

ZAMIA

CORTEX

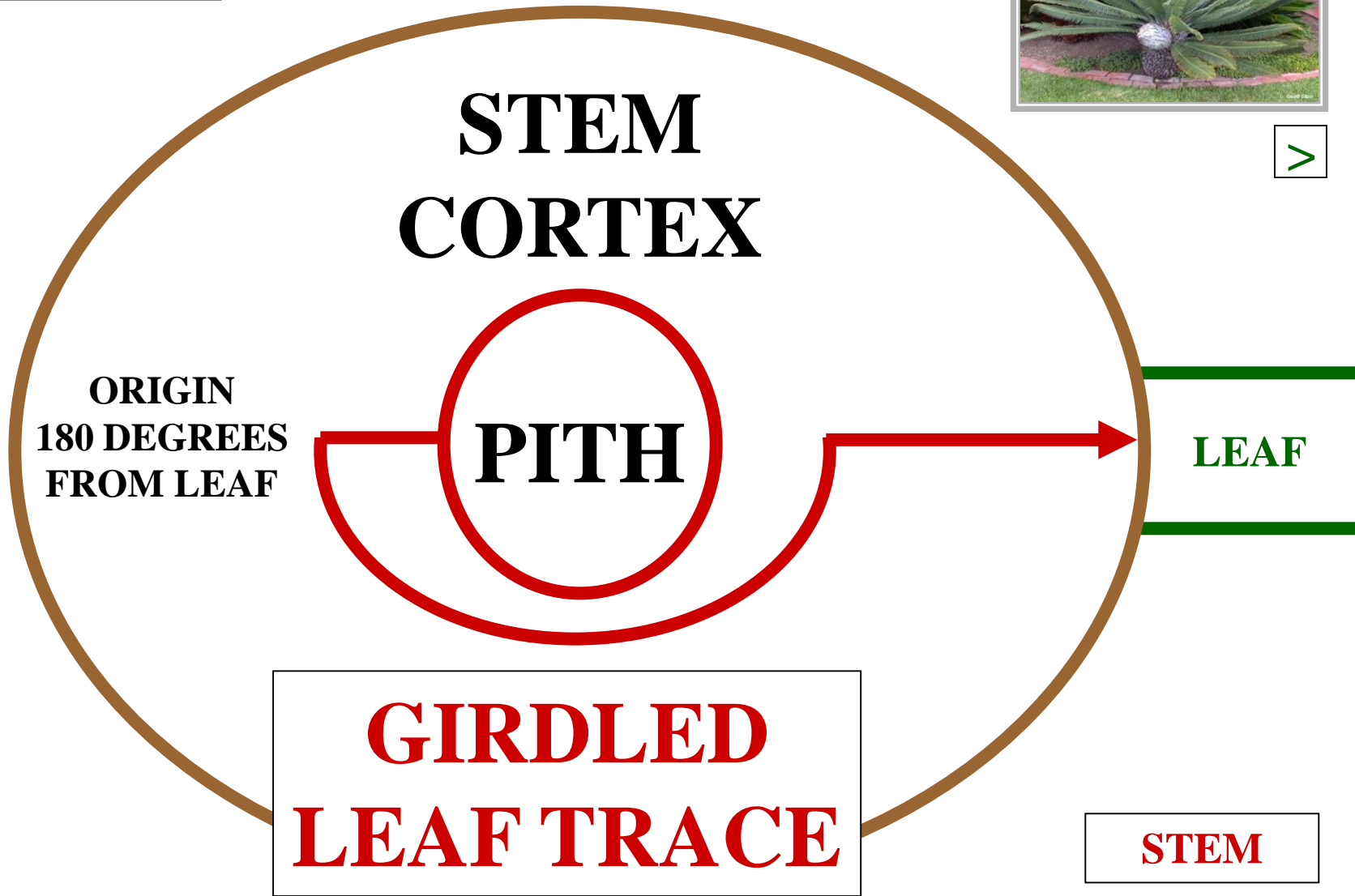
**GIRDLED
LEAF TRACE**

STEM

C.S.



ZAMIA



**STEM
CORTEX**

**ORIGIN
180 DEGREES
FROM LEAF**

PITH

LEAF

**GIRDLED
LEAF TRACE**

STEM

C.S.

VASCULAR TISSUE



**GIRDLED
LEAF TRACE
DIAGNOSTIC
CYCADOPHYTA
CHARACTER**



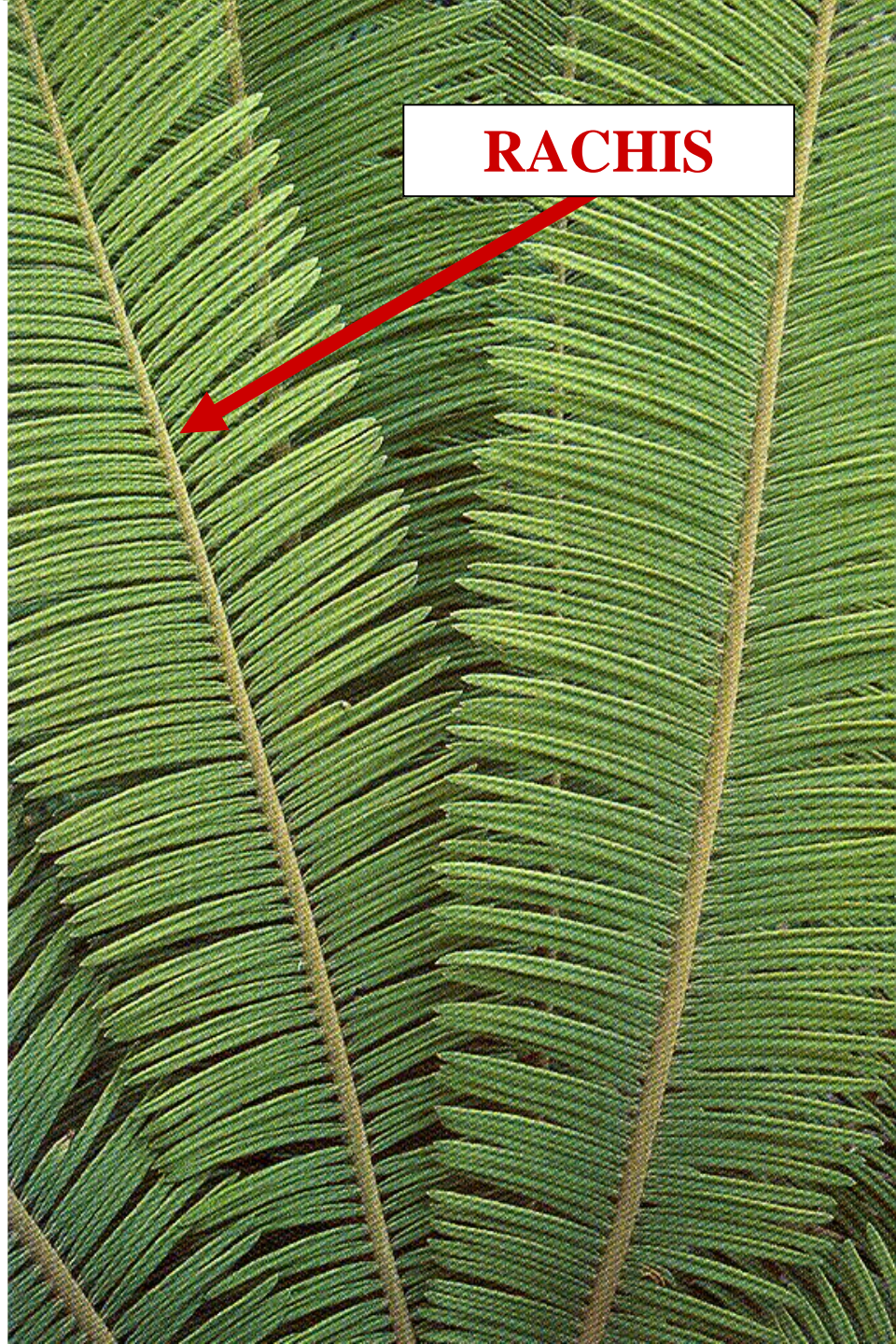
LEAF MORPHOLOGY



LL



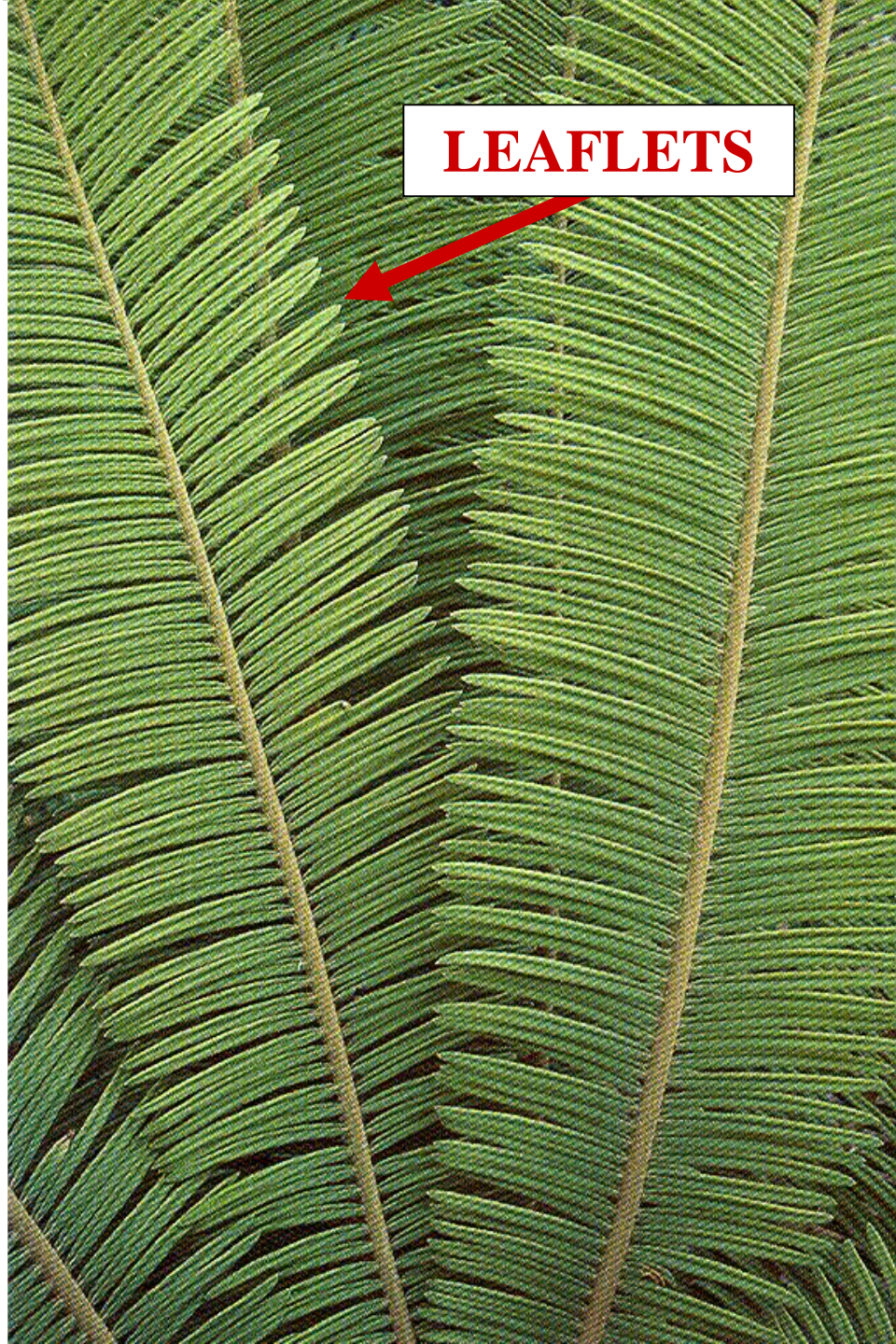
RACHIS



CL



LEAFLETS



PC

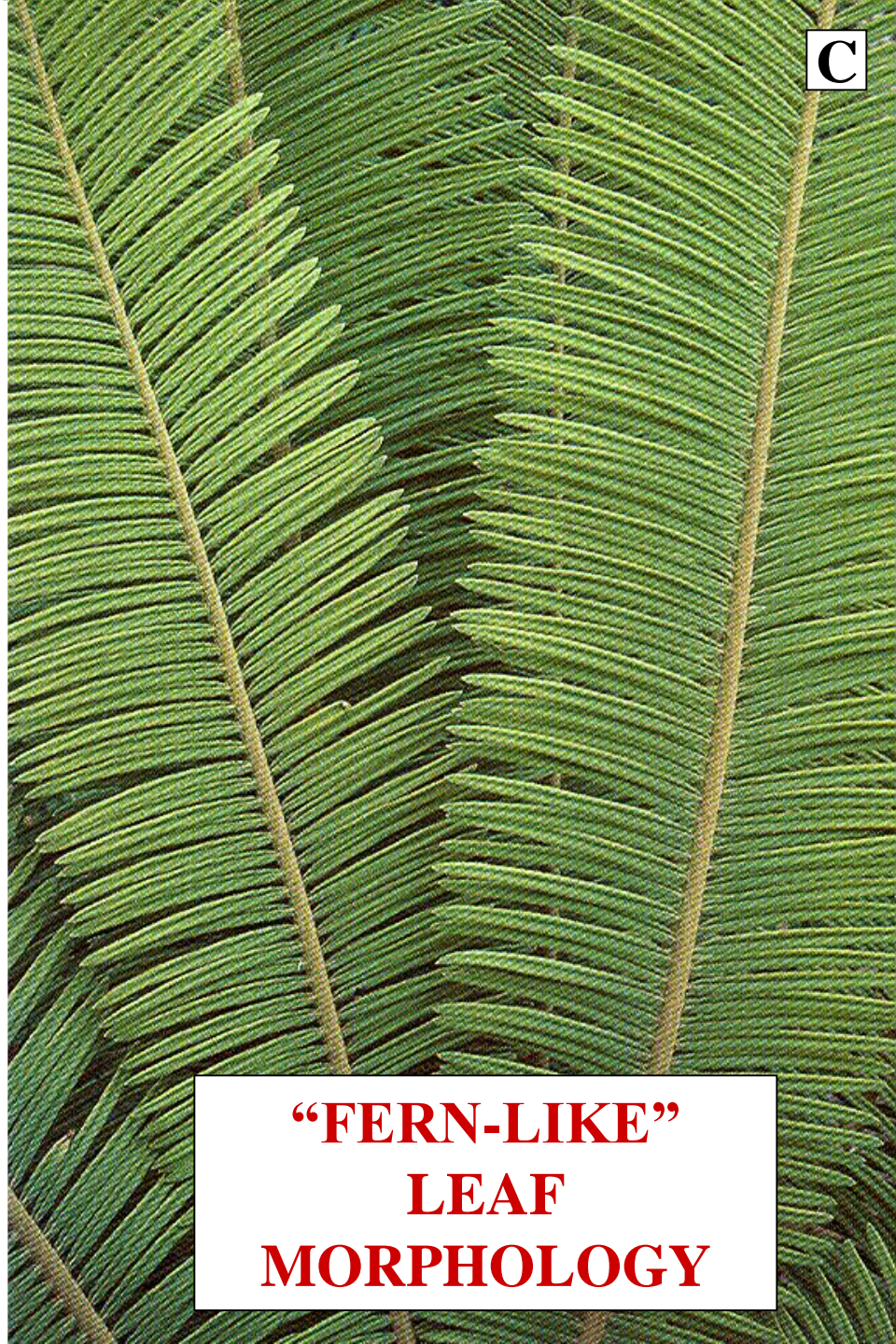


**COMPOUND
LEAF**



“F”

**PINNATELY
COMPOUND**



C

**“FERN-LIKE”
LEAF
MORPHOLOGY**

**CORIACEOUS
LEAF**

CYCADOPHYTA
CORIACEOUS LEAF

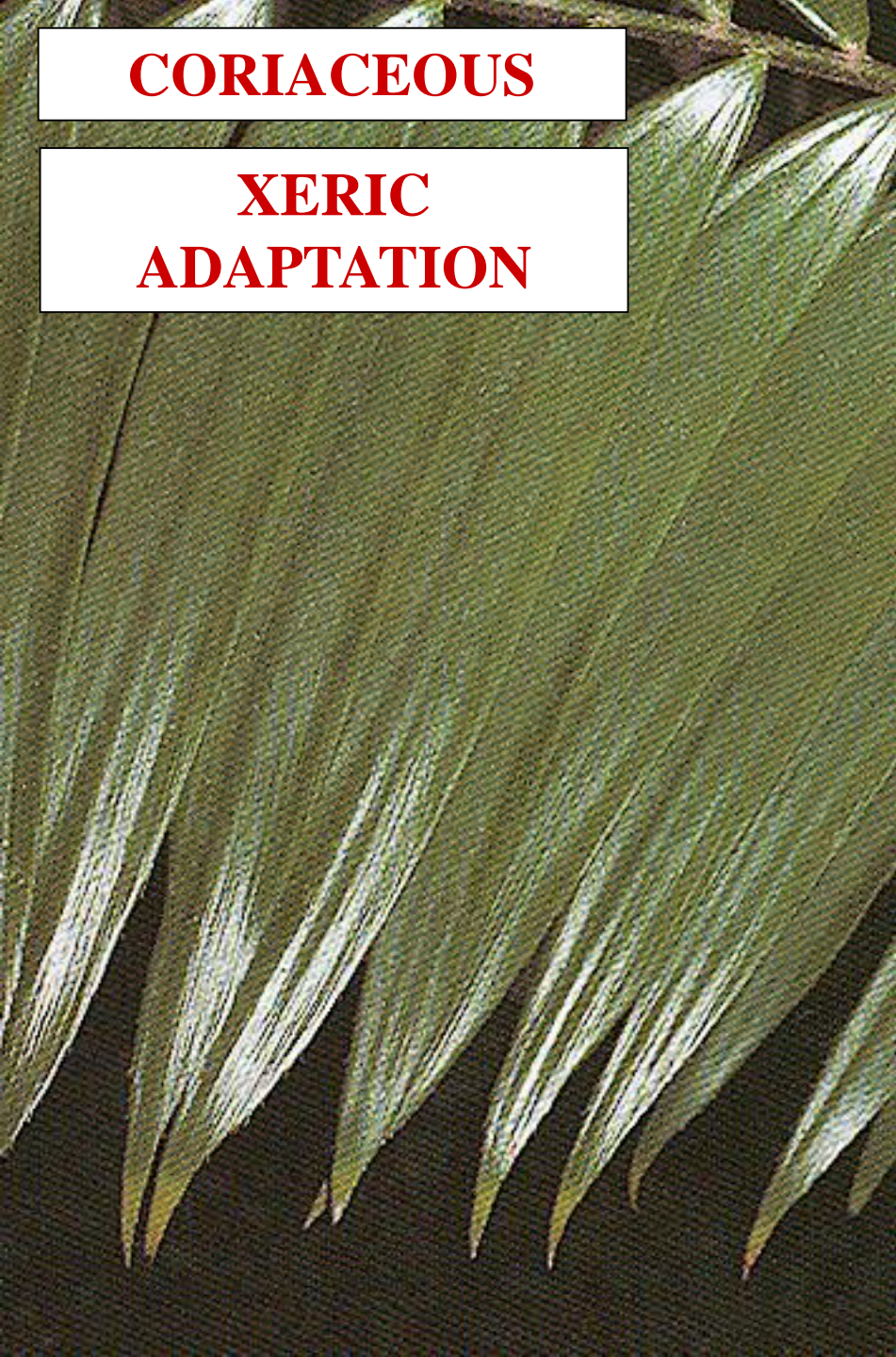


LEATHER TEXTURE

CYCADOPHYTA
CORIACEOUS LEAF

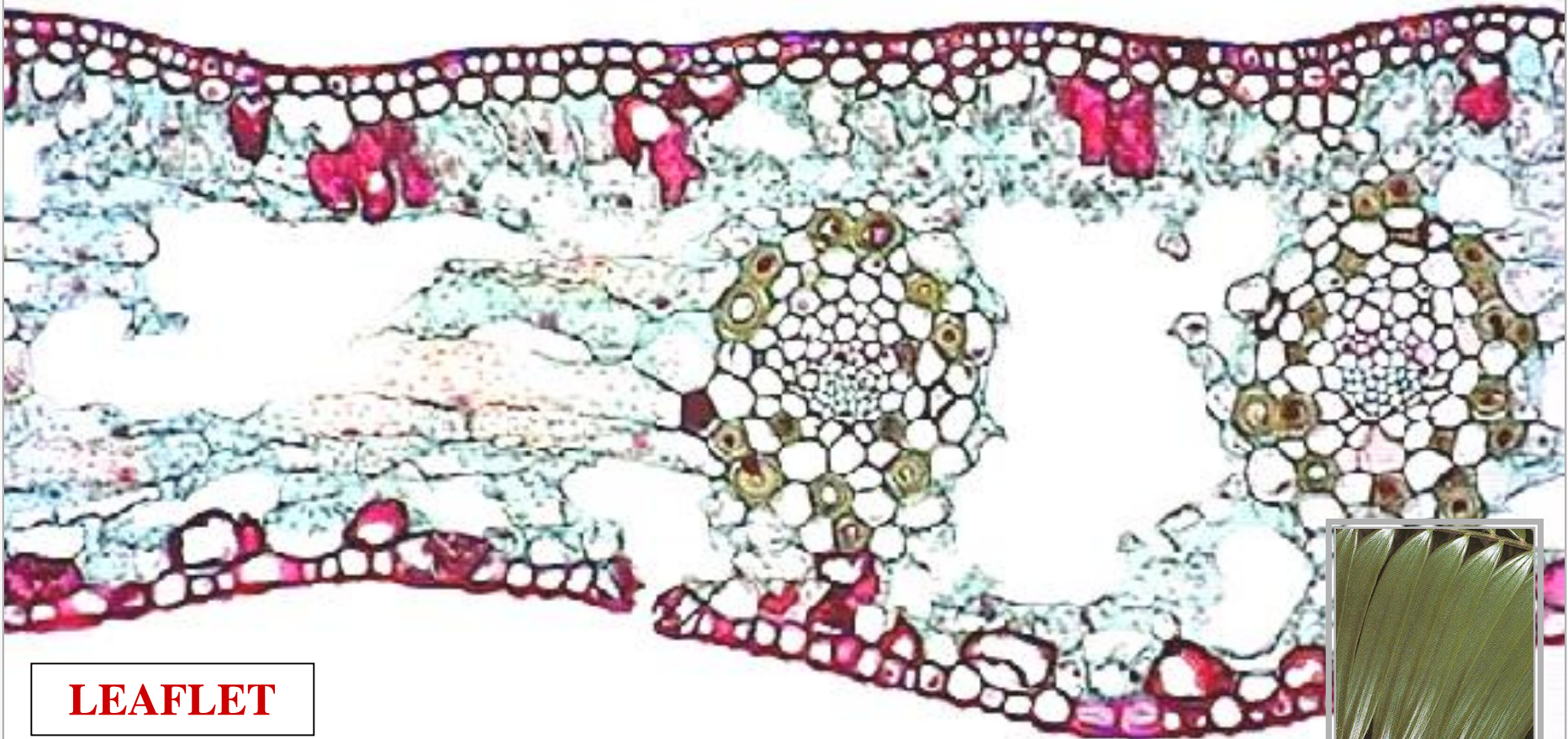
CORIACEOUS

**XERIC
ADAPTATION**





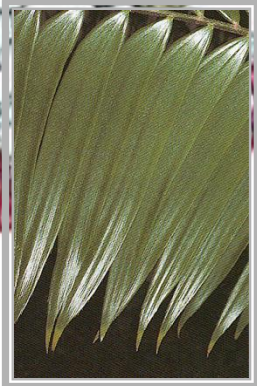
LEAF ANATOMY



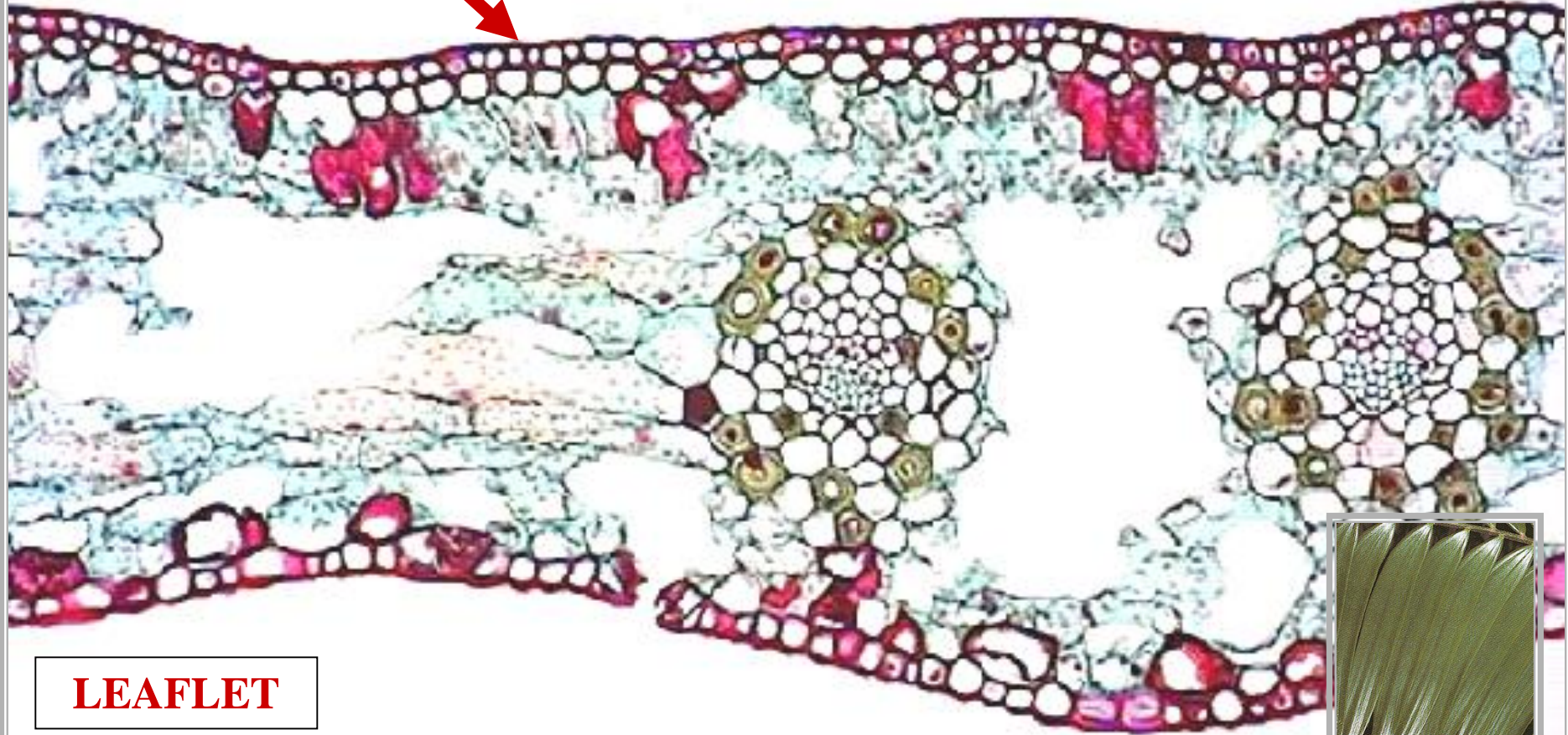
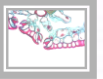
LEAFLET

C.S.

CYCAS



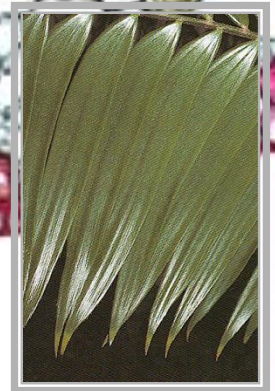
THICK CUTICLE



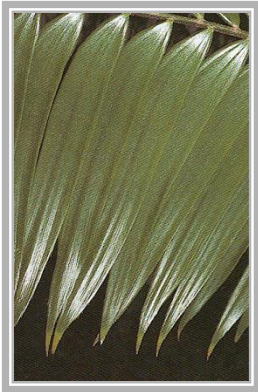
LEAFLET

C.S.

CYCAS



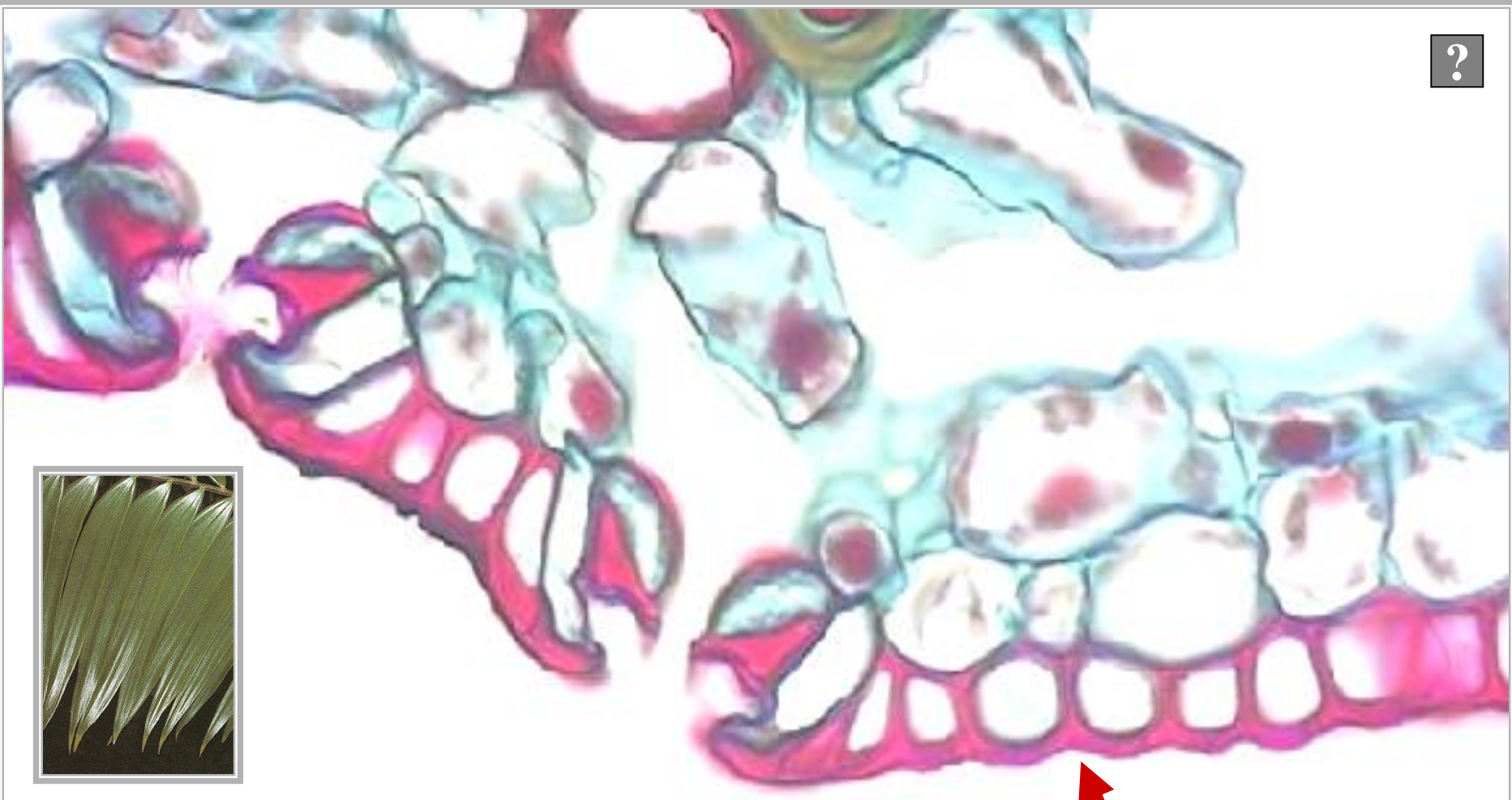
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LEAFLET

C.S.

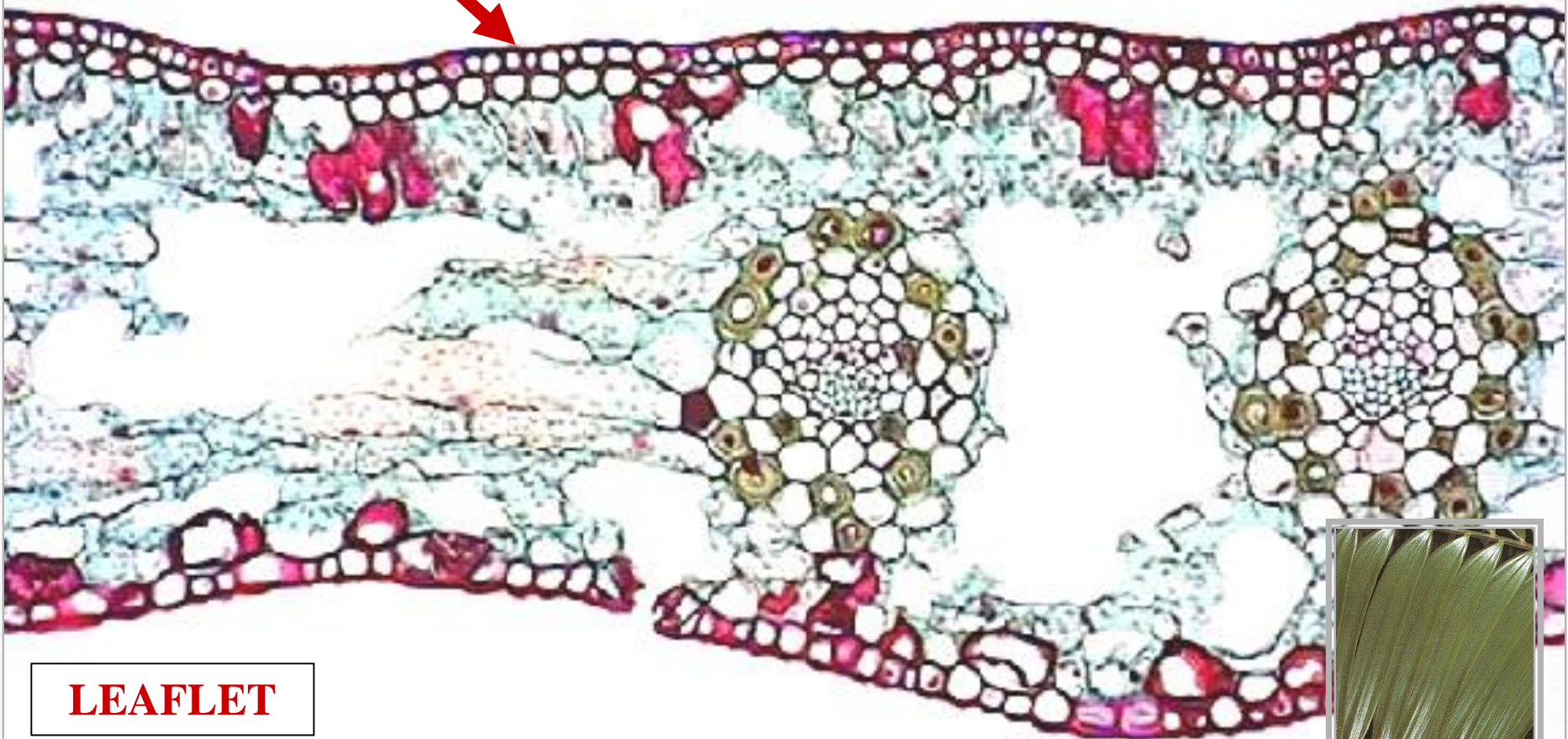
CYCAS



THICK CUTICLE

A

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LEAFLET

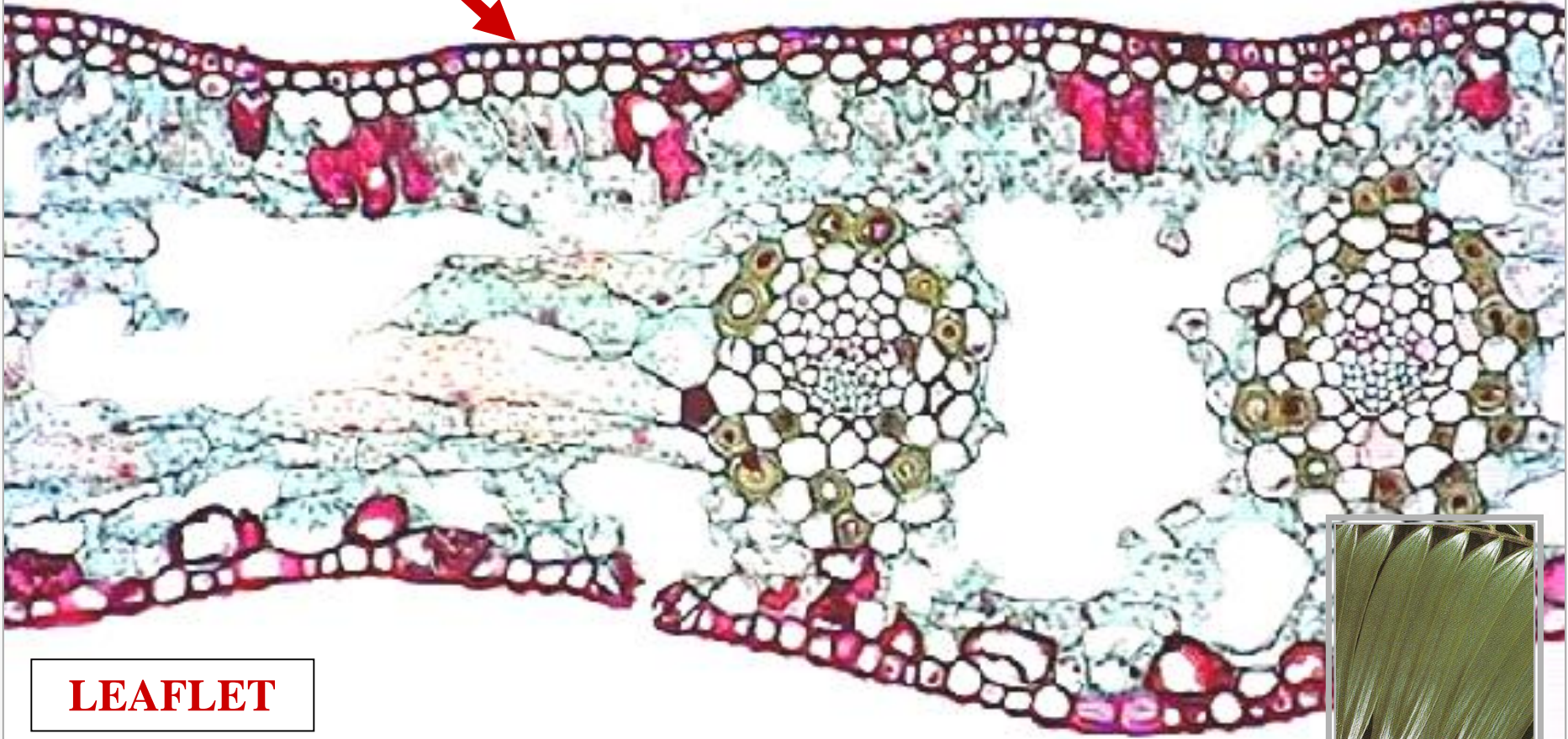
C.S.

CYCAS



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ADAXIAL EPIDERMIS



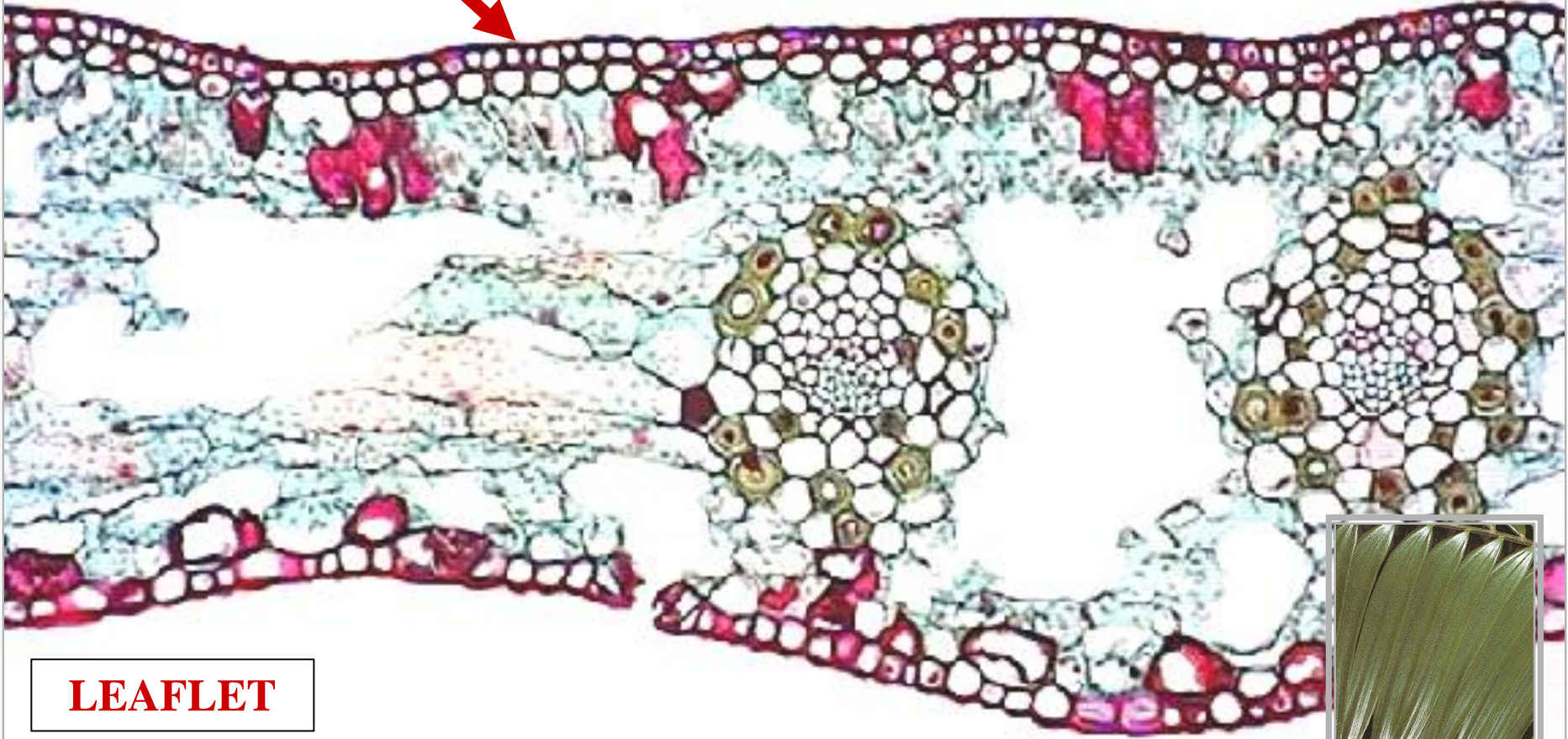
LEAFLET

C.S.

CYCAS



? ABSENT



LEAFLET

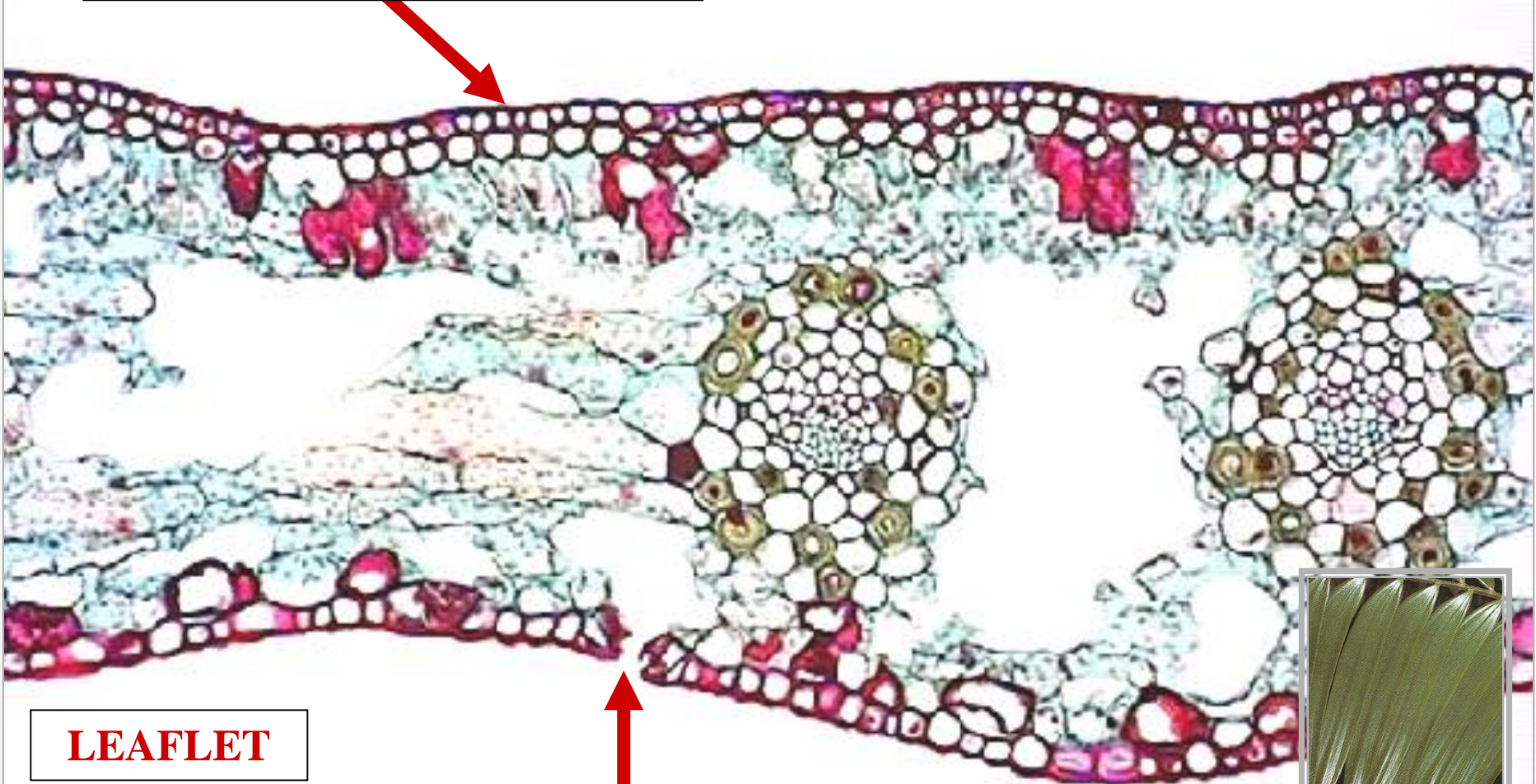
C.S.

CYCAS



?

STOMATES ABSENT



LEAFLET

C.S.

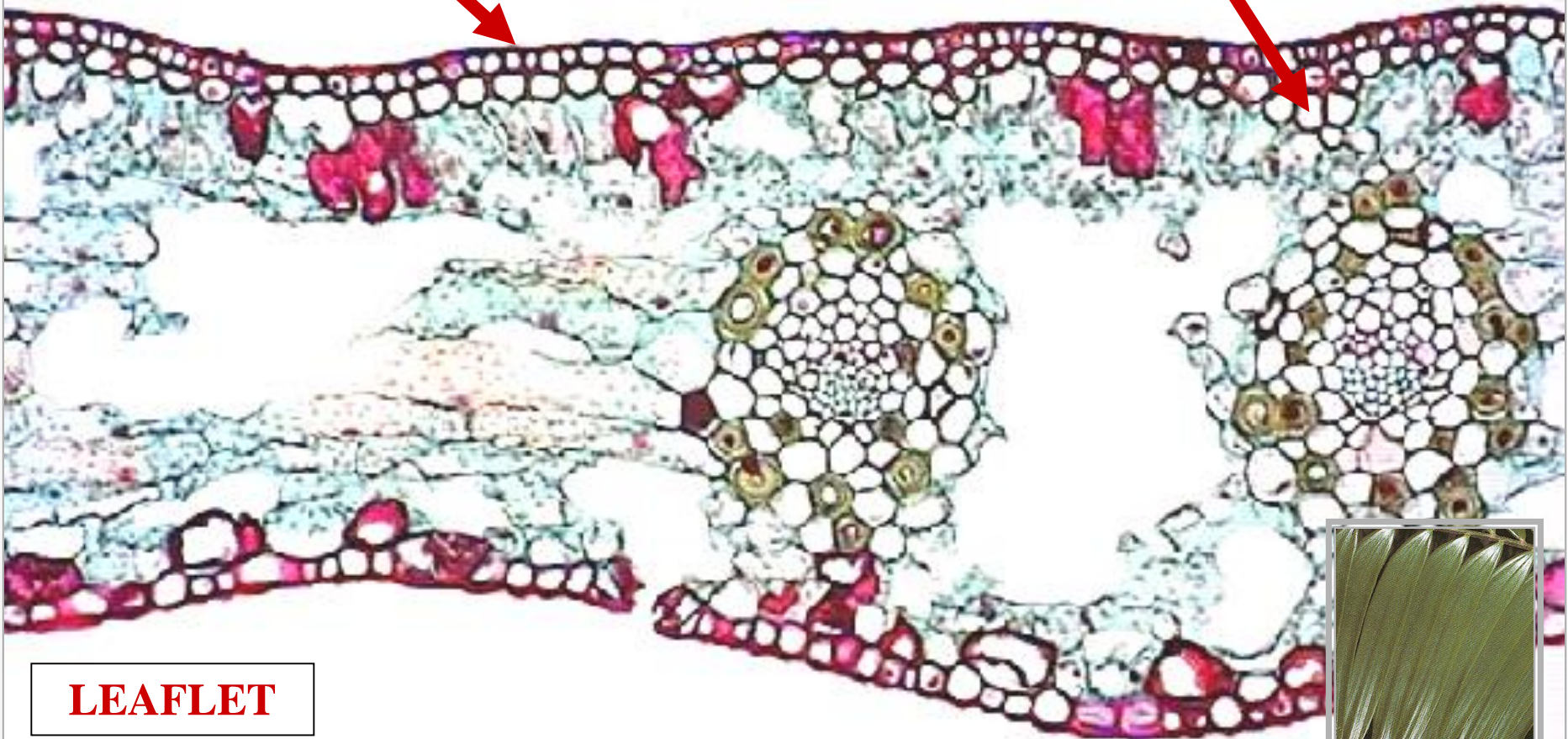
CYCAS

STOMATE



ADAXIAL EPIDERMIS

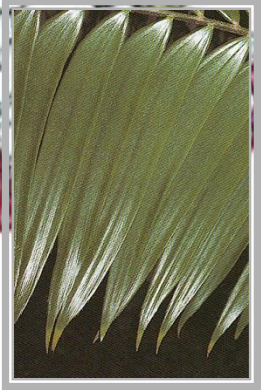
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LEAFLET

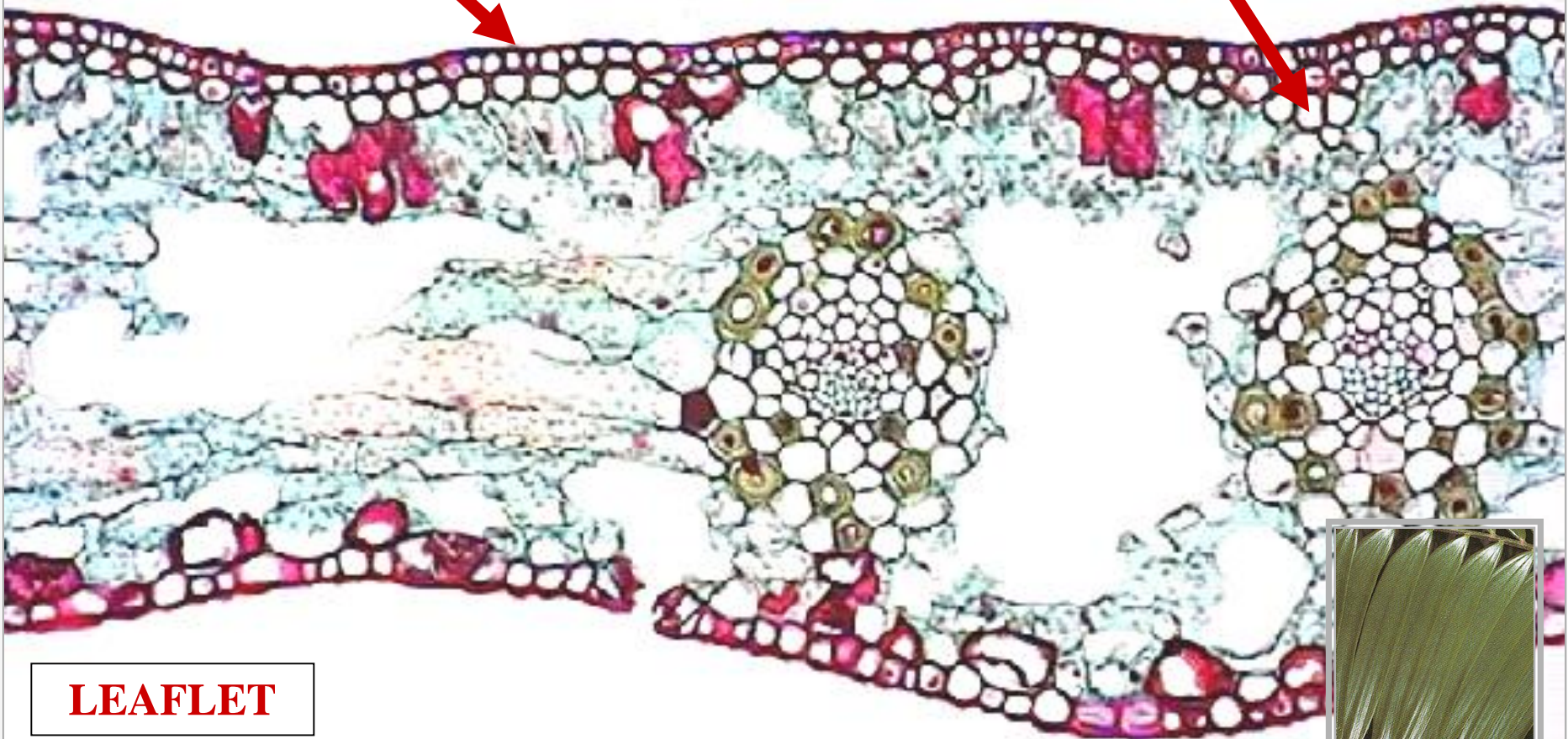
C.S.

CYCAS



ADAXIAL EPIDERMIS

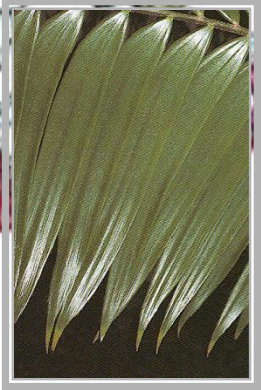
HYPODERMIS



LEAFLET

C.S.

CYCAS



HYPODERMIS



CYCADOPHYTA
LEAF HYPODERMIS

CELL LAYER
UNDER EPIDERMIS

CYCADOPHYTA
LEAF HYPODERMIS

CYCADOPHYTA
LEAF HYPODERMIS
UNDER EPIDERMIS

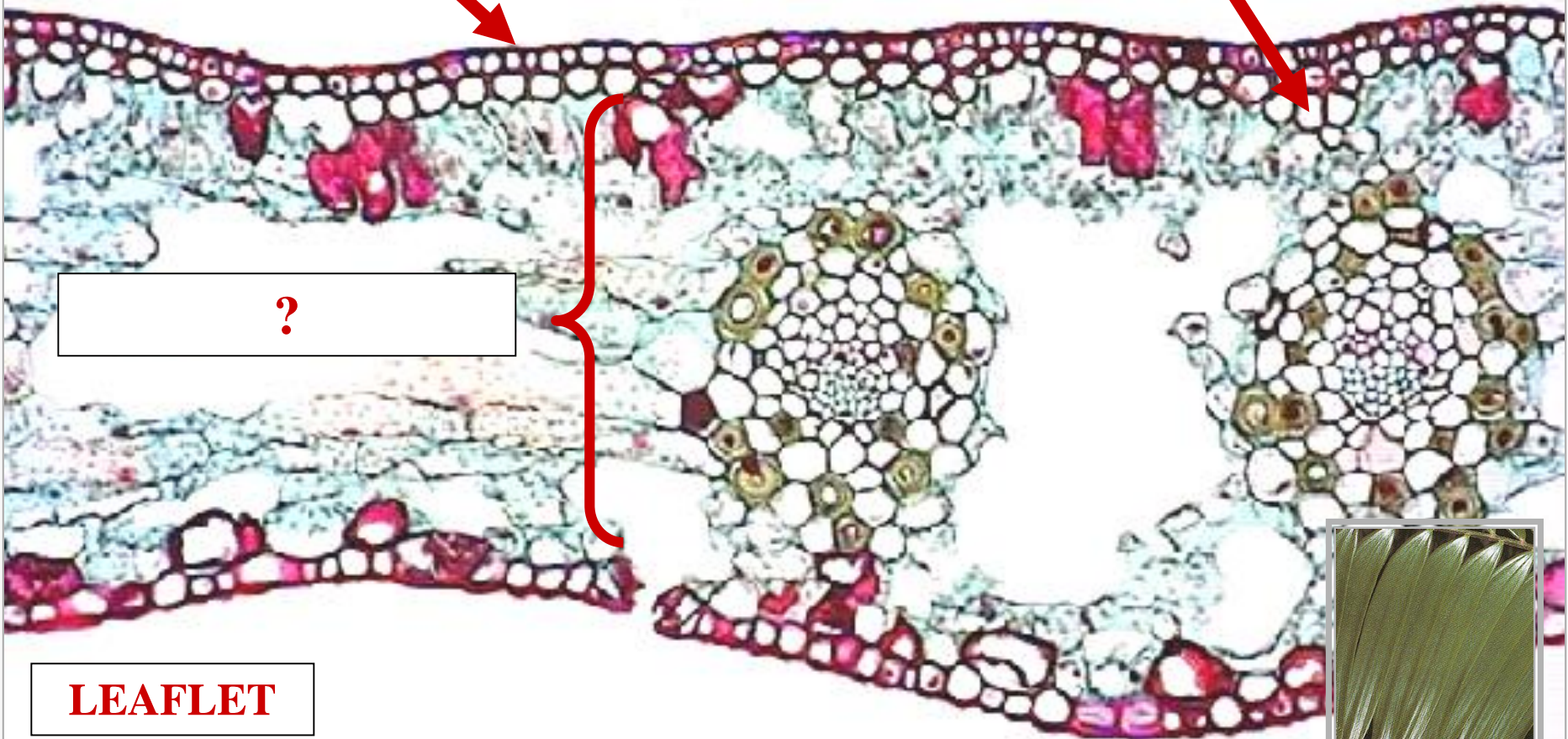
INHIBITS
WATER LOSS

CYCADOPHYTA
LEAF HYPODERMIS



ADAXIAL EPIDERMIS

HYPODERMIS

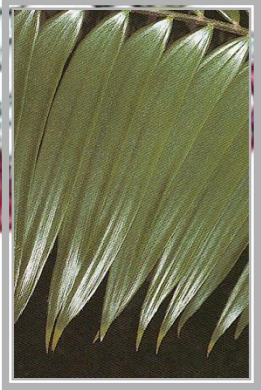


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LEAFLET

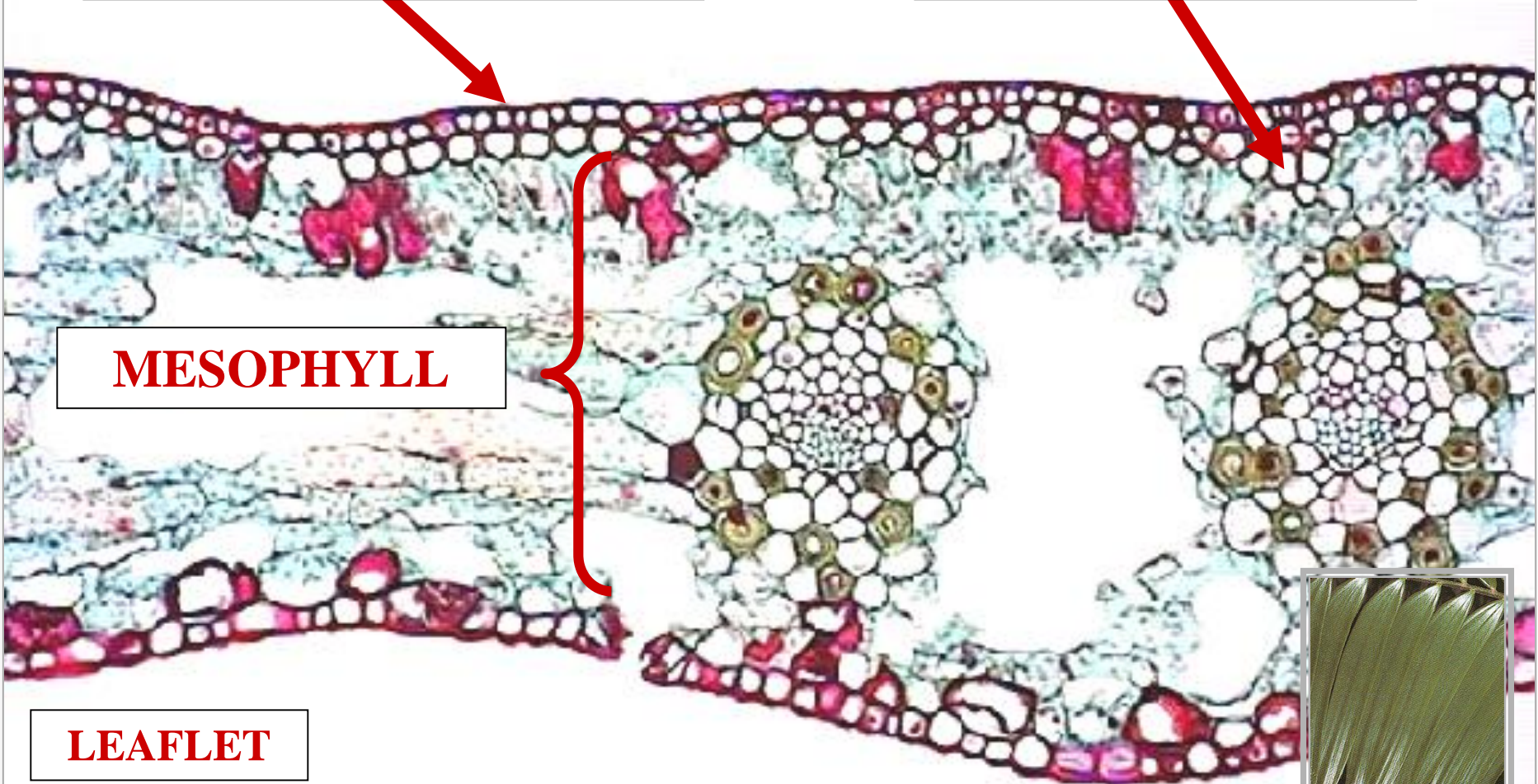
C.S.

CYCAS



ADAXIAL EPIDERMIS

HYPODERMIS

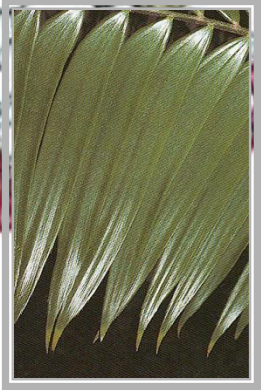


MESOPHYLL

LEAFLET

C.S.

CYCAS



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ADAXIAL EPIDERMIS

HYPODERMIS

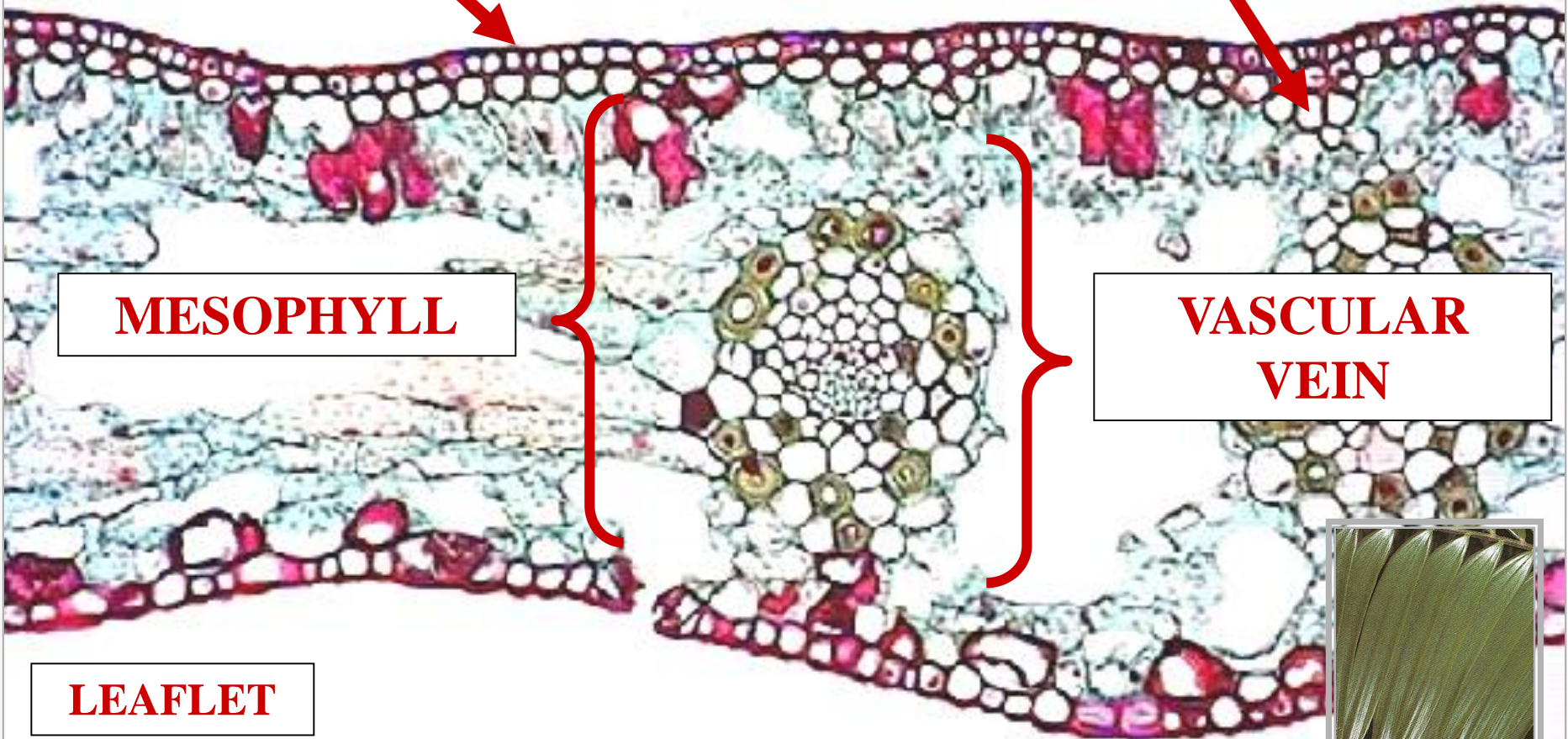
MESOPHYLL

VASCULAR VEIN

LEAFLET

C.S.

CYCAS



ADAXIAL EPIDERMIS

HYPODERMIS

X

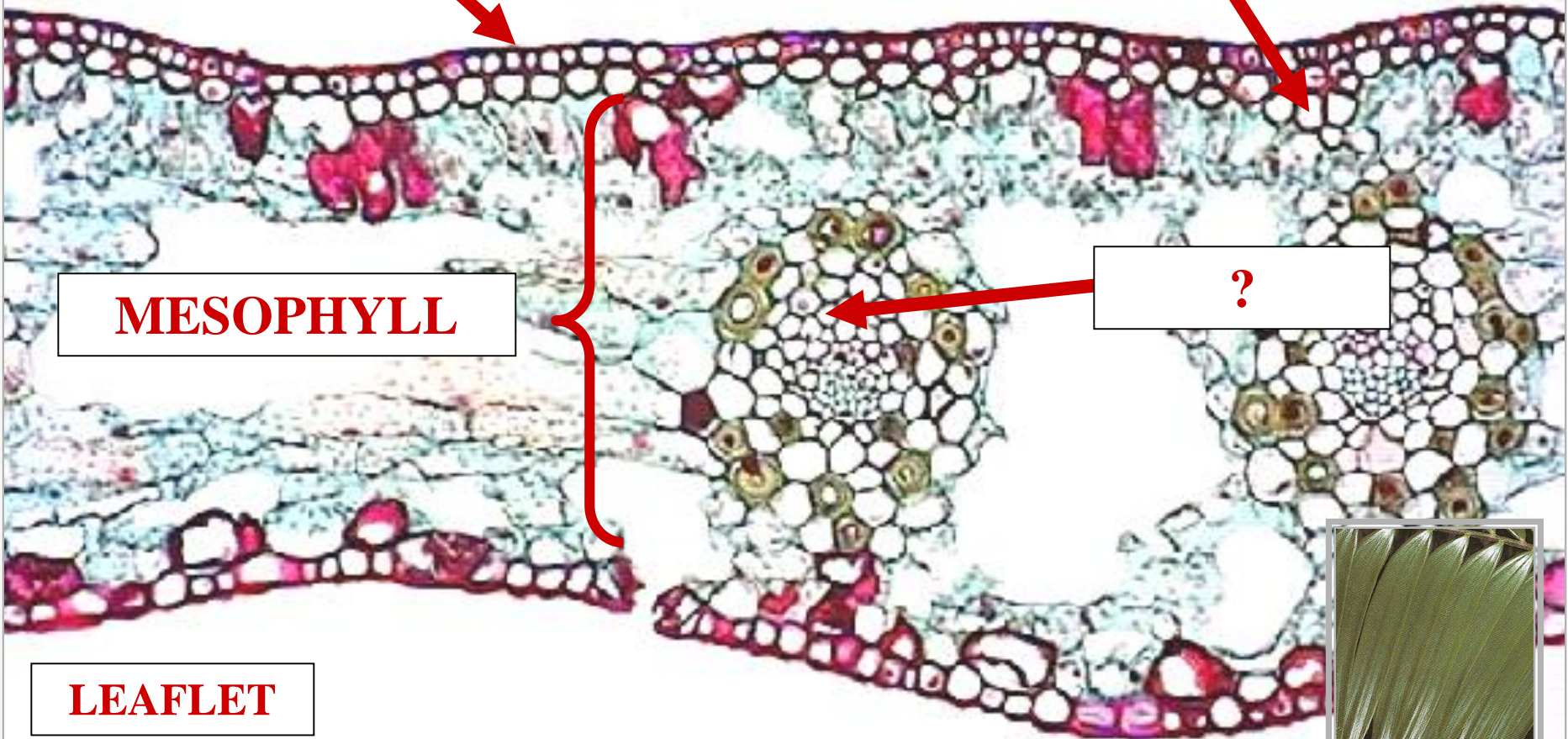
MESOPHYLL

?

LEAFLET

C.S.

CYCAS



ADAXIAL EPIDERMIS

HYPODERMIS

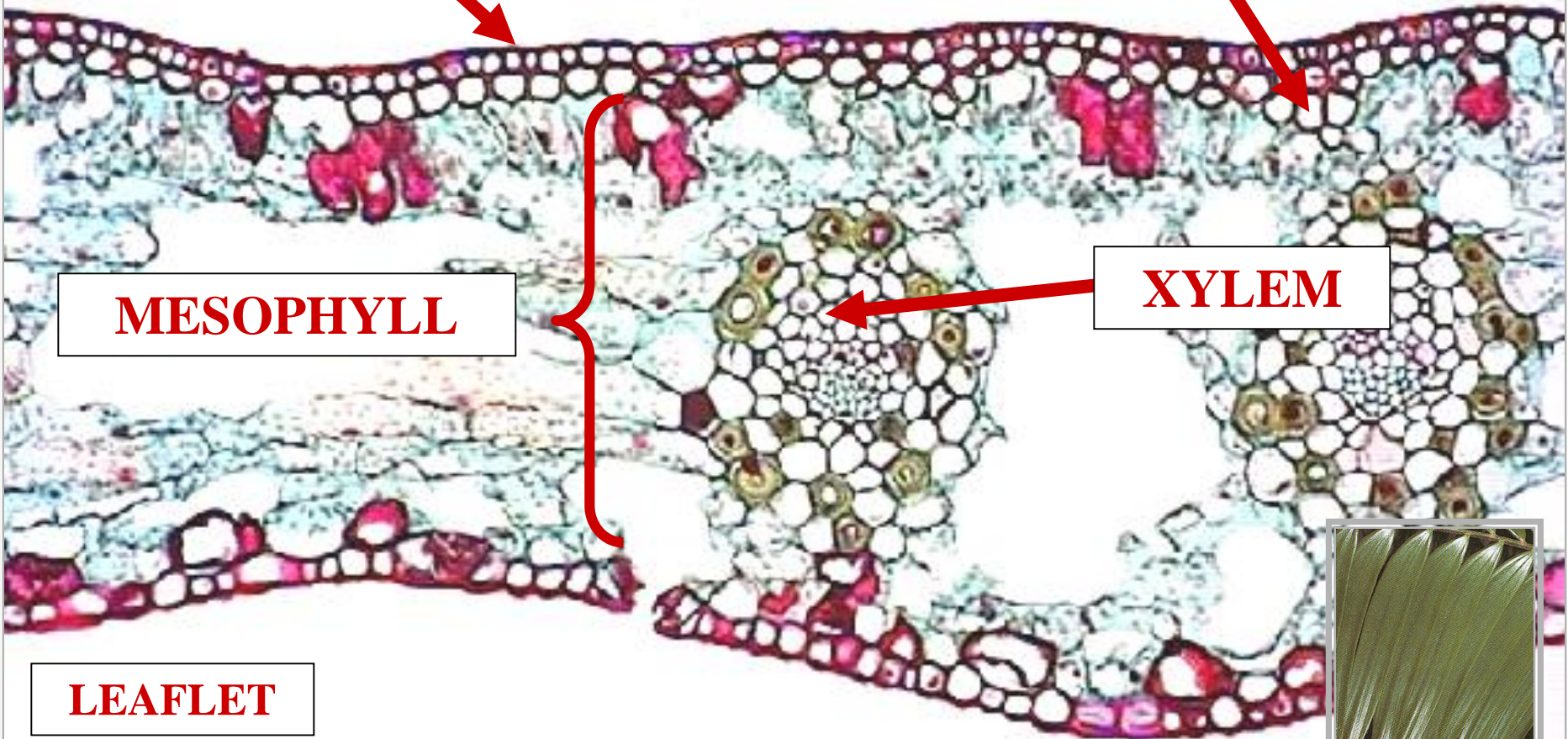
MESOPHYLL

XYLEM

LEAFLET

C.S.

CYCAS



?

ADAXIAL EPIDERMIS

HYPODERMIS

MESOPHYLL

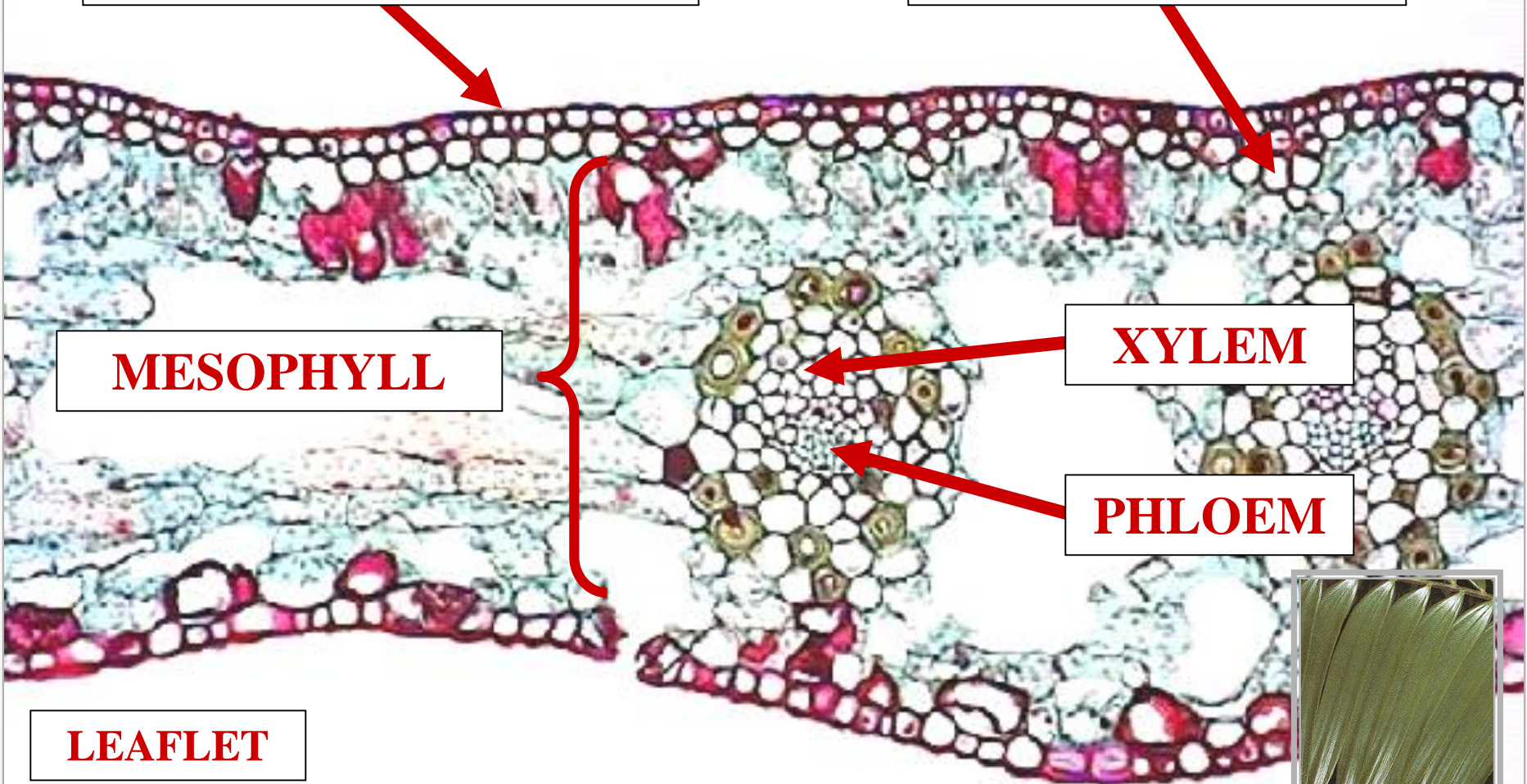
XYLEM

PHLOEM

LEAFLET

C.S.

CYCAS



A

ADAXIAL EPIDERMIS

HYPODERMIS

MESOPHYLL

XYLEM

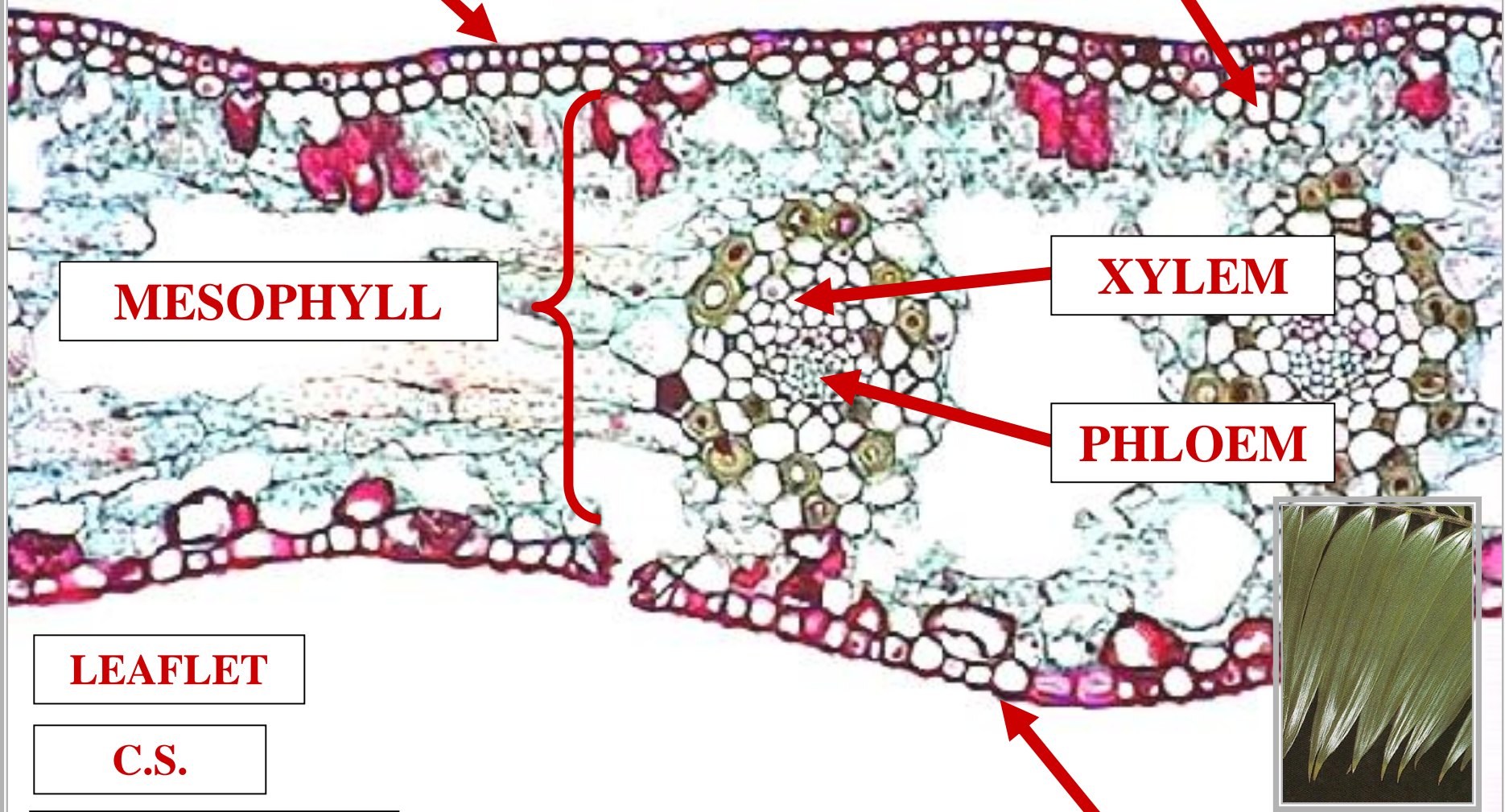
PHLOEM

LEAFLET

C.S.

CYCAS

?



ADAXIAL EPIDERMIS

HYPODERMIS

?

MESOPHYLL

XYLEM

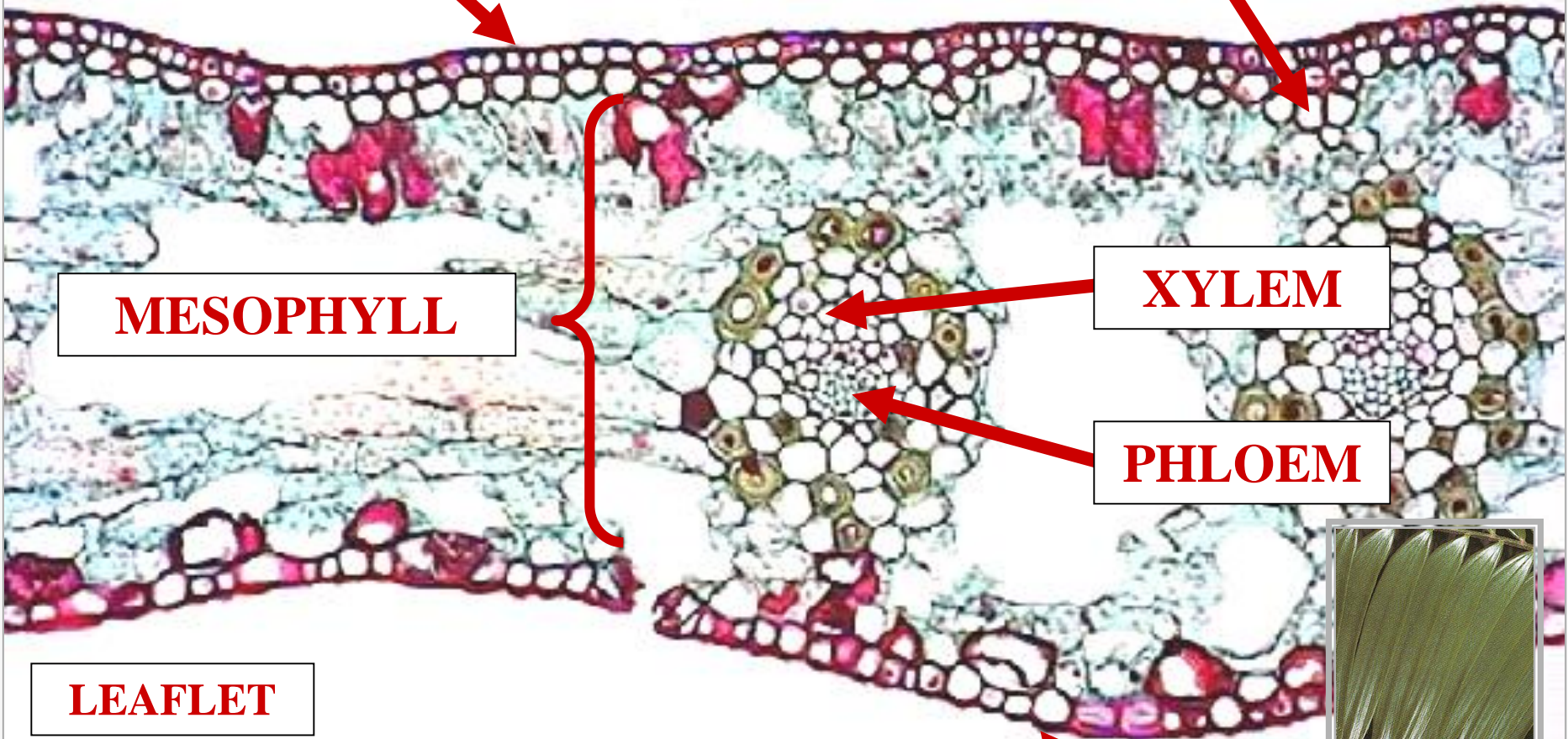
PHLOEM

LEAFLET

C.S.

CYCAS

ABAXIAL EPIDERMIS



S

ADAXIAL EPIDERMIS

HYPODERMIS

MESOPHYLL

XYLEM

PHLOEM

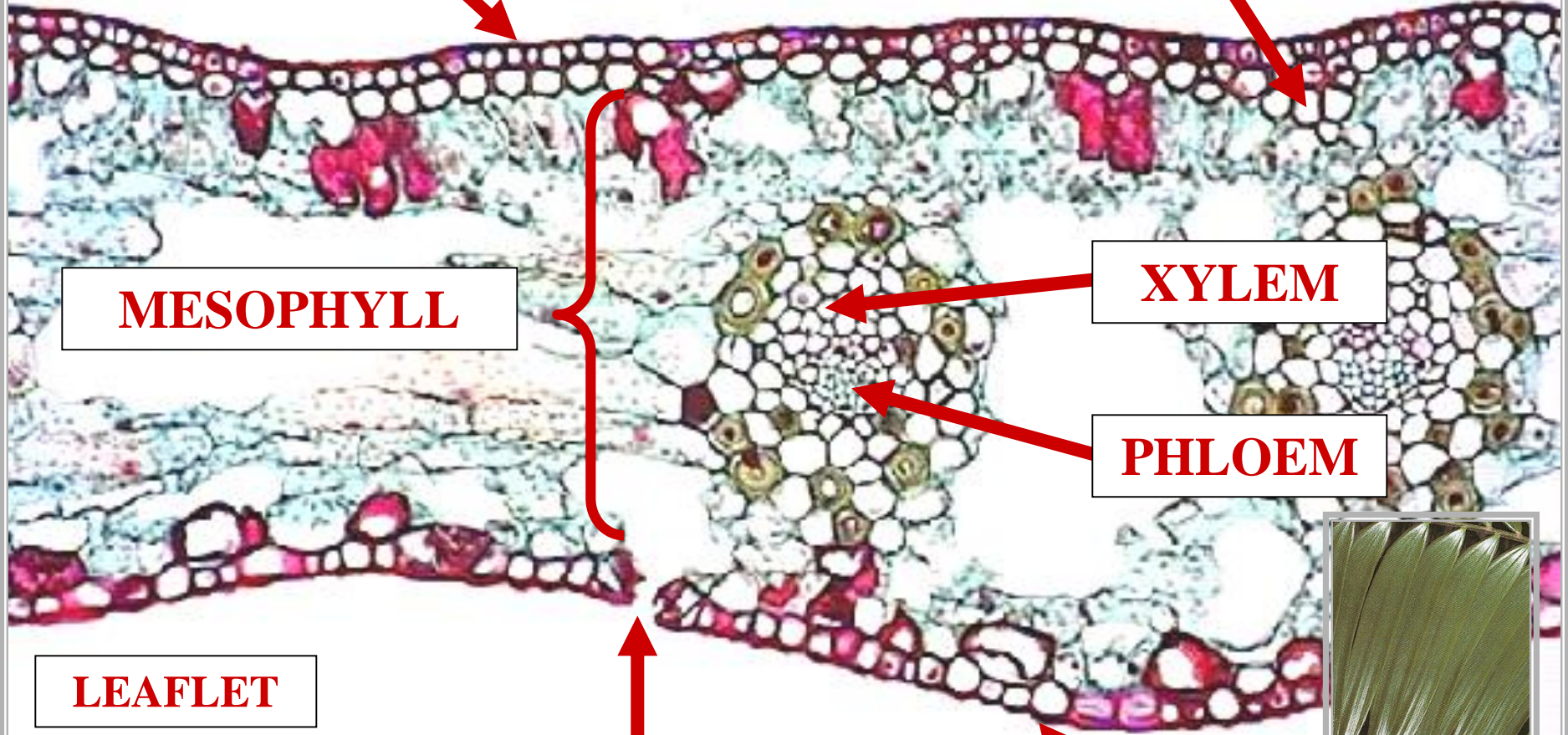
LEAFLET

C.S.

?

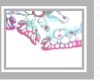
CYCAS

ABAXIAL EPIDERMIS



ADAXIAL EPIDERMIS

HYPODERMIS



MESOPHYLL

XYLEM

PHLOEM

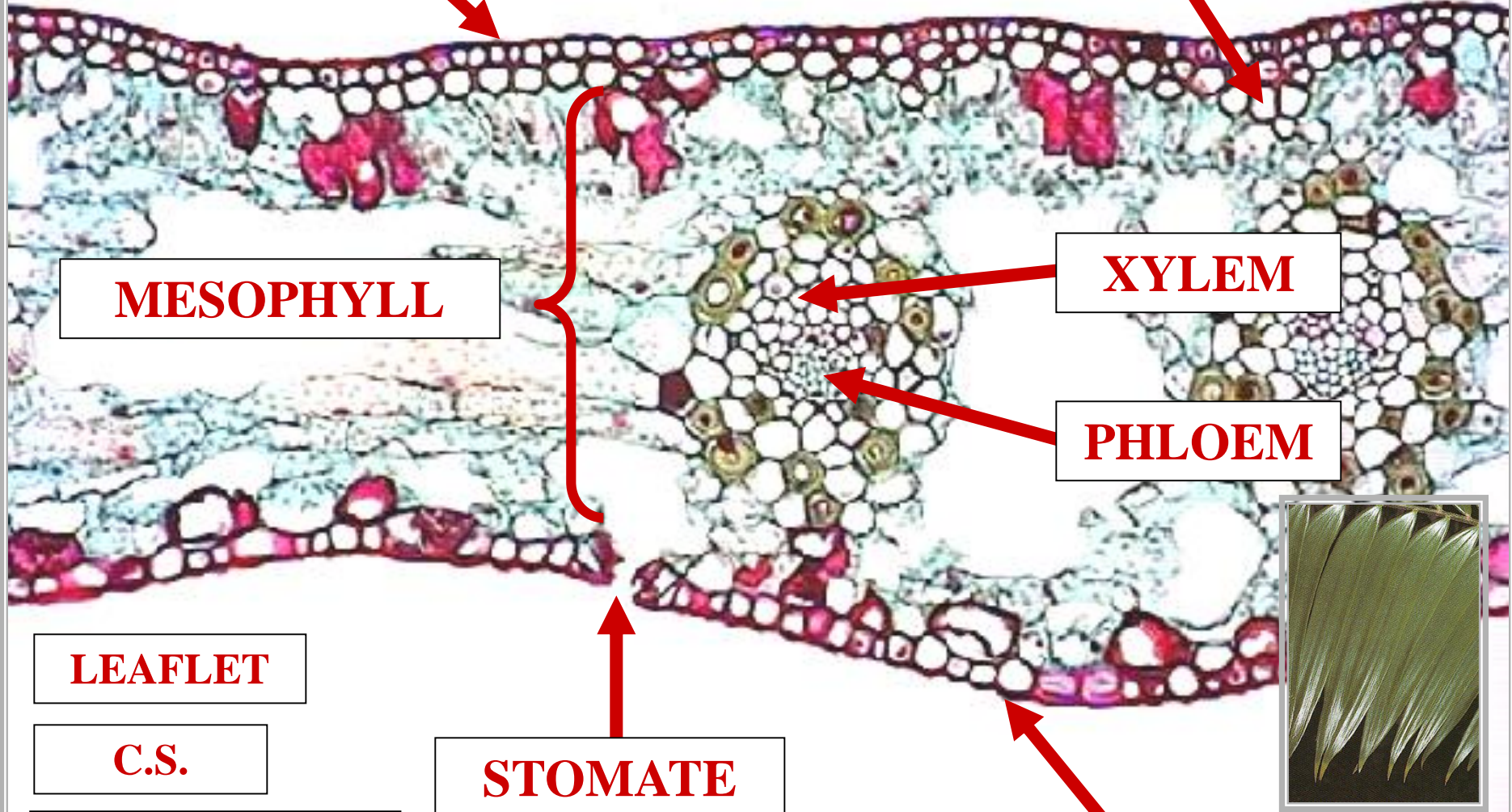
LEAFLET

C.S.

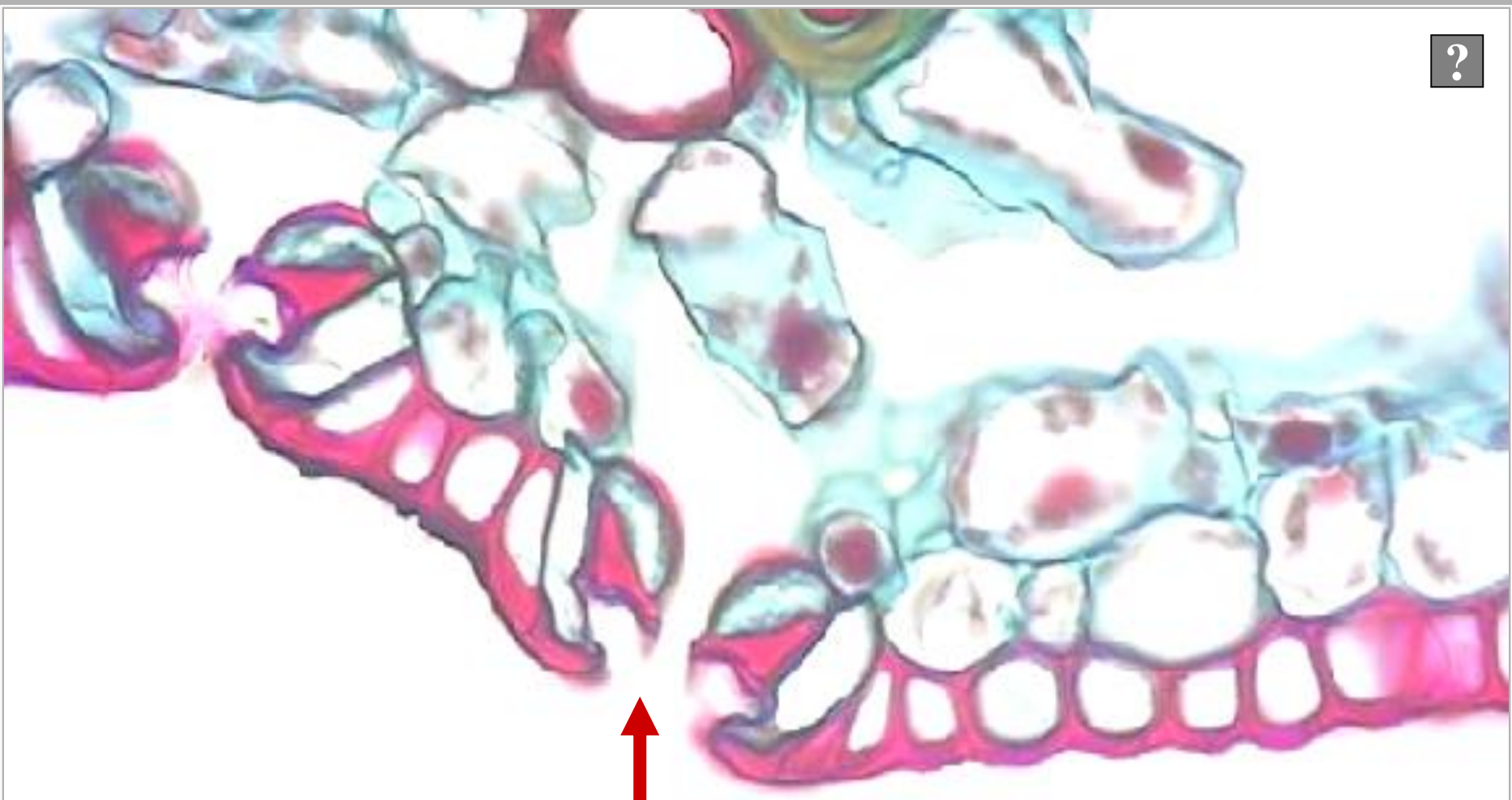
STOMATE

CYCAS

ABAXIAL EPIDERMIS



?

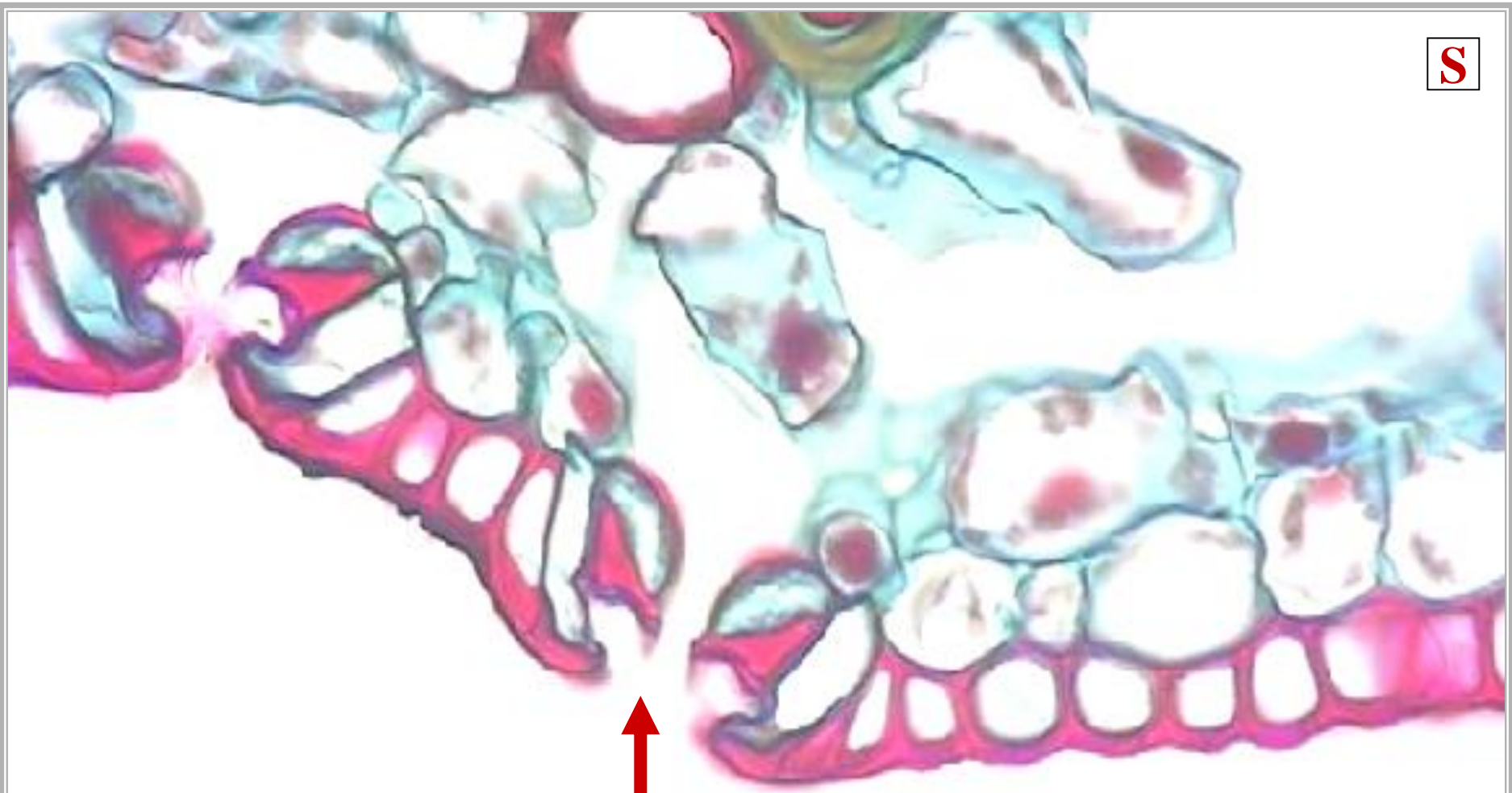


LEAFLET

C.S.

CYCAS

STOMATE



LEAFLET

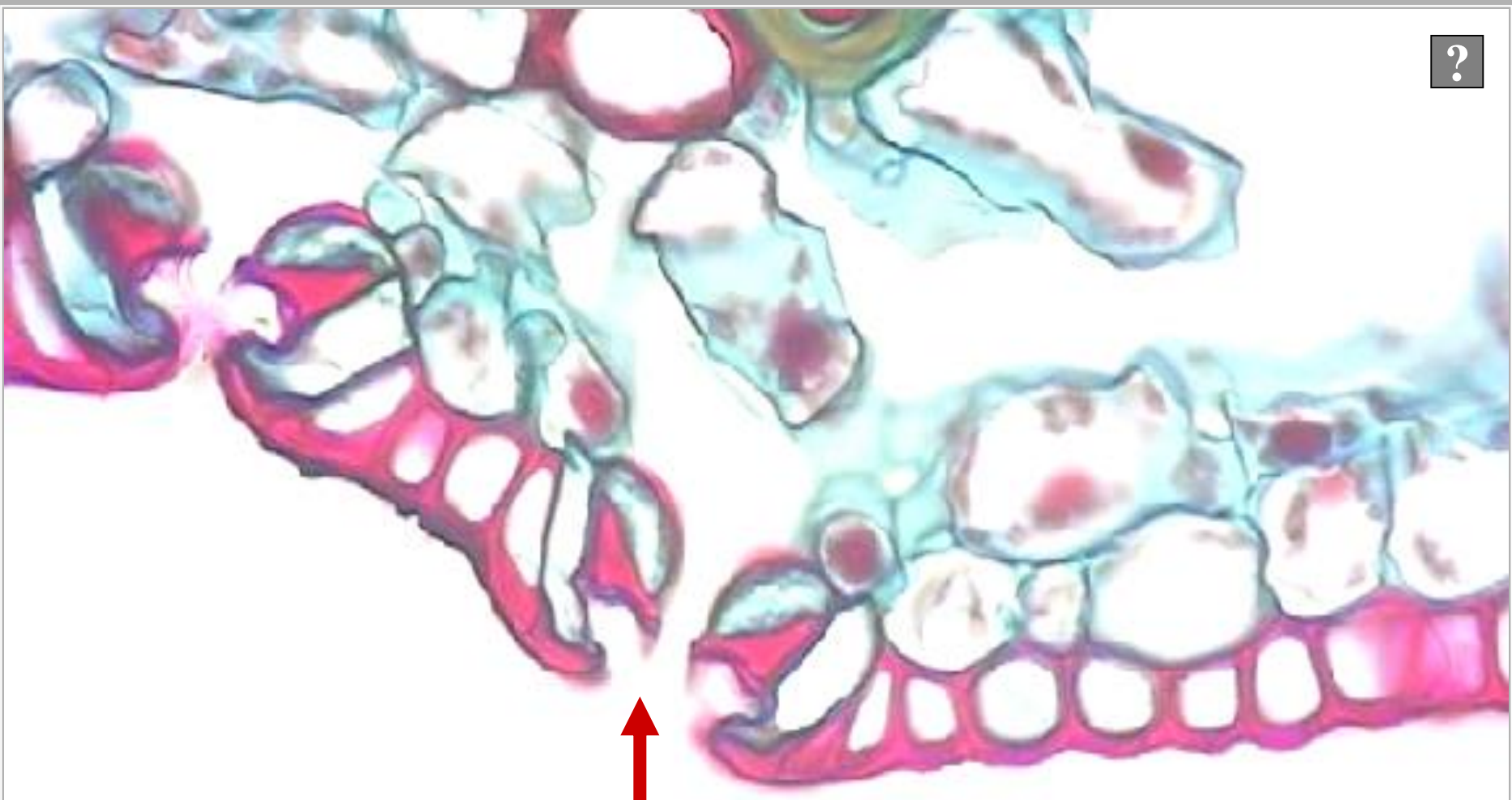
C.S.

CYCAS

?



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LEAFLET

C.S.

CYCAS

STOMA



?

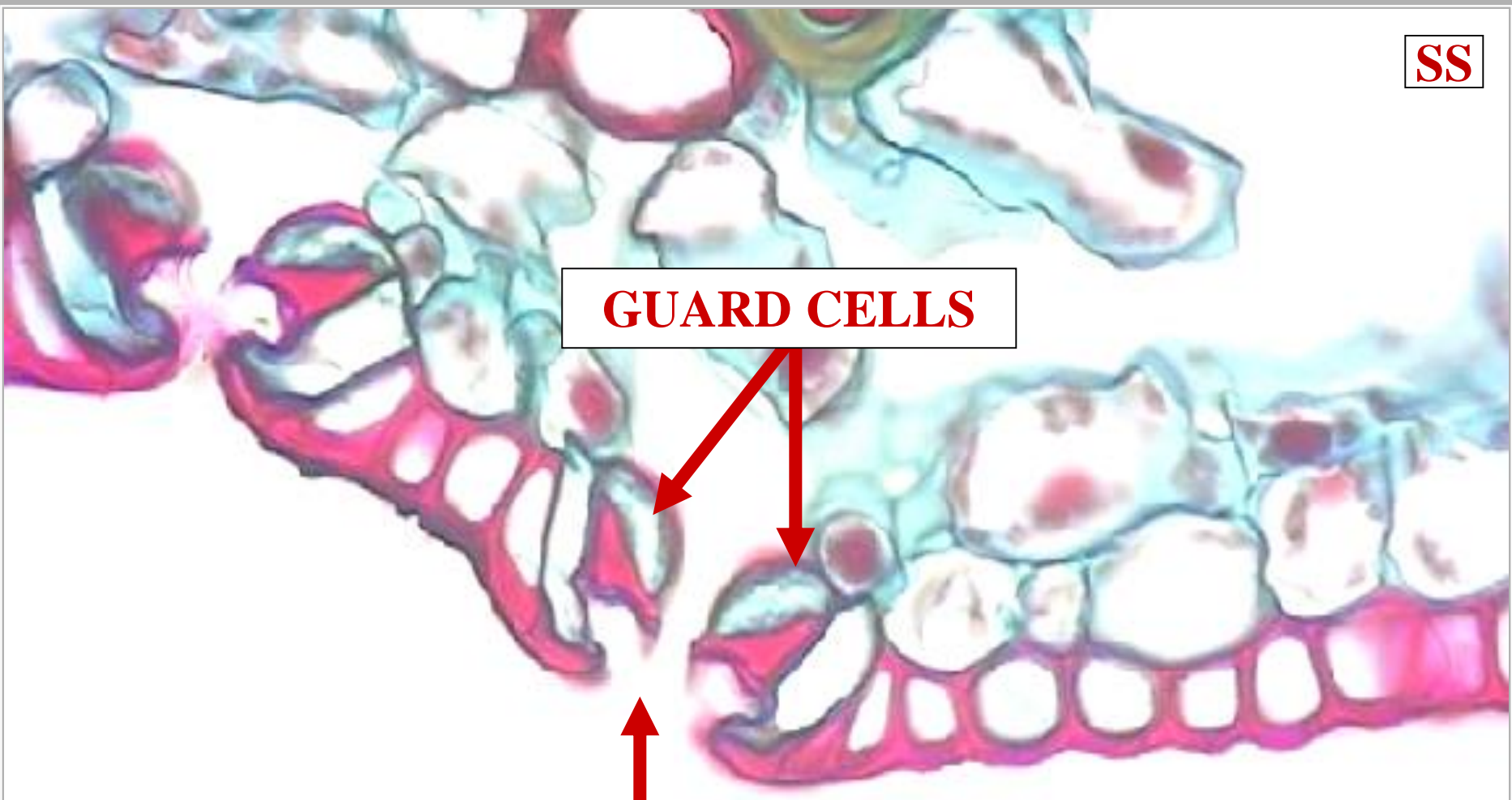
LEAFLET

C.S.

CYCAS

STOMA

SS



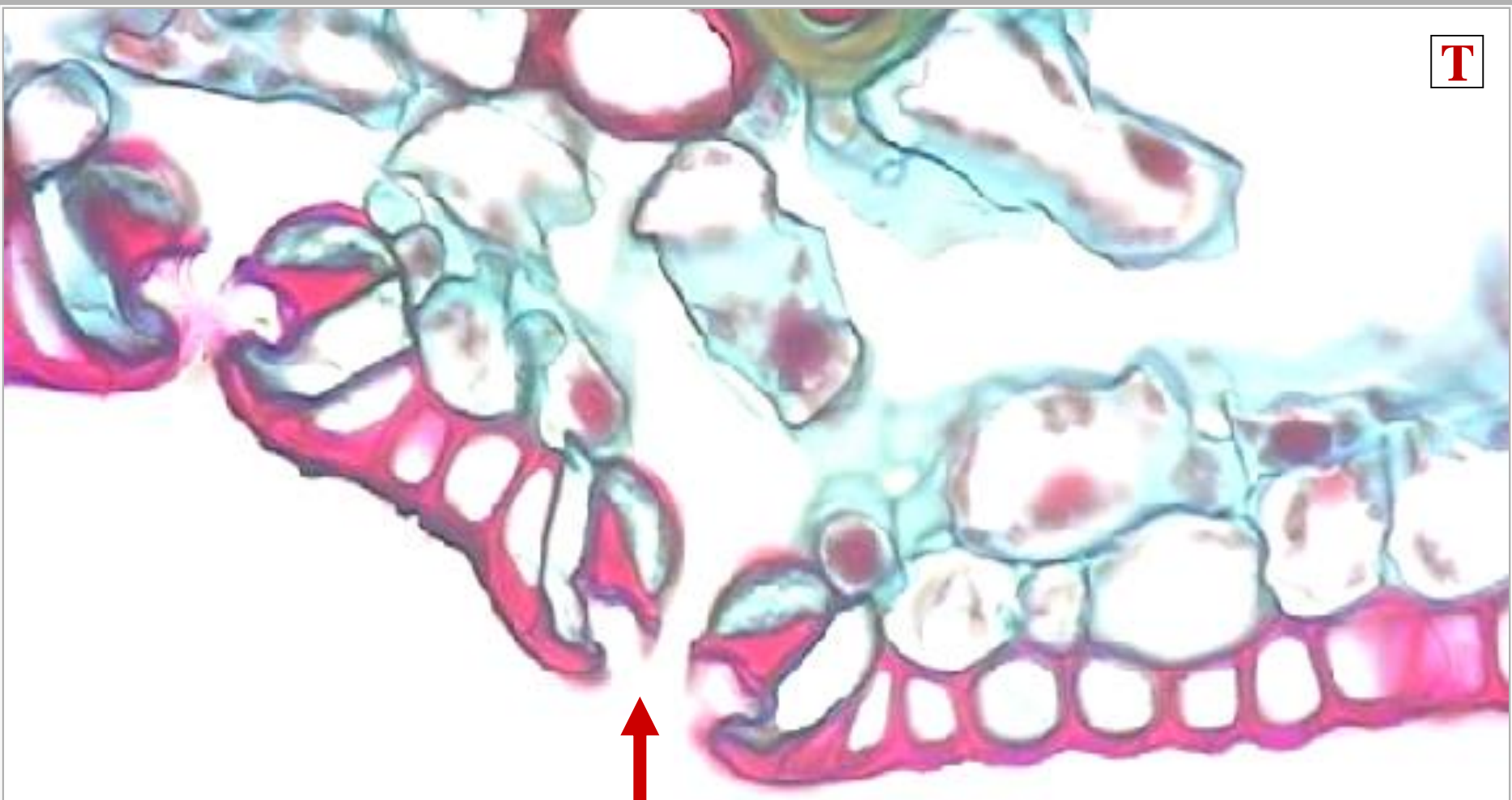
GUARD CELLS

LEAFLET

C.S.

CYCAS

STOMA



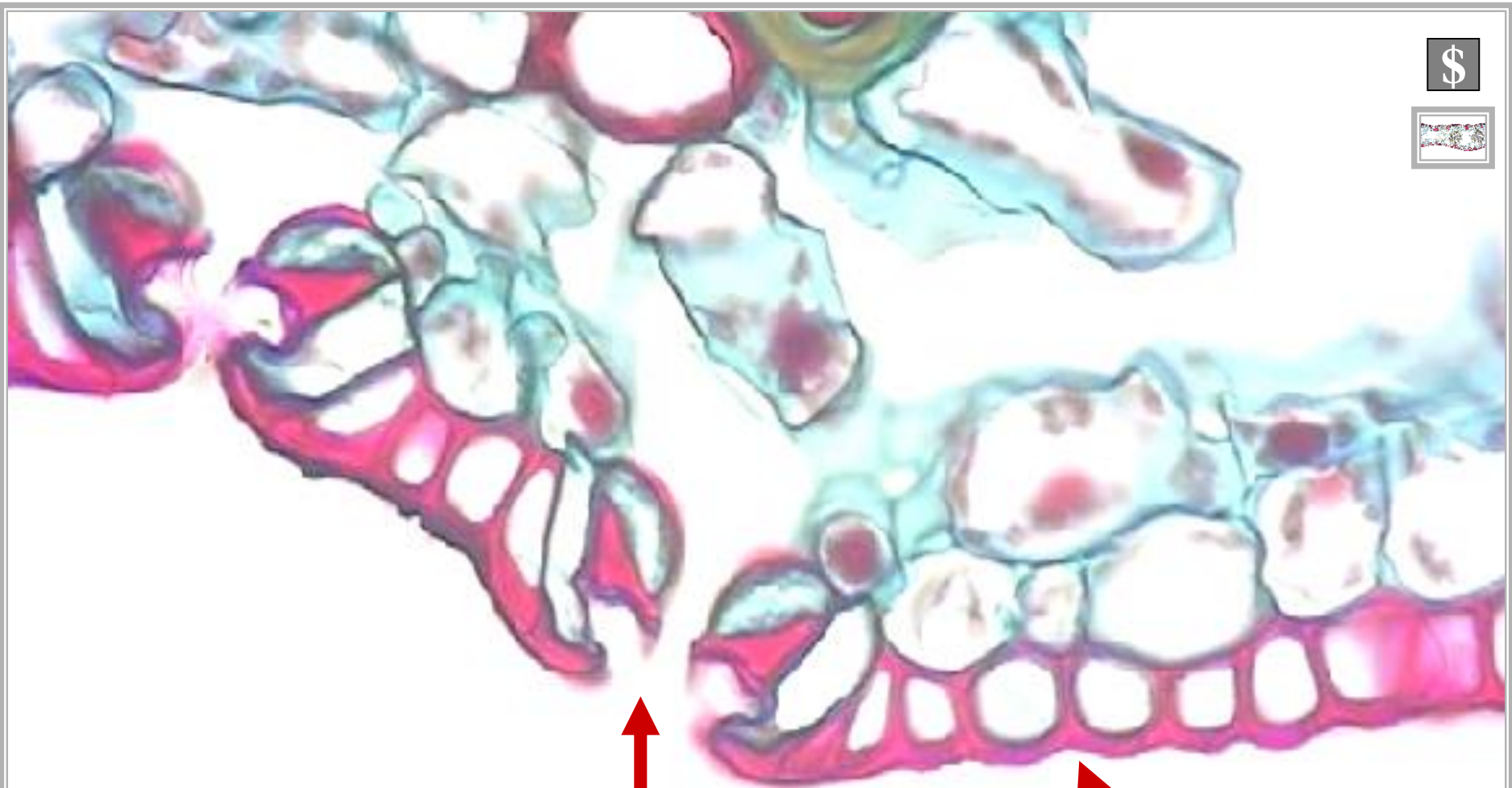
LEAFLET

C.S.

CYCAS



**SUNKEN
STOMATE**



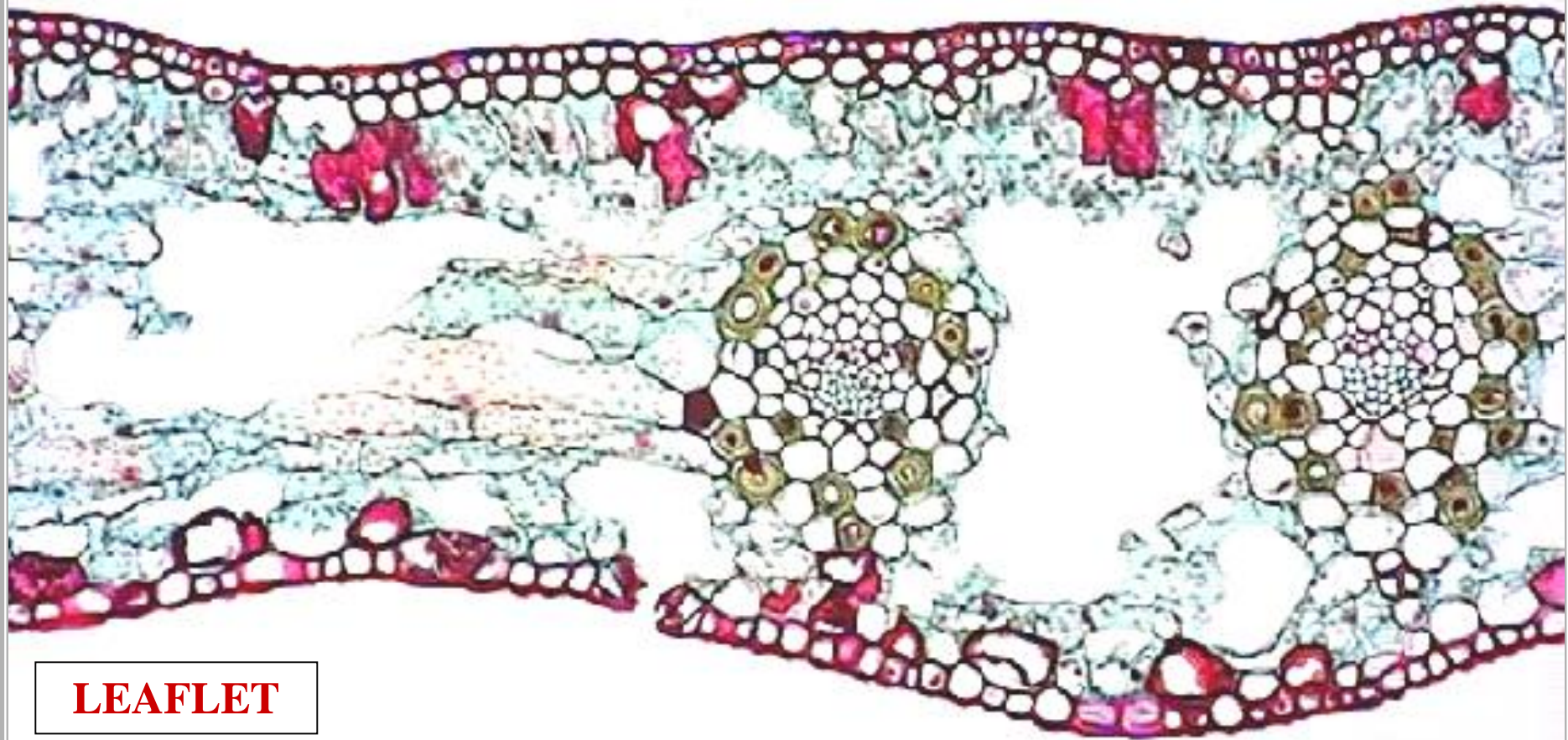
LEAFLET

C.S.

CYCAS

**SUNKEN
STOMATE**

THICK CUTICLE

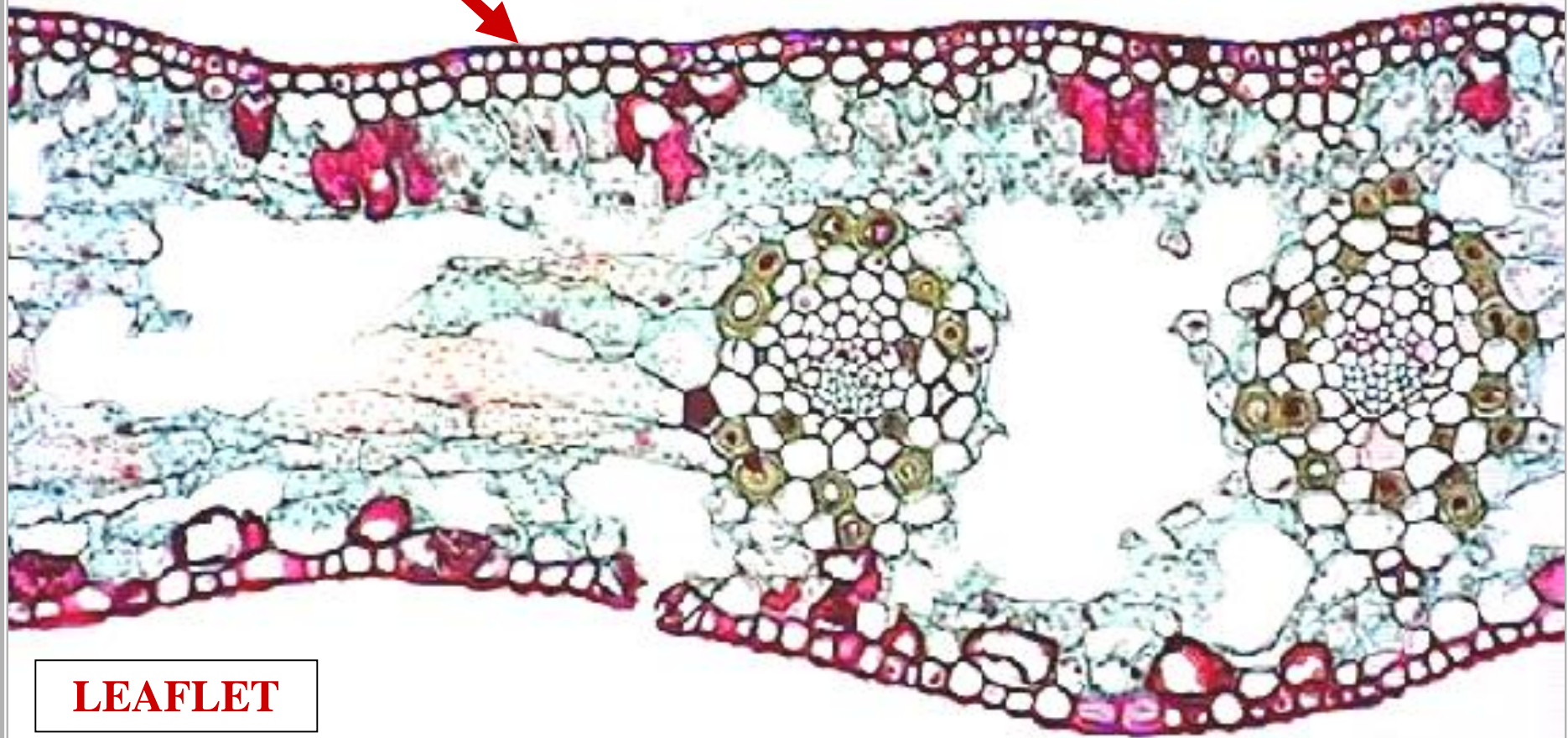


LEAFLET

C.S.

CYCAS

THICK CUTICLE



LEAFLET

C.S.

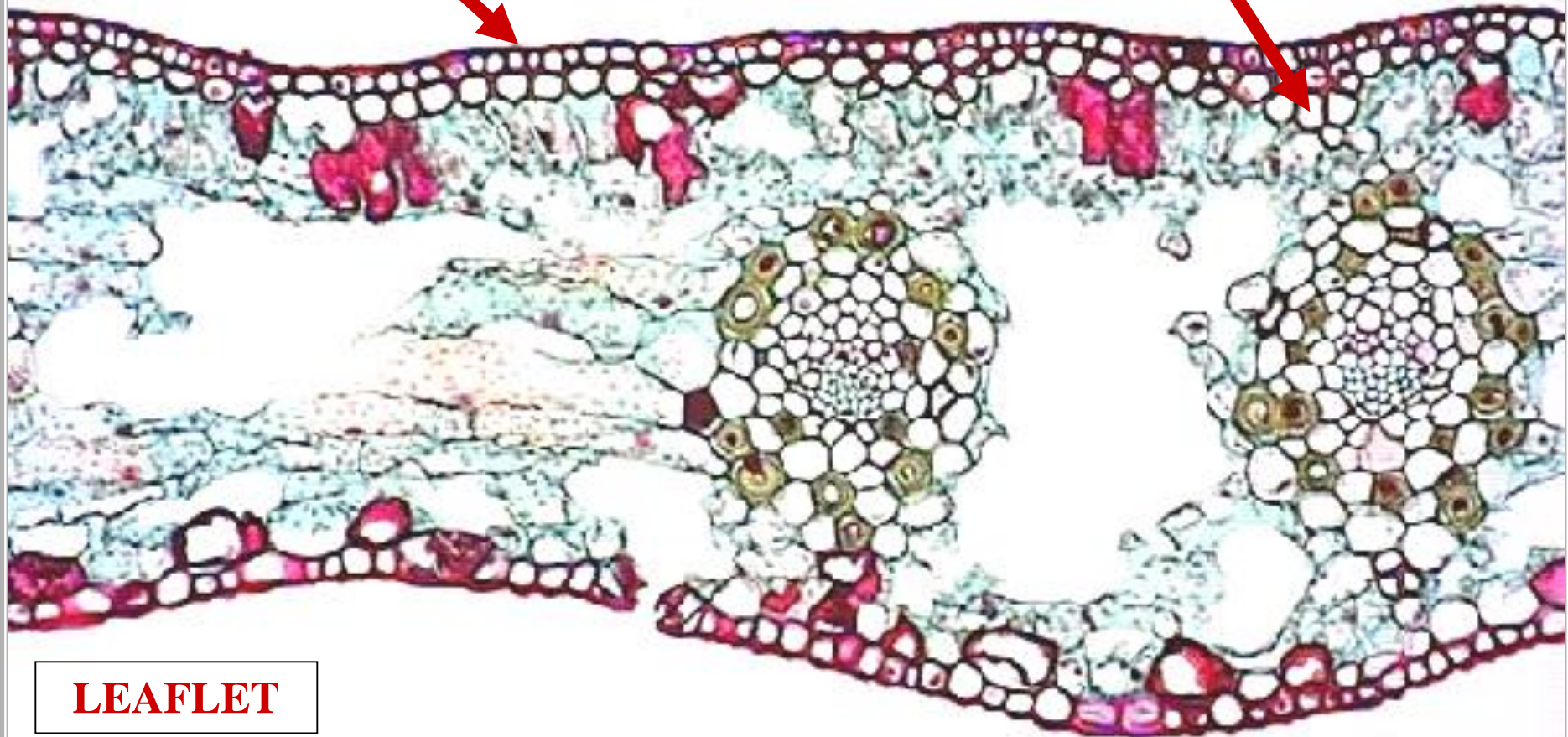
CYCAS

THICK CUTICLE

HYPODERMIS

\$

S



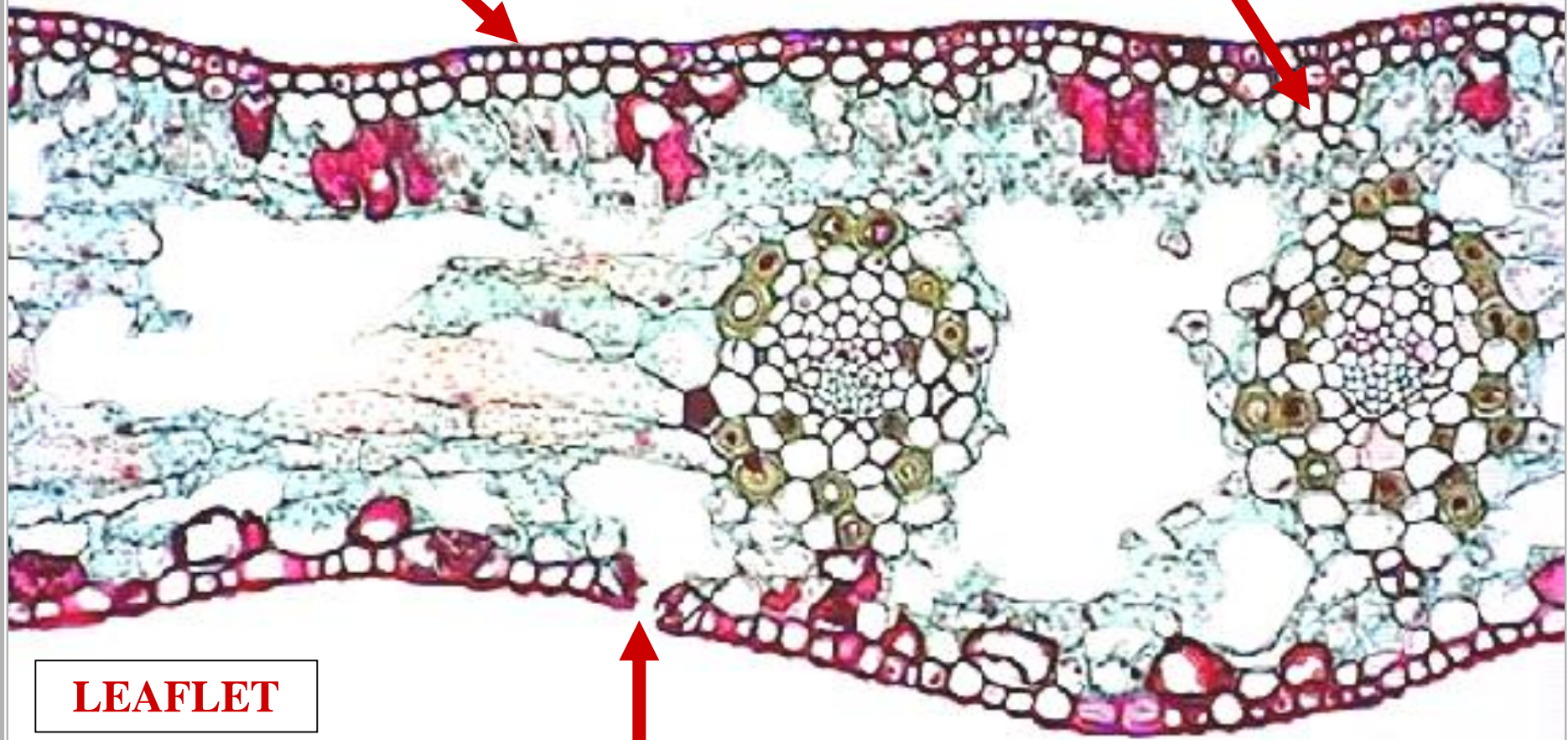
LEAFLET

C.S.

CYCAS

THICK CUTICLE

HYPODERMIS



LEAFLET

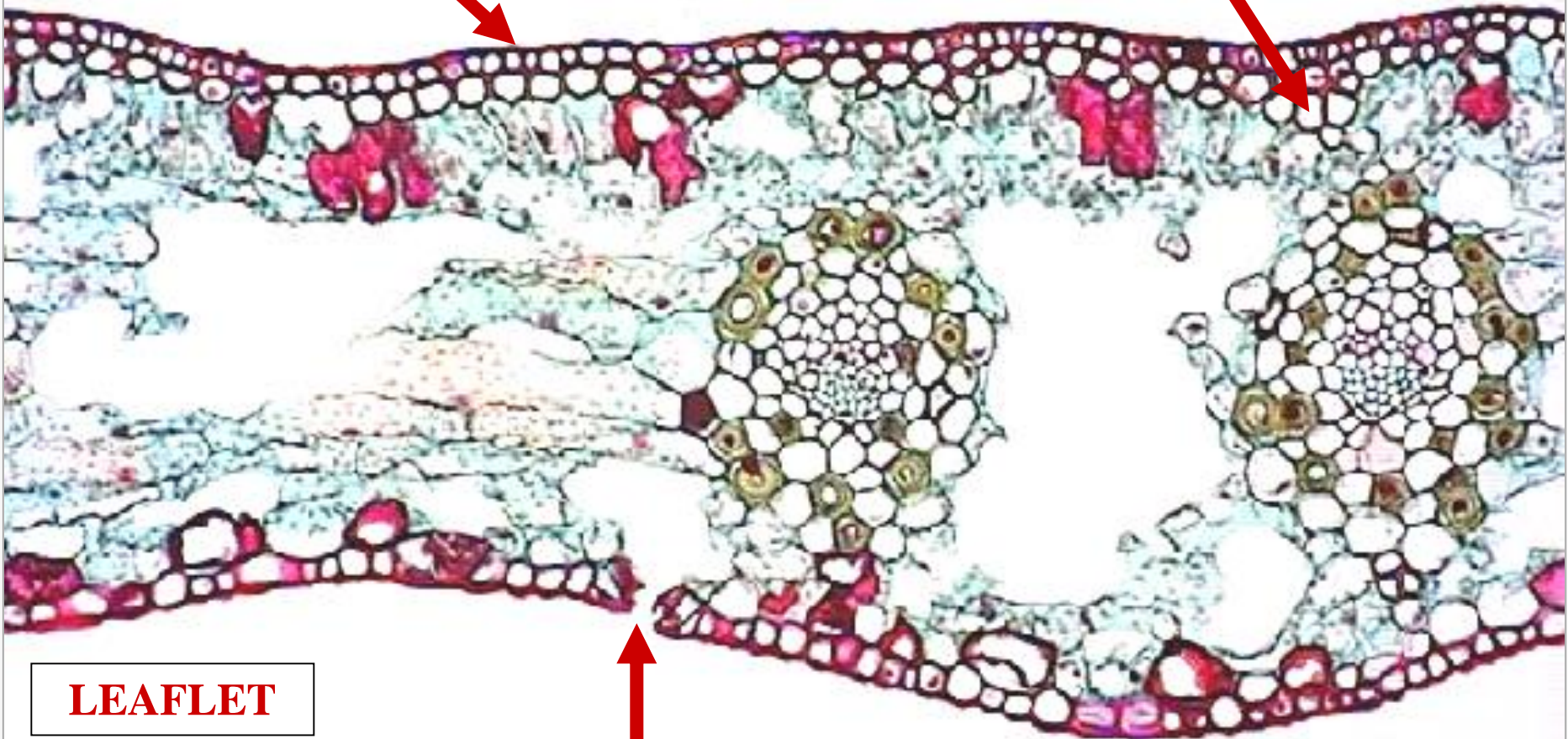
C.S.

CYCAS

**SUNKEN
STOMATE**

THICK CUTICLE

HYPODERMIS



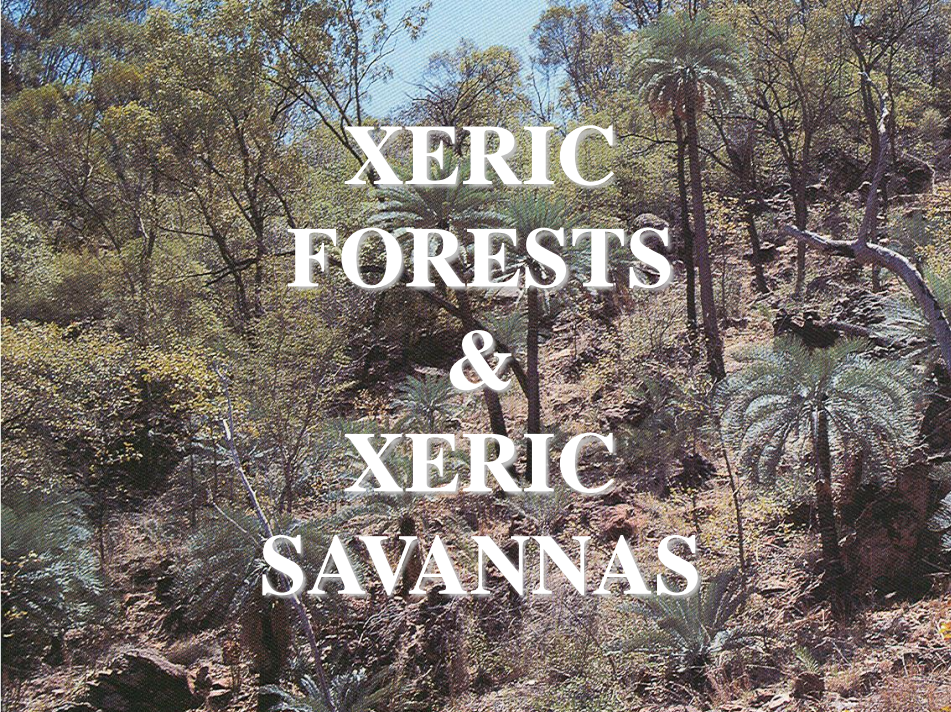
LEAFLET

C.S.

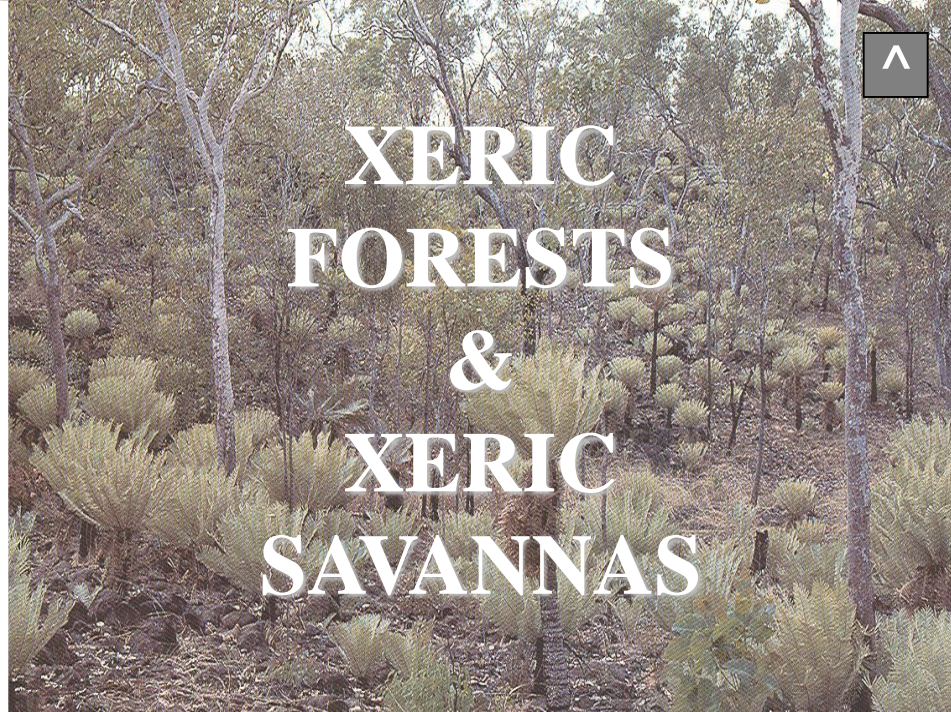
CYCAS

**SUNKEN
STOMATE**

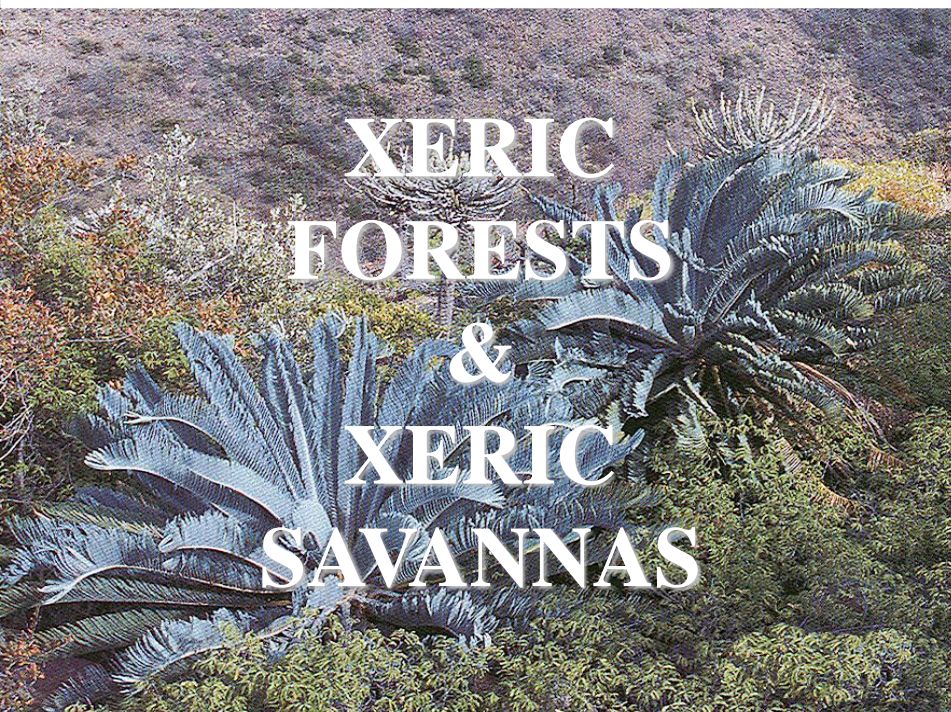
INHIBIT H₂O LOSS

A photograph of a xeric forest and savanna landscape. The scene shows a mix of tall, thin trees and large, fan-shaped cycad plants on a hillside. The ground is rocky and covered with sparse vegetation.

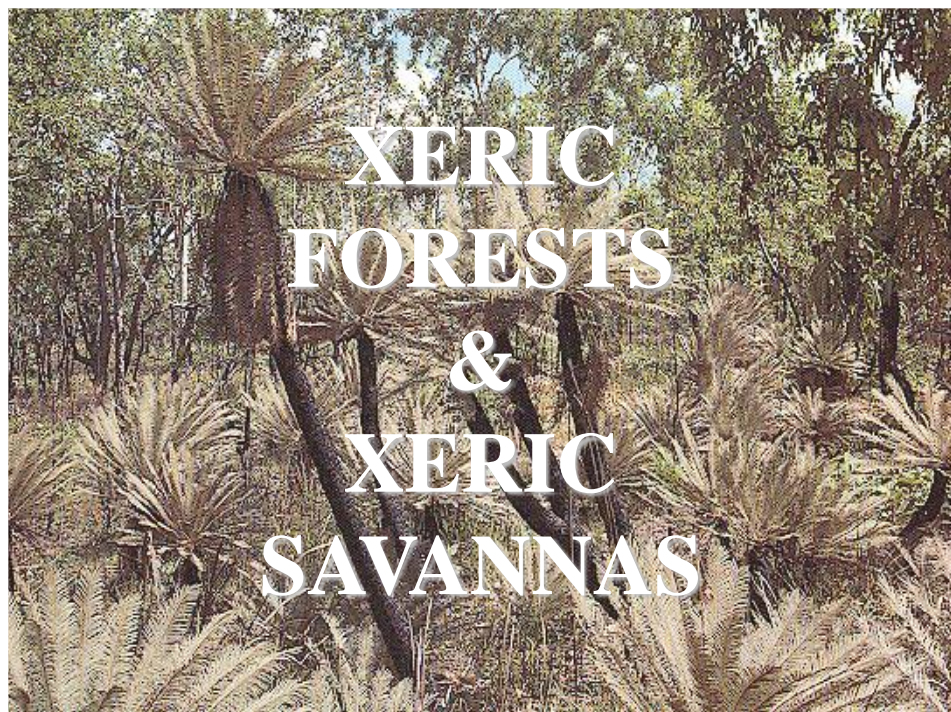
**XERIC
FORESTS
&
XERIC
SAVANNAS**

A photograph of a xeric forest and savanna landscape, similar to the first image. It features a dense stand of trees and cycad plants. In the top right corner, there is a small black square icon containing a white upward-pointing arrow.

**XERIC
FORESTS
&
XERIC
SAVANNAS**

A close-up photograph of several large, fan-shaped cycad plants. The plants are green and have a textured, layered appearance. They are surrounded by other vegetation in a natural setting.

**XERIC
FORESTS
&
XERIC
SAVANNAS**

A photograph of a xeric forest and savanna landscape, showing a dense stand of trees and cycad plants. The scene is filled with greenery, with the cycad plants being a prominent feature in the foreground.

**XERIC
FORESTS
&
XERIC
SAVANNAS**

LEAF ABSCISSION

ABSCISSION

**CYCADOPHYTA
LEAF ABSCISSION**

TO SHED

**CYCADOPHYTA
LEAF ABSCISSION**

ABSCISSION LAYER

CYCADOPHYTA
LEAF ABSCISSION LAYER



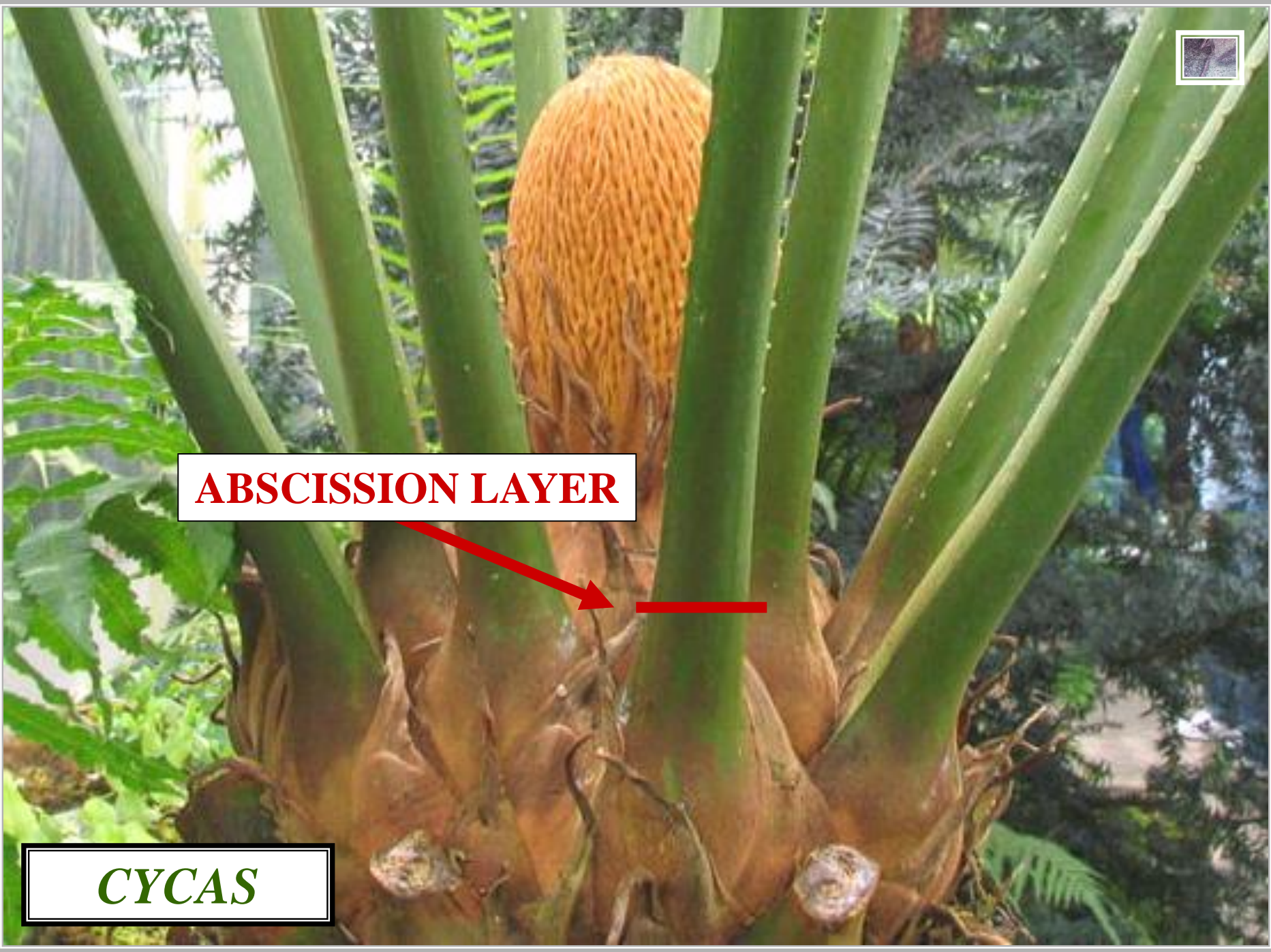
ISOLATES LEAF
FROM STEM

CYCADOPHYTA
LEAF ABSCISSION LAYER



LEAF PETIOLE

CYCAS



ABSCISSION LAYER



CYCAS

A

STEM

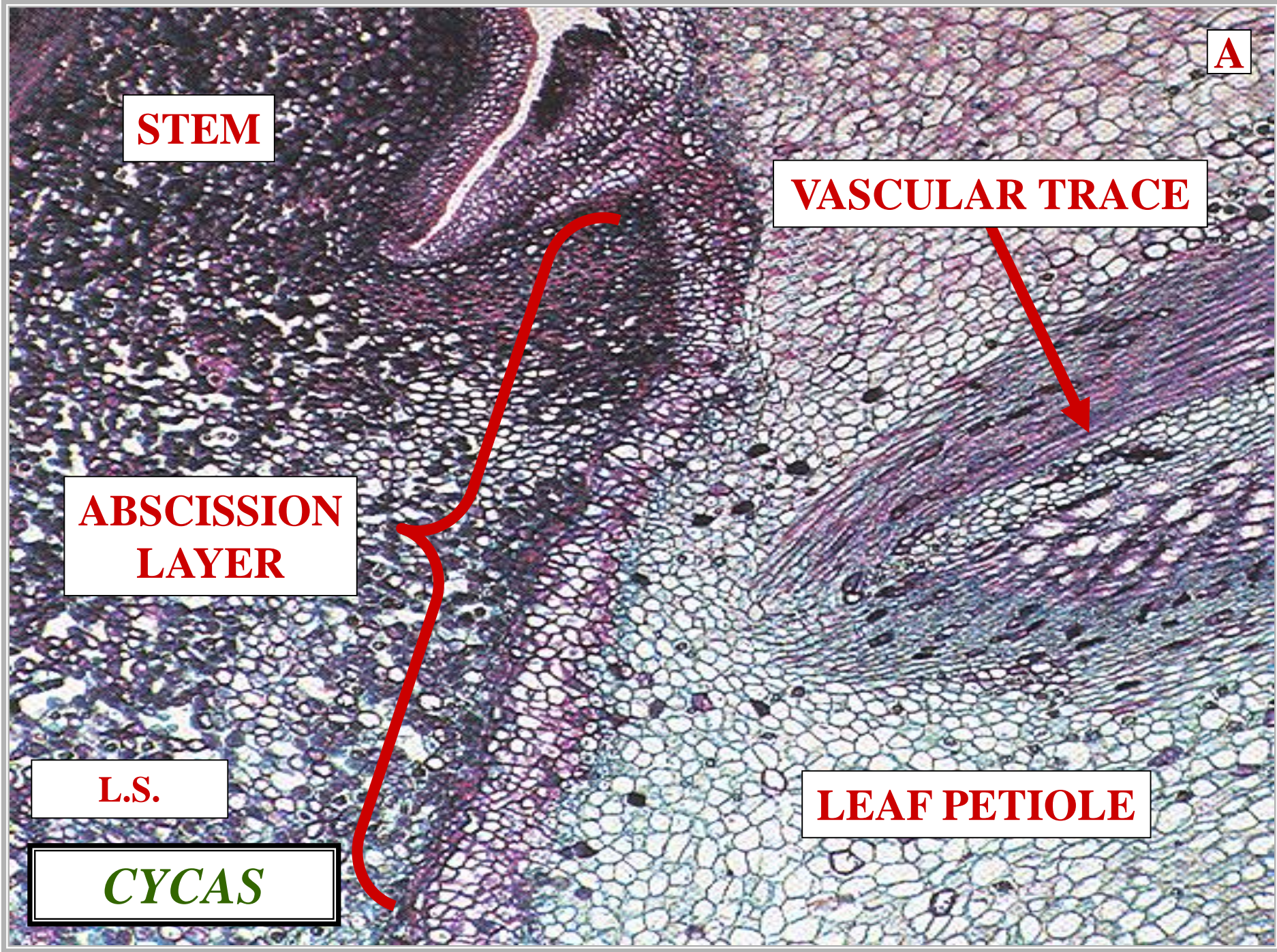
VASCULAR TRACE

**ABSCISSION
LAYER**

L.S.

CYCAS

LEAF PETIOLE



LB

ABSCISSION LAYER

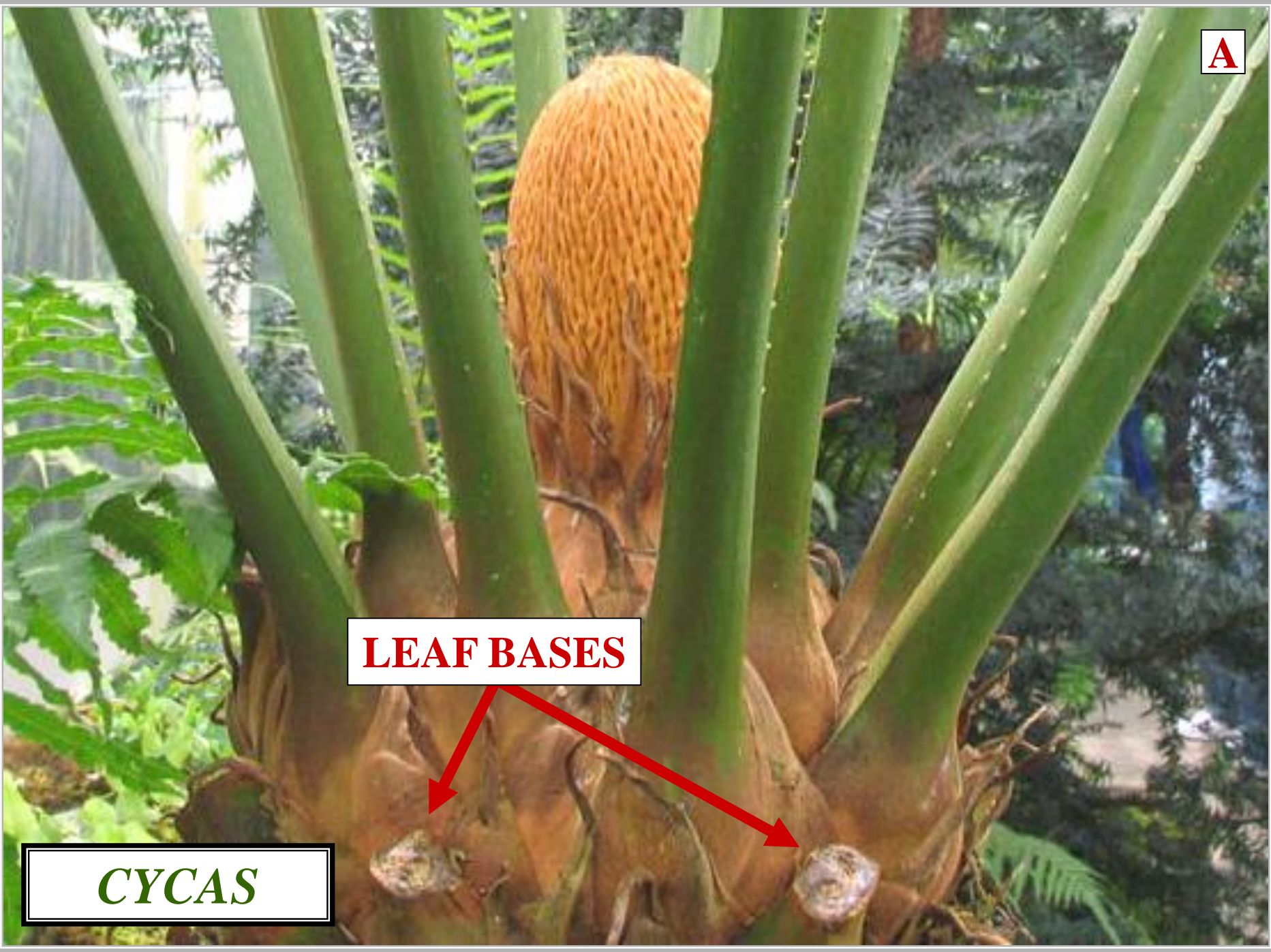


CYCAS

LEAF BASES



CYCAS





ARMOR-LIKE STEM





ROOT

ROOT TYPES

CYCADOPHYTA ROOT TYPES

TYPICAL ROOTS

CYCADOPHYTA ROOT TYPES

CYCADOPHYTA

ROOT TYPES



TYPICAL ROOTS

CORALLOID ROOTS

CYCADOPHYTA

ROOT TYPES

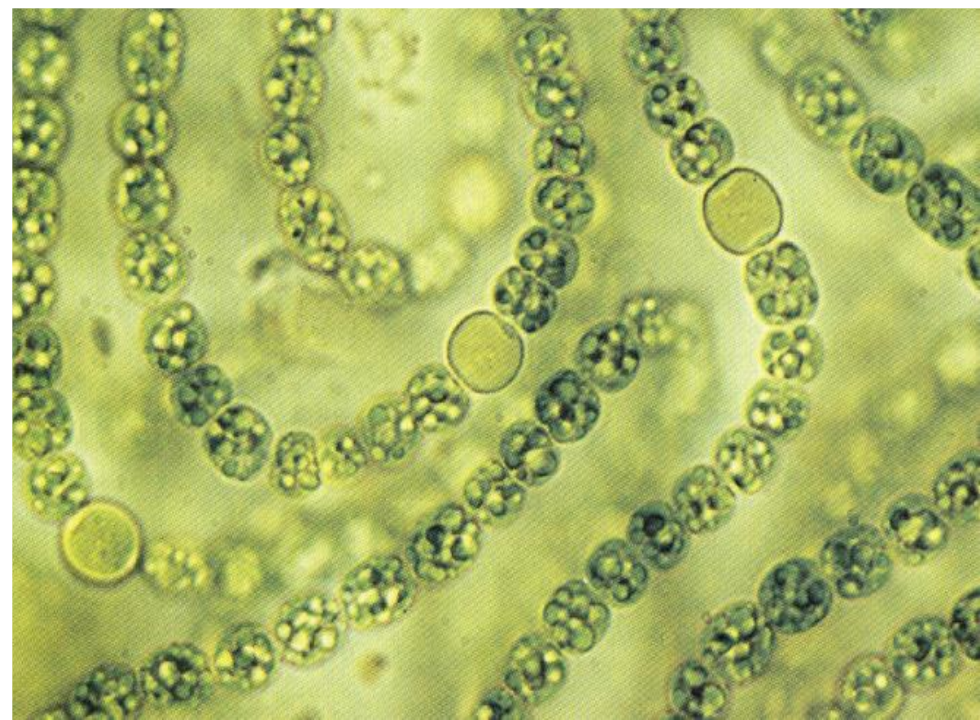


T

TYPICAL ROOTS

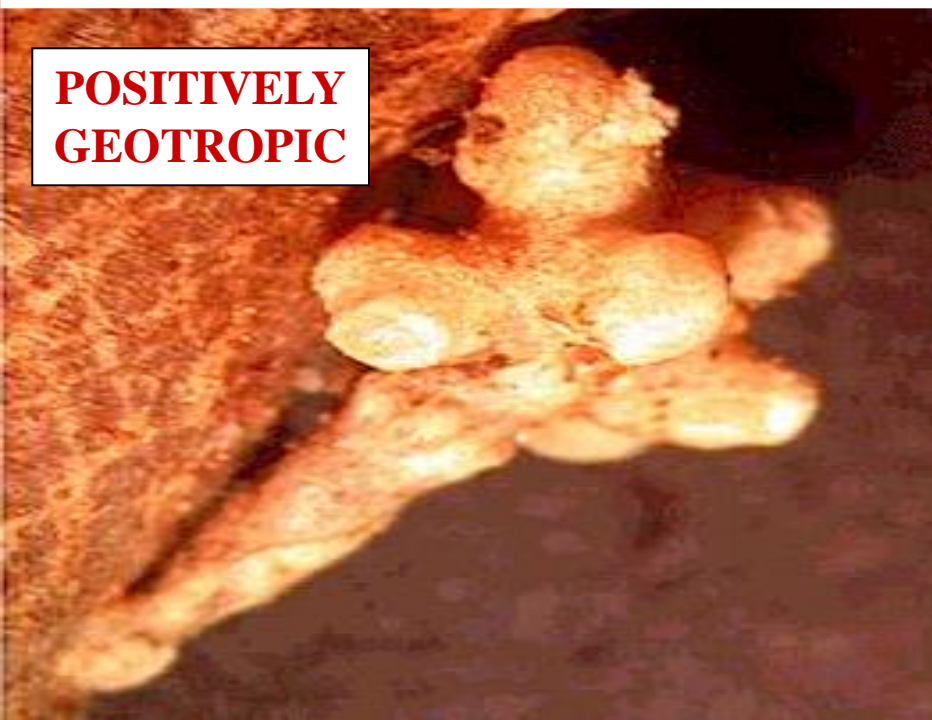


**TYPICAL
ROOT**





**POSITIVELY
GEOTROPIC**





**POSITIVELY
GEOTROPIC**



**DOWN-WARD
GROWTH**

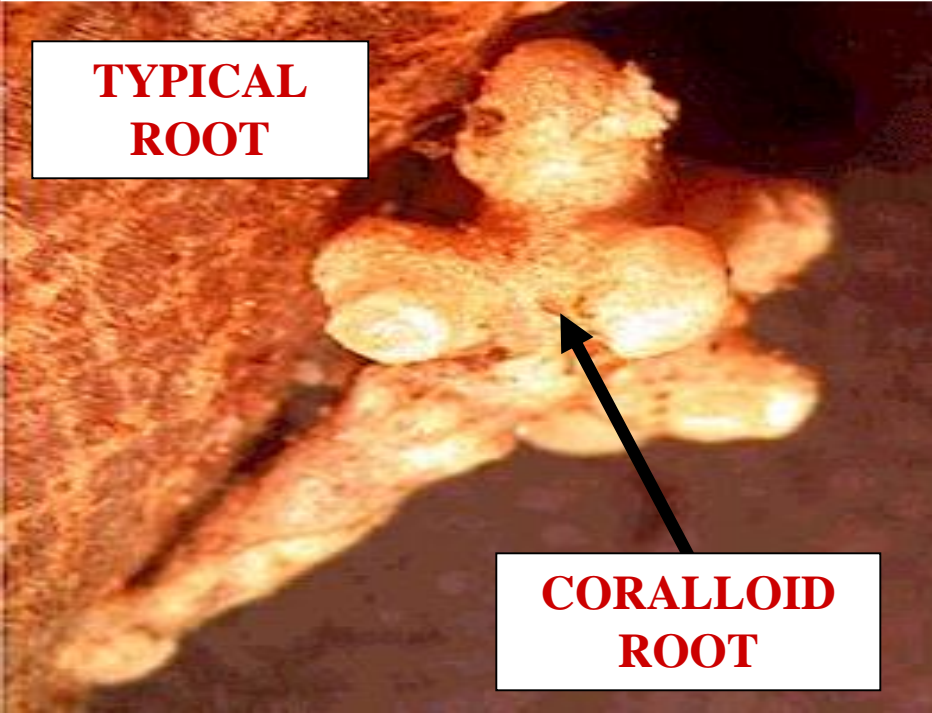




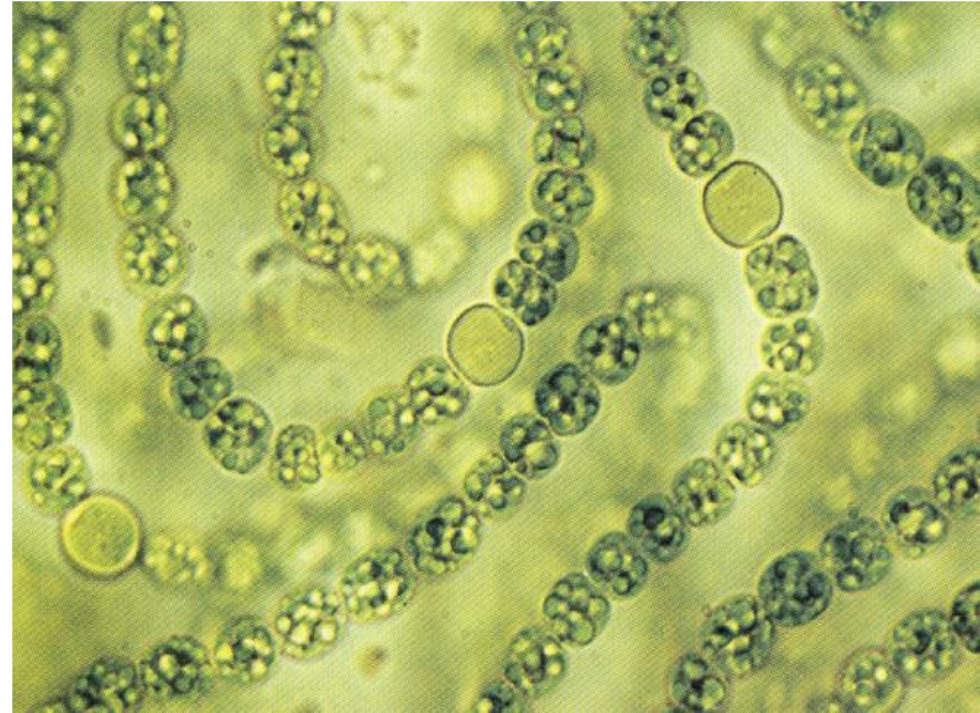
CORALLOID ROOTS



**TYPICAL
ROOT**

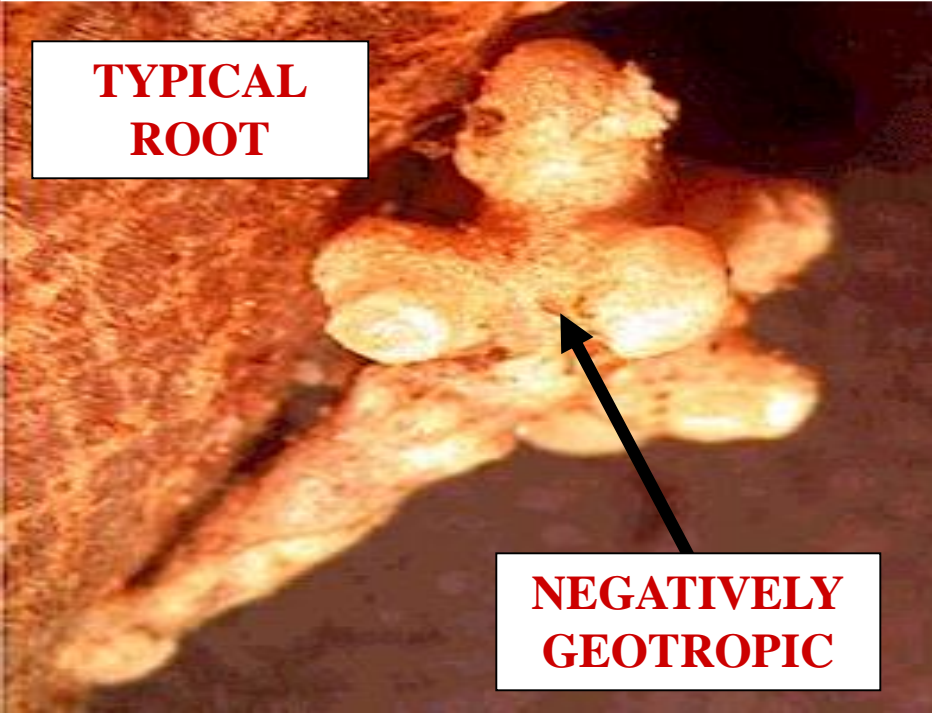


**CORALLOID
ROOT**

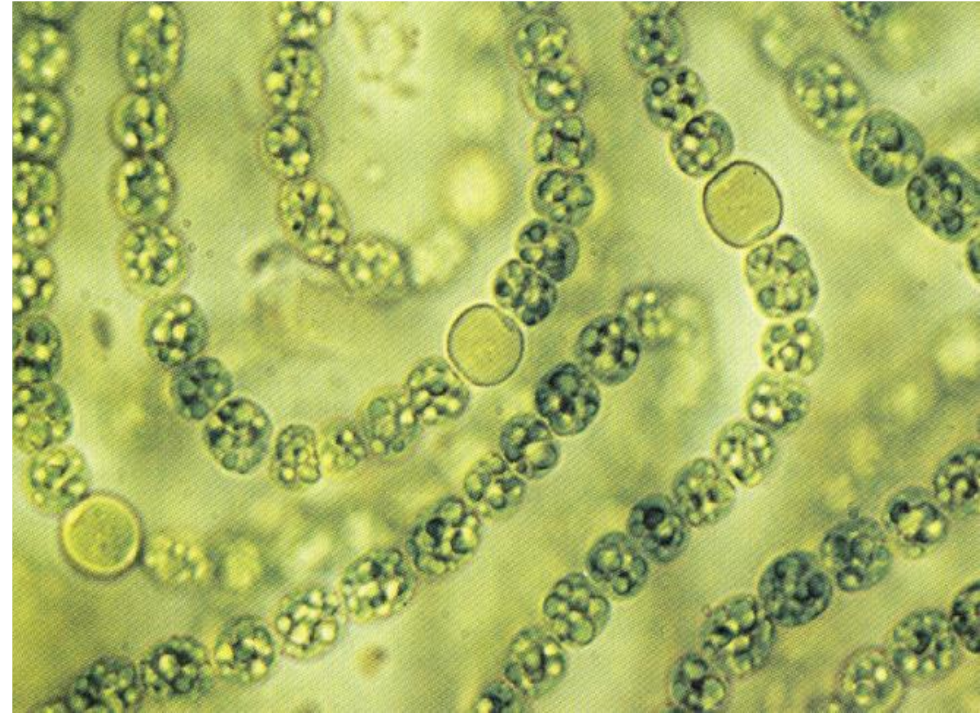




**TYPICAL
ROOT**

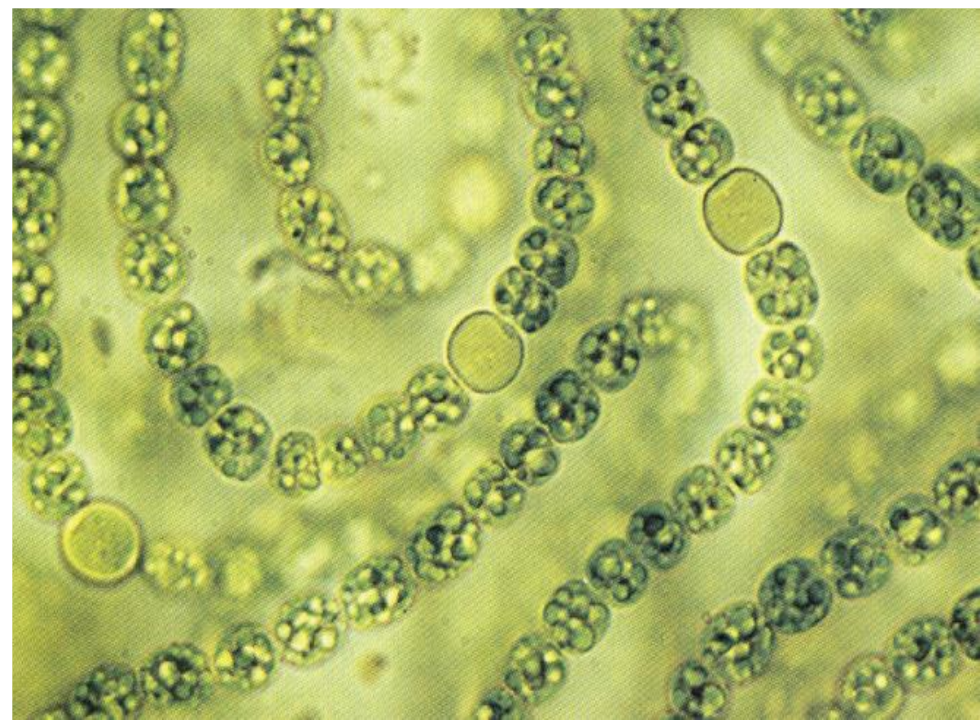
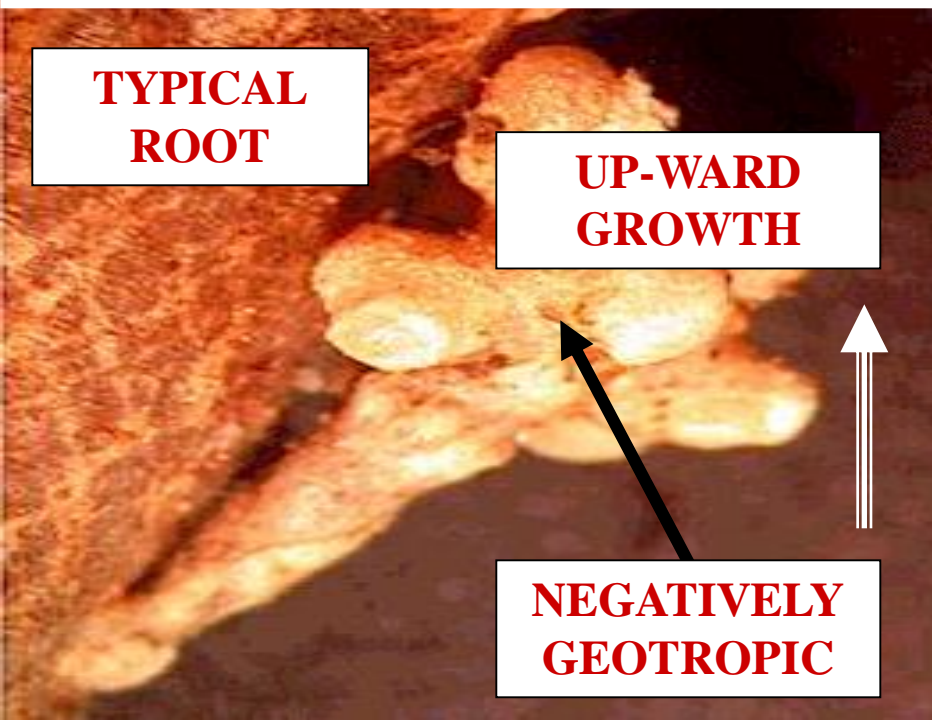


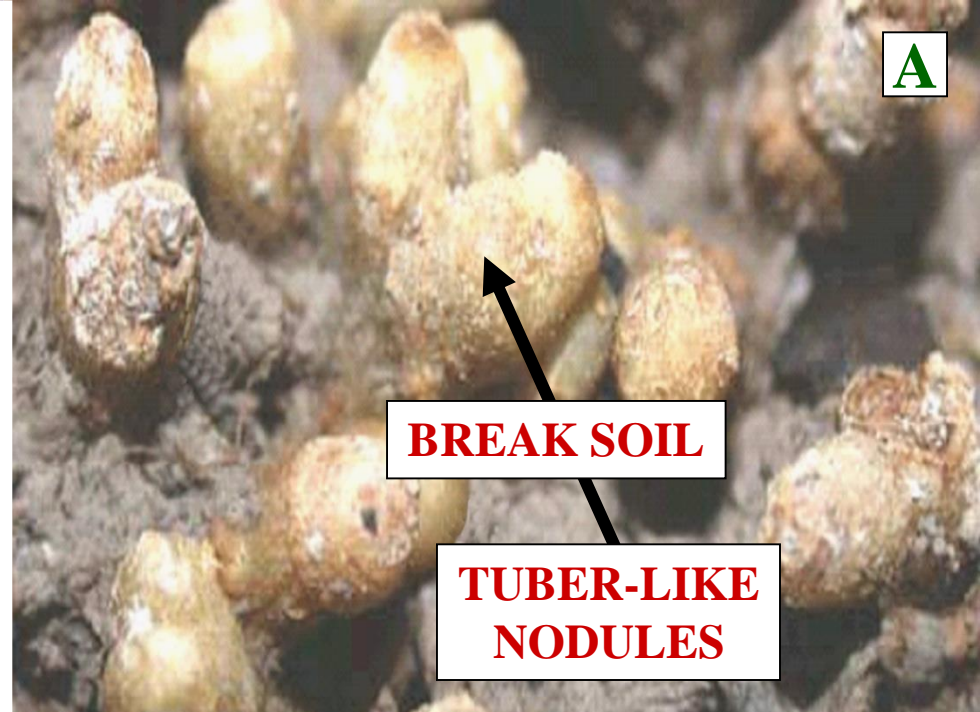
**NEGATIVELY
GEOTROPIC**





T

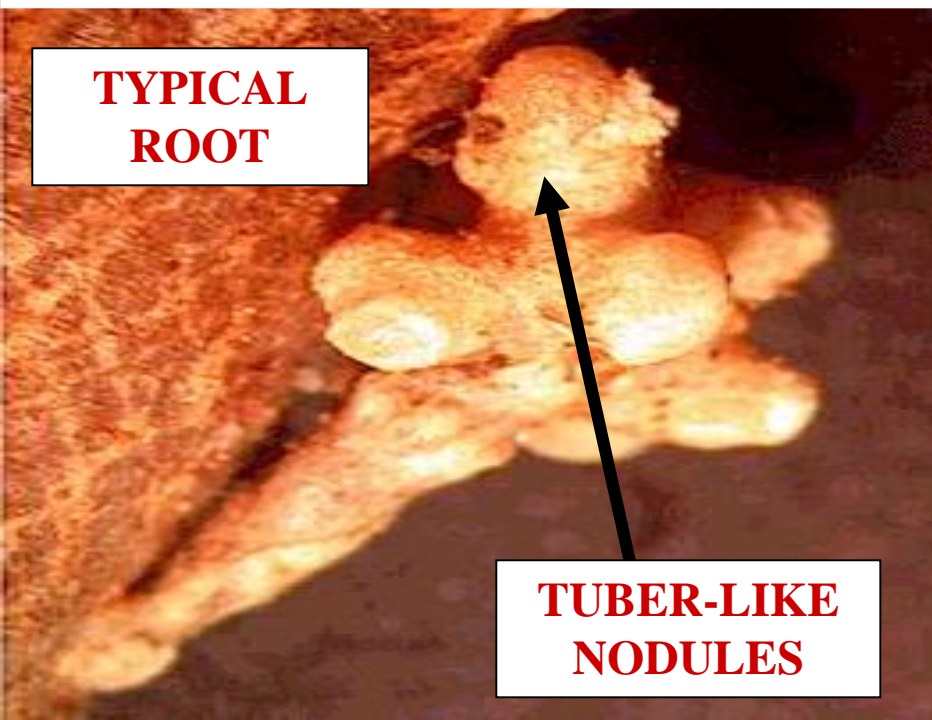




A

BREAK SOIL

**TUBER-LIKE
NODULES**

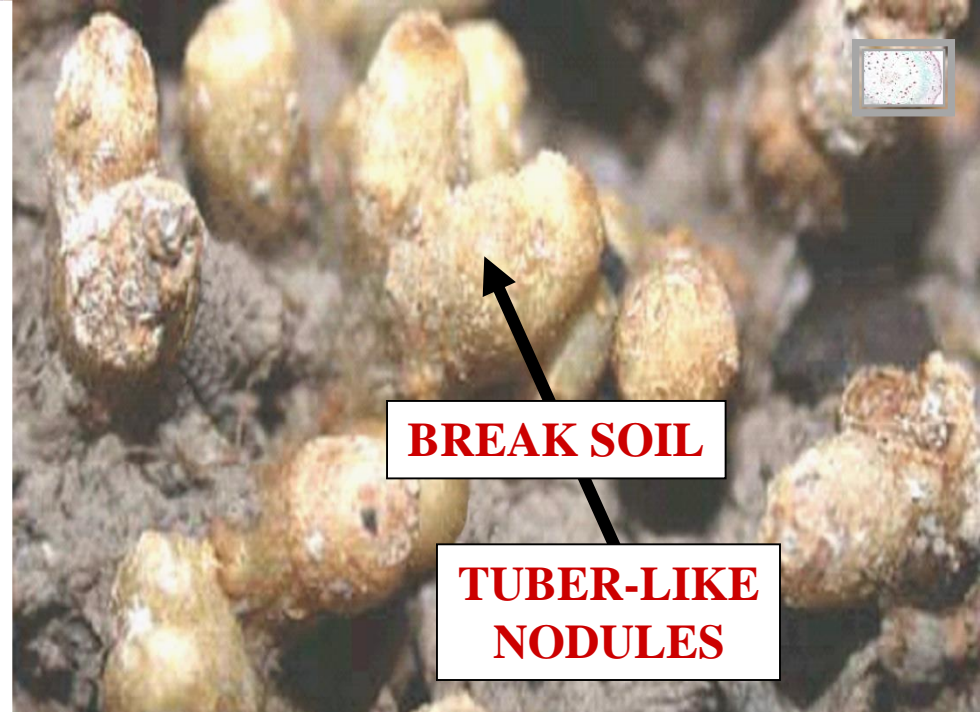


**TYPICAL
ROOT**

**TUBER-LIKE
NODULES**

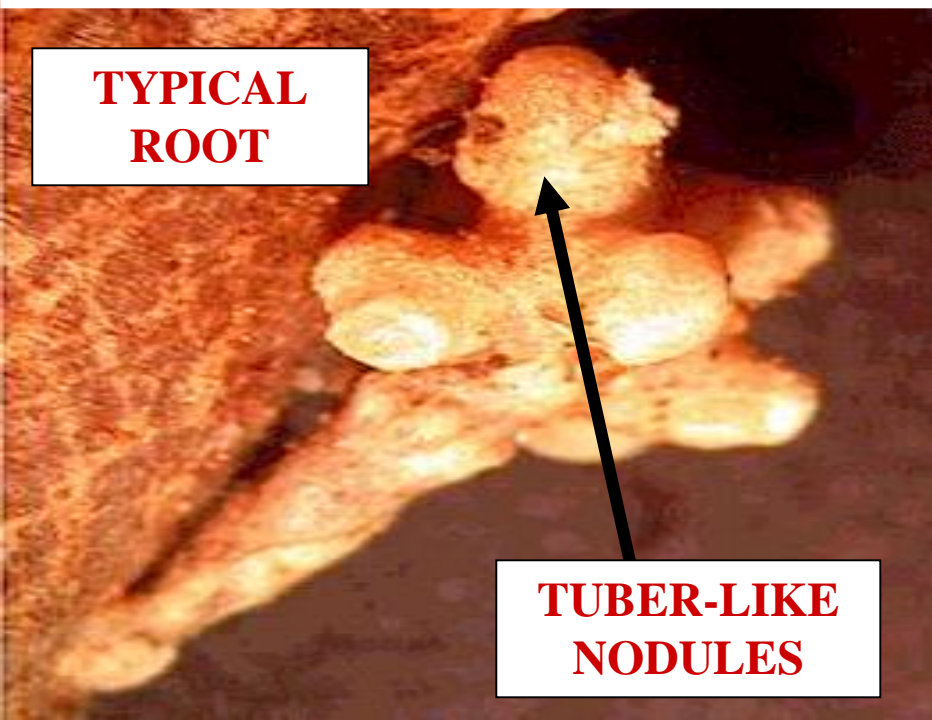


SYMBIONT



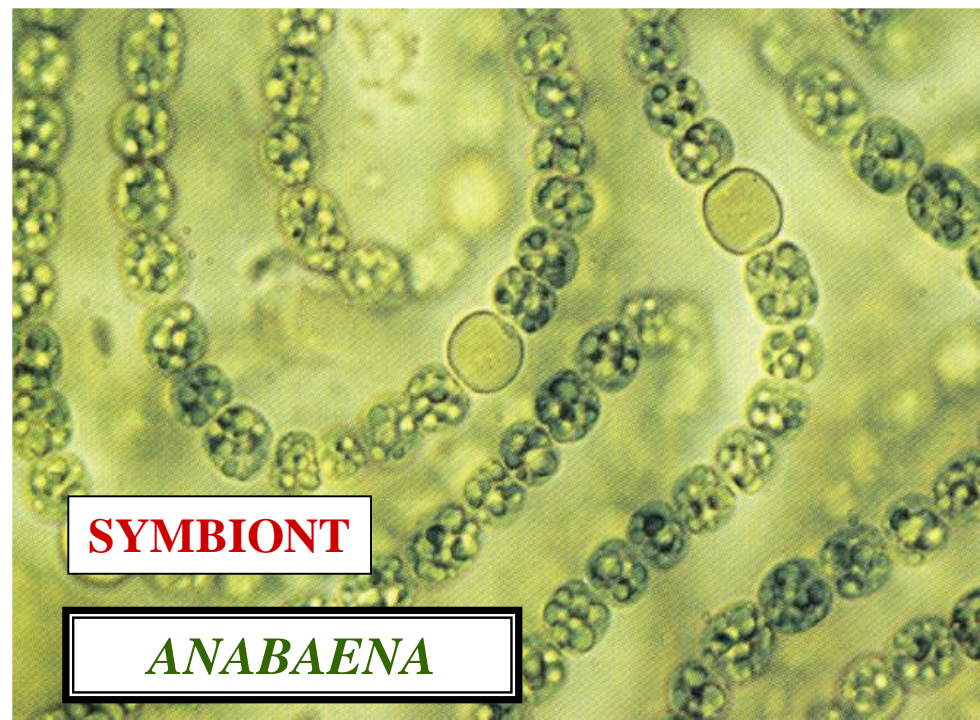
BREAK SOIL

**TUBER-LIKE
NODULES**



**TYPICAL
ROOT**

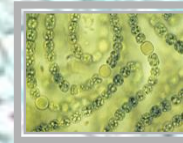
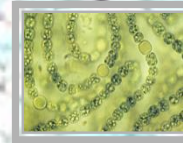
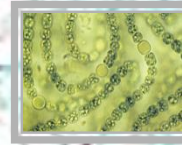
**TUBER-LIKE
NODULES**



SYMBIONT

ANABAENA

CYCAS



CORALLOID ROOT



C.S.

CYCAS

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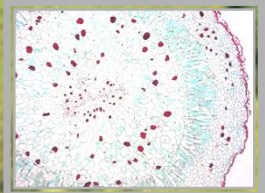
ANABAENA

CORALLOID ROOT

C.S.

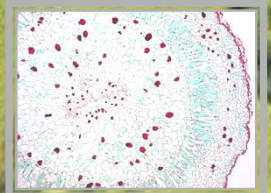


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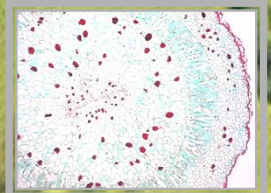


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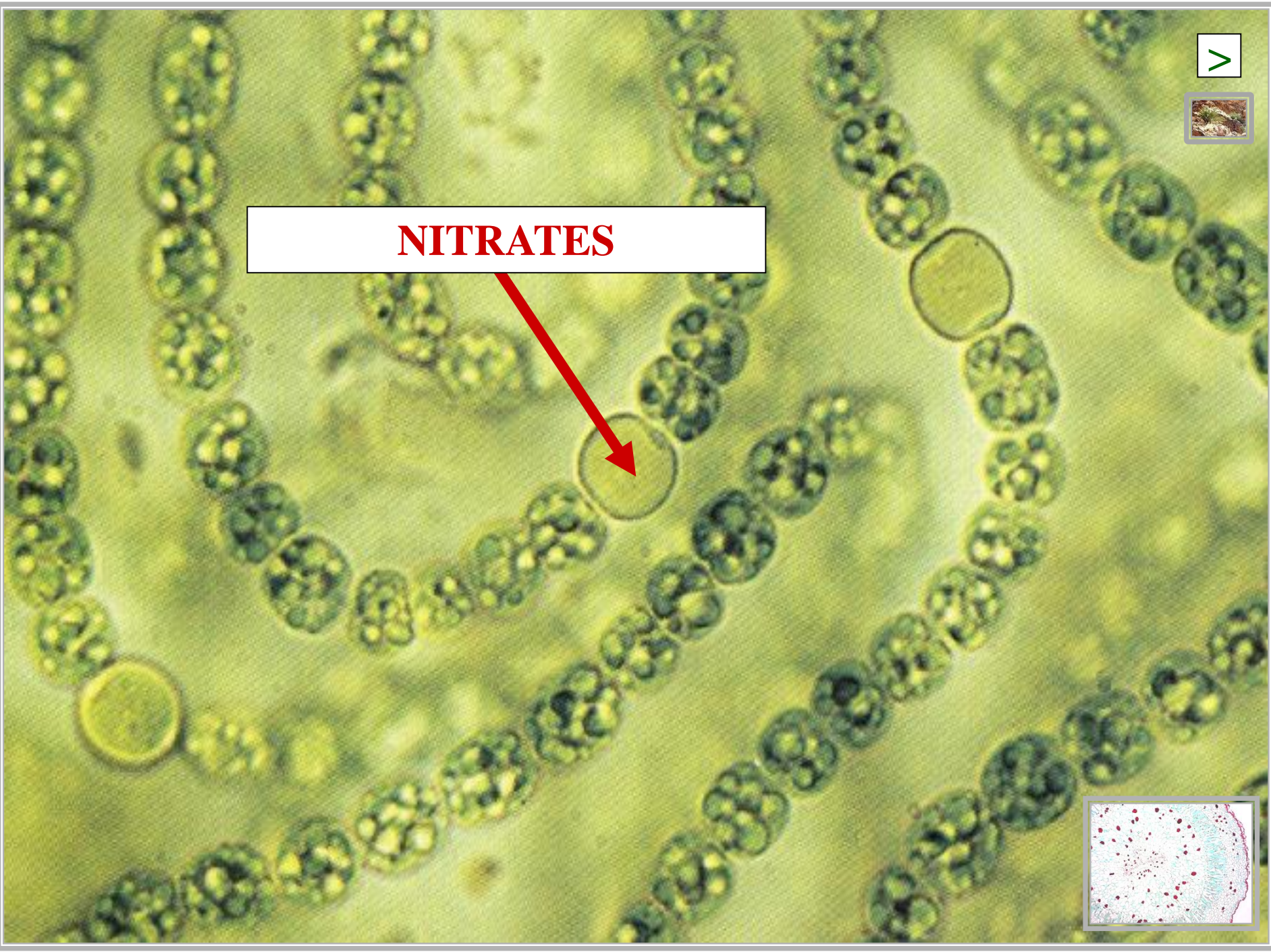
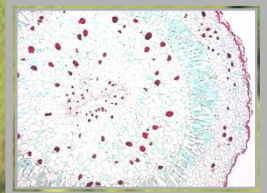


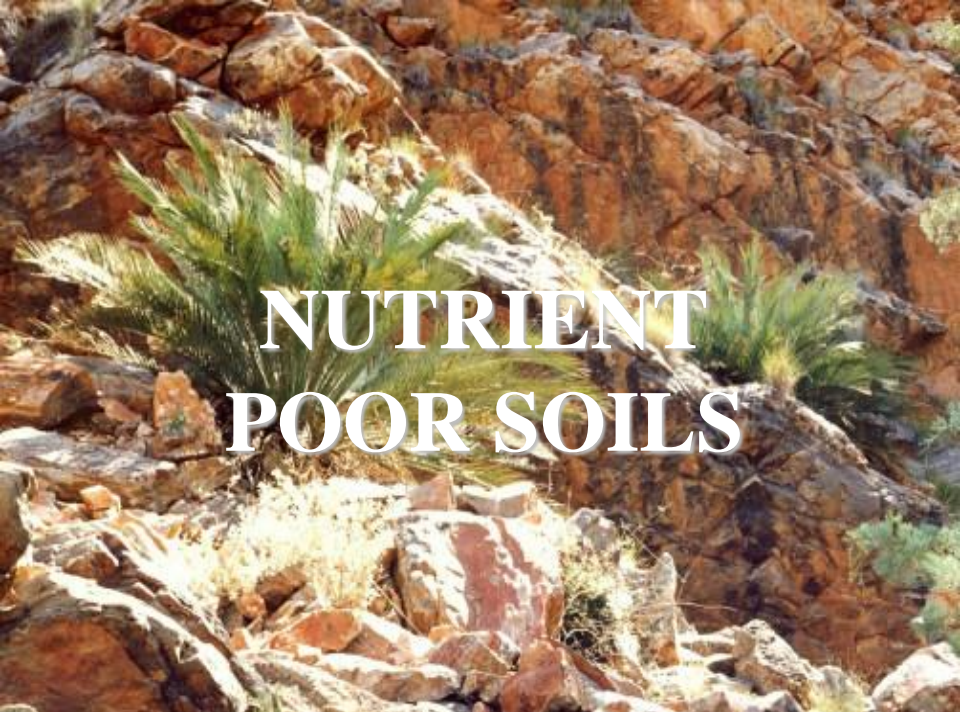
NITROGEN FIXATION





NITRATES

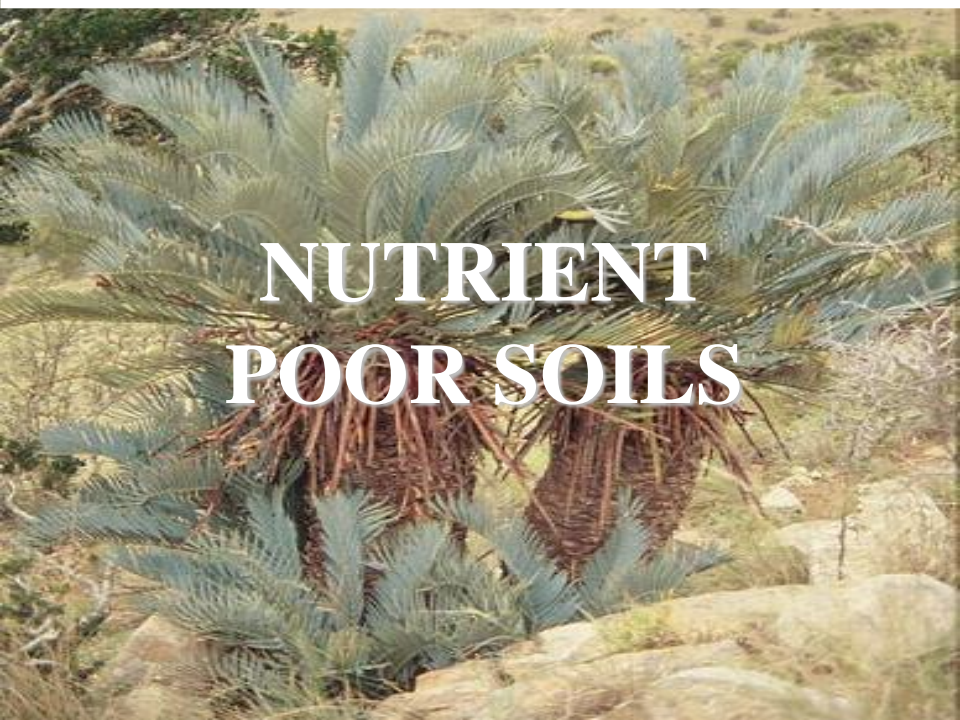




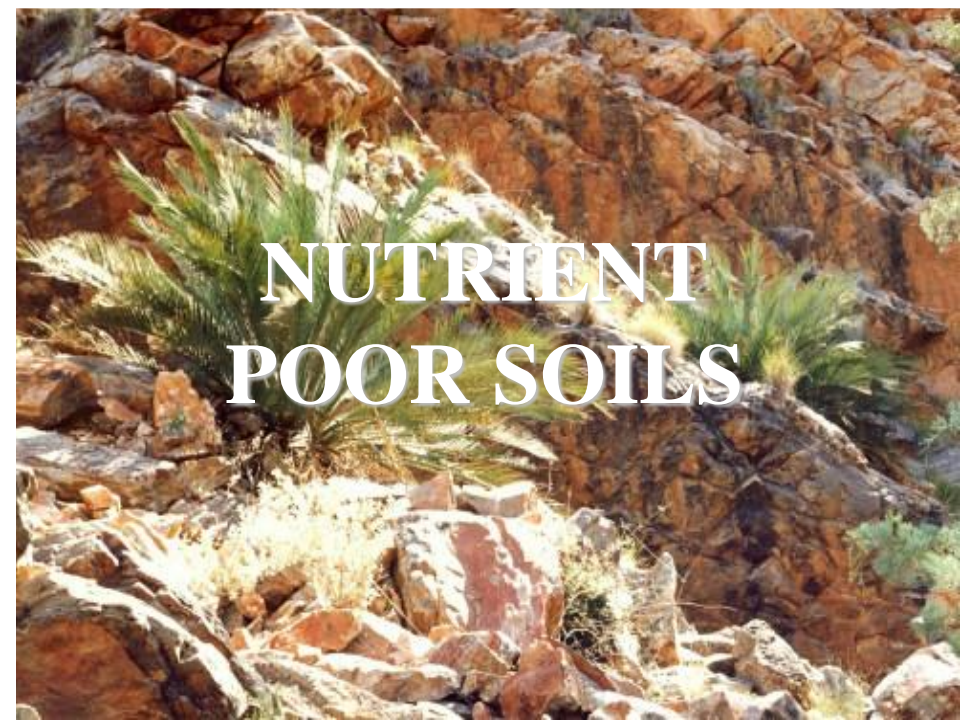
**NUTRIENT
POOR SOILS**



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POOR SOILS**



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POOR SOILS**



EMBRYO



EMBRYO STRUCTURE

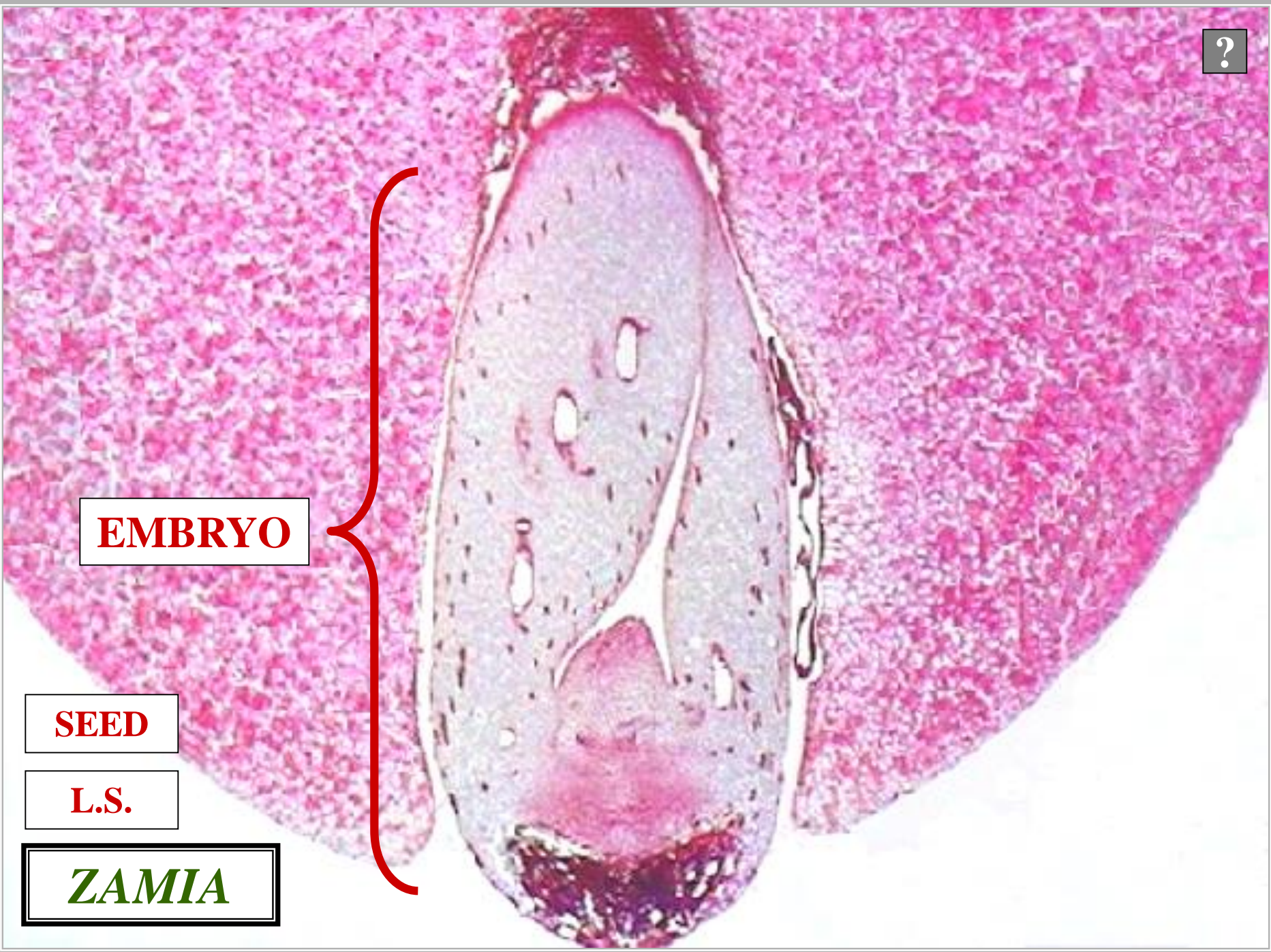
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EMBRYO

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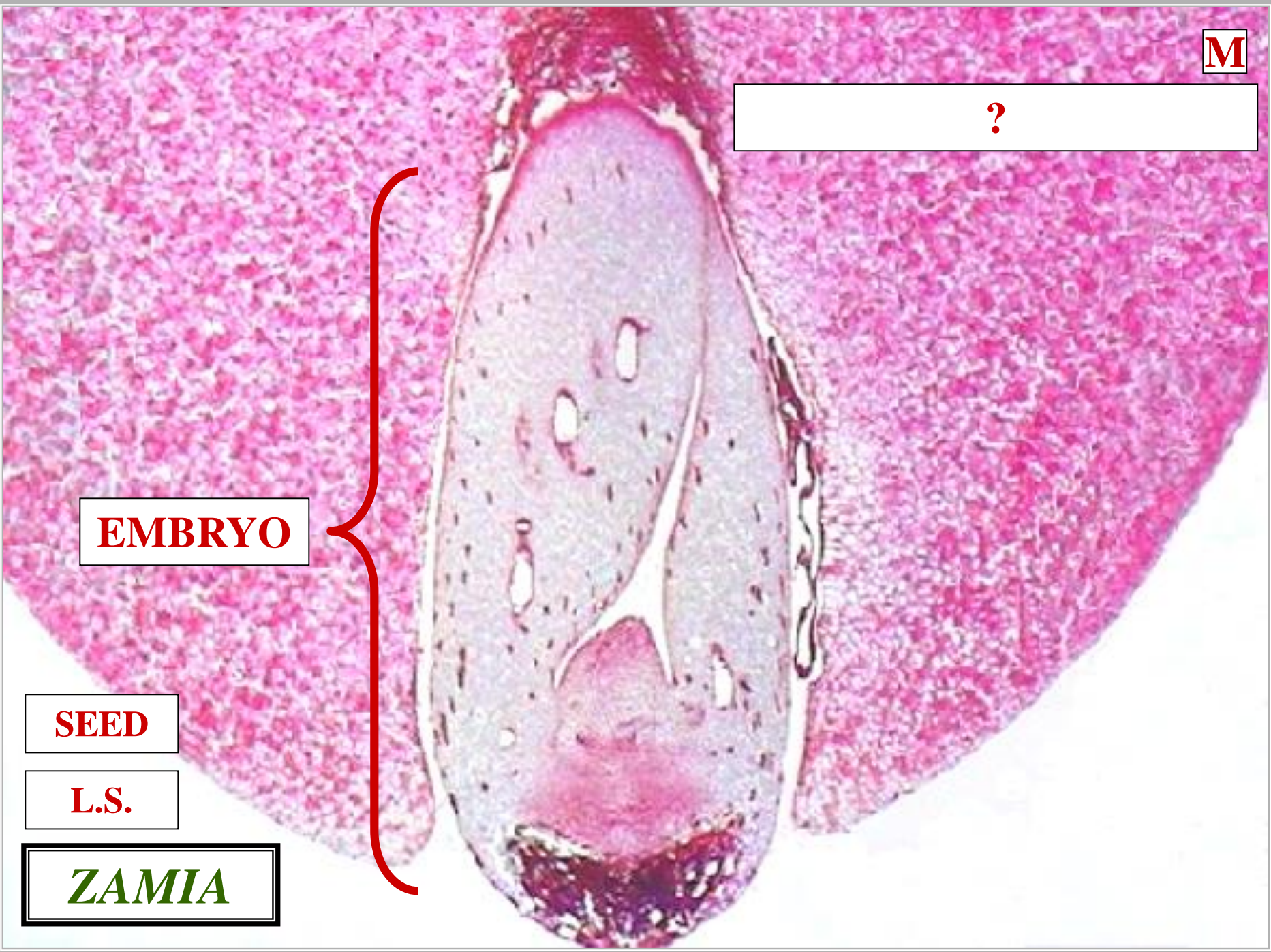
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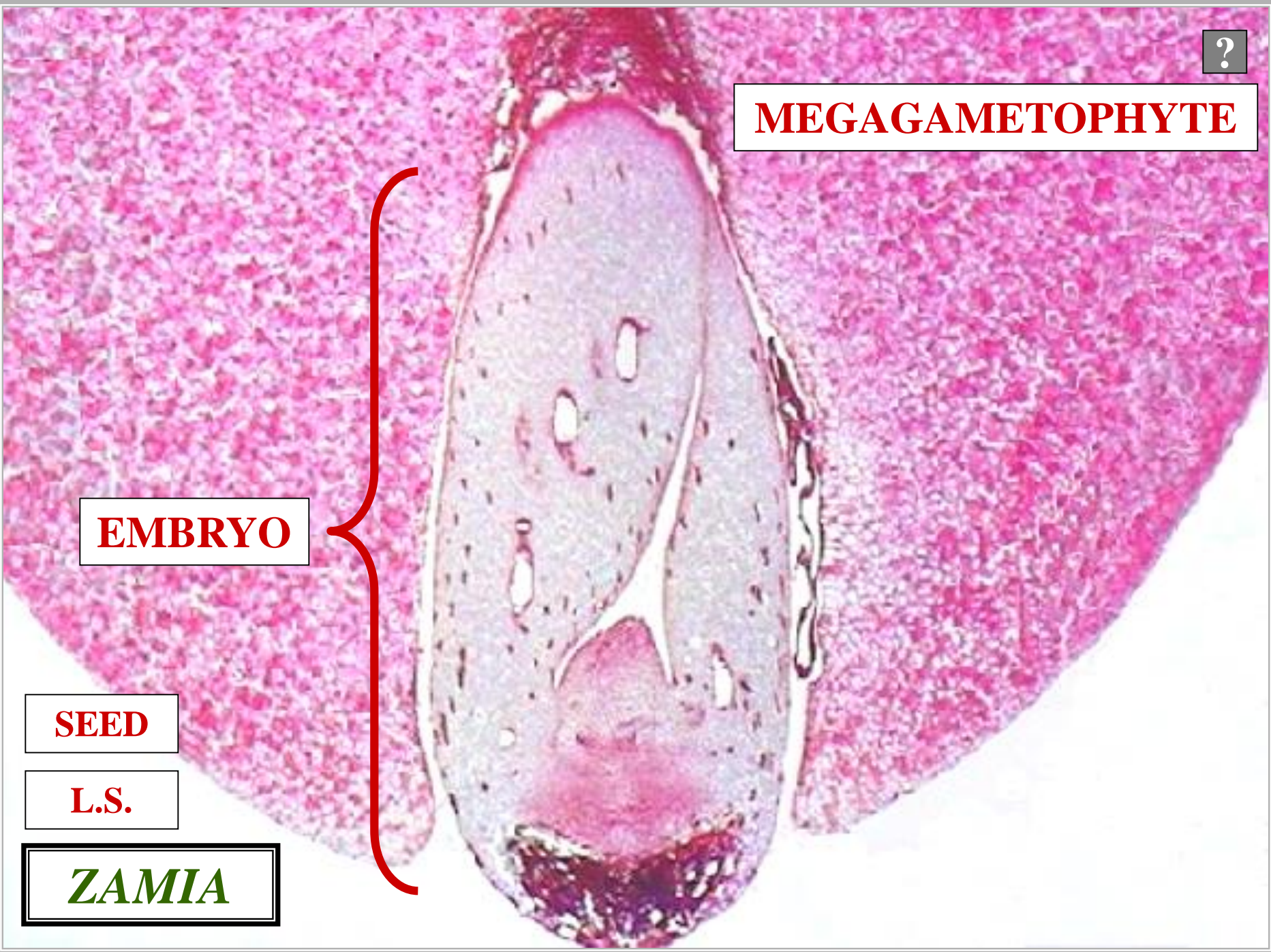
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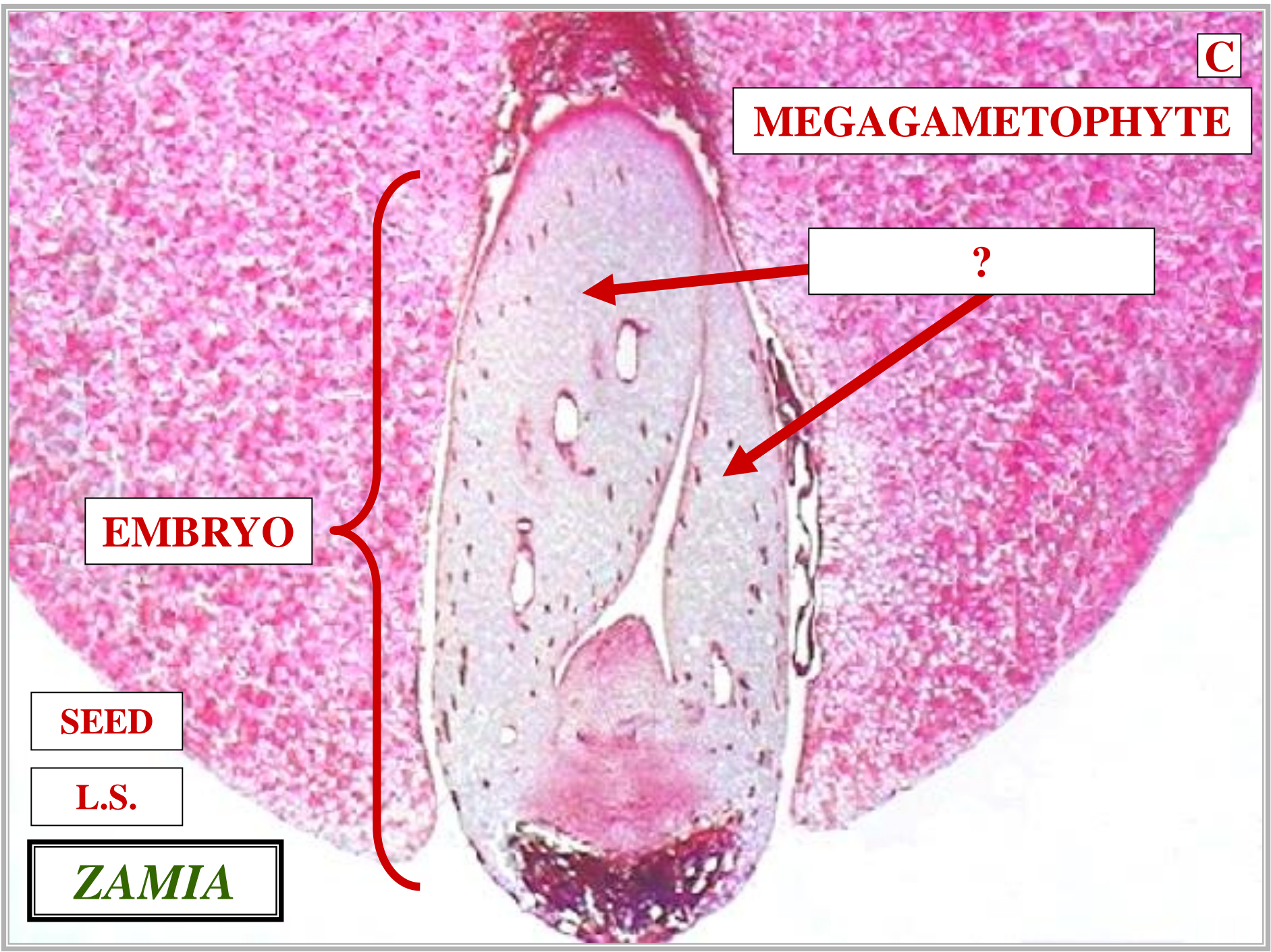
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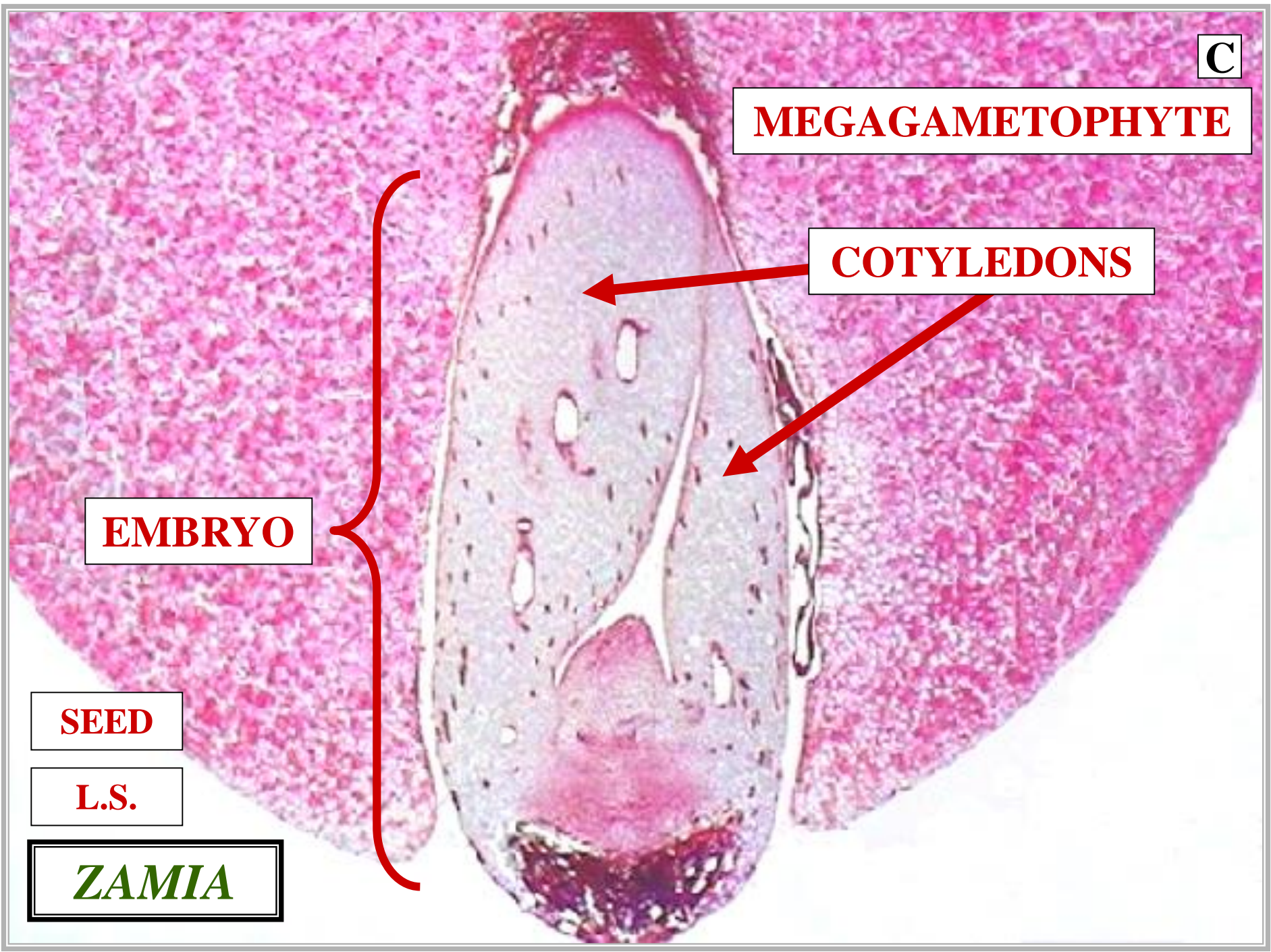
COTYLEDONS

EMBRYO

SEED

L.S.

ZAMIA



COTYLEDON

CYCADOPHYTA
EMBRYO COTYLEDON



EMBRYO SEED LEAF

CYCADOPHYTA
EMBRYO COTYLEDON

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MEGAGAMETOPHYTE

COTYLEDONS

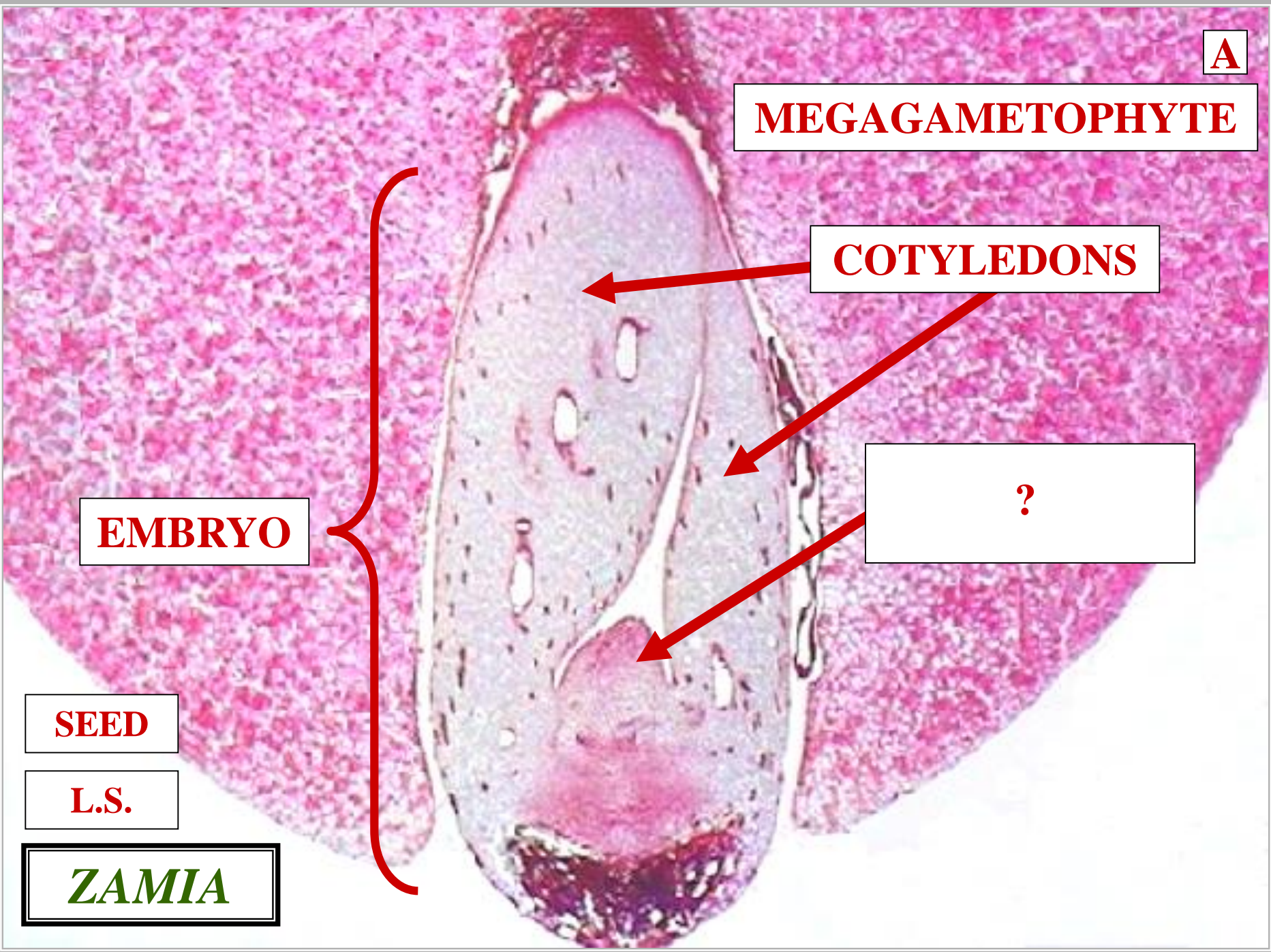
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MEGAGAMETOPHYTE

COTYLEDONS

**STEM APICAL
MERISTEM**

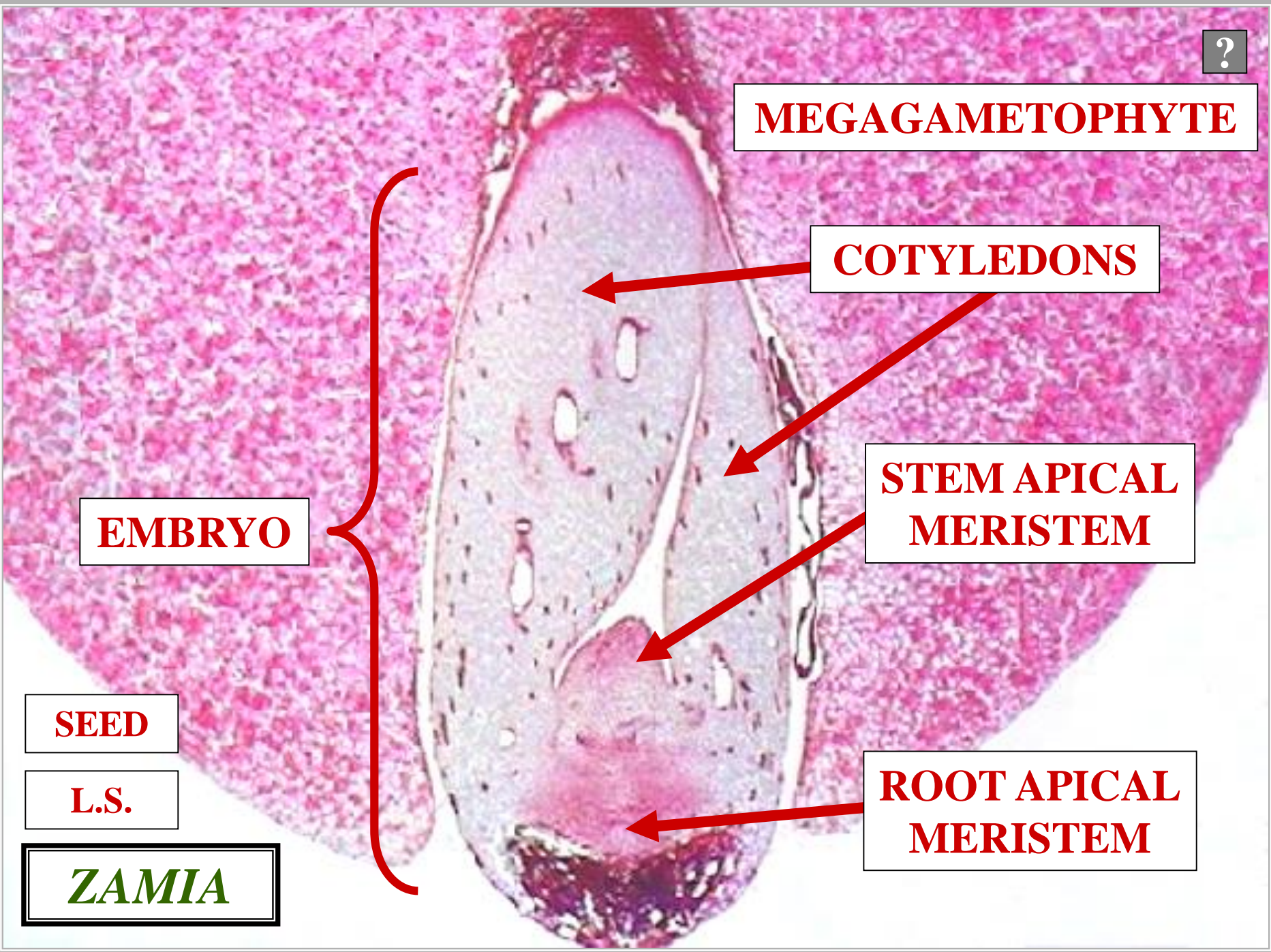
**ROOT APICAL
MERISTEM**

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MEGAGAMETOPHYTE

COTYLEDONS

STEM APICAL
MERISTEM

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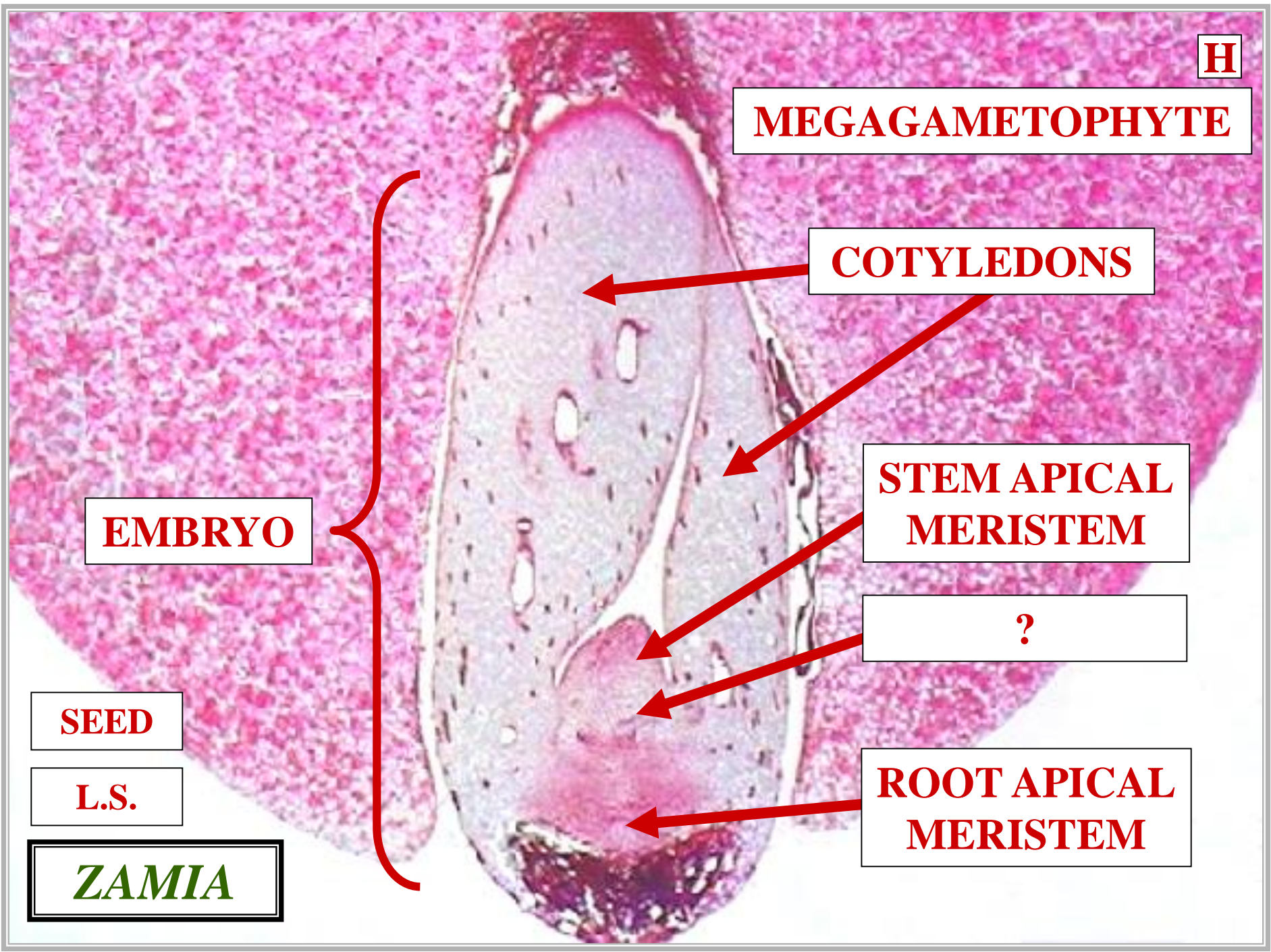
ROOT APICAL
MERISTEM

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MEGAGAMETOPHYTE

COTYLEDONS

**STEM APICAL
MERISTEM**

HYPOCOTYL

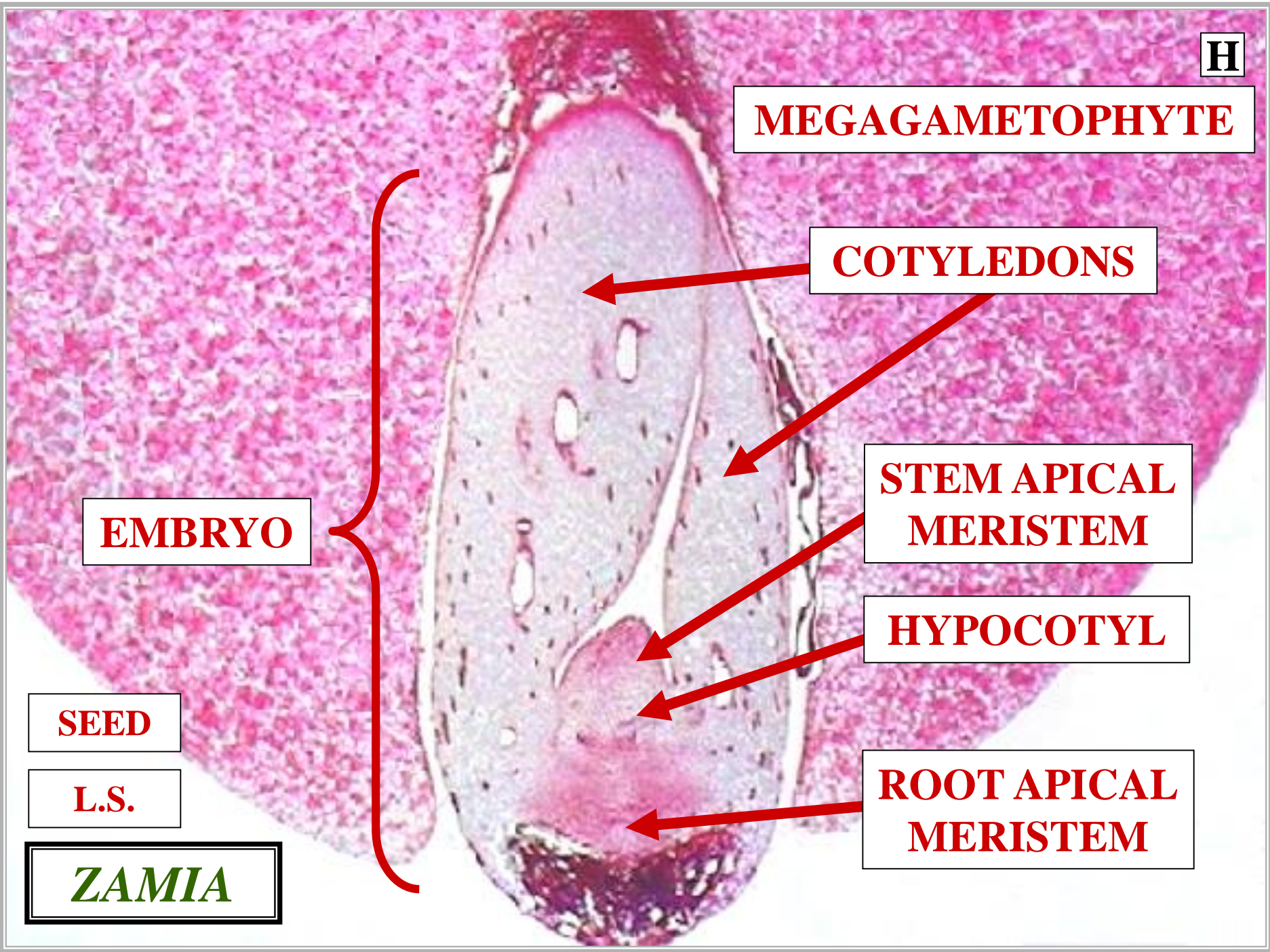
**ROOT APICAL
MERISTEM**

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ZAMIA



HYPOCOTYL

CYCADOPHYTA
EMBRYO HYPOCOTYL



EMBRYO STEM

CYCADOPHYTA
EMBRYO HYPOCOTYL

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MEGAGAMETOPHYTE

COTYLEDONS

STEM APICAL
MERISTEM

HYPOCOTYL

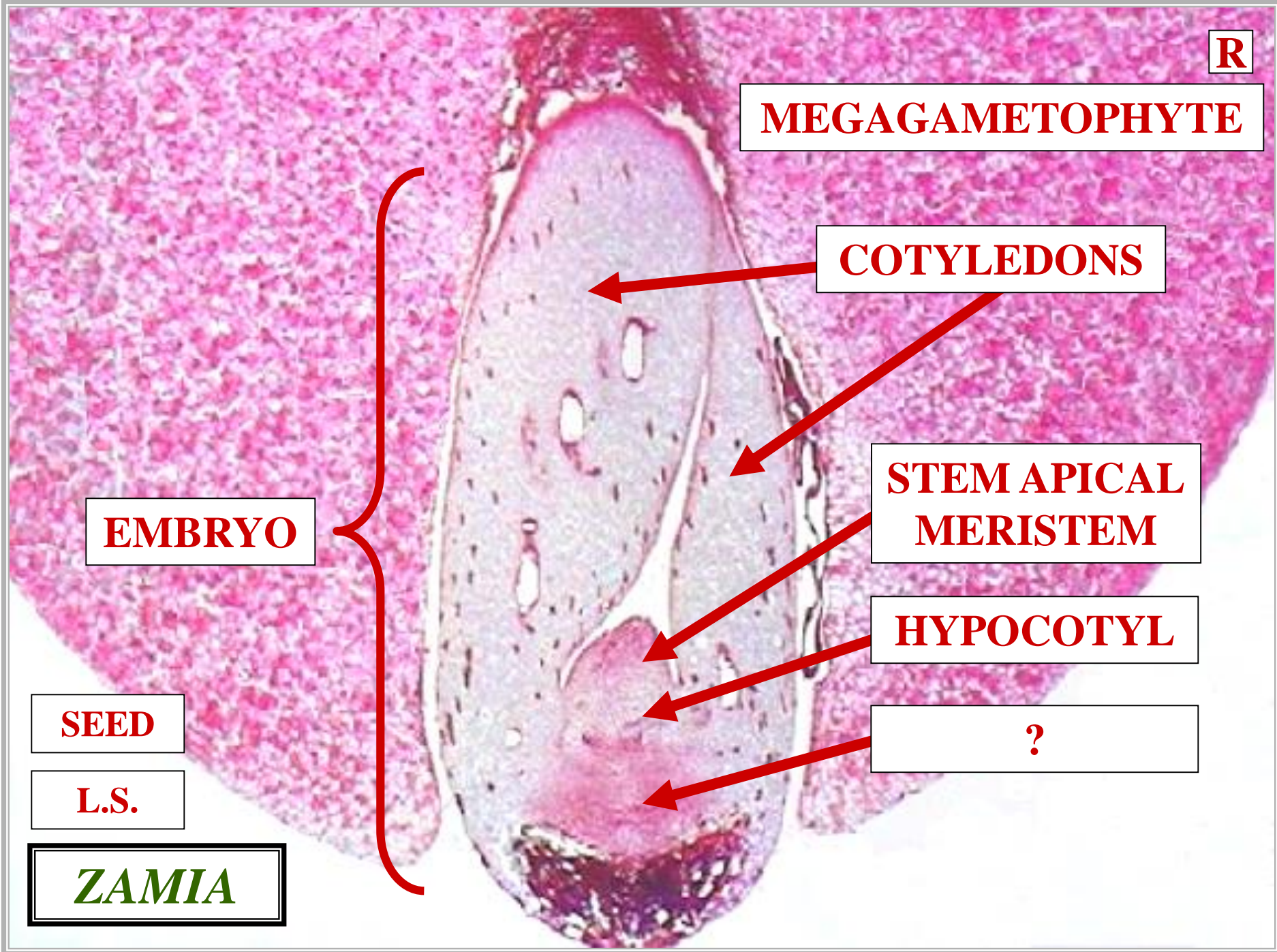
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COTYLEDONS

**STEM APICAL
MERISTEM**

HYPOCOTYL

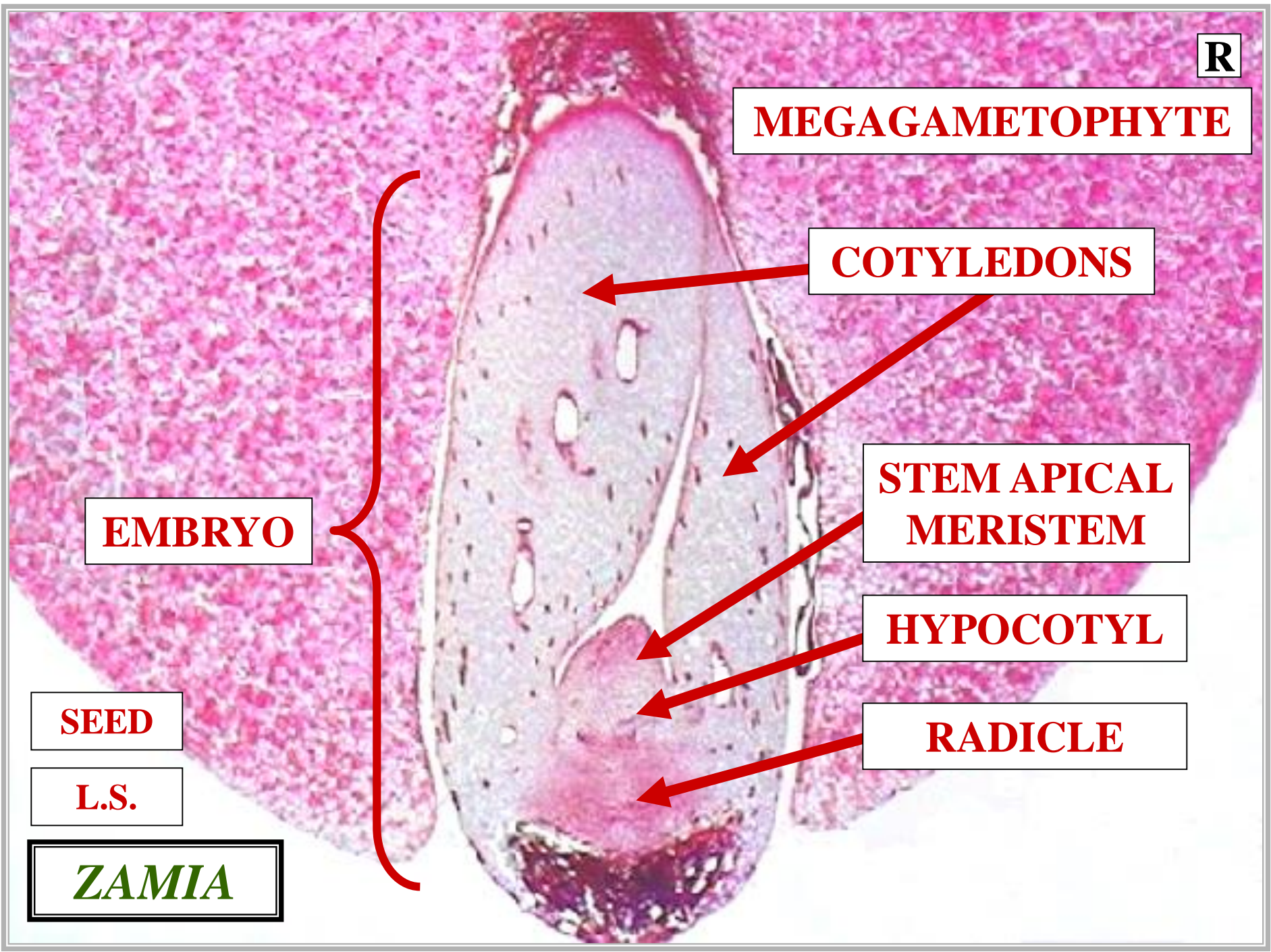
RADICLE

EMBRYO

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RADICLE

CYCADOPHYTA
EMBRYO HYPOCOTYL



EMBRYO ROOT

CYCADOPHYTA
EMBRYO HYPOCOTYL