

MEGASPORES →

MEGASPORANGIUM →

→ **?**

STROBILUS

L.S.

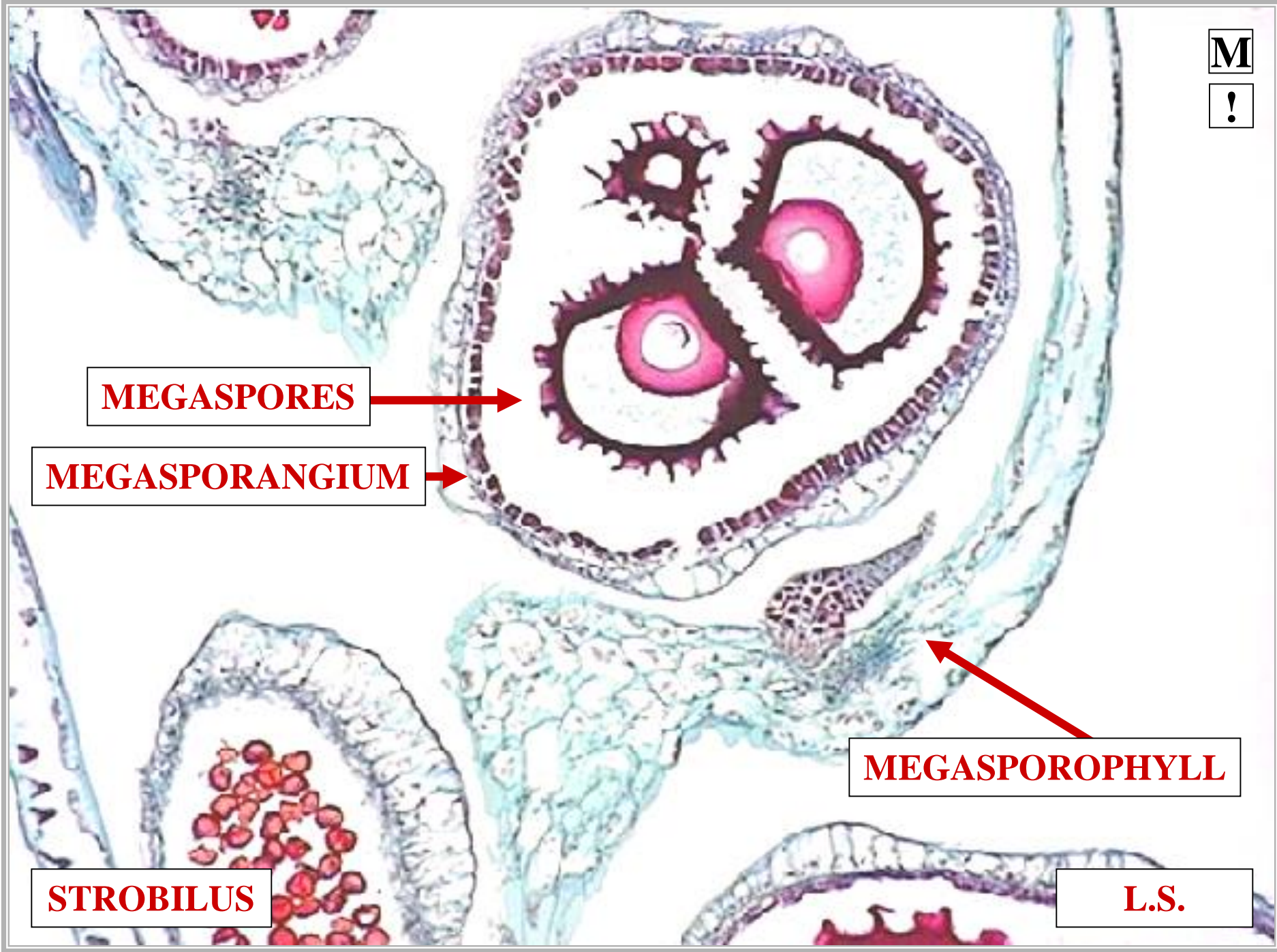
MEGASPORES

MEGASPORANGIUM

MEGASPOROPHYLL

STROBILUS

L.S.



MEGASPOROPHYLL



MEGASPOROPHYLL

LEAF

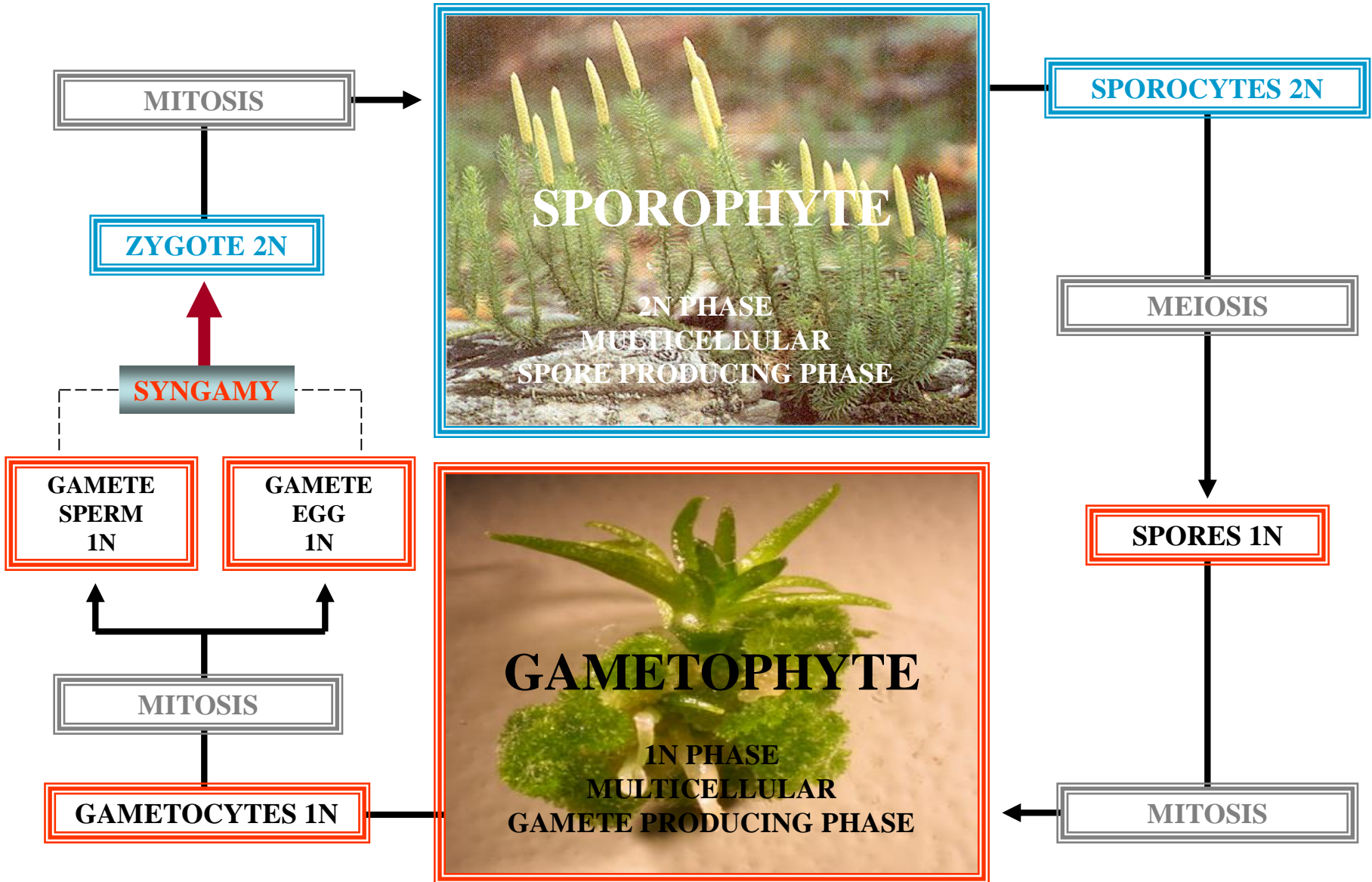
BEARING

MEGASPORANGIUM

MEGASPOROPHYLL

LYCOPODIOPHYTA

LIFE CYCLE





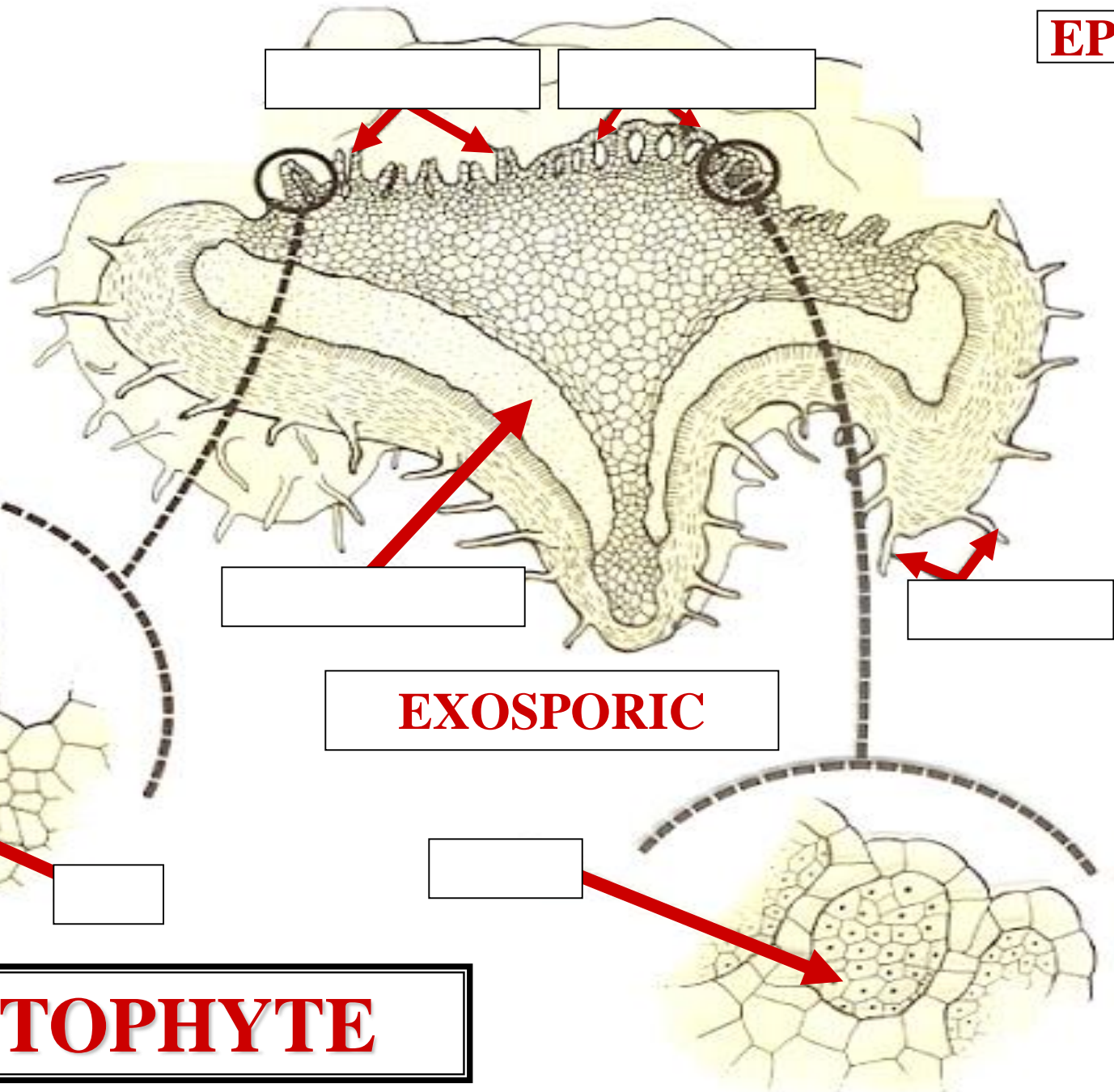
GAMETOPHYTE CHARACTERS



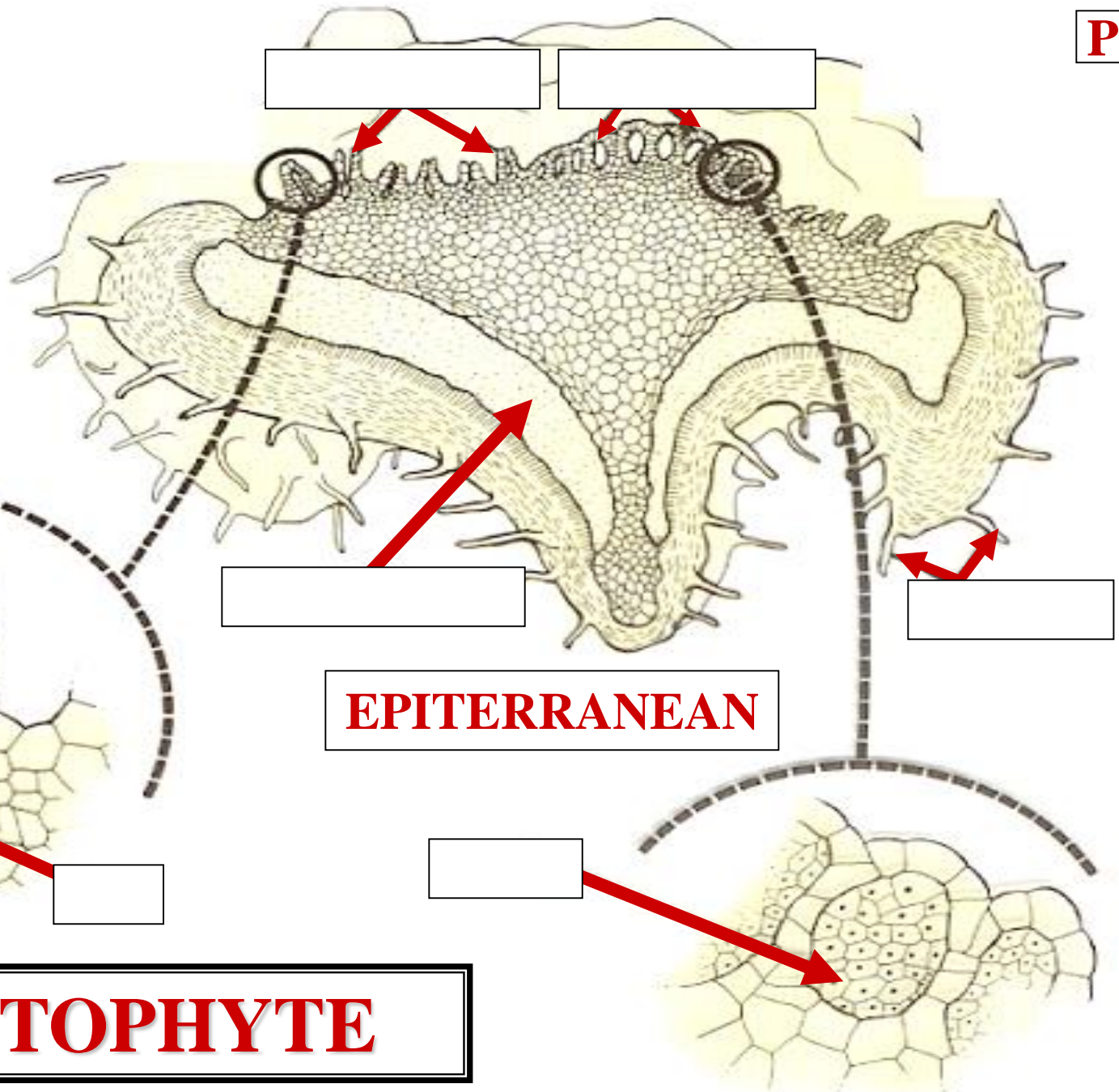
EXOSPORIC GAMETOPHYTE



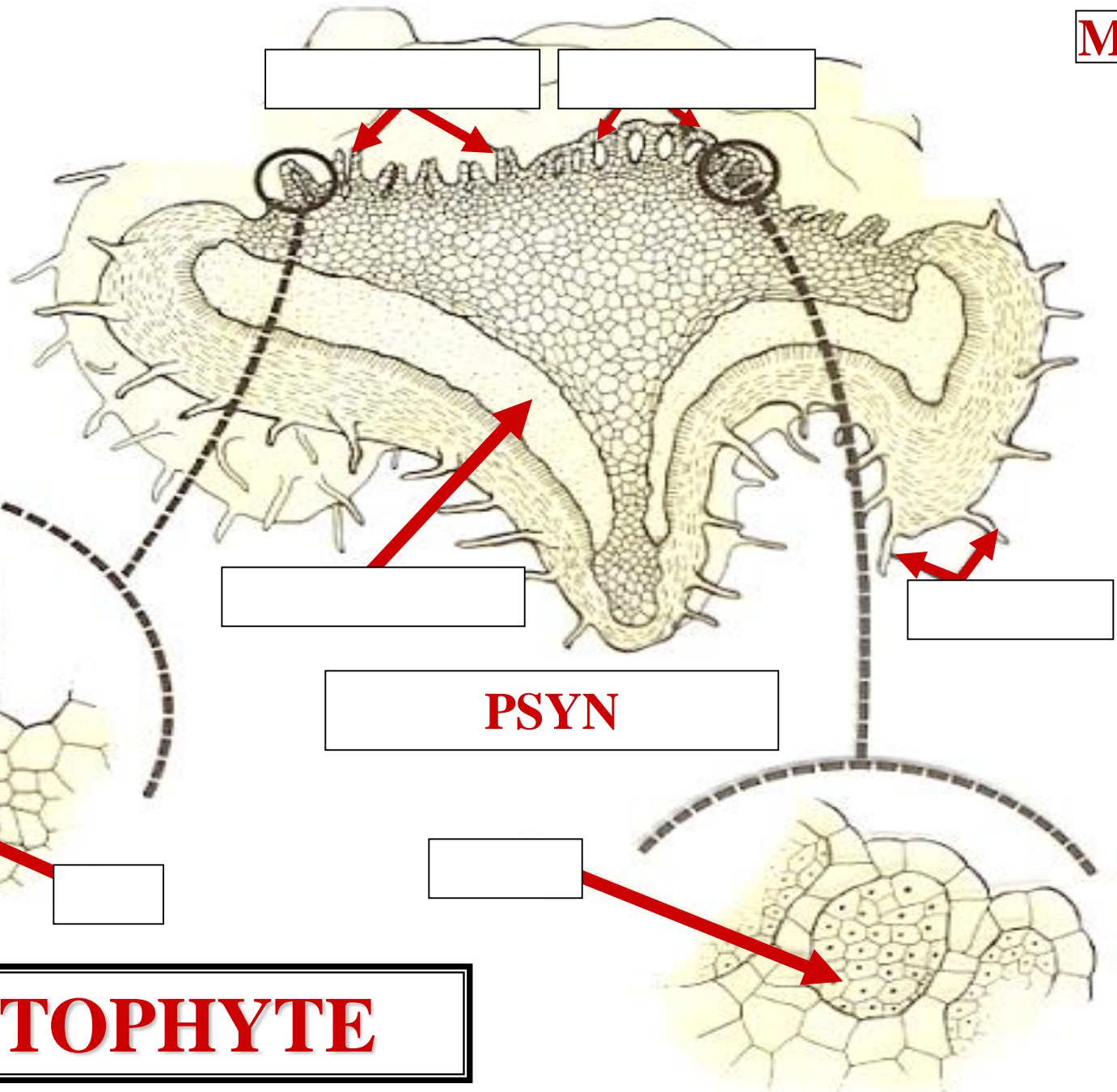
EP



GAMETOPHYTE



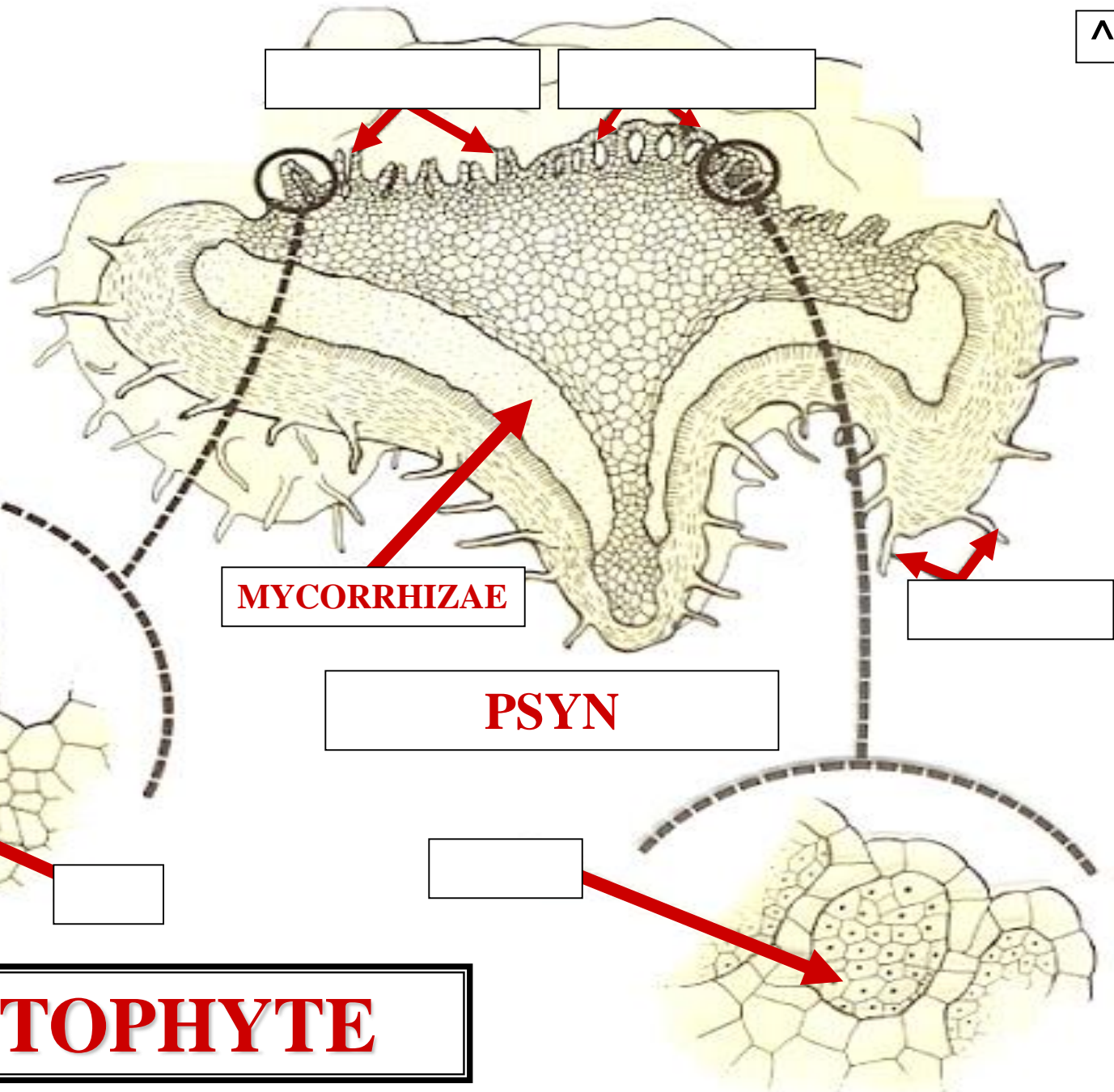
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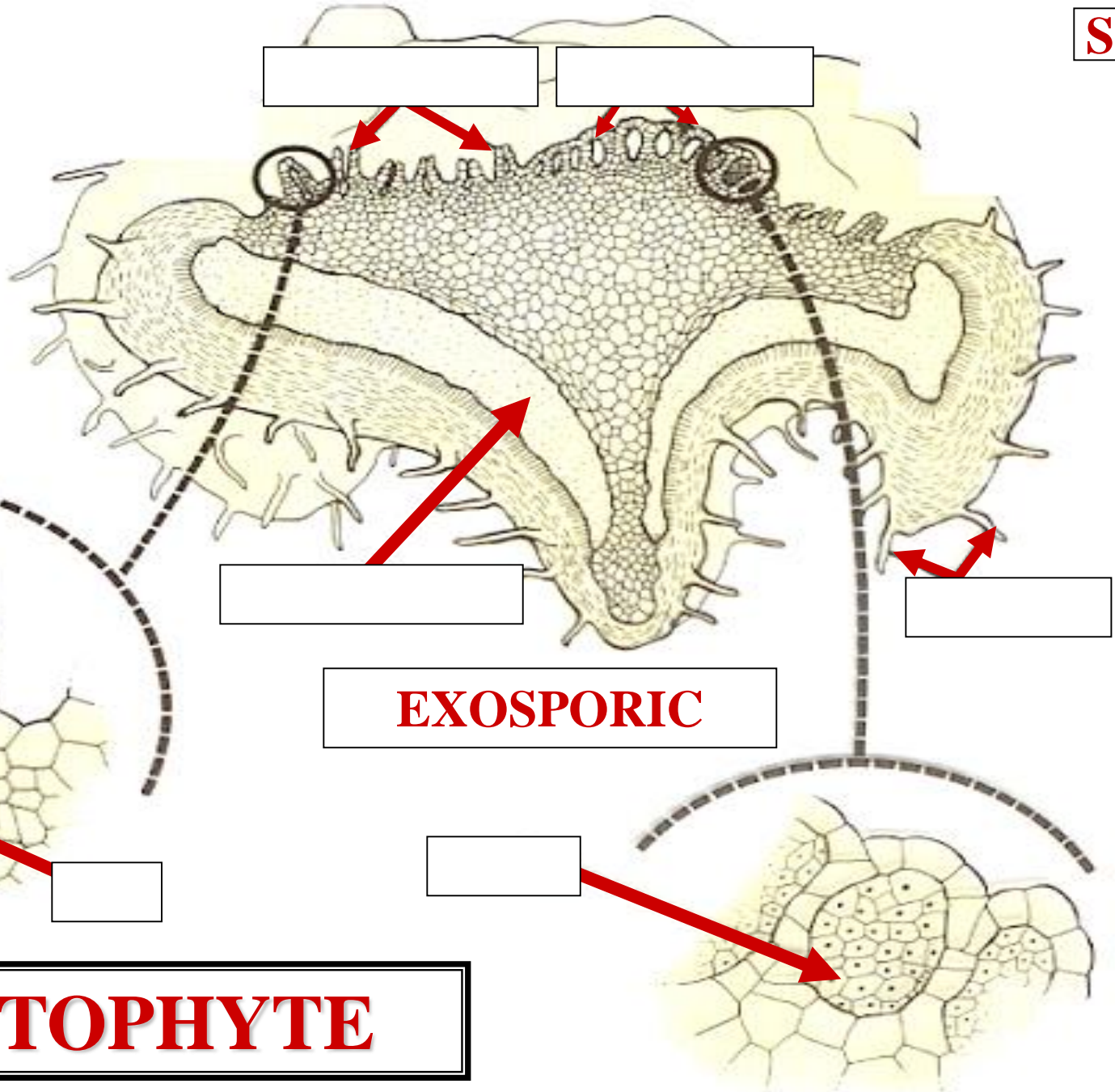
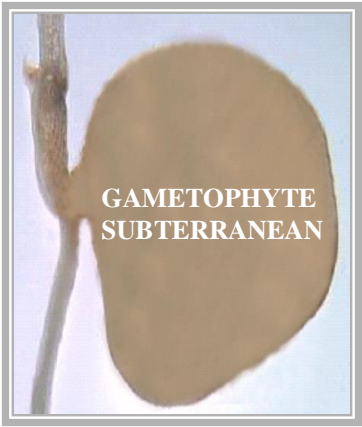


GAMETOPHYTE



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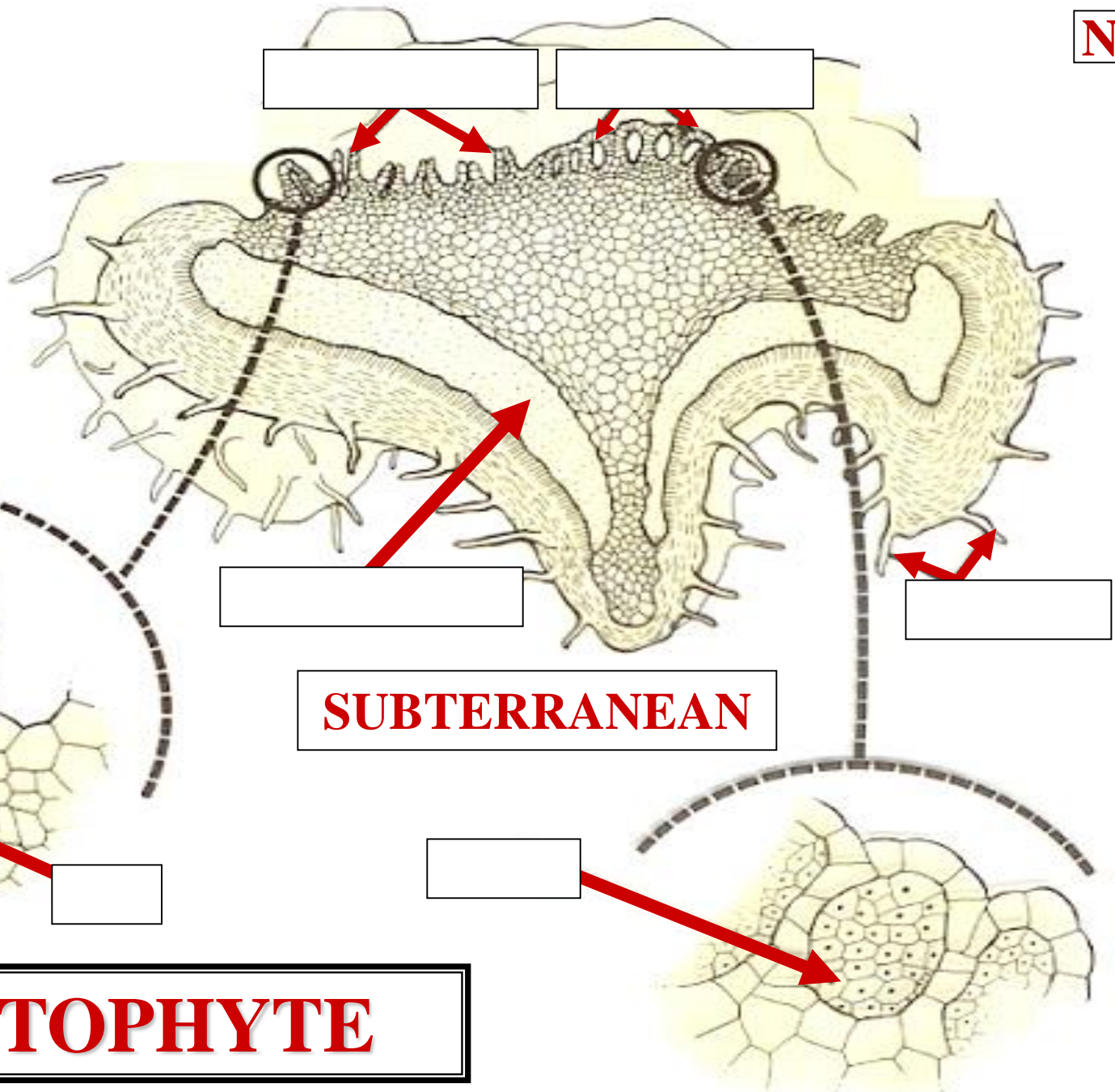
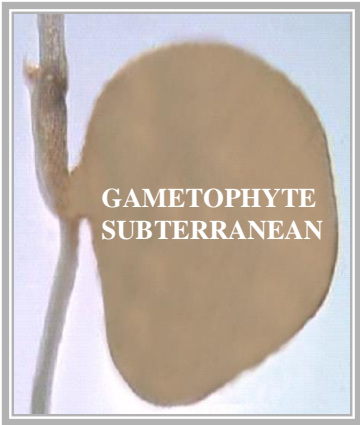




EXOSPORIC

GAMETOPHYTE

N



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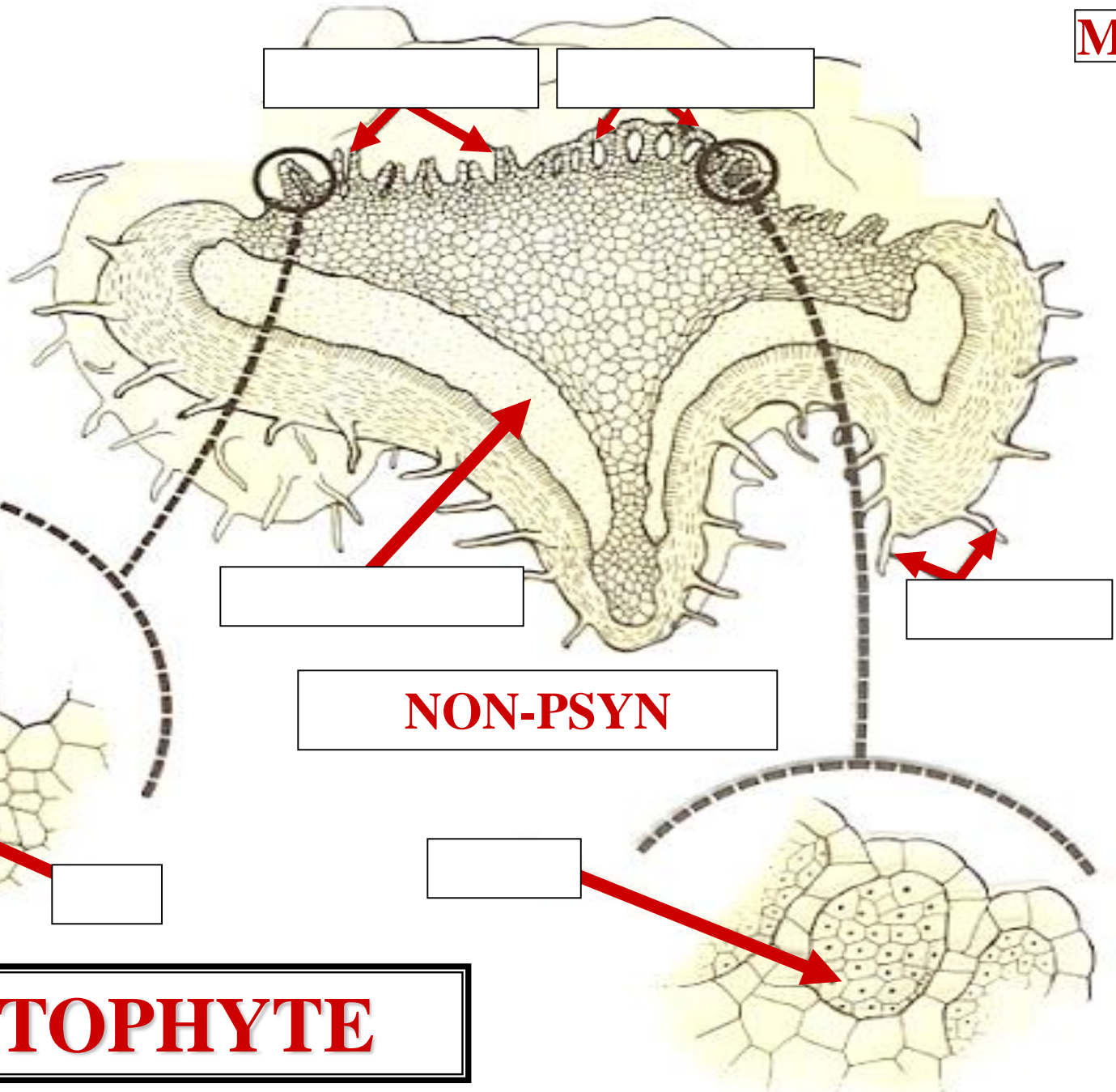
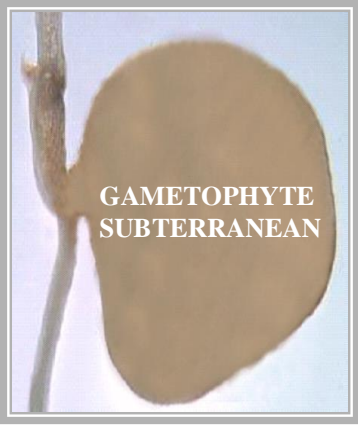
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SUBTERRANEAN

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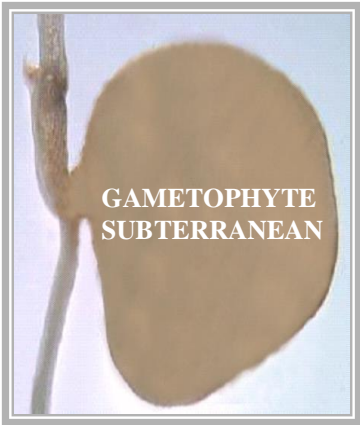
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GAMETOPHYTE

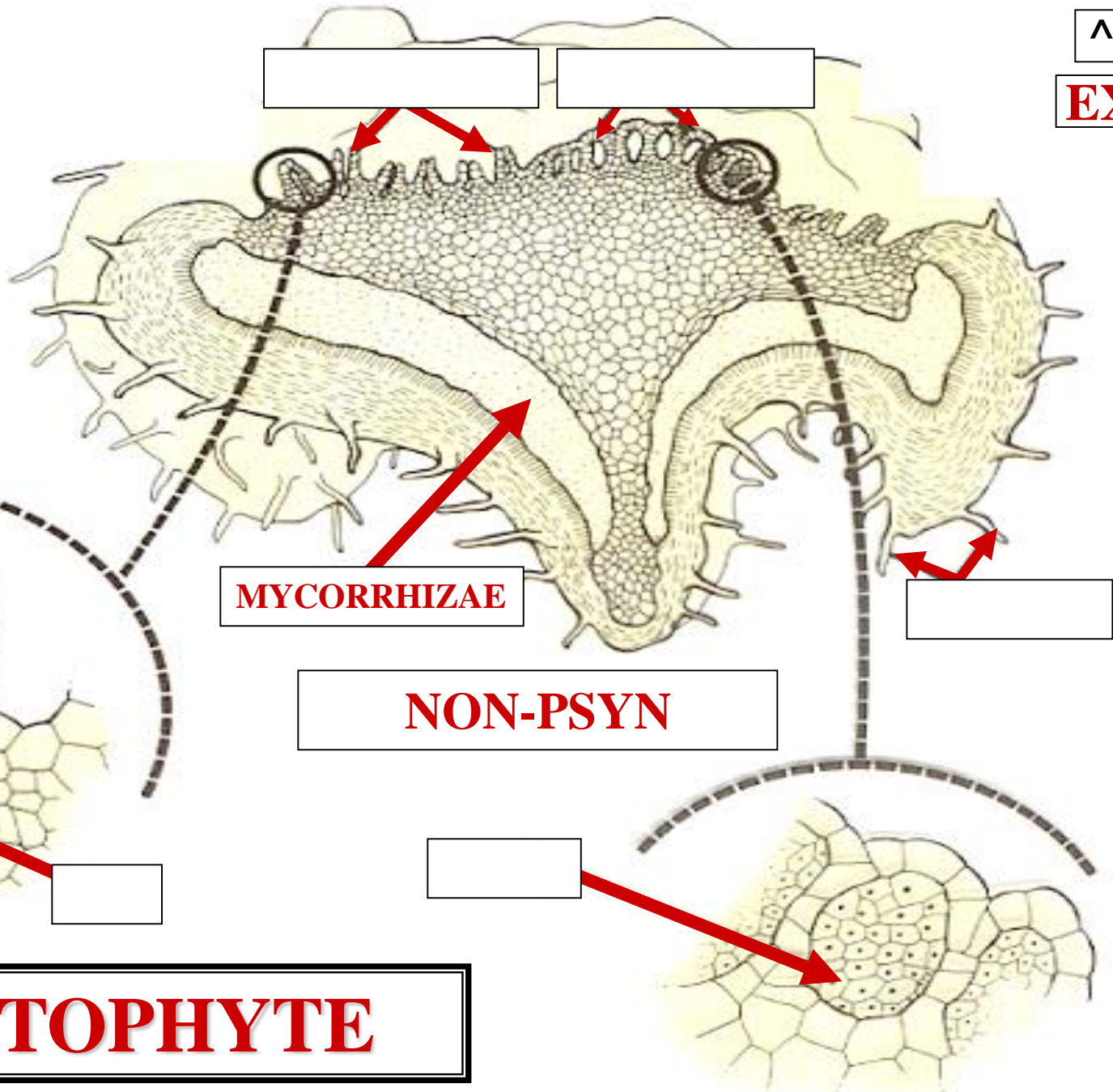


NON-PSYN

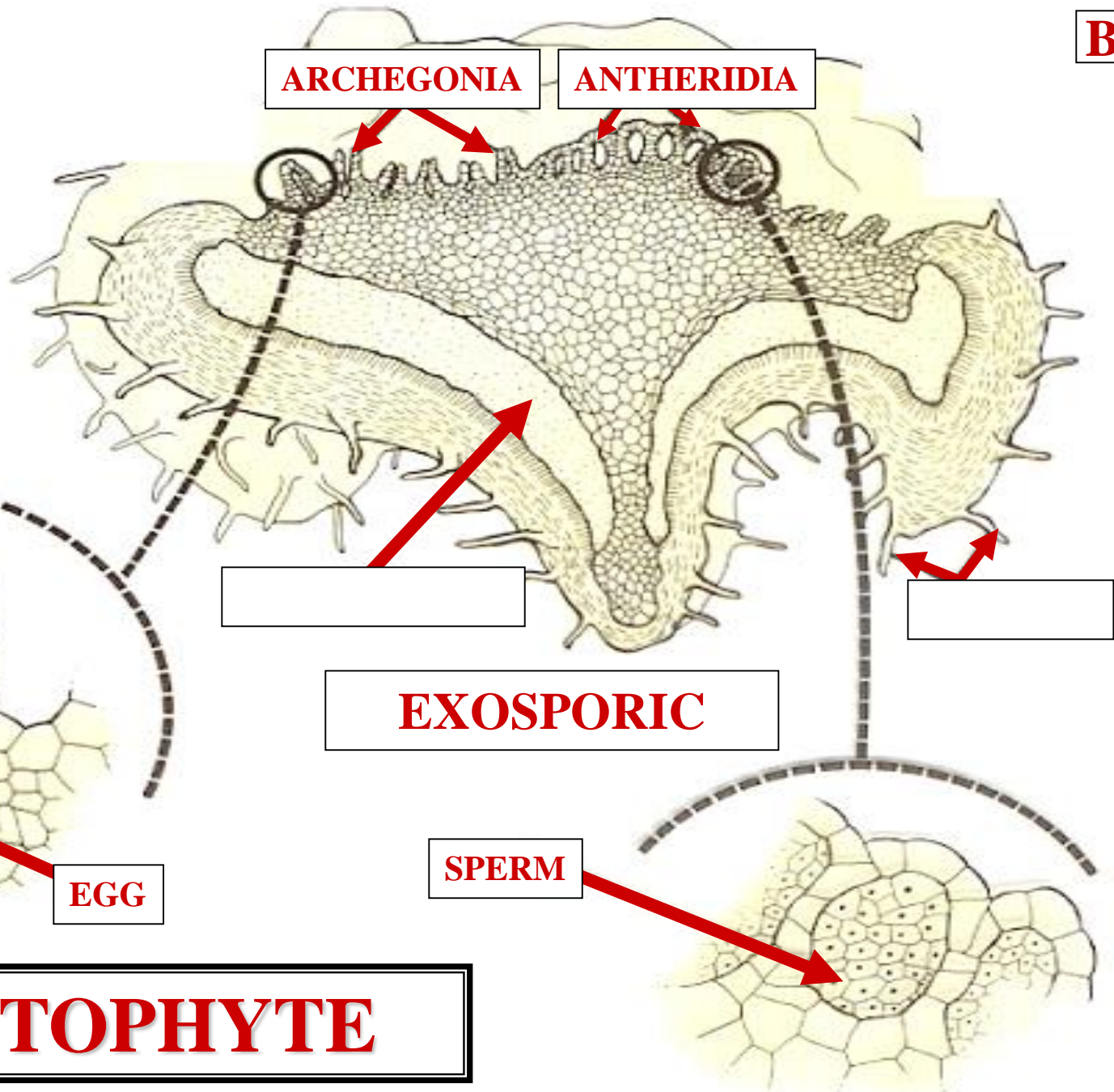
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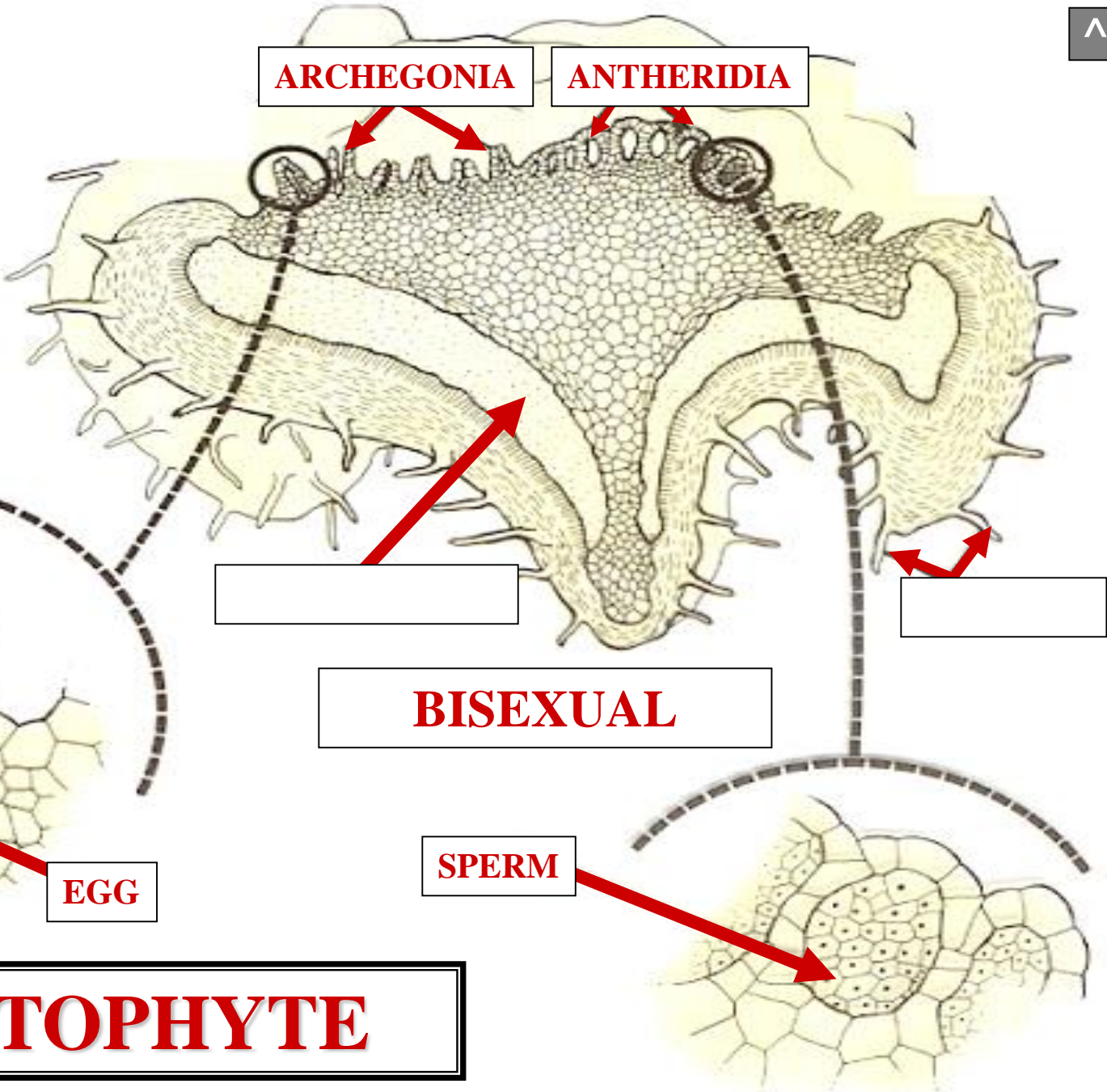


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EX



B





GAMETOPHYTE MYCORRHIZAE

MYCORRHIZAE

MYCORRHIZAE

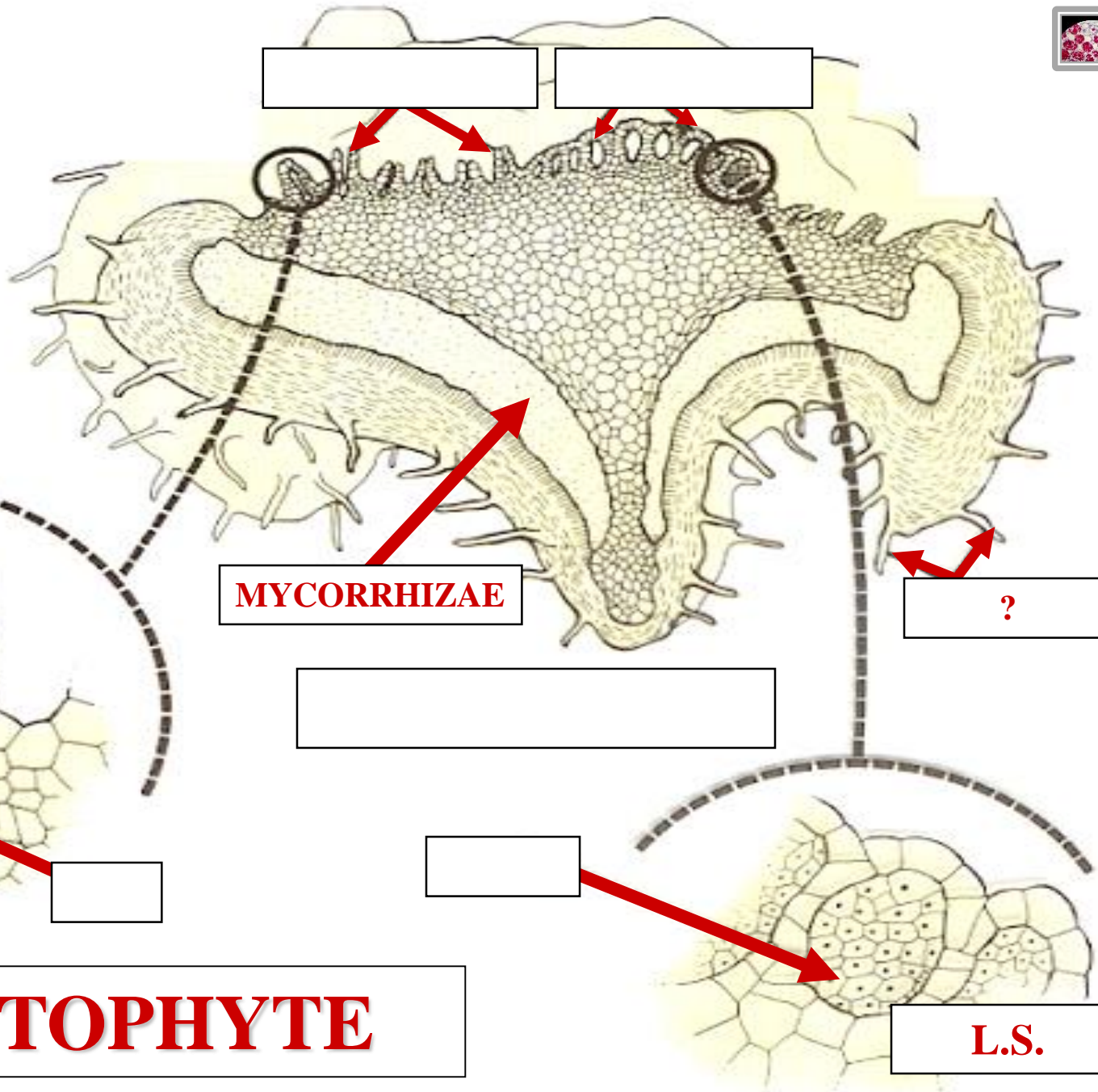


FUNGUS SYMBIONT

MYCORRHIZAE



GAMETOPHYTE



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MYCORRHIZAE

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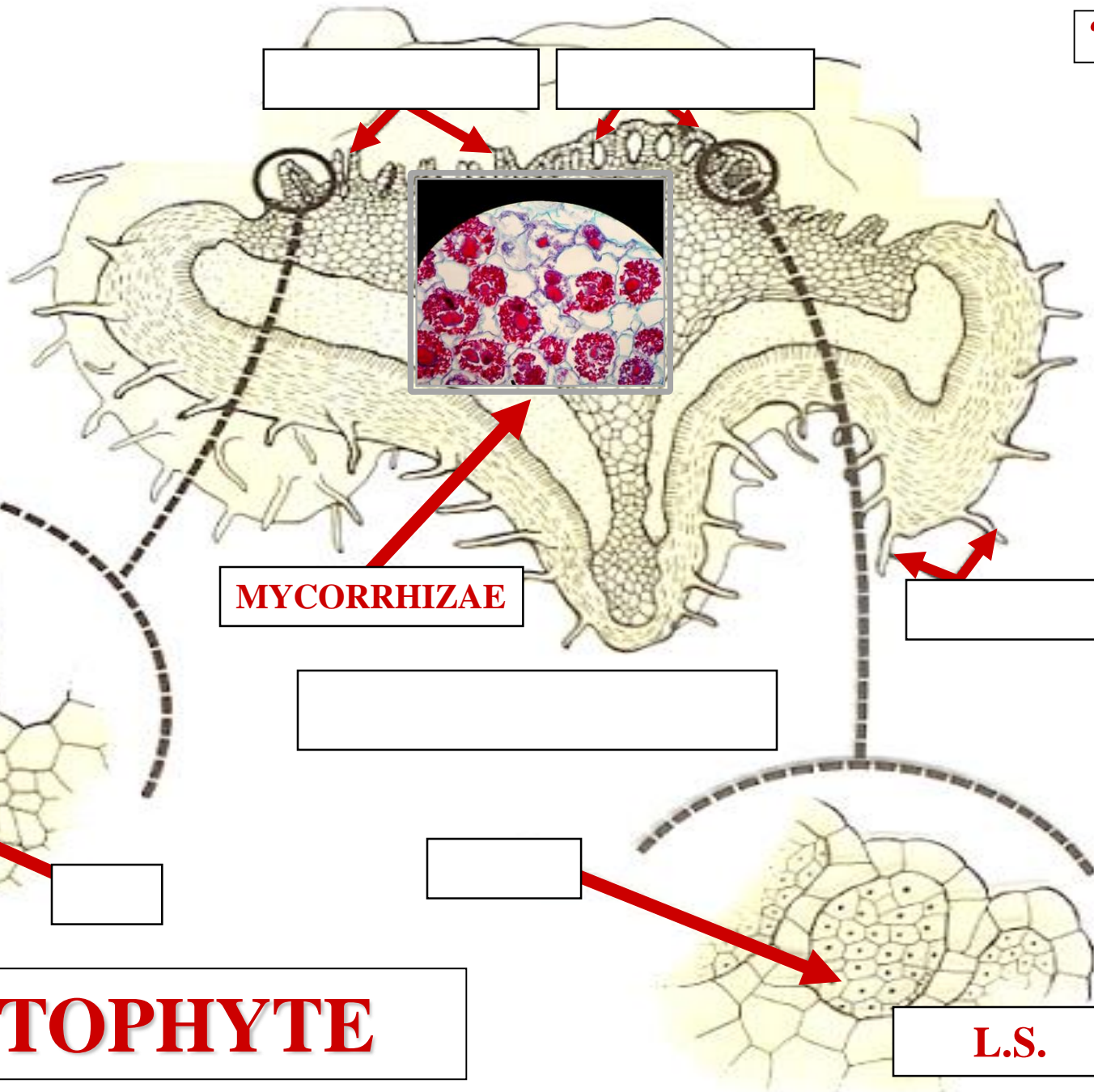
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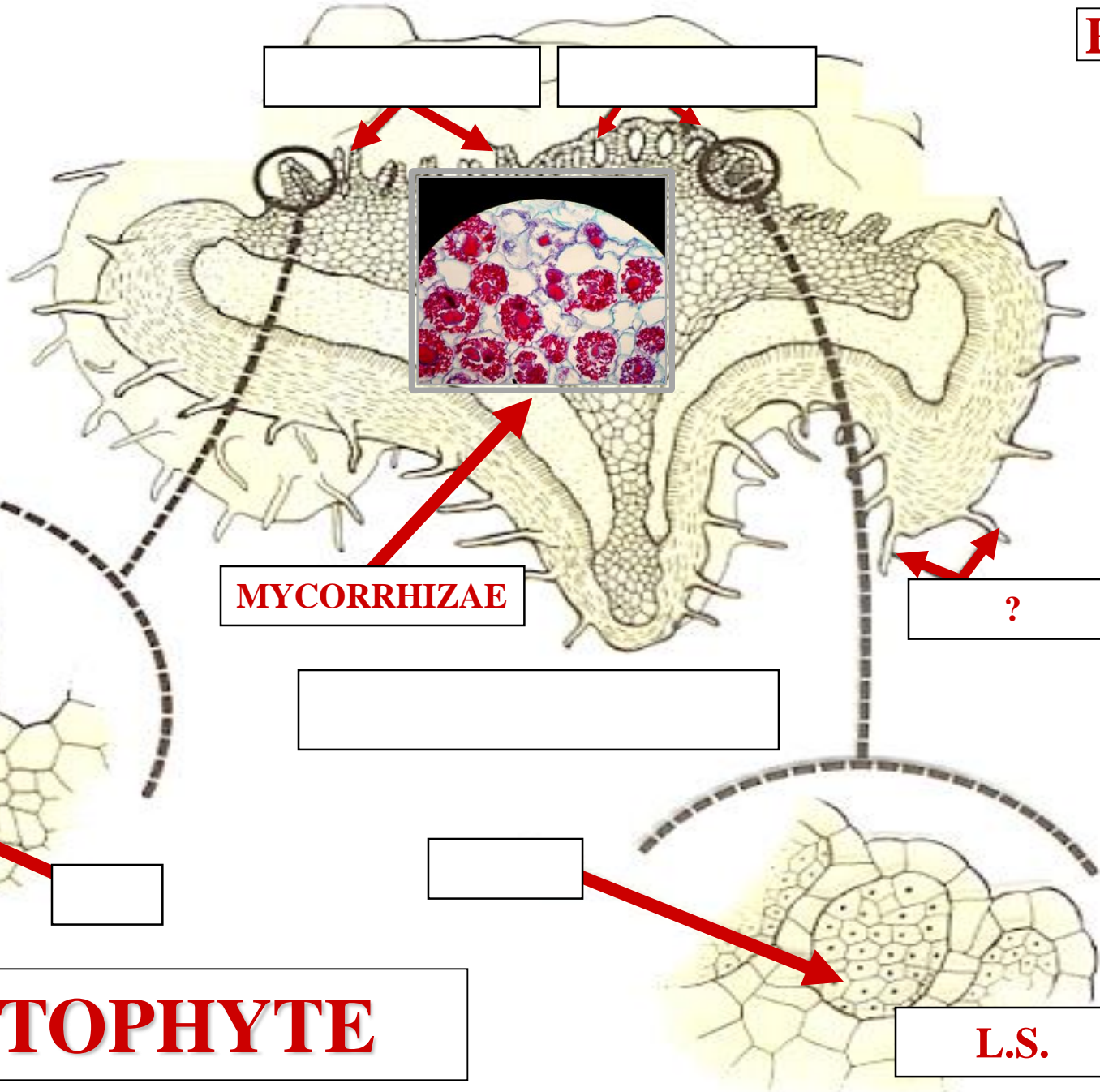
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GAMETOPHYTE

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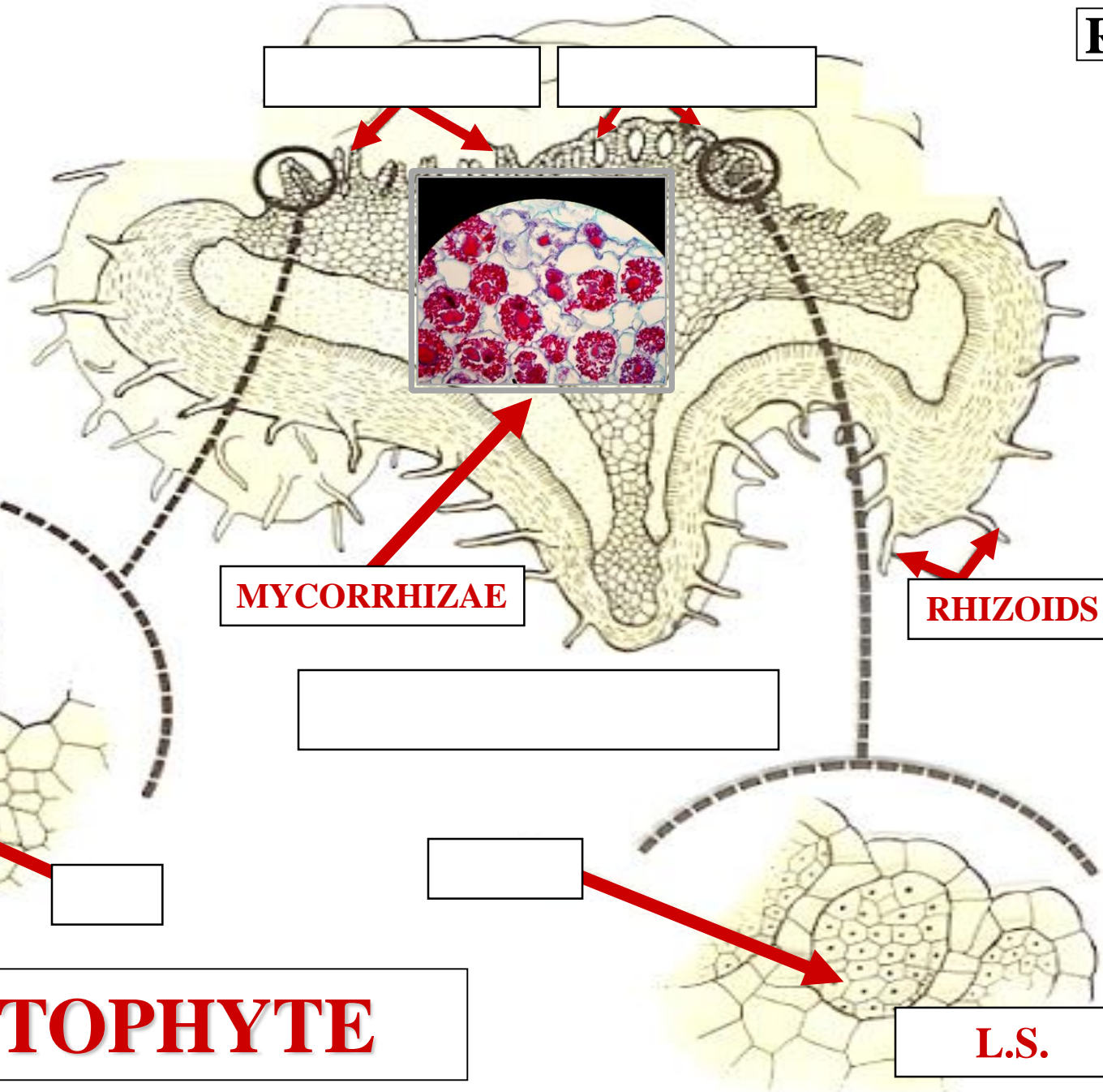


MYCORRHIZAE

?

GAMETOPHYTE

L.S.



GAMETOPHYTE

L.S.

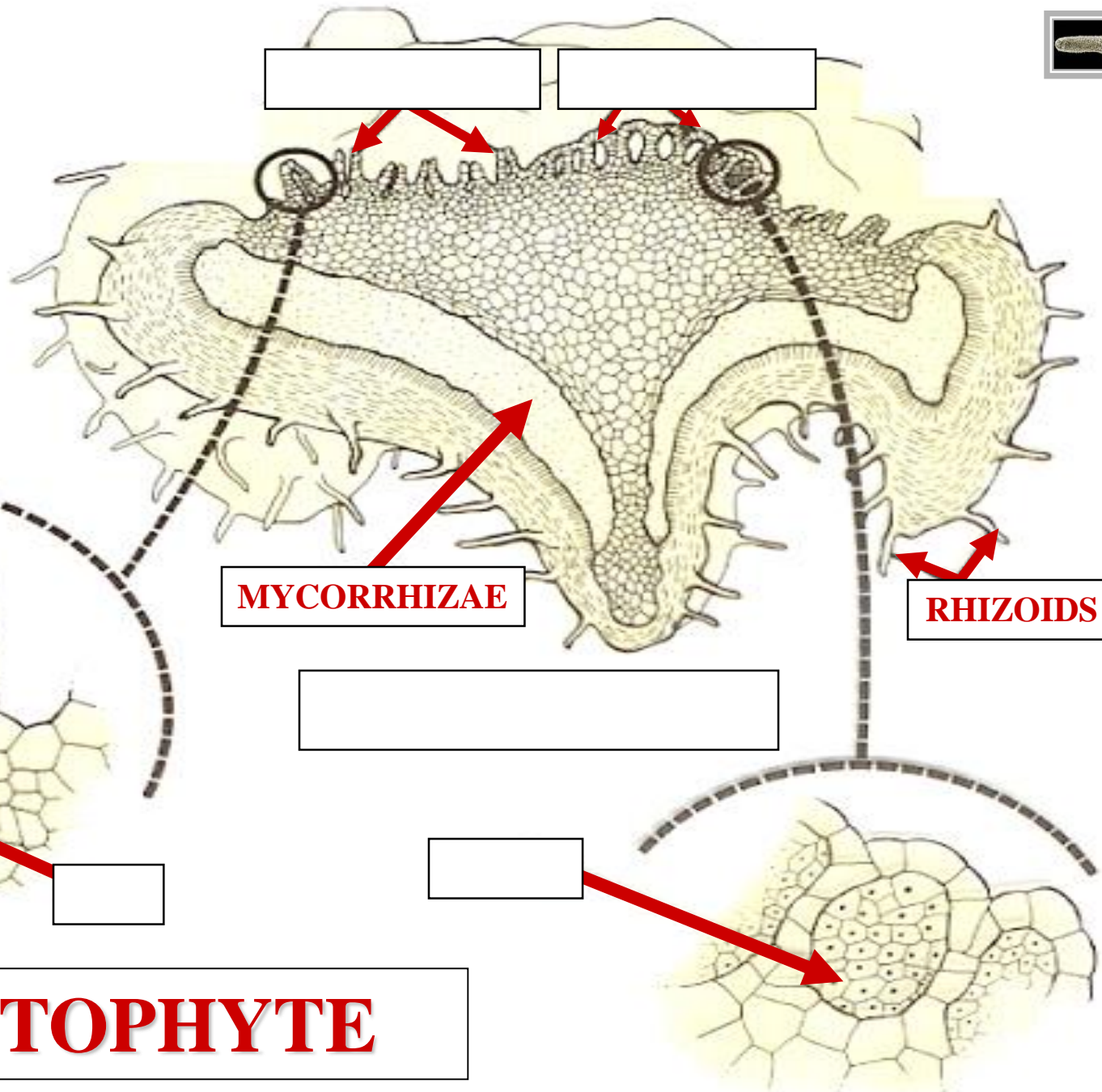
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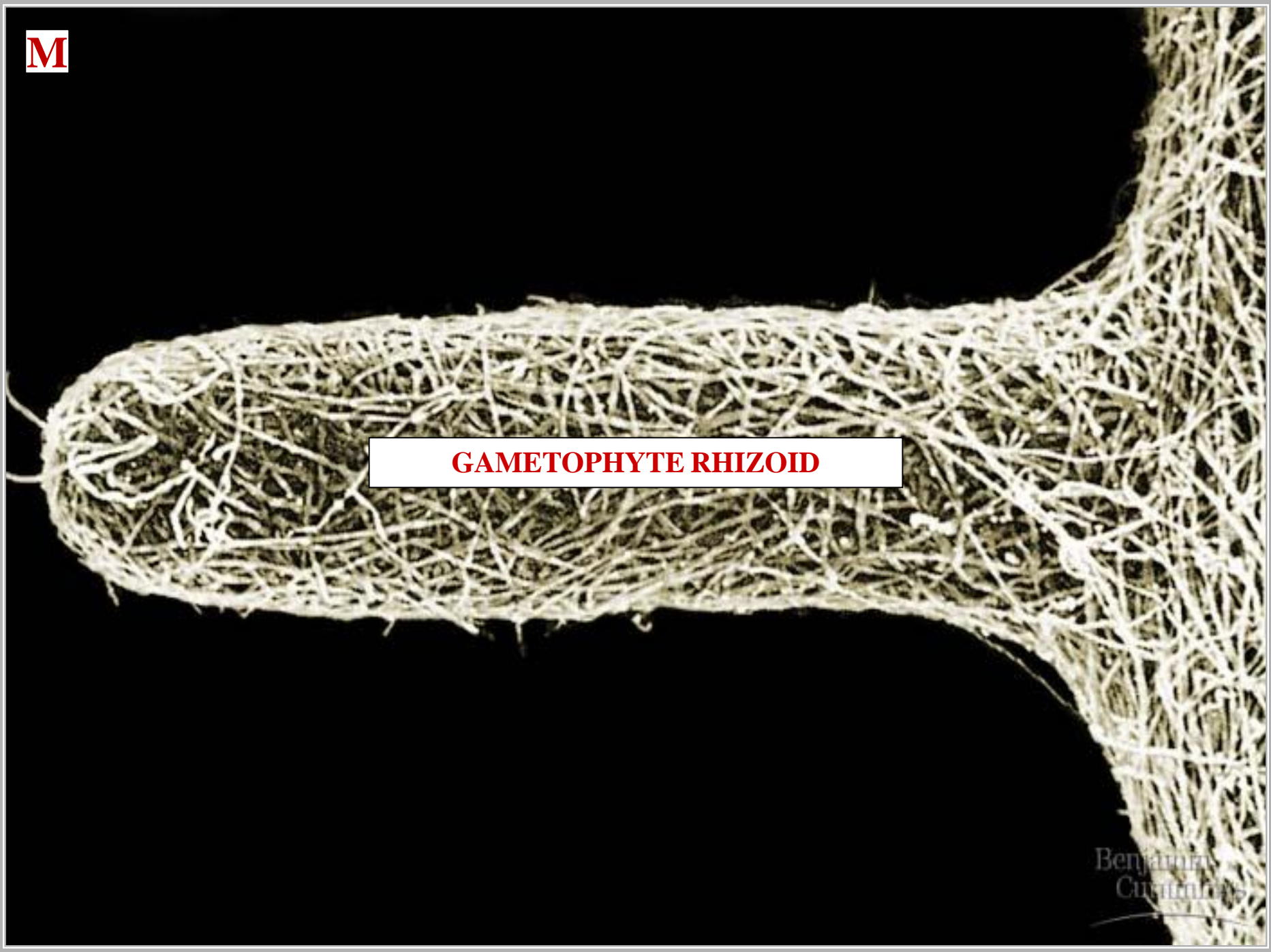


RHIZOID

**ROOT-LIKE
GAMETOPHYTE
OUTGROWTH**

RHIZOID



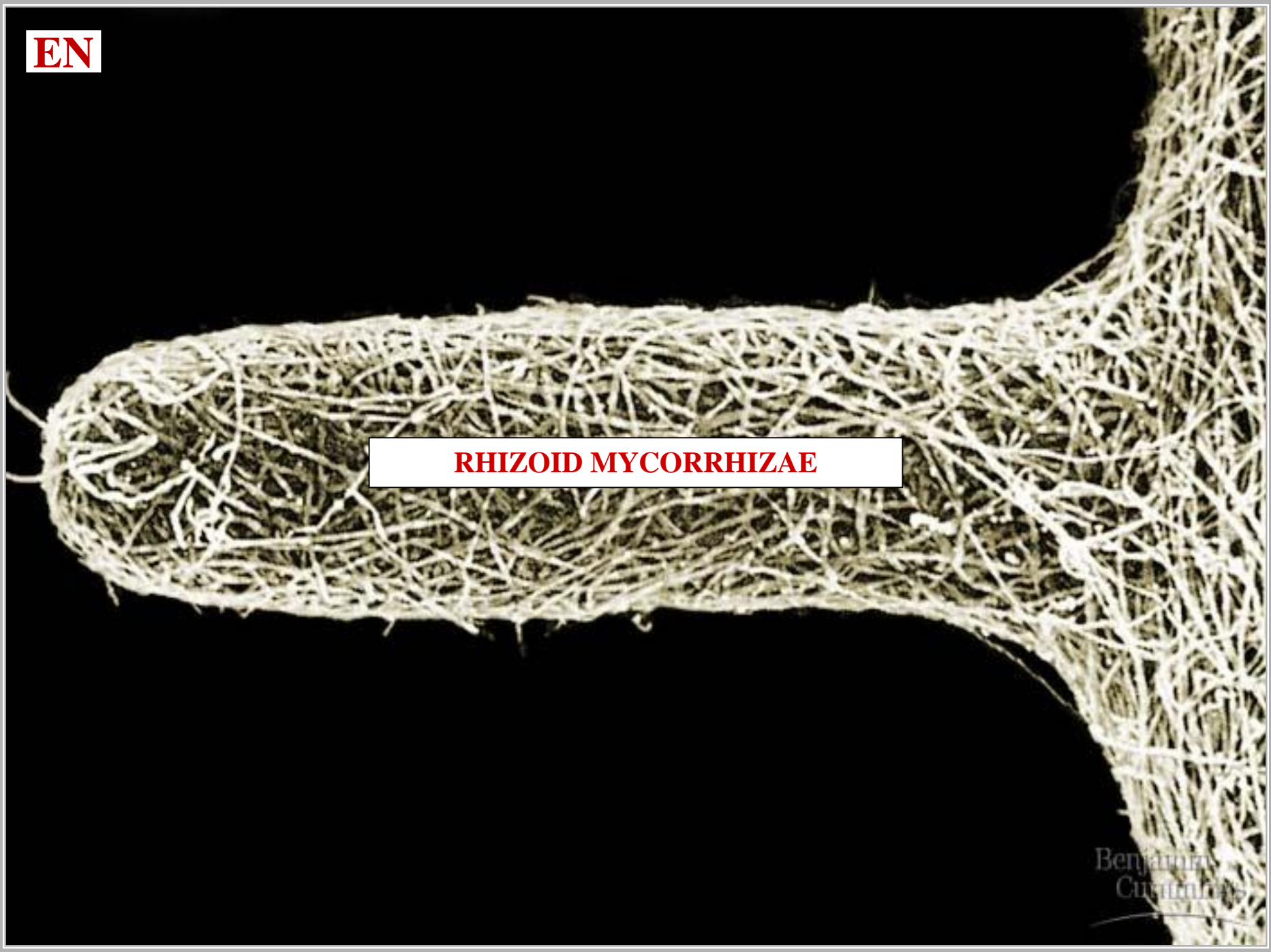


GAMETOPHYTE RHIZOID

EN

RHIZOID MYCORRHIZAE

Benjamin
C. Curtis

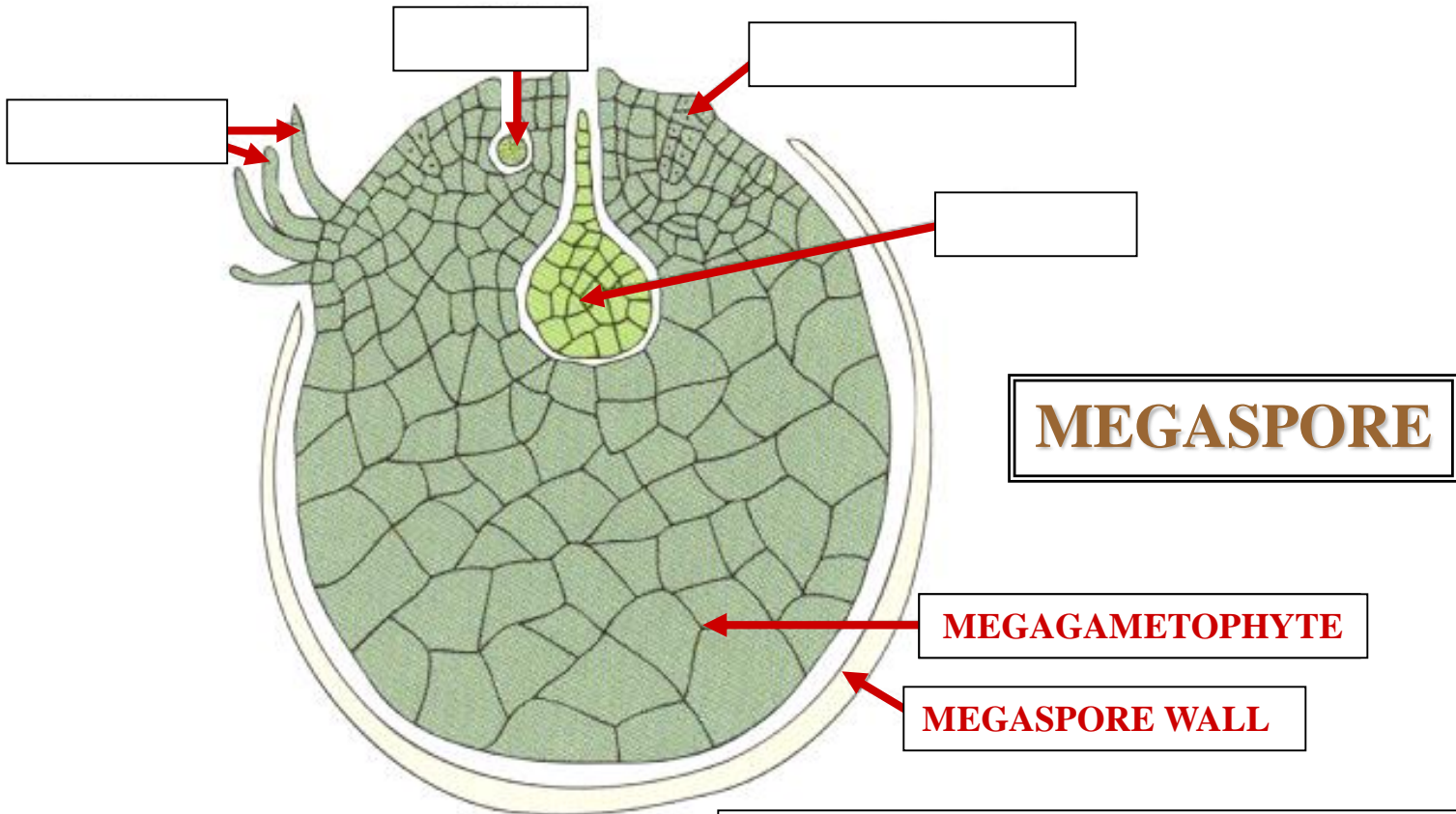




ENHANCE WATER & NUTRIENT ABSORPTION



ENDOSPORIC GAMETOPHYTE



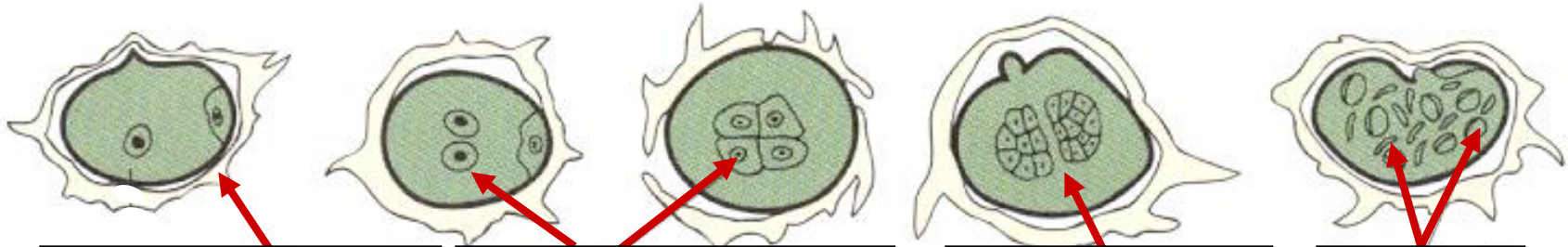
MEGASPORE

MEGAGAMETOPHYTE

MEGASPORE WALL

MICROSPORE

GAMETOPHYTE



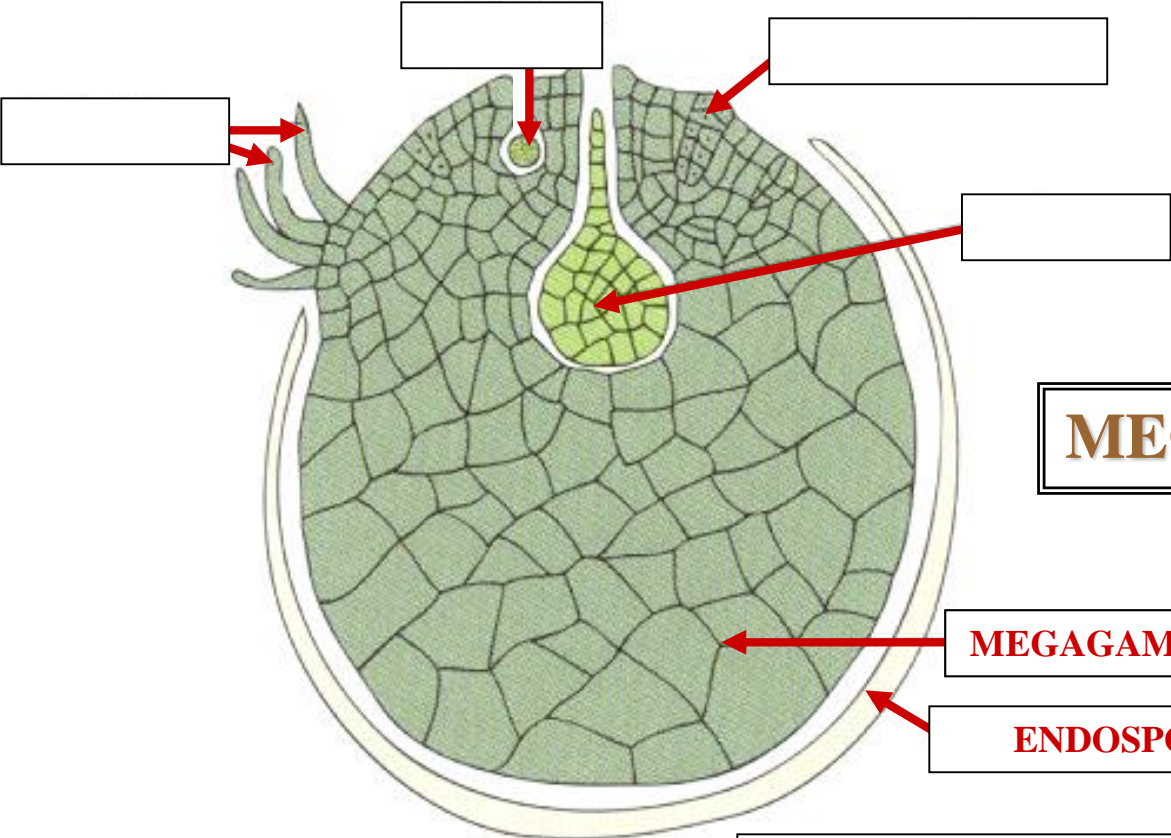
MICROSPORE WALL

MICROGAMETOPHYTE

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EP



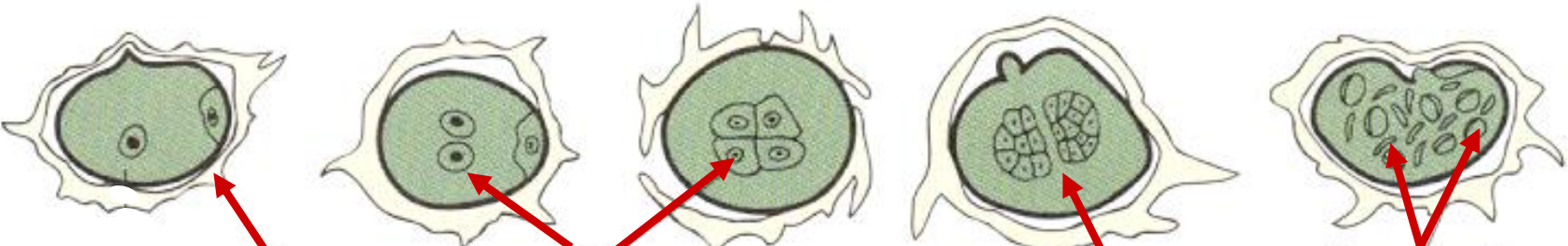
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MEGAGAMETOPHYTE

ENDOSPORIC

MICROSPORE

GAMETOPHYTE

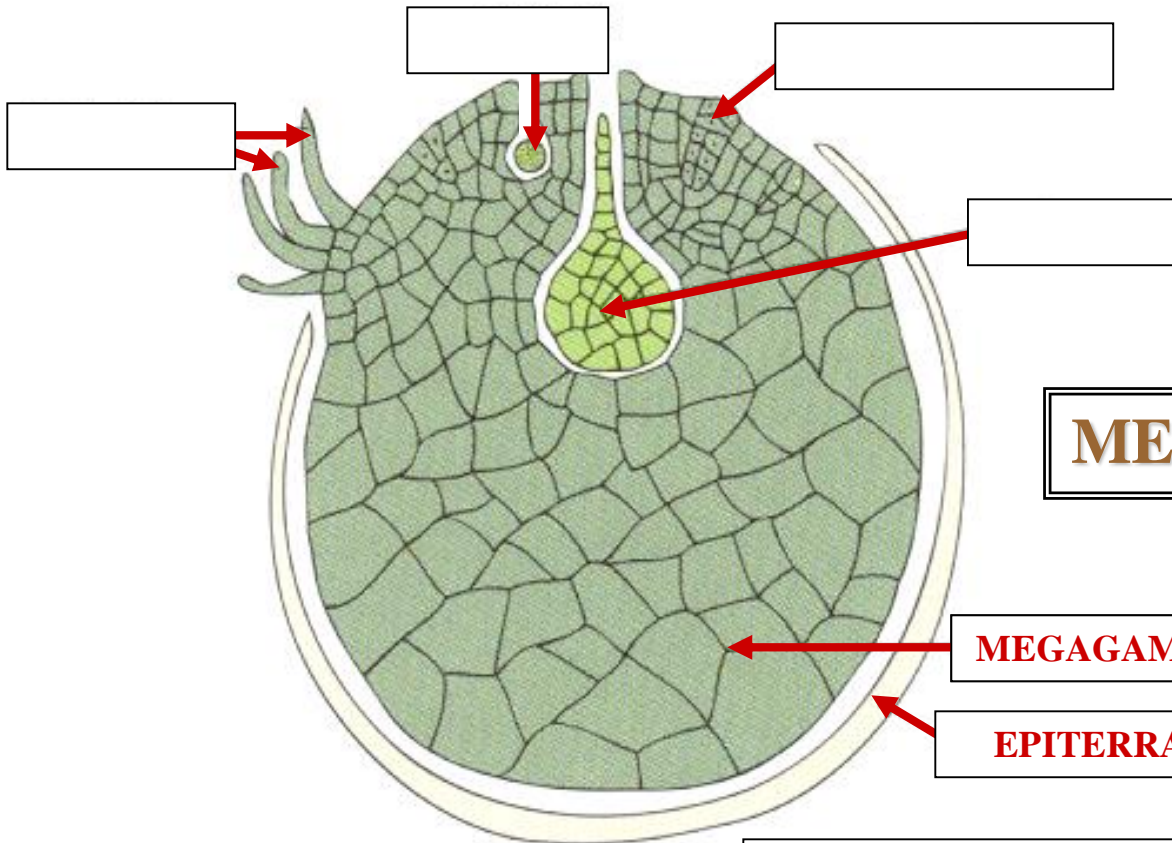


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MICROGAMETOPHYTE

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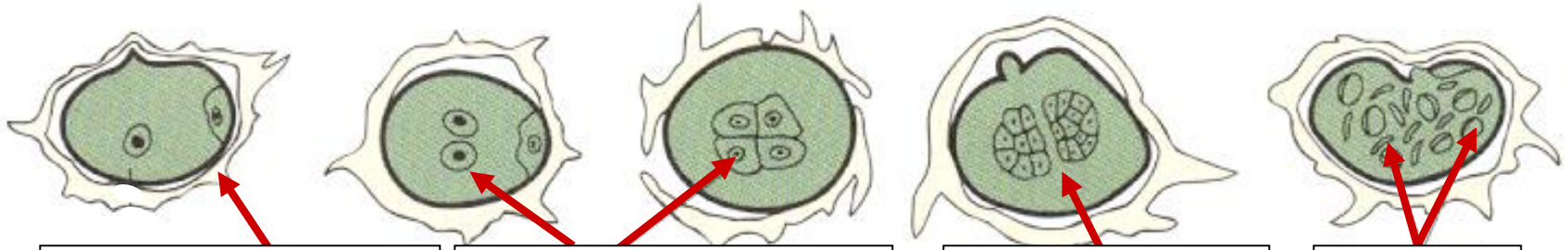
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MEGAGAMETOPHYTE

EPITERRANEAN

MICROSPORE

GAMETOPHYTE

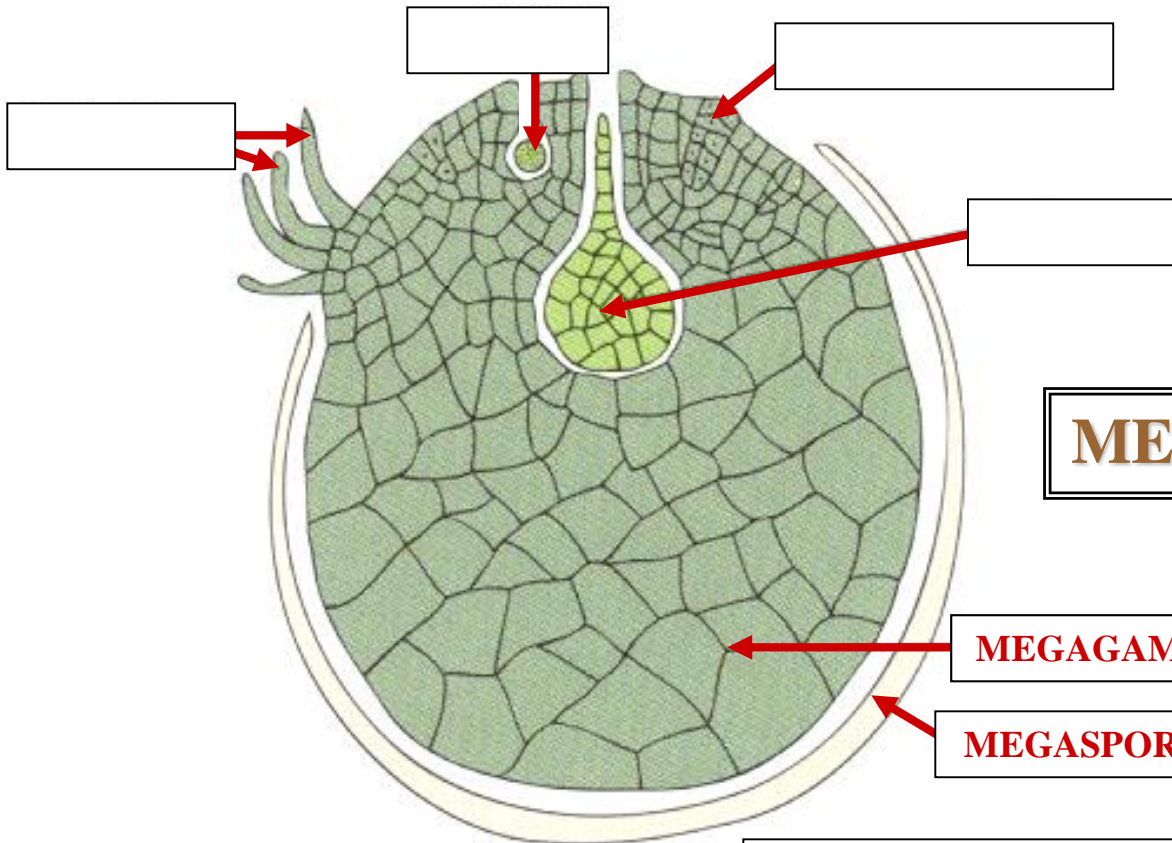


EPITERRANEAN

MICROGAMETOPHYTE

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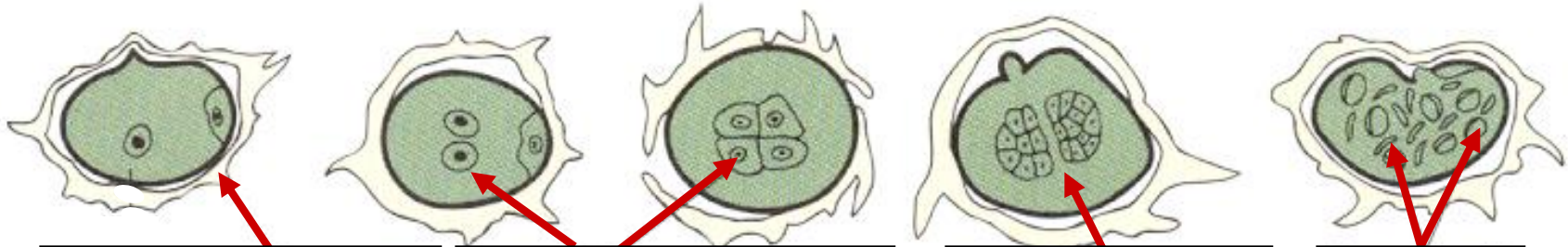
MEGASPORE

MEGAGAMETOPHYTE

MEGASPORE WALL

MICROSPORE

GAMETOPHYTE

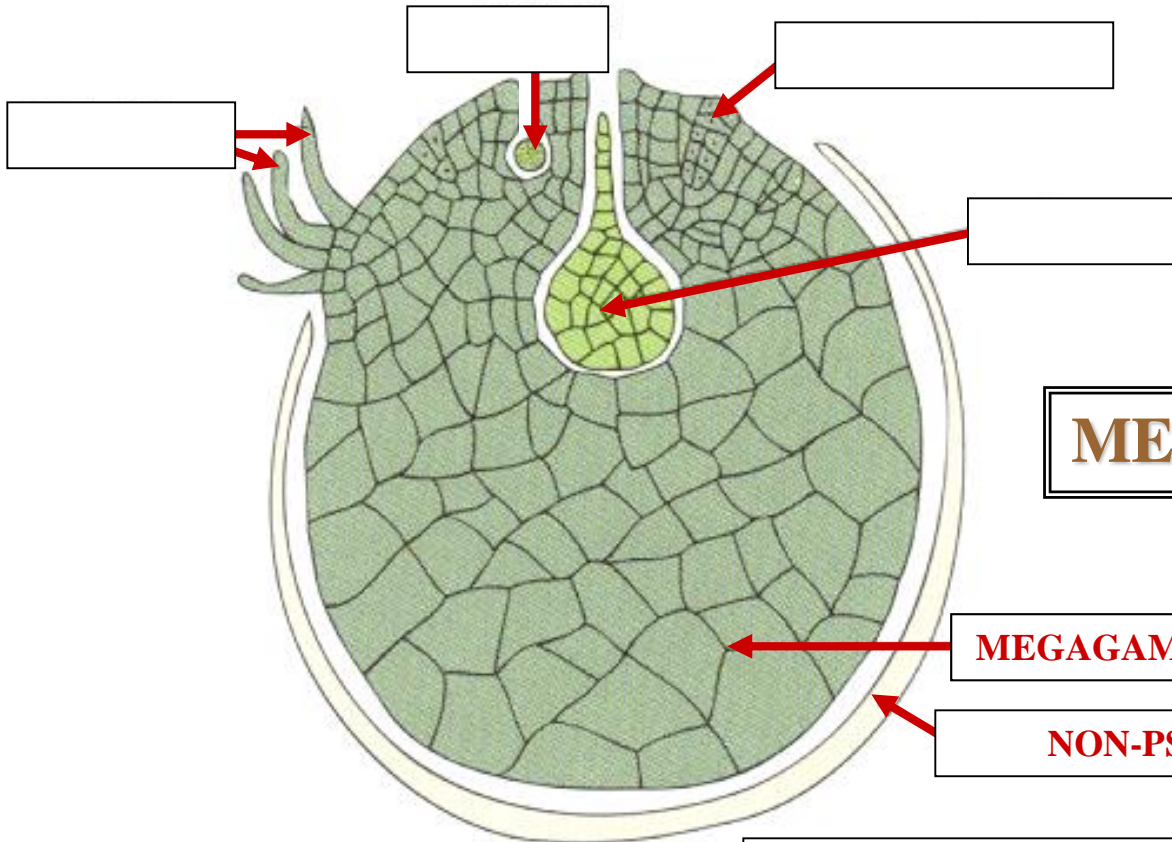


MICROSPORE WALL

MICROGAMETOPHYTE

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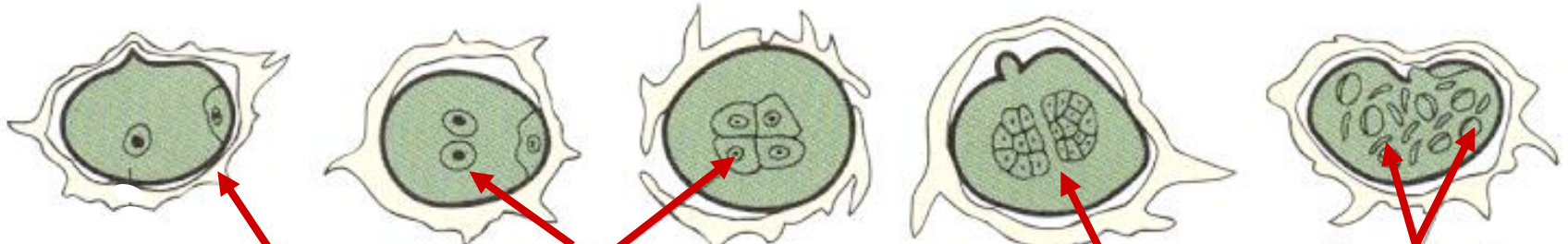
MEGASPORE

MEGAGAMETOPHYTE

NON-PSYN

MICROSPORE

GAMETOPHYTE



NON-PSYN

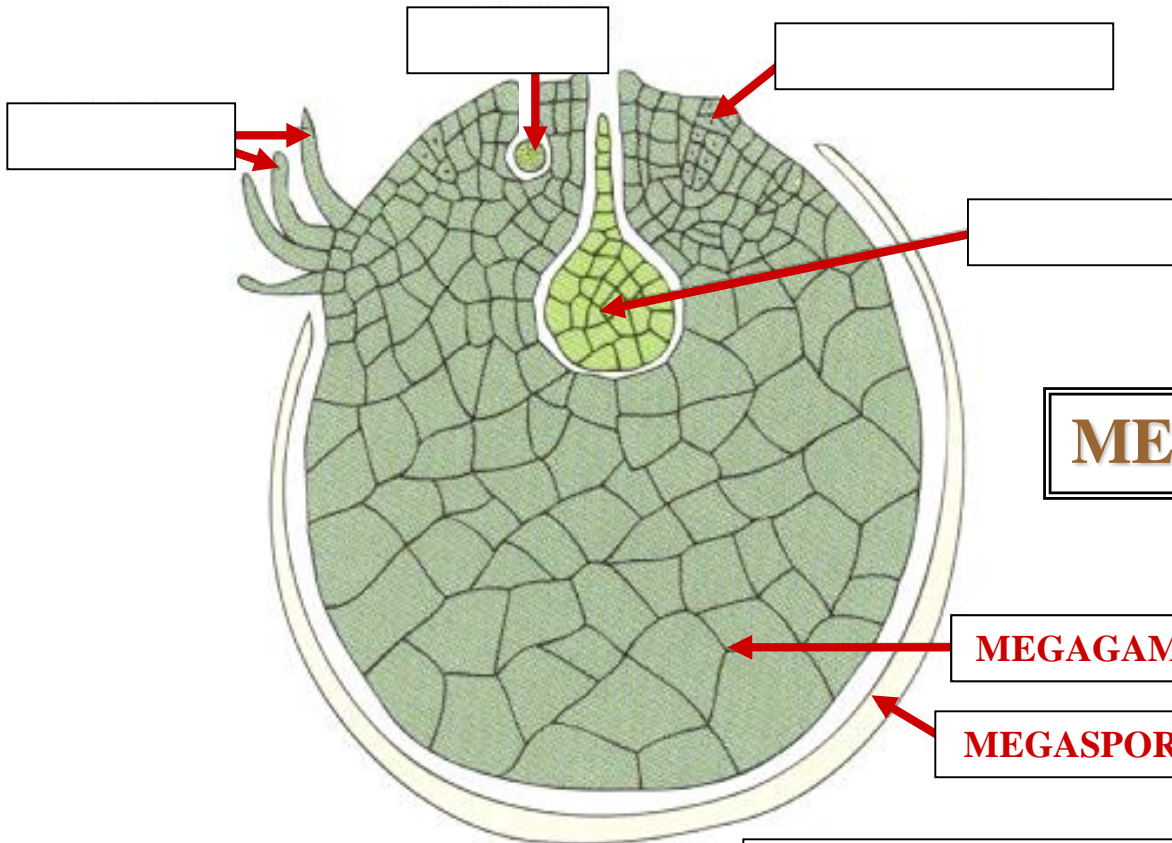
MICROGAMETOPHYTE

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M

AB



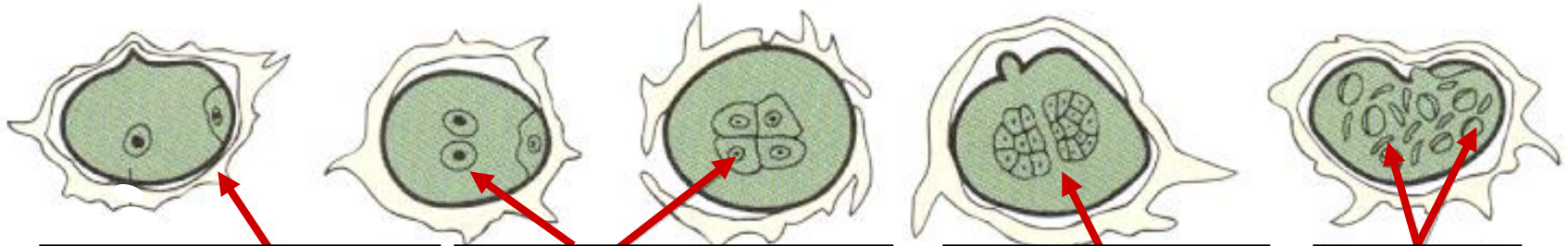
MEGASPORE

MEGAGAMETOPHYTE

MEGASPORE WALL

MICROSPORE

GAMETOPHYTE



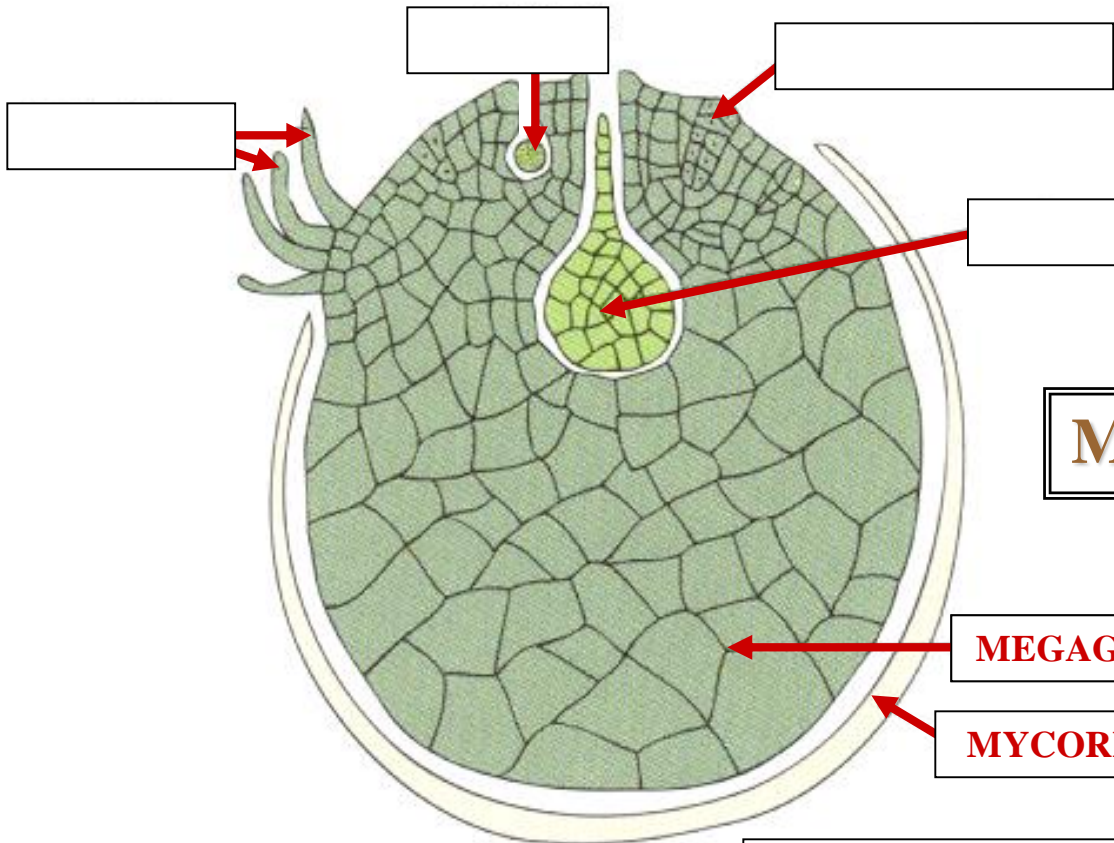
MICROSPORE WALL

MICROGAMETOPHYTE

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EN



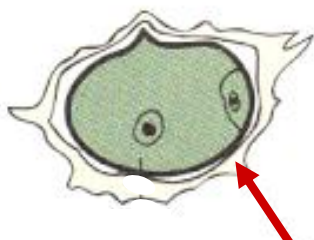
MEGASPORE

MEGAGAMETOPHYTE

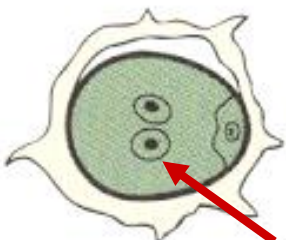
MYCORRHIZAE ABSENT

MICROSPORE

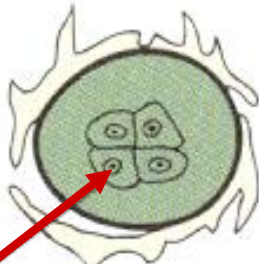
GAMETOPHYTE



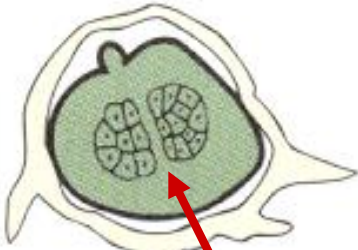
MYCORRHIZAE ABSENT



MICROGAMETOPHYTE



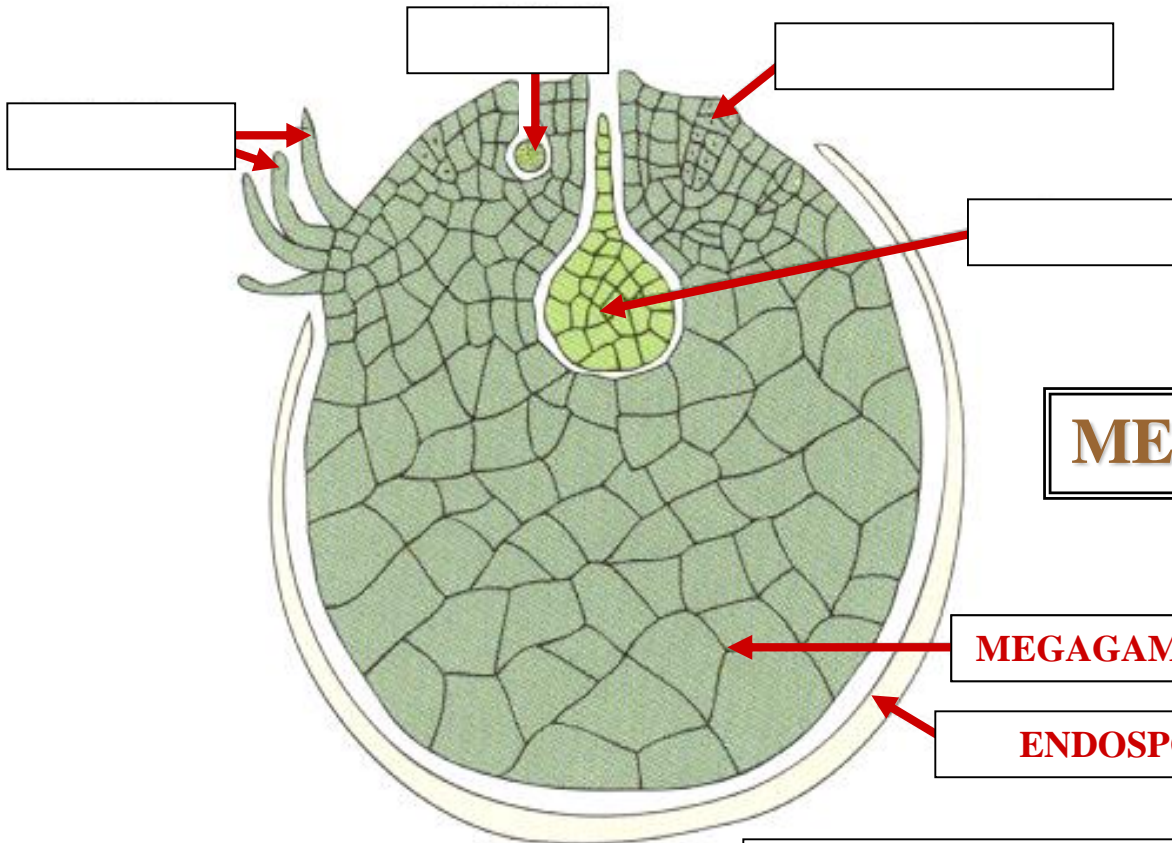
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ER



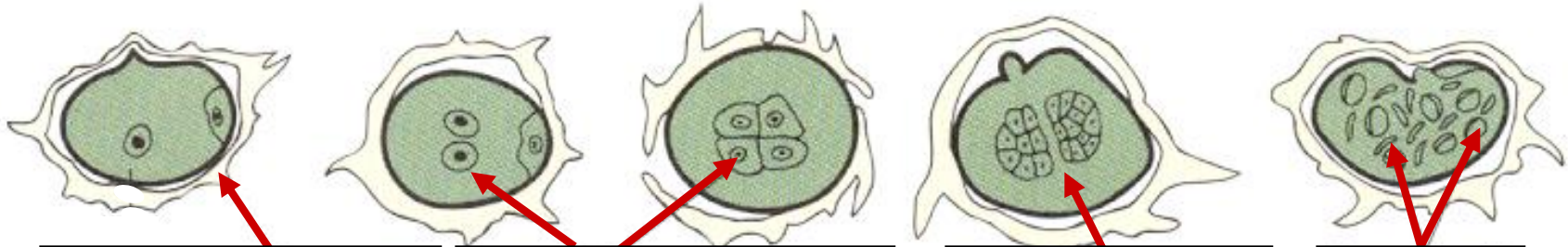
MEGASPORE

MEGAGAMETOPHYTE

ENDOSPORIC

MICROSPORE

GAMETOPHYTE

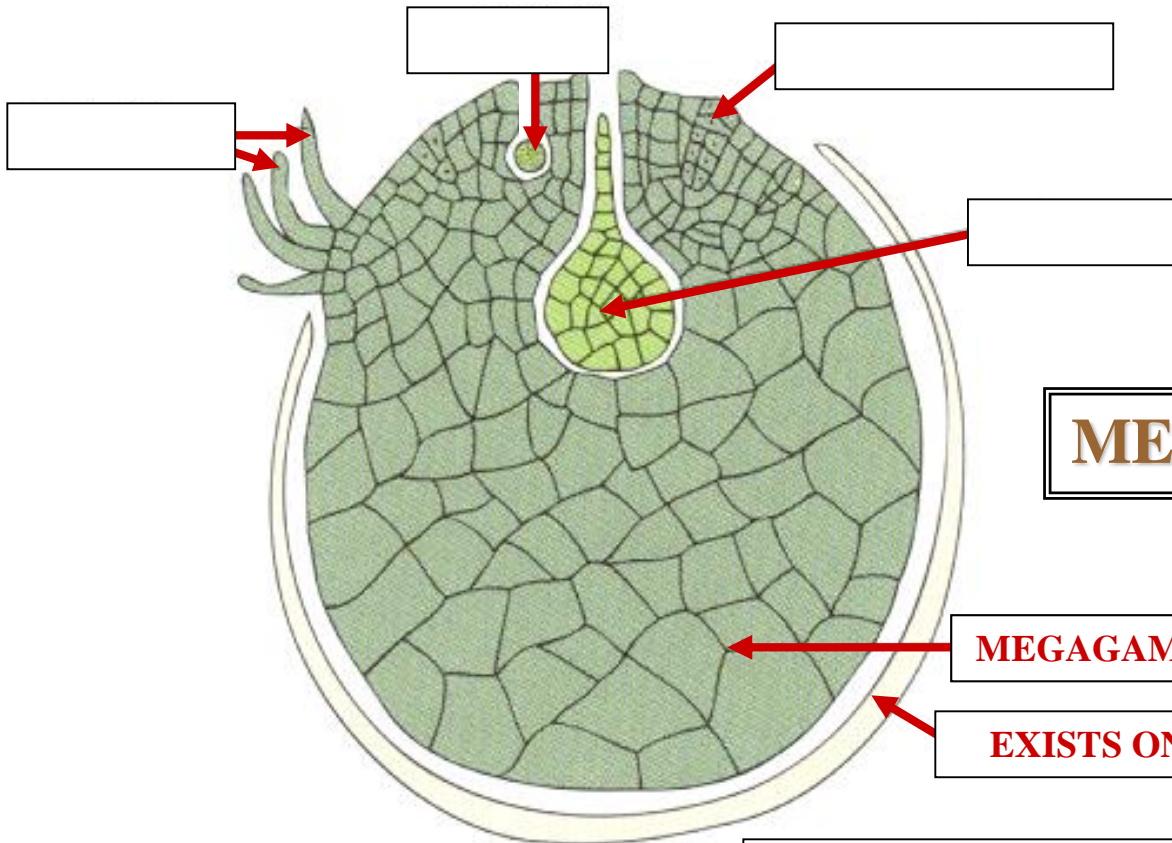


ENDOSPORIC

MICROGAMETOPHYTE

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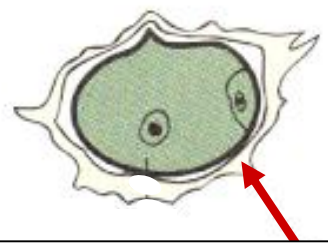
MEGASPORE

MEGAGAMETOPHYTE

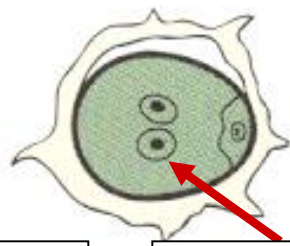
EXISTS ON RESERVES

MICROSPORE

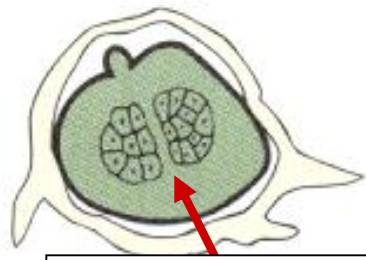
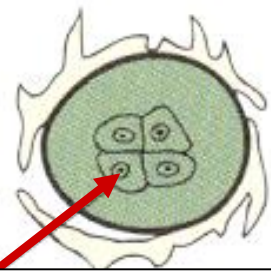
GAMETOPHYTE



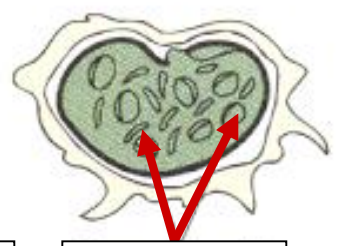
EXISTS ON RESERVES



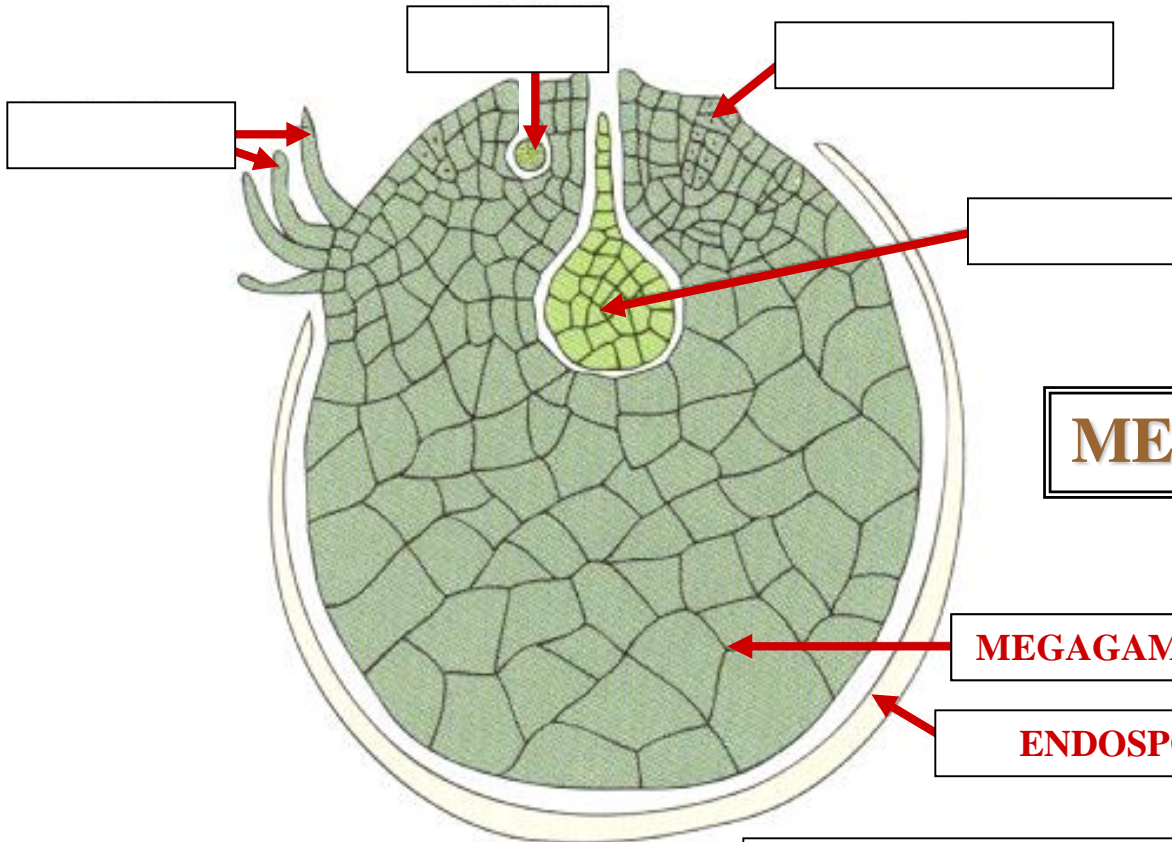
MICROGAMETOPHYTE



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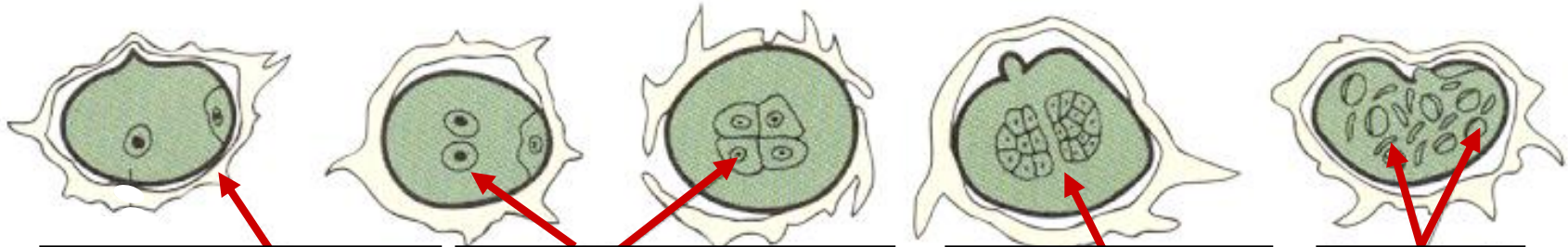
MEGASPORE

MEGAGAMETOPHYTE

ENDOSPORIC

MICROSPORE

GAMETOPHYTE

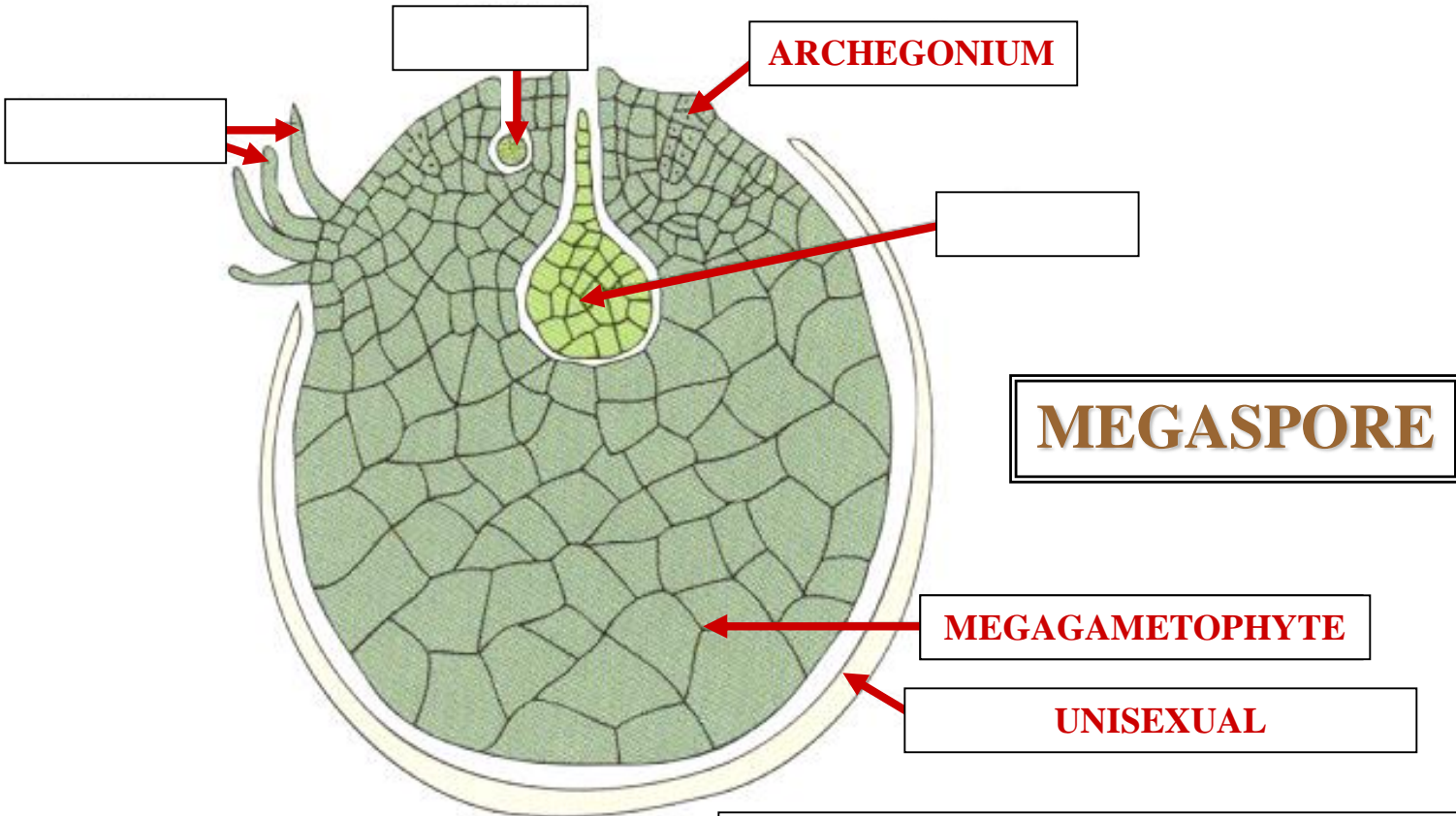


ENDOSPORIC

MICROGAMETOPHYTE

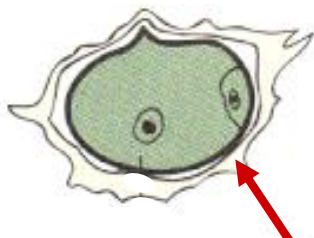
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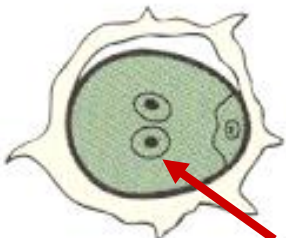


MICROSPORE

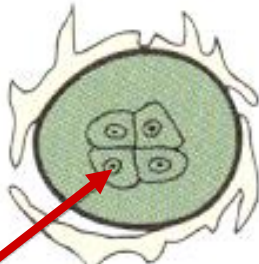
GAMETOPHYTE



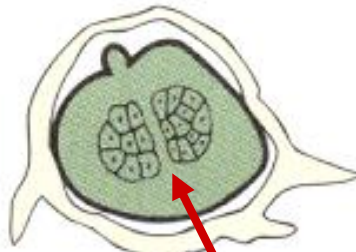
UNISEXUAL



MICROGAMETOPHYTE



ANTHERIDIUM



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B

SPERM

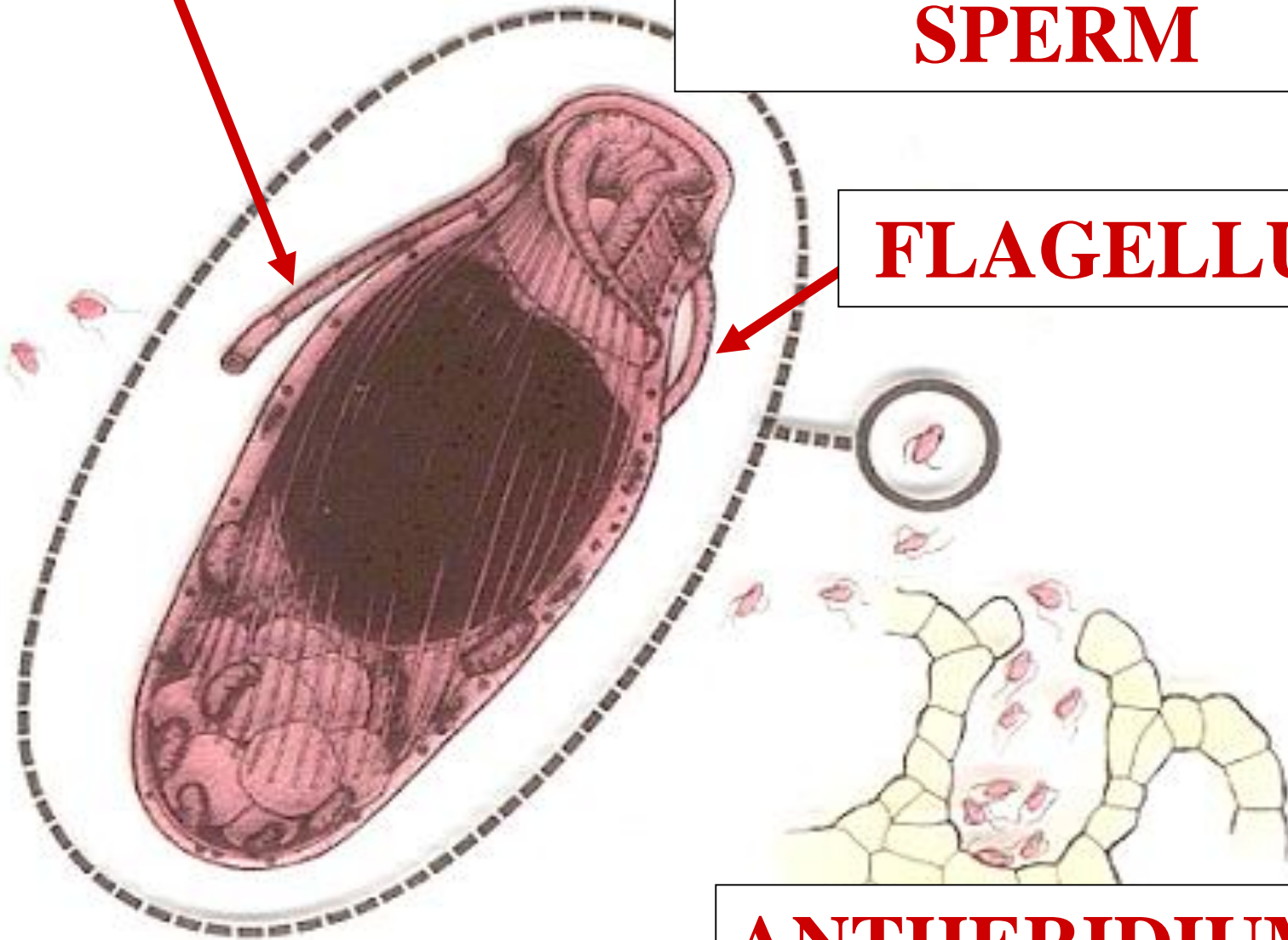
FLAGELLUM

**BIFLAGELLATED
SPERM**

M

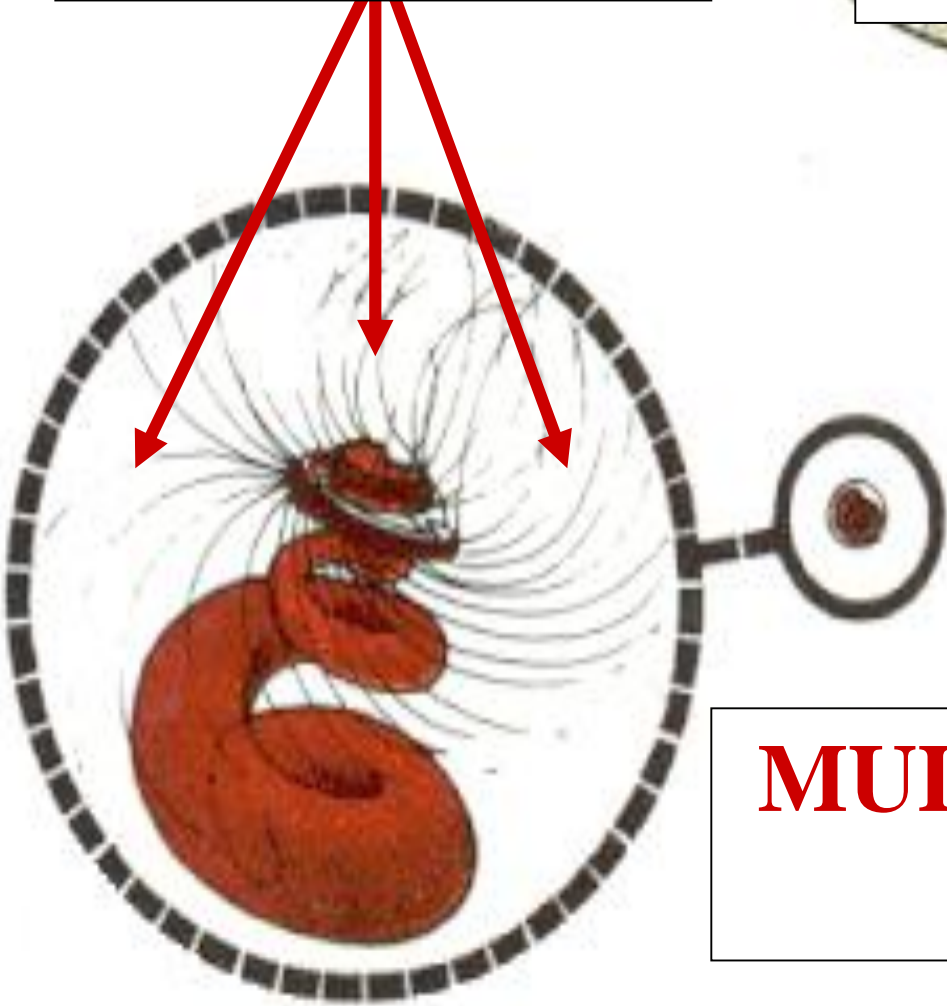
FLAGELLUM

ANTHERIDIUM

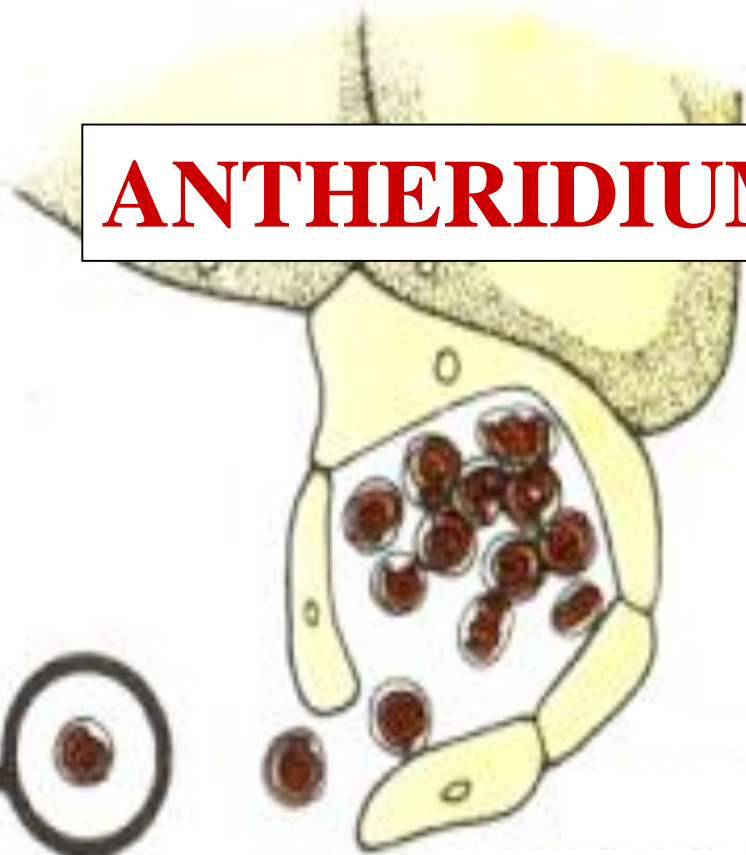


**MULTIPLE
FLAGELLA**

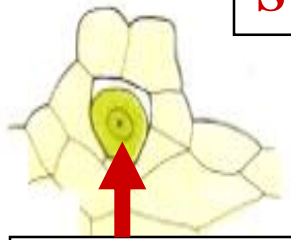
ANTHERIDIUM



**MULTIFLAGELLATED
SPERM**

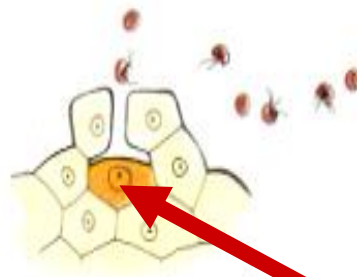


SYNGAMY REQUIRES



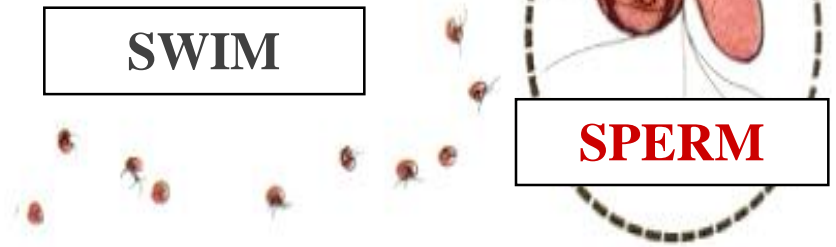
ZYGOTE

SYNGAMY



EGG

SWIM



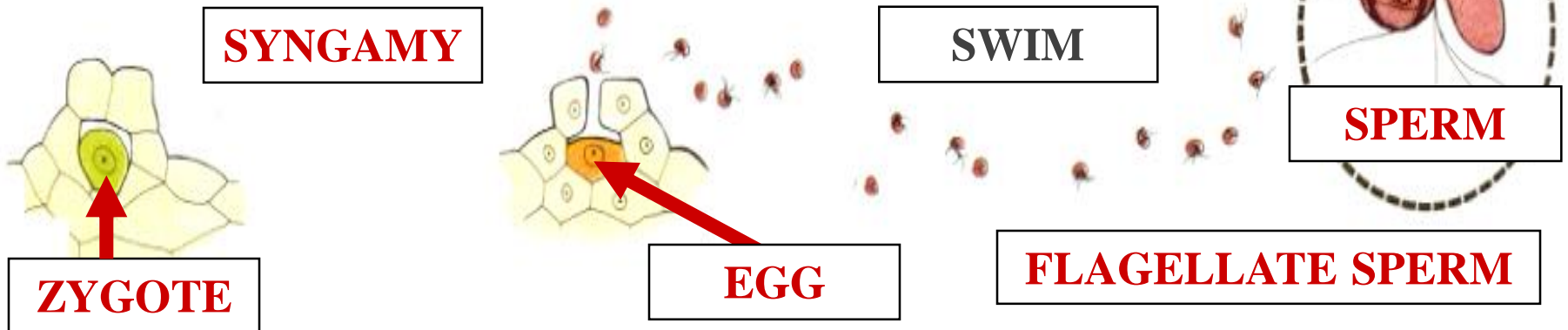
SPERM

FLAGELLATE SPERM

LYCOPHYTES

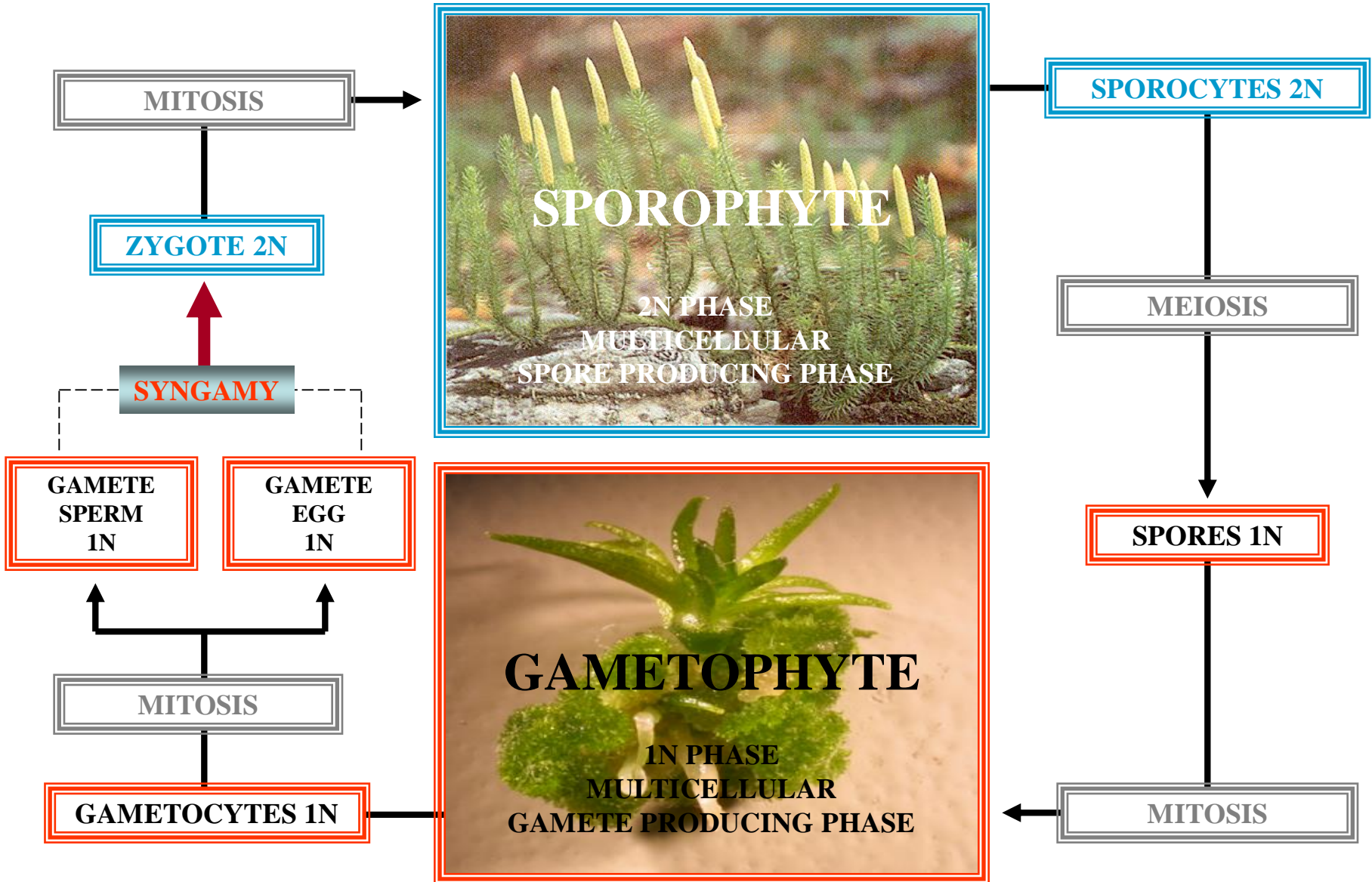


SYNGAMY REQUIRES WATER



LYCOPODIOPHYTA

LIFE CYCLE





LYCOPHYTE FOSSIL RECORD



~410

MILLION YEARS



SILURIAN





B

LYCOPHYTES EVOLVE





**AUSTRALIA
SILURIAN**

O

BARAGWANATHIA

**AUSTRALIA
SILURIAN**

?

**OLDEST
KNOWN
LYCOPHYTE**

BARAGWANATHIA



QUESTION

**HOW DO BOTANISTS
KNOW**

BARAGWANATHIA

IS A LYCOPHYTE?

QUESTION

AUSTRALIA SILURIAN

A red arrow originates from the 'LEAF' label and points diagonally upwards and to the right, towards a faint, elongated fossil impression on the rock surface.

LEAF

BARAGWANATHIA



LEAF

BARAGWANATHIA



LEAF

The image shows a longitudinal section of a leaf with several vascular traces visible as darker, parallel lines. A red arrow points from the 'LEAF' label to the leaf tissue.

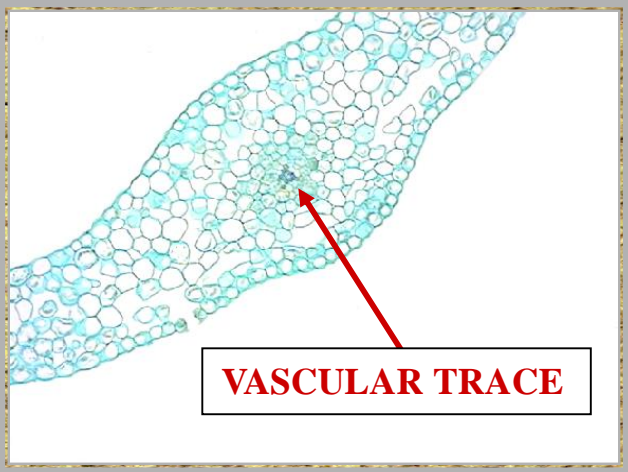


VASCULAR TRACE

The inset diagram shows a cross-section of a vascular trace, with a red arrow pointing from the 'VASCULAR TRACE' label to a specific structure within the trace.

M

BARAGWANATHIA



VASCULAR TRACE



LEAF

MICROPHYLL

BARAGWANATHIA



MICROPHYLLS

LYCOPODIOPHYTA



O

**AUSTRALIA
SILURIAN**



**OLDEST
FOSSIL
LYCOPHYTE**

BARAGWANATHIA



C

~280

MILLION YEARS

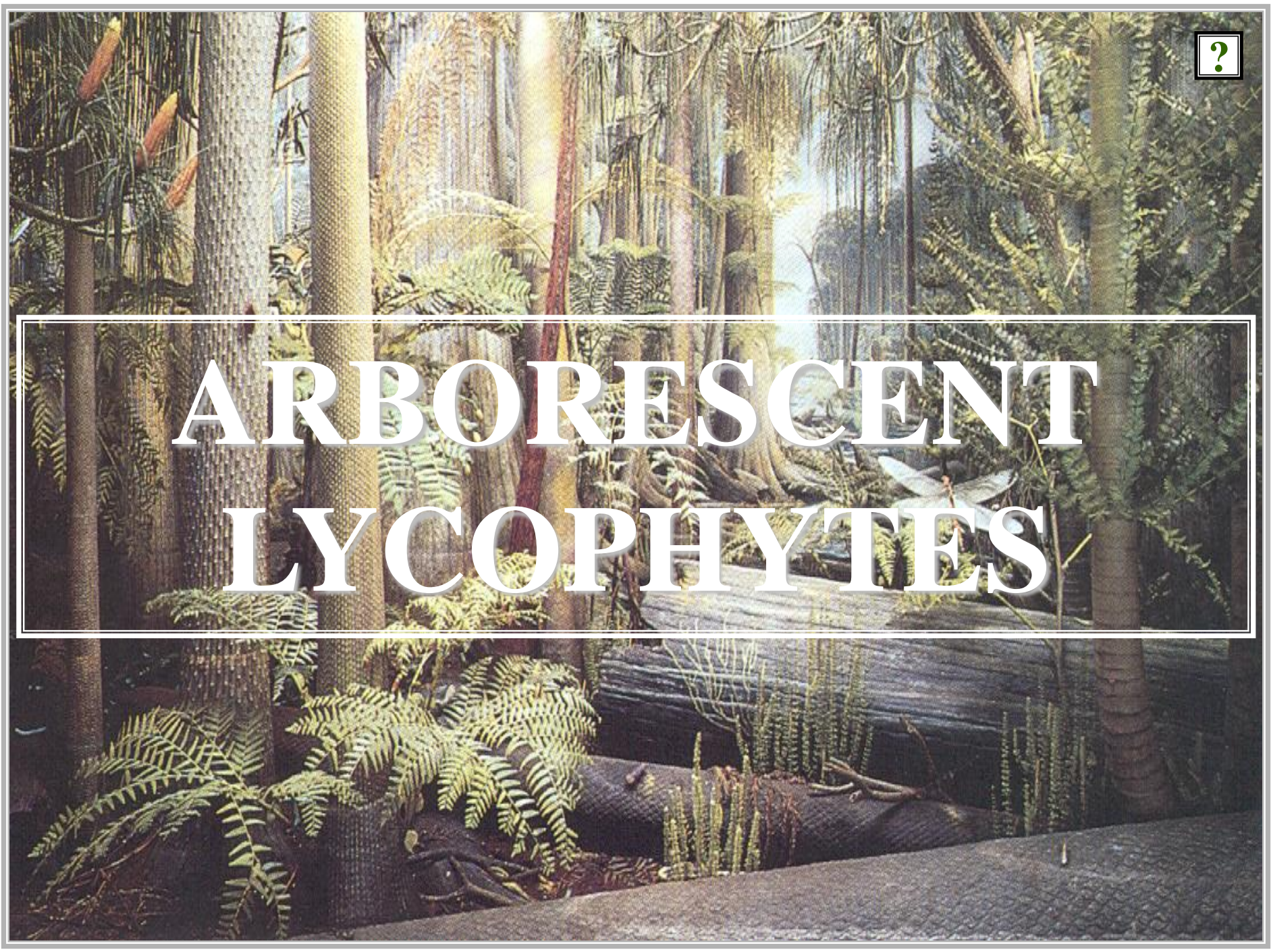
CARBONIFEROUS

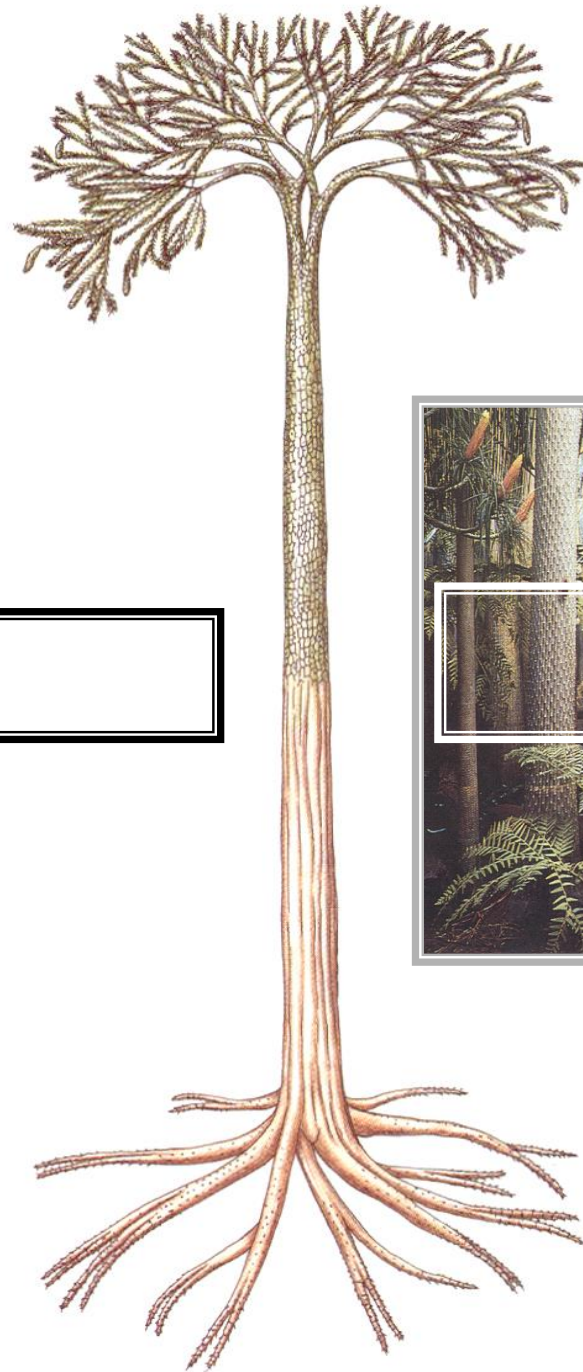
LYCOPHYTE ZENITH





ARBORESCENT LYCOPHYTES





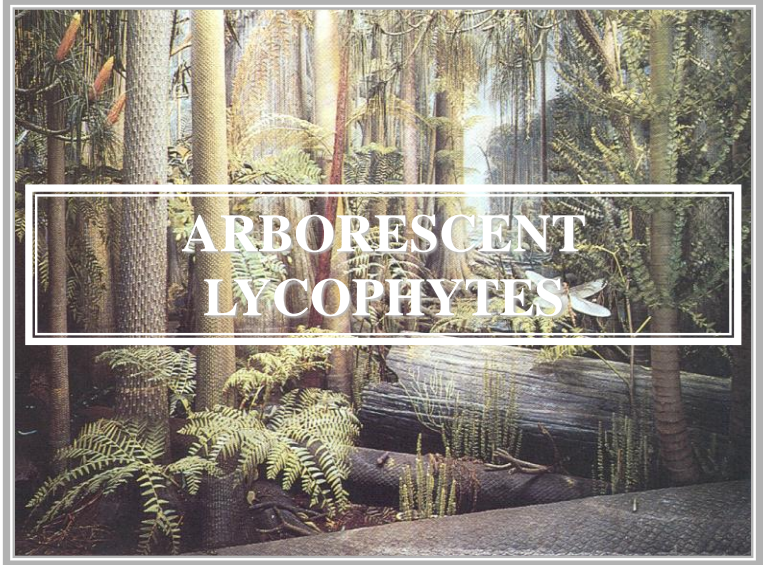
?



ARBORESCENT
LYCOPHYTES



LEPIDODENDRON



ARBORESCENT
LYCOPHYTES



SIGILLARIA



ARBORESCENT
LYCOPHYTES



S

NON-ARBORESCENT

LYCOPODIUM



NON-ARBORESCENT

SELAGINELLA

PHYLOGENETIC RELATIONSHIP

TRACHEOPHYTES

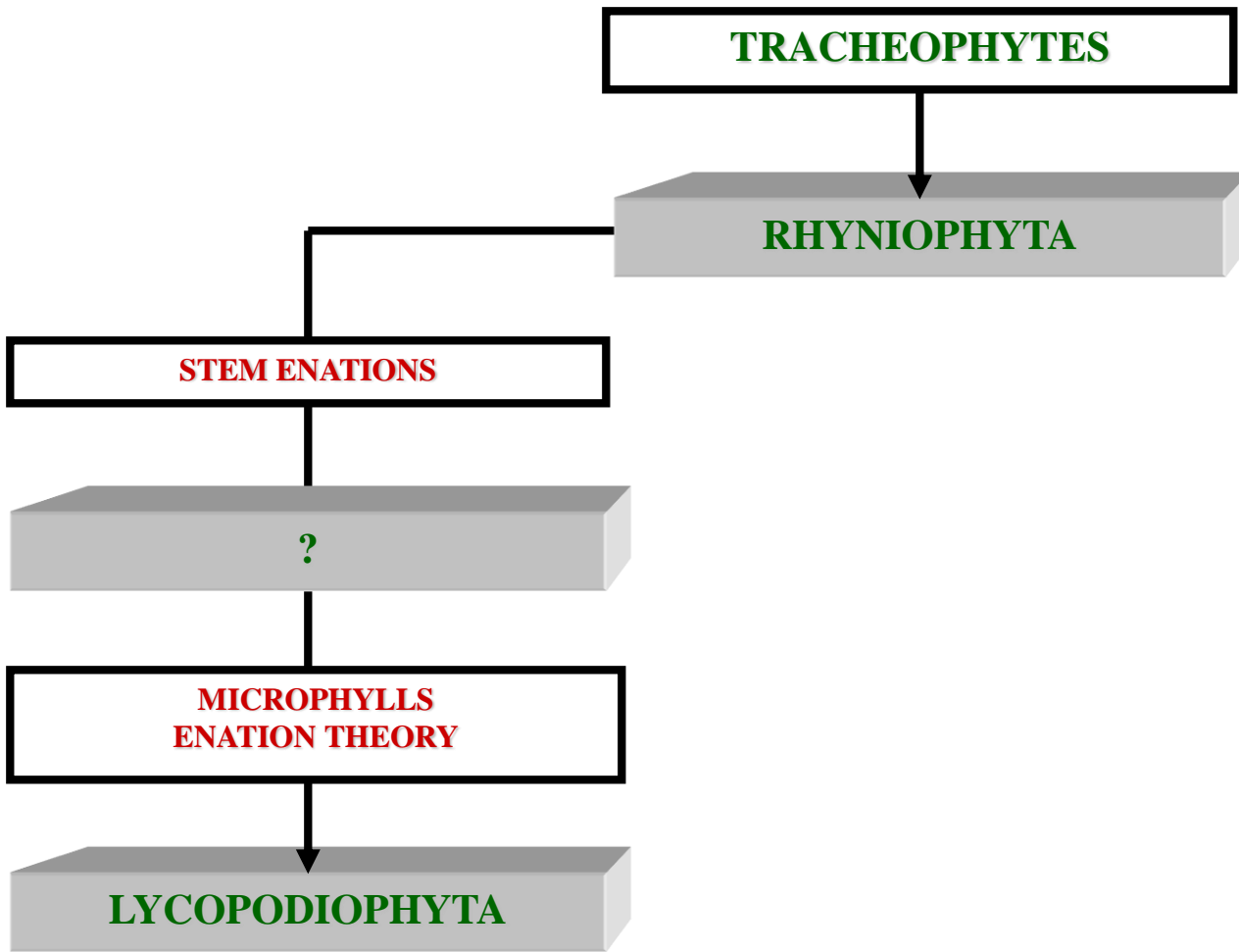
RHYNIOPHYTA

STEM ENATIONS

?

**MICROPHYLLS
ENATION THEORY**

LYCOPODIOPHYTA





TRACHEOPHYTES



RHYNIOPHYTA

STEM ENATIONS



ZOSTEROPHYLLOPHYTA

**MICROPHYLLS
ENATION THEORY**



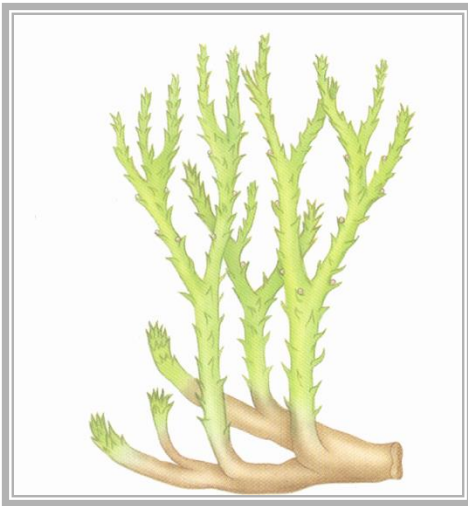
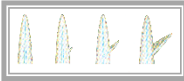
LYCOPODIOPHYTA



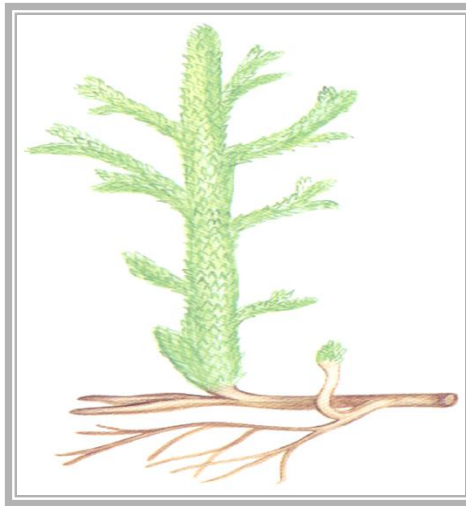


**ZOSTEROPHYLLOPHYTA
EVOLVED
LYCOPODIOPHYTA**

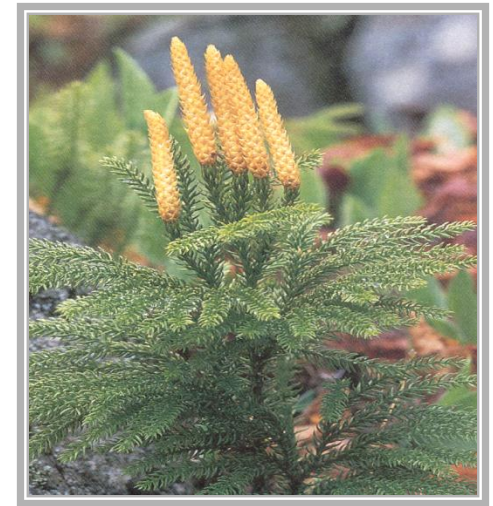
LYCOPHYTE EVOLUTION



ZOSTEROPHYTE

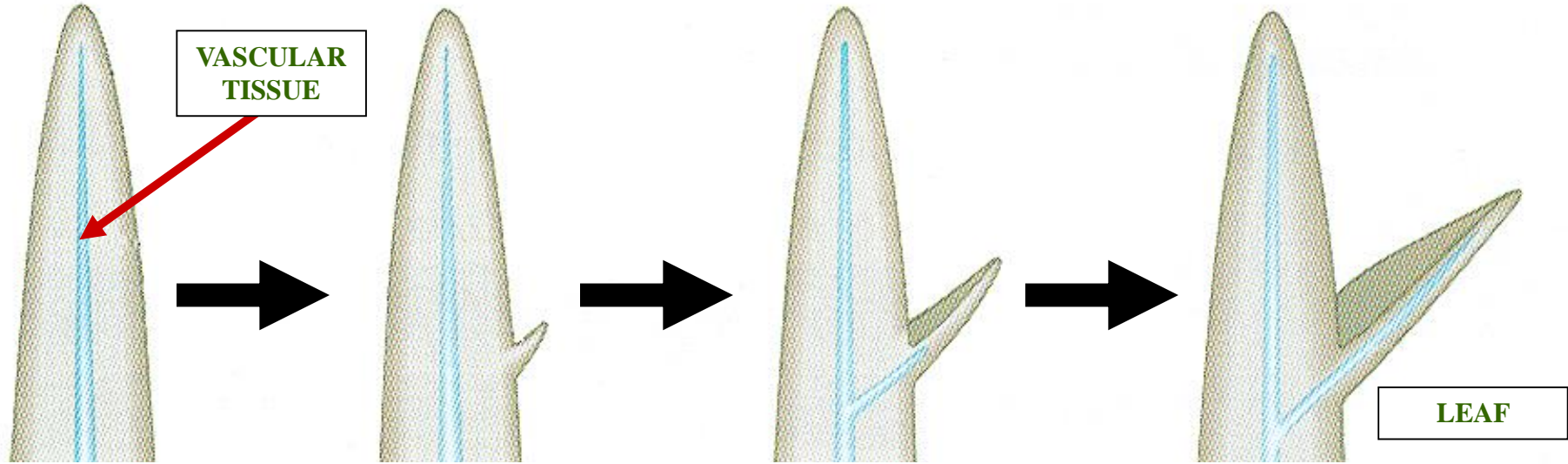


ASTEROXYLON



LYCOPHYTE

ASTEROXYLON



A

B

C

D

ENATION ABSENT

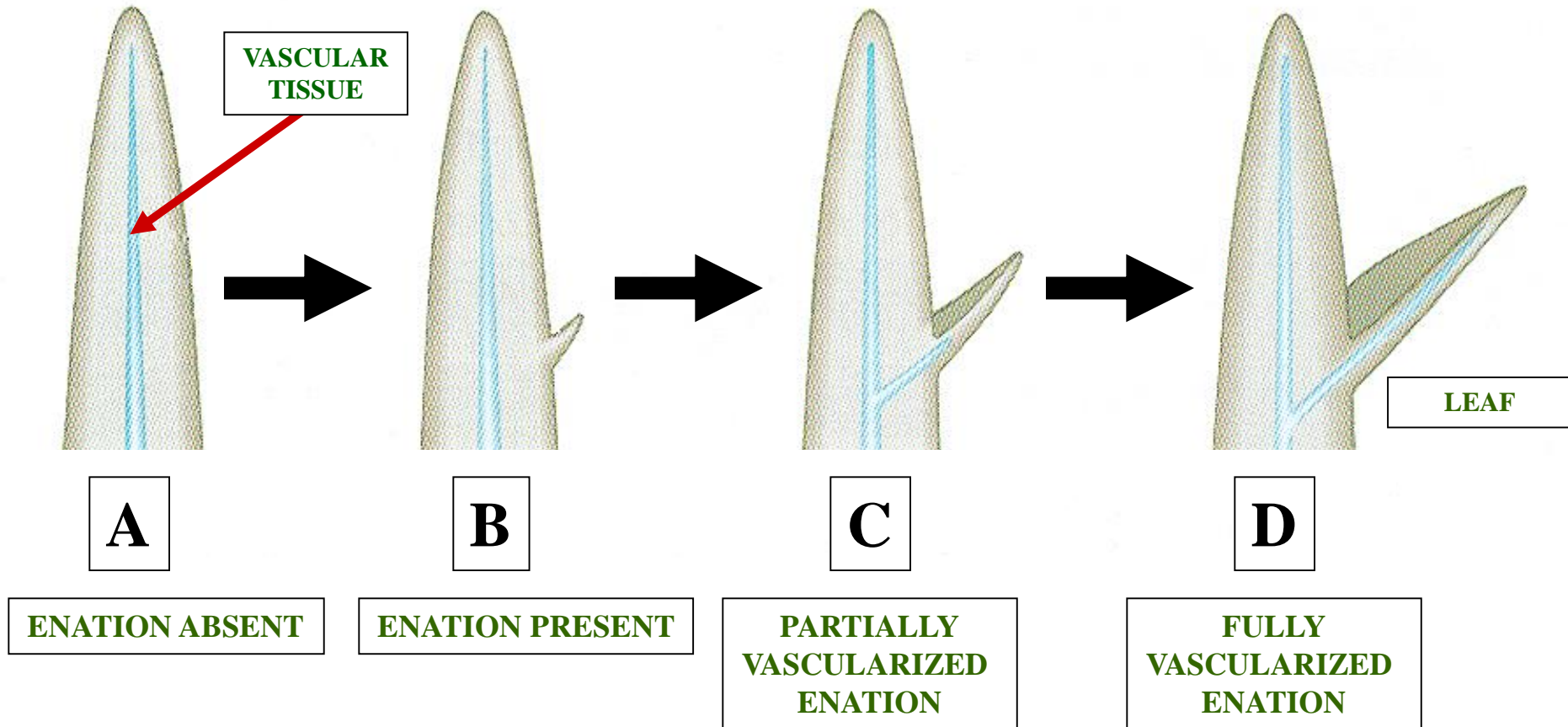
ENATION PRESENT

PARTIALLY
VASCULARIZED
ENATION

FULLY
VASCULARIZED
ENATION

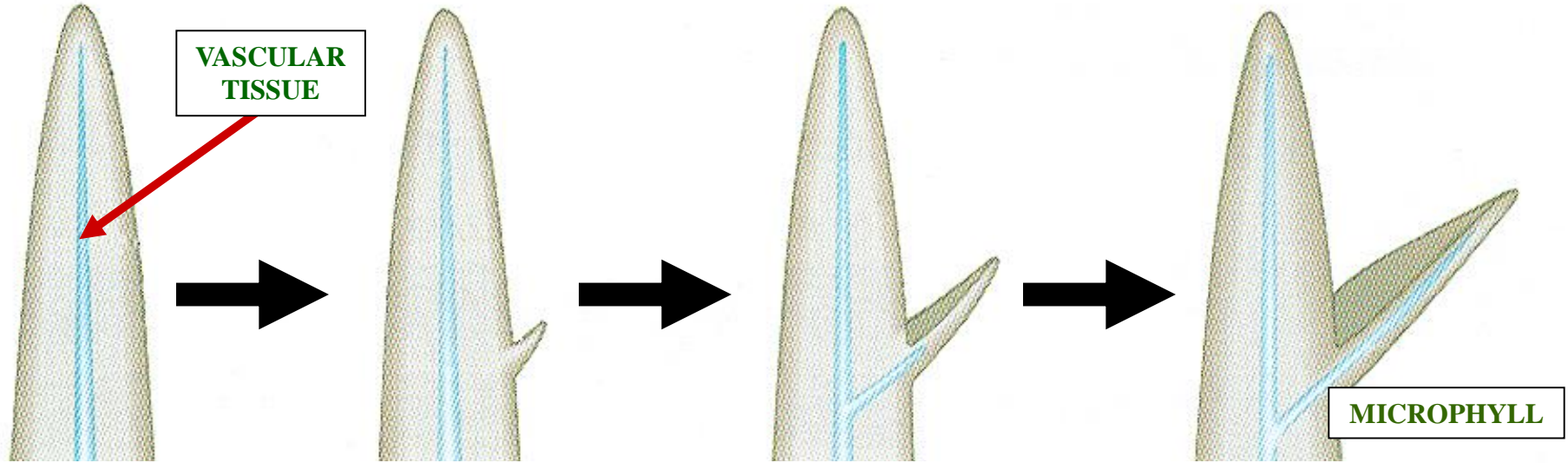
→ = TIME

ENATION THEORY



➔ = TIME

MICROPHYLL



A

B

C

D

ENATION ABSENT

ENATION PRESENT

PARTIALLY
VASCULARIZED
ENATION

FULLY
VASCULARIZED
ENATION

→ = TIME



MICROPHYLLS

MICROPHYLLS

LYCOPHYTES



MICROPHYLLS

LYCOPHYTES

LYCOPODIOPHYTA



TRACHEOPHYTES



RHYNIOPHYTA



STEM ENATIONS

ZOSTEROPHYLLOPHYTA

**MICROPHYLLS
ENATION THEORY**

LYCOPODIOPHYTA

**PHYLOGENTIC
DEAD-END**



LYCOPODIOPHYTA CLASSIFICATION

**EXTANT
ORDER**

LYCOPODIALES

**EXTANT
ORDER**



COMMON NAME

CLUB-MOSSES



CLUB





MOSS

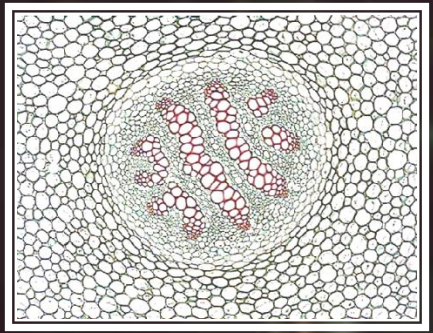




CLUB-MOSSES

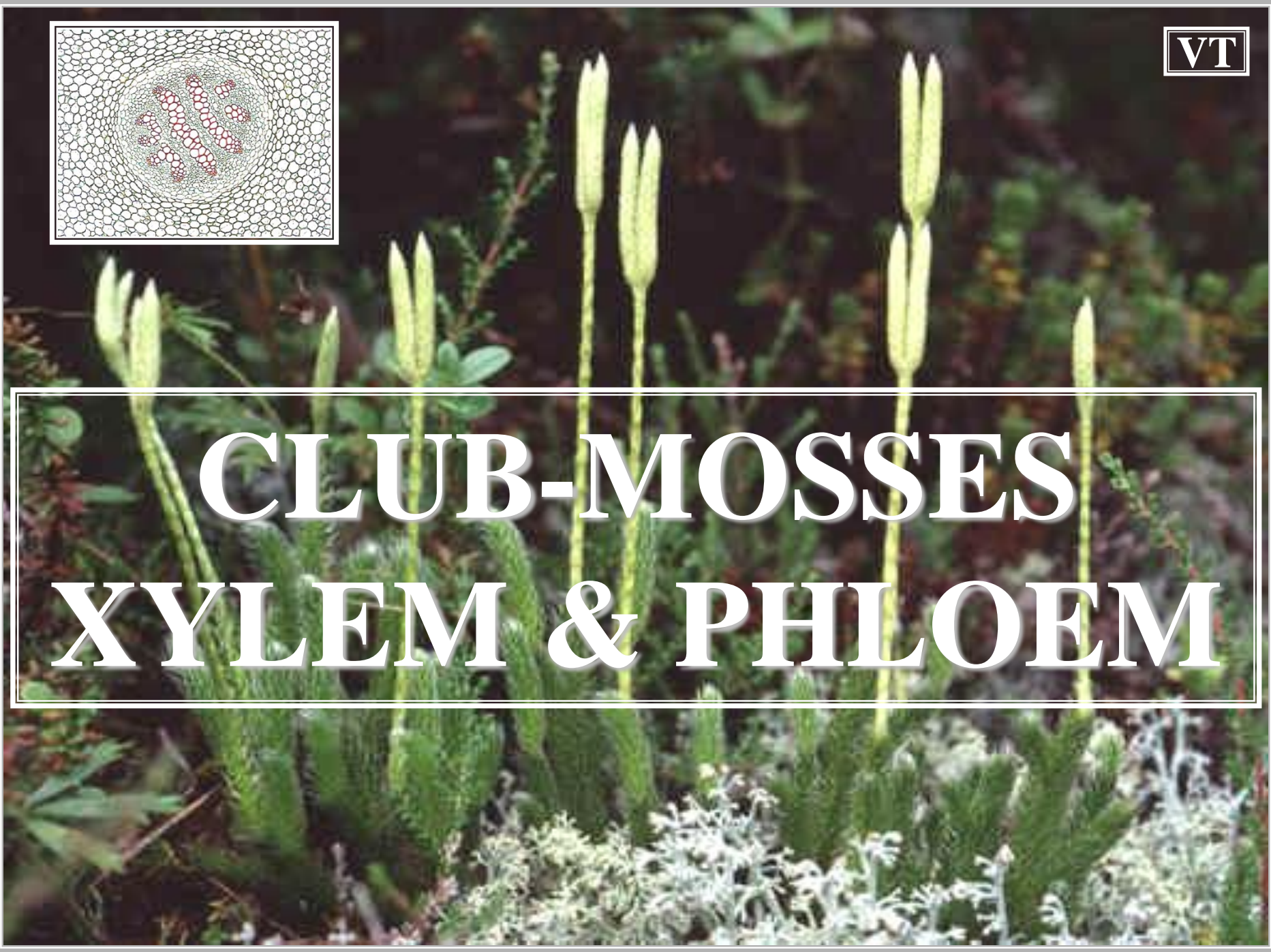
XP

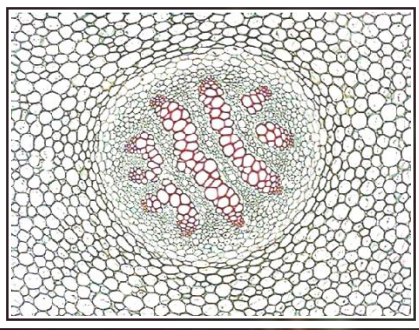




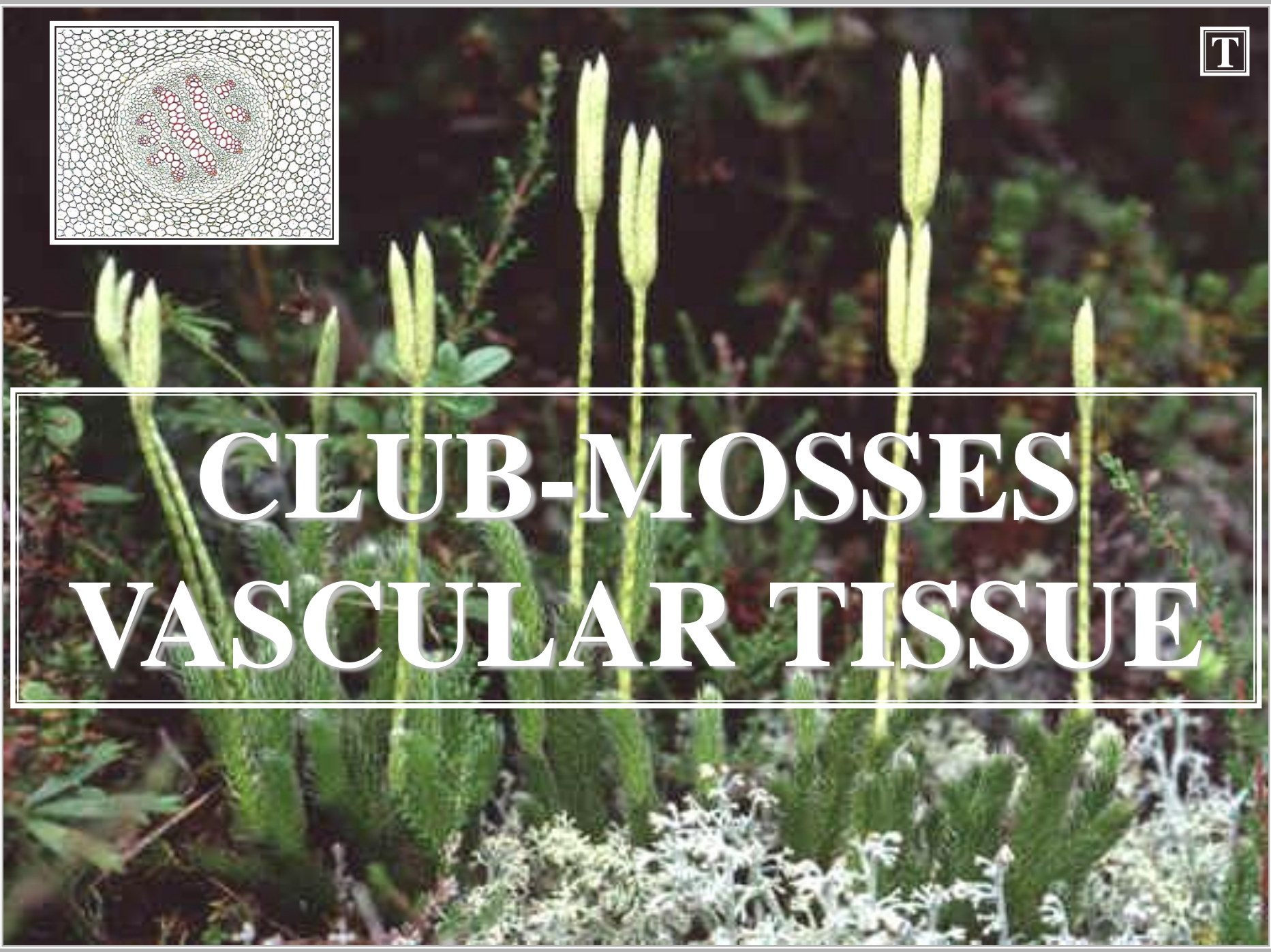
CLUB-MOSSES

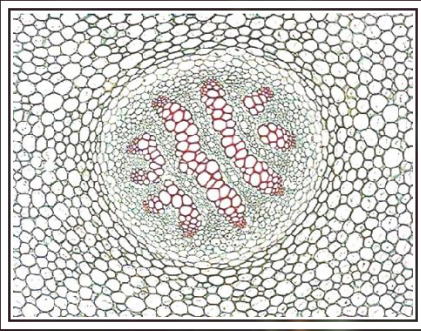
XYLEM & PHLOEM





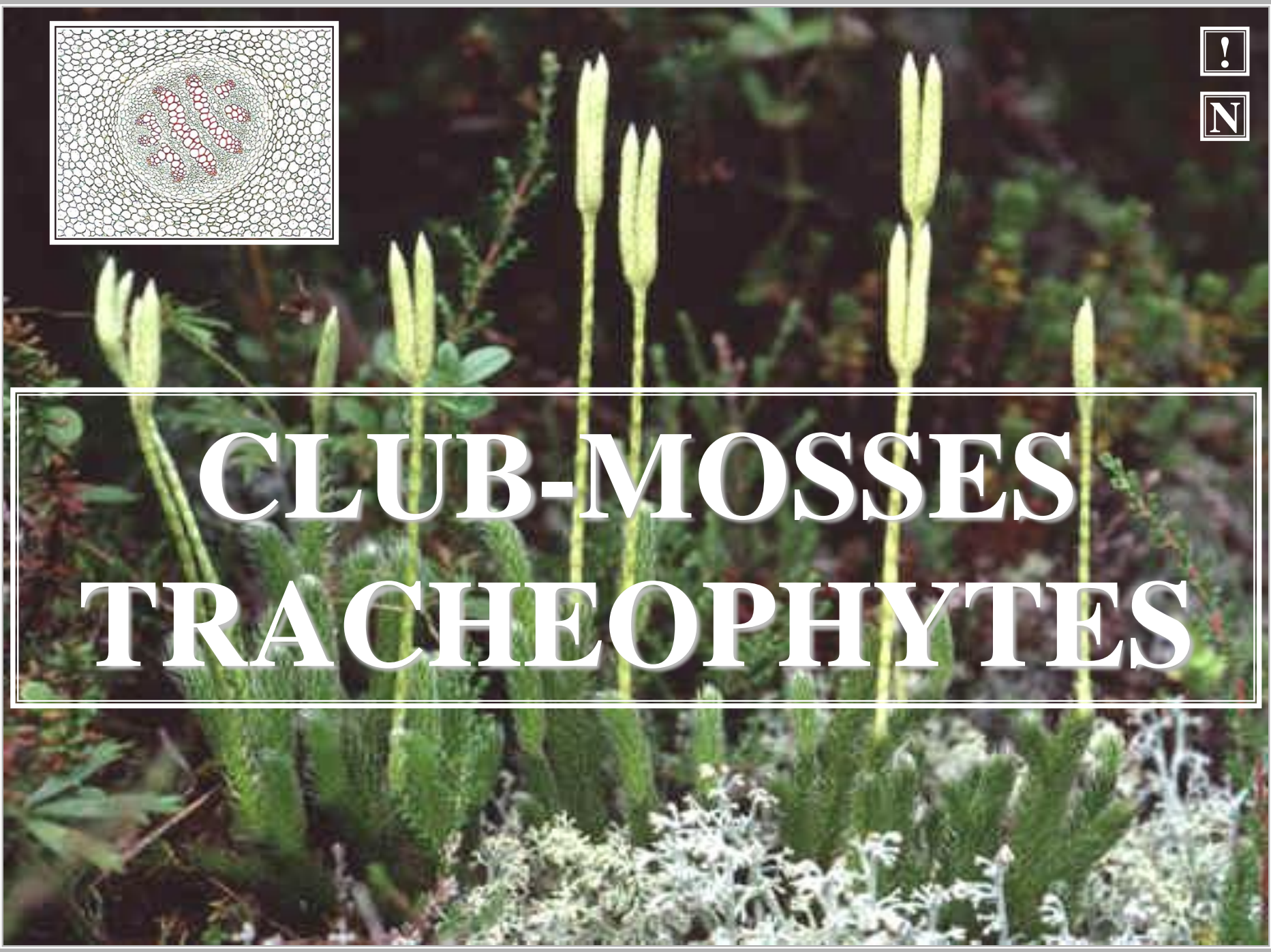
CLUB-MOSSES VASCULAR TISSUE

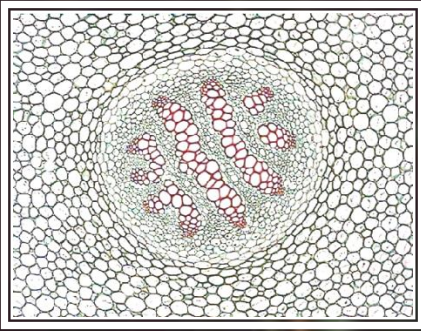




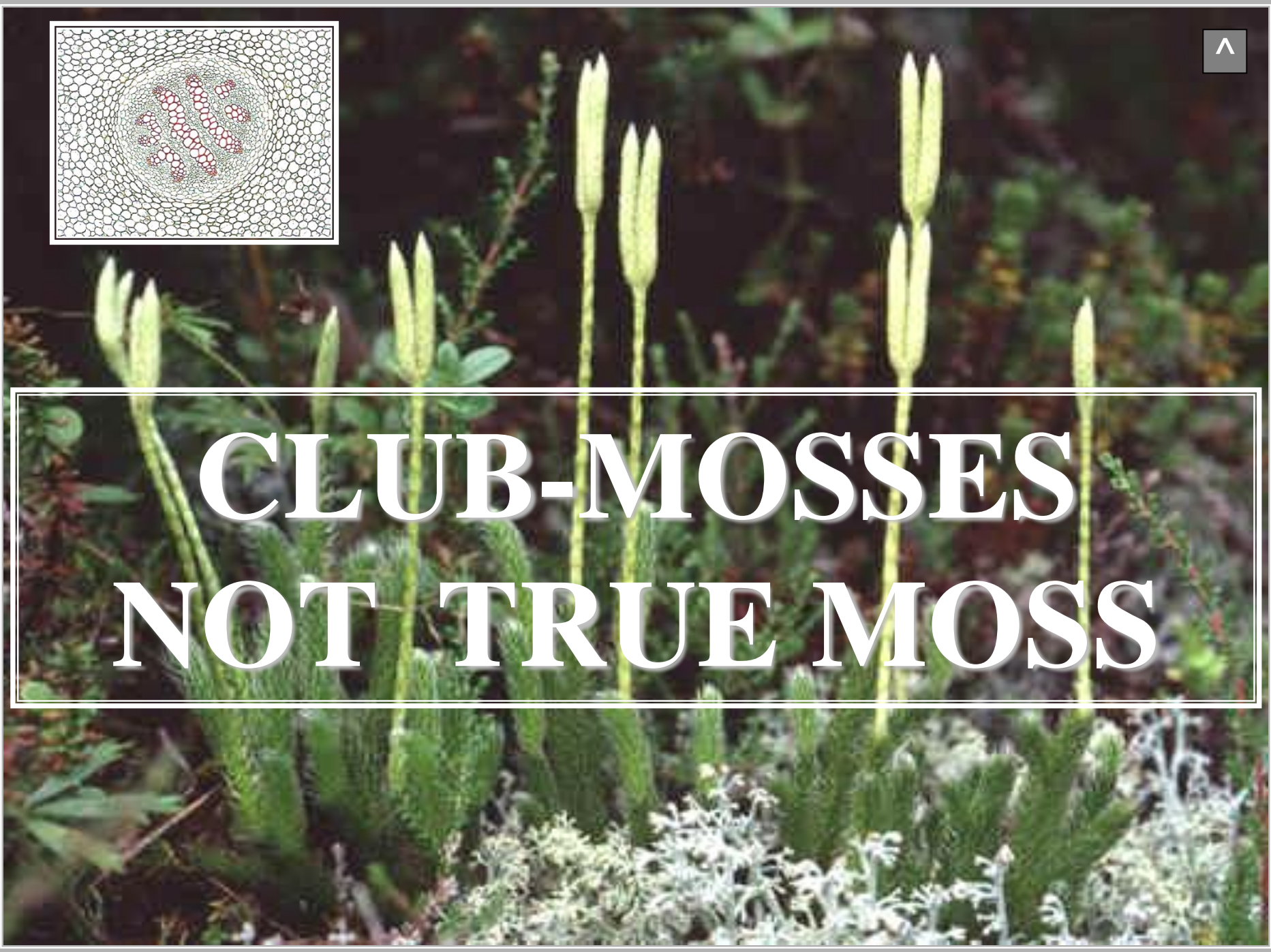
CLUB-MOSSES

TRACHEOPHYTES





CLUB-MOSSES NOT TRUE MOSS



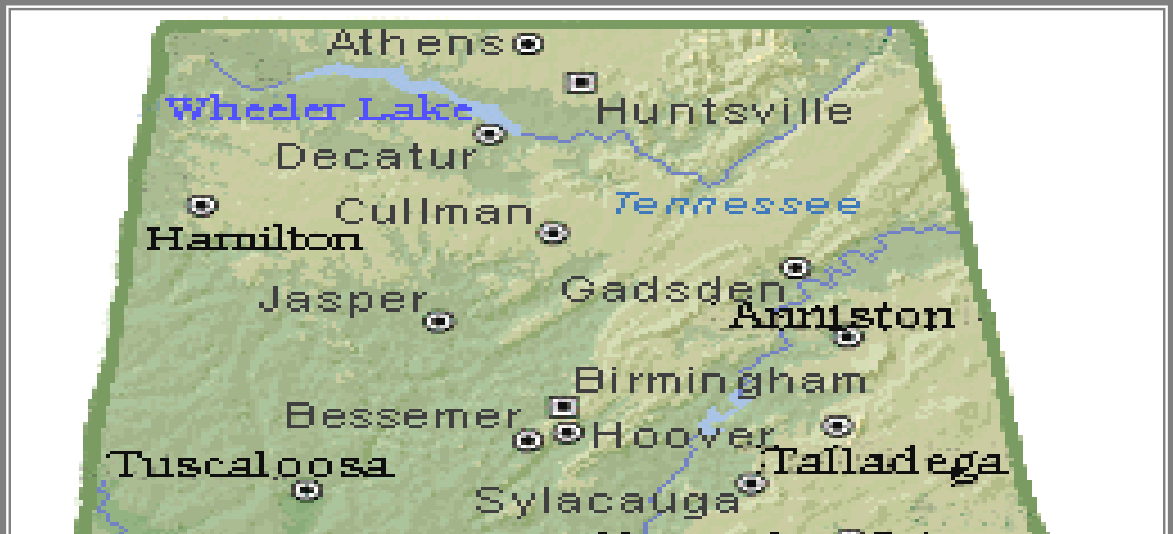


DIVERSITY



~400 SPECIES

EARTH



~6 SPECIES





REPRESENTATIVE GENUS

L



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