

PINUS

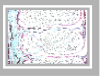


MICROSTROBILI



L.S.

PINUS



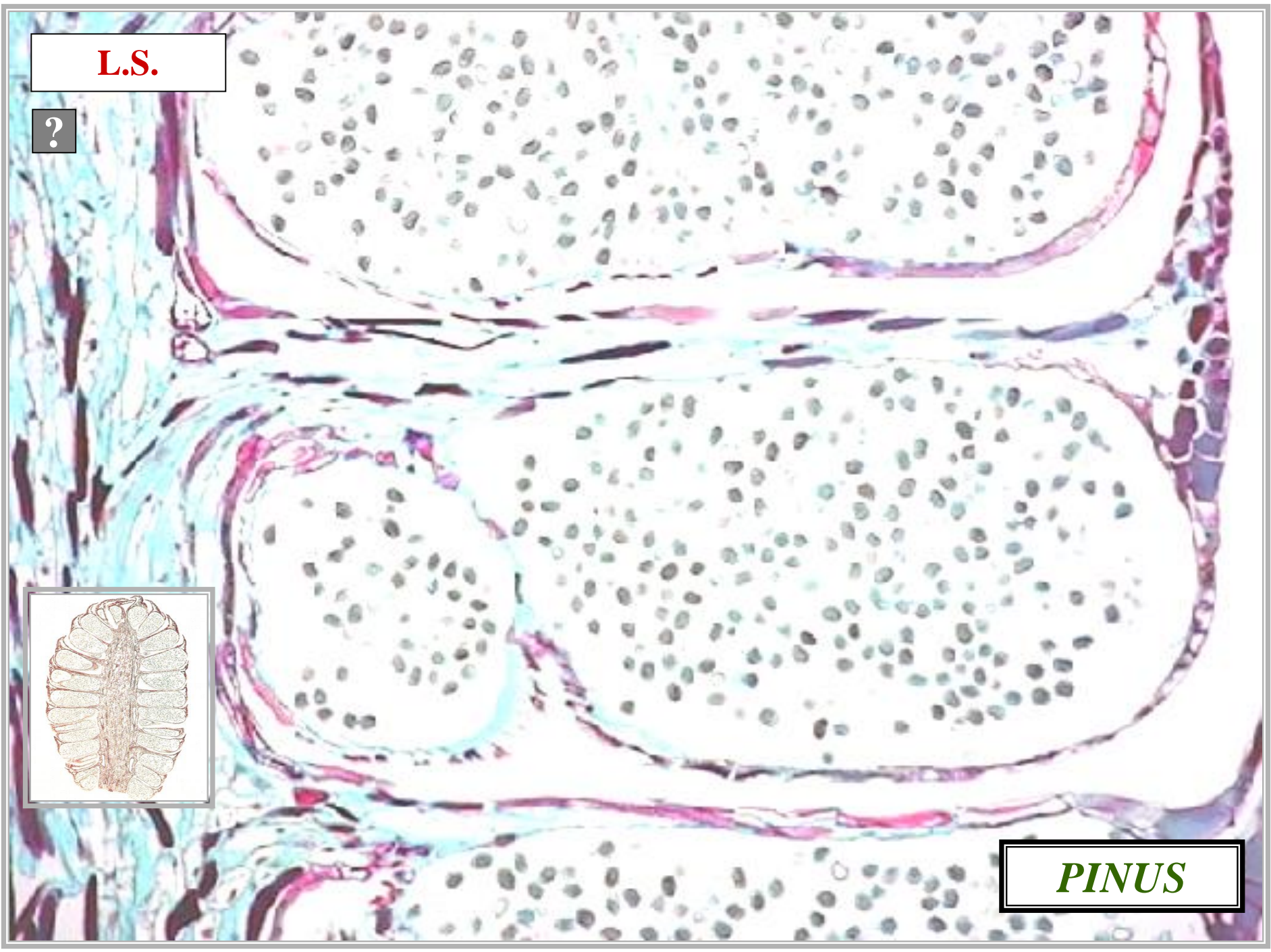
MICROSTROBILUS

L.S.

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PINUS

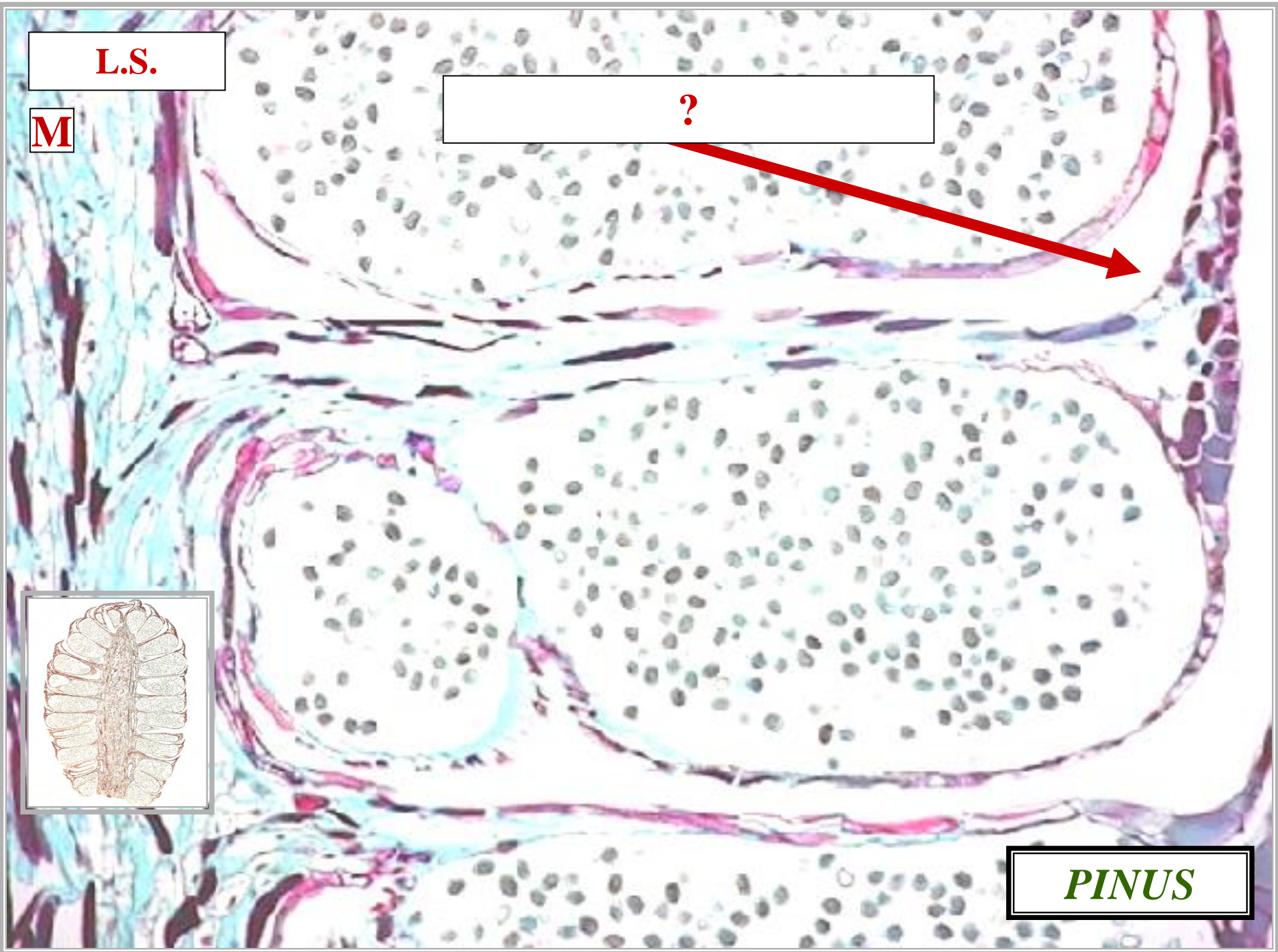
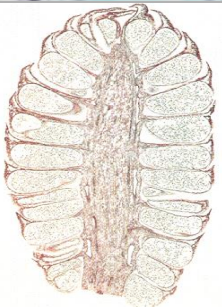


L.S.

M

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PINUS

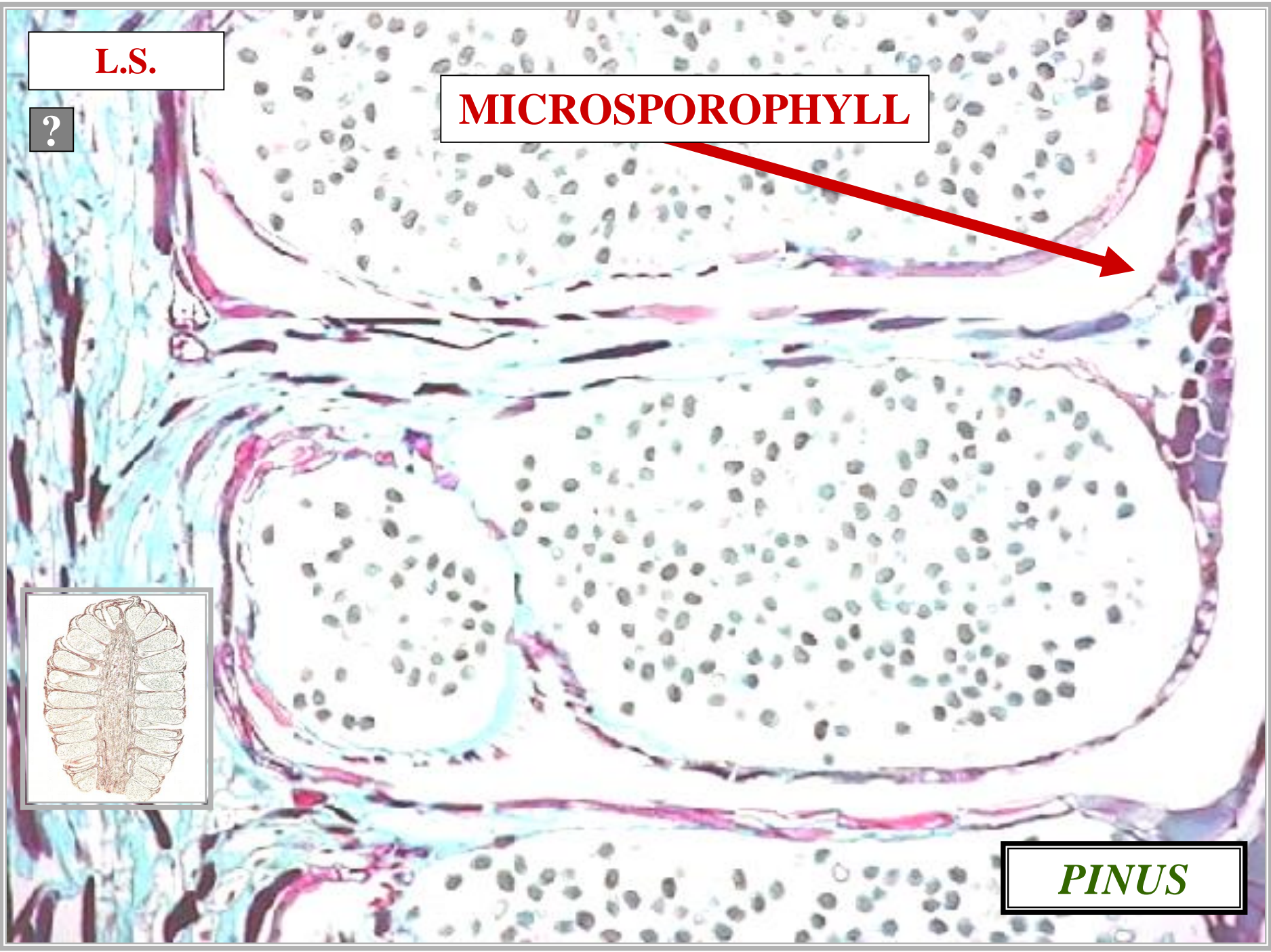
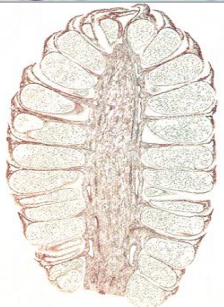


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MICROSPOROPHYLL

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PINUS



L.S.

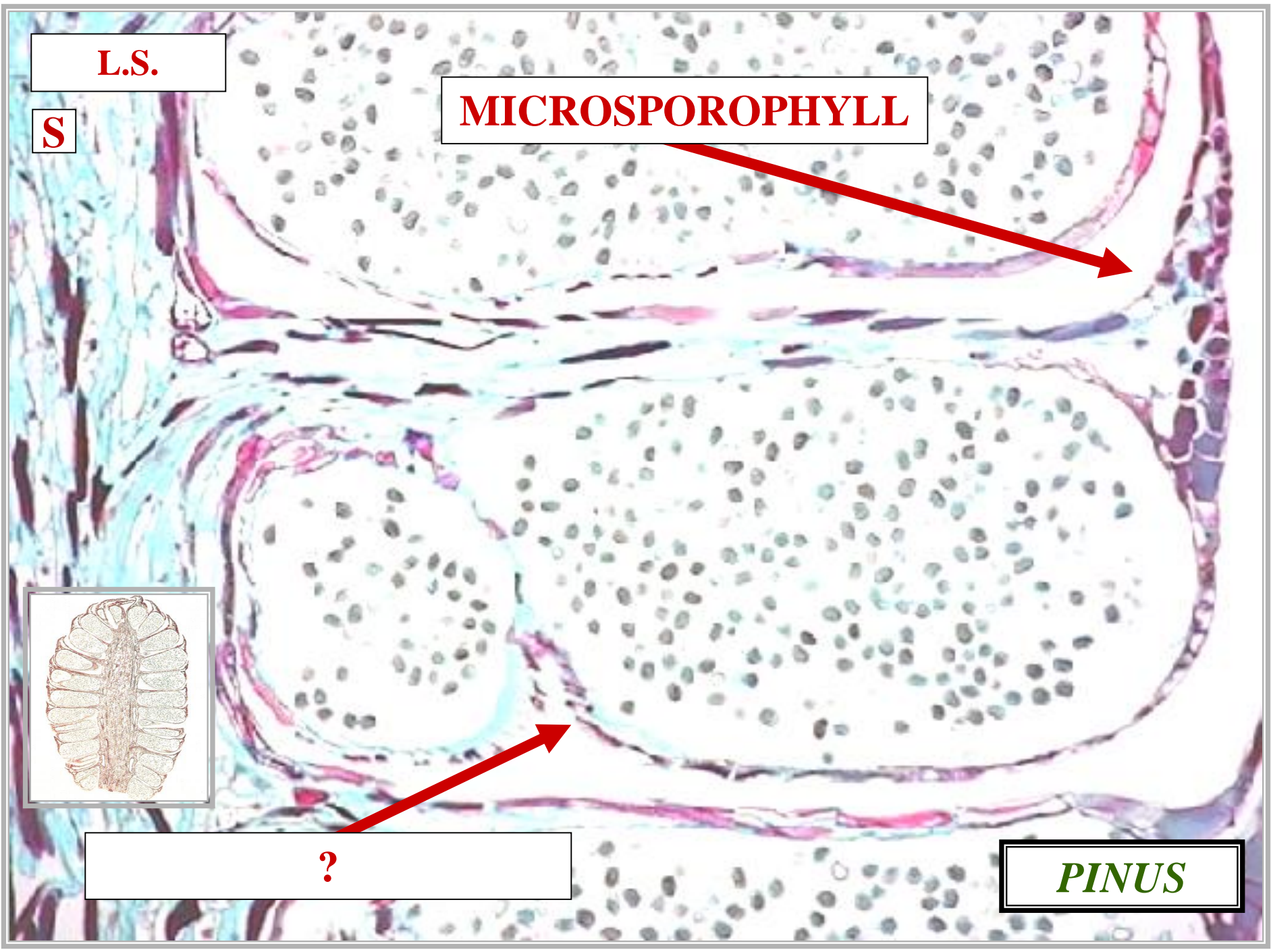
MICROSPOROPHYLL

S



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PINUS



L.S.

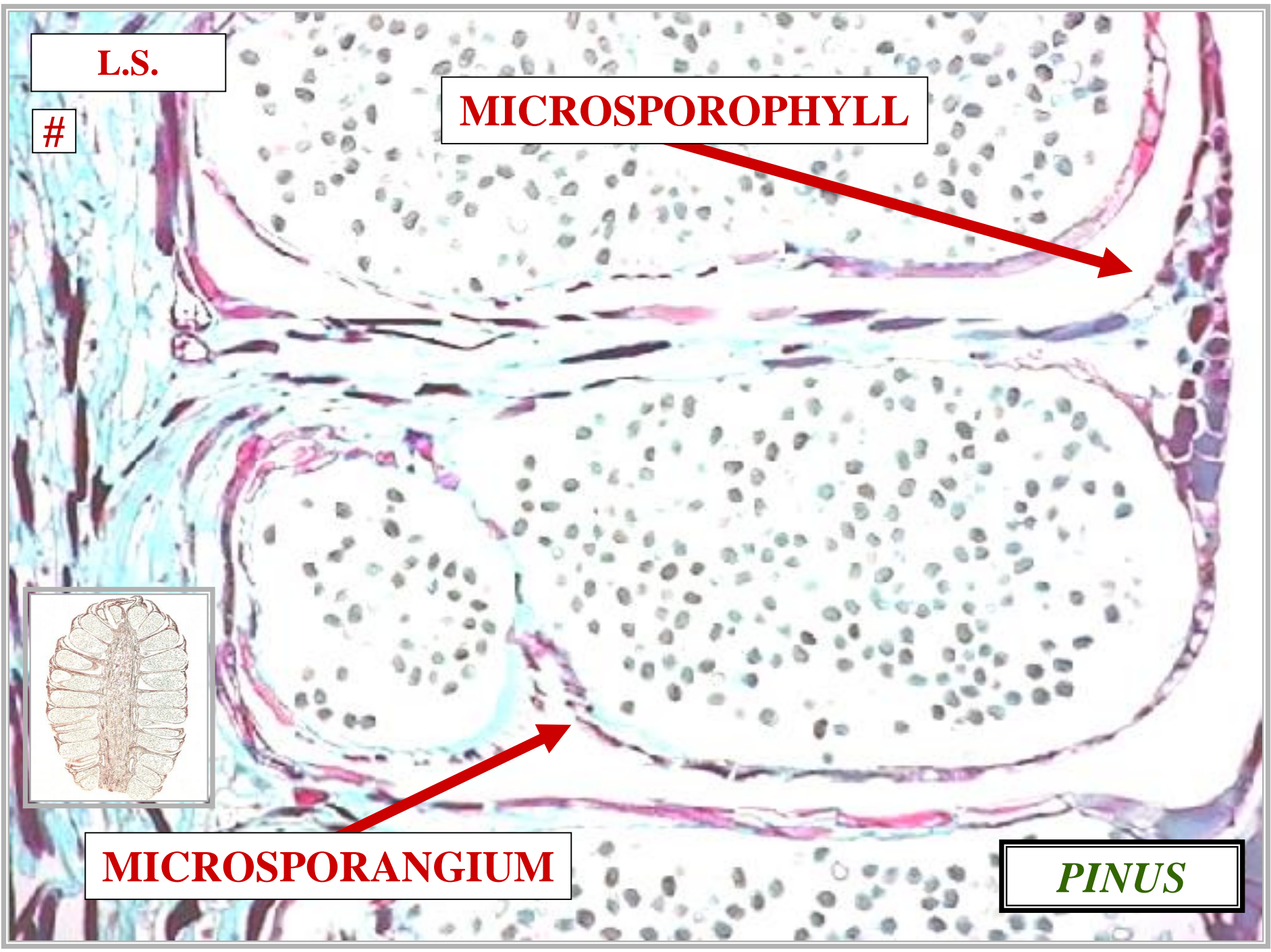
MICROSPOROPHYLL

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MICROSPORANGIUM

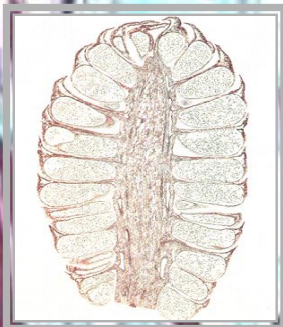
PINUS



L.S.

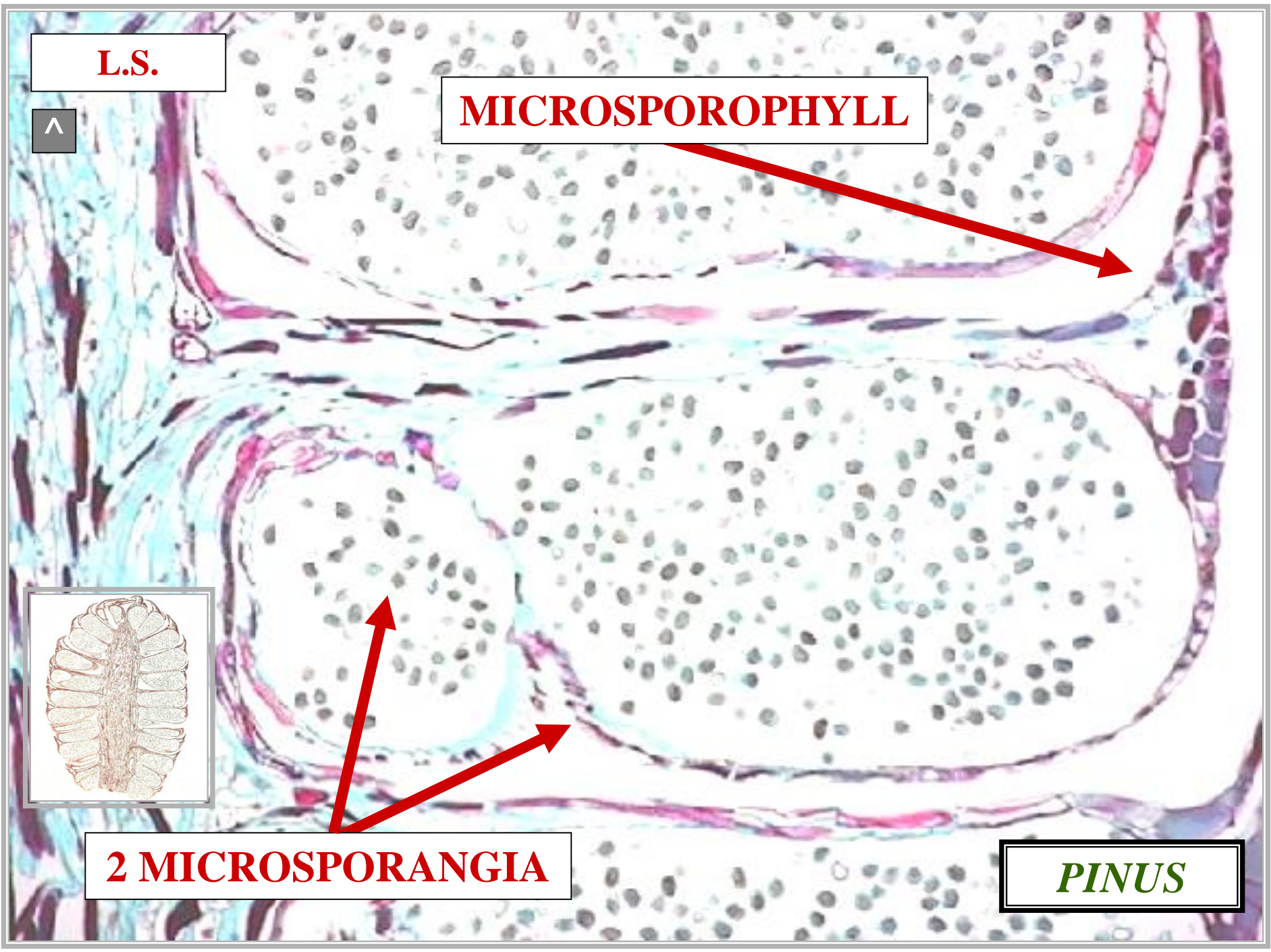
MICROSPOROPHYLL

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2 MICROSPORANGIA

PINUS





MEGASTROBILUS

PINUS



MEGASTROBIUS



MEGASTROBILUS



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PINUS

L.S.

MEGASTROBILUS

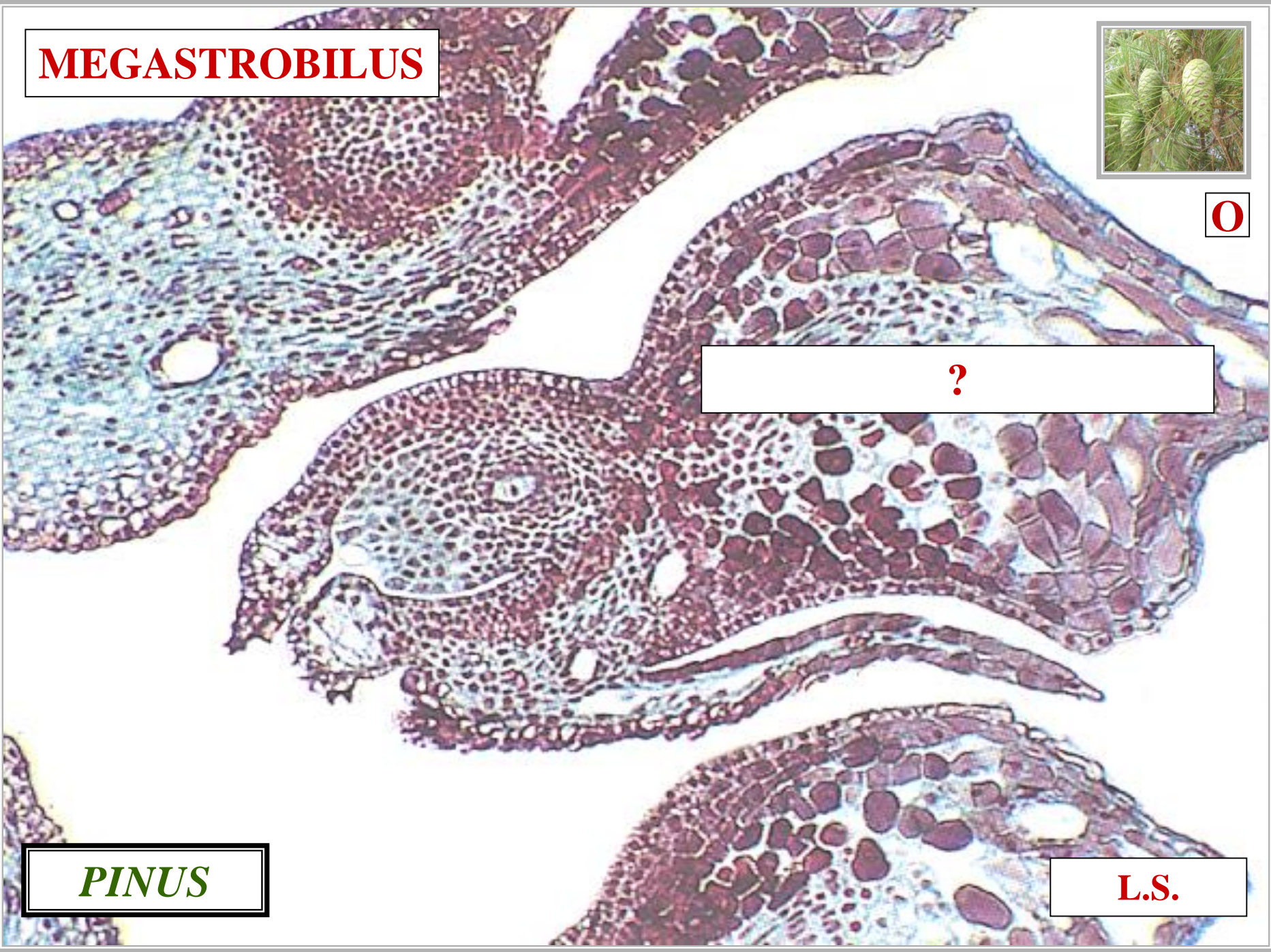


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PINUS

L.S.



MEGASTROBILUS

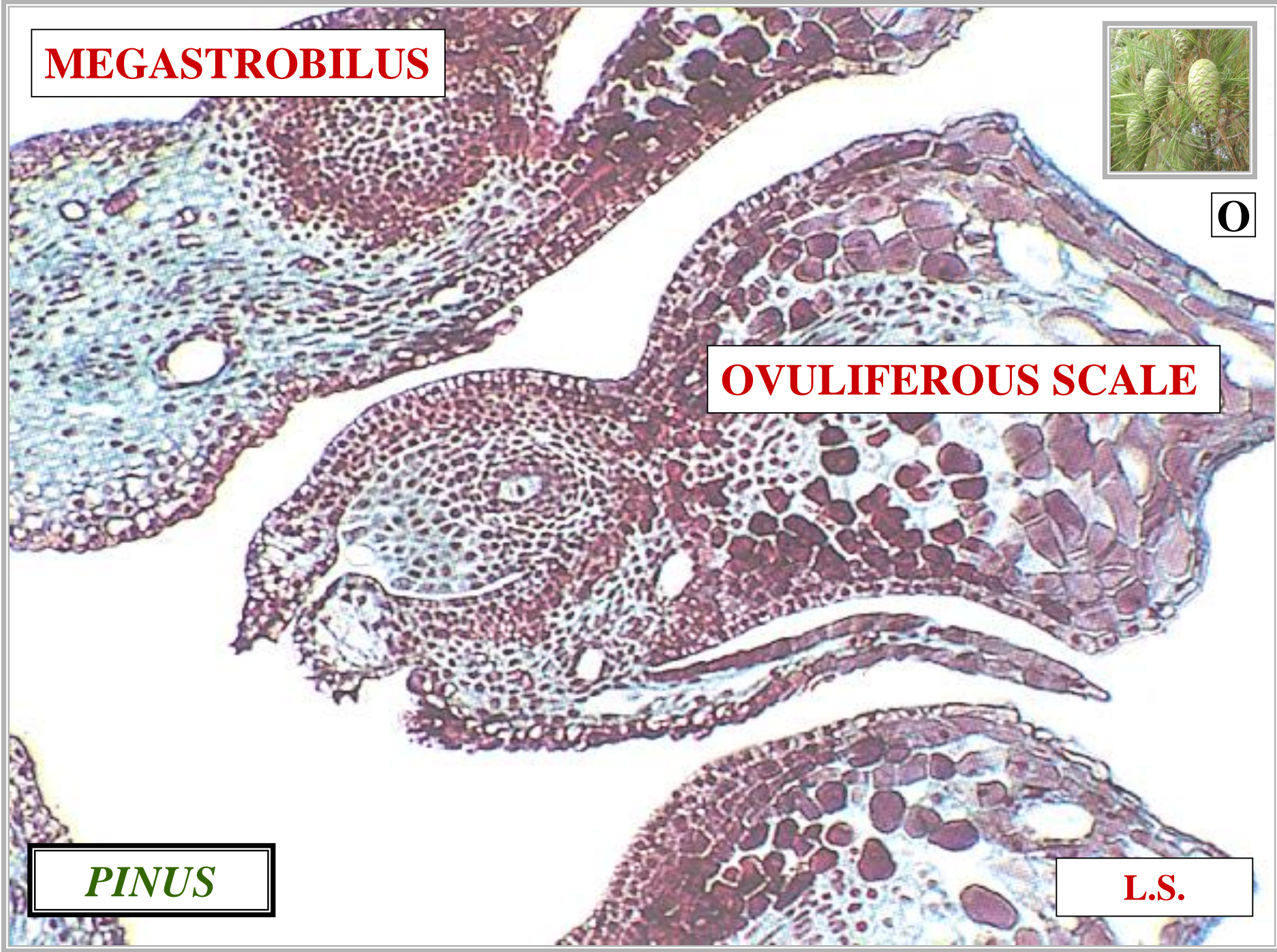


O

OVULIFEROUS SCALE

PINUS

L.S.



OVULIEROUS SCALES



PINOPHYTA
OVULIFEROUS SCALES

OVULE BEARING
BRANCHES

PINOPHYTA
OVULIFEROUS SCLALES

MEGASTROBILUS



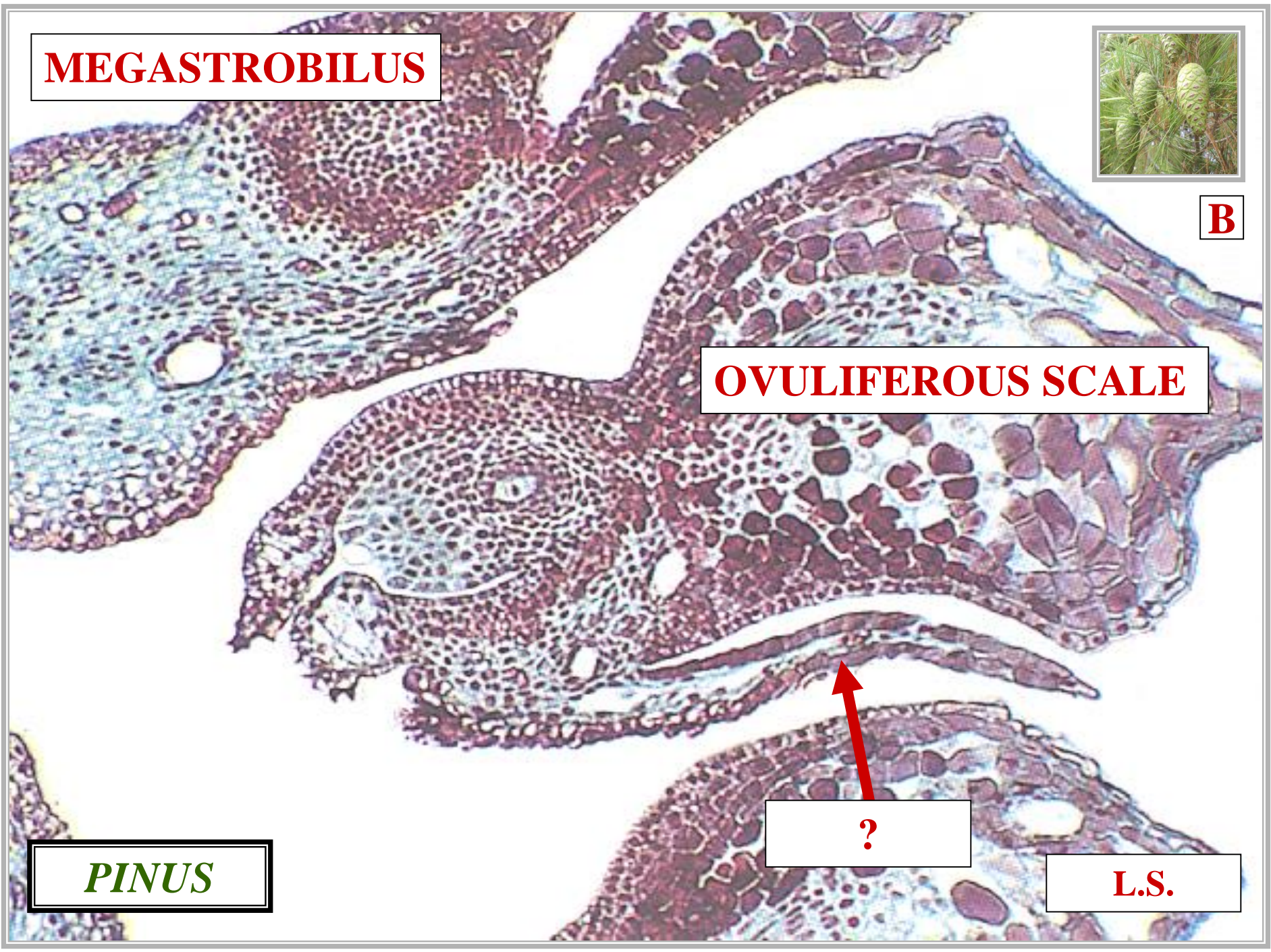
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OVULIFEROUS SCALE

?

PINUS

L.S.



MEGASTROBILUS



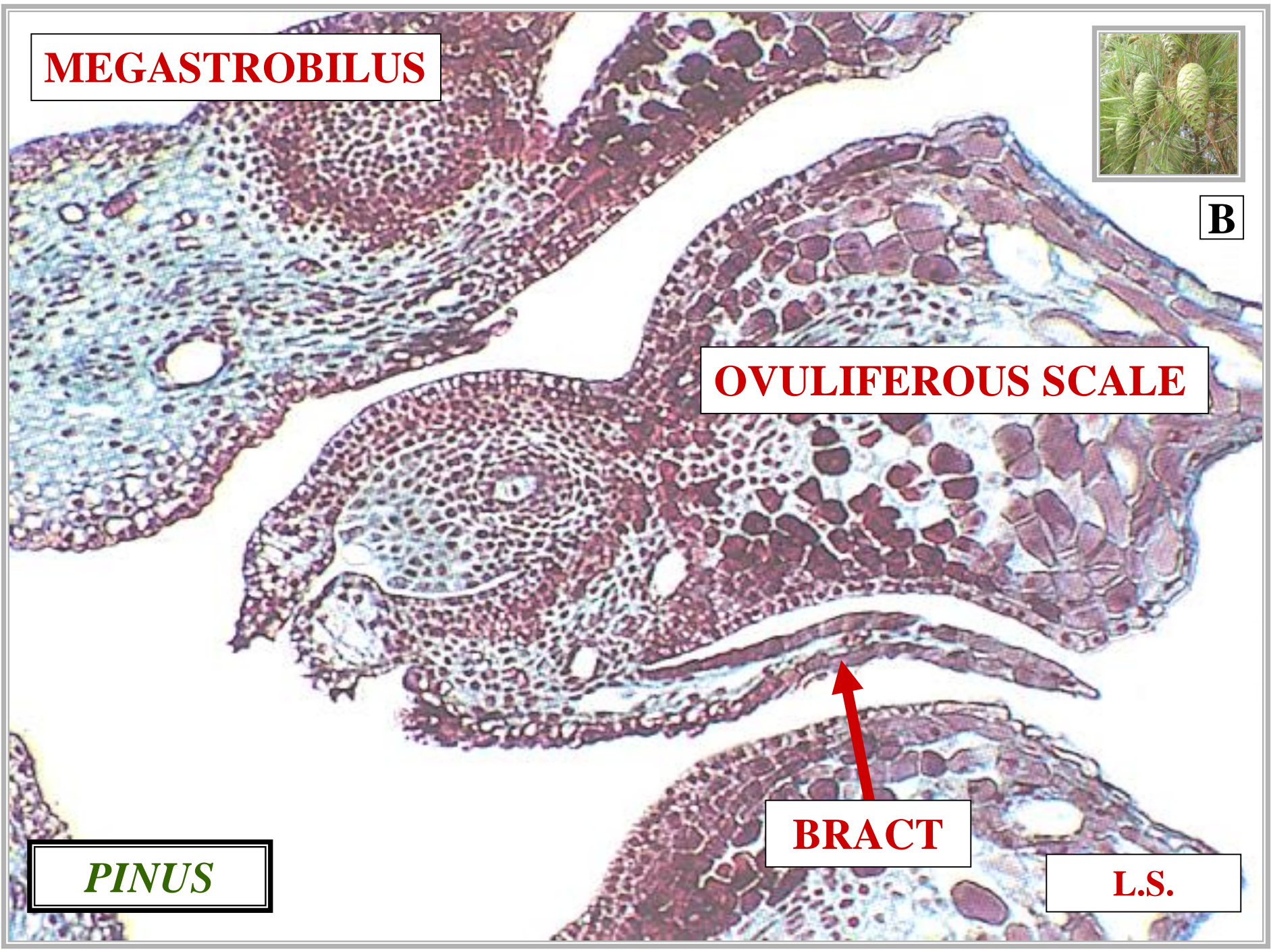
B

OVULIFEROUS SCALE

BRACT

PINUS

L.S.



BRACT



PINOPHYTA

BRACT

OVULIFEROUS

SCALE

MODIFIED LEAF

PINOPHYTA

BRACT

MEGASTROBILUS



O

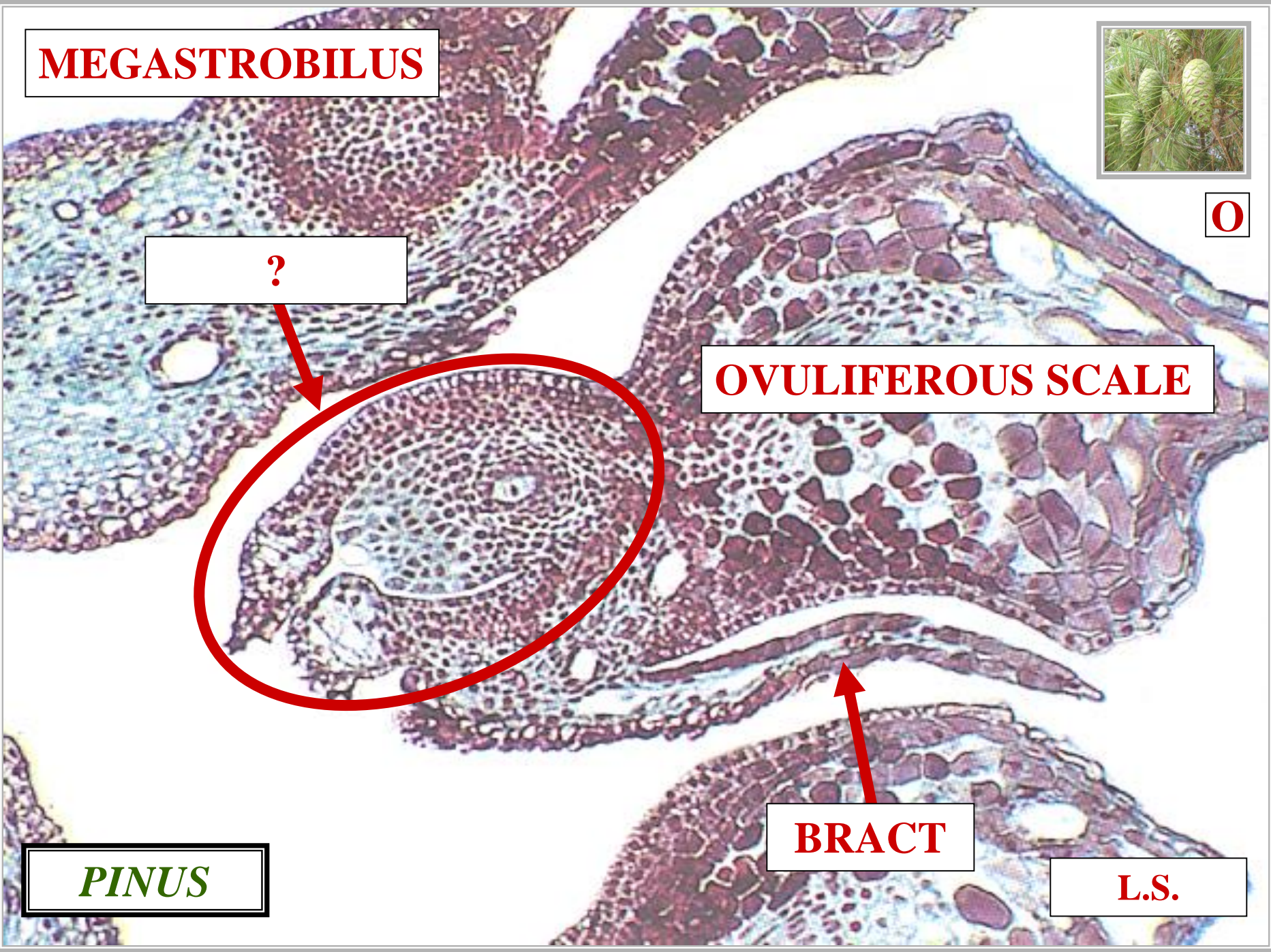
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OVULIFEROUS SCALE

BRACT

PINUS

L.S.



MEGASTROBILUS



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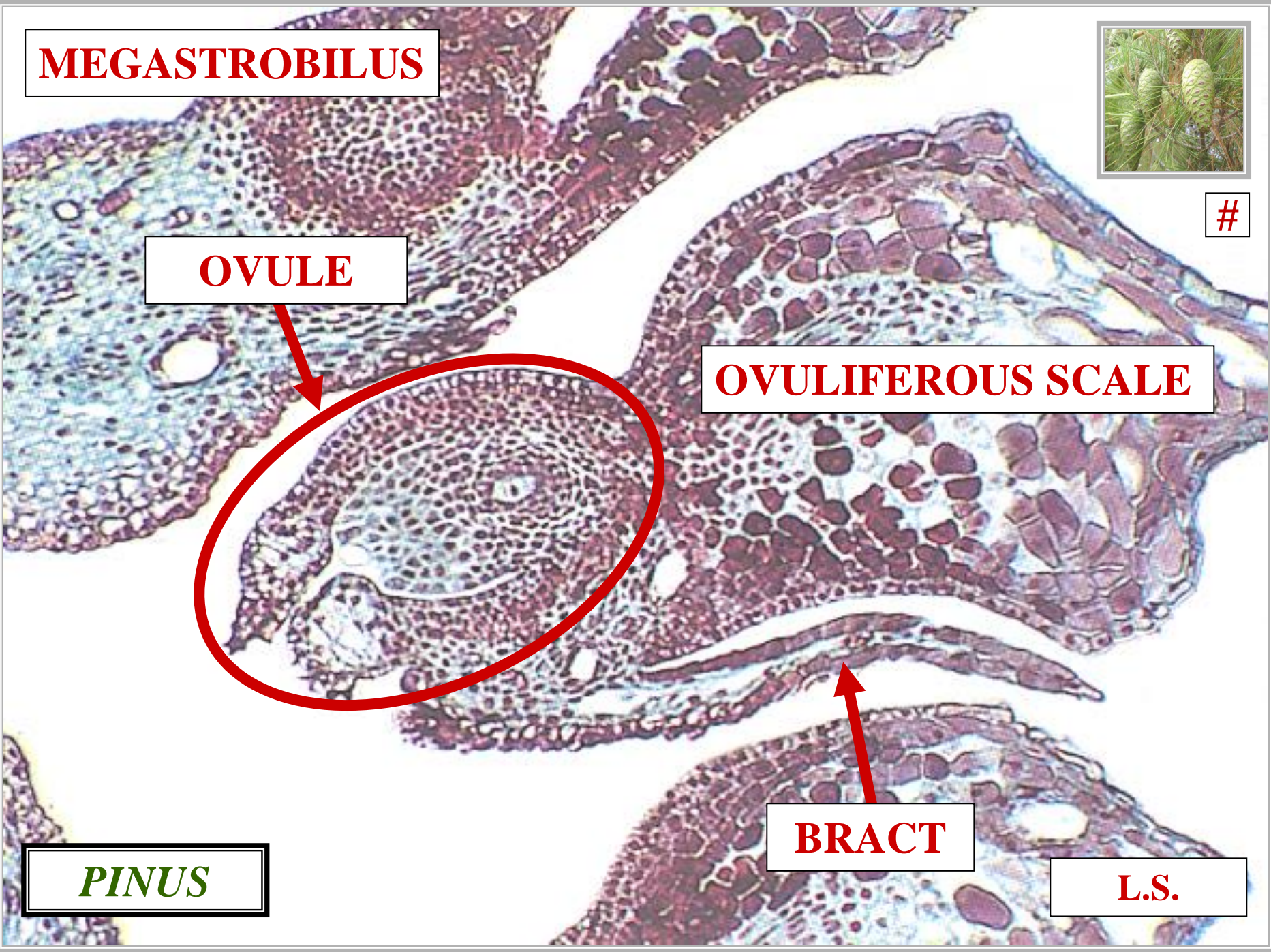
OVULE

OVULIFEROUS SCALE

BRACT

PINUS

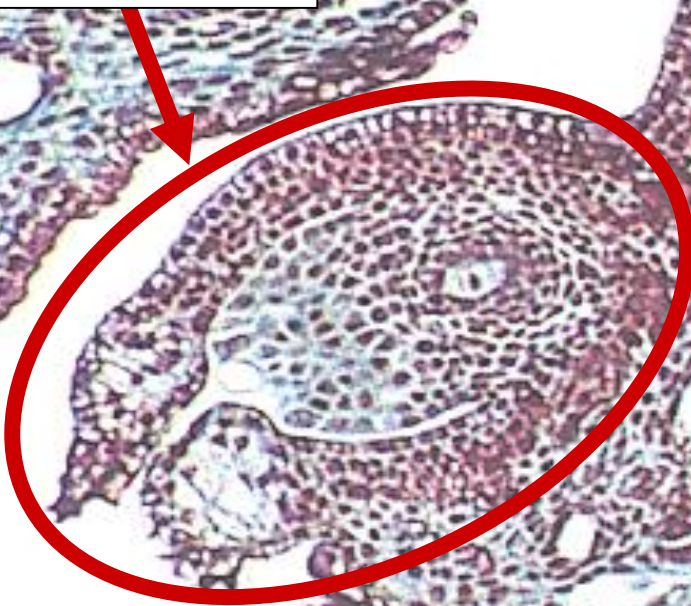
L.S.



MEGASTROBILUS



2 OVULES

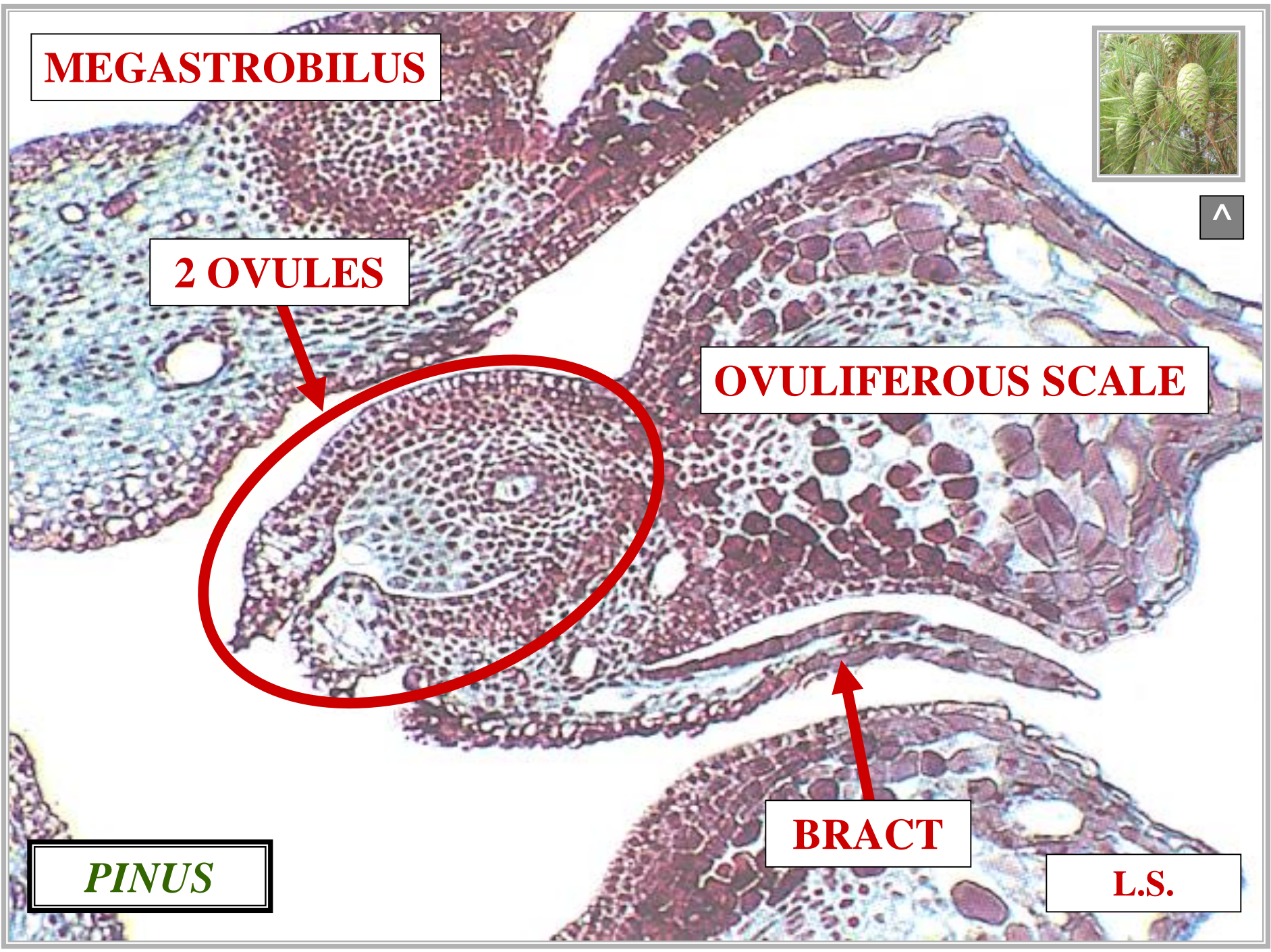


OVULIFEROUS SCALE

BRACT

PINUS

L.S.





STROBILI POSITION

PINUS

M

U



MEGASTROBILI



PINUS

M

L



MEGASTROBILI



MICROSTROBILI

PINUS



MEGASTROBILI

PINUS



**ENSURES
CROSS
POLLINATION**

MICROSTROBILI

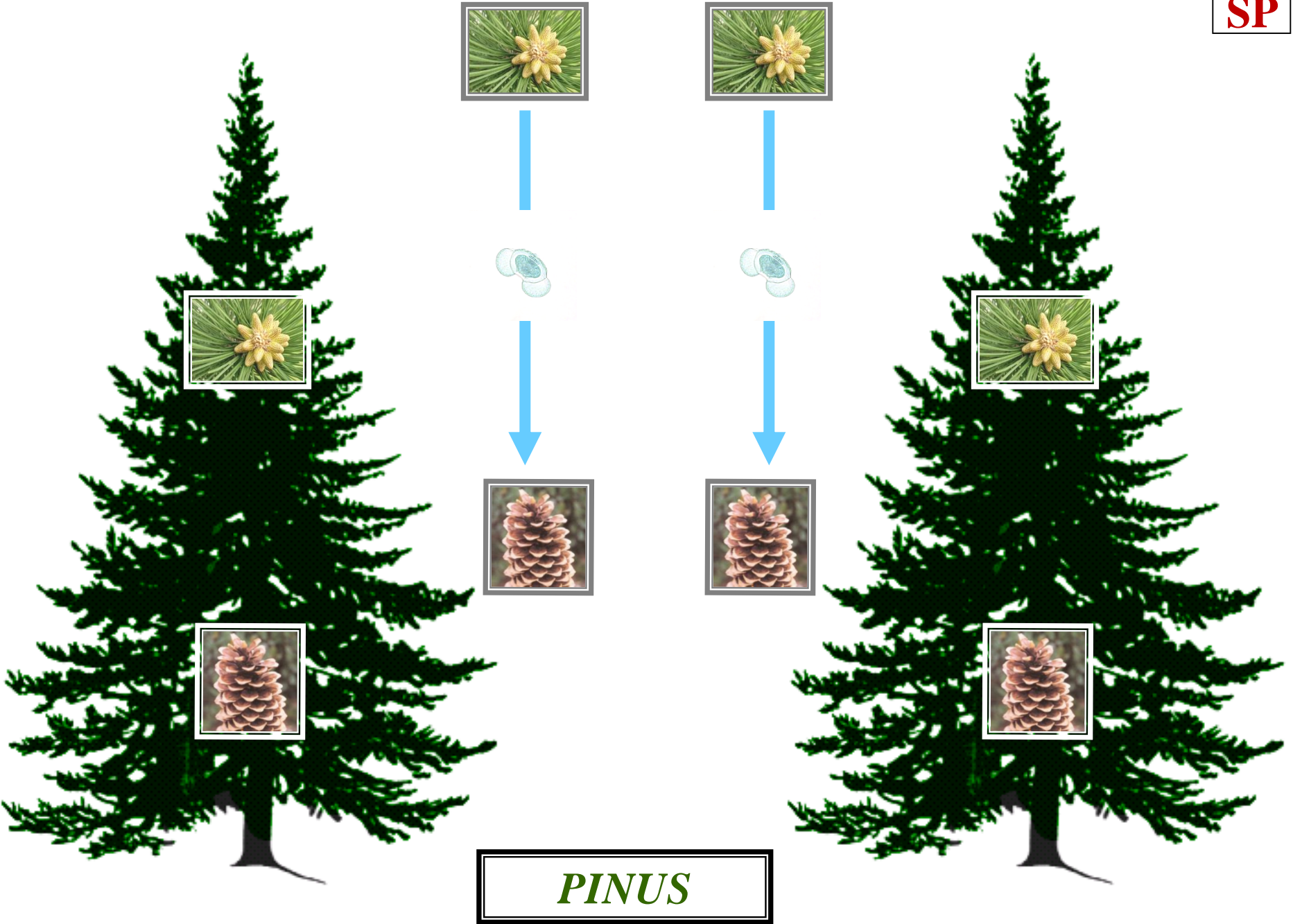




STROBILI POSITION



PINUS



PINUS

SELF POLLINATION



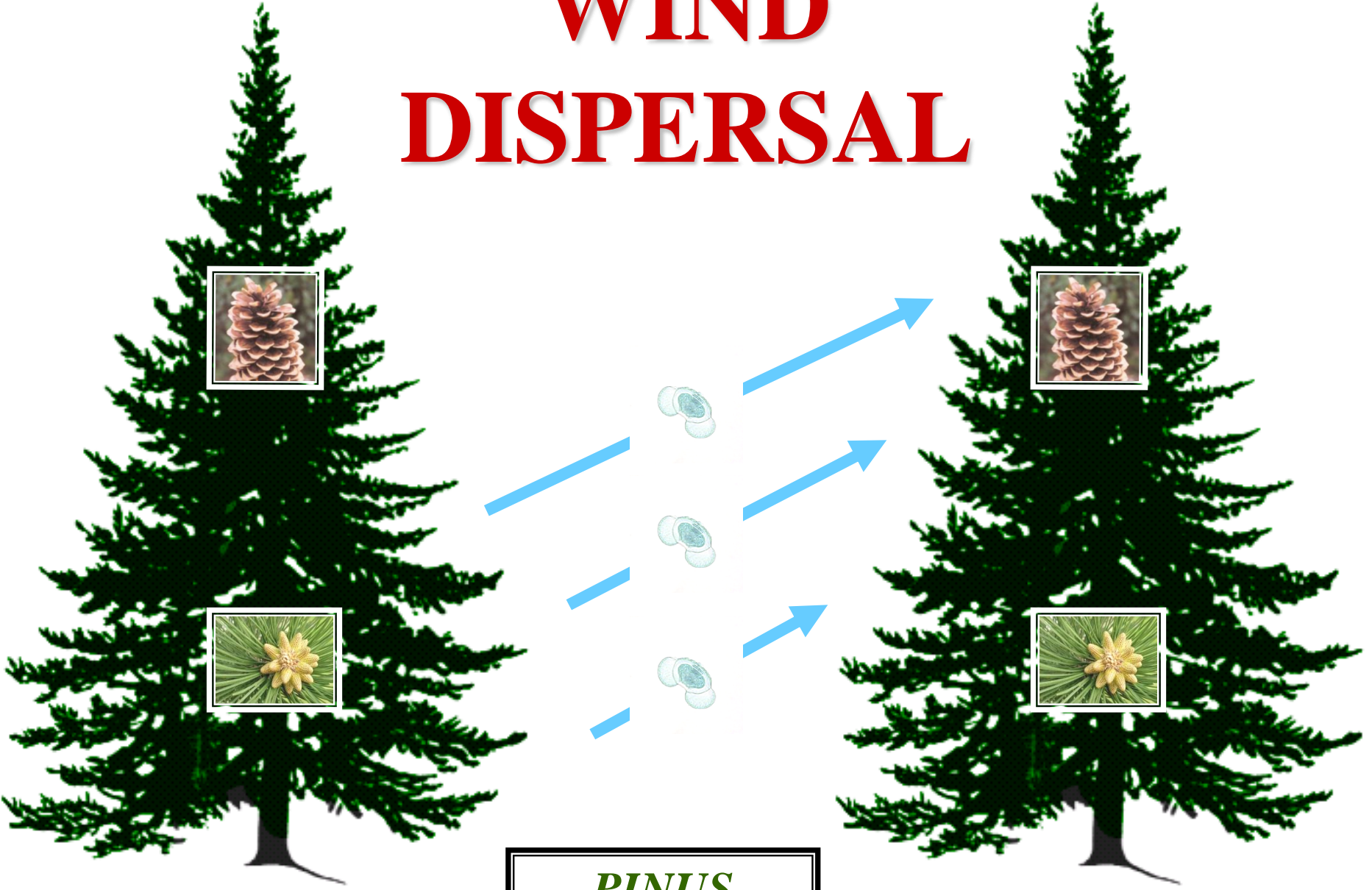
PINUS

STROBILI POSITION



PINUS

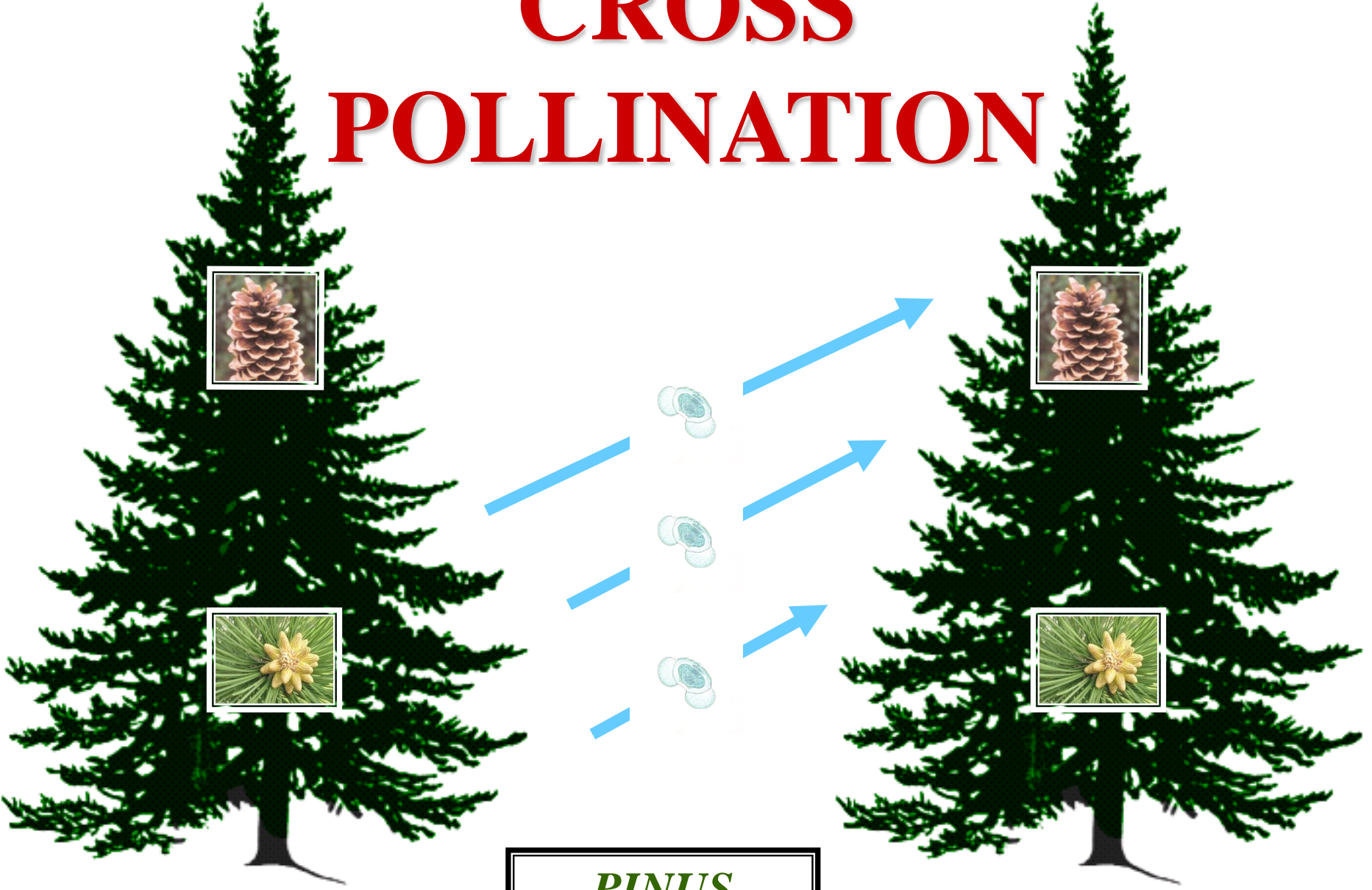
WIND DISPERSAL



PINUS



CROSS POLLINATION



PINUS



CROSS POLLINATION



ENSURES
GENETIC
DIVERSITY

A large rectangular frame with a thin grey border contains the text 'ENSURES GENETIC DIVERSITY' in red, bold, serif font. The frame is set against a background of two green pine trees. Inside the frame, several blue arrows point from the left tree to the right tree, and several light blue pollen grains are shown in flight between the trees, illustrating the process of cross-pollination.

PINUS



POLLINATION



PINUS

W

ANEMOPHILOUS



PINUS



WIND POLLINATION

MICROSTROBILI

PINUS

M



MICROSPORANGIA

PINUS

D



DEHISCENT

PINUS

M



MICROSPORANGIA

PINUS

=

**MICROGAMETOPHYTES
ARE RELEASED**

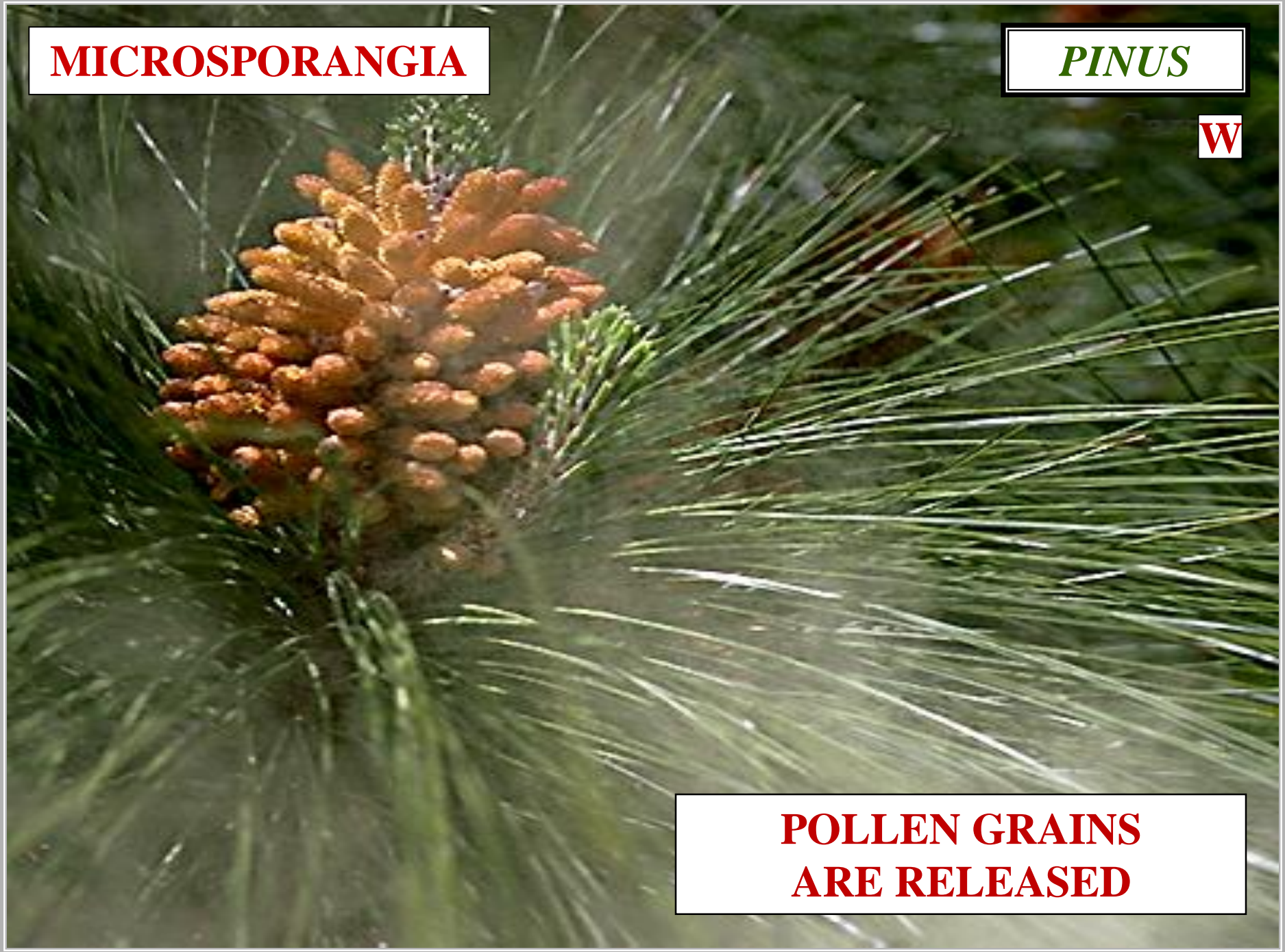


MICROSPORANGIA

PINUS

W

**POLLEN GRAINS
ARE RELEASED**



MICROSPORANGIA

PINUS

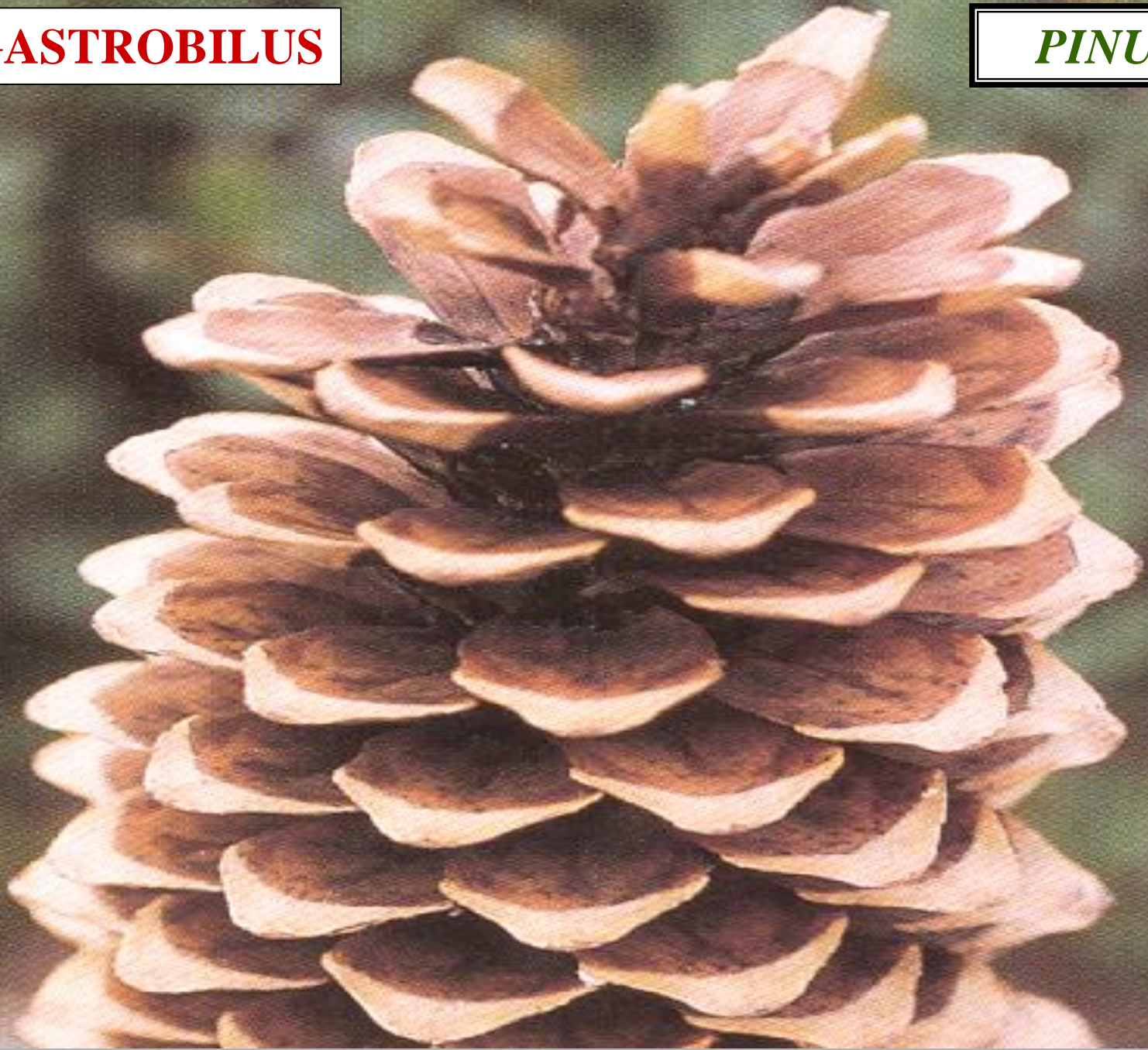


WIND DISSEMINATED

MEGASTROBILUS

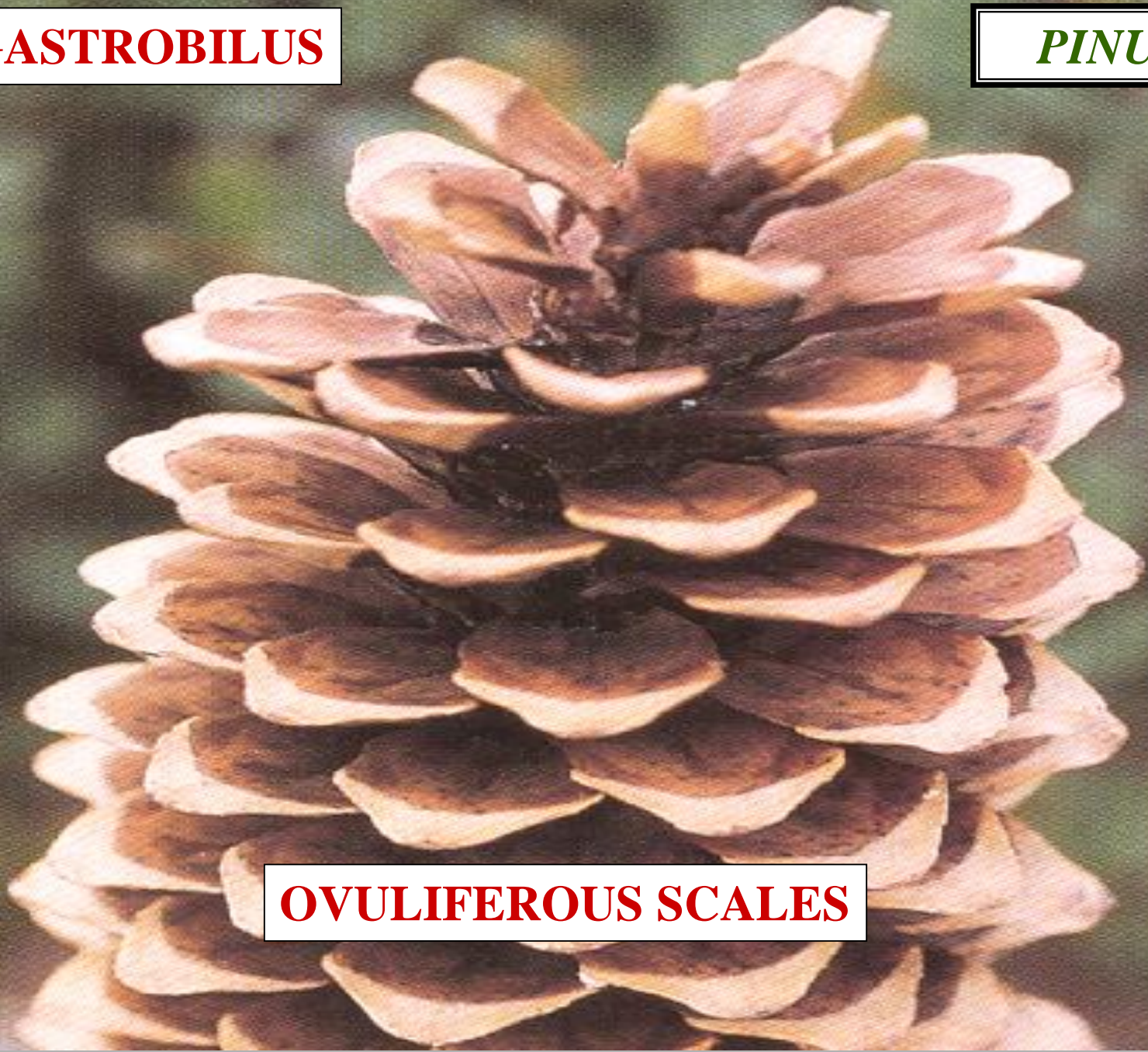
PINUS

O



MEGASTROBILUS

PINUS



OVULIFEROUS SCALES

MEGASTROBILUS

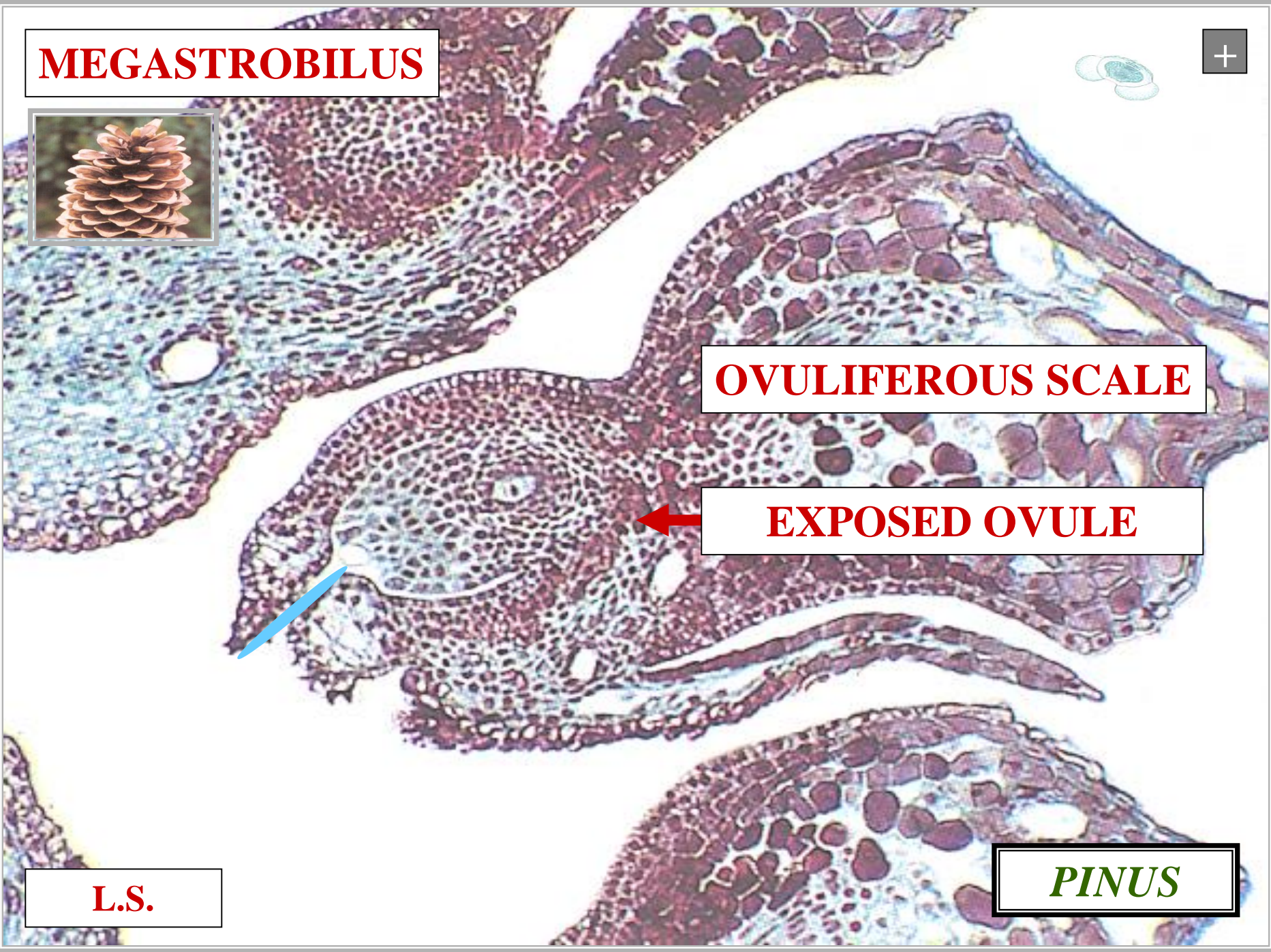


OVULIFEROUS SCALE

EXPOSED OVULE

L.S.

PINUS



MEGASTROBILUS

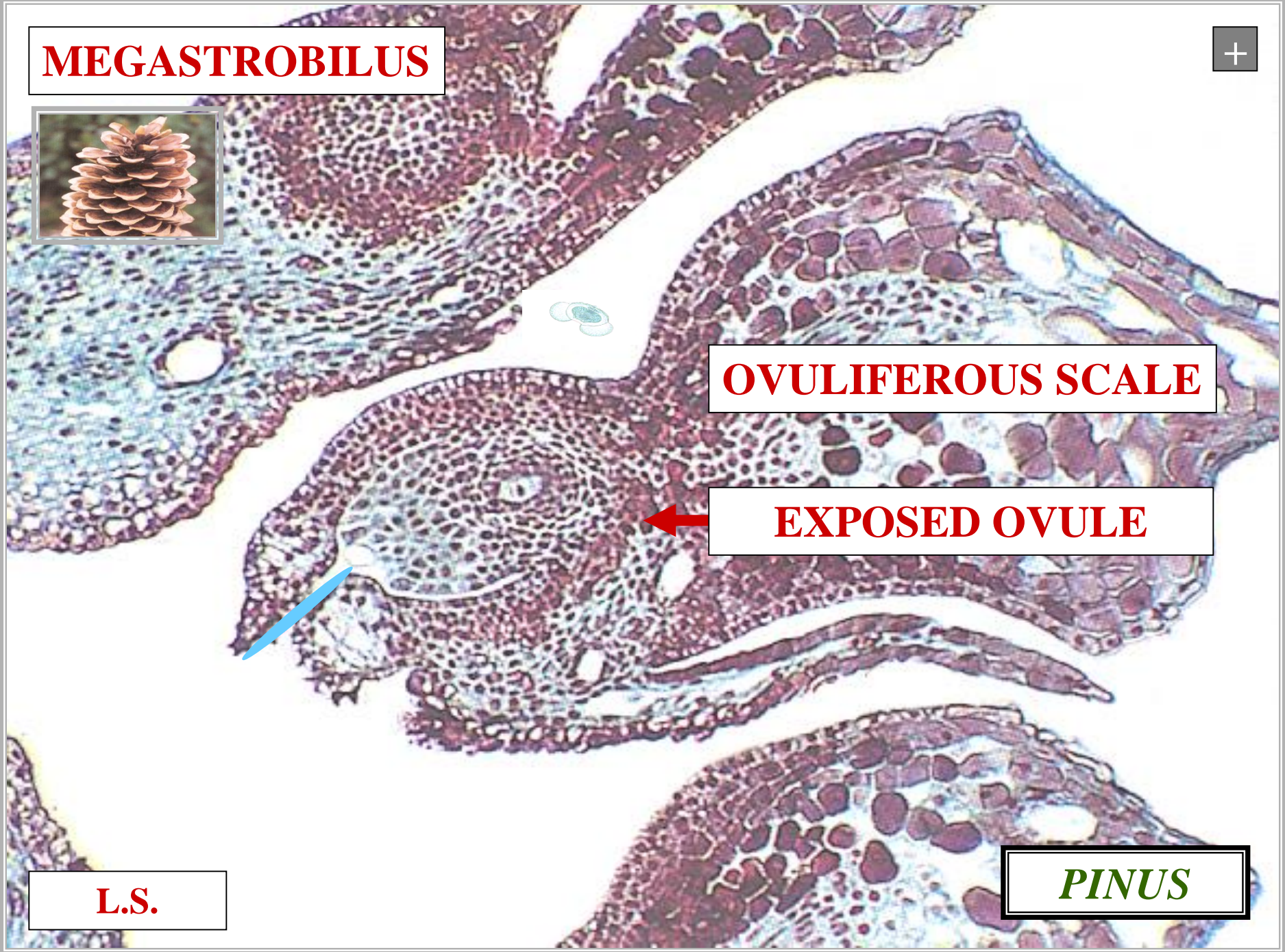


OVULIFEROUS SCALE

EXPOSED OVULE

L.S.

PINUS



MEGASTROBILUS



+

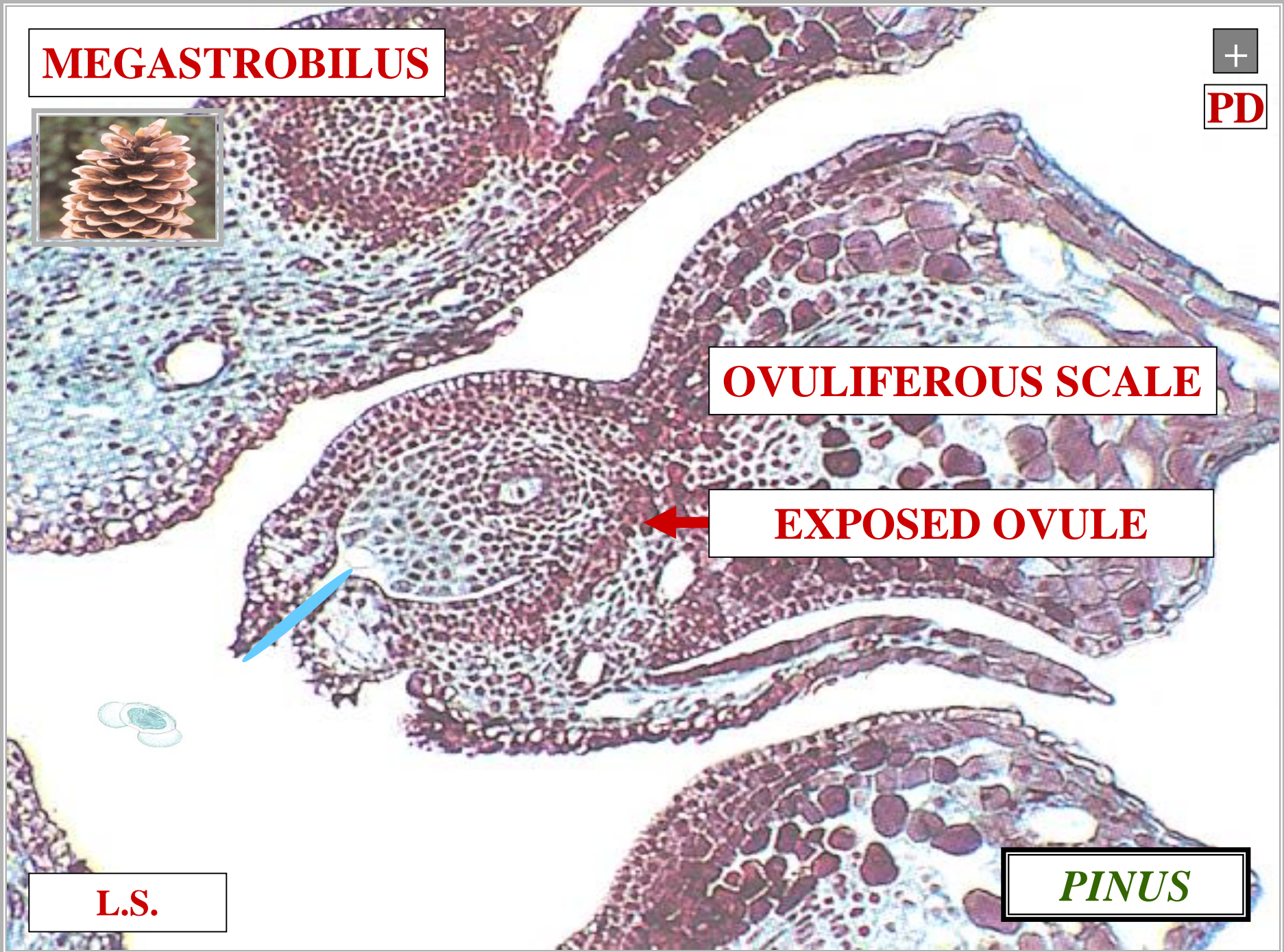
PD

OVULIFEROUS SCALE

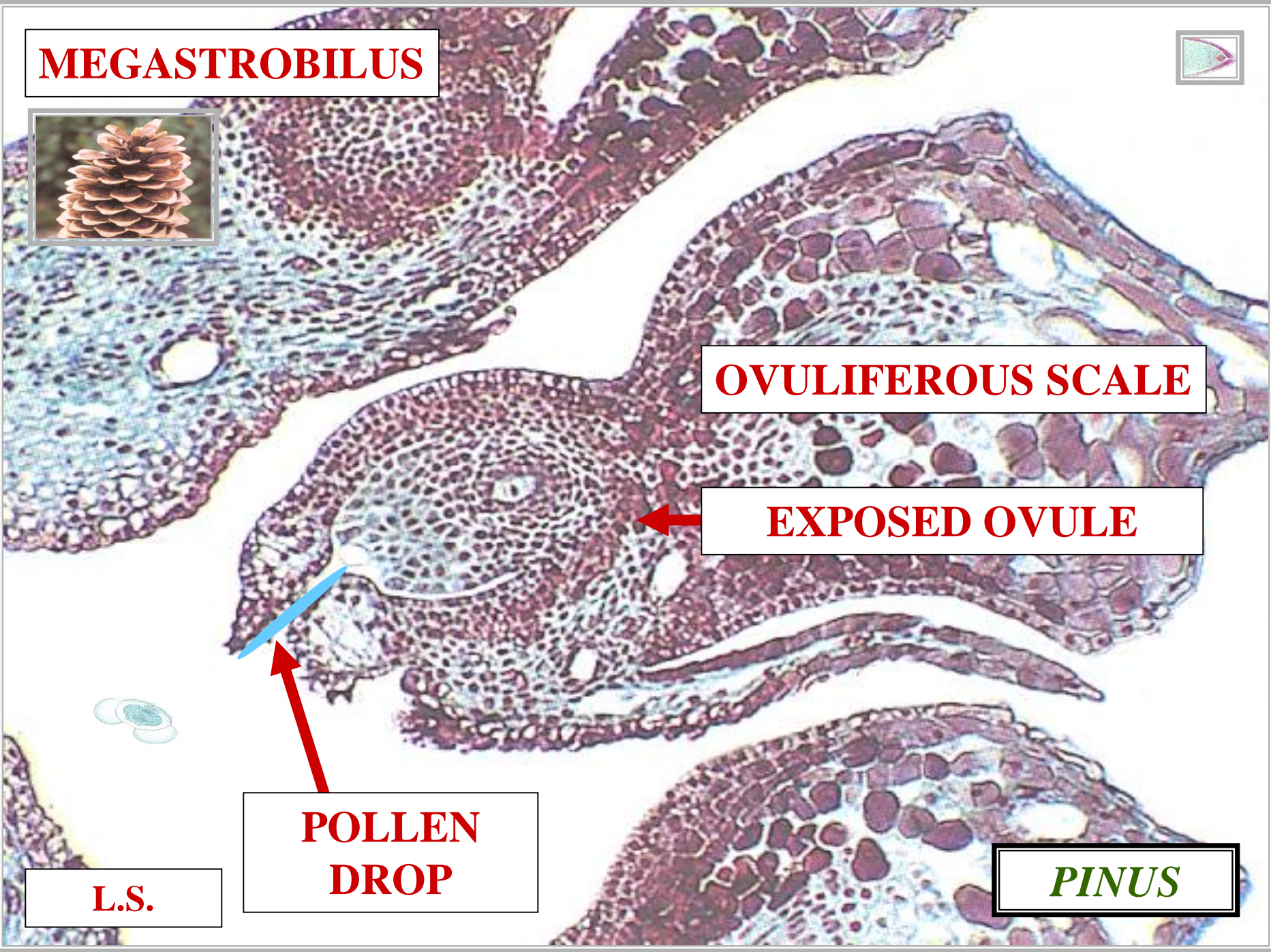
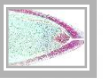
EXPOSED OVULE

L.S.

PINUS



MEGASTROBILUS



OVULIFEROUS SCALE

EXPOSED OVULE

**POLLEN
DROP**

L.S.

PINUS

OVULE

INTEGUMENT

?

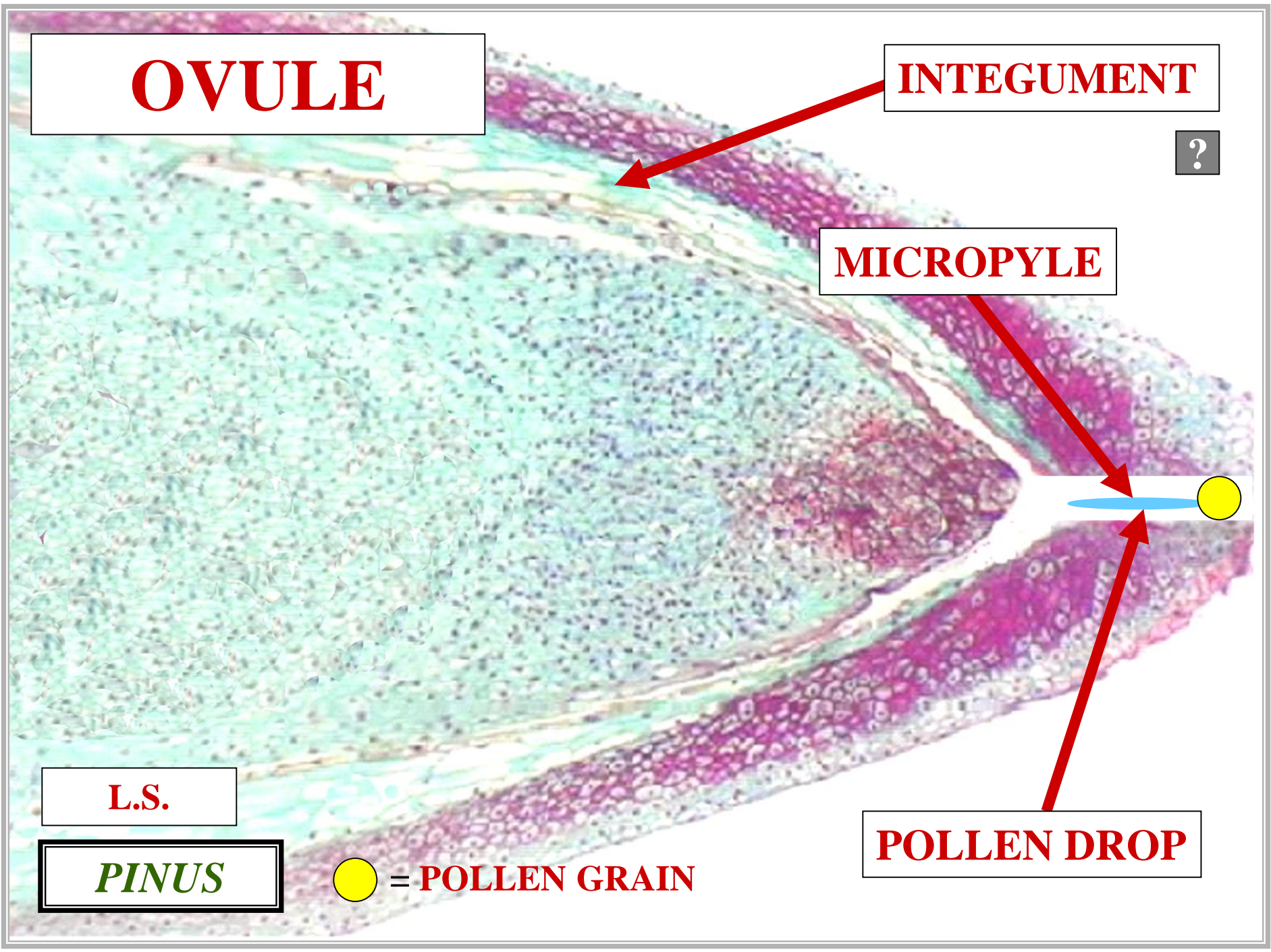
MICROPYLE

L.S.

PINUS

● = **POLLEN GRAIN**

POLLEN DROP



OVULE

INTEGUMENT

M

MICROPYLE

POLLEN GRAIN

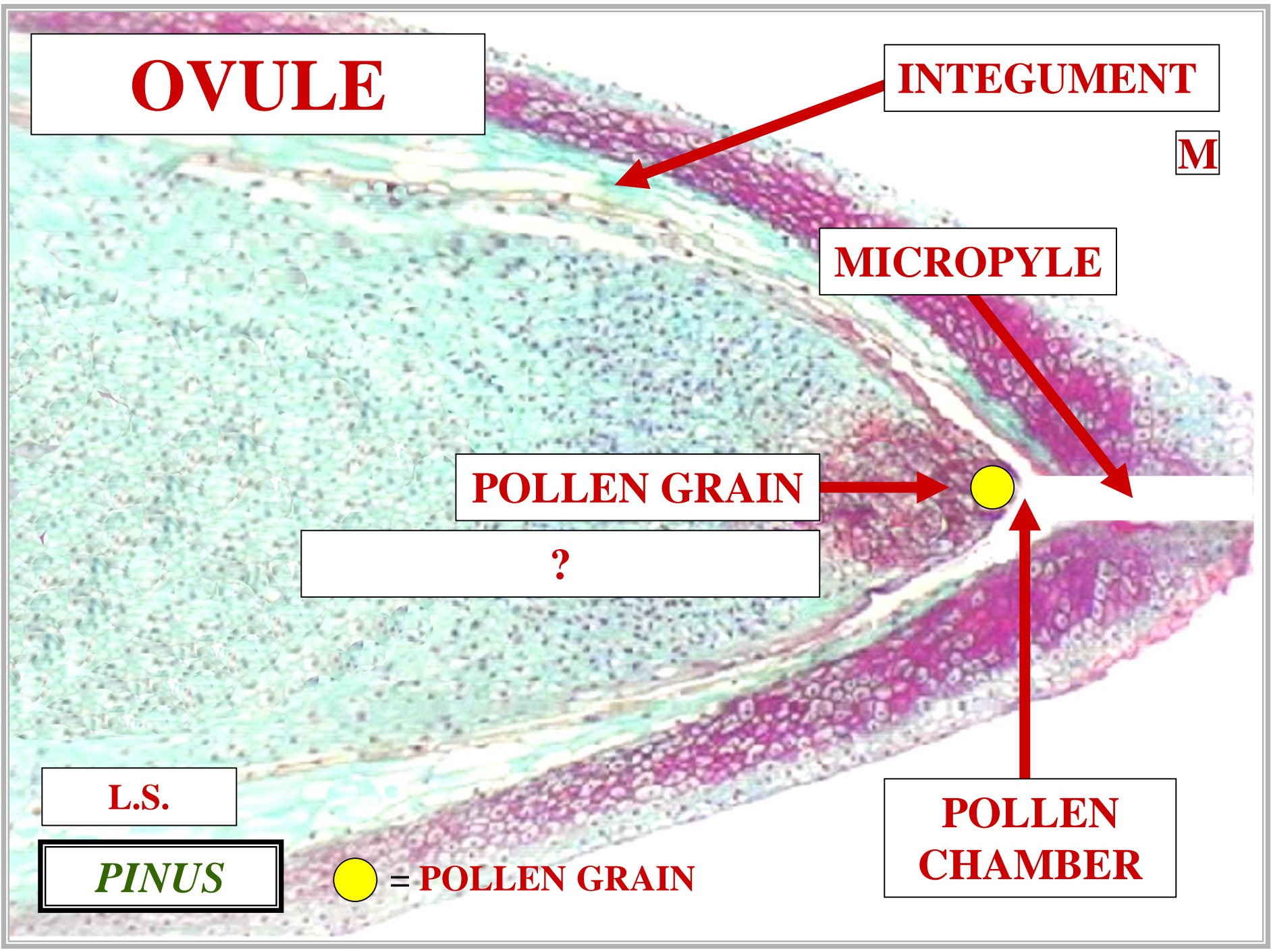
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L.S.

PINUS

● = POLLEN GRAIN

POLLEN CHAMBER



OVULE

INTEGUMENT

=

MICROPYLE

POLLEN GRAIN

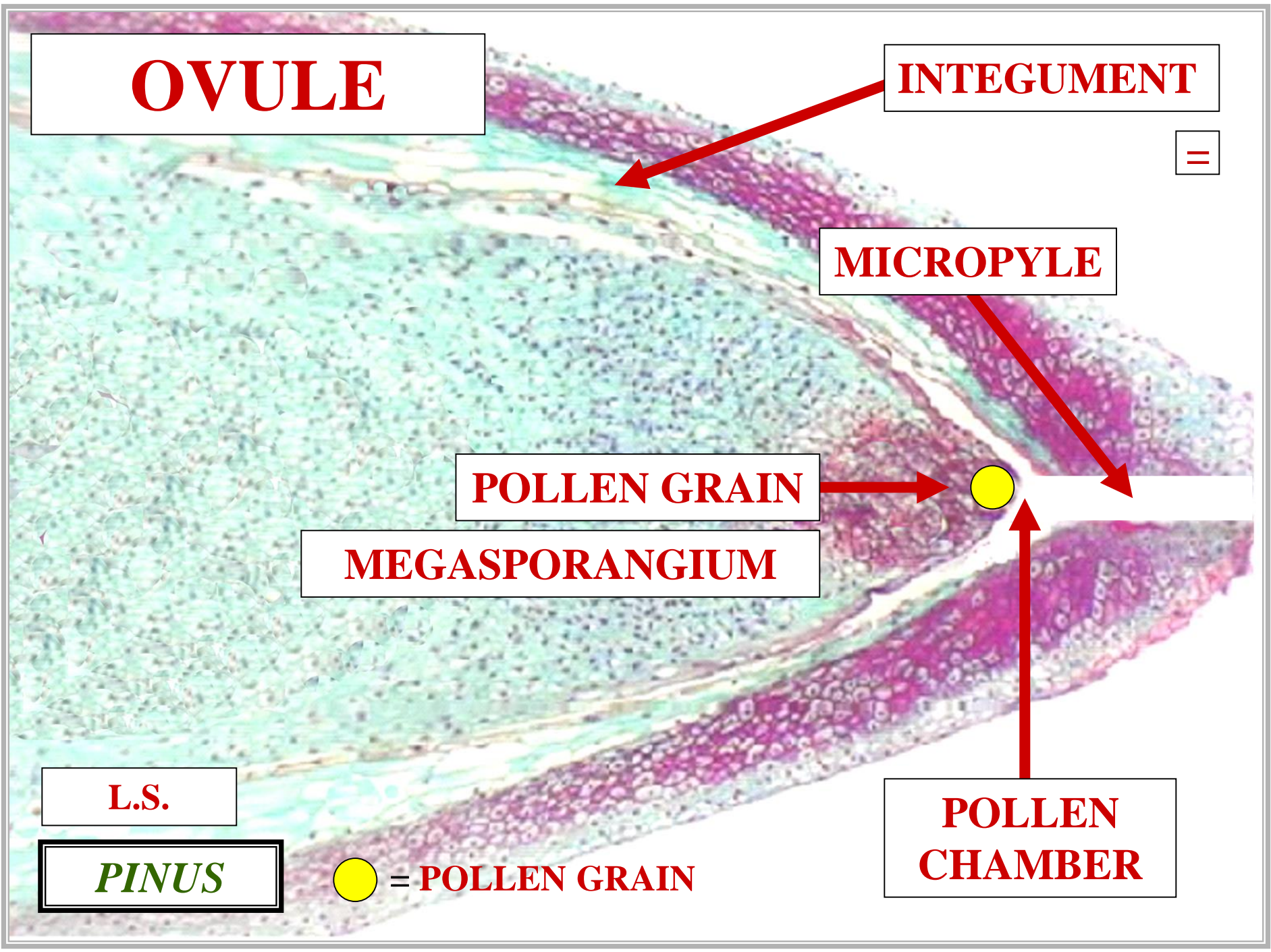
MEGASPORANGIUM

L.S.

PINUS

● = **POLLEN GRAIN**

POLLEN CHAMBER



OVULE

INTEGUMENT

?

MICROPYLE

POLLEN GRAIN

MEGASPORANGIUM

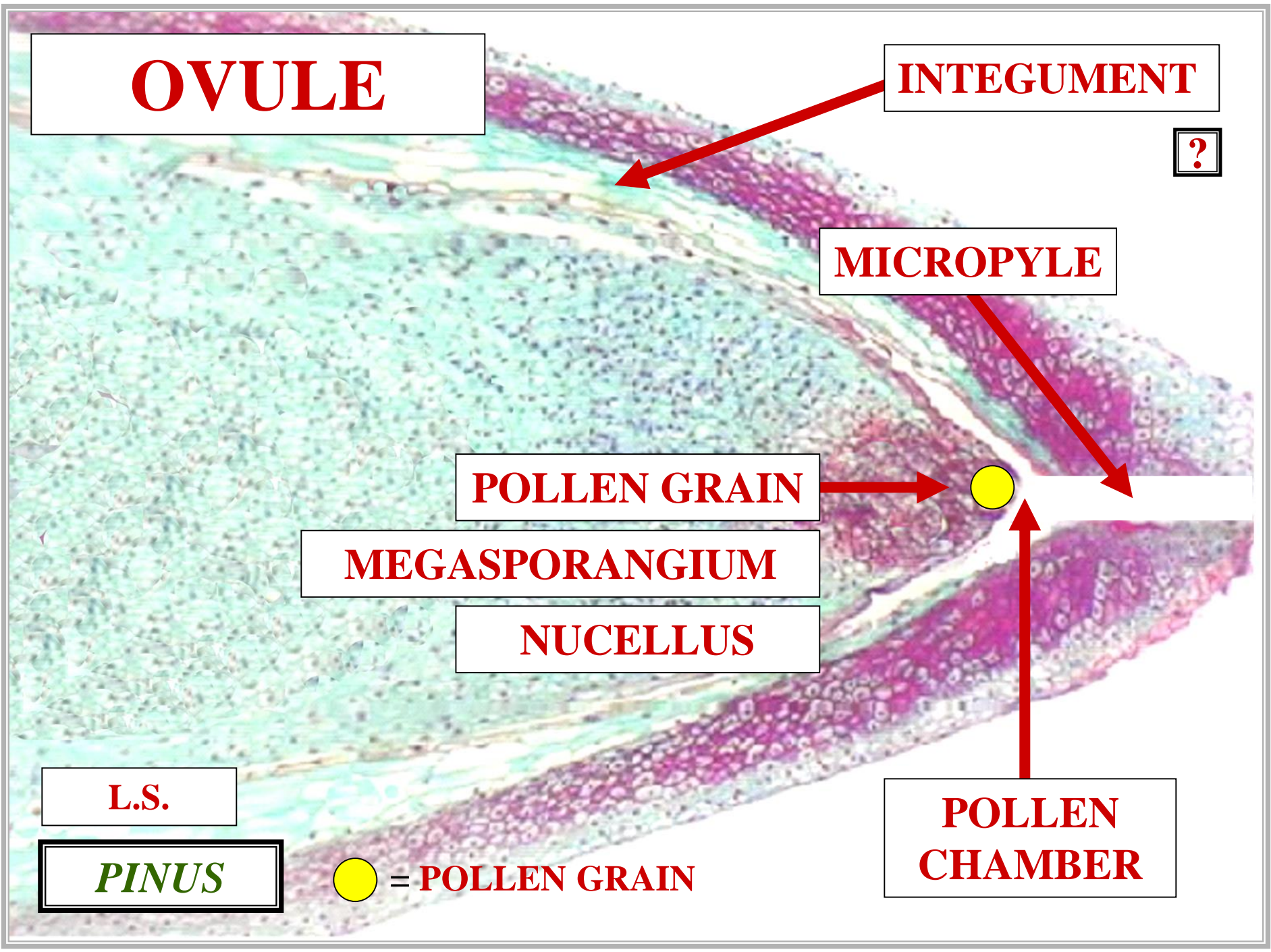
NUCELLUS

L.S.

PINUS

● = POLLEN GRAIN

POLLEN CHAMBER



OVULE

INTEGUMENT

P

MICROPYLE

?

POLLEN GRAIN

MEGASPORANGIUM

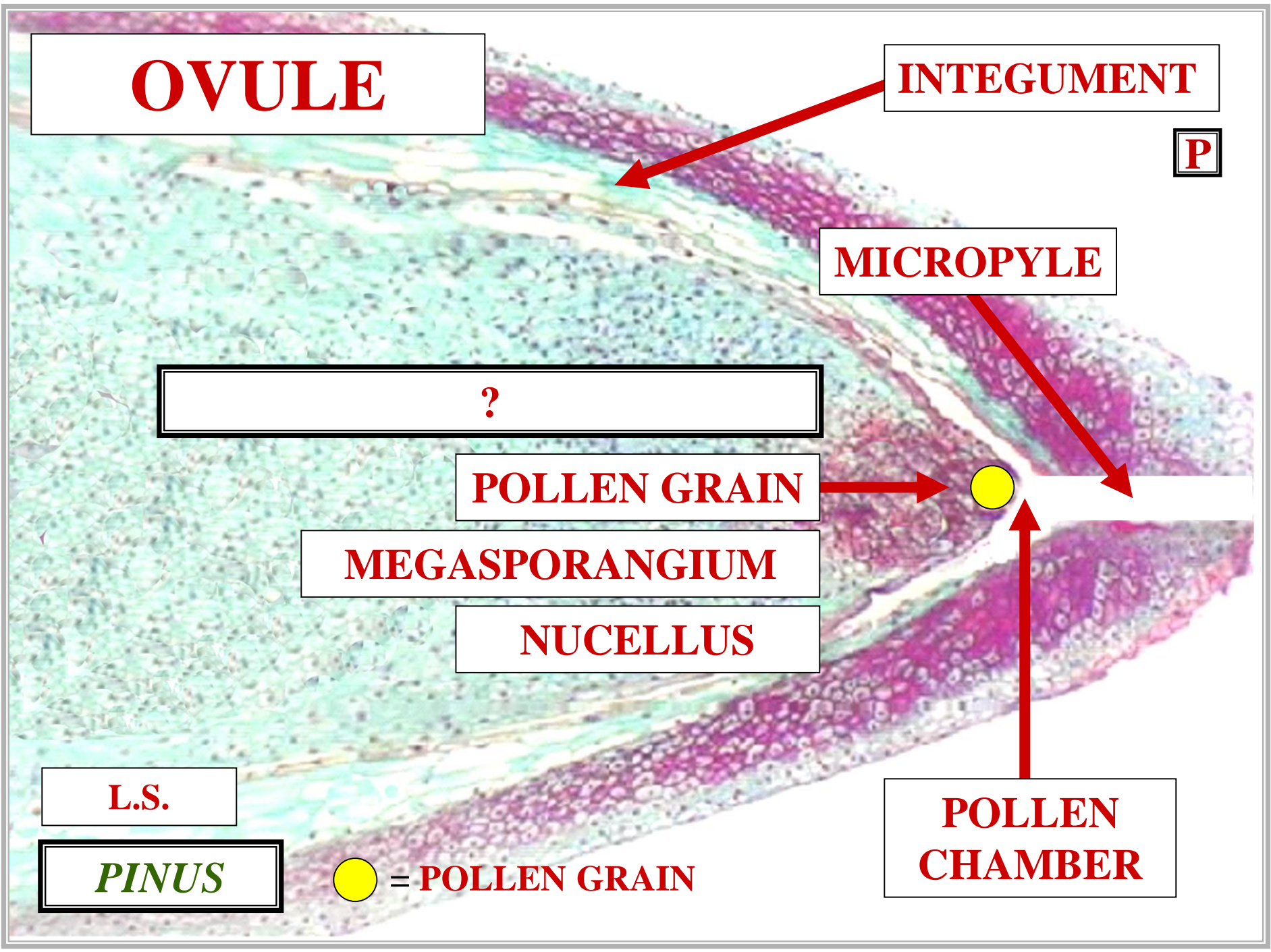
NUCELLUS

L.S.

PINUS

● = POLLEN GRAIN

POLLEN CHAMBER



OVULE

INTEGUMENT

+

MICROPYLE

POLLINATION

POLLEN GRAIN

MEGASPORANGIUM

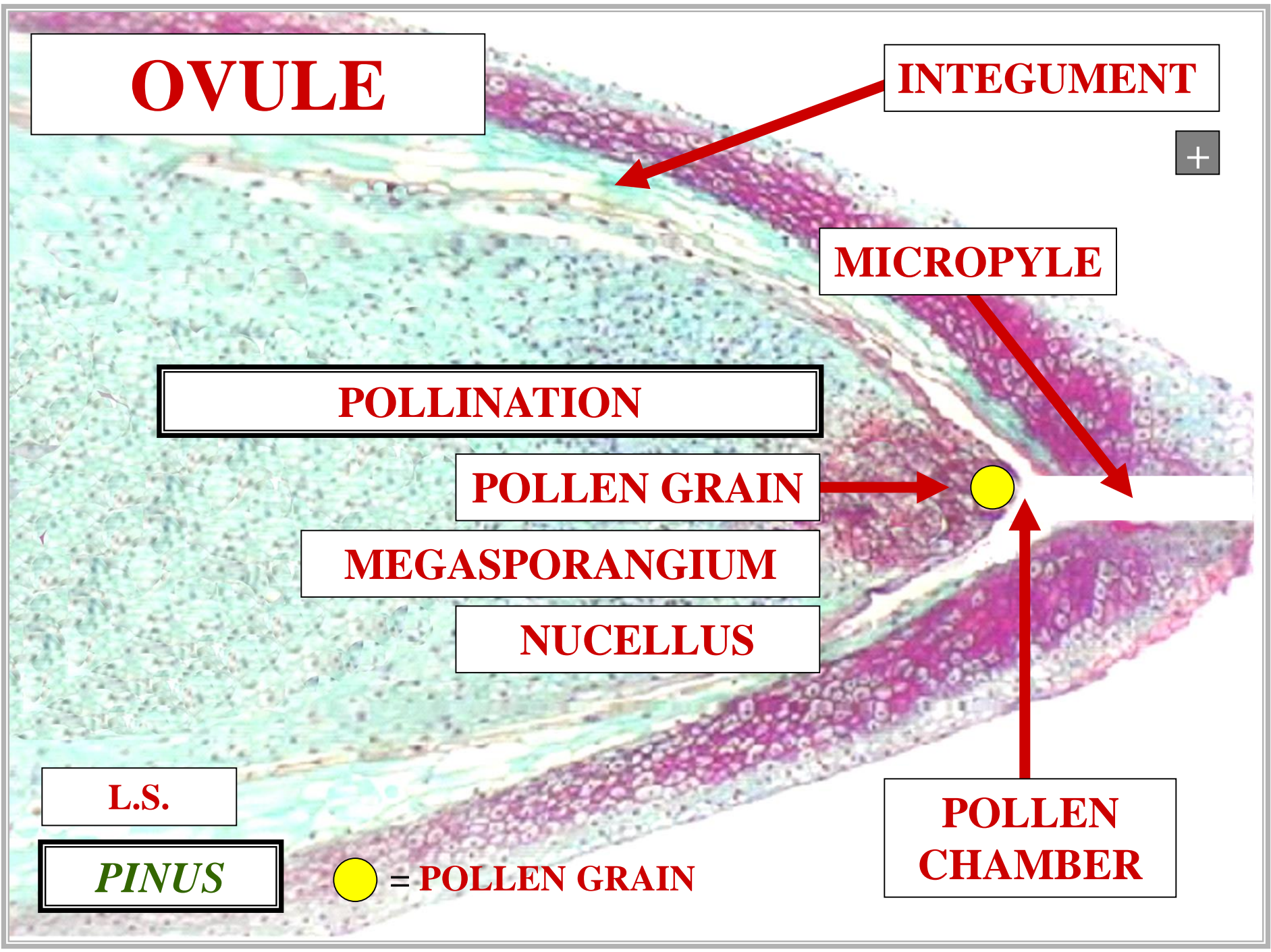
NUCELLUS

L.S.

PINUS

● = **POLLEN GRAIN**

POLLEN CHAMBER



OVULE

INTEGUMENT

PT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

ENDOSPORIC

1N

EGG

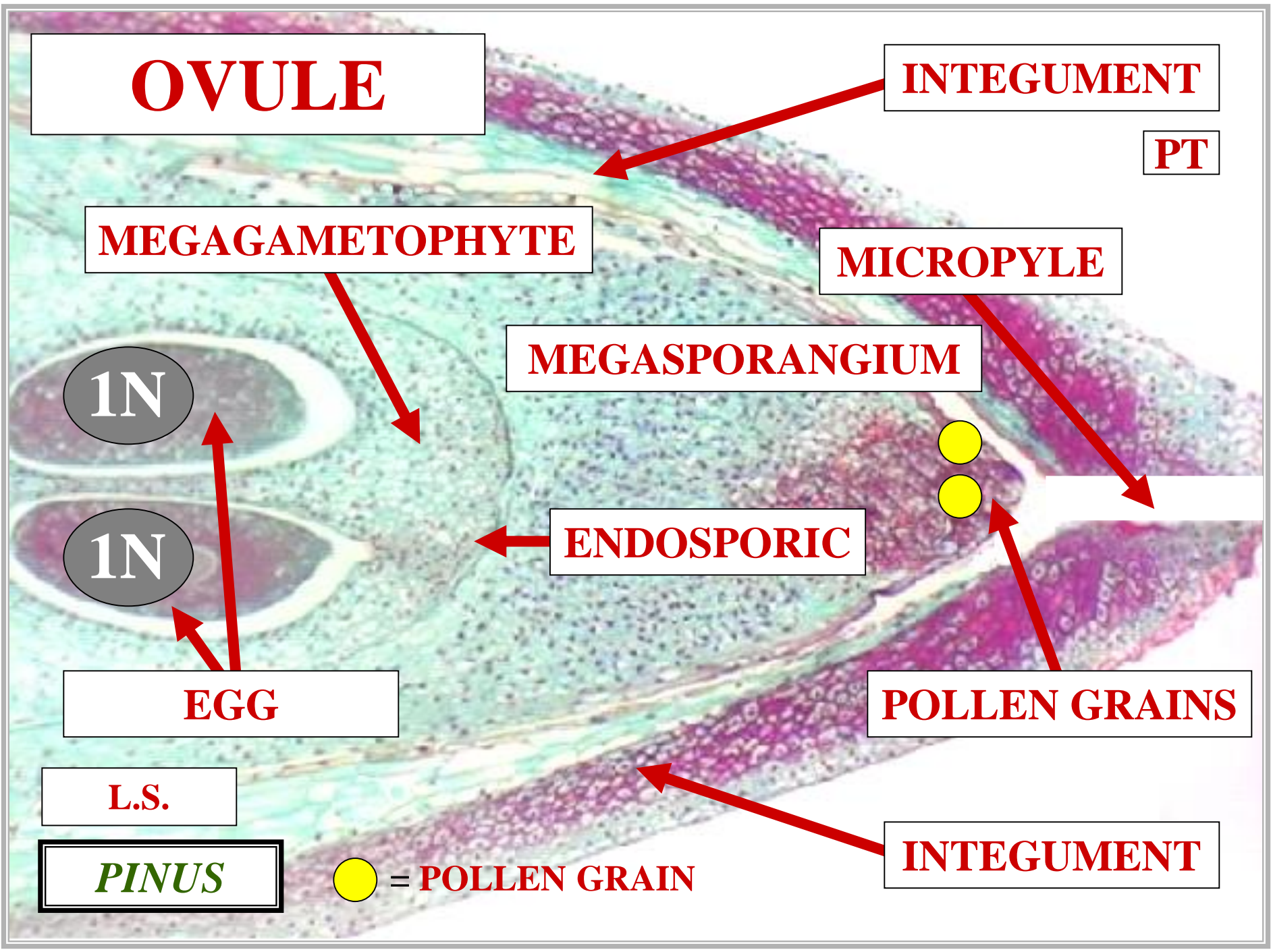
POLLEN GRAINS

L.S.

INTEGUMENT

PINUS

● = POLLEN GRAIN



OVULE

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

1N

EGG

POLLEN TUBE

POLLEN GRAINS

L.S.

PINUS

● = POLLEN GRAIN

INTEGUMENT

OVULE

INTEGUMENT

S

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

1N

SPERM

EGG

POLLEN GRAINS

L.S.

PINUS

● = POLLEN GRAIN

INTEGUMENT

OVULE

INTEGUMENT



MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

2N

2N

POLLEN TUBE

SYNGAMY

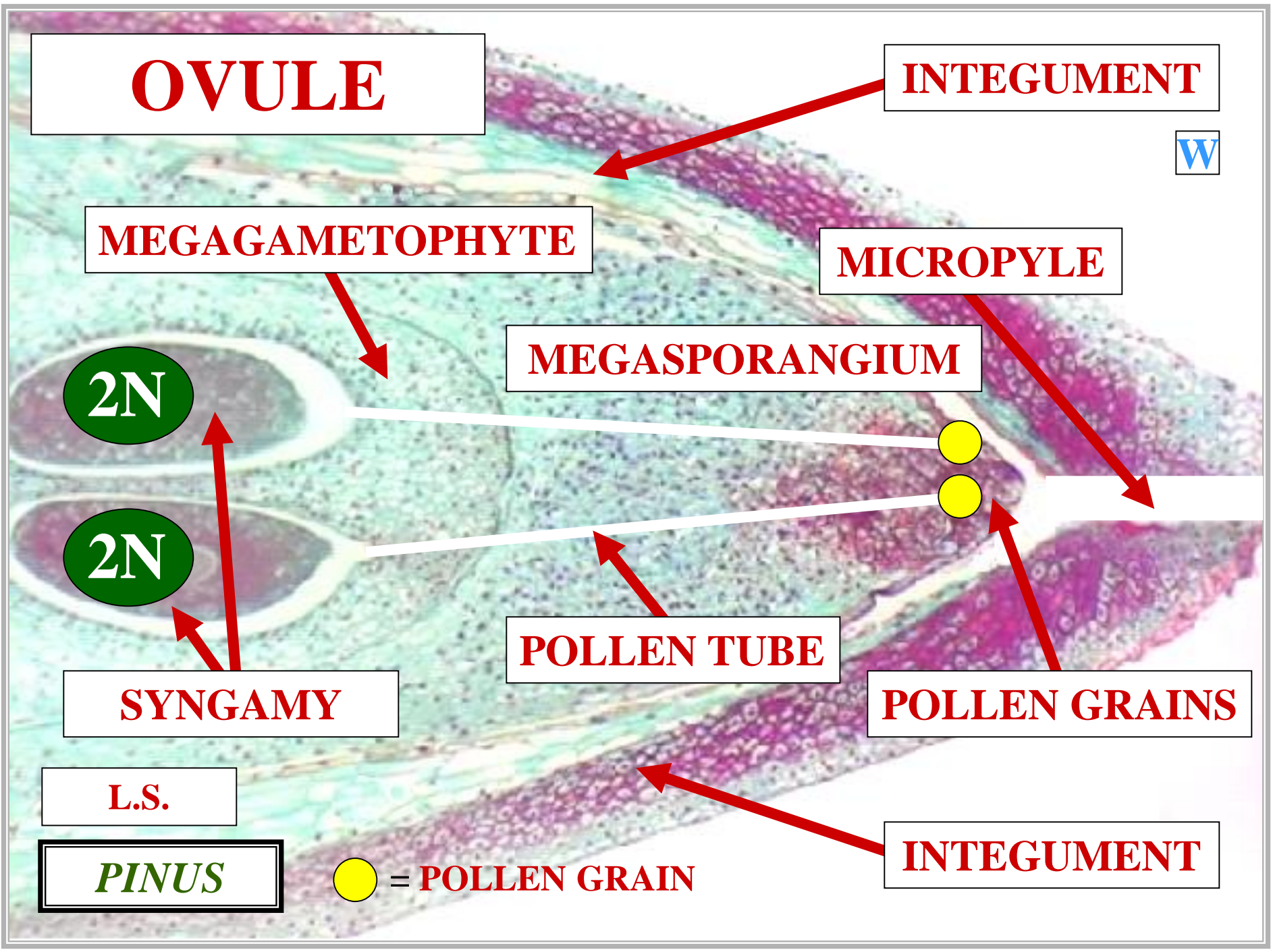
POLLEN GRAINS

L.S.

PINUS

 = **POLLEN GRAIN**

INTEGUMENT



OVULE

INTEGUMENT

?

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

2N

2N

POLLEN TUBE

SYNGAMY

POLLEN GRAINS

WATER NOT REQUIRED

PINUS

● = **POLLEN GRAIN**

INTEGUMENT

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INTEGUMENT

S

MEGAGAMETOPHYTE

MICROPYLE

2N

NUCELLUS

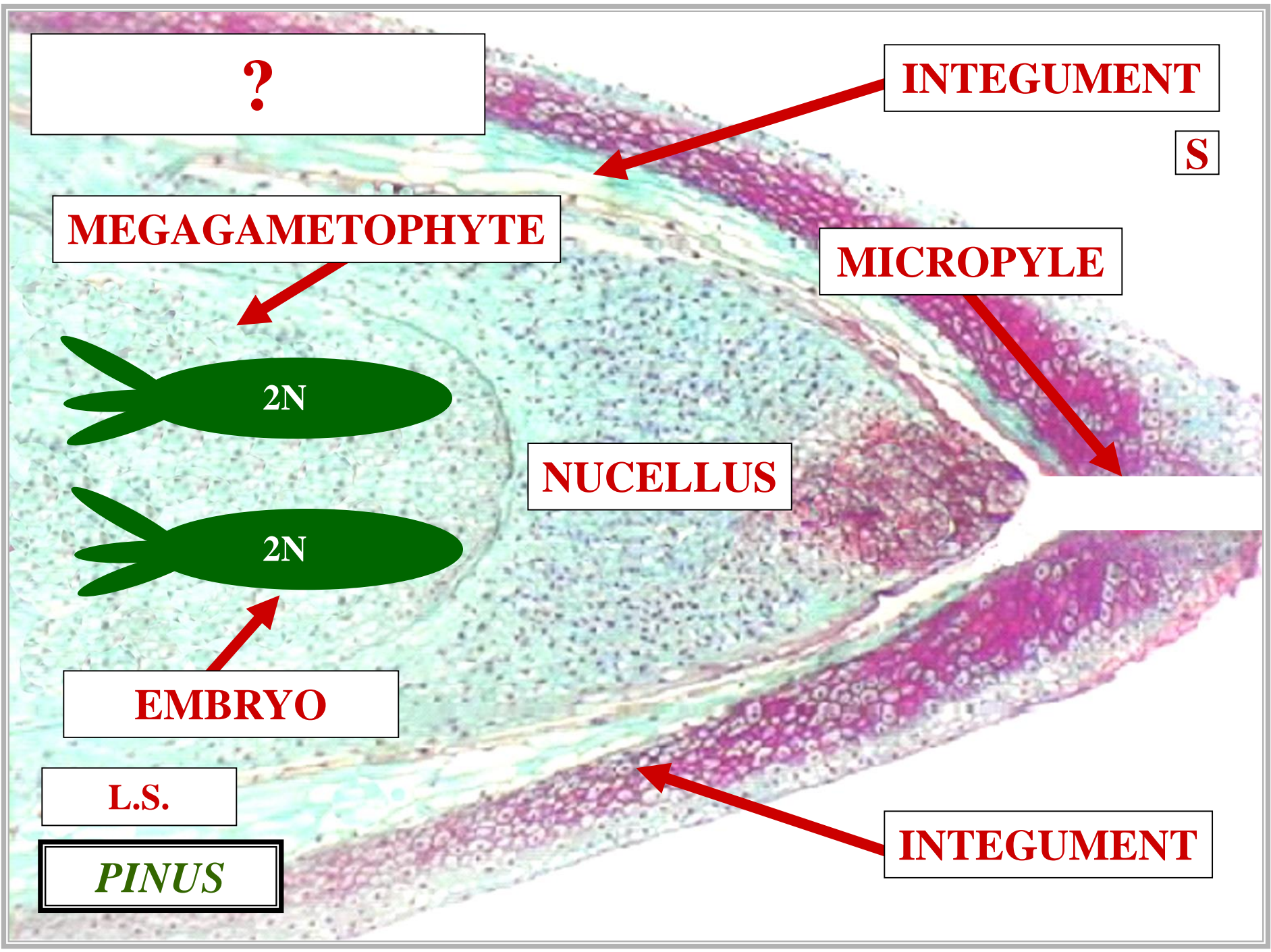
2N

EMBRYO

L.S.

INTEGUMENT

PINUS



SEED

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

2N

NUCELLUS

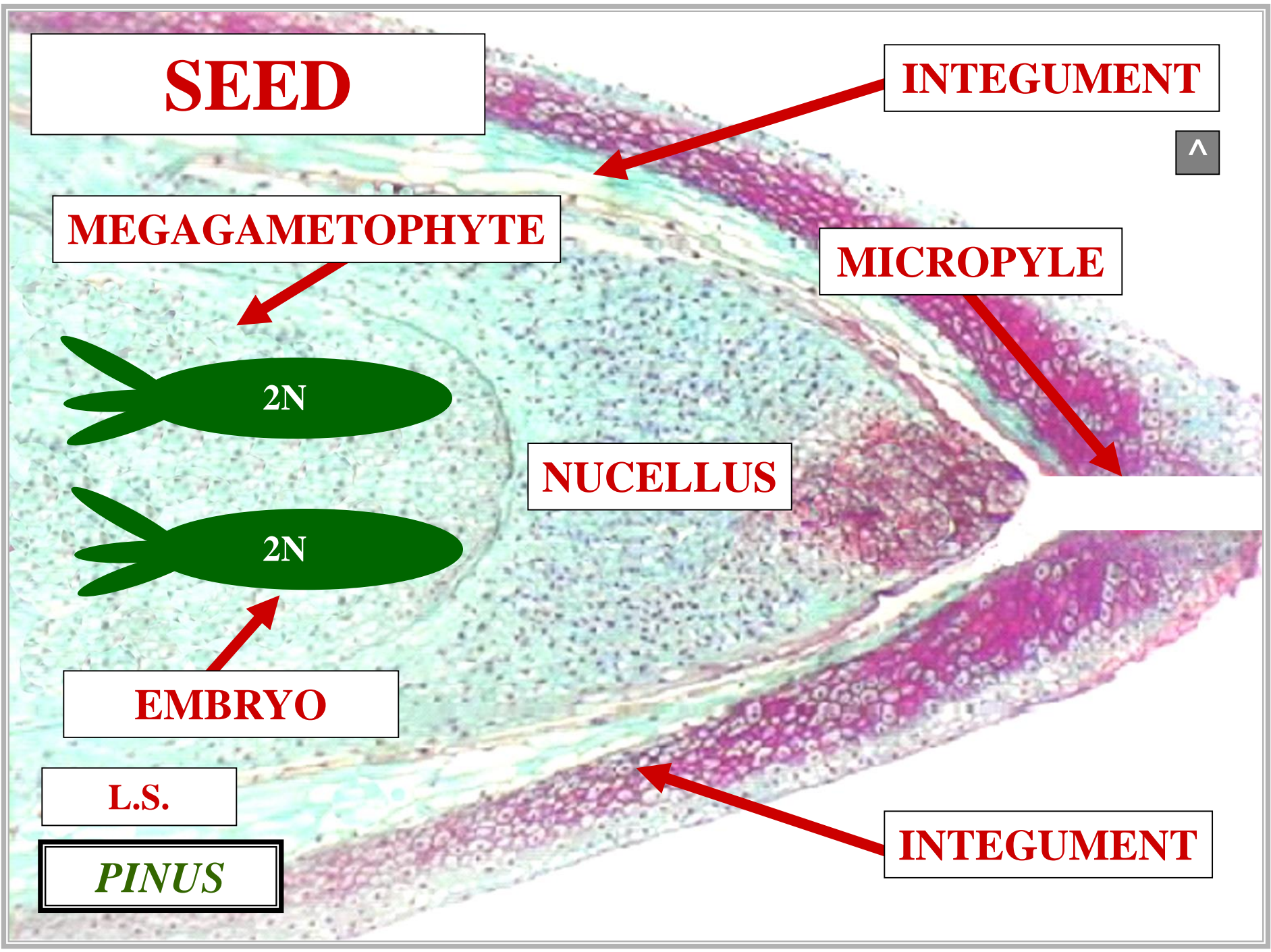
2N

EMBRYO

L.S.

INTEGUMENT

PINUS





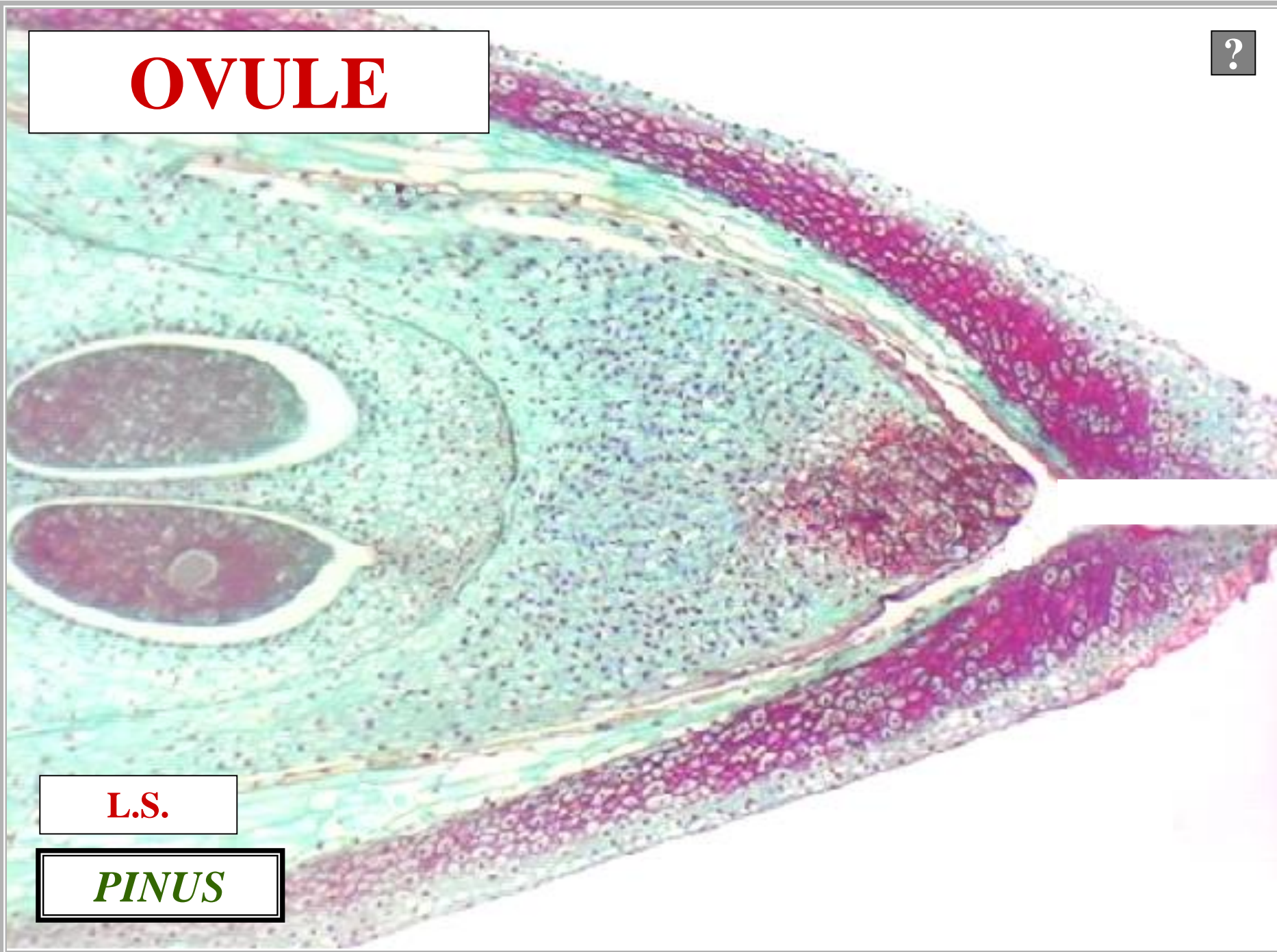
SEED



SEED ANATOMY

OVULE

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PINUS

OVULE

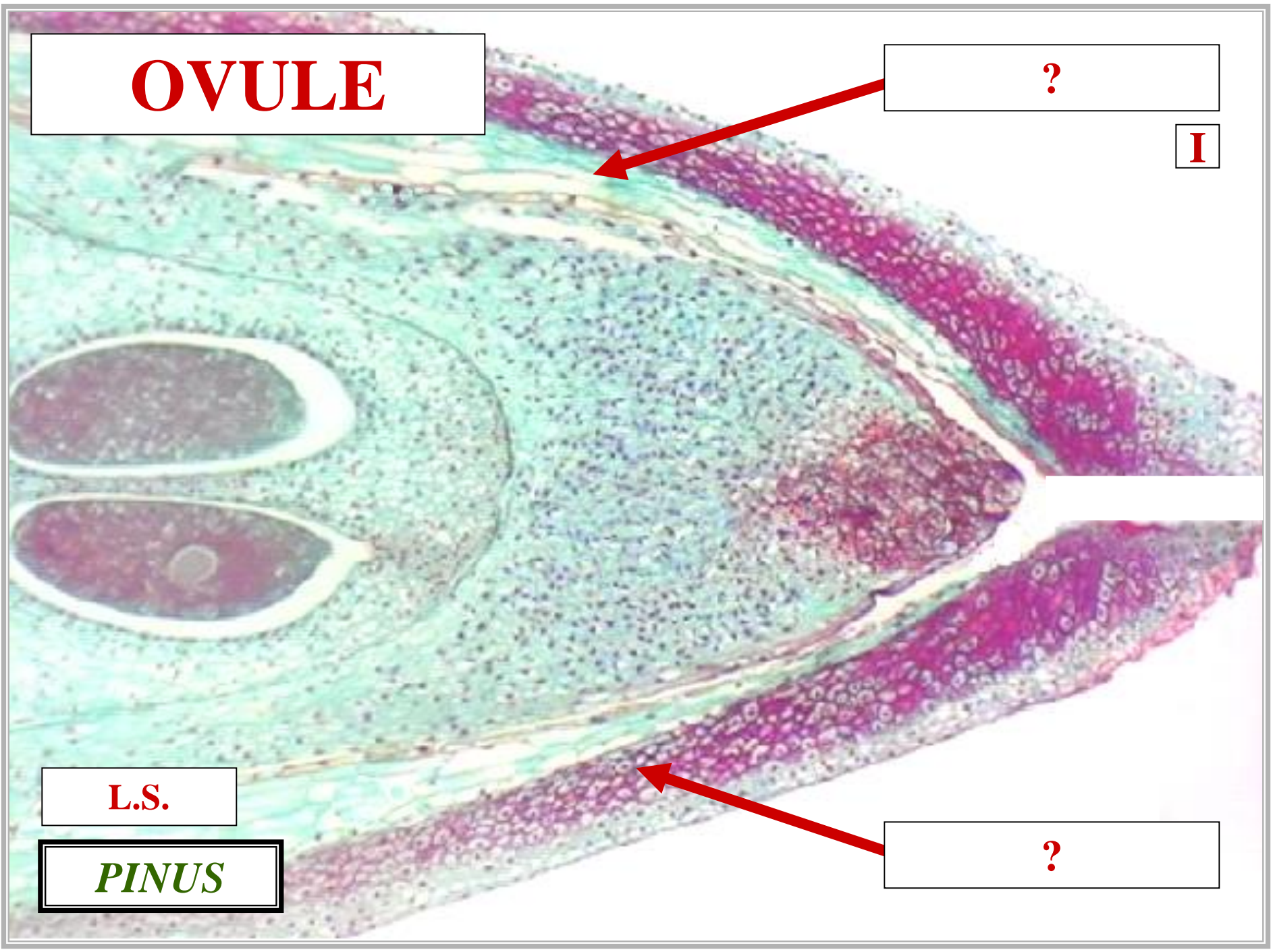
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L.S.

PINUS

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OVULE

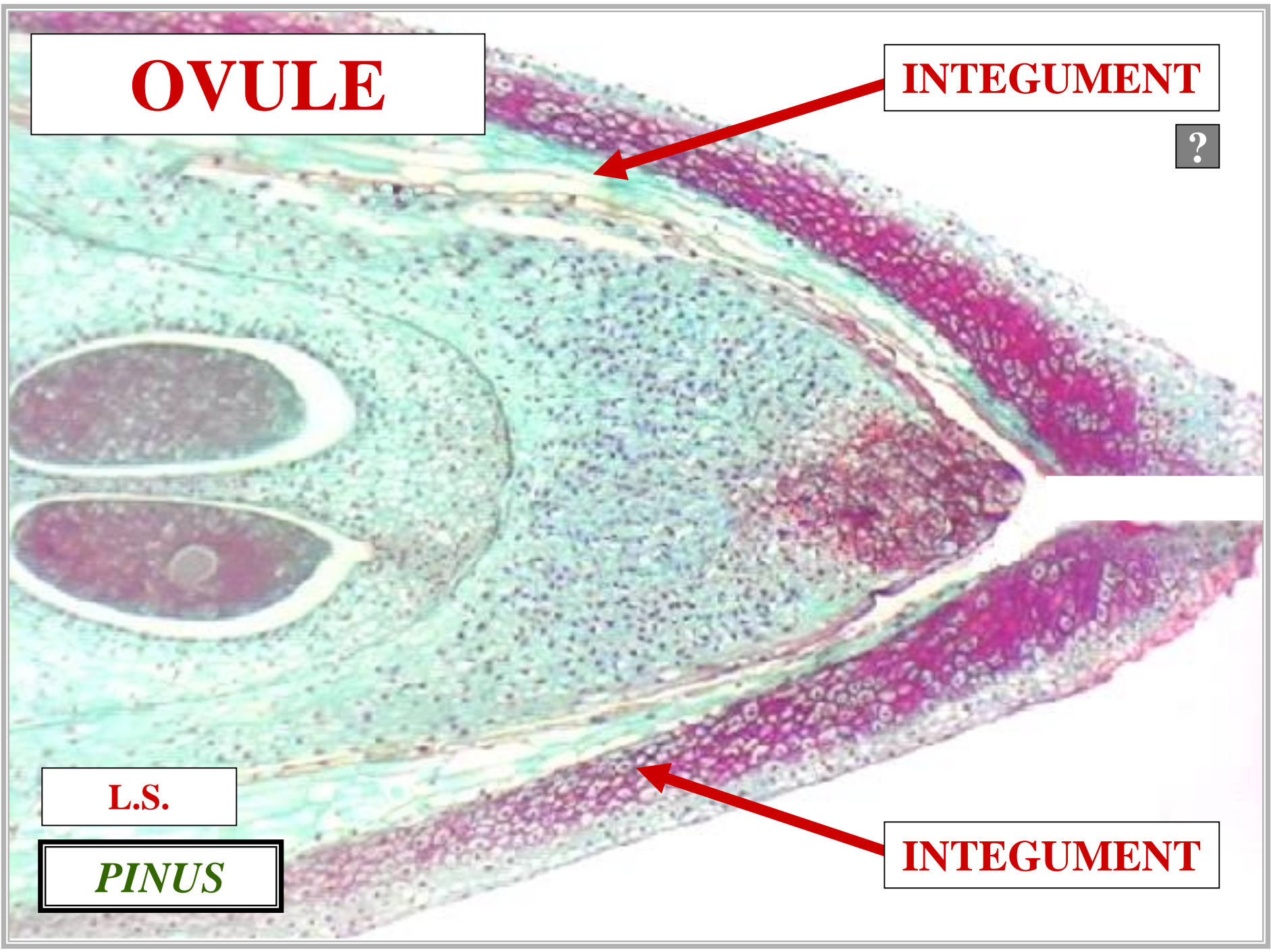
INTEGUMENT

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L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

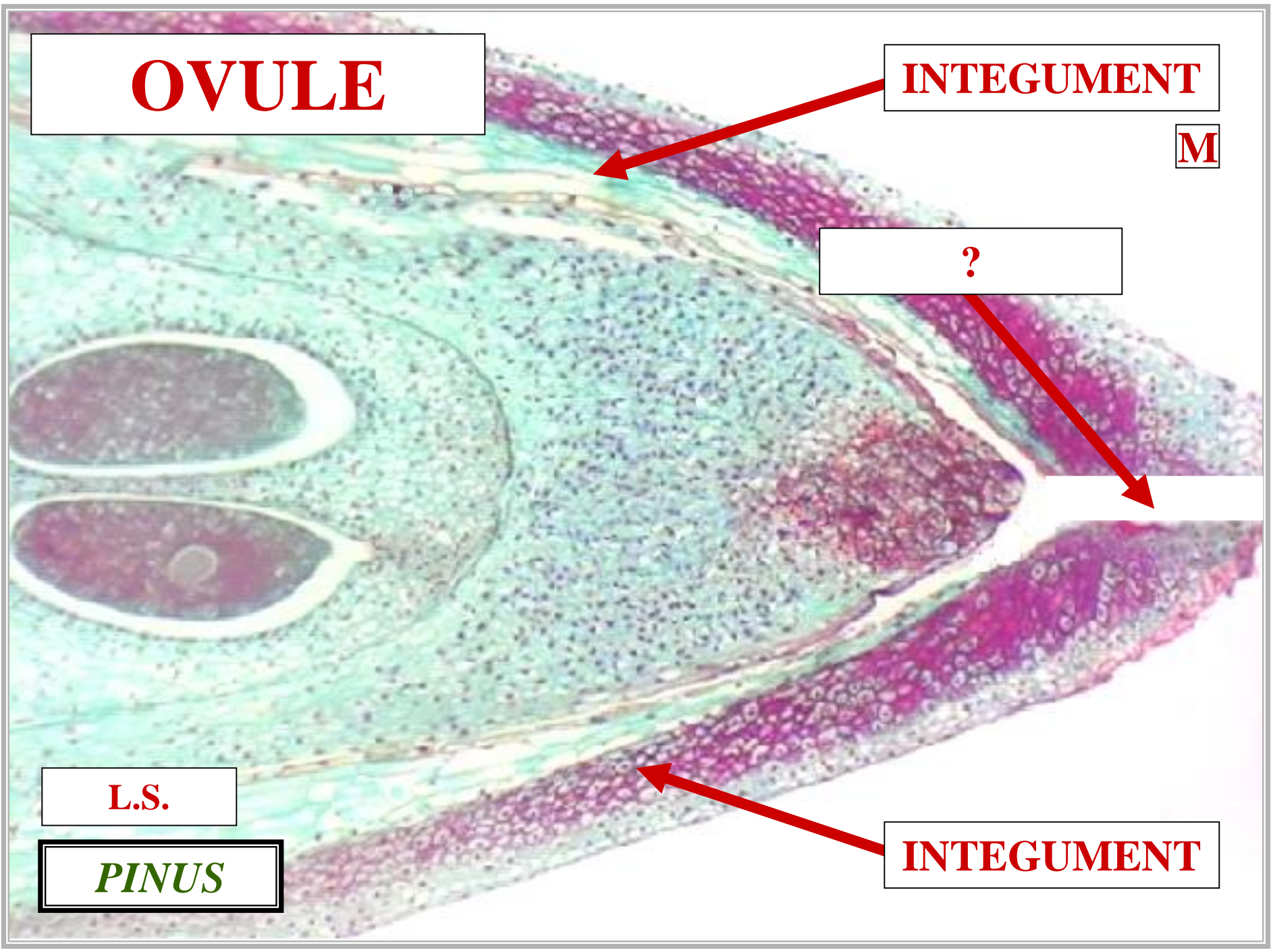
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L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

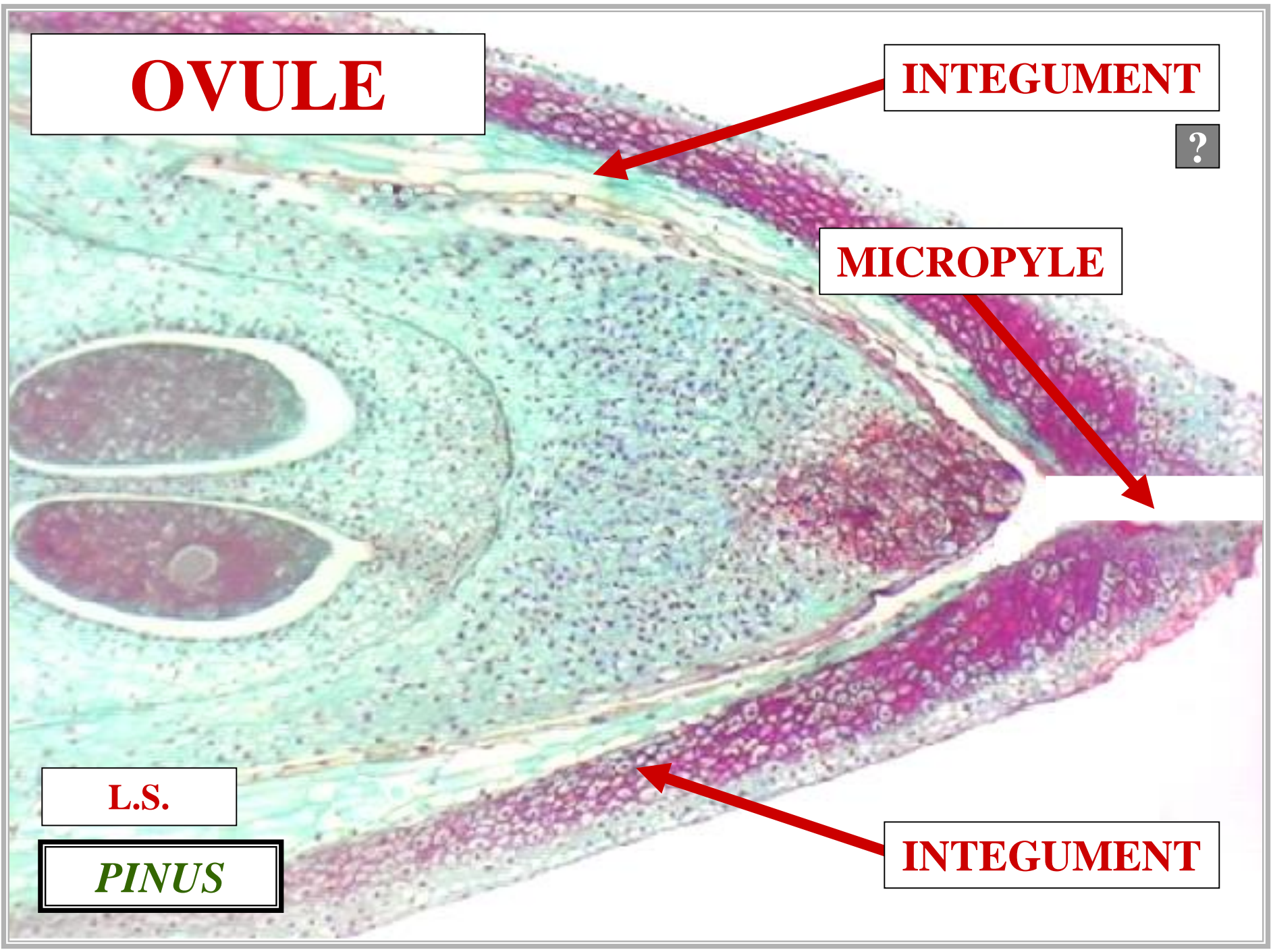
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MICROPYLE

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

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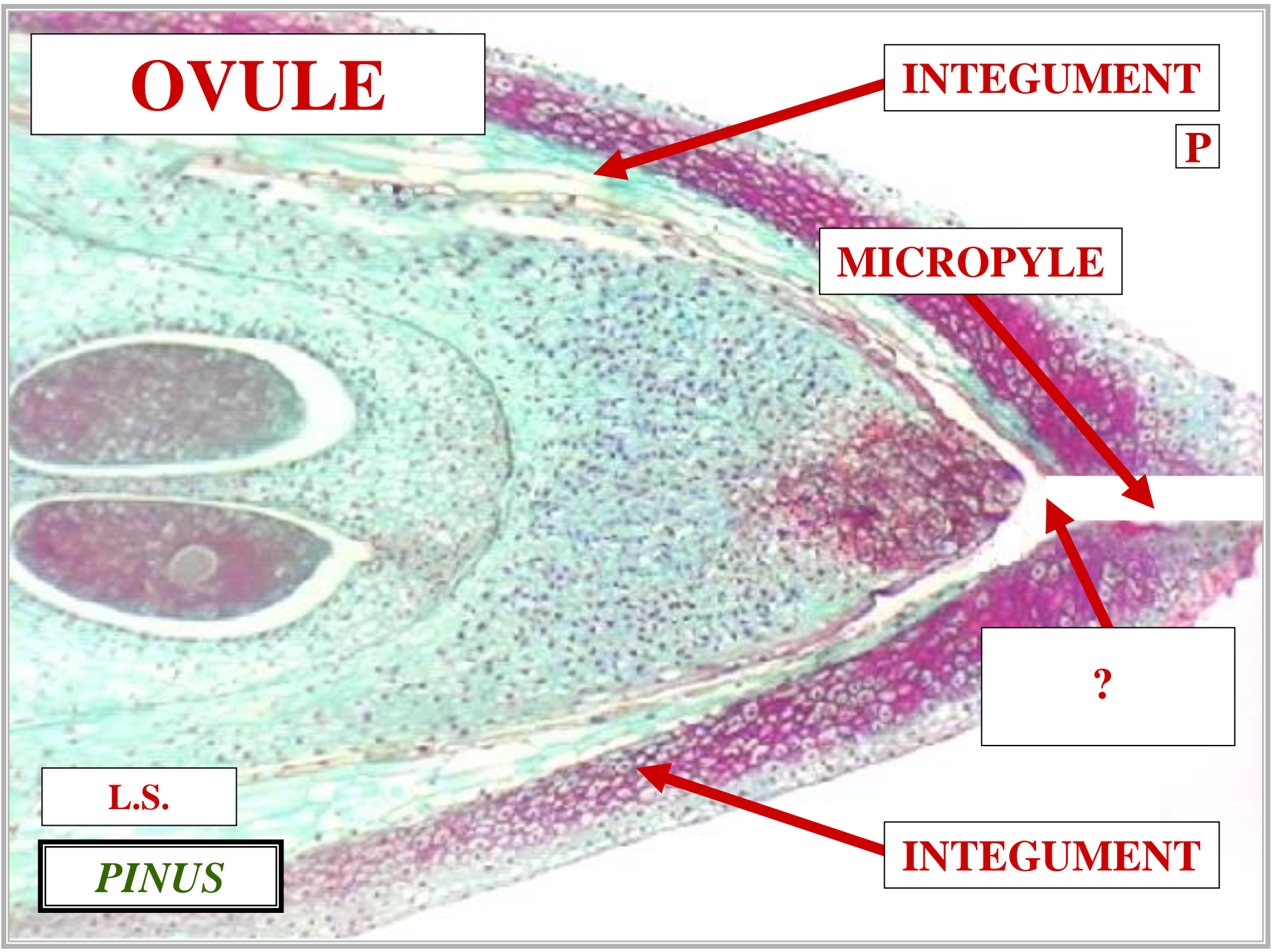
MICROPYLE

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L.S.

PINUS

INTEGUMENT



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INTEGUMENT

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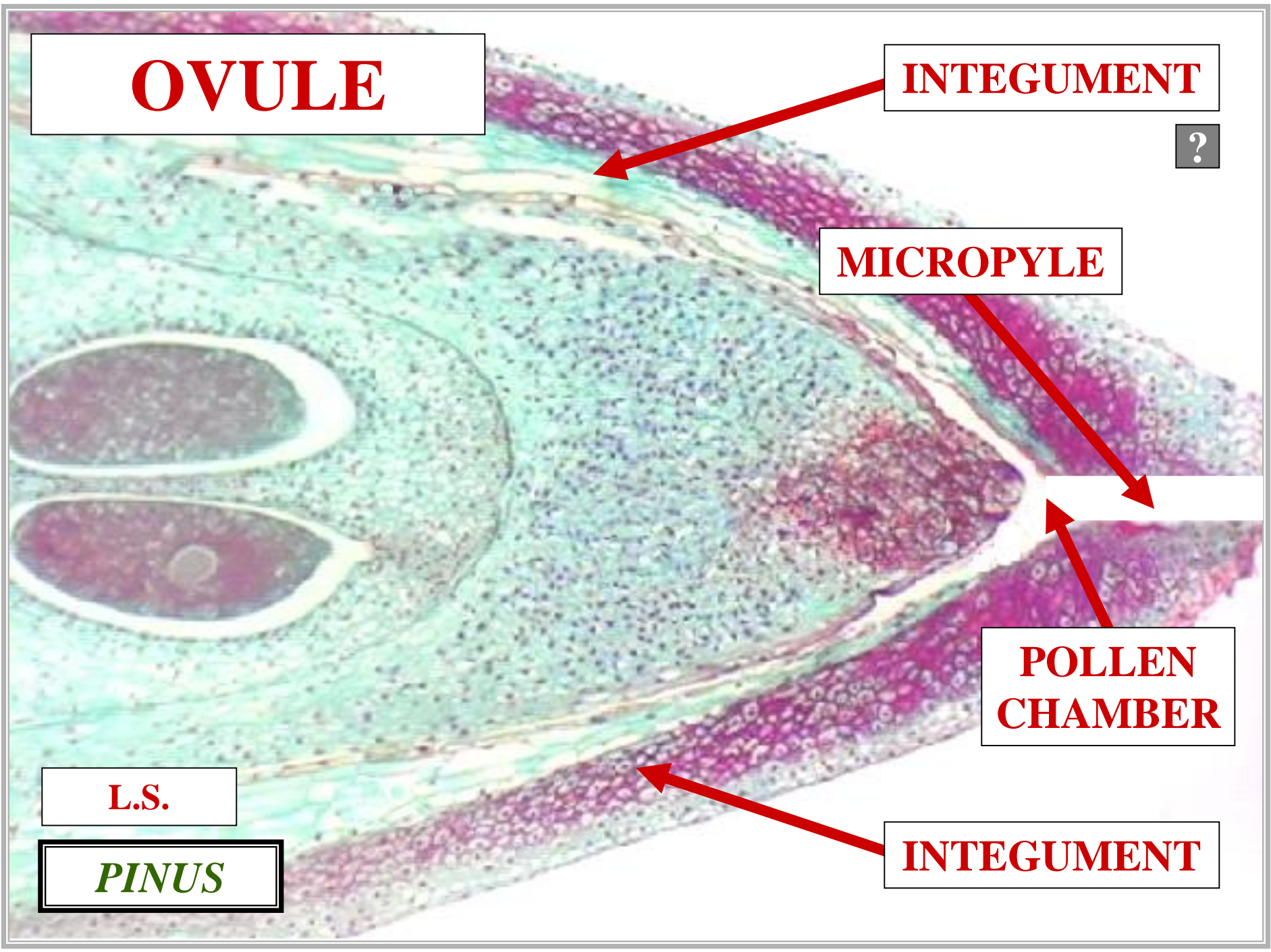
MICROPYLE

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

M

MICROPYLE

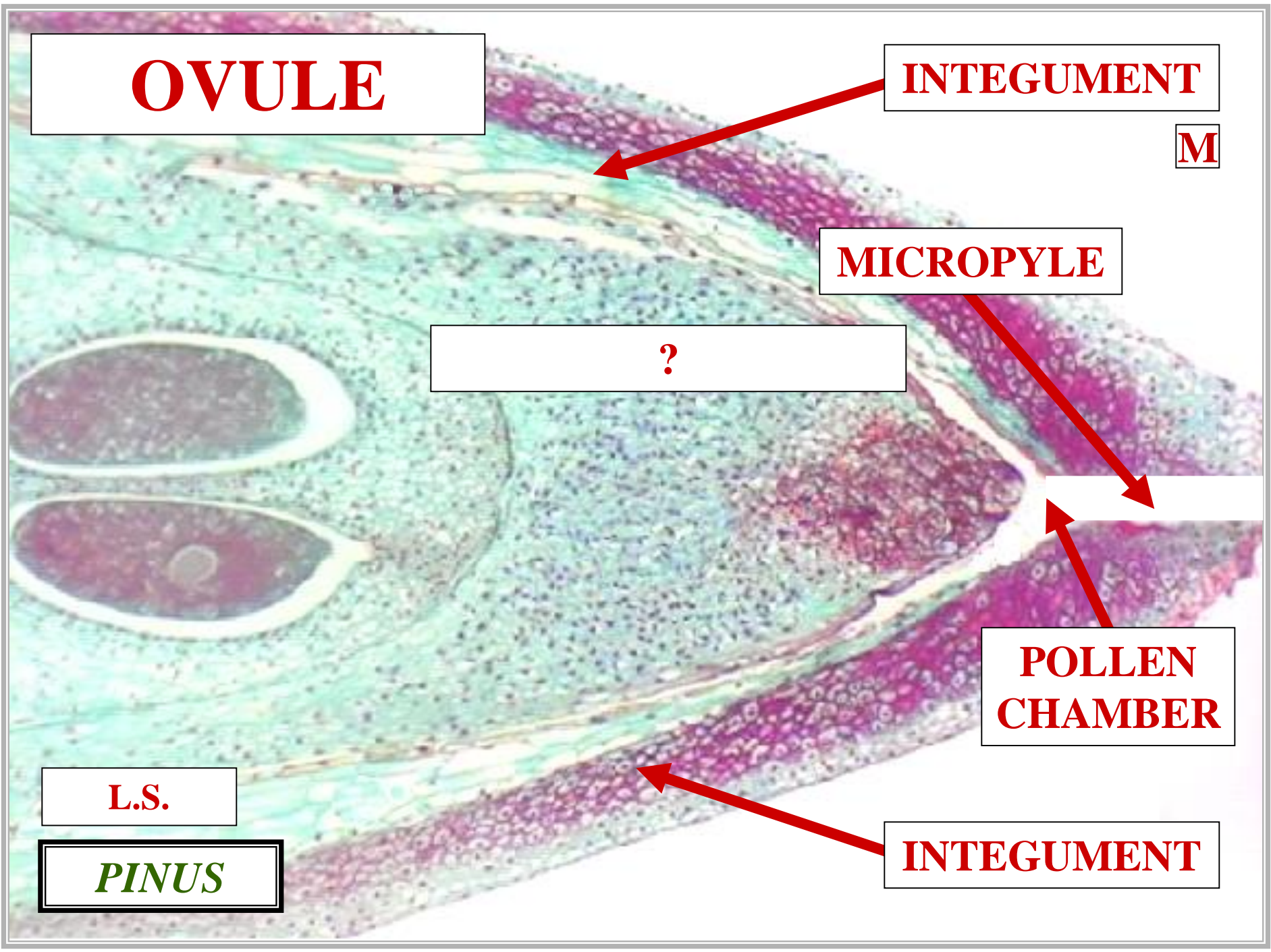
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**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

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MICROPYLE

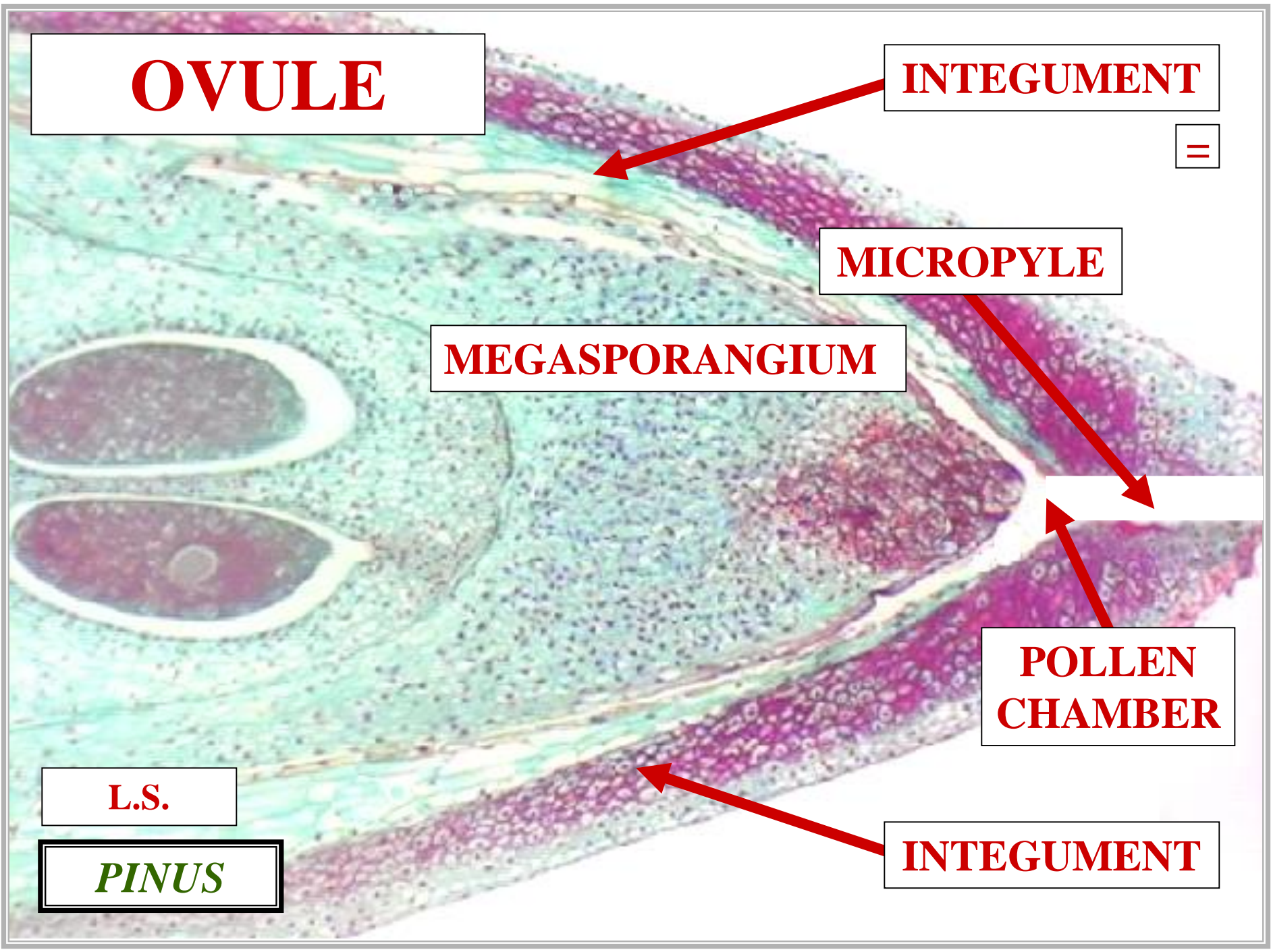
MEGASPORANGIUM

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

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MICROPYLE

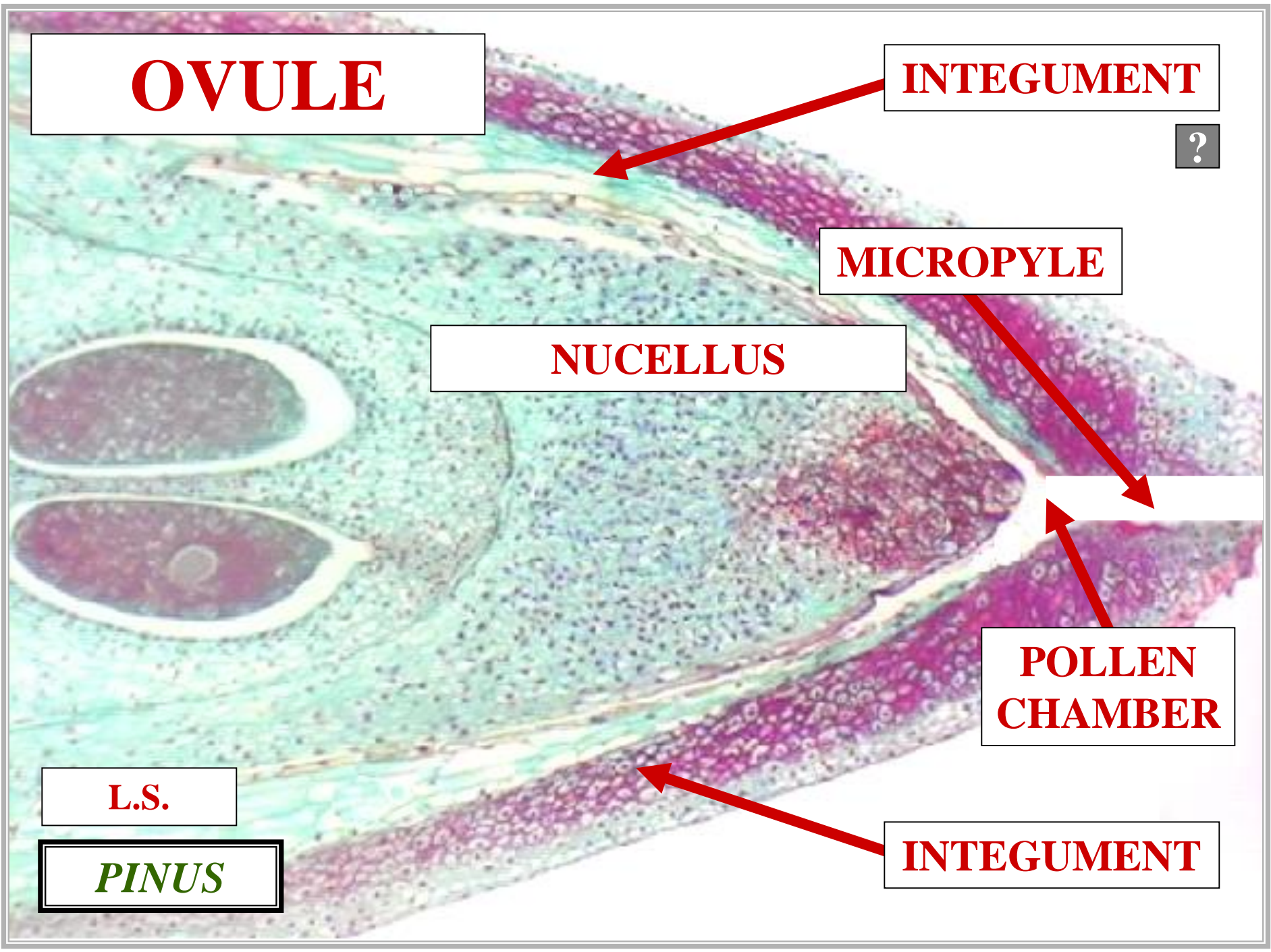
NUCELLUS

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

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MEGAGAMETOPHYTE

MICROPYLE

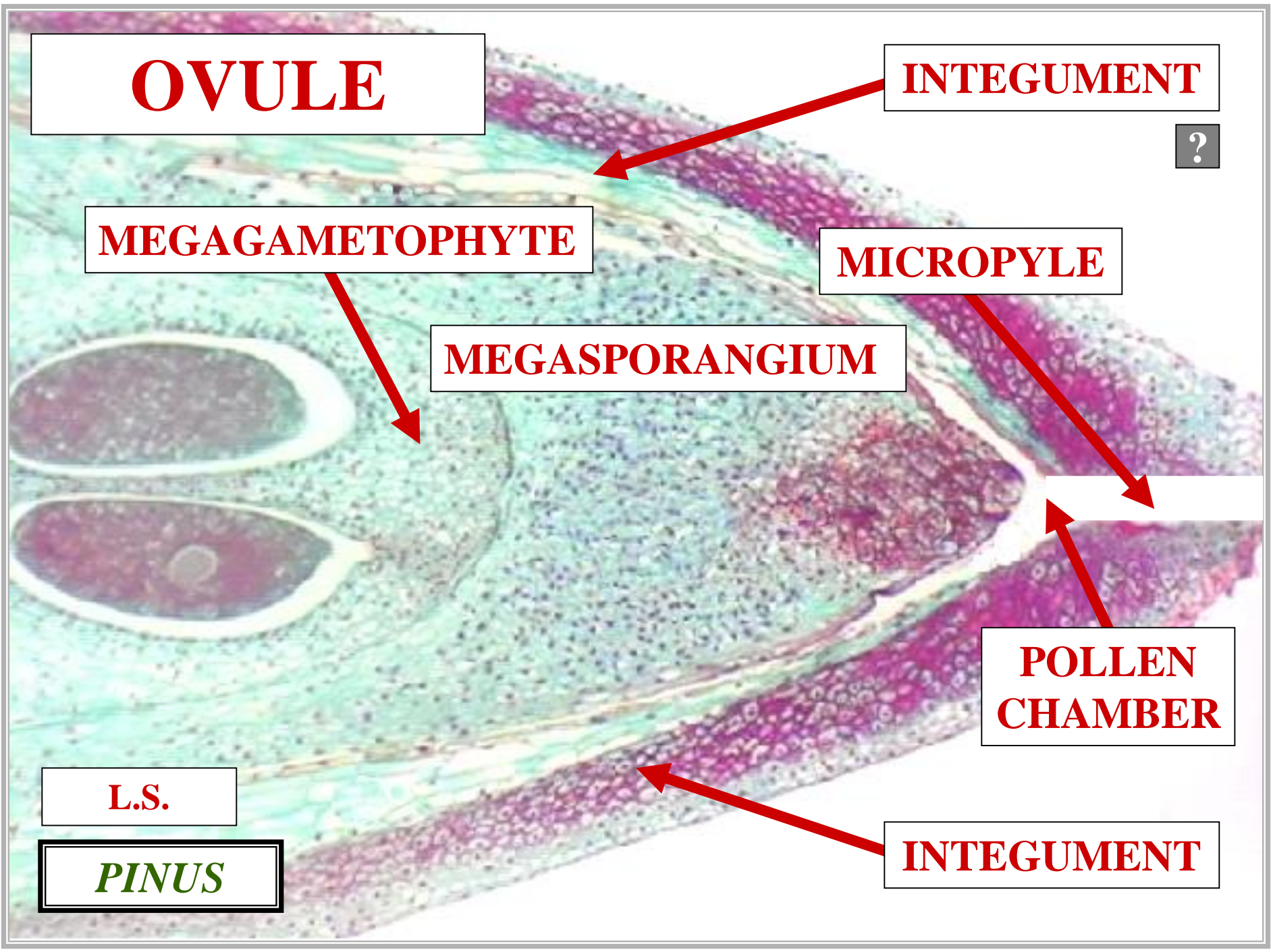
MEGASPORANGIUM

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

M

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

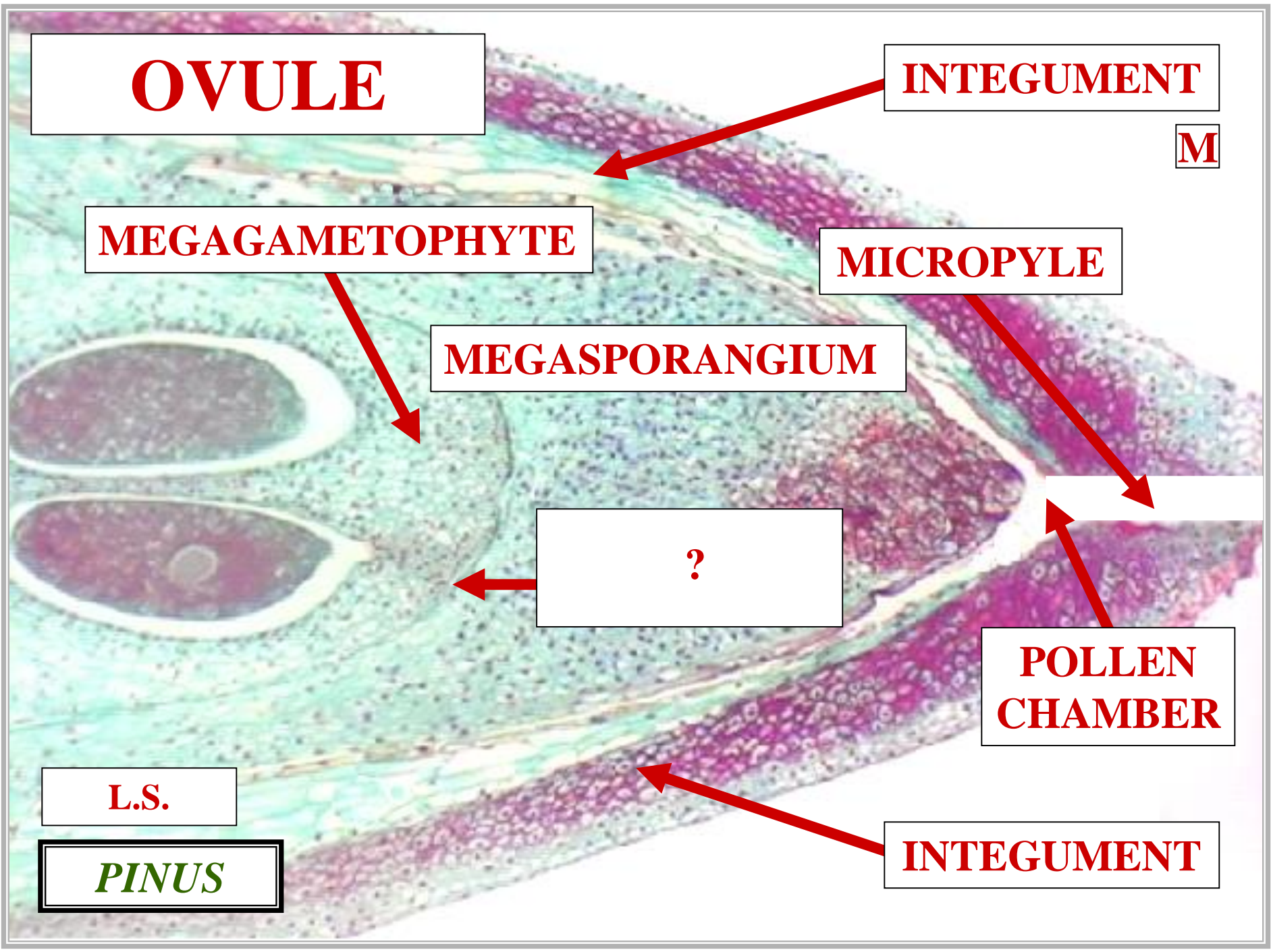
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**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

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MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

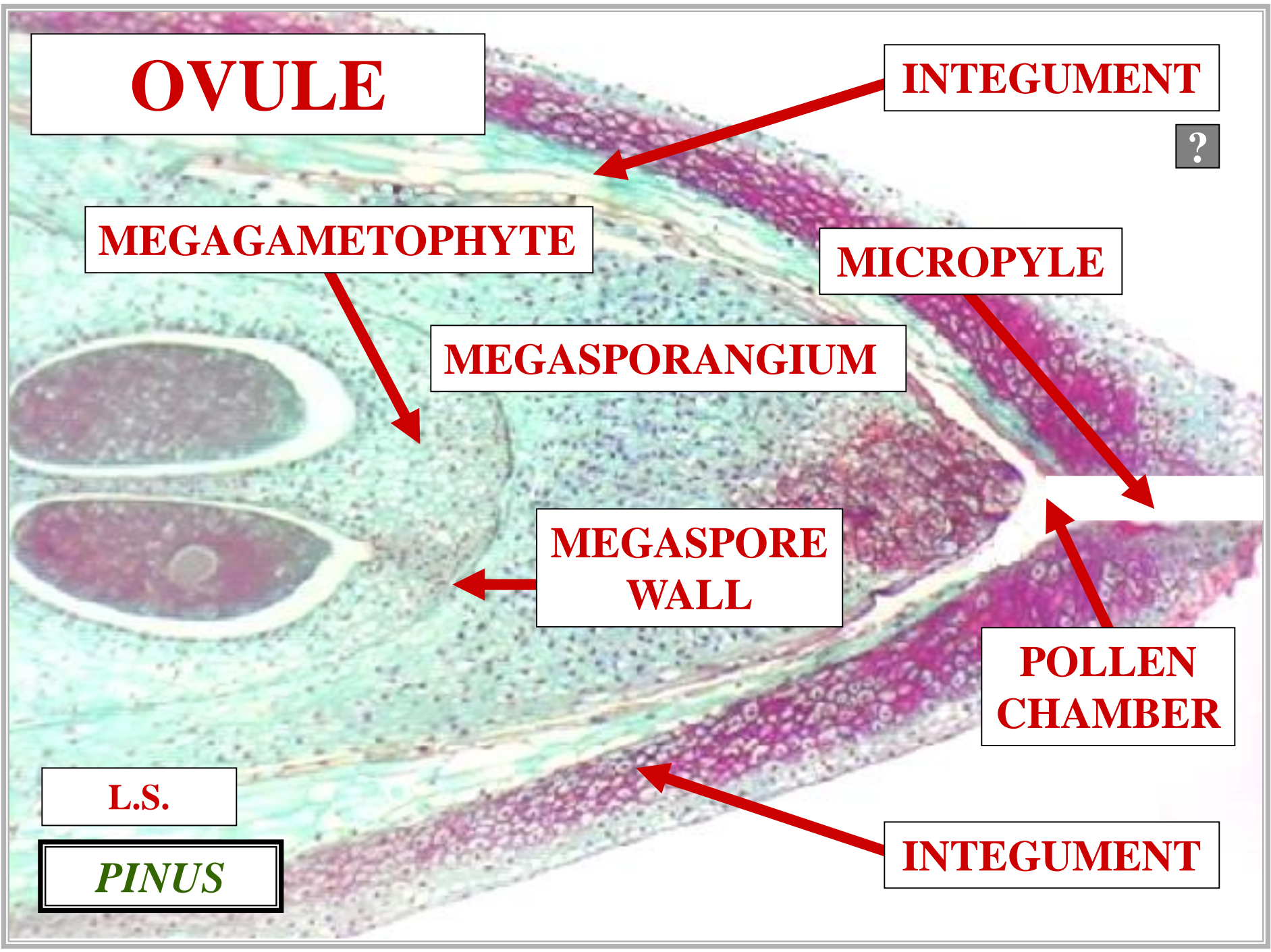
**MEGASPORE
WALL**

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

A

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

**MEGASPORE
WALL**

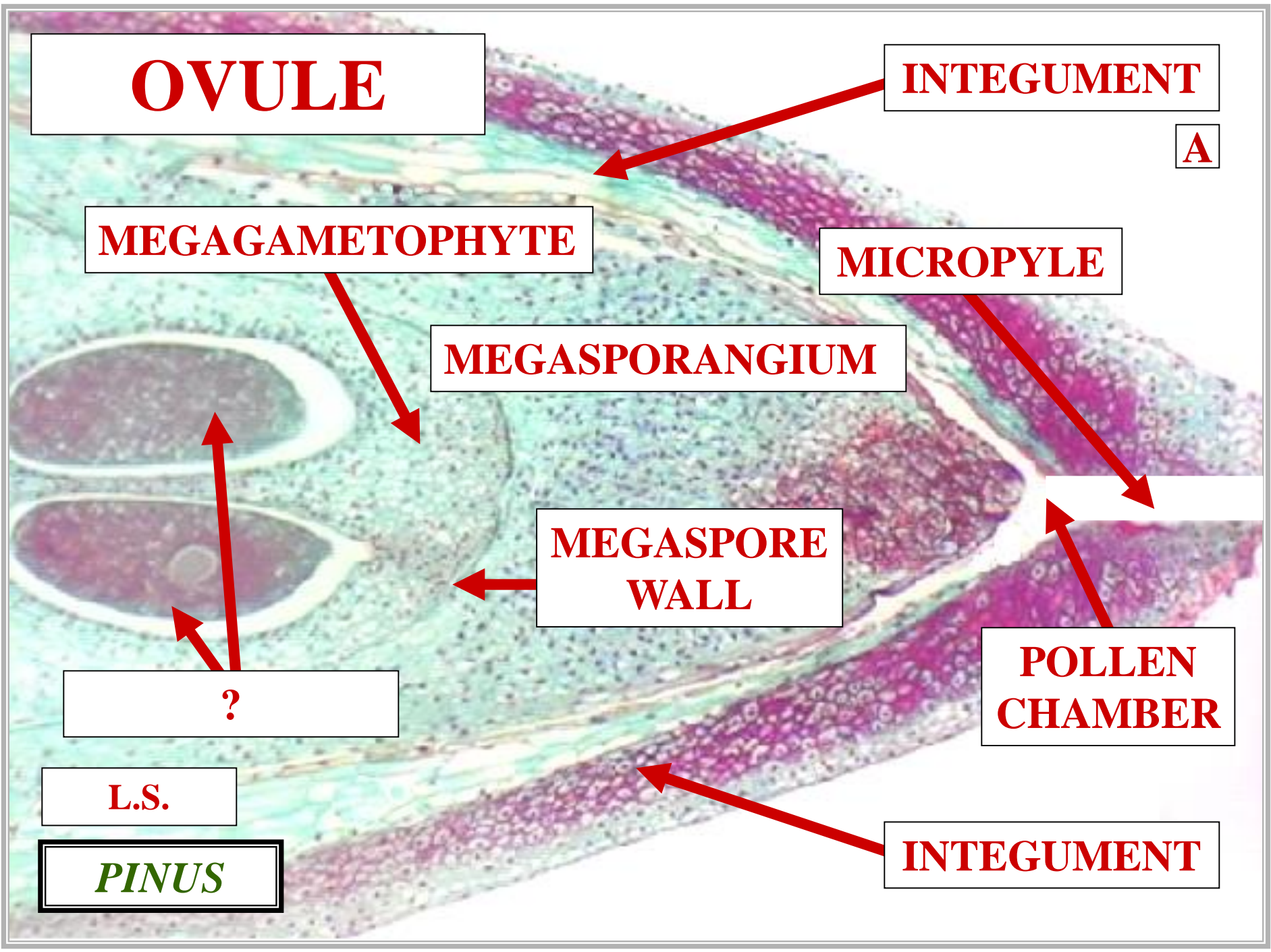
**POLLEN
CHAMBER**

?

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

**MEGASPORE
WALL**

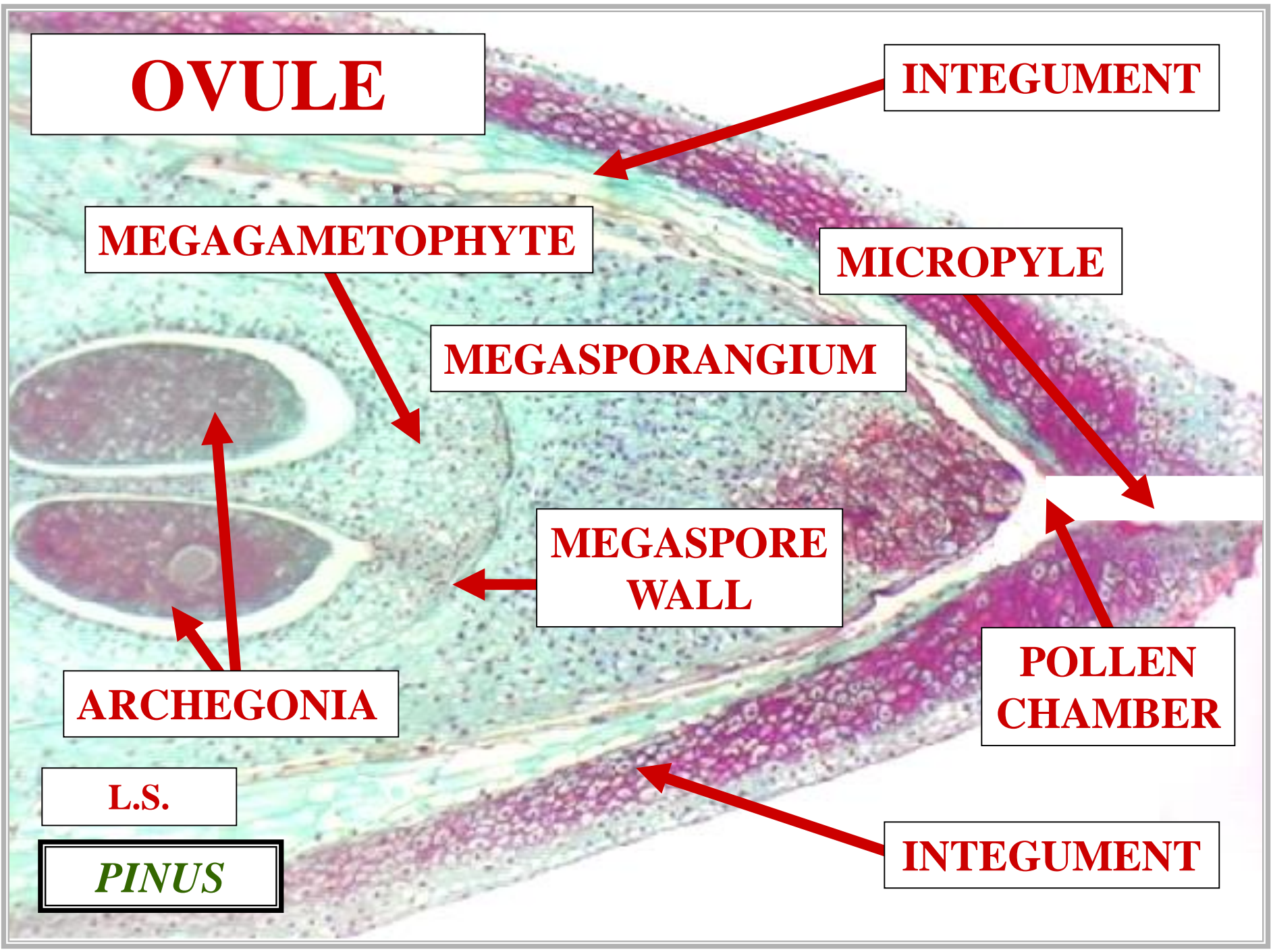
ARCHEGONIA

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

MEGASPORE WALL

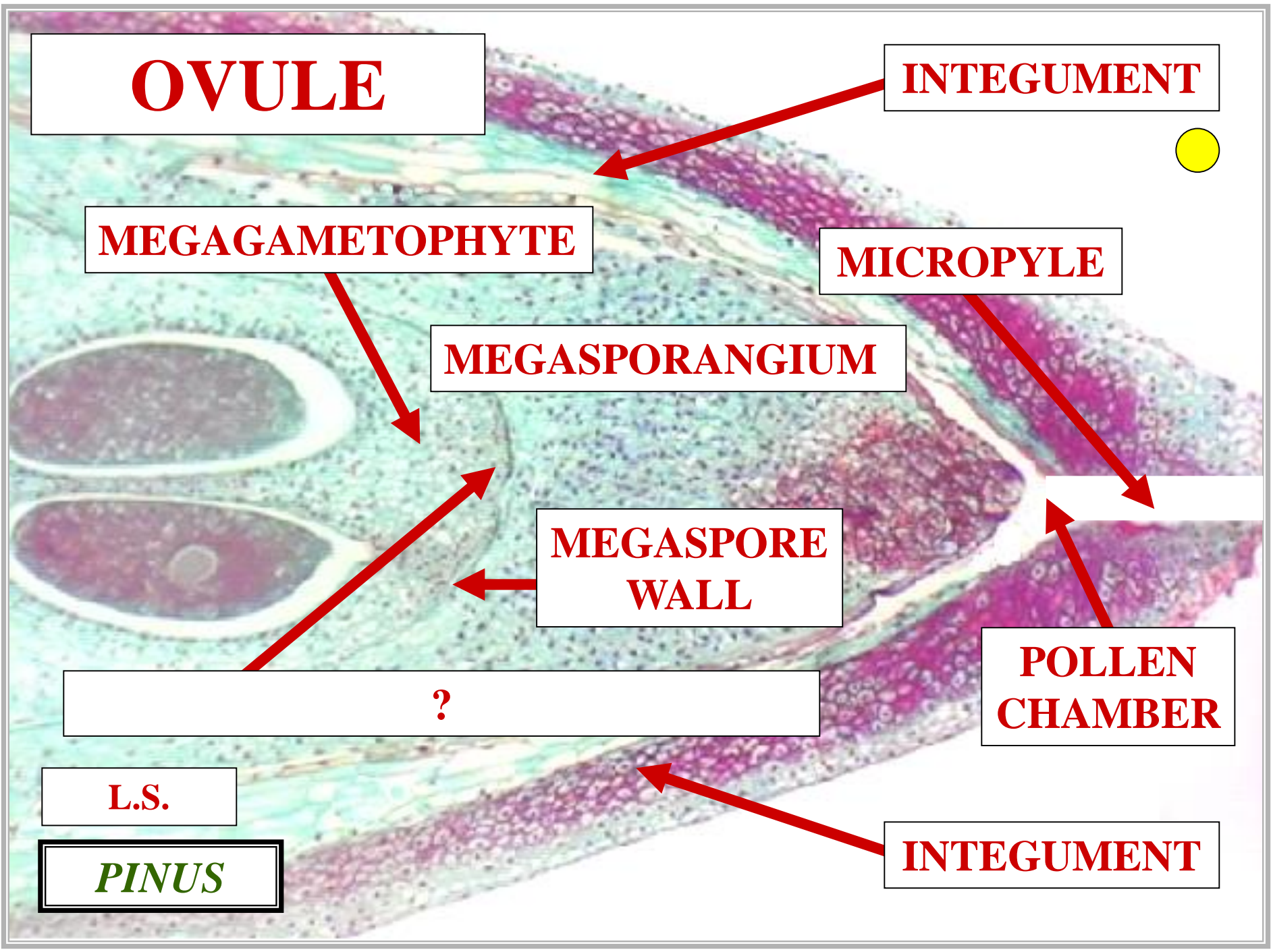
POLLEN CHAMBER

?

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

**MEGASPORE
WALL**

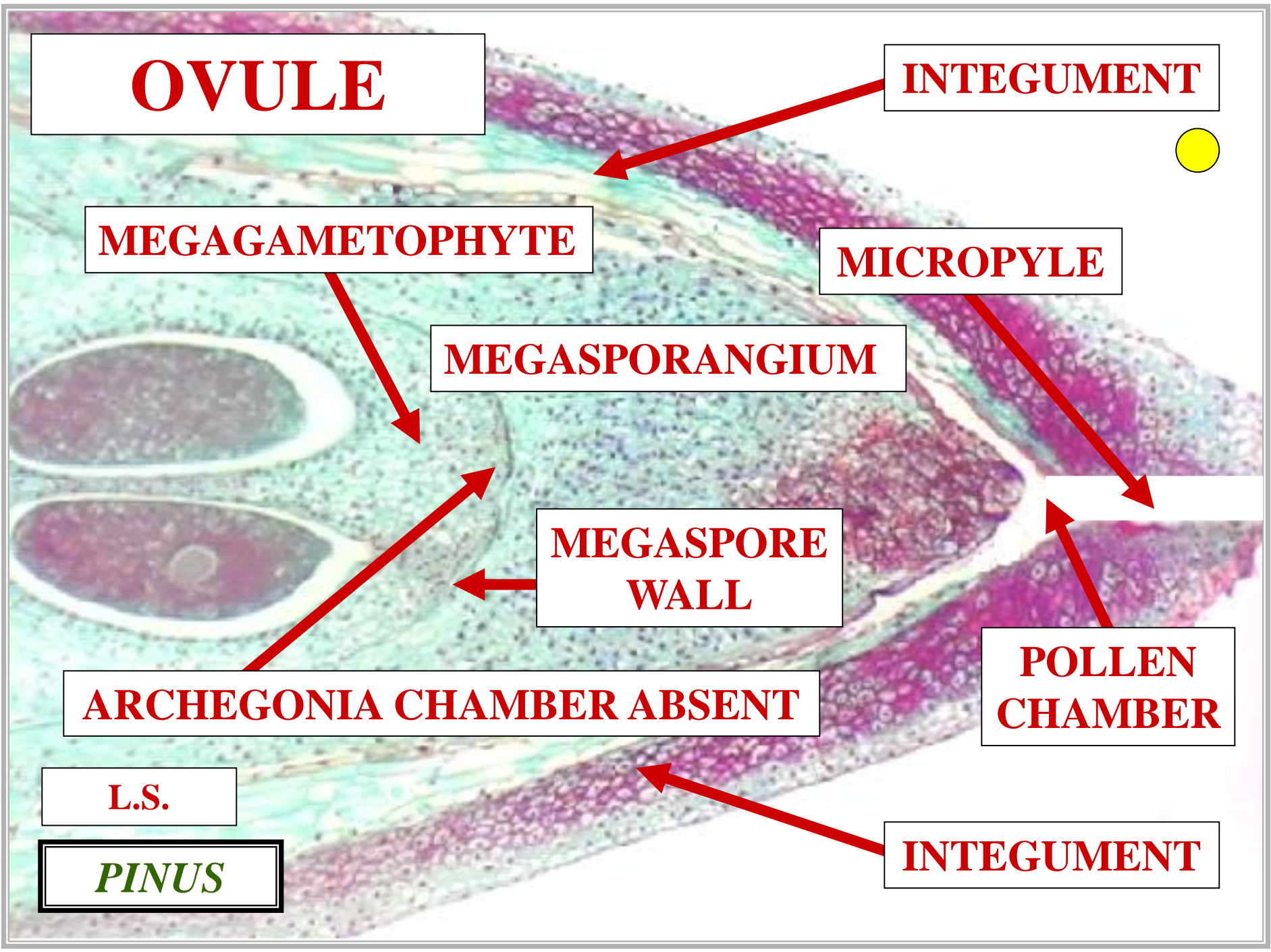
ARCHEGONIA CHAMBER ABSENT

**POLLEN
CHAMBER**

L.S.

PINUS

INTEGUMENT



OVULE

INTEGUMENT

PT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

1N

ENDOSPORIC

EGG

POLLEN GRAINS

L.S.

PINUS

● = POLLEN GRAIN

INTEGUMENT

OVULE

INTEGUMENT

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

1N

EGG

POLLEN TUBE

POLLEN GRAINS

L.S.

PINUS

● = POLLEN GRAIN

INTEGUMENT

OVULE

INTEGUMENT

S

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

1N

1N

SPERM

EGG

POLLEN GRAINS

L.S.

PINUS

● = POLLEN GRAIN

INTEGUMENT

OVULE

INTEGUMENT

?

MEGAGAMETOPHYTE

MICROPYLE

MEGASPORANGIUM

2N

2N

POLLEN TUBE

SYNGAMY

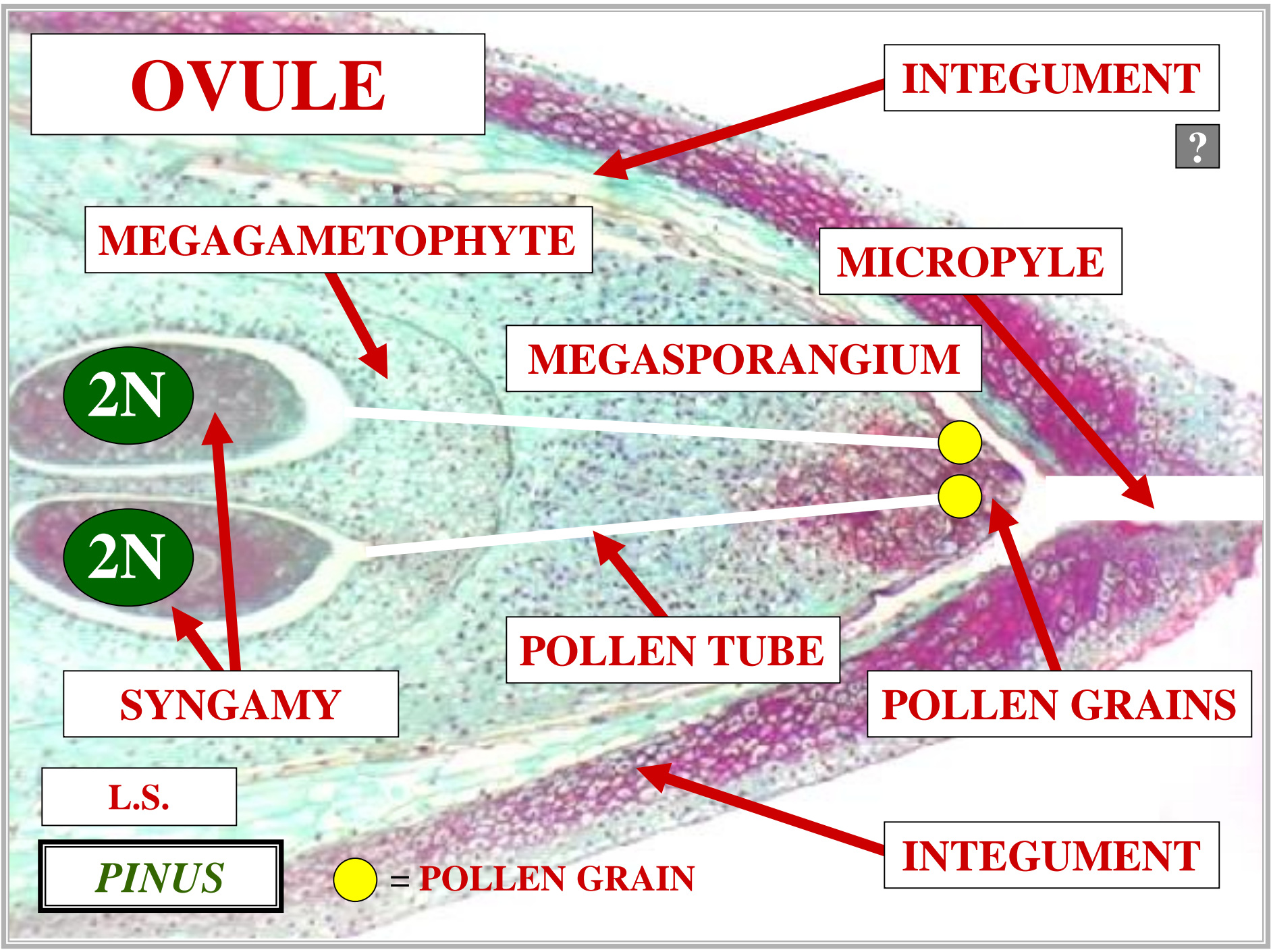
POLLEN GRAINS

L.S.

PINUS

● = **POLLEN GRAIN**

INTEGUMENT



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INTEGUMENT

S

MEGAGAMETOPHYTE

MICROPYLE

2N

MEGASPORANGIUM

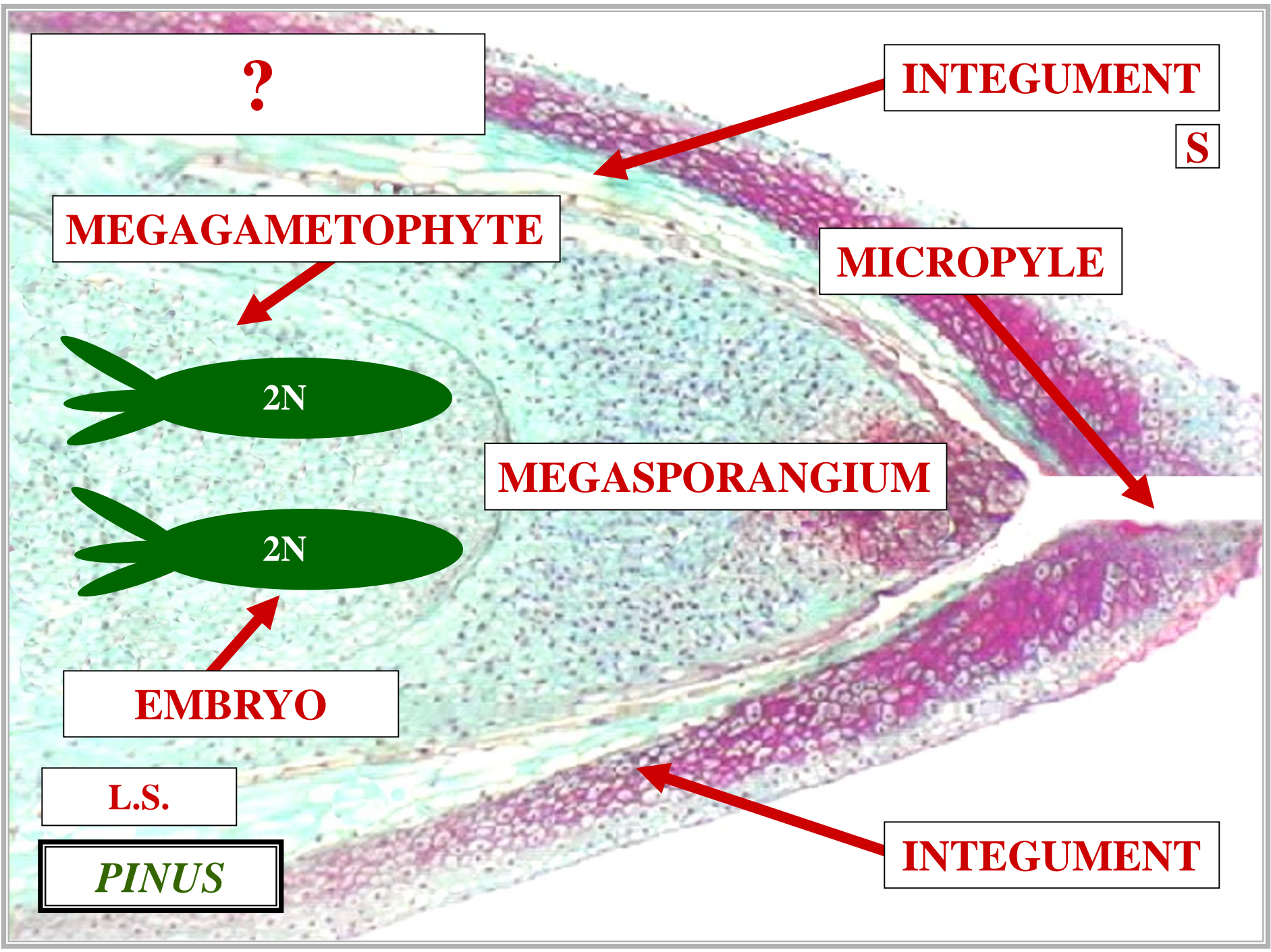
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EMBRYO

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SEED

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MEGAGAMETOPHYTE

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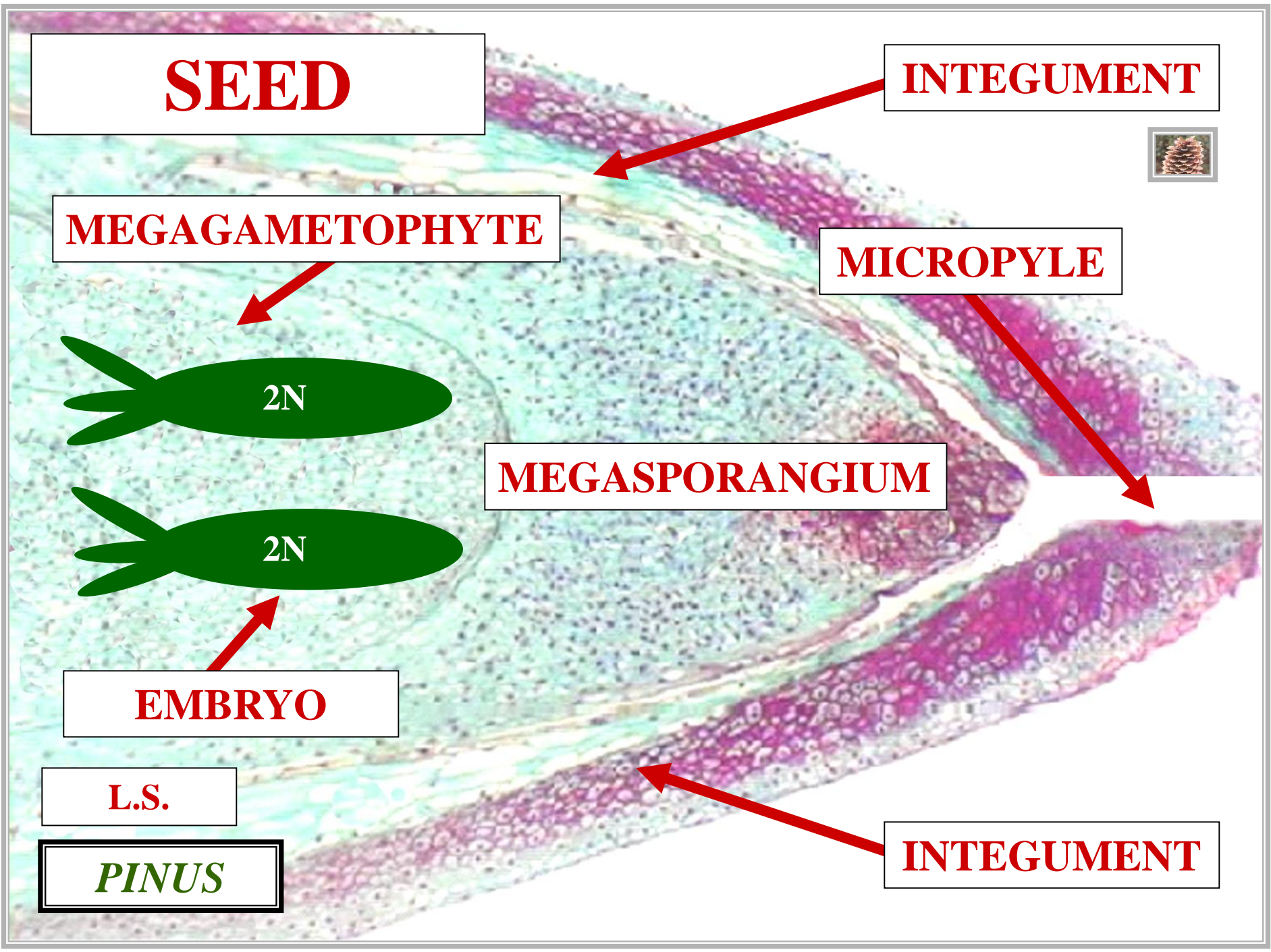
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MEGASTROBILUS



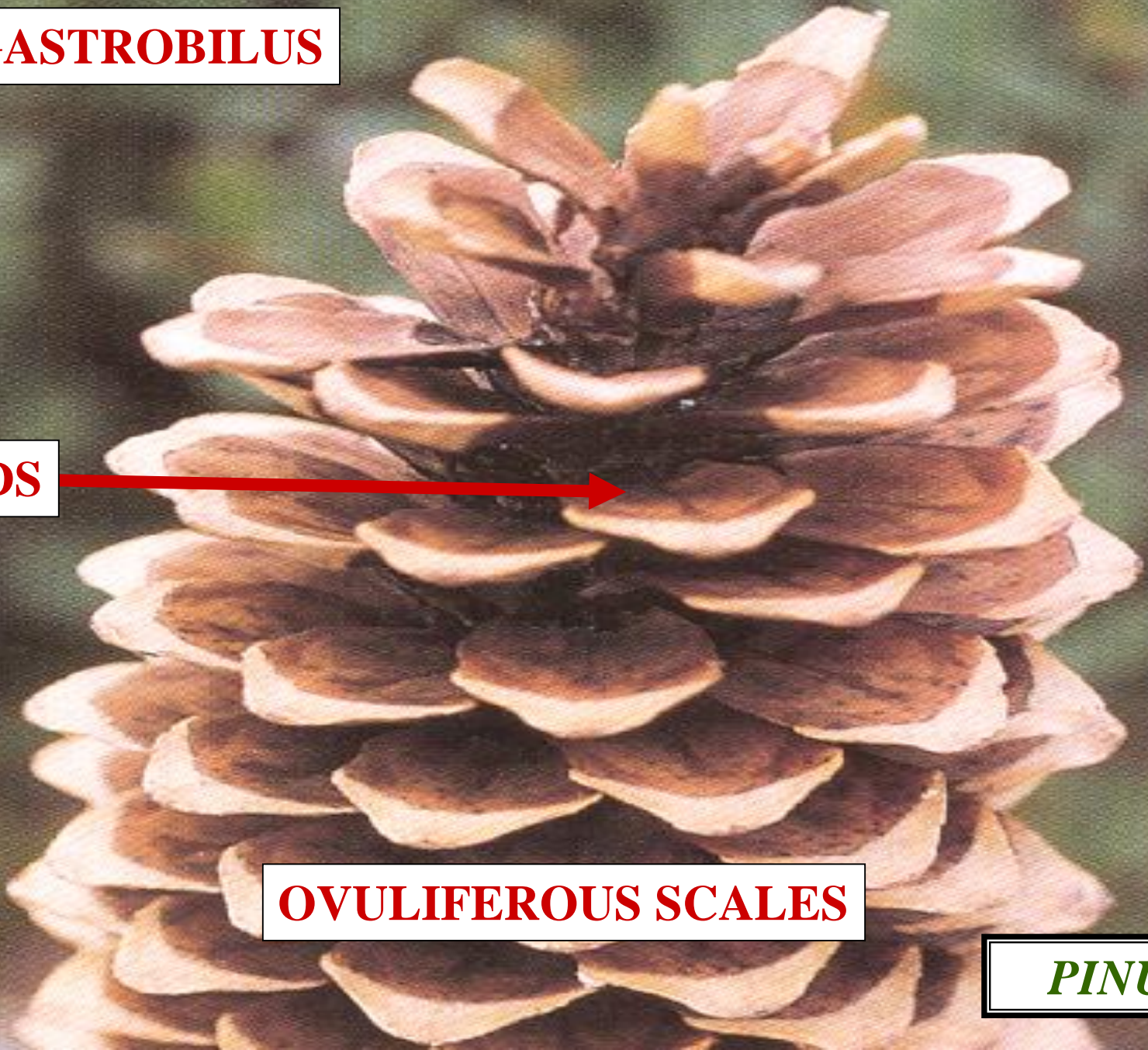
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SEEDS



OVULIFEROUS SCALES

PINUS





SEED DISPERSAL



SEED

INTEGUMENT WING

WIND DISPERSAL

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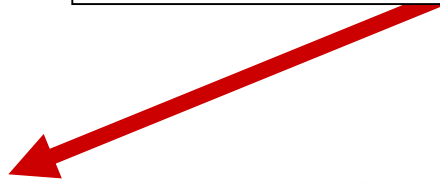
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LIFE CYCLE

PG 442-443

PINUS

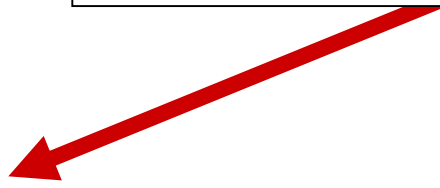
MATURE SPOROPHYTE



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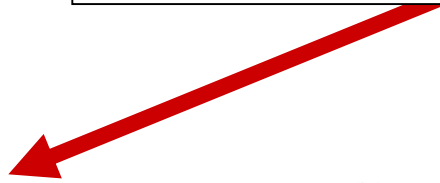


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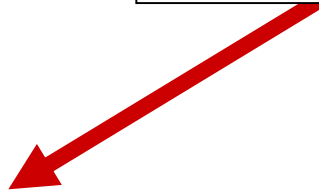
MICROSTROBILI



PINUS



**MICROSTROBILI
LOWER BRANCHES**





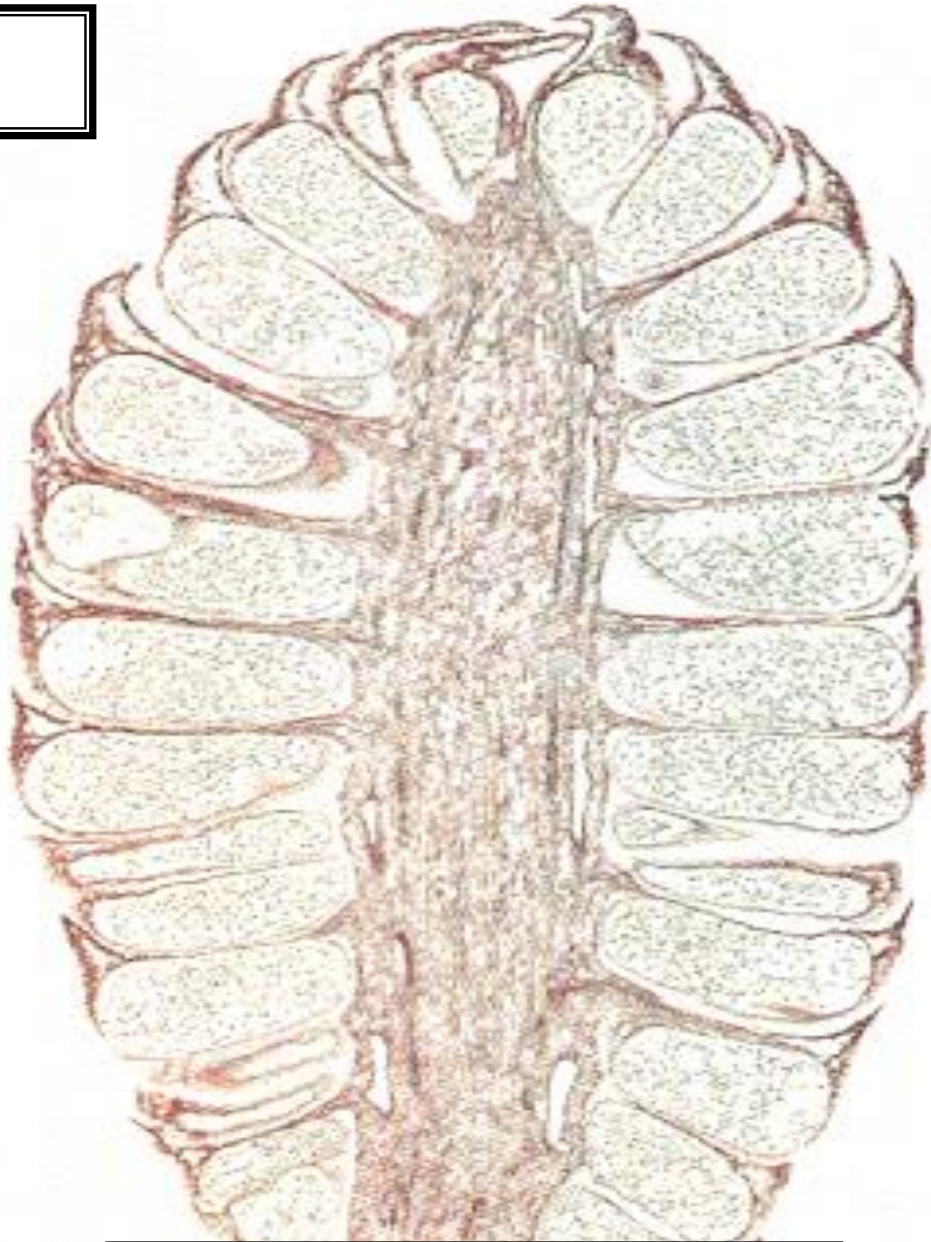
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PINUS

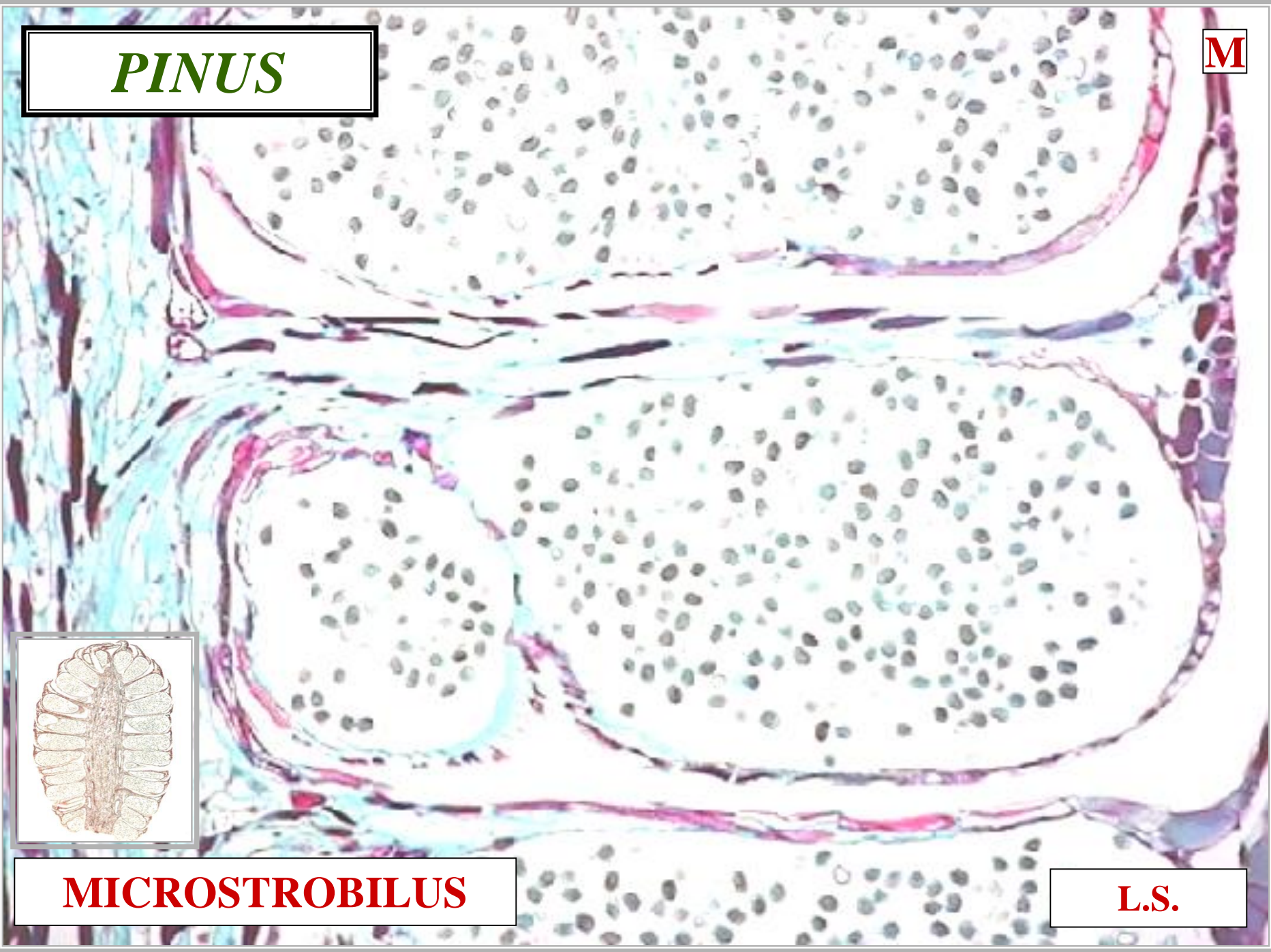


MICROSTROBILUS

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PINUS

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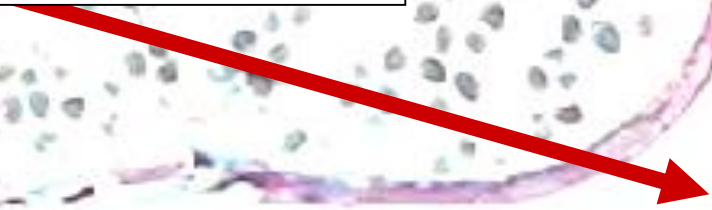


MICROSTROBILUS

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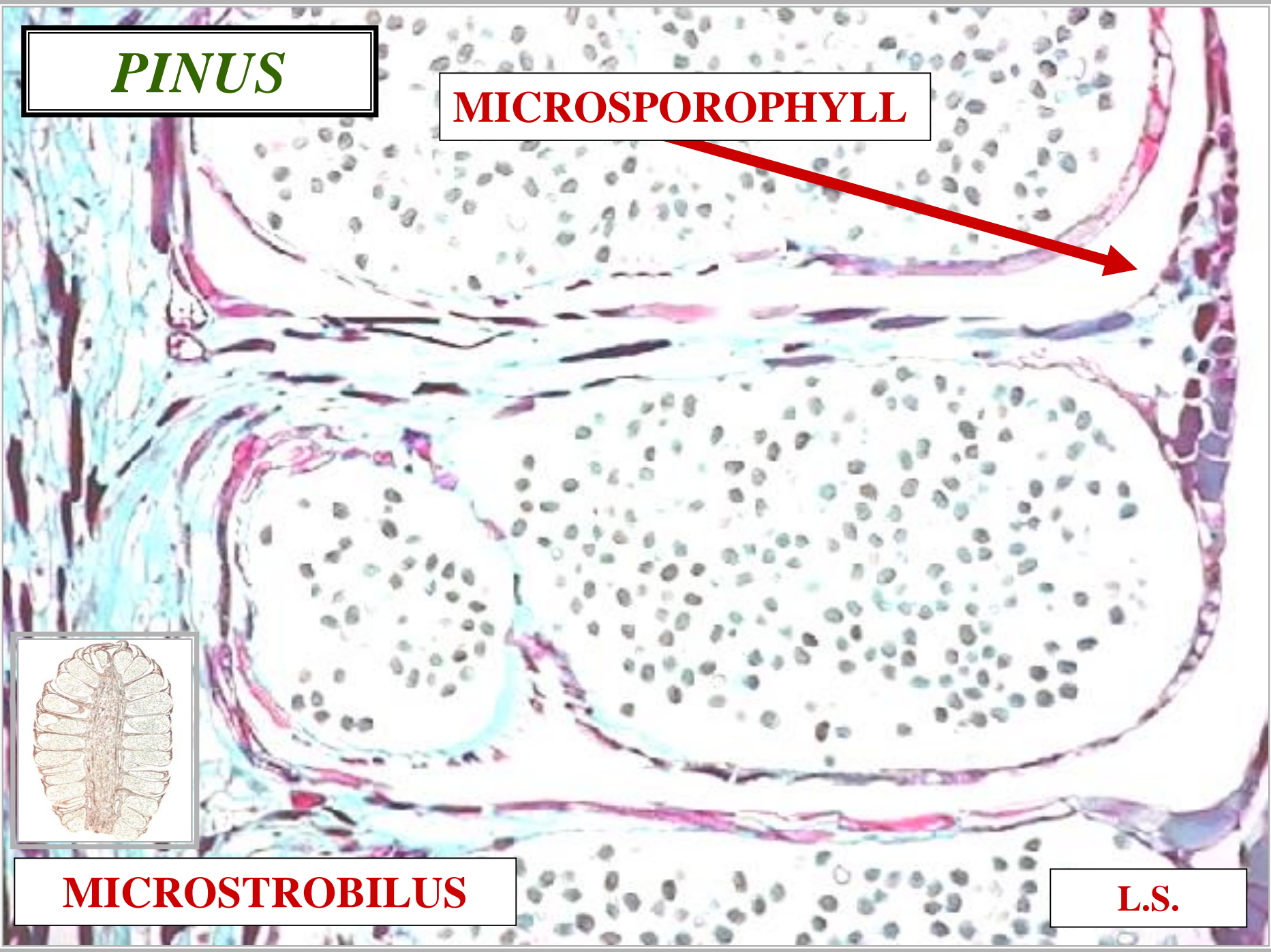
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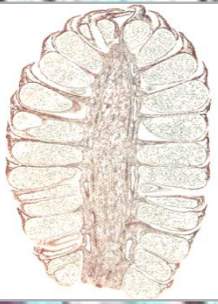
MICROSTROBILUS

L.S.



PINUS

MICROSPORANGIUM



MICROSTROBILUS

L.S.

