



*PSILOTUM*

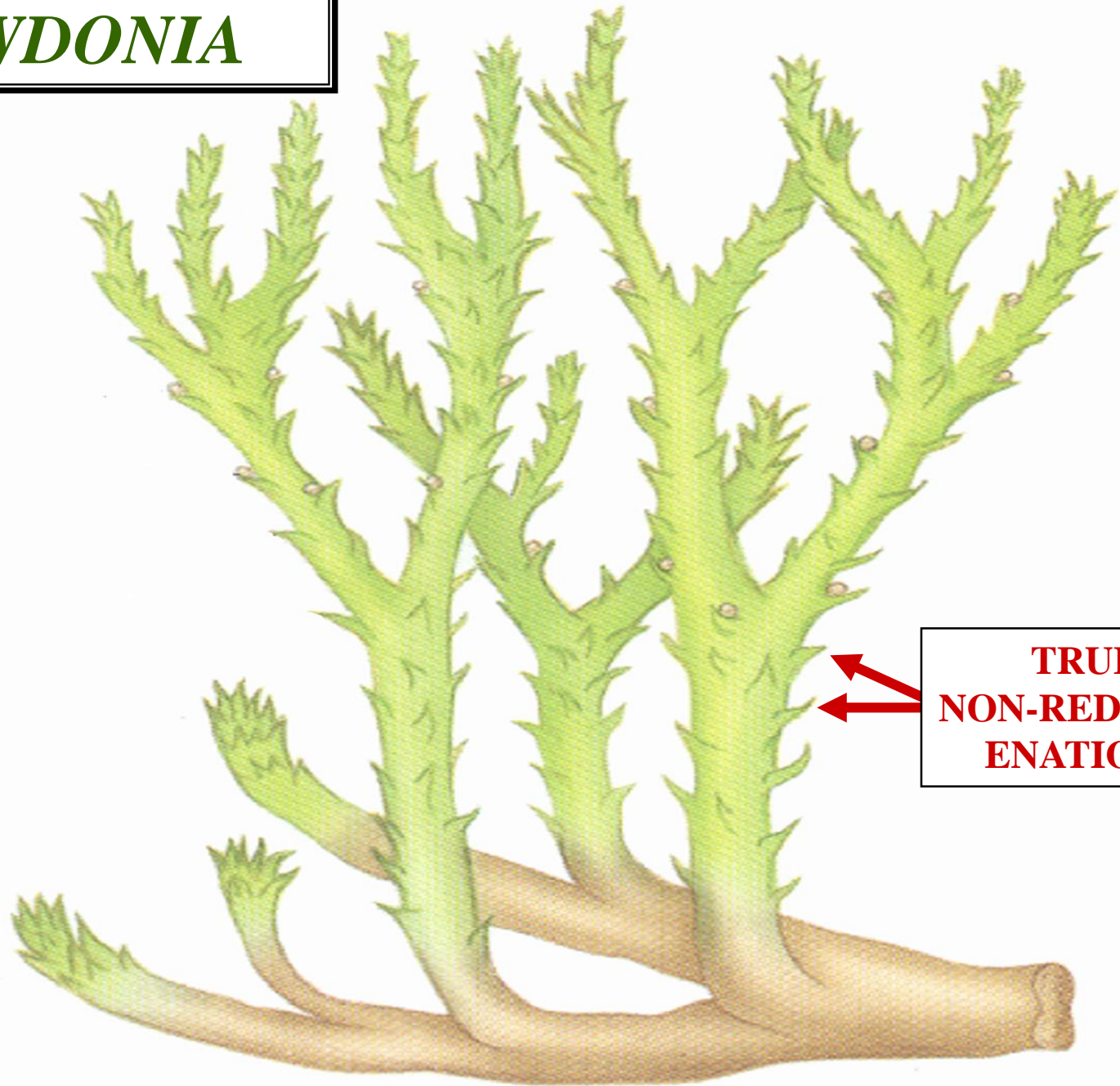


**HIGHLY  
REDUCED  
MEGAPHYLL**



*PSILOTUM*

# *SAWDONIA*



**TRUE  
NON-REDUCED  
ENATIONS**





R

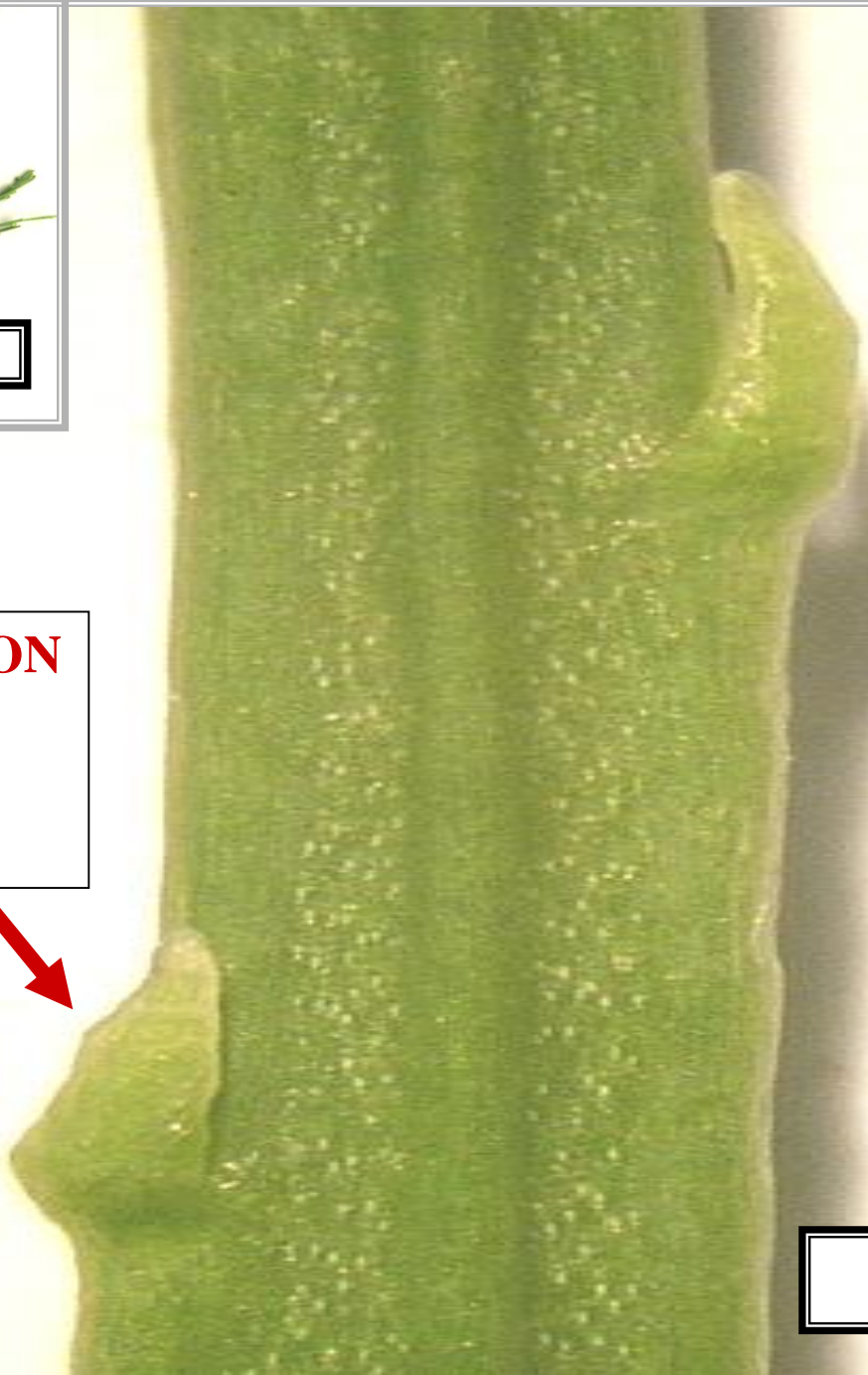
# FROND / ENATION EVOLUTION



*PSILOTUM*



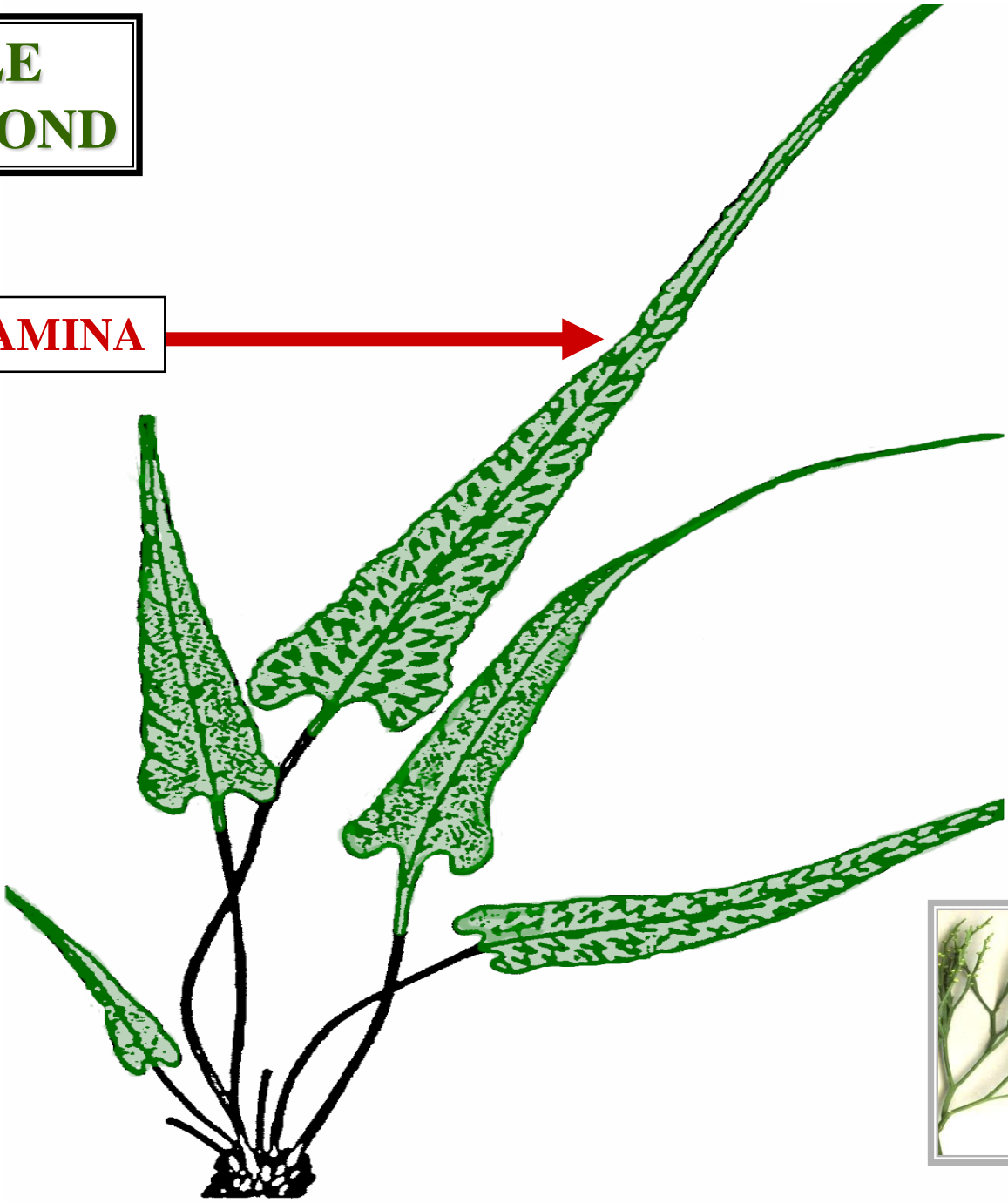
**FROND / ENATION  
EVOLVED  
VIA  
REDUCTION**



*PSILOTUM*

**SIMPLE  
FERN FROND**

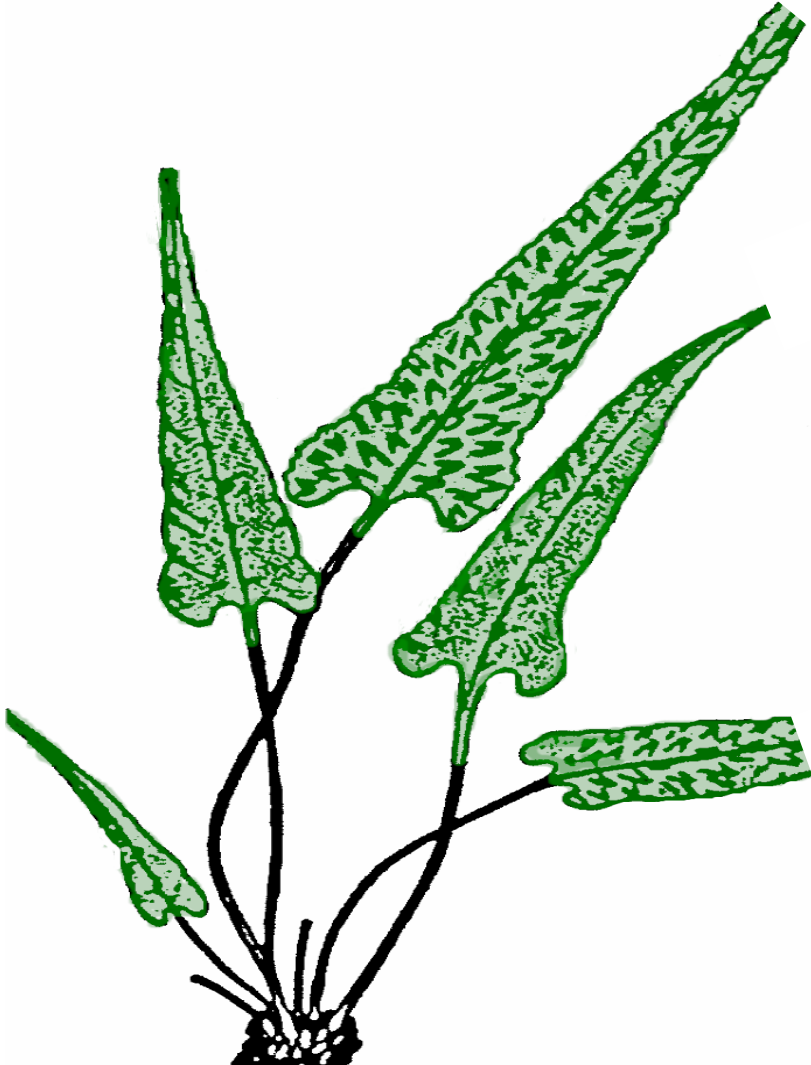
**LAMINA**





# SIMPLE FERN FROND

# REDUCTION



# SIMPLE FERN FROND

# REDUCTION





*PSILOTUM*



**FROND  
SCALE-LIKE  
ENATION**



*PSILOTUM*





*PSILOTUM*

**FROND  
HIGHLY  
REDUCED  
MEGAPHYLL**



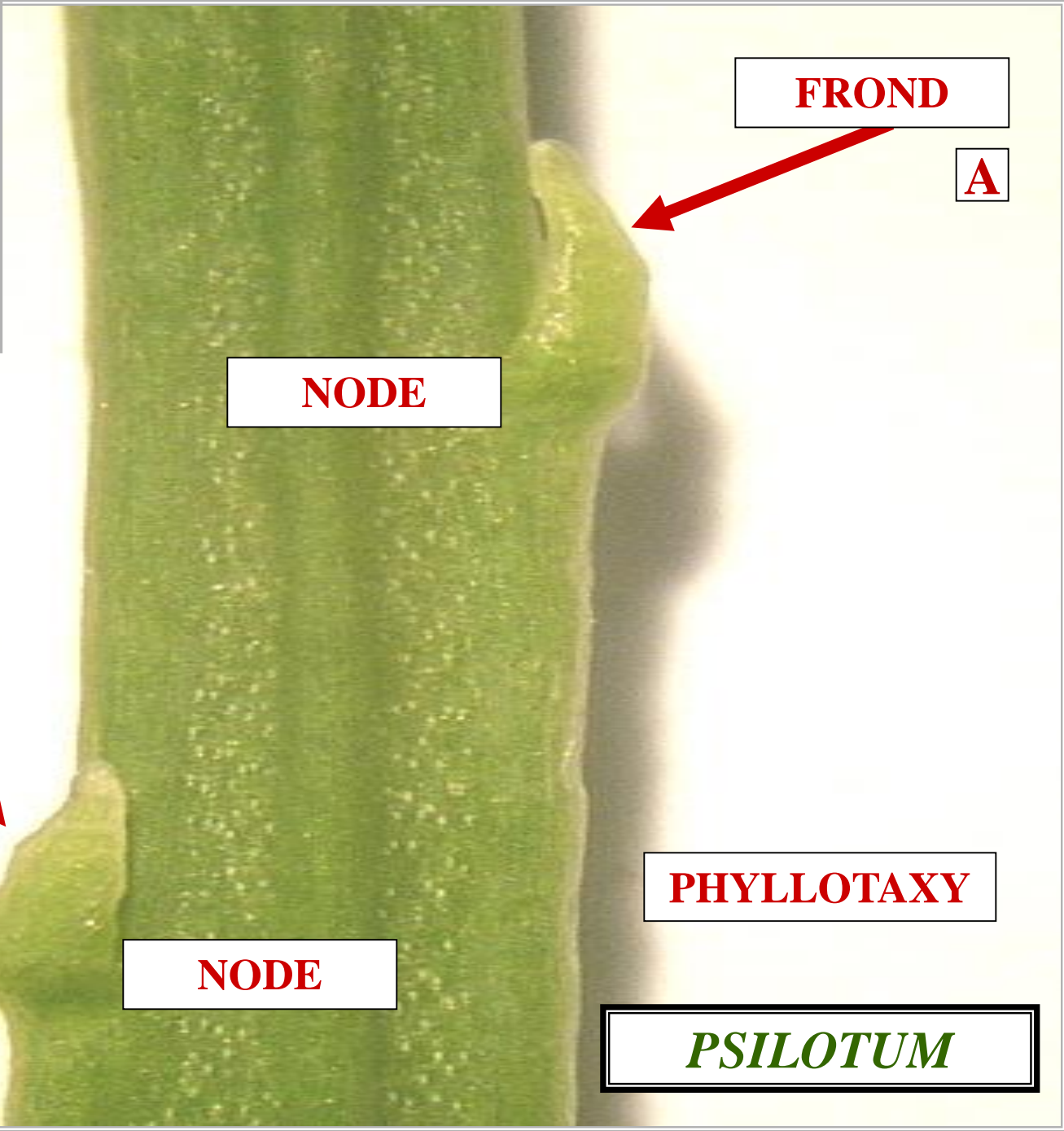
*PSILOTUM*



# PHYLOTAXY



*PSILOTUM*



**FROND**

**A**

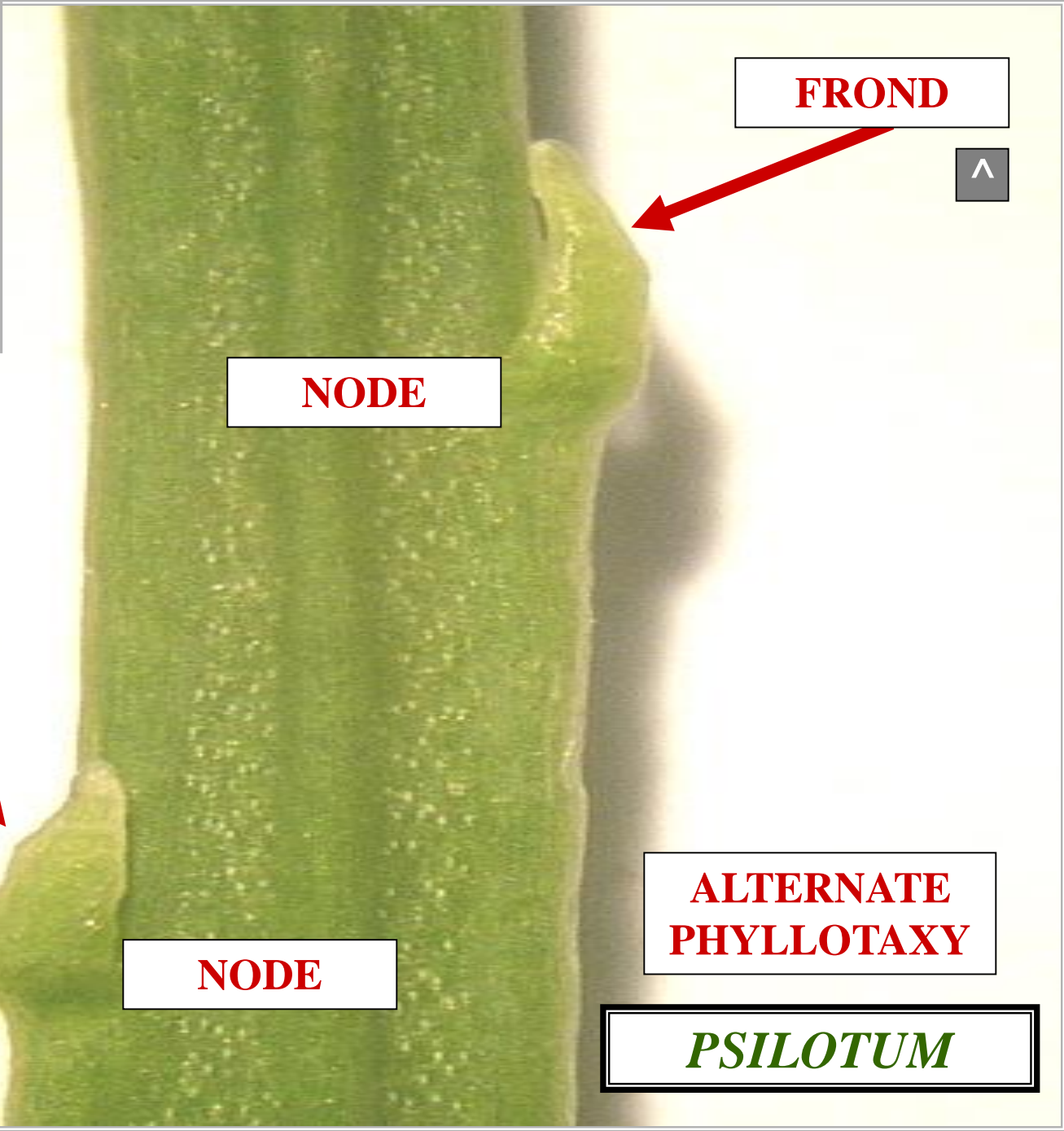
**NODE**

**FROND**

**PHYLLOTAXY**

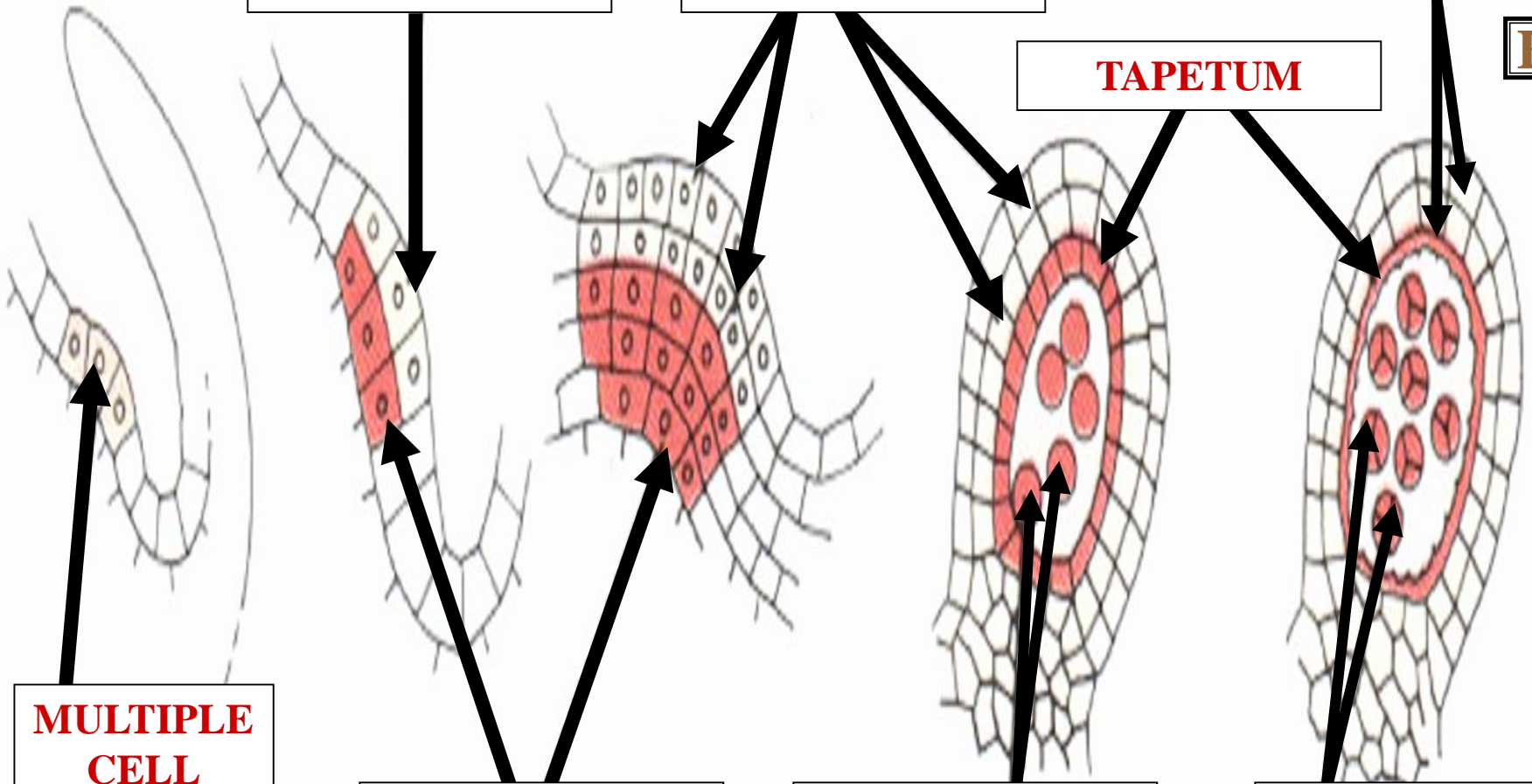
**NODE**

*PSILOTUM*





# SPORANGIUM



**MULTIPLE  
CELL  
INITIALS**

**WALL CELLS**

**WALL CELLS**

**TAPETUM**

**LARGE SIZE**

**THICK WALL**

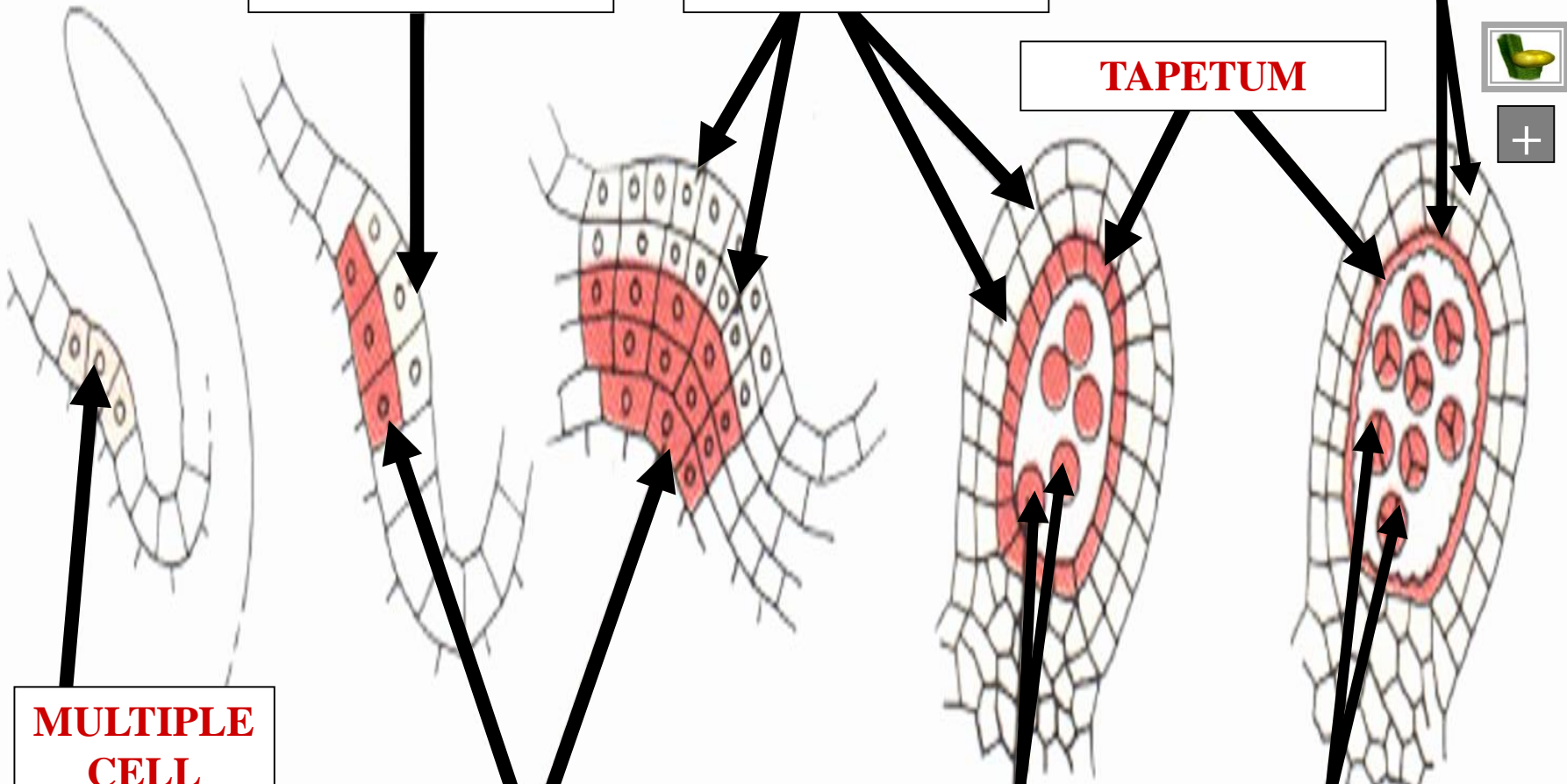
**E**

**SPOROCTES**

**SPOROCTES**

**NUMEROUS  
SPORES**

**L.S.**



**WALL CELLS**

**WALL CELLS**

**LARGE SIZE**

**THICK WALL**

**TAPETUM**



**MULTIPLE  
CELL  
INITIALS**

**SPOROCTES**

**SPOROCTES**

**NUMEROUS  
SPORES**

**EUSPORANGIUM**

**L.S.**

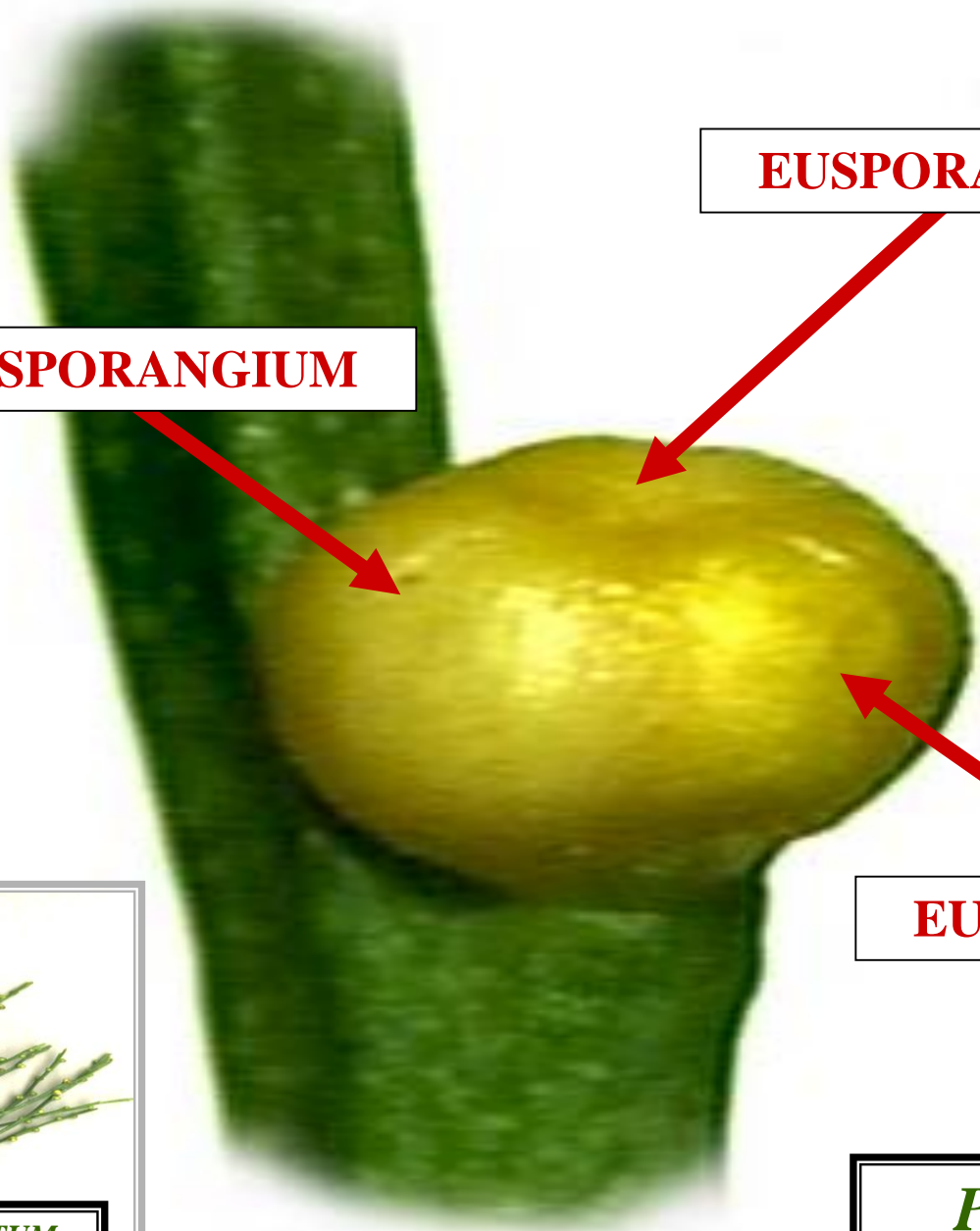
**EUSPORANGIUM**

**EUSPORANGIUM**

**EUSPORANGIUM**



*PSILOTUM*



*PSILOTUM*





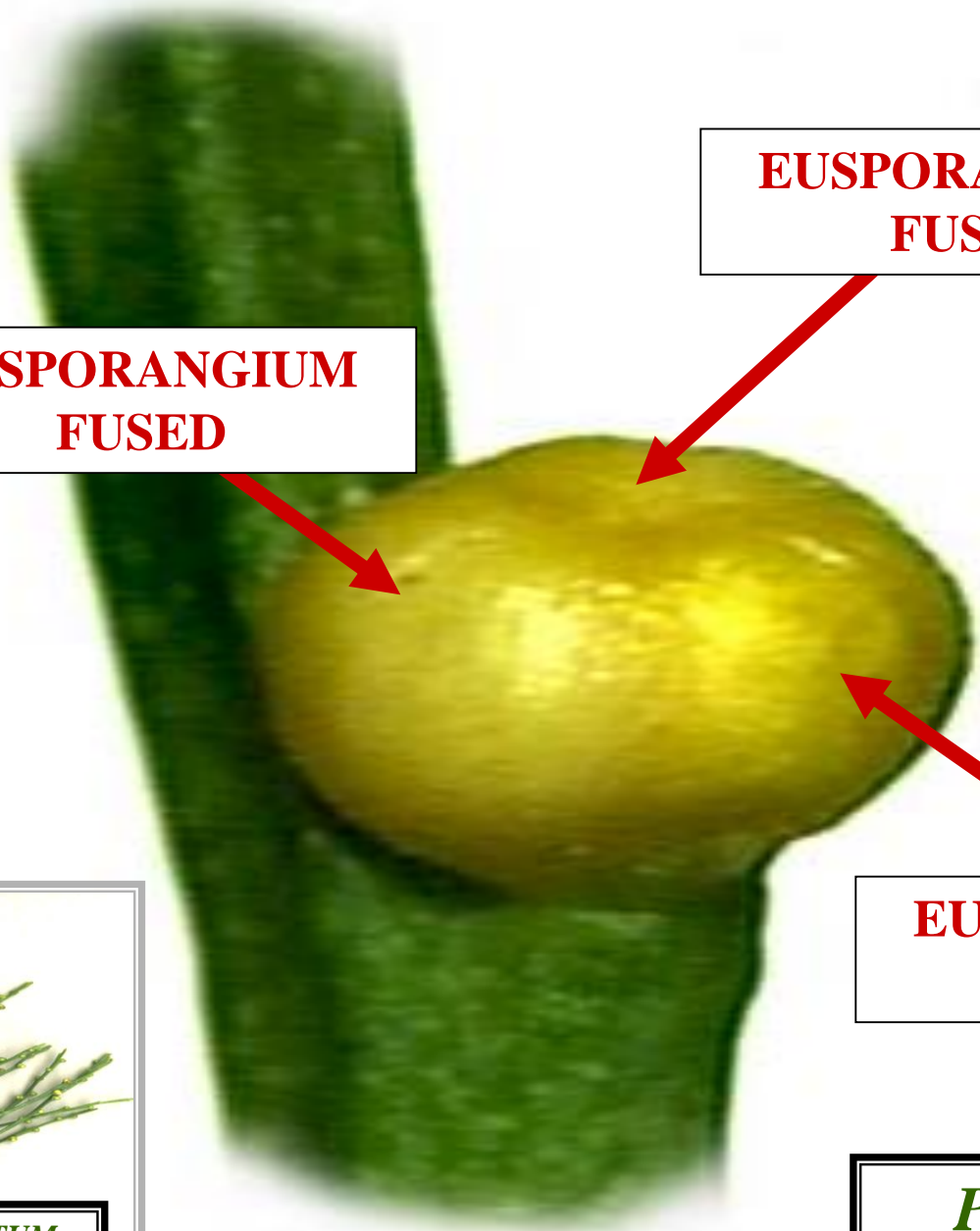
**EUSPORANGIUM  
FUSED**

**EUSPORANGIUM  
FUSED**

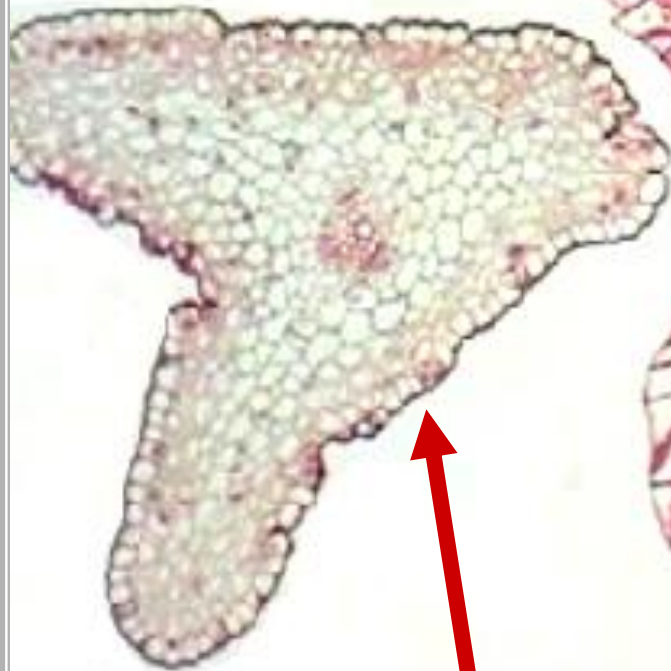
**EUSPORANGIUM  
FUSED**



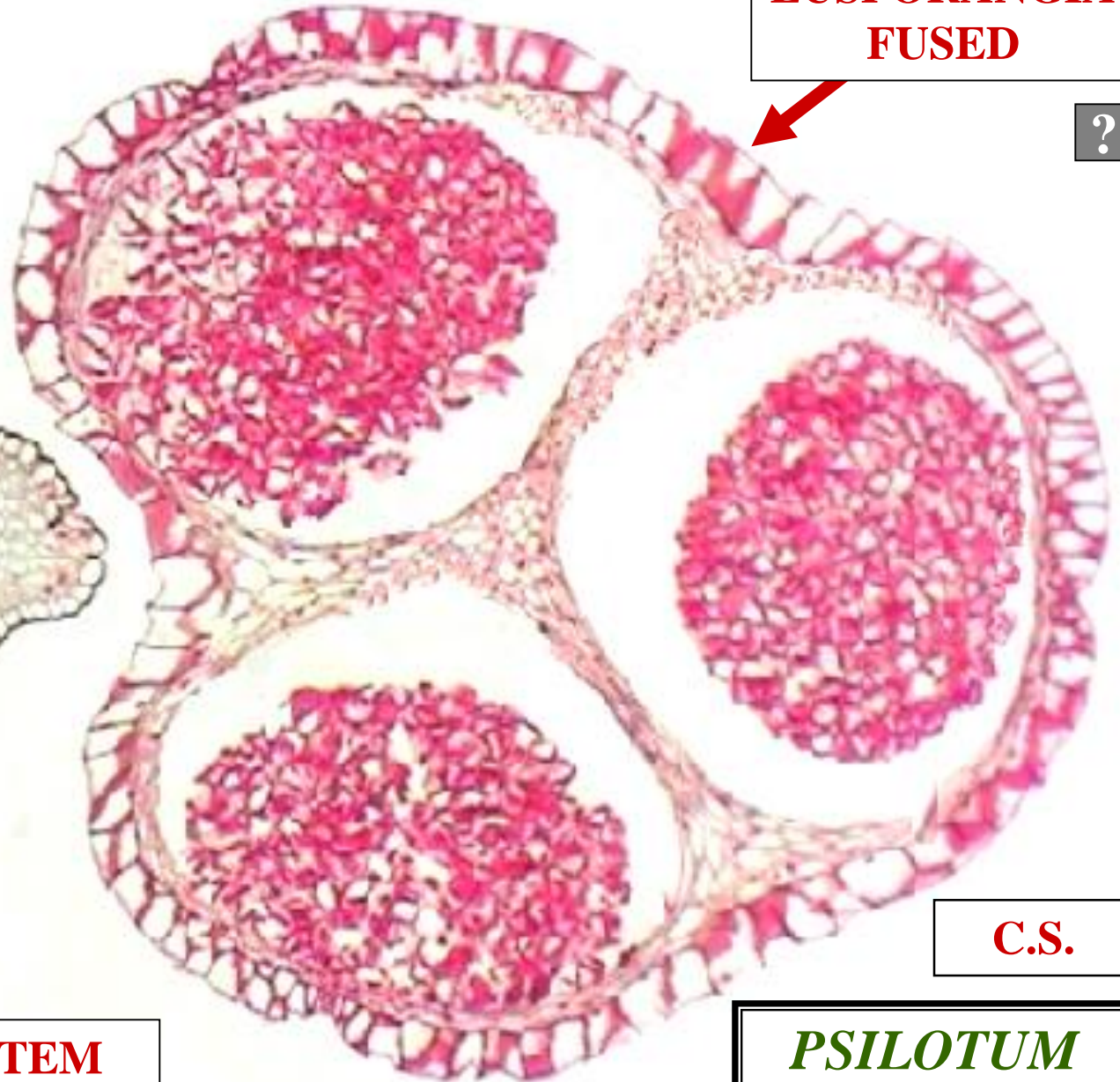
*PSILOTUM*



*PSILOTUM*



**AERIAL STEM**



**EUSPORANGIA  
FUSED**

?

**C.S.**

***PSILOTUM***



**AERIAL STEM**

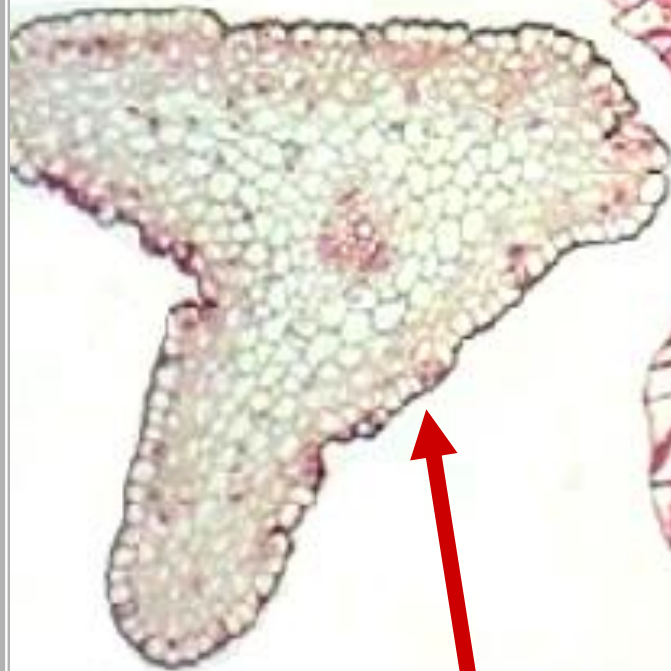


?

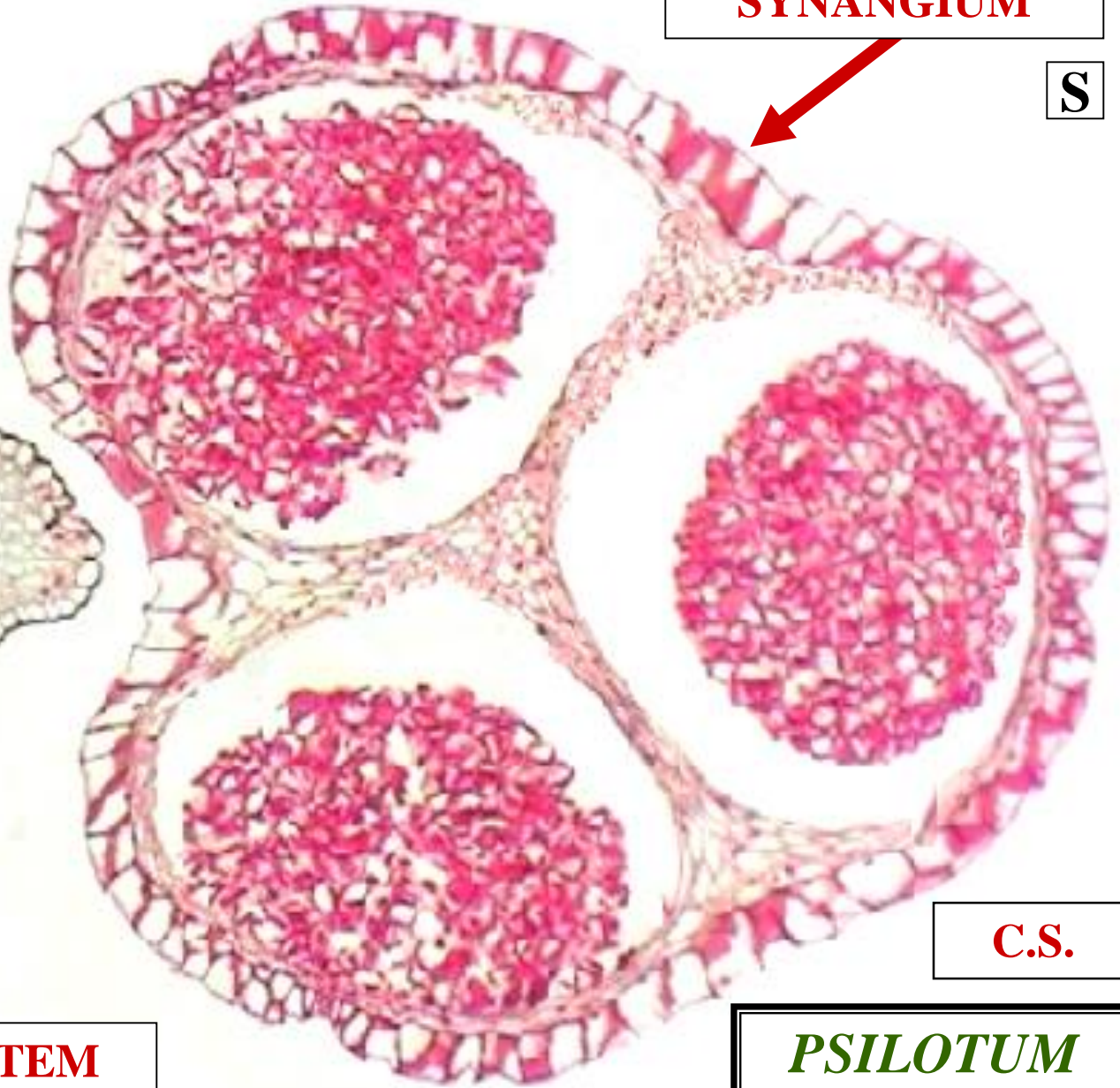
**S**

**C.S.**

***PSILOTUM***



**AERIAL STEM**



**SYNANGIUM**

**S**

**C.S.**

***PSILOTUM***

**SYNANGIUM**

*PSILOTUM*  
**SYNANGIUM**



**FUSED**  
**SPORANGIA**

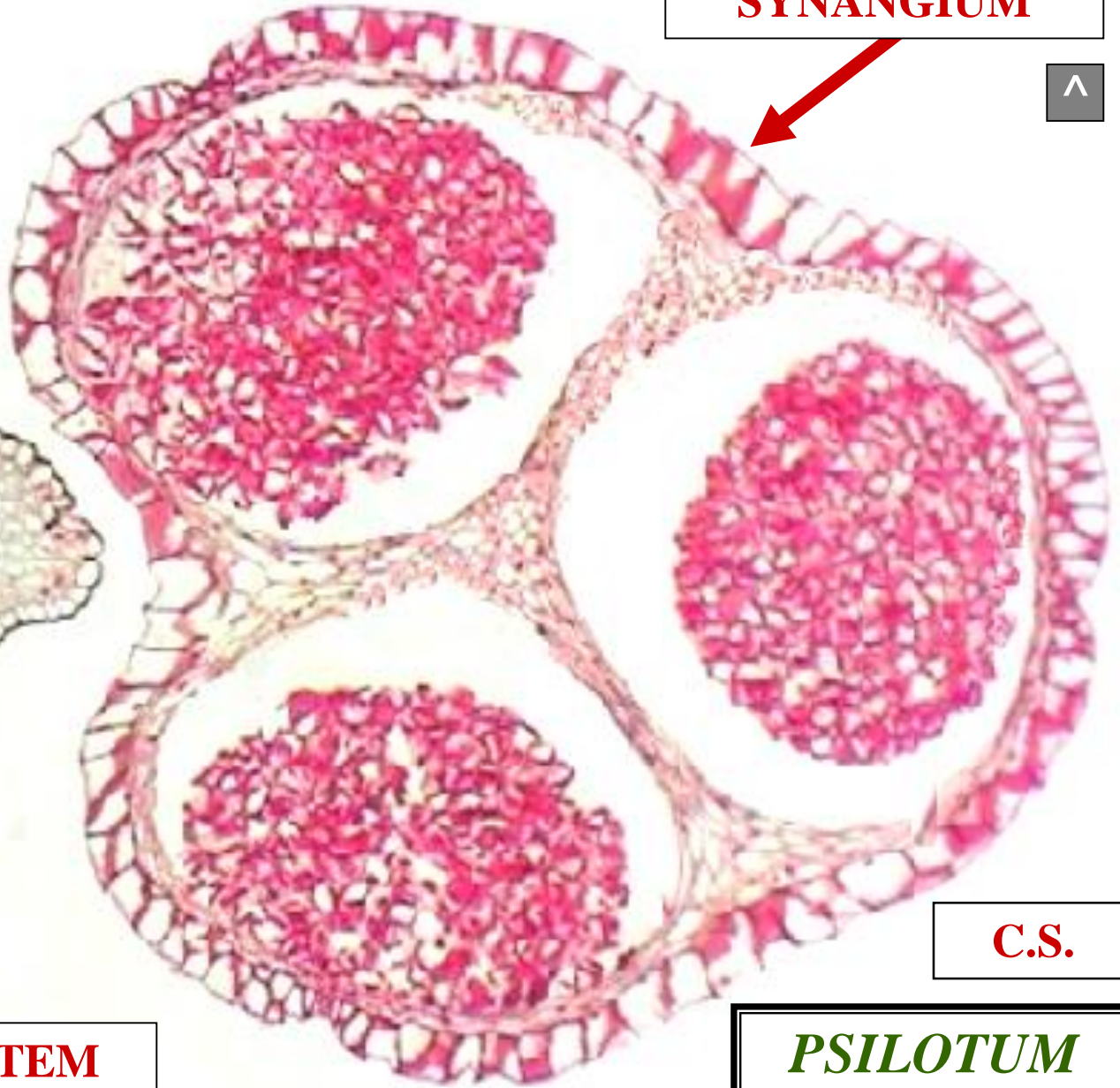
*PSILOTUM*  
**SYNANGIUM**



**SYNANGIUM**



**AERIAL STEM**



**C.S.**

***PSILOTUM***

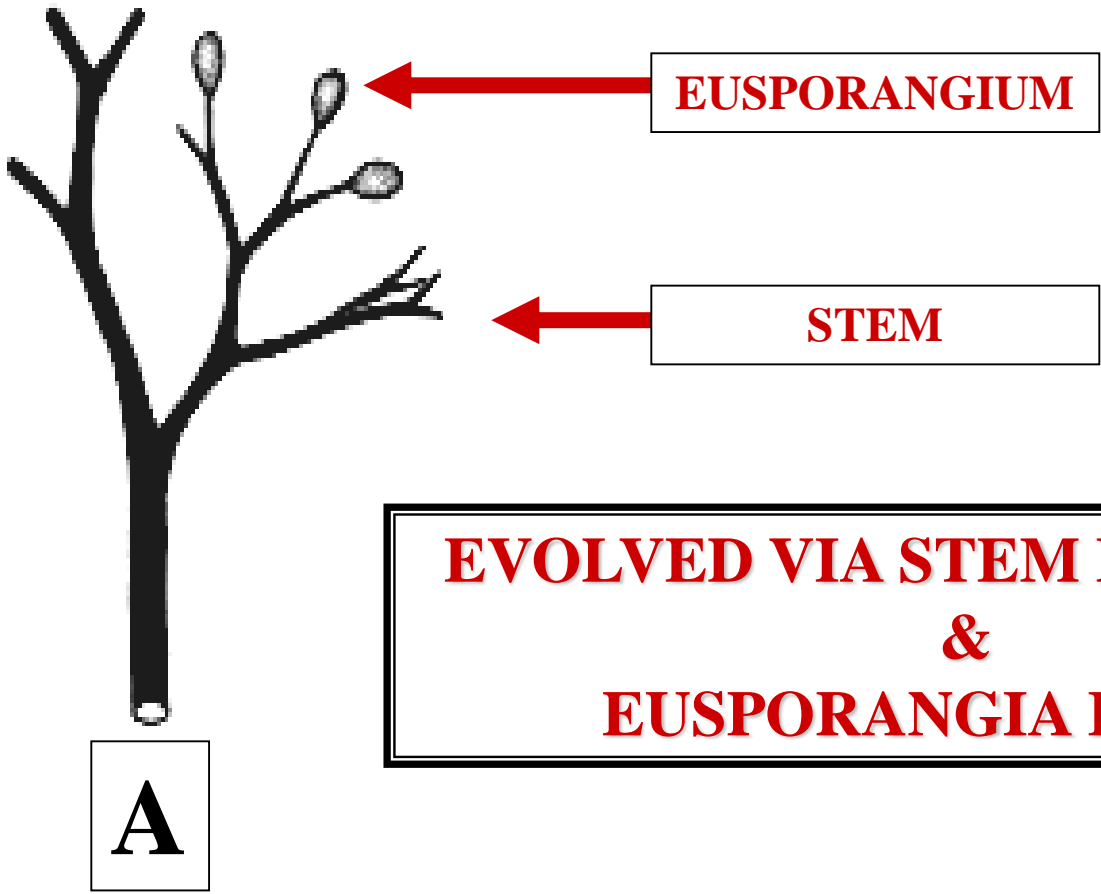


# SYNANGIUM EVOLUTION





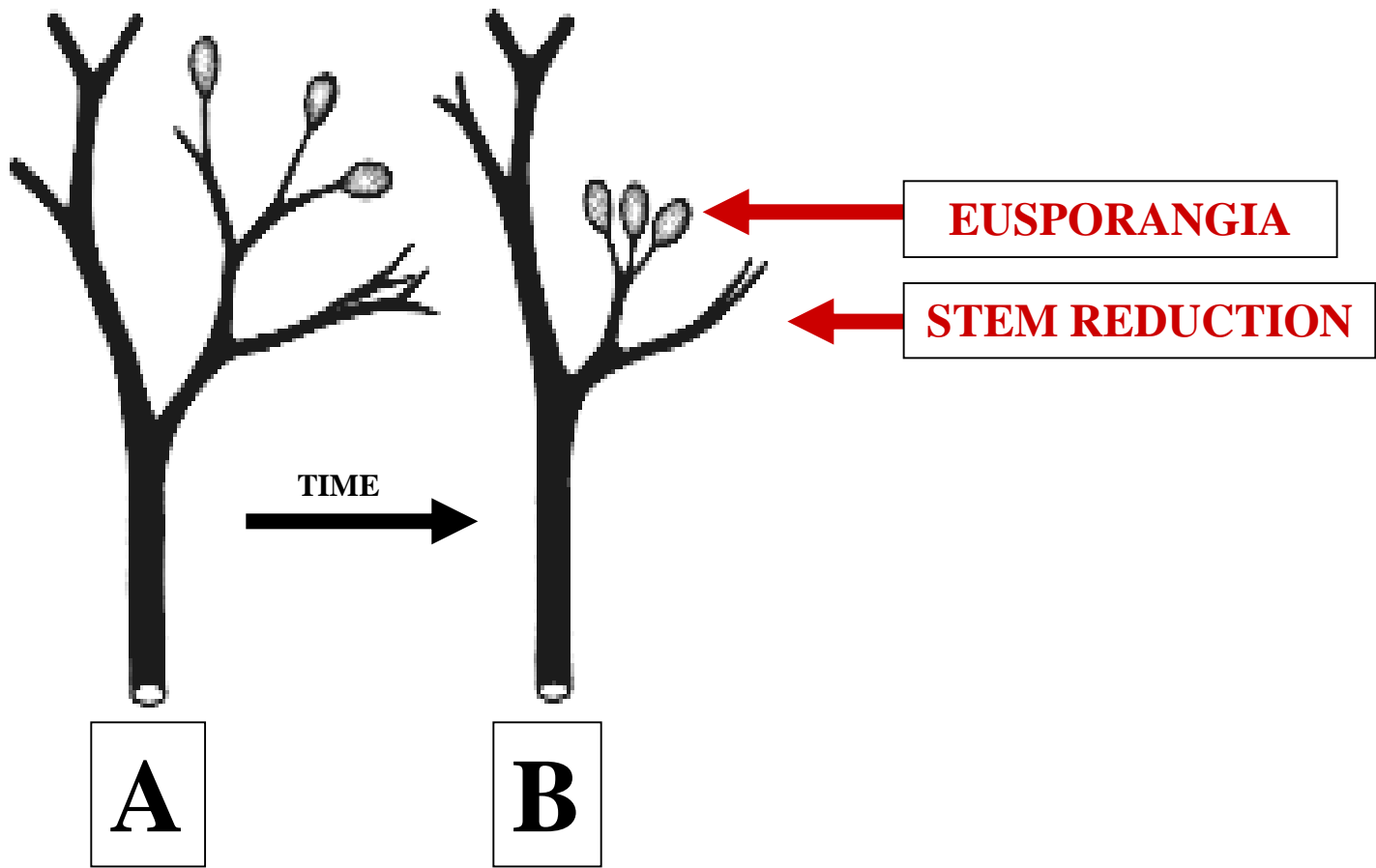
# SYNANGIUM EVOLUTION



**EVOLVED VIA STEM REDUCTION  
&  
EUSPORANGIA FUSION**



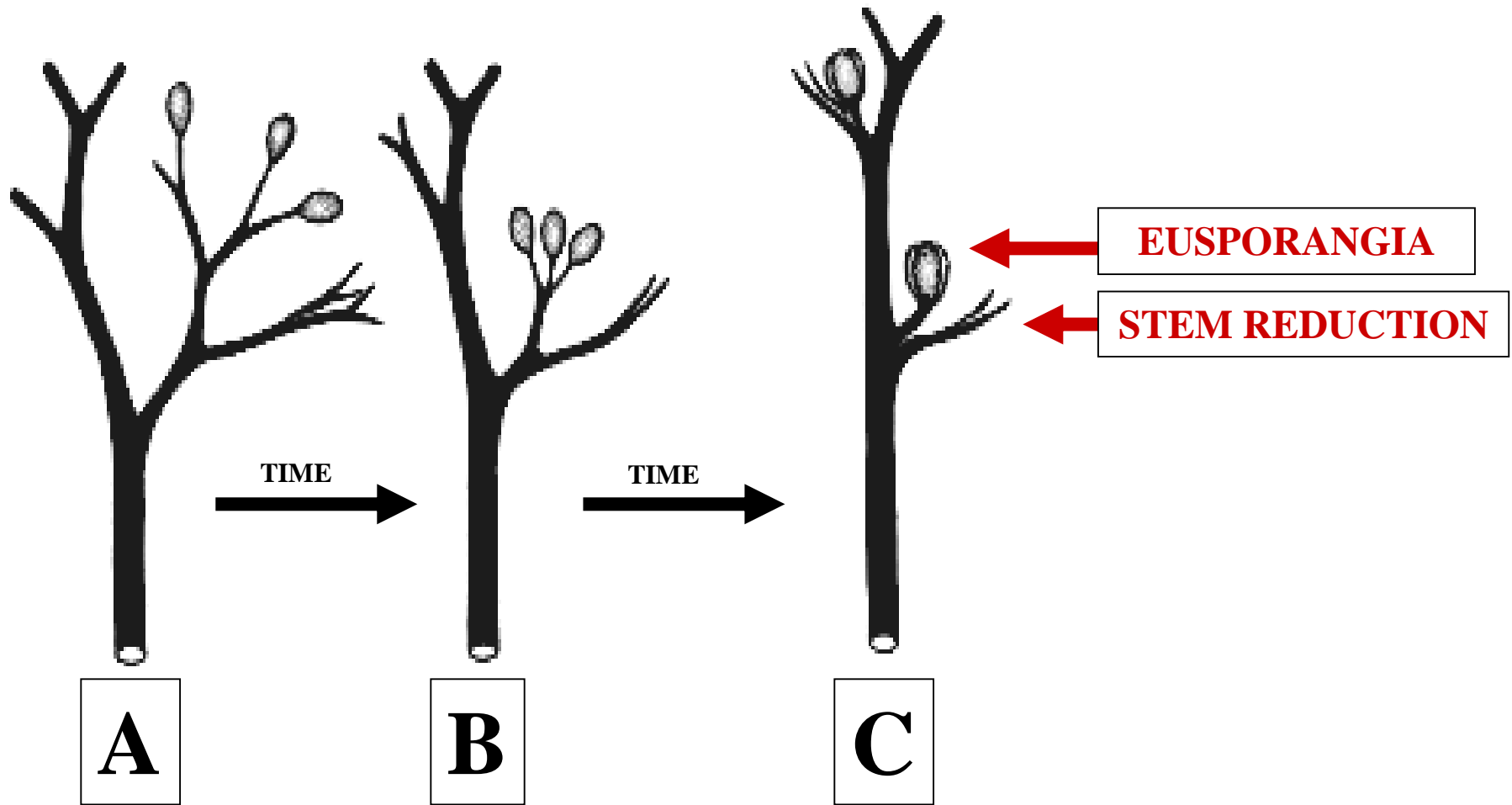
# SYNANGIUM EVOLUTION



**EVOLVED VIA STEM REDUCTION**



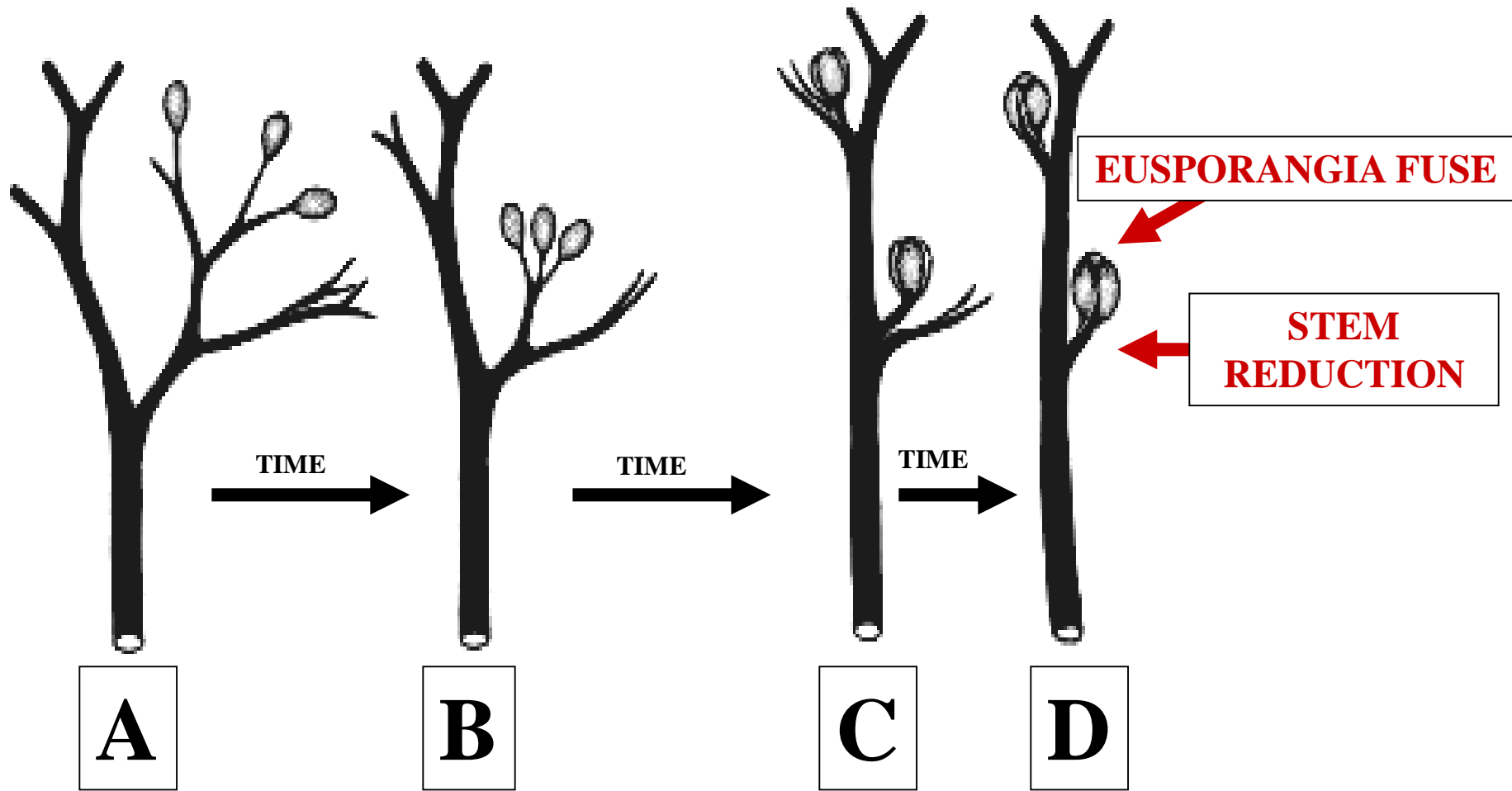
# SYNANGIUM EVOLUTION



**EVOLVED VIA STEM REDUCTION**

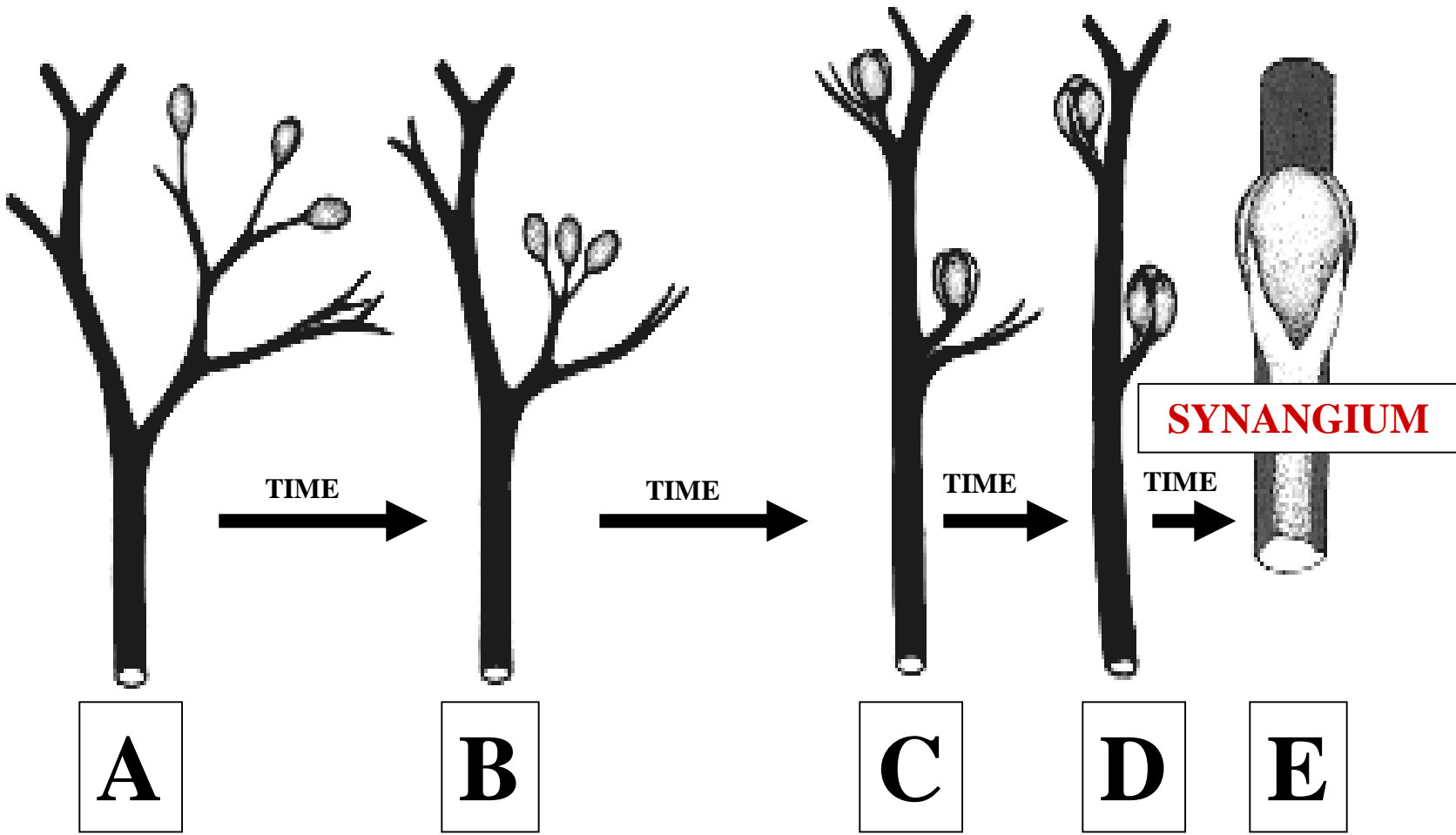


# SYNANGIUM EVOLUTION



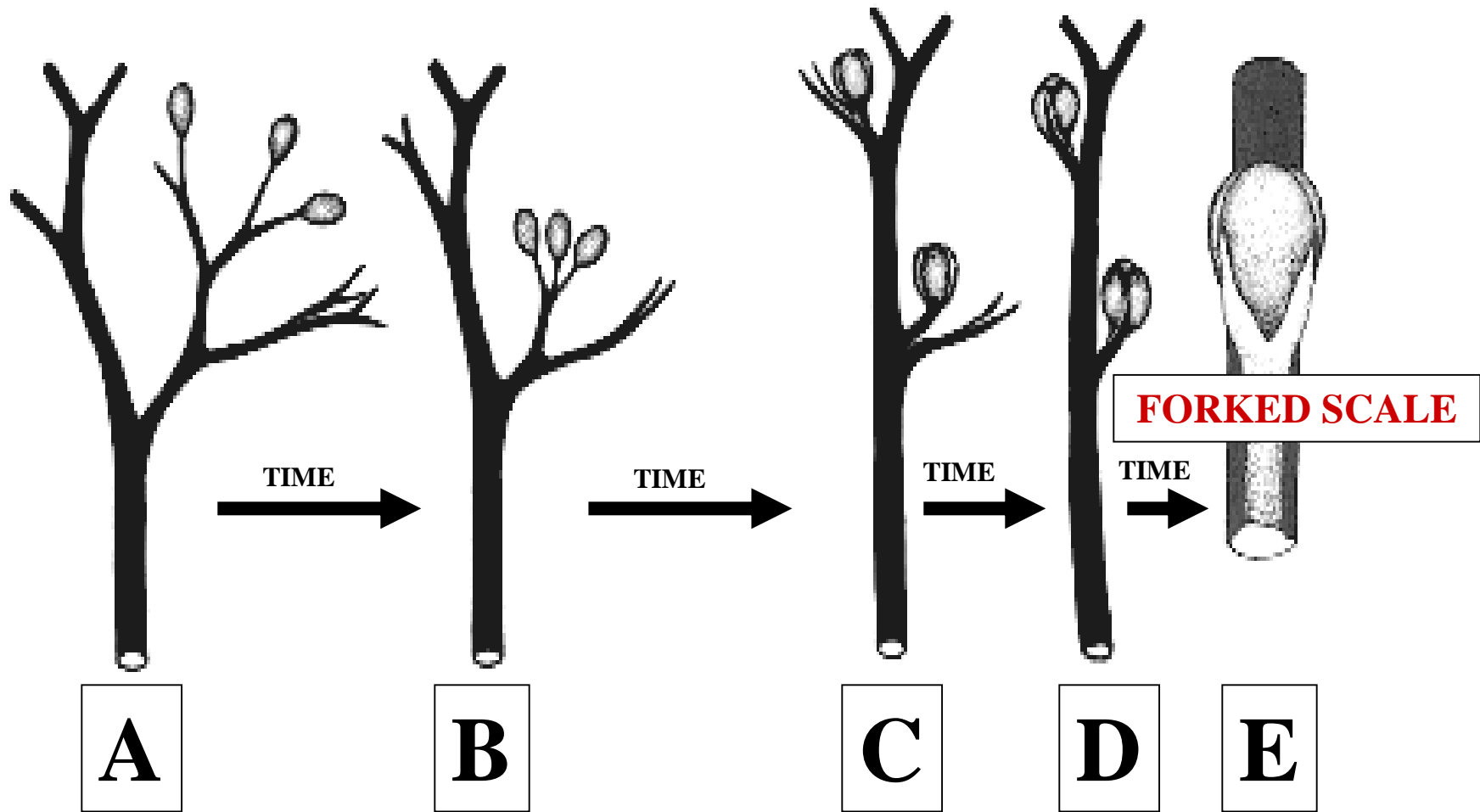
**EVOLVED VIA STEM REDUCTION & EUSPORANGIUM FUSION**

# SYNANGIUM EVOLUTION



**EVOLVED VIA STEM REDUCTION & EUSPORANGIUM FUSION**

# SYNANGIUM EVOLUTION



**EVOLVED VIA STEM REDUCTION & EUSPORANGIUM FUSION**

# **FORKED SCALE**

*PSILOTUM*  
**FORKED SCALE**



**SYNANGIUM**  
**SUPPORT BRANCH**

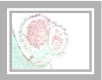
*PSILOTUM*  
**FORKED SCALE**





*PSILOTUM*

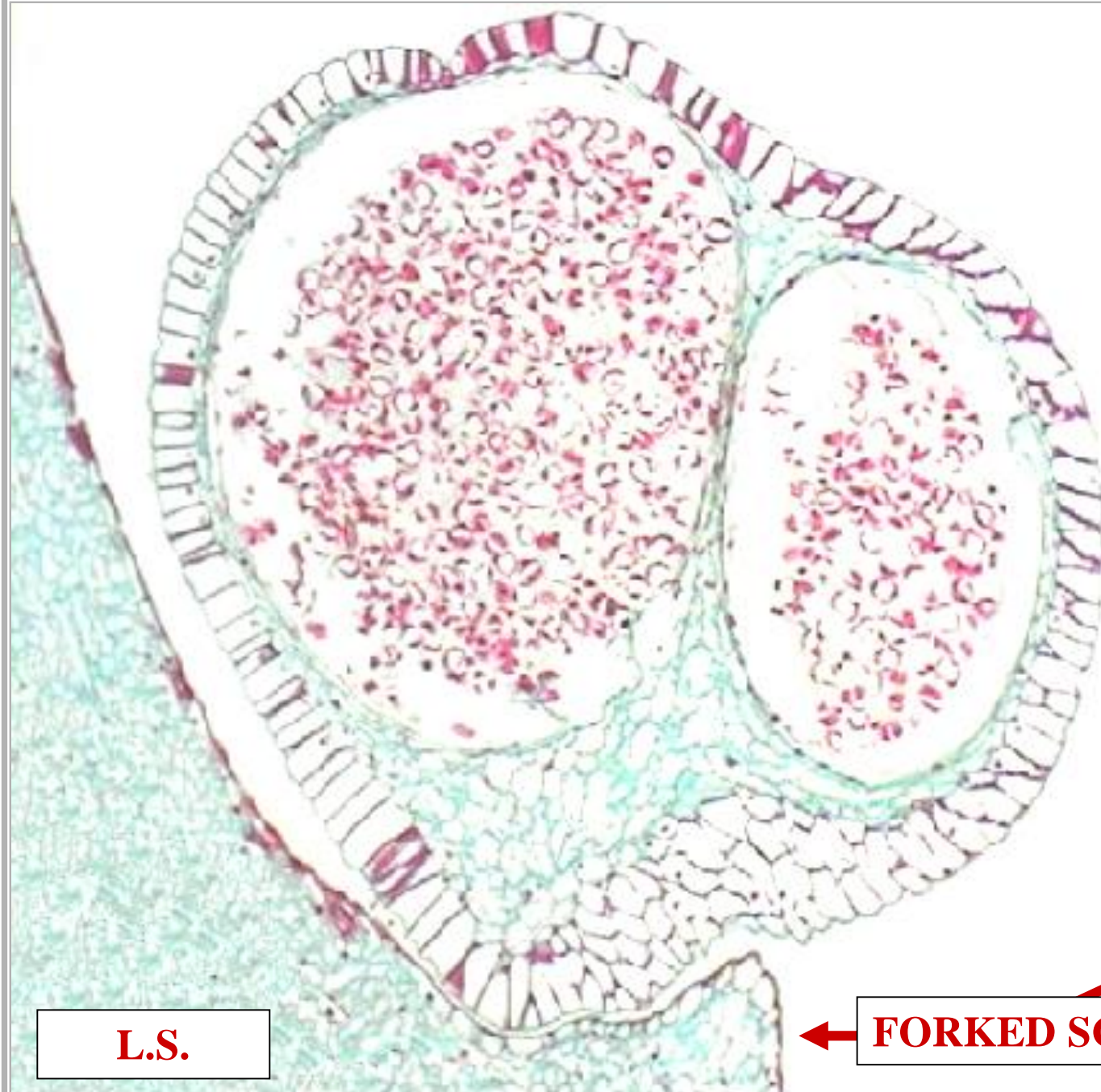
**SYNANGIUM**



**FORKED SCALE**

**SYNANGIUM EVOLUTION**

*PSILOTUM*



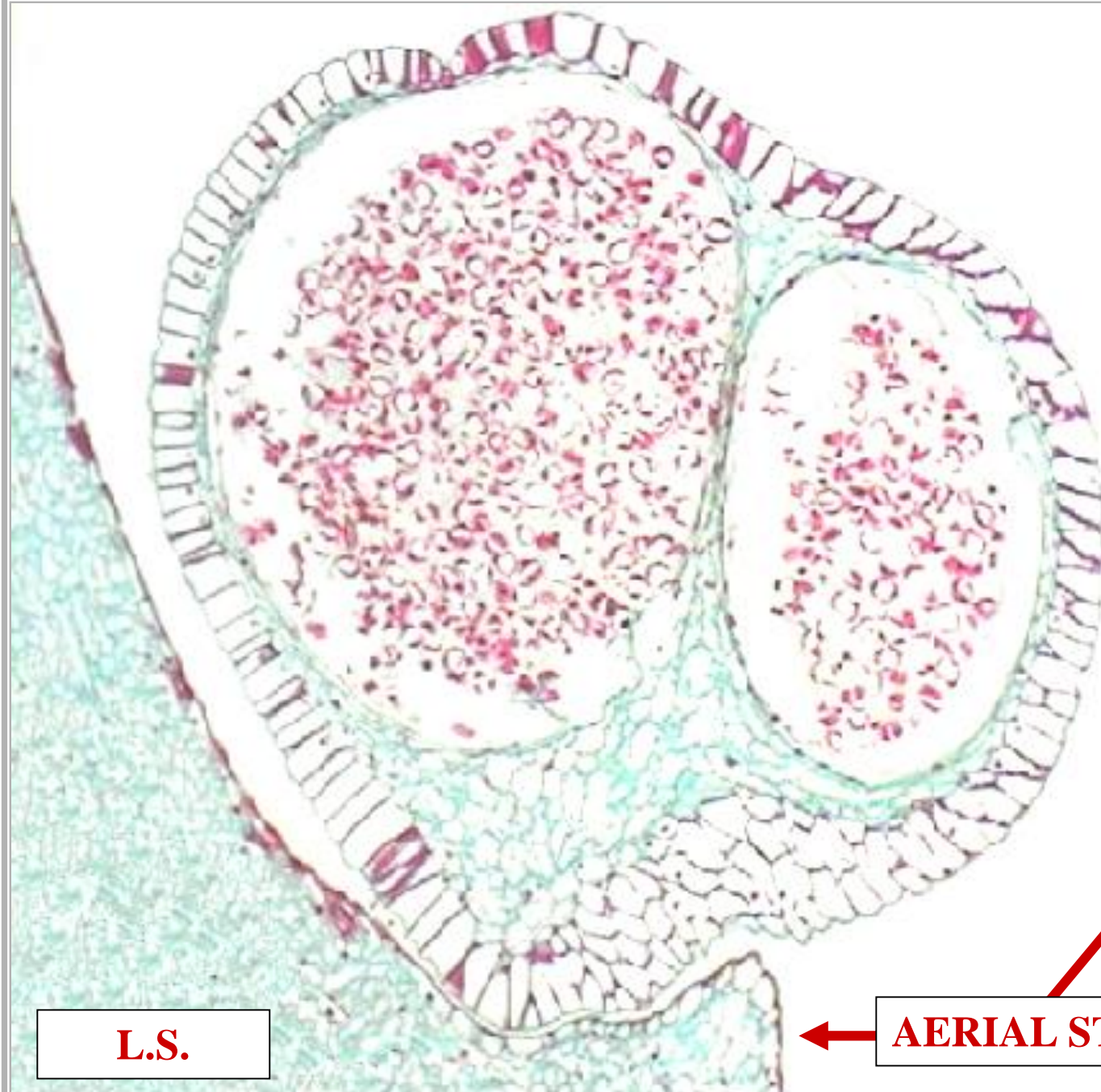
L.S.

FORKED SCALE

# **SPORANGIUM POSITION**

*PSILOTUM*

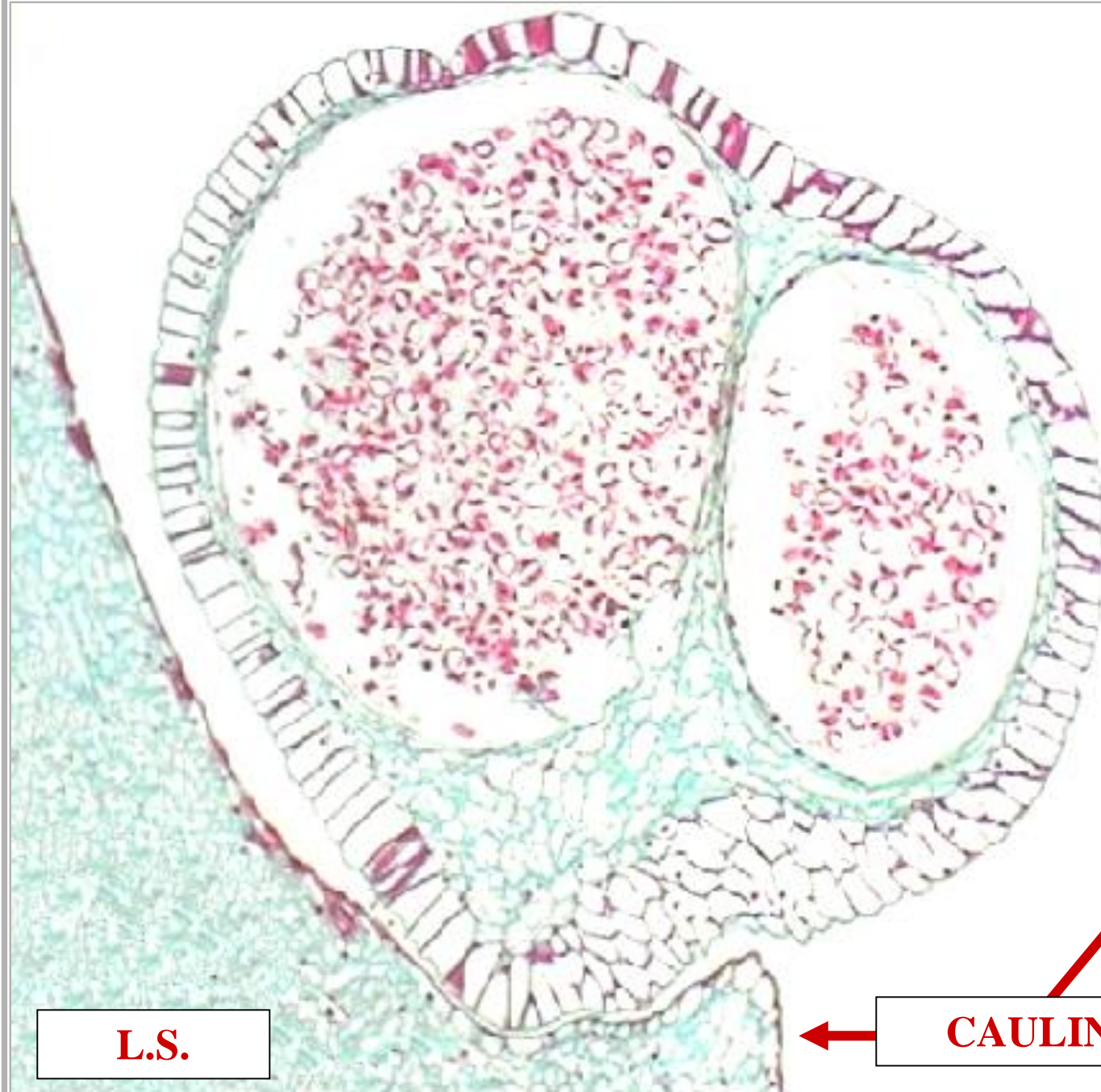
C



L.S.

AERIAL STEM

*PSILOTUM*



L.S.

CAULINE





# SPORE HABIT

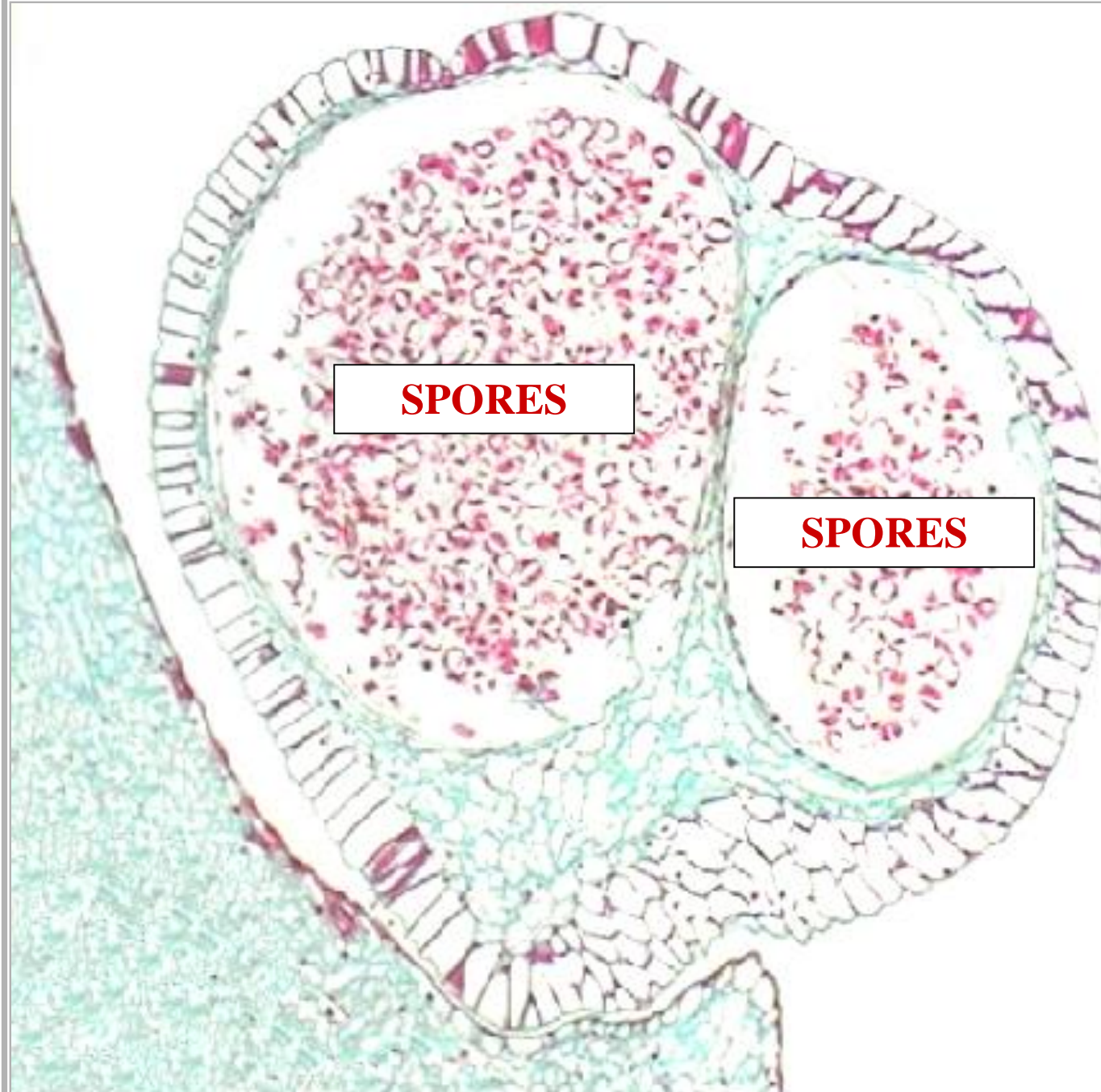
*PSILOTUM*

L.S.

I

SPORES

SPORES



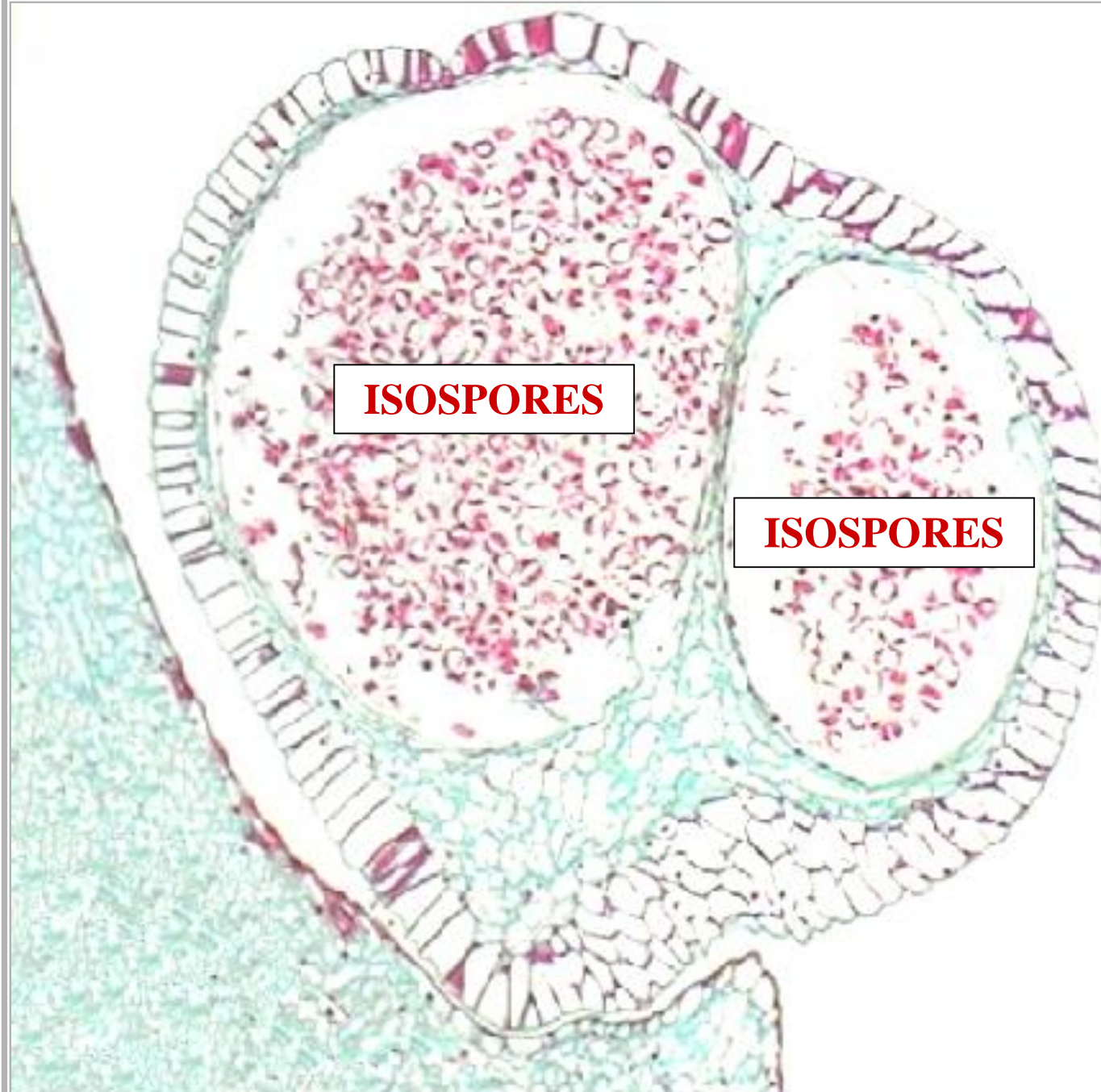
*PSILOTUM*

L.S.

H

ISOSPORES

ISOSPORES





*PSILOTUM*

L.S.



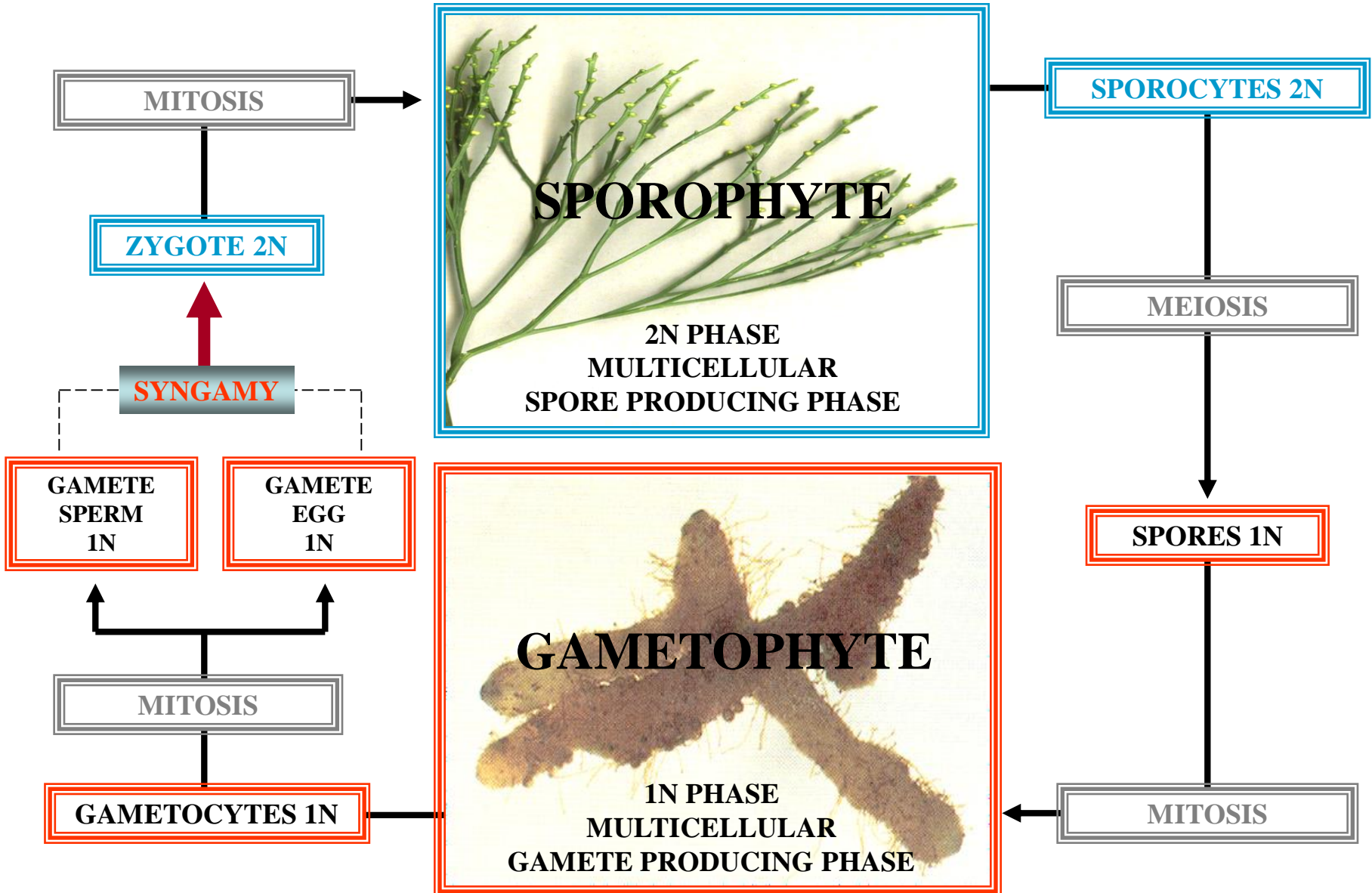
ISOSPORES

ISOSPORES

HOMOSPOROUS



# PSILOTALES LIFE CYCLE





# GAMETOPHYTE CHARACTERS

*PSILOTUM*

L.S.



ISOSPORES

ISOSPORES

HOMOSPOROUS





# EXOSPORIC GAMETOPHYTE

*PSILOTUM*

S



**EXOSPORIC**

**GAMETOPHYTE**

*PSILOTUM*

N



**SUBTERRANEAN**

**GAMETOPHYTE**

*PSILOTUM*

M



**NON-PSYN**

**GAMETOPHYTE**



*PSILOTUM*

**EX**

**MYCORRHIZAE ABUNDANT**

**GAMETOPHYTE**



*PSILOTUM*

**B**



**EXOSPORIC**

**GAMETOPHYTE**

*PSILOTUM*

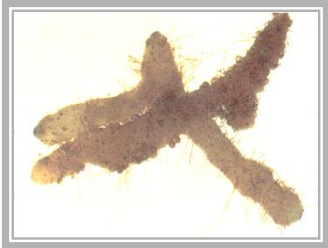


**BISEXUAL**

**GAMETOPHYTE**

*PSILOTUM*

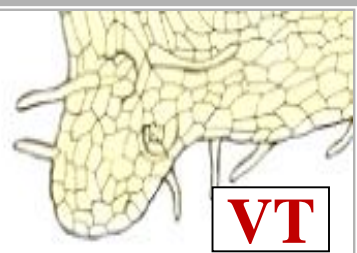
**ANTHERIDIUM**



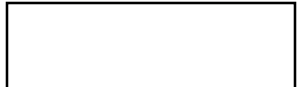
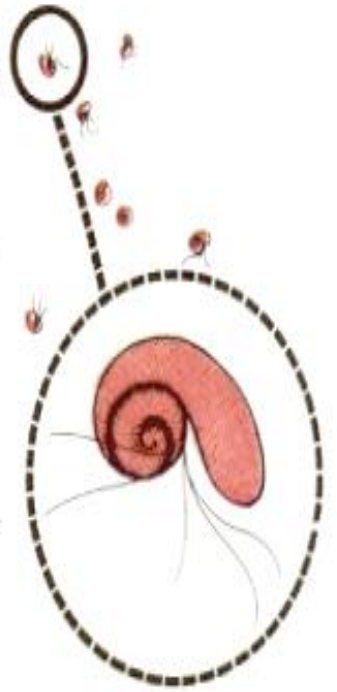
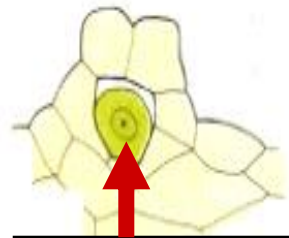
**C.S.**

**ARCHEGONIUM**

**GAMETOPHYTE**

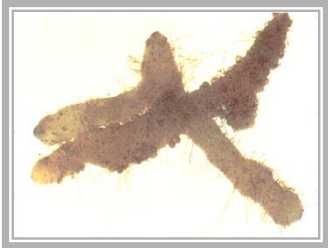


**VT**



*PSILOTUM*

**ANTHERIDIUM**

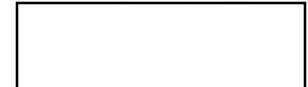
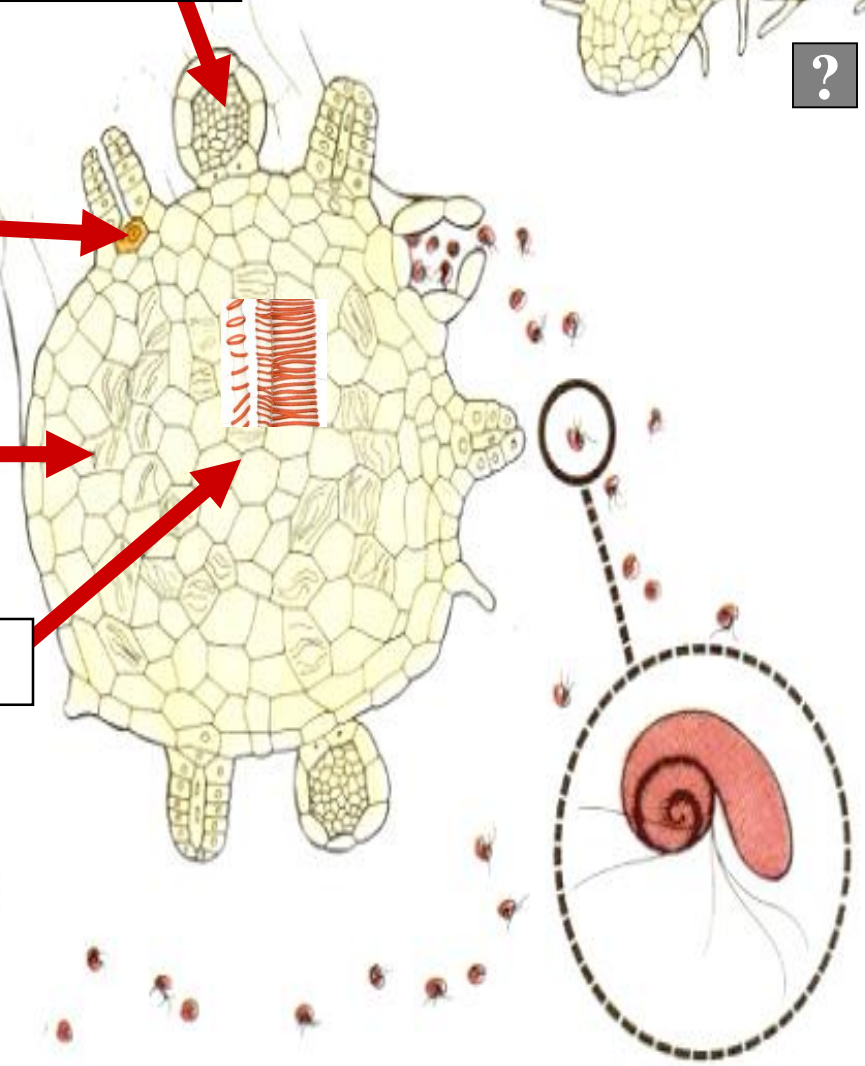
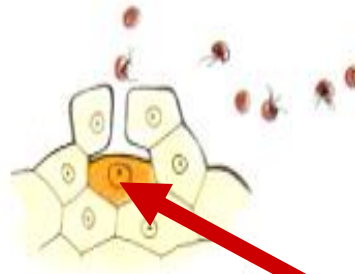
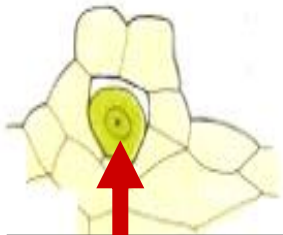


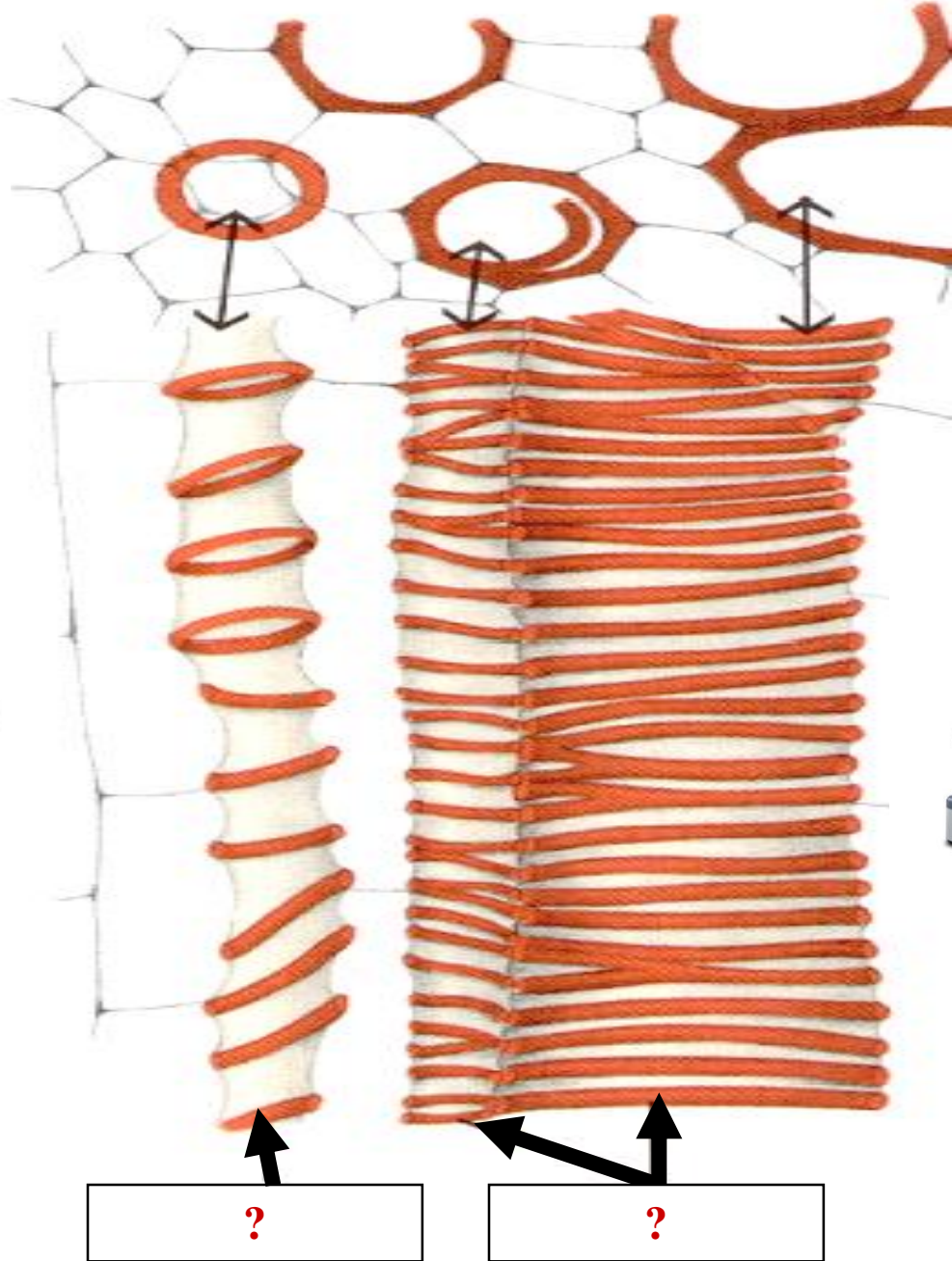
**C.S.**

**ARCHEGONIUM**

**GAMETOPHYTE**

**VASCULAR TISSUE**





**XYLEM  
TRACHEIDS**

**~2 CELL WALL  
MATURATION**



?

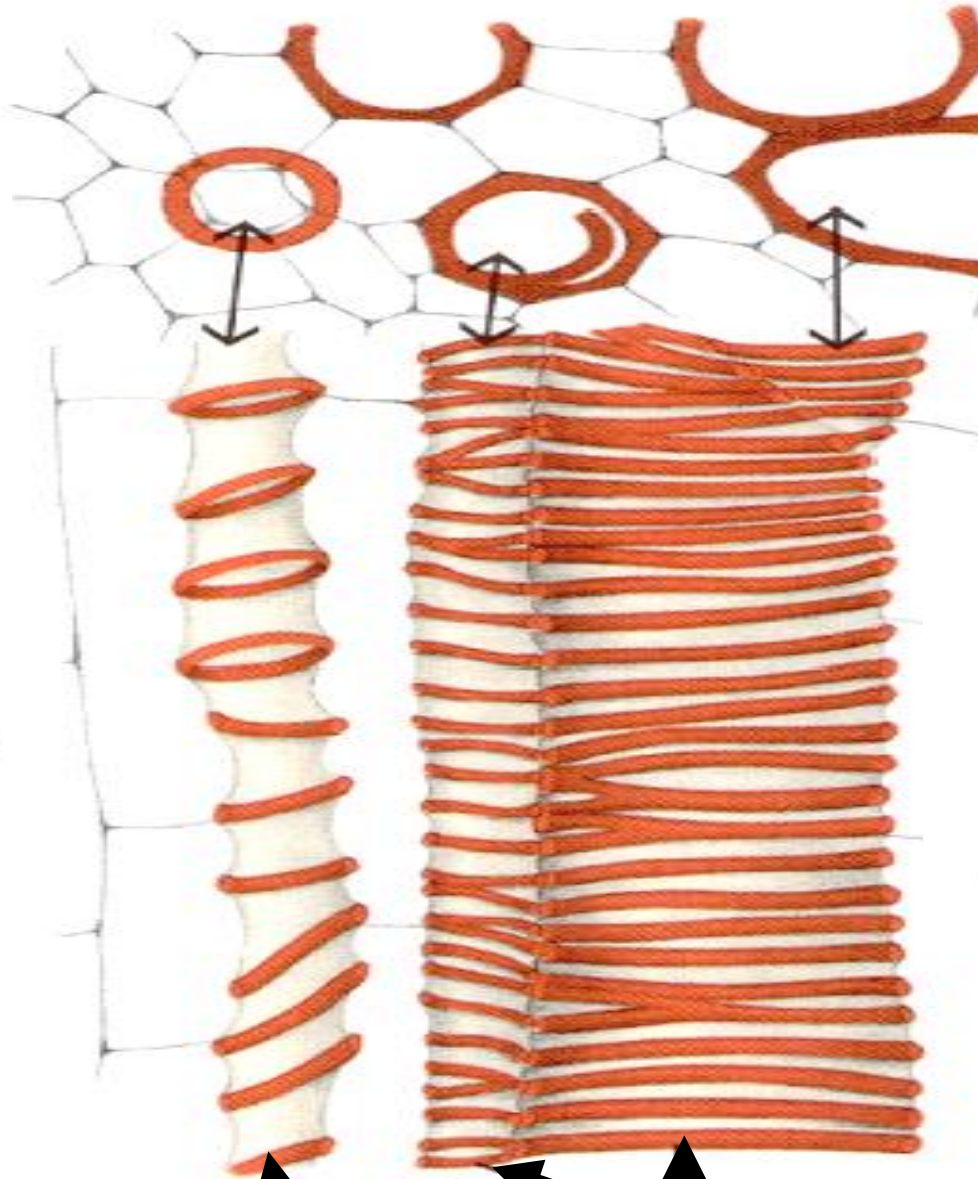
?

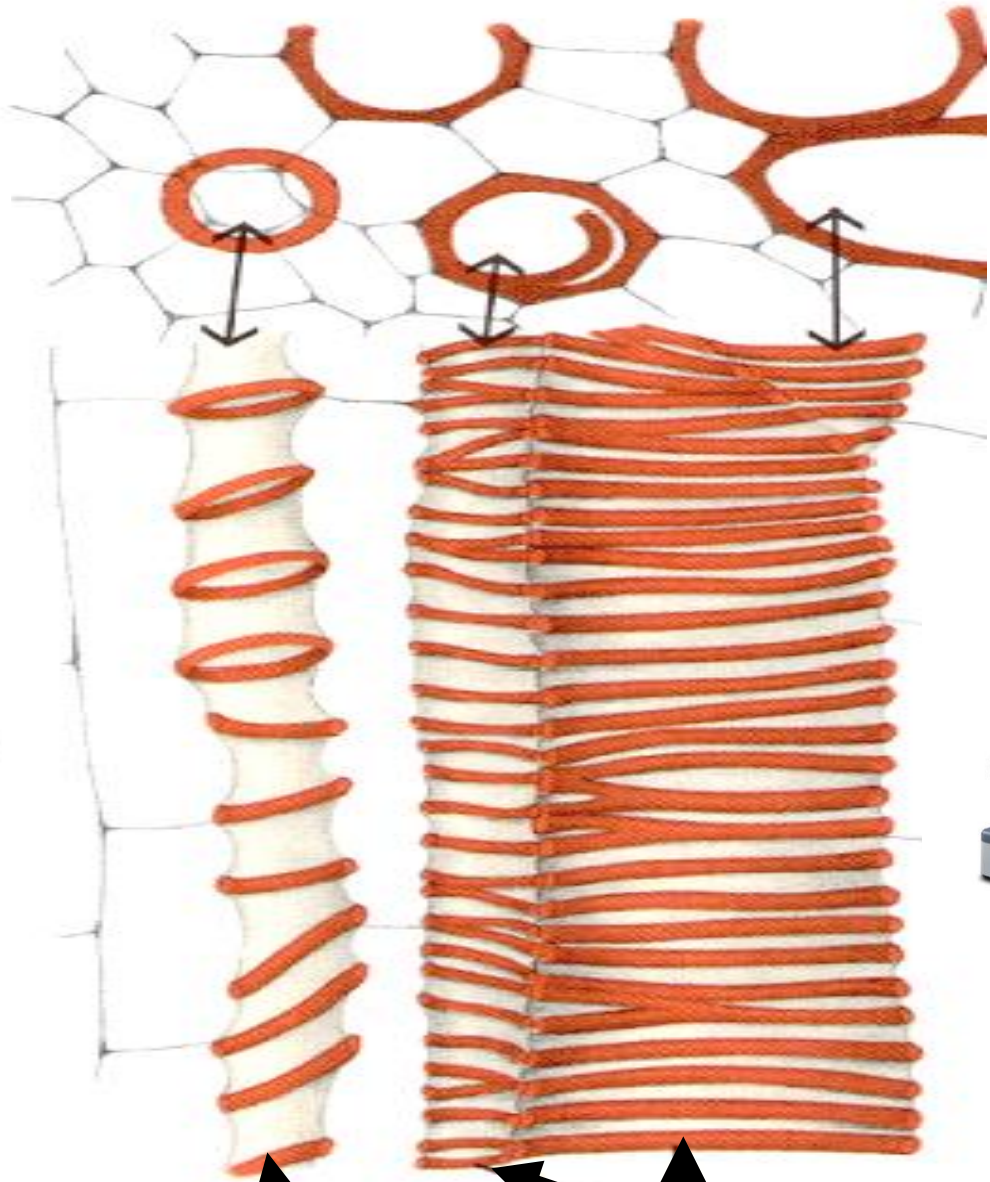
**XYLEM  
TRACHEIDS**

**~2 CELL WALL  
MATURATION**

**ANNULAR**

**?**





**XYLEM  
TRACHEIDS**

**~2 CELL WALL  
MATURATION**

**ANNULAR**

**HELICAL**





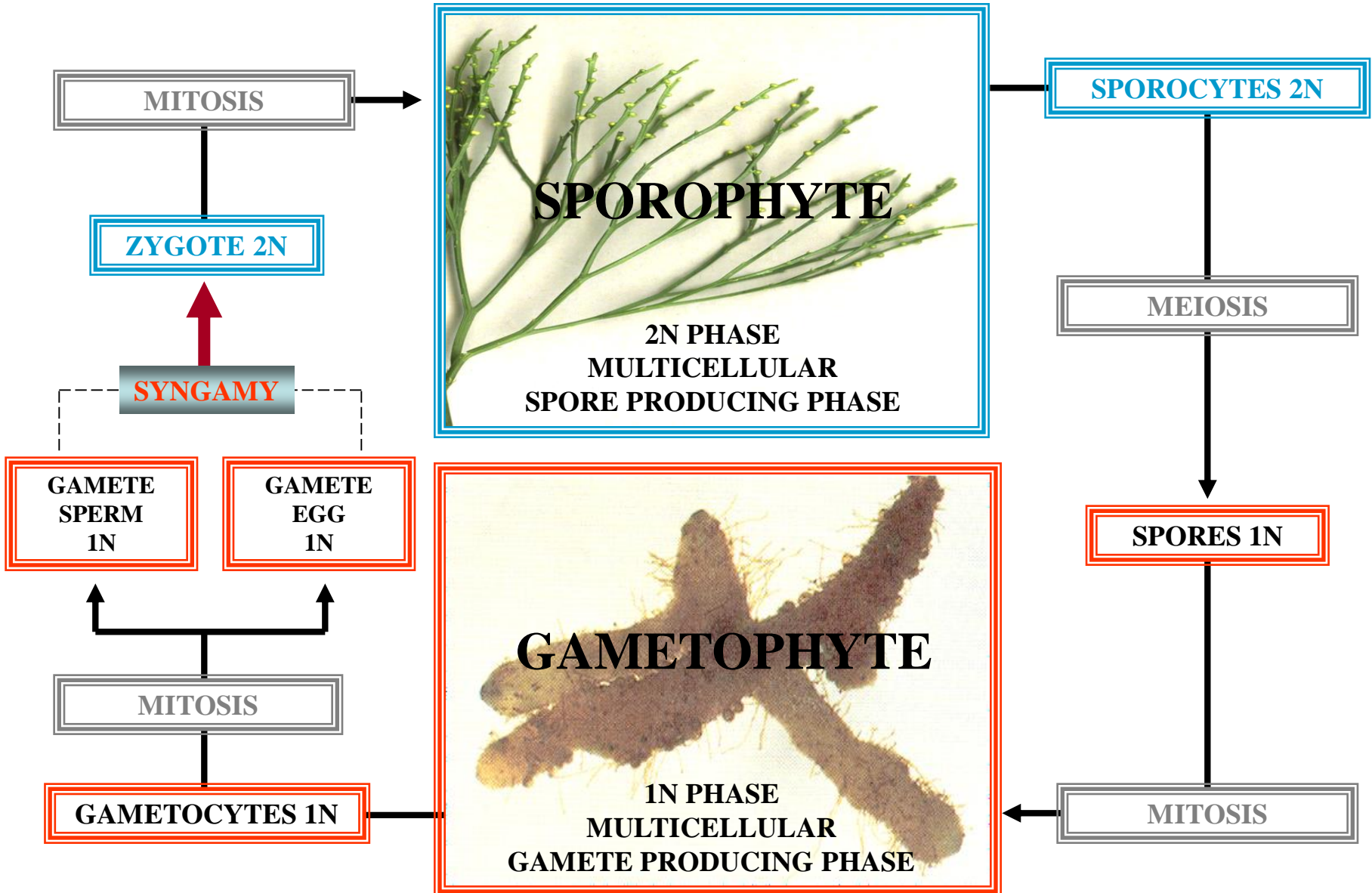
*PSILOTUM*



**ONLY KNOWN  
TRACHEOPHYTE  
WITH VASCULAR  
GAMETOPHYTE**

**GAMETOPHYTE**

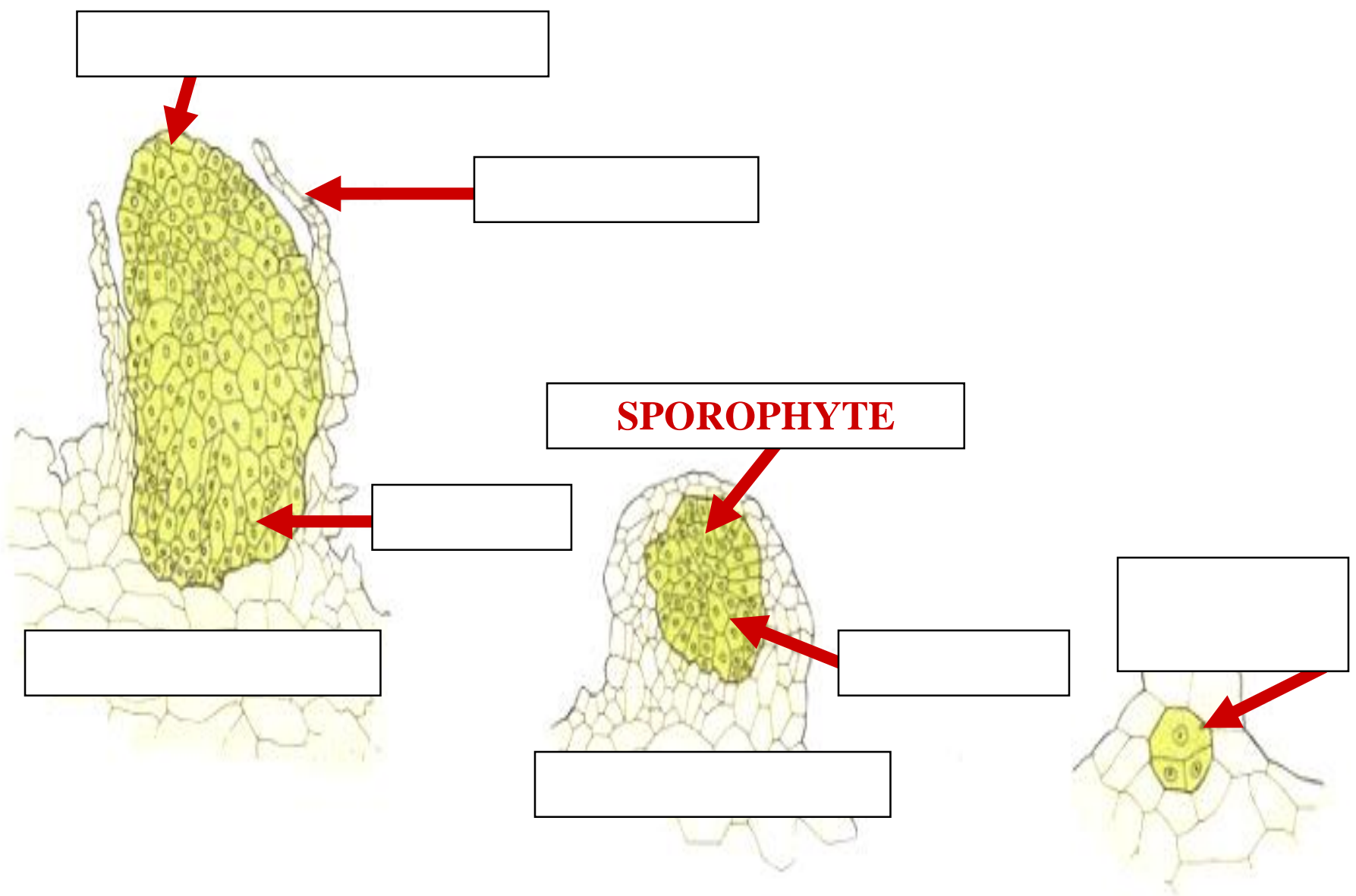
# PSILOTALES LIFE CYCLE





# REPRODUCTION

*PSILOTUM*  
**LIFE CYCLE**



[Empty box]

[Empty box]

**SPOROPHYTE**

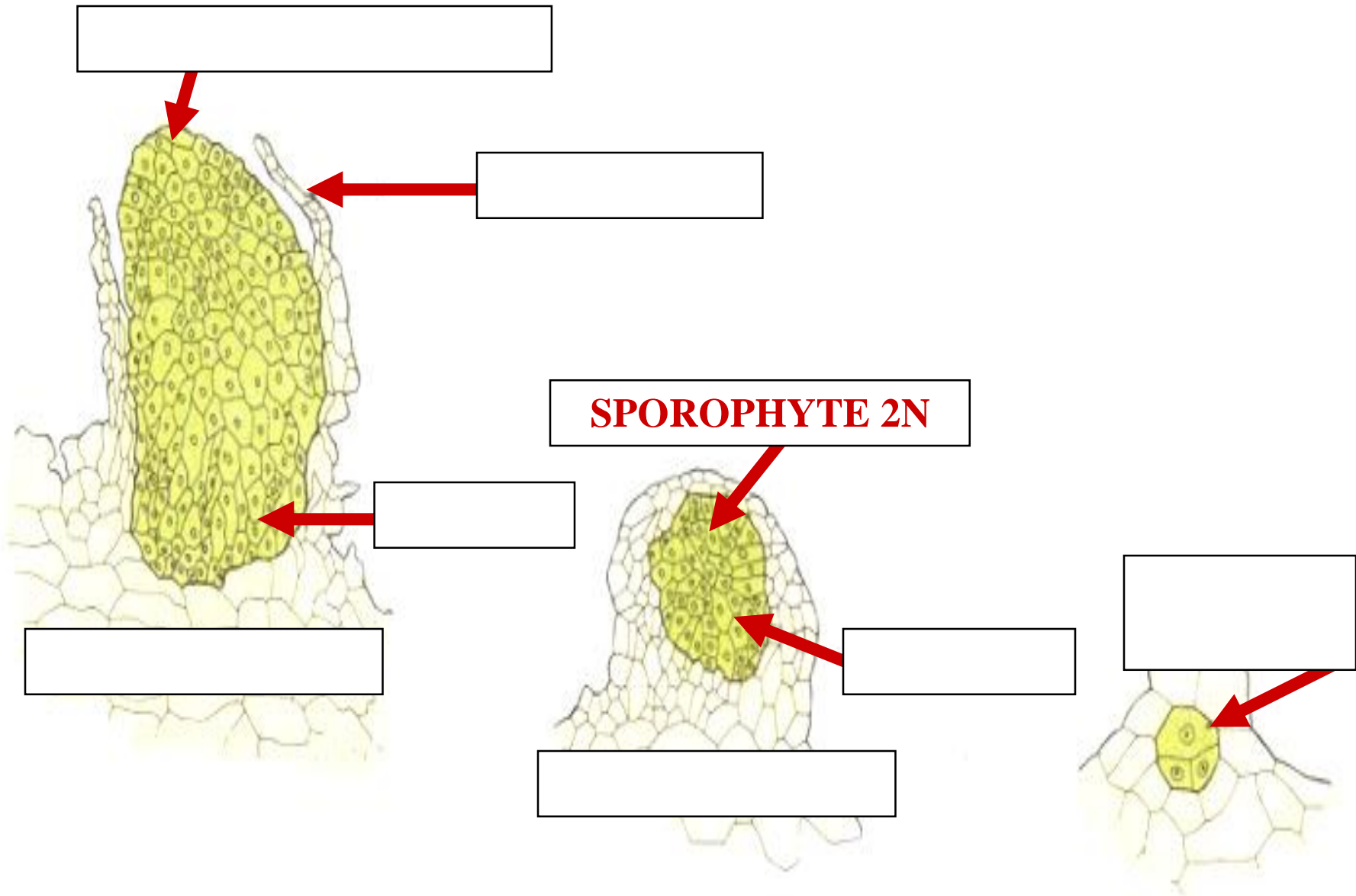
[Empty box]

[Empty box]

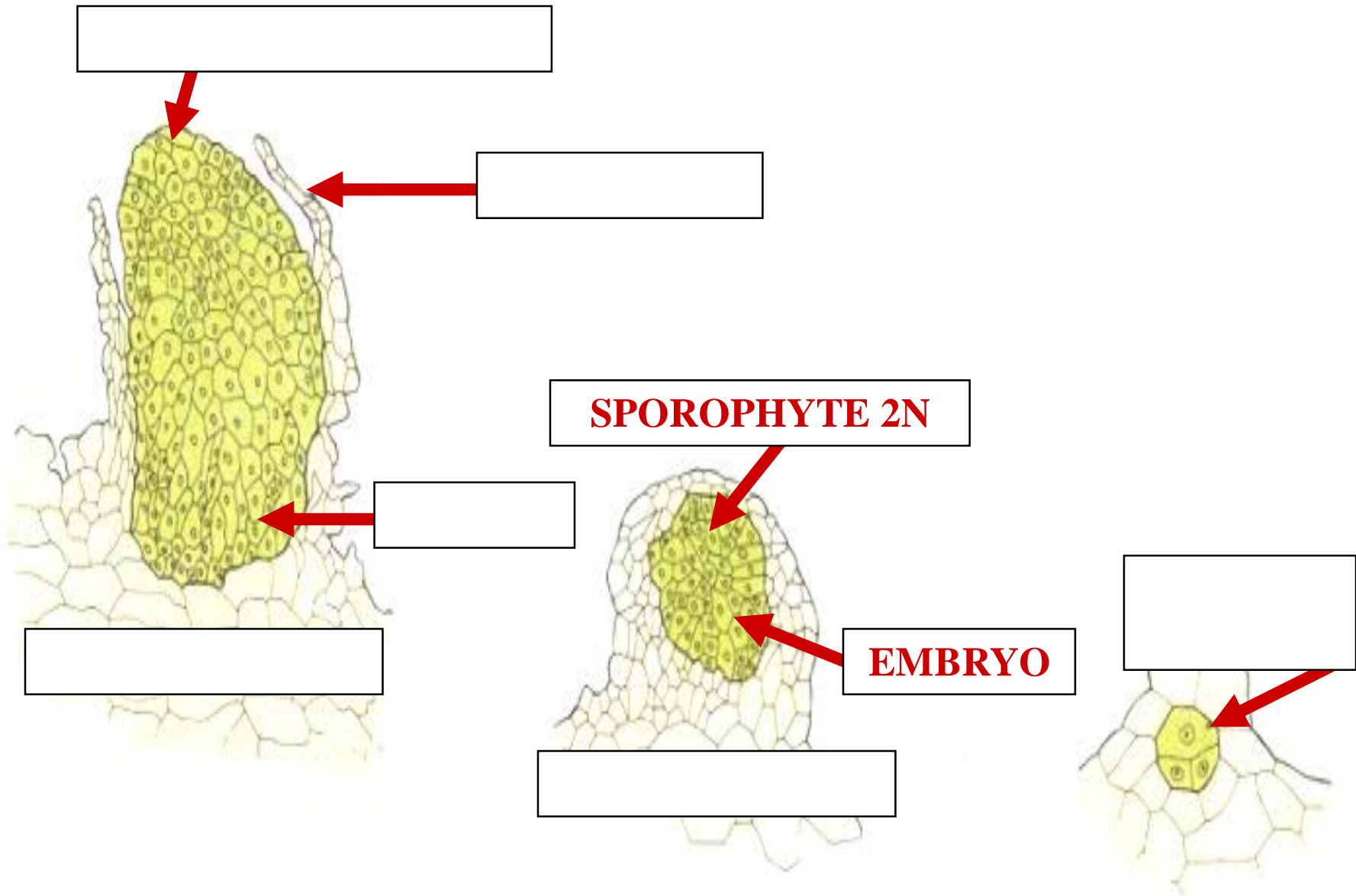
[Empty box]

[Empty box]

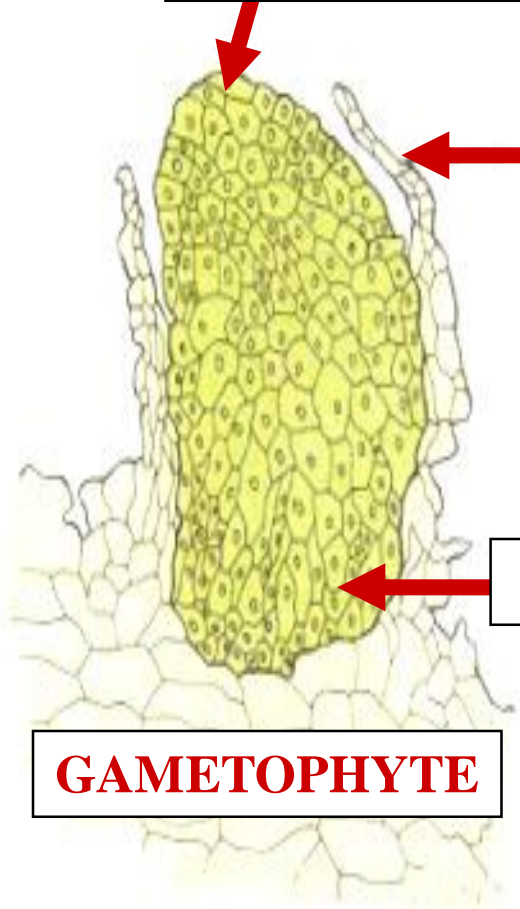
[Empty box]



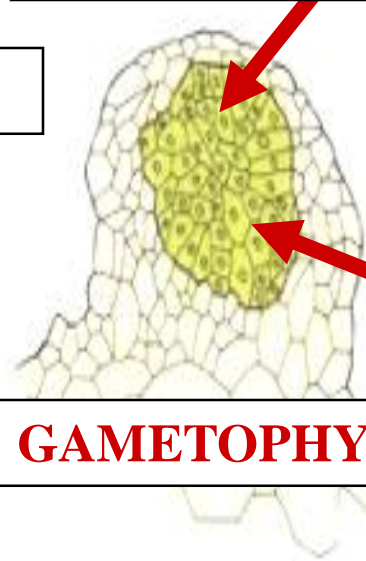
**SPOROPHYTE 2N**



**YOUNG EMBRYO**



**SPOROPHYTE 2N**

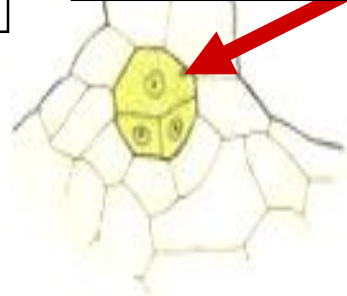
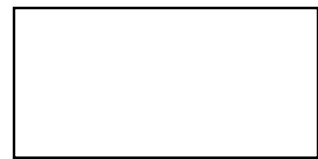


**GAMETOPHYTE**



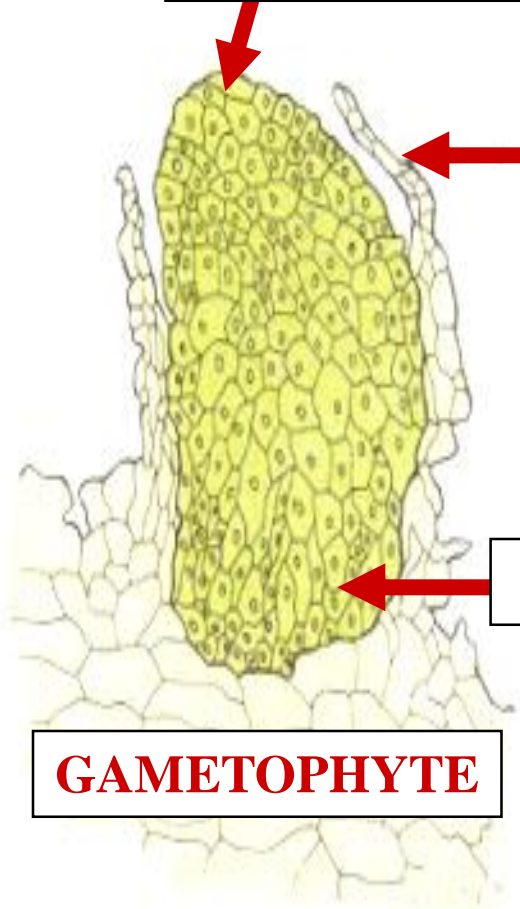
**EMBRYO**

**GAMETOPHYTE**



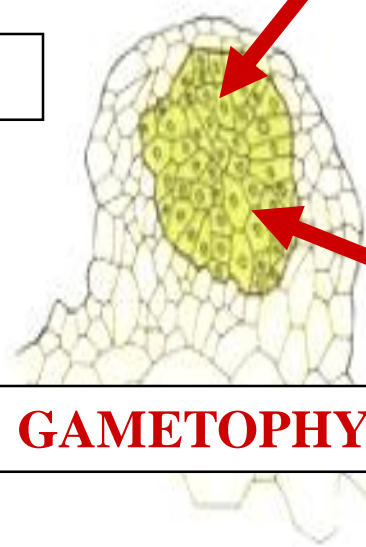


**YOUNG EMBRYO**



[Empty box]

**SPOROPHYTE 2N**



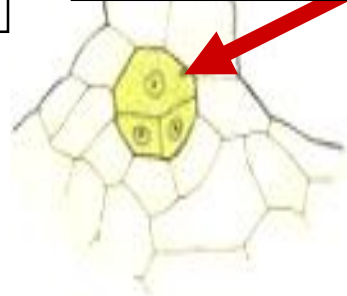
**FOOT**

**EMBRYO**

**GAMETOPHYTE**

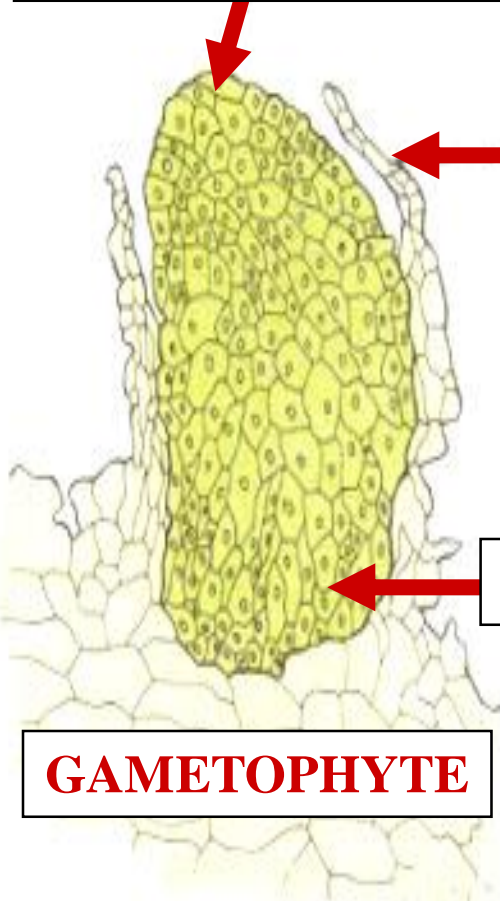
**GAMETOPHYTE**

[Empty box]





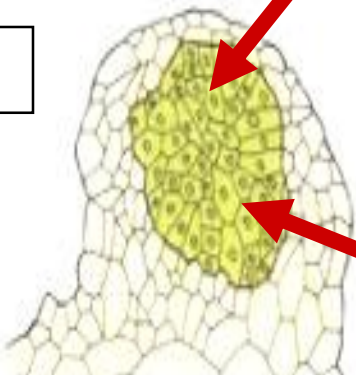
**EMBRYONIC ROOT ABSENT**



[Empty box]

**SPOROPHYTE 2N**

**FOOT**



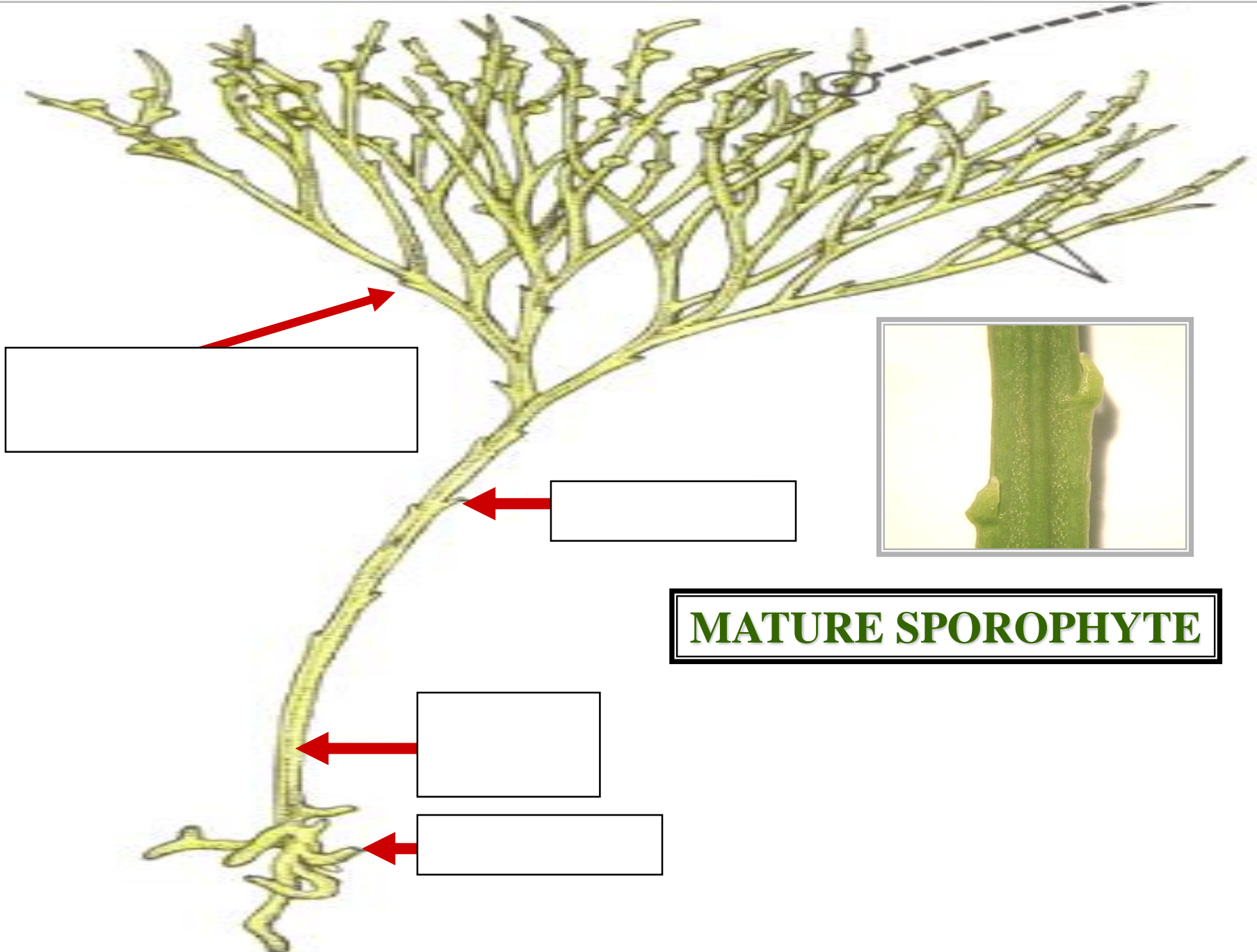
**EMBRYO**

**GAMETOPHYTE**

**GAMETOPHYTE**

[Empty box]



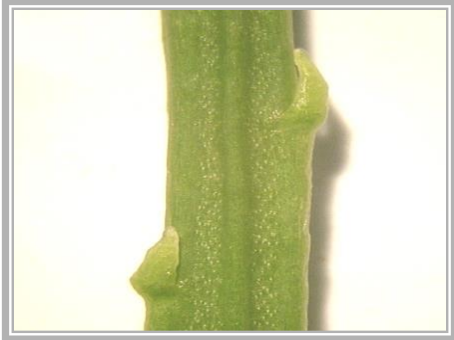


[Empty box for label]

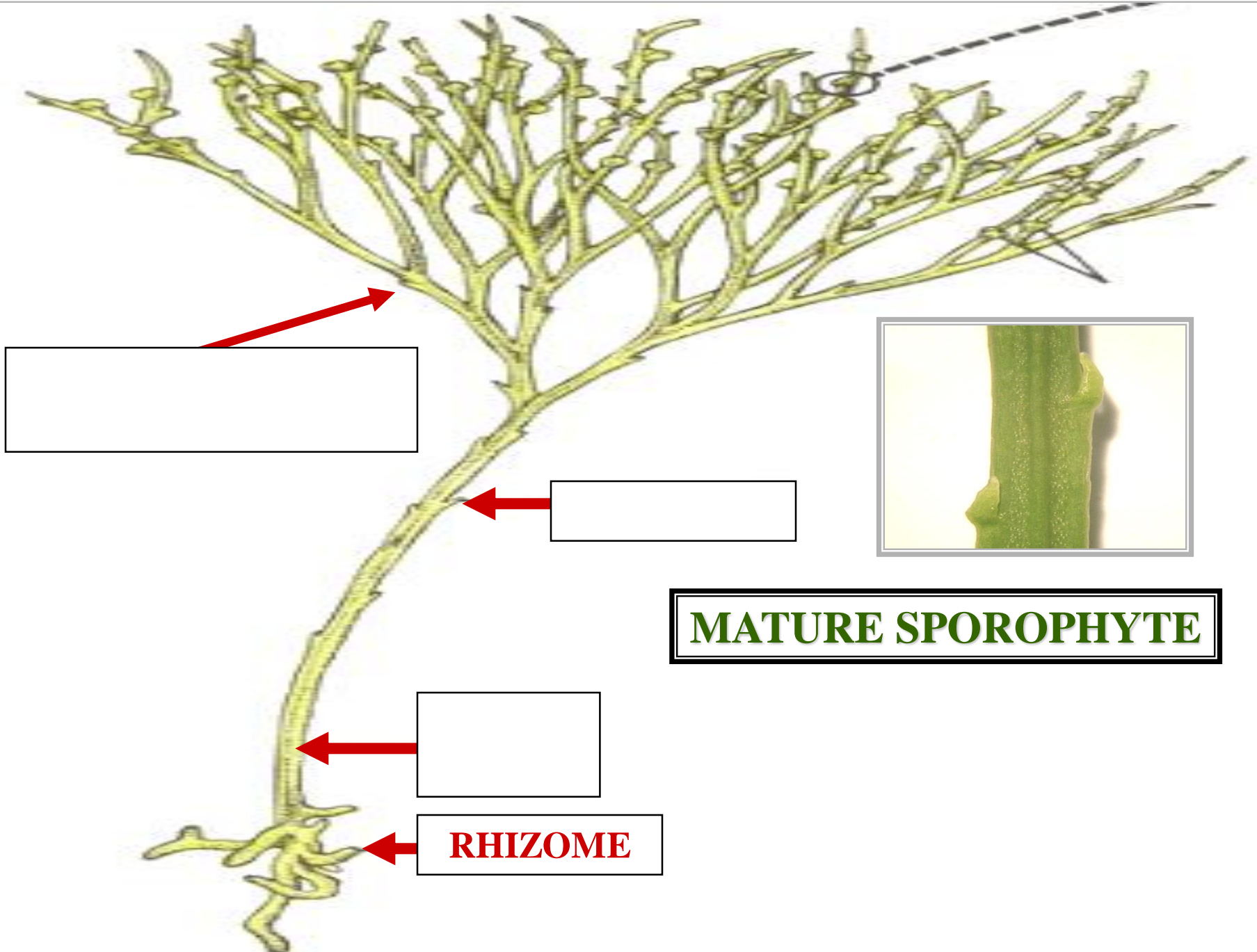
[Empty box for label]

[Empty box for label]

[Empty box for label]



**MATURE SPOROPHYTE**



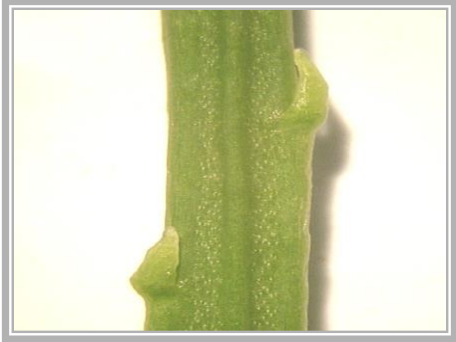
[Empty box]

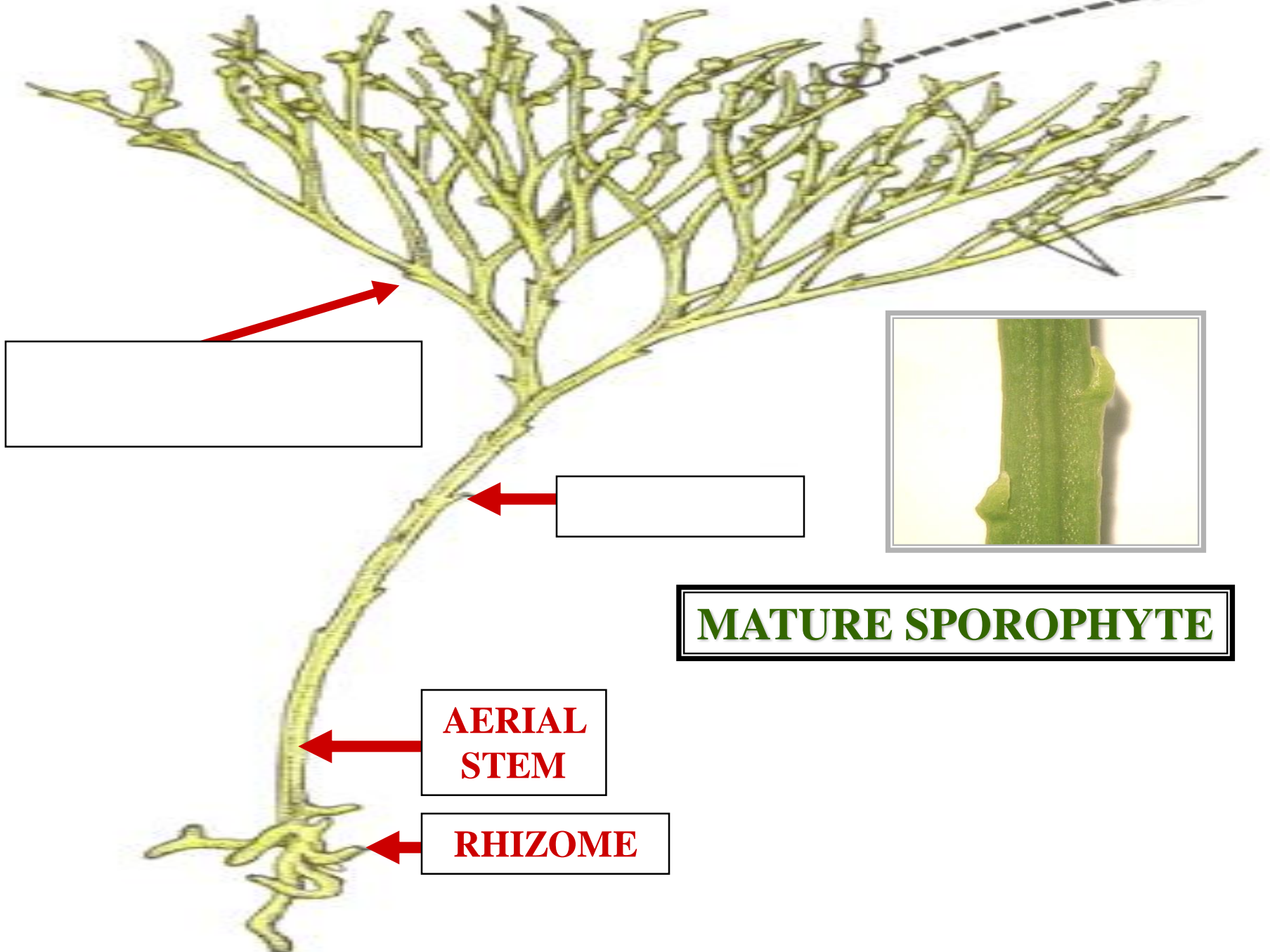
[Empty box]

[Empty box]

**RHIZOME**

**MATURE SPOROPHYTE**

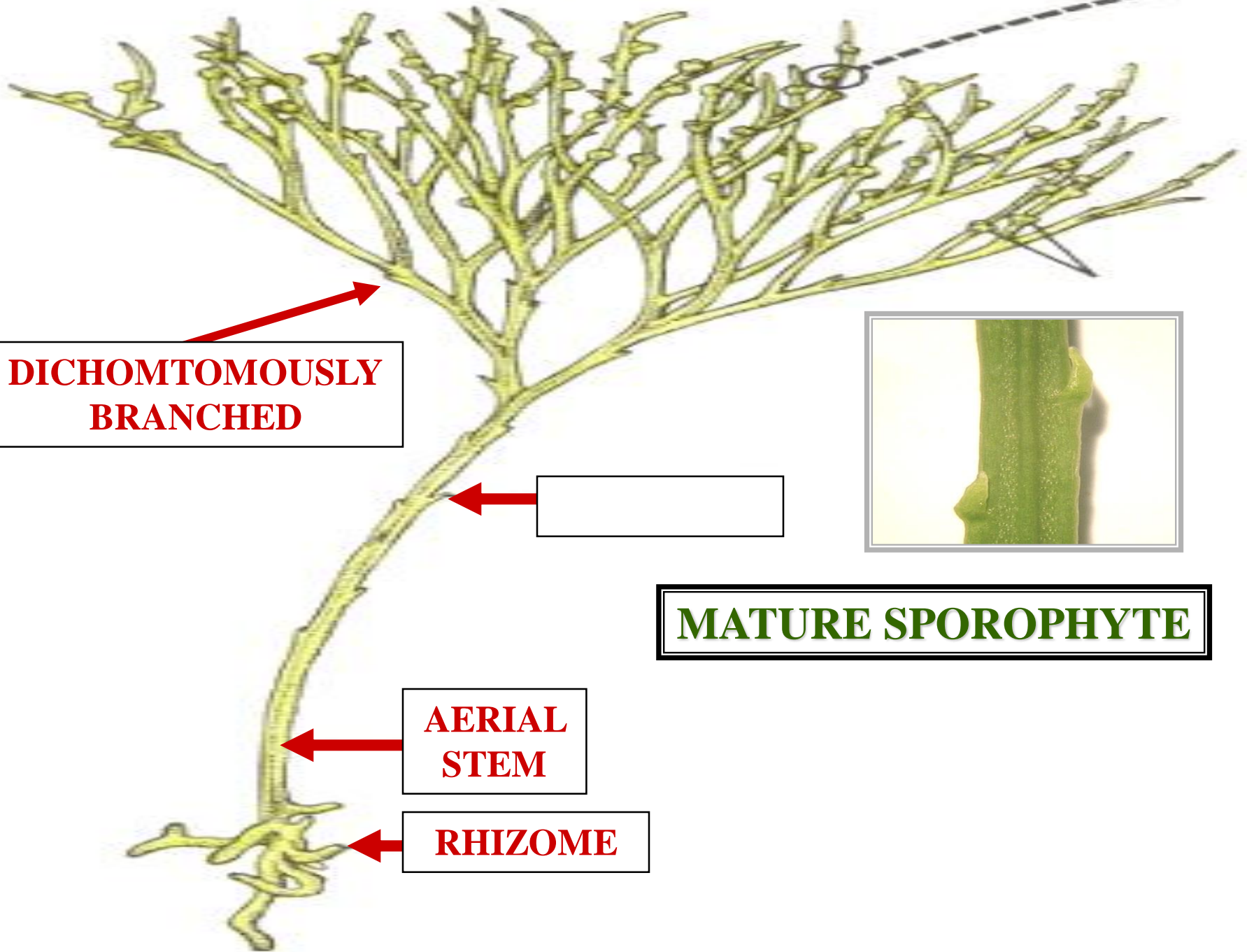




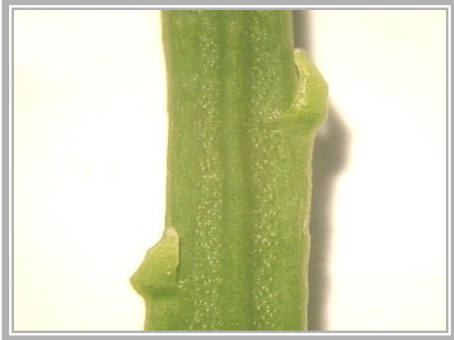
**MATURE SPOROPHYTE**

**AERIAL  
STEM**

**RHIZOME**



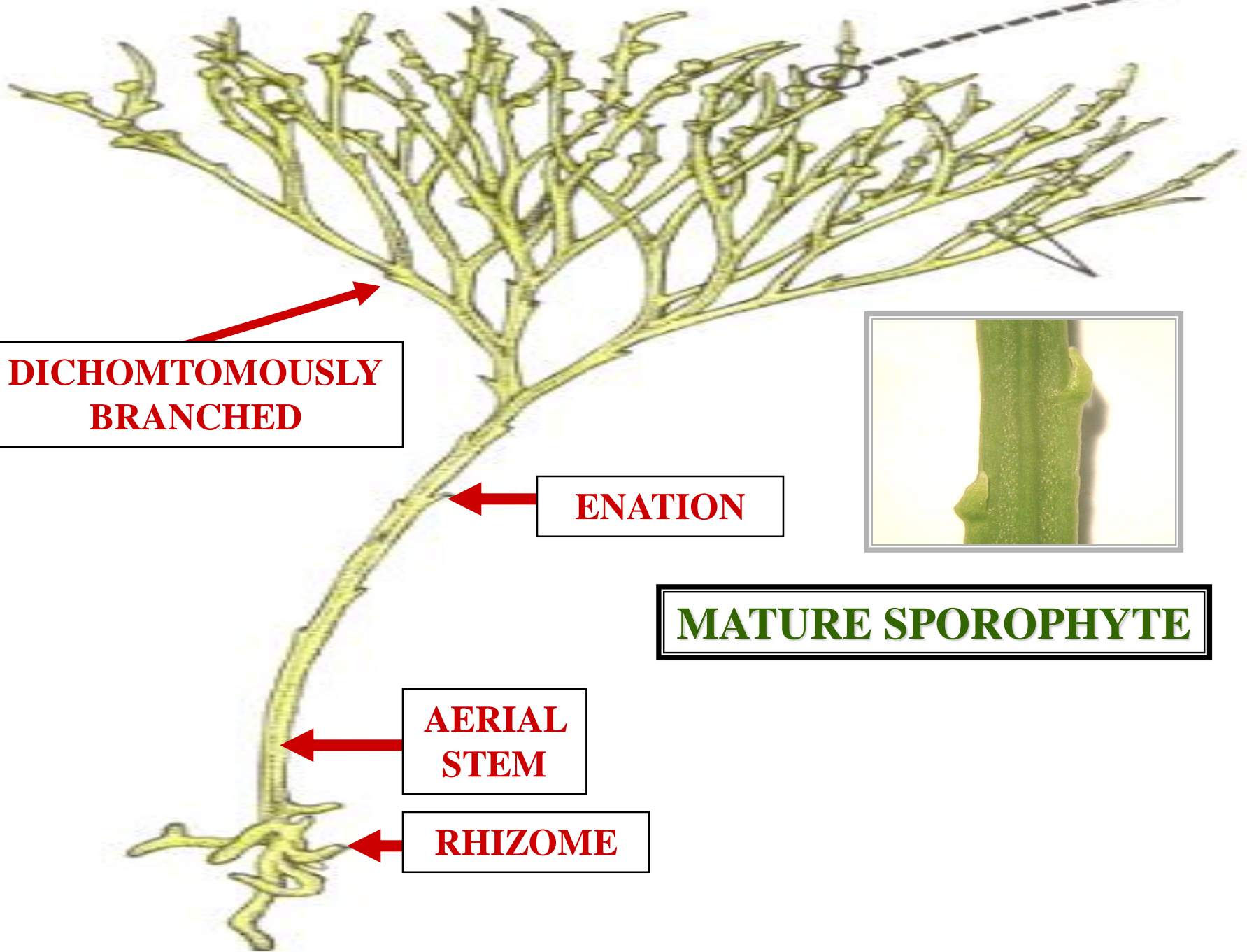
**DICHOTOMOUSLY  
BRANCHED**



**MATURE SPOROPHYTE**

**AERIAL  
STEM**

**RHIZOME**



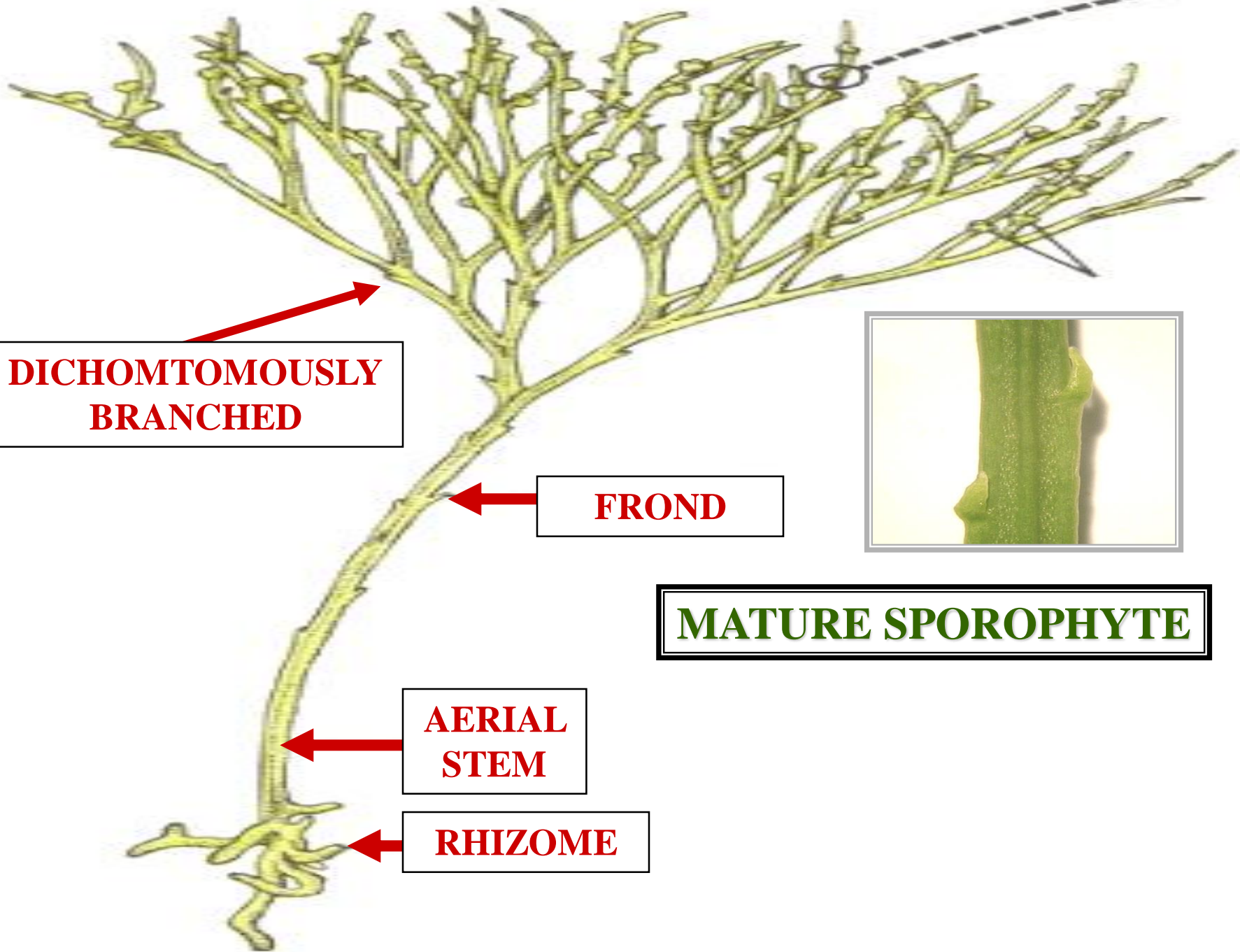
**DICHOTOMOUSLY  
BRANCHED**

**ENATION**

**MATURE SPOROPHYTE**

**AERIAL  
STEM**

**RHIZOME**



**DICHOTOMOUSLY  
BRANCHED**

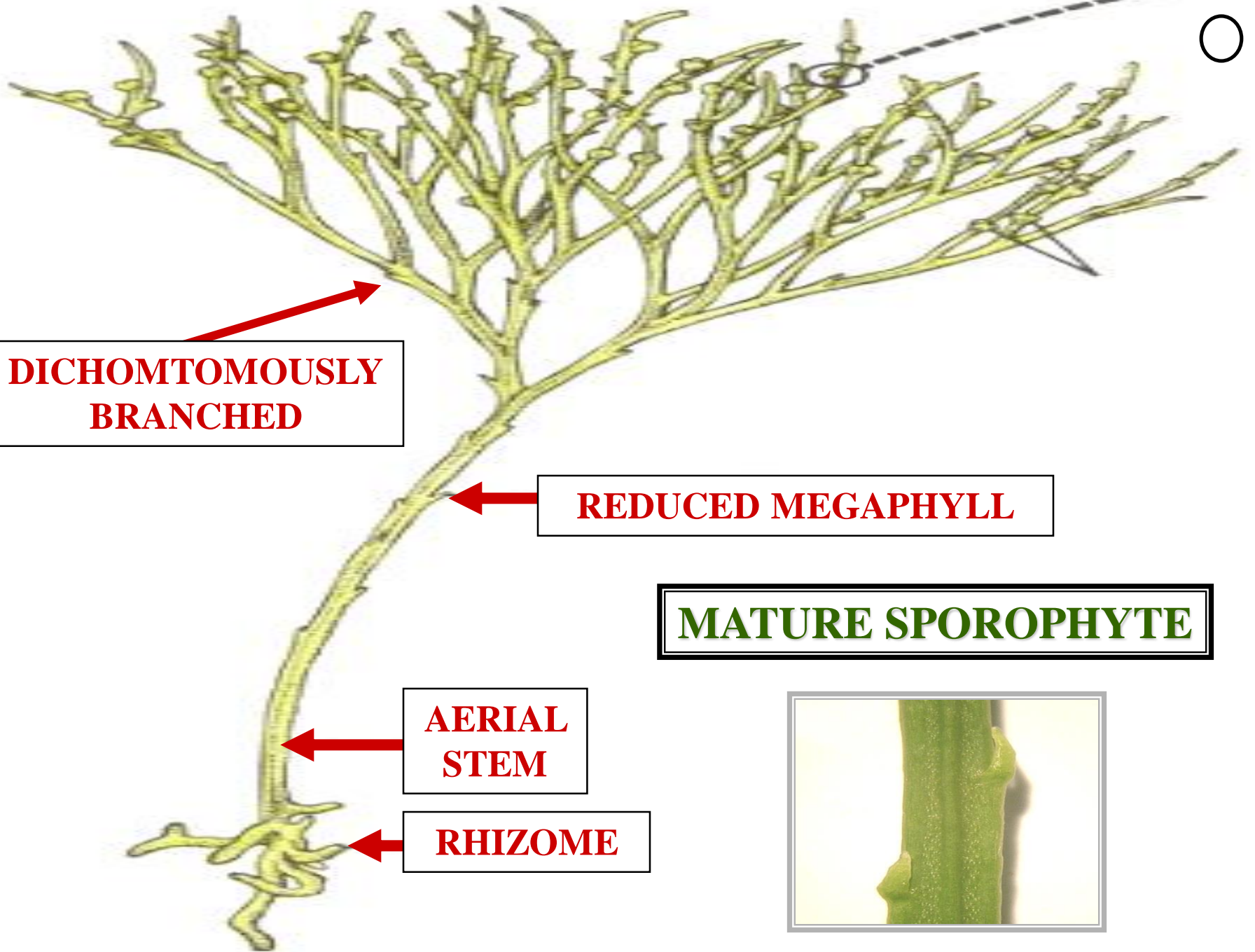
**FROND**

**MATURE SPOROPHYTE**

**AERIAL  
STEM**

**RHIZOME**





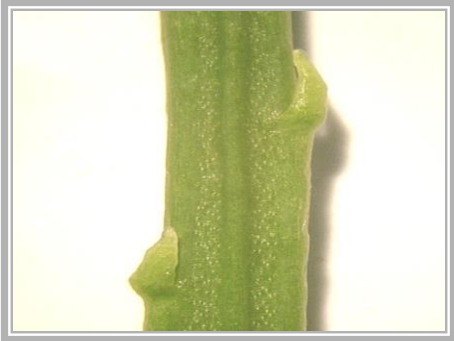
**DICHOTOMOUSLY  
BRANCHED**

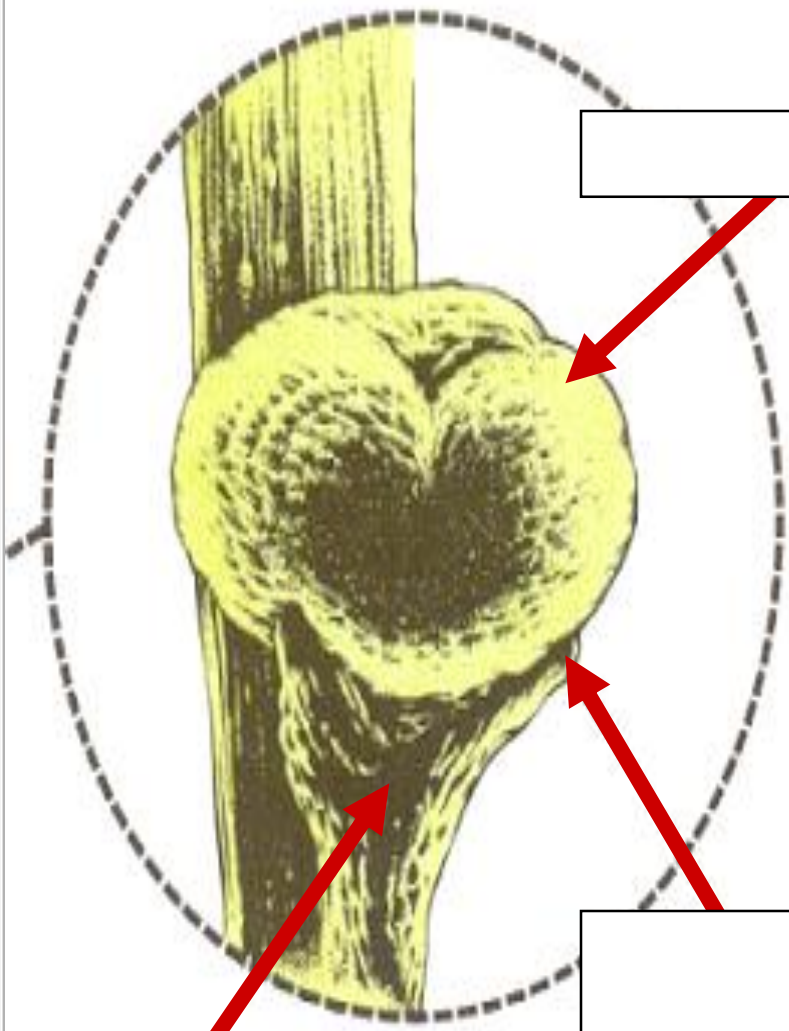
**REDUCED MEGAPHYLL**

**MATURE SPOROPHYTE**

**AERIAL  
STEM**

**RHIZOME**

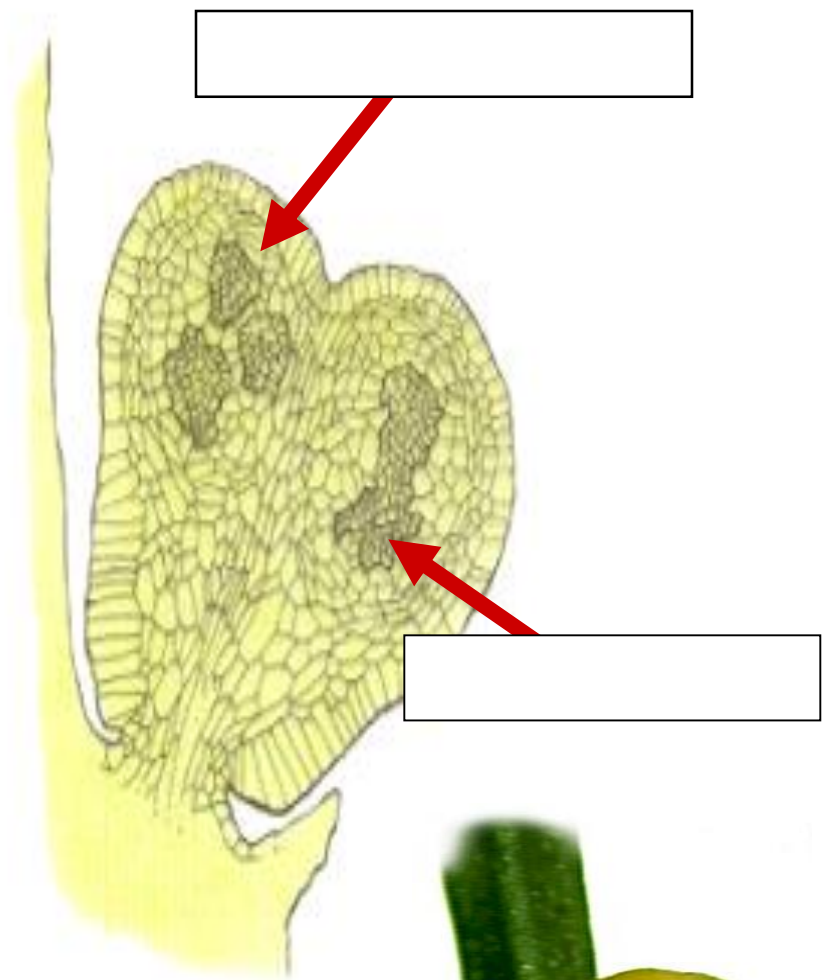




[Empty box]

[Empty box]

[Empty box]

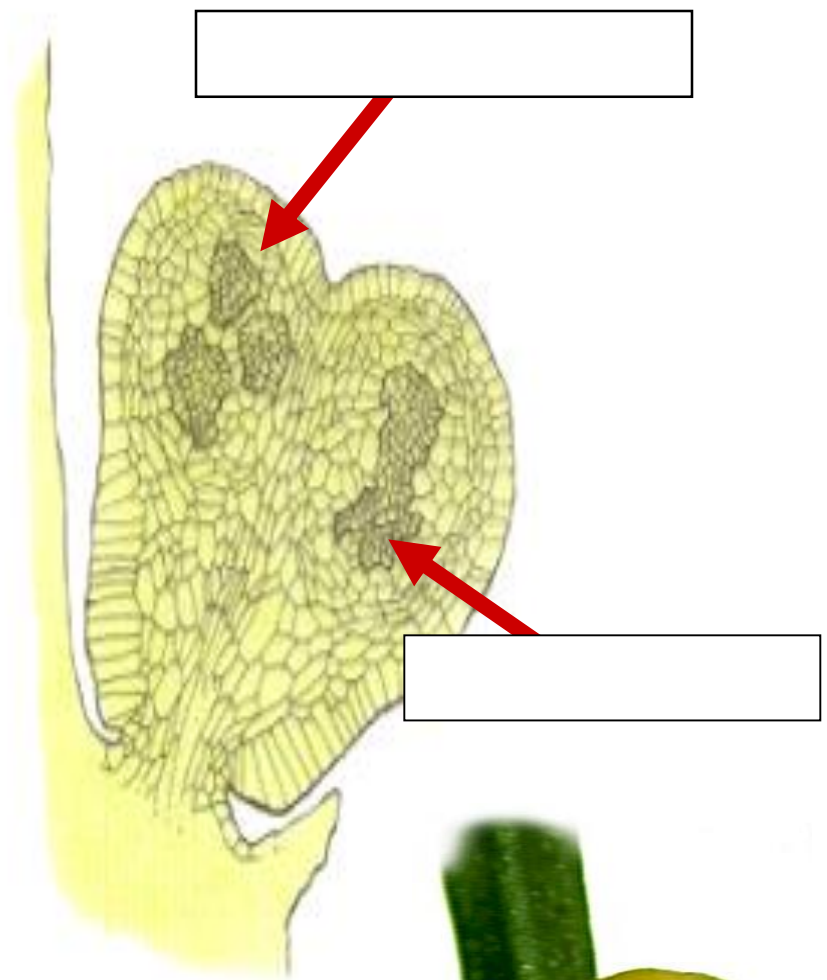
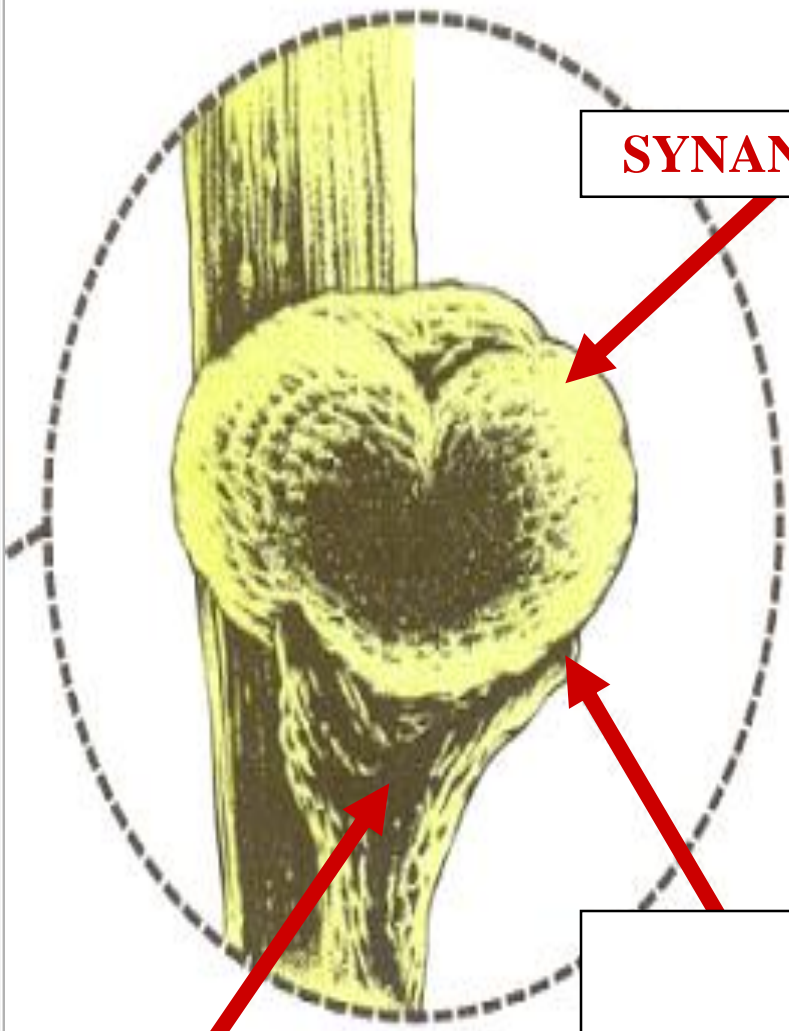


[Empty box]

[Empty box]



**SYNANGIUM**

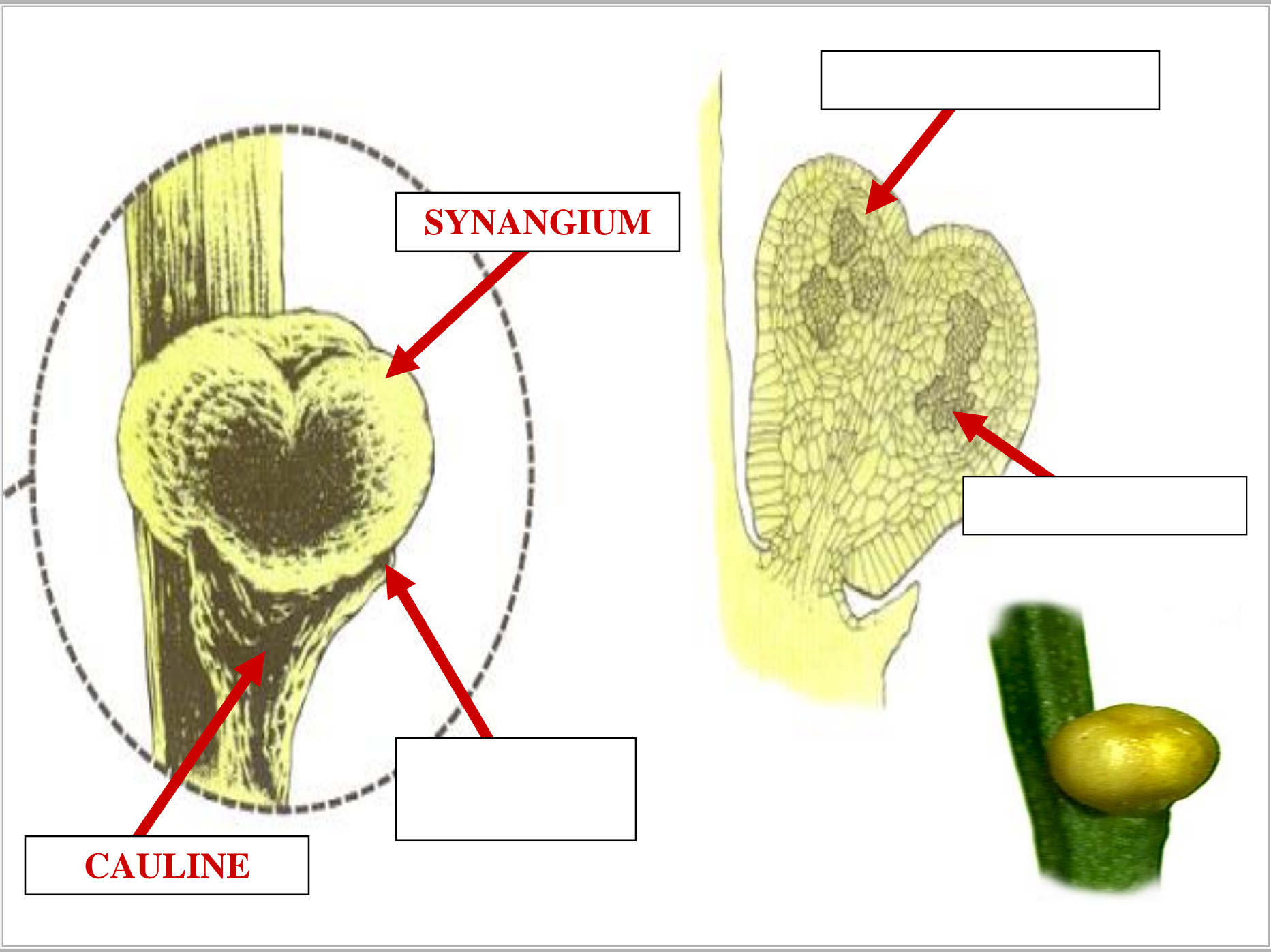


[Empty box]

[Empty box]

[Empty box]

[Empty box]



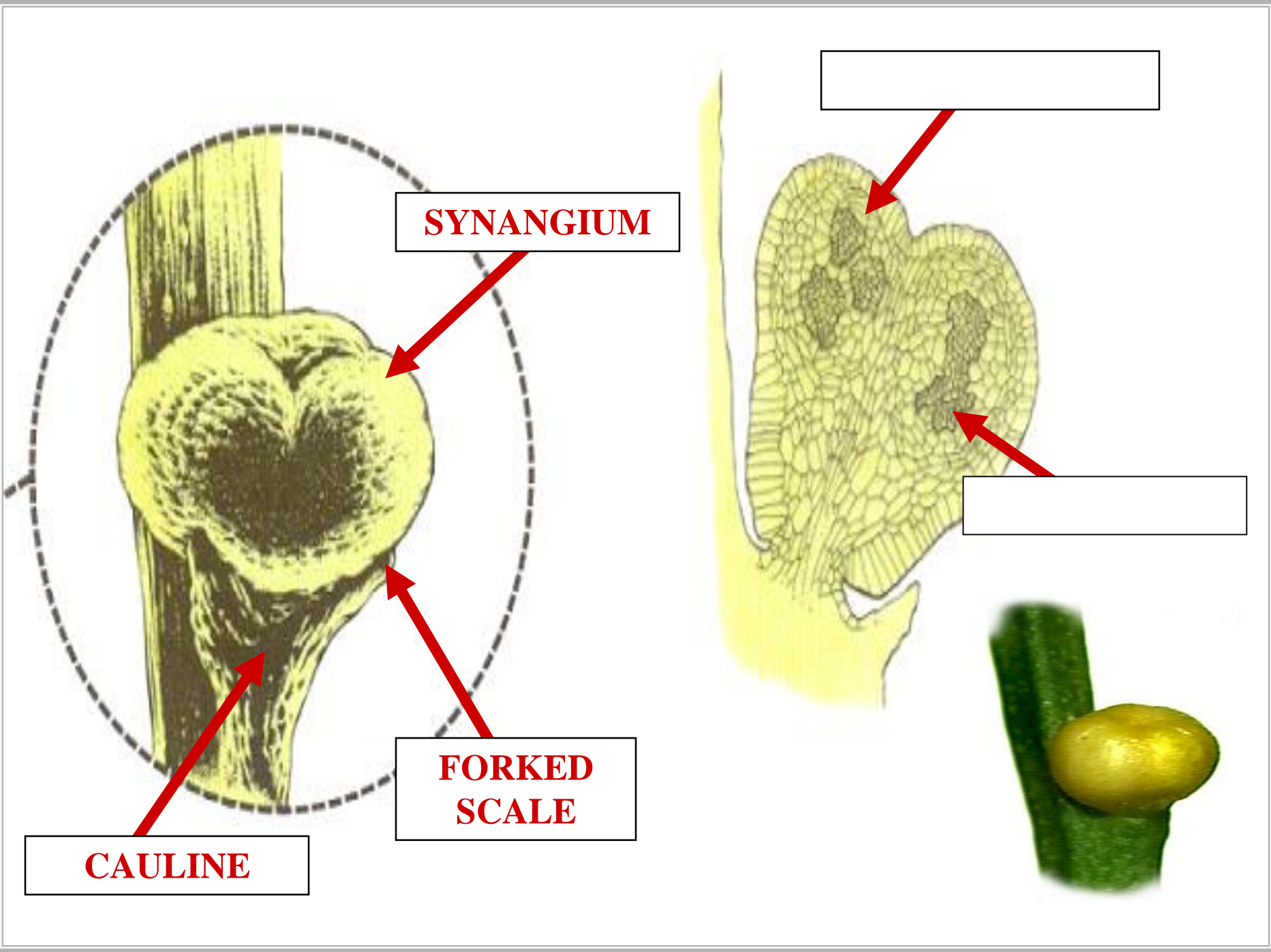
**SYNANGIUM**

**CAULINE**

[Empty box]

[Empty box]

[Empty box]



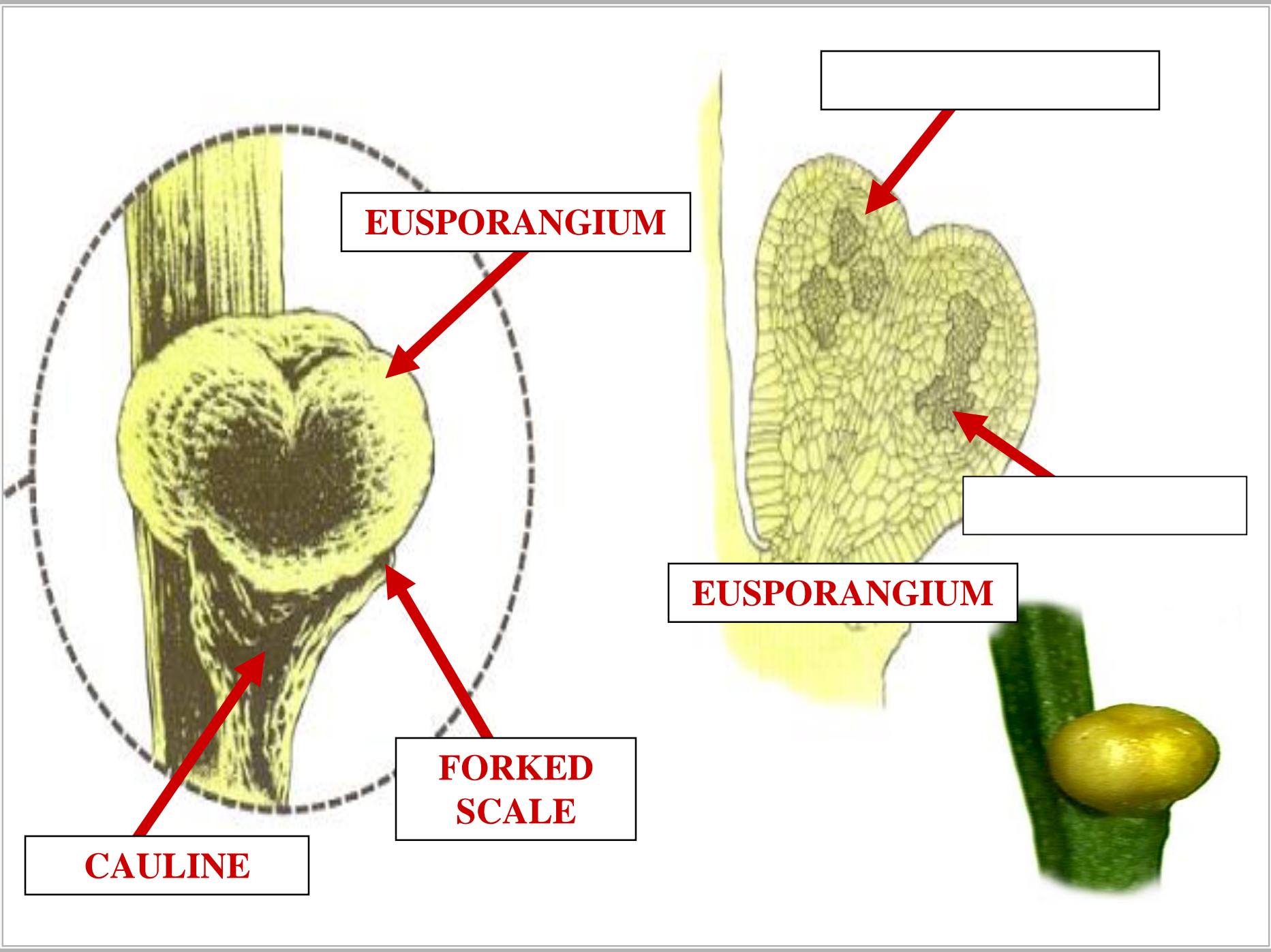
**SYNANGIUM**

**FORKED  
SCALE**

**CAULINE**

[Empty box]

[Empty box]



**EUSPORANGIUM**

**FORKED  
SCALE**

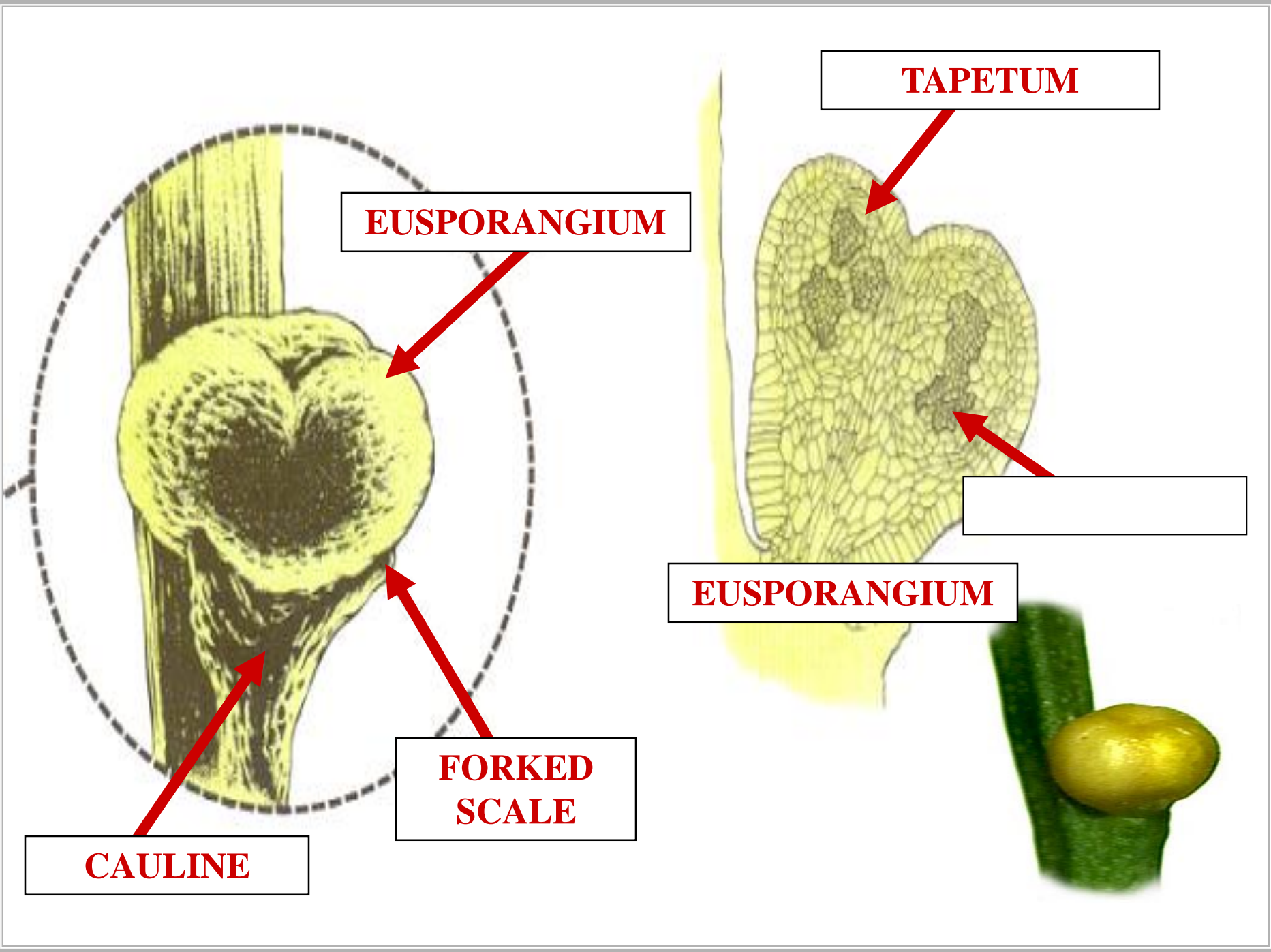
**CAULINE**

[Empty box]

[Empty box]

**EUSPORANGIUM**





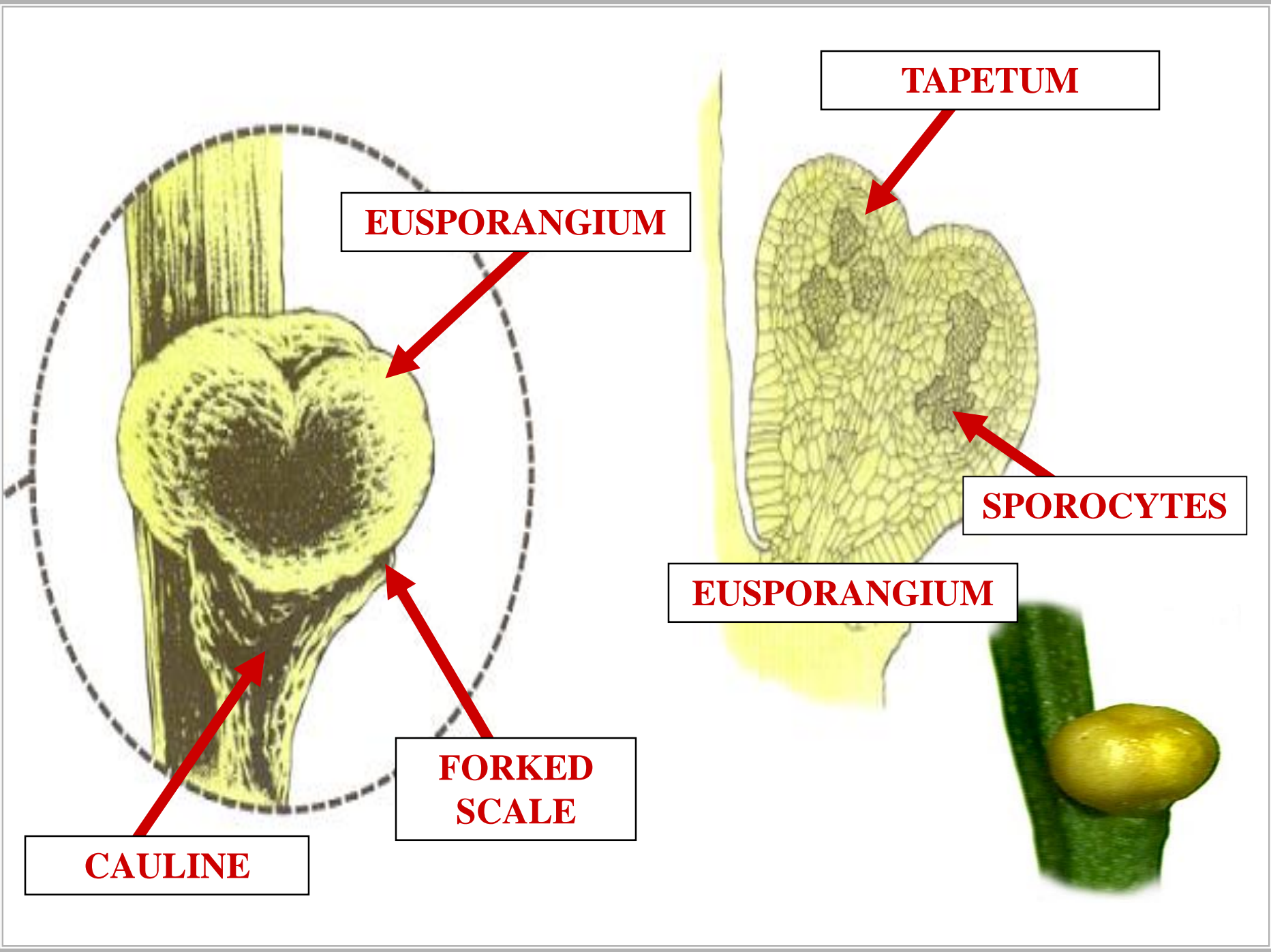
**TAPETUM**

**EUSPORANGIUM**

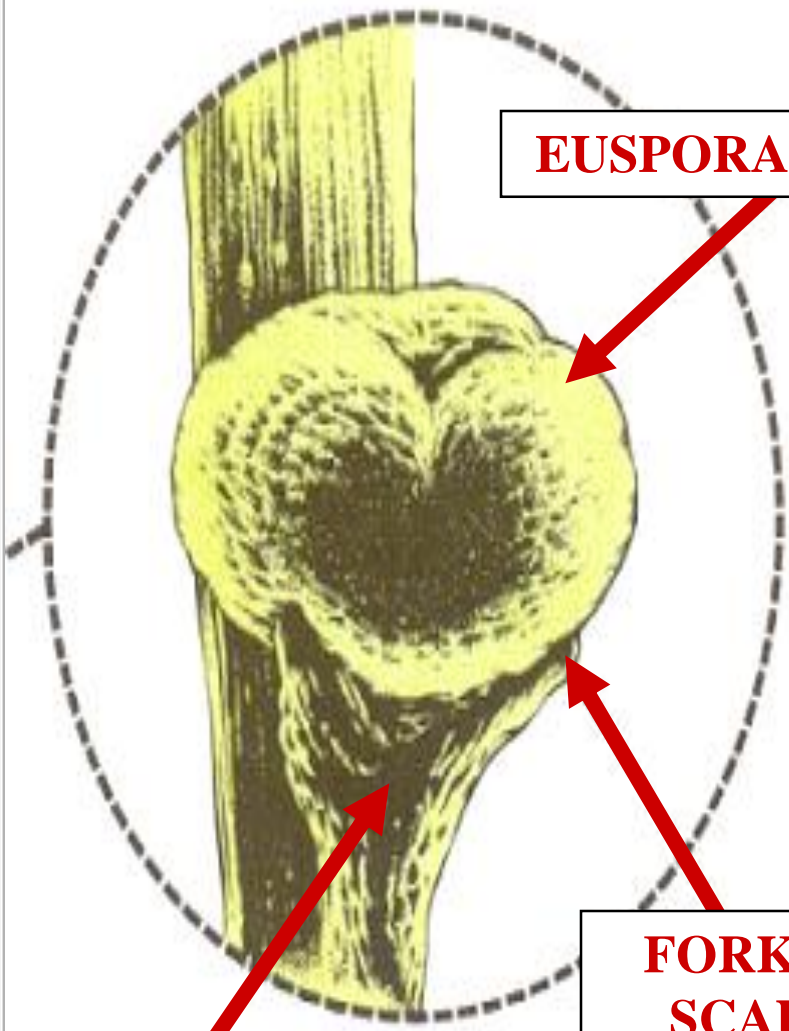
**EUSPORANGIUM**

**FORKED  
SCALE**

**CAULINE**



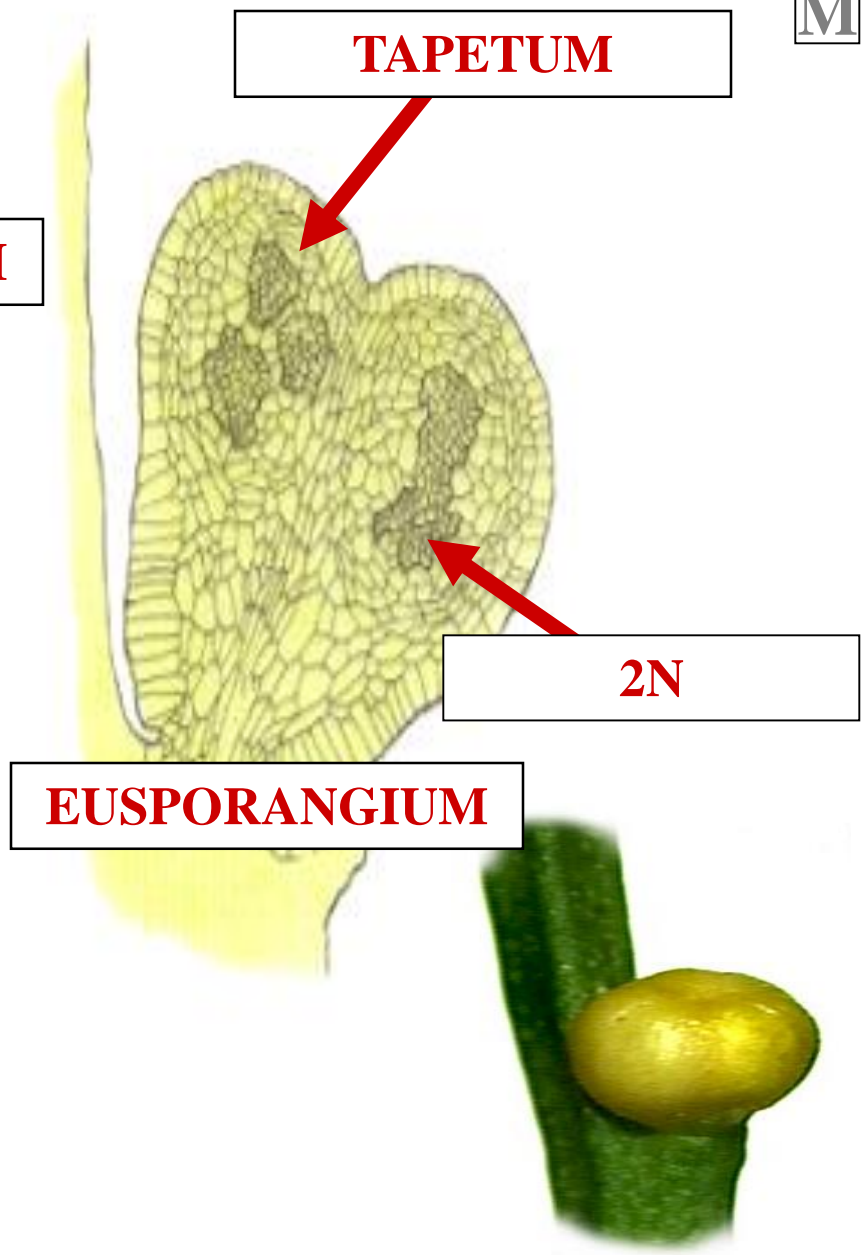




**EUSPORANGIUM**

**FORKED SCALE**

**CAULINE**

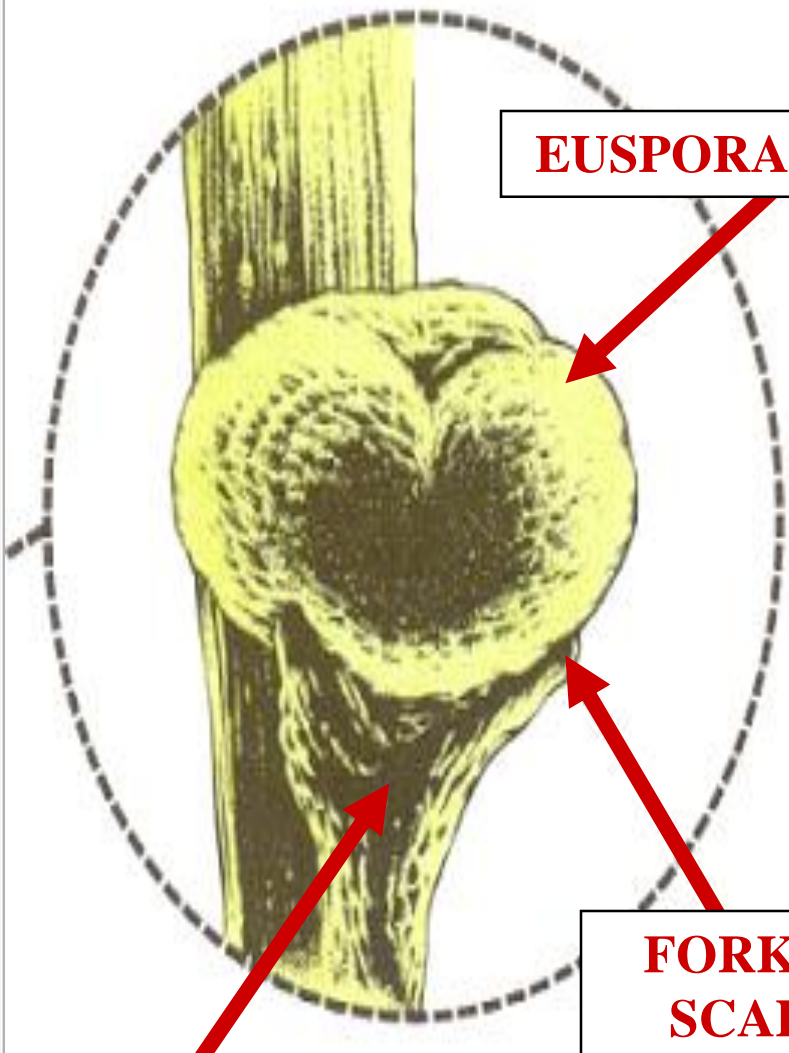


**TAPETUM**

**2N**

**EUSPORANGIUM**

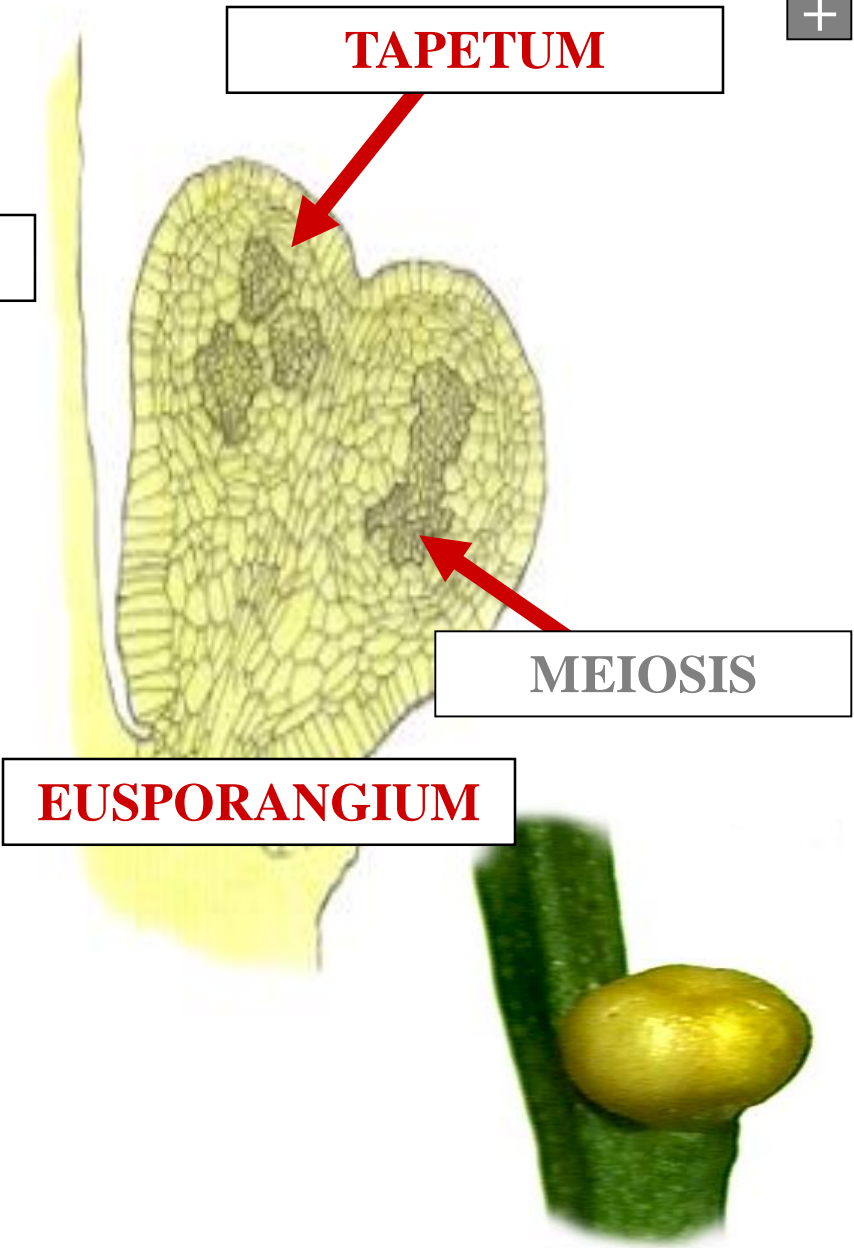




**EUSPORANGIUM**

**FORKED  
SCALE**

**CAULINE**



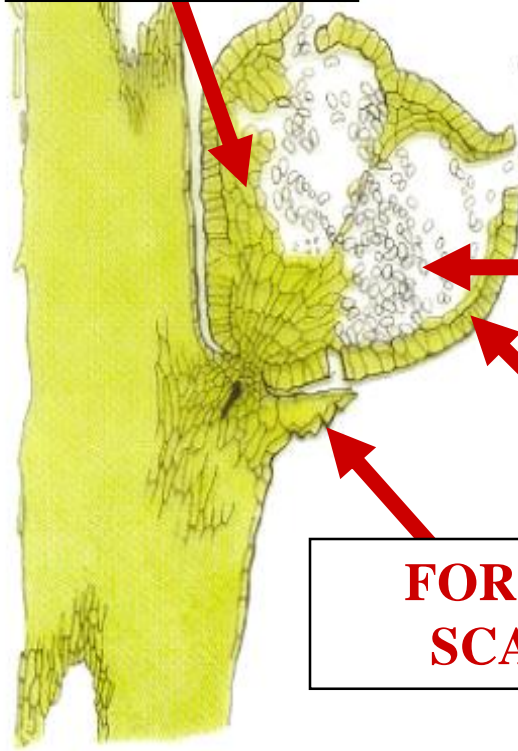
**TAPETUM**

**MEIOSIS**

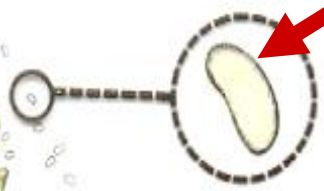
**EUSPORANGIUM**



**TAPETUM**



[Empty box]

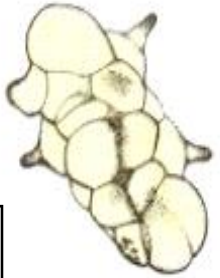


[Empty box]



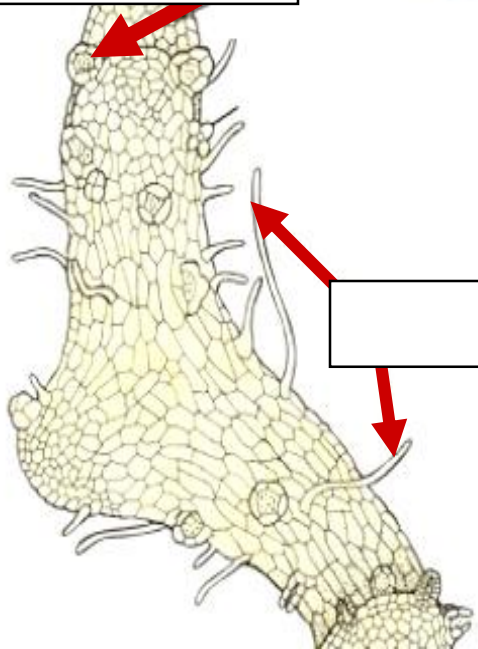
**EUSPORANGIUM**

**FORKED  
SCALE**



[Empty box]

[Empty box]



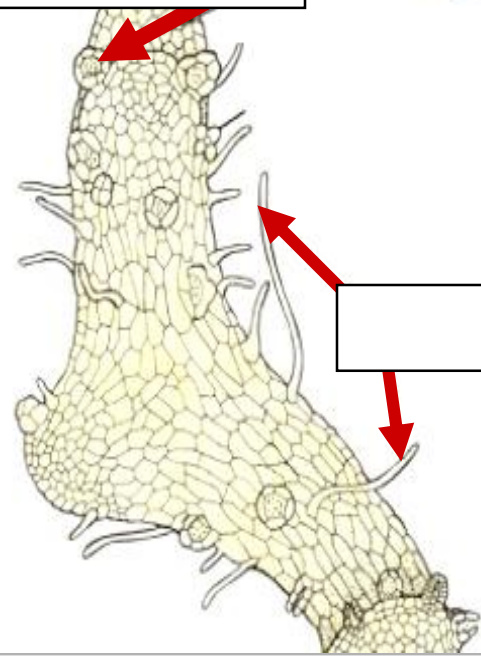
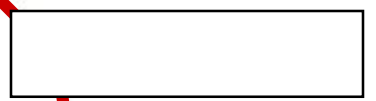
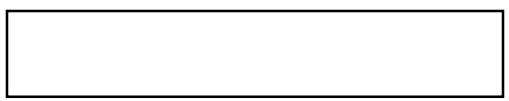
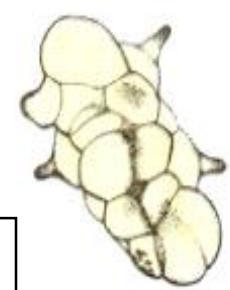
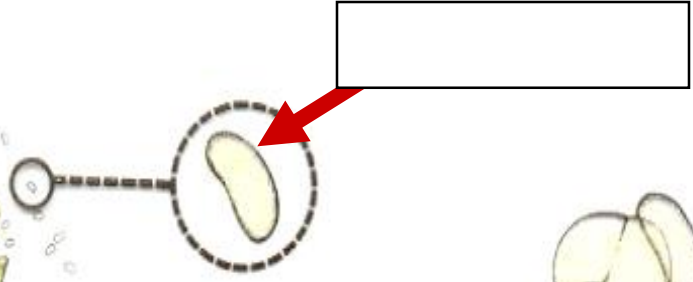
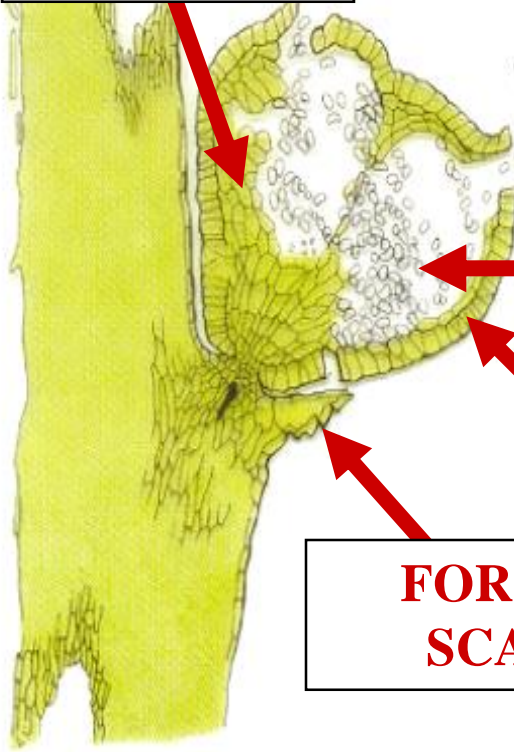
[Empty box]

**TAPETUM**

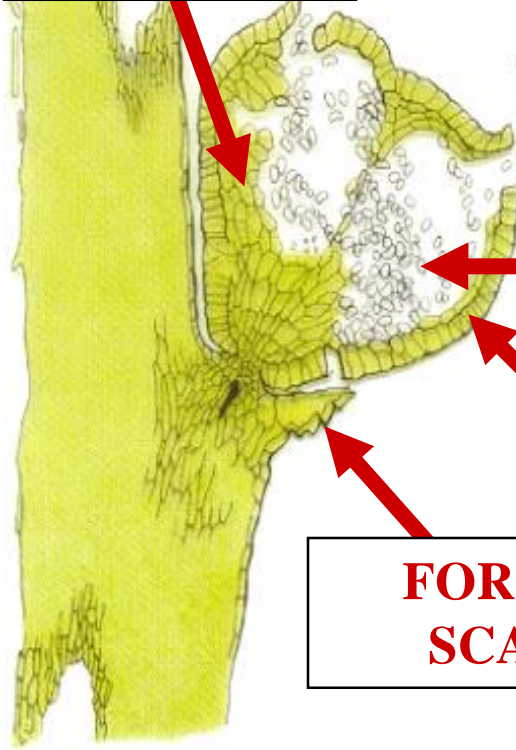
**ISOSPORES**

**EUSPORANGIUM**

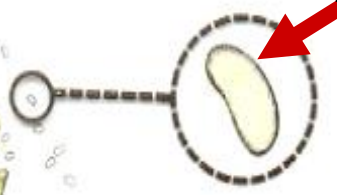
**FORKED  
SCALE**



**TAPETUM**



[Empty box]



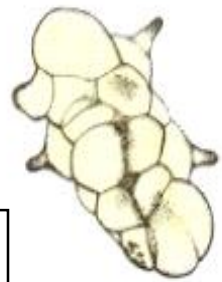
**1N**



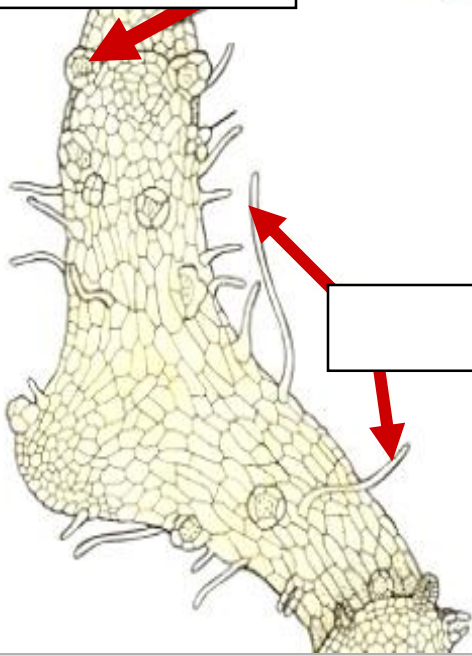
**EUSPORANGIUM**

**FORKED  
SCALE**

[Empty box]



[Empty box]



[Empty box]

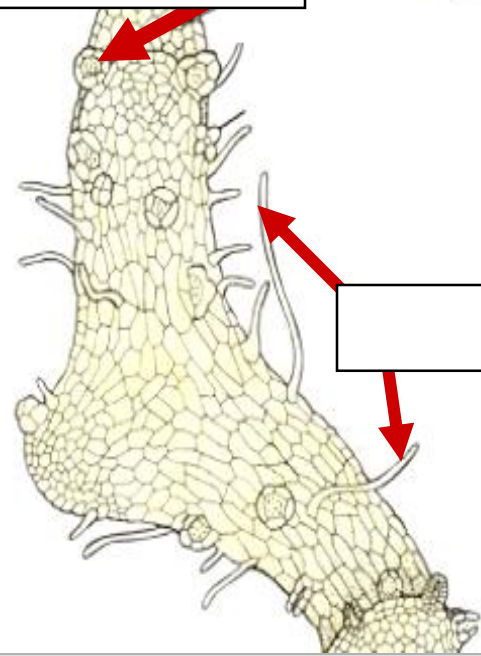
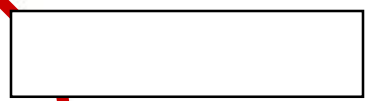
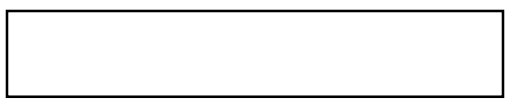
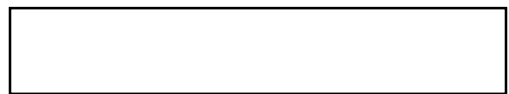
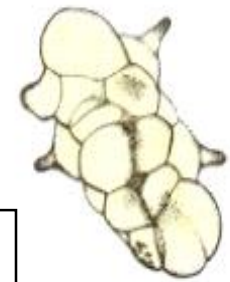
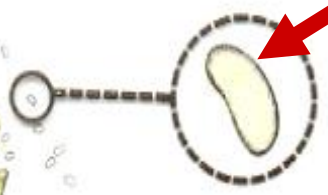
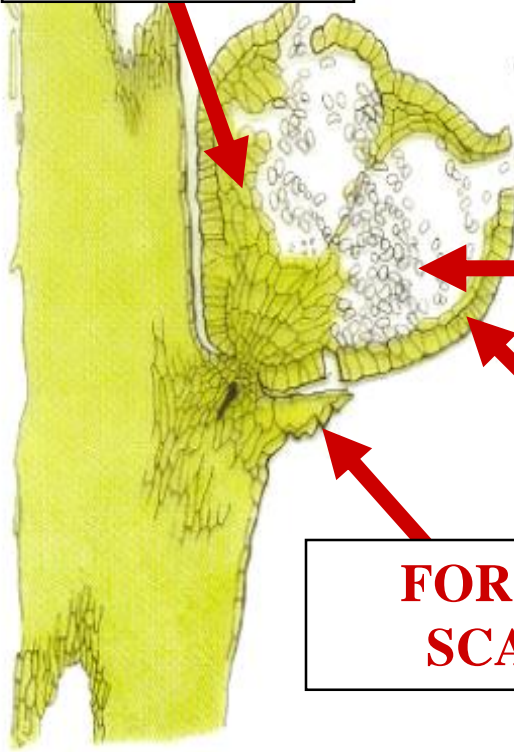
**TAPETUM**

**MITOSIS**

**1N**

**EUSPORANGIUM**

**FORKED  
SCALE**



**TAPETUM**

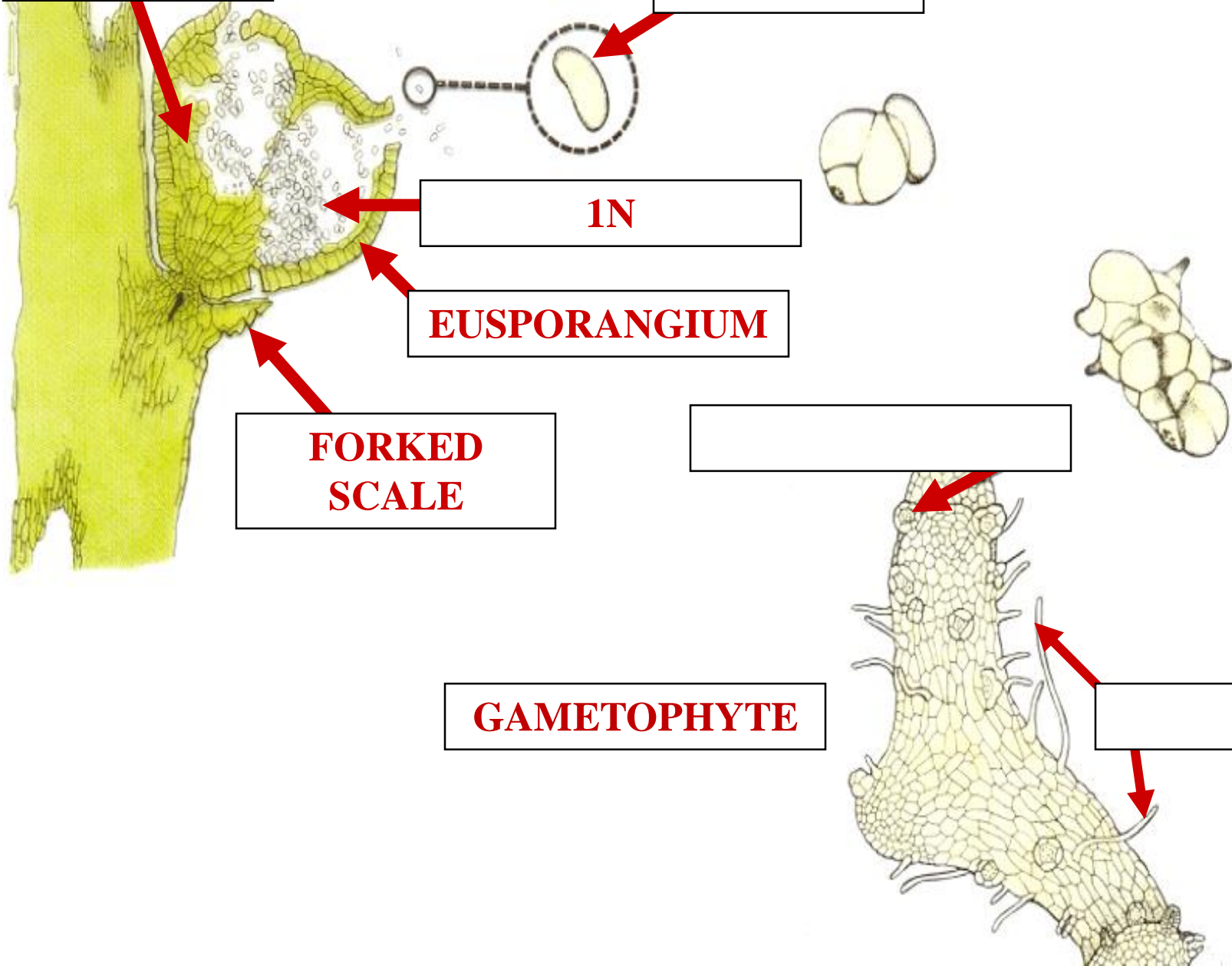
**MITOSIS**

**1N**

**EUSPORANGIUM**

**FORKED  
SCALE**

**GAMETOPHYTE**



**TAPETUM**

**MITOSIS**

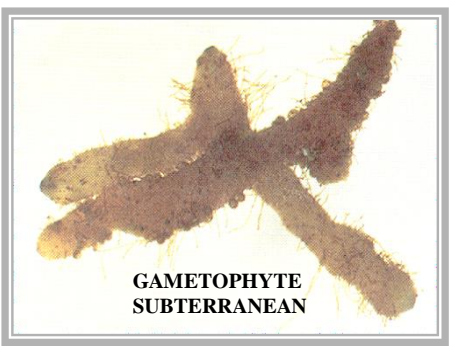
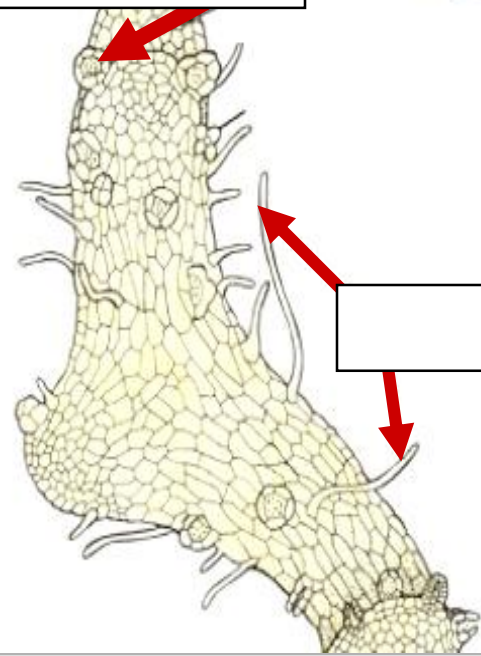
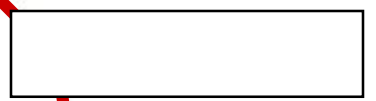
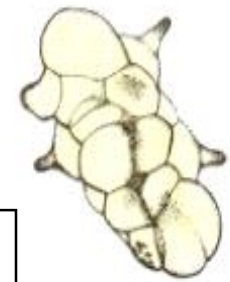
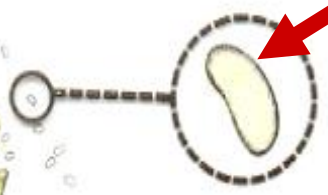
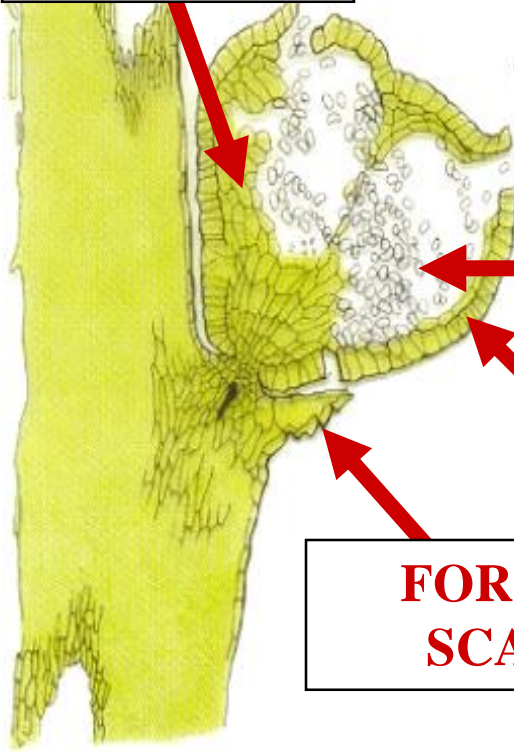
**ISOSPORES**

**EUSPORANGIUM**

**FORKED  
SCALE**

**1N**

**GAMETOPHYTE  
SUBTERRANEAN**





**TAPETUM**

**MITOSIS**

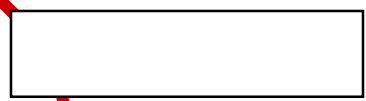
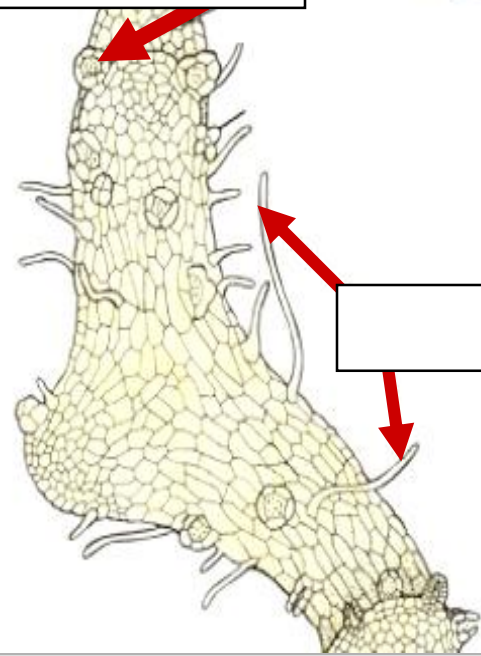
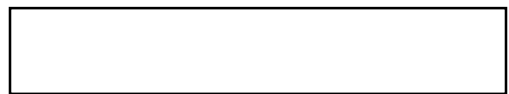
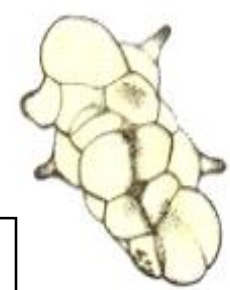
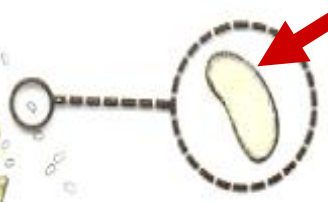
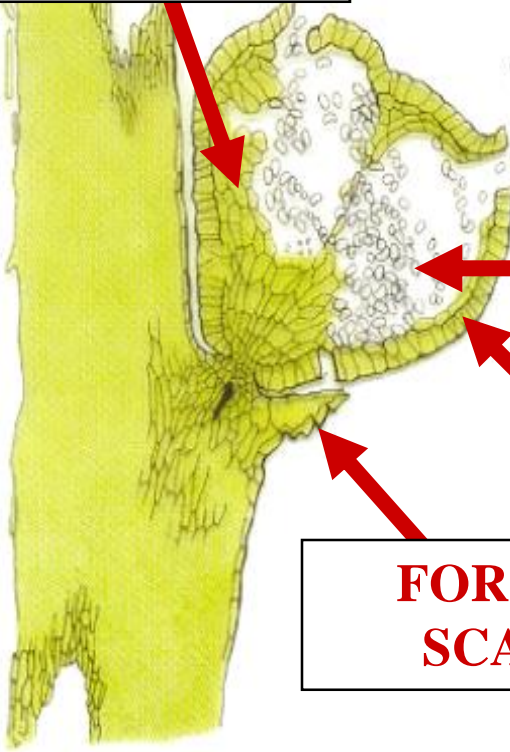
**ISOSPORES**

**EUSPORANGIUM**

**FORKED  
SCALE**

**EXOSPORIC**

**GAMETOPHYTE  
SUBTERRANEAN**



**TAPETUM**

**MITOSIS**

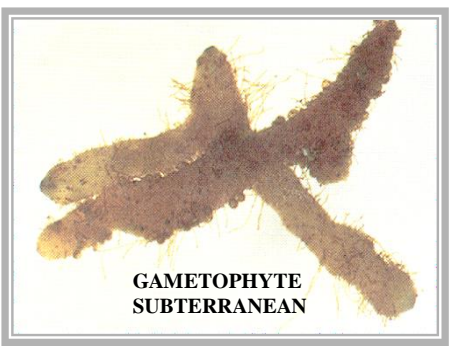
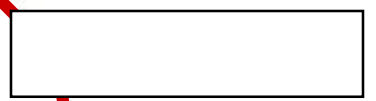
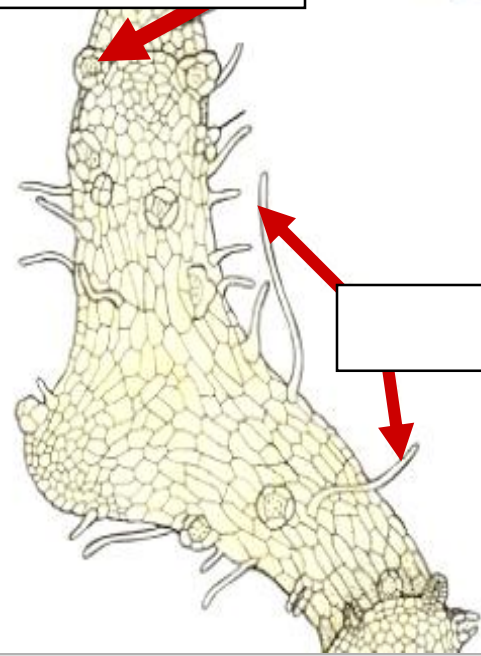
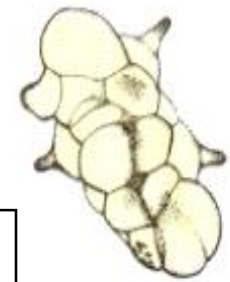
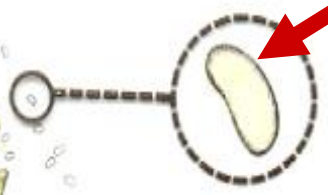
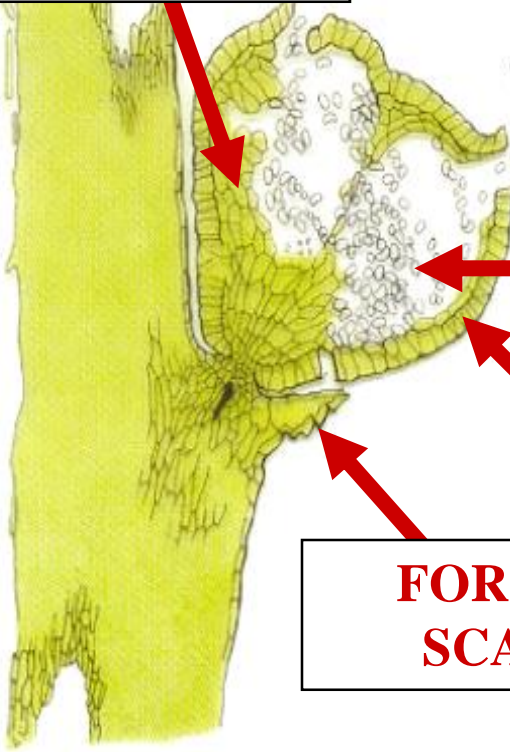
**ISOSPORES**

**EUSPORANGIUM**

**FORKED  
SCALE**

**SUBTERRANEAN**

**GAMETOPHYTE  
SUBTERRANEAN**



**TAPETUM**

**MITOSIS**

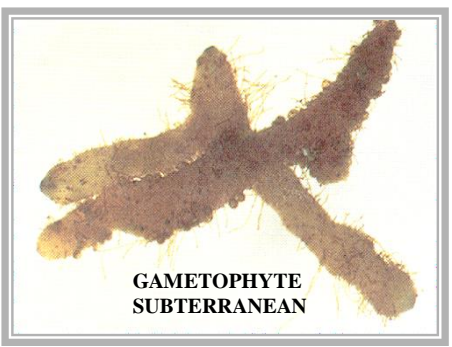
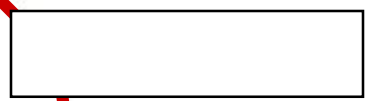
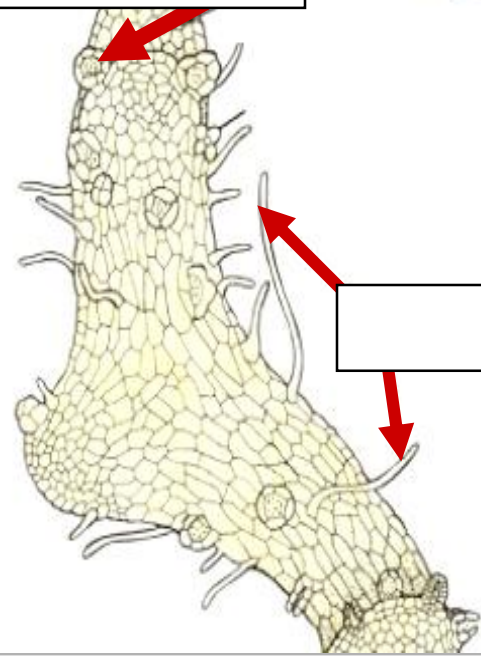
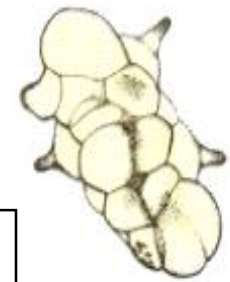
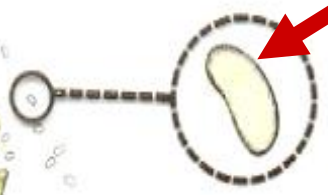
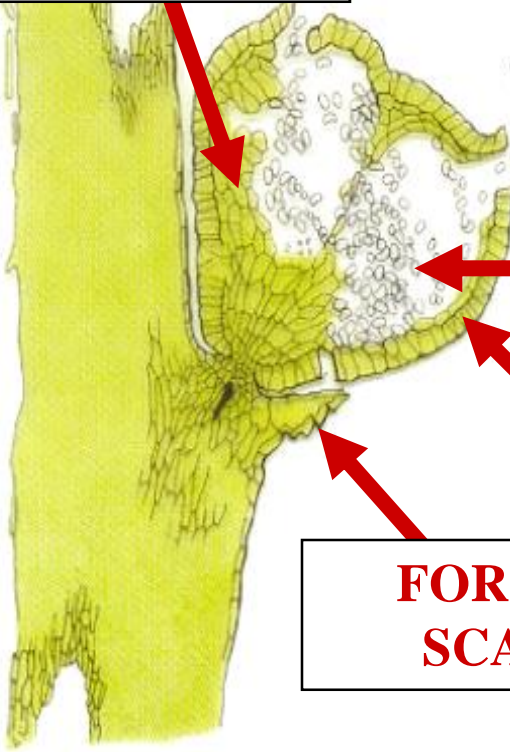
**ISOSPORES**

**EUSPORANGIUM**

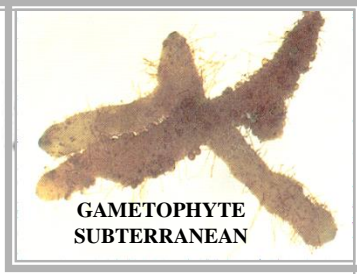
**FORKED  
SCALE**

**NON-PSYN**

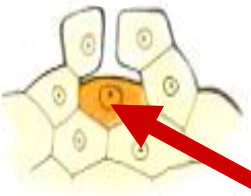
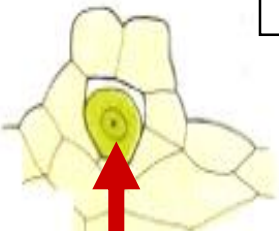
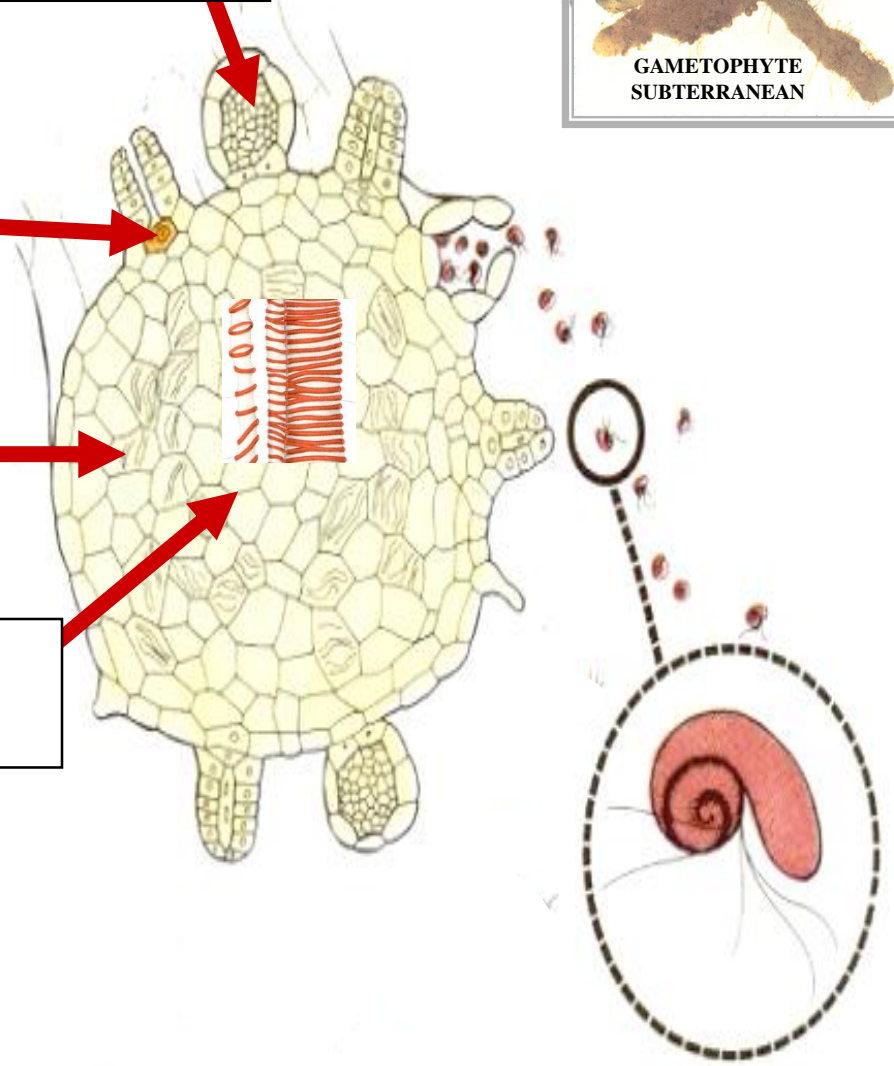
**GAMETOPHYTE  
SUBTERRANEAN**



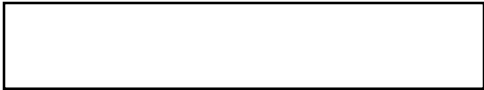
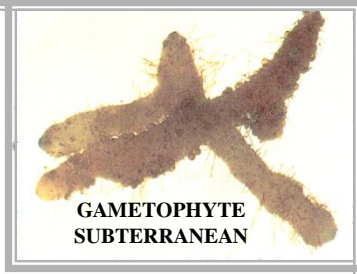
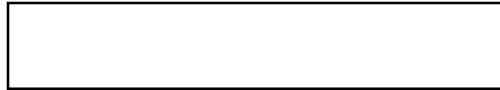
**GAMETOPHYTE**



**MYCORRHIZAE  
ABUNDANT**

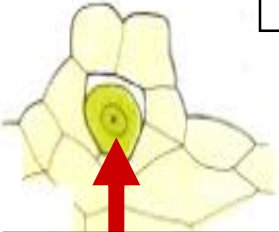
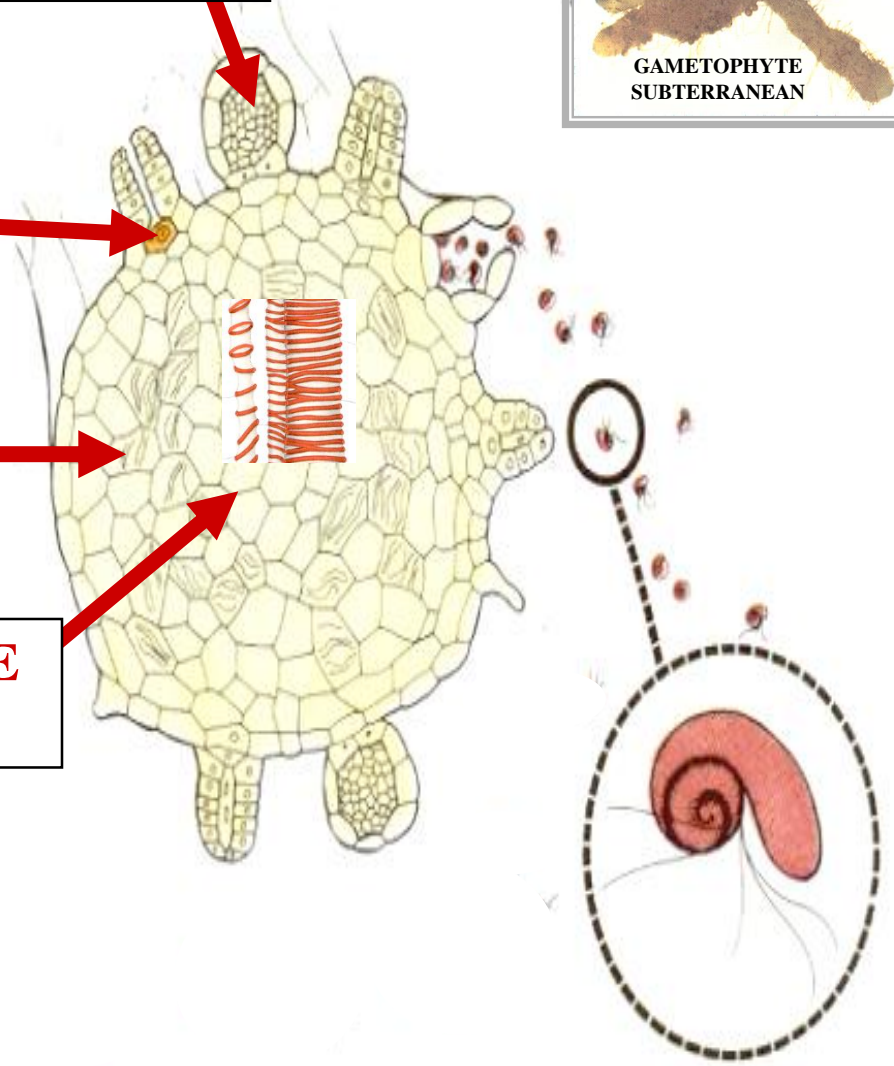


**GAMETOPHYTE**

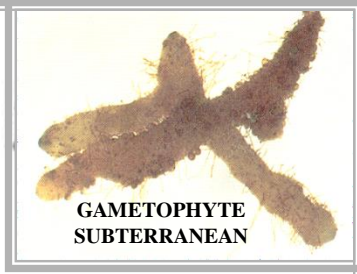


**MYCORRHIZAE  
ABUNDANT**

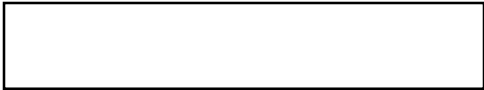
**VASCULAR TISSUE  
PRESENT**



**GAMETOPHYTE**

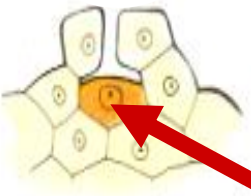
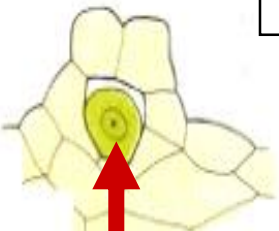
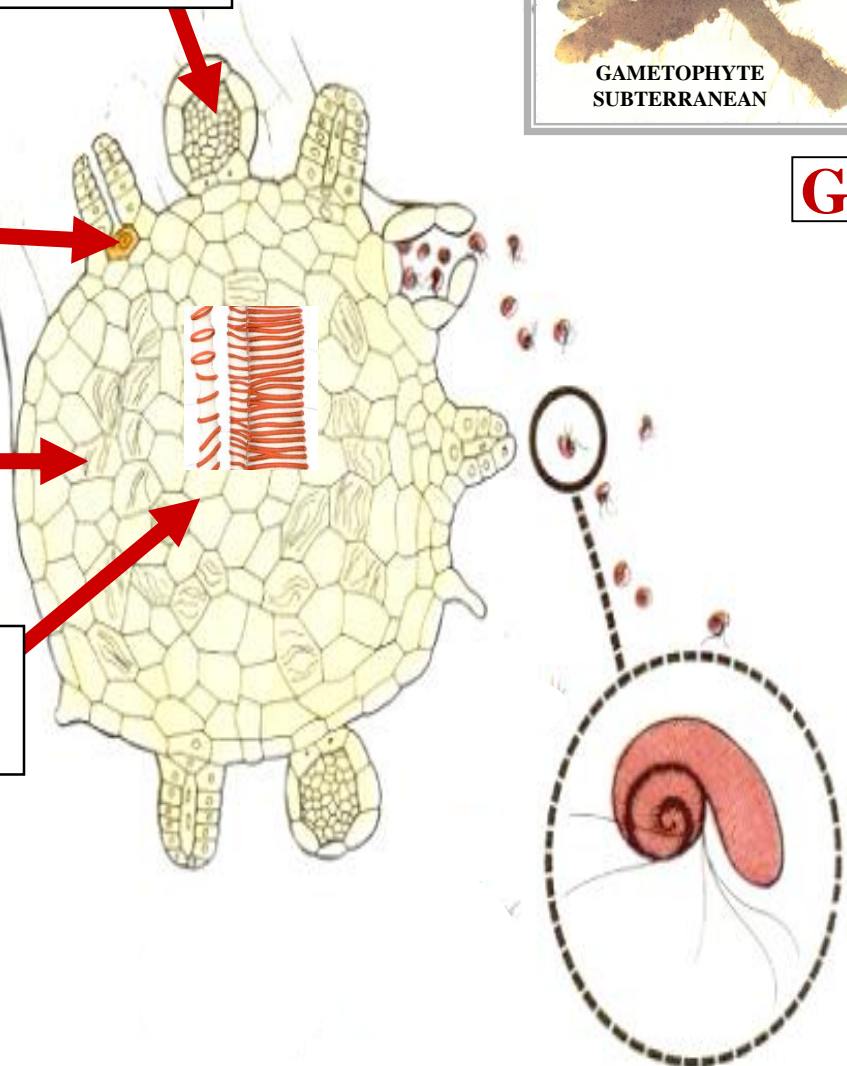


**G**

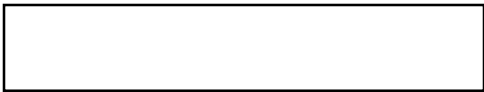
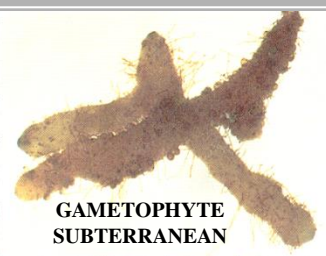


**BISEXUAL**

**VASCULAR TISSUE  
PRESENT**

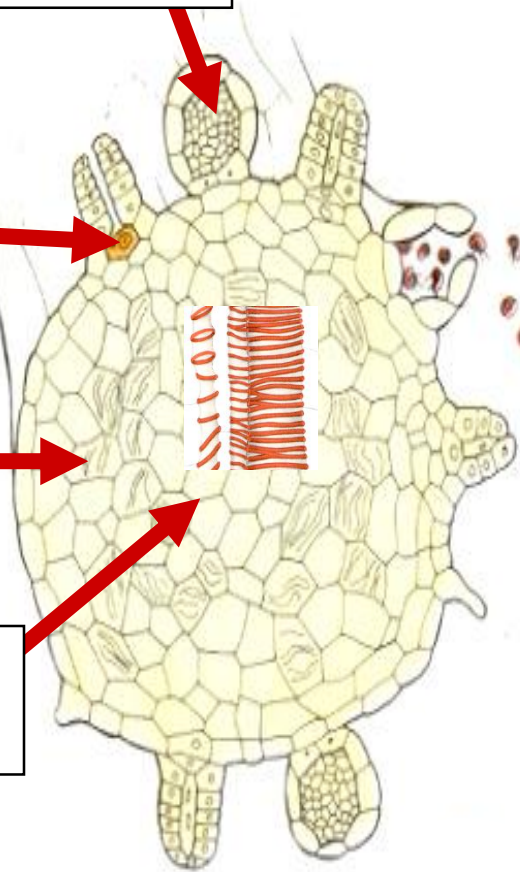


**GAMETOPHYTE**



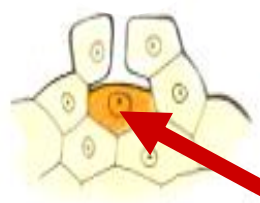
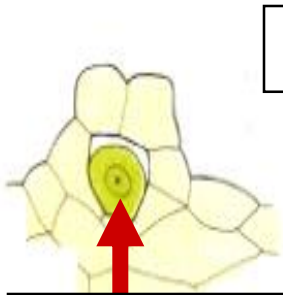
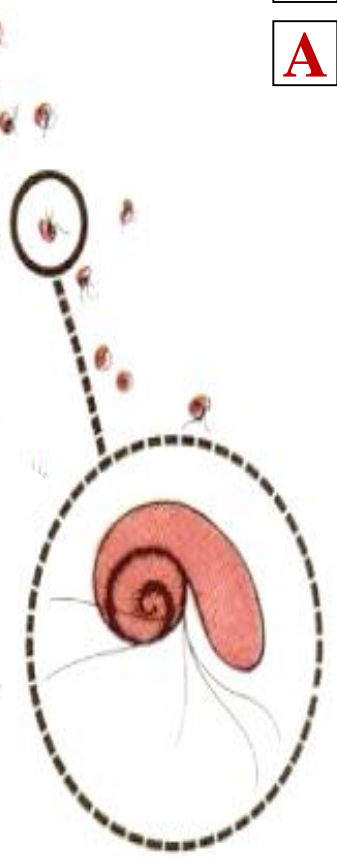
**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**



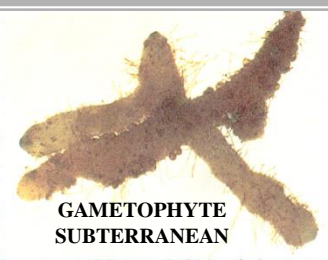
**A**

**A**



**GAMETOPHYTE**

**ANTHERIDIUM**

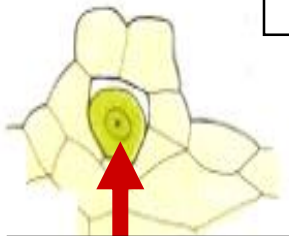
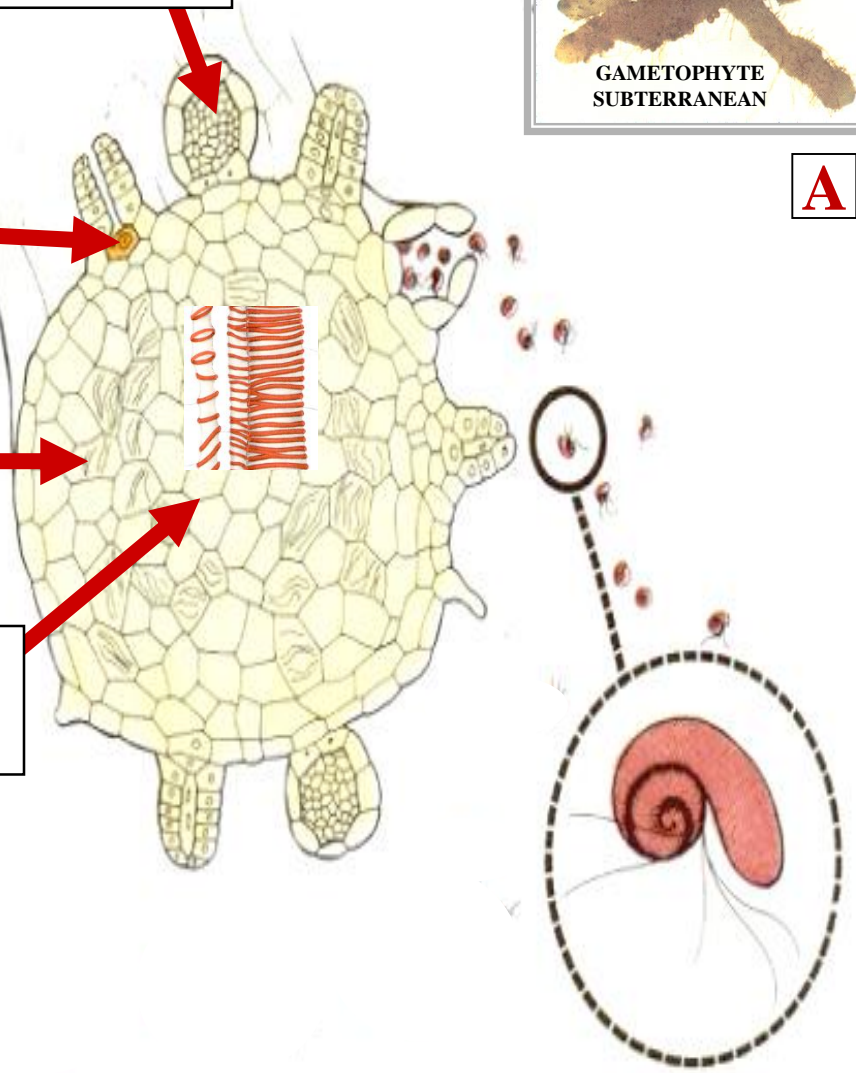


**A**

**ARCHEGONIUM**

**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**



[Empty box]

[Empty box]

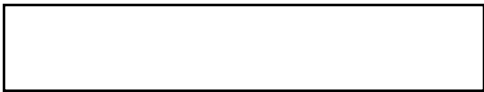
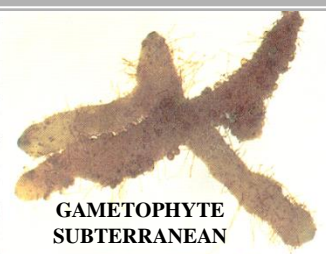
[Empty box]

[Empty box]



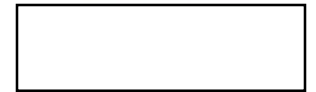
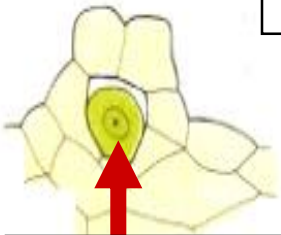
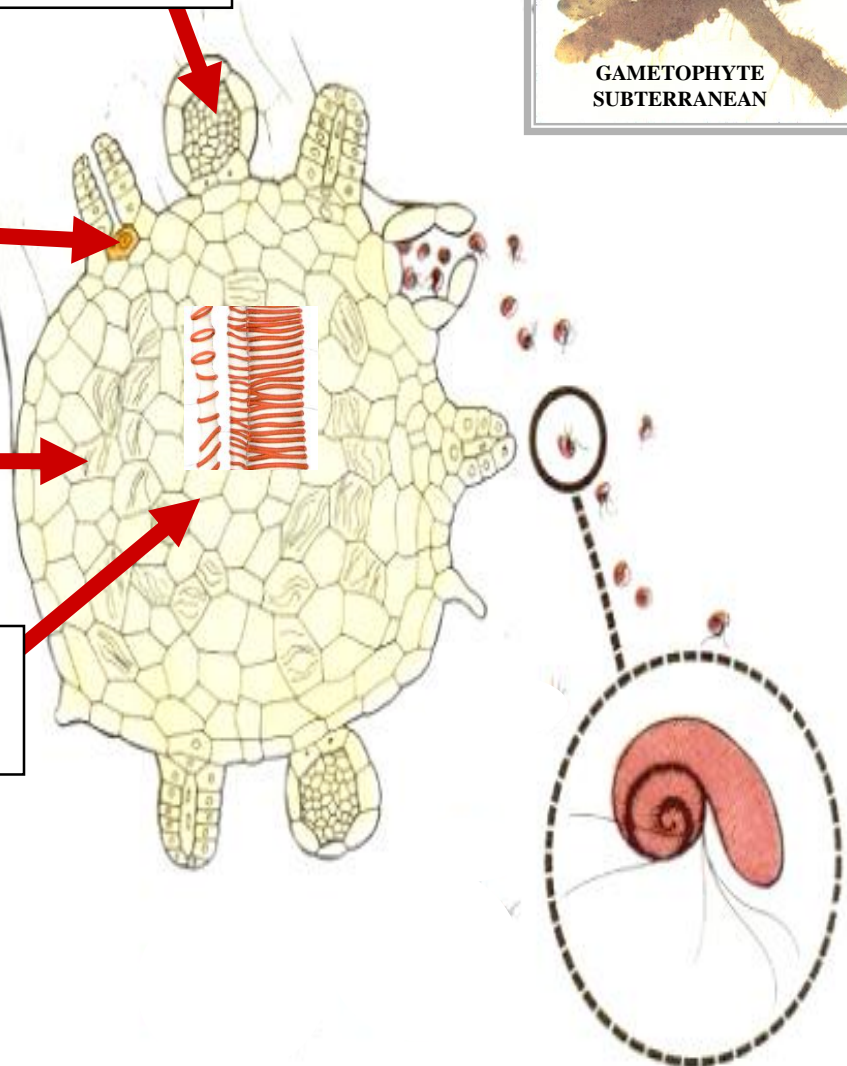
**GAMETOPHYTE**

**ANTHERIDIUM**



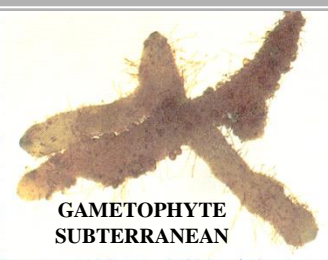
**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**



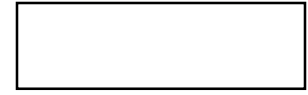
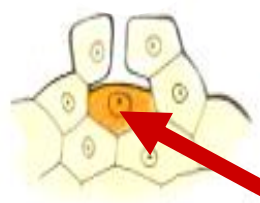
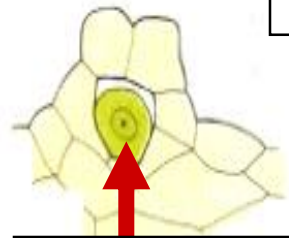
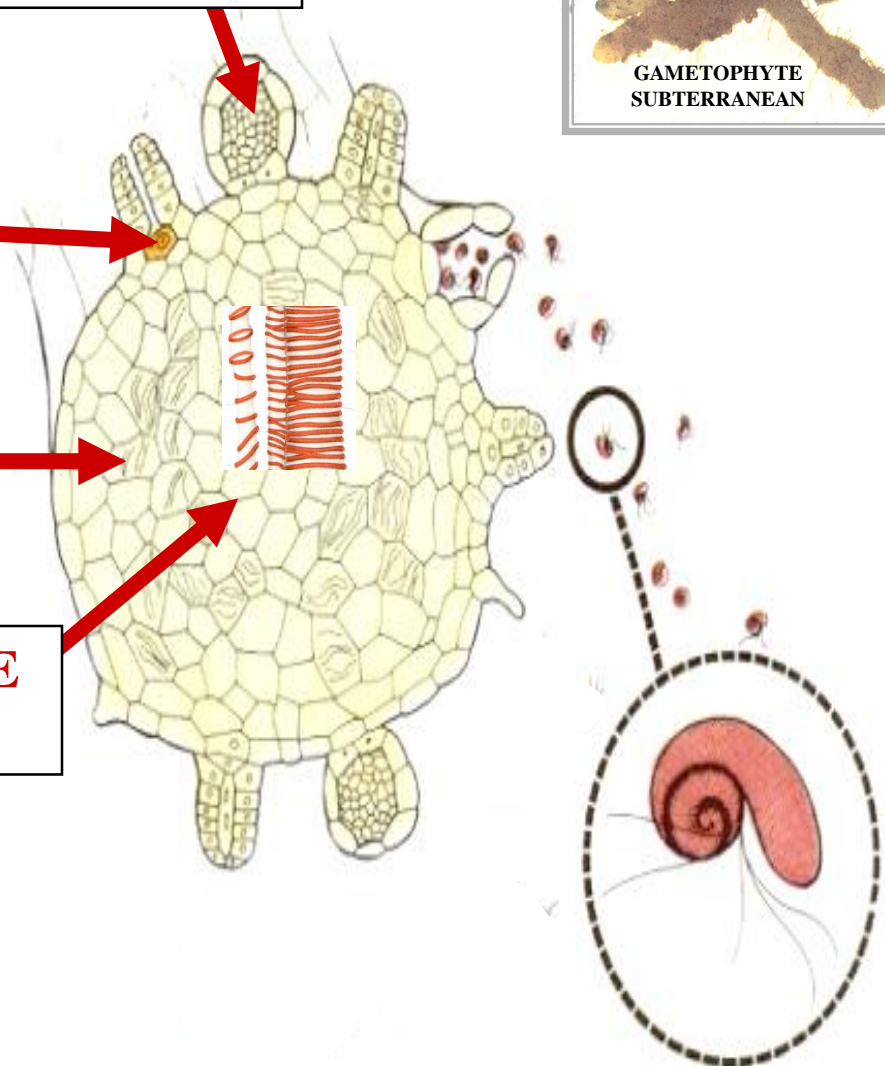
**GAMETOPHYTE**

**SPERMATOCYTES**



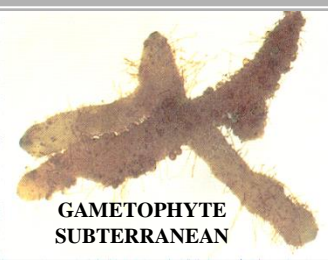
**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**



**GAMETOPHYTE**

**1N**

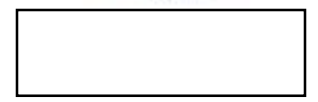
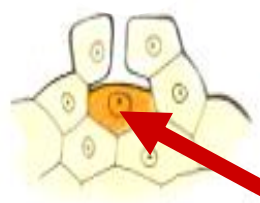
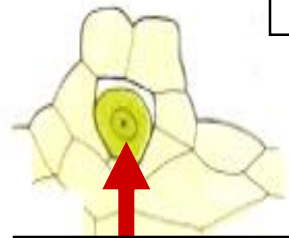
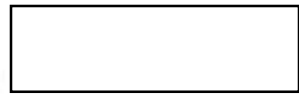
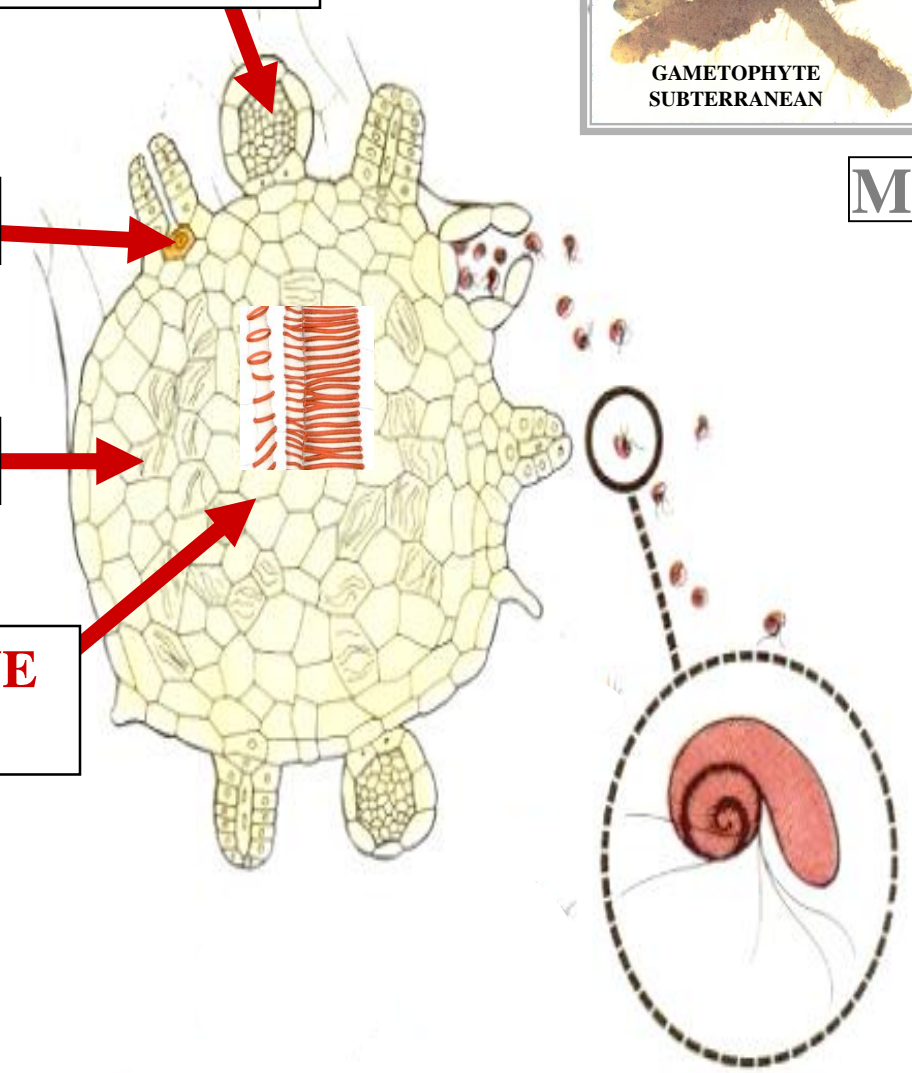


**M**



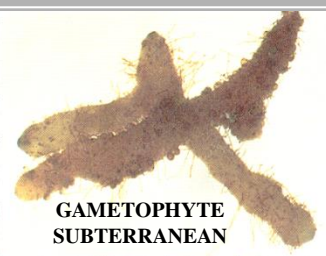
**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**



**GAMETOPHYTE**

**MITOSIS**



**GAMETANGIA**

**VASCULAR TISSUE  
PRESENT**

