

***PINUS***

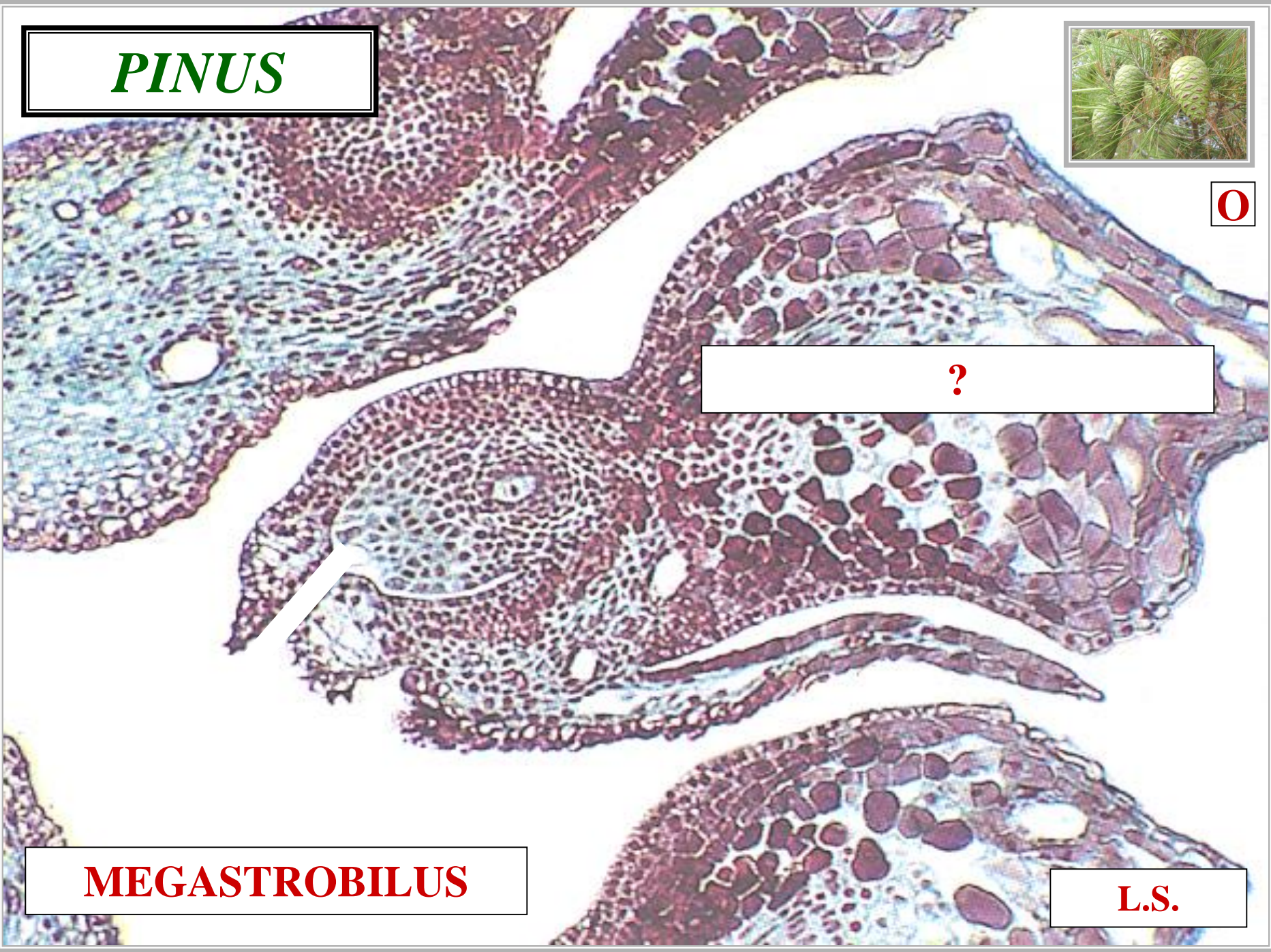


**O**

**?**

**MEGASTROBILUS**

**L.S.**



***PINUS***

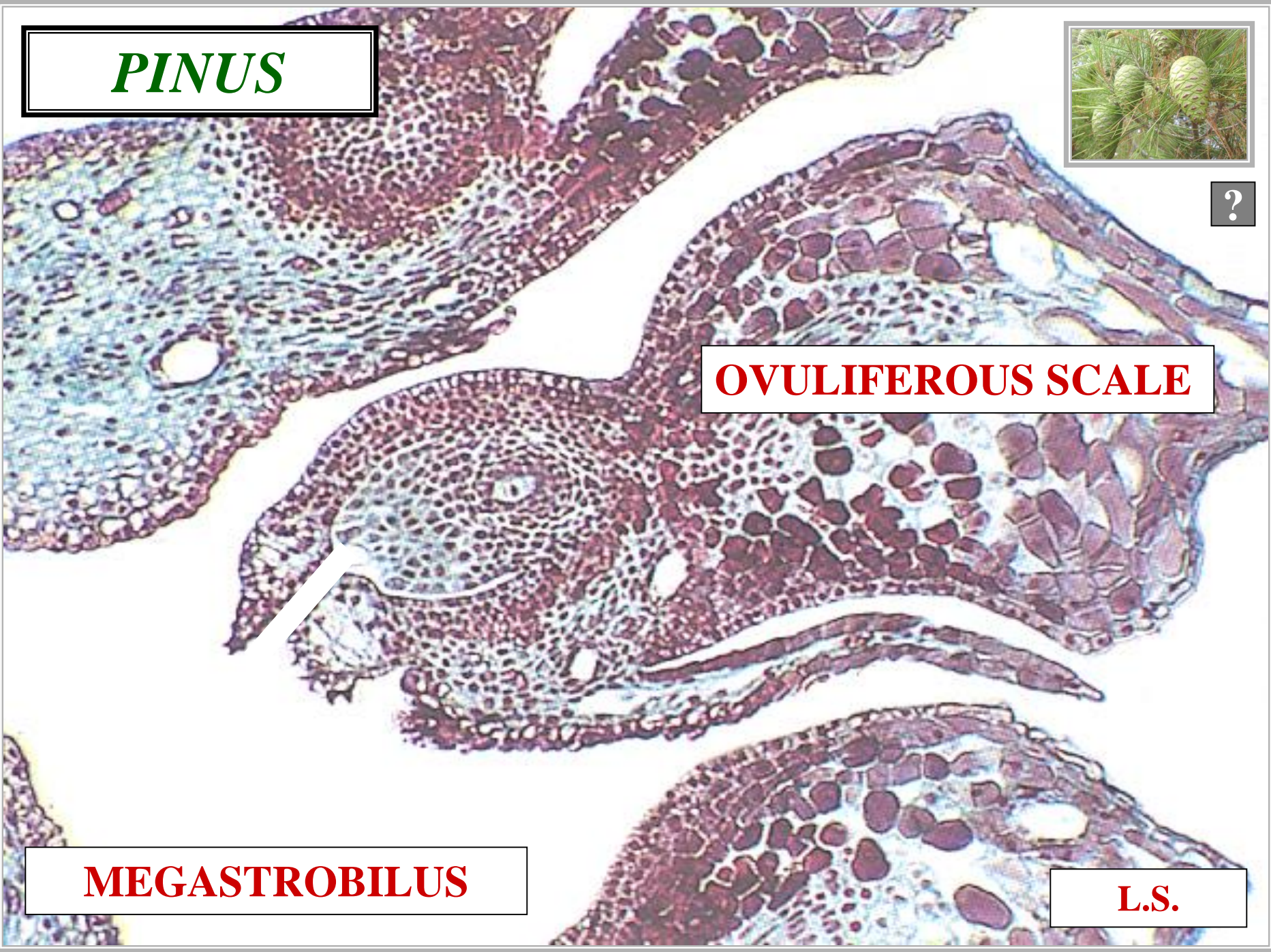


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**OVULIFEROUS SCALE**

**MEGASTROBILUS**

**L.S.**



***PINUS***



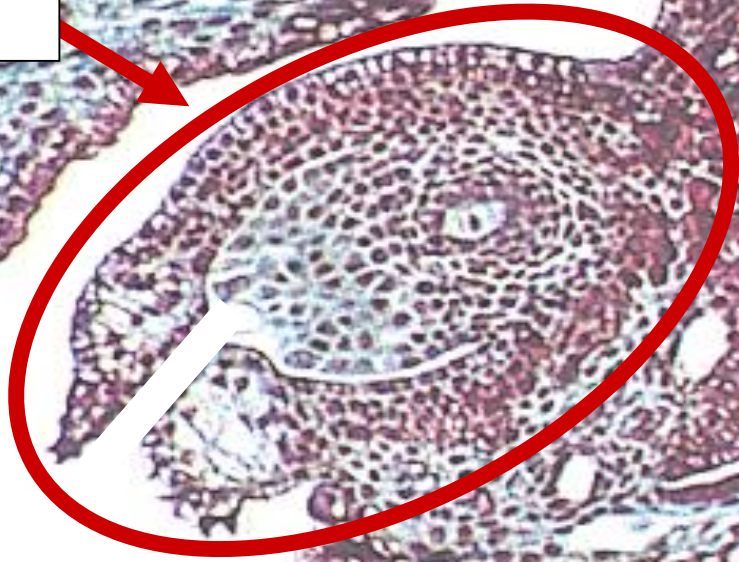
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**?**

**OVULIFEROUS SCALE**

**MEGASTROBILUS**

**L.S.**



***PINUS***



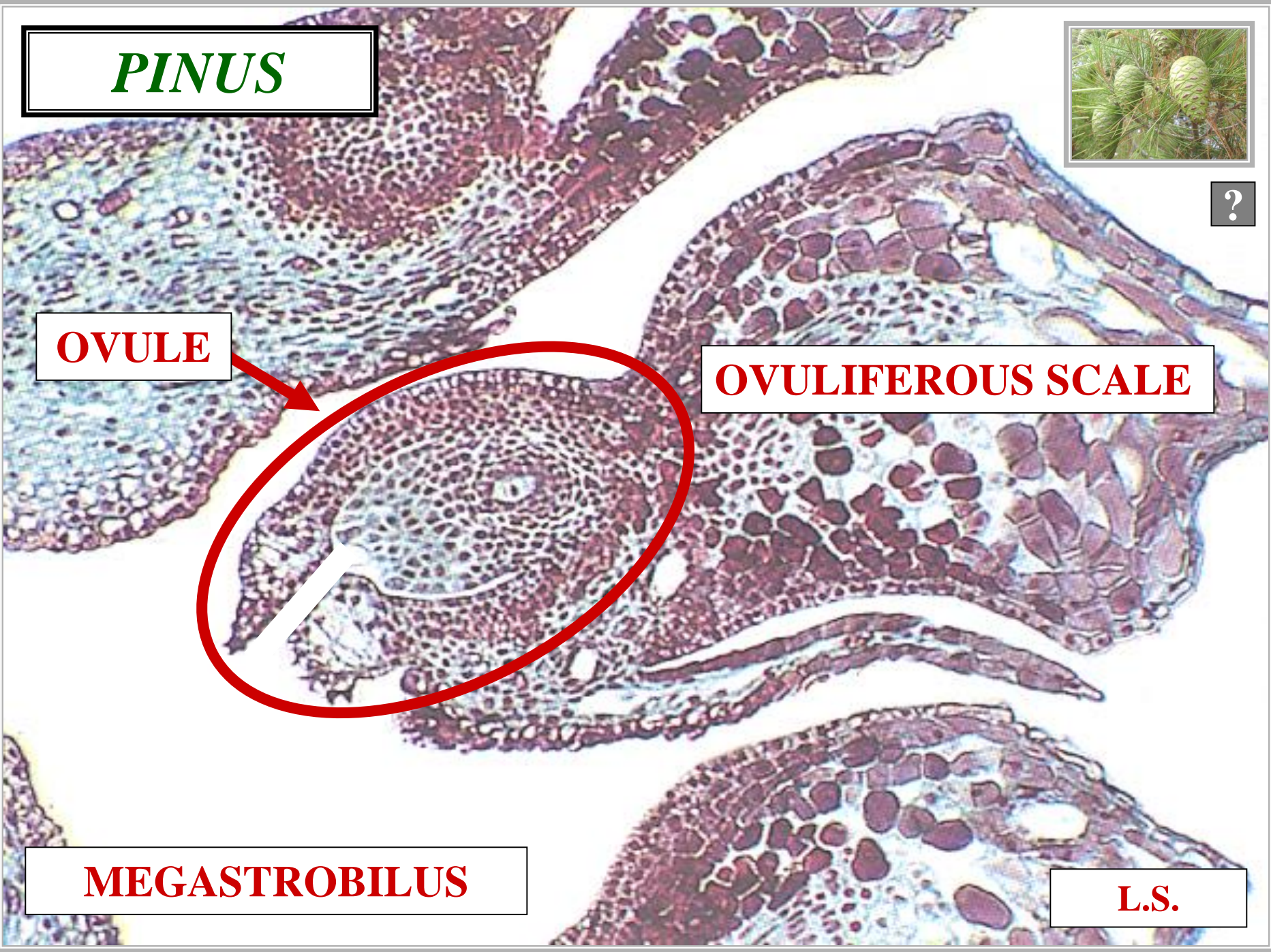
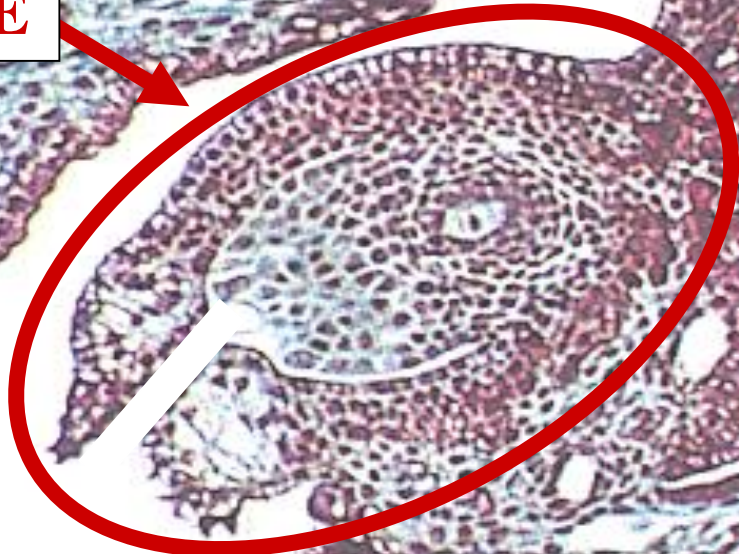
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**OVULE**

**OVULIFEROUS SCALE**

**MEGASTROBILUS**

**L.S.**



***PINUS***



**I**

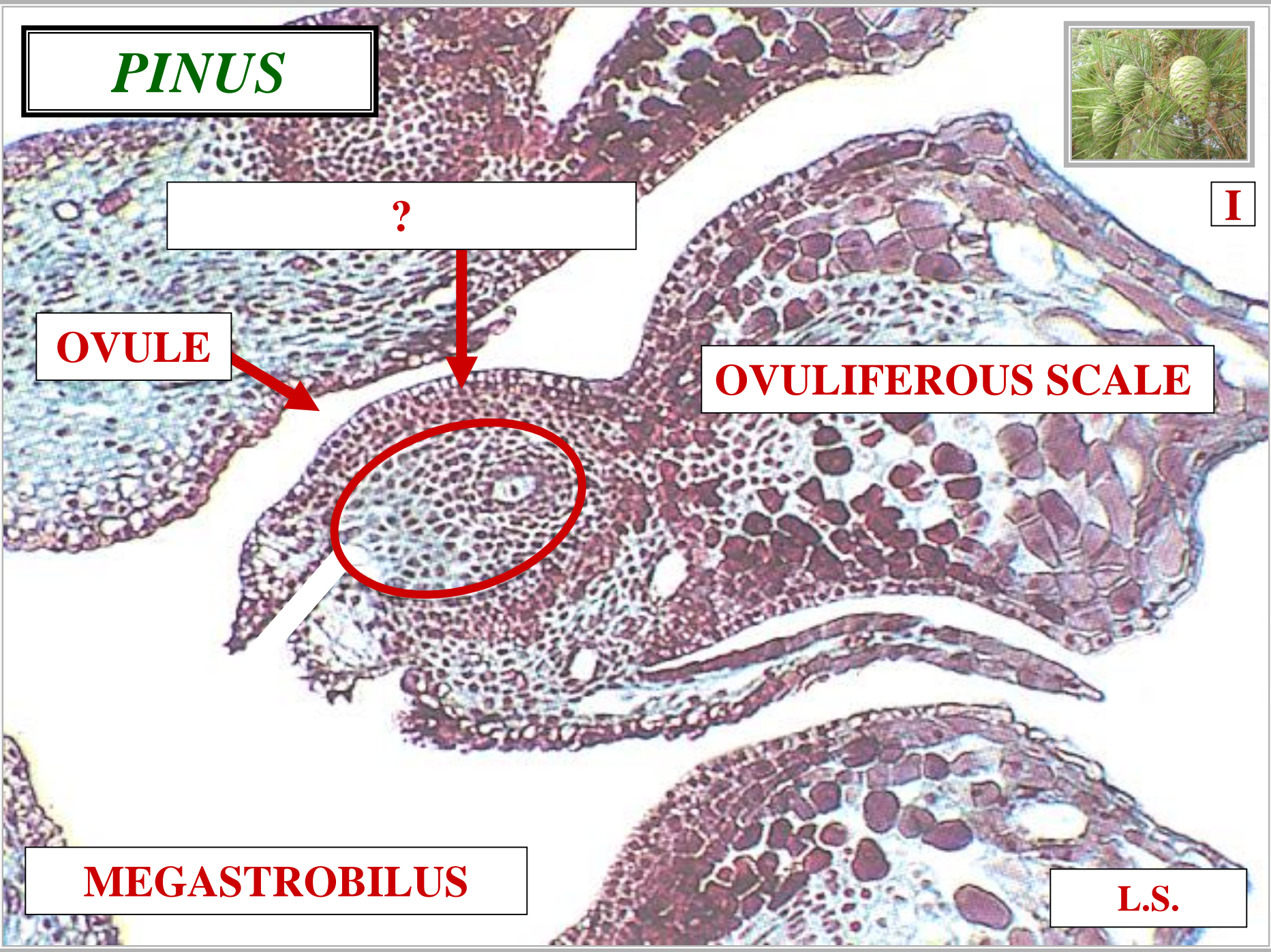
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**OVULE**

**OVULIFEROUS SCALE**

**MEGASTROBILUS**

**L.S.**



***PINUS***



?

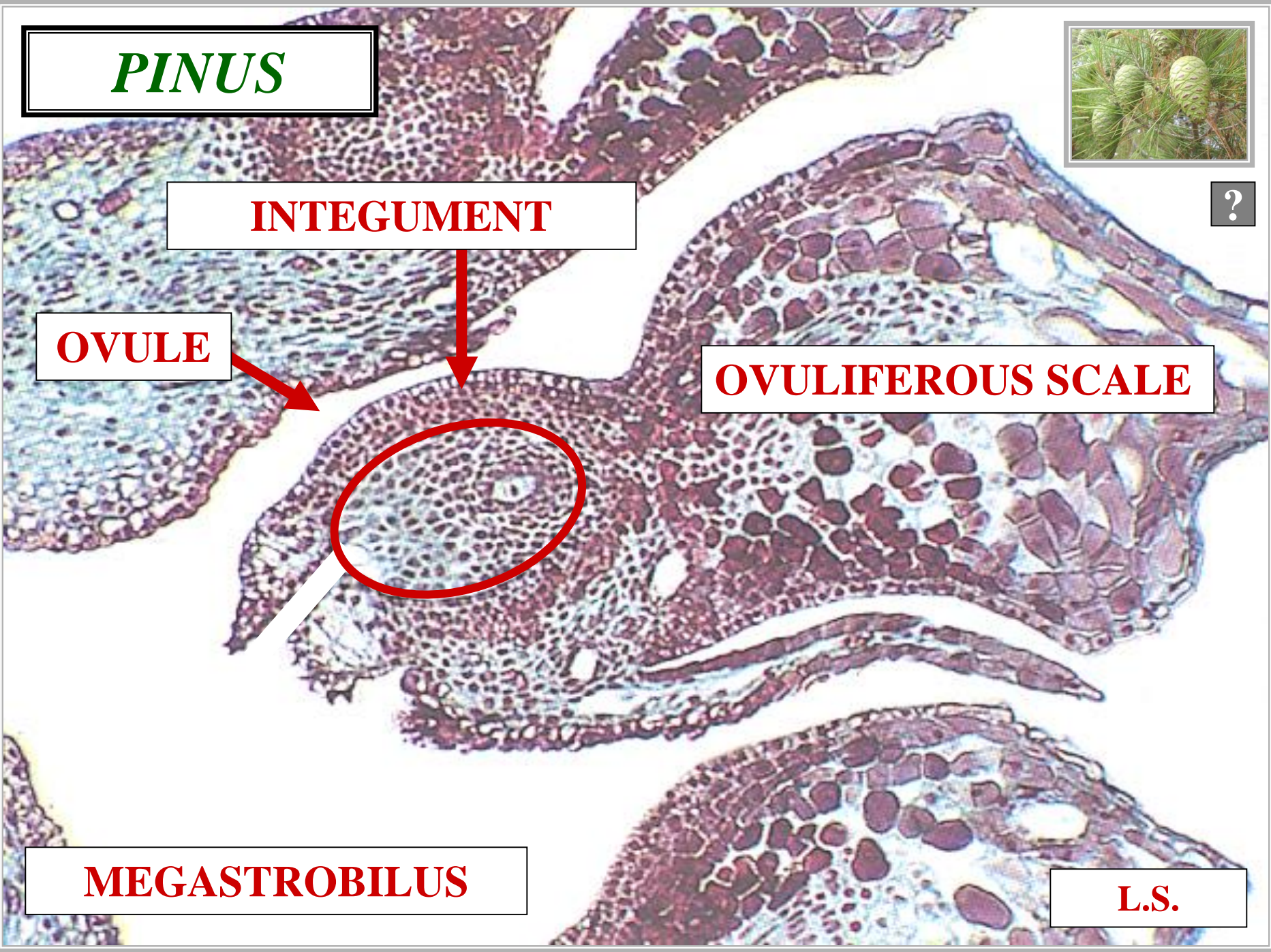
**INTEGUMENT**

**OVULE**

**OVULIFEROUS SCALE**

**MEGASTROBILUS**

**L.S.**



***PINUS***



**M**

**INTEGUMENT**

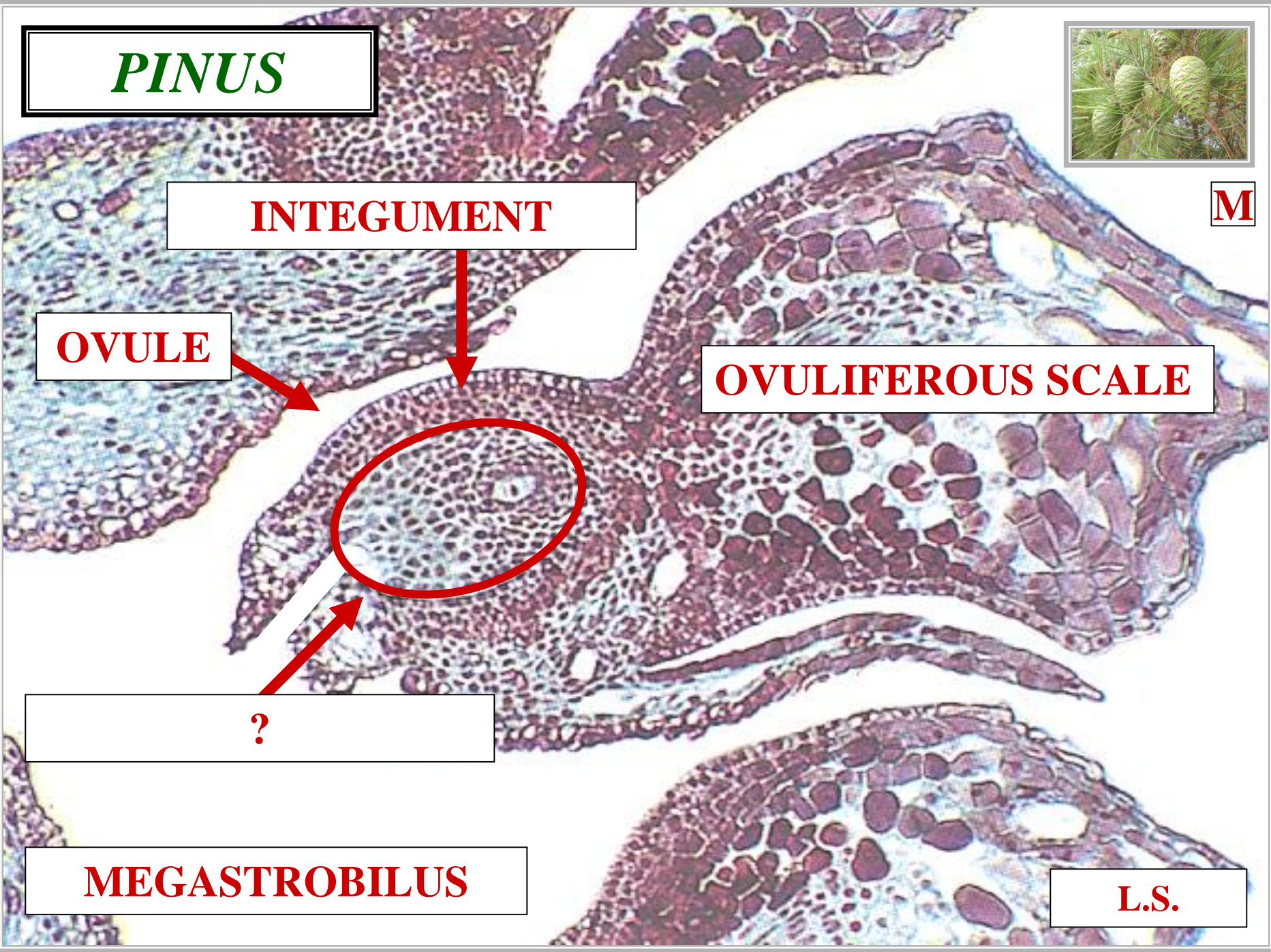
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**OVULIFEROUS SCALE**

**?**

**MEGASTROBILUS**

**L.S.**



***PINUS***



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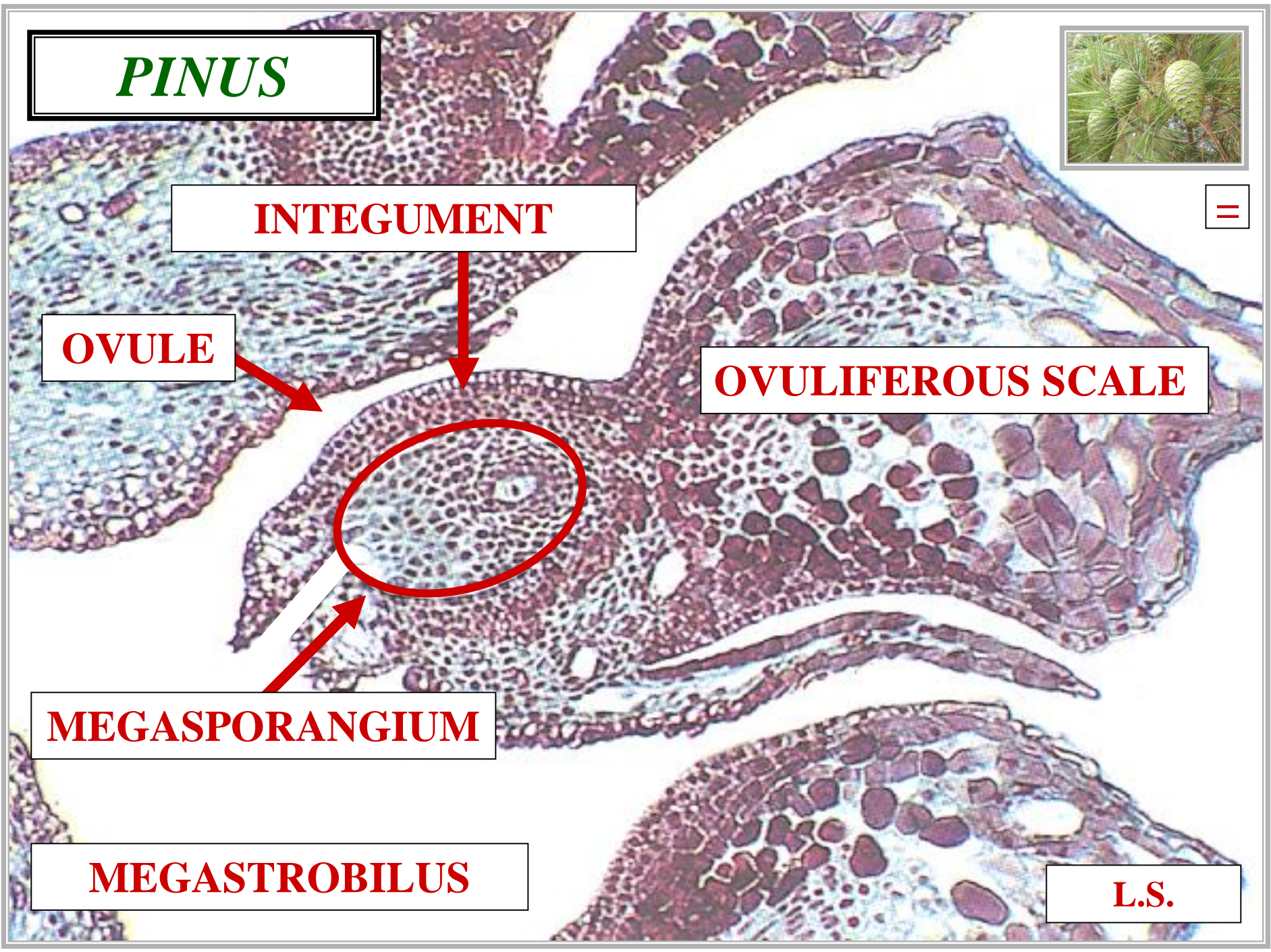
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**OVULIFEROUS SCALE**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**







***PINUS***



**M**

**INTEGUMENT**

**OVULE**

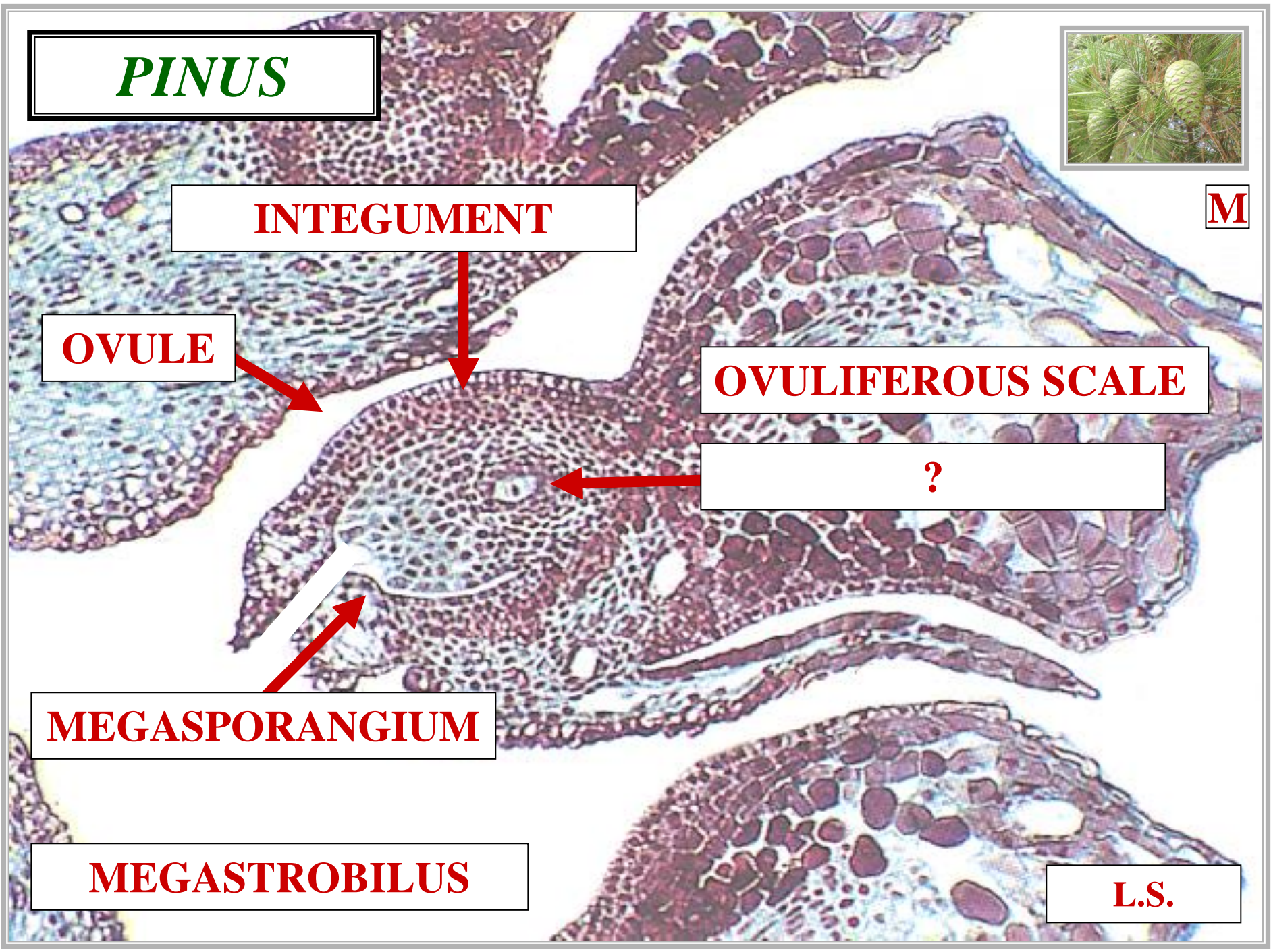
**OVULIFEROUS SCALE**

**?**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**



# *PINUS*



2

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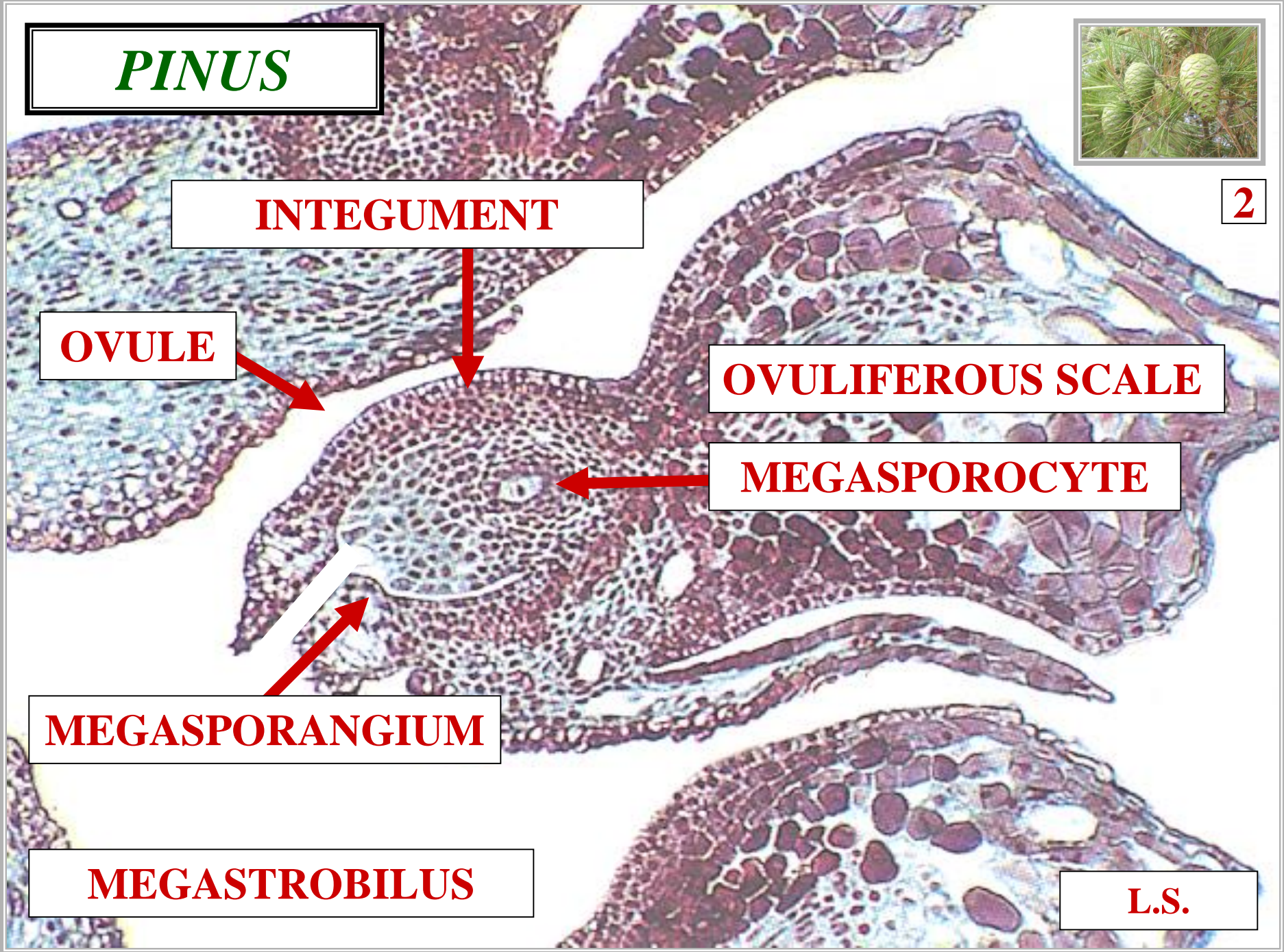
**OVULIFEROUS SCALE**

**MEGASPOROCYTE**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**



# *PINUS*



M

**INTEGUMENT**

**OVULE**

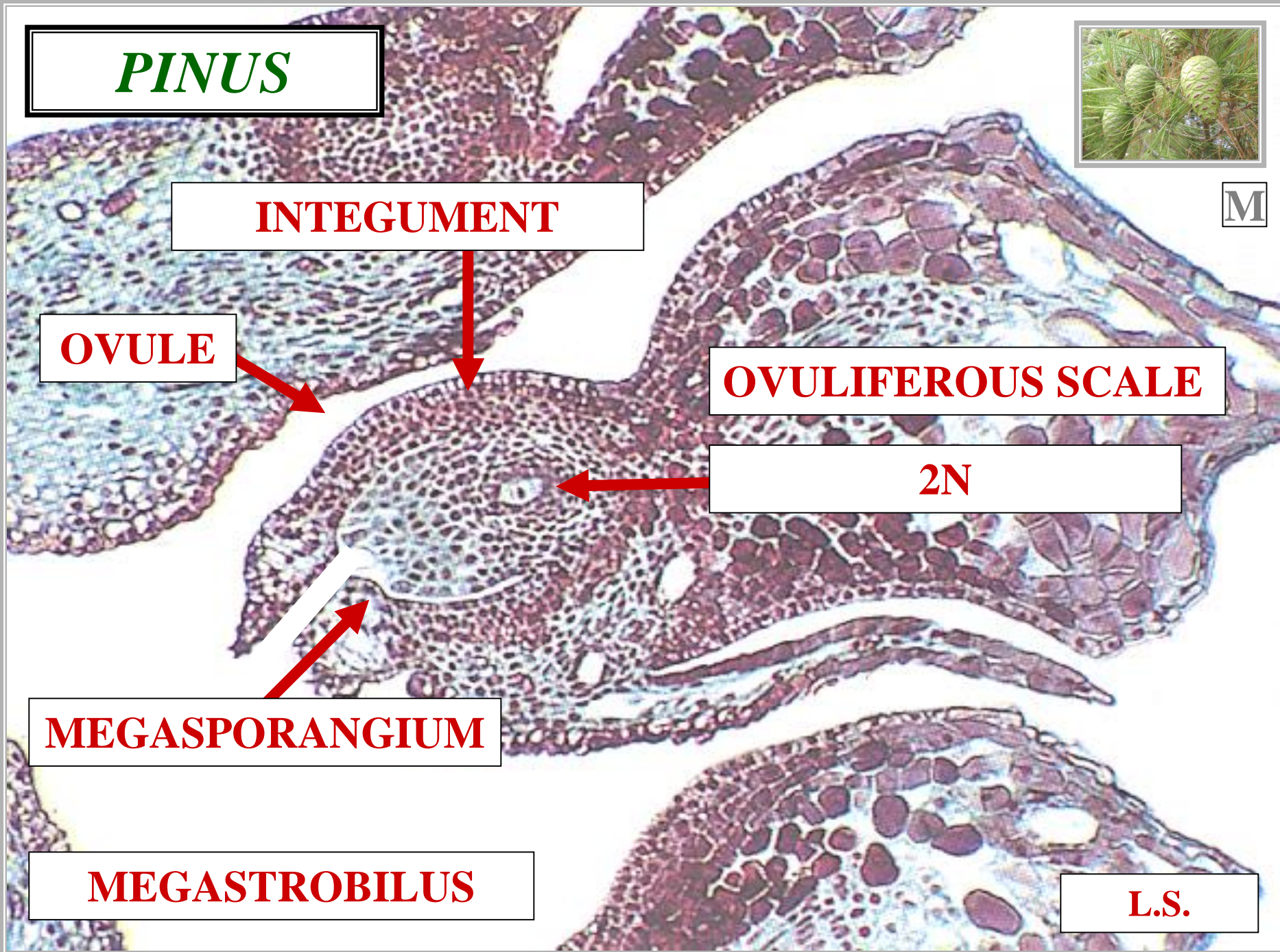
**OVULIFEROUS SCALE**

**2N**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**



# *PINUS*



M

**INTEGUMENT**

**OVULE**

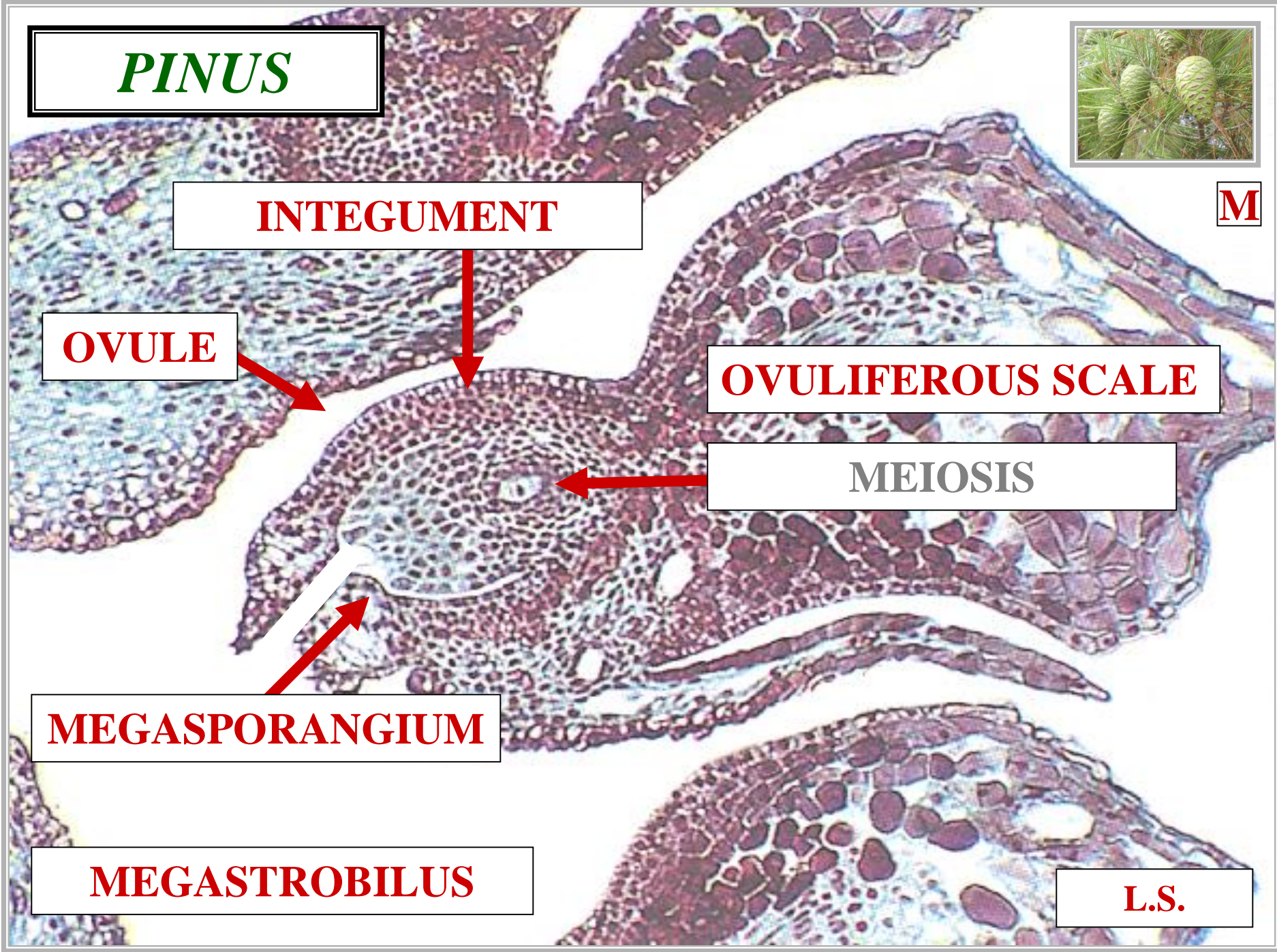
**OVULIFEROUS SCALE**

**MEIOSIS**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**



# *PINUS*



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**OVULE**

**OVULIFEROUS SCALE**

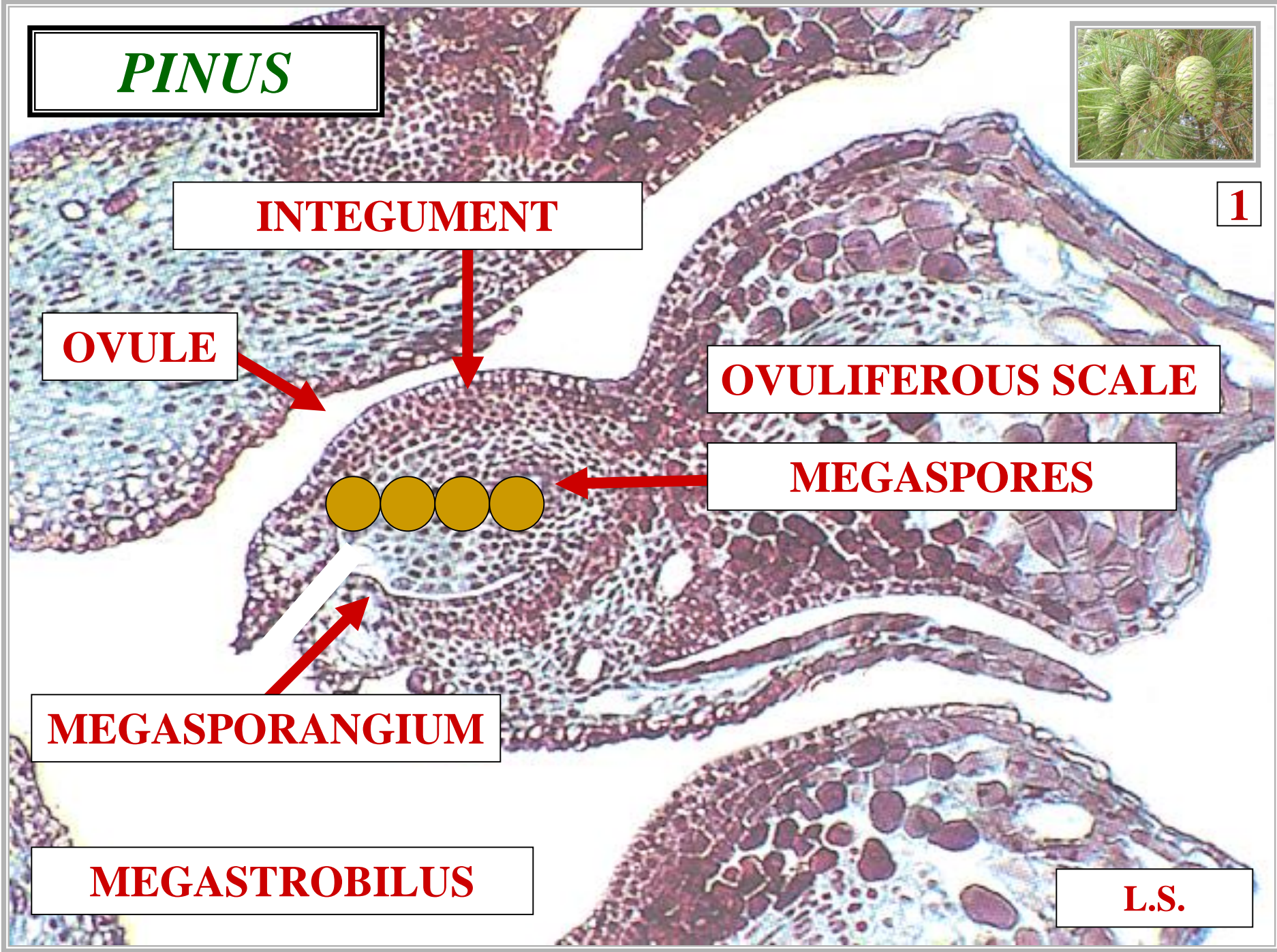
**MEGASPORES**



**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**



# *PINUS*



RT  
!

INTEGUMENT

OVULE

OVULIFEROUS SCALE

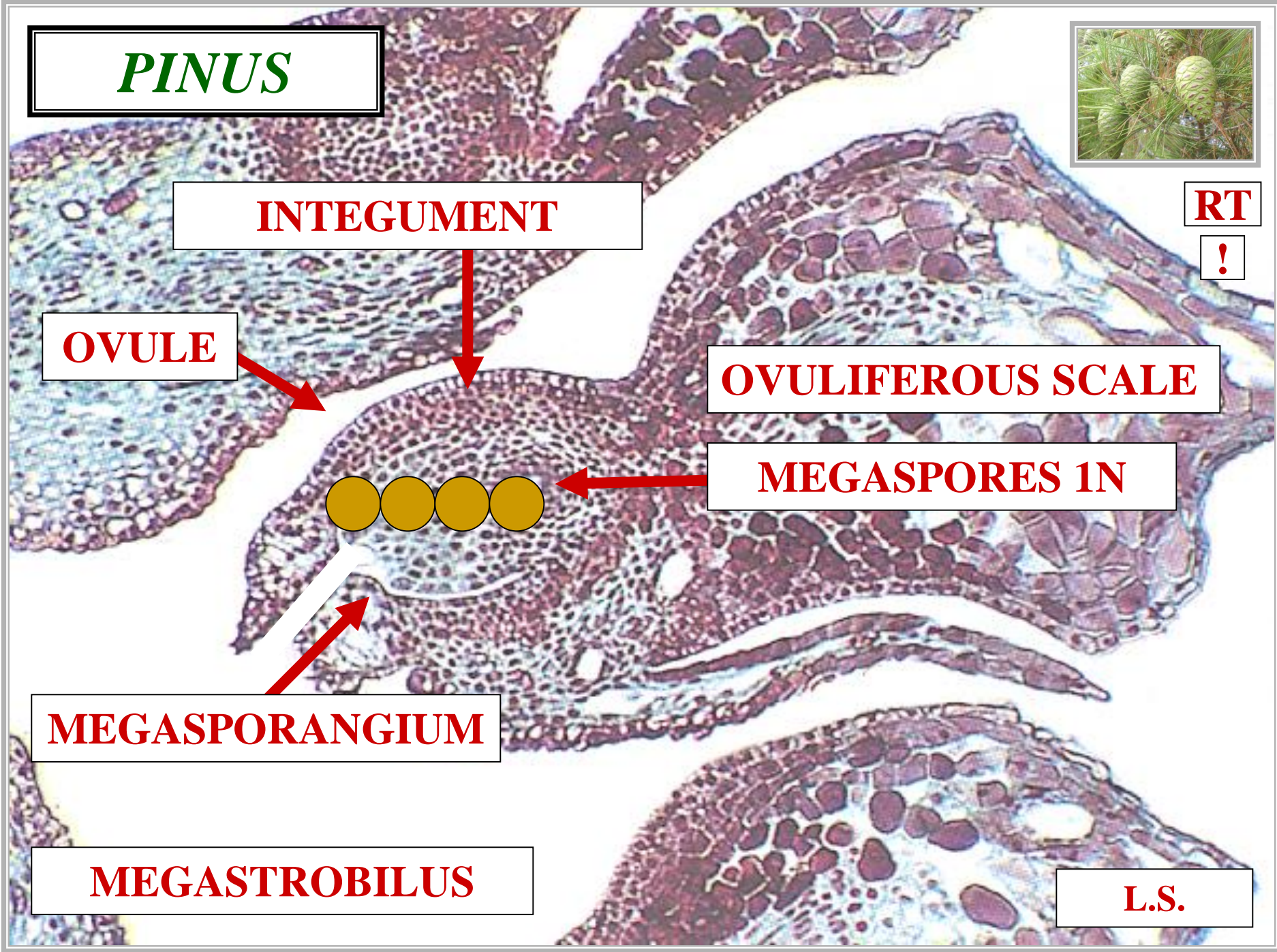
MEGASPORES 1N



MEGASPORANGIUM

MEGASTROBILUS

L.S.



# *PINUS*



**I**

**INTEGUMENT**

**OVULE**

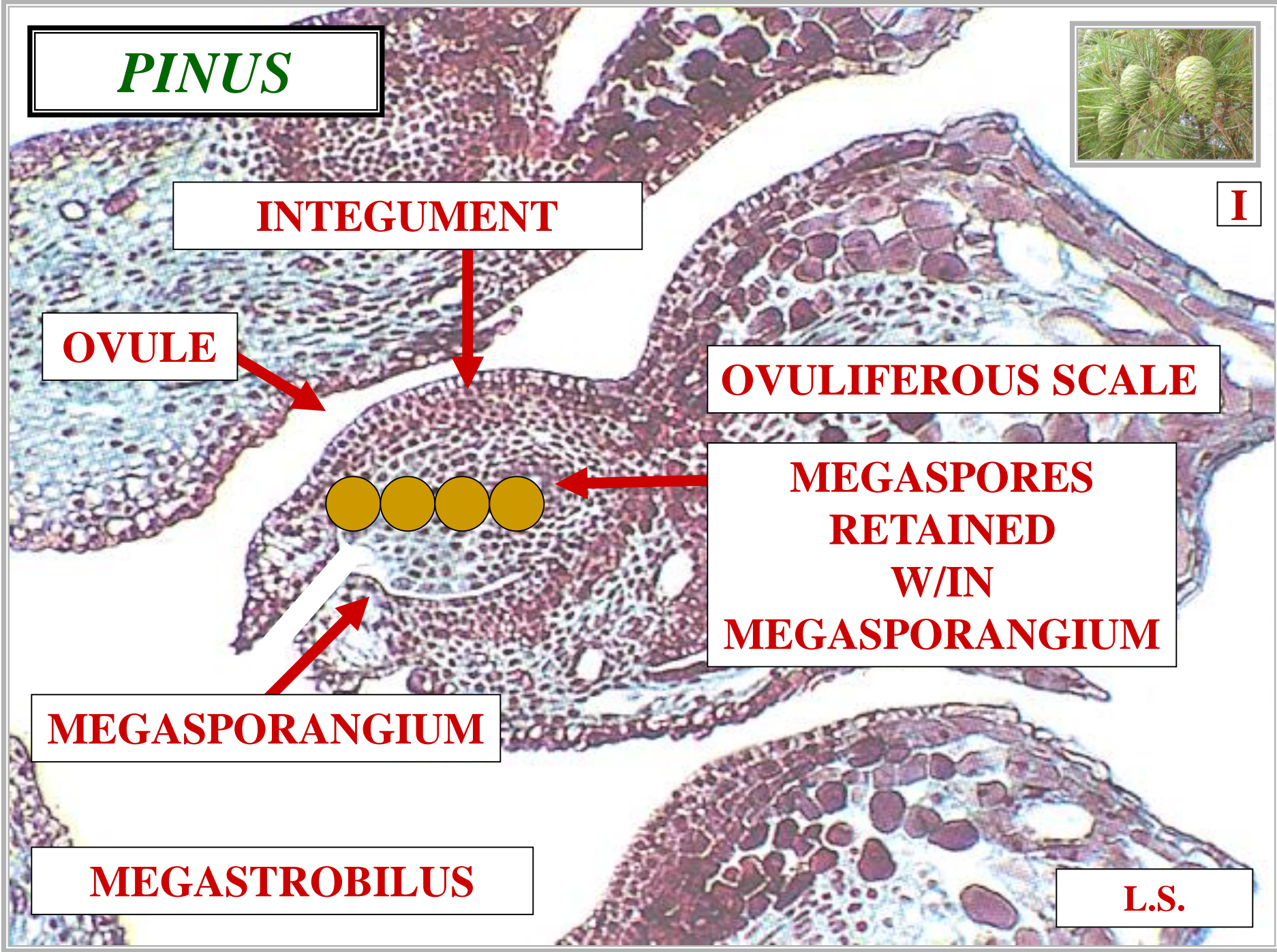
**OVULIFEROUS SCALE**

**MEGASPORES  
RETAINED  
W/IN  
MEGASPORANGIUM**

**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**





# *PINUS*



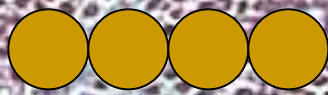
**I**

**INTEGUMENT**

**OVULE**

**OVULIFEROUS SCALE**

**MEGASPORES  
RETAINED  
W/IN  
MEGASPORANGIUM**

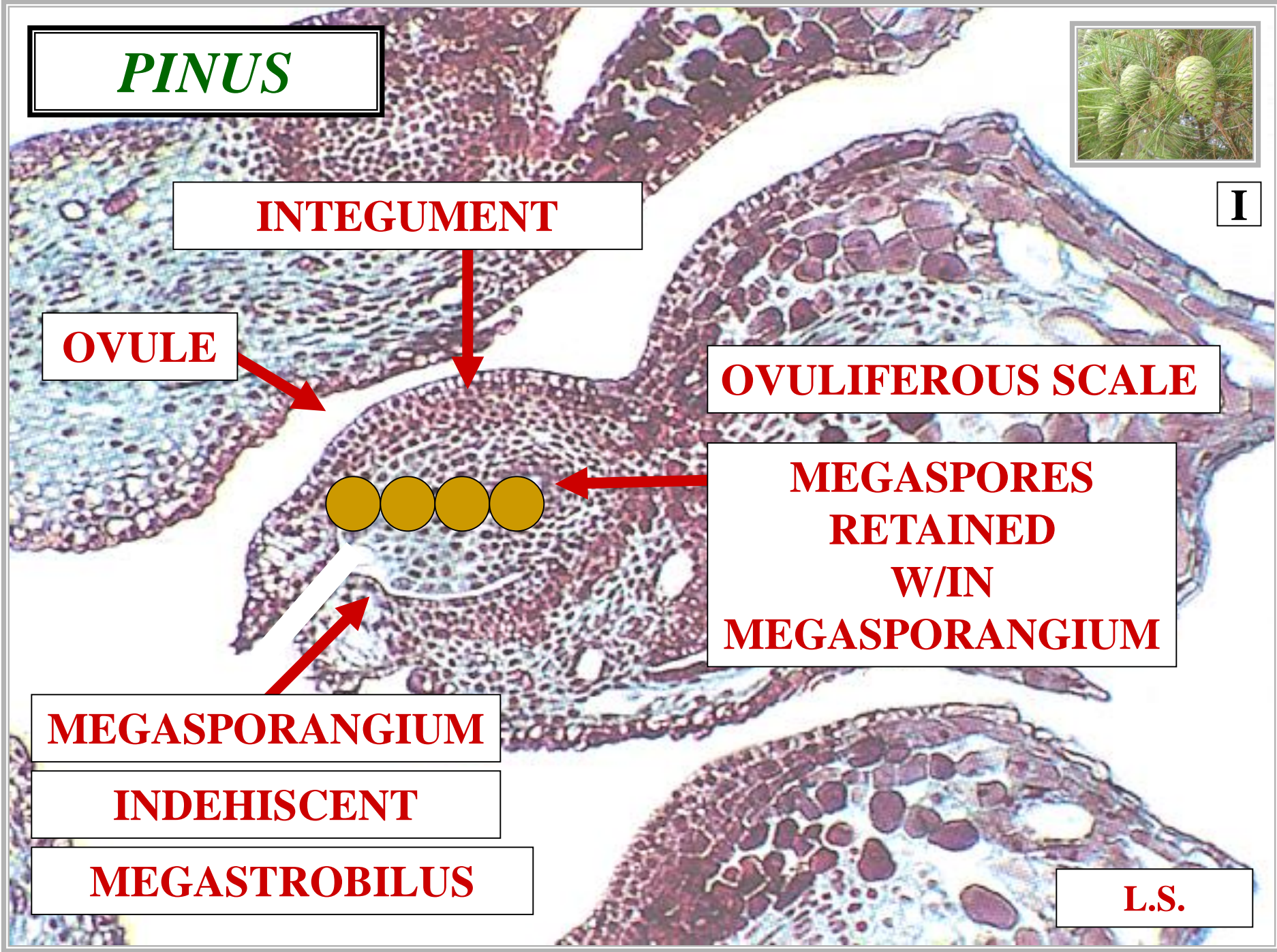


**MEGASPORANGIUM**

**INDEHISCENT**

**MEGASTROBILUS**

**L.S.**



**INDEHISCENT  
SPORANGIUM**

**INDEHISCENT  
MEGASPORANGIUM**



**SPORANGIUM  
DOES NOT OPEN  
MEGASPORES RETAINED**

**INDEHISCENT  
MEGASPORANGIUM**



**MEGASPORES  
RETAINED  
WITHIN  
INDEHISCENT  
MEGASPORANGIUM**



**INDEHISCENT  
MEGASPORANGIUM  
DIAGNOSTIC  
TO  
SPERMATOPHYTES**



**M**

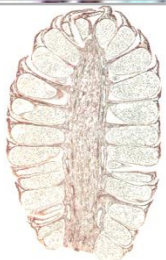
# SPORE HABIT

***PINUS***



**M**

**MICROSPORES**



**MICROSPORANGIUM**

**L.S.**

***PINUS***



**H**

**MEGASPORES**

**OVULE**

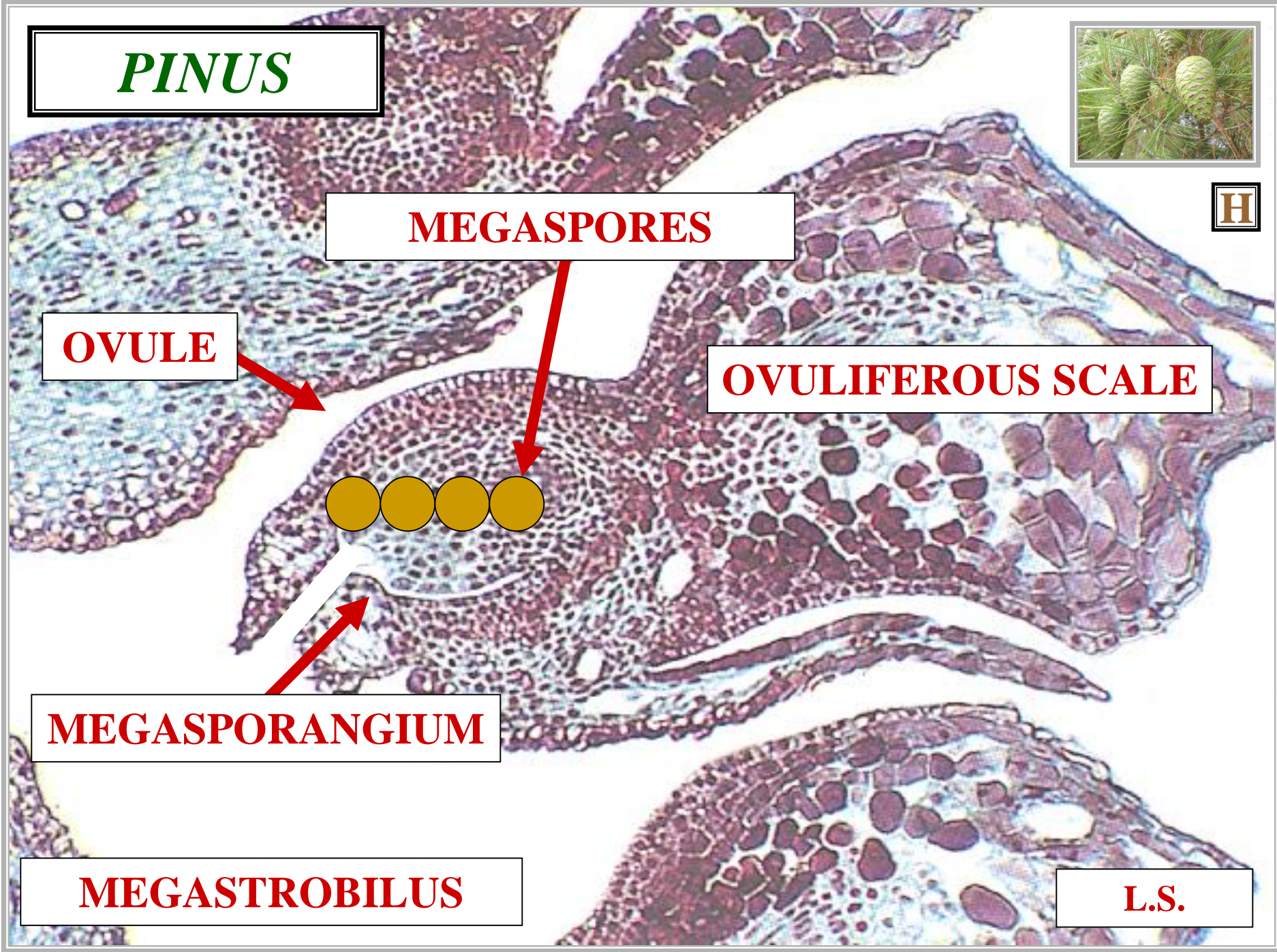
**OVULIFEROUS SCALE**



**MEGASPORANGIUM**

**MEGASTROBILUS**

**L.S.**





# HETEROSPOROUS

A  
H



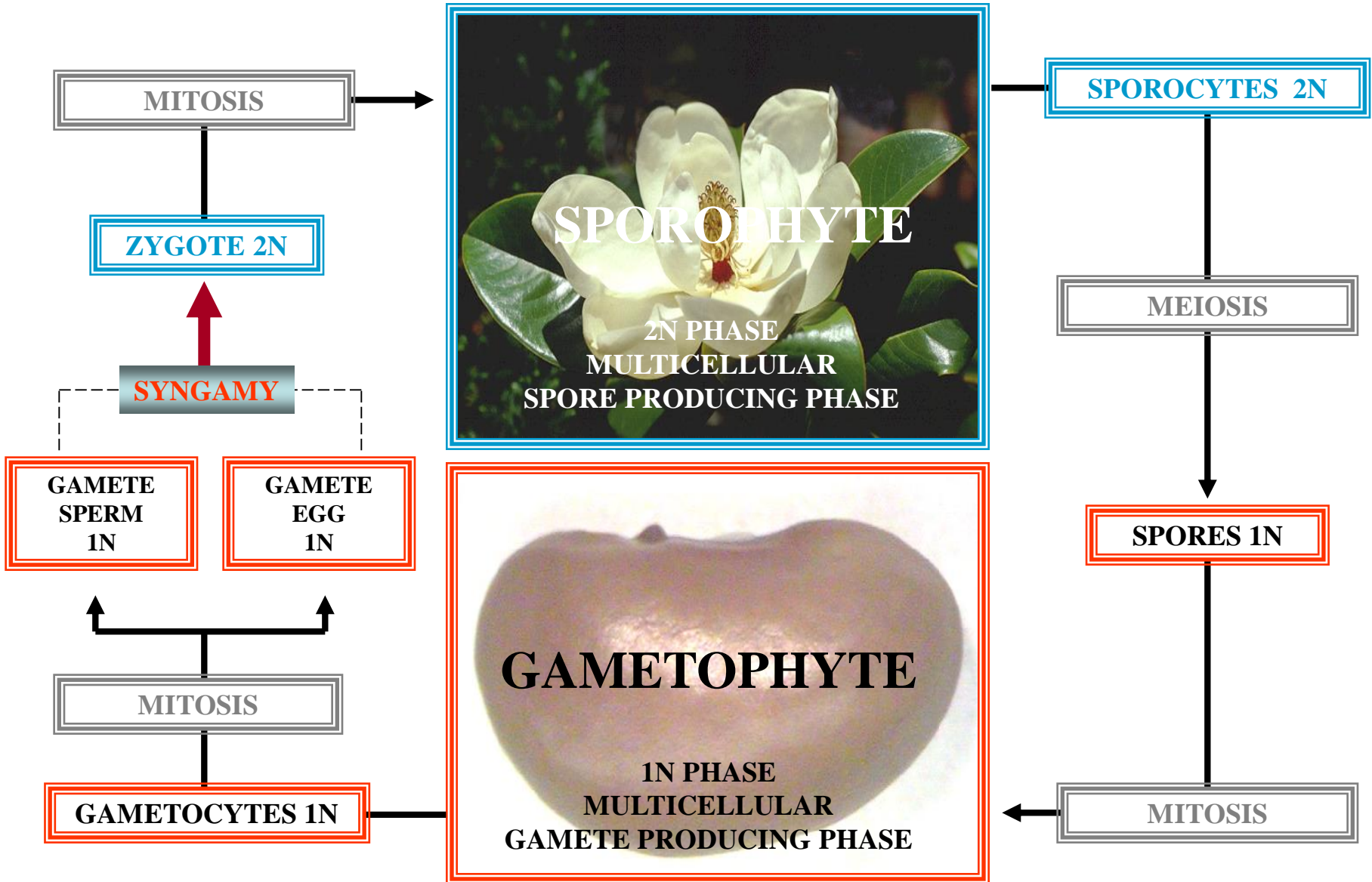
# GYMNOSPERMS

# HETEROSPOROUS



# ANGIOSPERMS

# SPERMATOPHYTE LIFE CYCLE

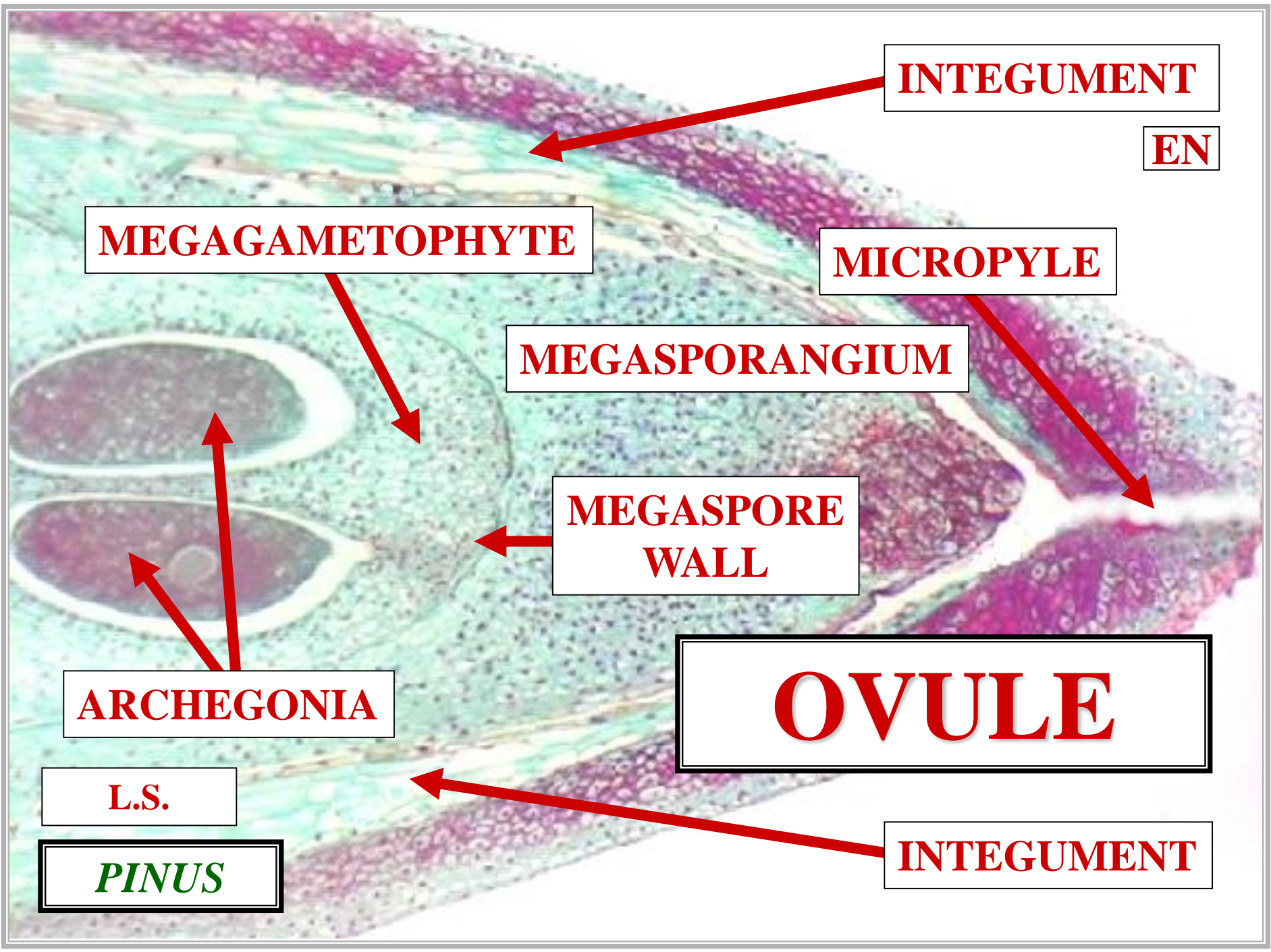




# GAMETOPHYTE CHARACTERS



# MEGAGAMETOPHYTE



**INTEGUMENT**

**EN**

**MEGAGAMETOPHYTE**

**MICROPYLE**

**MEGASPORANGIUM**

**MEGASPORE  
WALL**

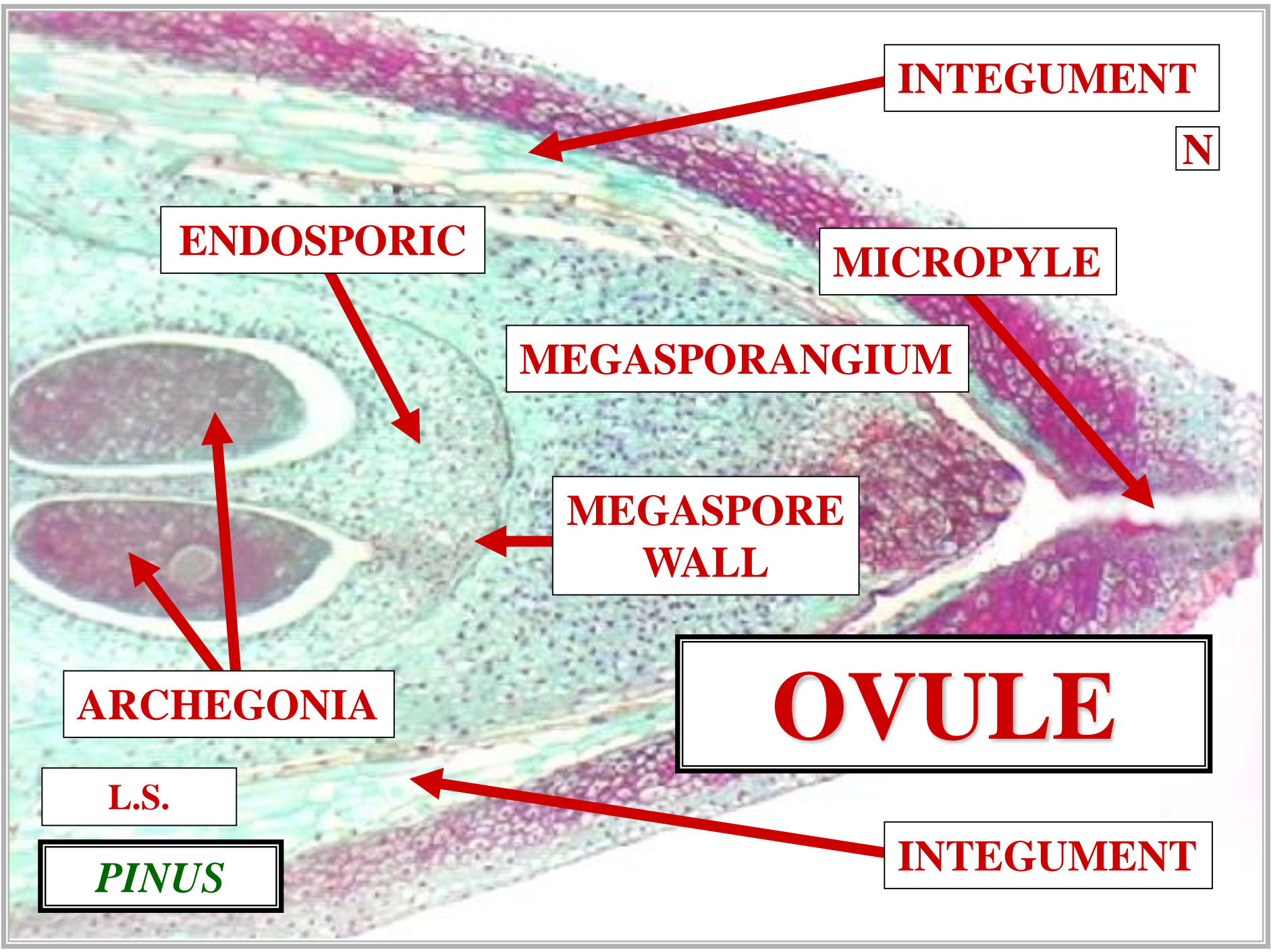
**ARCHEGONIA**

**OVULE**

**L.S.**

***PINUS***

**INTEGUMENT**



**INTEGUMENT**

**N**

**ENDOSPORIC**

**MICROPYLE**

**MEGASPORANGIUM**

**MEGASPORE  
WALL**

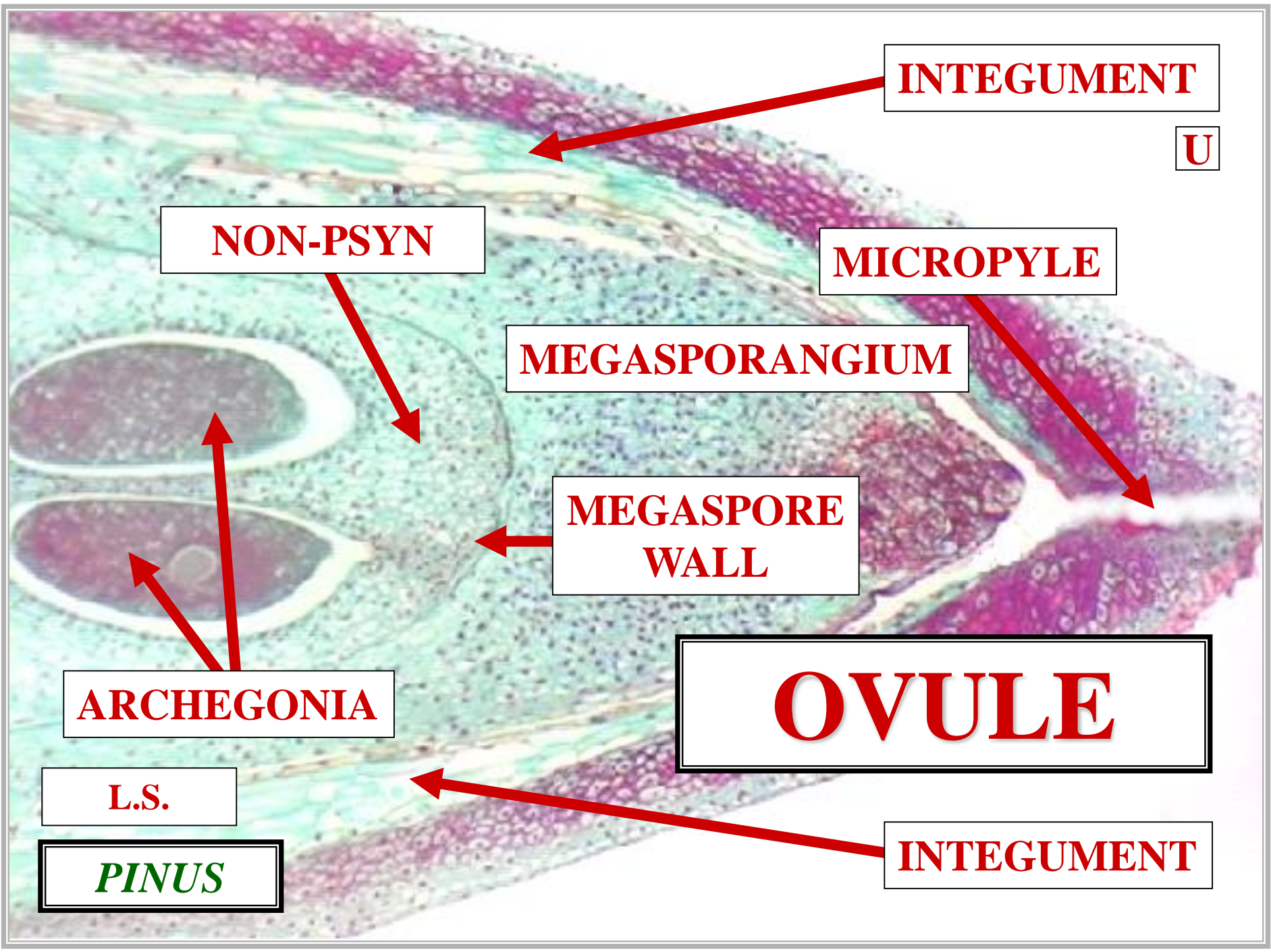
**ARCHEGONIA**

**OVULE**

**L.S.**

***PINUS***

**INTEGUMENT**



**INTEGUMENT**

**U**

**NON-PSYN**

**MICROPYLE**

**MEGASPORANGIUM**

**MEGASPORE  
WALL**

**ARCHEGONIA**

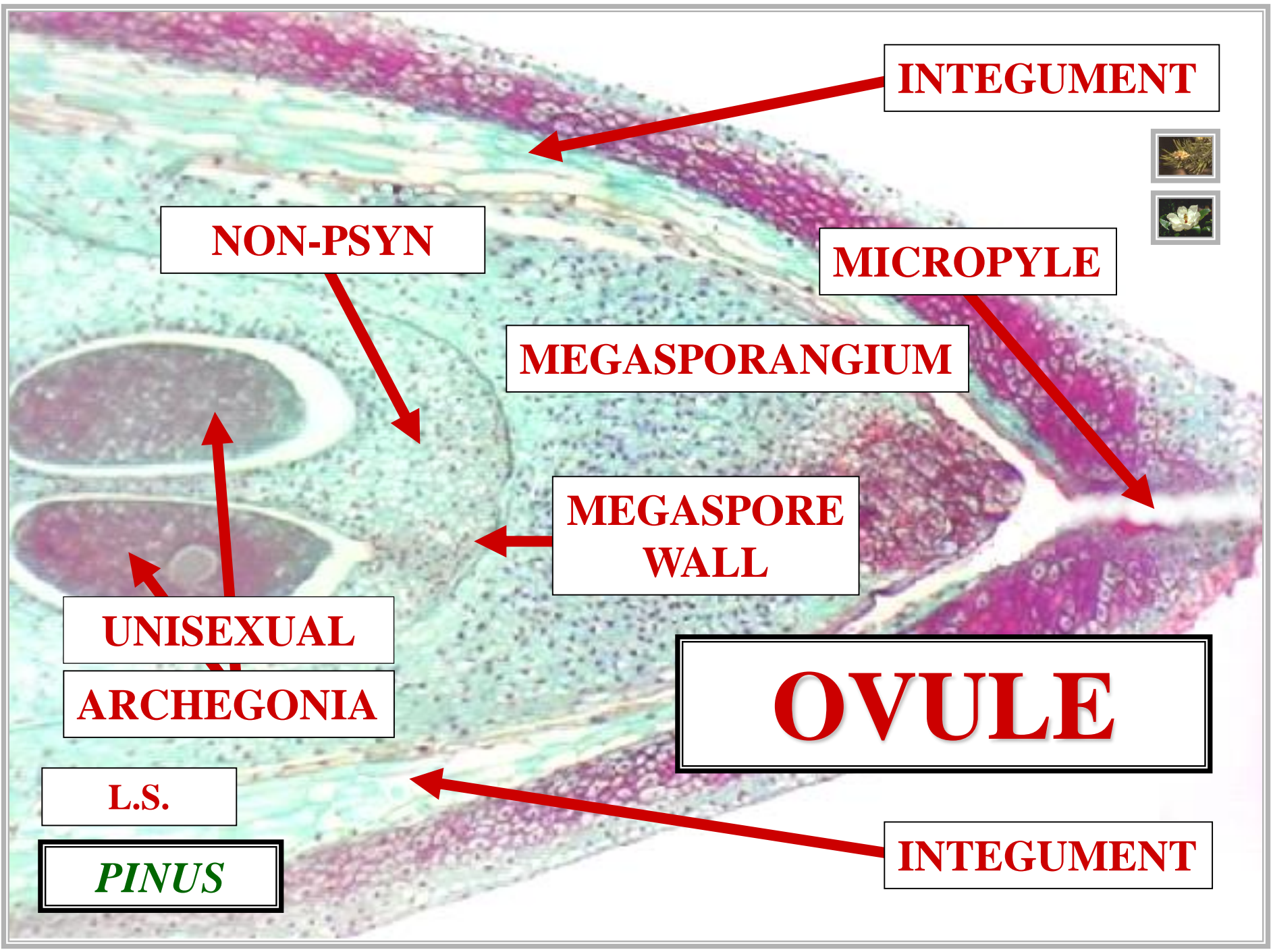
**OVULE**

**L.S.**

***PINUS***

**INTEGUMENT**





**INTEGUMENT**

**NON-PSYN**

**MICROPYLE**

**MEGASPORANGIUM**

**MEGASPORE  
WALL**

**UNISEXUAL  
ARCHEGONIA**

**OVULE**

**L.S.**

***PINUS***

**INTEGUMENT**

# MEGAGAMETOPHYTE

A



# GYMNOSPERMS

**MICROGAMETOPHYTE**



**ANGIOSPERMS**



# MICROGAMETOPHYTE

# MICROGAMETOPHYTE



*PINUS*

# MICROGAMETOPHYTE

**ENDOSPORIC**



***PINUS***

# MICROGAMETOPHYTE

**NON-PSYN**



*PINUS*

# MICROGAMETOPHYTE



**UNISEXUAL**



***PINUS***



# MICROGAMETOPHYTE



**GYMNOSPERMS**

**MICROGAMETOPHYTE**



**ANGIOSPERMS**



# SYNONYM

# MICROGAMETOPHYTE



*PINUS*

?

# MICROGAMETOPHYTE



*PINUS*

**POLLEN GRAIN**



**MICROGAMETOPHYTE**  
**SPERMATOPHYTE**  
**GAMETOPHYTE**  
**HIGHLY REDUCED**  
**VS**  
**PTERIDOPHYTE**  
**GAMETOPHYTE**  
**POLLEN GRAIN**

A faint, circular microscopic image of a pollen grain is centered behind the text. It shows a textured, multi-layered structure with a central opening.



# MICROGAMETOPHYTE

## 4 CELLS

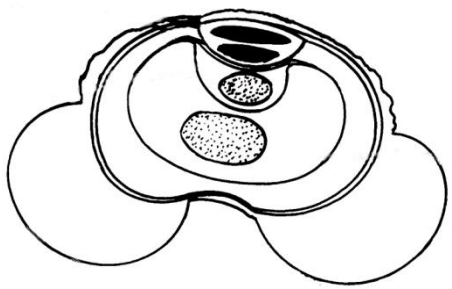


*PINUS*

# POLLEN GRAIN

# MICROGAMETOPHYTE

?



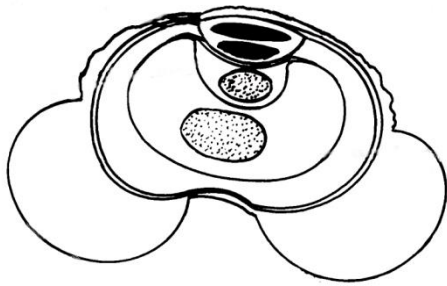
*PINUS*

# POLLEN GRAIN



# MICROGAMETOPHYTE

**PROTHALLIAL CELLS**



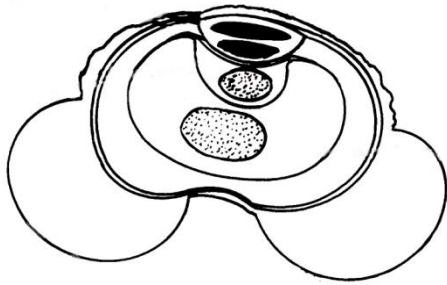
*PINUS*

**POLLEN GRAIN**

# MICROGAMETOPHYTE

?

PROTHALLIAL CELLS



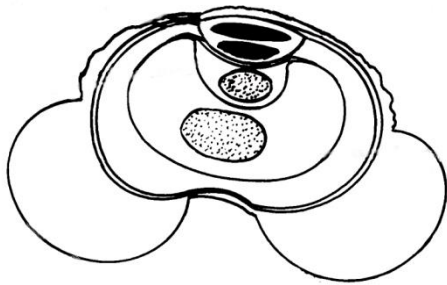
*PINUS*

# POLLEN GRAIN

# MICROGAMETOPHYTE

**GENERATIVE CELL**

**PROTHALLIAL CELLS**



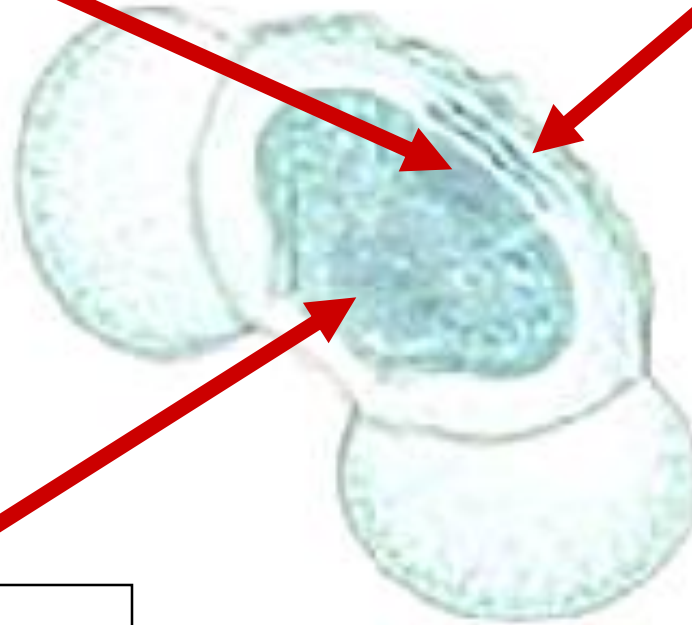
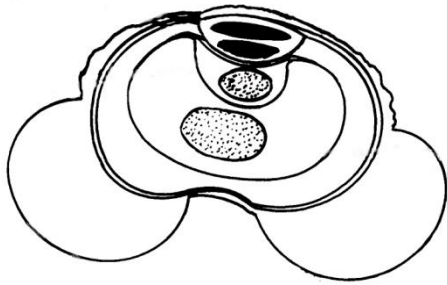
*PINUS*

**POLLEN GRAIN**

# MICROGAMETOPHYTE

**GENERATIVE CELL**

**PROTHALLIAL CELLS**



*PINUS*

?

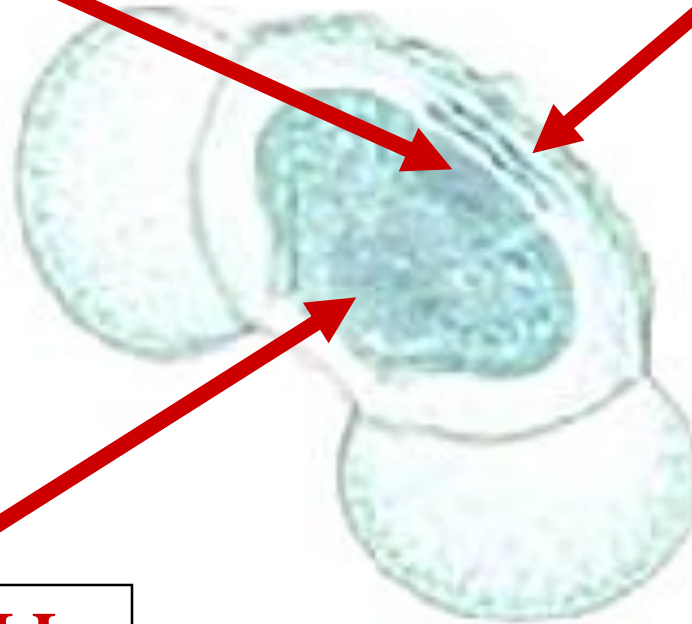
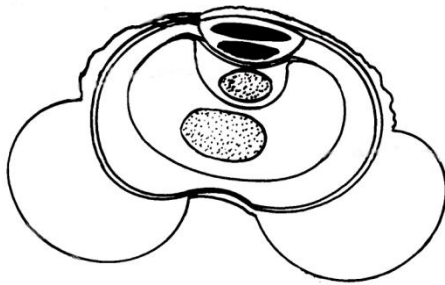
**POLLEN GRAIN**

# MICROGAMETOPHYTE



**GENERATIVE CELL**

**PROTHALLIAL CELLS**



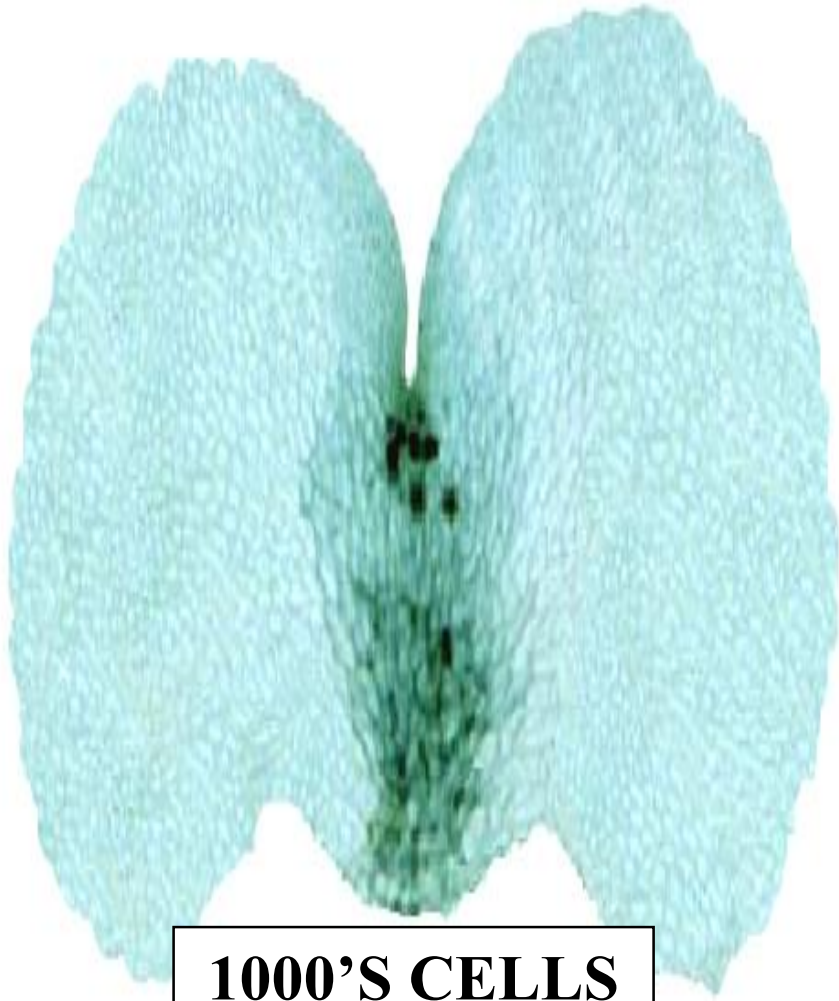
*PINUS*

**TUBE CELL**

**POLLEN GRAIN**



**PTERIDOPHYTE**



**1000'S CELLS**

**GAMETOPHYTE**

**SPERMATOPHYTE**



**4 CELLS**

**GAMETOPHYTE**



**PTERIDOPHYTE**

**SPERMATOPHYTE**

**SPERMATOPHYTE  
GAMETOPHYTE  
HIGHLY REDUCED  
VS  
PTERIDOPHYTE  
GAMETOPHYTE**



**1000'S CELLS**

**4 CELLS**

**GAMETOPHYTE**

**GAMETOPHYTE**



**SPERM**





**PTERIDOPHYTES**



**FLAGELLATED  
SPERM**

**PTERIDOPHYTES**



# GYMNOSPERMS



**NON-FLAGELLATED  
SPERM**

**GYMNOSPERMS**



**ANGIOSPERMS**



**NON-FLAGELLATED  
SPERM**

**ANGIOSPERMS**



# SYNGAMY



# PTERIDOPHYTES

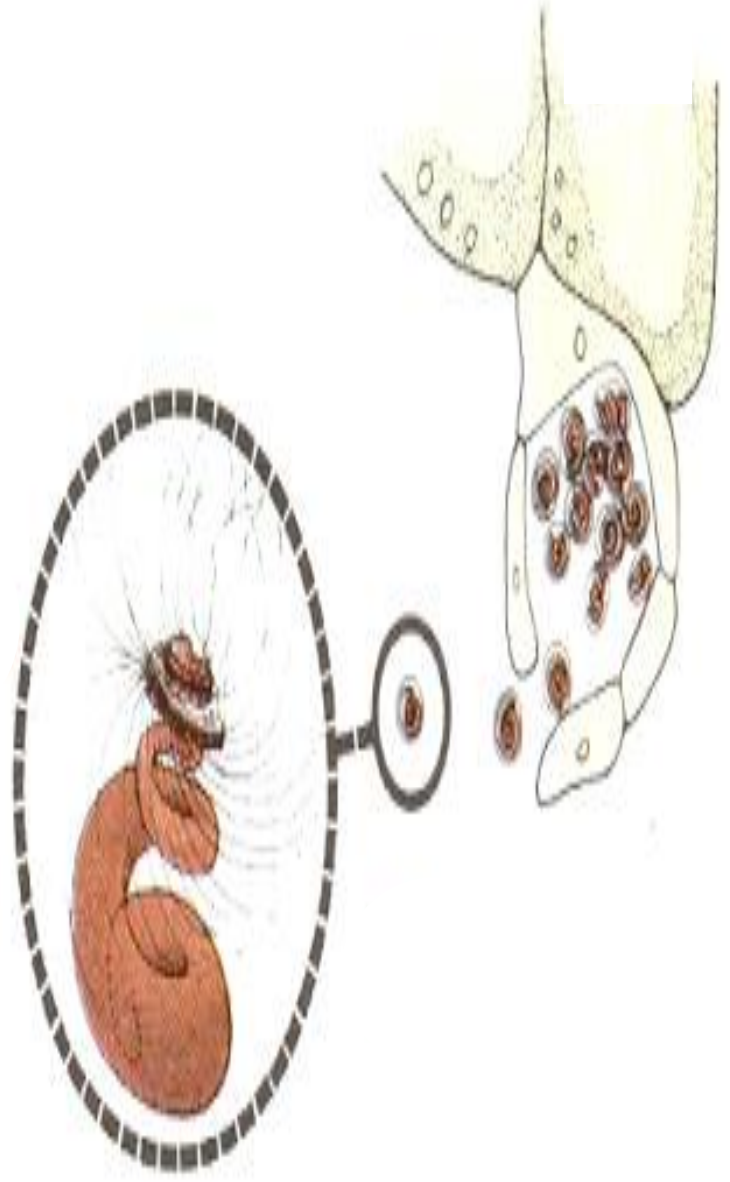
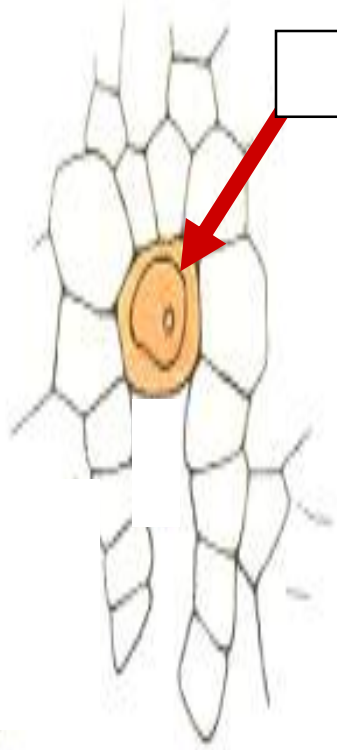
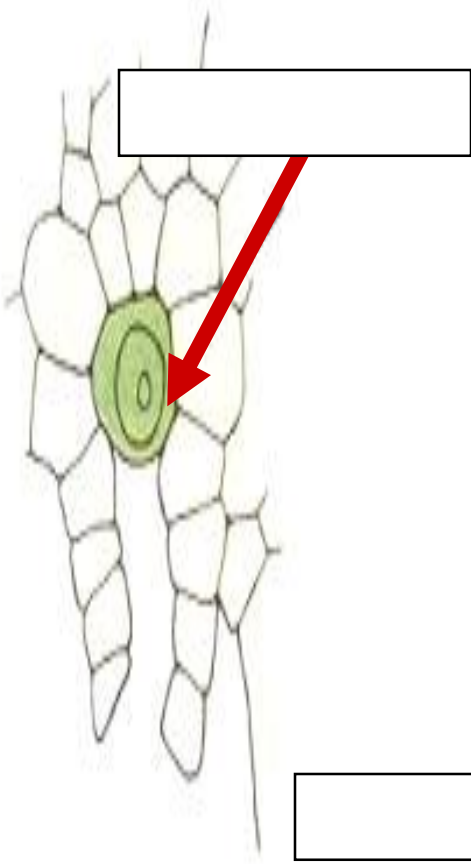




**ARCHEGONIUM**

**EGG**

**ANTHERIDIUM**



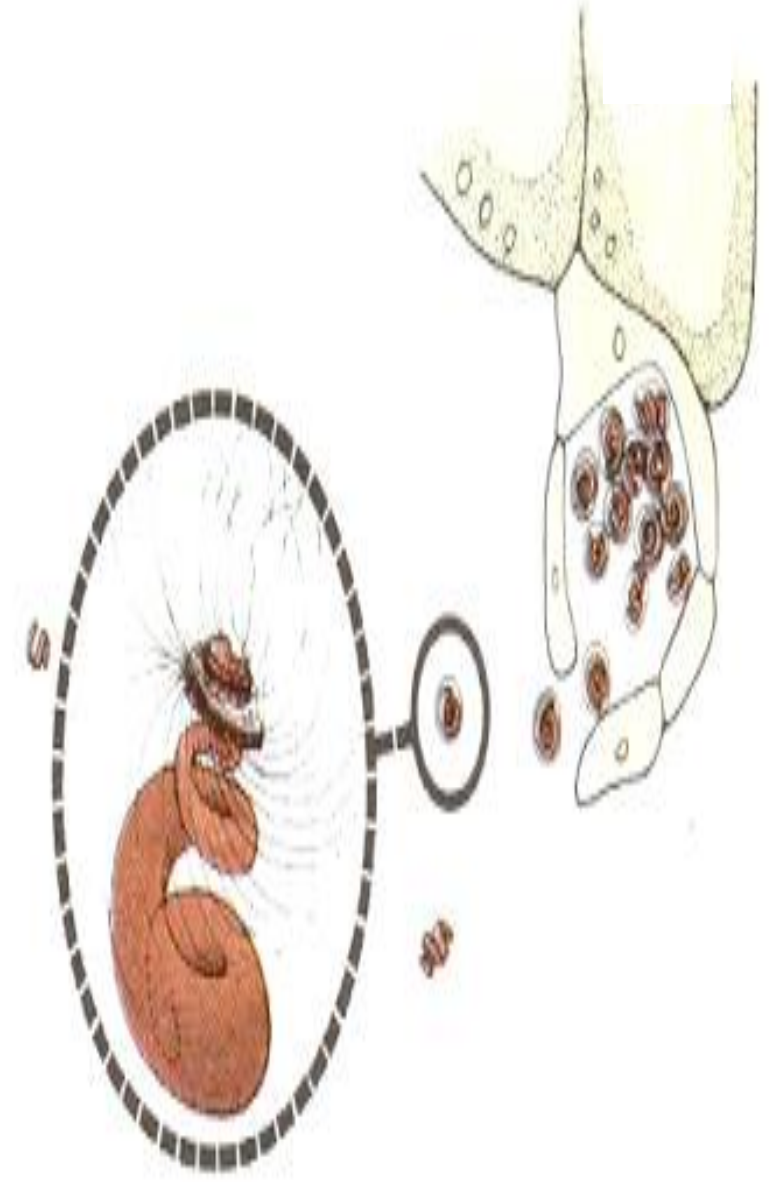
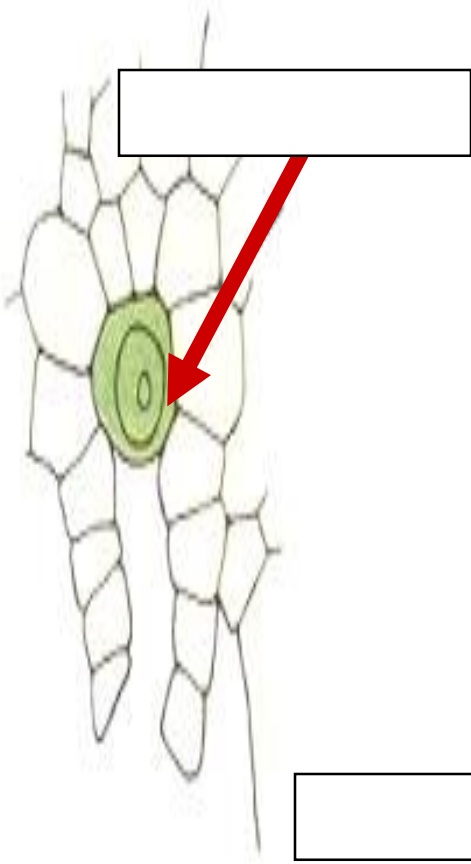
**FLAGELLATED  
SPERM**



**ARCHEGONIUM**

**EGG**

**ANTHERIDIUM**

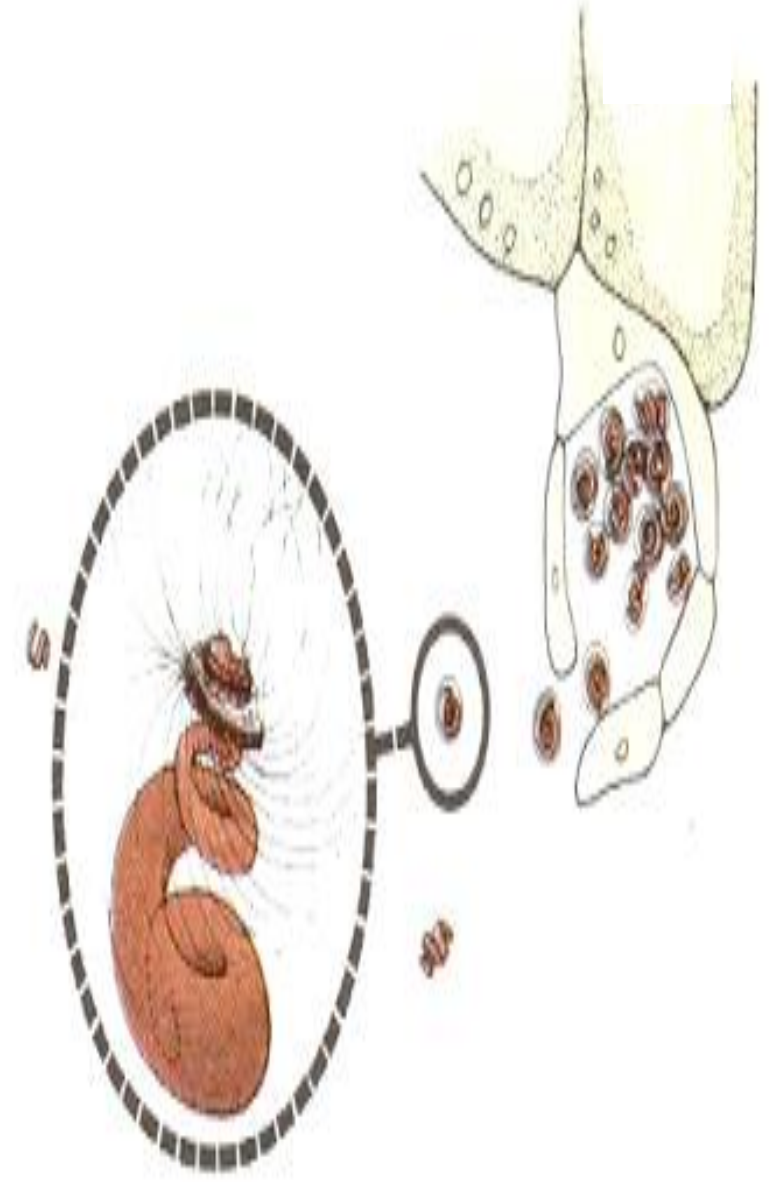
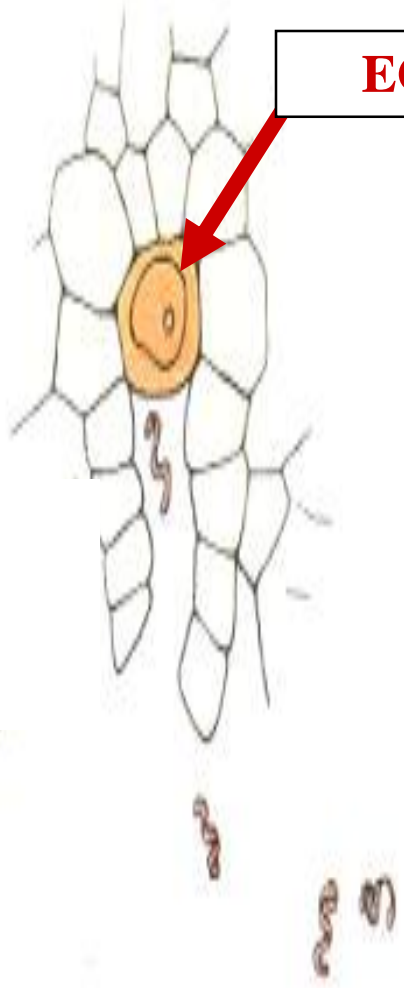
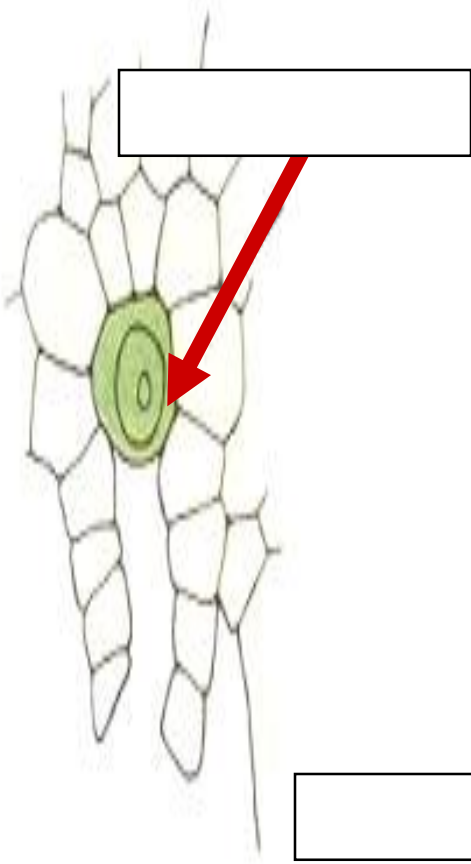


**FLAGELLATED  
SPERM**

**ARCHEGONIUM**

**EGG**

**ANTHERIDIUM**

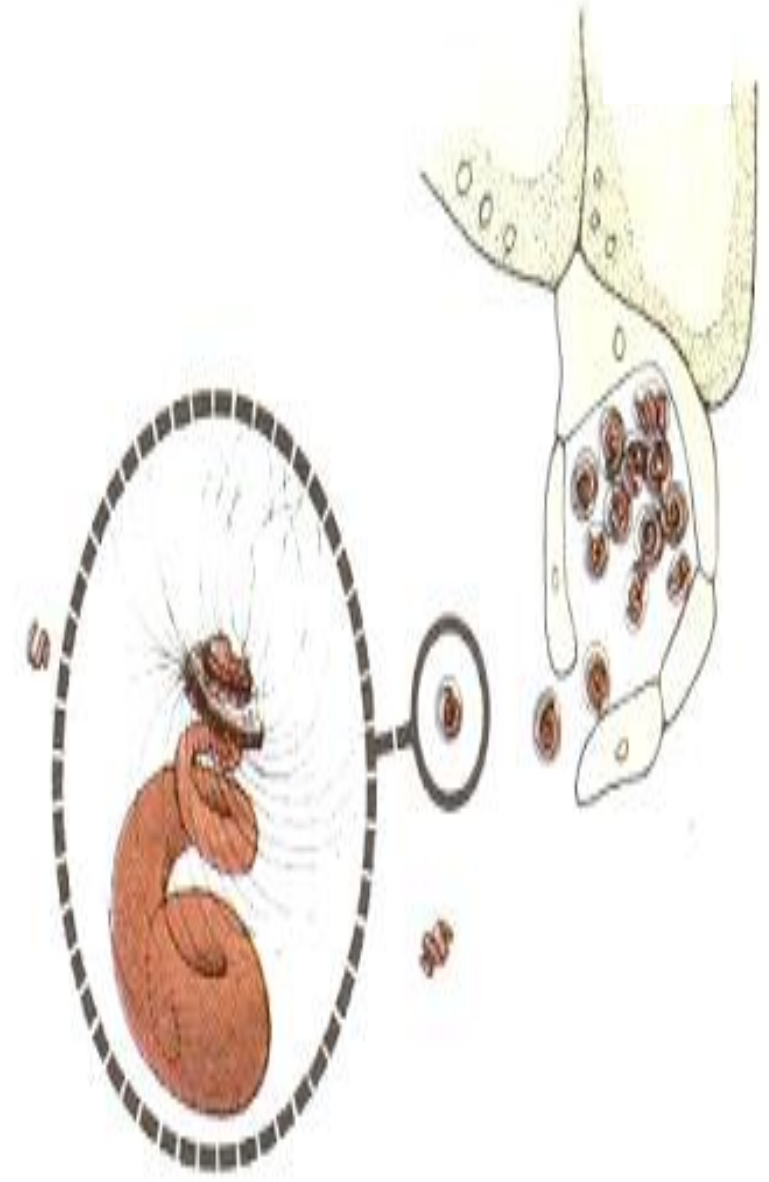
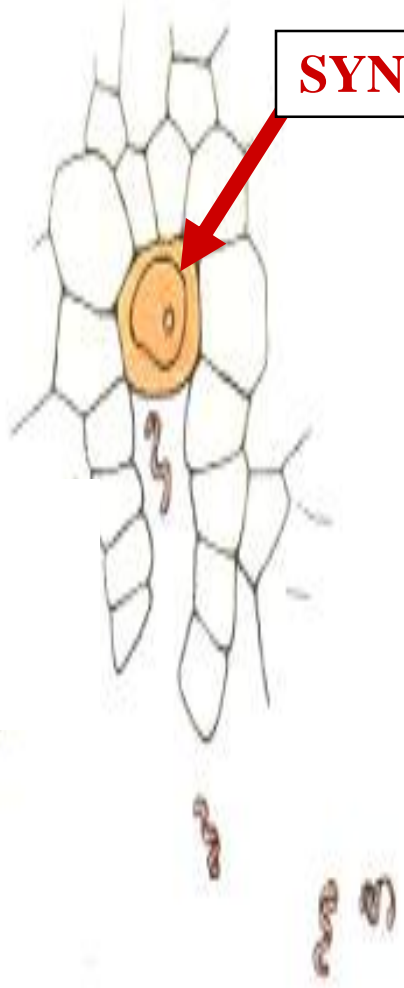
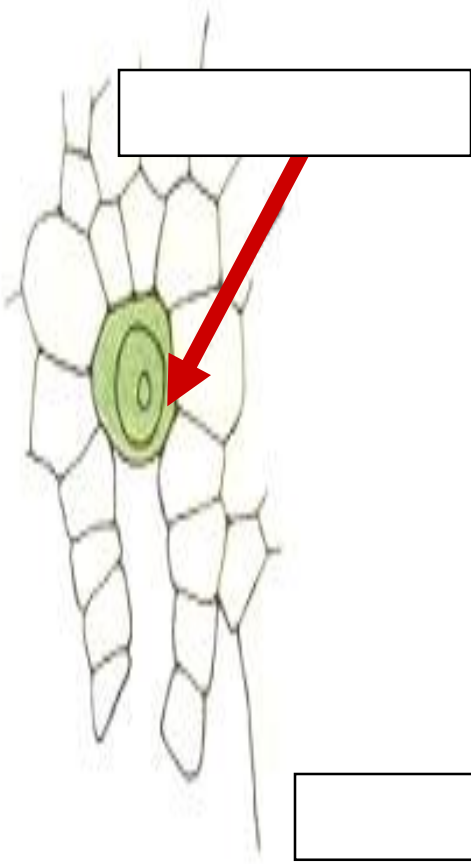


**FLAGELLATED  
SPERM**

**ARCHEGONIUM**

**SYNGAMY**

**ANTHERIDIUM**

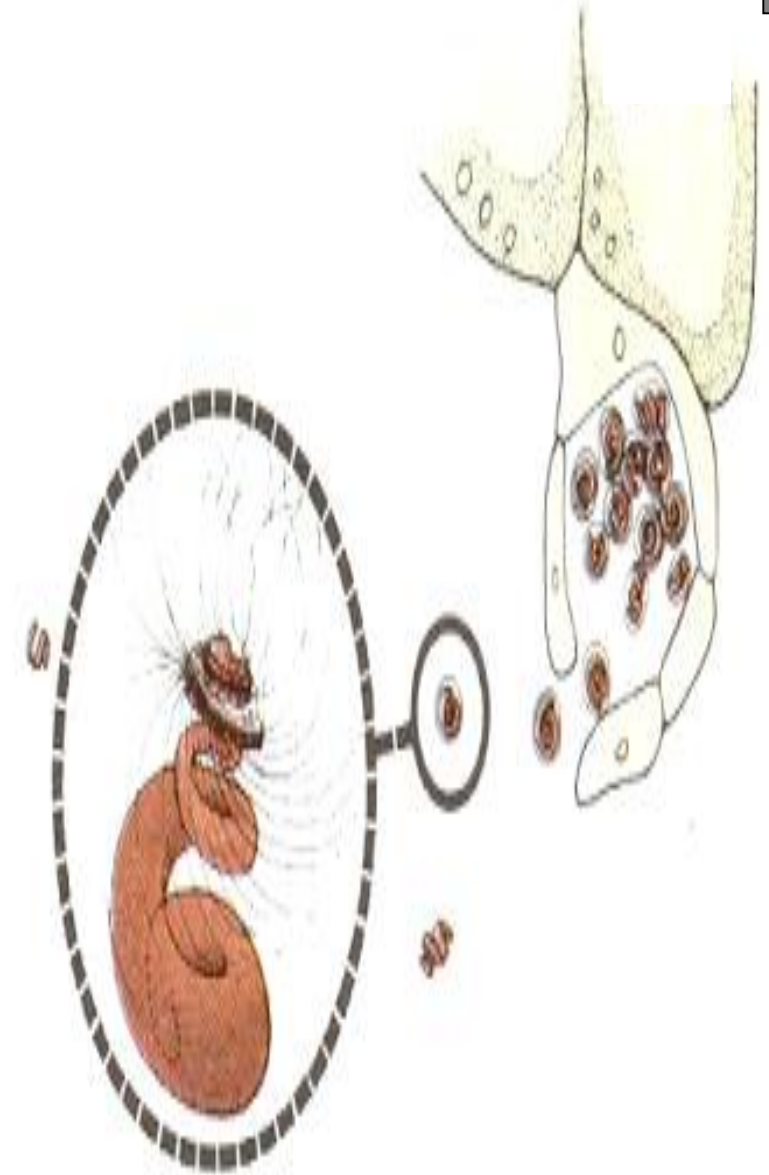
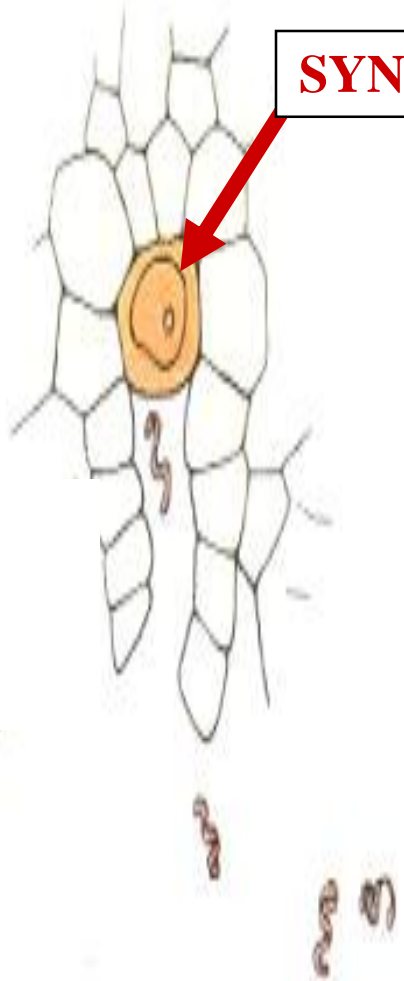
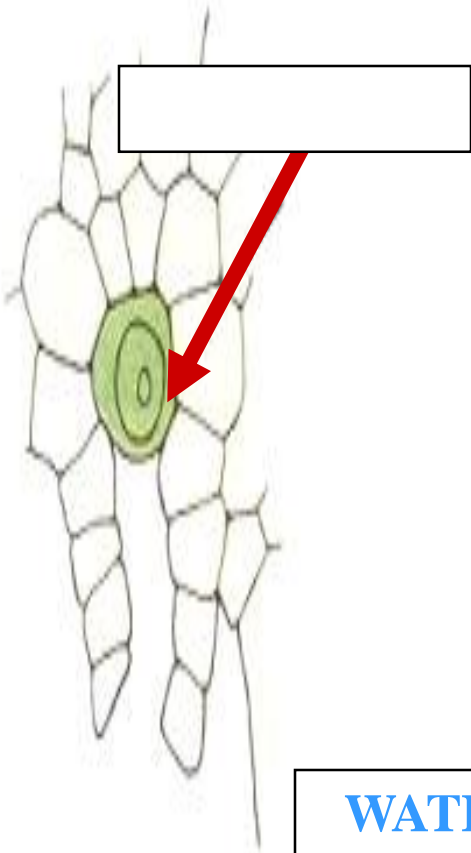


**FLAGELLATED  
SPERM**

**ARCHEGONIUM**

**SYNGAMY**

**ANTHERIDIUM**



**WATER**

**FLAGELLATED  
SPERM**



SYNGAMY  
WATER REQUIRED

**PTERIDOPHYTES**



**SYNGAMY  
WATER  
NOT REQUIRED**

**GYMNOSPERMS**



**PO**

**SYNGAMY  
WATER  
NOT REQUIRED**

**ANGIOSPERMS**



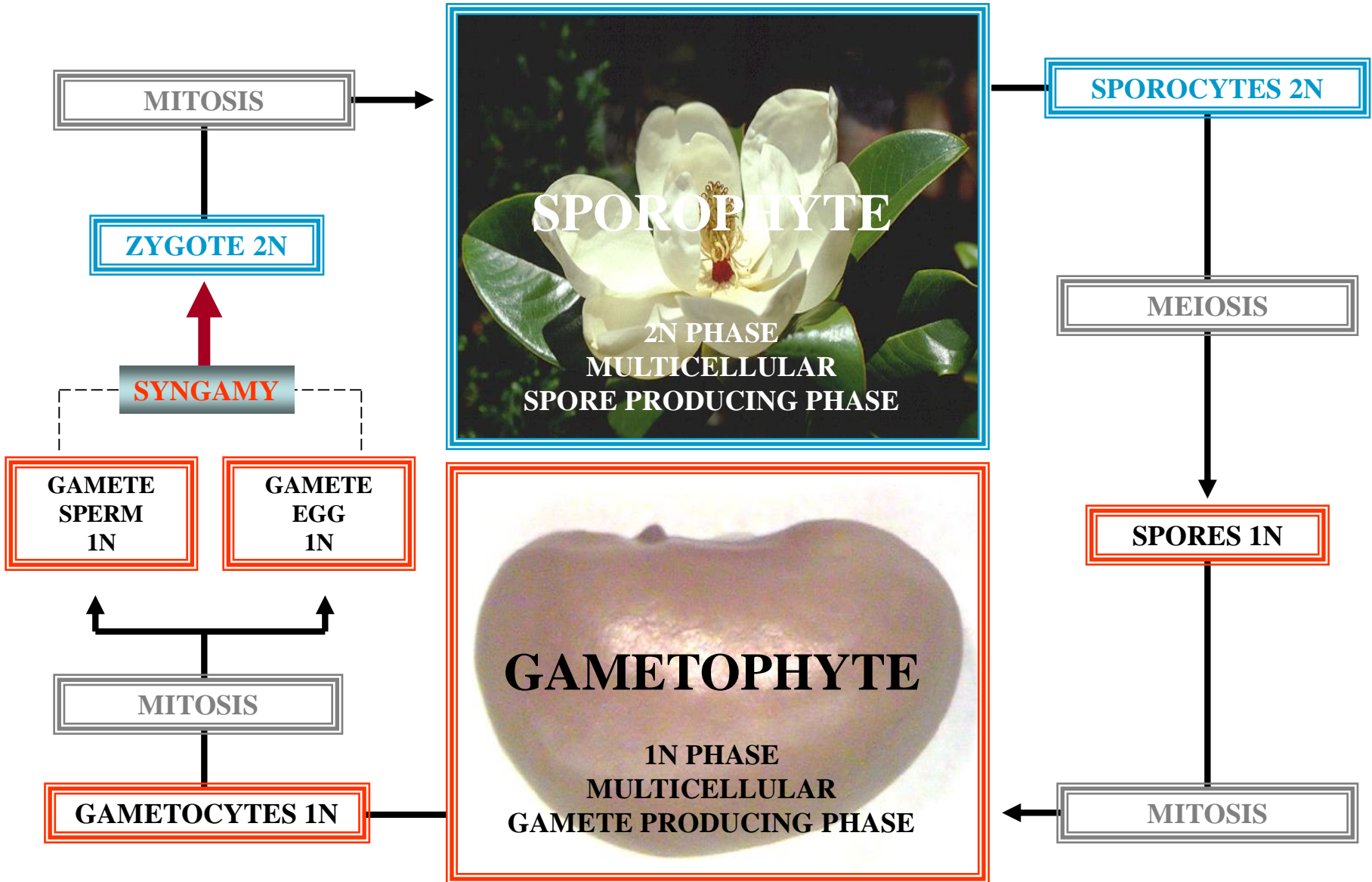


**POLLINATION**

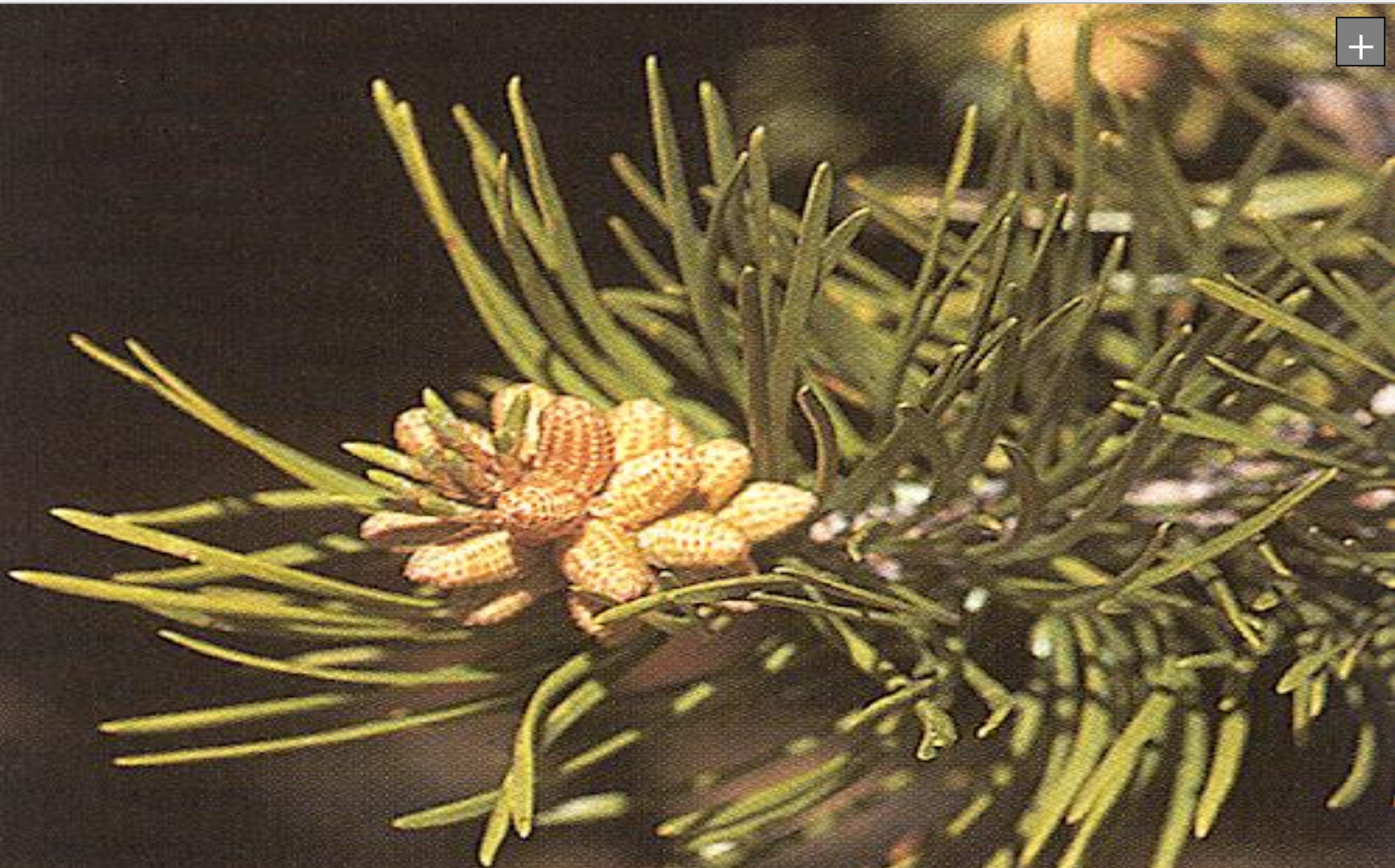


**POLLINATION  
ELIMINATES  
WATER SYNGAMY  
REQUIREMENT**

# SPERMATOPHYTE LIFE CYCLE



**ALABAMA  
SPERMATOPHYTE  
PHYLA**



**PINOPHYTA**



**MAGNOLIOPHYTA**



ALABAMA  
TRACHEOPHYTE

PHYLUM  
PINOPHYTA

ALABAMA  
TRACHEOPHYTE

# SYNONYM





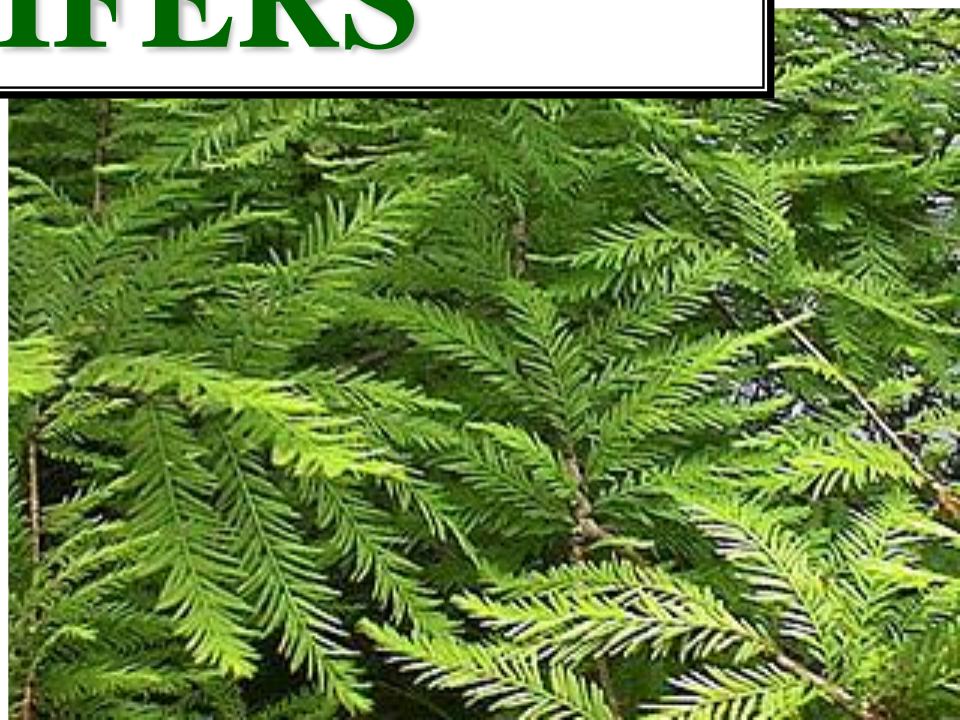
# CONIFEROPHYTA



# COMMON NAME



# CONIFERS



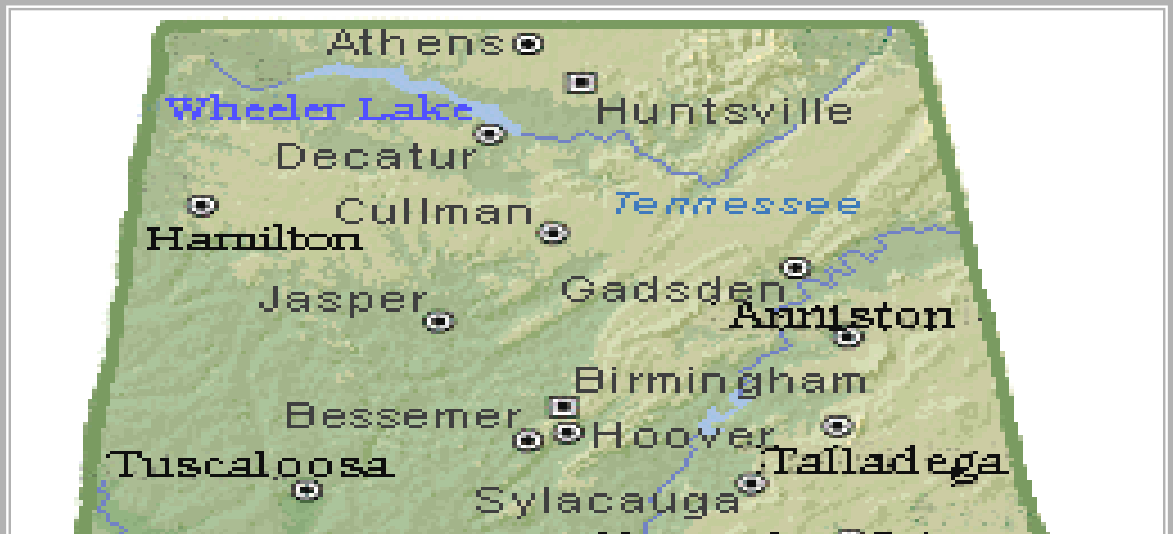


# DIVERSITY



**~650 SPECIES**

**EARTH**



**~12 SPECIES**





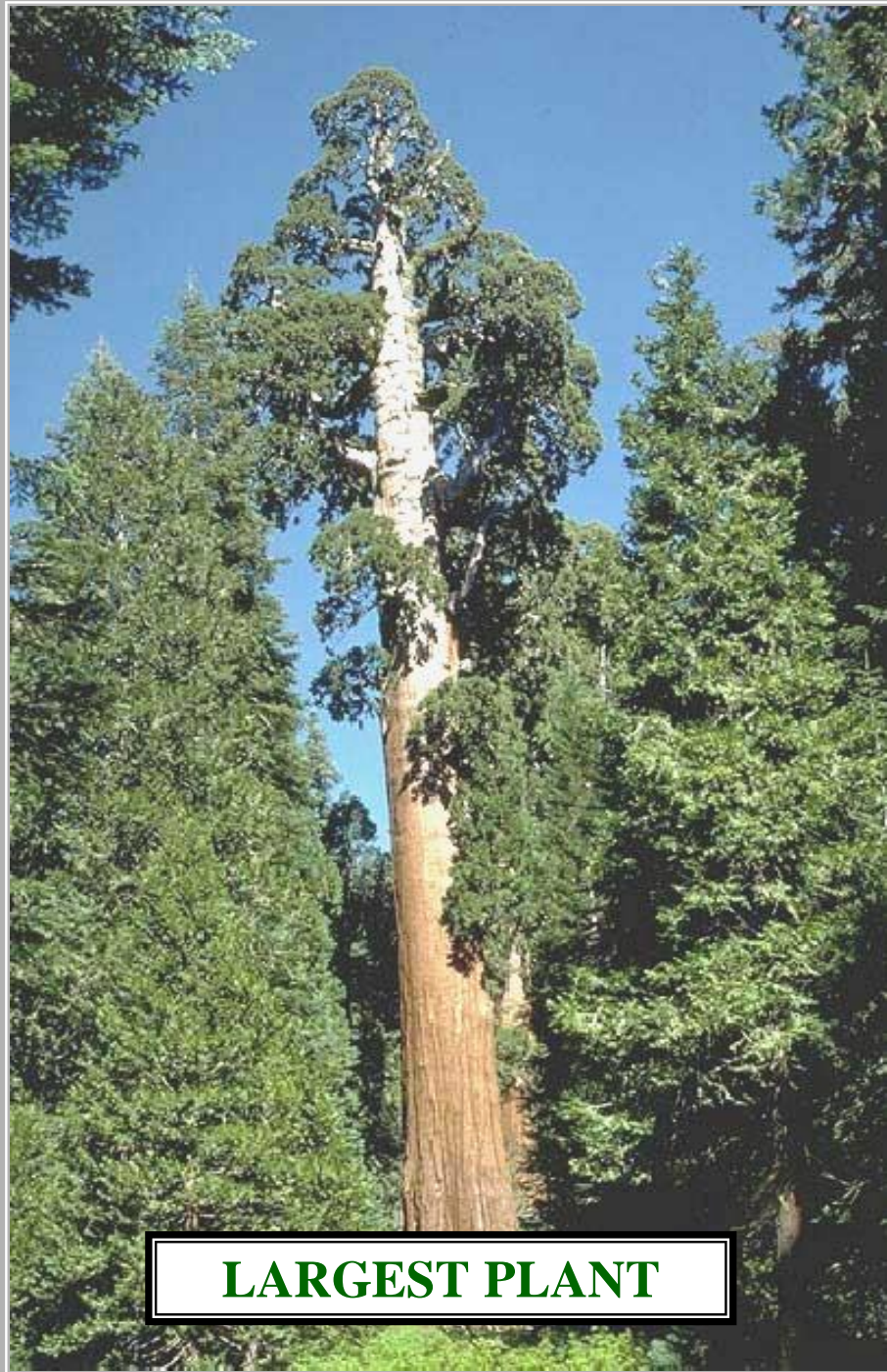
**PINOPHYTA  
MOST DIVERSE  
GYMNOSPERM  
PHYLUM**

**EARTH**

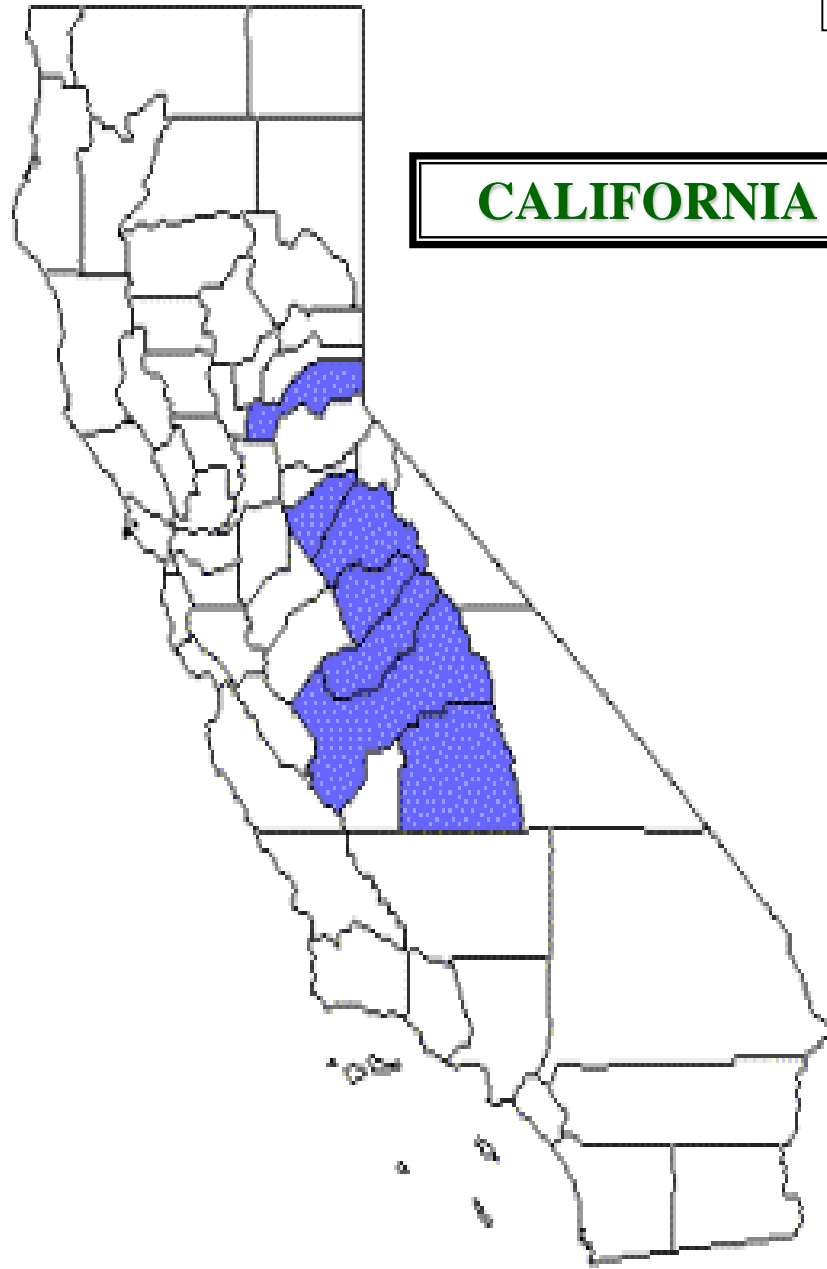


# LARGEST TRACHEOPHYTES



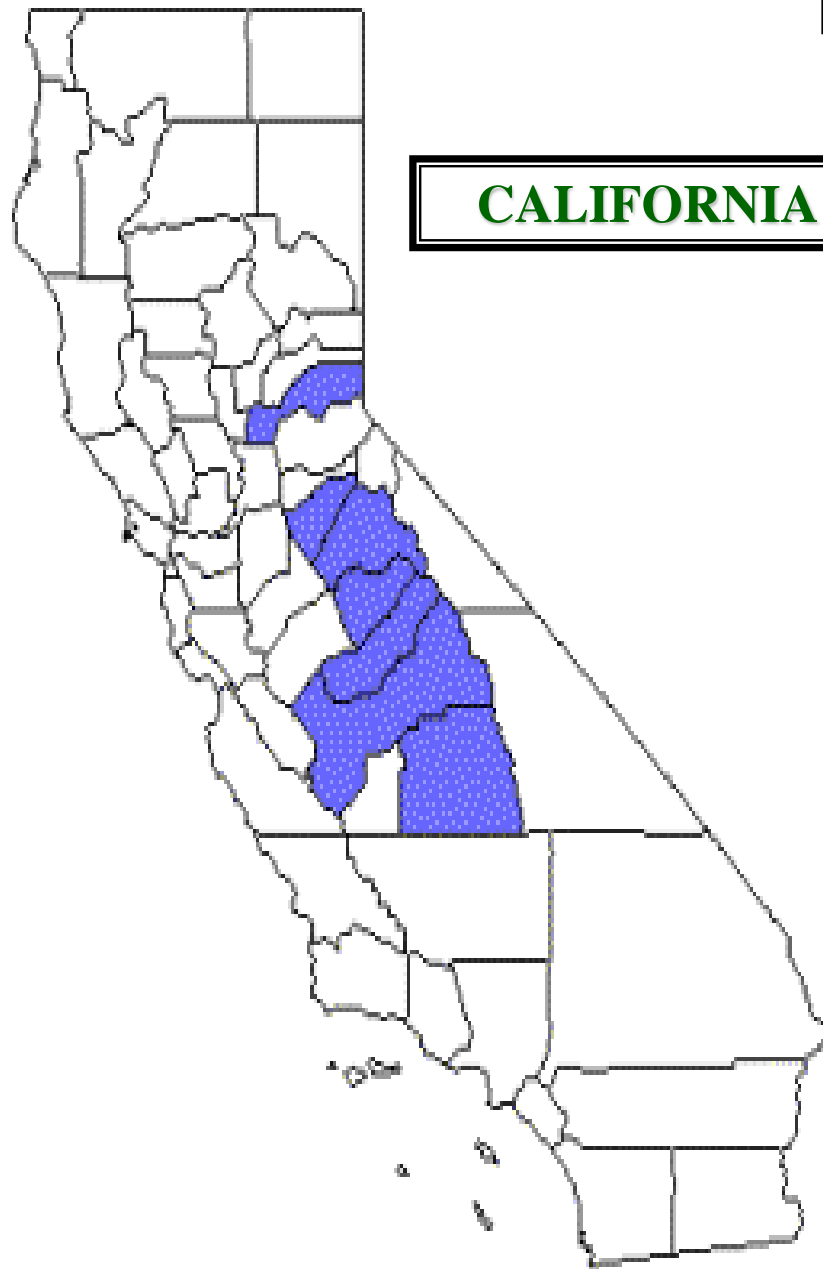


**LARGEST PLANT**

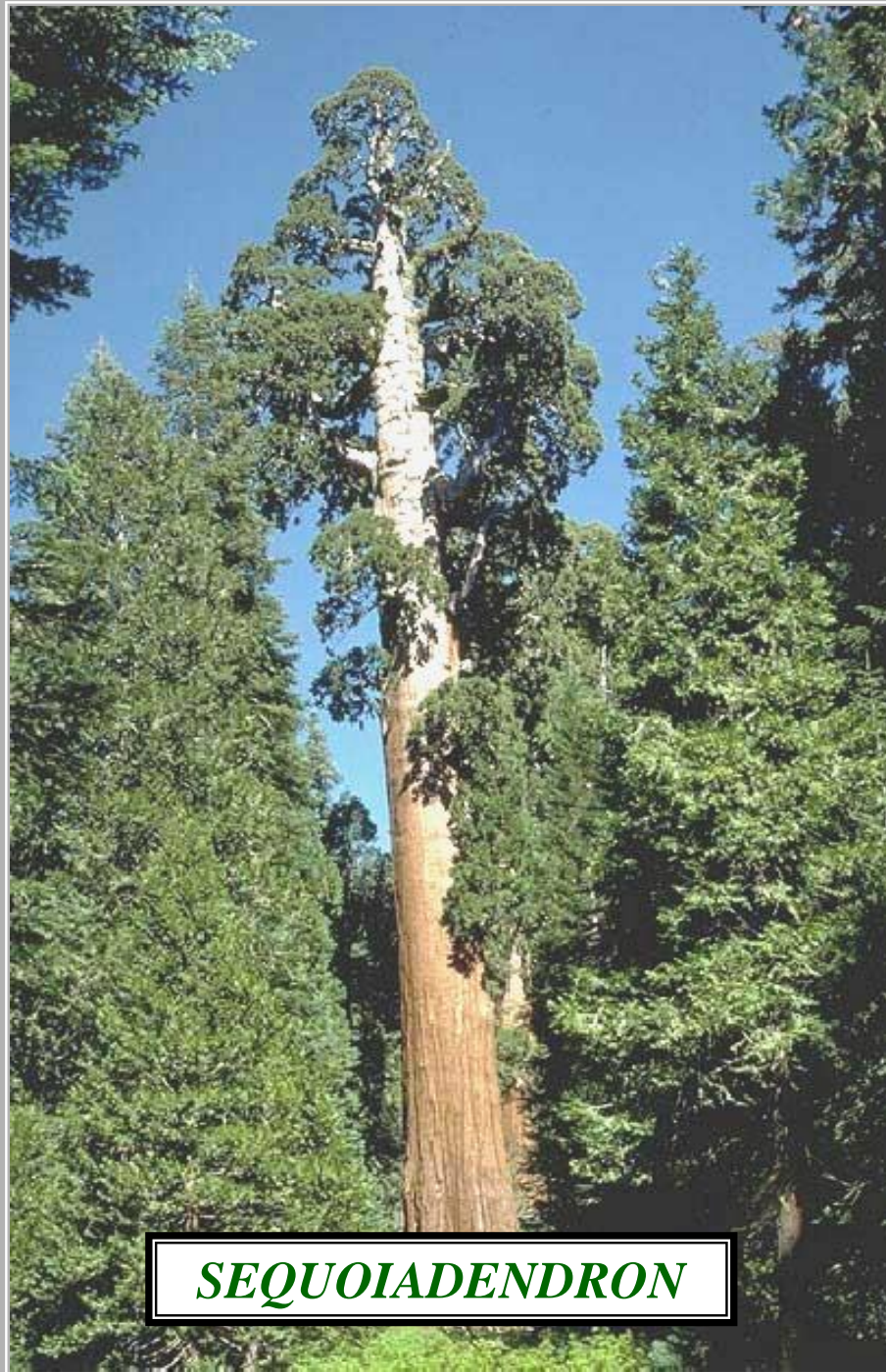


**CALIFORNIA**

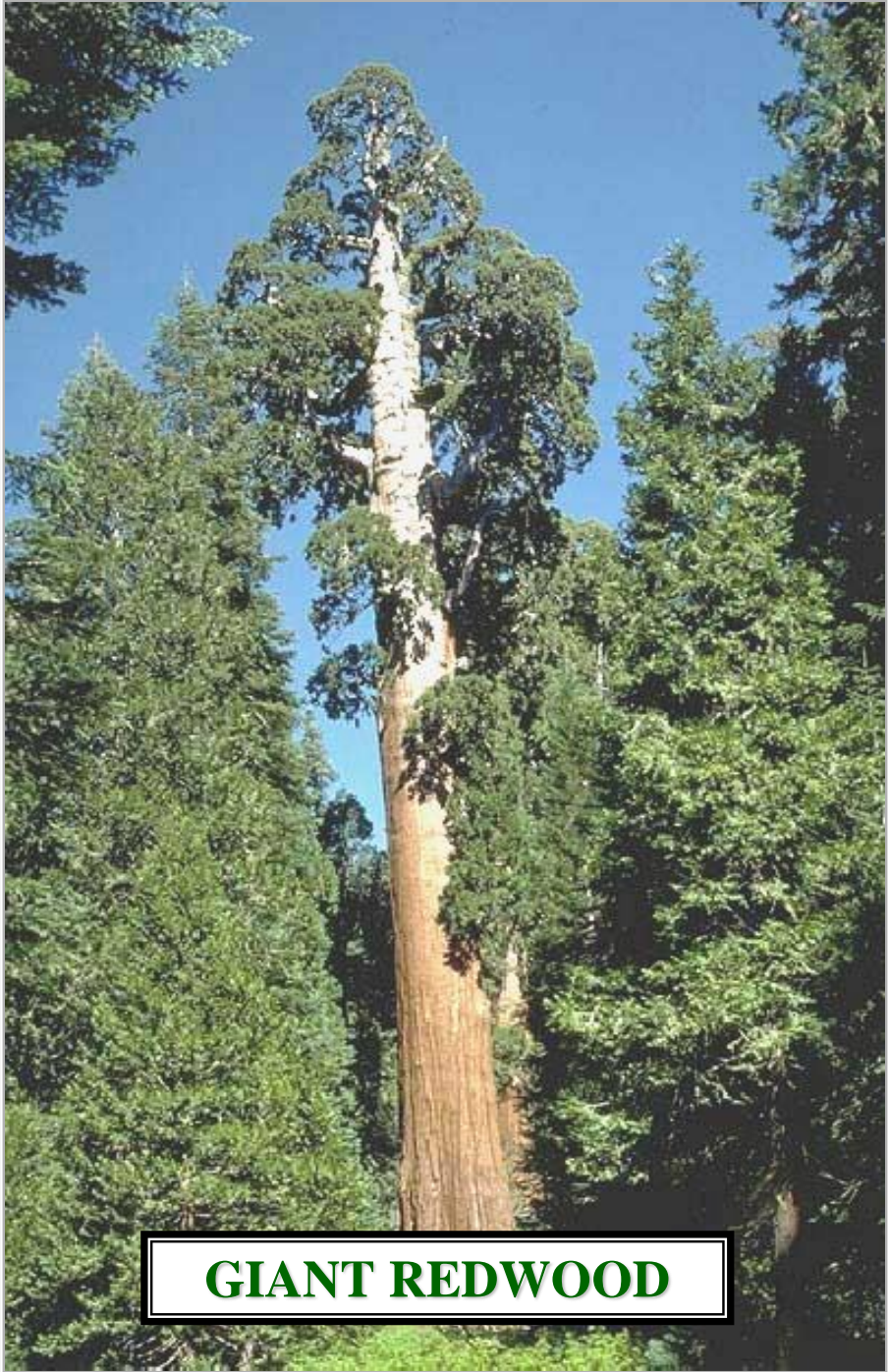
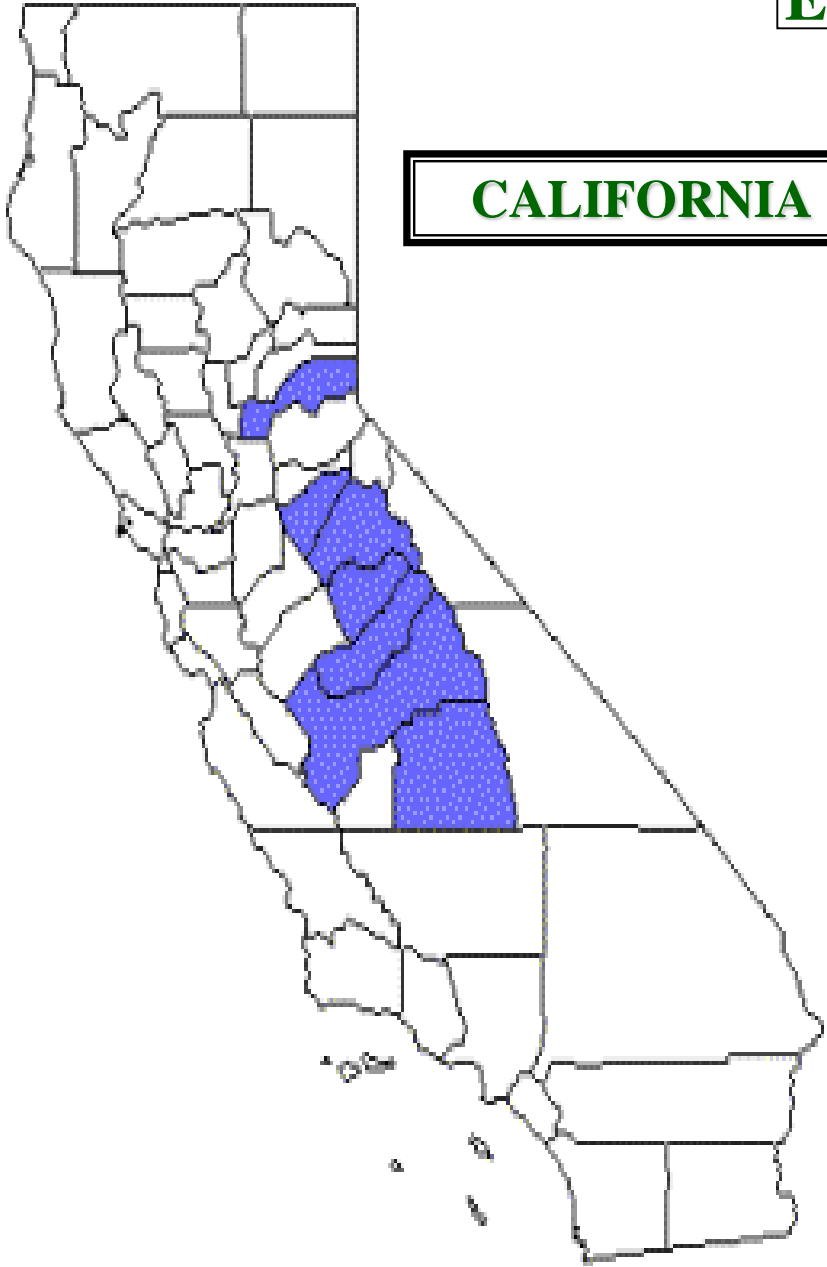
**CALIFORNIA**



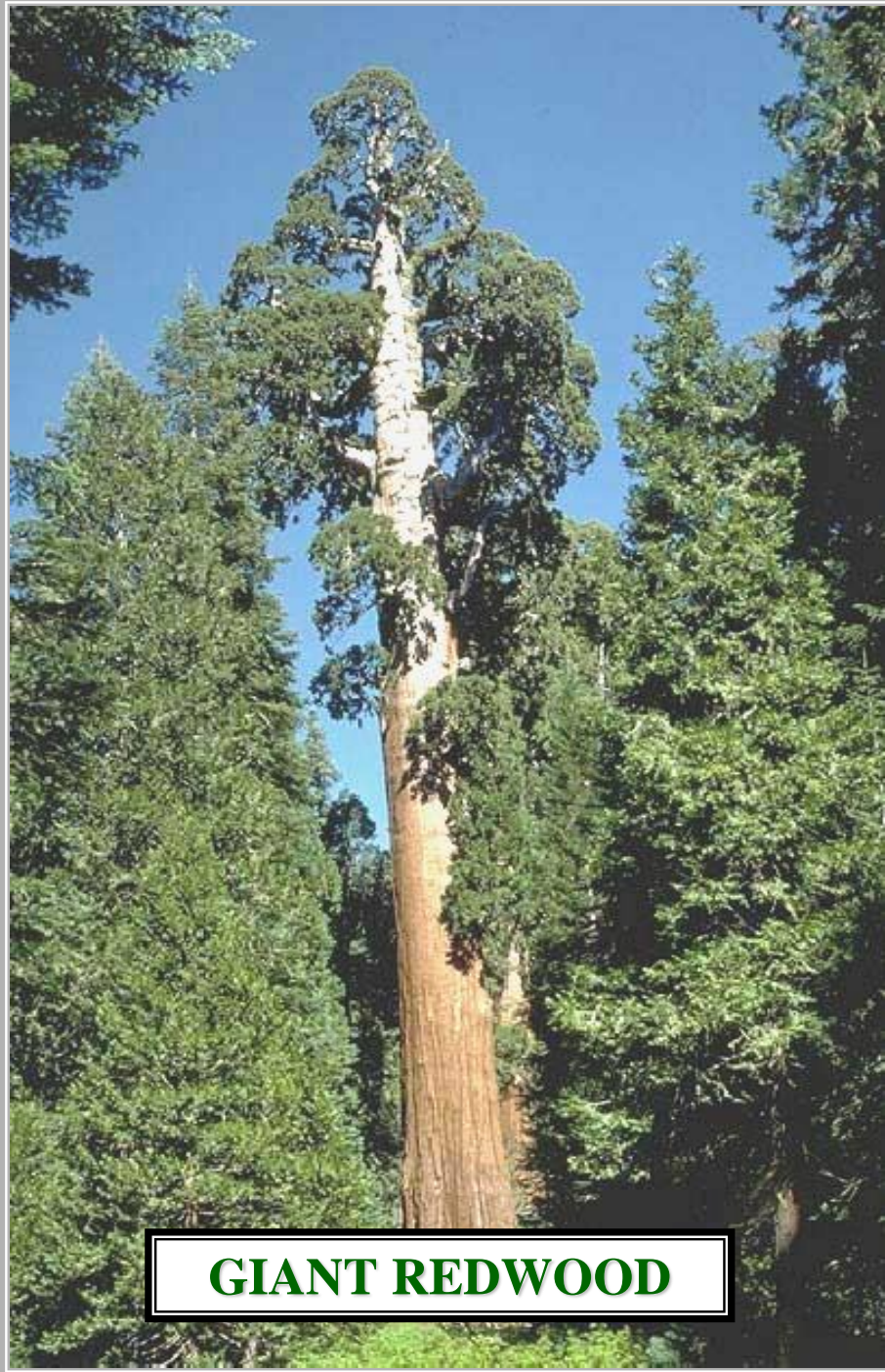
***SEQUIADENDRON***



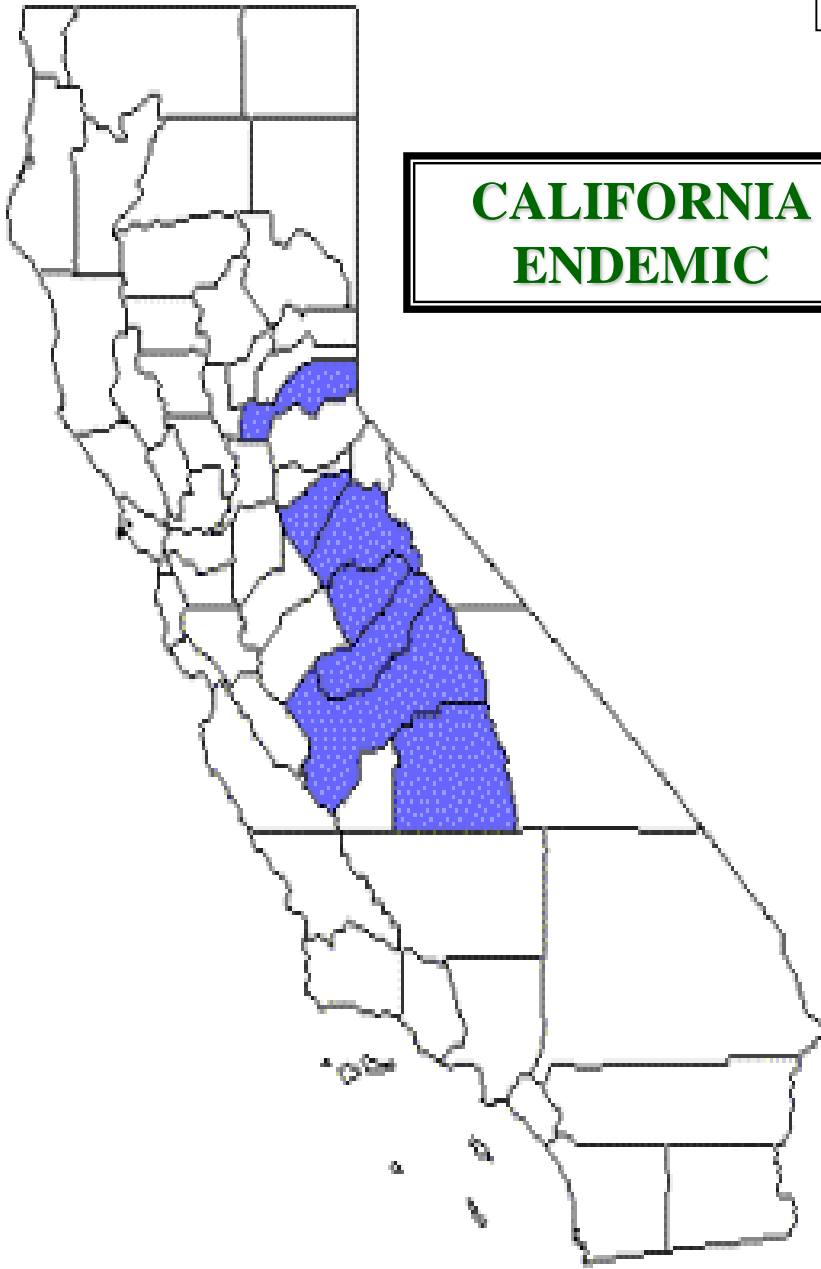
**CALIFORNIA**



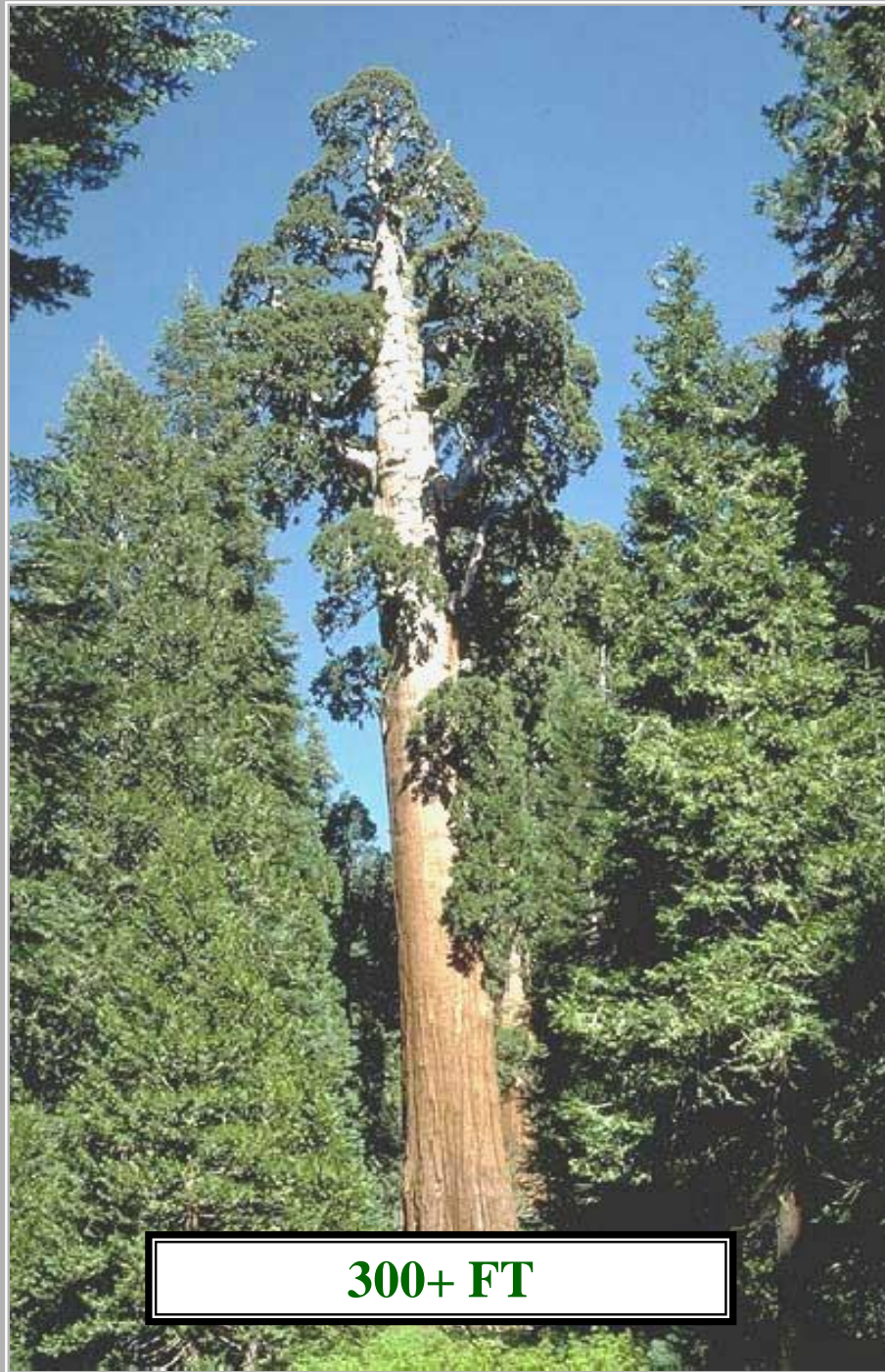
**GIANT REDWOOD**



**GIANT REDWOOD**



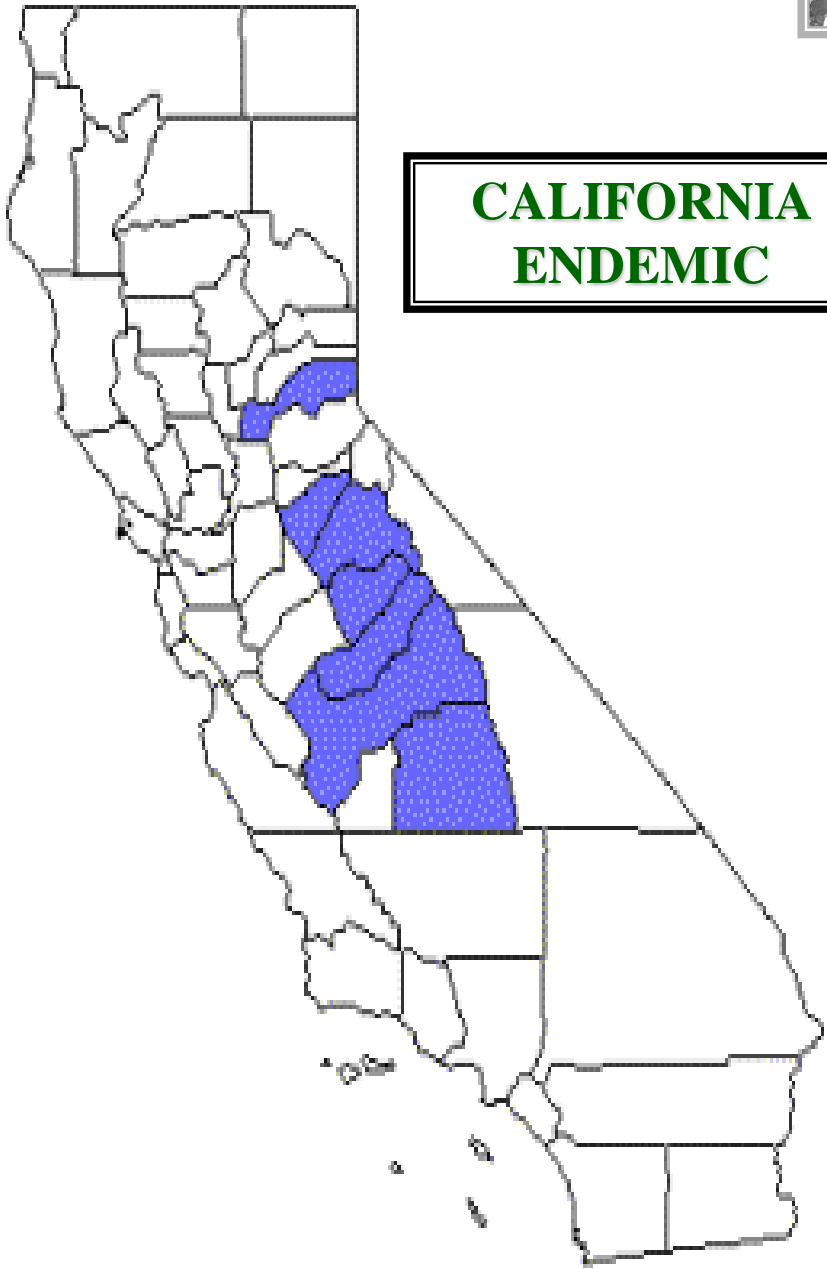
**CALIFORNIA ENDEMIC**

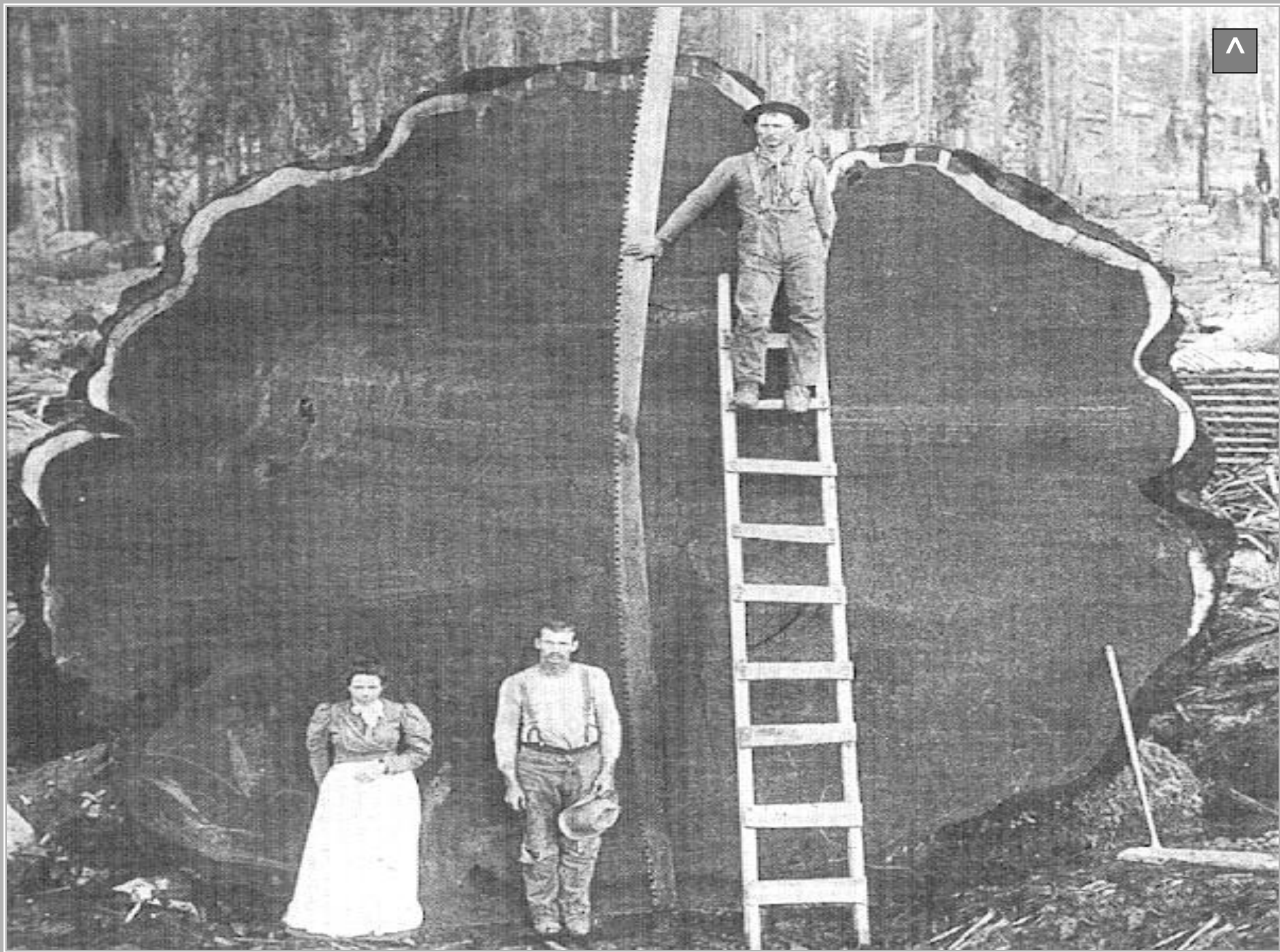


**300+ FT**



**CALIFORNIA  
ENDEMIC**







# OLDEST TRACHEOPHYTES

B



*PINUS LONGAVA*





**BRISTLECONE PINE**

#



**US ENDEMIC**



~4,500 YRS

*PINUS LONGAeva*



**PINOPHYTA**  
**ONLY INDIGENOUS**  
**ALABAMA**  
**GYMNOSPERM**  
**PHYLUM**

