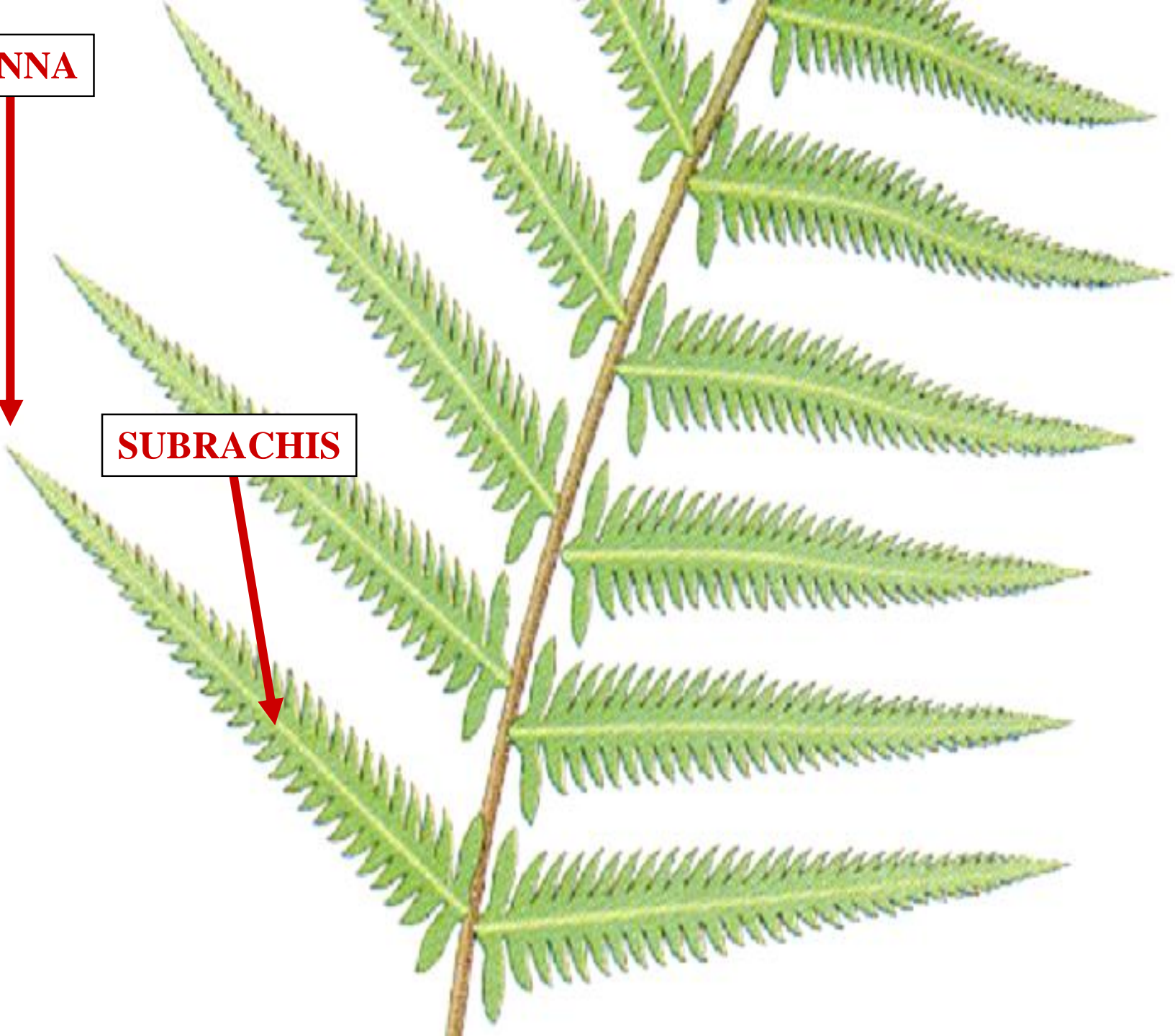


PINNA



SUBRACHIS



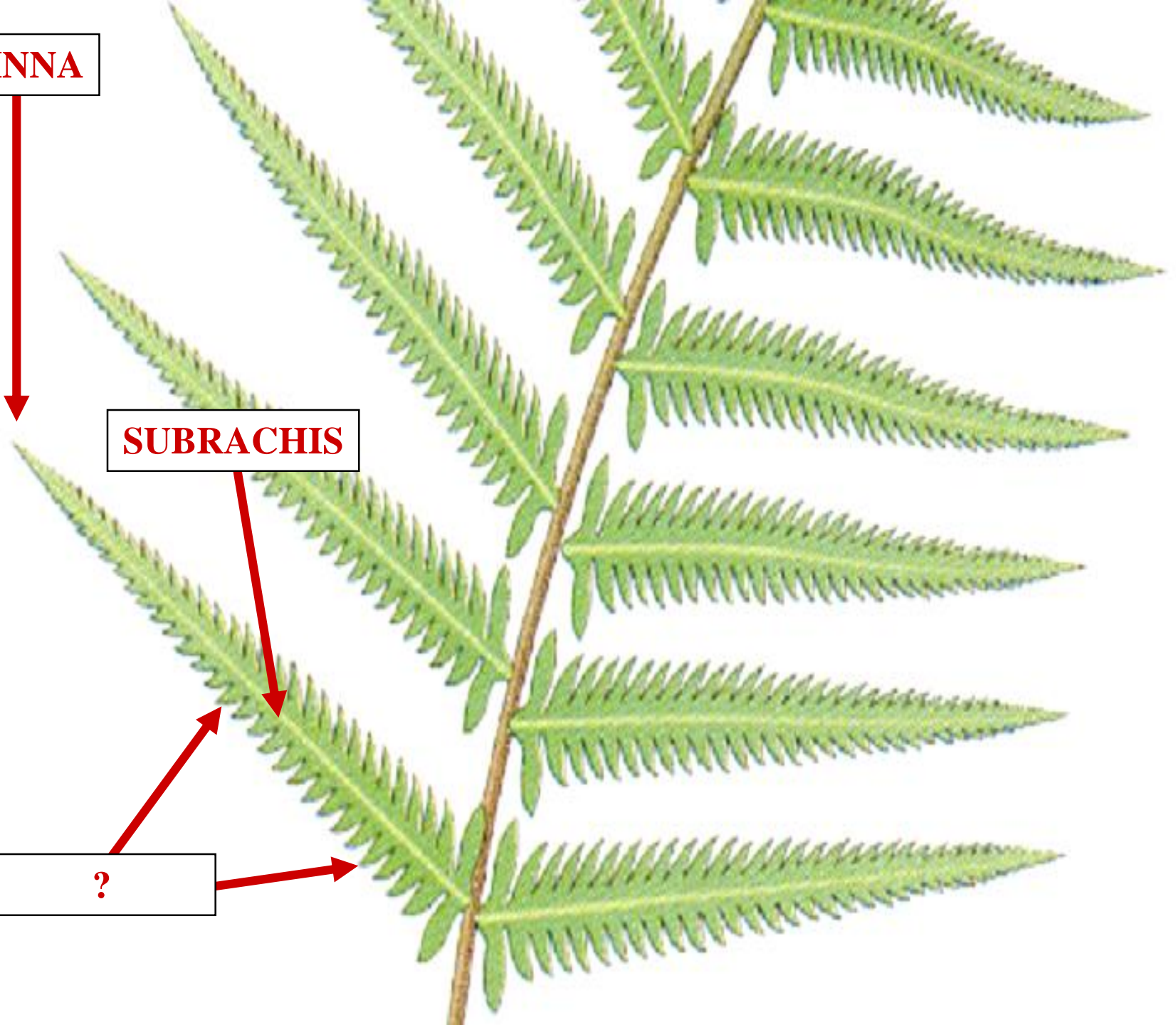
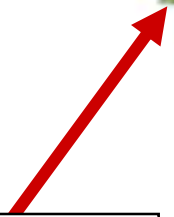
PINNA



SUBRACHIS



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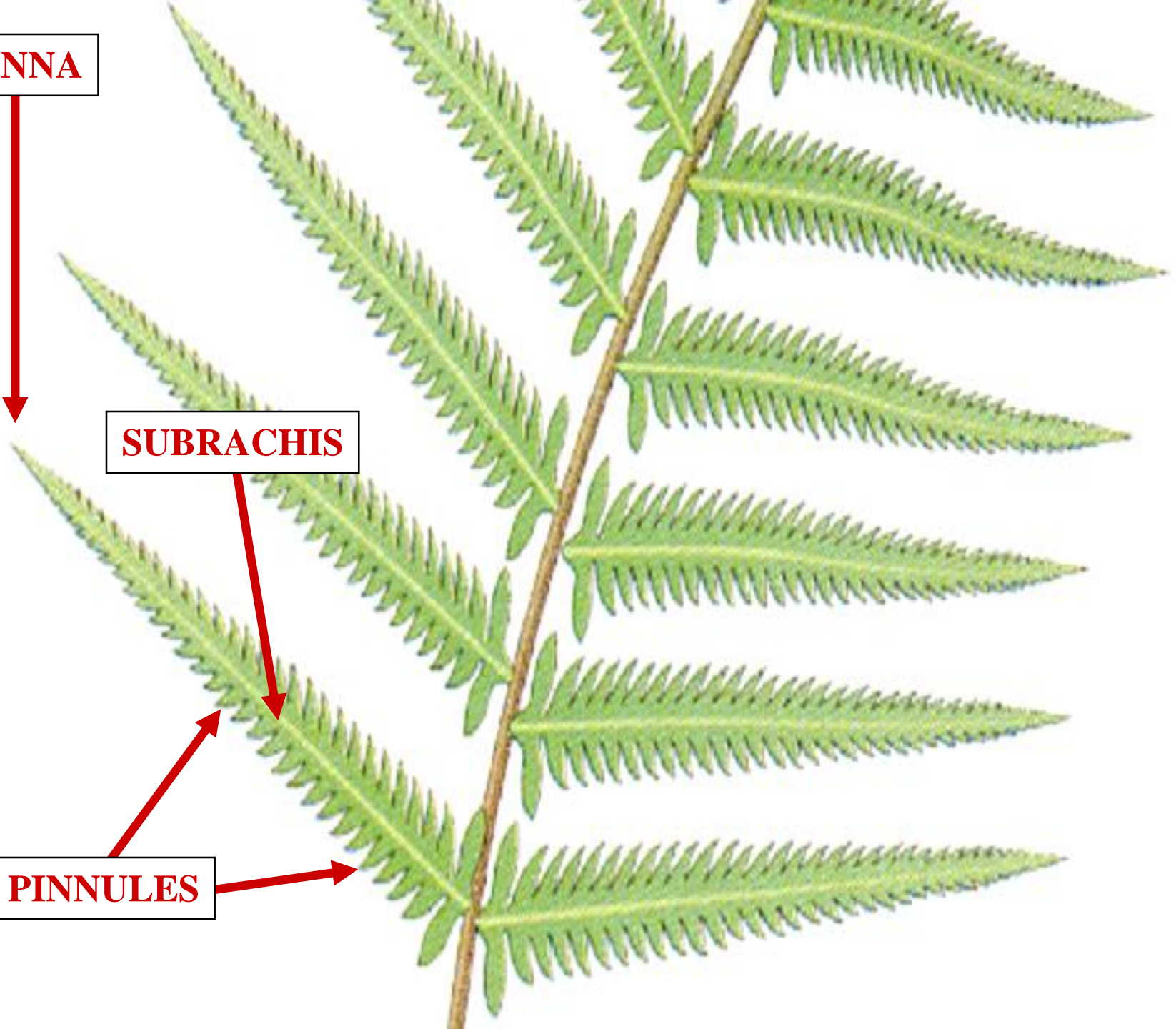
PINNA



SUBRACHIS



PINNULES



**COMPOUND
FERN FROND
MORPHOLOGY**



COMPOUND FROND TYPES

COMPOUND FROND TYPES

ONCE PINNATE

COMPOUND FROND TYPES

COMPOUND FROND TYPES

0

ONCE PINNATE
TWICE PINNATE

COMPOUND FROND
TYPES

**ONCE PINNATE
COMPOUND
FROND**

**COMPOUND FROND
ONCE PINNATE**



**BEARS
PINNAE ONLY**

**COMPOUND FROND
ONCE PINNATE**

**ONCE PINNATE
COMPOUND
FROND**

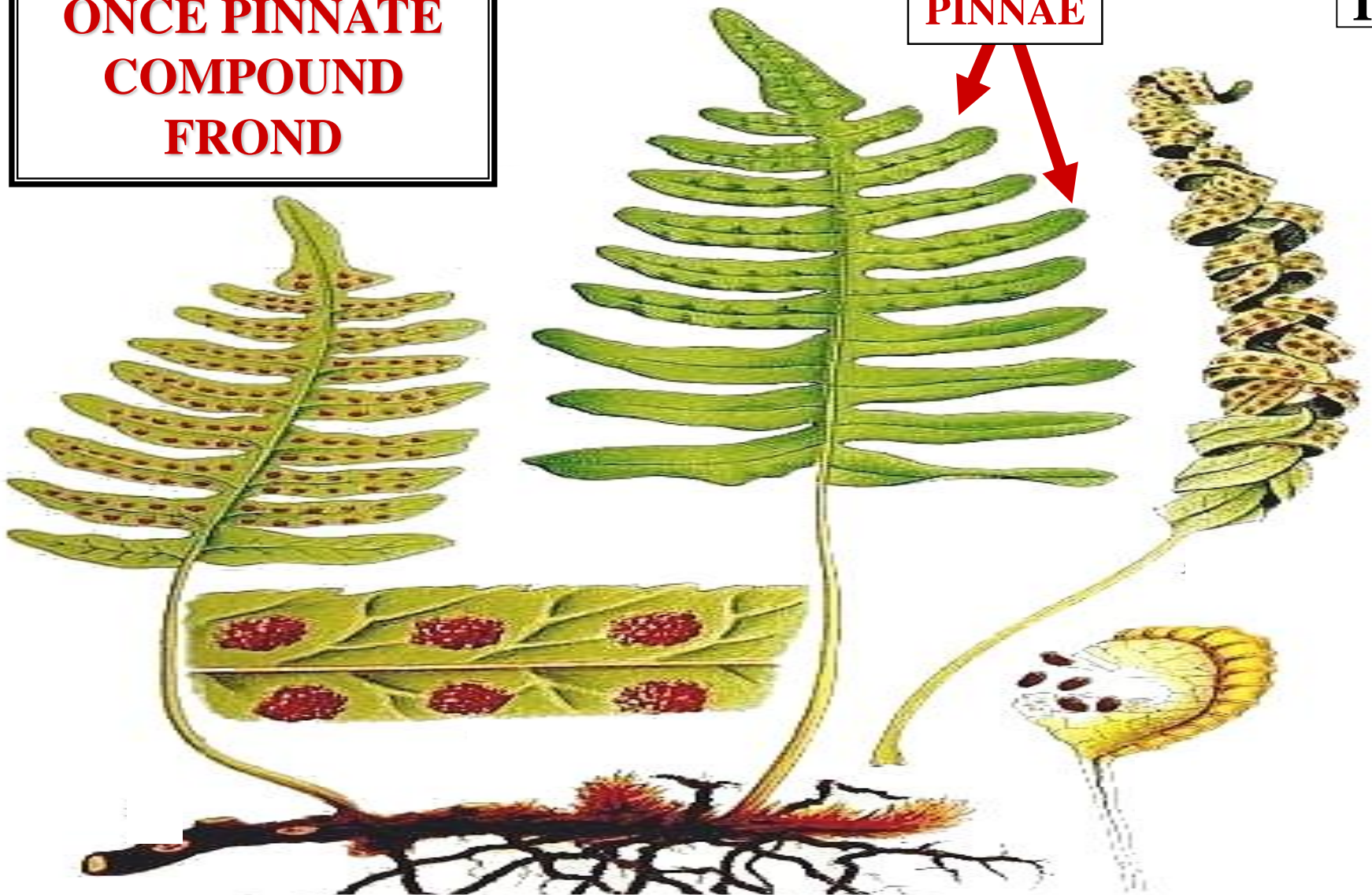


POLYPODIUM

**ONCE PINNATE
COMPOUND
FROND**

PINNAE

T



POLYPODIUM

**TWICE PINNATE
COMPOUND
FROND**

COMPOUND FROND TWICE PINNATE



BEARS
PINNAE & PINNULES

COMPOUND FROND
TWICE PINNATE

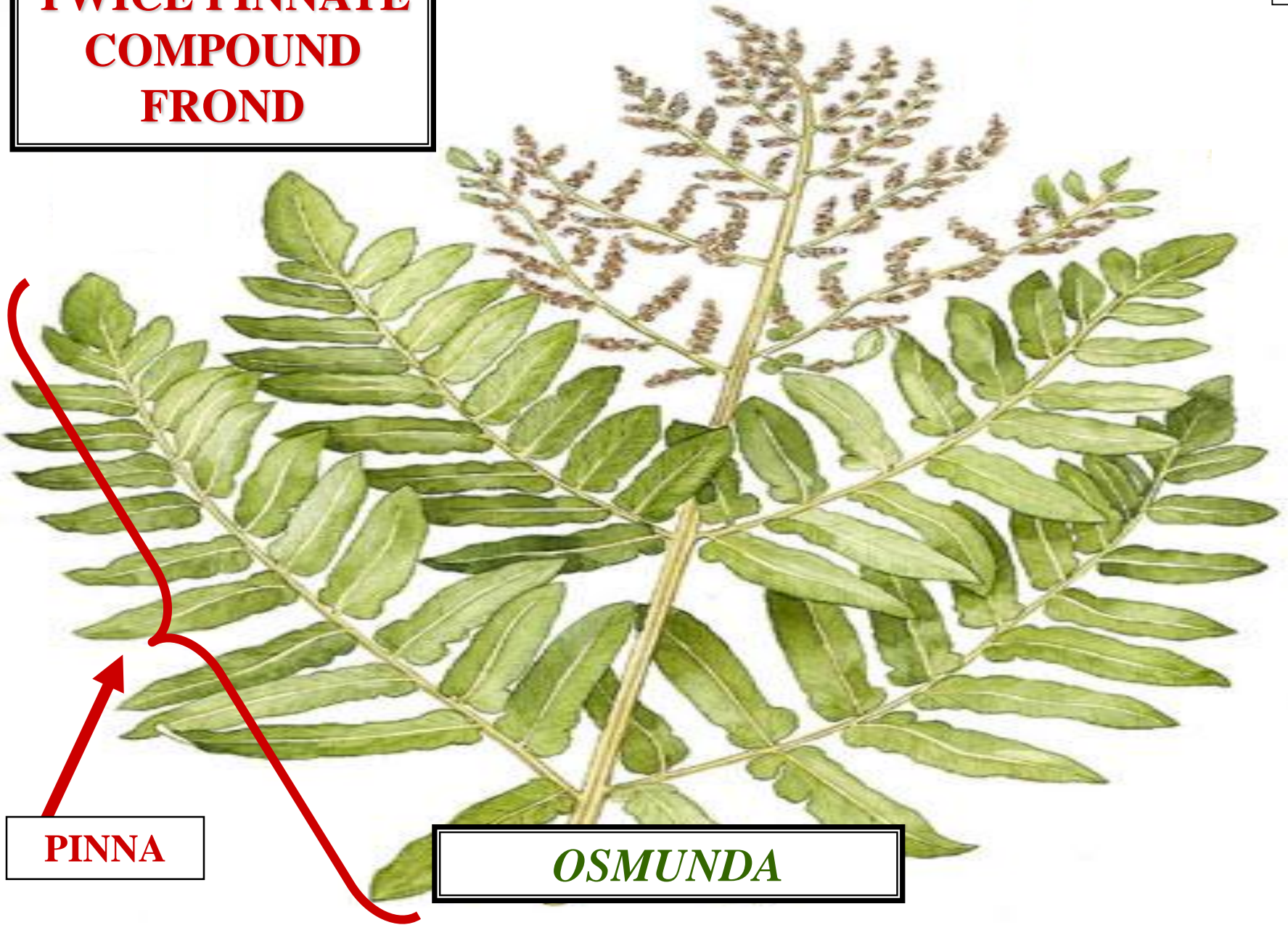
**TWICE PINNATE
COMPOUND
FROND**

P



OSMUNDA

**TWICE PINNATE
COMPOUND
FROND**

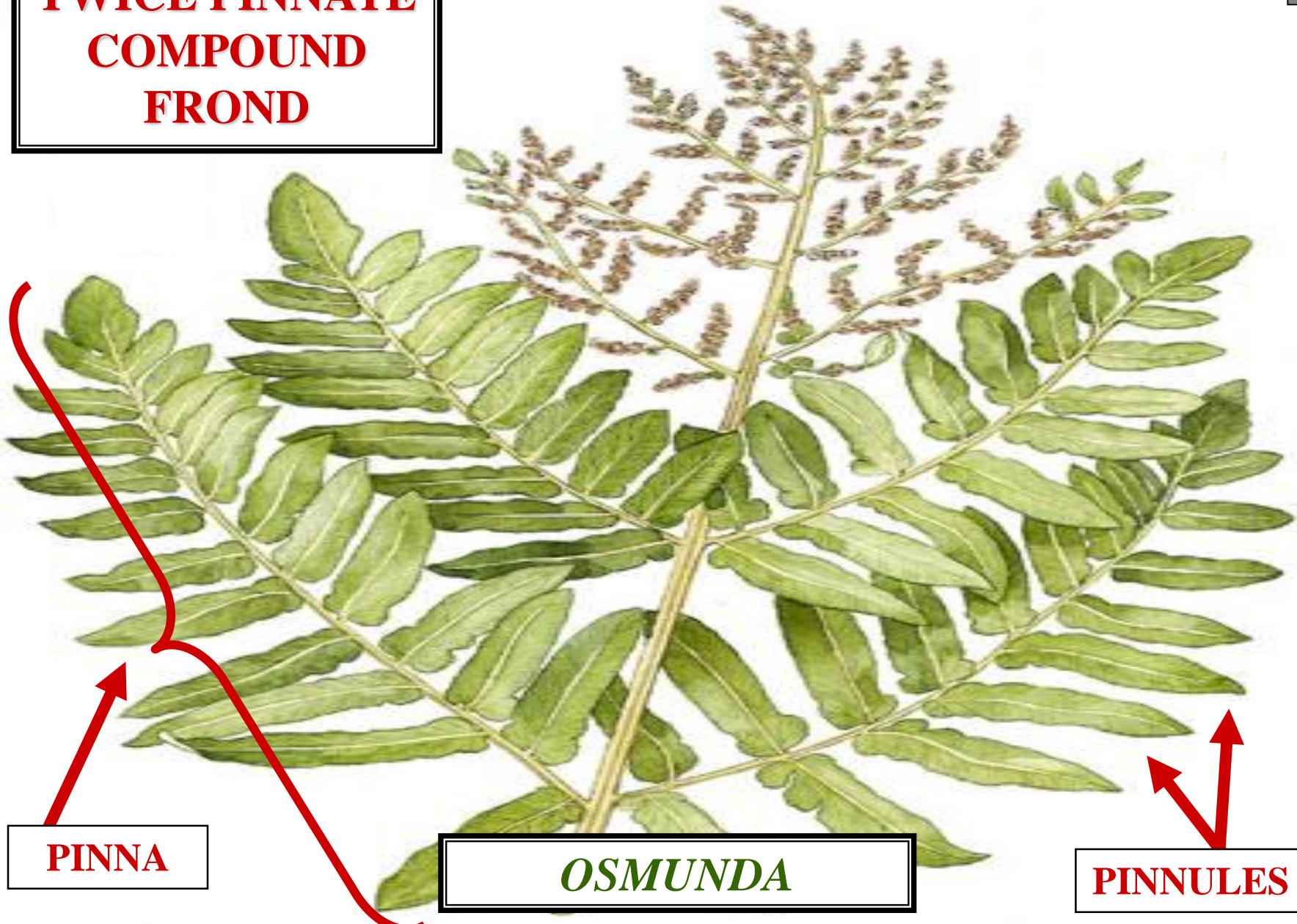


PINNA

OSMUNDA



**TWICE PINNATE
COMPOUND
FROND**



PINNA

OSMUNDA

PINNULES

SIMPLE FROND

SIMPLE FROND

FROND MORPHOLOGY

SIMPLE FROND



PINNAE ASBSENT

FROND MORPHOLOGY

SIMPLE FROND

**SIMPLE
FERN FROND
MORPHOLOGY**



**SIMPLE
FERN FROND
MORPHOLOGY**

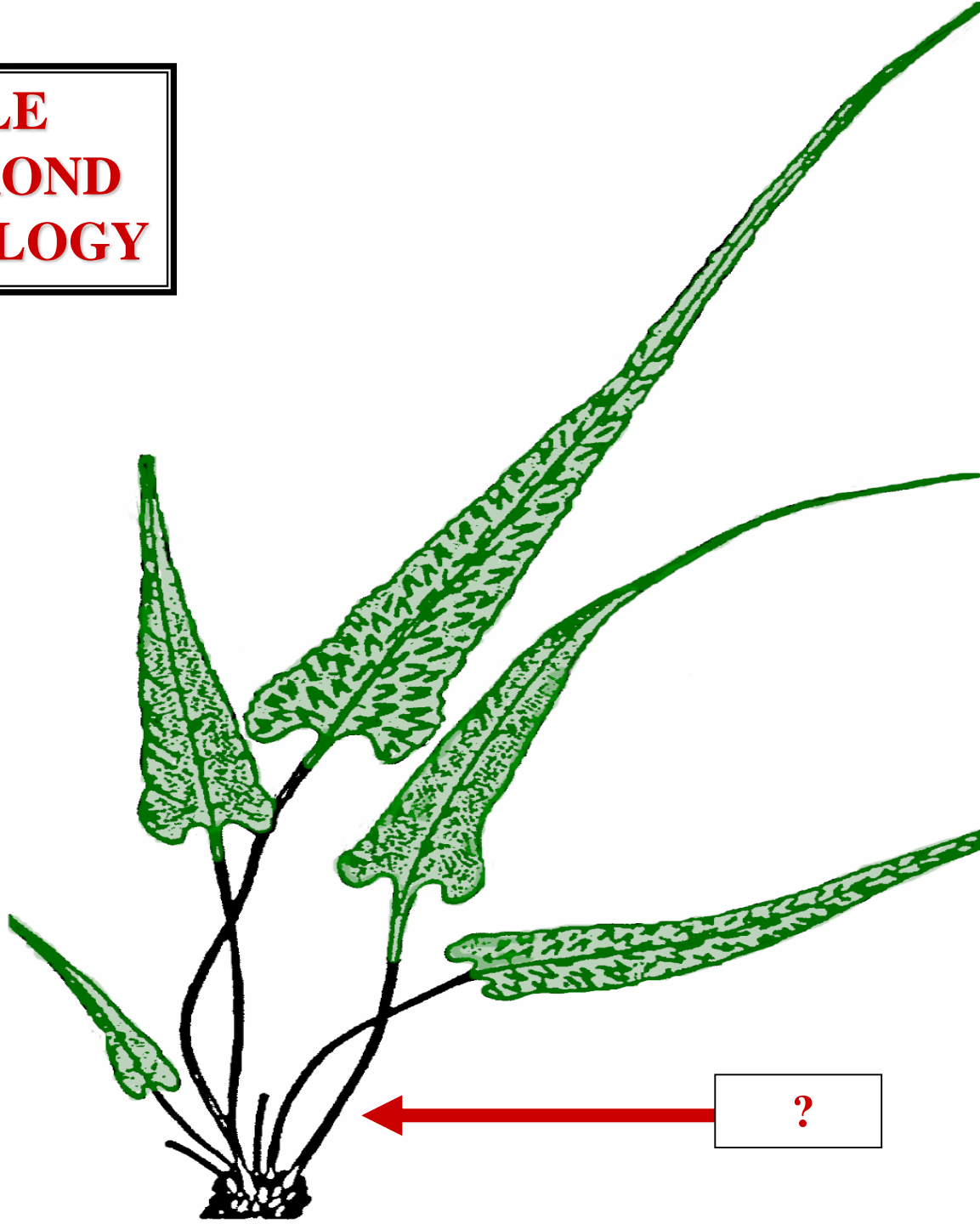


**PINNAE
ABSENT**



SIMPLE FROND MORPHOLOGY

**SIMPLE
FERN FROND
MORPHOLOGY**



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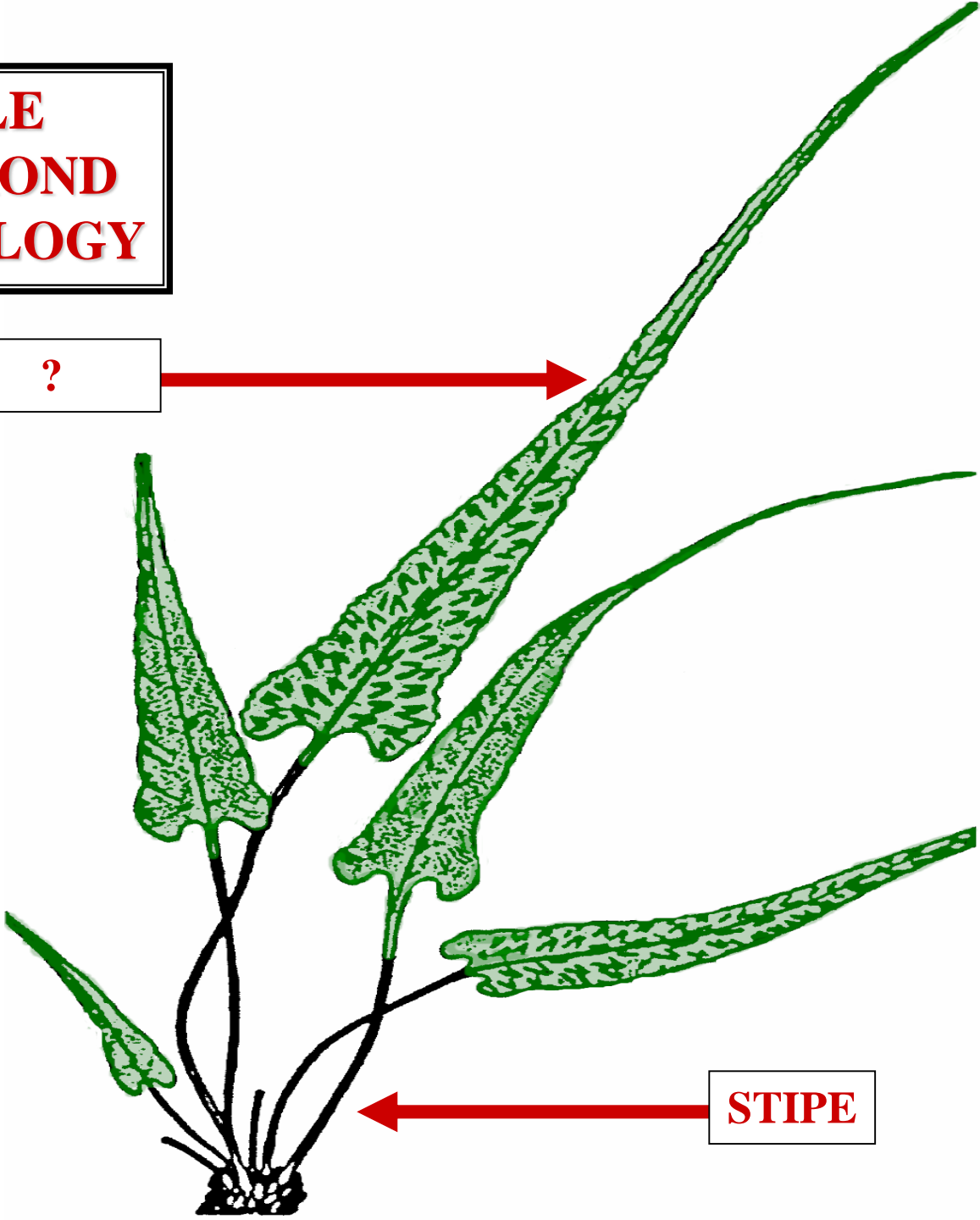
**SIMPLE
FERN FROND
MORPHOLOGY**



STIPE

**SIMPLE
FERN FROND
MORPHOLOGY**

?

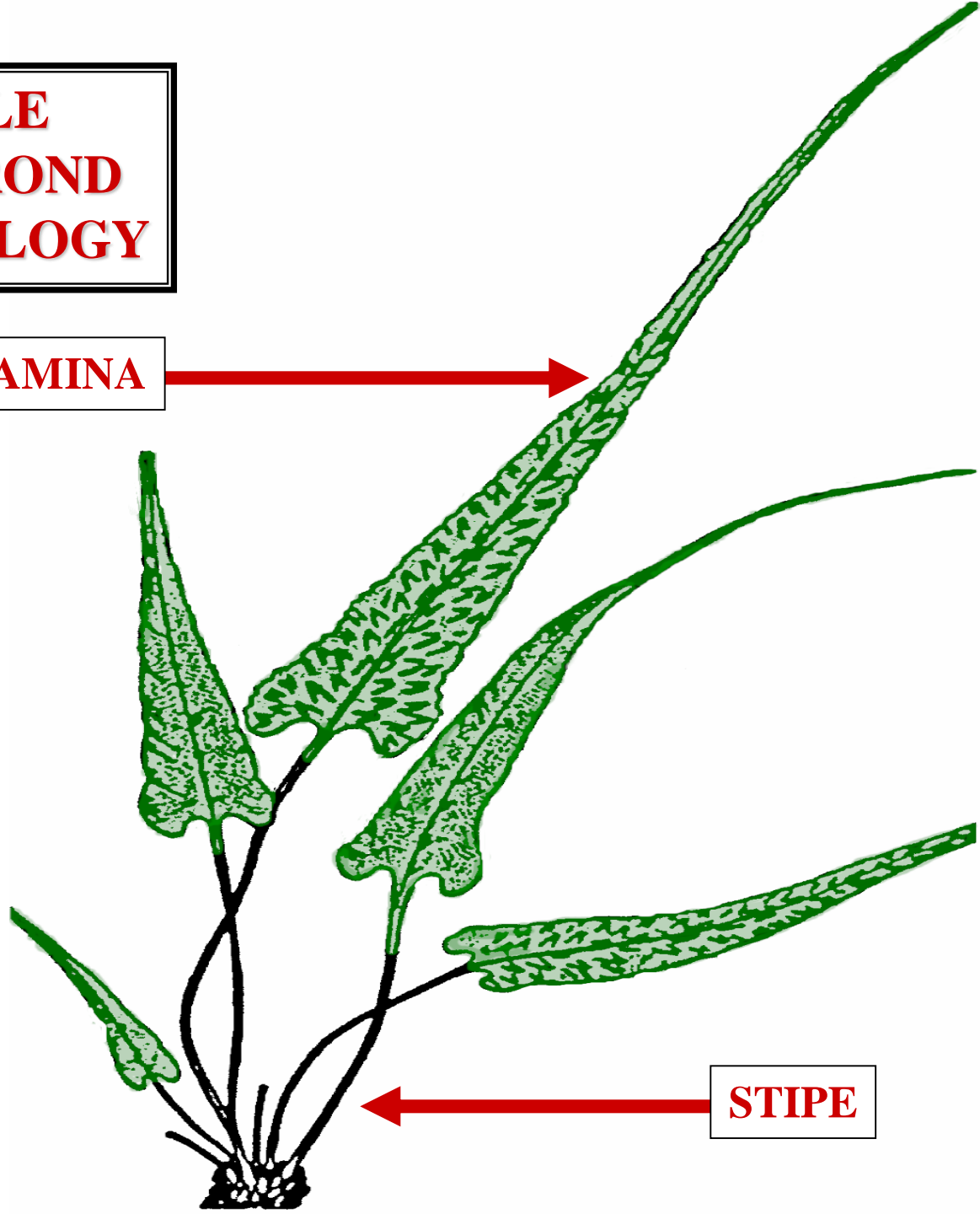


STIPE



**SIMPLE
FERN FROND
MORPHOLOGY**

LAMINA



STIPE



SORUS

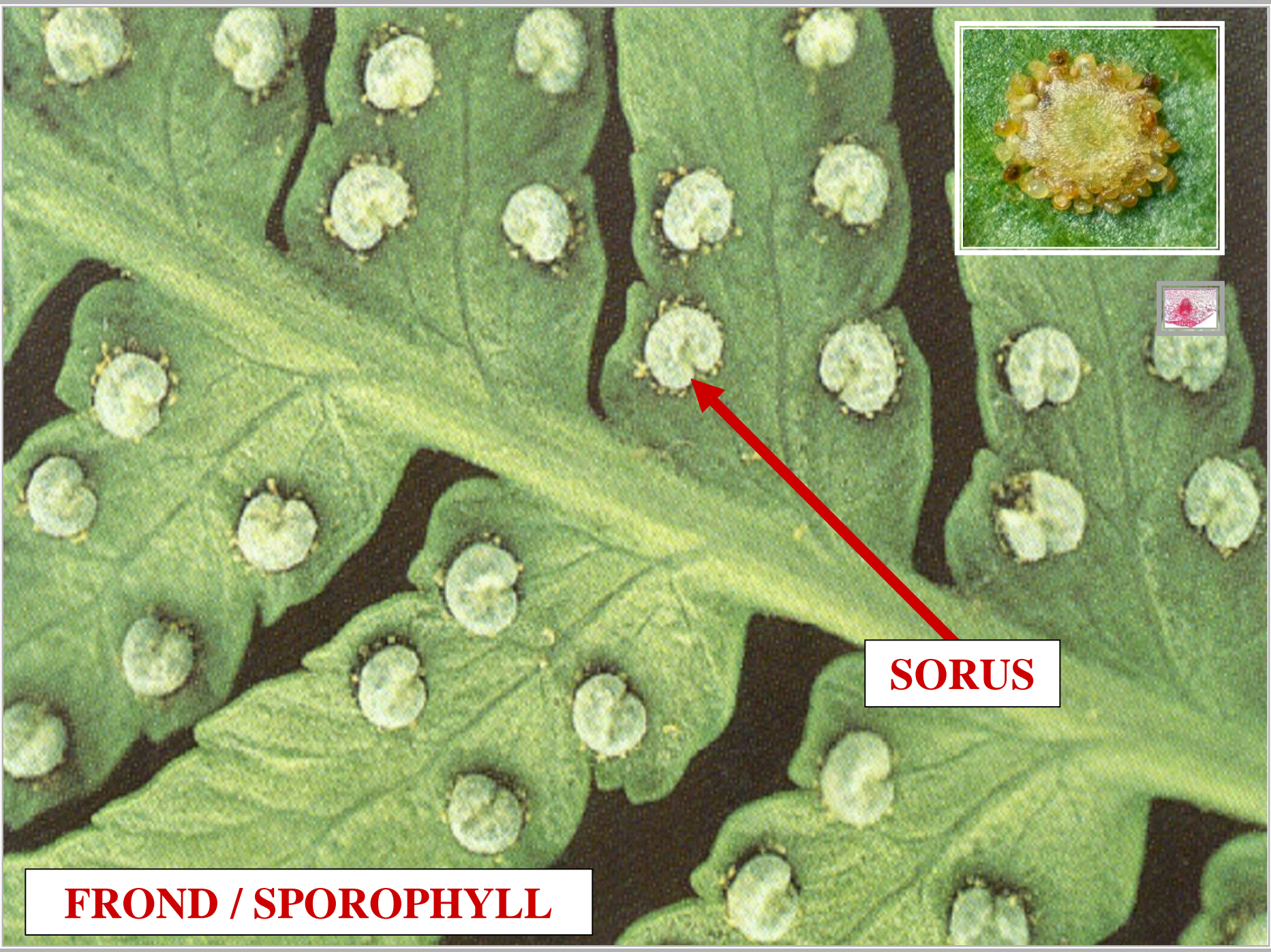
SORUS

PTERALES SORUS



**SPORANGIA
CLUSTER**

**PTERALES
SORUS**



SORUS

FROND / SPOROPHYLL



L.S.

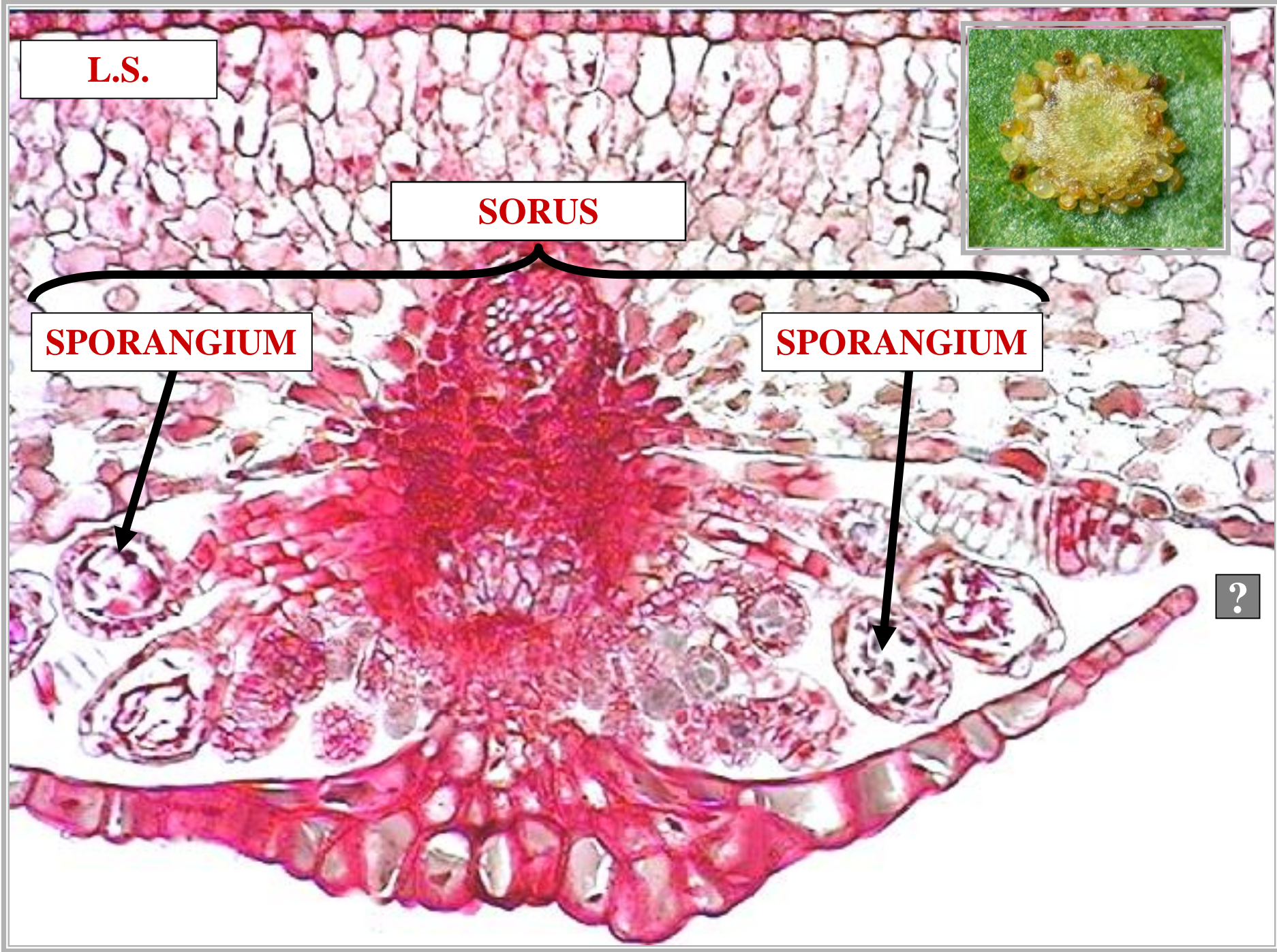
SORUS



SPORANGIUM

SPORANGIUM

?



L.S.

SORUS

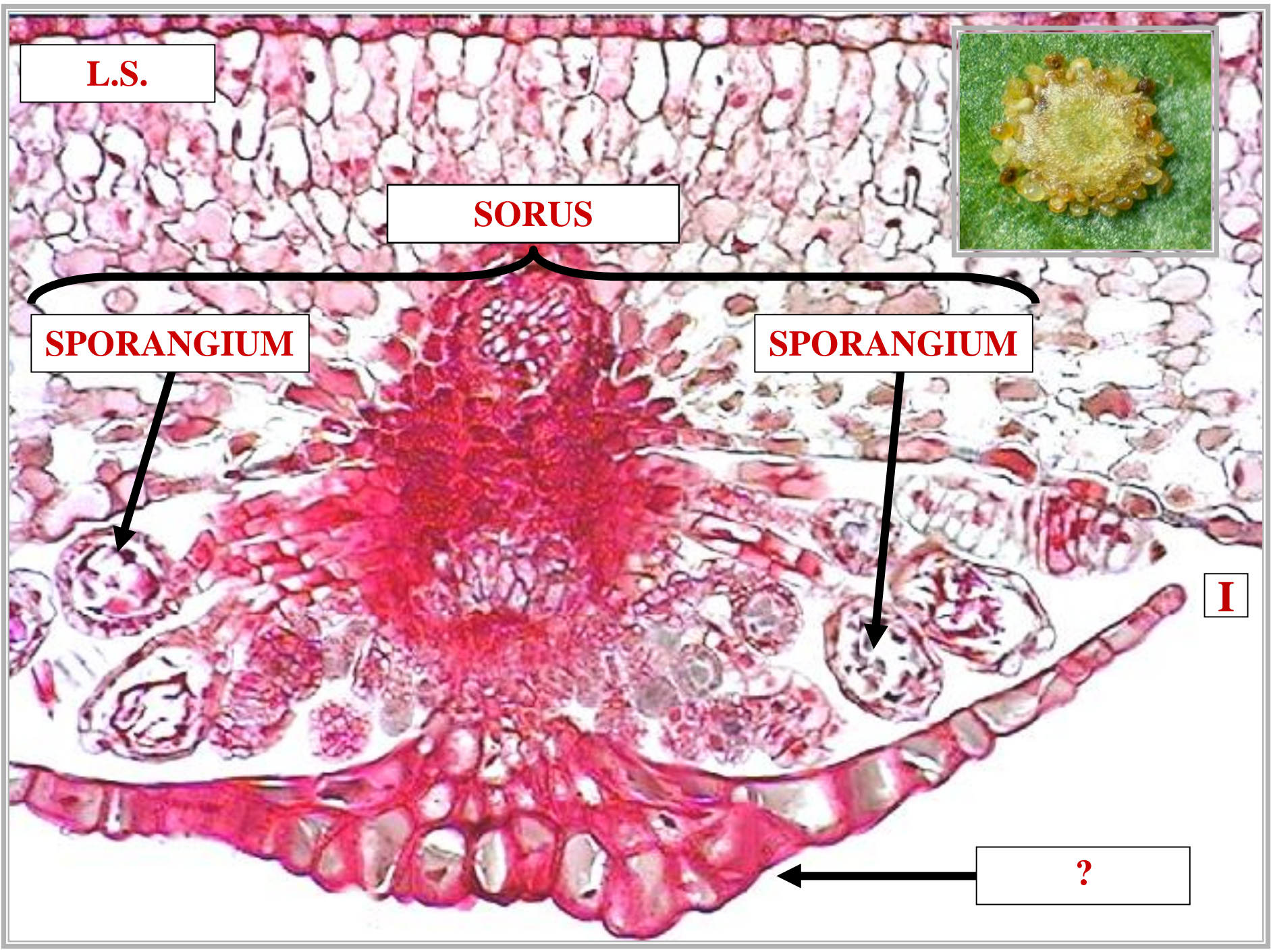


SPORANGIUM

SPORANGIUM

I

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L.S.

SORUS

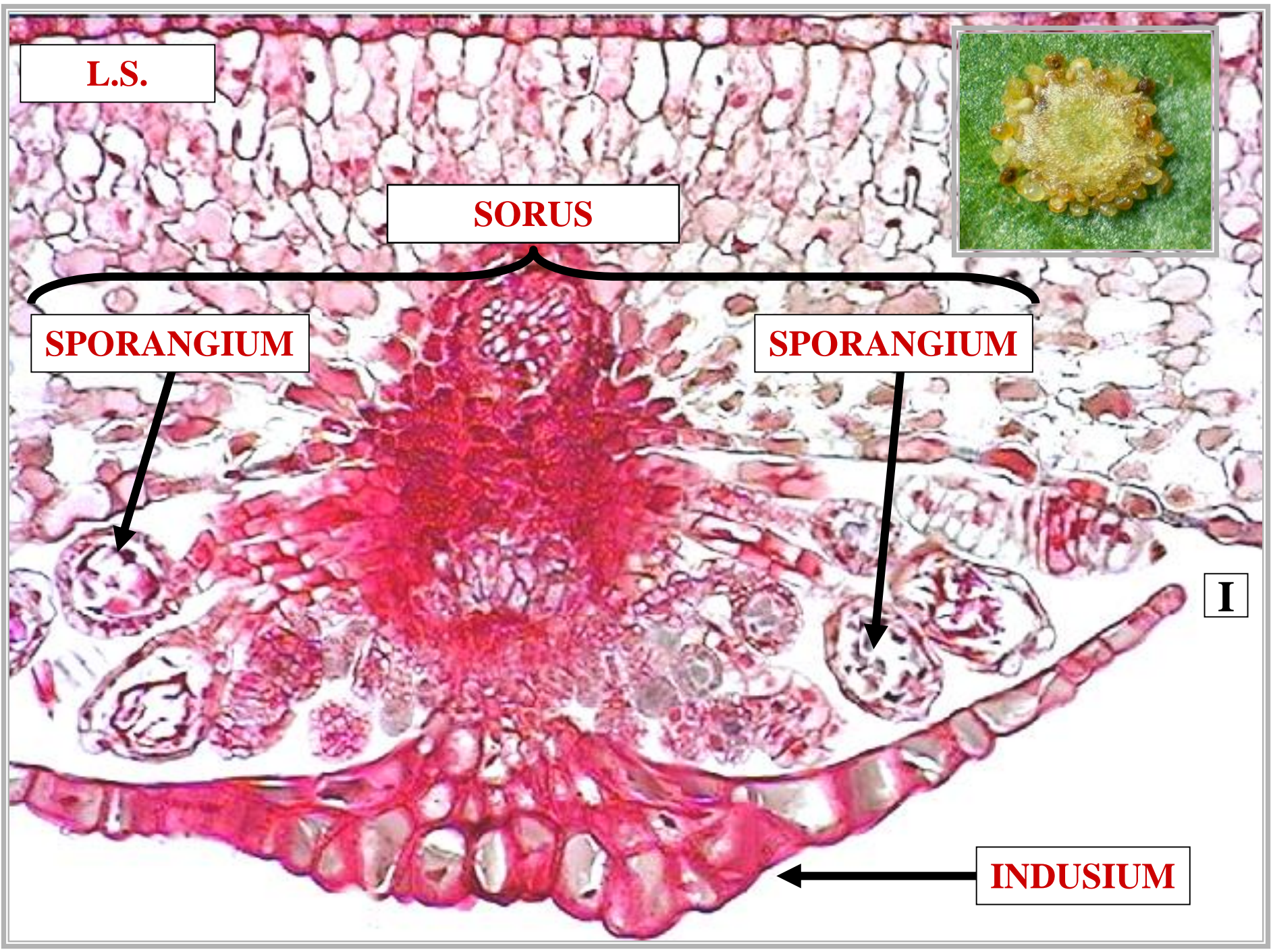


SPORANGIUM

SPORANGIUM

I

INDUSIUM



INDUSIUM



**PTERALES
INDUSIUM**

MODIFIED PLT HAIR

**PTERALES
INDUSIUM**

**PTERALES
INDUSIUM**



MODIFIED PLT HAIR

PROTECTS SPORANGIA

**PTERALES
INDUSIUM**



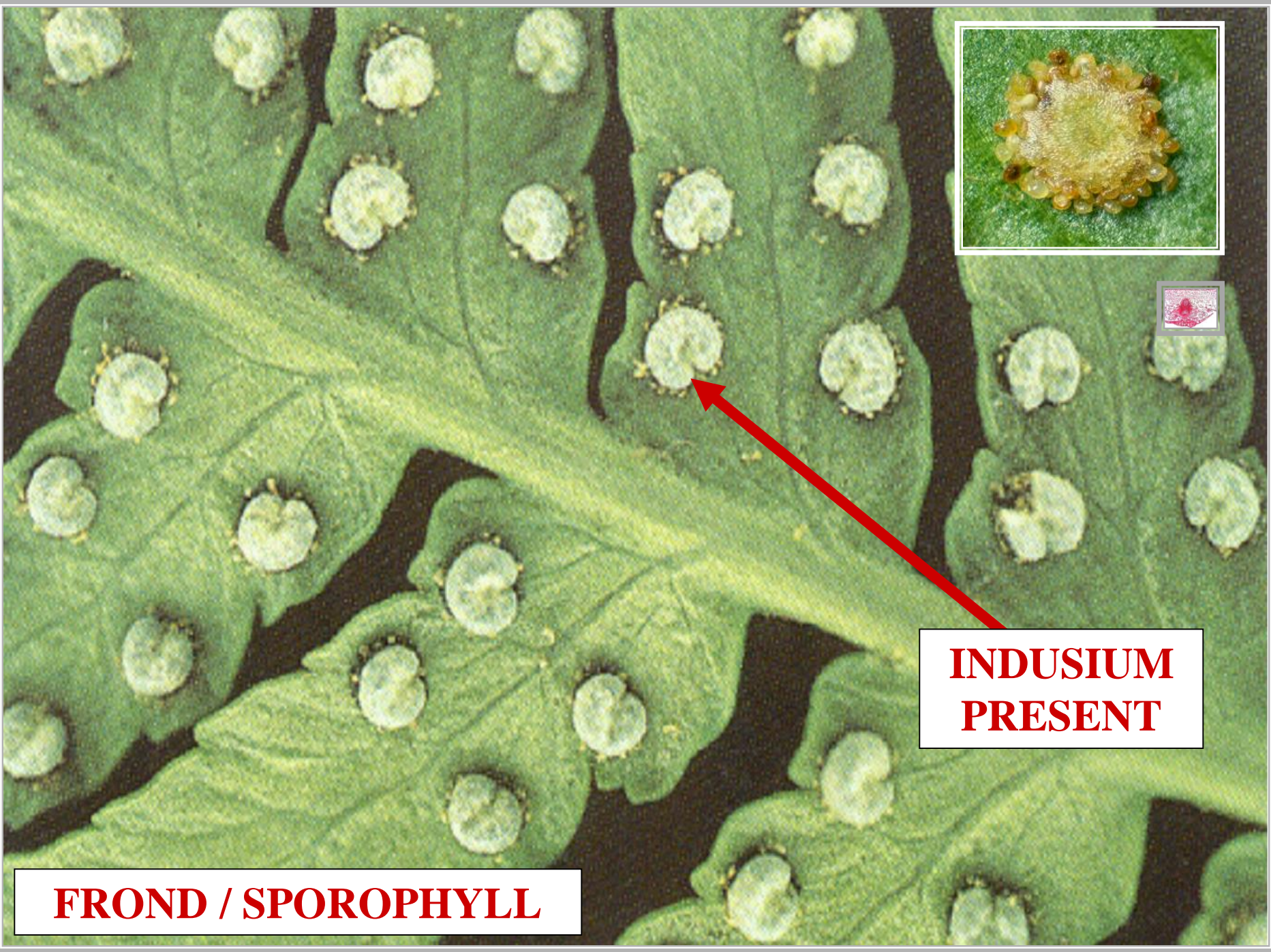
**PTERALES
INDUSIUM**

MODIFIED PLT HAIR

PROTECT SPORANGIA

PRESENT OR ABSENT

**PTERALES
INDUSIUM**



**INDUSIUM
PRESENT**

FROND / SPOROPHYLL

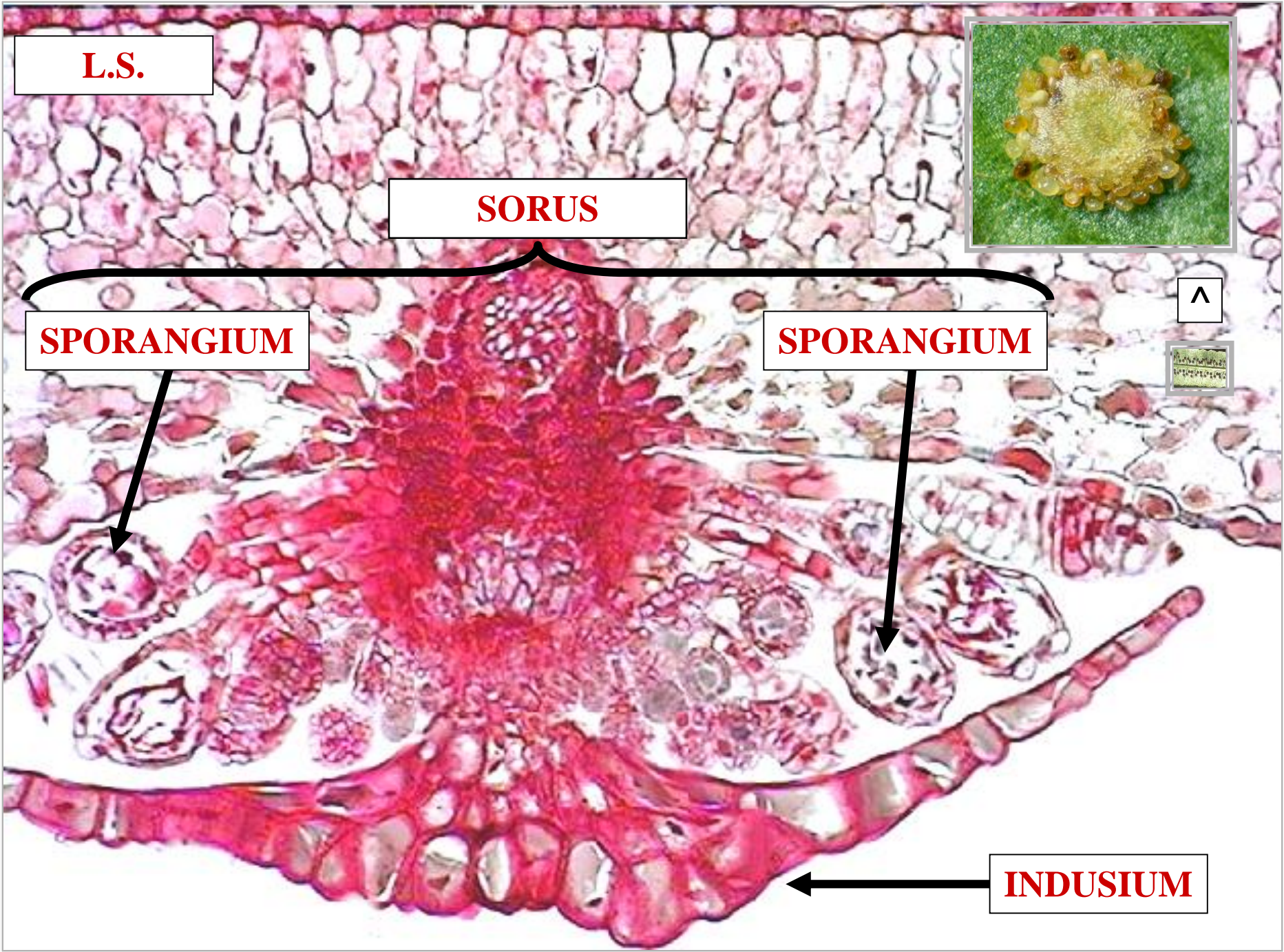
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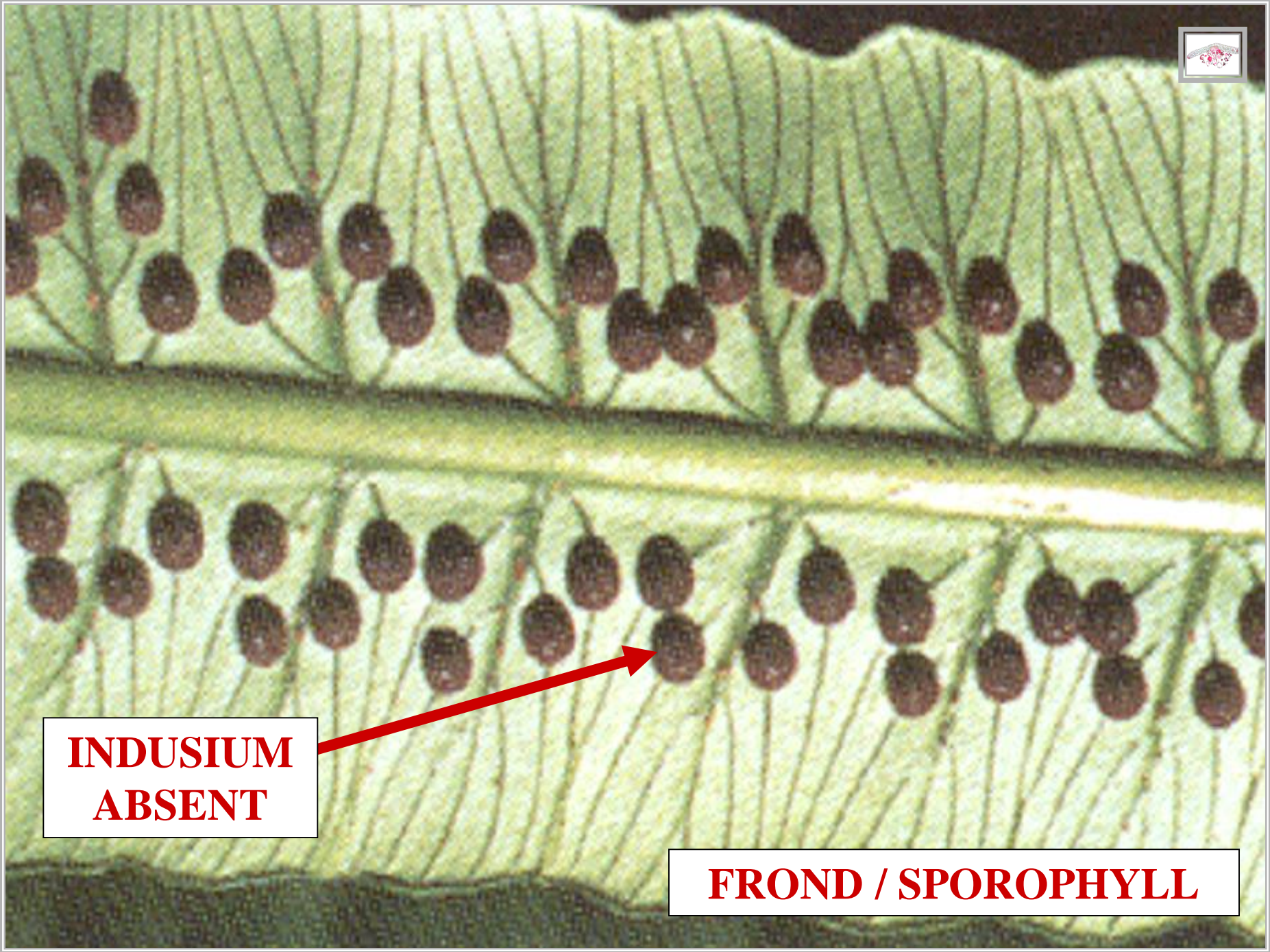
SORUS

SPORANGIUM

SPORANGIUM

INDUSIUM

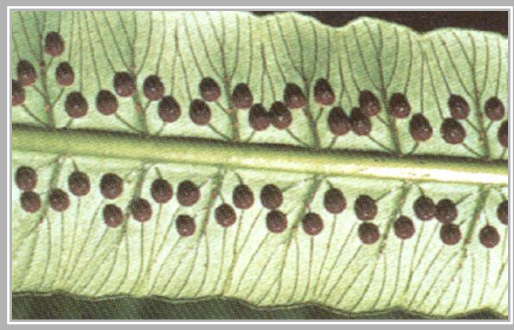




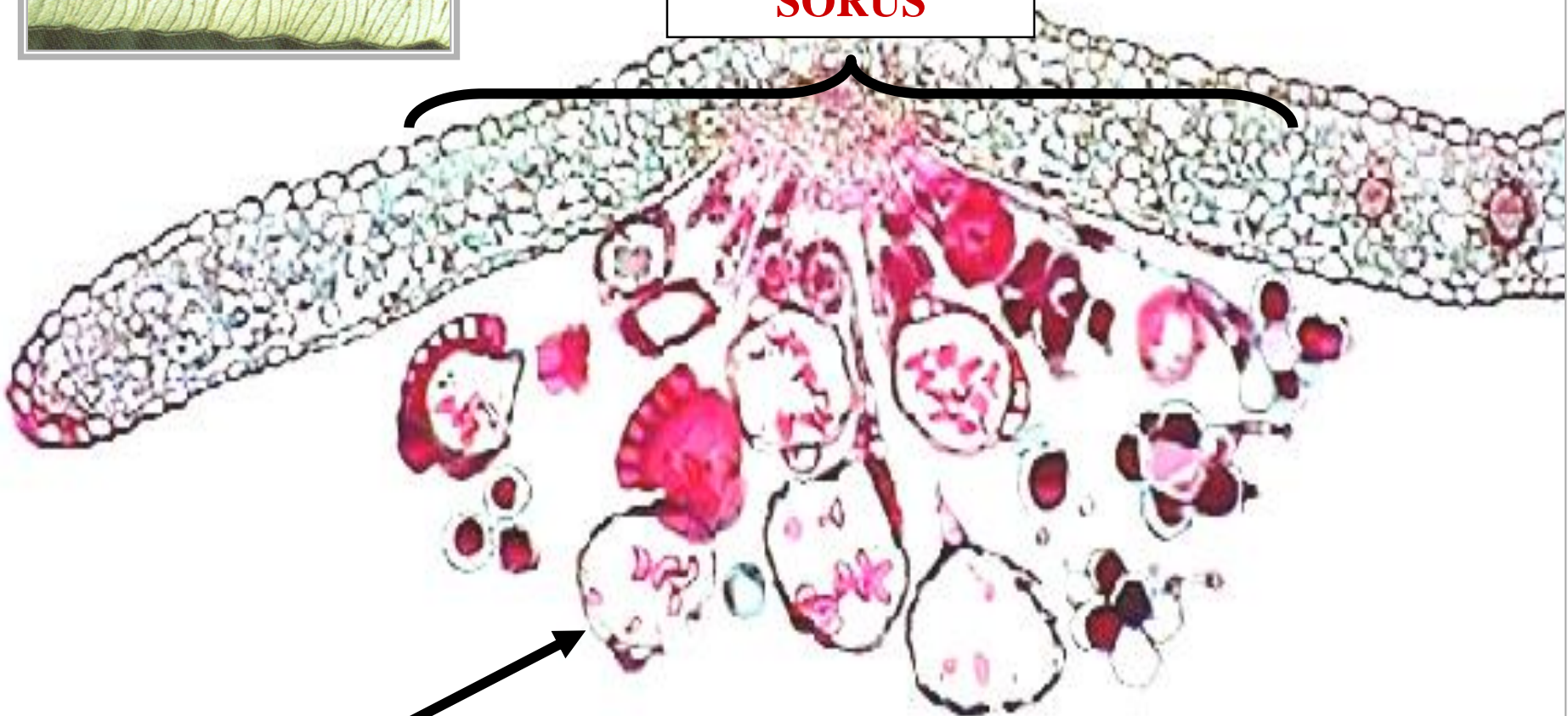
**INDUSIUM
ABSENT**

FROND / SPOROPHYLL

POLYPODIUM



SORUS



SPORANGIUM

INDUSIUM ABSENT

L.S.



SPORANGIUM

“T”



“ADVANCED FERNS”

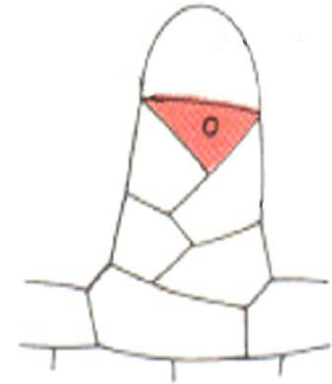
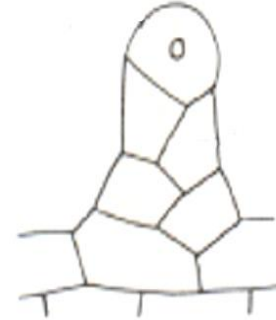
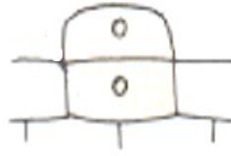
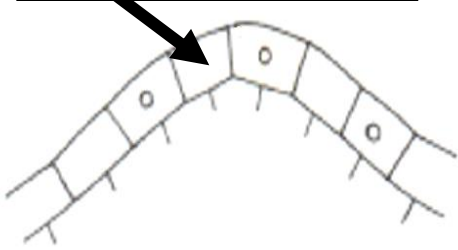




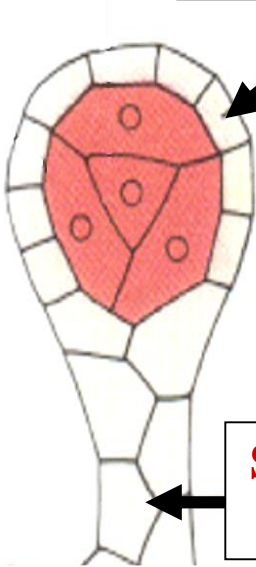
“TRUE FERNS”



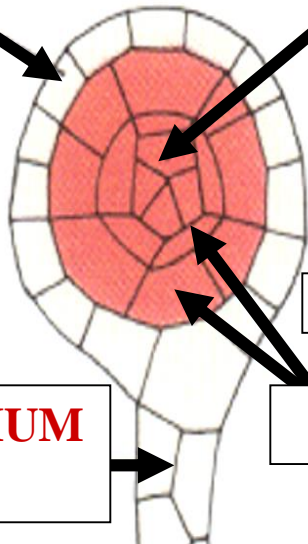
CELL INITIAL



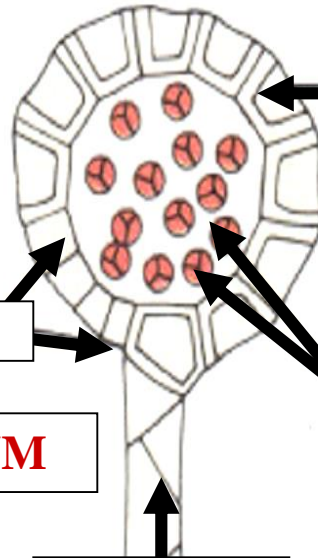
SPORANGIUM WALL



SPOROCYTES



SMALL SIZE



ANNULUS

THIN WALL

FEW SPORES

STOMIUM

TAPETUM

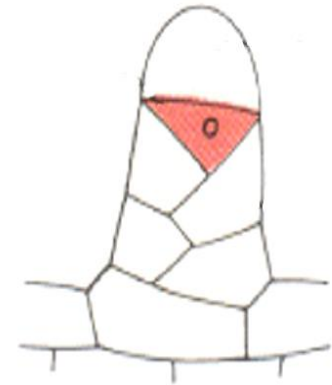
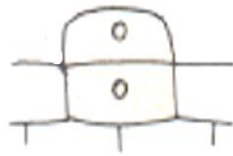
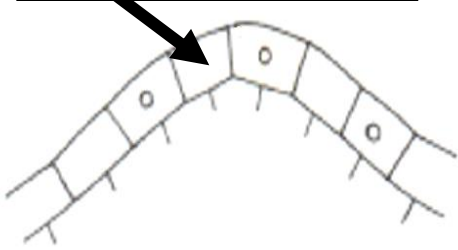
SPORANGIUM STALK

STALK

L.S.



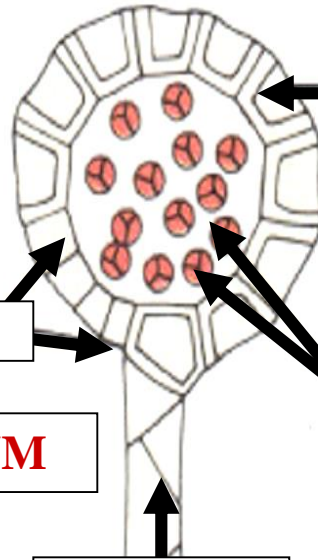
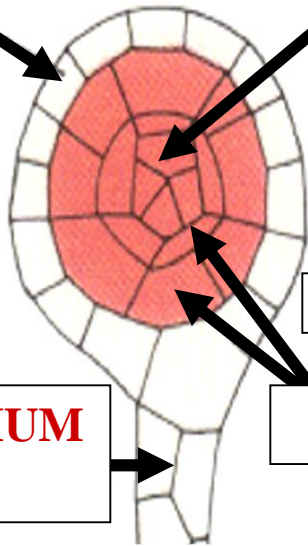
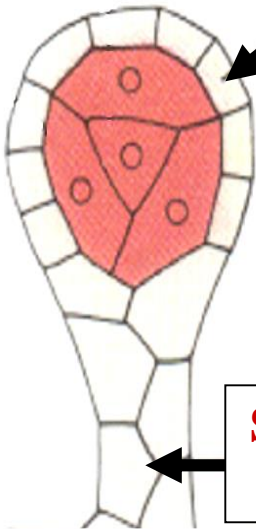
CELL INITIAL



SPORANGIUM WALL

SPOROCYTES

SMALL SIZE



ANNULUS

THIN WALL

FEW SPORES

STOMIUM

TAPETUM

SPORANGIUM STALK

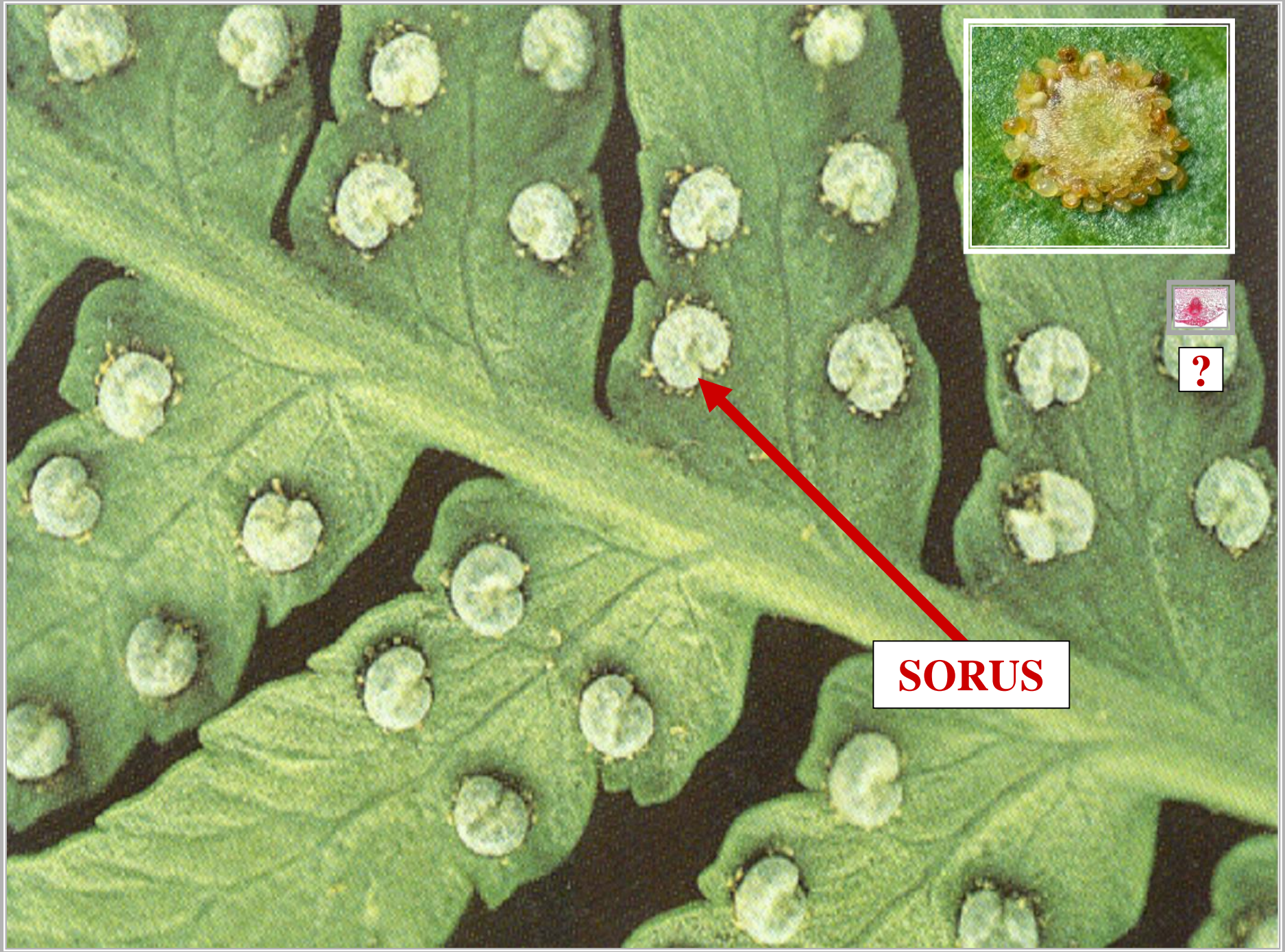
STALK

LEPTOSPORANGIUM

L.S.



SPORANGIUM POSITION



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SORUS



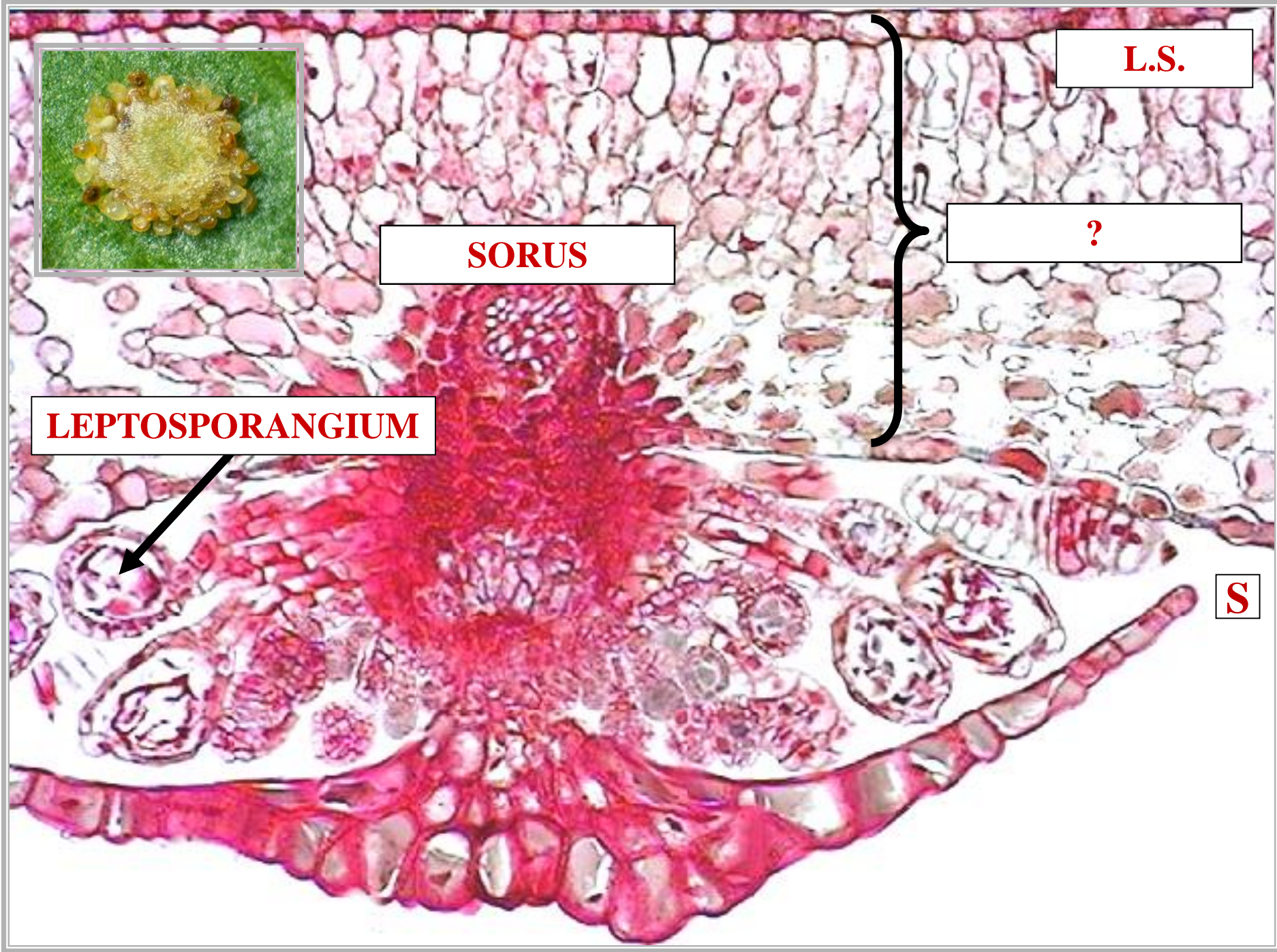
SORUS

L.S.

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LEPTOSPORANGIUM

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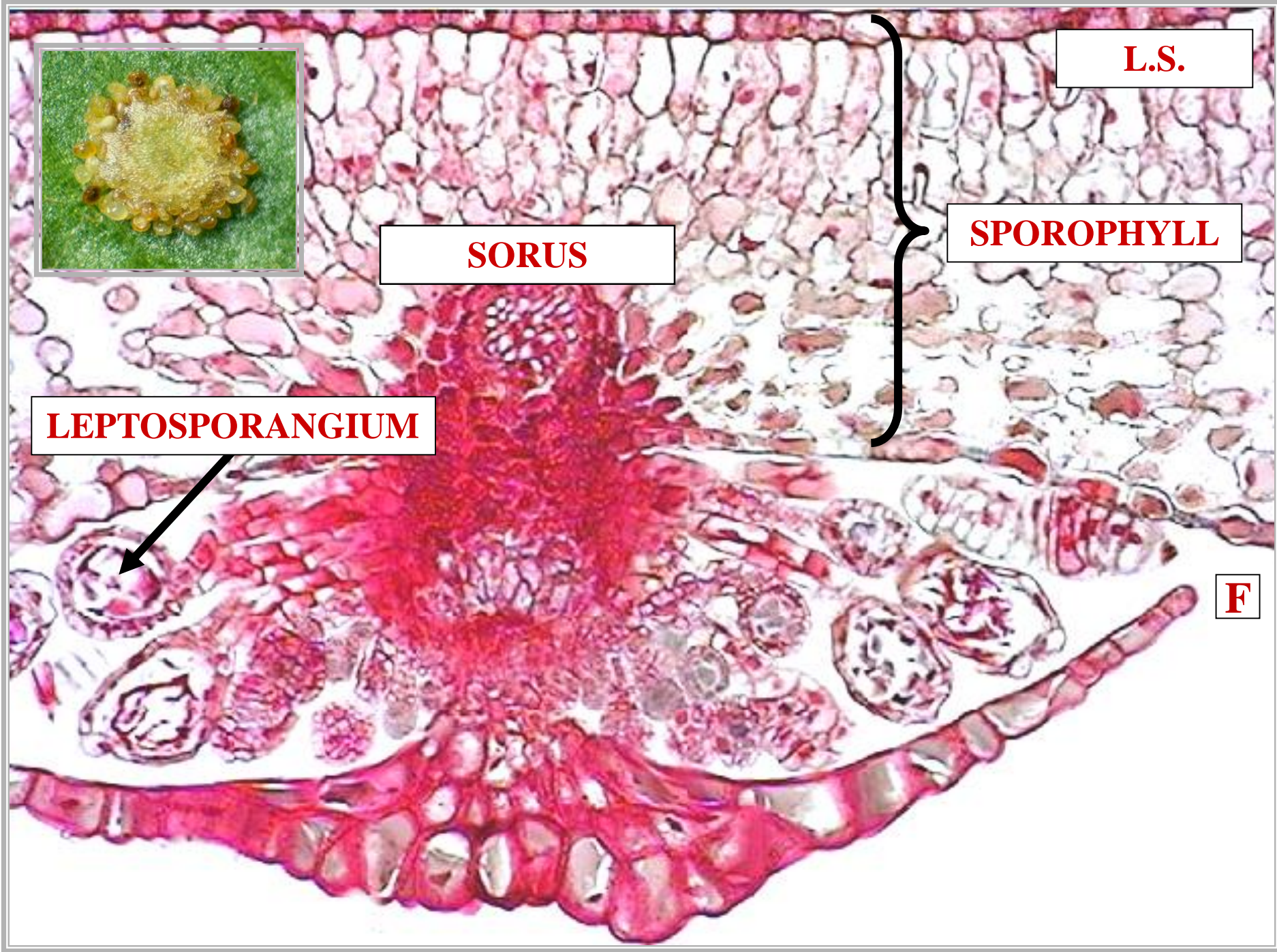
SORUS

L.S.

SPOROPHYLL

LEPTOSPORANGIUM

F





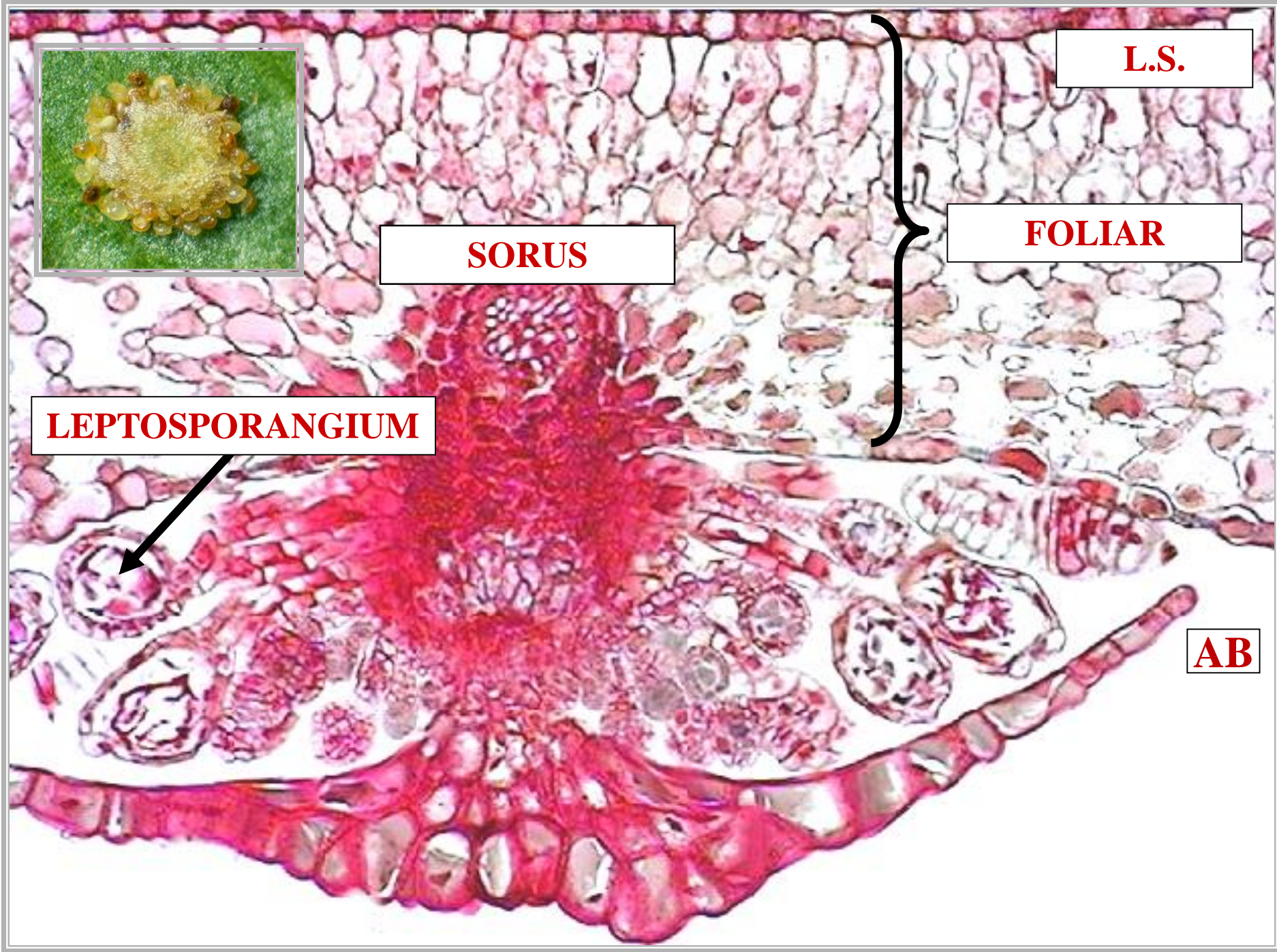
SORUS

L.S.

FOLIAR

LEPTOSPORANGIUM

AB





SORUS

L.S.

SPOROPHYLL

LEPTOSPORANGIUM



**ABAXIAL
SURFACE**

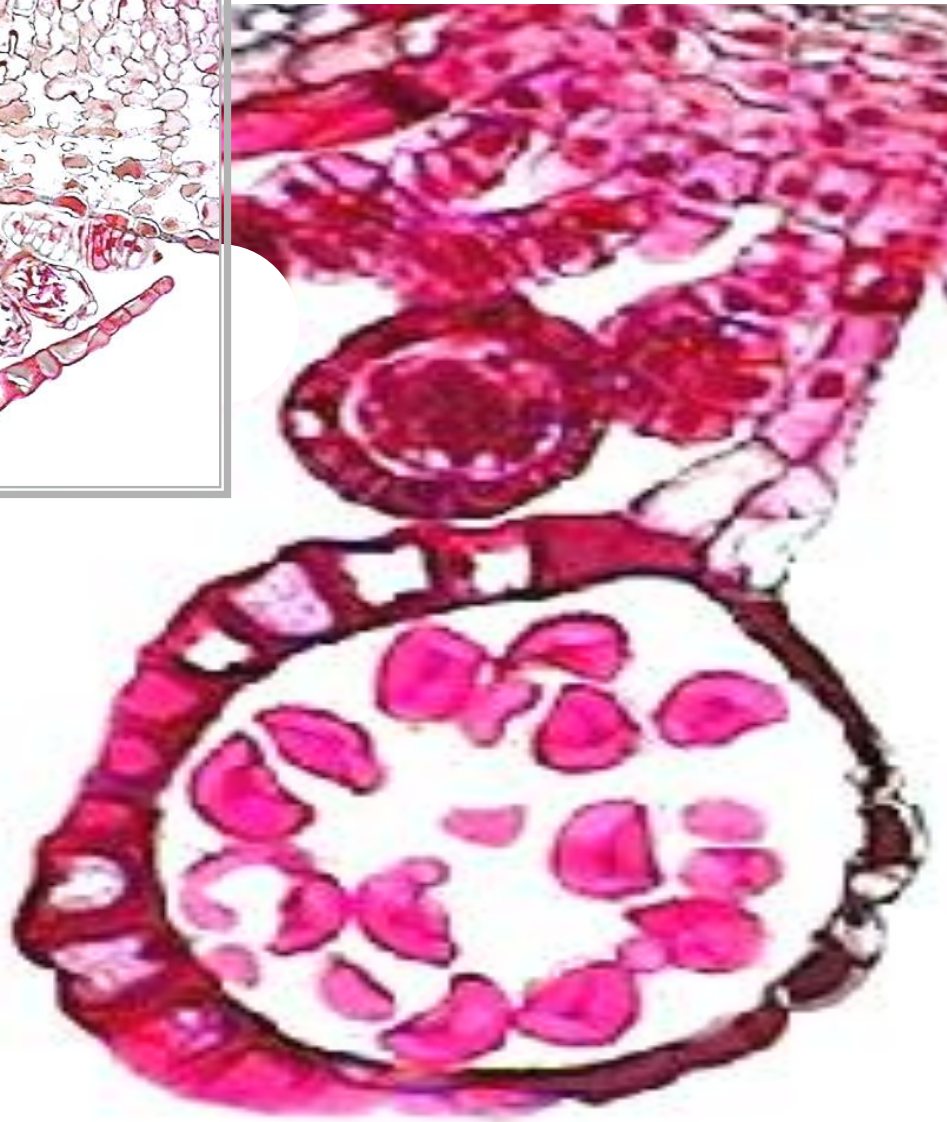
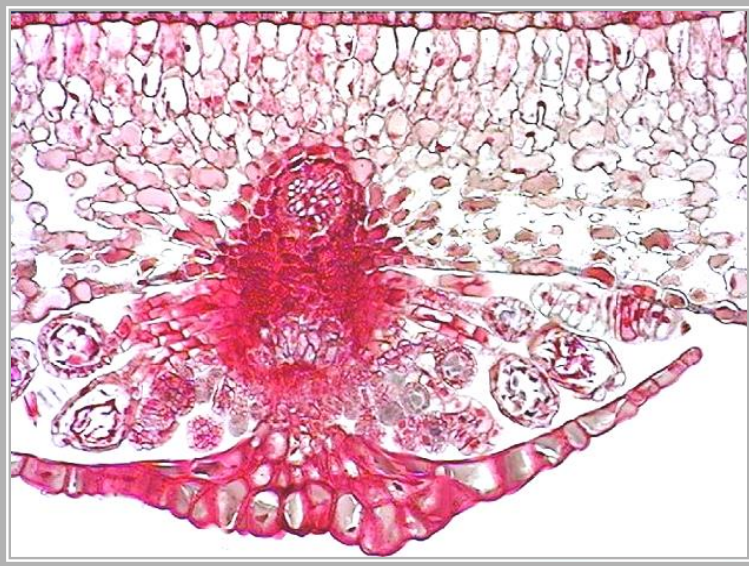




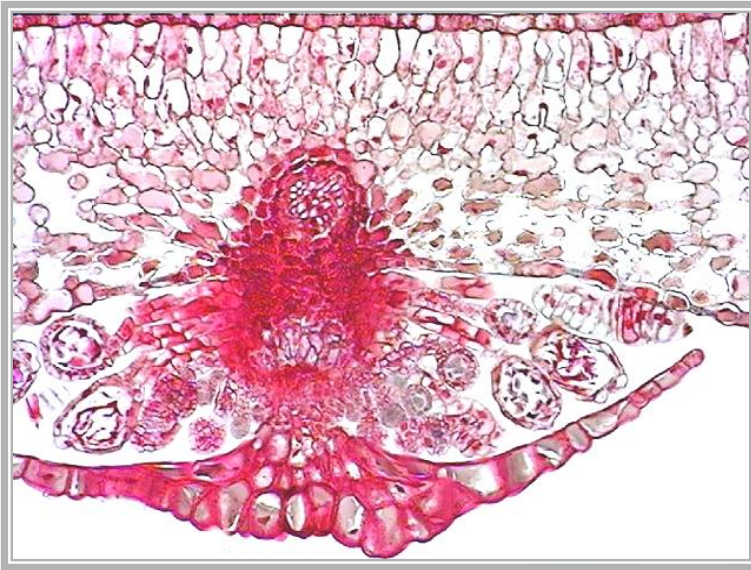
LEPTOSPORANGIUM STRUCTURE

L.S.

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LEPTOSPORANGIUM



L.S.

S

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LEPTOSPORANGIUM



L.S.

S

STALK

LEPTOSPORANGIUM

STALK

LEPTOSPORANGIUM STALK



BEARS
SPORANGIUM

LEPTOSPORANGIUM
STALK



L.S.

?



STALK

SPORANGIUM

LEPTOSPORANGIUM



L.S.

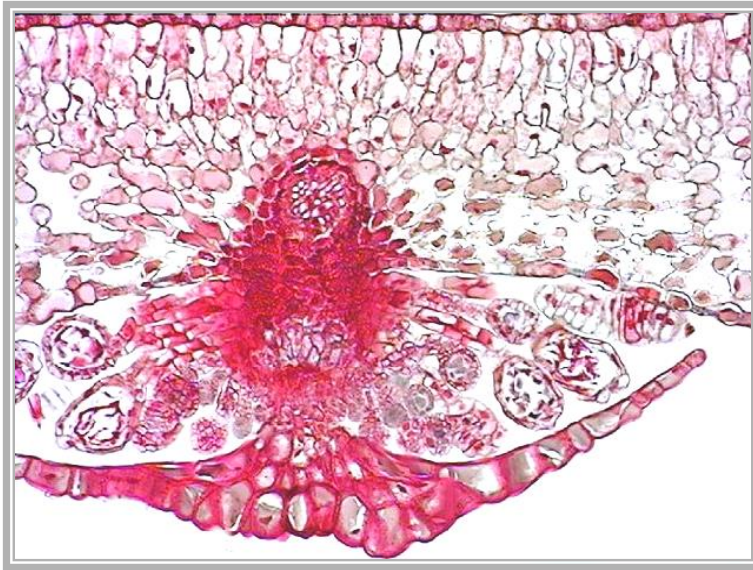
A



STALK

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LEPTOSPORANGIUM



L.S.

A



STALK

ANNULUS

LEPTOSPORANGIUM

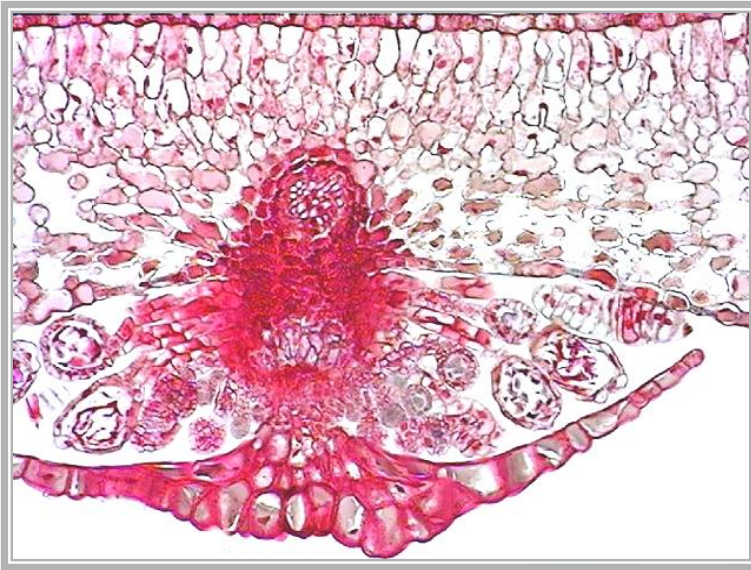
ANNULUS

LEPTOSPORANGIUM ANNULUS



SPORANGIUM
WALL

LEPTOSPORANGIUM
ANNULUS



L.S.

?



STALK

ANNULUS

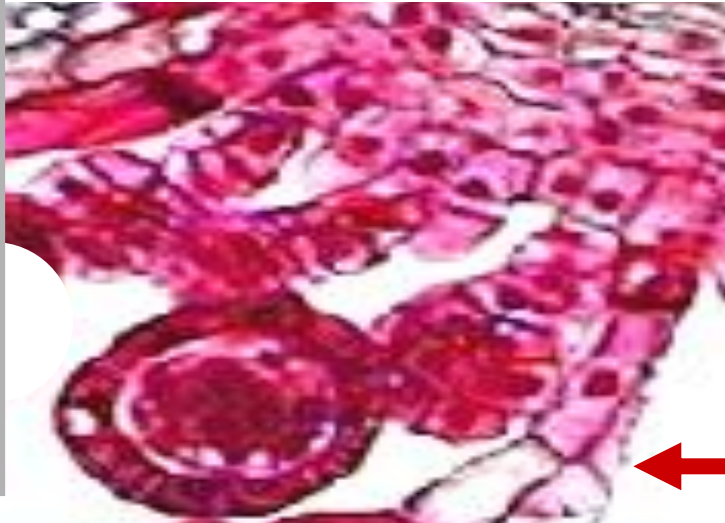


LEPTOSPORANGIUM



L.S.

S



STALK

ANNULUS



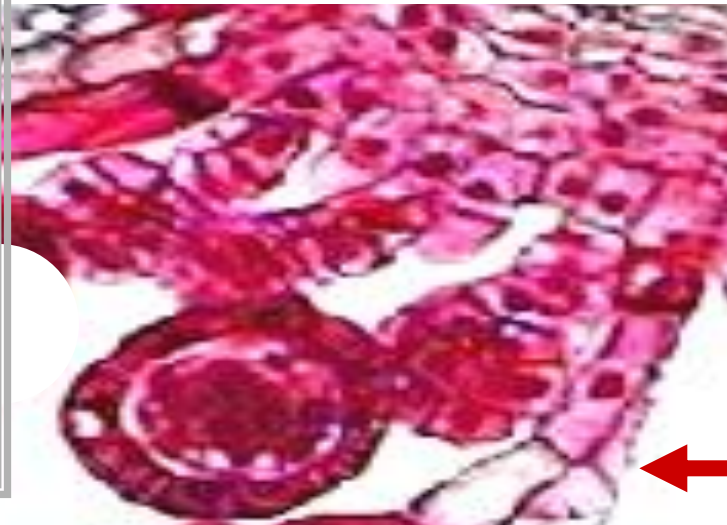
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LEPTOSPORANGIUM



L.S.

S



STALK

ANNULUS



STOMIUM

LEPTOSPORANGIUM

STOMIUM

LEPTOSPORANGIUM STOMIUM



MODIFIED
ANNULUS CELLS

LEPTOSPORANGIUM
STOMIUM

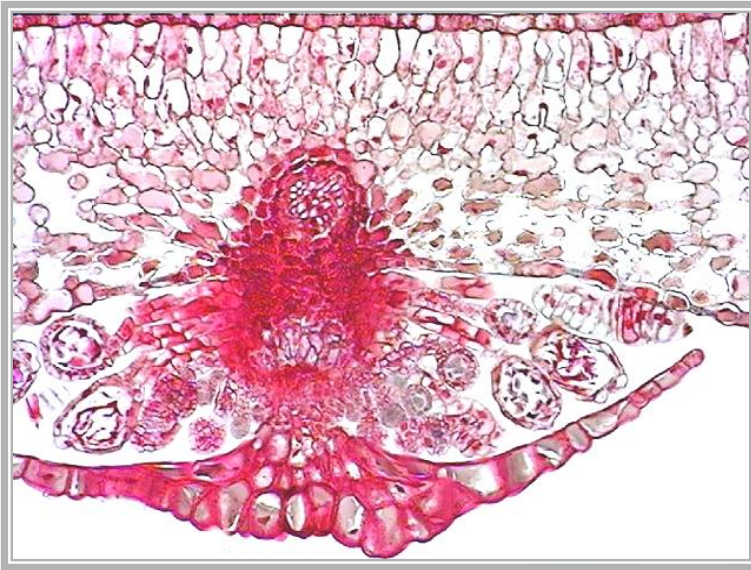
LEPTOSPORANGIUM STOMIUM



**MODIFIED
ANNULUS CELLS**

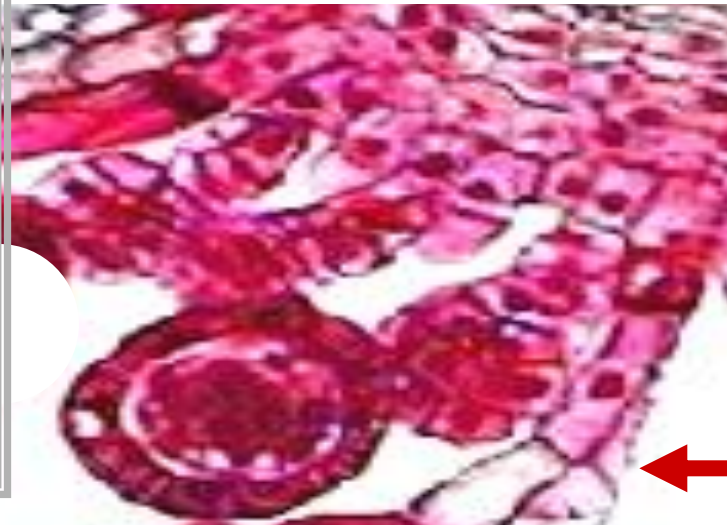
DEHISCENCE POINT

LEPTOSPORANGIUM STOMIUM



L.S.

+



STALK

ANNULUS



STOMIUM

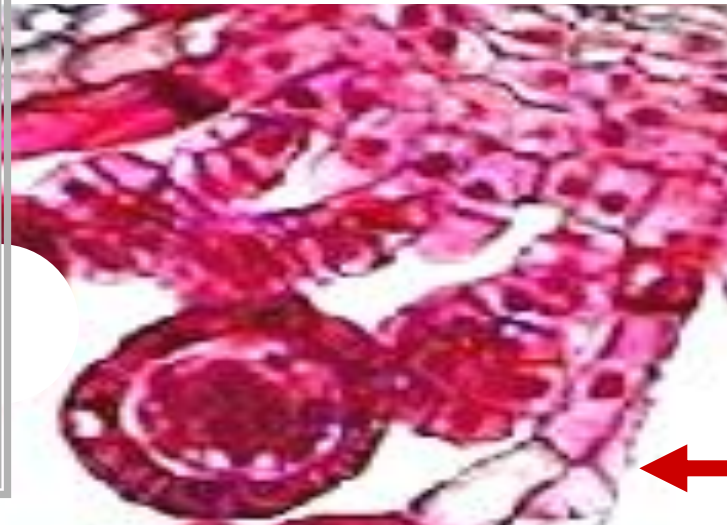
LEPTOSPORANGIUM



L.S.

S

+



STALK

ANNULUS

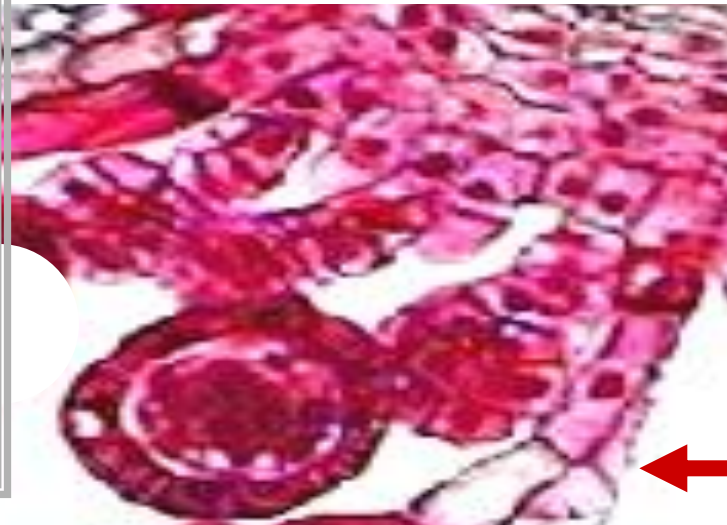


STOMIUM
MODIFIED
ANNULUS CELLS

LEPTOSPORANGIUM



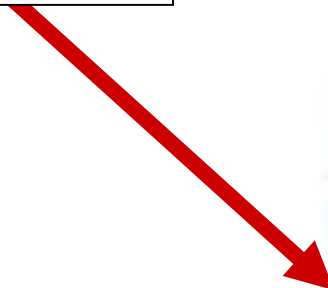
L.S.



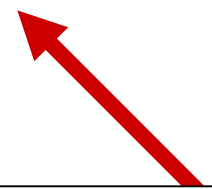
STALK



ANNULUS



**STOMIUM
DEHISCENCE
POINT**



LEPTOSPORANGIUM



SPORE DISPERSAL



SPORE DISPERSAL CATAPULT-LIKE

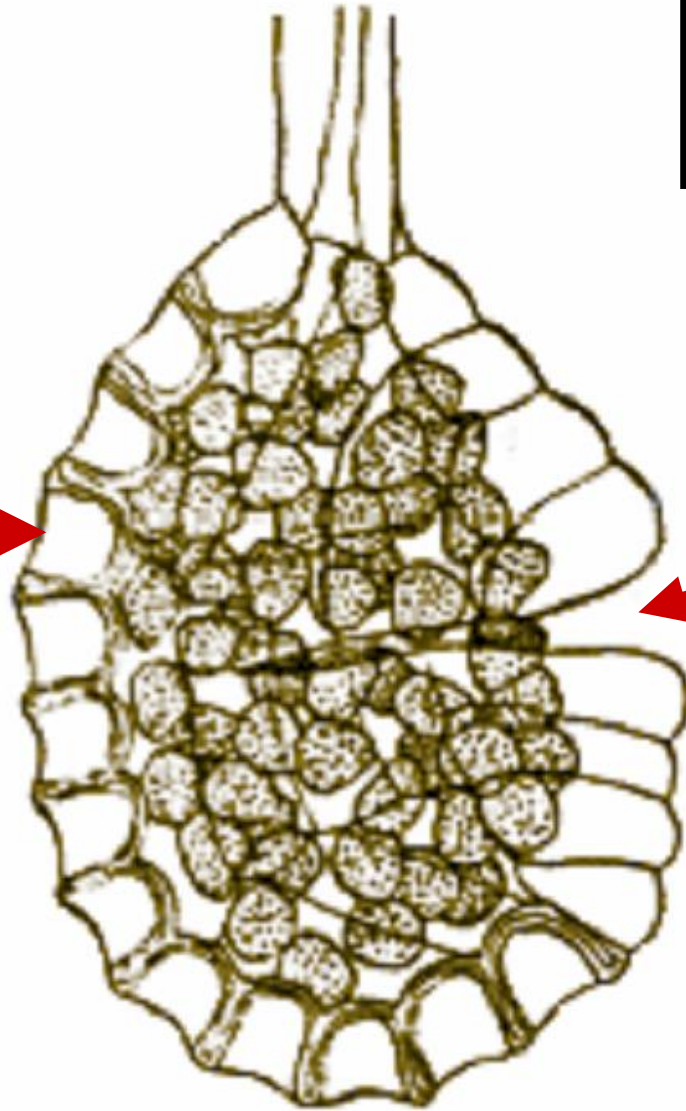
LEPTOSPORANGIUM

D

START
POSITION

ANNULUS

STOMIUM

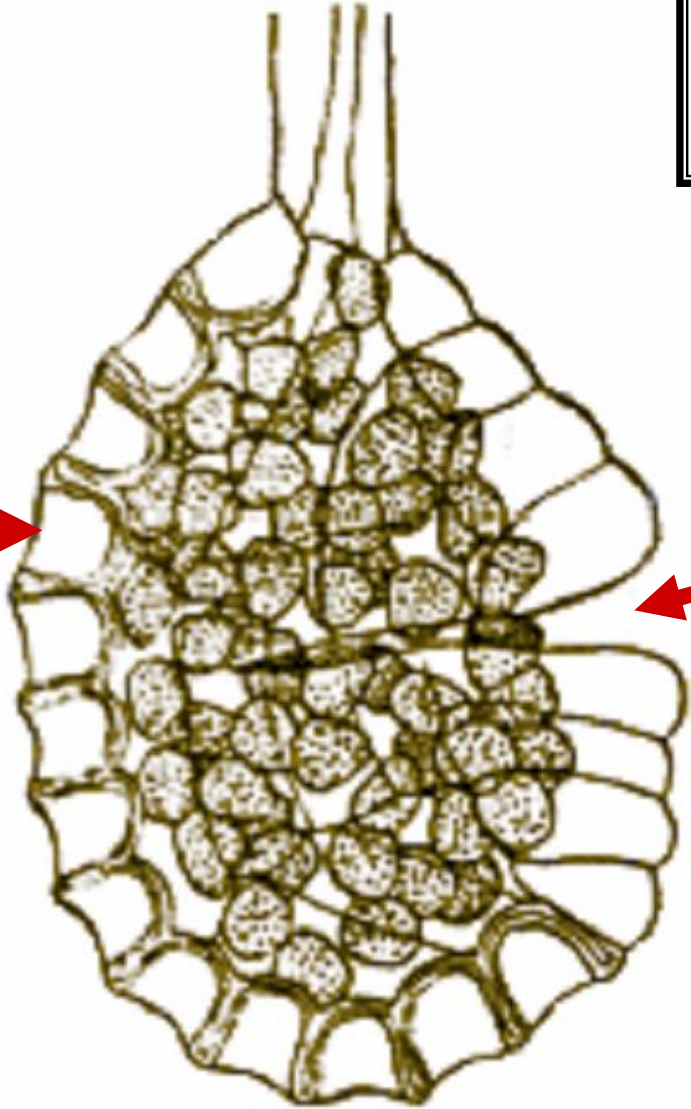


LEPTOSPORANGIUM

**DRY
CONDITIONS**

ANNULUS

STOMIUM



LEPTOSPORANGIUM

C

**DRY
CONDITIONS**

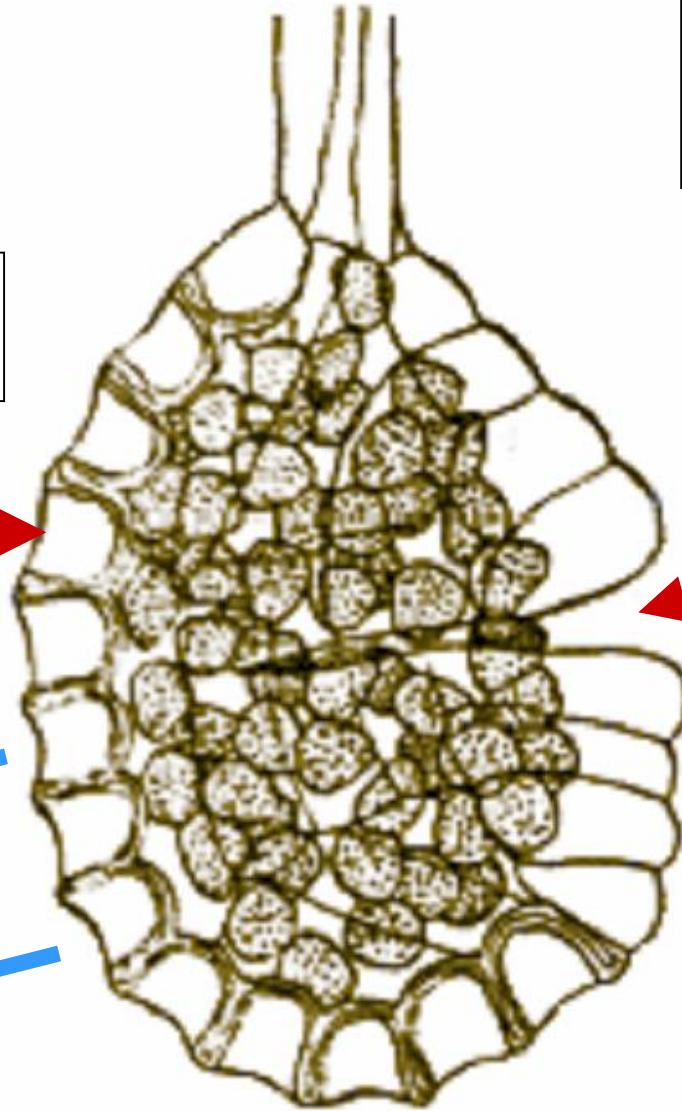
ANNULUS CELLS
CONTRACT

ANNULUS

STOMIUM

WATER

WATER

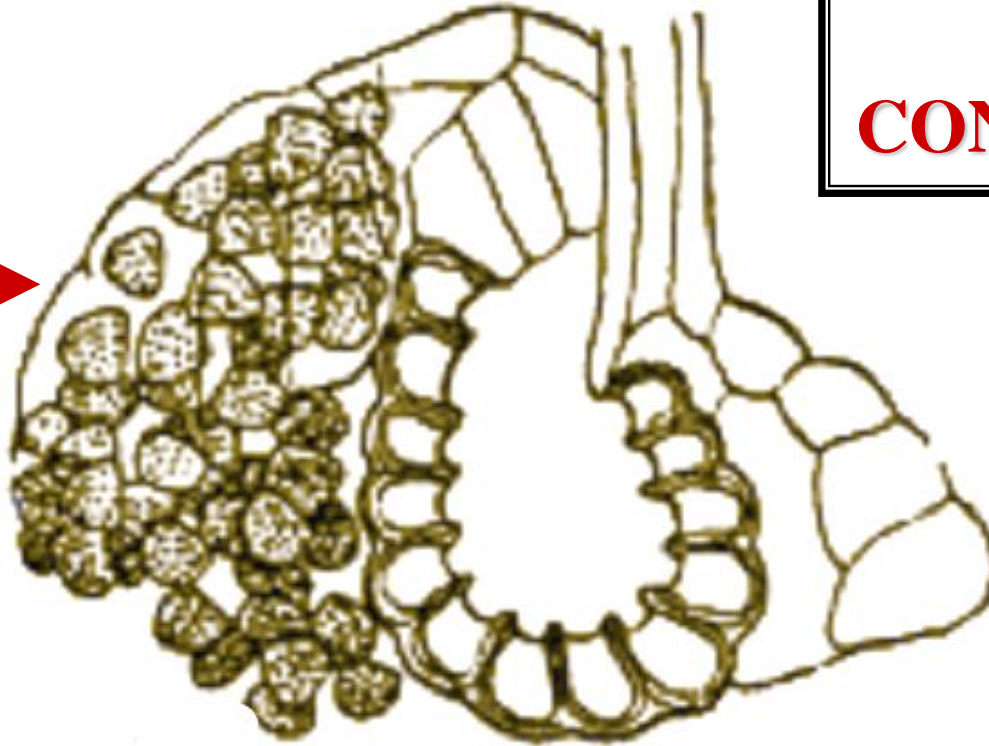


LEPTOSPORANGIUM



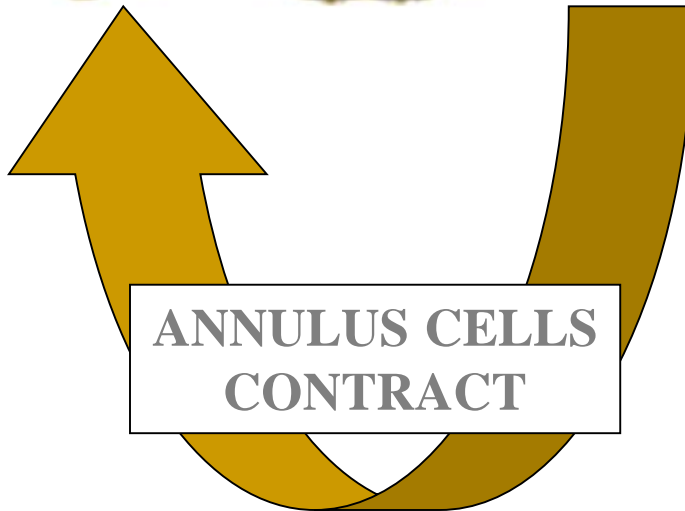
**DRY
CONDITIONS**

ANNULUS



**CATAPULT
POSITION**

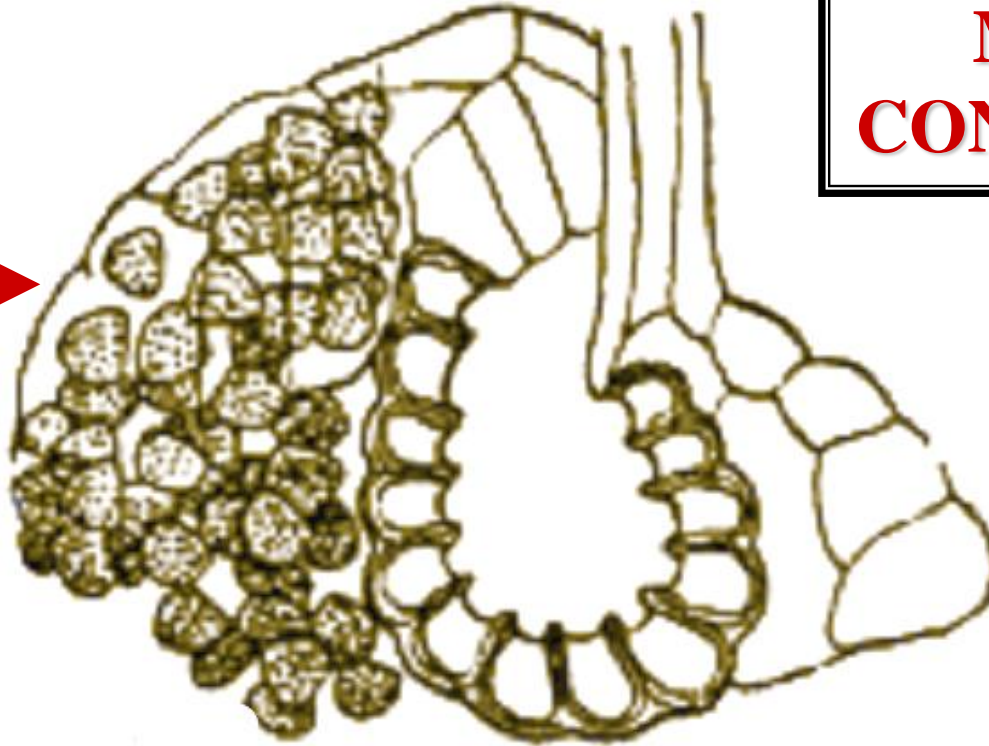
**ANNULUS CELLS
CONTRACT**



LEPTOSPORANGIUM

**MOIST
CONDITIONS**

ANNULUS



LEPTOSPORANGIUM

→ C

**MOIST
CONDITIONS**

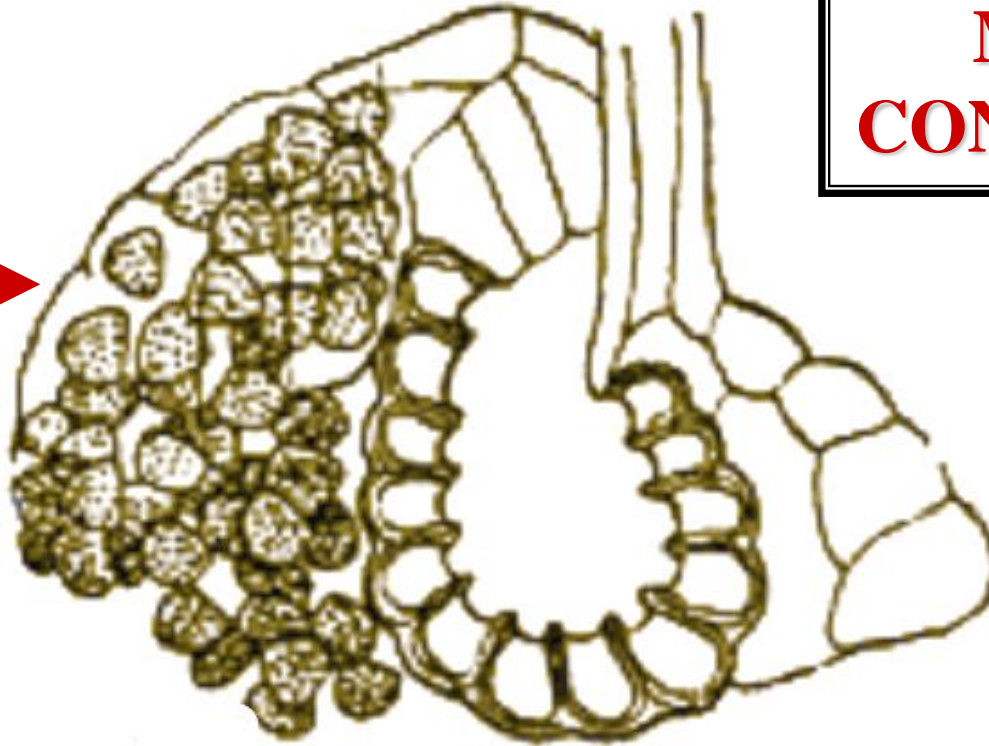
ANNULUS



WATER



WATER



**ANNULUS CELLS
EXPAND**



LEPTOSPORANGIUM



**MOIST
CONDITIONS**

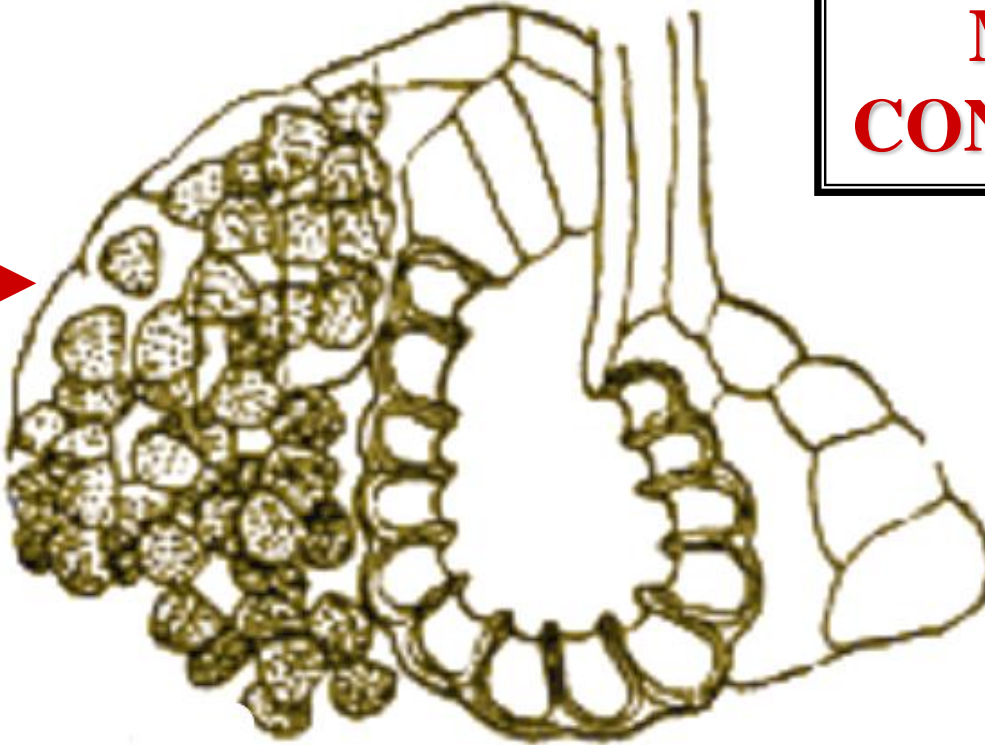
ANNULUS



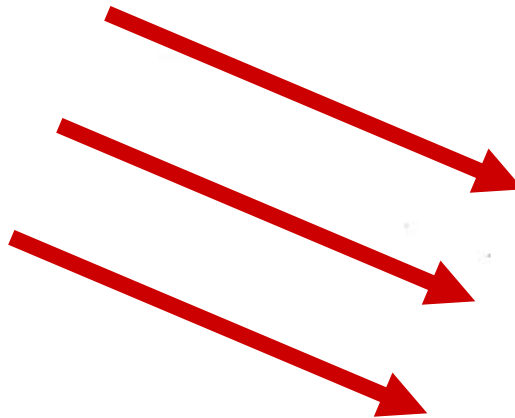
WATER



WATER

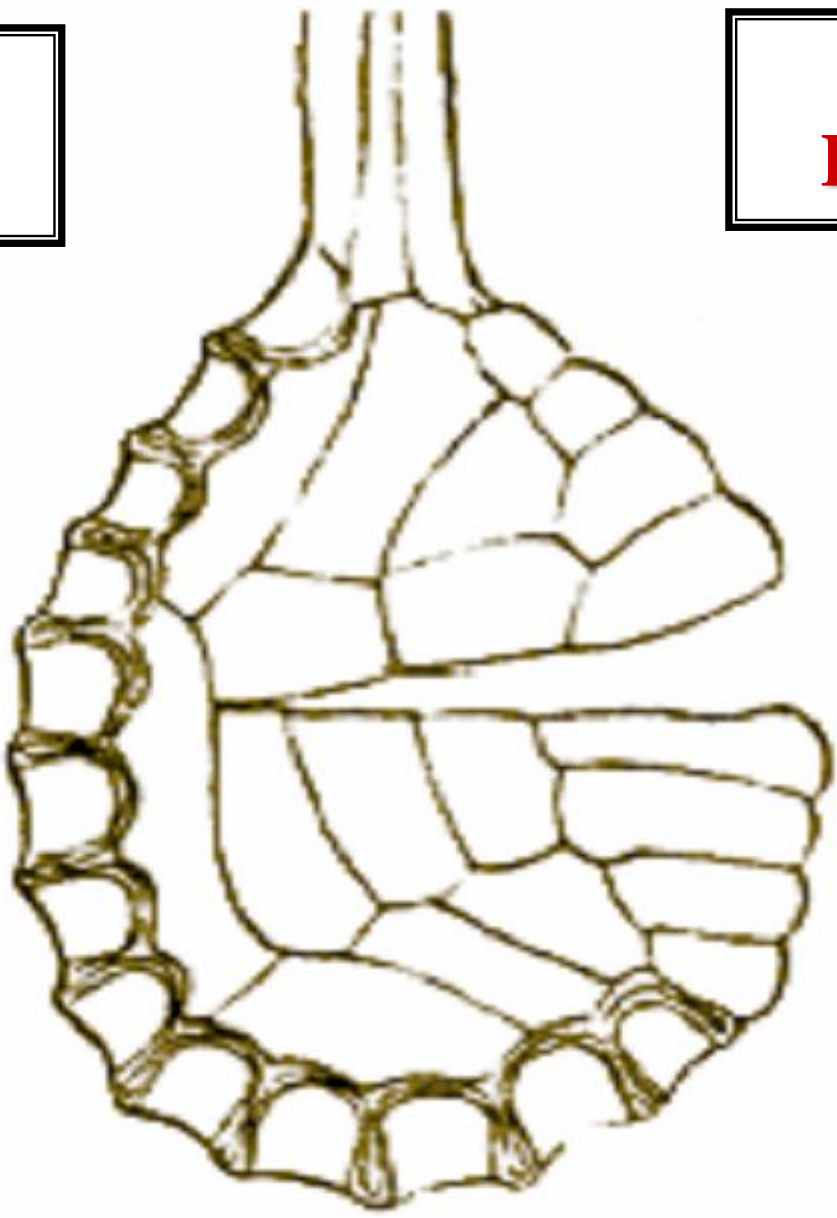


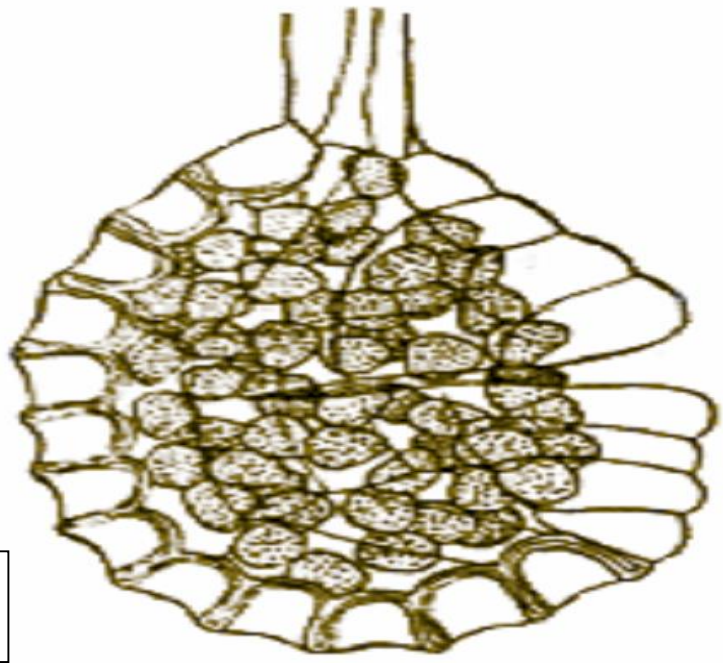
**CATAPULTS
FORWARD**



**SPORE
DISPERSAL**

**END
POSITION**





1



1



2



**DRY
CONDITIONS**





1

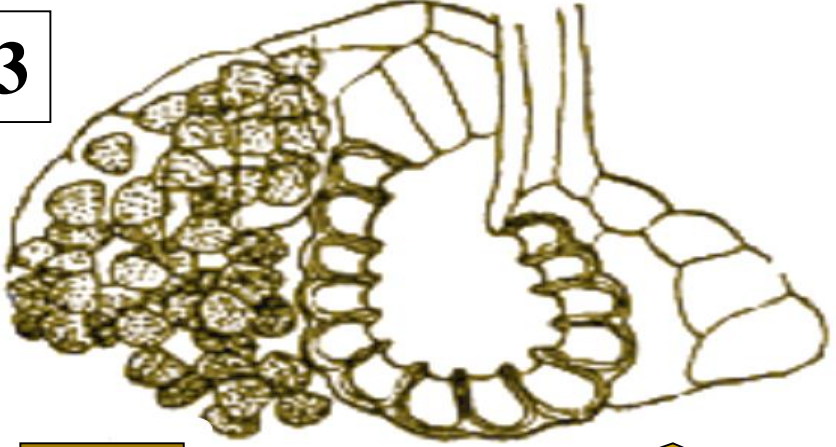


2



**DRY
CONDITIONS**

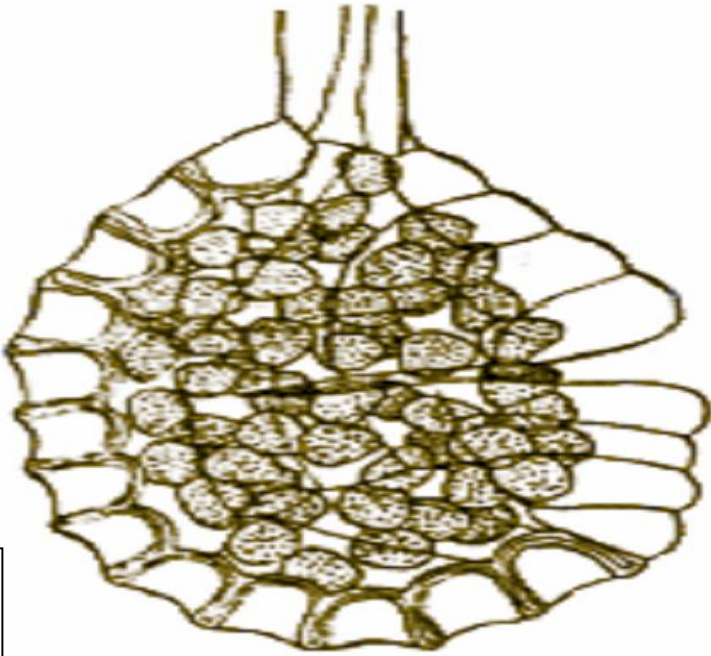
3



**MOIST
CONDITIONS**



1

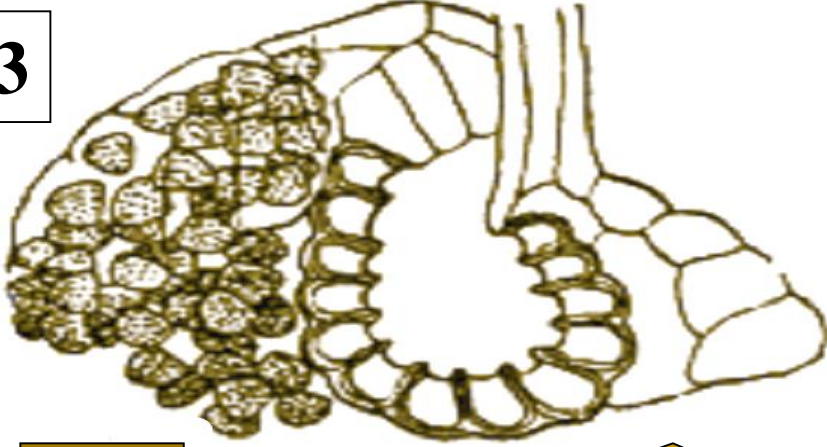


2



**DRY
CONDITIONS**

3



4



**MOIST
CONDITIONS**



SPORE HABIT

L.S.

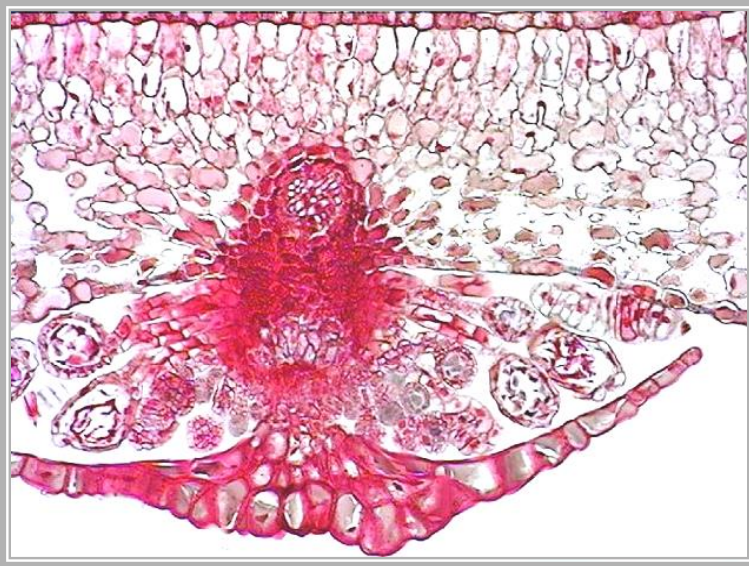
I



SPORES

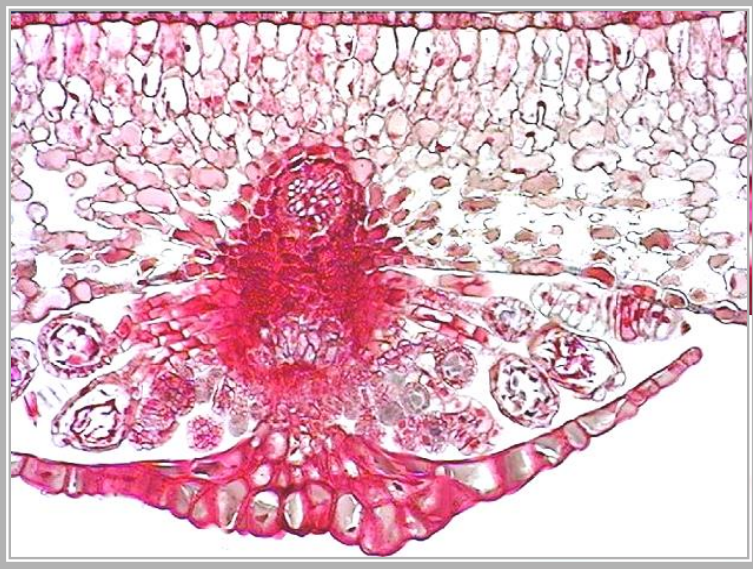
L.S.

H



ISOSPORES

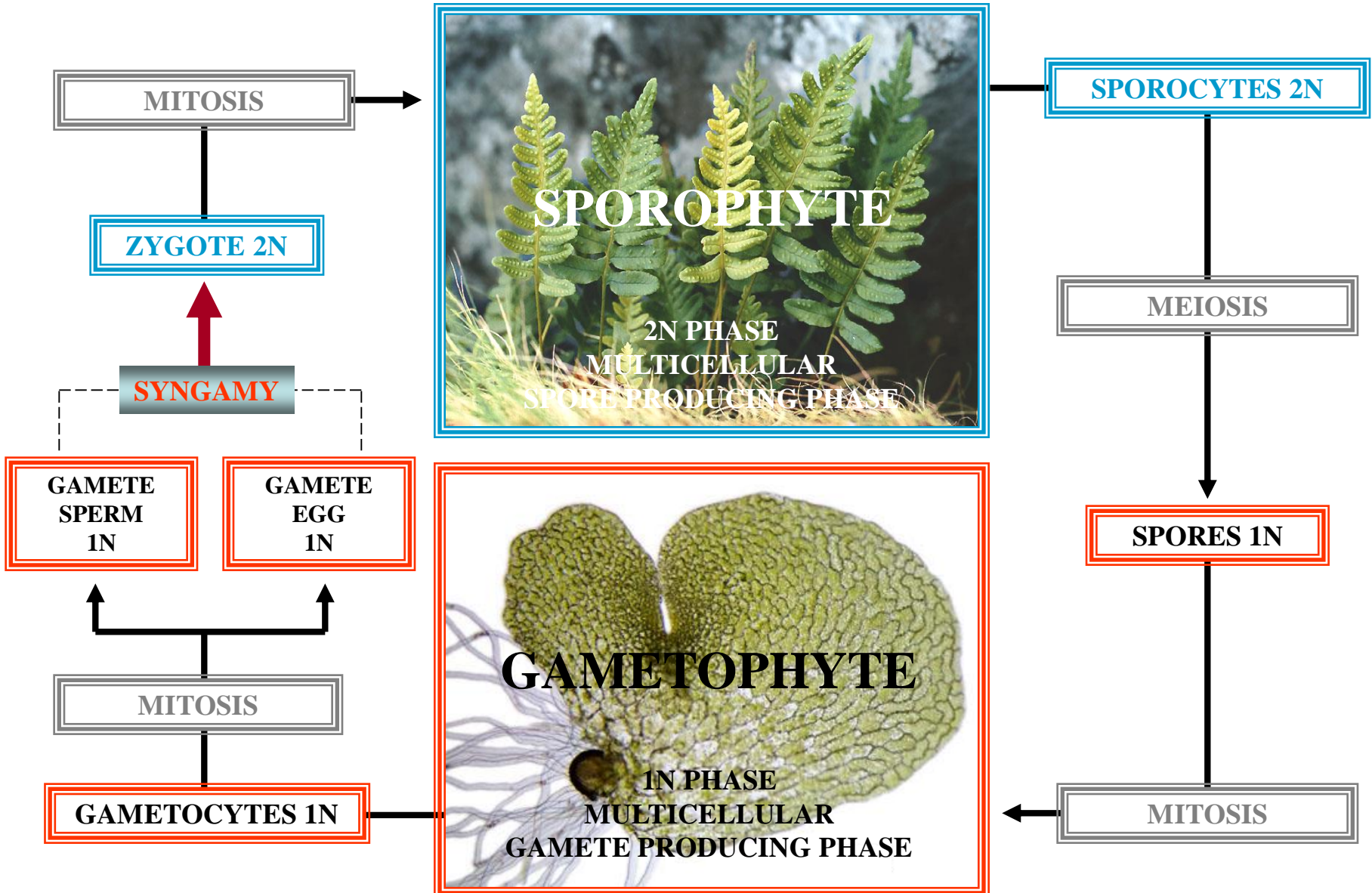
L.S.



ISOSPORES

HOMOSPOROUS

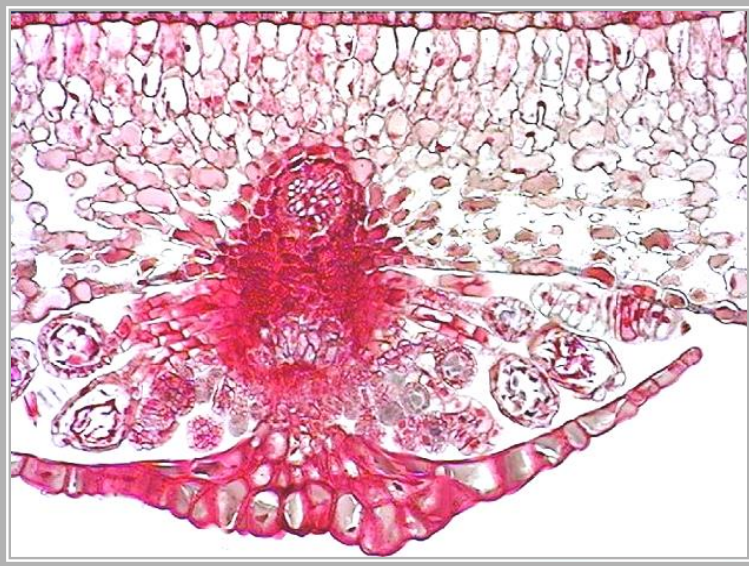
PTERIDALES LIFE CYCLE





GAMETOPHYTE CHARACTERS

L.S.



ISOSPORES

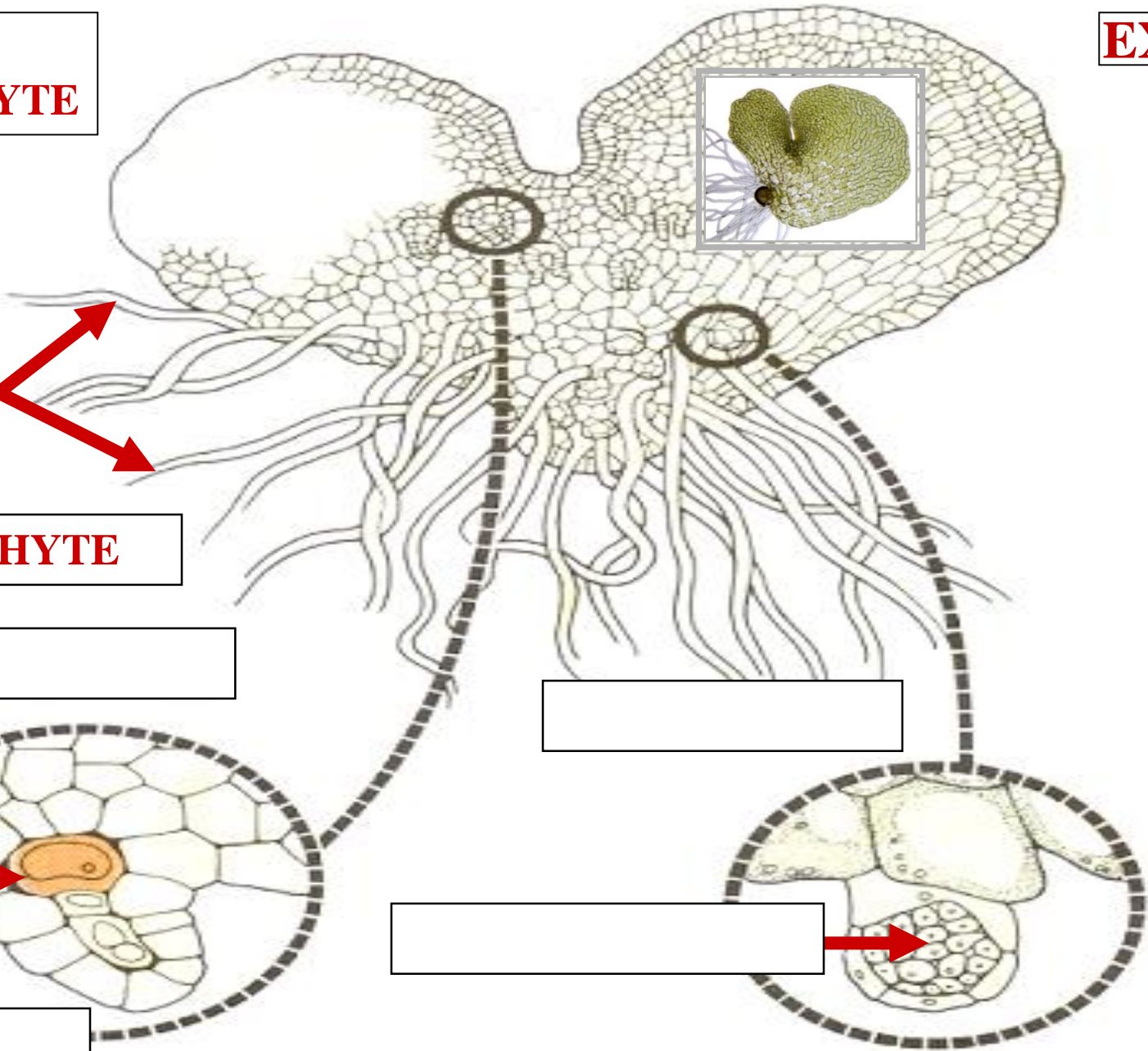
HOMOSPOROUS



EXOSPORIC GAMETOPHYTE

EX

**MATURE
GAMETOPHYTE**



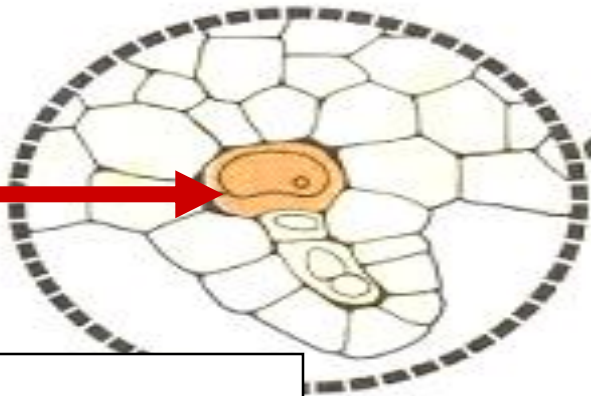
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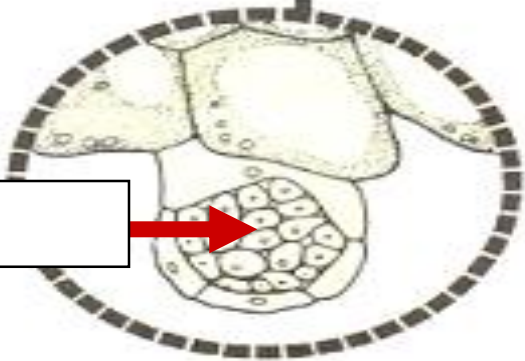
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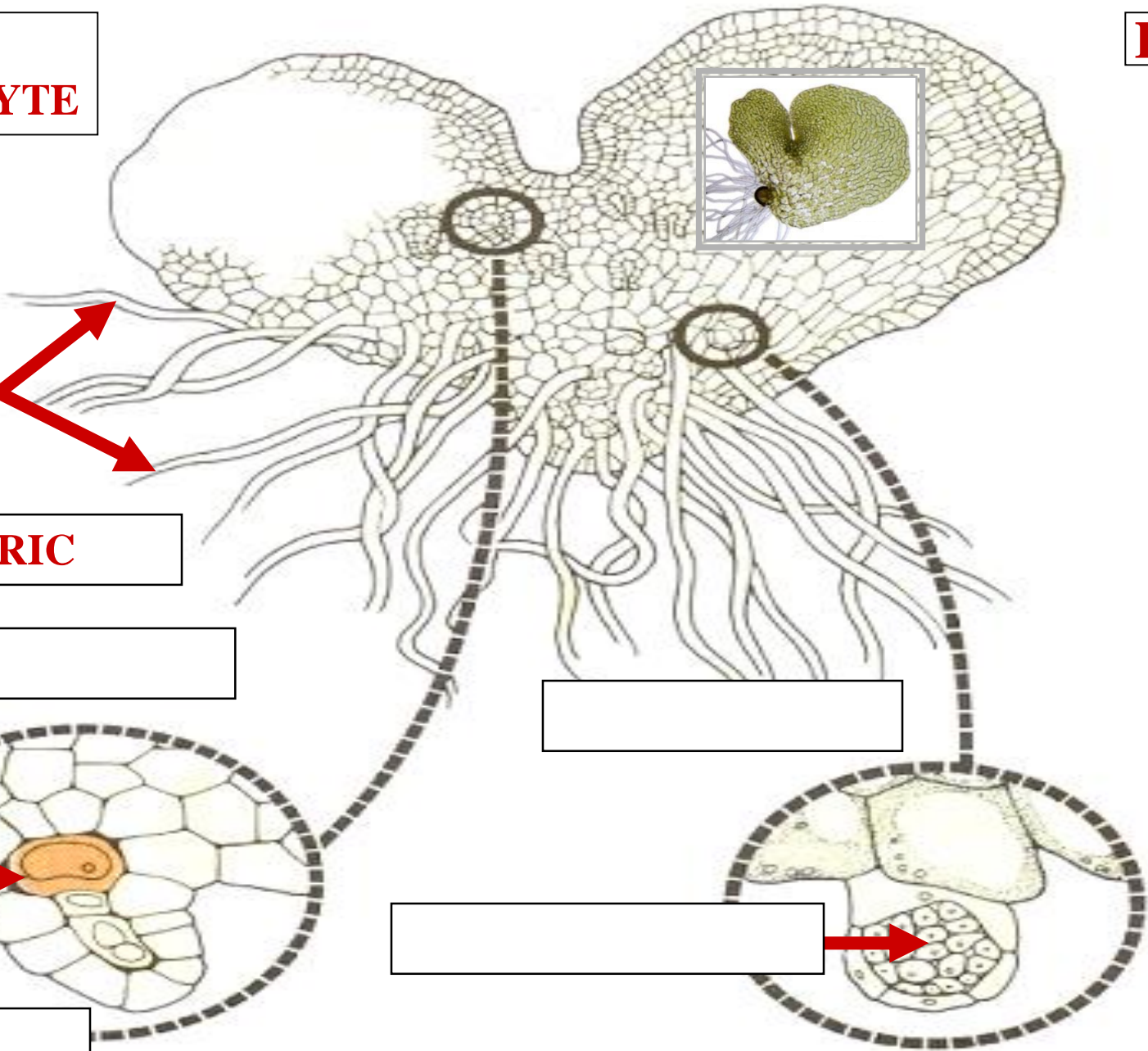
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**MATURE
GAMETOPHYTE**



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EXOSPORIC

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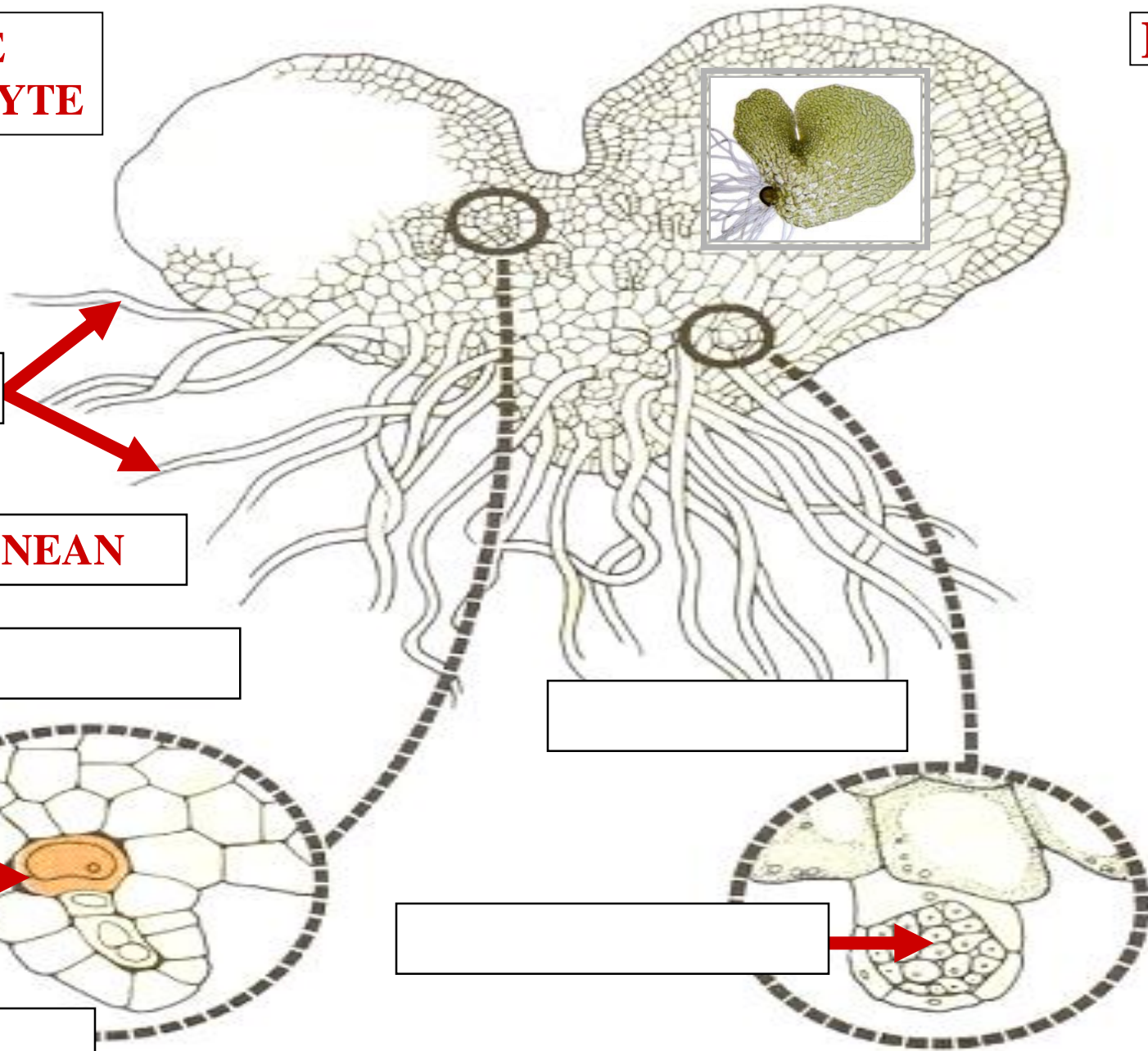


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GAMETOPHYTE**



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EPITERRANEAN

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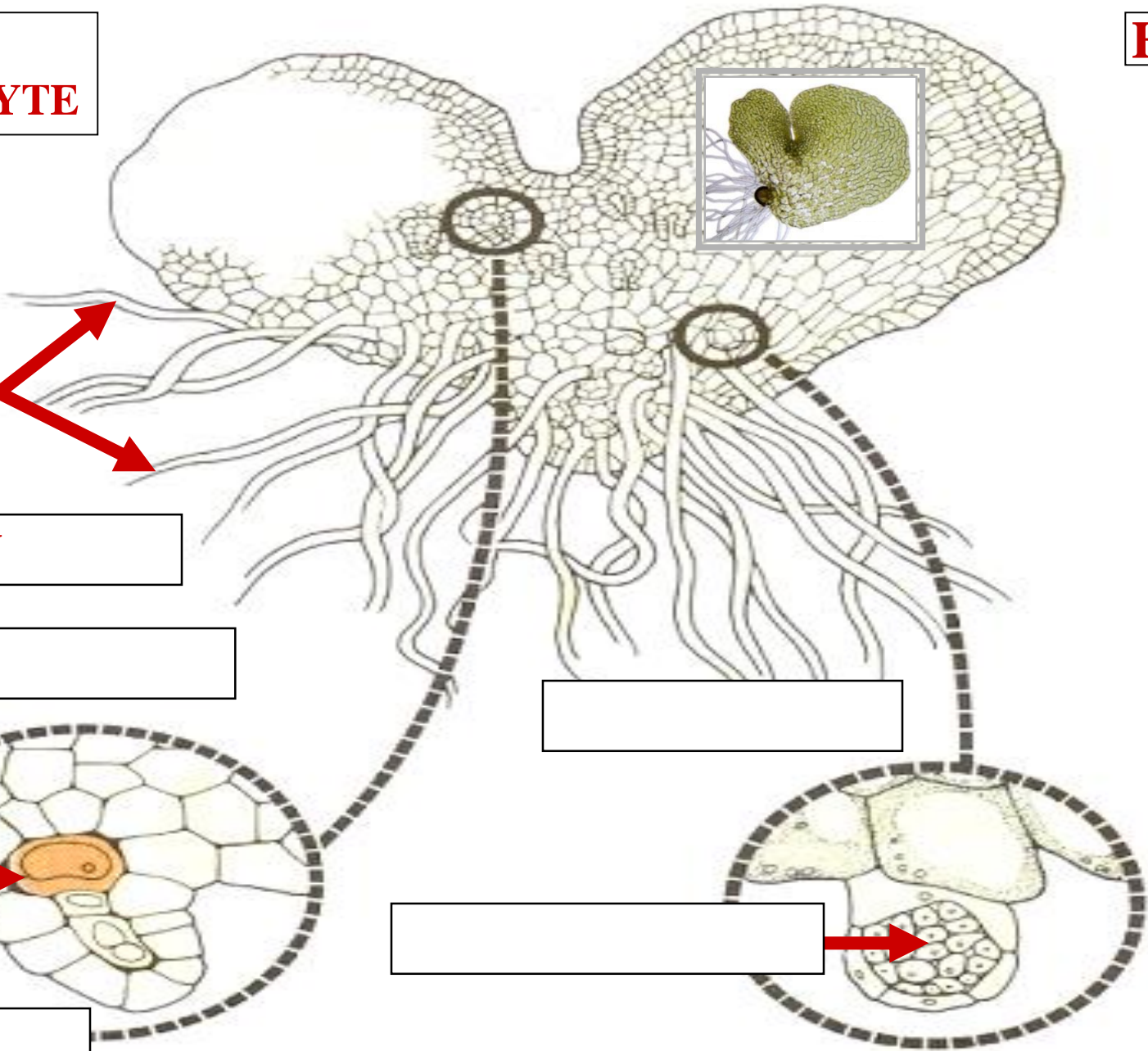
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GAMETOPHYTE**



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**MATURE
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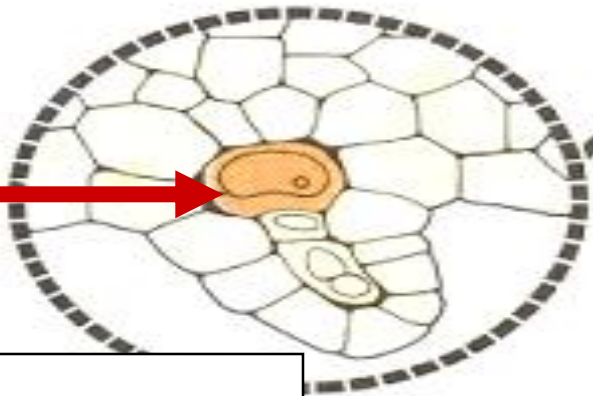


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HEART-SHAPE

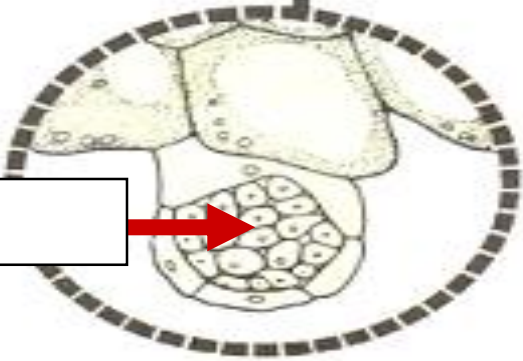
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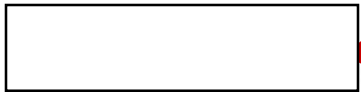
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**MATURE
GAMETOPHYTE**



BISEXUAL

ARCHEGONIUM

ANTHERIDIUM

