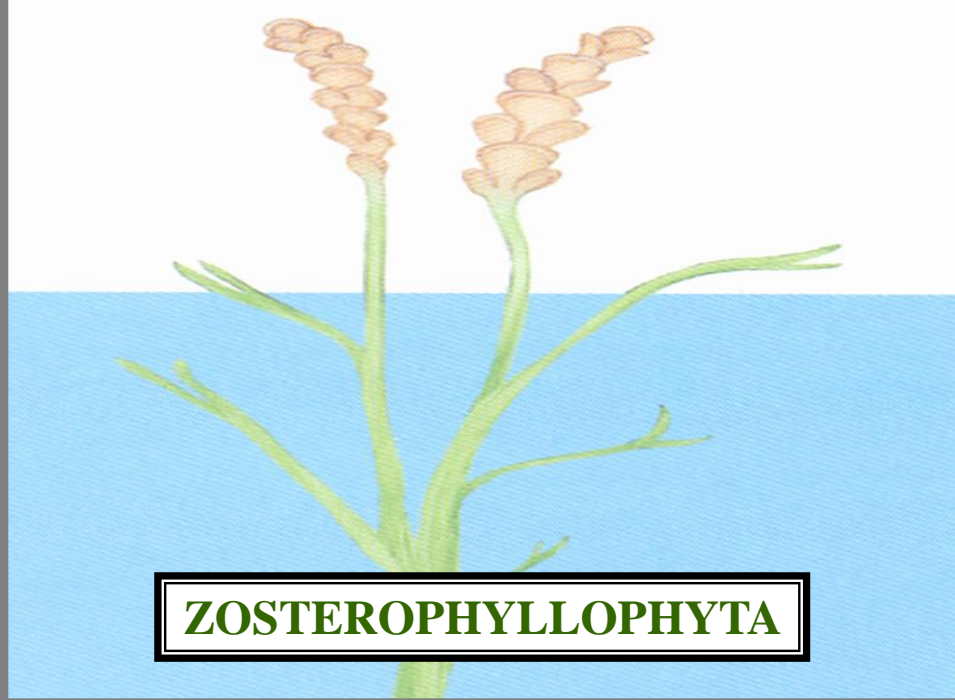


RHYNIOPHYTA

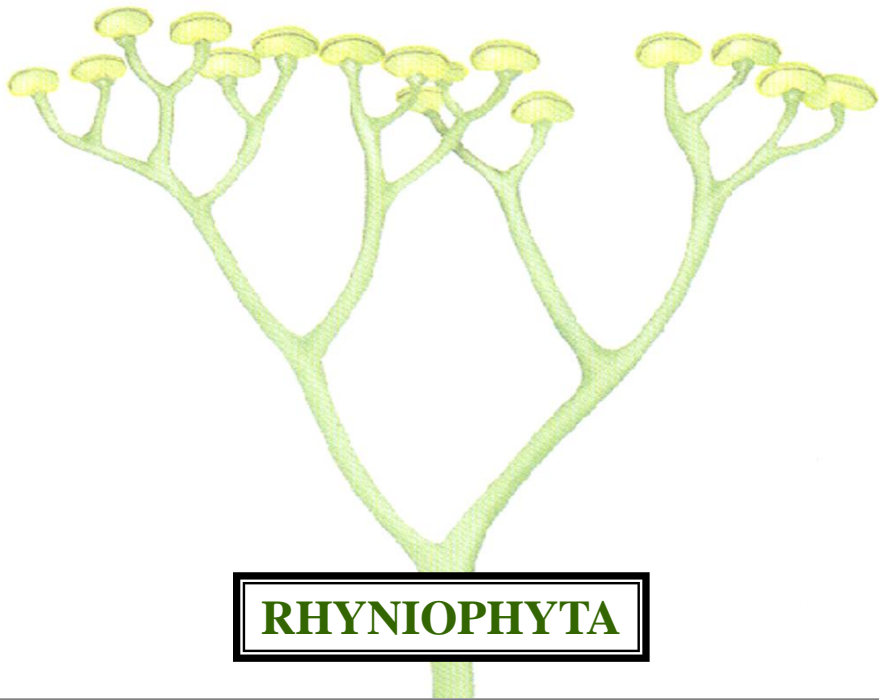


ZOSTEROPHYLLOPHYTA

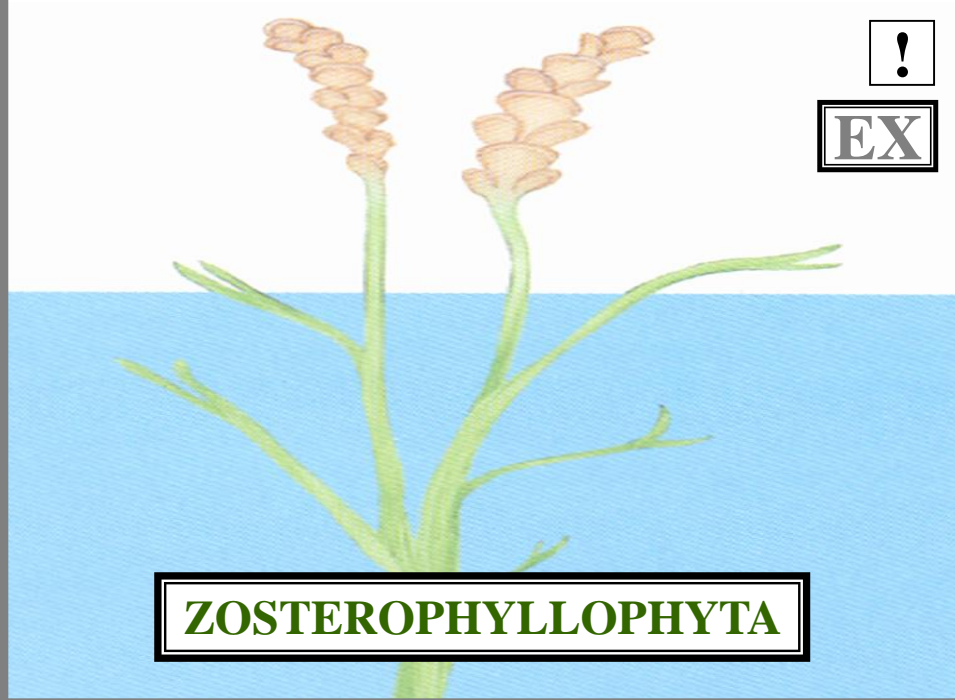


TRIMEROPHYTOPHYTA





RHYNIOPHYTA



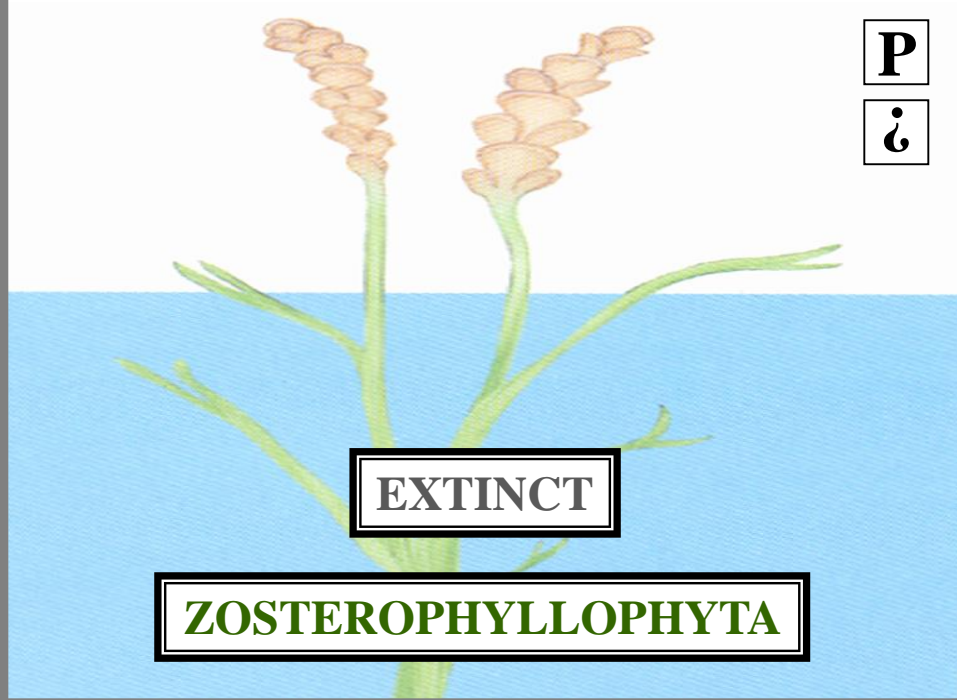
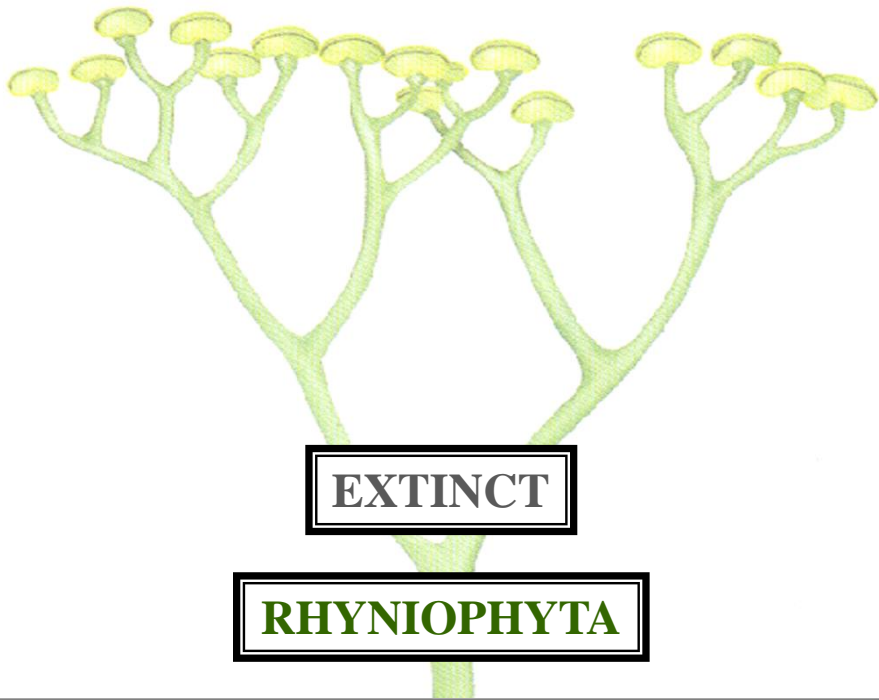
ZOSTEROPHYLLOPHYTA



TRIMEROPHYTOPHYTA



PROGYMNOSPERMOPHYTA



PALEOBOTANIST



PALEOBOTANIST

STUDIES

PLANT FOSSILS

AND

PLANT PHYLOGENY

PALEOBOTANIST



PALEOBOTANIST



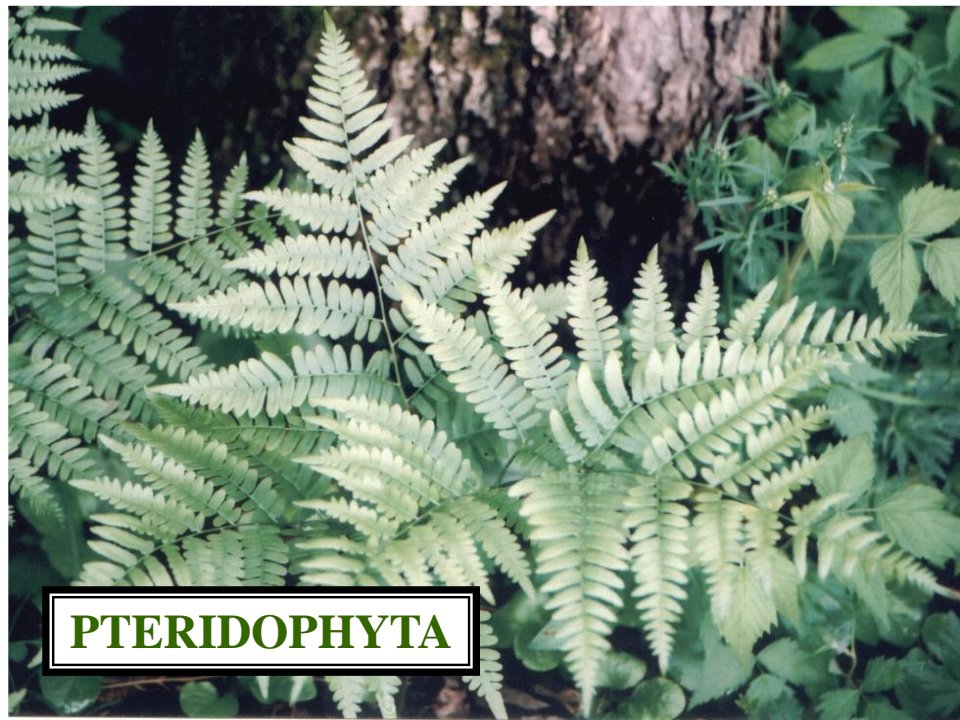
FOSSIL PLANT



EXTANT PTERIDOPHYTE PHYLA









EXTANT

LYCOPODIOPHYTA



P
i

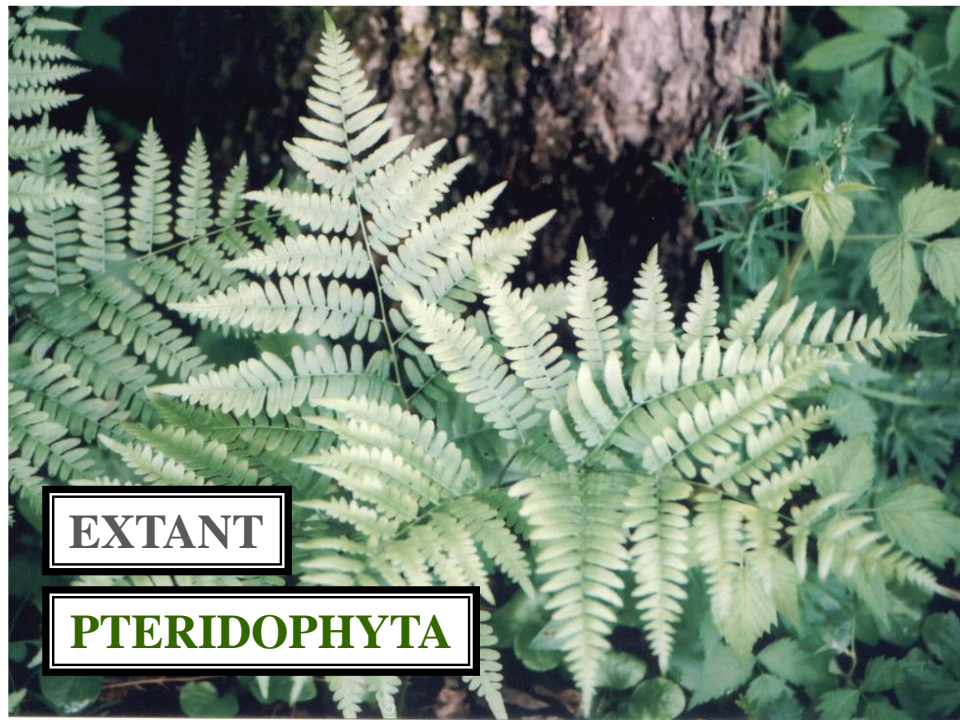
EXTANT

PTERIDOPHYTA



EXTANT

PTERIDOPHYTA



EXTANT

PTERIDOPHYTA

PTERIDOLOGIST



PTERIDOLOGIST

STUDIES

LYCOPHYTES

AND

FERNS

PTERIDOLOGIST



PTERIDOPHYTES

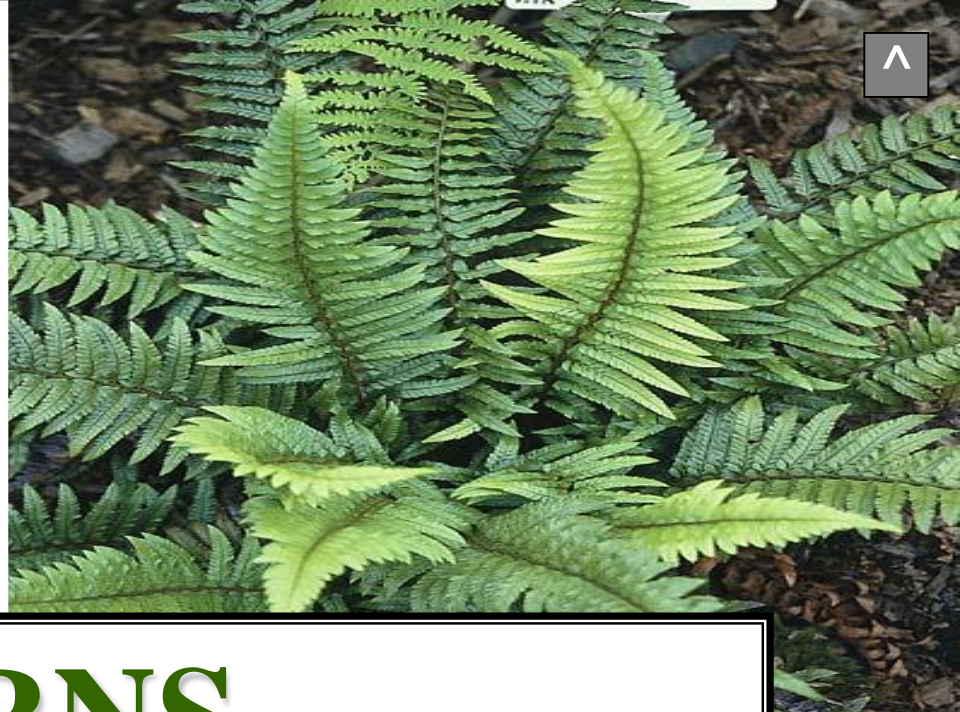


COMMON NAMES



LYCOPHYTES





FERNS





DIVERSITY



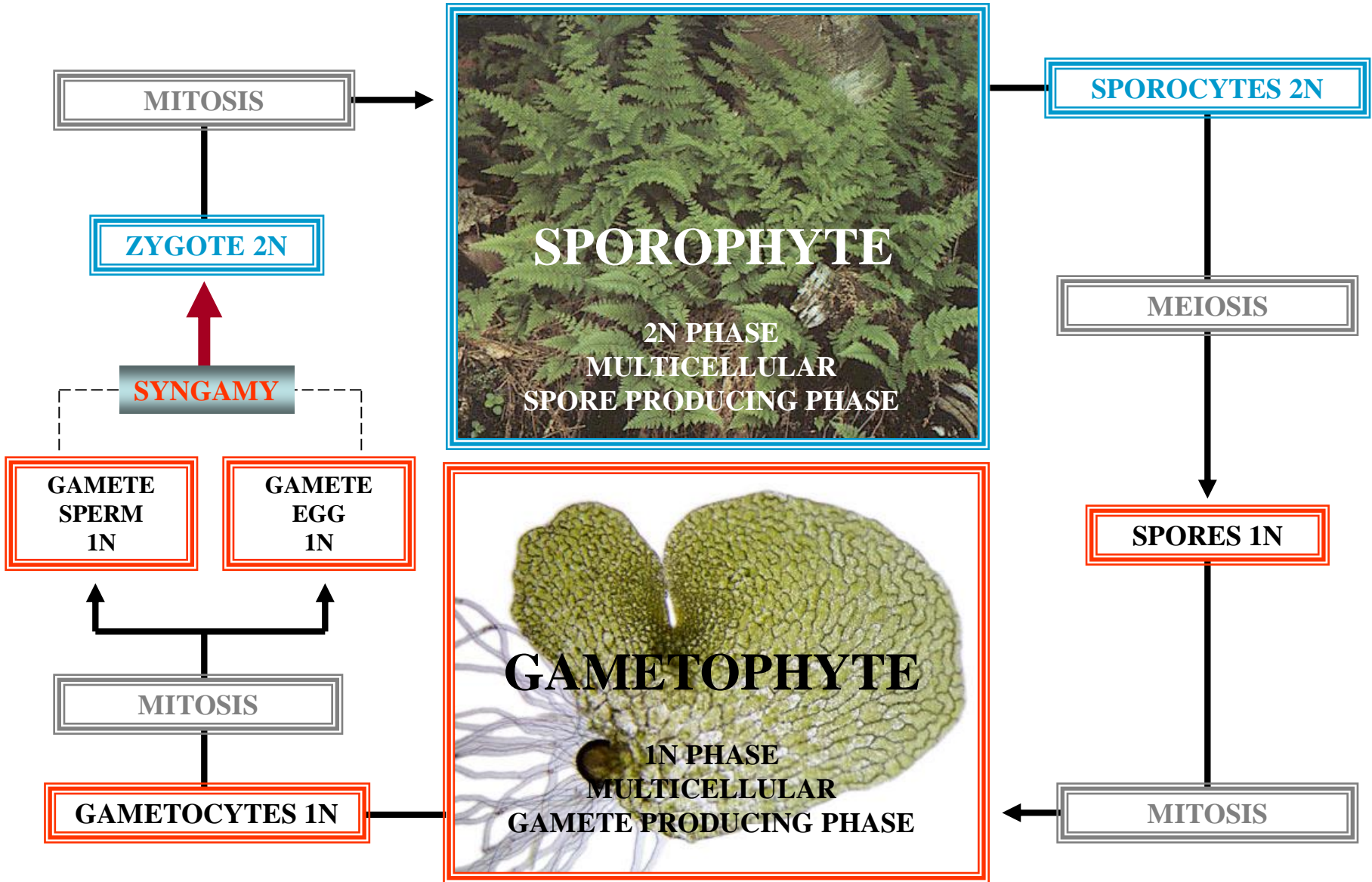
~12,000 SPECIES

EARTH



GENERAL CHARACTERS

PTERIDOPHYTE LIFE CYCLE



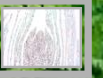


SPOROPHYTE CHARACTERS

MERISTEM



APICAL MERISTEM



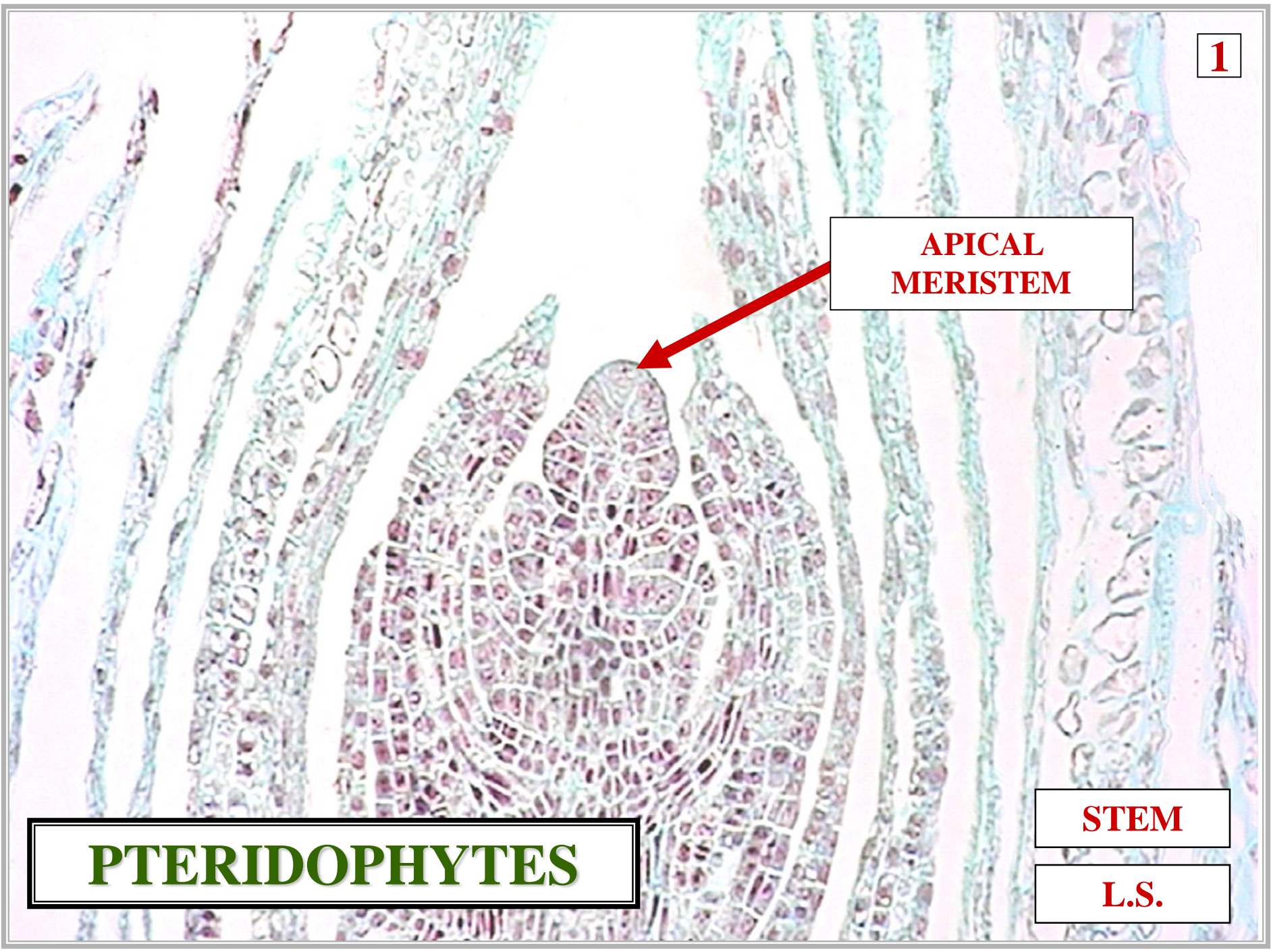
PTERIDOPHYTES

**APICAL
MERISTEM**

STEM

L.S.

PTERIDOPHYTES





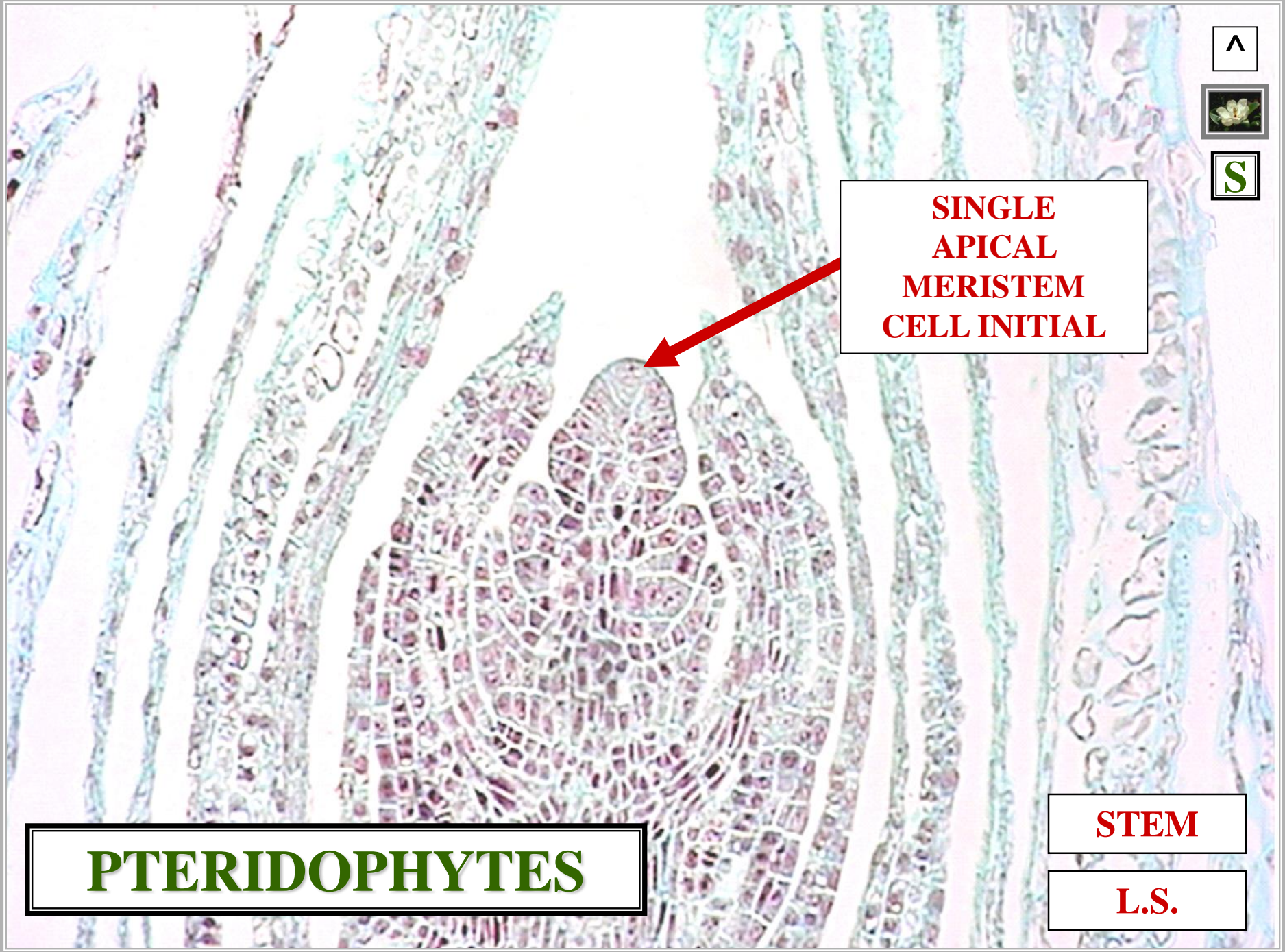
**SINGLE
APICAL
MERISTEM
CELL INITIAL**



STEM

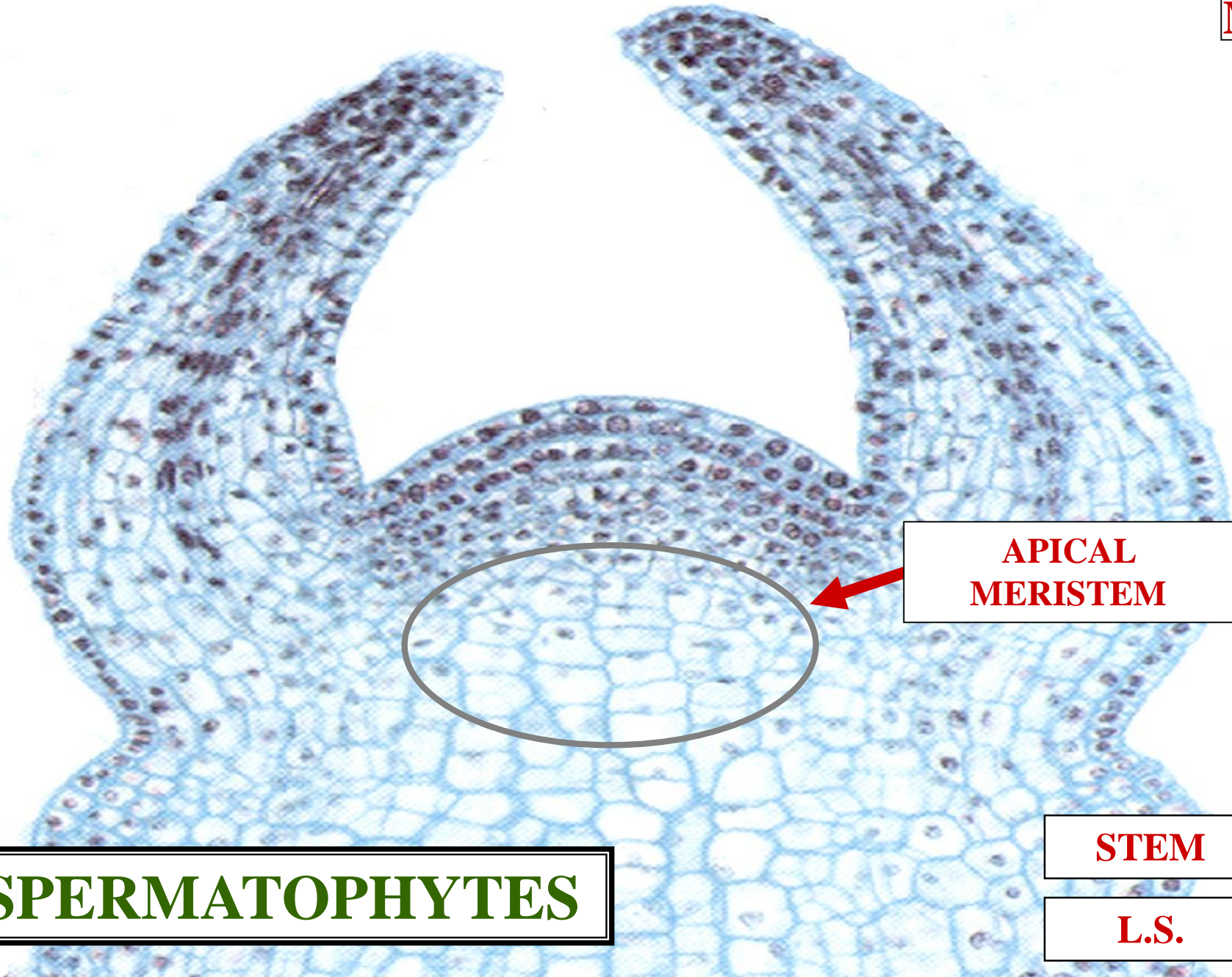
L.S.

PTERIDOPHYTES





SPERMATOPHYTES



**APICAL
MERISTEM**

STEM

L.S.

SPERMATOPHYTES

^

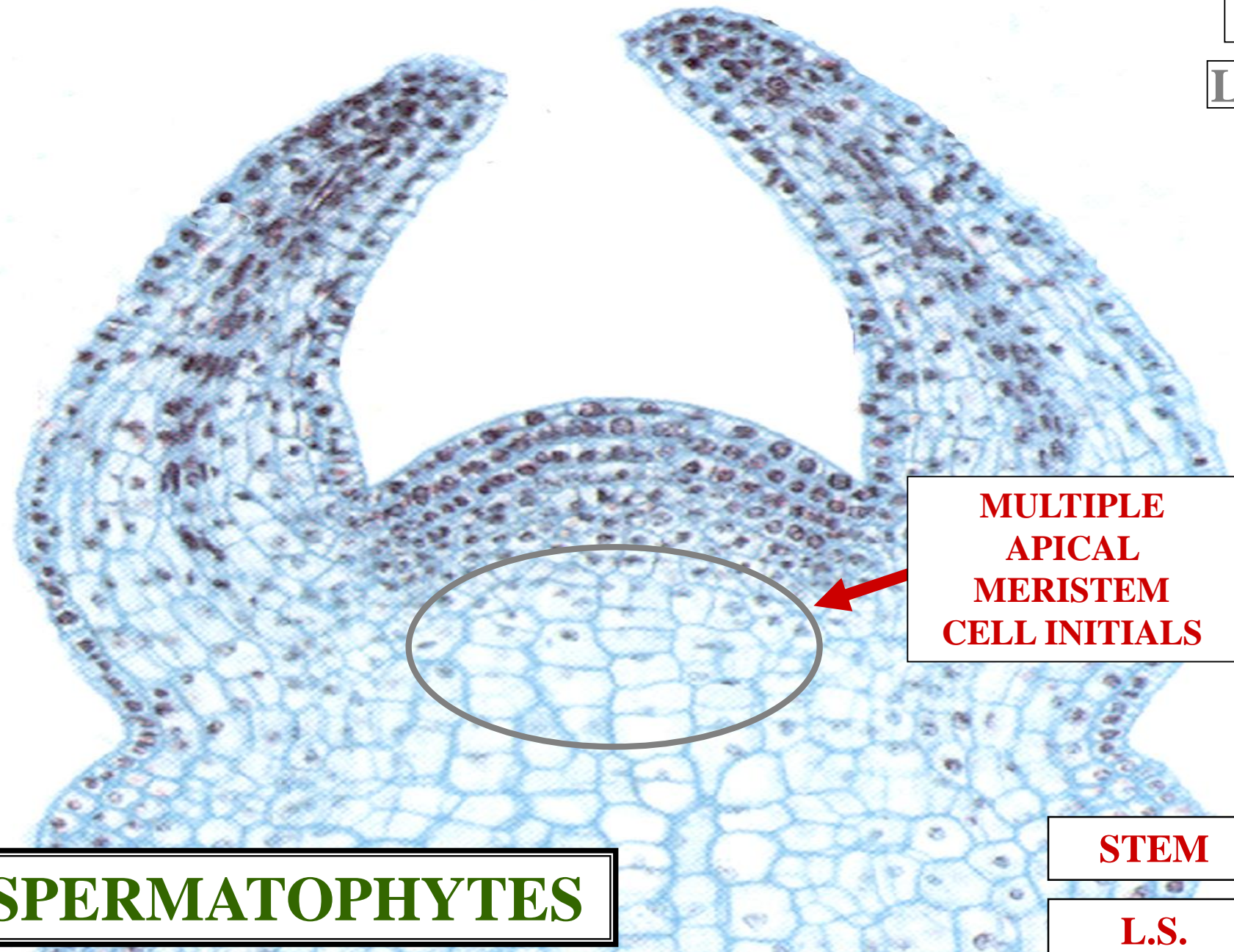
LM

**MULTIPLE
APICAL
MERISTEM
CELL INITIALS**

STEM

L.S.

SPERMATOPHYTES





LATERAL MERISTEM

LATERAL MERISTEMS

PTERIDOPHYTES



SG

+

LATERAL MERISTEMS: ABSENT

PTERIDOPHYTES



AB

!

SECONDARY GROWTH

PTERIDOPHYTES



^



S

SECONDARY GROWTH: ABSENT

PTERIDOPHYTES

LATERAL MERISTEMS

PR



SPERMATOPHYTES

LATERAL MERISTEMS: **PRESENT**

SG

+



SPERMATOPHYTES

SECONDARY GROWTH

PR

?



SPERMATOPHYTES

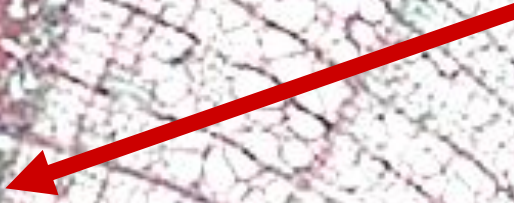
SECONDARY GROWTH: PRESENT

?



SPERMATOPHYTES

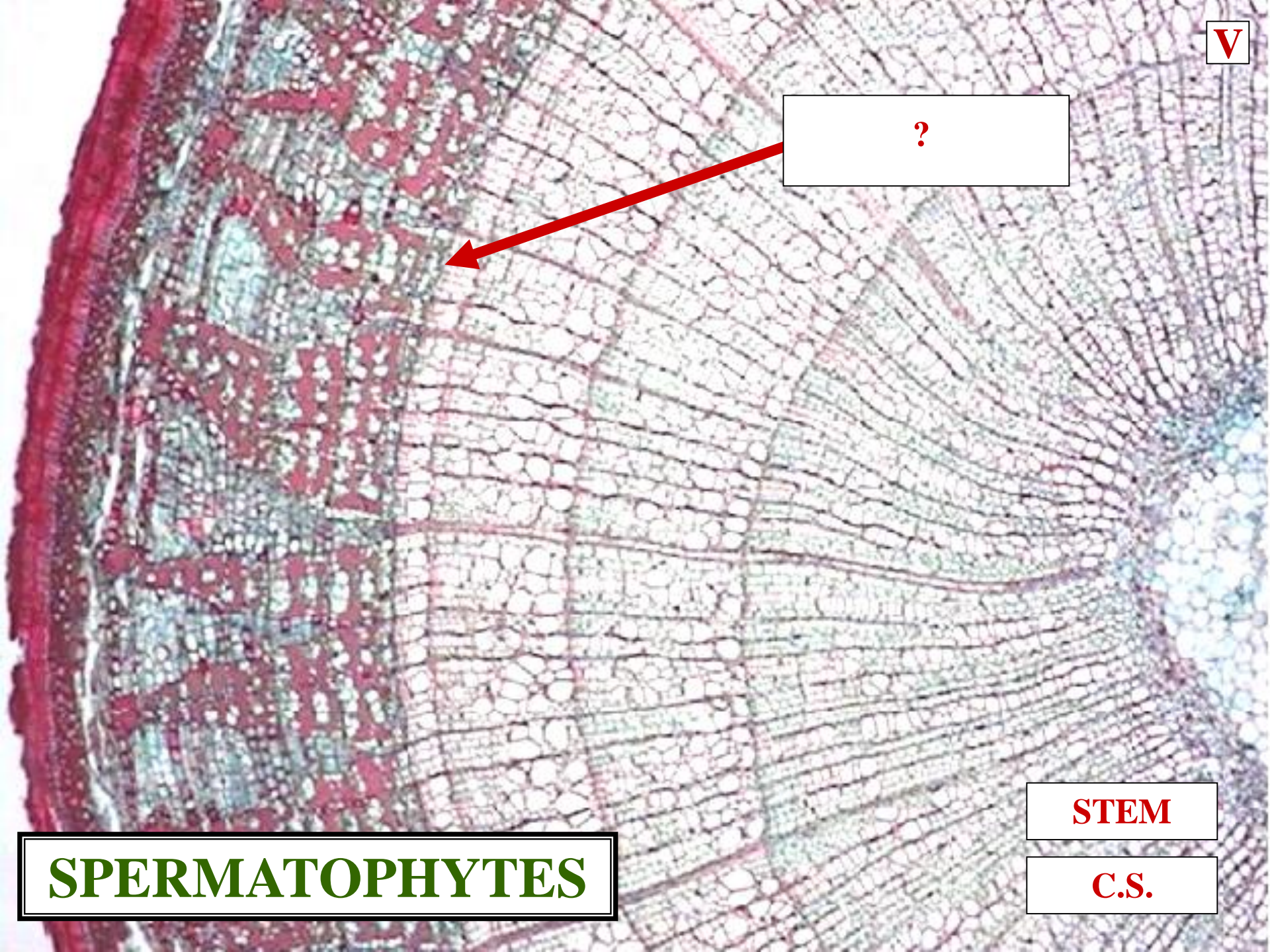
?



STEM

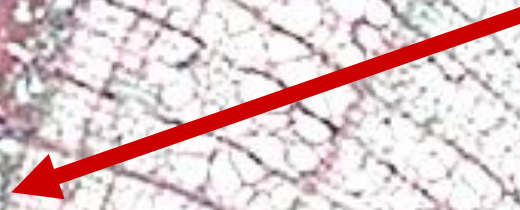
C.S.

SPERMATOPHYTES



?

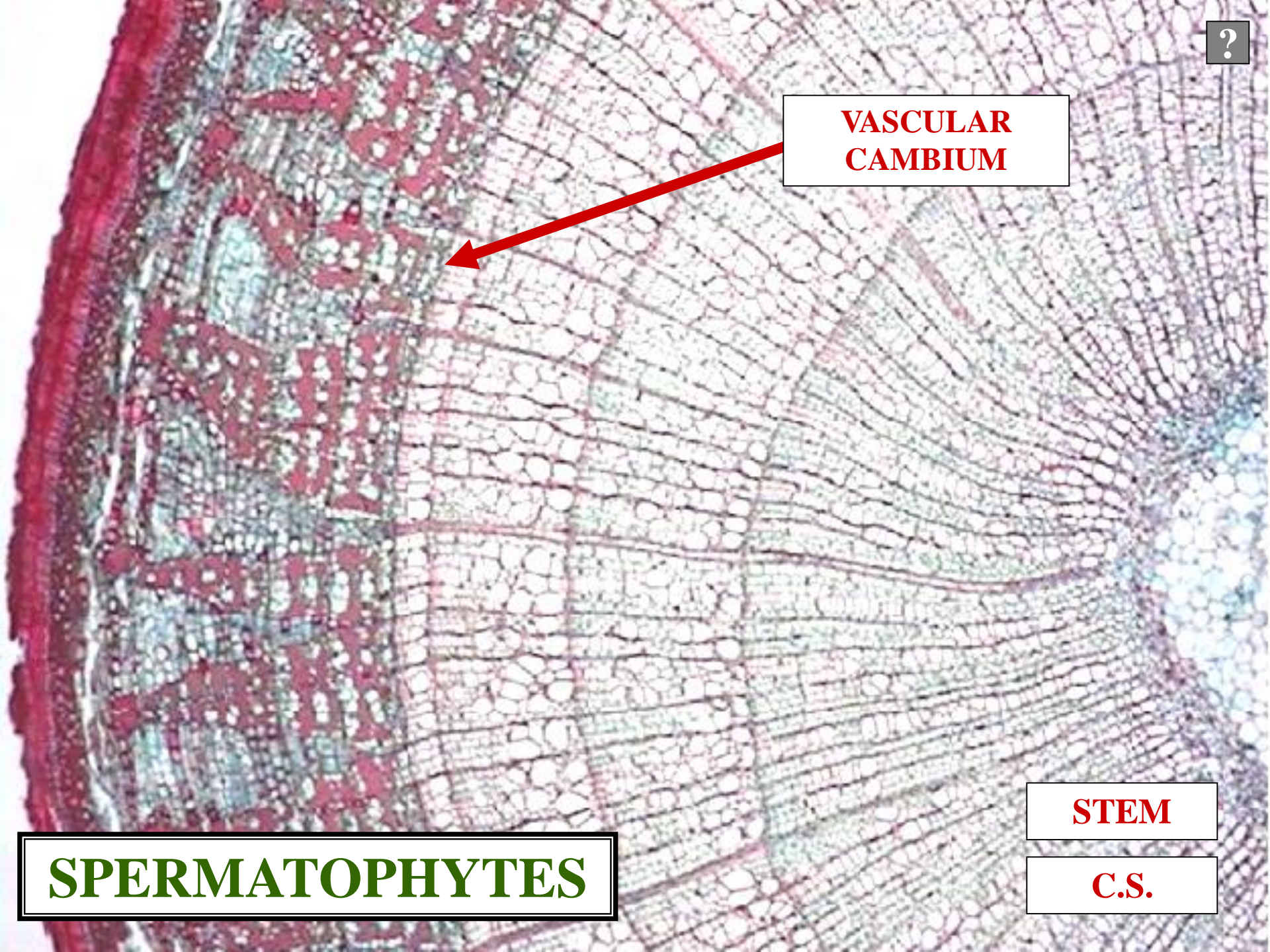
**VASCULAR
CAMBIUM**



STEM

C.S.

SPERMATOPHYTES



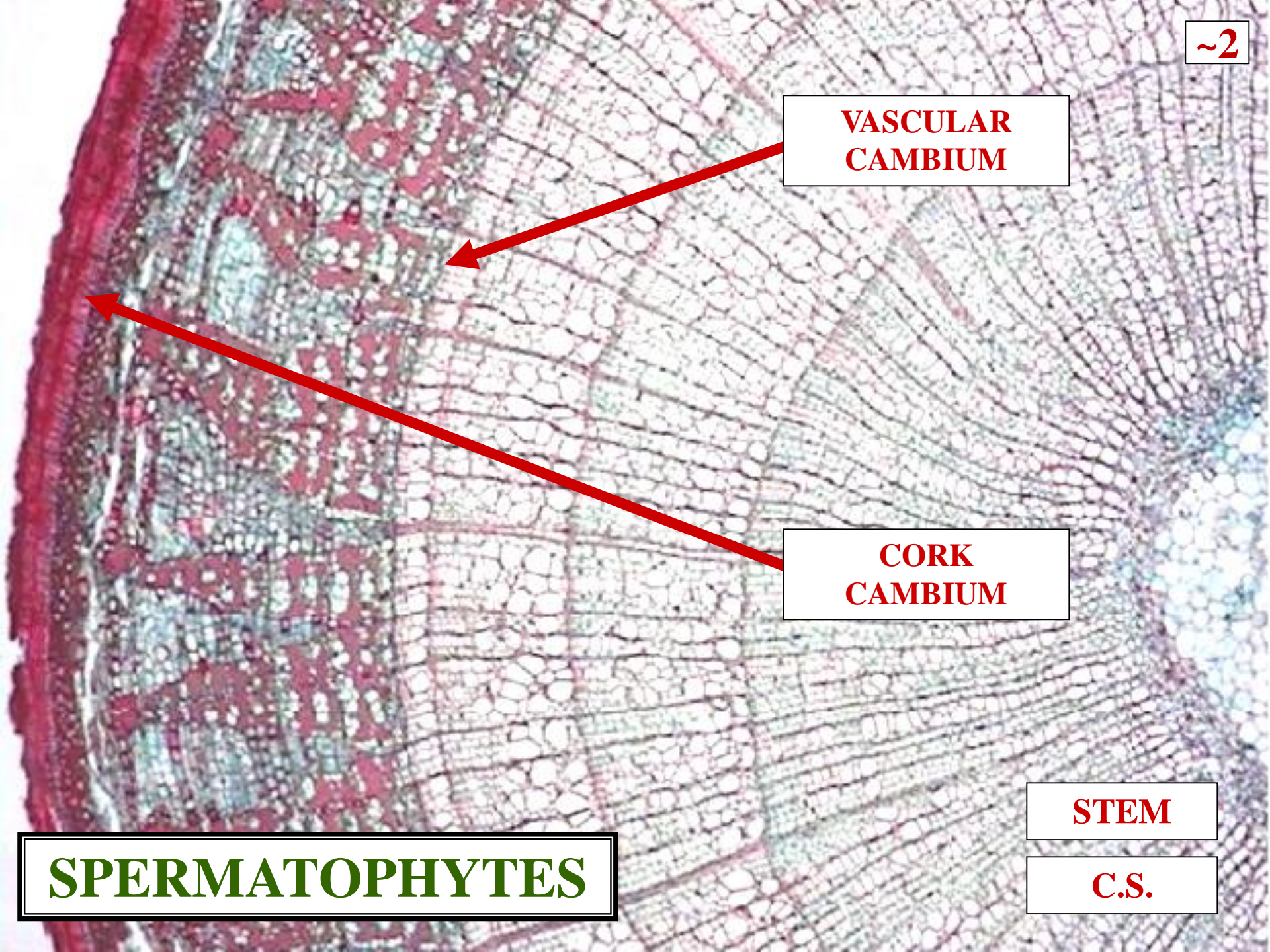
**VASCULAR
CAMBIUM**

**CORK
CAMBIUM**

STEM

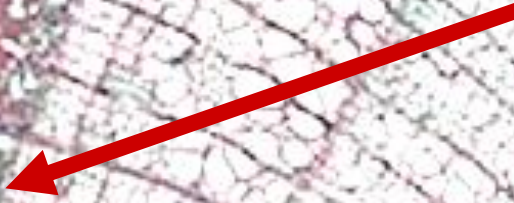
C.S.

SPERMATOPHYTES

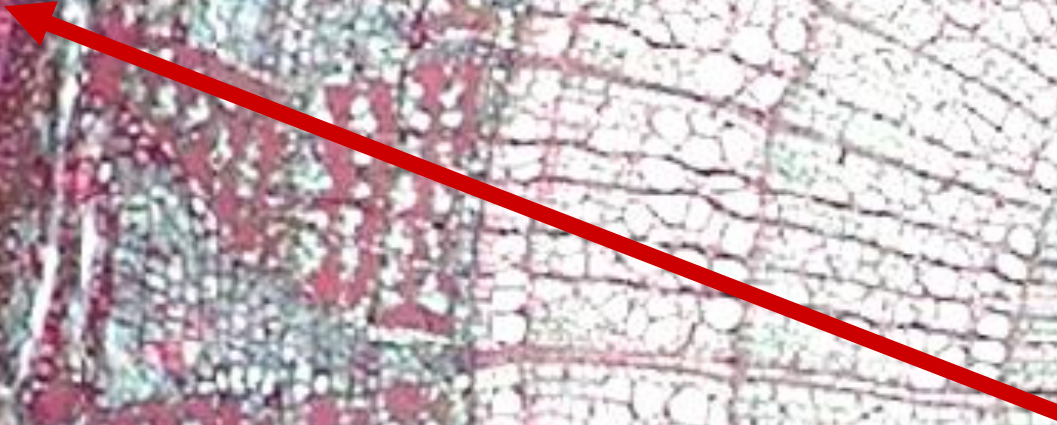




**VASCULAR
CAMBIUM**



**CORK
CAMBIUM**



SECONDARY GROWTH



STEM

SPERMATOPHYTES

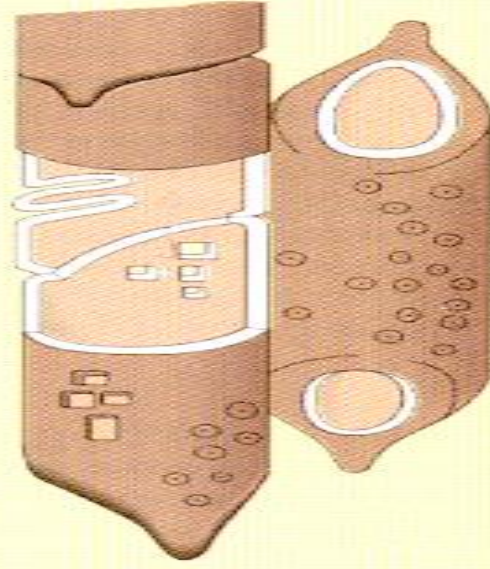
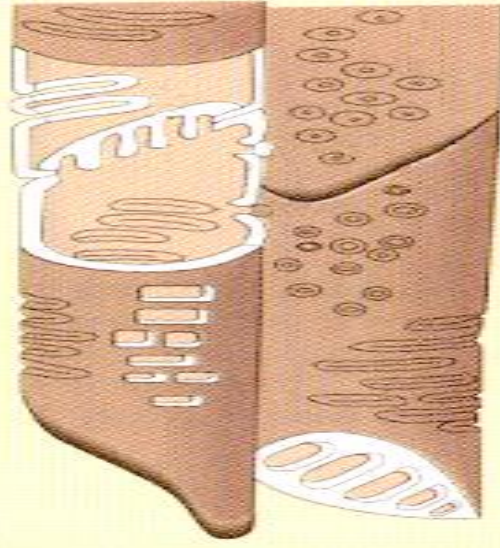
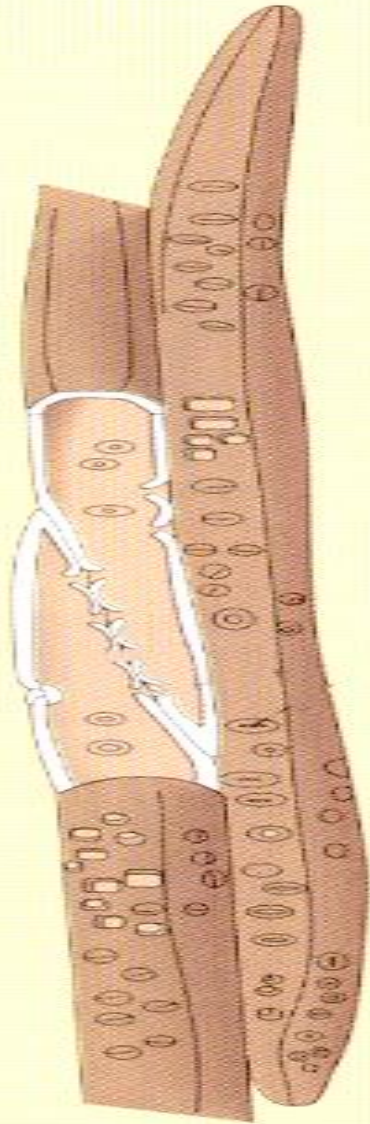
C.S.



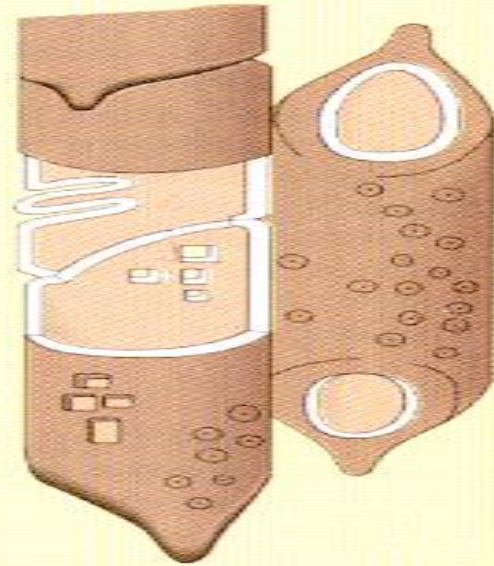
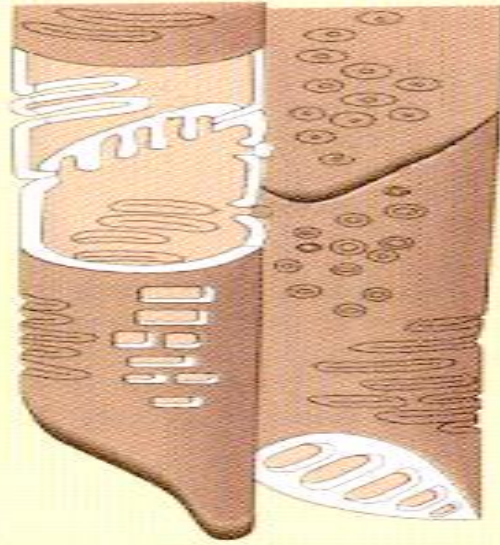
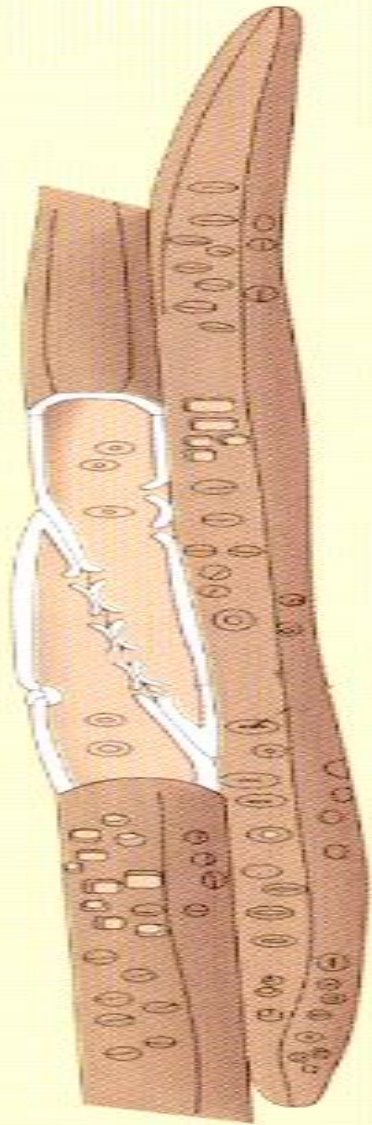
VASCULAR TISSUE



XYLEM



XYLEM CELLS



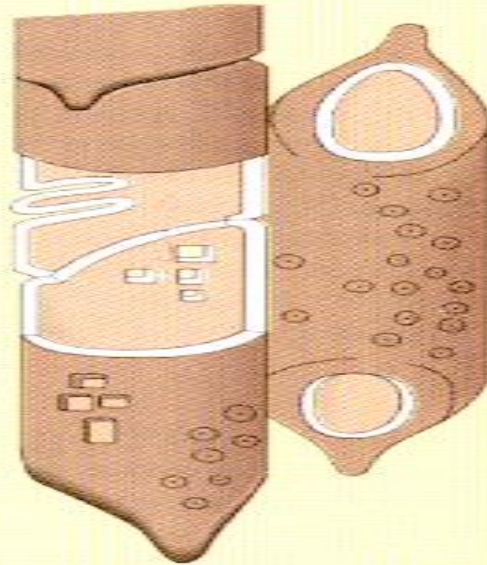
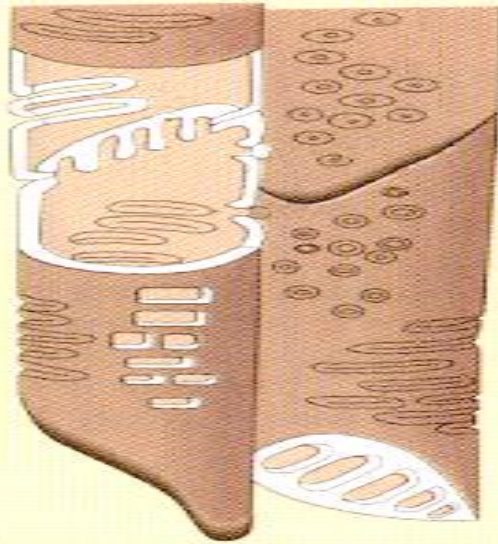
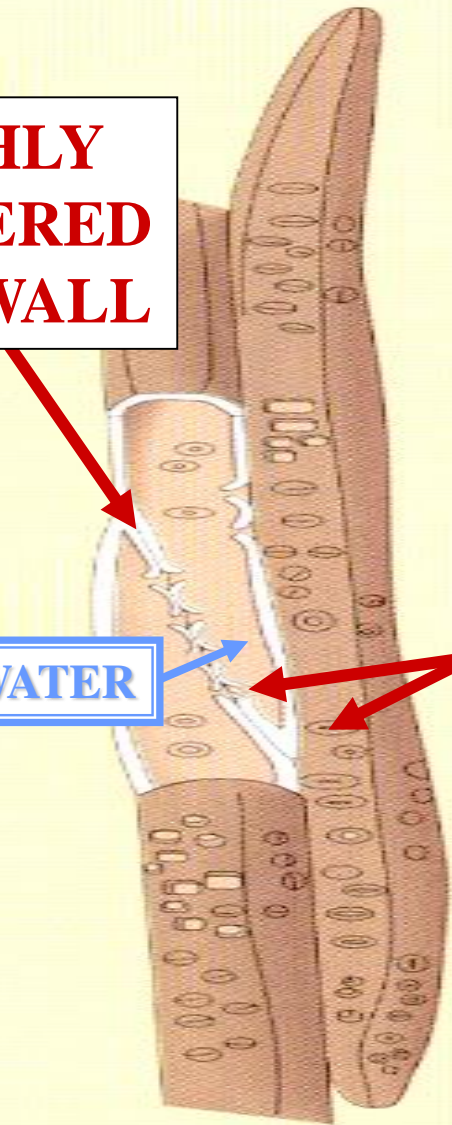
TRACHEARY ELEMENTS

**HIGHLY
TAPPED
END WALL**

WATER

PITS

?

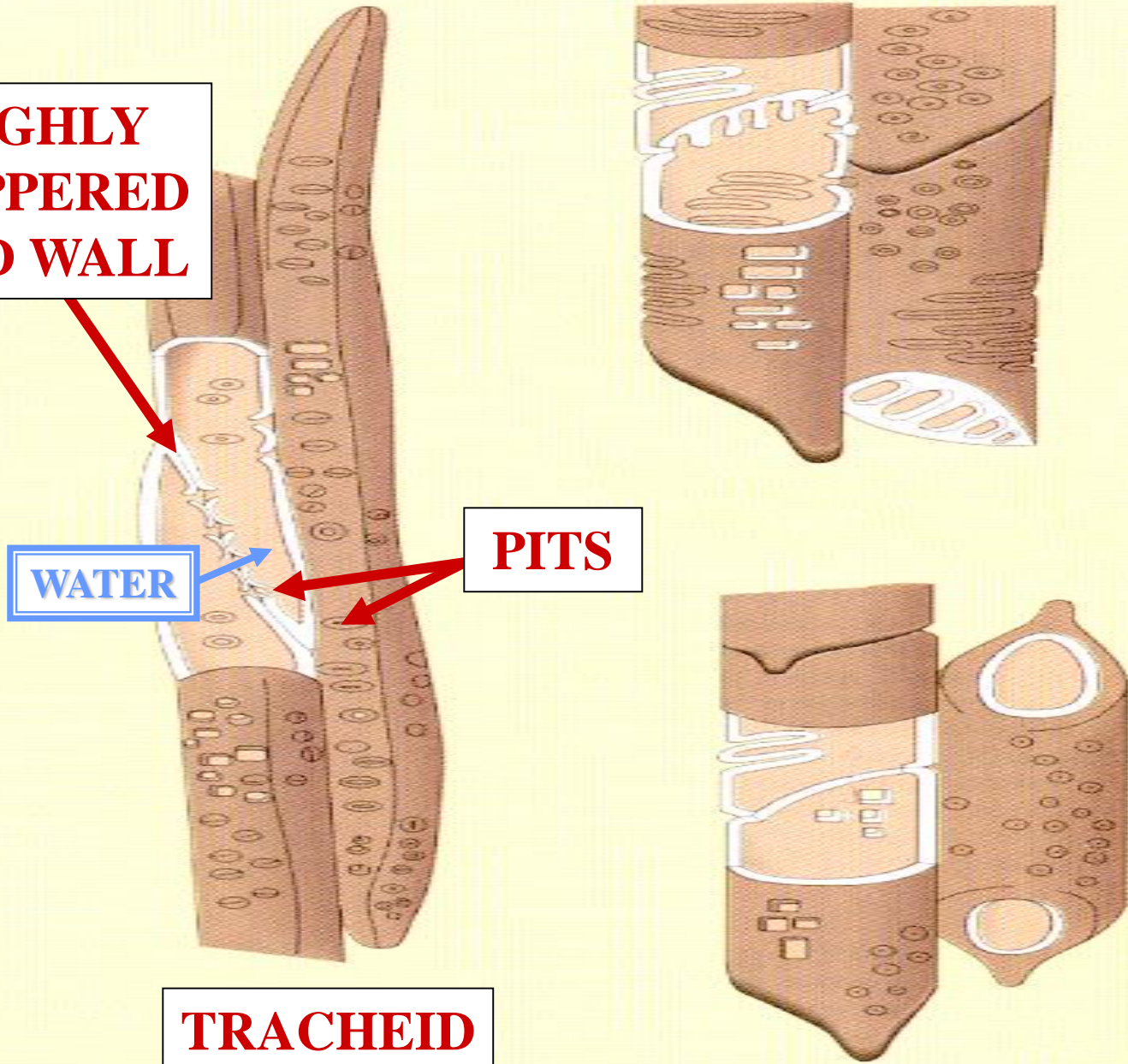


**HIGHLY
TAPPED
END WALL**

WATER

PITS

TRACHEID



**HIGHLY
TAPPED
END WALL**

**LESS
TAPPED
END WALL**

?

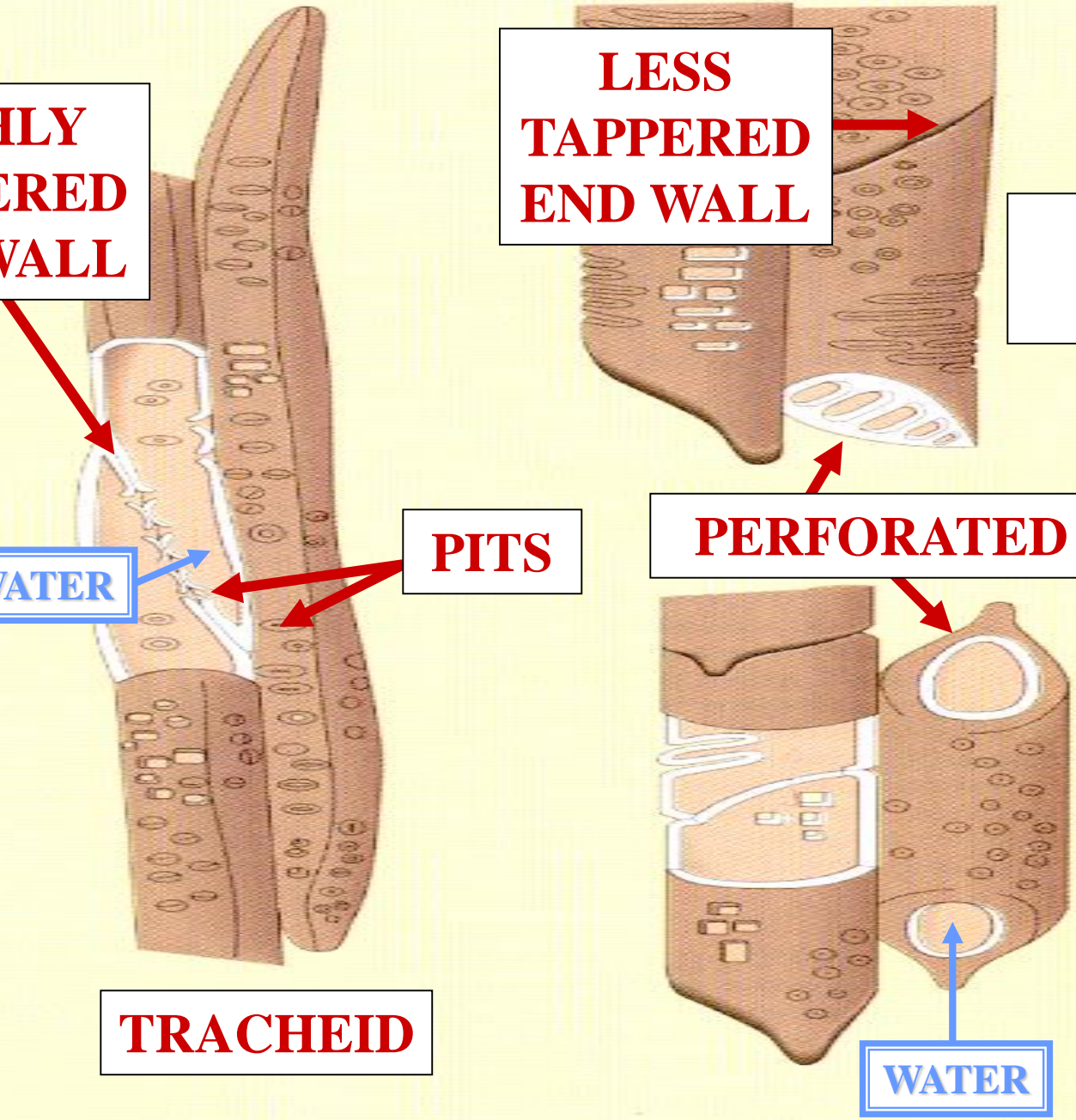
WATER

PITS

PERFORATED PLATE

TRACHEID

WATER





**HIGHLY
TAPPED
END WALL**

**LESS
TAPPED
END WALL**

**VESSEL
MEMBER**

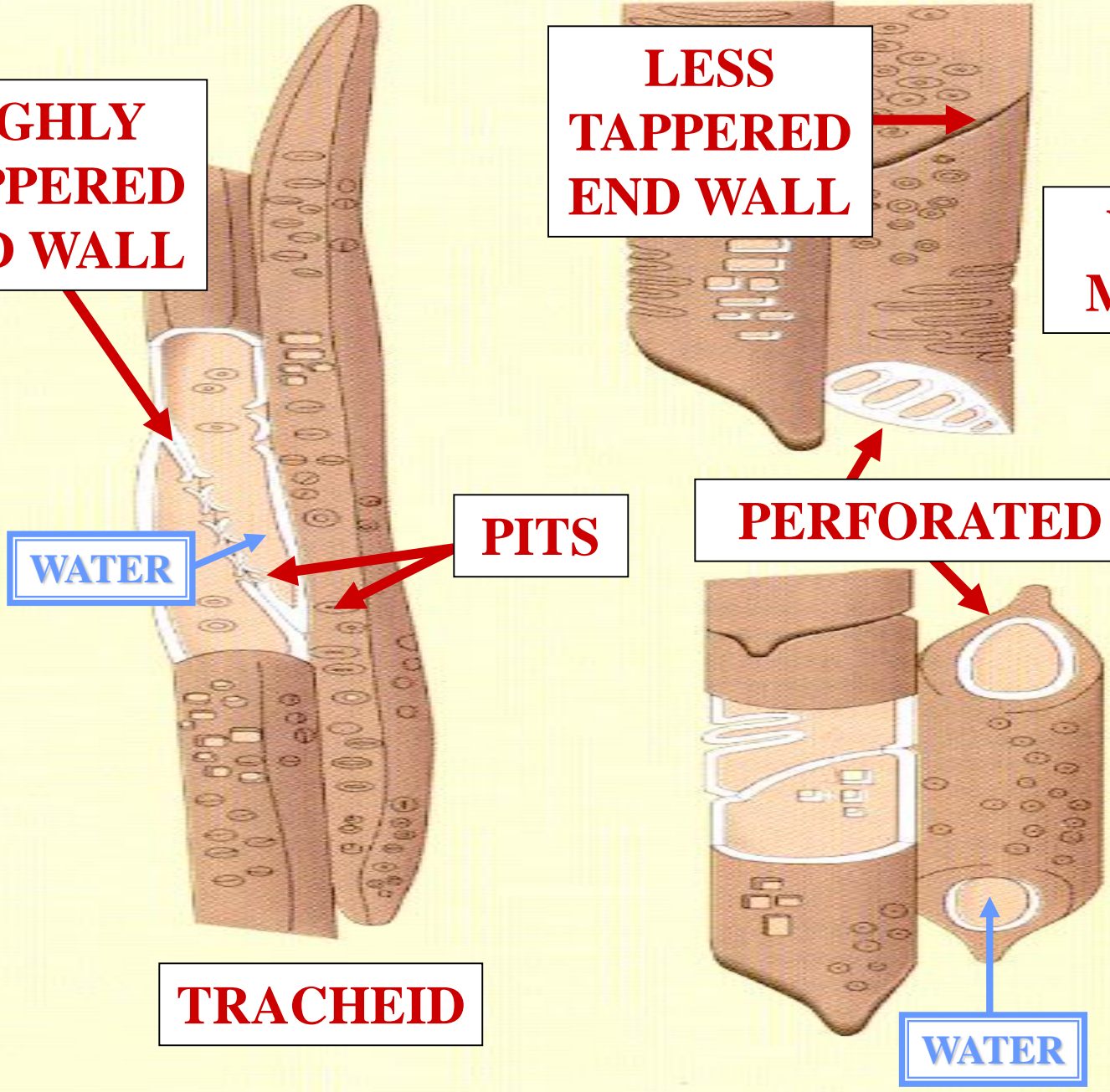
WATER

PITS

PERFORATED PLATE

TRACHEID

WATER



A close-up photograph of a dense thicket of bright green ferns. The ferns have delicate, feathery fronds and small, white, star-shaped flowers. The lighting is bright, highlighting the vibrant green color of the leaves. In the top right corner, there are two small icons: a white 'T' in a black square and a white '+' in a grey square.

T

+

PTERIDOPHYTES



V

+

TRACHEIDS

PTERIDOPHYTES



**TRACHEIDS
&
VESSEL MEMBERS**

PTERIDOPHYTES



PHLOEM

PTERIDOPHYTES

SE

NUCLEUS



SUGAR



PHLOEM CELL



END WALL

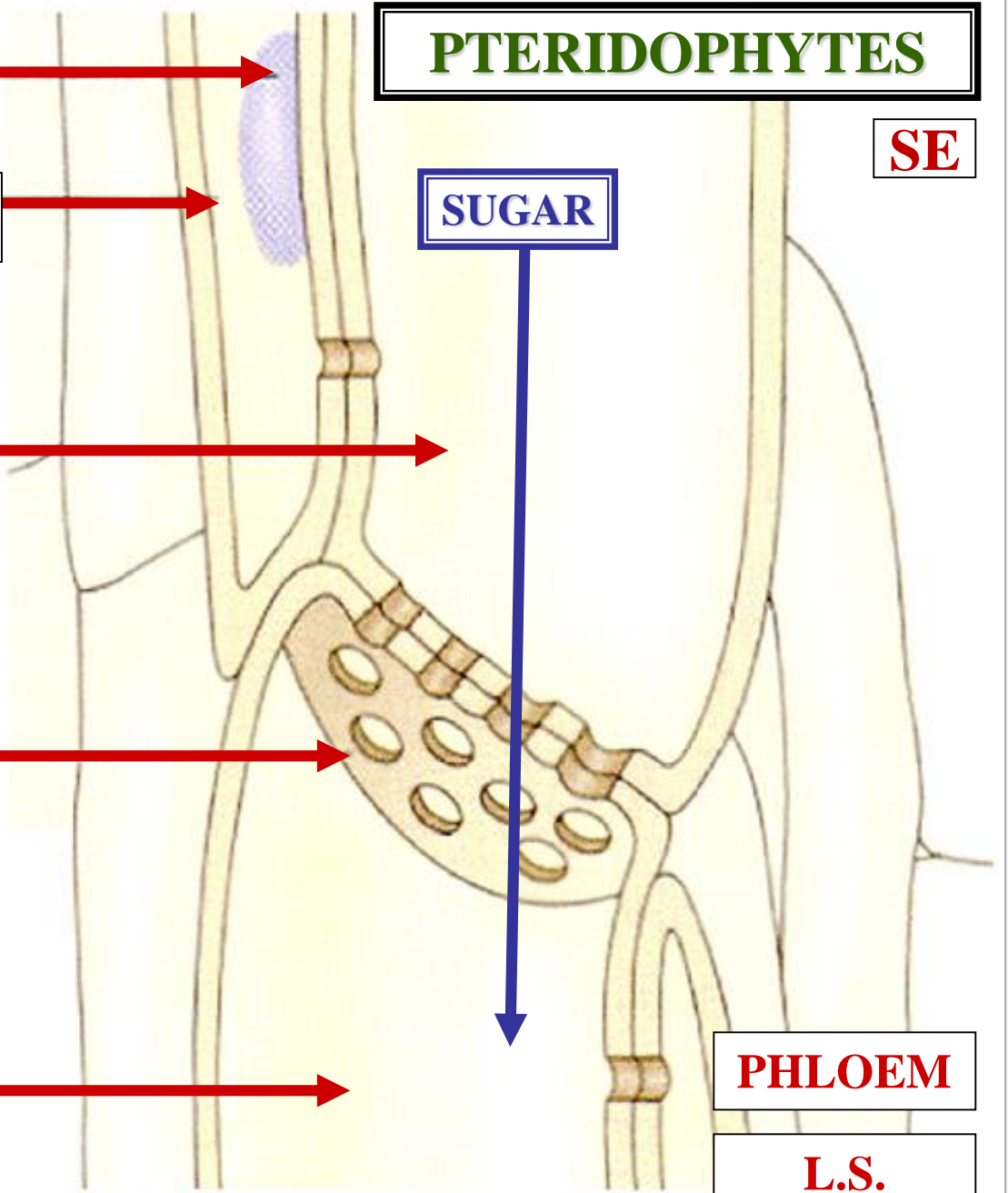


PHLOEM CELL



PHLOEM

L.S.



PTERIDOPHYTES

?

NUCLEUS



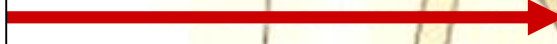
SUGAR



SIEVE ELEMENTS



**SIEVE AREA
SMALL PORES**

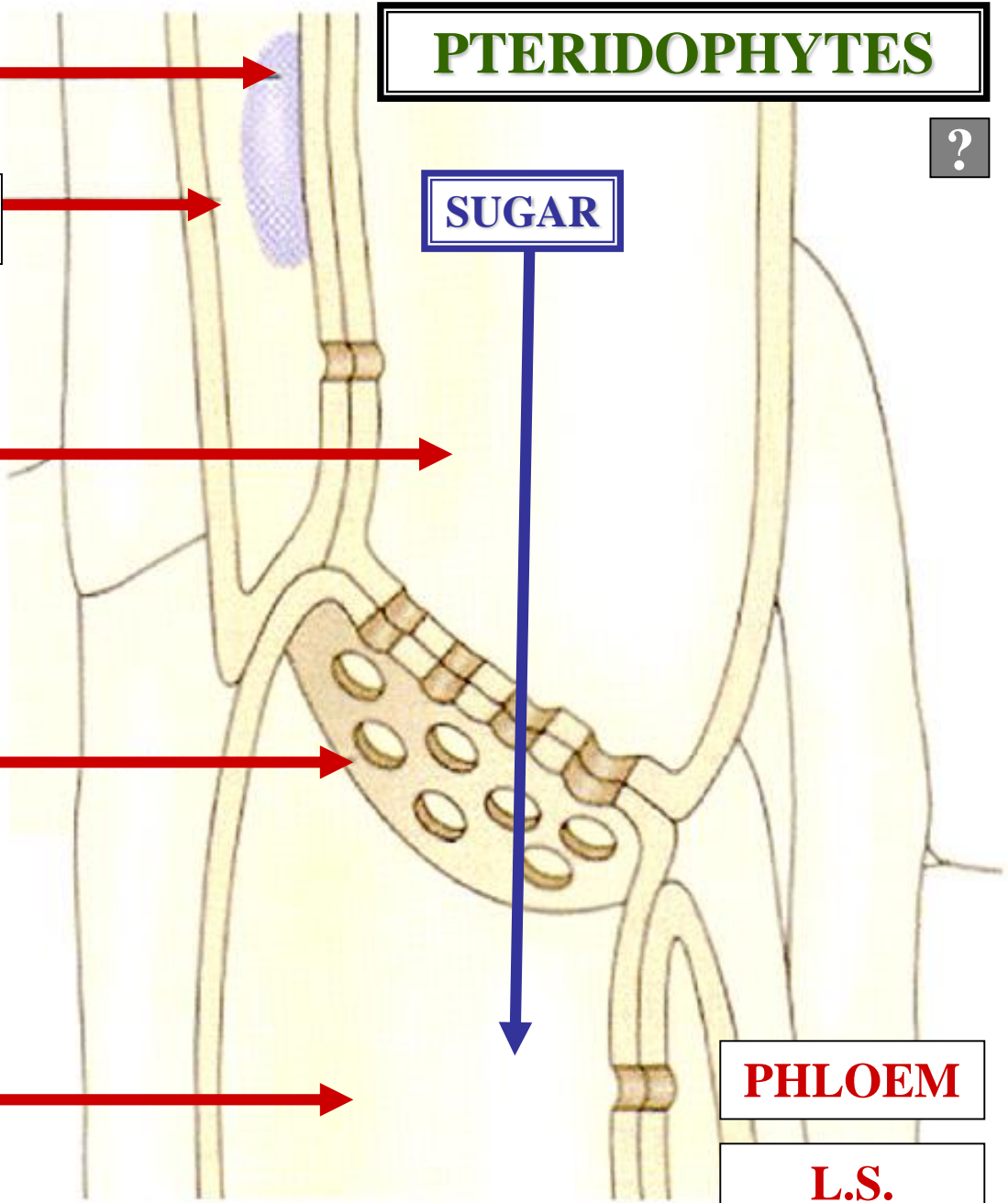


SIEVE ELEMENTS



PHLOEM

L.S.



PTERIDOPHYTES

SC

NUCLEUS

SUGAR

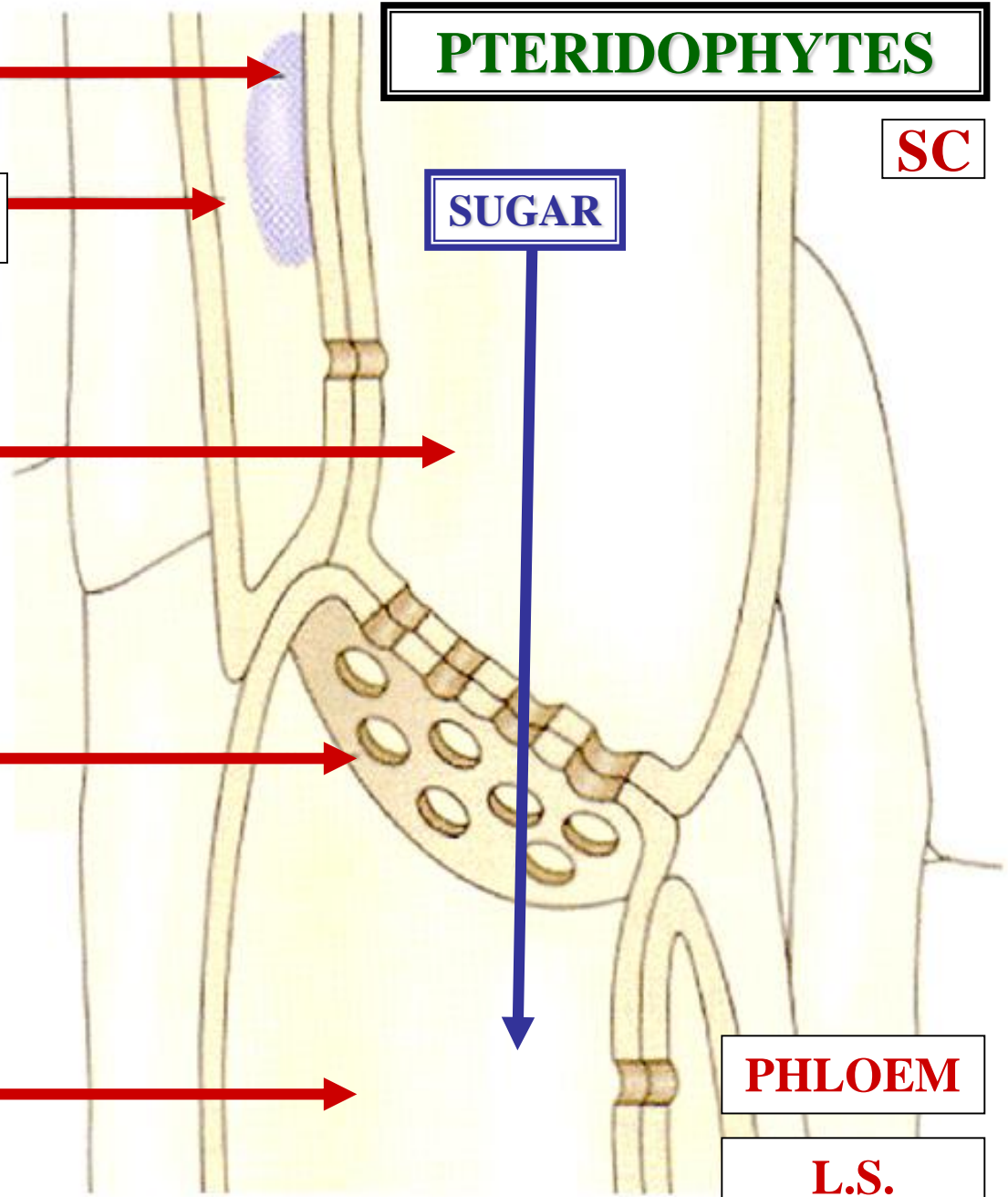
?

**SIEVE AREA
SMALL PORES**

?

PHLOEM

L.S.



PTERIDOPHYTES

?

NUCLEUS



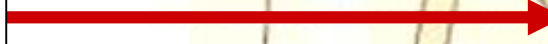
SUGAR



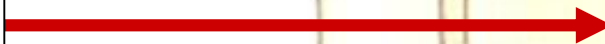
SIEVE CELL



**SIEVE AREA
SMALL PORES**

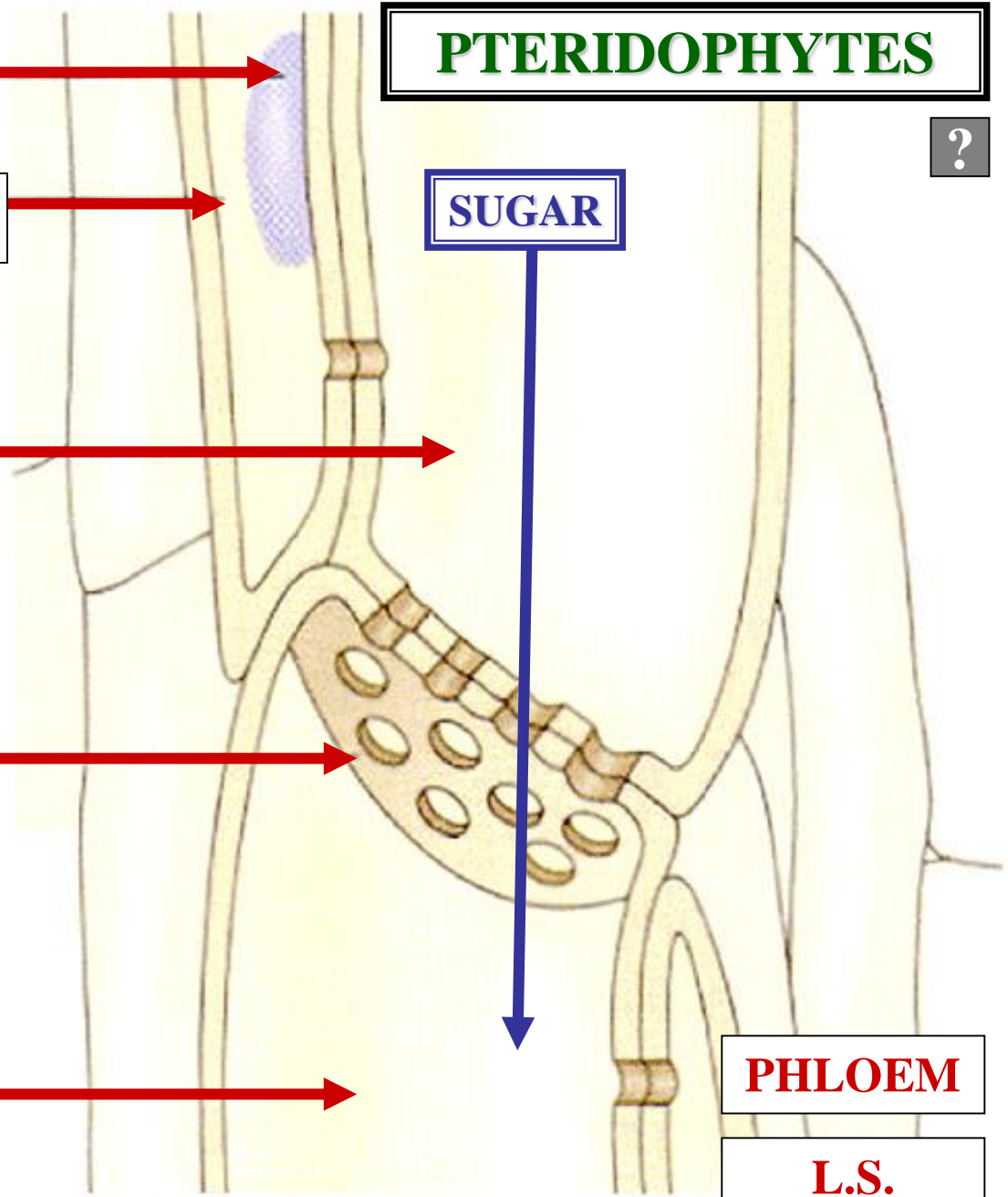


SIEVE CELL



PHLOEM

L.S.



PTERIDOPHYTES

AC

NUCLEUS



?



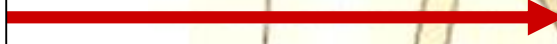
SUGAR



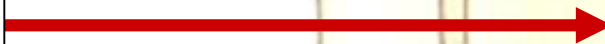
SIEVE CELL



**SIEVE AREA
SMALL PORES**

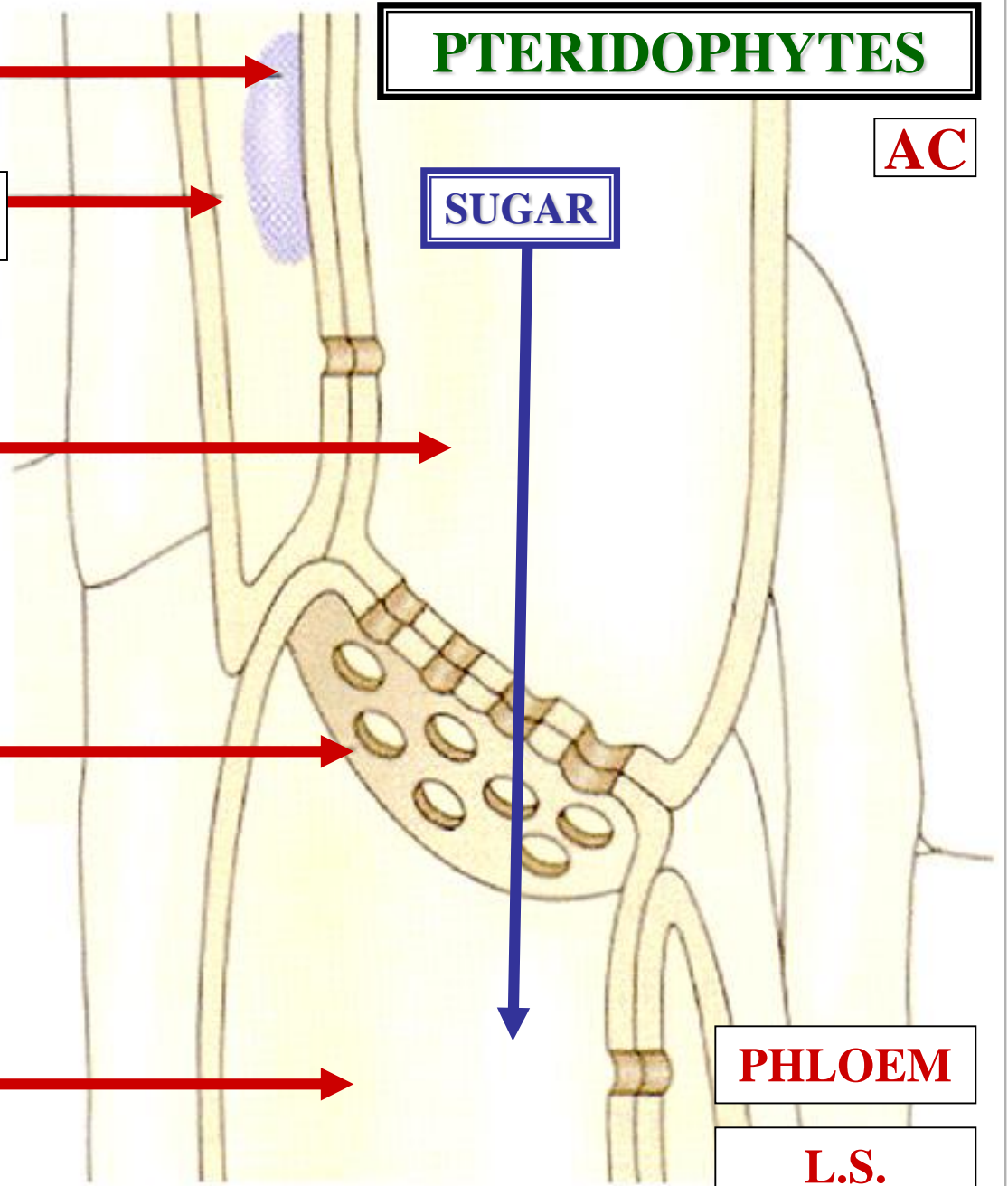


SIEVE CELL



PHLOEM

L.S.



PTERIDOPHYTES

NUCLEUS

ALBUMINOUS CELL

SIEVE CELL

**SIEVE AREA
SMALL PORES**

SIEVE CELL

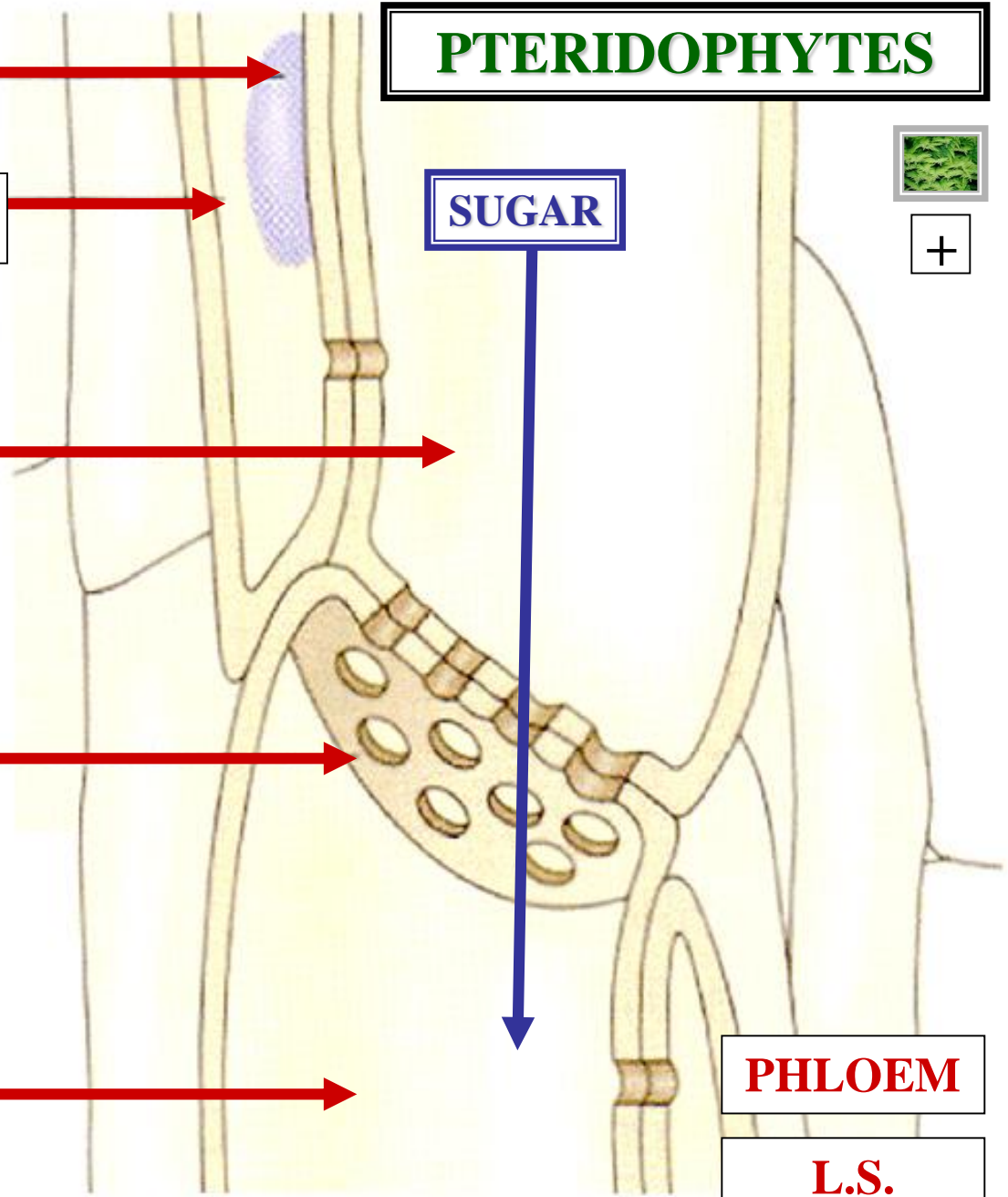
SUGAR

PHLOEM

L.S.



+



A close-up photograph of a dense thicket of bright green ferns. The ferns have a delicate, feathery appearance with many small, pointed leaflets. Interspersed among the foliage are several small, white, bell-shaped flowers. The lighting is bright, highlighting the vibrant green color of the leaves.

S

PTERIDOPHYTES

SIEVE CELLS

PTERIDOPHYTES



**SIEVE CELLS
&
ALBUMINOUS CELLS**

PTERIDOPHYTES



STEM



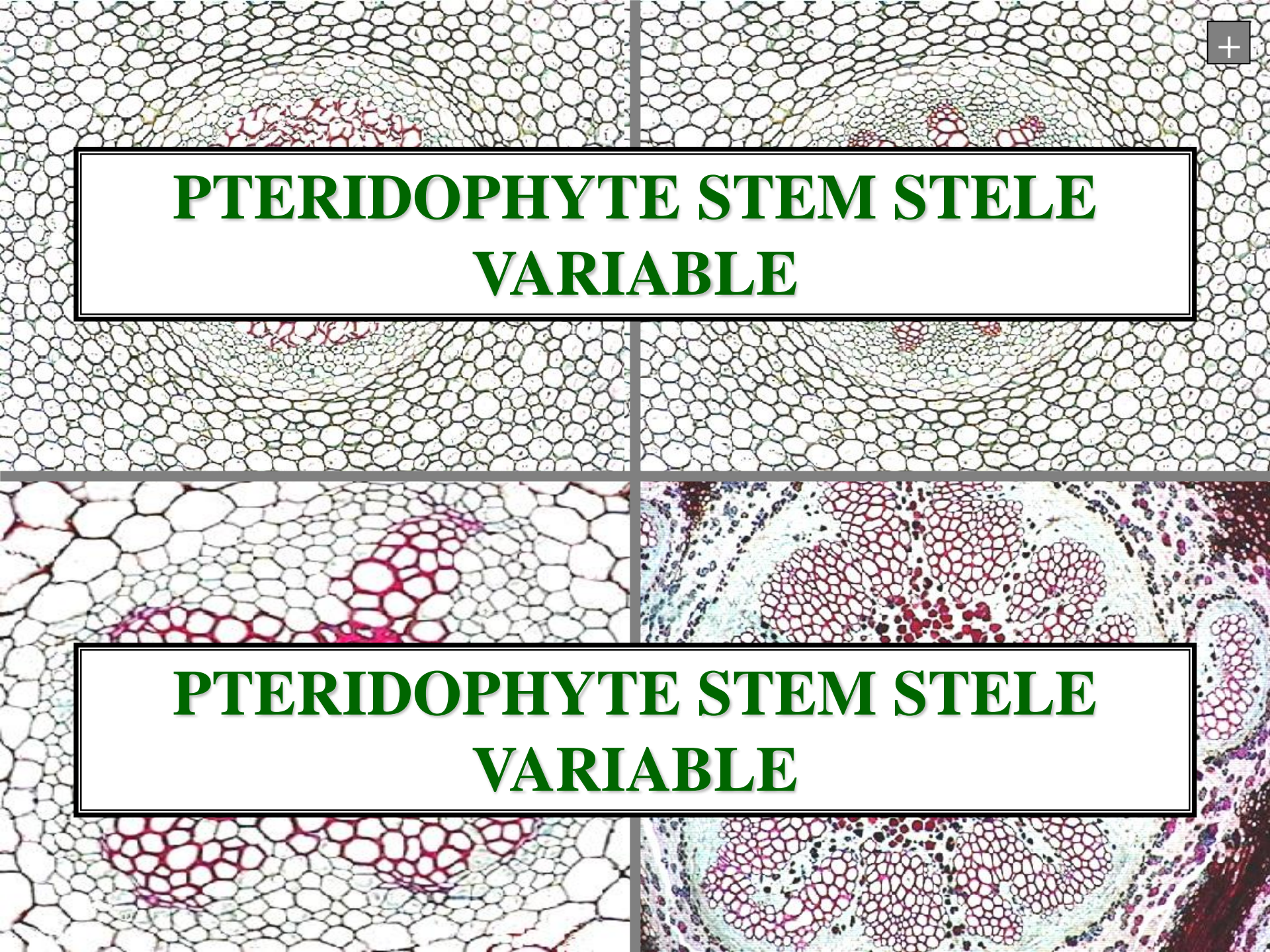
V

+

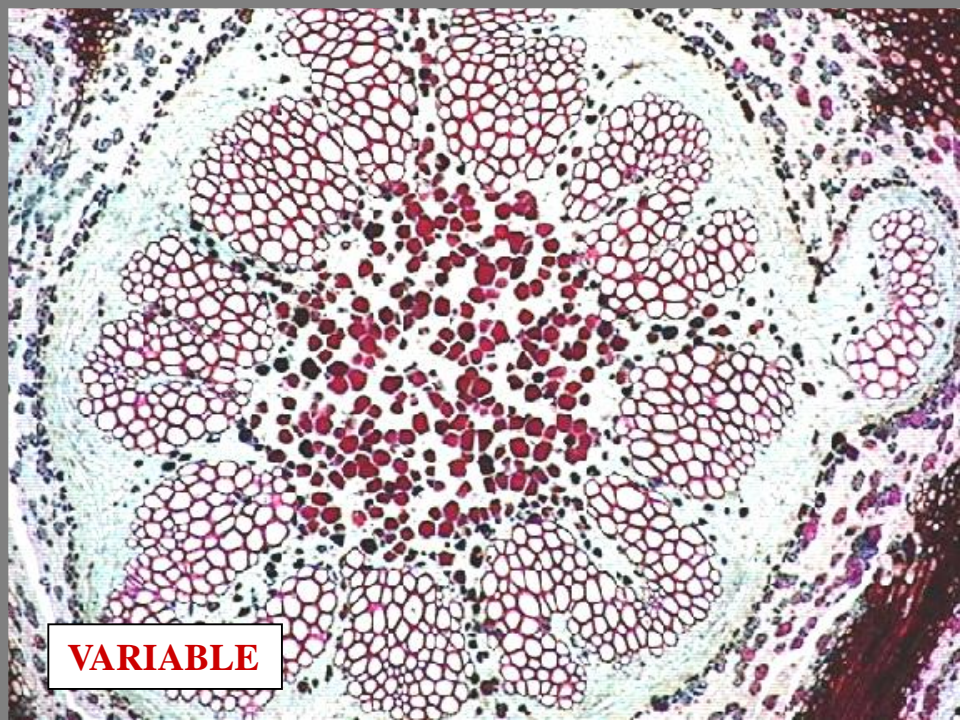
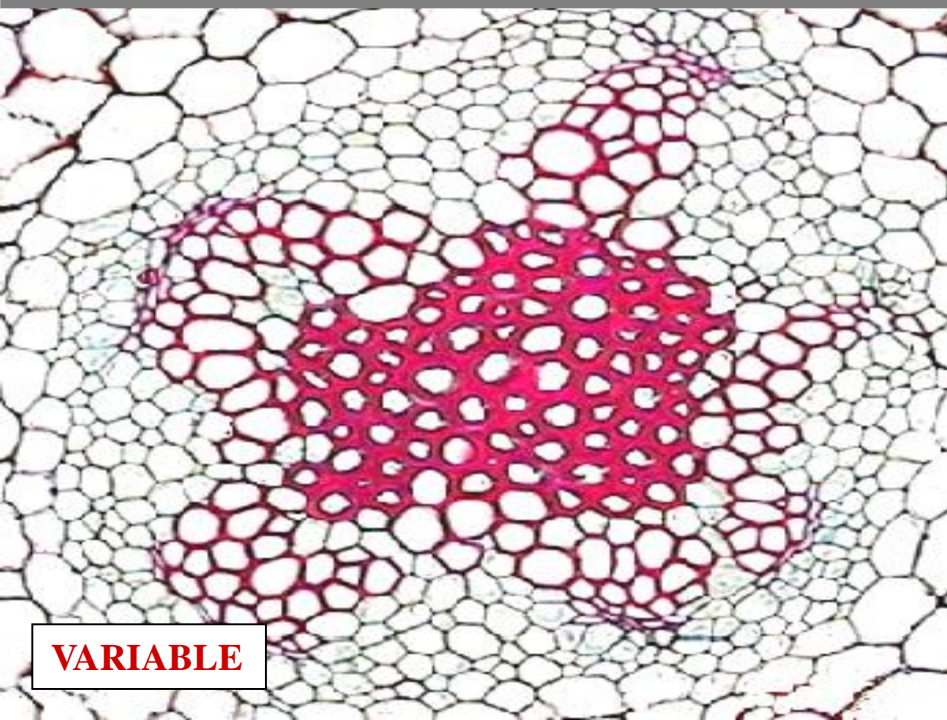
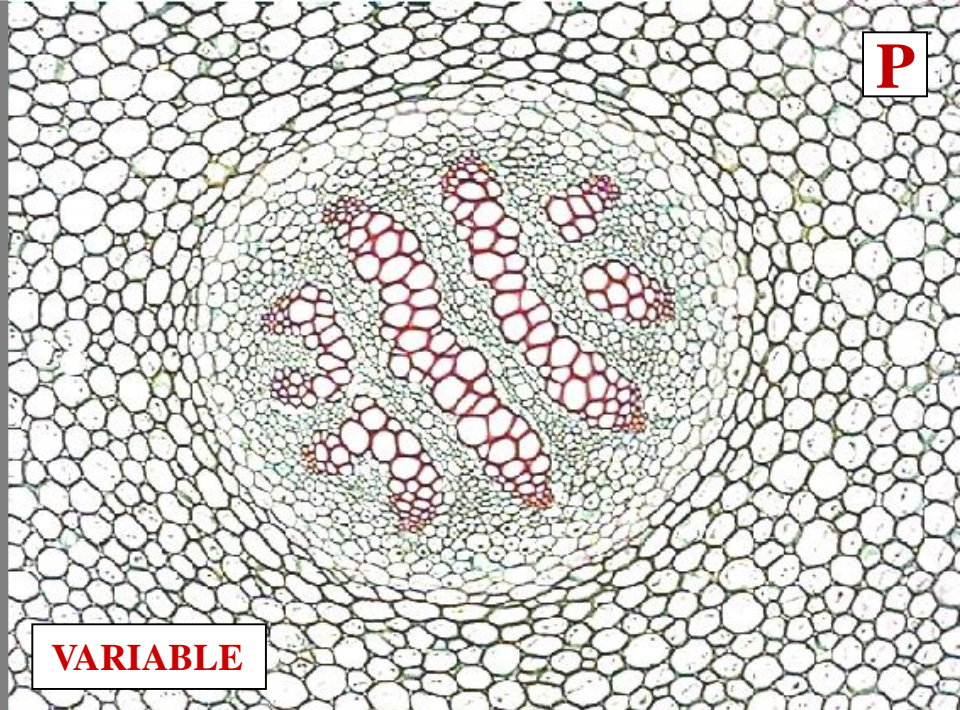
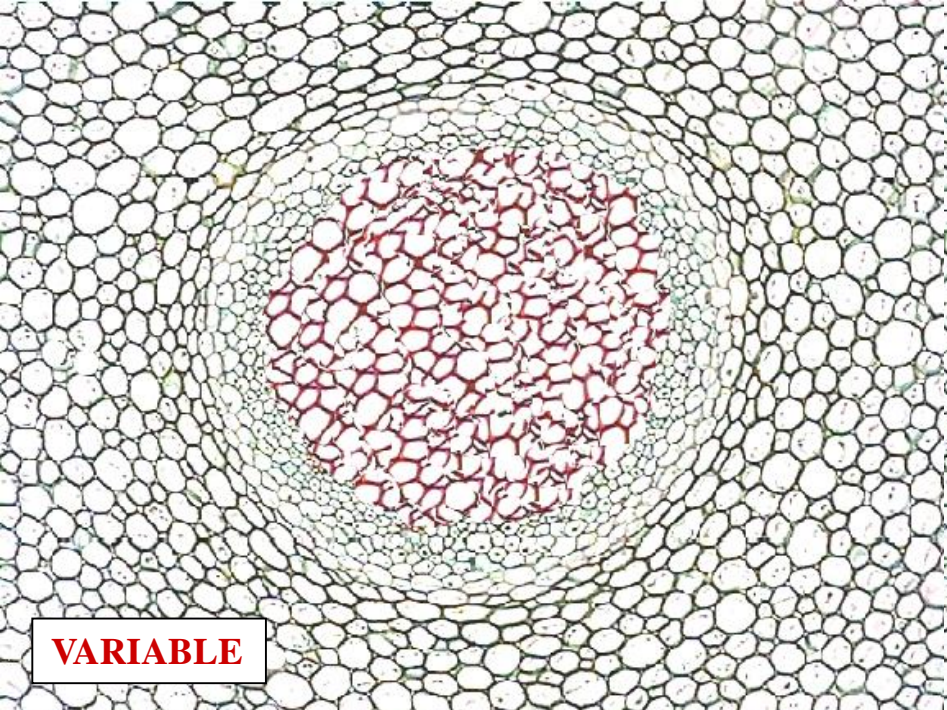
STEM STELE

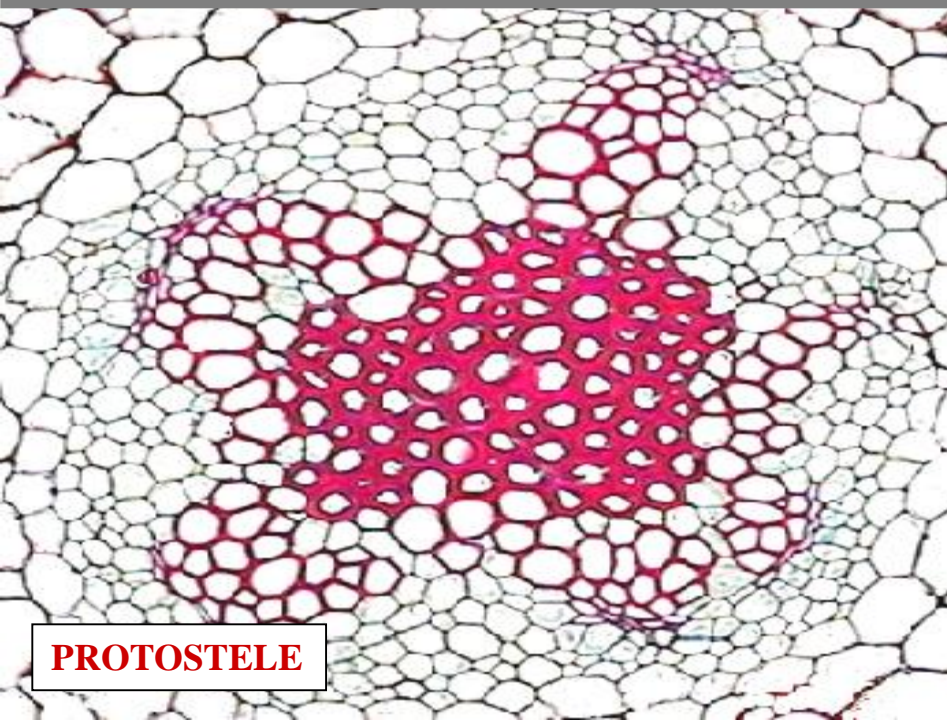
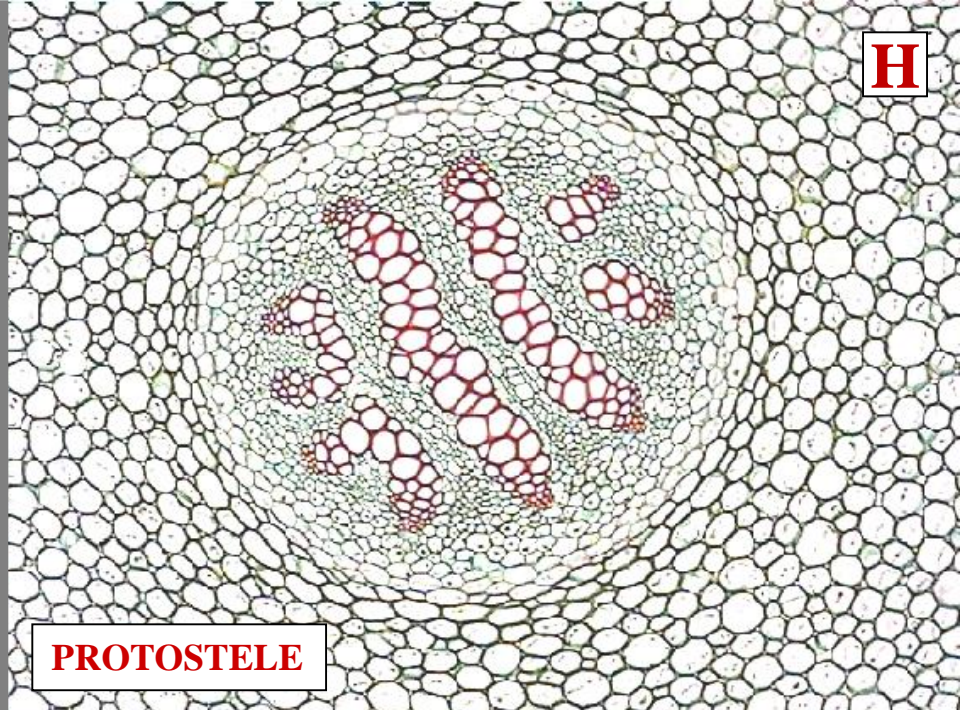
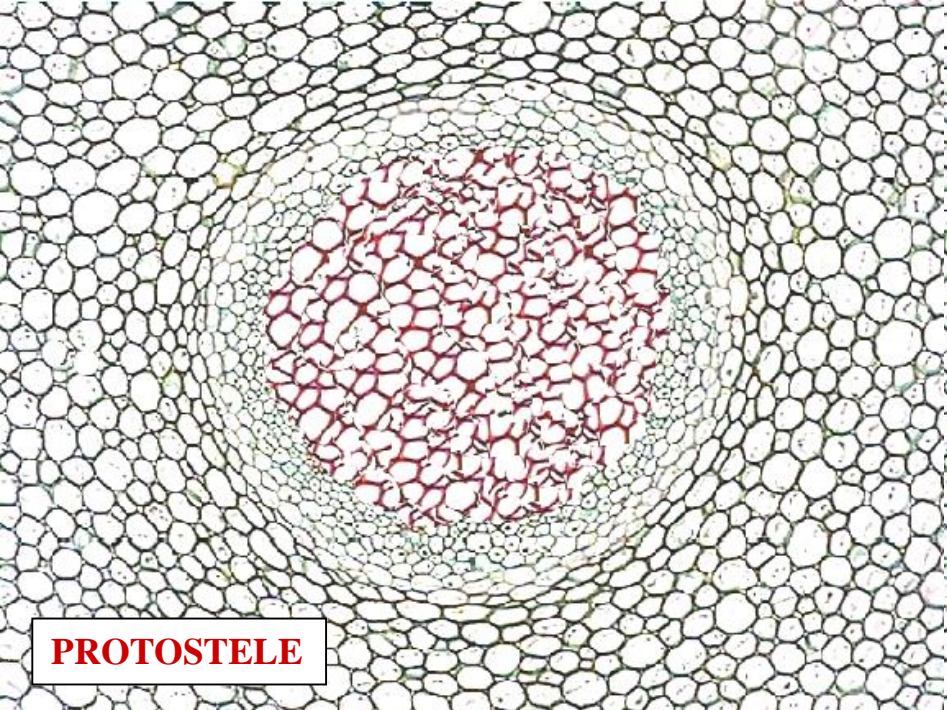


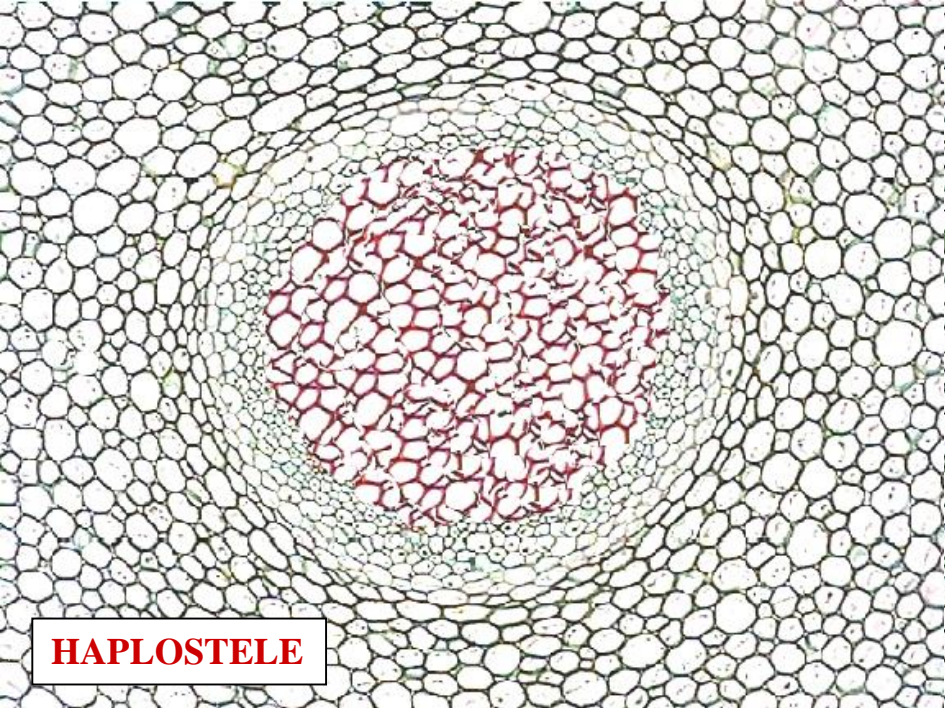
**PTERIDOPHYTE STEM STELE
VARIABLE**



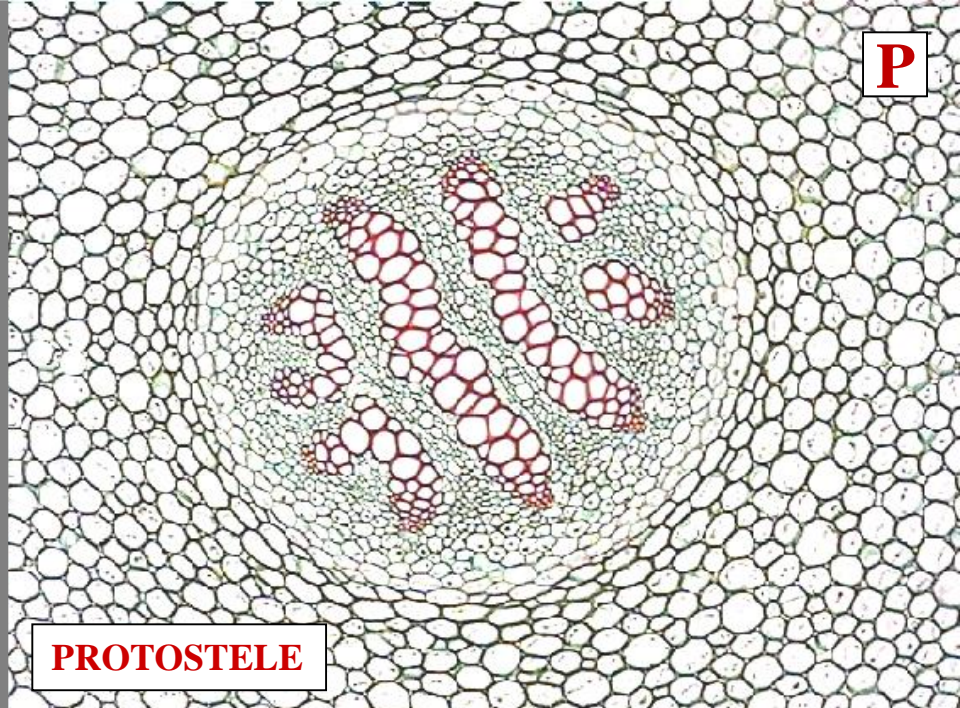
**PTERIDOPHYTE STEM STELE
VARIABLE**



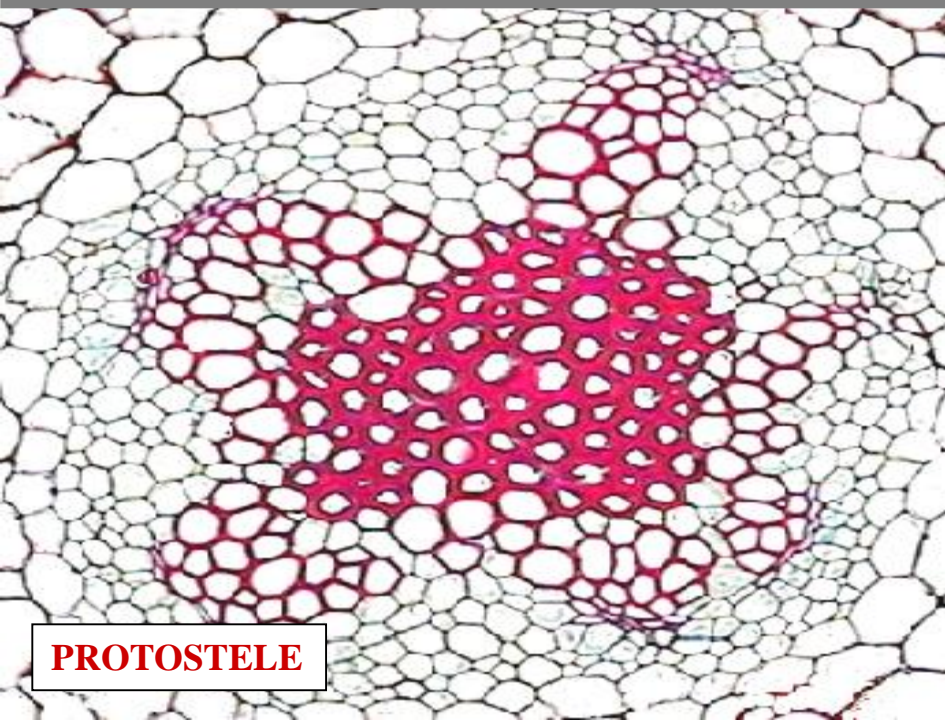




HAPLOSTELE



PROTOSTELE

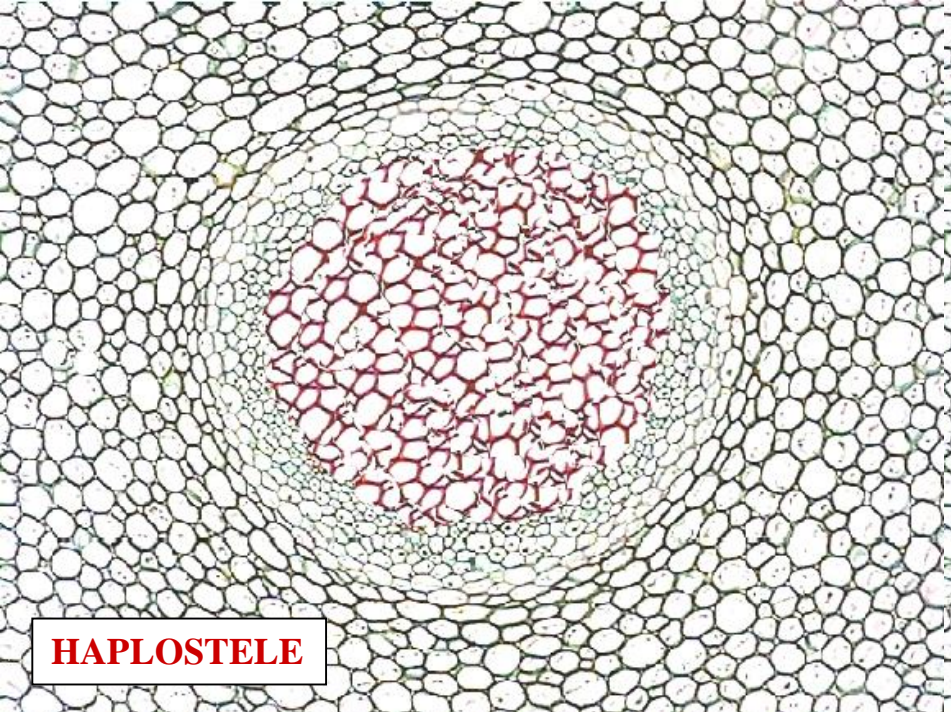


PROTOSTELE

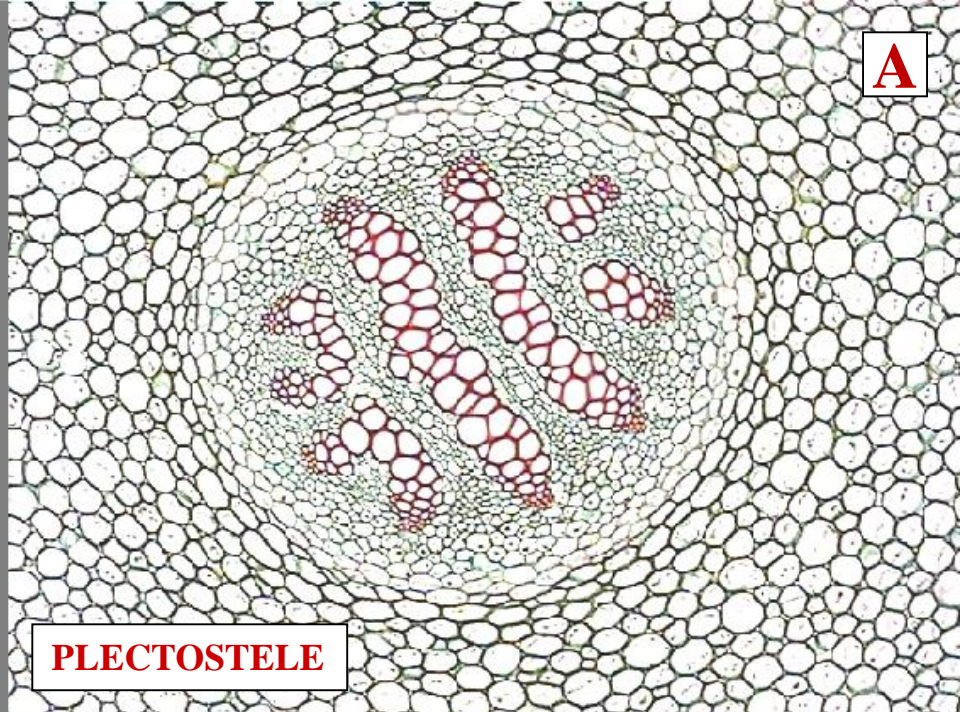


SIPHONOSTELE

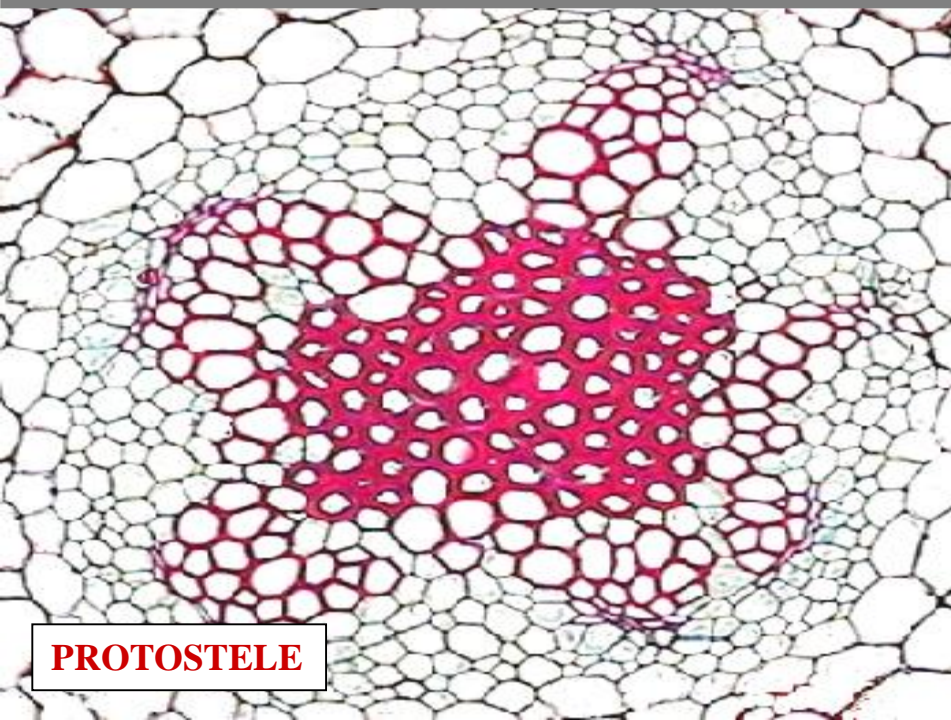
A



HAPLOSTELE



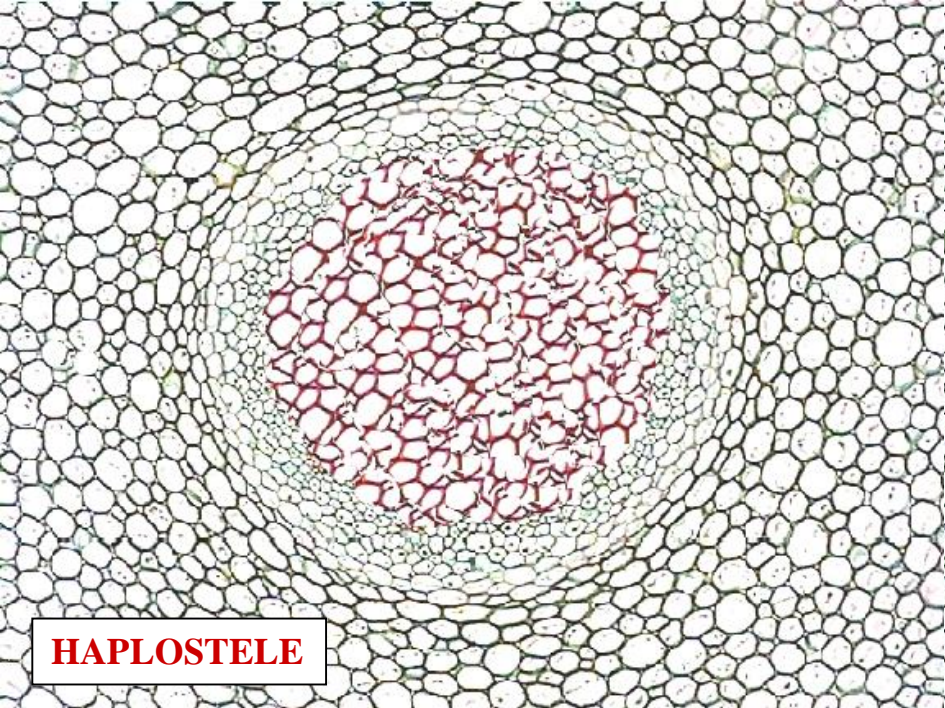
PLECTOSTELE



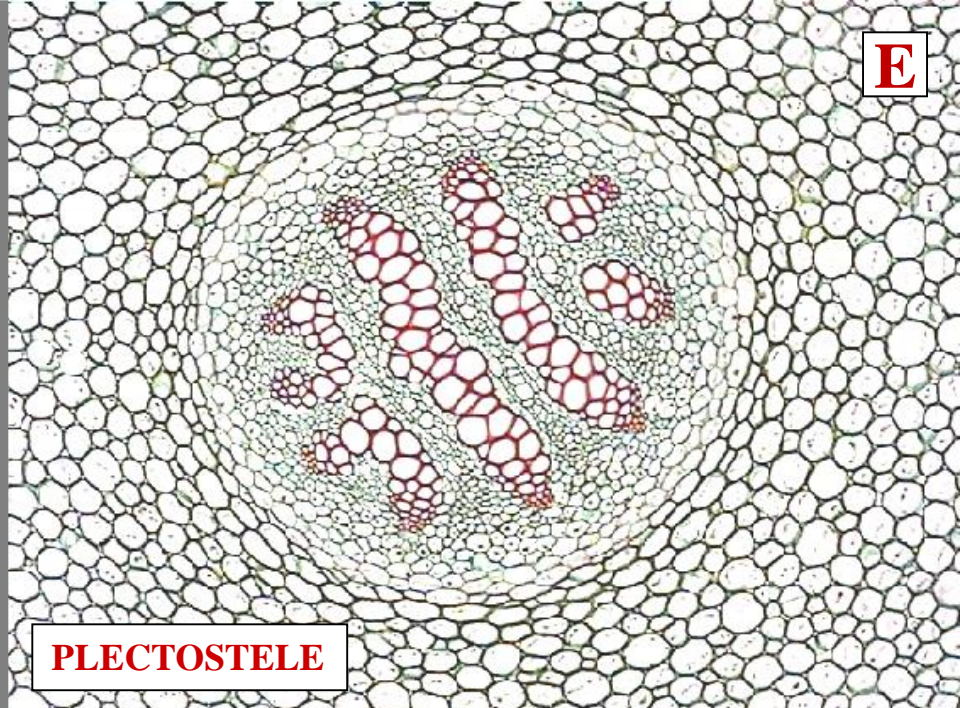
PROTOSTELE



SIPHONOSTELE

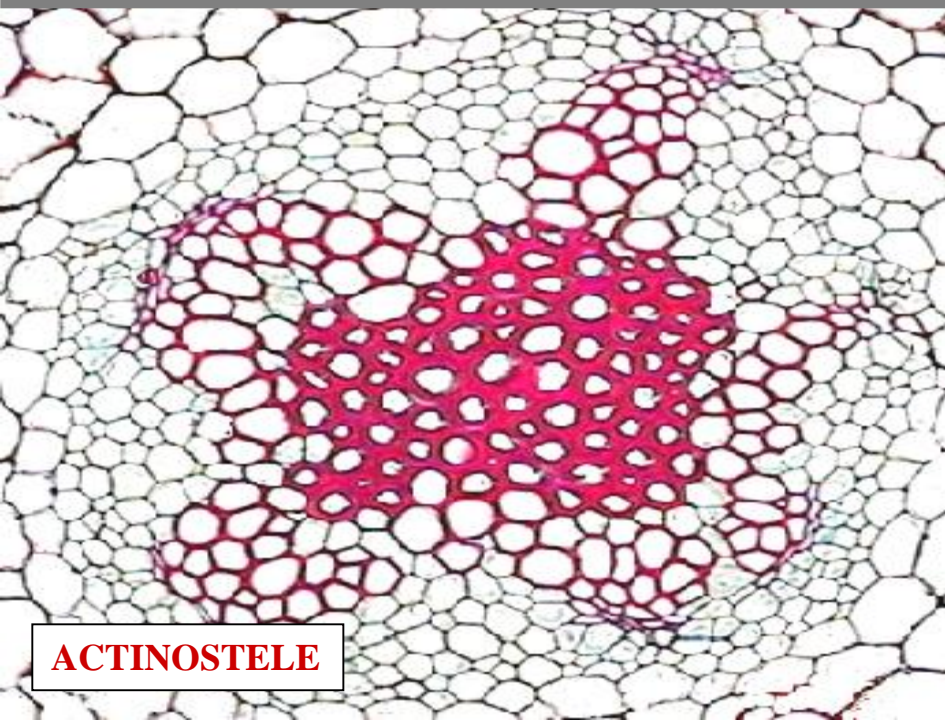


HAPLOSTELE



E

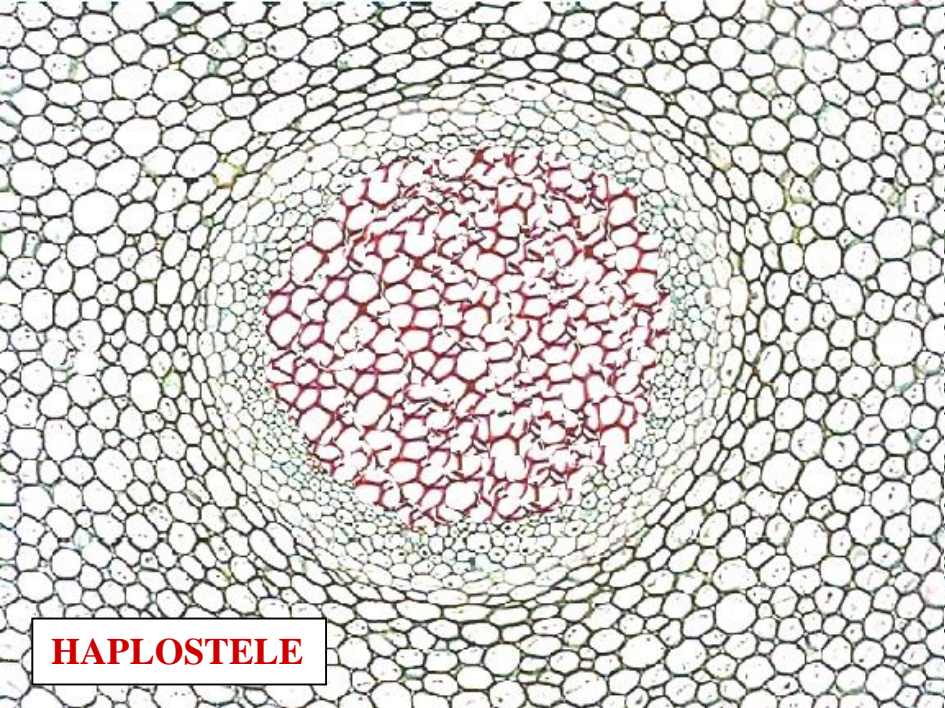
PLECTOSTELE



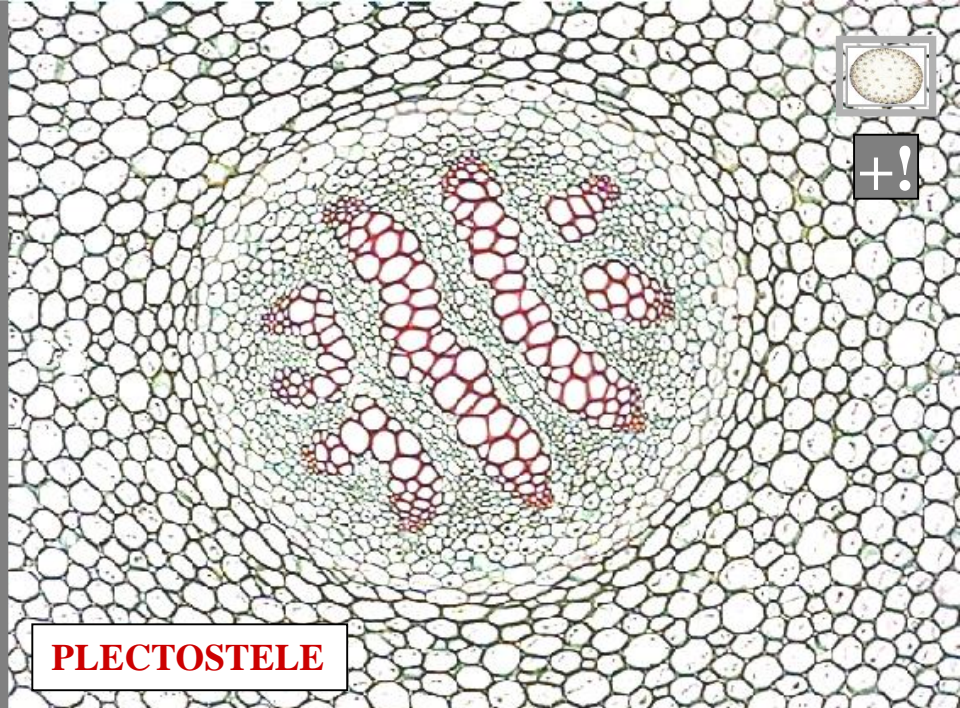
ACTINOSTELE



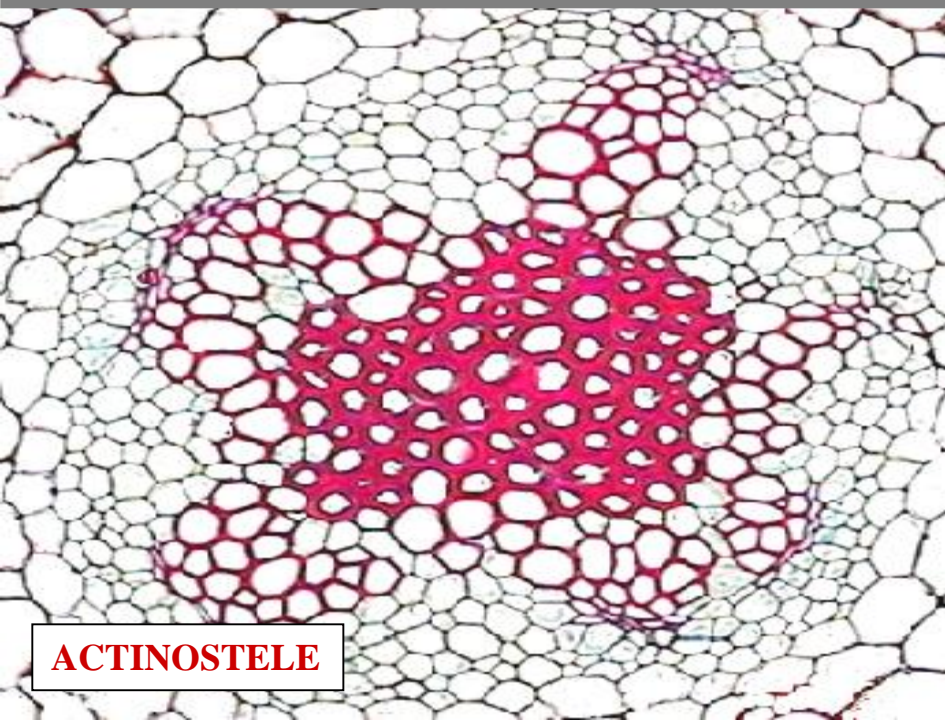
SIPHONOSTELE



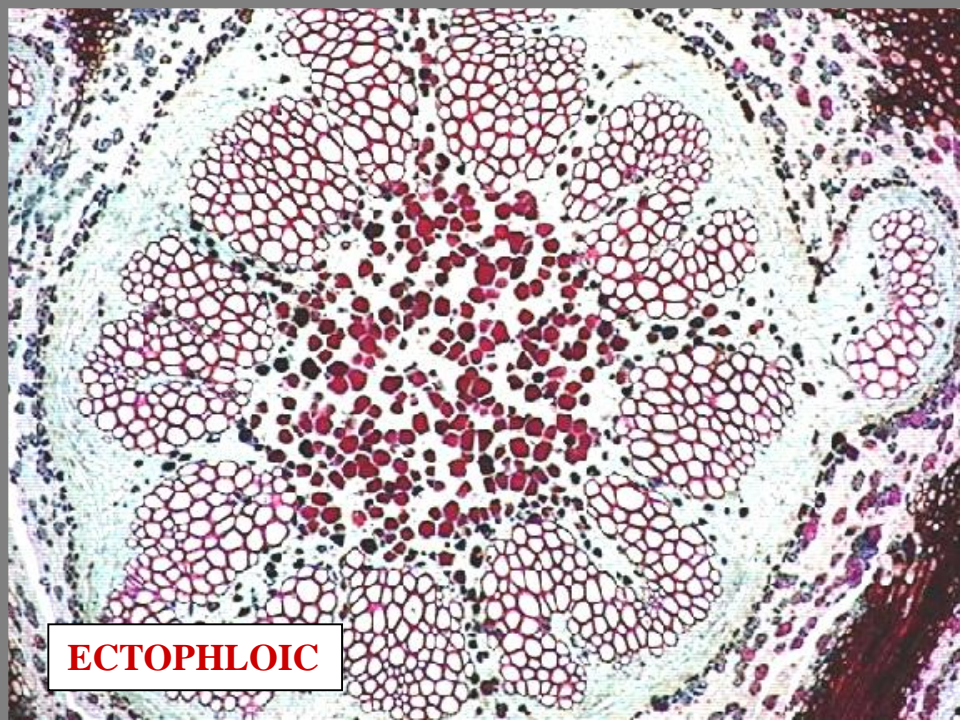
HAPLOSTELE



PLECTOSTELE

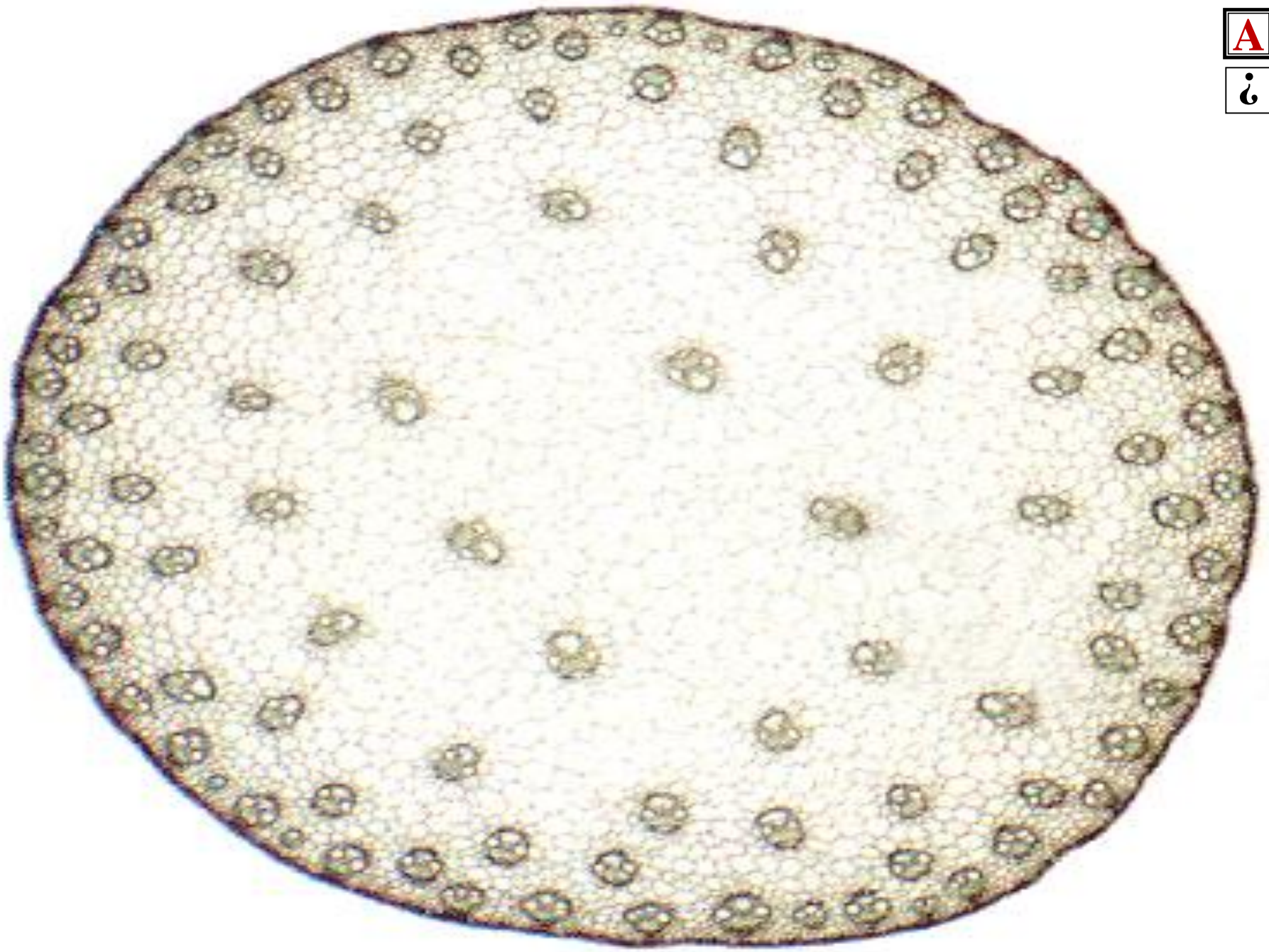


ACTINOSTELE



ECTOPHLOIC







ATACTOSTELE: ABSENT



LEAF

A close-up photograph of a forest floor covered in various types of mosses and ferns. The plants are vibrant green and appear to be growing in a moist, shaded environment. The mosses have different textures, some being more leafy and others more fibrous. The ferns have small, delicate fronds. The overall scene is a dense, lush carpet of green vegetation.

M

i

LYCOPHYTES

LYCOPODIOPHYTA



MICROPHYLLS

LYCOPHYTES

LYCOPODIOPHYTA



A close-up photograph of a dense thicket of bright green ferns. The fronds are finely divided and have a vibrant, almost neon green color. Small, delicate white flowers are scattered throughout the foliage, adding a soft contrast to the green. The background is a soft-focus continuation of the ferns, creating a sense of depth and texture.

M

i

FERNS

PTERIDOPHYTA



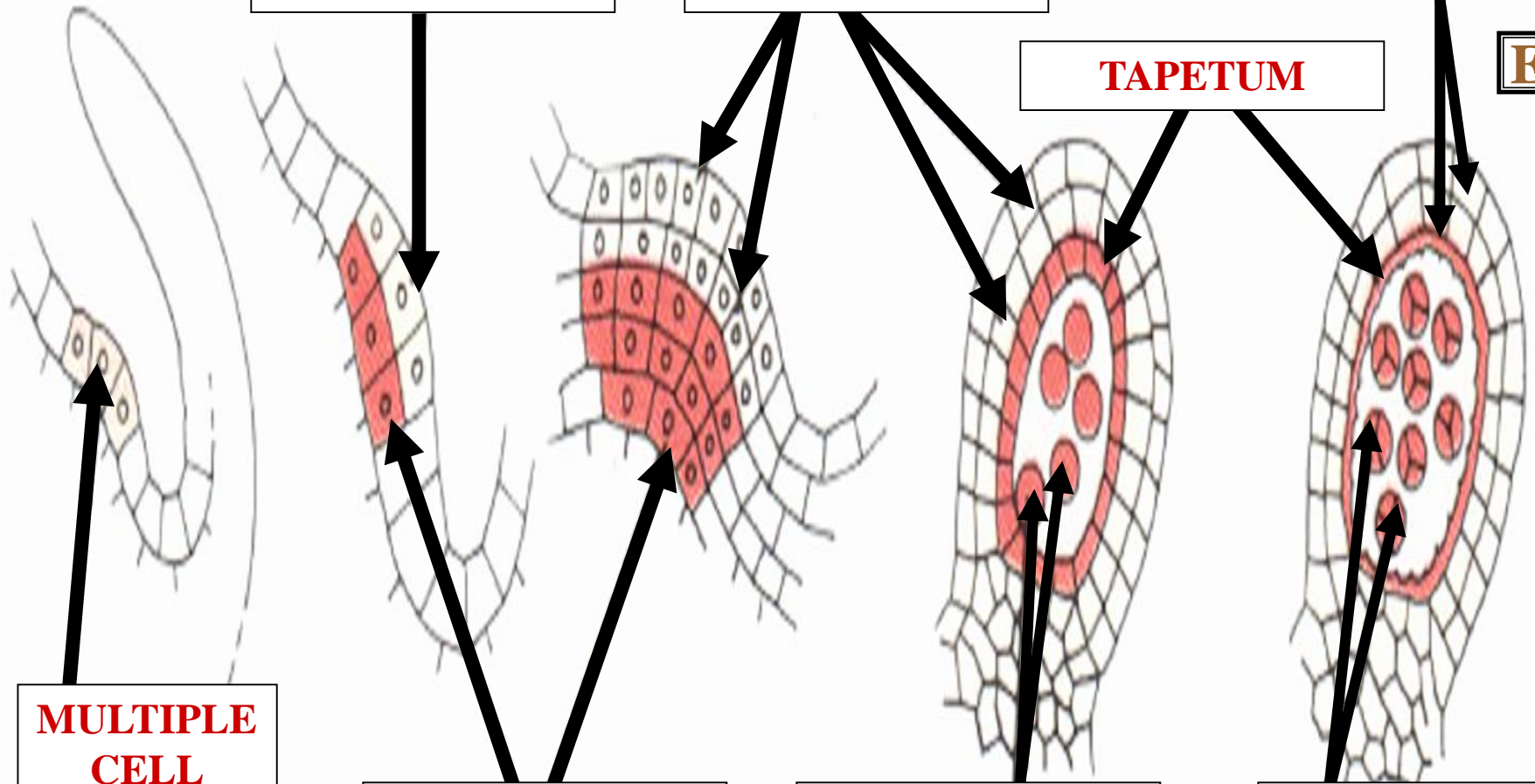
MEGAPHYLLS

FERNS

PTERIDOPHYTA



SPORANGIUM



**MULTIPLE
CELL
INITIALS**

WALL CELLS

WALL CELLS

TAPETUM

LARGE SIZE

THICK WALL

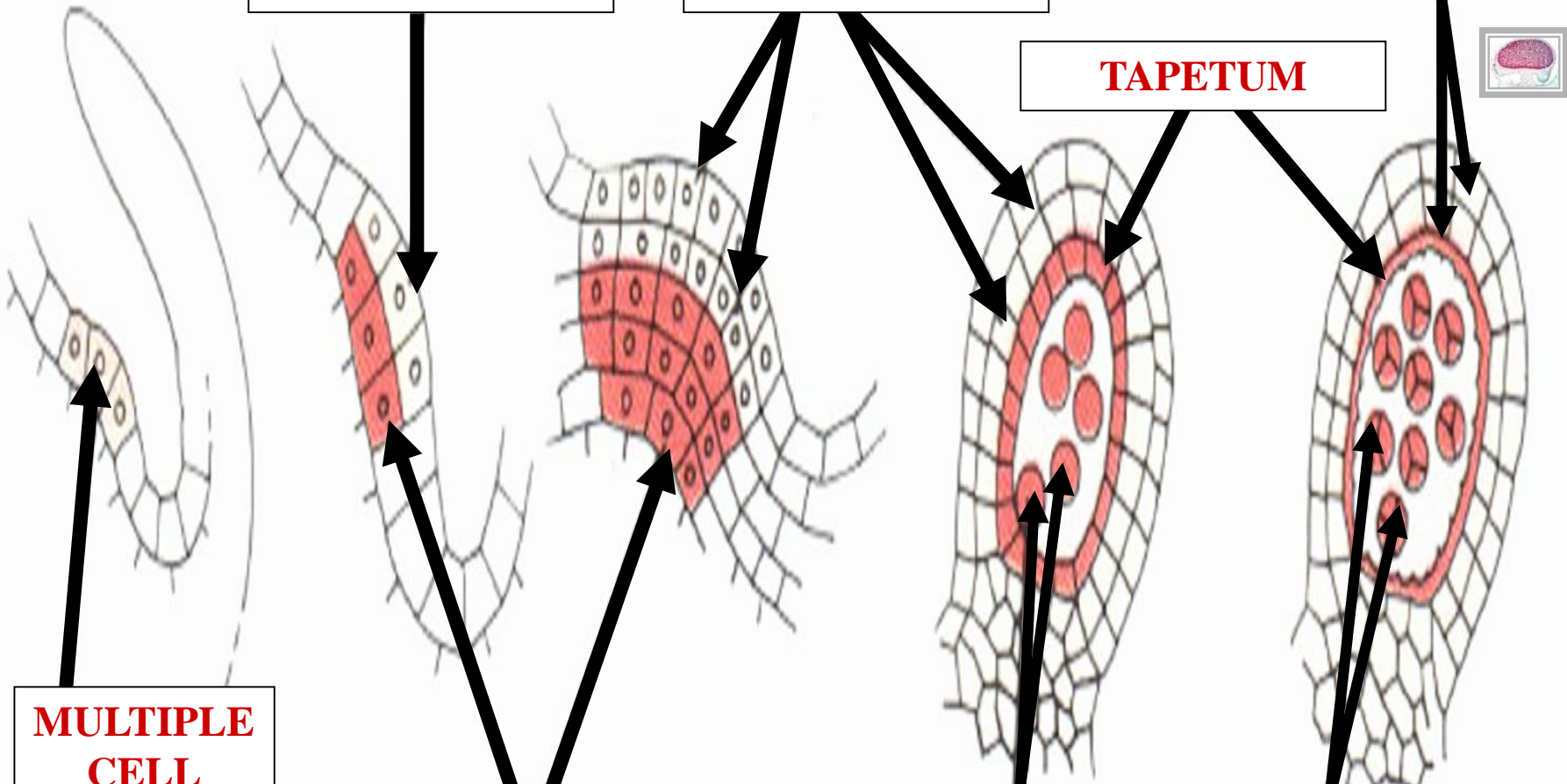
E

SPOROCYTES

SPOROCYTES

**NUMEROUS
SPORES**

L.S.



**MULTIPLE
CELL
INITIALS**

WALL CELLS

WALL CELLS

LARGE SIZE

THICK WALL

TAPETUM

SPOROCYTES

SPOROCYTES

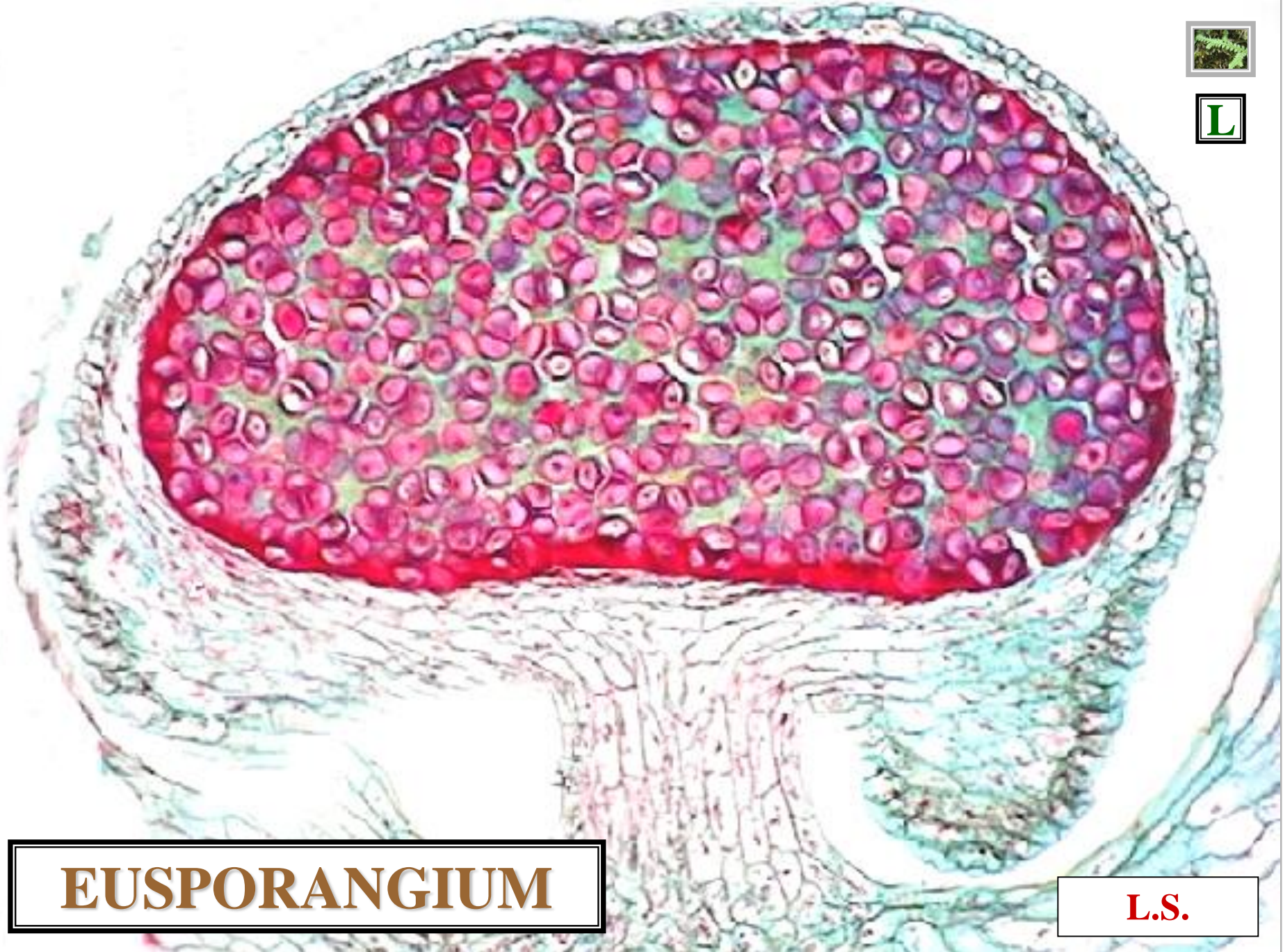
**NUMEROUS
SPORES**

EUSPORANGIUM

L.S.



L



EUSPORANGIUM

L.S.

EUSPORANGIUM

LYCOPHYTES



^

L

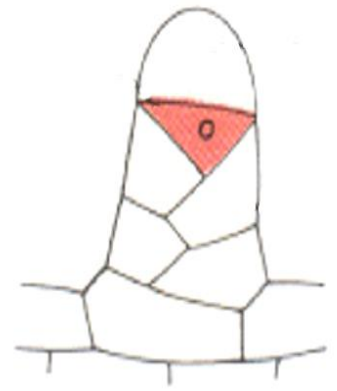
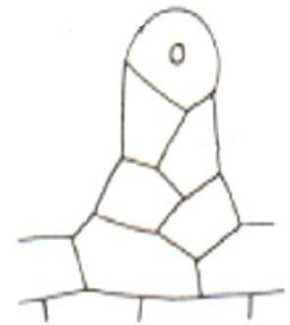
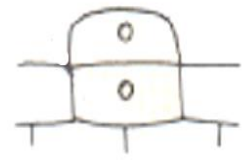
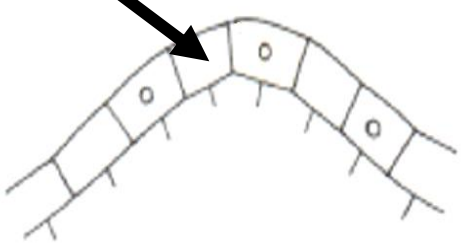


SOME FERNS

EUSPORANGIUM



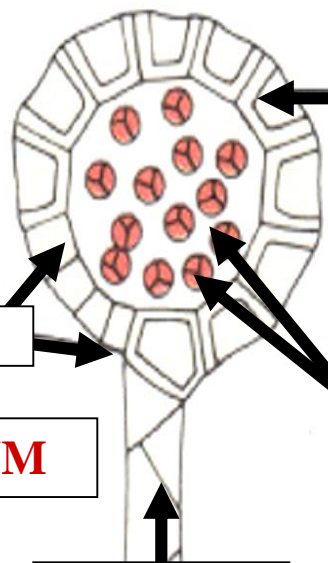
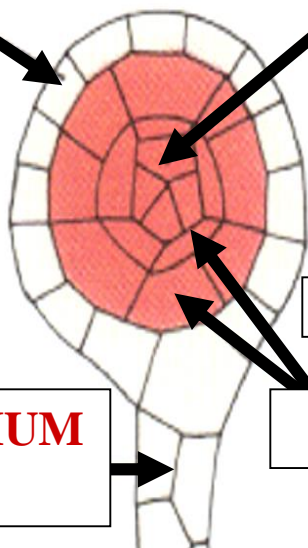
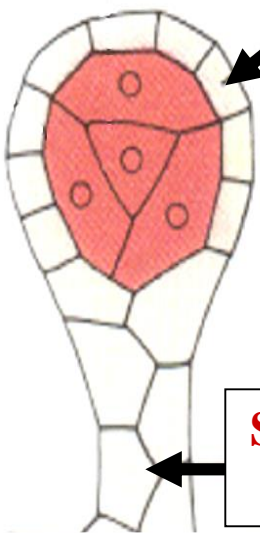
CELL INITIAL



SPORANGIUM WALL

SPOROCYTES

SMALL SIZE



ANNULUS

THIN WALL

STOMIUM

FEW SPORES

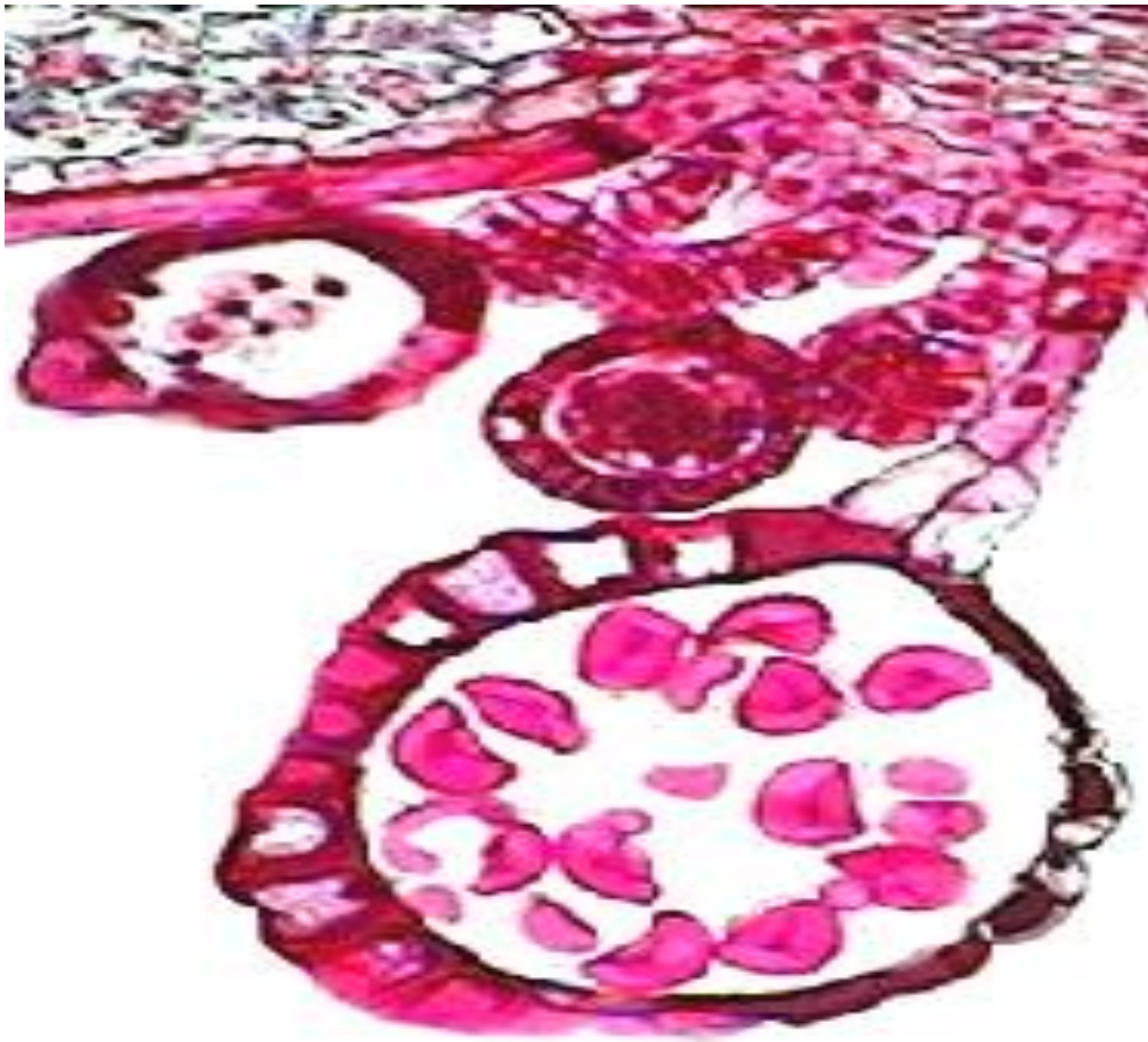
SPORANGIUM STALK

TAPETUM

STALK

LEPTOSPORANGIUM

L.S.



LEPTOSPORANGIUM

L.S.

LEPTOSPORANGIUM: PRESENT



LEPTOSPORANGIUM: PRESENT



“ADVANCED FERNS”

LEPTOSPORANGIUM: PRESENT



LEPTOSPORANGIUM: PRESENT





SPORE HABIT

L

?



S

+

LYCOPODIUM



STROBILUS



LYCOPODIUM

A light micrograph showing a longitudinal section of a lycopodium stem. The central vascular cylinder is stained green, while the surrounding cortex is stained pink. Four large, oval-shaped structures, the eusporangia, are visible, each containing a dense cluster of small, dark-stained cells. A red arrow points from a white box containing the text 'EUSPORANGIUM' to one of these structures.

EUSPORANGIUM

LYCOPODIUM

L.S.

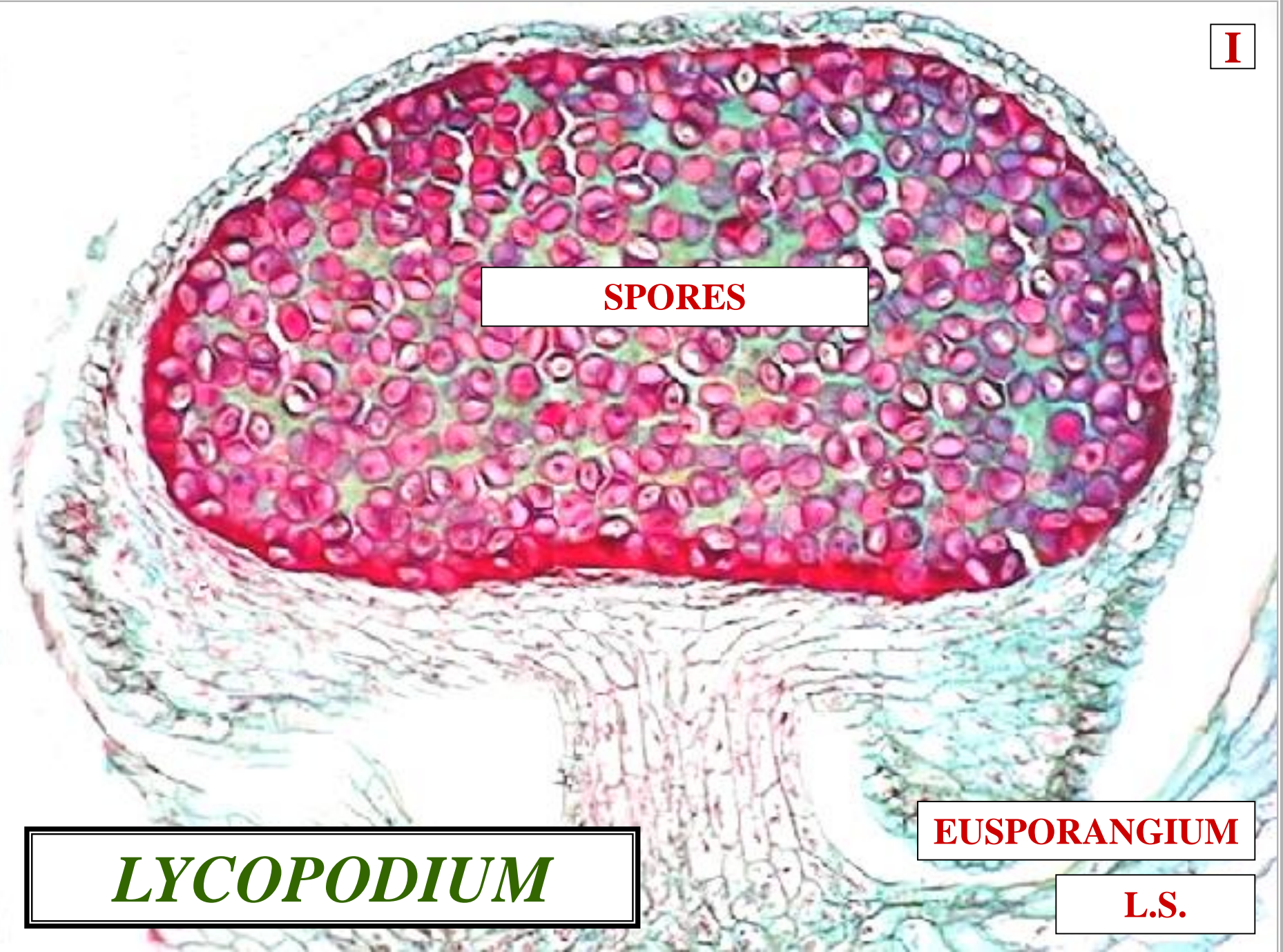
I

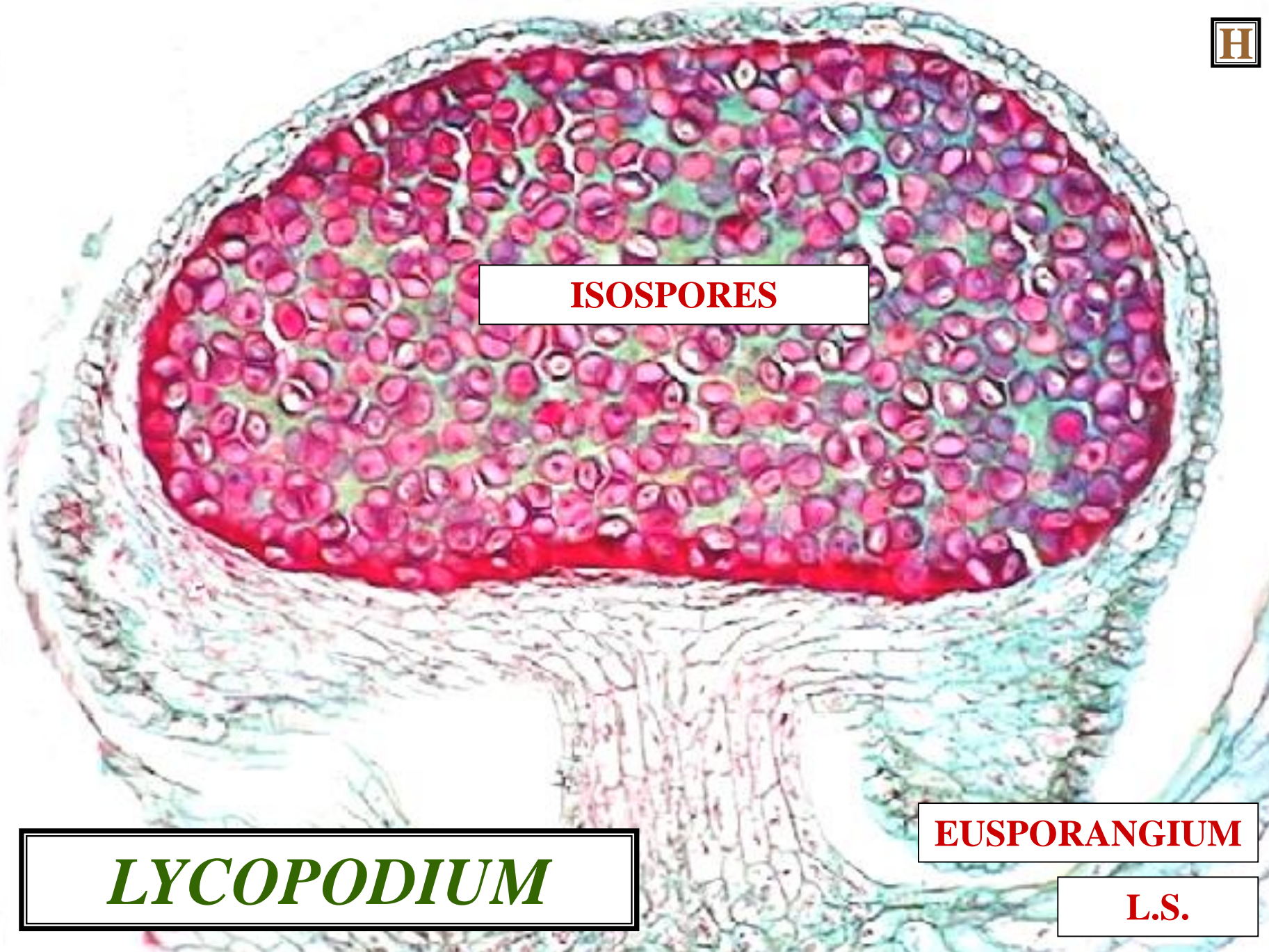
SPORES

LYCOPODIUM

EUSPORANGIUM

L.S.





ISOSPORES

EUSPORANGIUM

LYCOPODIUM

L.S.

S

L

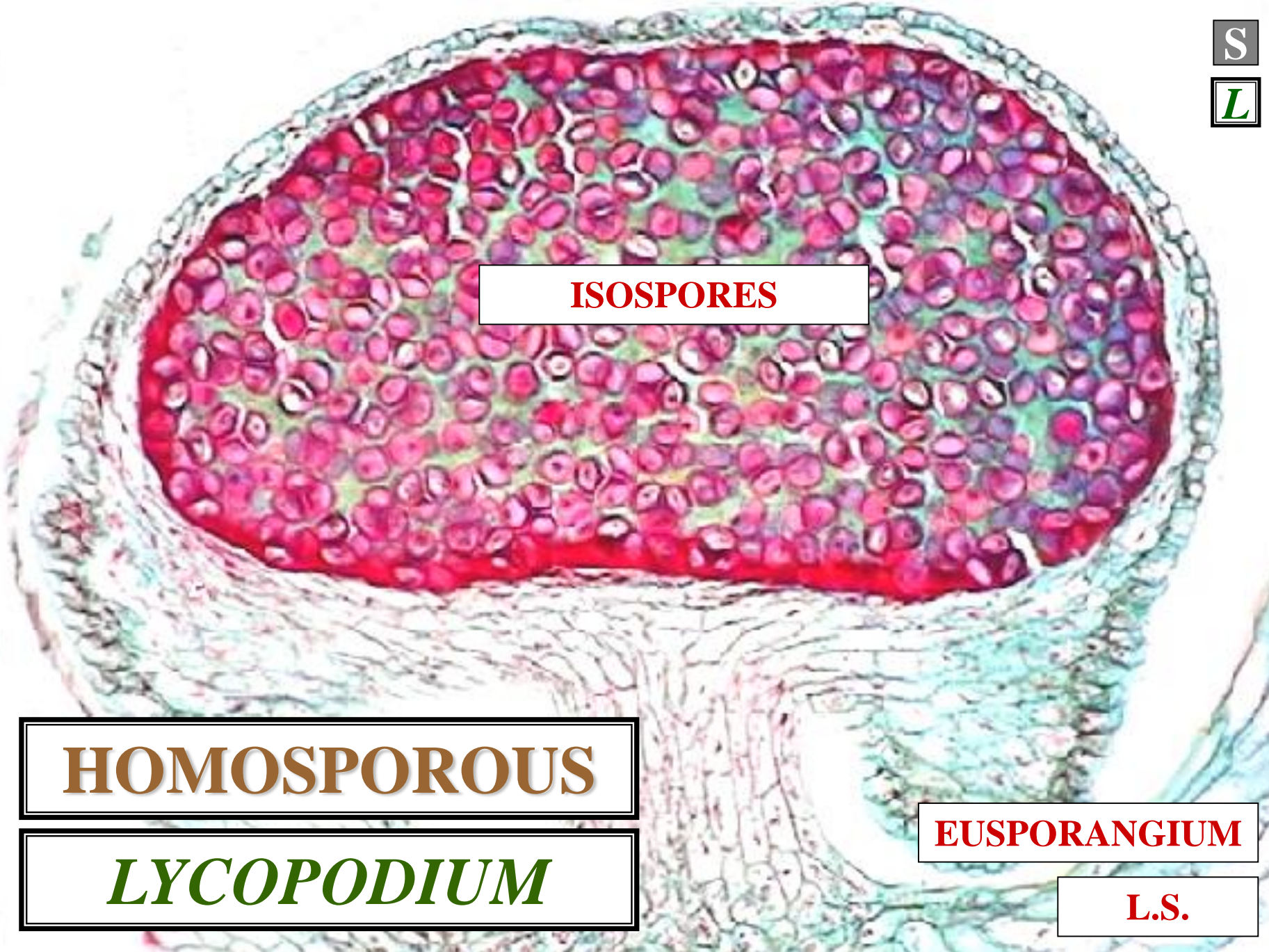
ISOSPORES

HOMOSPOROUS

LYCOPODIUM

EUSPORANGIUM

L.S.





^

?

HOMOSPOROUS

LYCOPODIUM

S

?

