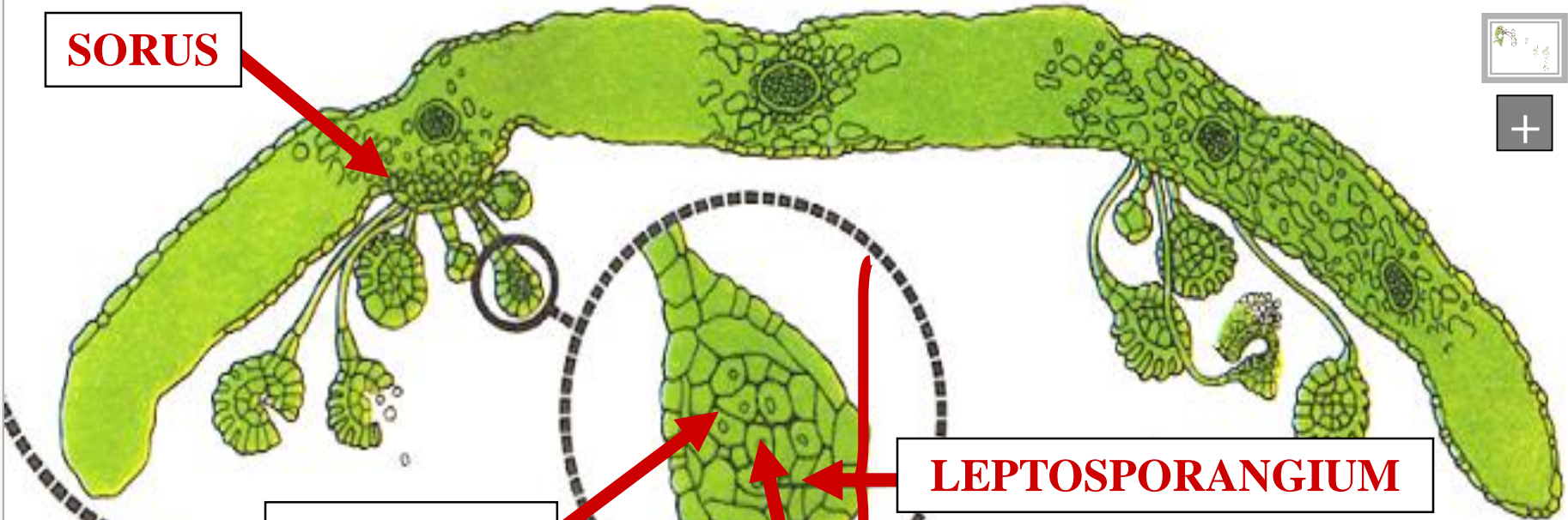


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TAPETUM

LEPTOSPORANGIUM

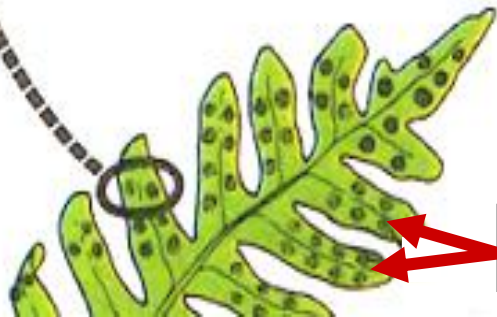
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ANNULUS

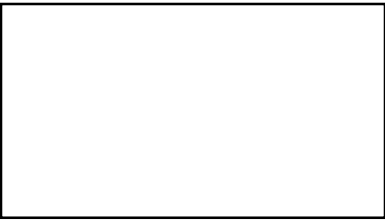
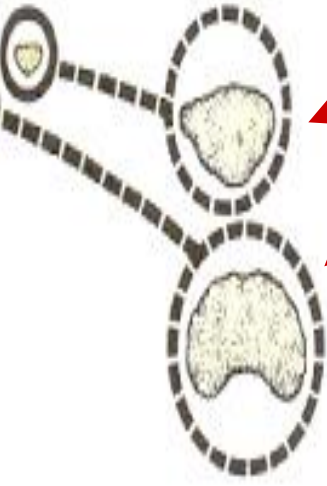
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**MATURE
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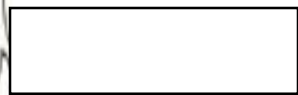
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ISOSPORES

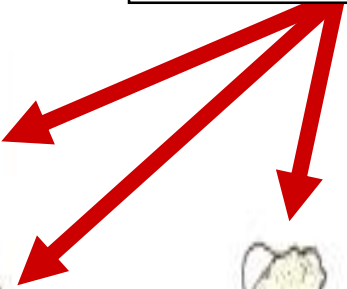


**MATURE
GAMETOPHYTE**





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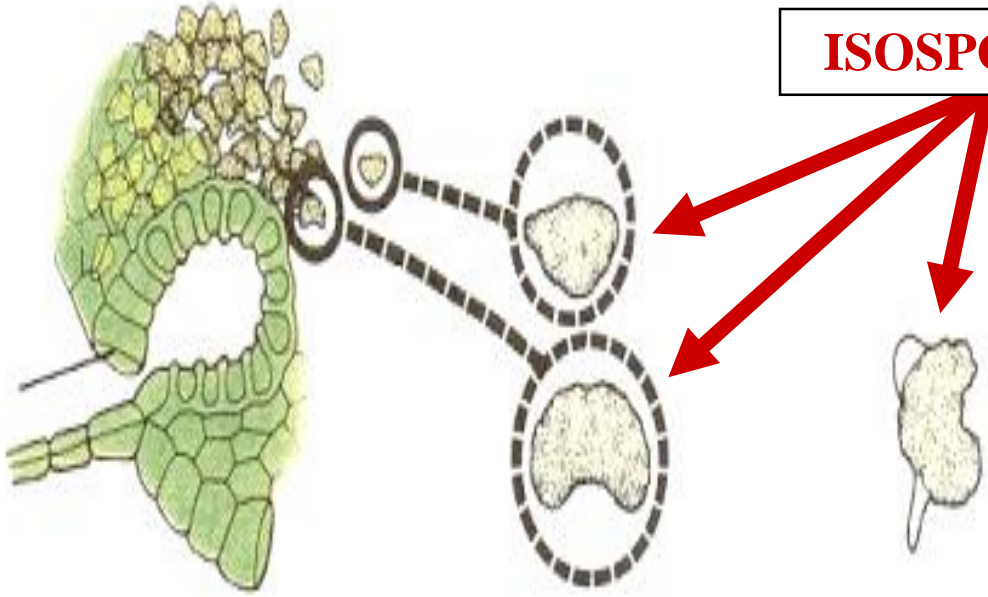
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GAMETOPHYTE**

ISOSPORES



**ISOSPORES
CATAPULT
DISPERSAL**

**MATURE
GAMETOPHYTE**

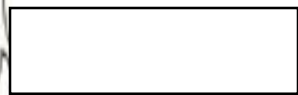
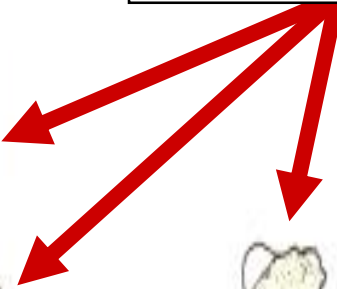


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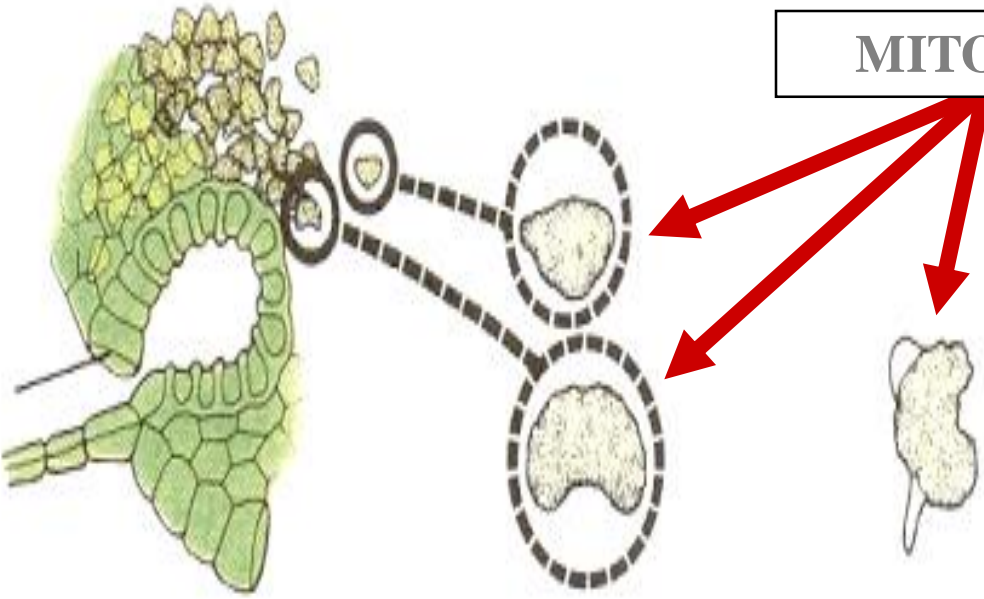


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CATAPULT
DISPERSAL**

**MATURE
GAMETOPHYTE**

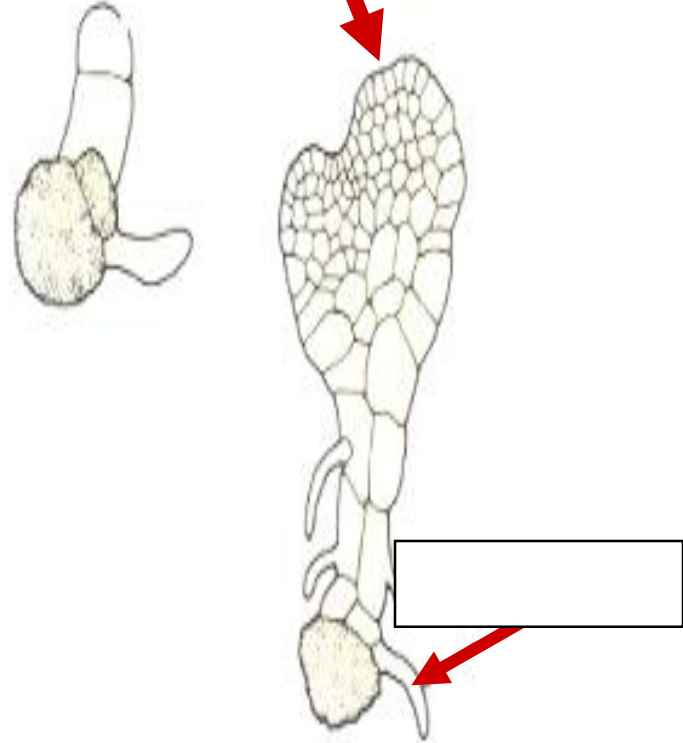


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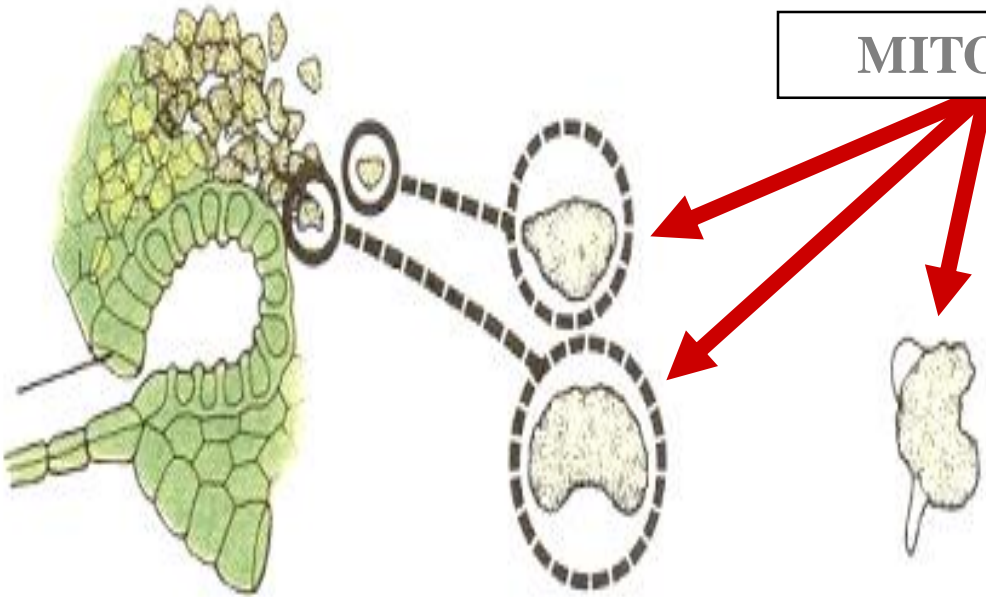
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YOUNG
GAMETOPHYTE



MATURE
GAMETOPHYTE

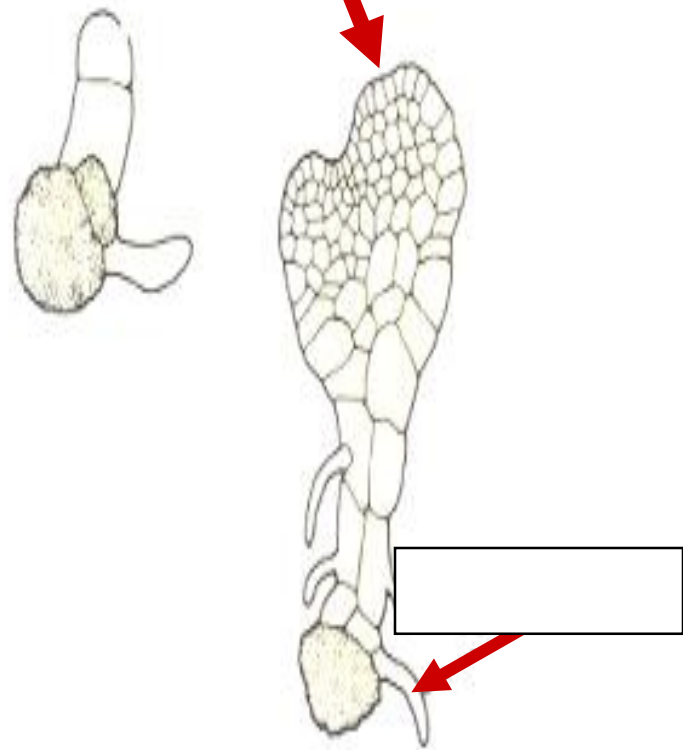
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**ISOSPORES
CATAPULT
DISPERSAL**

**MATURE
GAMETOPHYTE**

MITOSIS



**MATURE
GAMETOPHYTE**



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GAMETOPHYTE

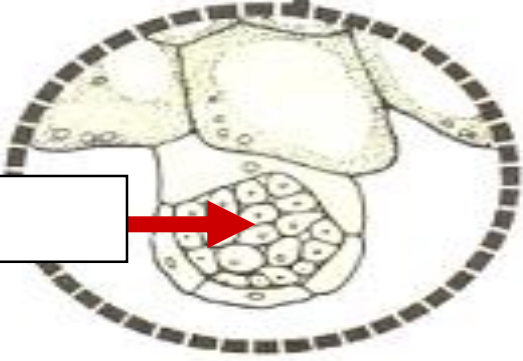
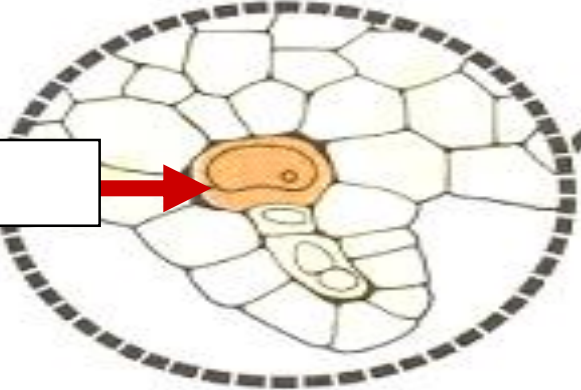
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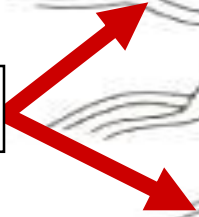
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**MATURE
GAMETOPHYTE**



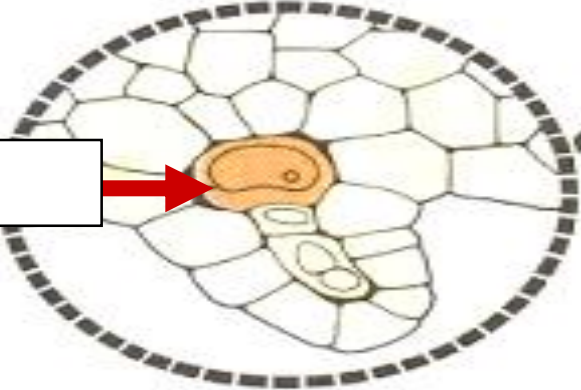
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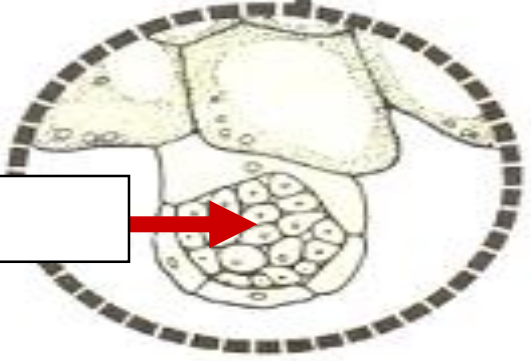
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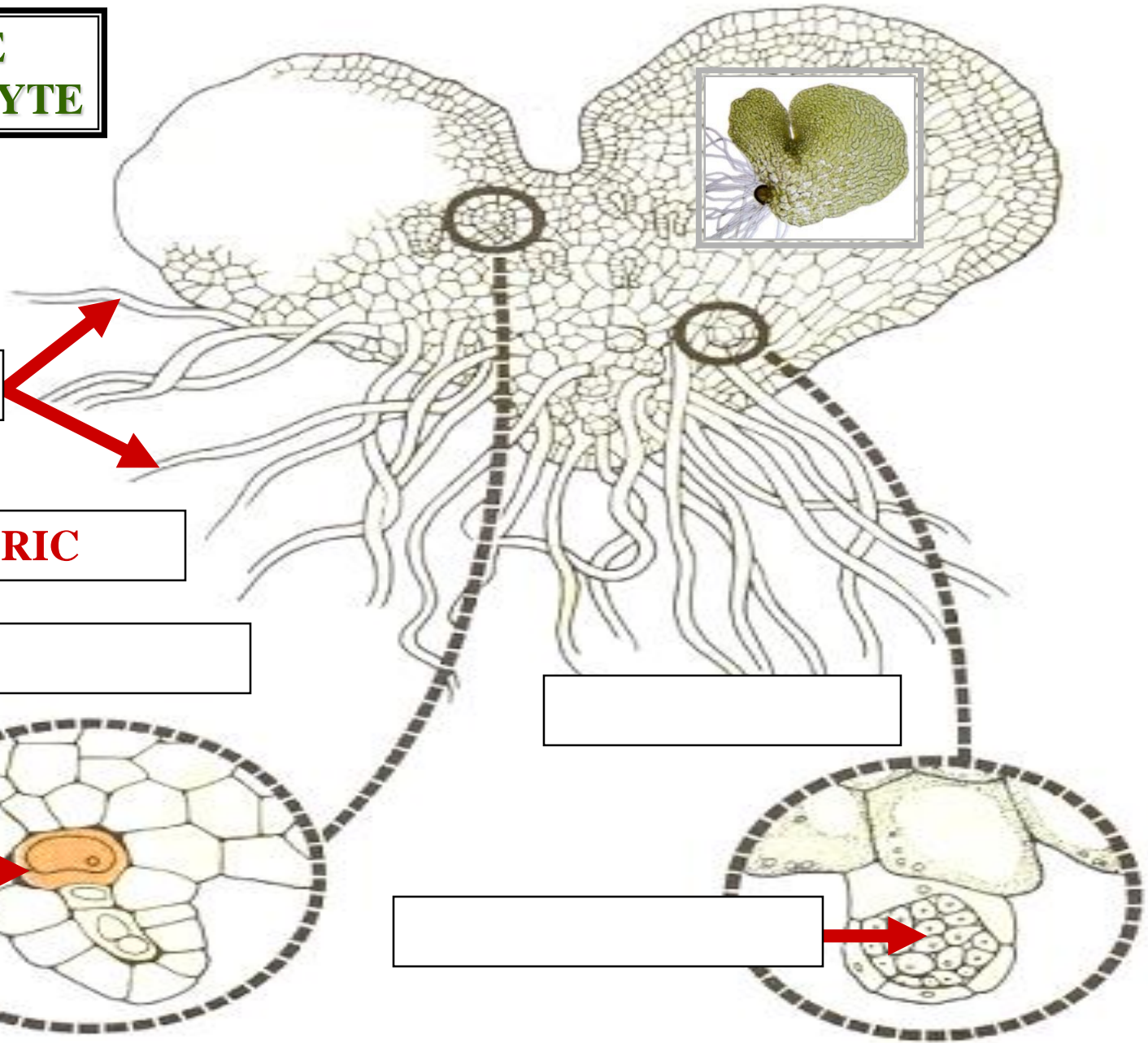


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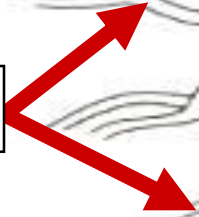
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EXOSPORIC

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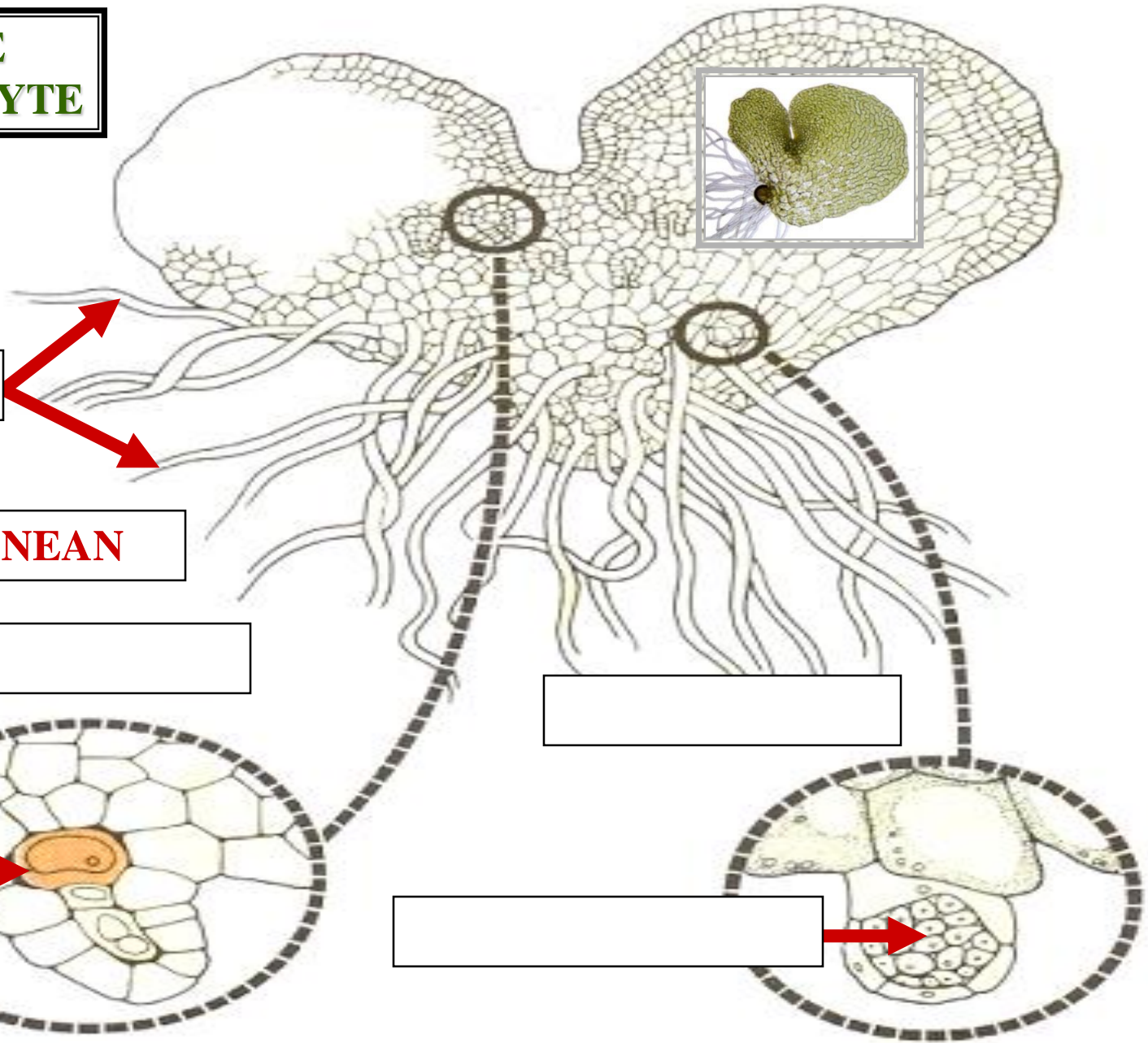
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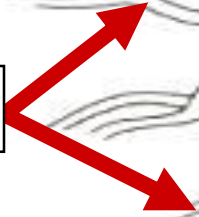
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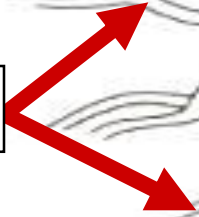
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GAMETOPHYTE**



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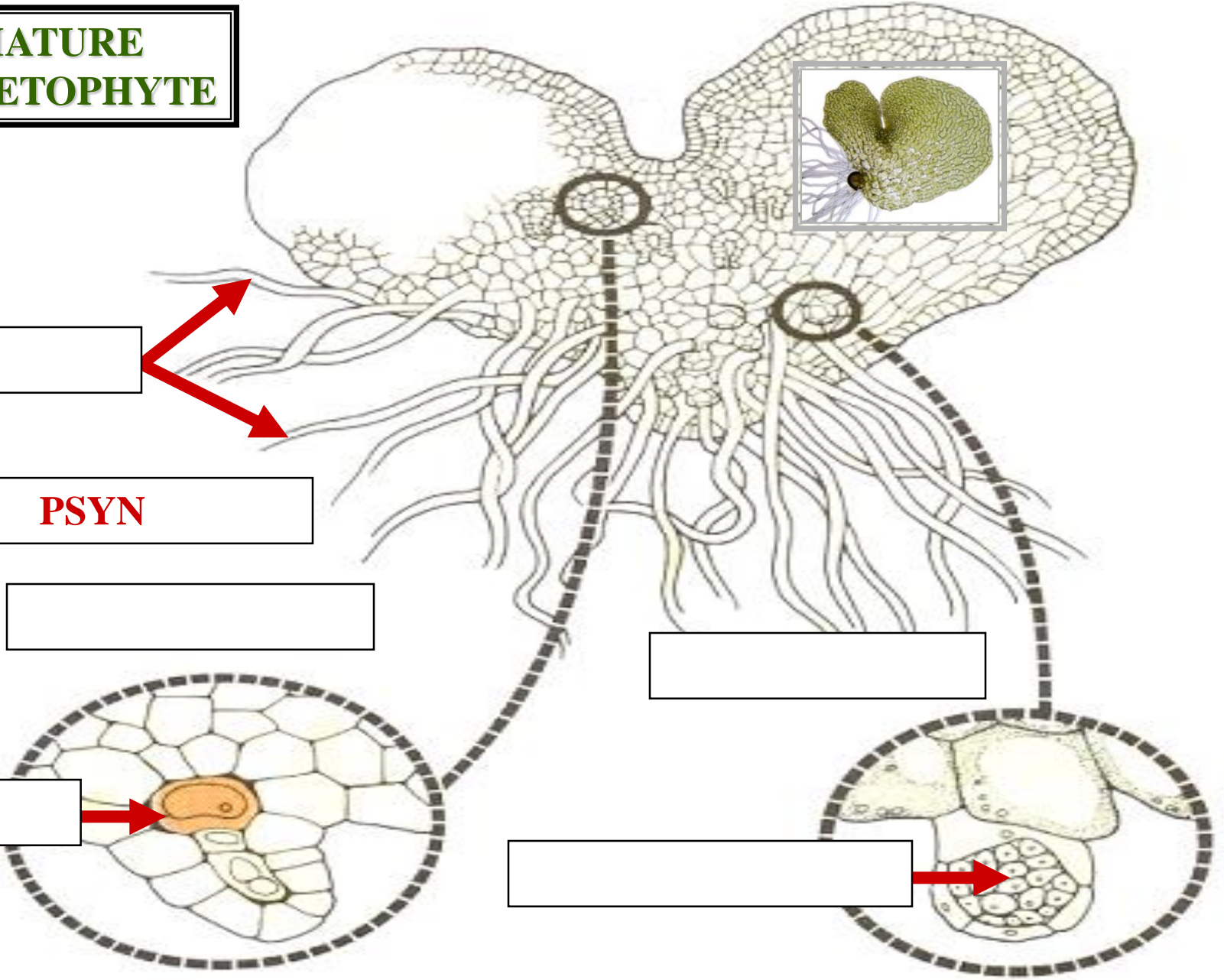
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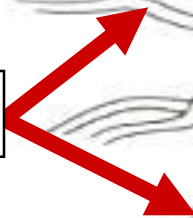


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**MATURE
GAMETOPHYTE**



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HEART-SHAPE

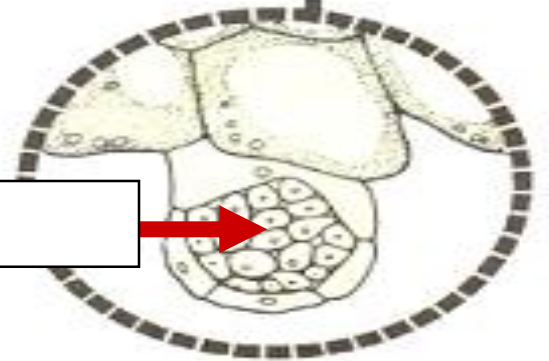
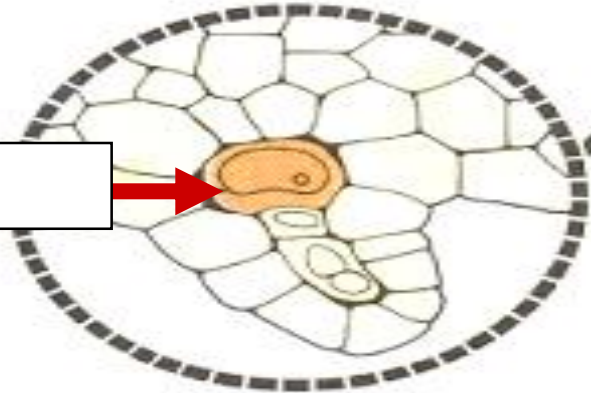
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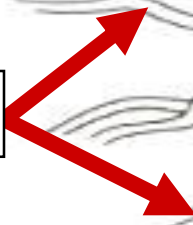
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**MATURE
GAMETOPHYTE**



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BISEXUAL

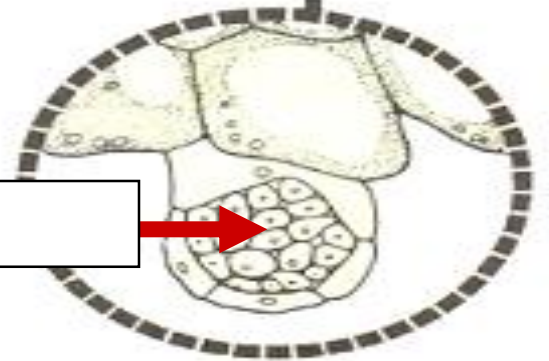
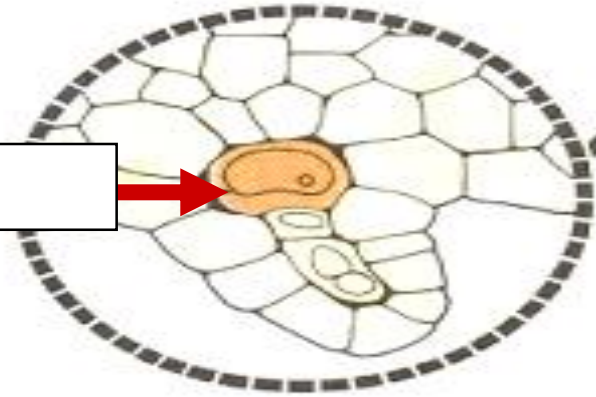
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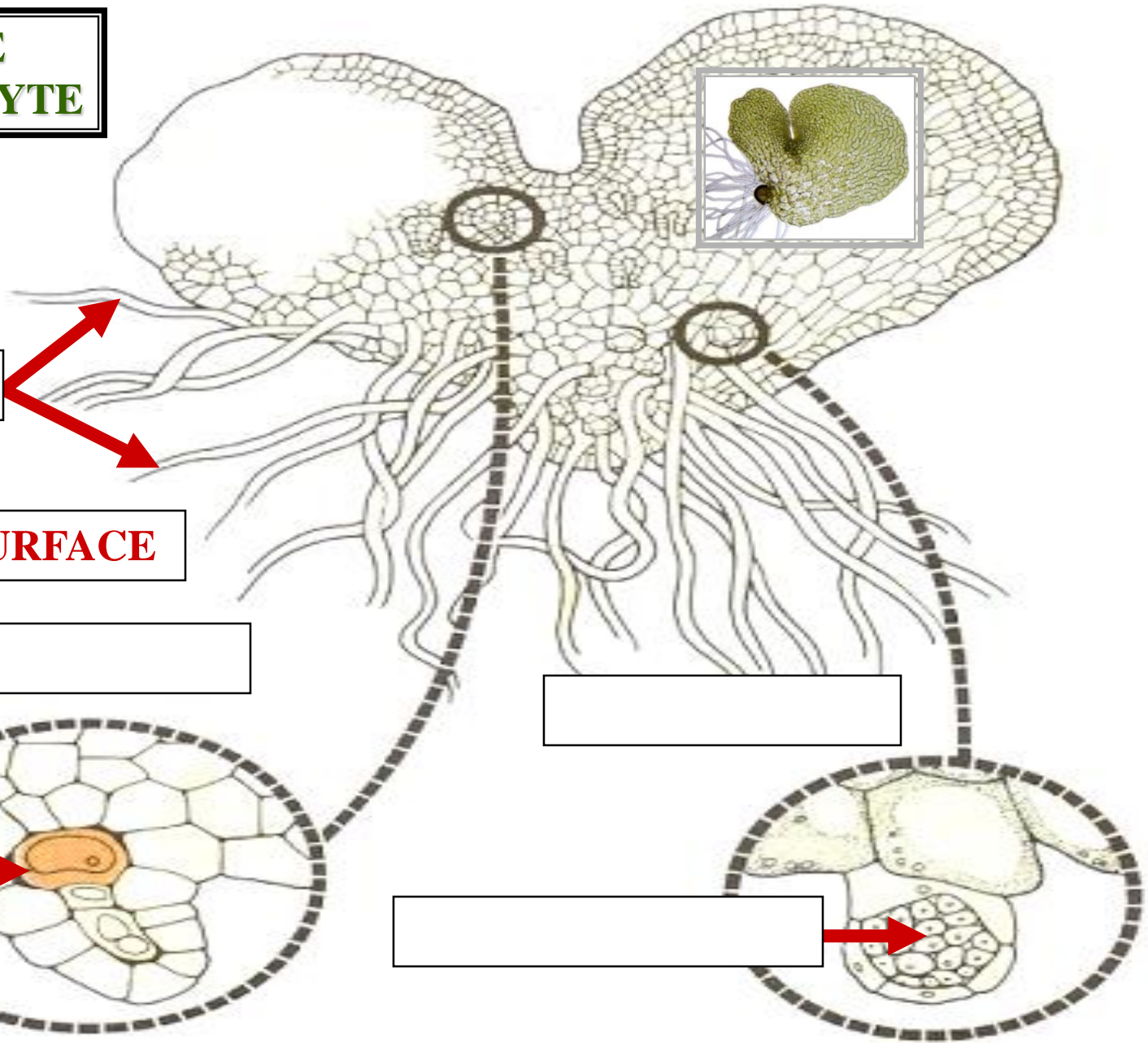


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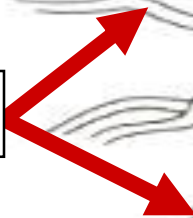
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**MATURE
GAMETOPHYTE**



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ABAXIAL SURFACE

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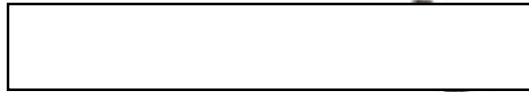
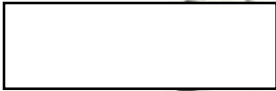
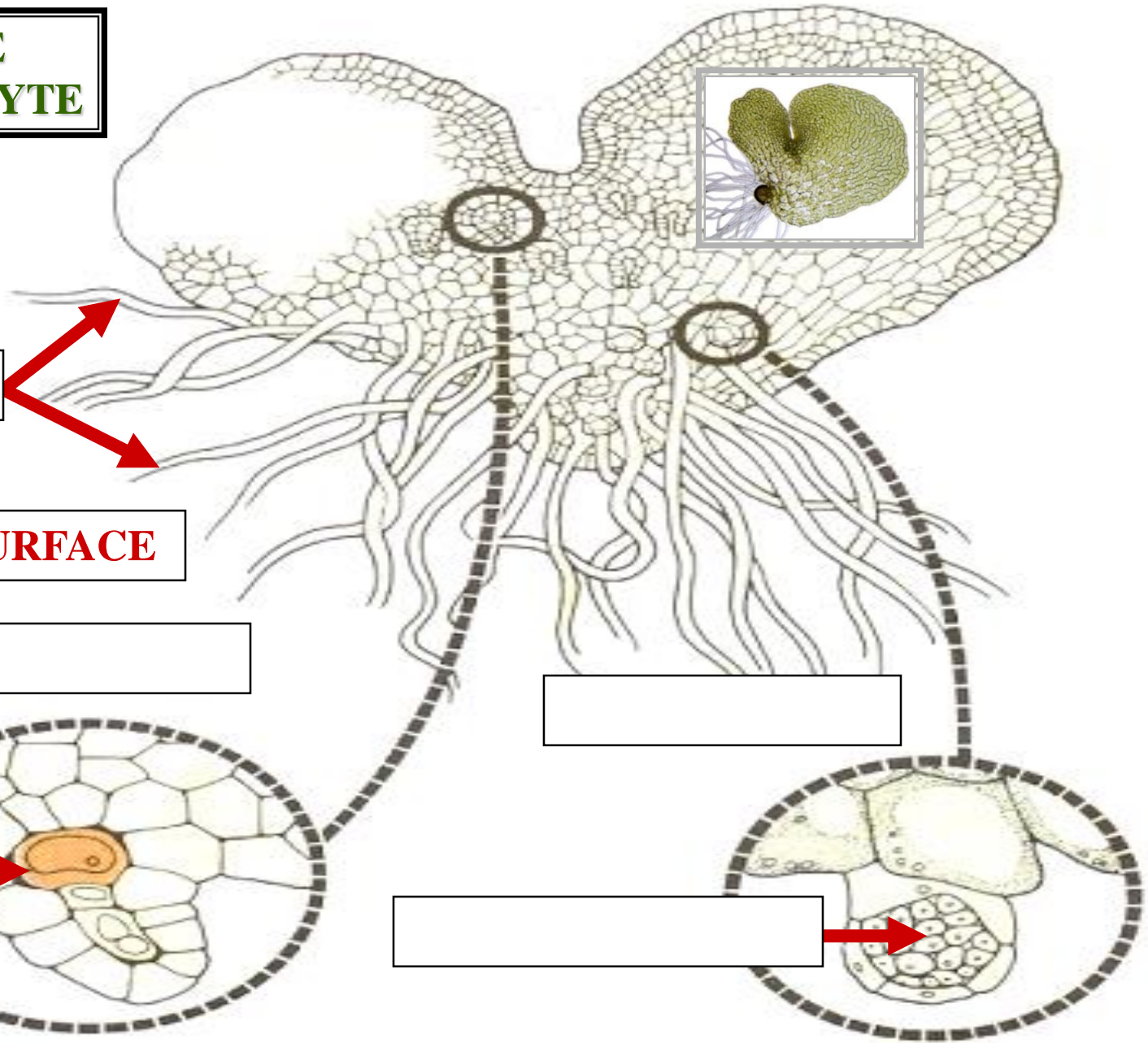
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**MATURE
GAMETOPHYTE**

RHIZOIDS

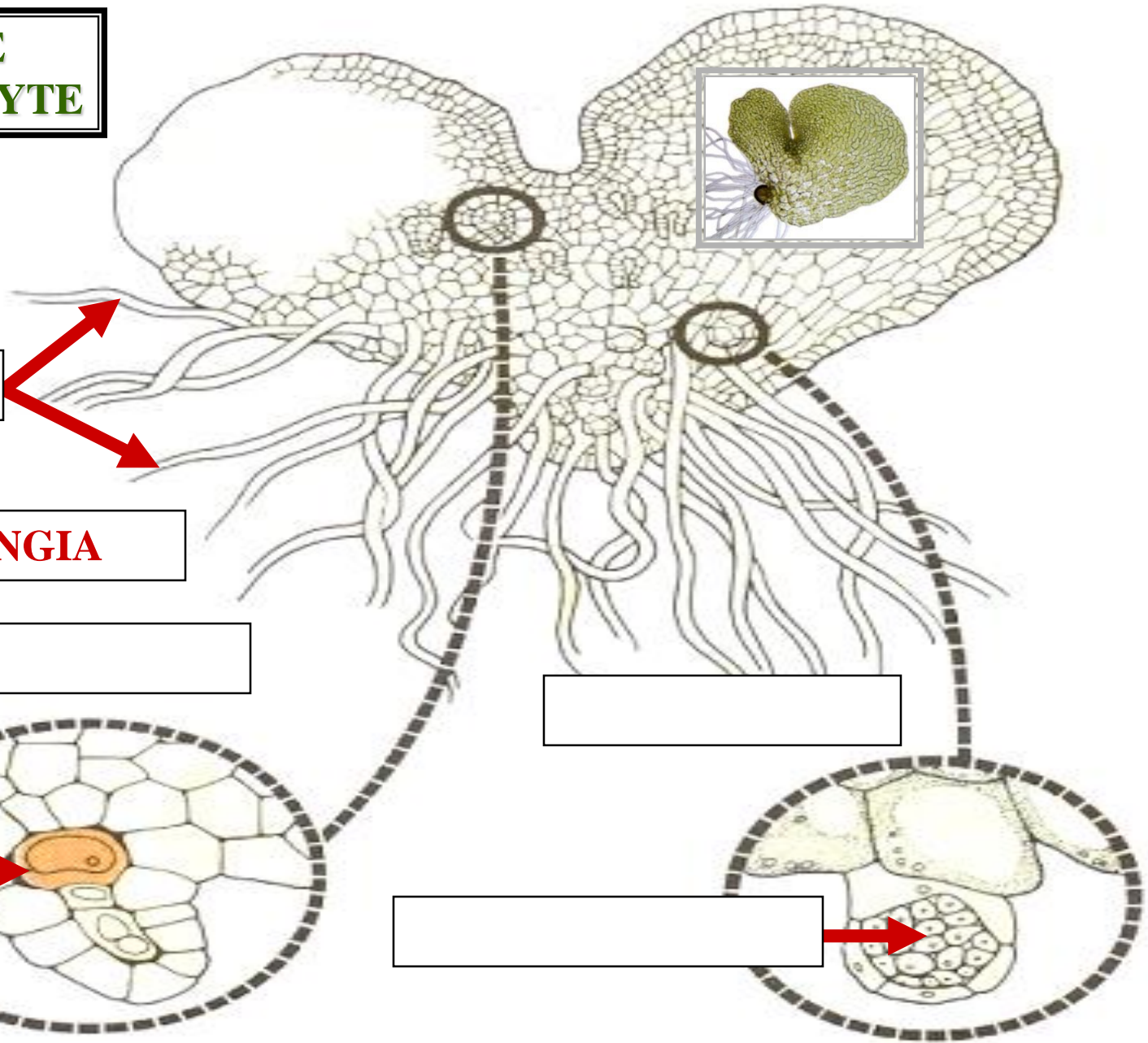
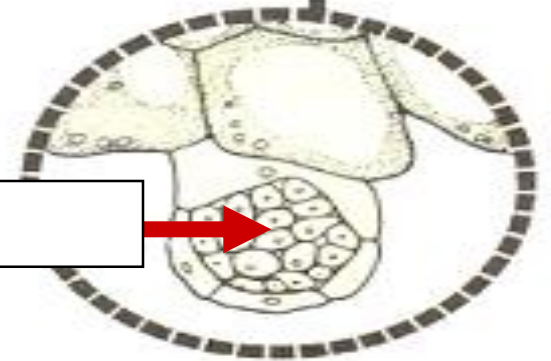
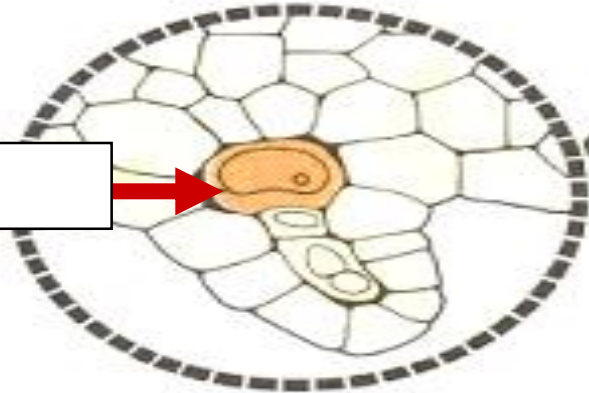
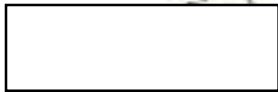
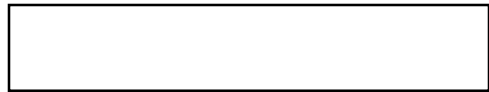
ABAXIAL SURFACE



**MATURE
GAMETOPHYTE**

RHIZOIDS

GAMETANGIA



**MATURE
GAMETOPHYTE**

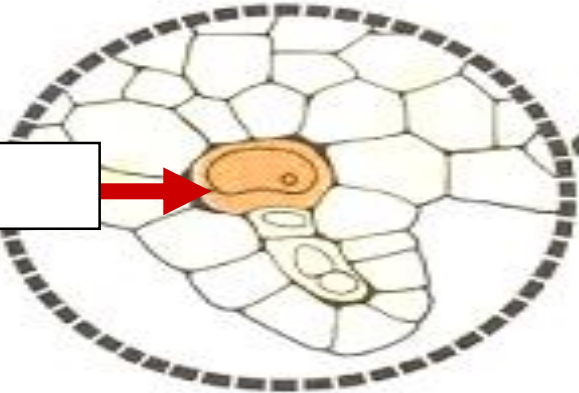
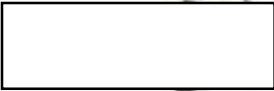


RHIZOIDS

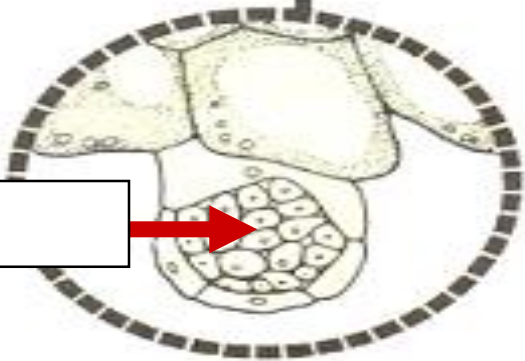


GAMETANGIA

ARCHEGONIA



ANTHERIDIA

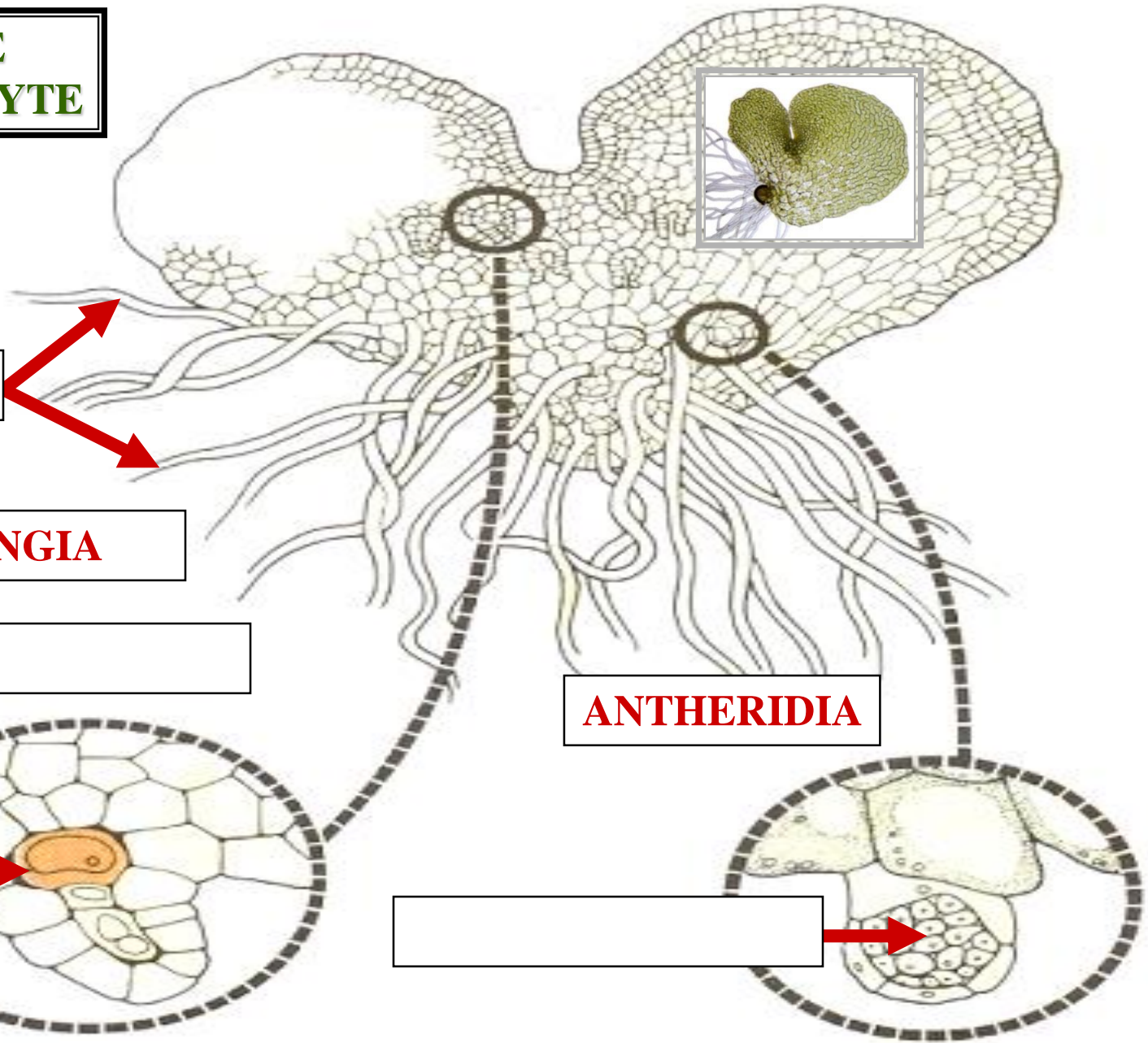
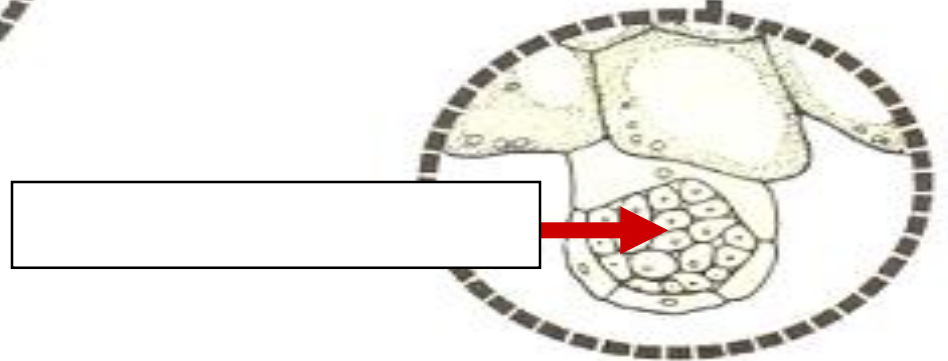
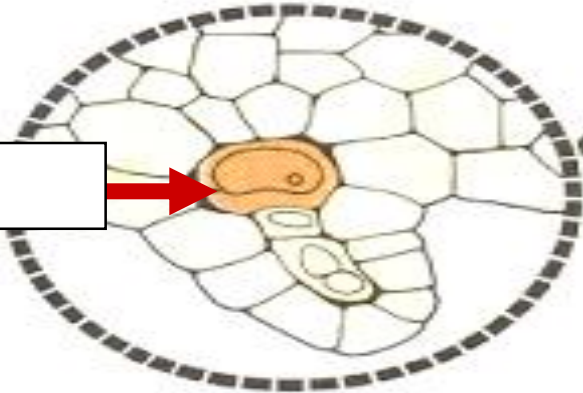


**MATURE
GAMETOPHYTE**

RHIZOIDS

GAMETANGIA

ANTHERIDIA

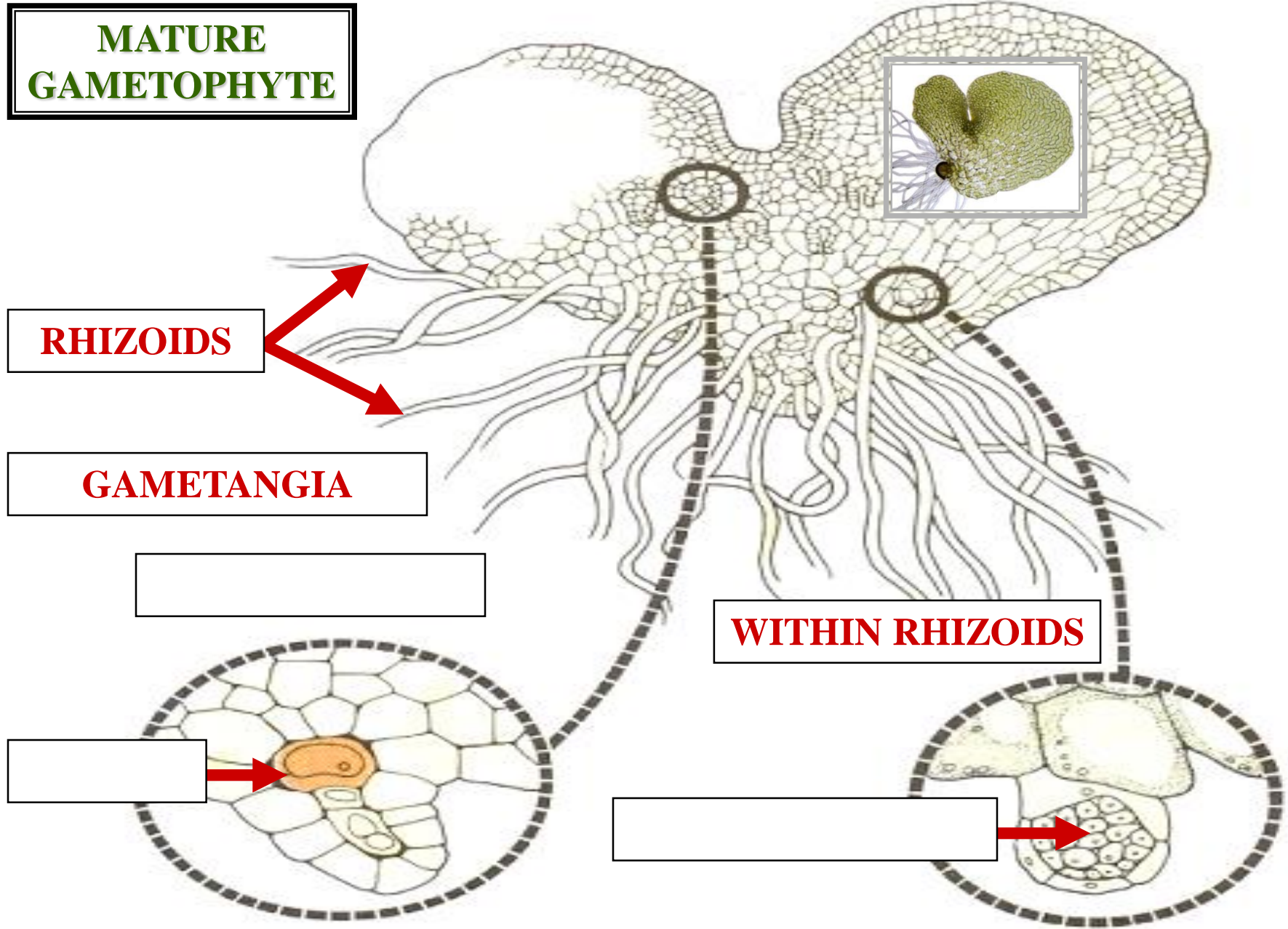


**MATURE
GAMETOPHYTE**

RHIZOIDS

GAMETANGIA

WITHIN RHIZOIDS



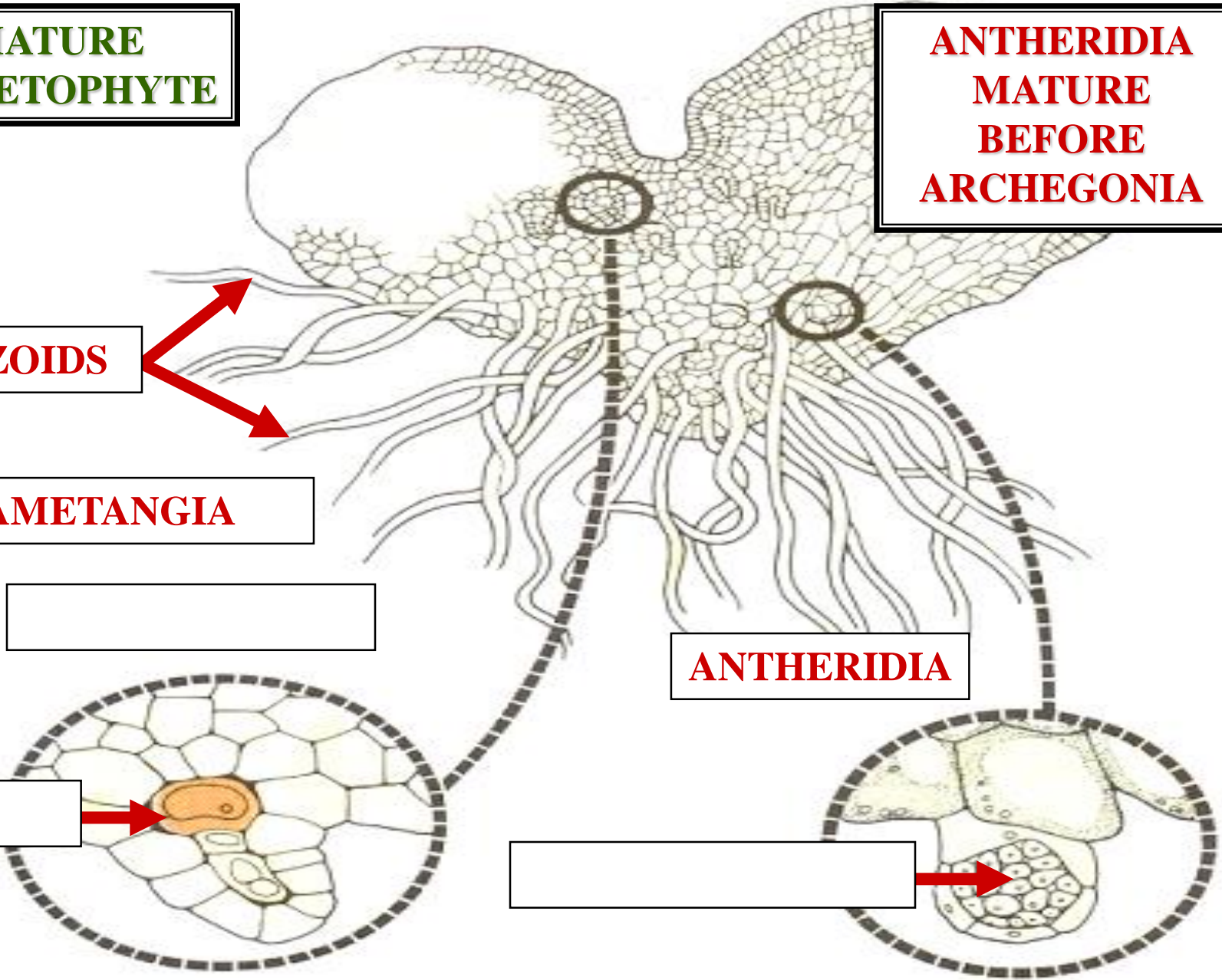
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GAMETOPHYTE**

**ANTHERIDIA
MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

GAMETANGIA

ANTHERIDIA



**MATURE
GAMETOPHYTE**

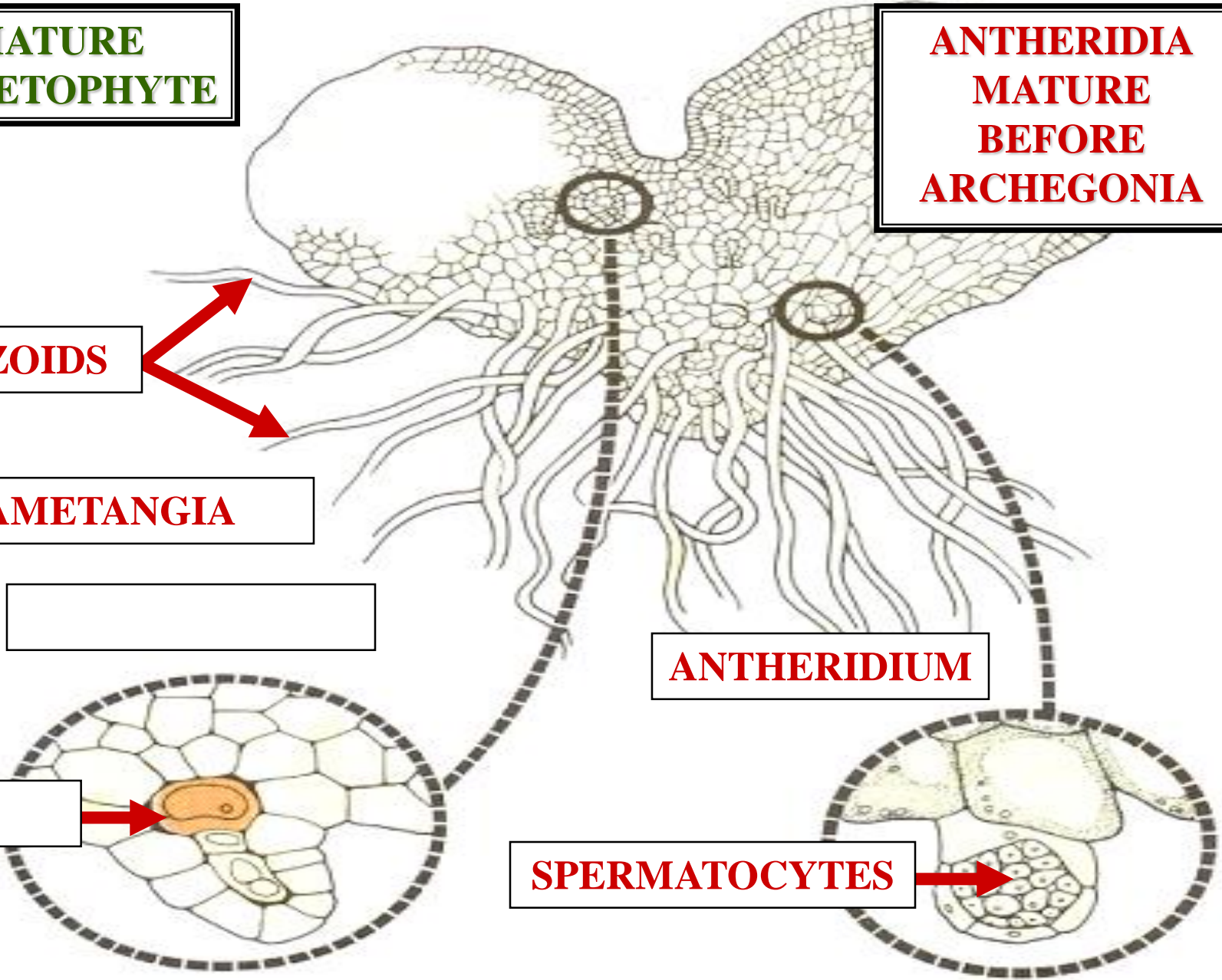
**ANTHERIDIA
MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

GAMETANGIA

ANTHERIDIUM

SPERMATOCYTES



**MATURE
GAMETOPHYTE**

**ANTHERIDIA
MATURE
BEFORE
ARCHEGONIA**

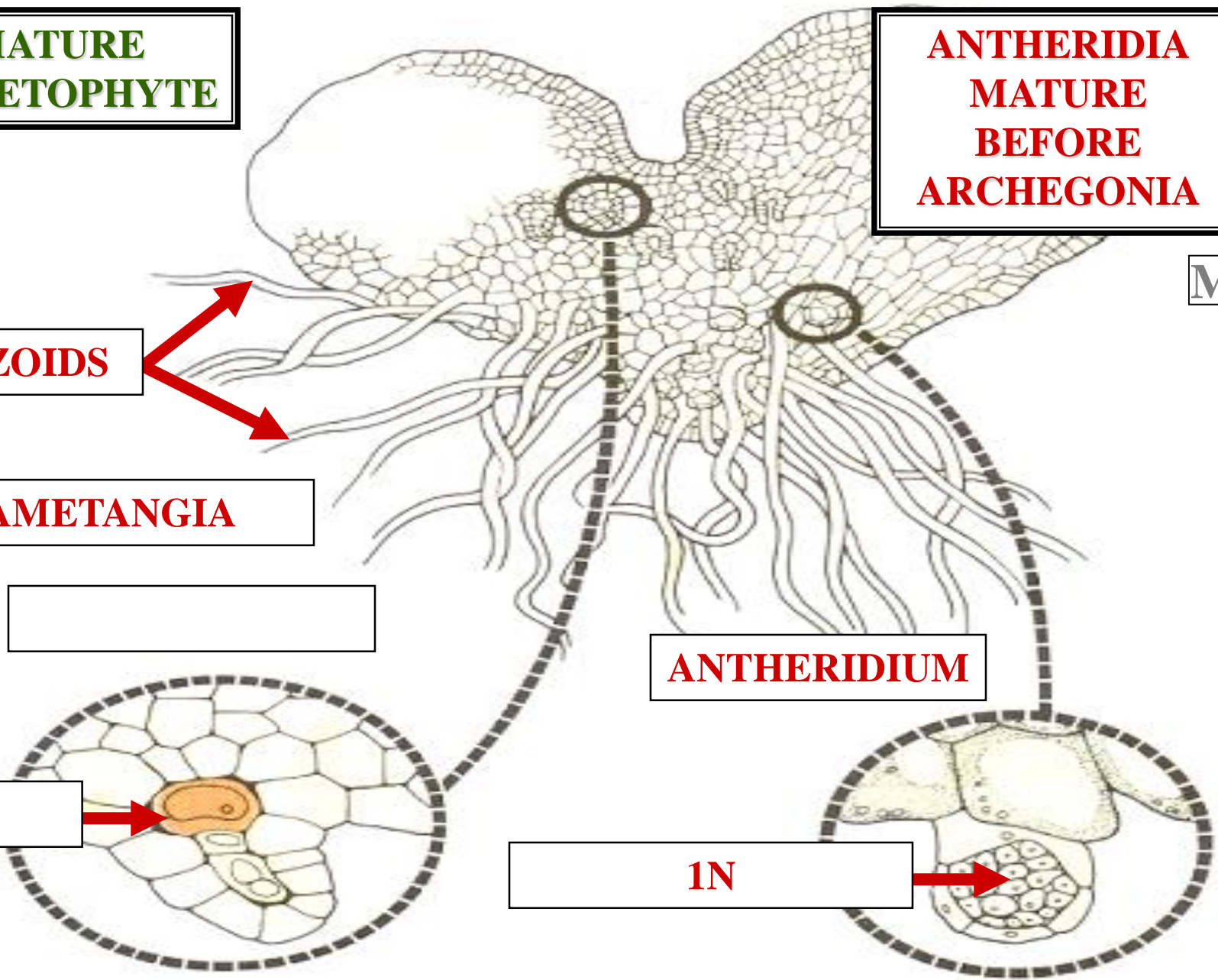
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GAMETANGIA

ANTHERIDIUM

1N

M



**MATURE
GAMETOPHYTE**

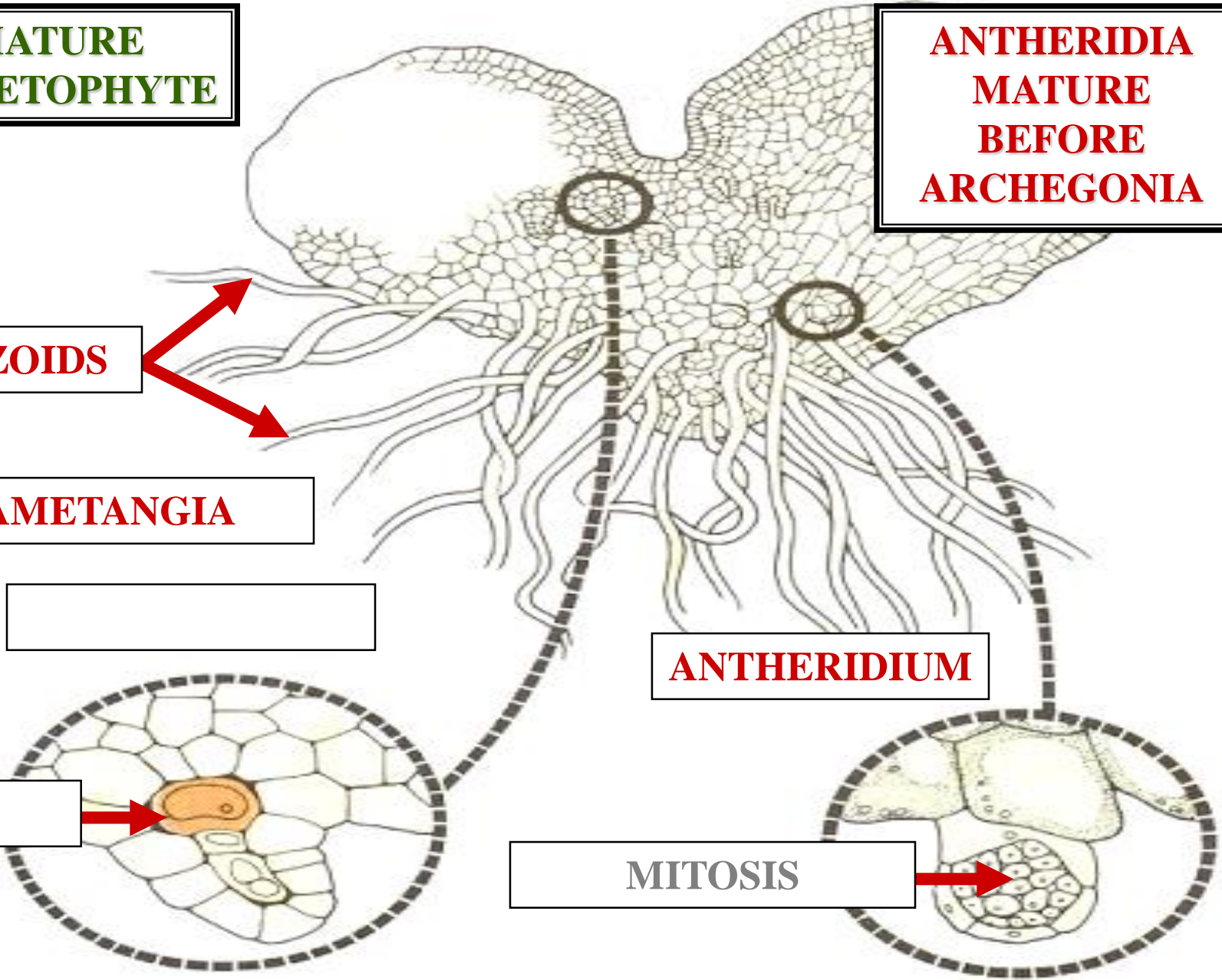
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MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

GAMETANGIA

ANTHERIDIUM

MITOSIS



**MATURE
GAMETOPHYTE**

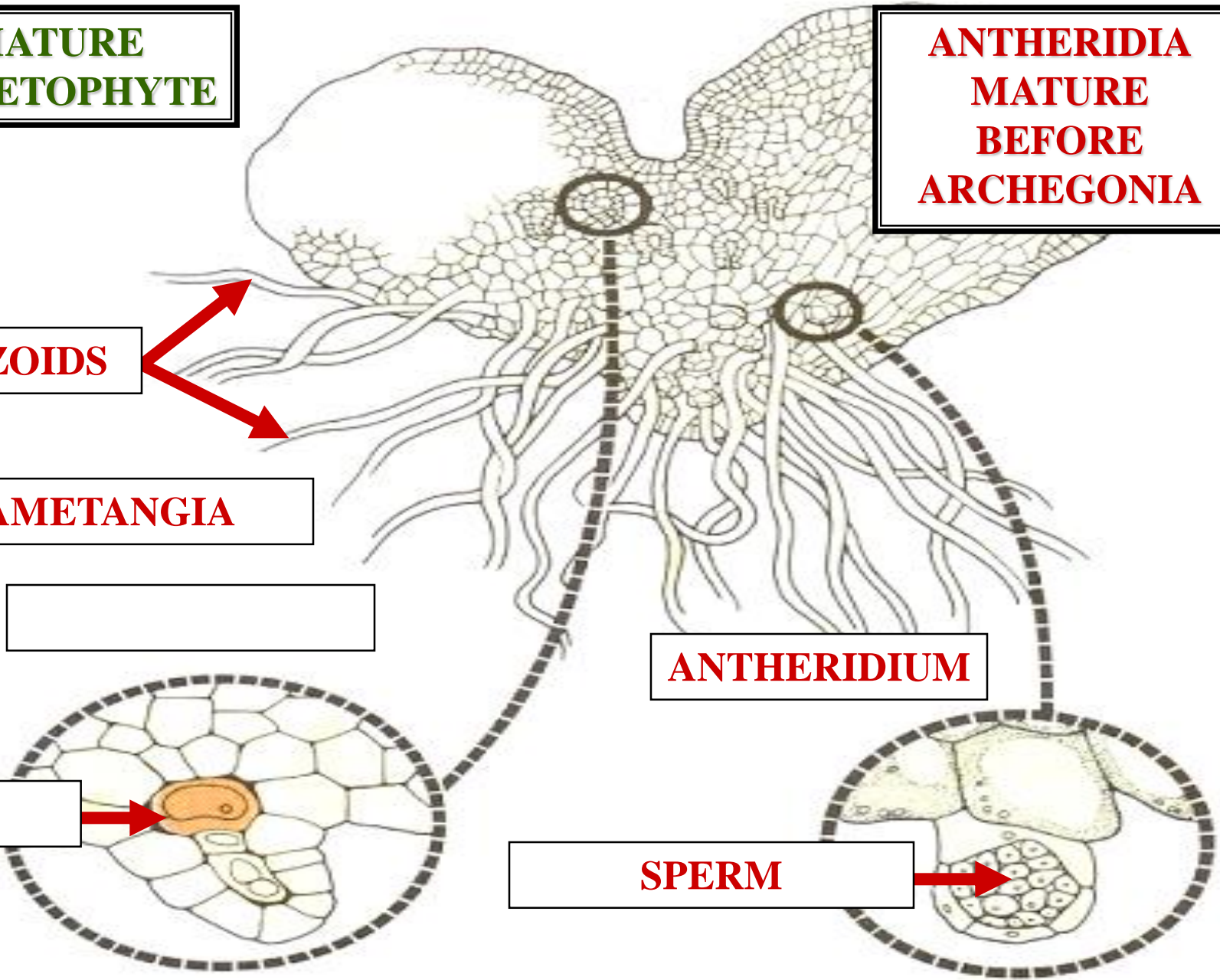
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MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

GAMETANGIA

ANTHERIDIUM

SPERM



**MATURE
GAMETOPHYTE**

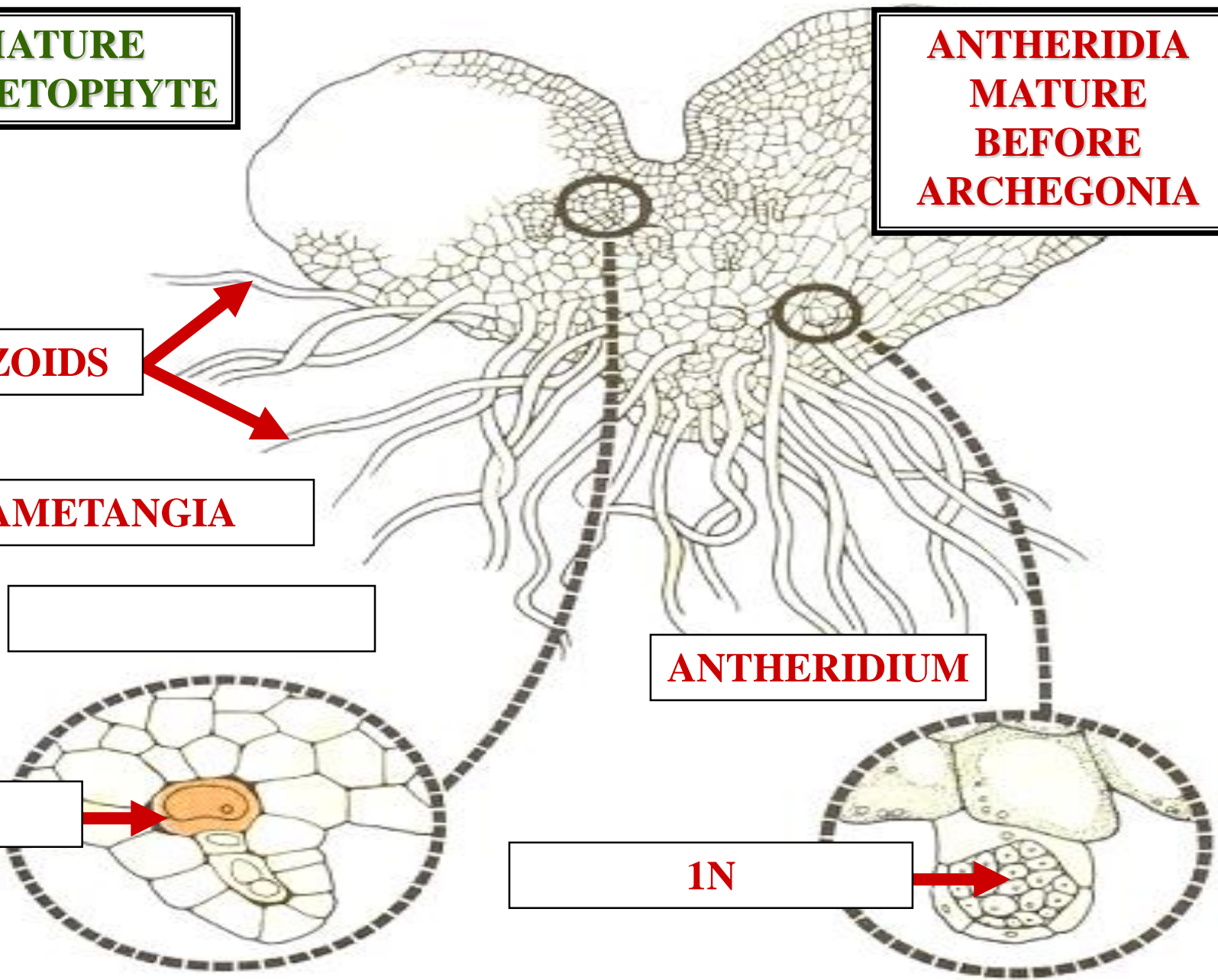
**ANTHERIDIA
MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

GAMETANGIA

ANTHERIDIUM

1N



**MATURE
GAMETOPHYTE**

**ANTHERIDIA
MATURE
BEFORE
ARCHEGONIA**

RHIZOIDS

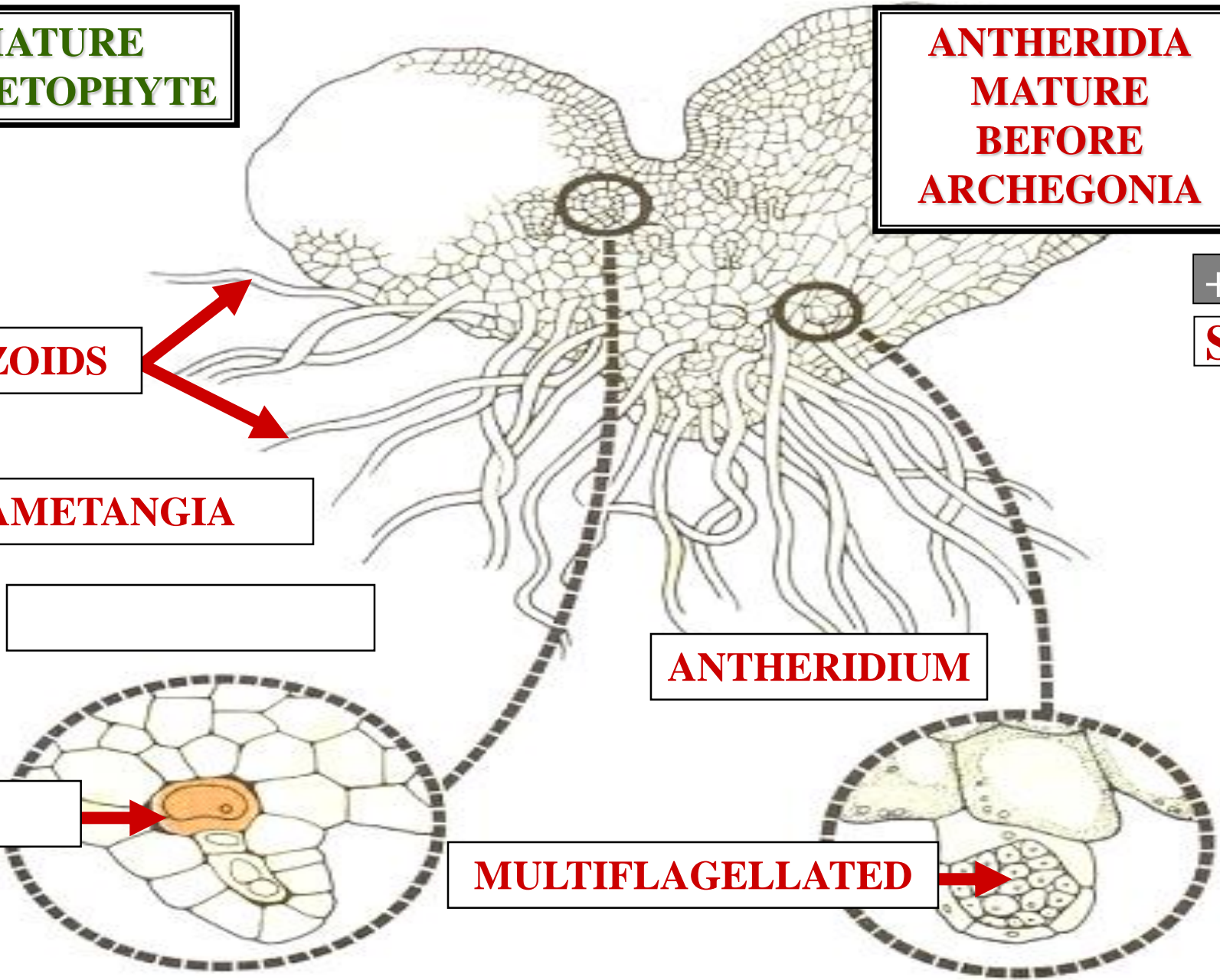
GAMETANGIA

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ANTHERIDIUM

MULTIFLAGELLATED





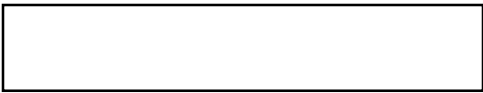
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GAMETOPHYTE**



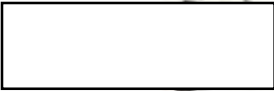
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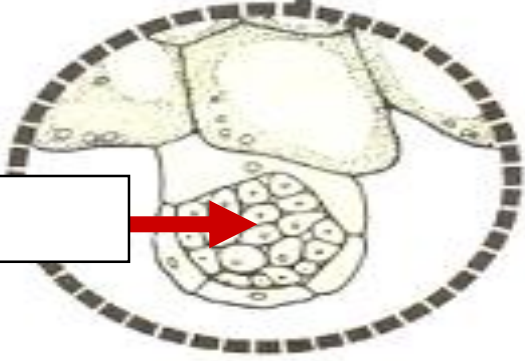
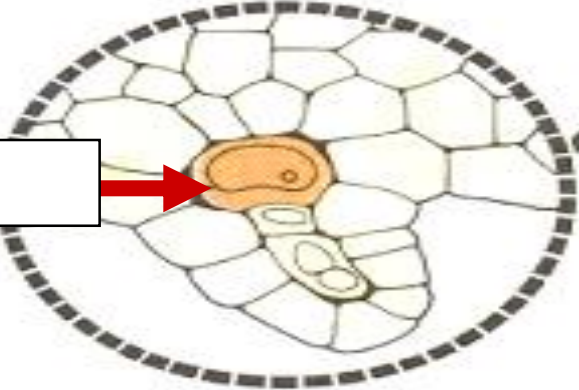
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ANTHERIDIUM



SPERM



**MATURE
GAMETOPHYTE**

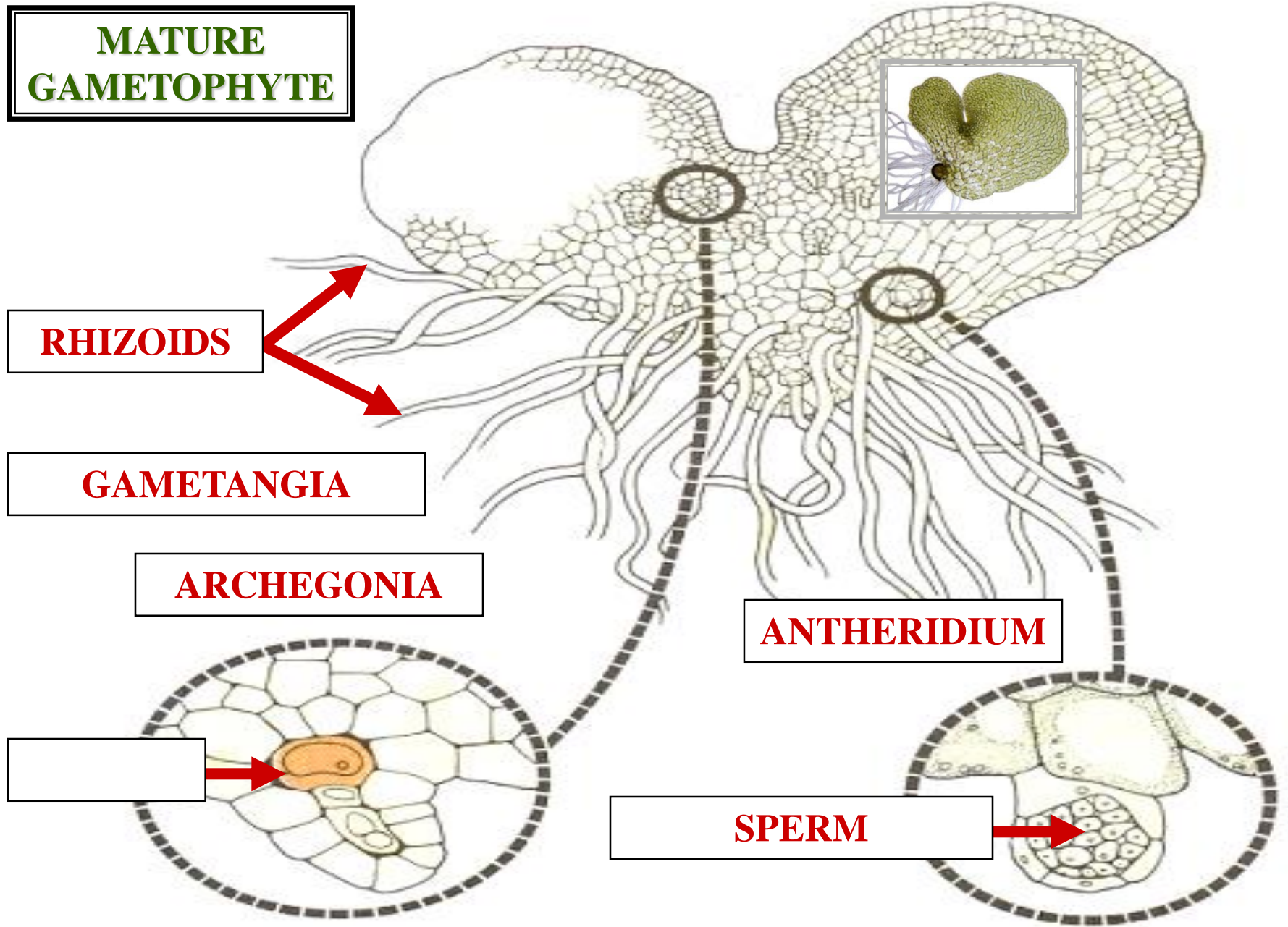
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ARCHEGONIA

ANTHERIDIUM

SPERM



**MATURE
GAMETOPHYTE**

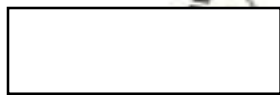
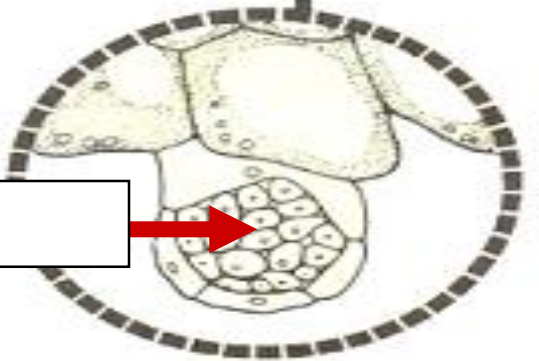
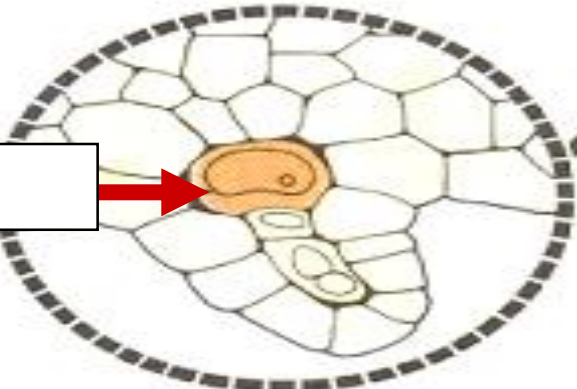
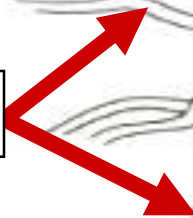
RHIZOIDS

GAMETANGIA

NEAR NOTCH

ANTHERIDIUM

SPERM



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

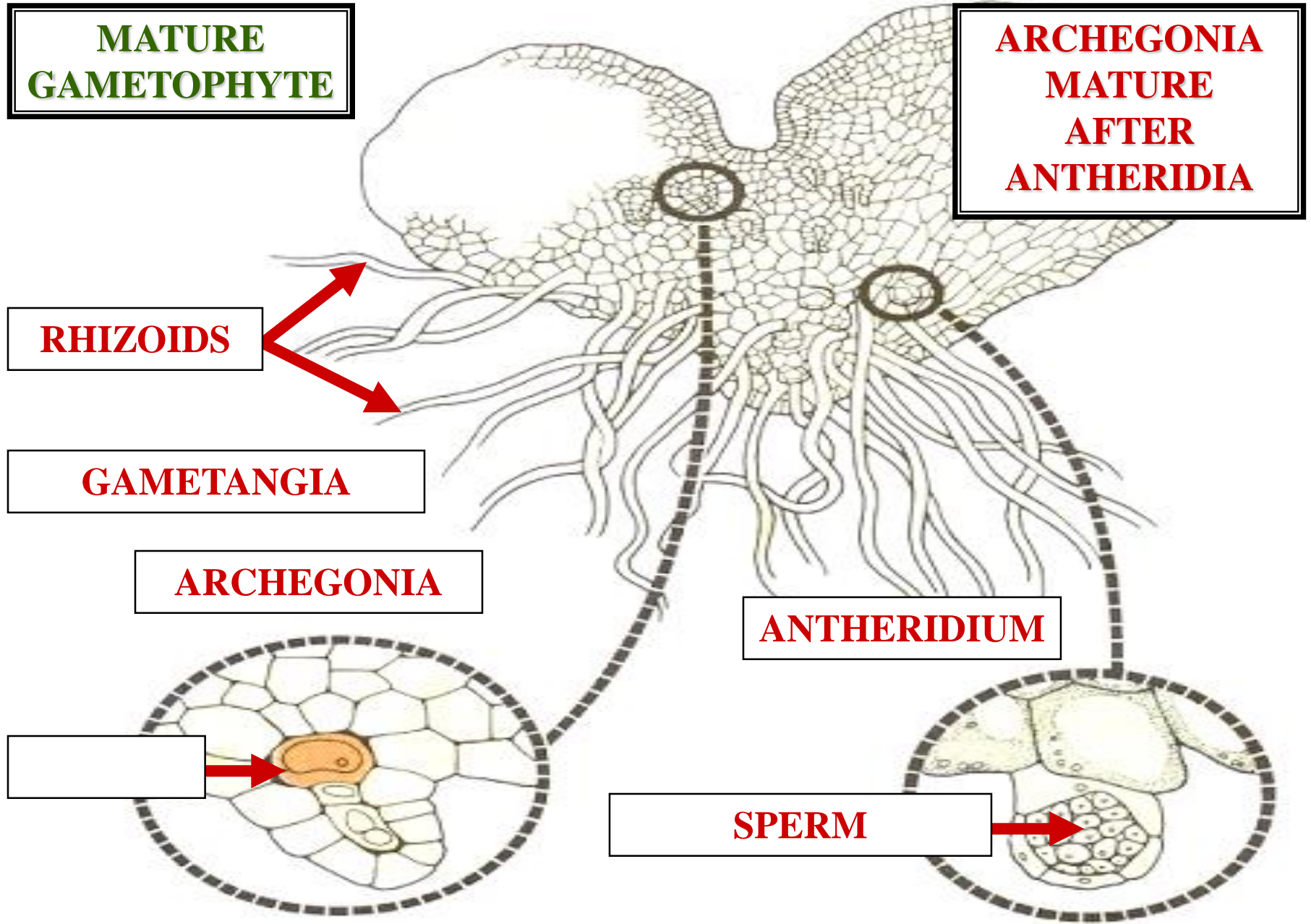
RHIZOIDS

GAMETANGIA

ARCHEGONIA

ANTHERIDIUM

SPERM



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

RHIZOIDS

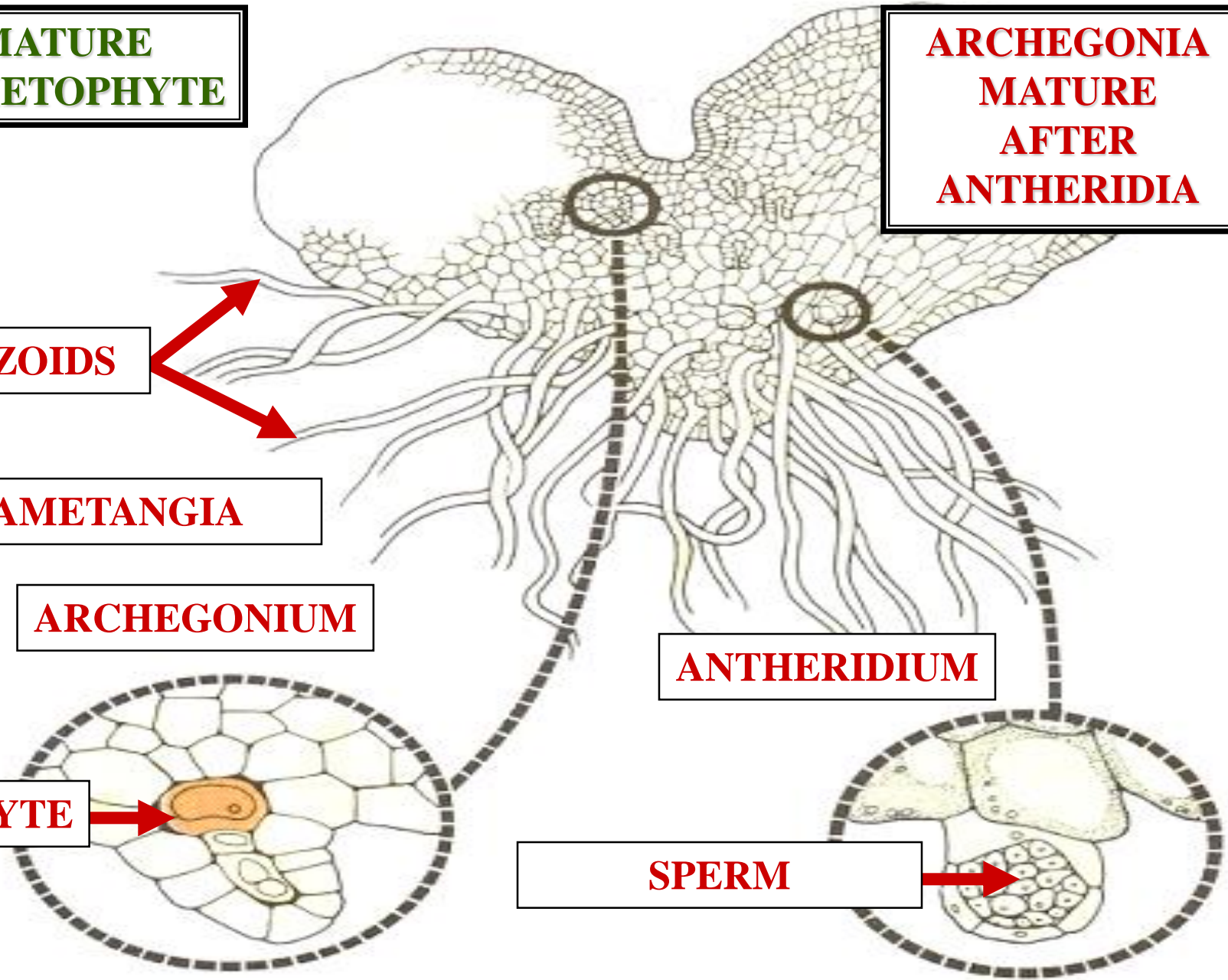
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ARCHEGONIUM

ANTHERIDIUM

OOCYTE

SPERM



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

RHIZOIDS

GAMETANGIA

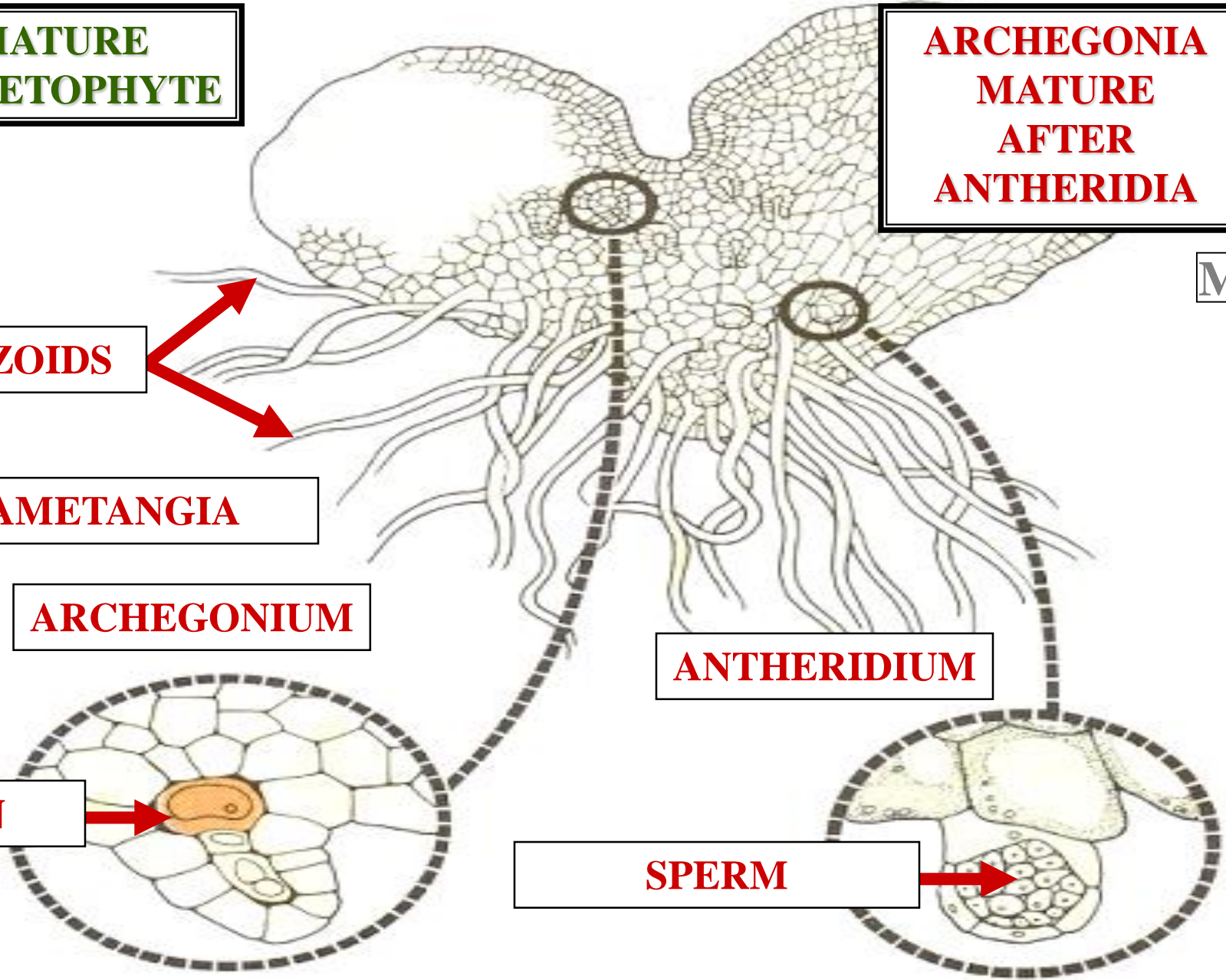
ARCHEGONIUM

ANTHERIDIUM

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SPERM

M



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

RHIZOIDS

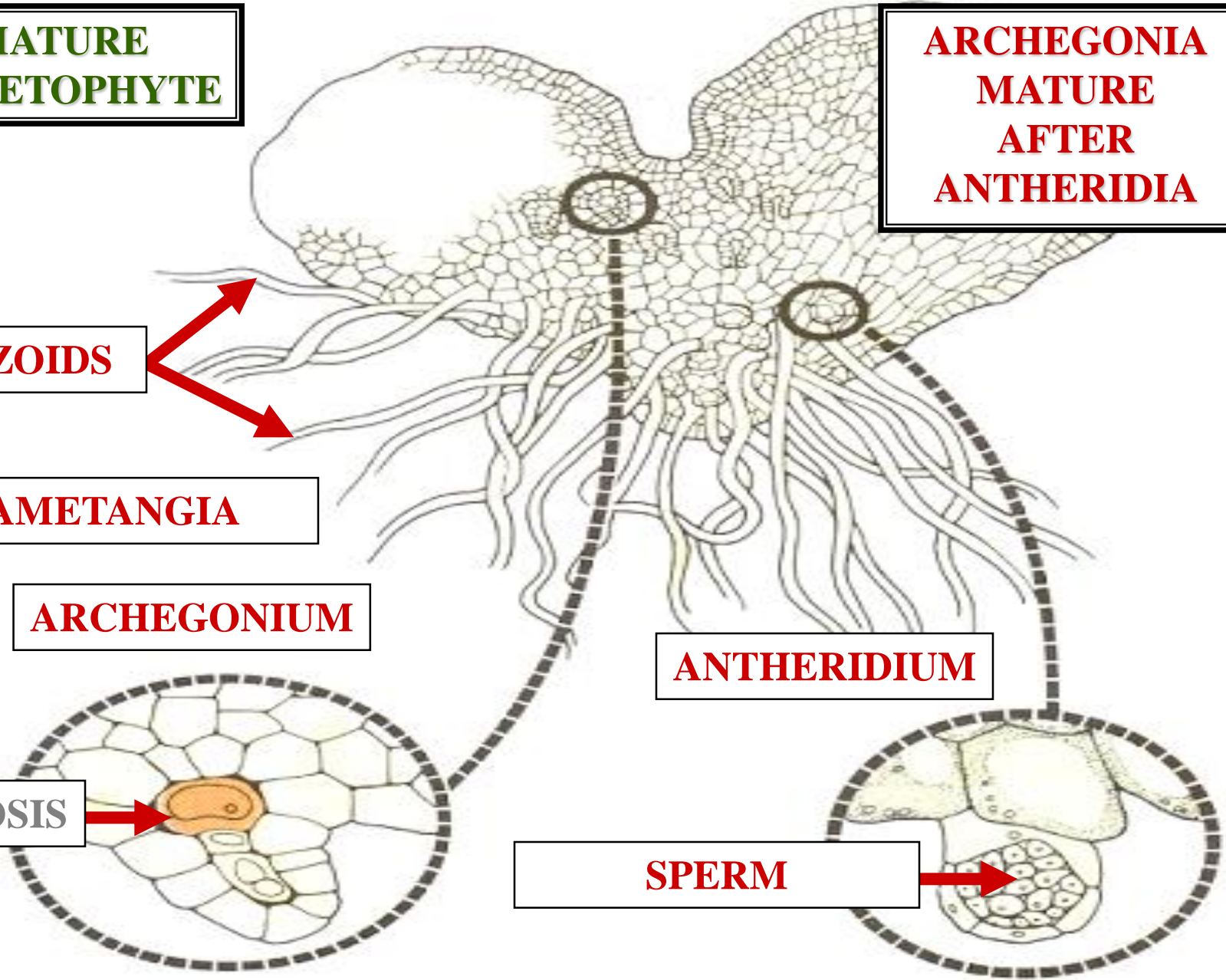
GAMETANGIA

ARCHEGONIUM

ANTHERIDIUM

MITOSIS

SPERM



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

RHIZOIDS

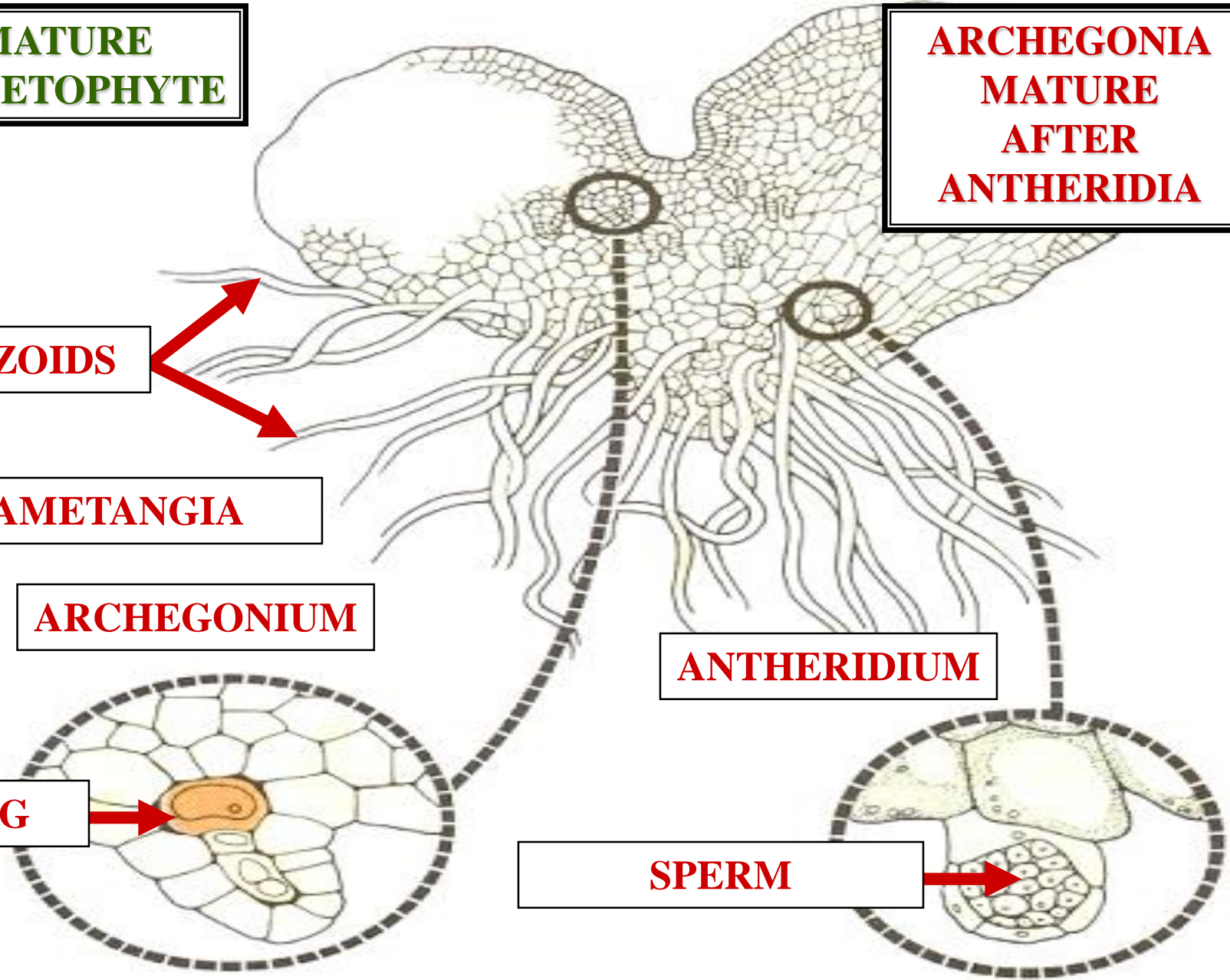
GAMETANGIA

ARCHEGONIUM

EGG

ANTHERIDIUM

SPERM



**MATURE
GAMETOPHYTE**

**ARCHEGONIA
MATURE
AFTER
ANTHERIDIA**

E

RHIZOIDS

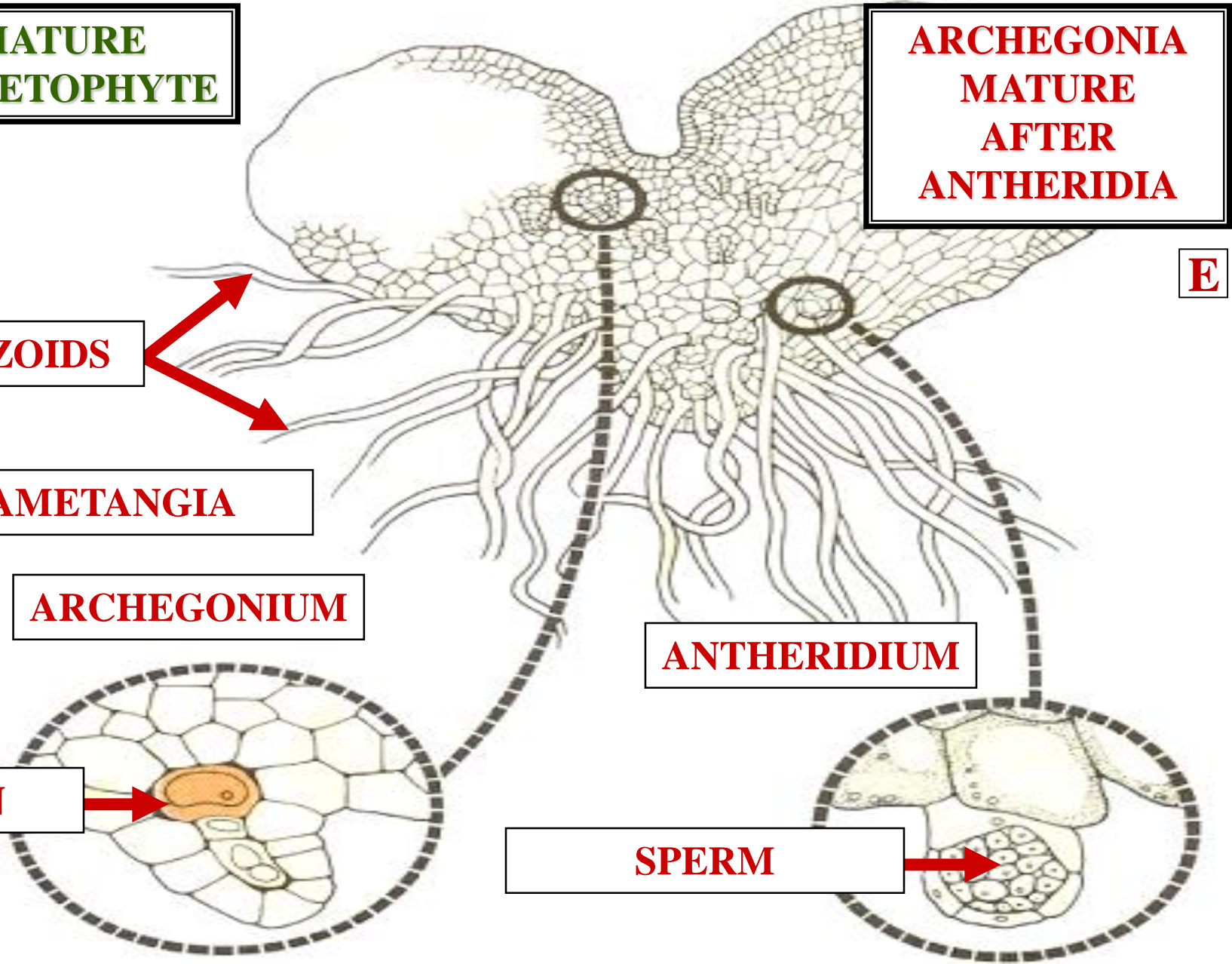
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ARCHEGONIUM

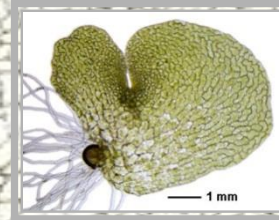
ANTHERIDIUM

1N

SPERM



**MATURE
GAMETOPHYTE**



RHIZOIDS

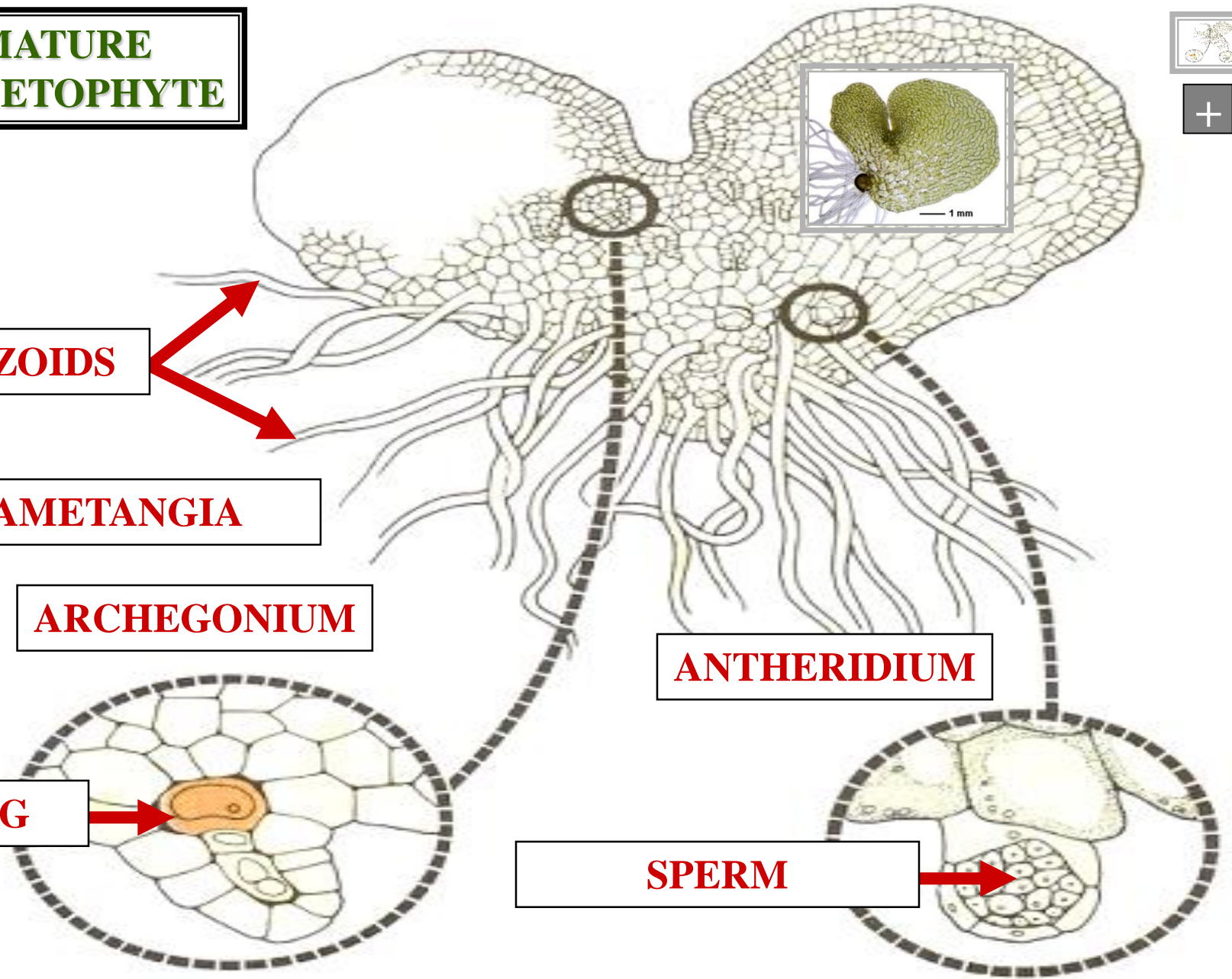
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ARCHEGONIUM

ANTHERIDIUM

EGG

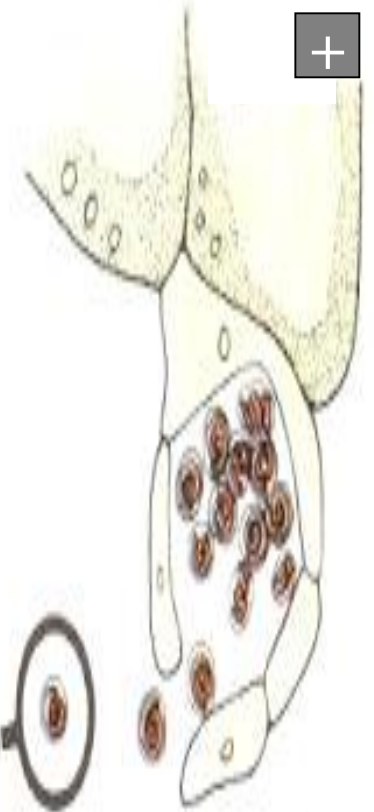
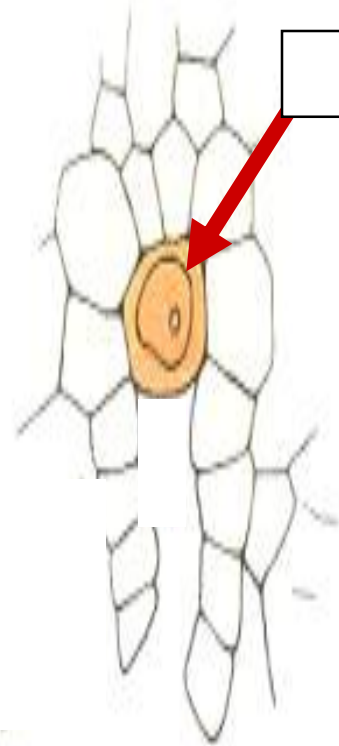
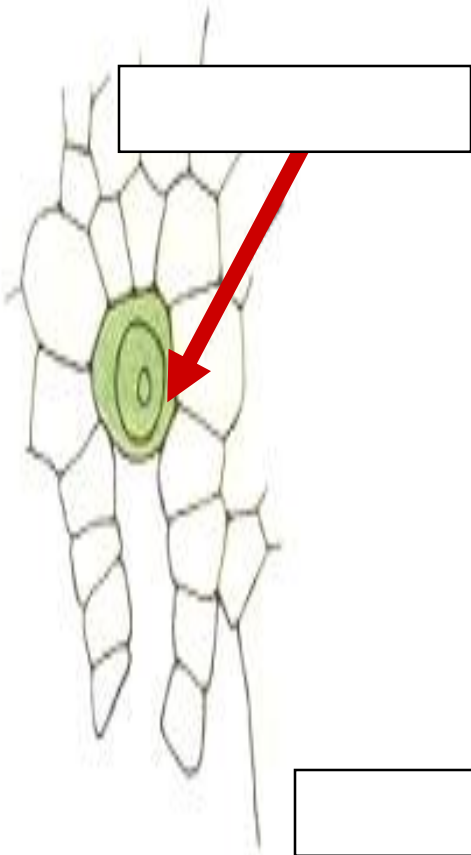
SPERM



ARCHEGONIUM

EGG

ANTHERIDIUM



**MULTIFLAGELLATED
SPERM**

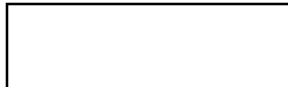
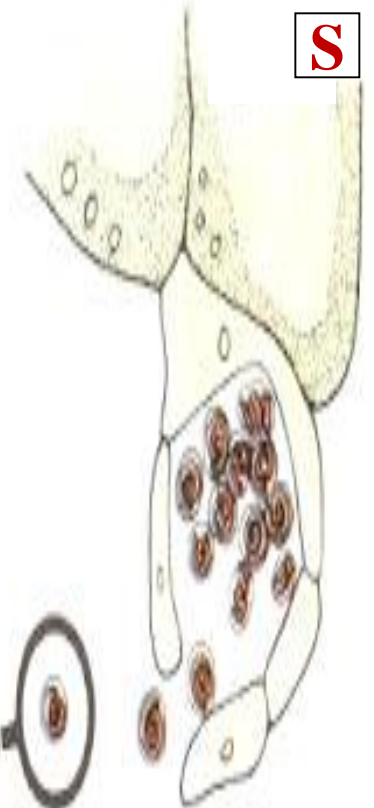
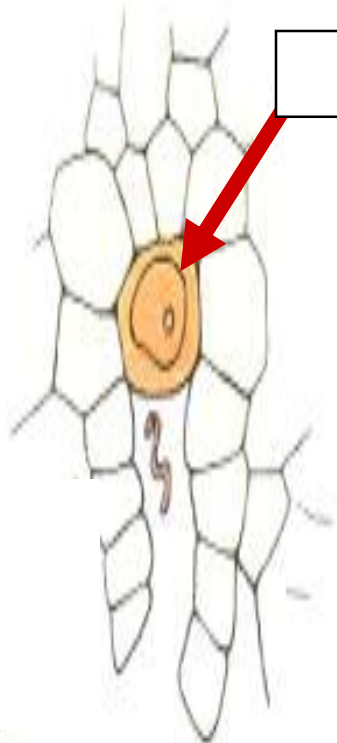
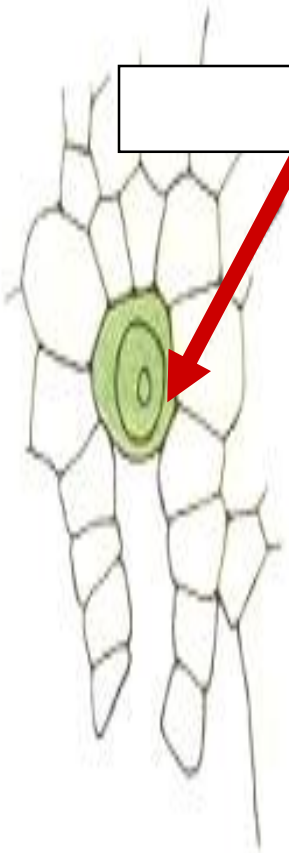


ARCHEGONIUM

EGG

ANTHERIDIUM

S



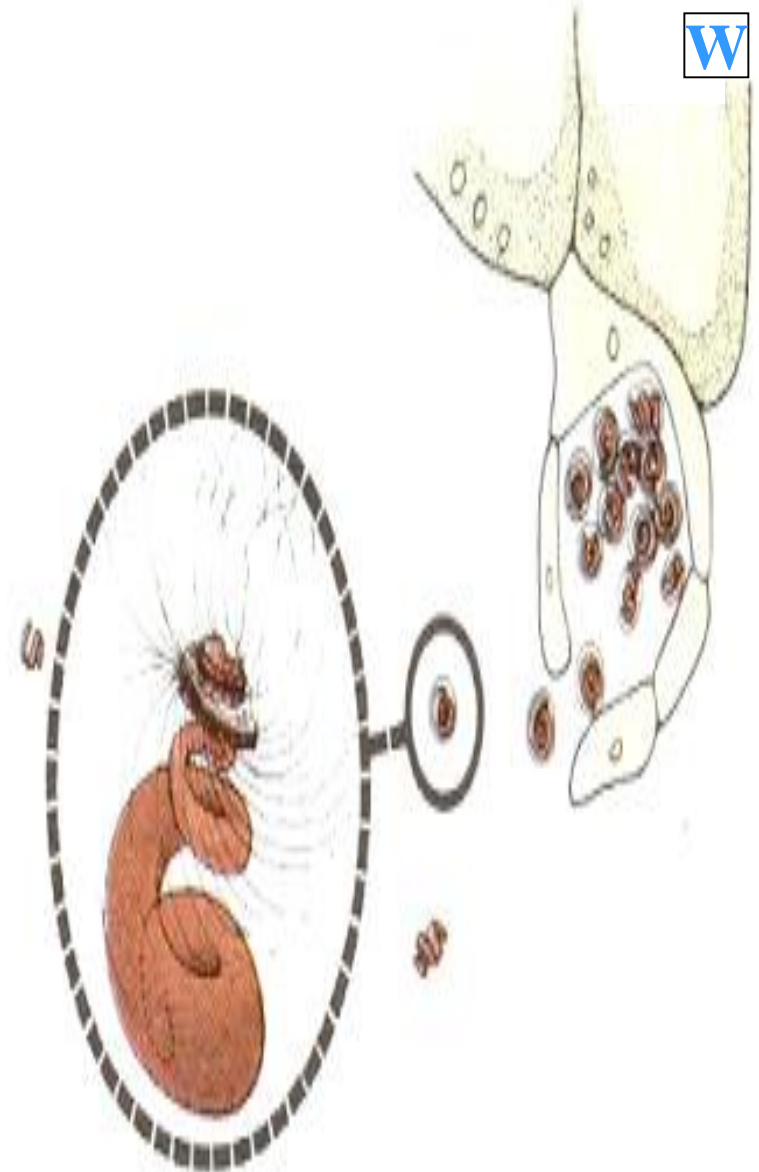
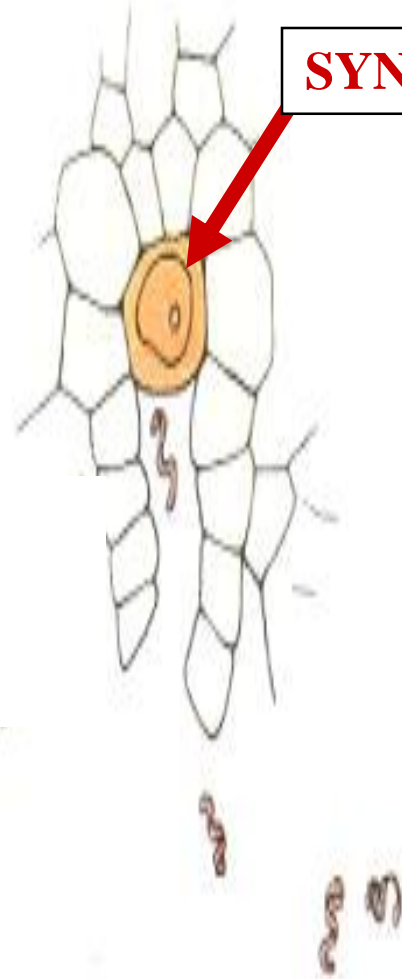
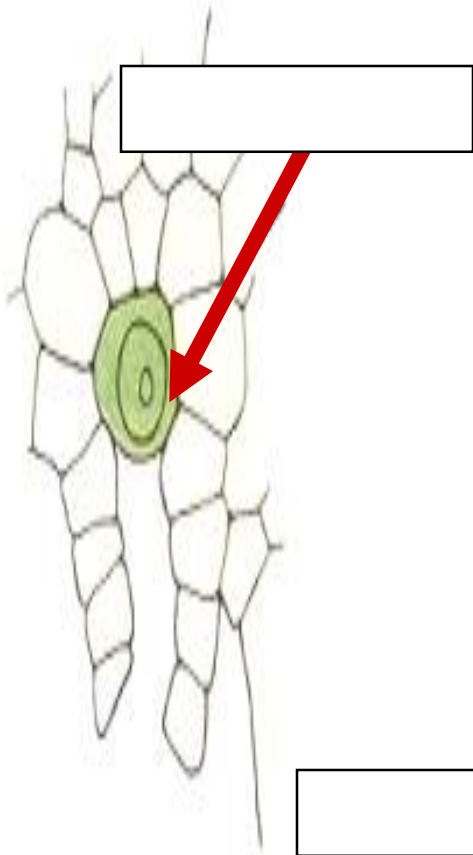
MULTIFLAGELLATED SPERM



ARCHEGONIUM

SYNGAMY

ANTHERIDIUM

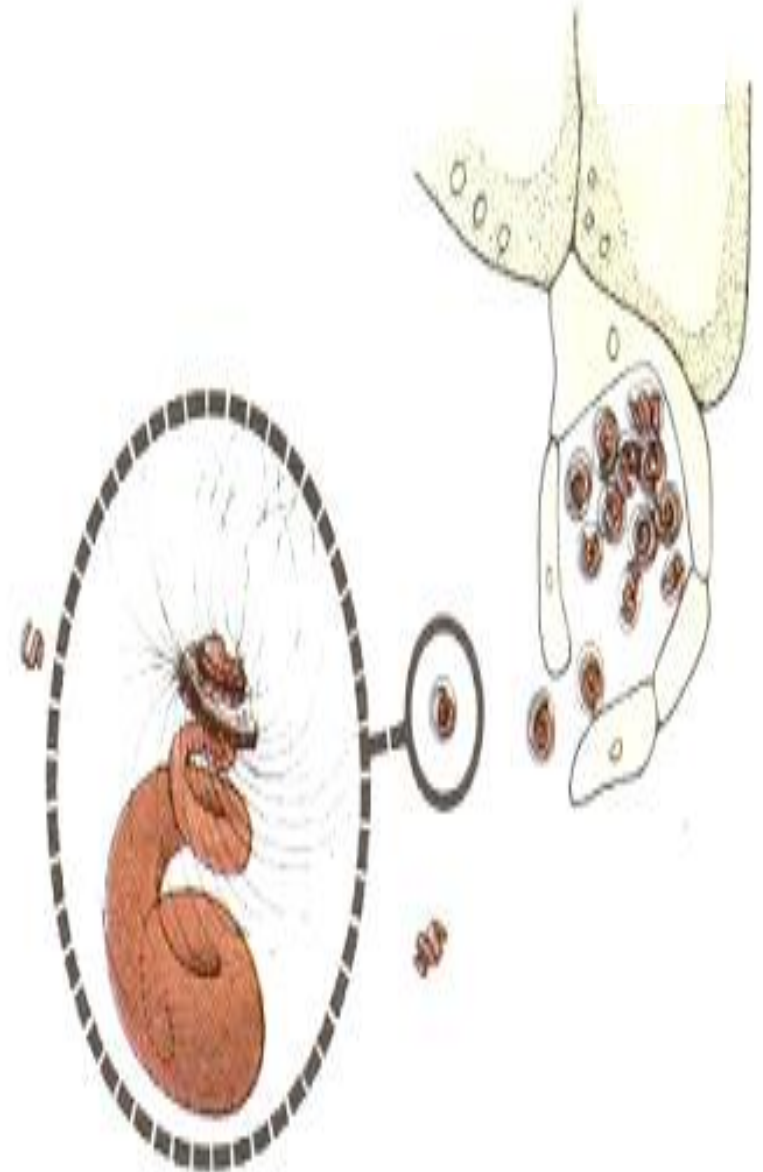
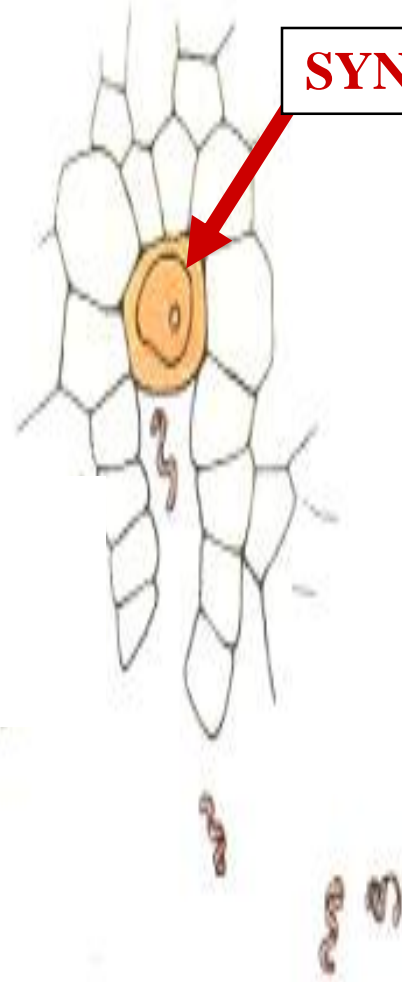
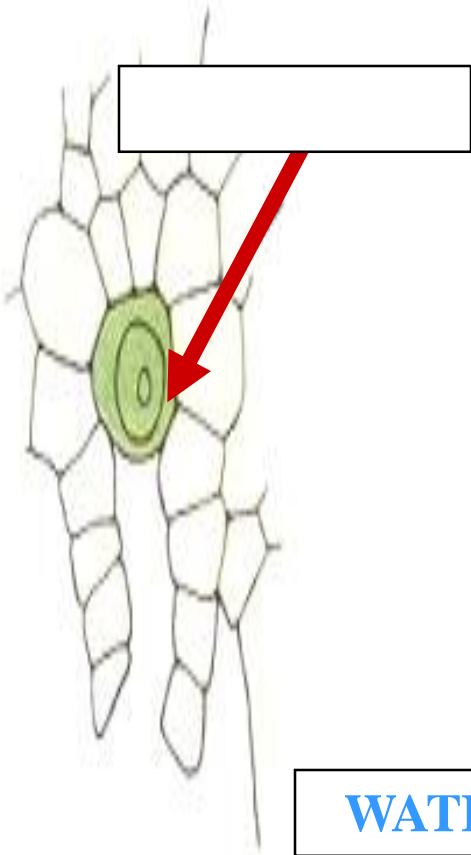


**MULTIFLAGELLATED
SPERM**

ARCHEGONIUM

SYNGAMY

ANTHERIDIUM



WATER

**MULTIFLAGELLATED
SPERM**

ARCHEGONIUM

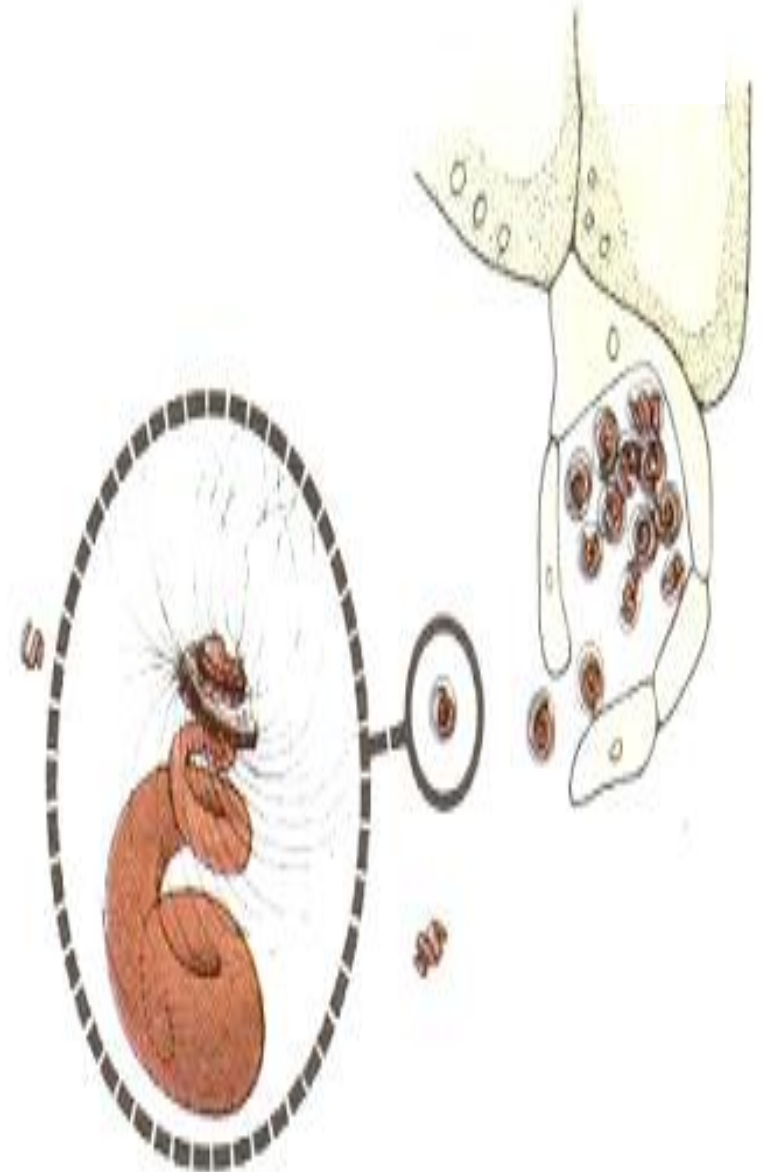
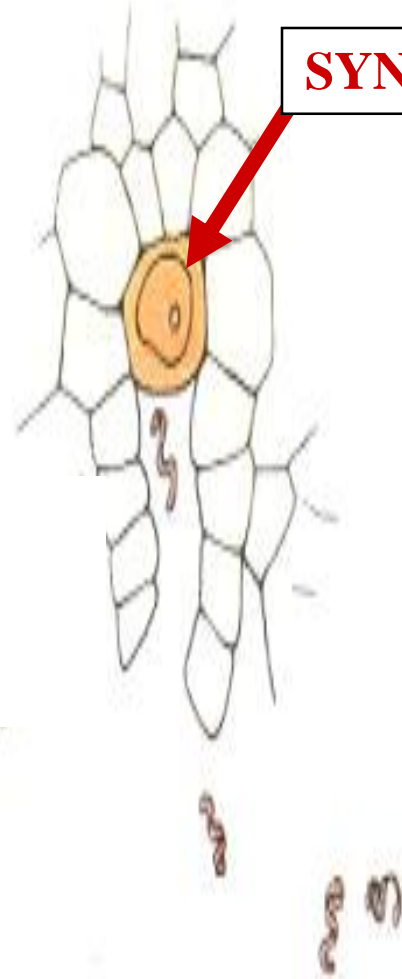
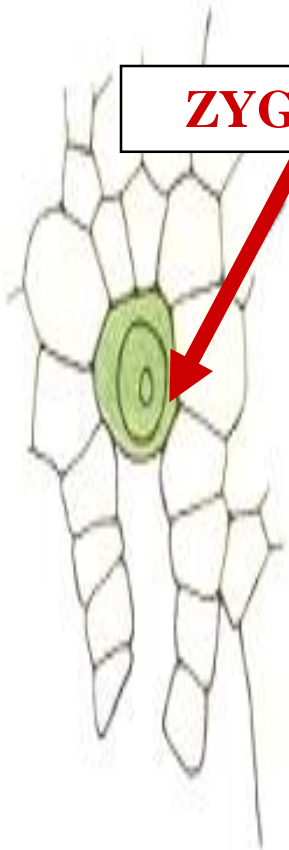
SYNGAMY

ANTHERIDIUM

ZYGOTE

WATER

**MULTIFLAGELLATED
SPERM**



ARCHEGONIUM

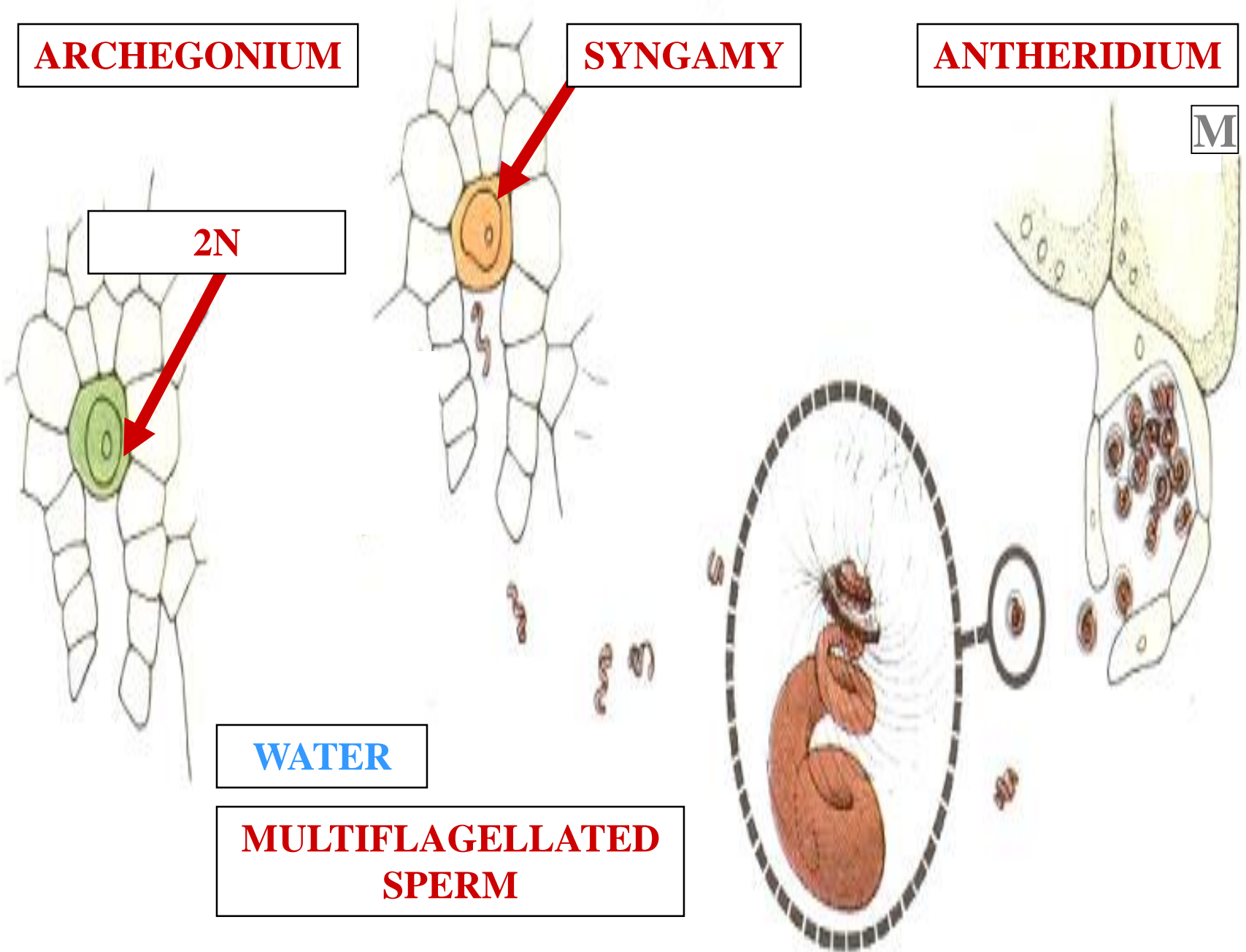
SYNGAMY

ANTHERIDIUM

2N

WATER

**MULTIFLAGELLATED
SPERM**



ARCHEGONIUM

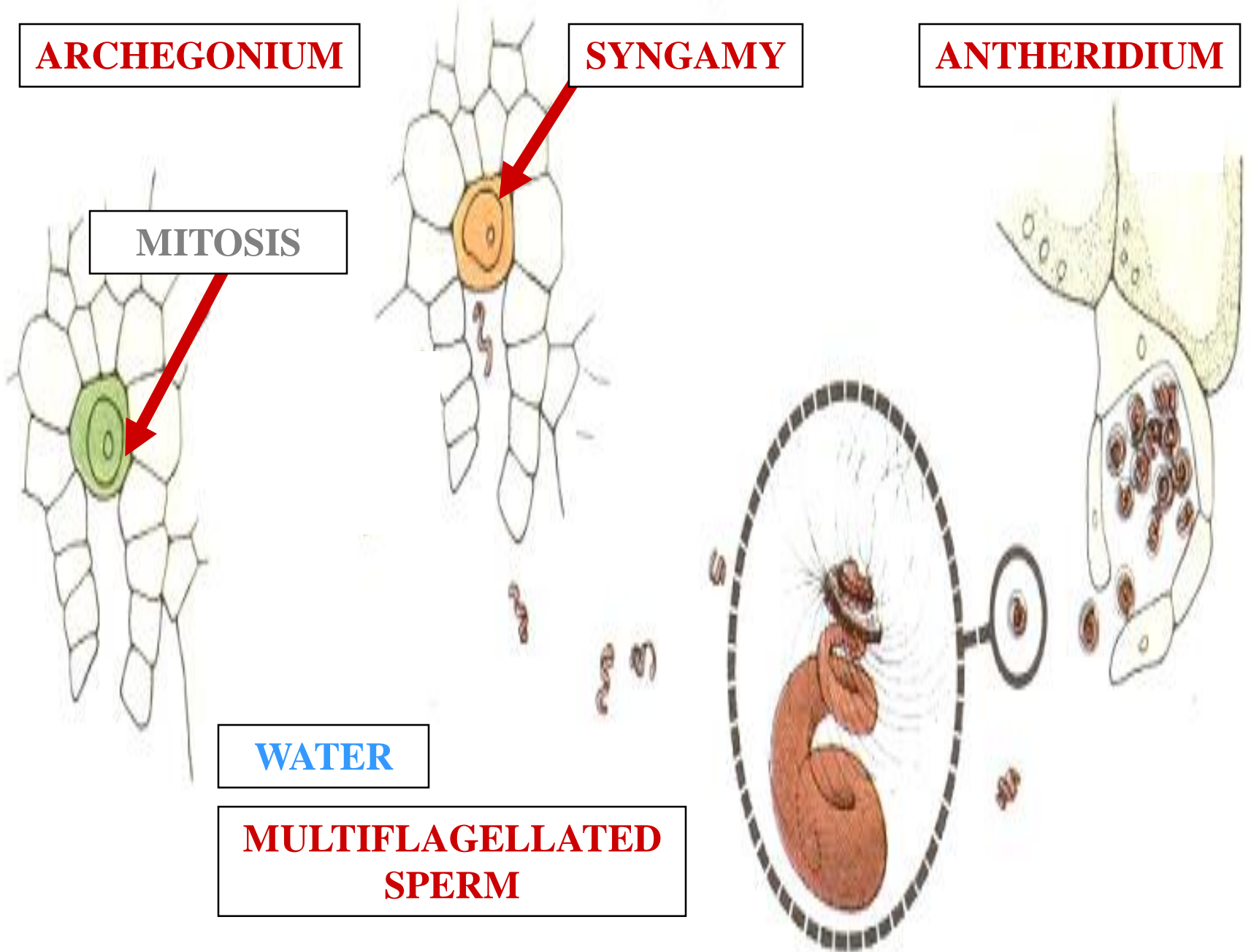
SYNGAMY

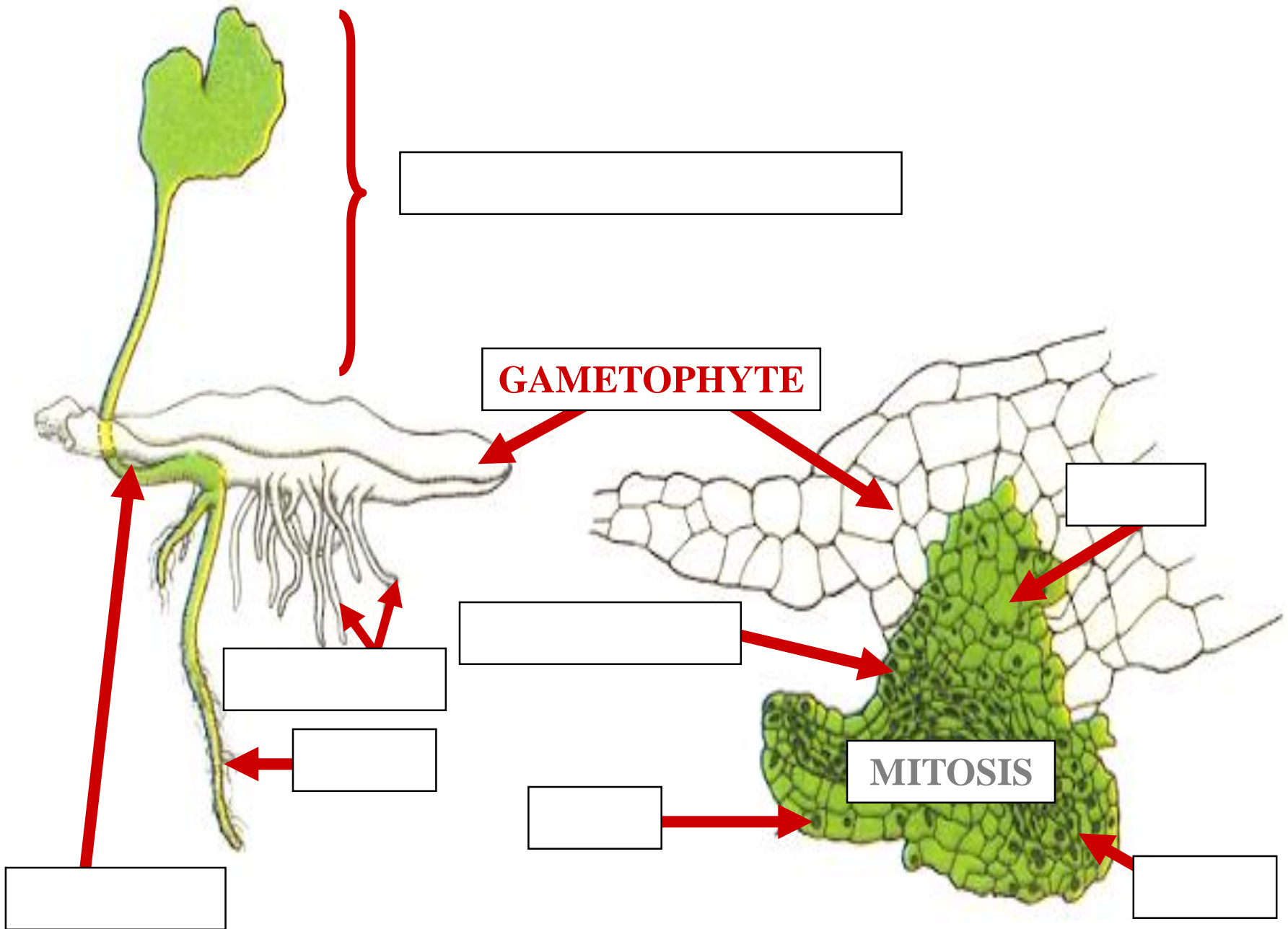
ANTHERIDIUM

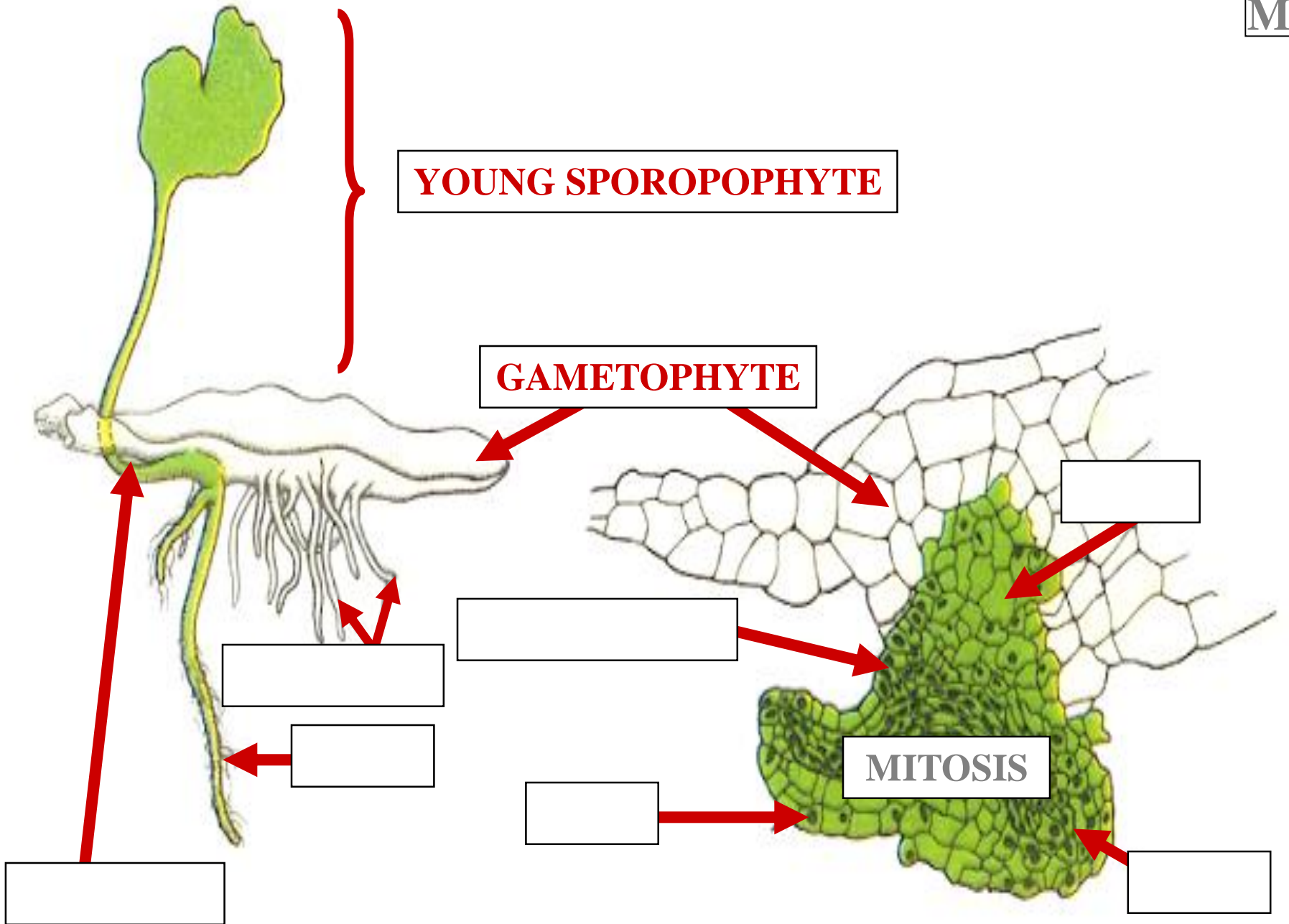
MITOSIS

WATER

**MULTIFLAGELLATED
SPERM**







YOUNG SPOROPOPHYTE

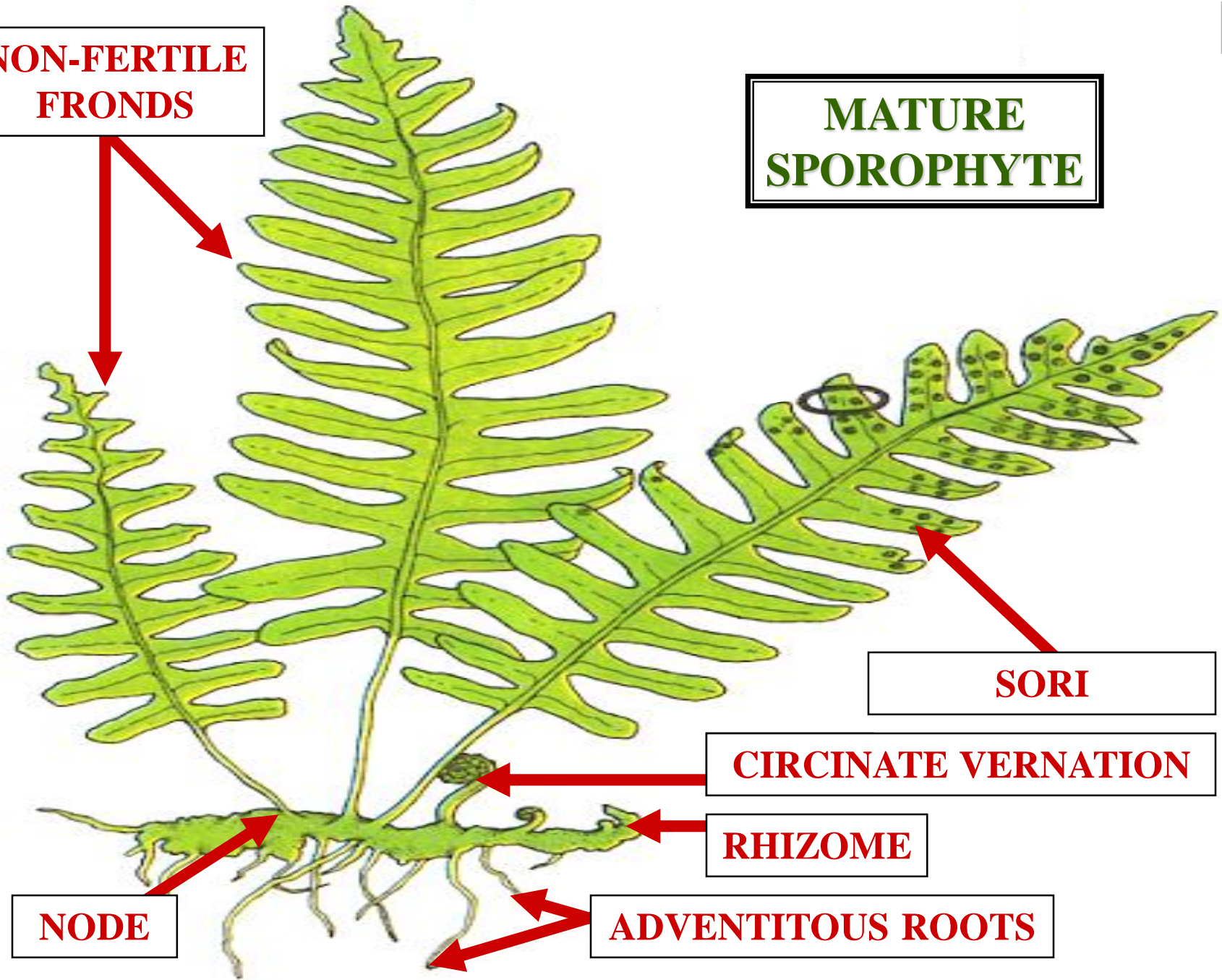
GAMETOPHYTE

MITOSIS



NON-FERTILE FRONDS

MATURE SPOROPHYTE



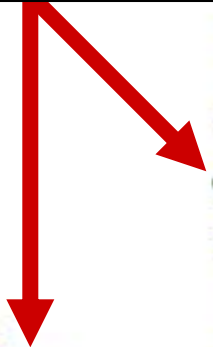
SORI

CIRCINATE VERNATION

RHIZOME

ADVENTITIOUS ROOTS

NODE





POLYPODIUM



PTERIDOPHYTA CLASSIFICATION

**EXTANT
ORDER**

MARSILEALES

**EXTANT
ORDER**

COMMON NAME



CLOVER WATER FERNS

CLOVER LEAF



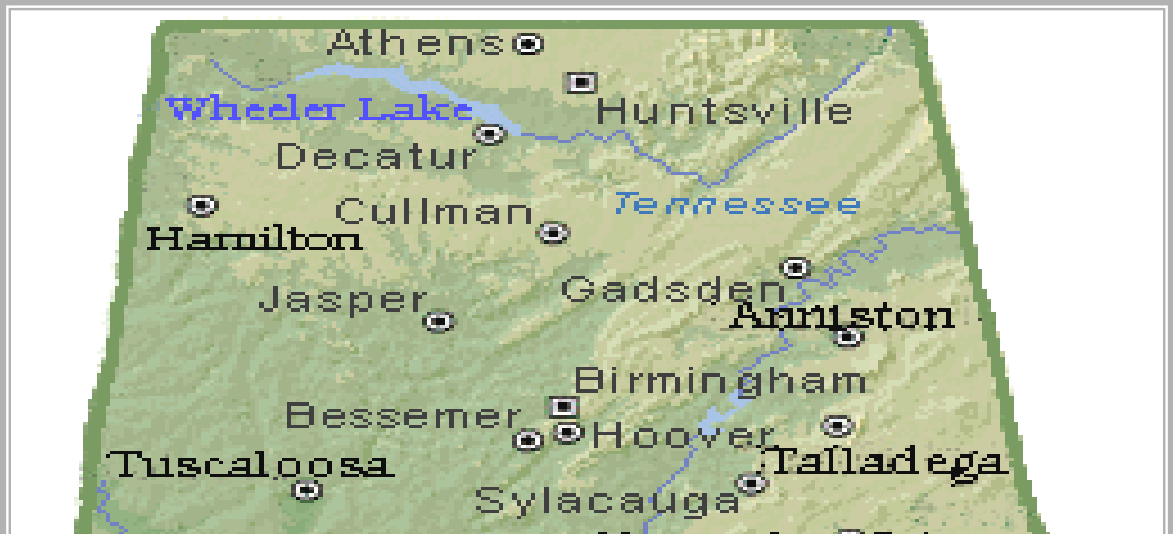


DIVERSITY



~56 SPECIES

EARTH

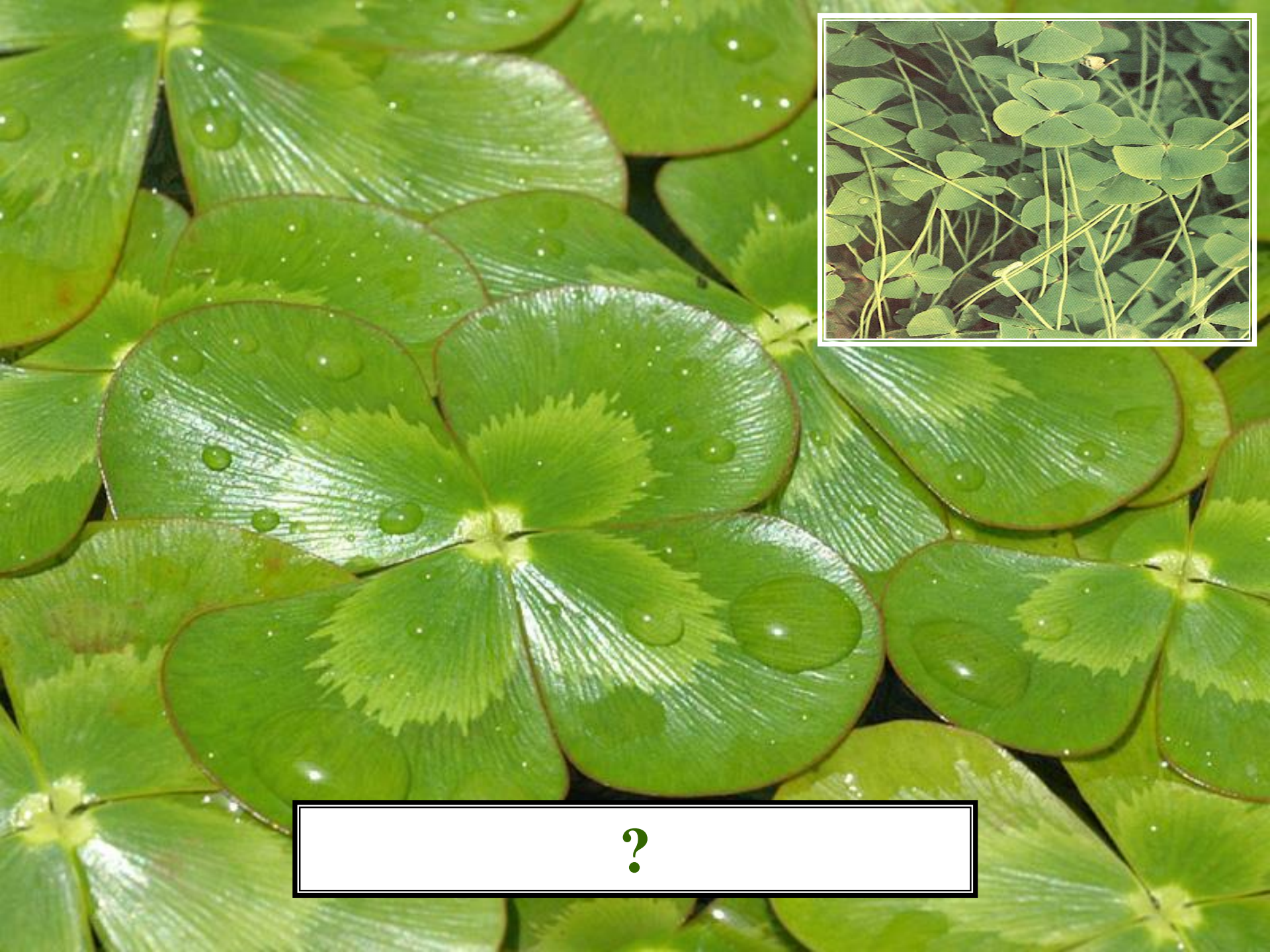


1 SPECIES

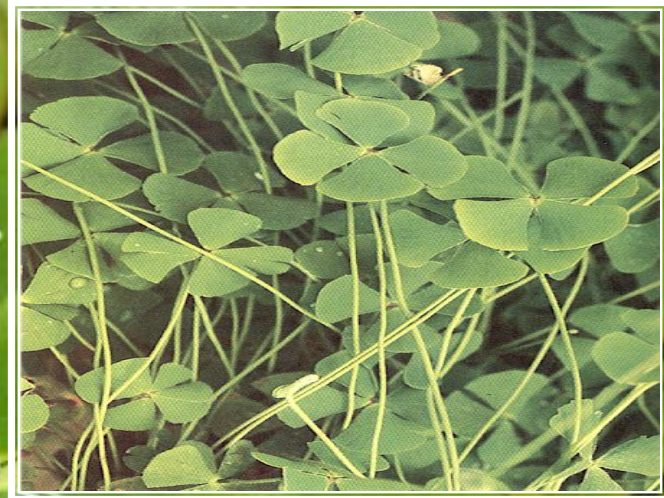




REPRESENTATIVE GENUS



?



MARSILEA



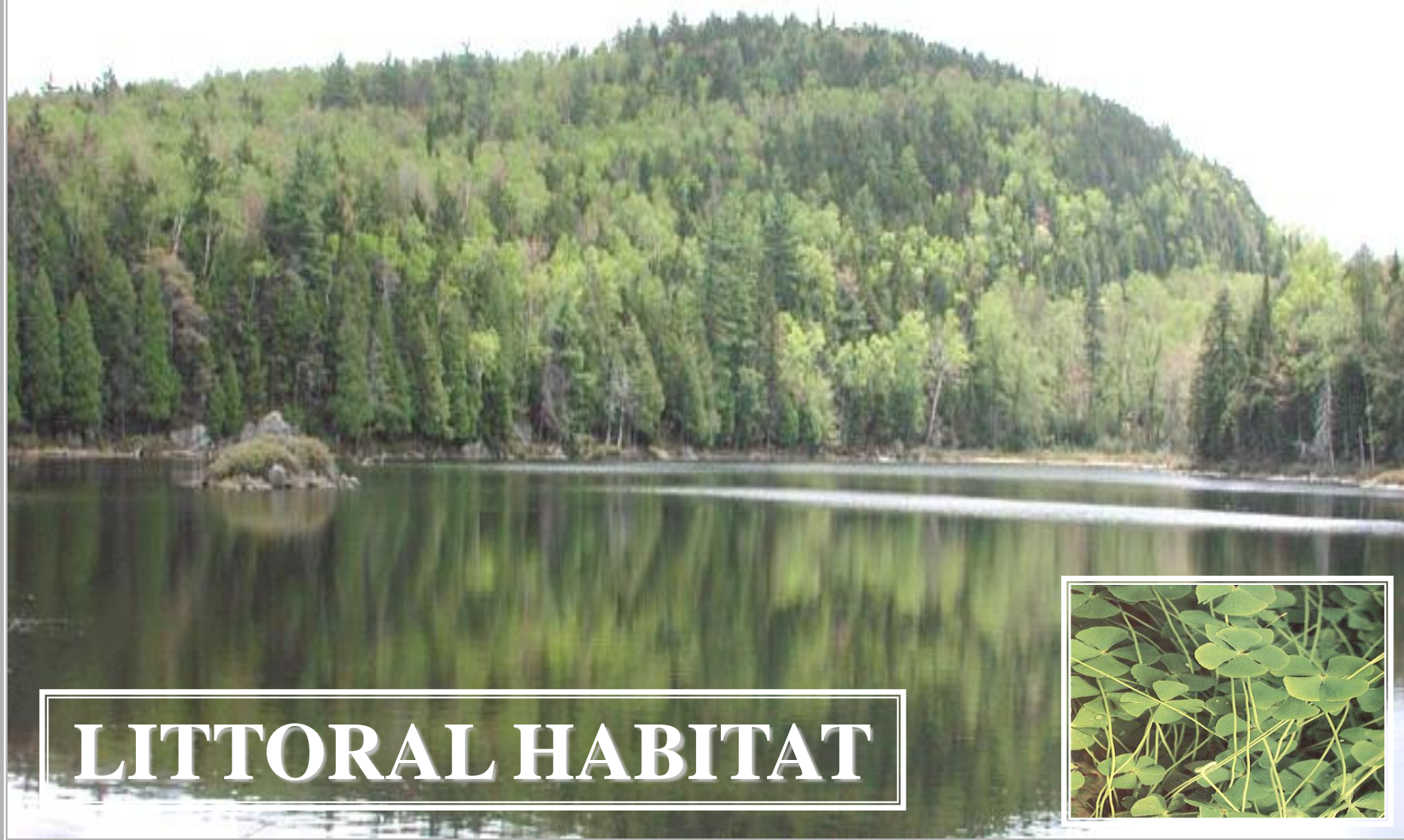
HABITAT

ALABAMA LAKE OR ALABAMA POND



AQUATIC HABITAT

ALABAMA LAKE OR ALABAMA POND



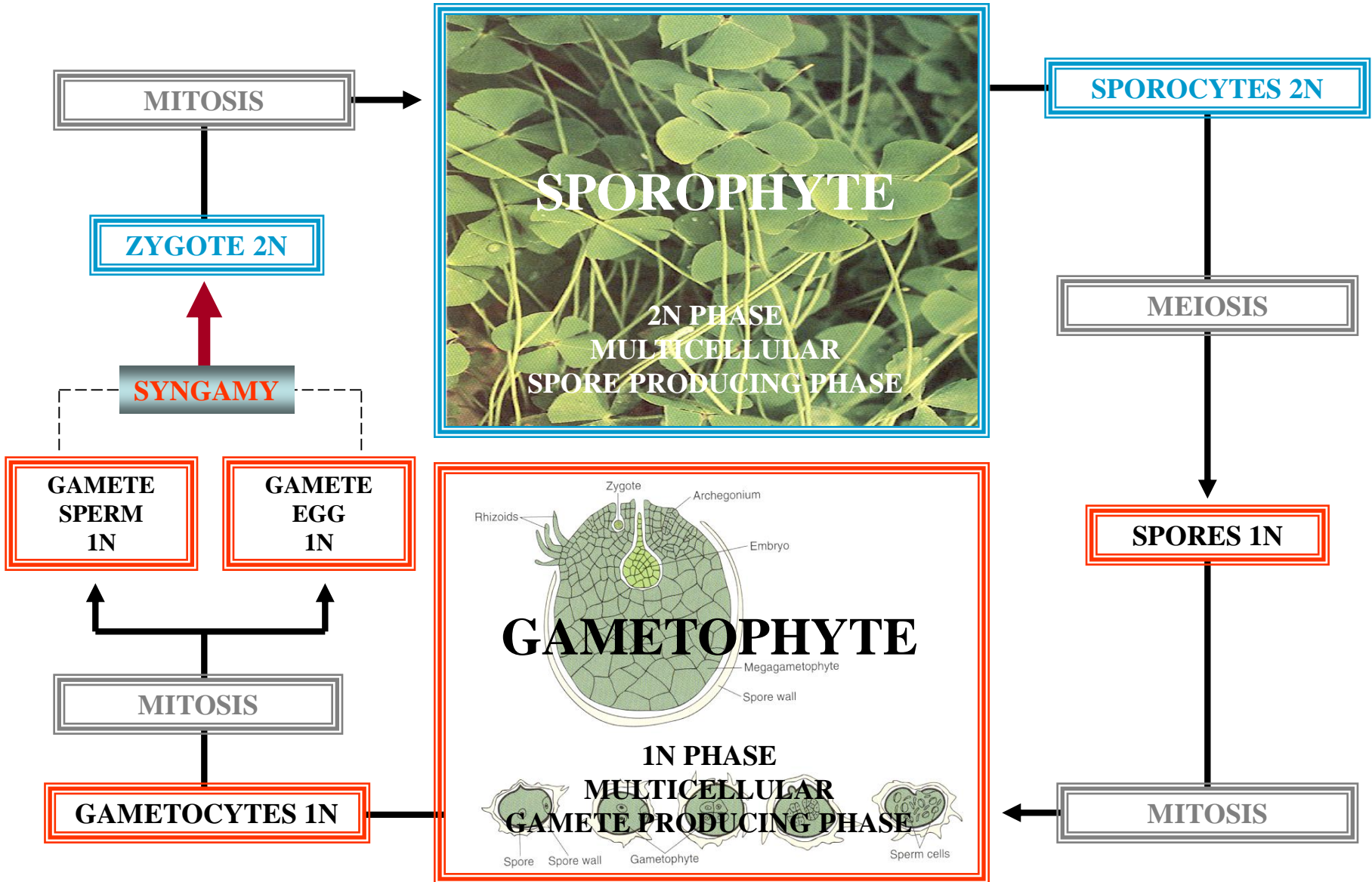
LITTORAL HABITAT





GENERAL CHARACTERS

MARSILEALES LIFE CYCLE



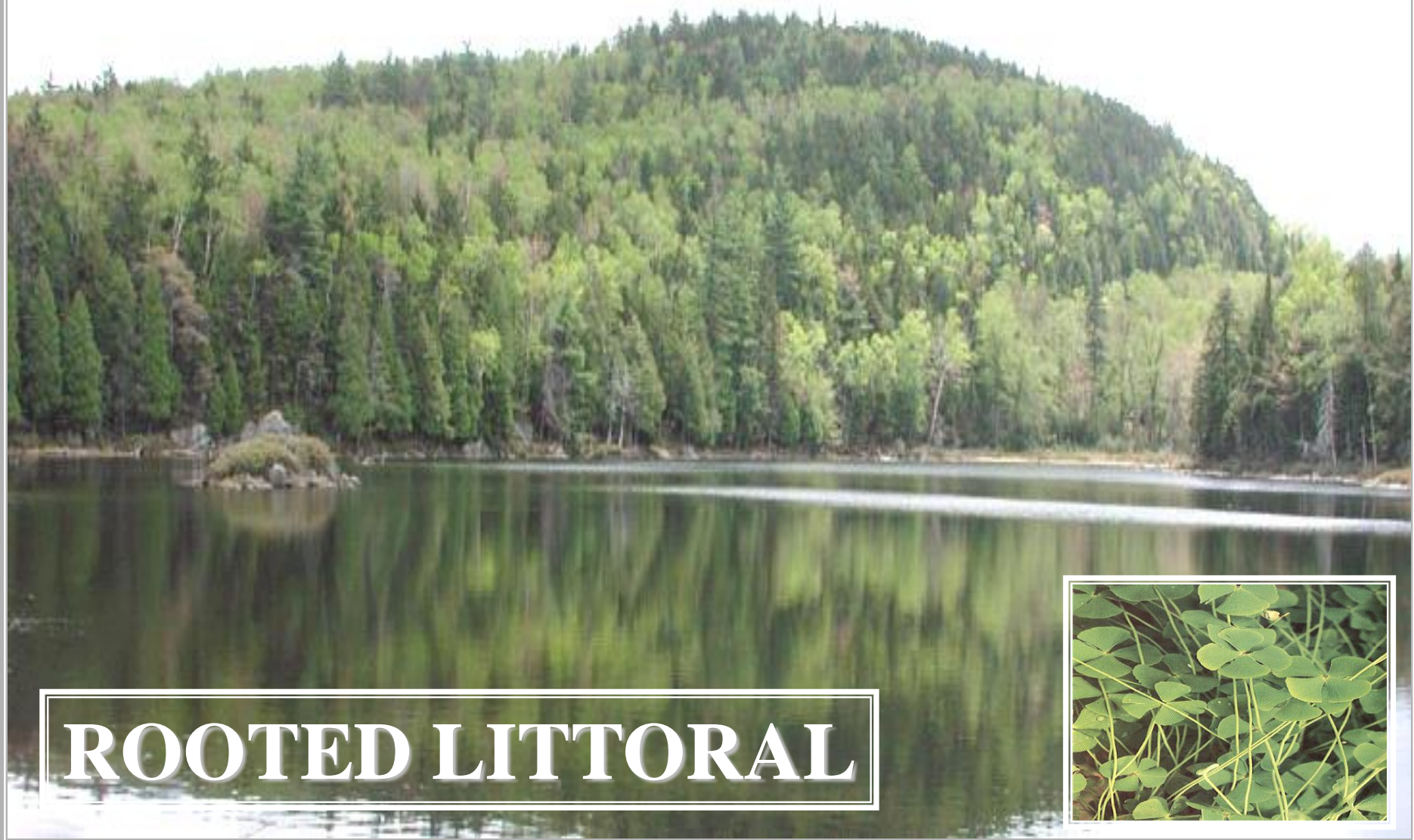


SPOROPHYTE CHARACTERS

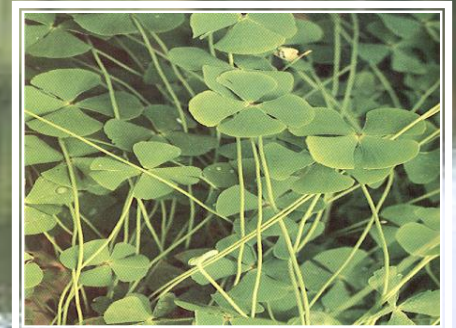


GROWTH HABIT

ALABAMA LAKE OR ALABAMA POND



ROOTED LITTORAL





MARSILEA



**ROOTED
LITTORAL
AQUATIC**

**ADVENTITIOUS
ROOTS**

WATER



MORPHOLOGY



A

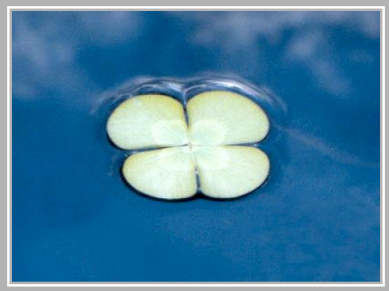
MARSILEA



MARSILEA



N



**ATYPICAL
MORPHOLOGY**



WATER

MARSILEA



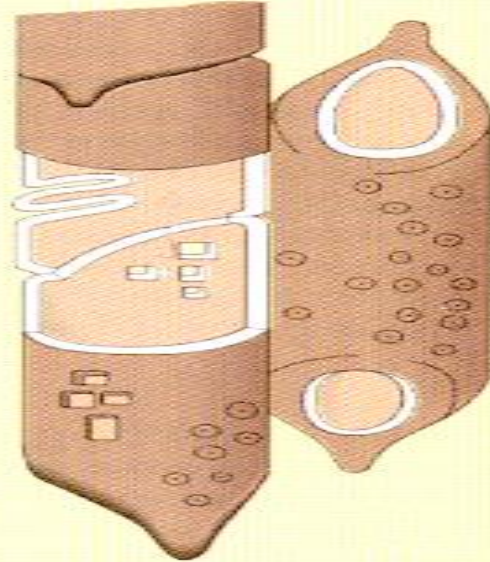
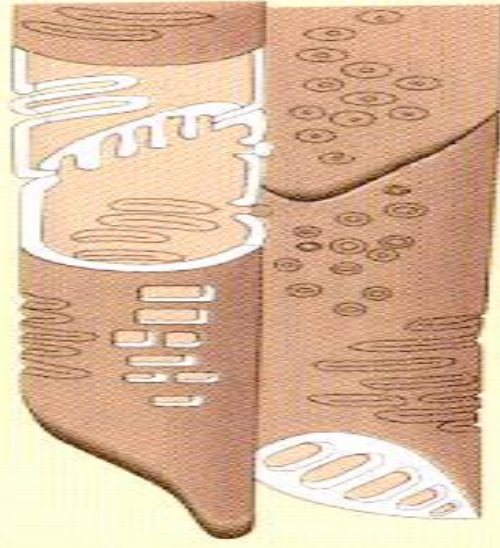
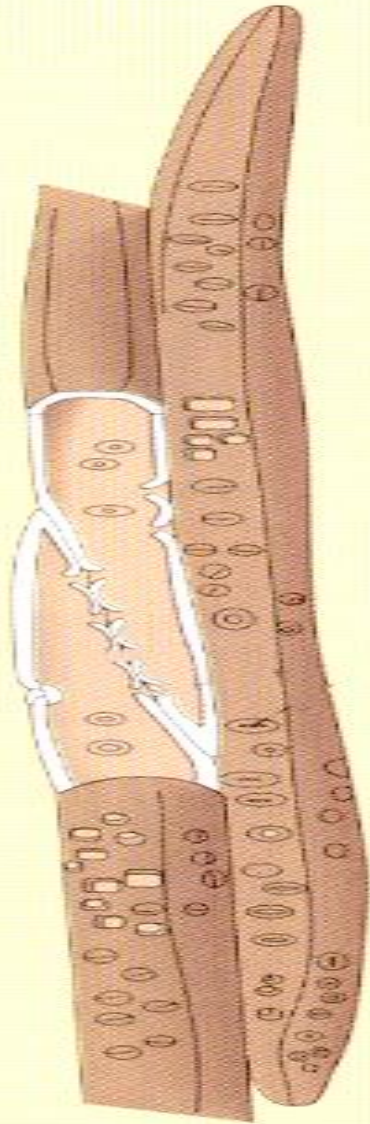
^

WATER

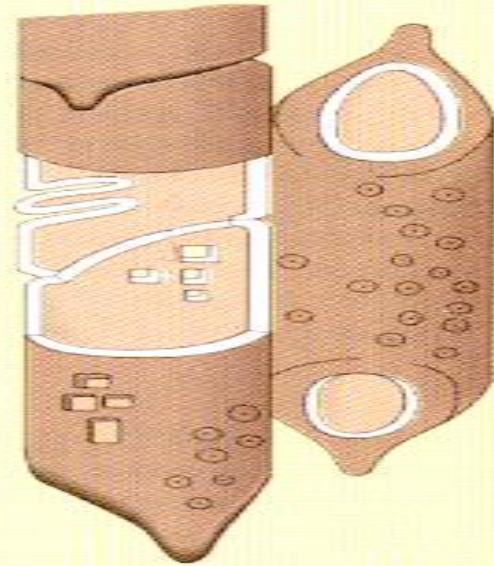
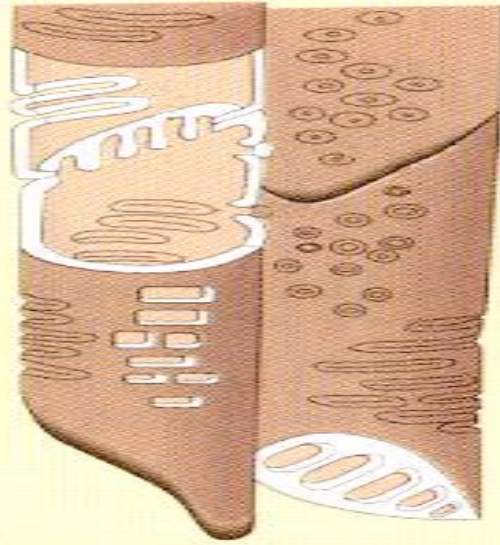
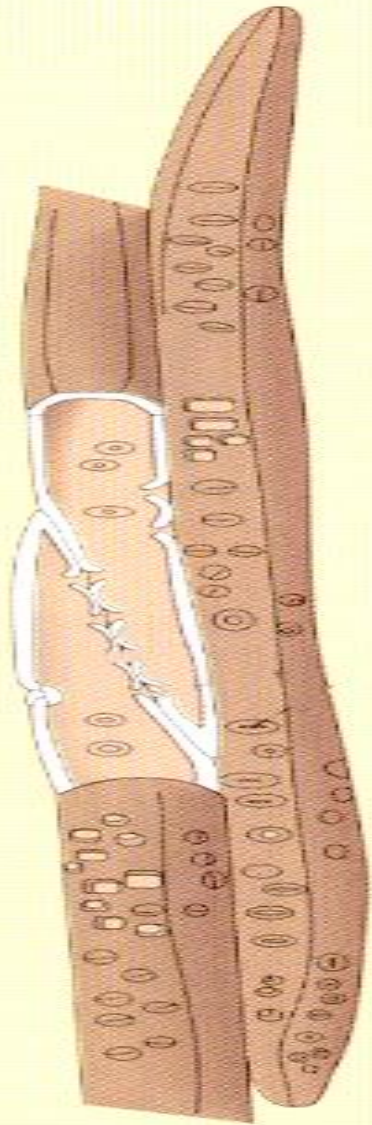
**ATYPICAL
MORPHOLOGY
NOT
FERN-LIKE**



XYLEM



XYLEM CELLS



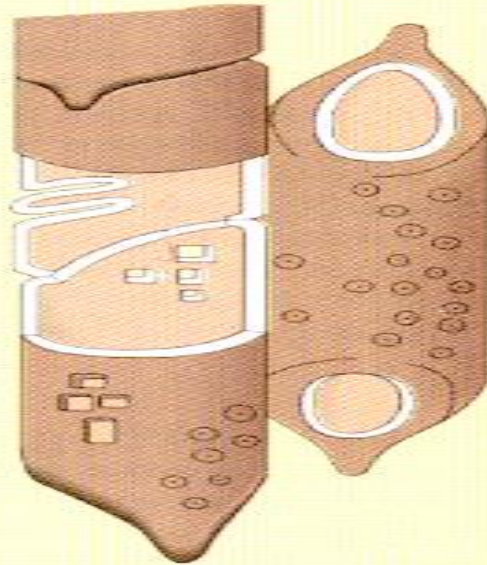
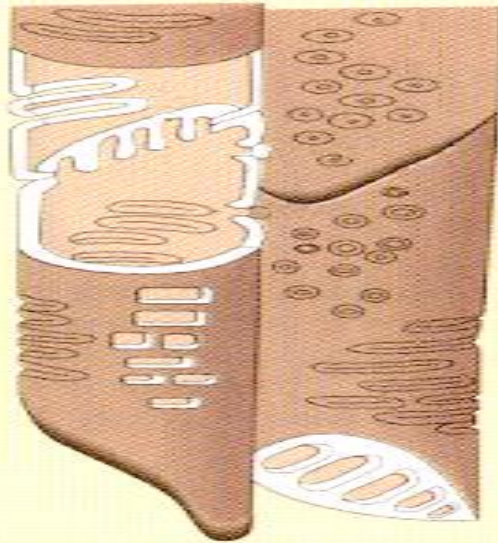
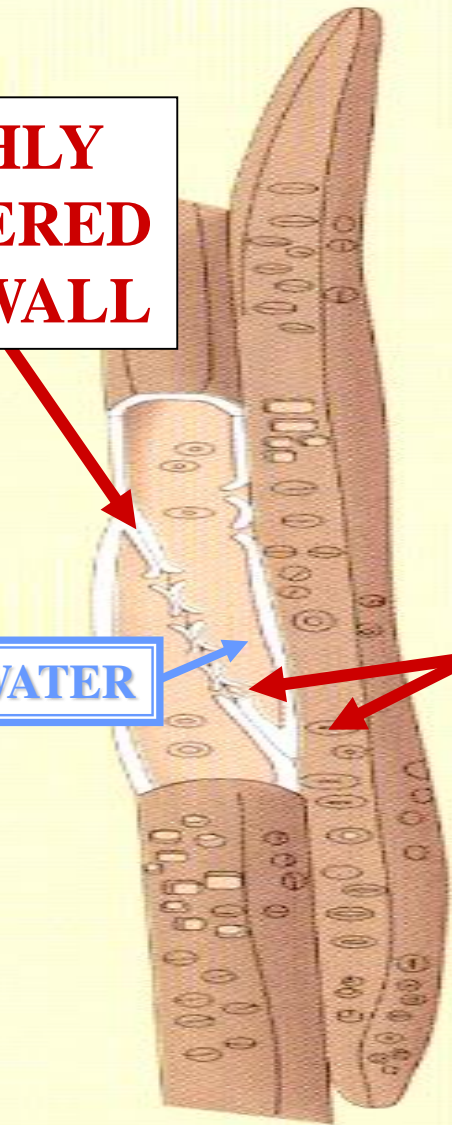
TRACHEARY ELEMENTS

**HIGHLY
TAPPED
END WALL**

WATER

PITS

?

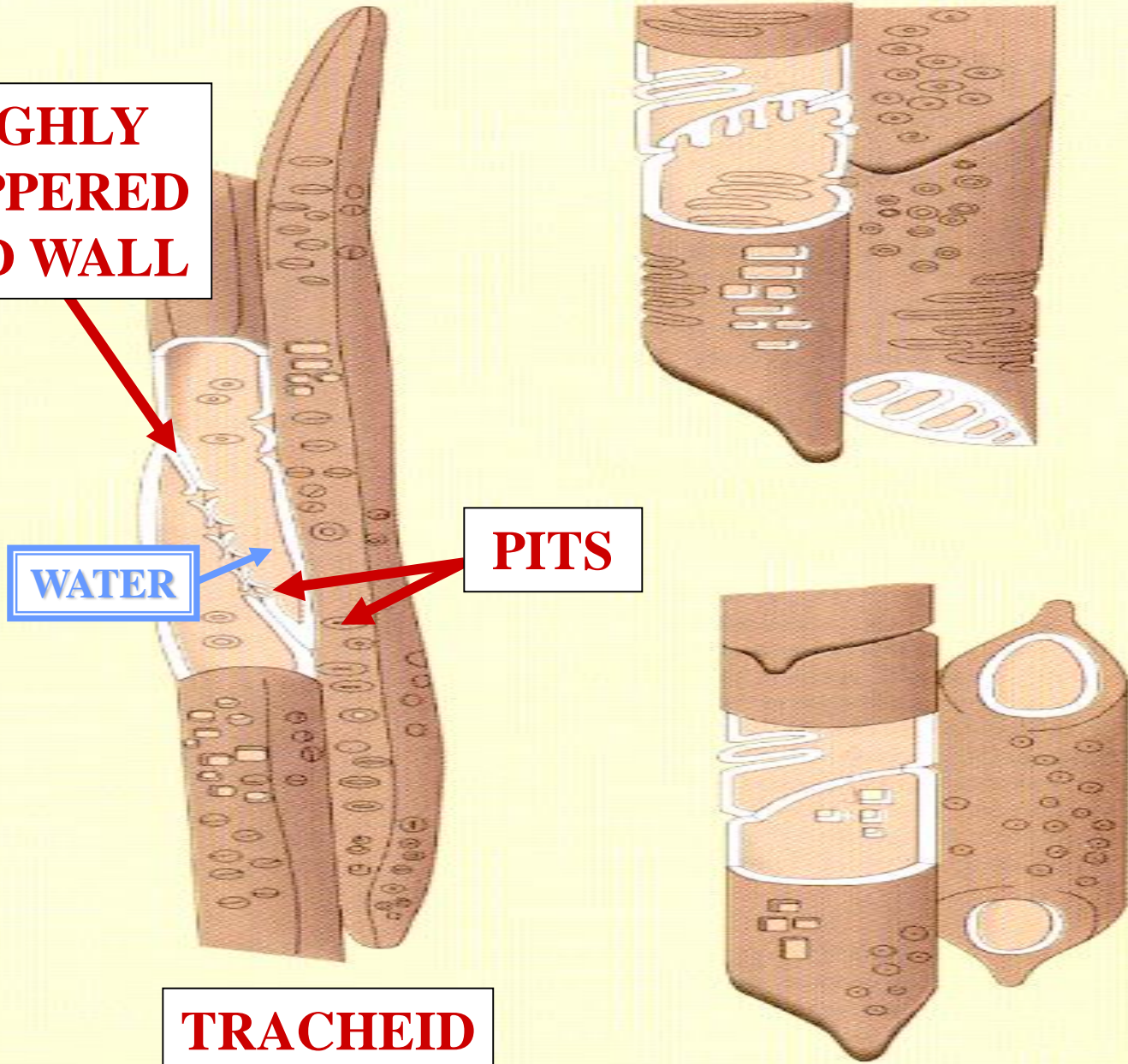


**HIGHLY
TAPPED
END WALL**

WATER

PITS

TRACHEID



**HIGHLY
TAPPED
END WALL**

**LESS
TAPPED
END WALL**

?

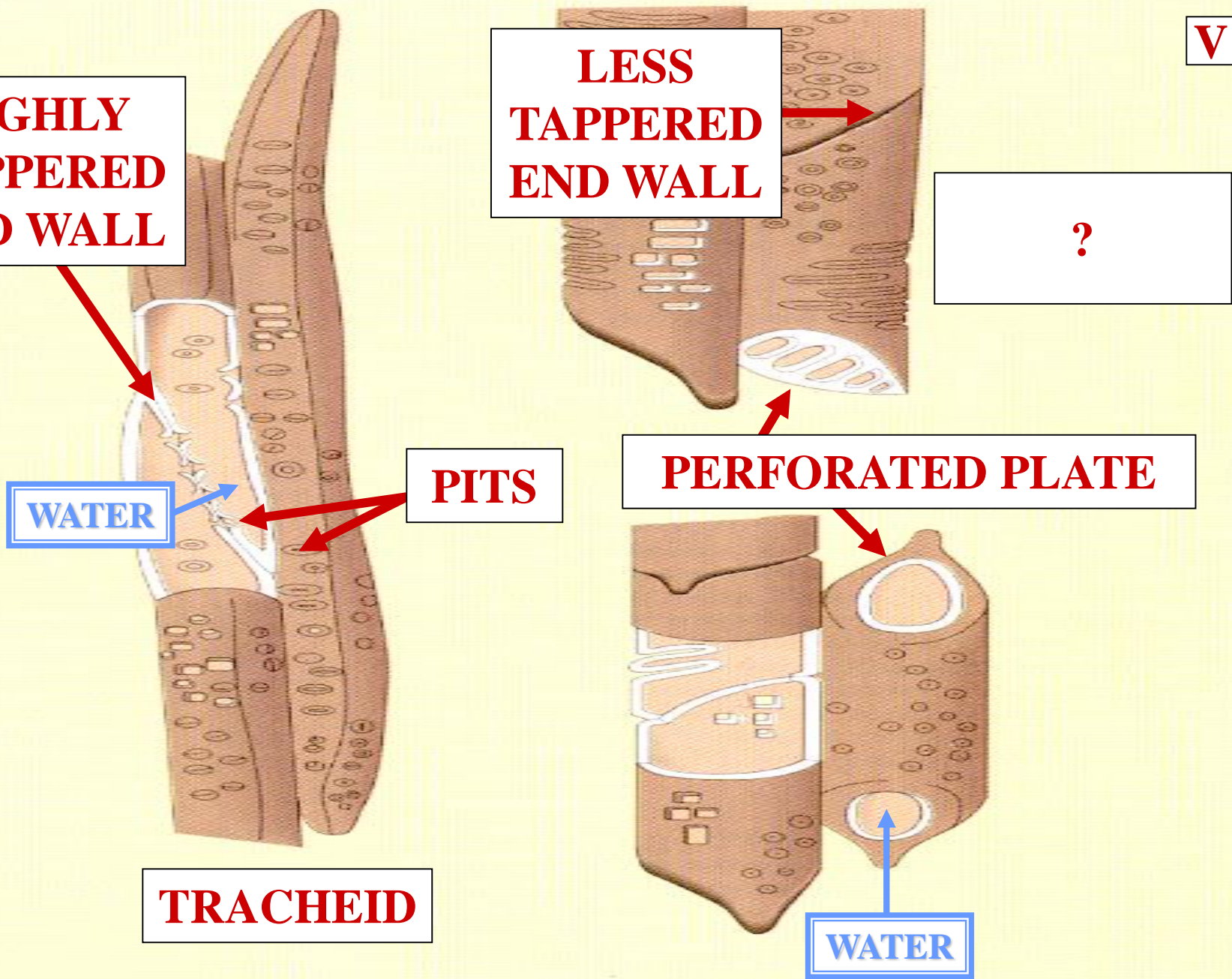
WATER

PITS

PERFORATED PLATE

TRACHEID

WATER





T **V**

**HIGHLY
TAPPED
END WALL**

**LESS
TAPPED
END WALL**

**VESSEL
MEMBER**

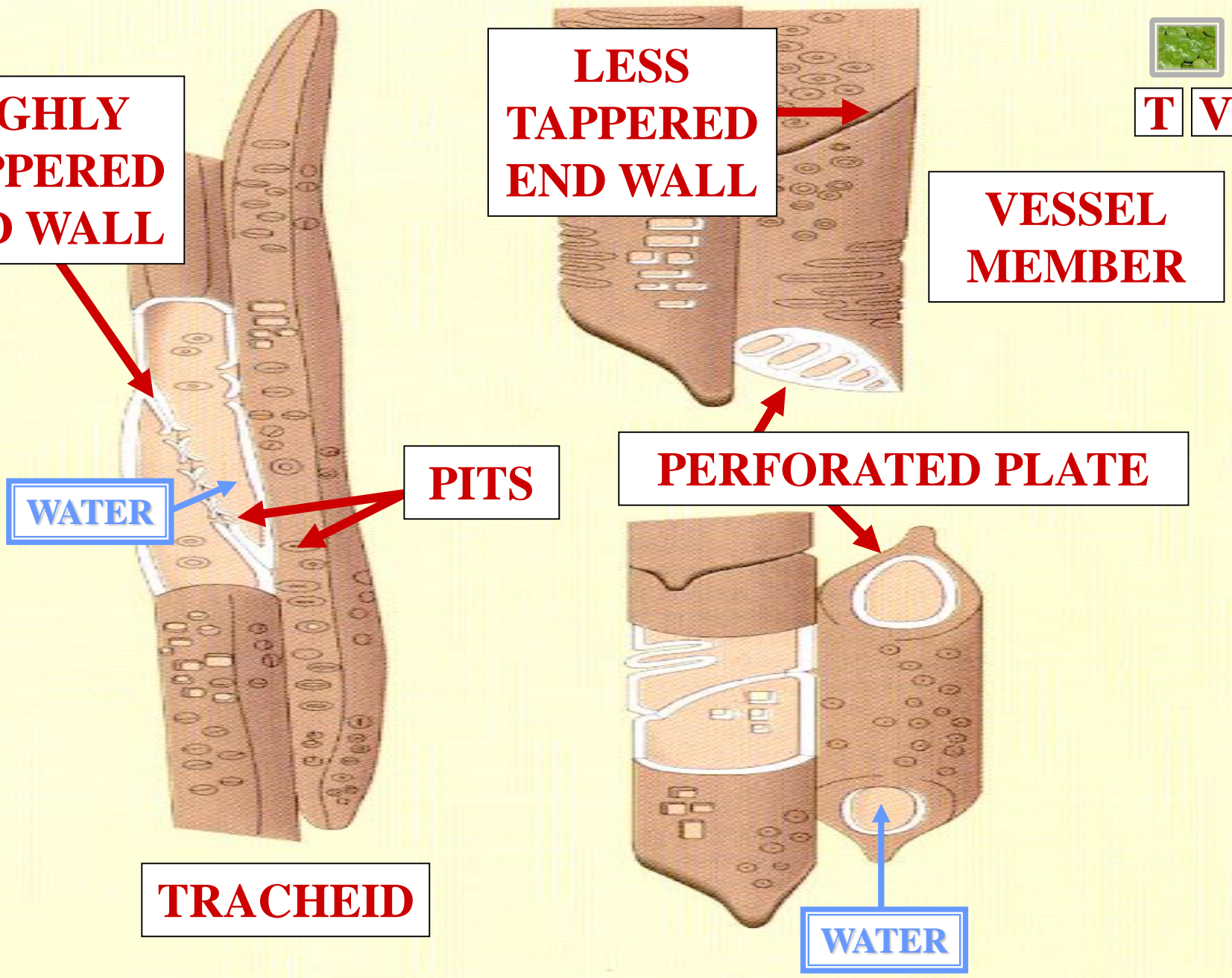
WATER

PITS

PERFORATED PLATE

TRACHEID

WATER





**TRACHEIDS
&
VESSEL MEMBERS**



MARSILEA

A photograph of moss plants, showing several upright stems with small, overlapping, light green leaves. The background is a dense carpet of moss, some of which is brownish and appears to be dead or dried. A white text box with a black border is positioned in the upper right corner of the image. The text inside the box is in red, bold, serif font. A small white box with a black border containing the letter 'S' is located in the lower right corner of the image.

**TRACHEIDS
&
VESSEL MEMBERS**

S



**TRACHEIDS
&
VESSEL MEMBERS**

?



SELAGINELLA

**TRACHEIDS
&
VESSEL MEMBERS**

E





**TRACHEIDS
&
VESSEL MEMBERS**



EQUISETUM



STEM



STEM STELE

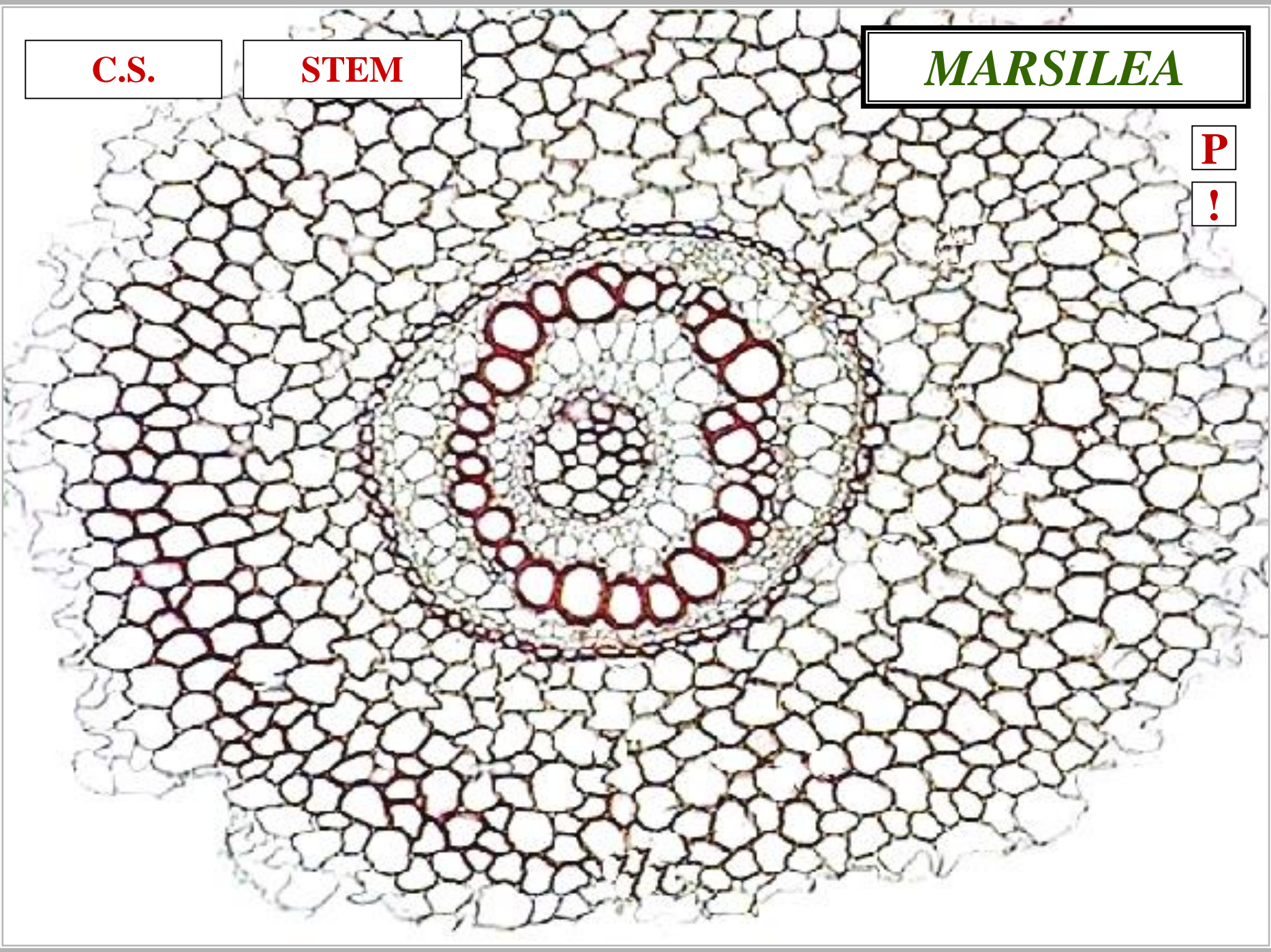
C.S.

STEM

MARSILEA

P

!



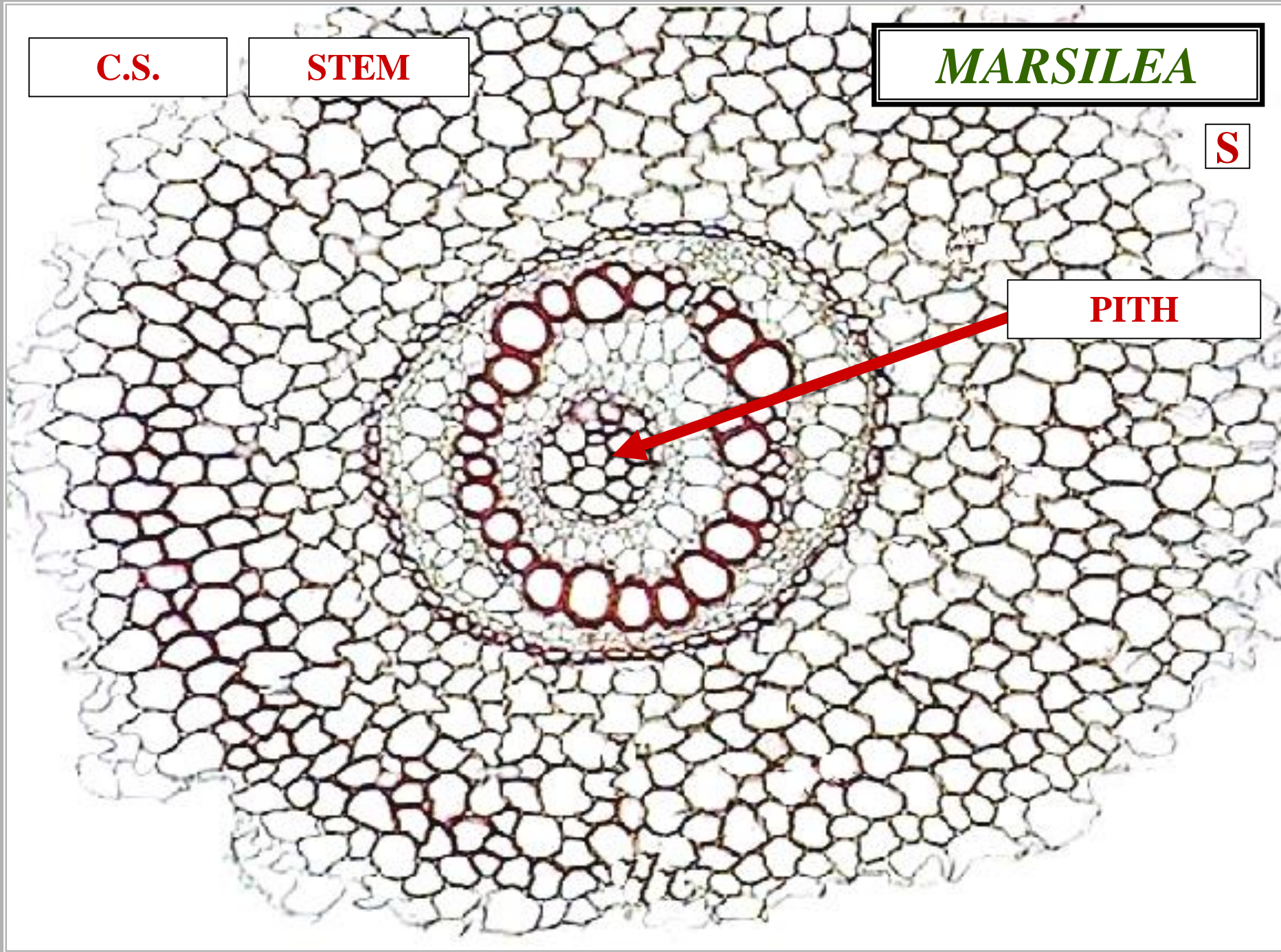
C.S.

STEM

MARSILEA

S

PITH



C.S.

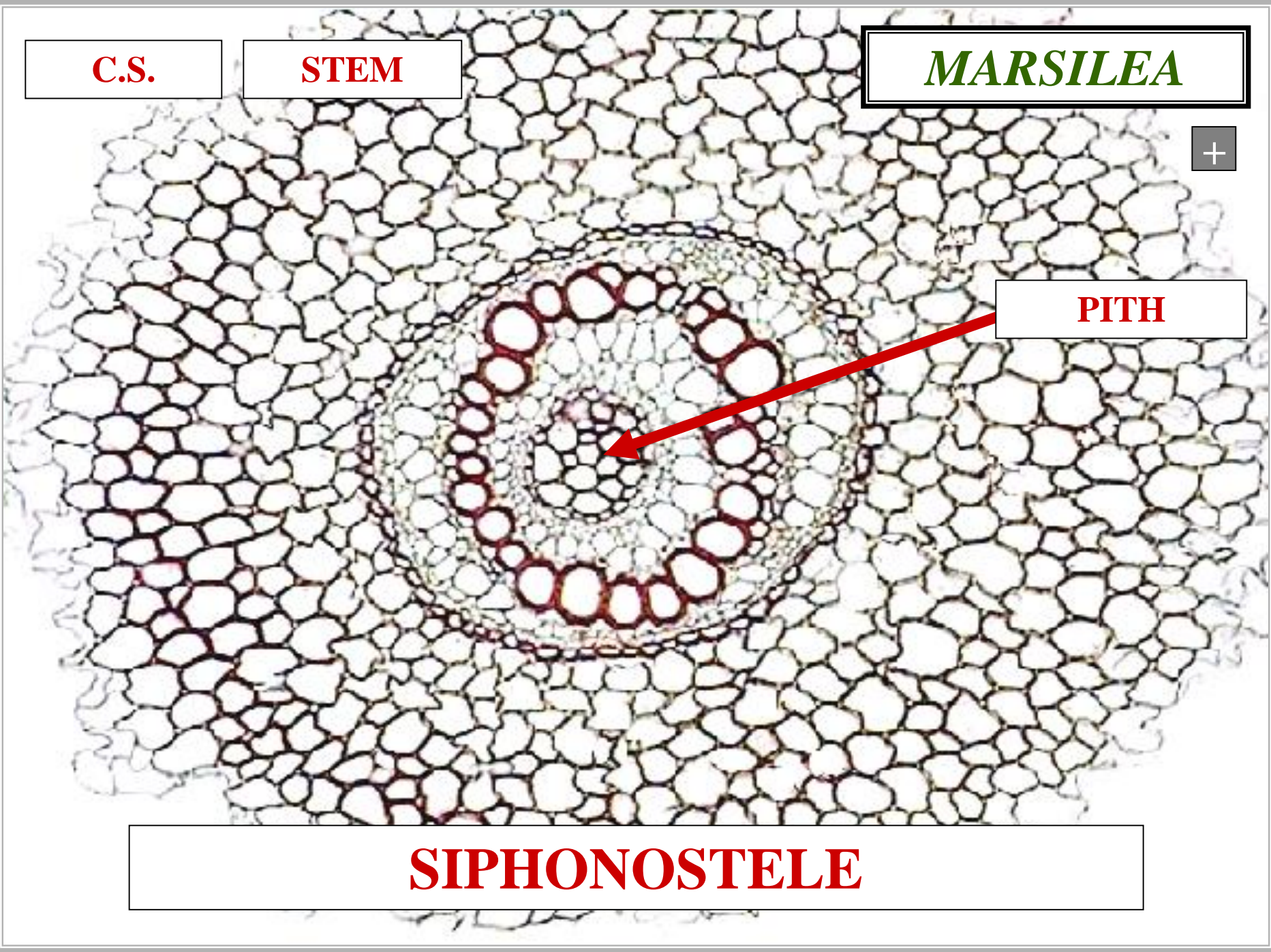
STEM

MARSILEA

+

PITH

SIPHONOSTELE



MARSILEA

A

C.S.

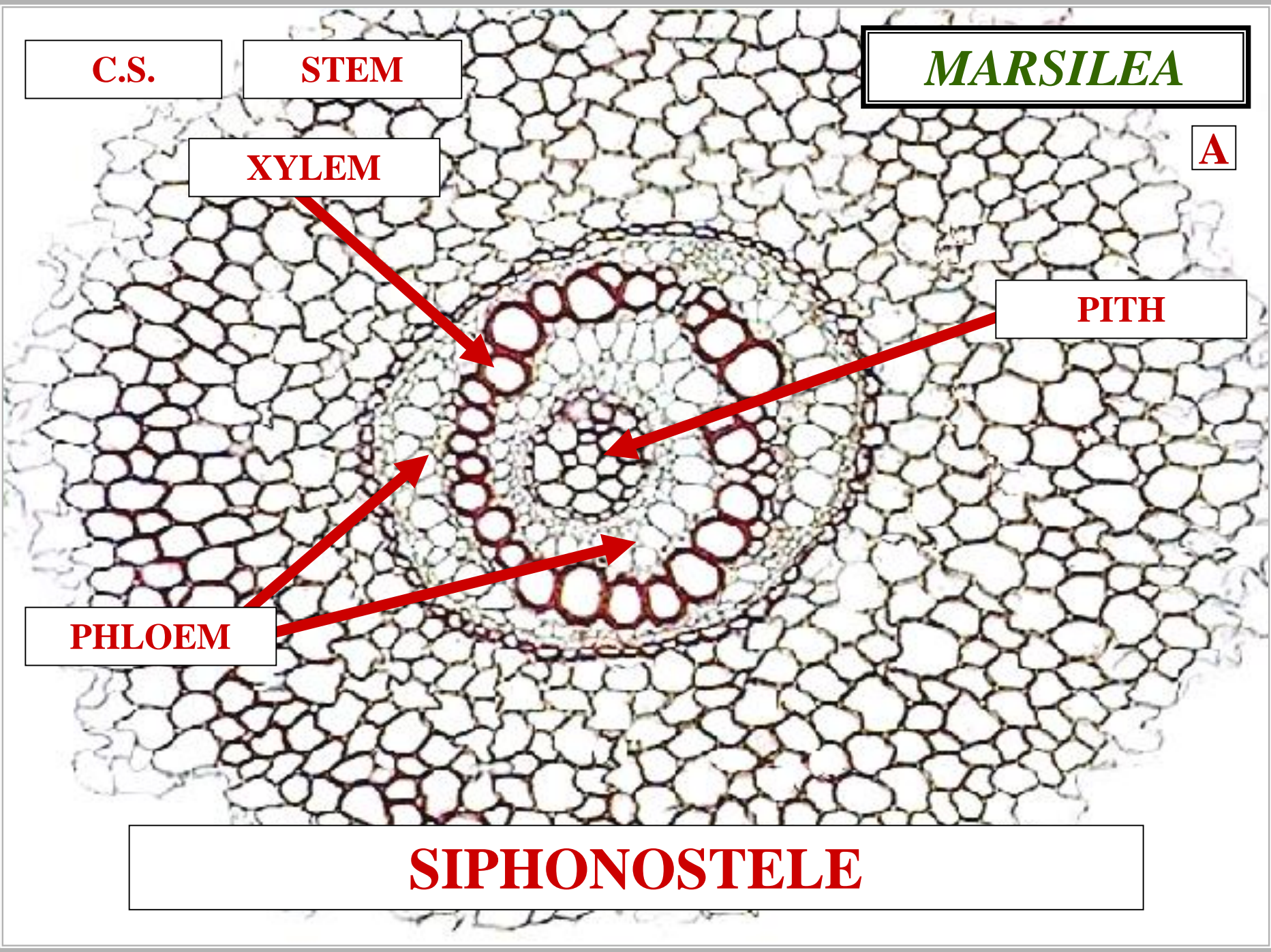
STEM

XYLEM

PITH

PHLOEM

SIPHONOSTELE



C.S.

STEM

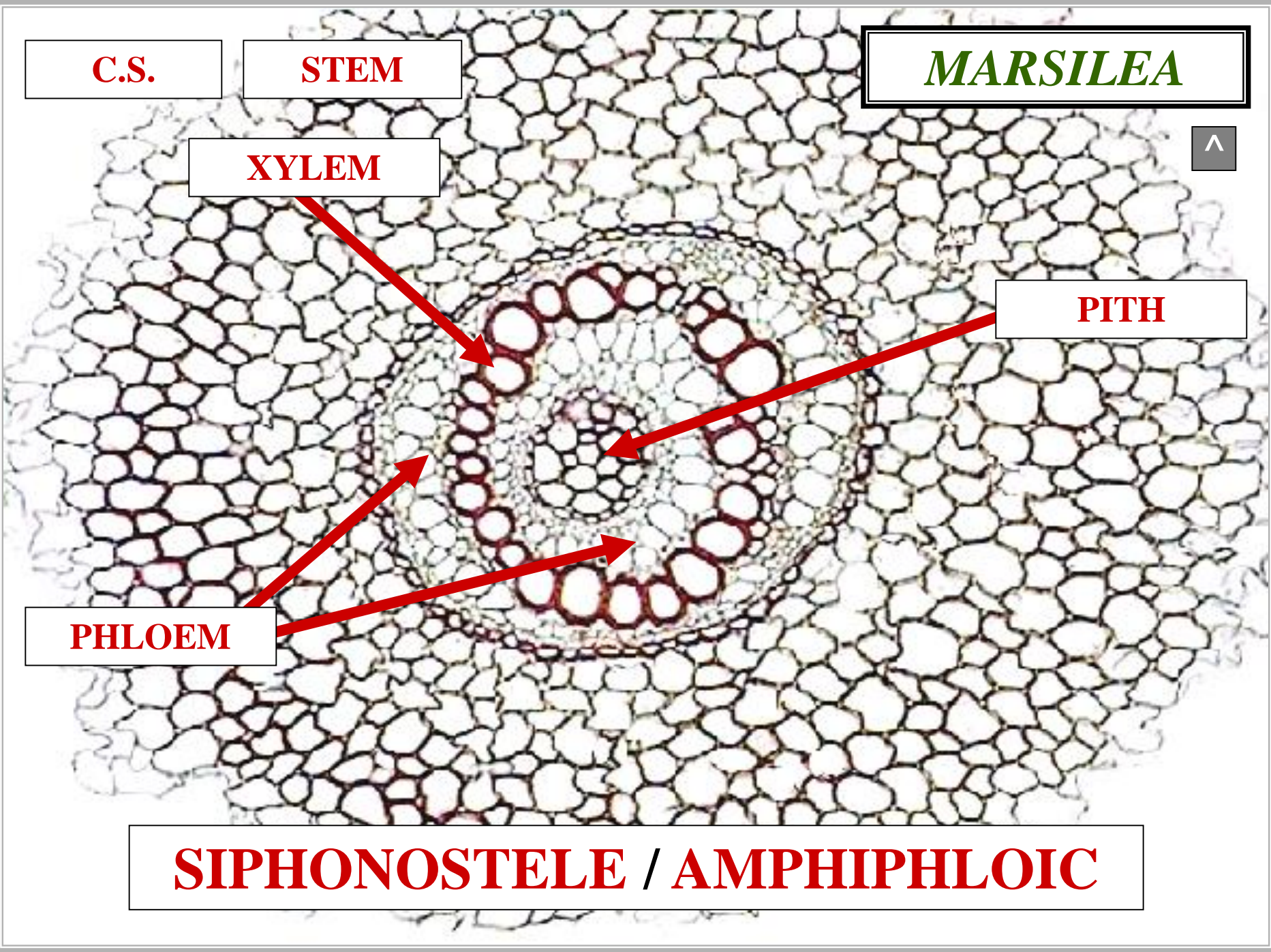
MARSILEA

XYLEM

PITH

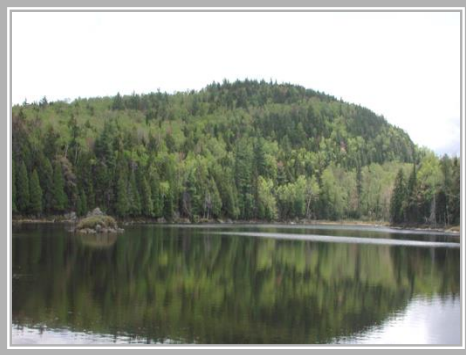
PHLOEM

SIPHONOSTELE / AMPHIPHLOIC



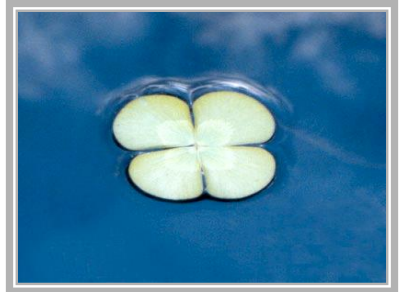


RHIZOME

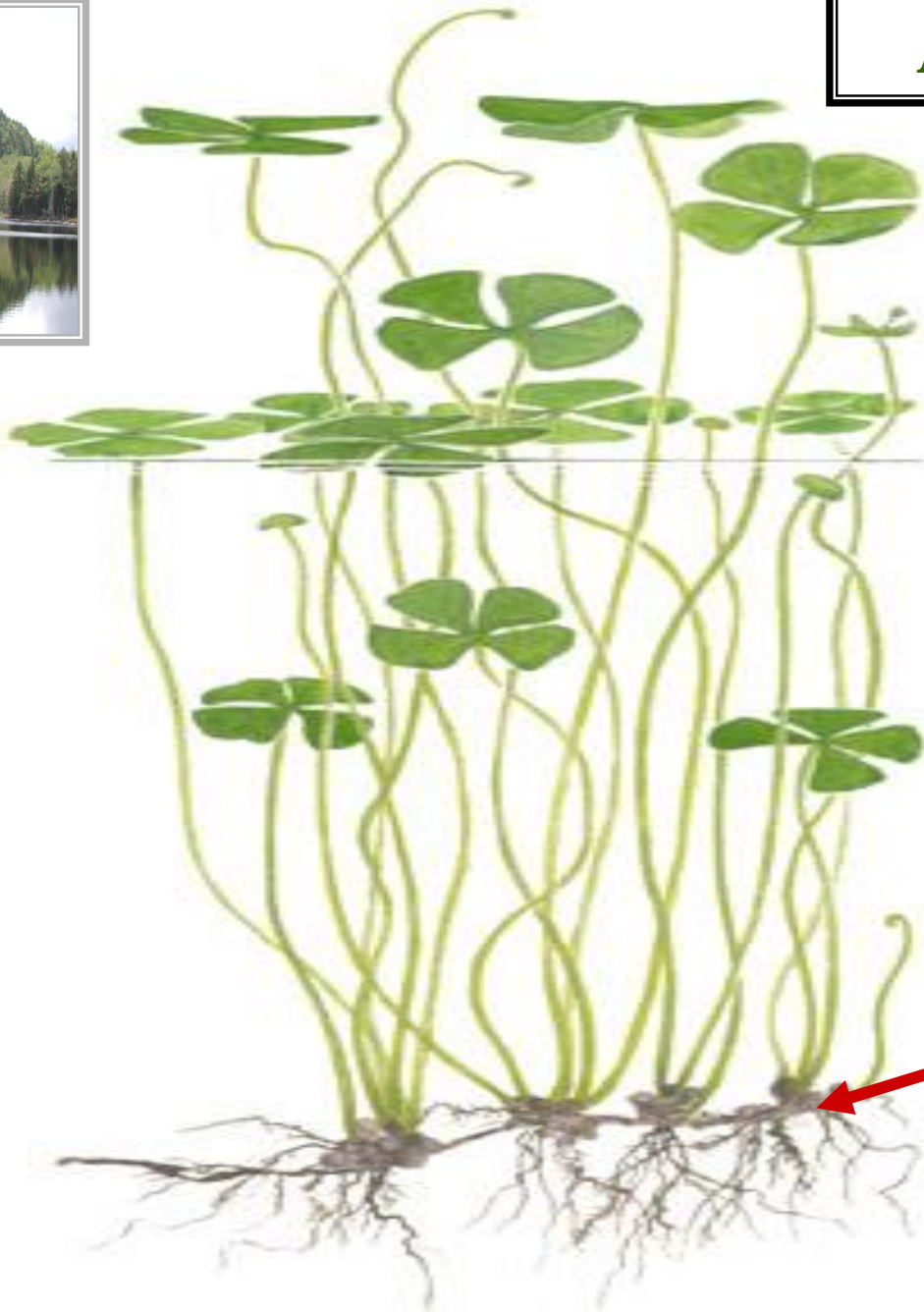


MARSILEA

L



WATER

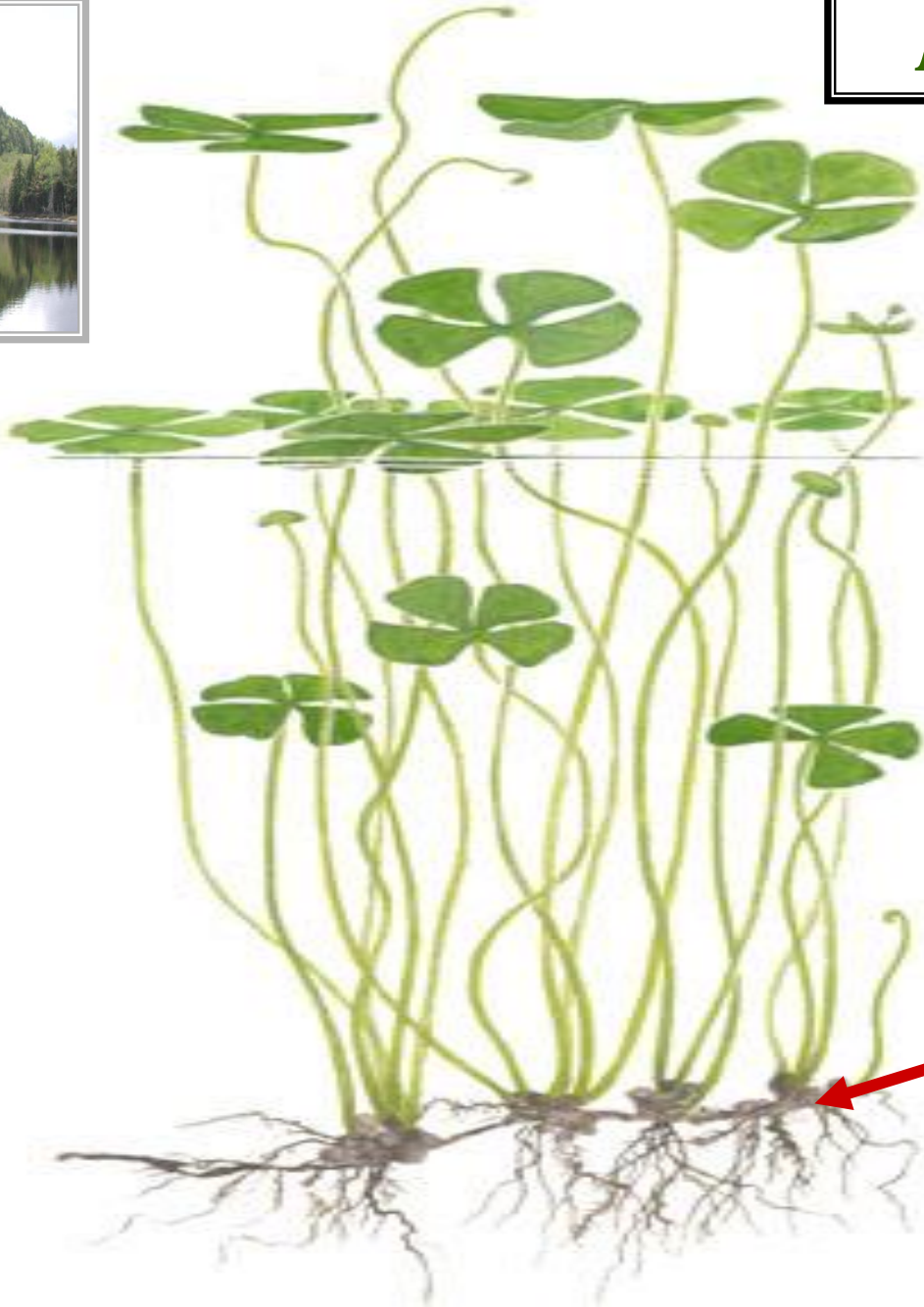
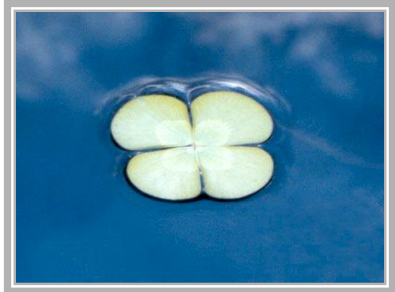


RHIZOME



MARSILEA

E

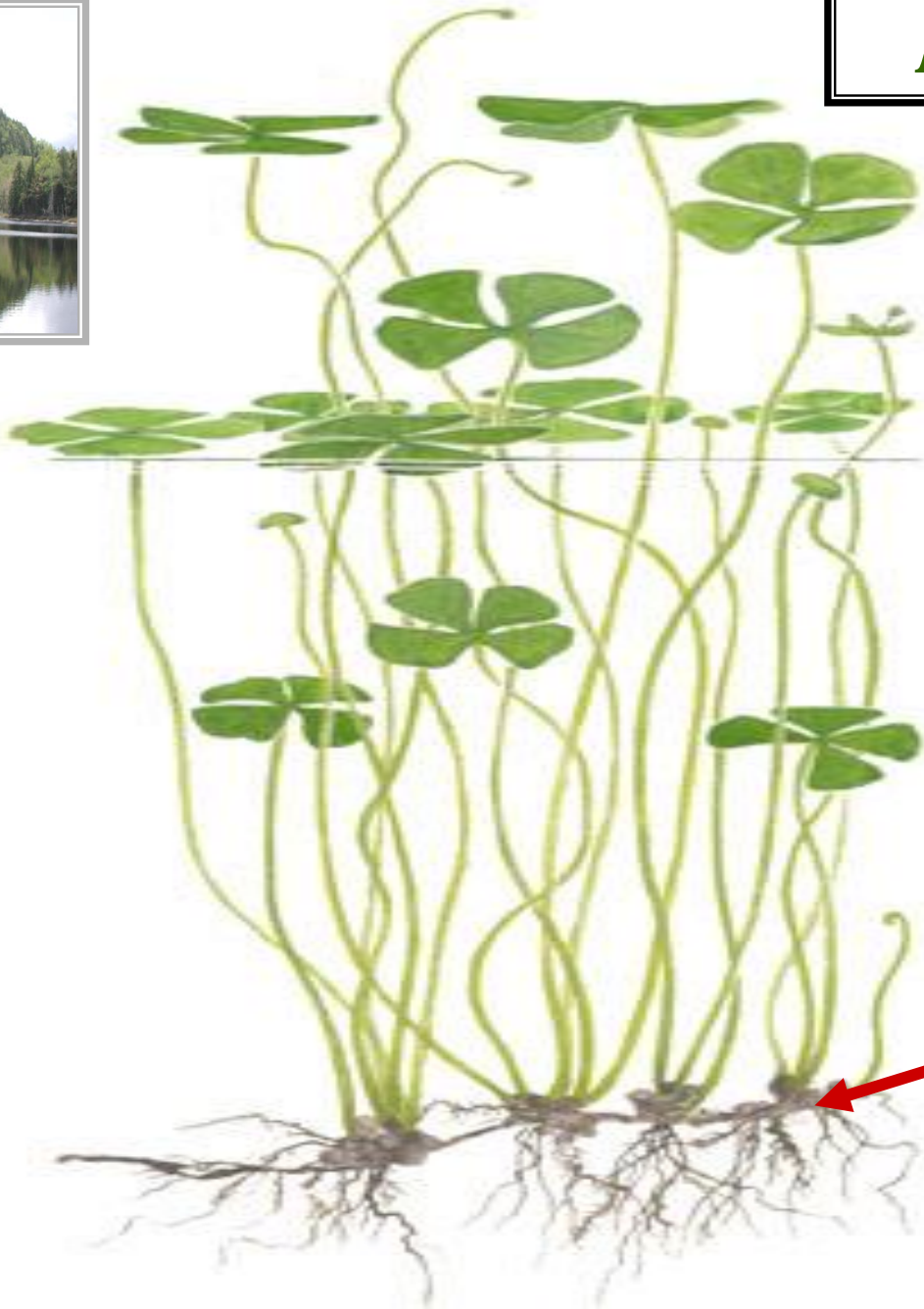


WATER

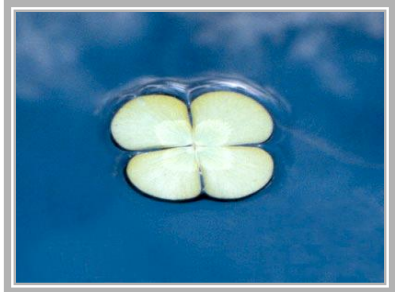
**LATERAL
GROWTH**



MARSILEA

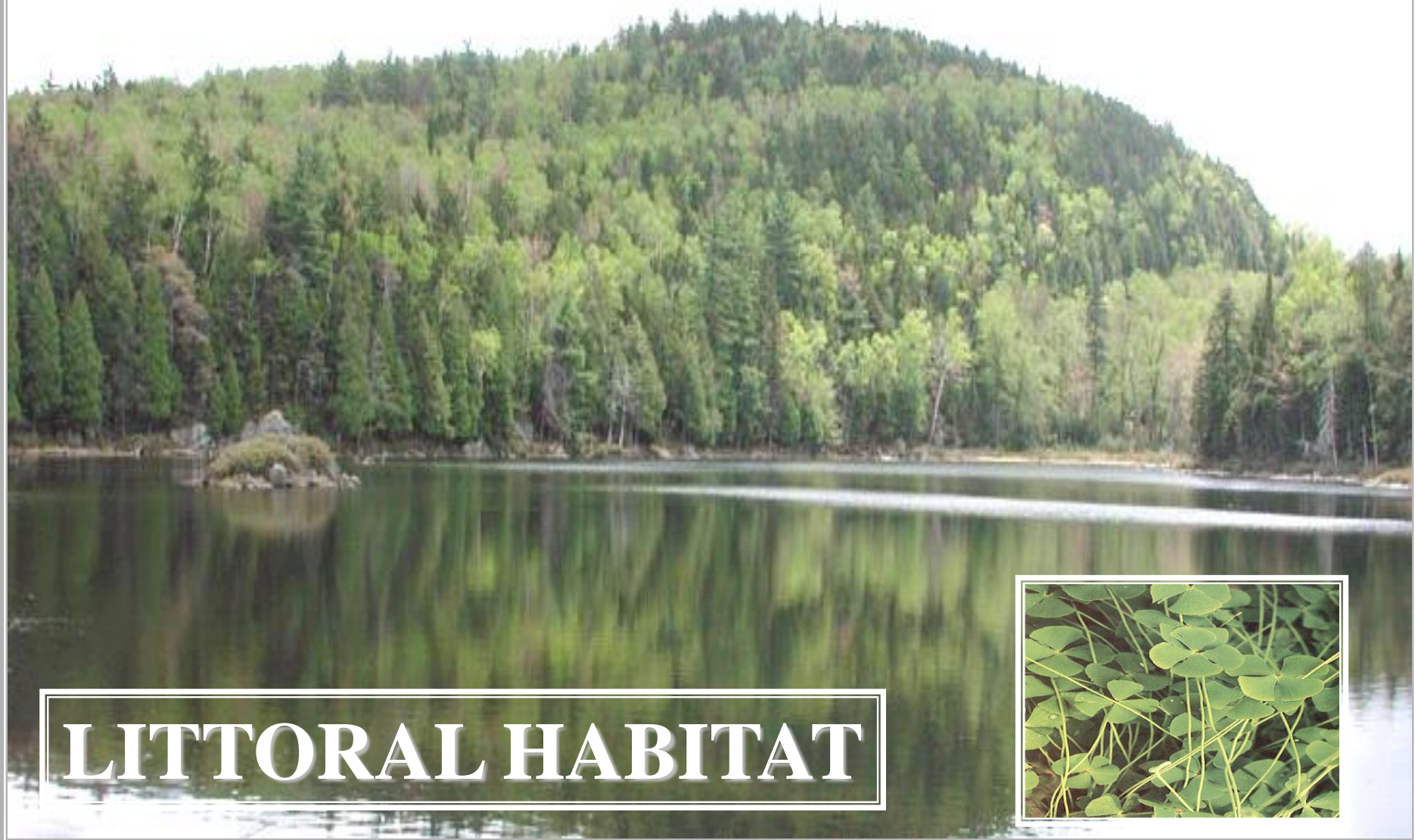


WATER

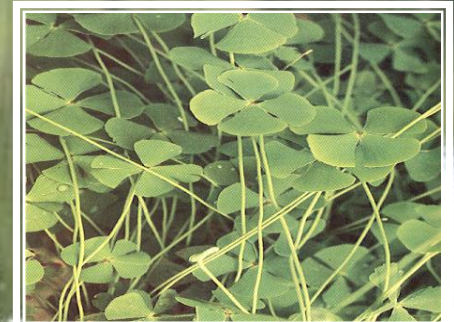


**EXTENSIVE
BRANCHING**

ALABAMA LAKE OR ALABAMA POND



LITTORAL HABITAT





FROND



PHYLLOTAXY