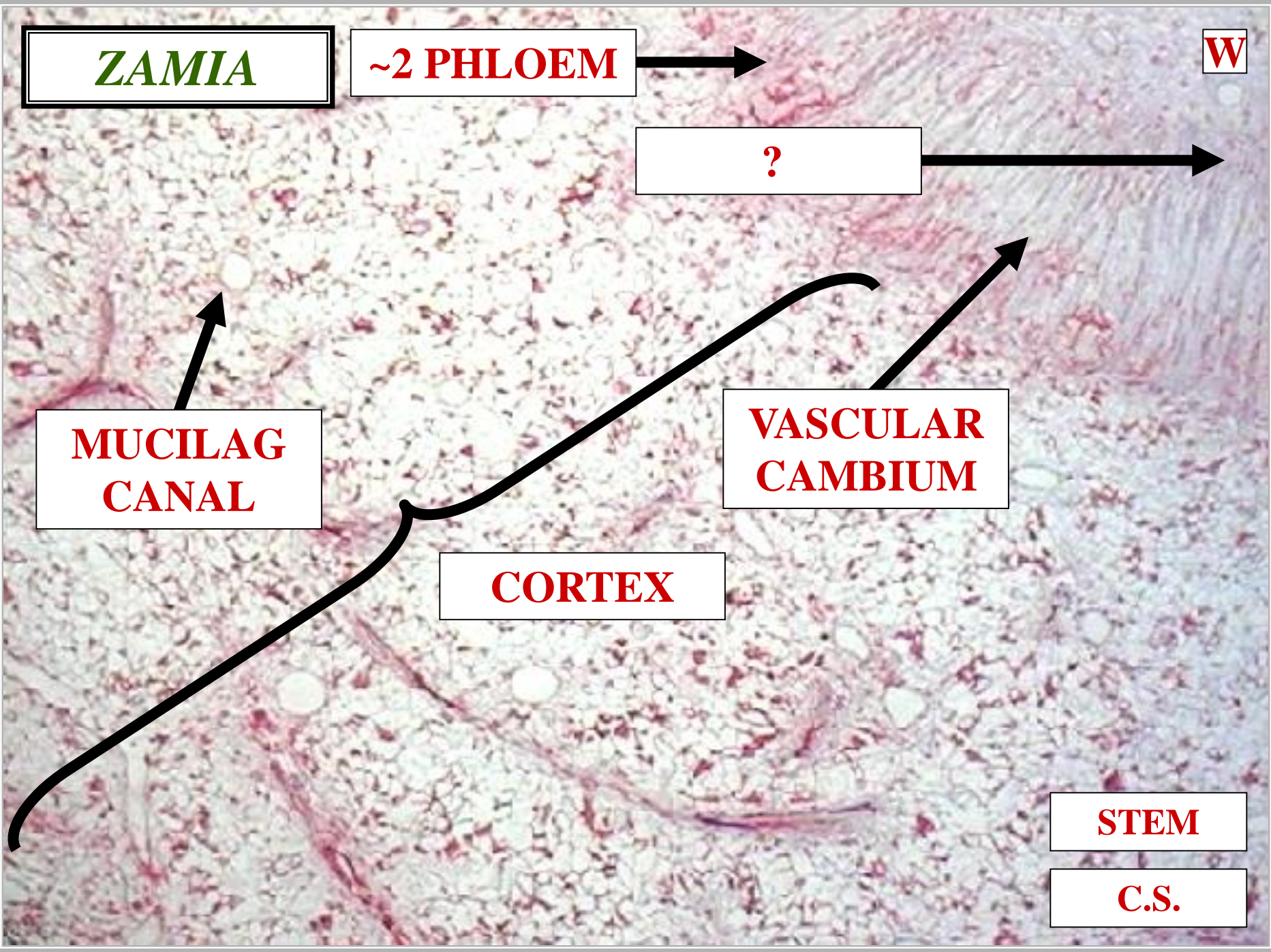
**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

**CORTEX**

**STEM**

**C.S.**



**ZAMIA**

**~2 PHLOEM**

?

**WOOD**

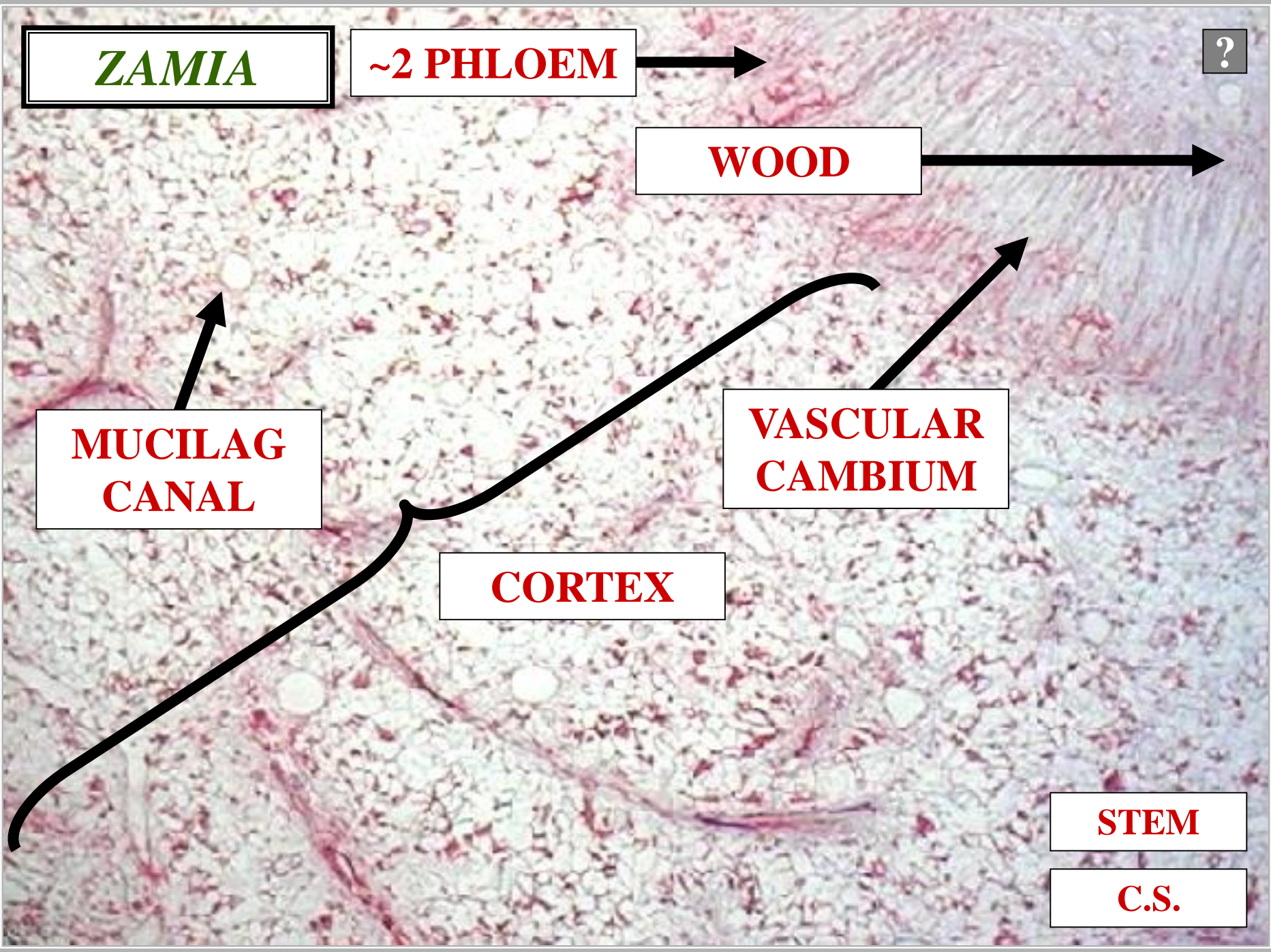
**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

**CORTEX**

**STEM**

**C.S.**



**ZAMIA**

**~2 PHLOEM**

**X**

**?**

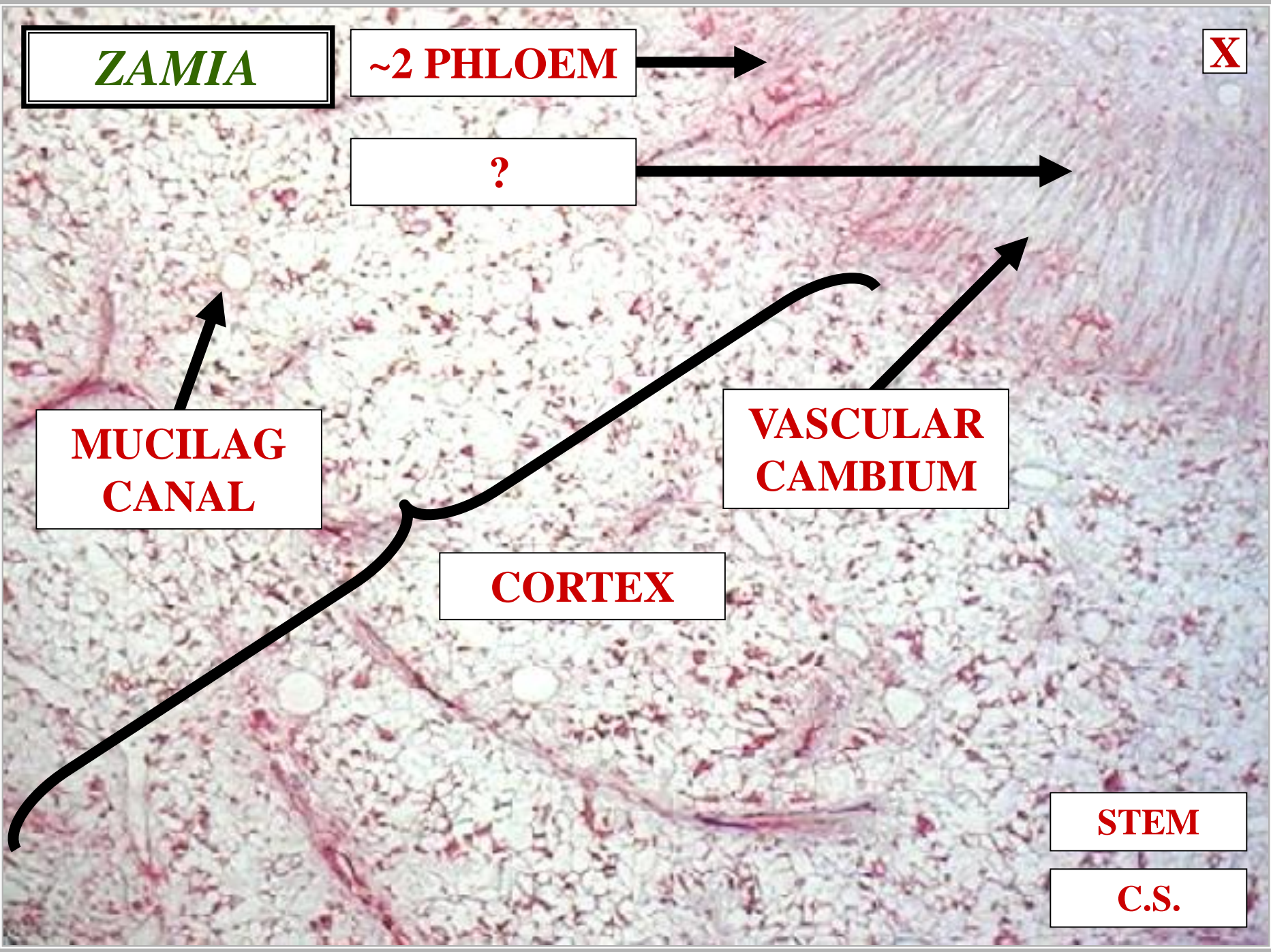
**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

**CORTEX**

**STEM**

**C.S.**



**ZAMIA**

**~2 PHLOEM**

**~2 XYLEM**

**MUCILAG  
CANAL**

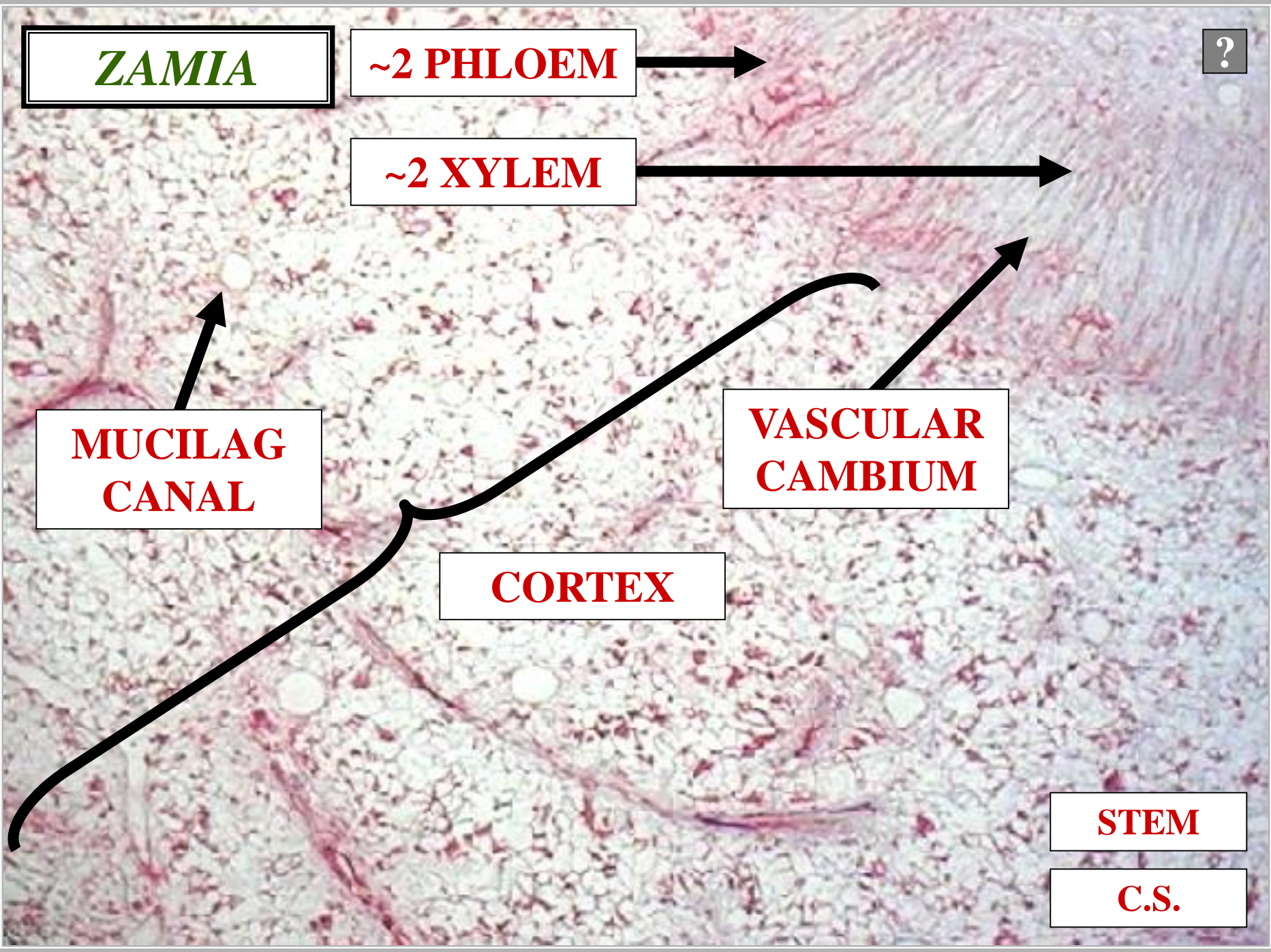
**VASCULAR  
CAMBIUM**

**CORTEX**

**STEM**

**C.S.**

**?**



**ZAMIA**

**~2 PHLOEM**

**~2 XYLEM**

**MUCILAG  
CANAL**

**CORTEX**

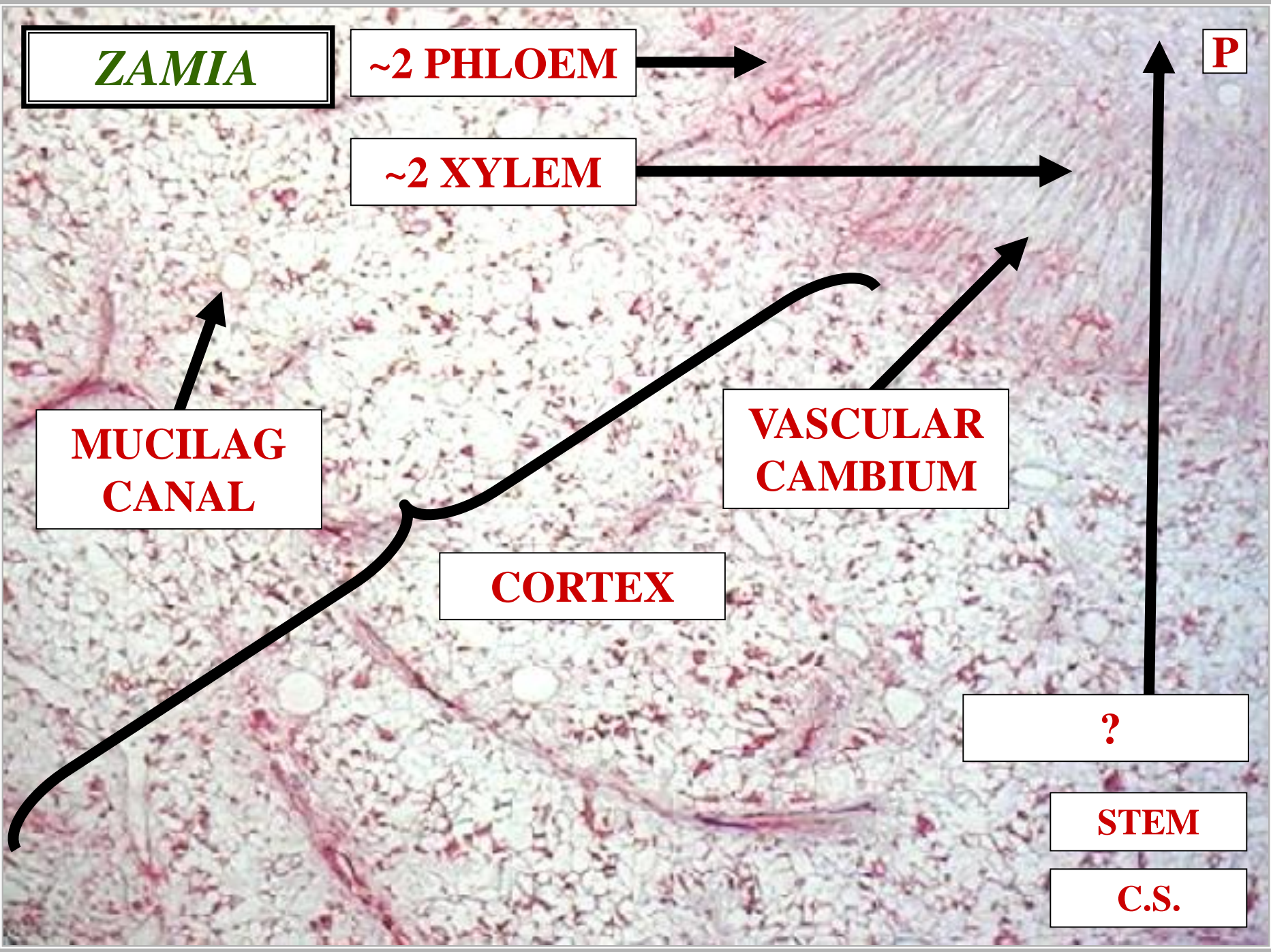
**VASCULAR  
CAMBIUM**

**P**

**?**

**STEM**

**C.S.**





**ZAMIA**

**~2 PHLOEM**

**~2 XYLEM**

**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

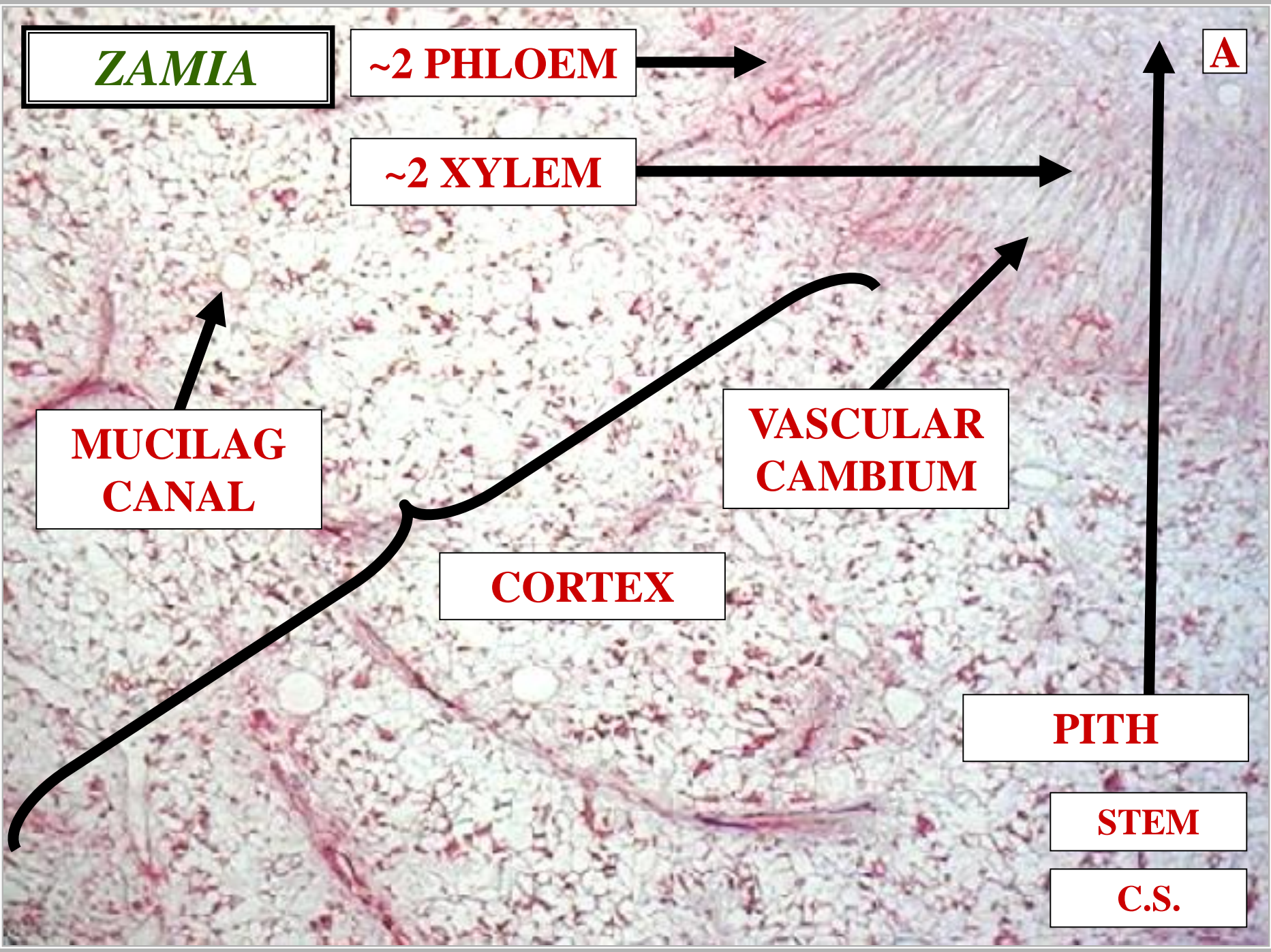
**CORTEX**

**PITH**

**STEM**

**C.S.**

**A**



**ZAMIA**

**~2 PHLOEM**

**~2 XYLEM**

**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

**CORTEX**

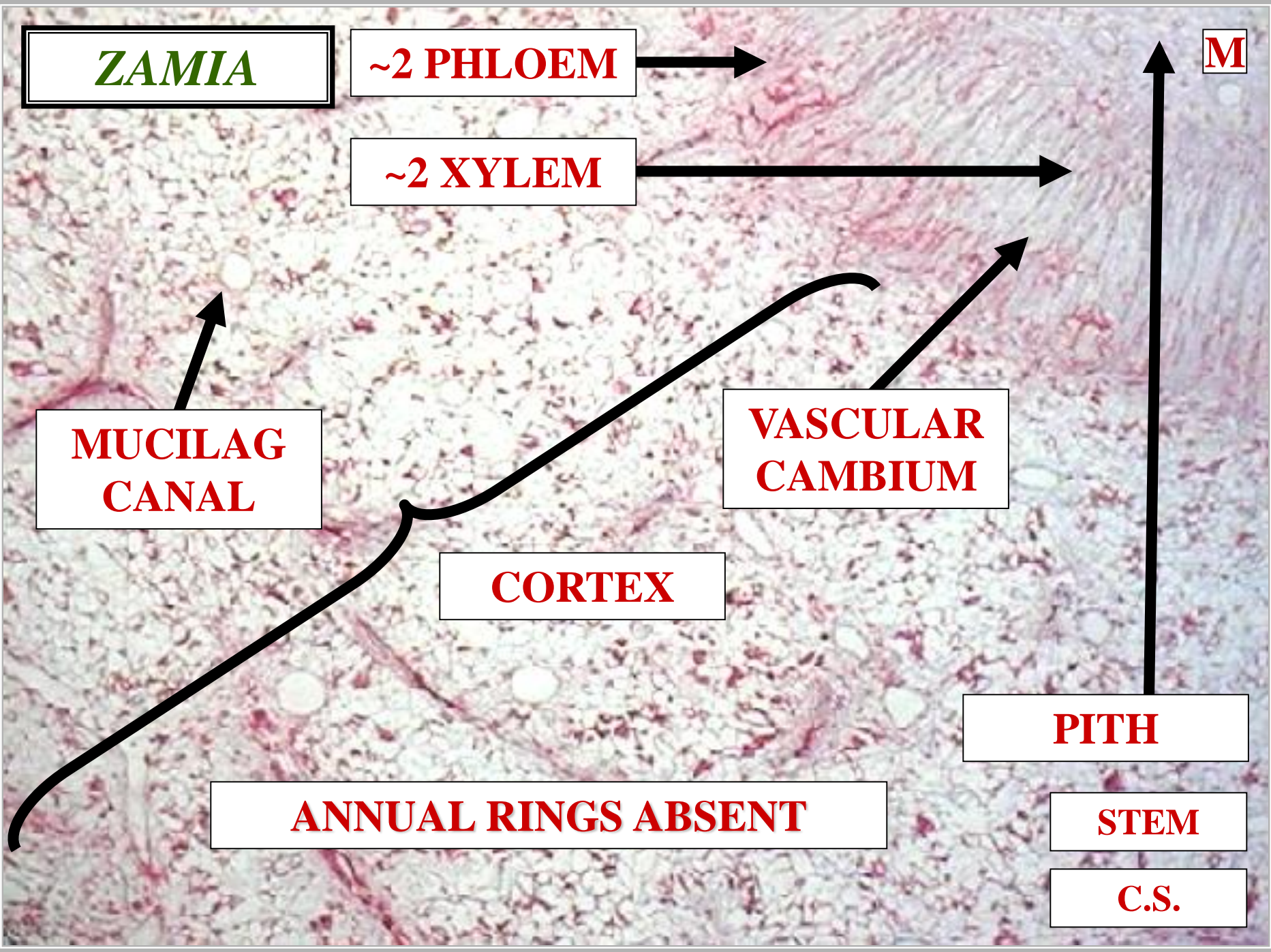
**ANNUAL RINGS ABSENT**

**PITH**

**STEM**

**C.S.**

**M**



**ZAMIA**

**~2 PHLOEM**

**~2 XYLEM**

**MUCILAG  
CANAL**

**VASCULAR  
CAMBIUM**

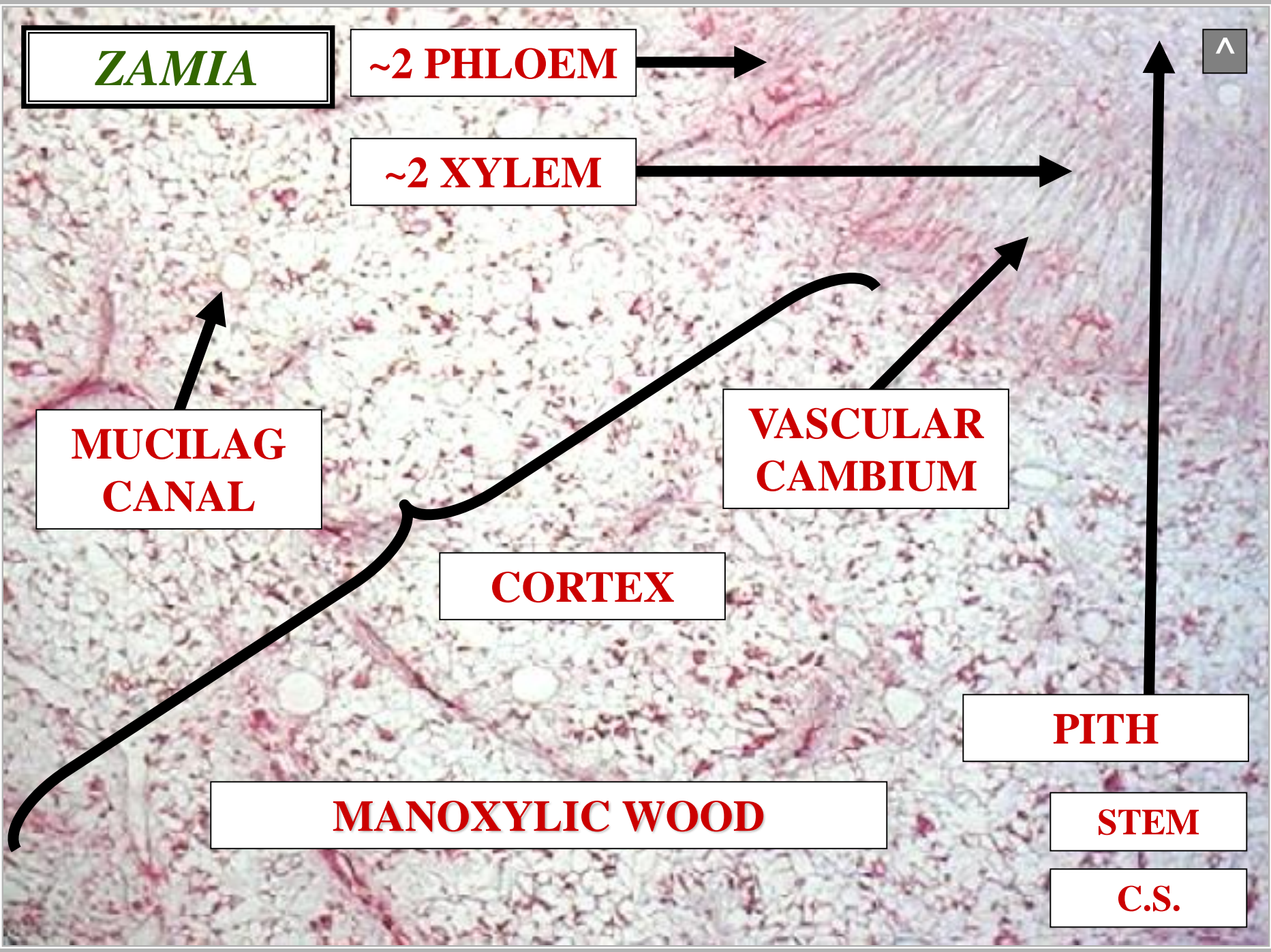
**CORTEX**

**PITH**

**MANOXYLIC WOOD**

**STEM**

**C.S.**





**LEAF**



Geoff S



A

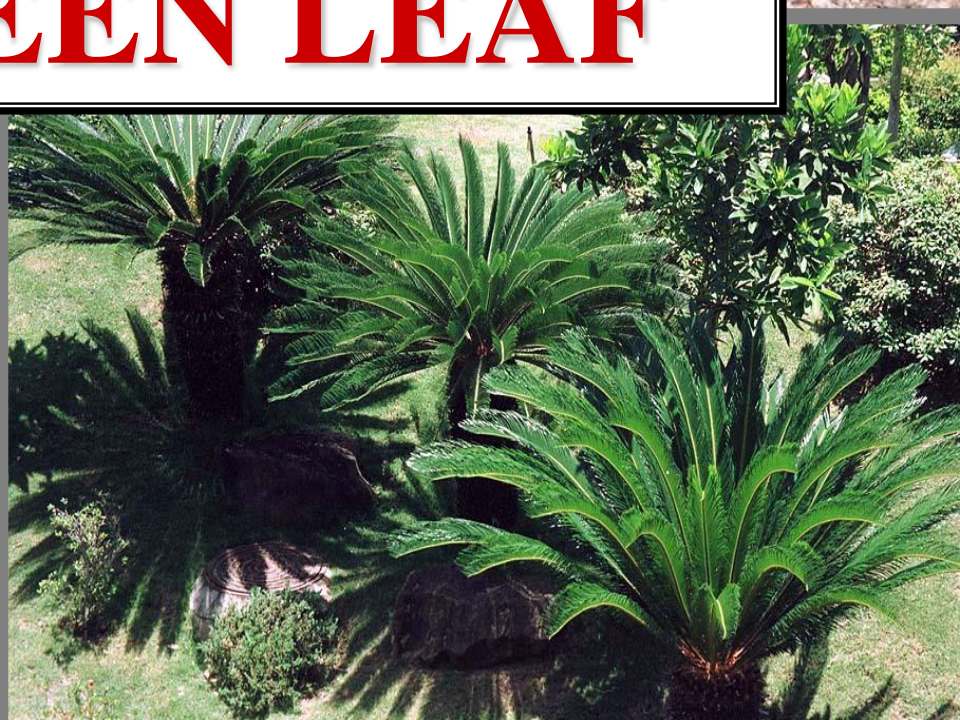




**LEAVES CLUSTERED STEM APEX**



# EVERGREEN LEAF



# **EVERGREEN LEAF**



**CYCADOPHYTA**  
**EVERGREEN LEAF**

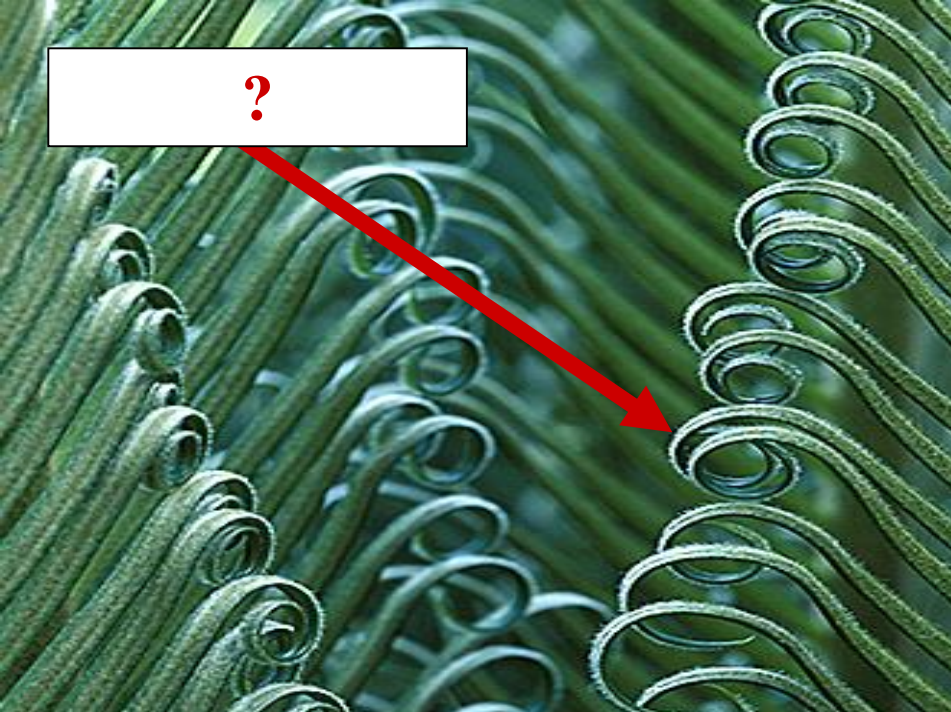


**FUNCTIONAL**  
**1+ SEASON**

**CYCADOPHYTA**  
**EVERGREEN LEAF**

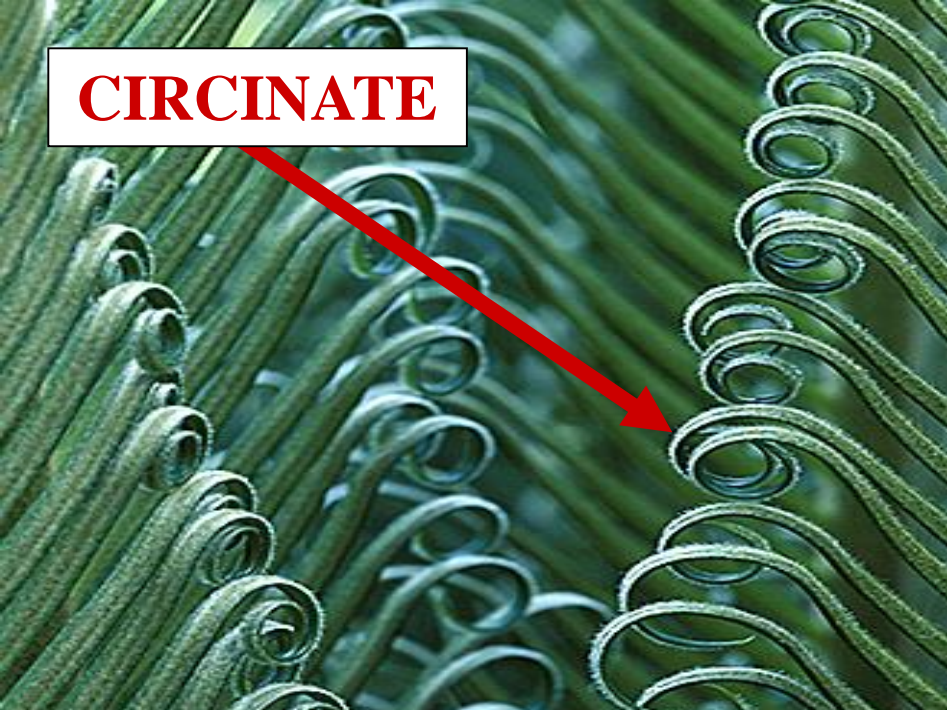


# LEAF VERNATION



C

**CIRCINATE**



# LEAF VASCULAR TRACE

**GIRDLED  
LEAF TRACE**

**CYCADOPHYTA**  
**EVERGREEN LEAF**



**LEAF**

**VASCULAR TRACE**

**ORIGIN 180 DEGREES**

**FROM LEAF**

**CYCADOPHYTA**  
**EVERGREEN LEAF**

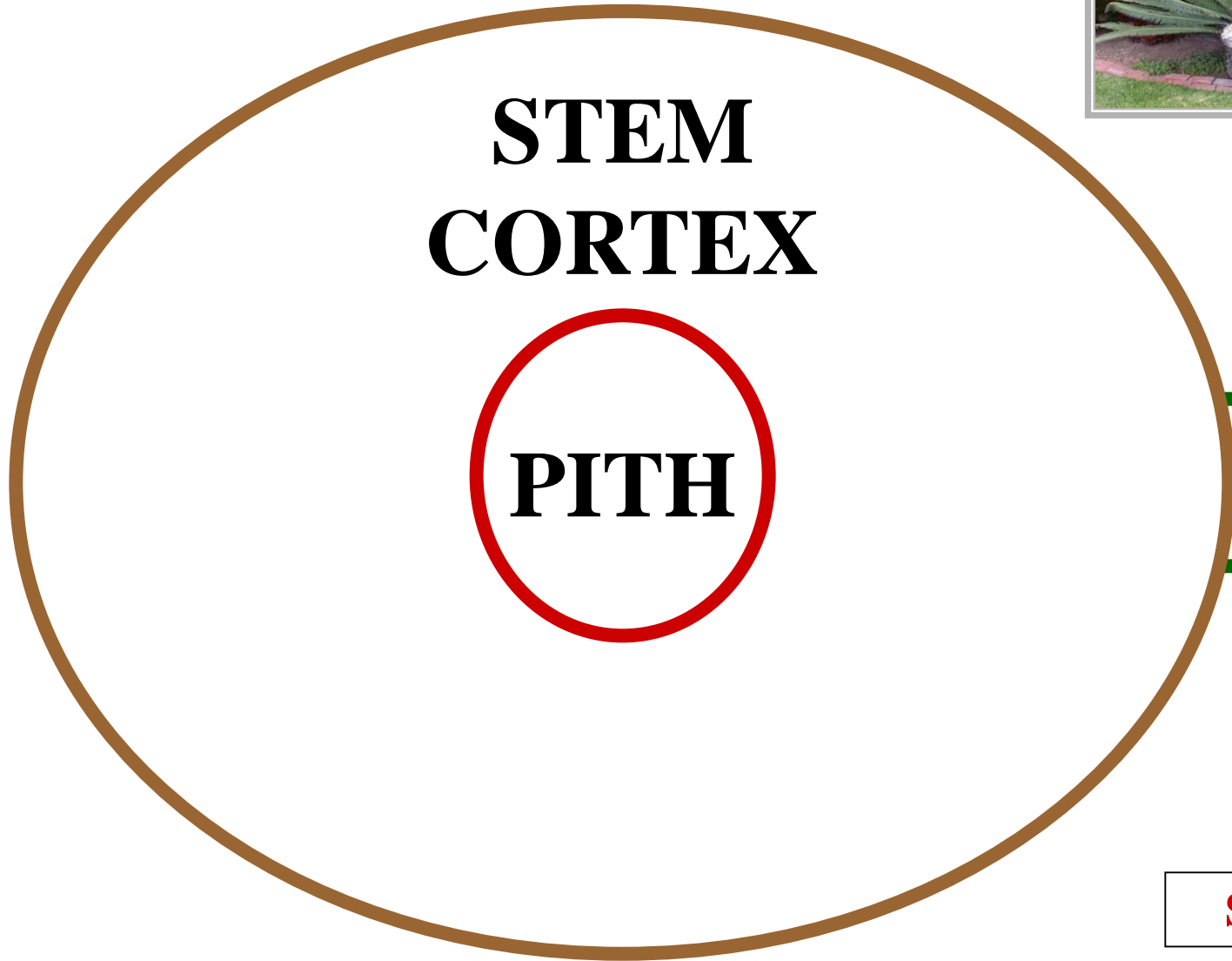


Geoff St





**ZAMIA**



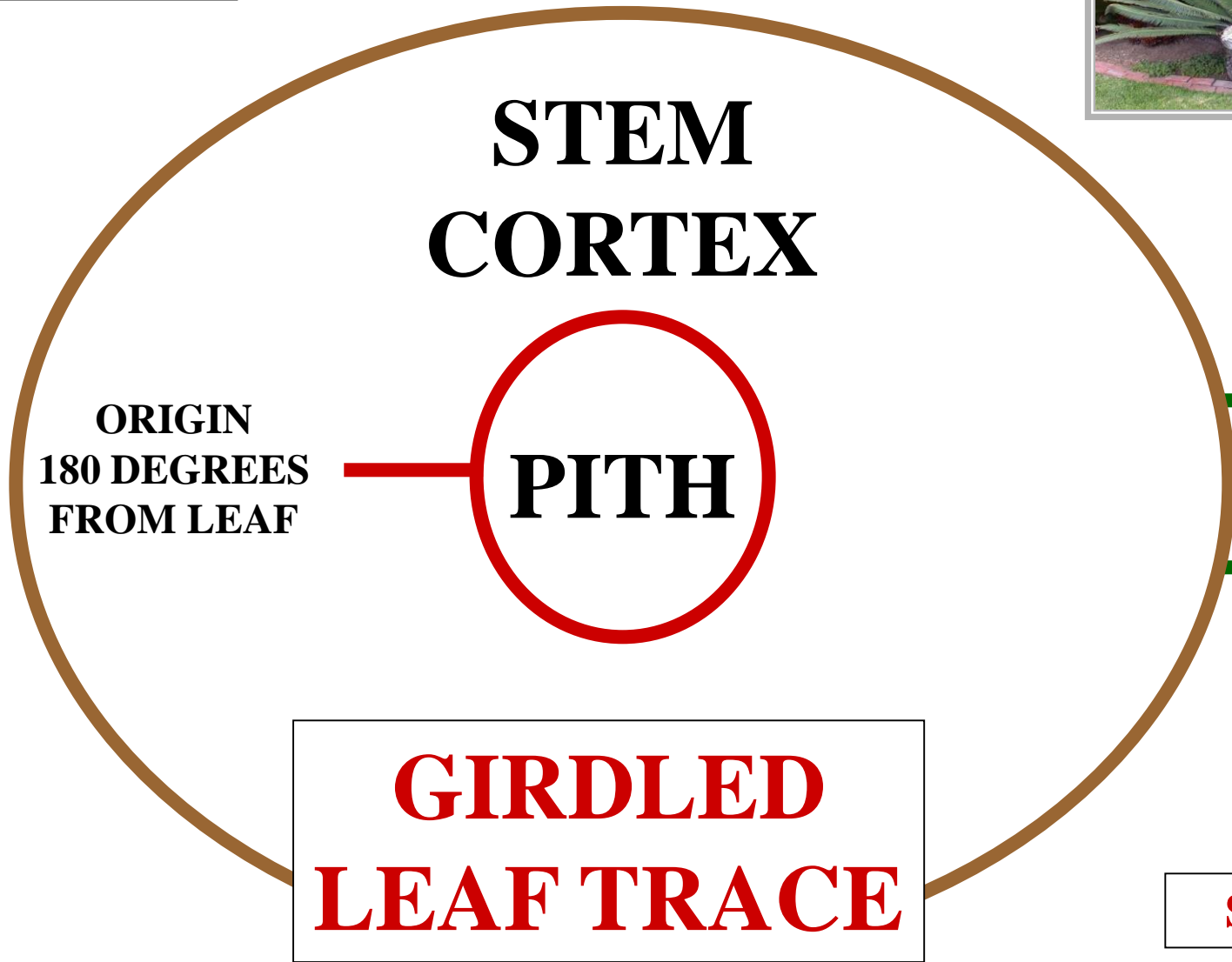
**LEAF**

**STEM**

**C.S.**

**— VASCULAR TISSUE**

# ZAMIA



**STEM  
CORTEX**

**ORIGIN  
180 DEGREES  
FROM LEAF**

**PITH**

**LEAF**

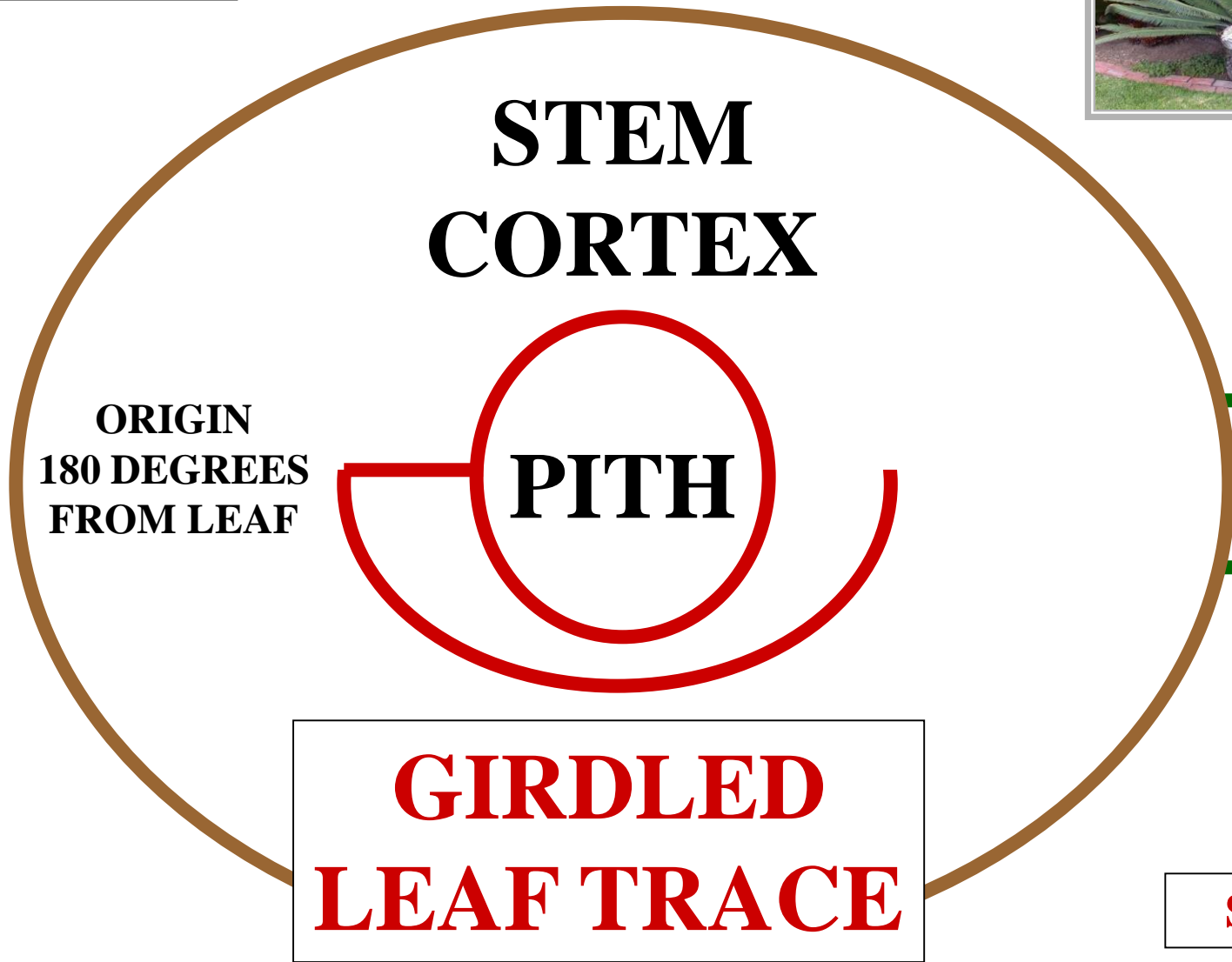
**GIRDLED  
LEAF TRACE**

**STEM**

**C.S.**

**VASCULAR TISSUE**

# ZAMIA



**STEM  
CORTEX**

**ORIGIN  
180 DEGREES  
FROM LEAF**

**PITH**

**LEAF**

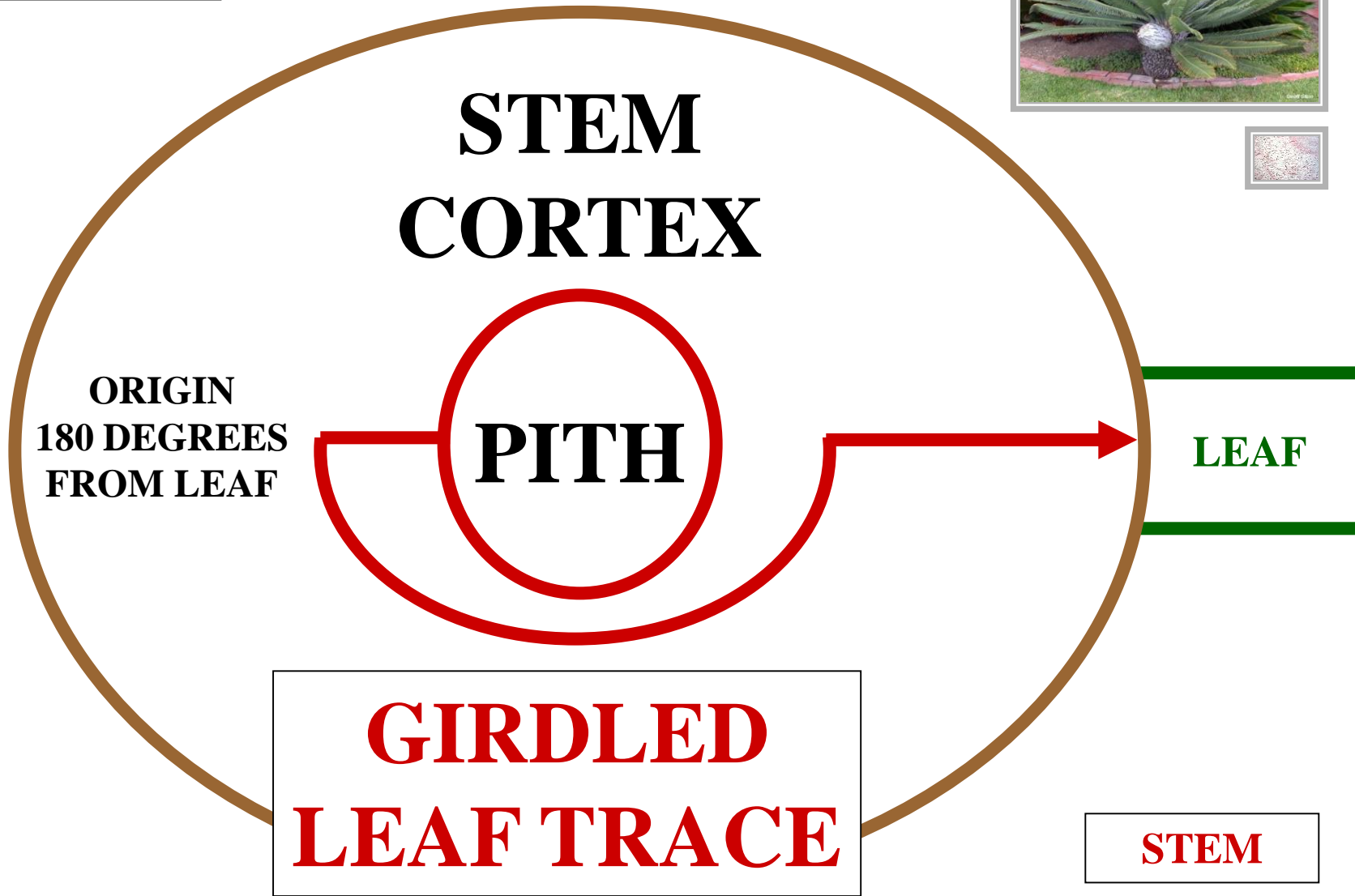
**GIRDLED  
LEAF TRACE**

**STEM**

**C.S.**

**VASCULAR TISSUE**

# ZAMIA



ORIGIN  
180 DEGREES  
FROM LEAF

STEM  
CORTEX

PITH

LEAF

GIRDLED  
LEAF TRACE

STEM

C.S.

VASCULAR TISSUE