

S

MEGAGAMETOPHYTE

COTYLEDONS

STEM APICAL  
MERISTEM

HYPOCOTYL

RADICLE

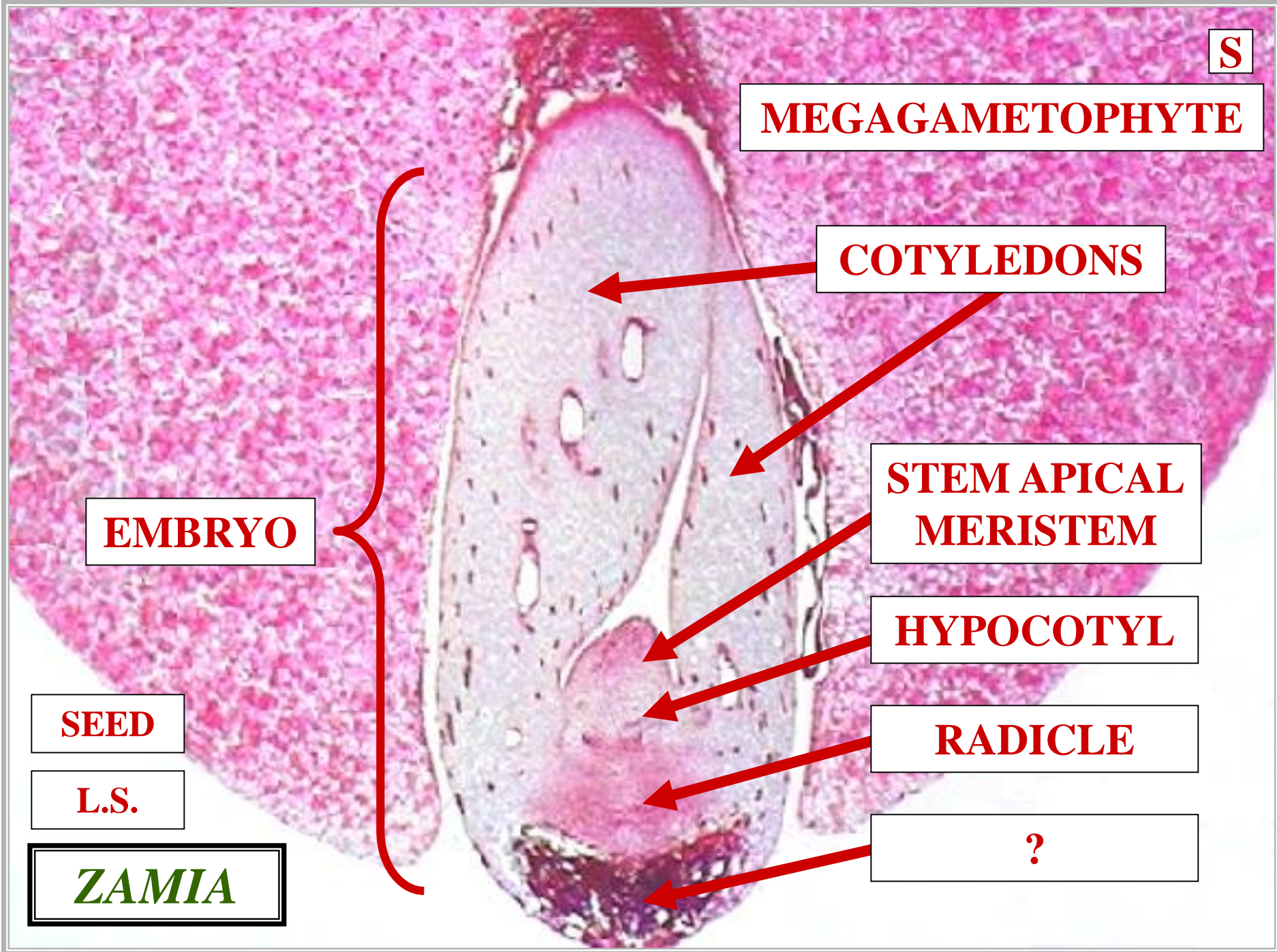
?

EMBRYO

SEED

L.S.

*ZAMIA*







**MEGAGAMETOPHYTE**

**COTYLEDONS**

**STEM APICAL  
MERISTEM**

**HYPOCOTYL**

**RADICLE**

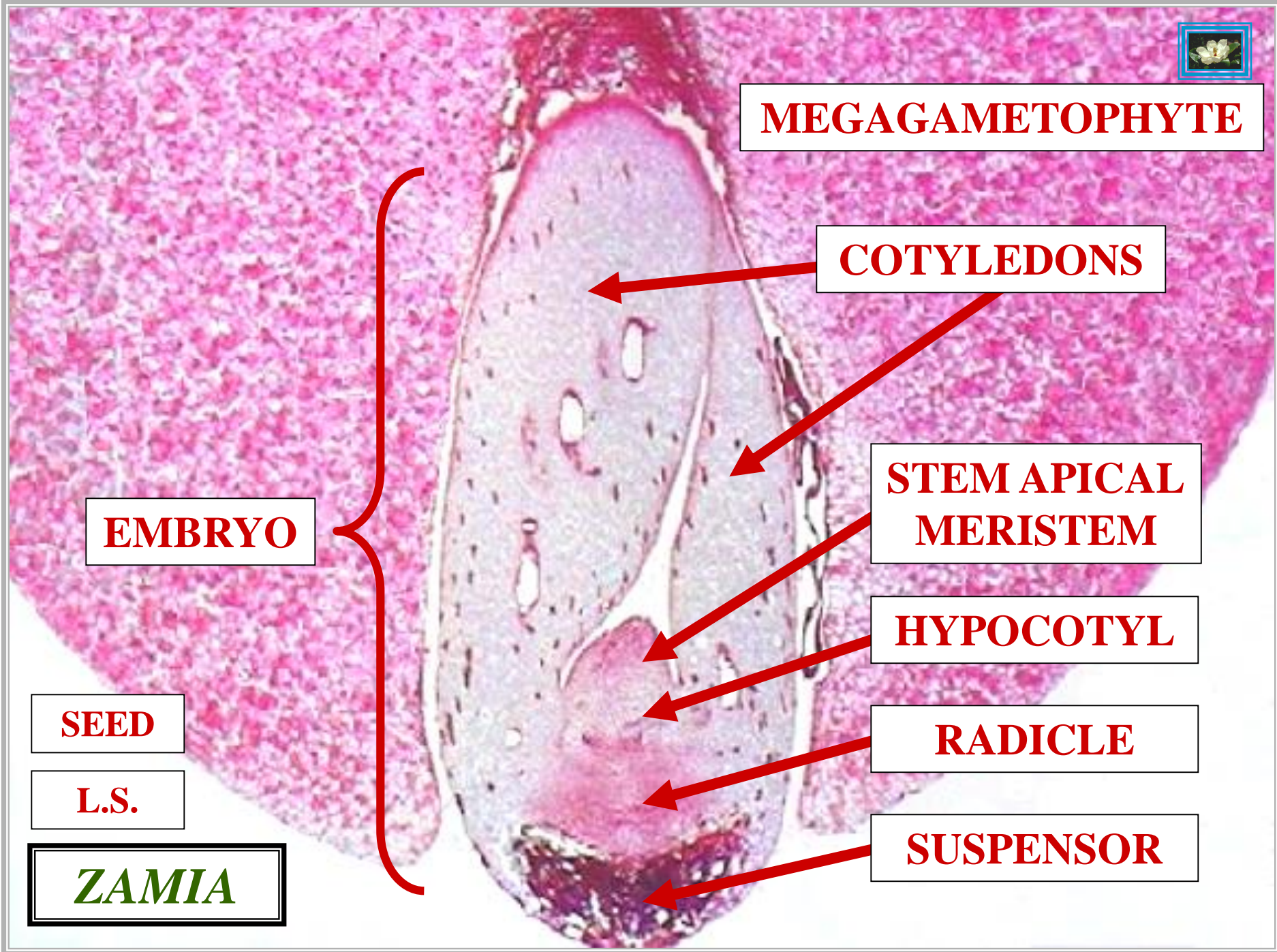
**SUSPENSOR**

**EMBRYO**

**SEED**

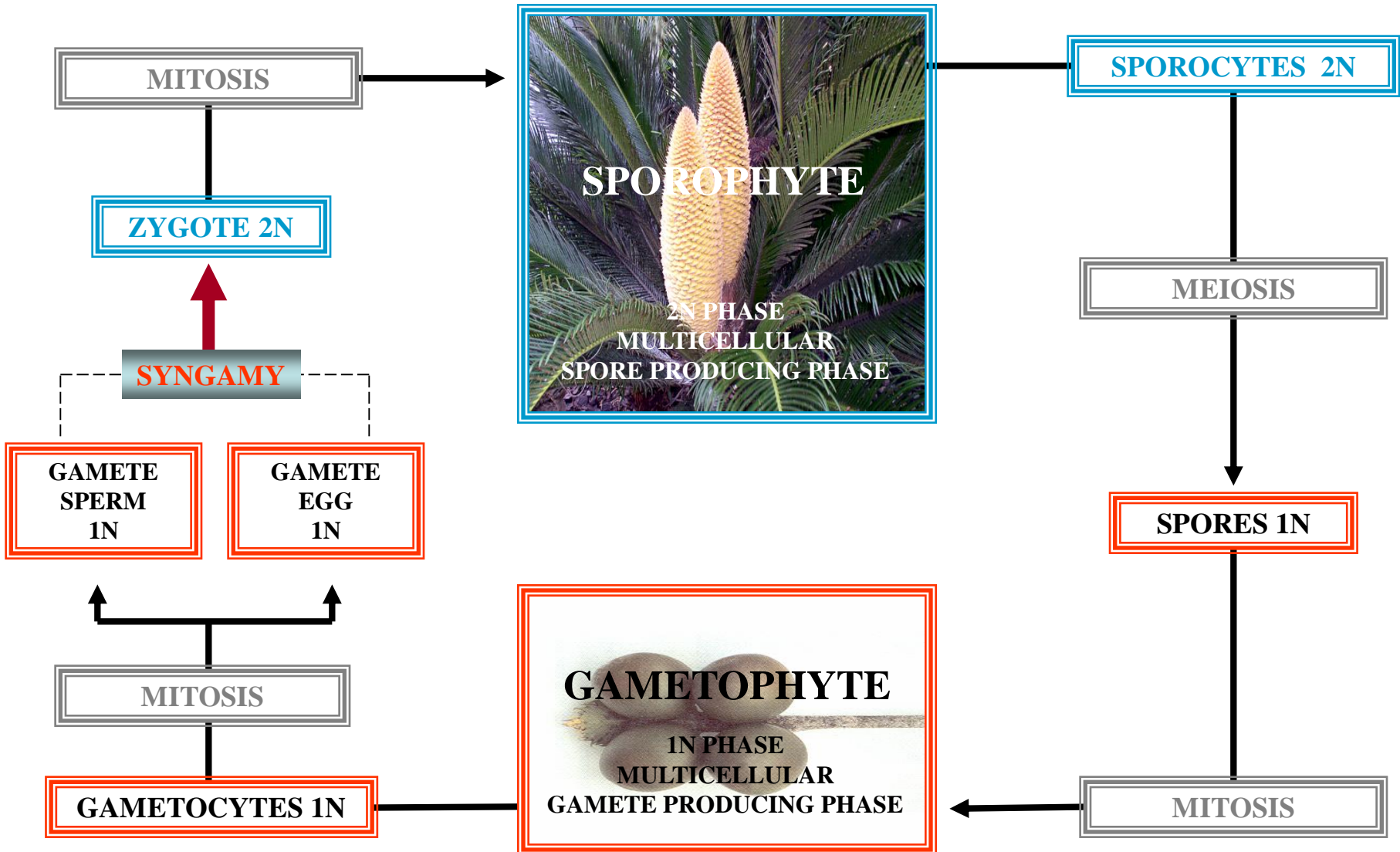
**L.S.**

***ZAMIA***



# CYCADOPHYTA

## LIFE CYCLE



# GAMETOPHYTE CHARACTERS



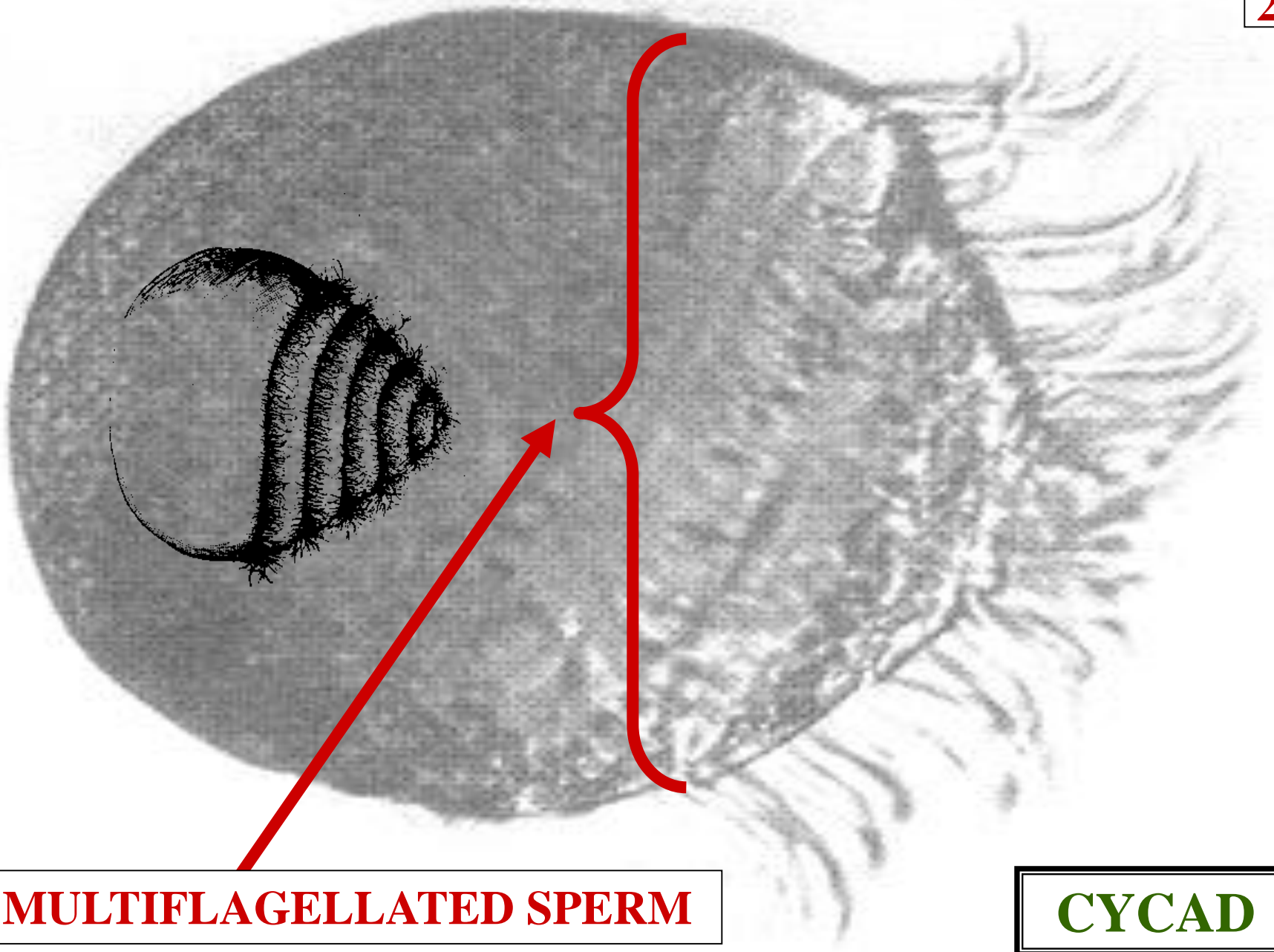


# MICROGAMETOPHYTE



# SPERM



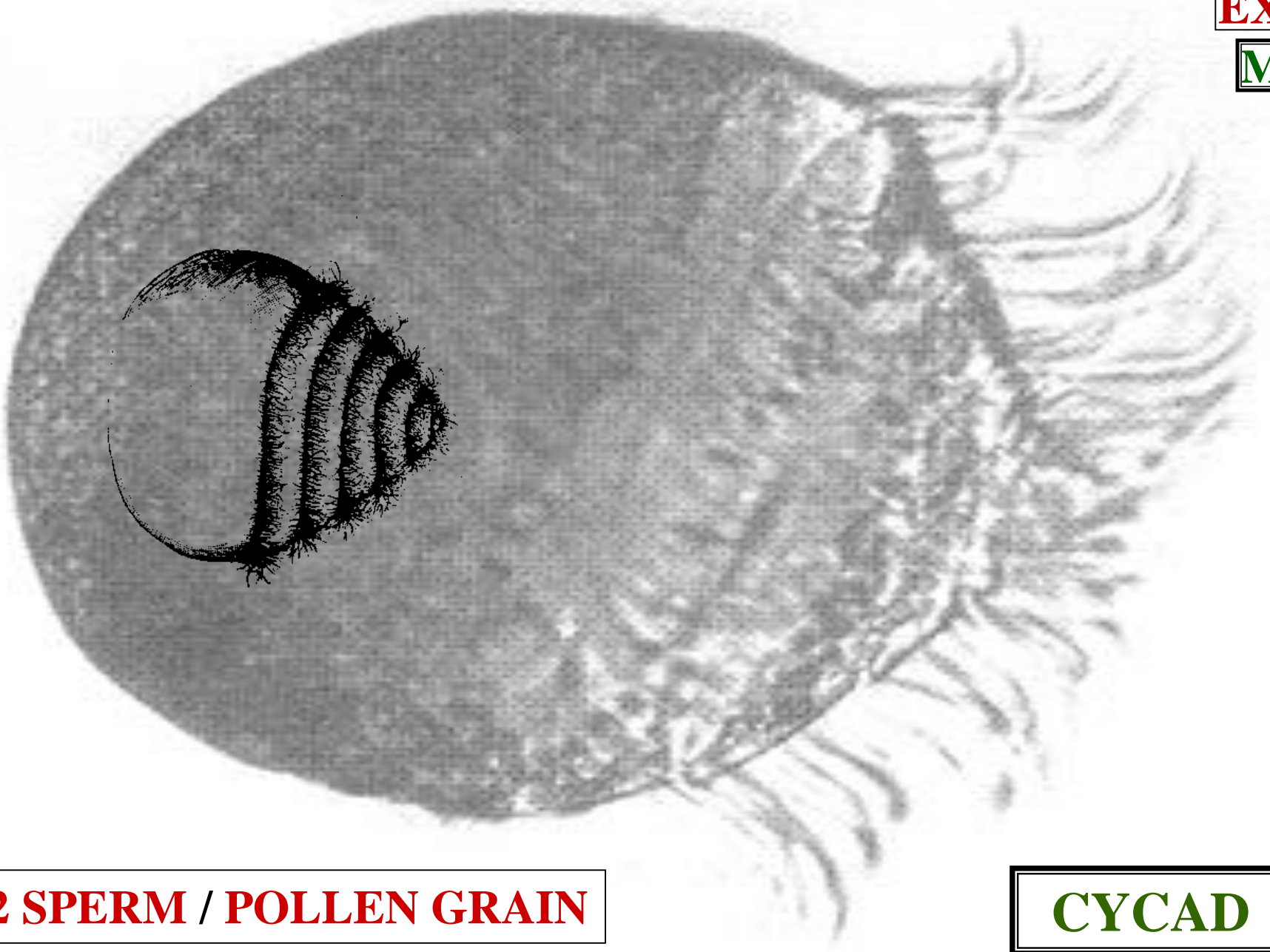


**MULTIFLAGELLATED SPERM**

**CYCAD**

**EX**

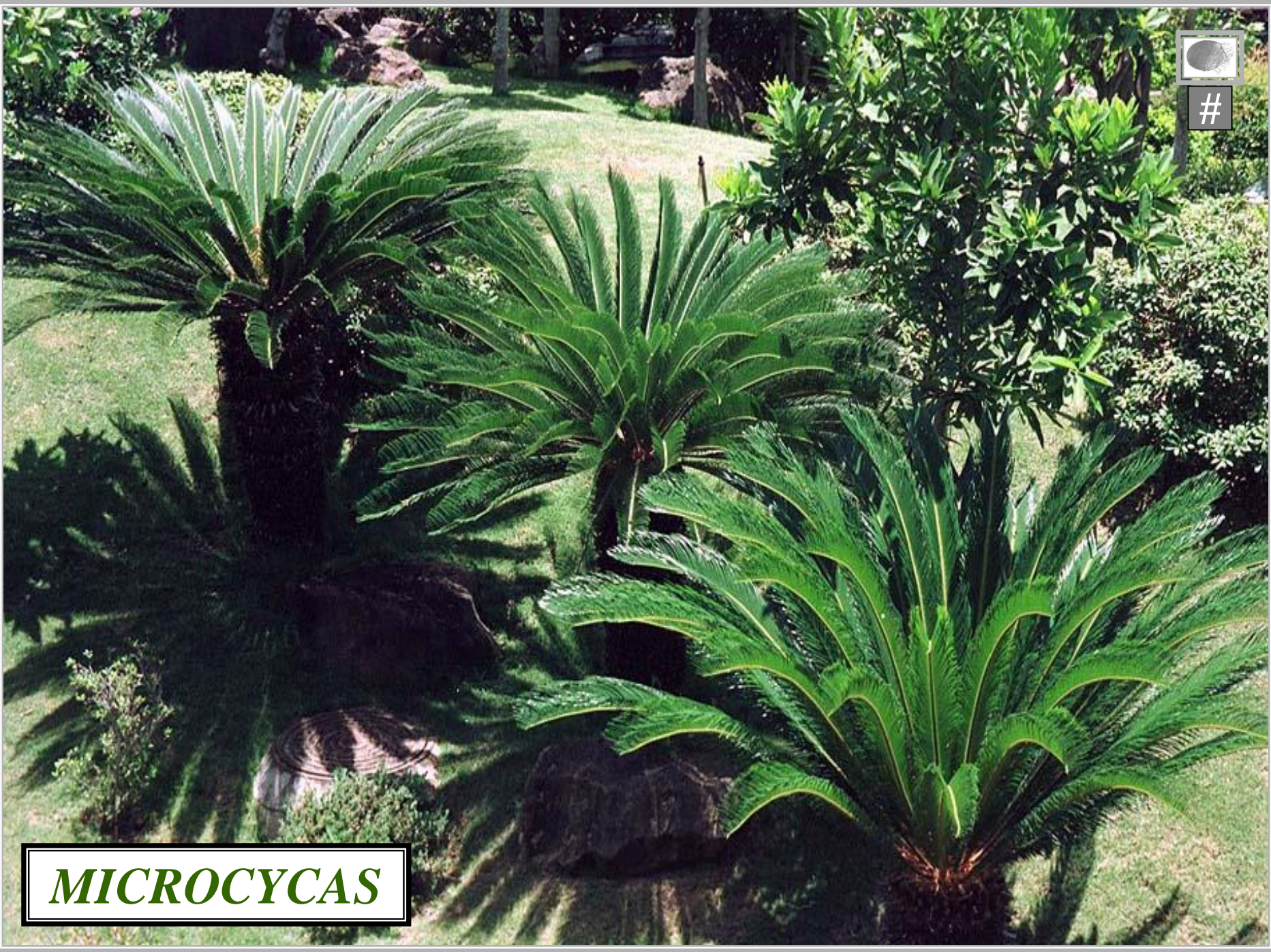
**M**



**2 SPERM / POLLEN GRAIN**

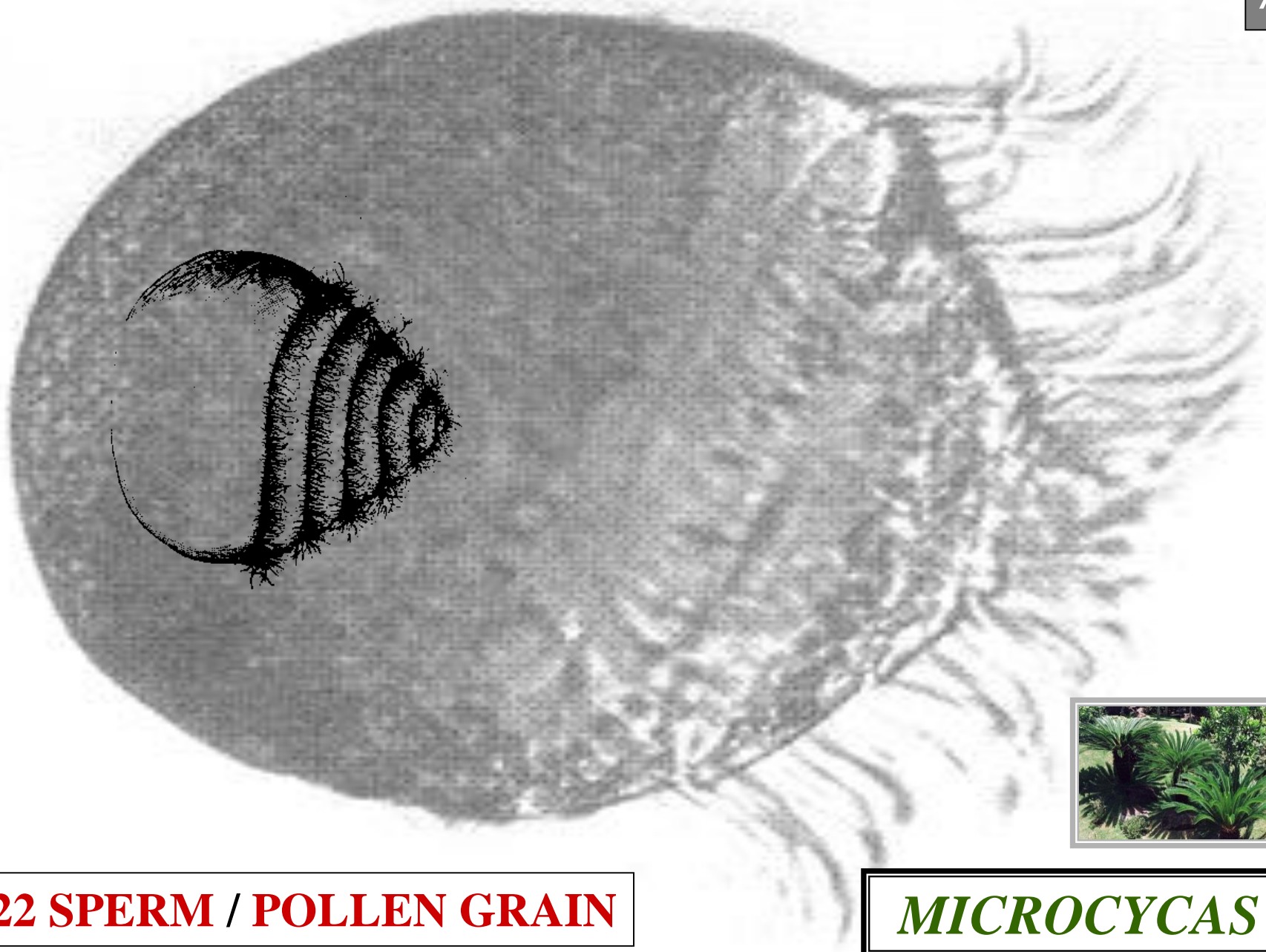
**CYCAD**





*MICROCYCAS*





**22 SPERM / POLLEN GRAIN**

***MICROCYCAS***





# MEGAGAMETOPHYTE



# ARCHEGONIA

**L.S.**

**?**

***ZAMIA***

**OVULE**



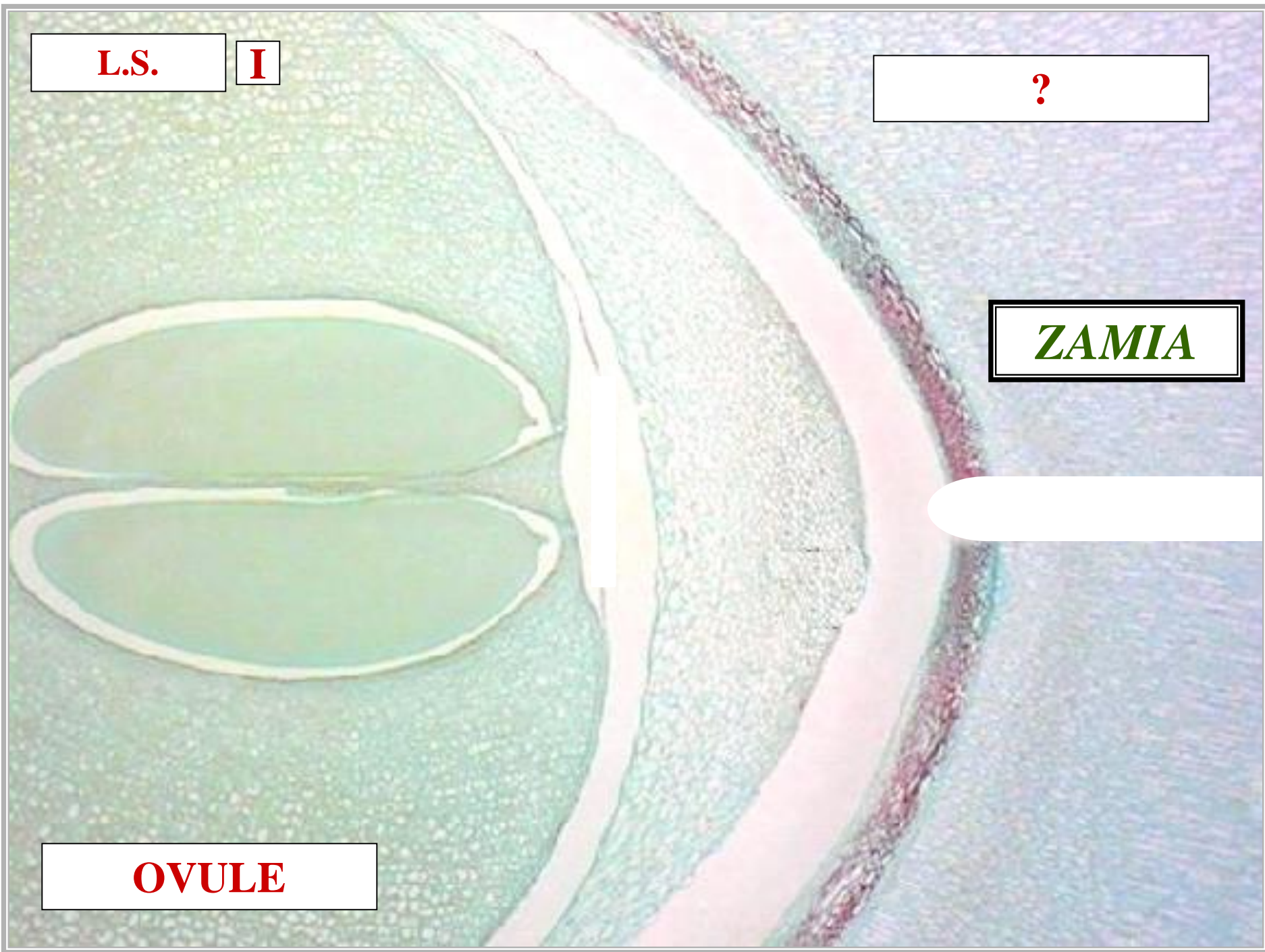
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**I**

**?**

***ZAMIA***

**OVULE**





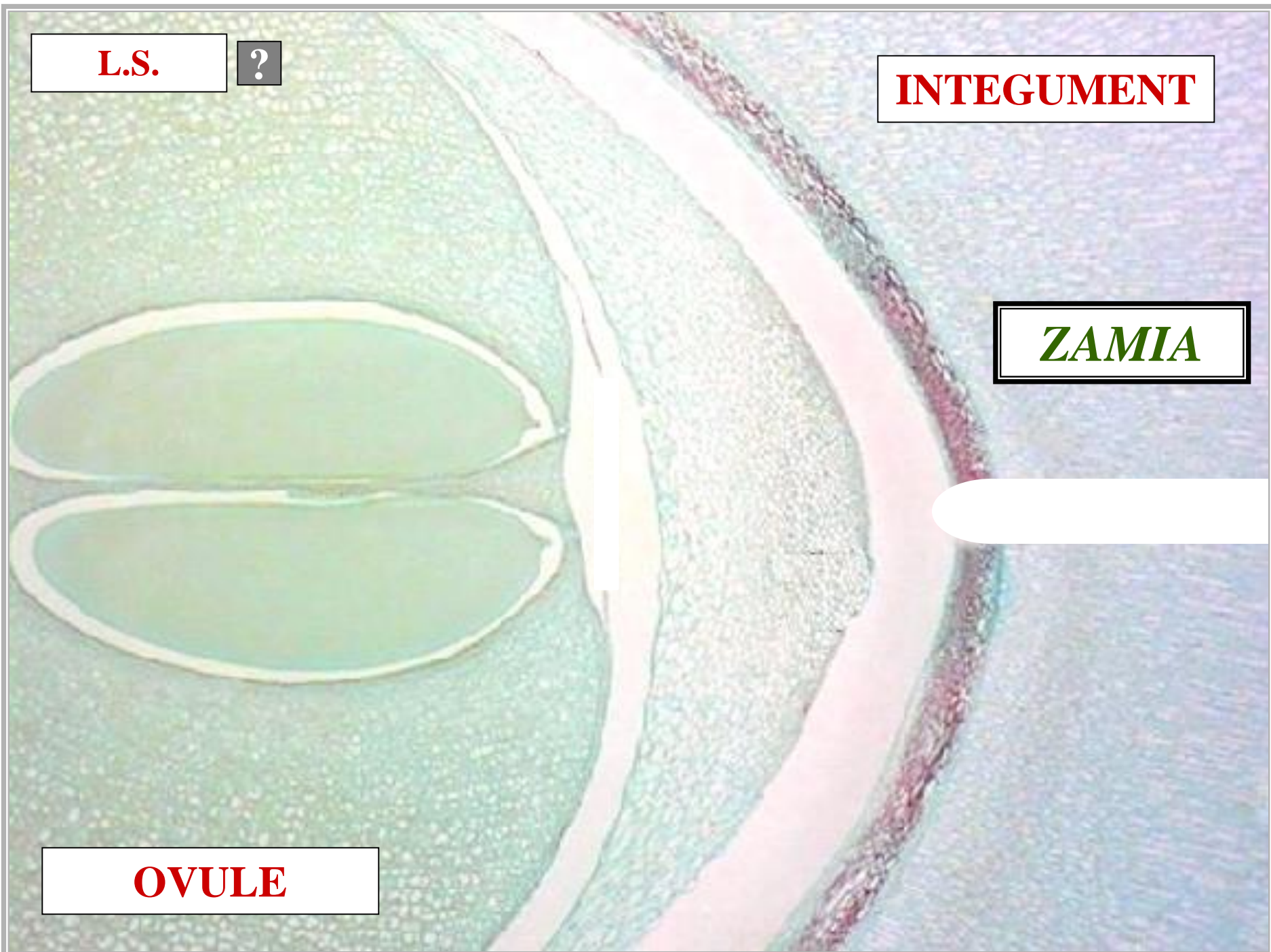
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**?**

**INTEGUMENT**

***ZAMIA***

**OVULE**



**L.S.**

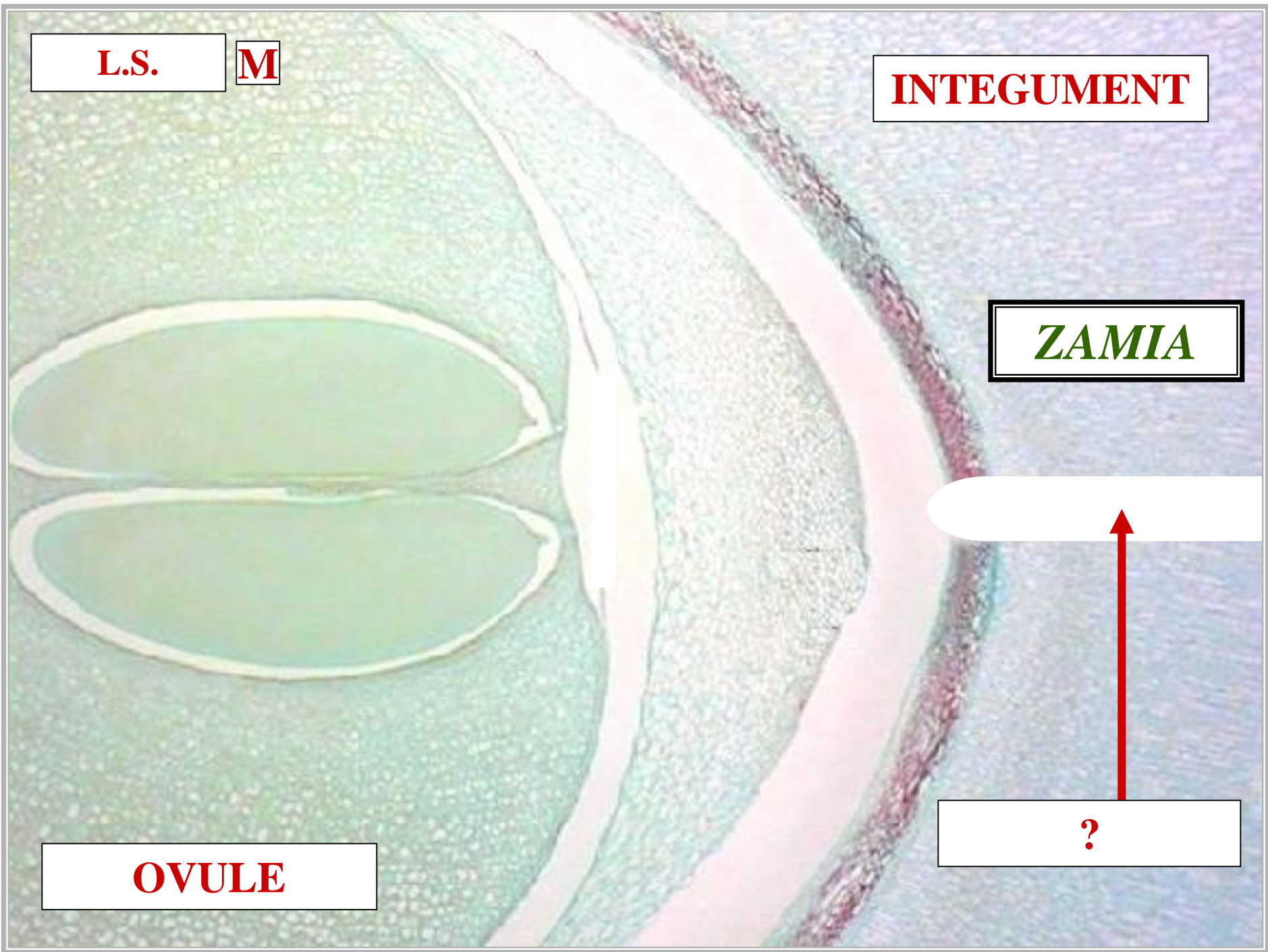
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**INTEGUMENT**

***ZAMIA***

**OVULE**

**?**





**L.S.**

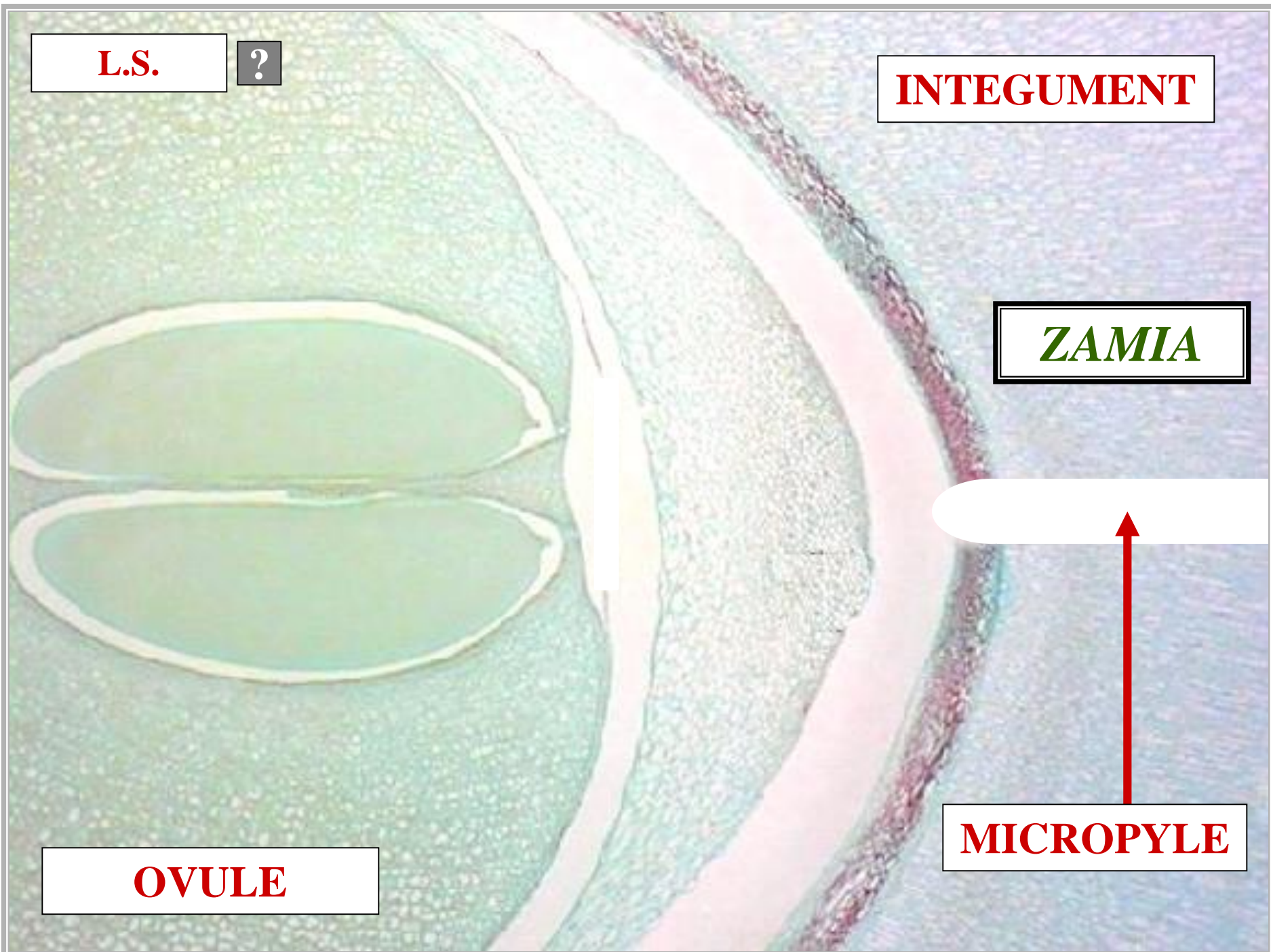
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**INTEGUMENT**

***ZAMIA***

**OVULE**

**MICROPYLE**





**L.S.**

**P**

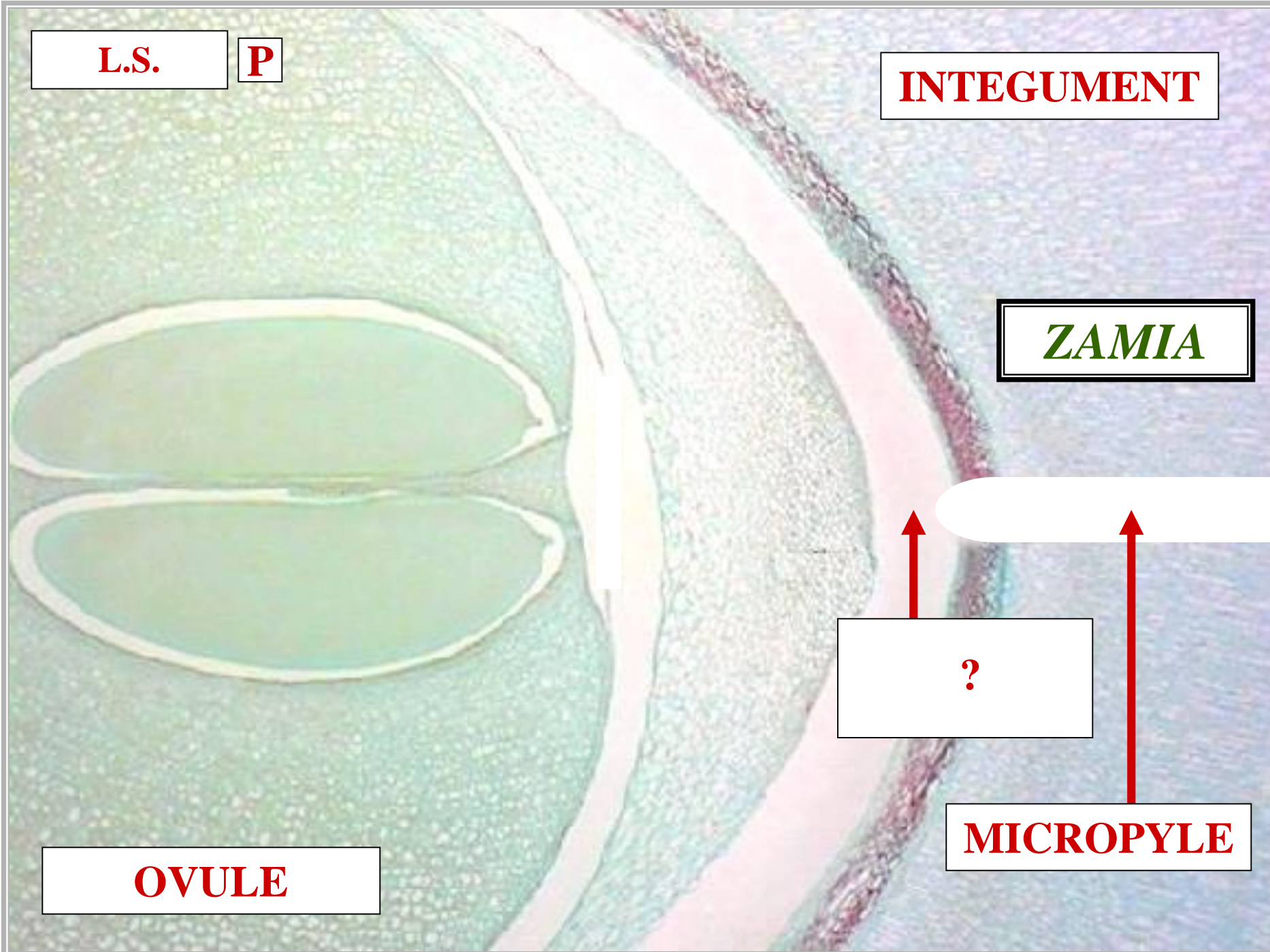
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**OVULE**

**?**

**MICROPYLE**



**L.S.**

**?**

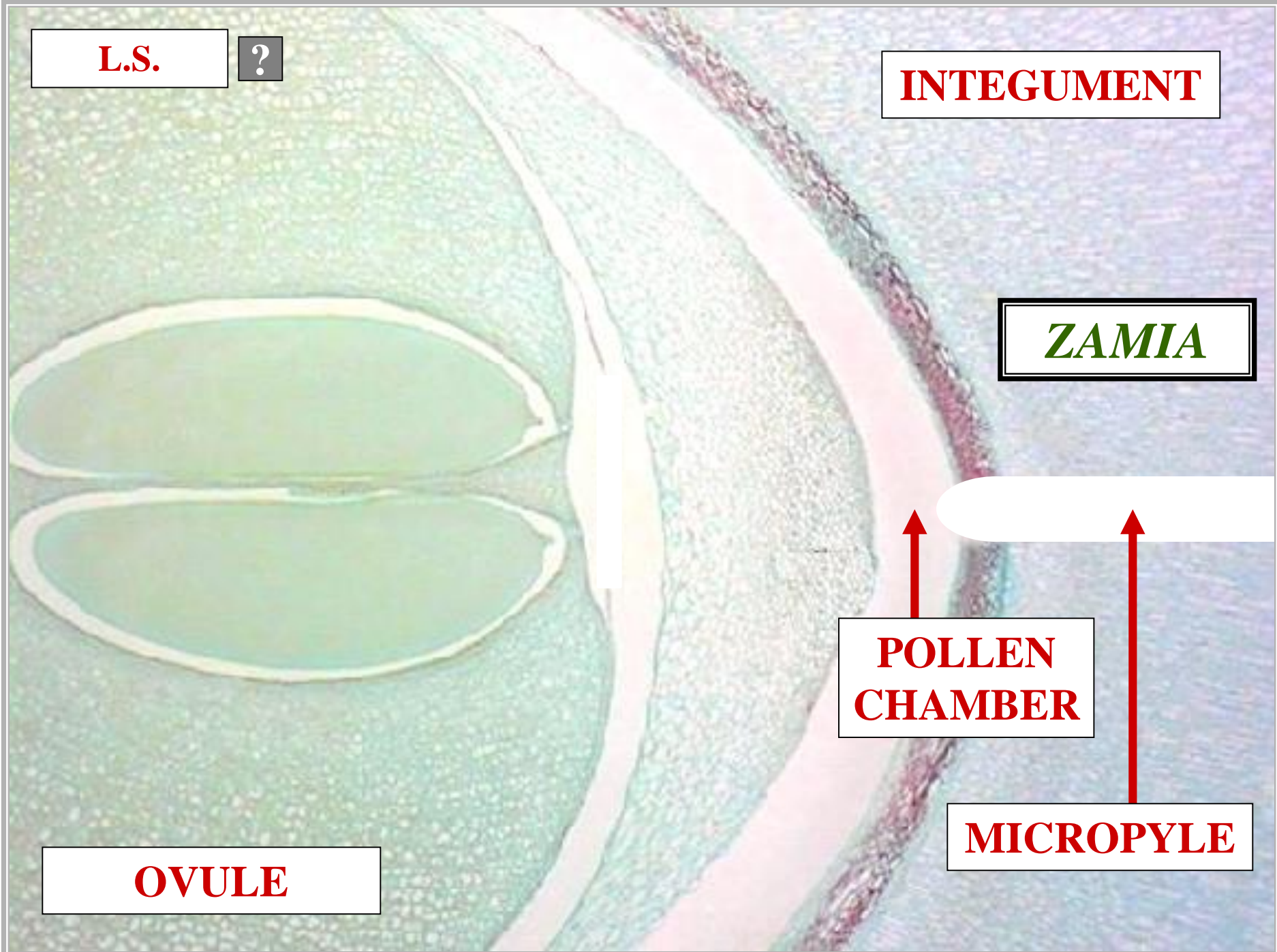
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***ZAMIA***

**POLLEN  
CHAMBER**

**MICROPYLE**

**OVULE**





**L.S.**

**M**

**INTEGUMENT**

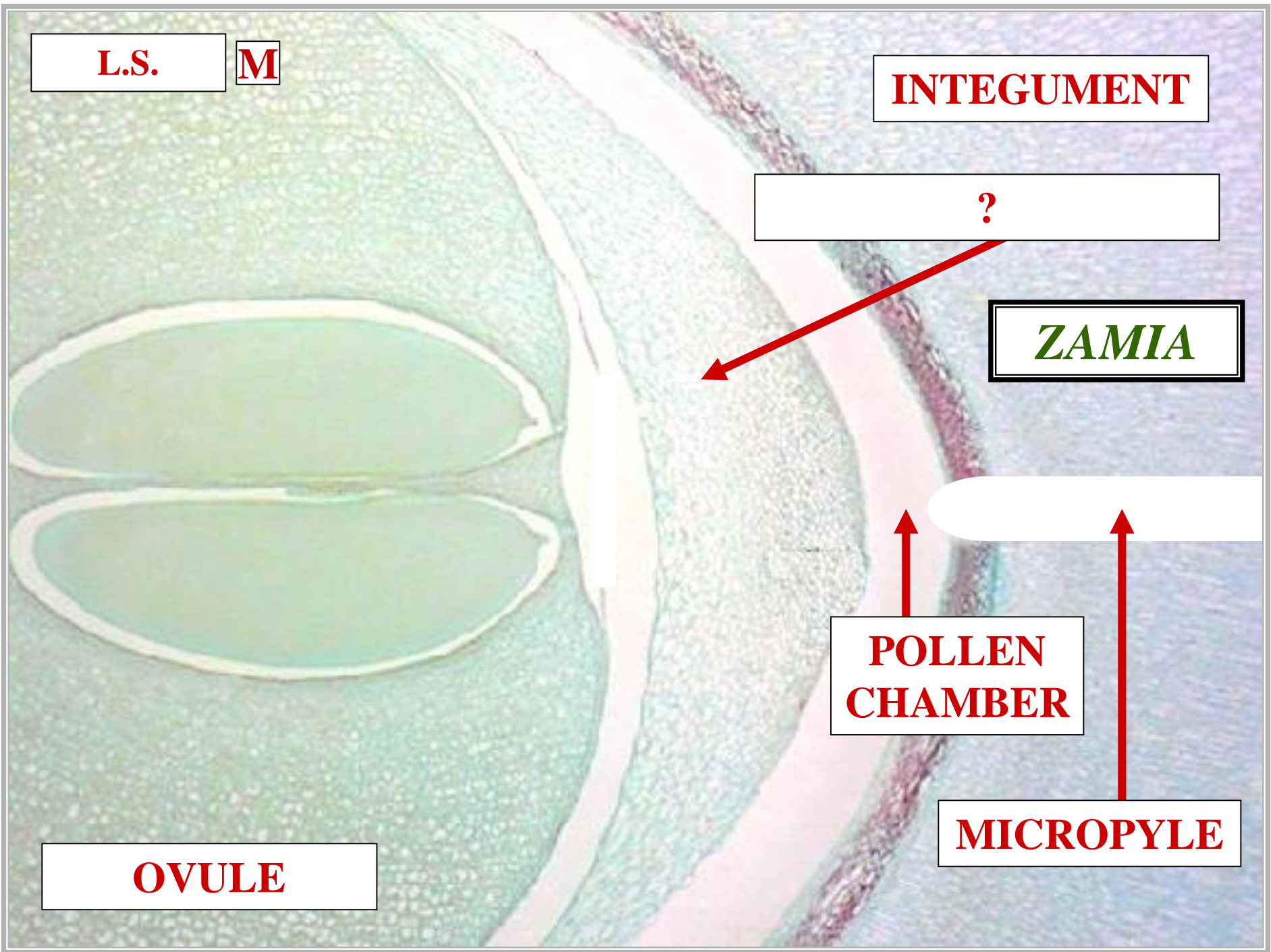
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***ZAMIA***

**POLLEN  
CHAMBER**

**MICROPYLE**

**OVULE**





**L.S.**

**=**

**INTEGUMENT**

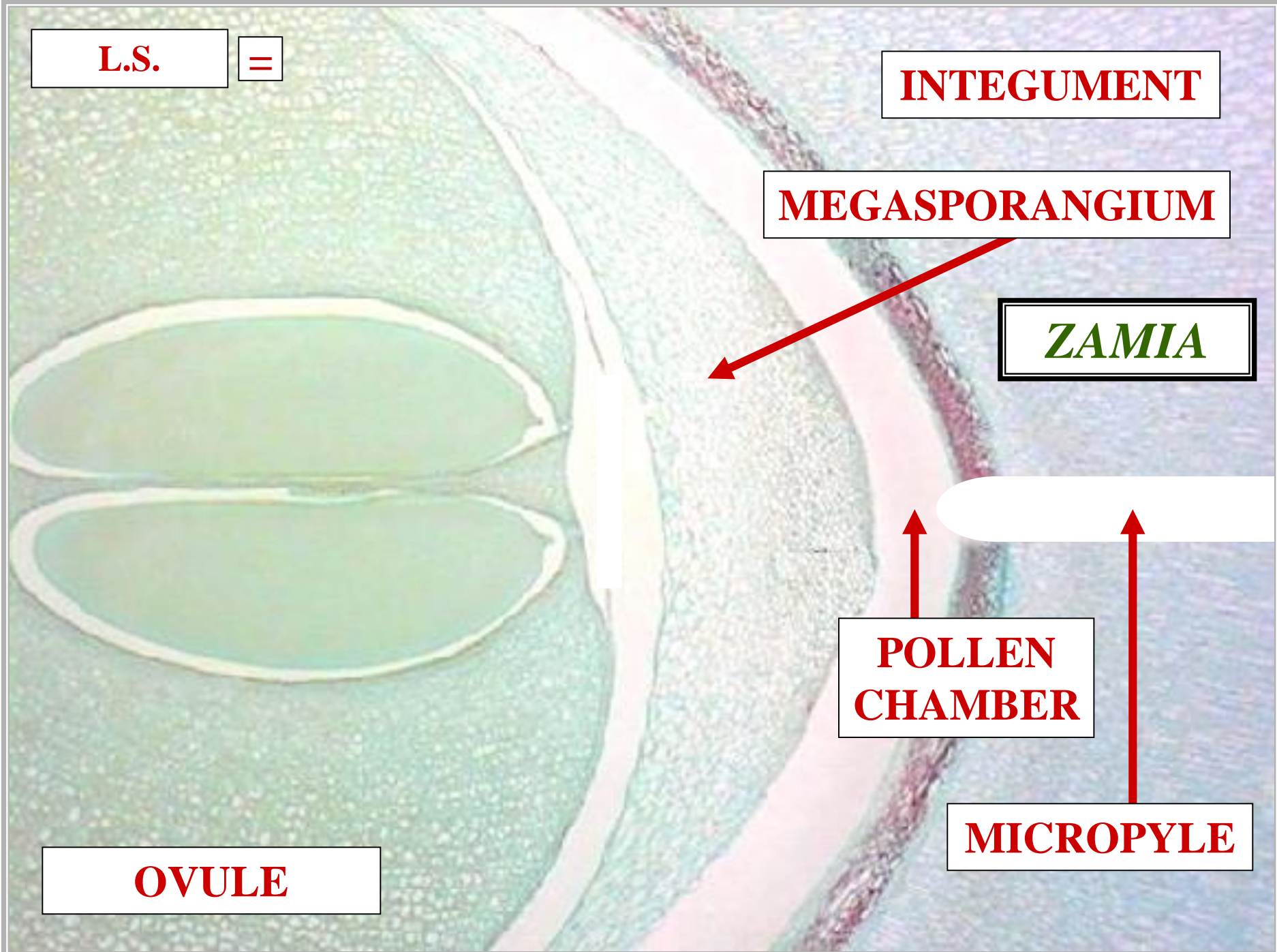
**MEGASPORANGIUM**

***ZAMIA***

**POLLEN  
CHAMBER**

**MICROPYLE**

**OVULE**



**L.S.**

**?**

**INTEGUMENT**

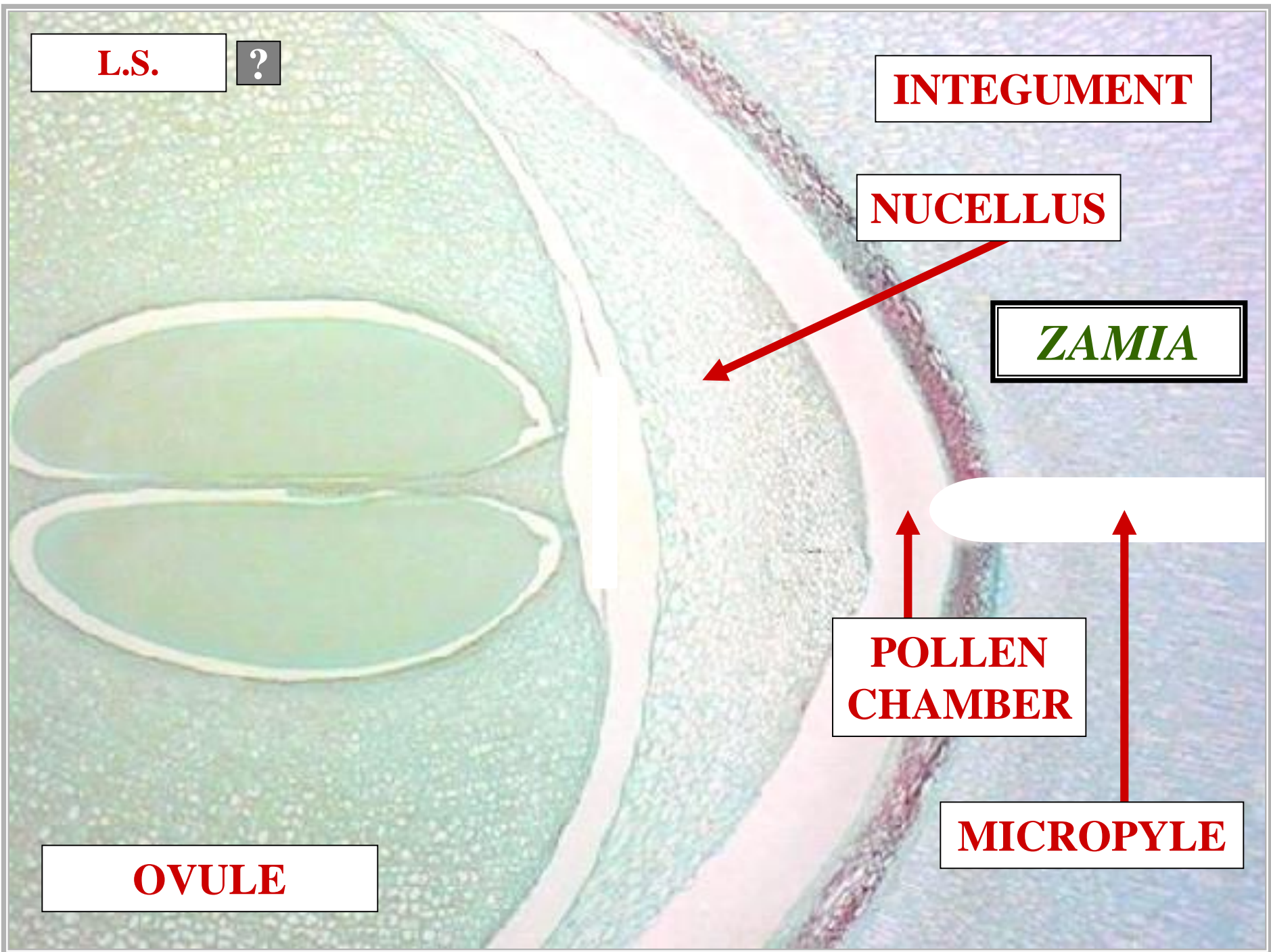
**NUCELLUS**

***ZAMIA***

**POLLEN  
CHAMBER**

**MICROPYLE**

**OVULE**





**L.S.**

**M**

**?**

**INTEGUMENT**

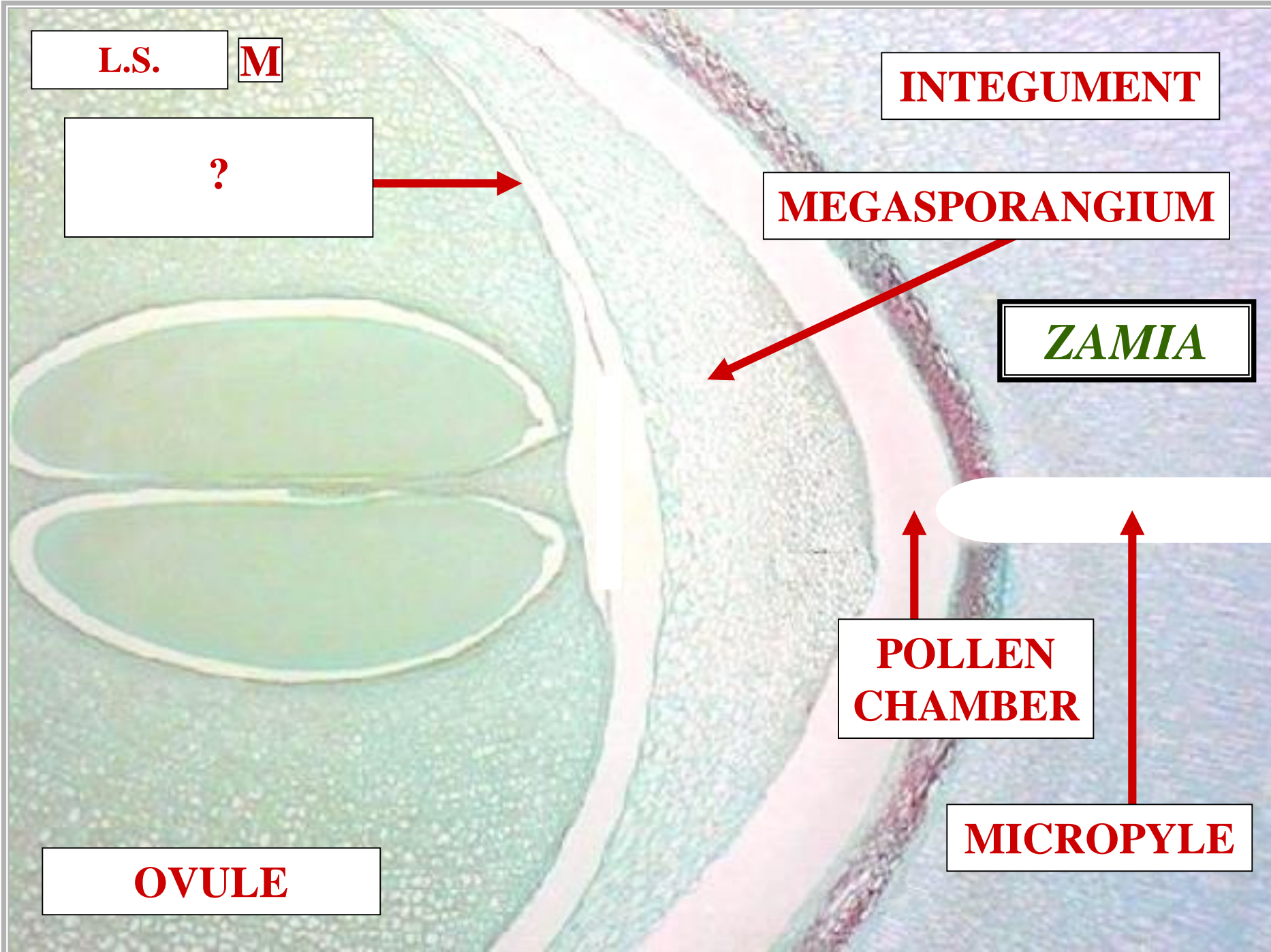
**MEGASPORANGIUM**

***ZAMIA***

**POLLEN  
CHAMBER**

**MICROPYLE**

**OVULE**





**L.S.**

**?**

**INTEGUMENT**

**MEGASPORE  
WALL**

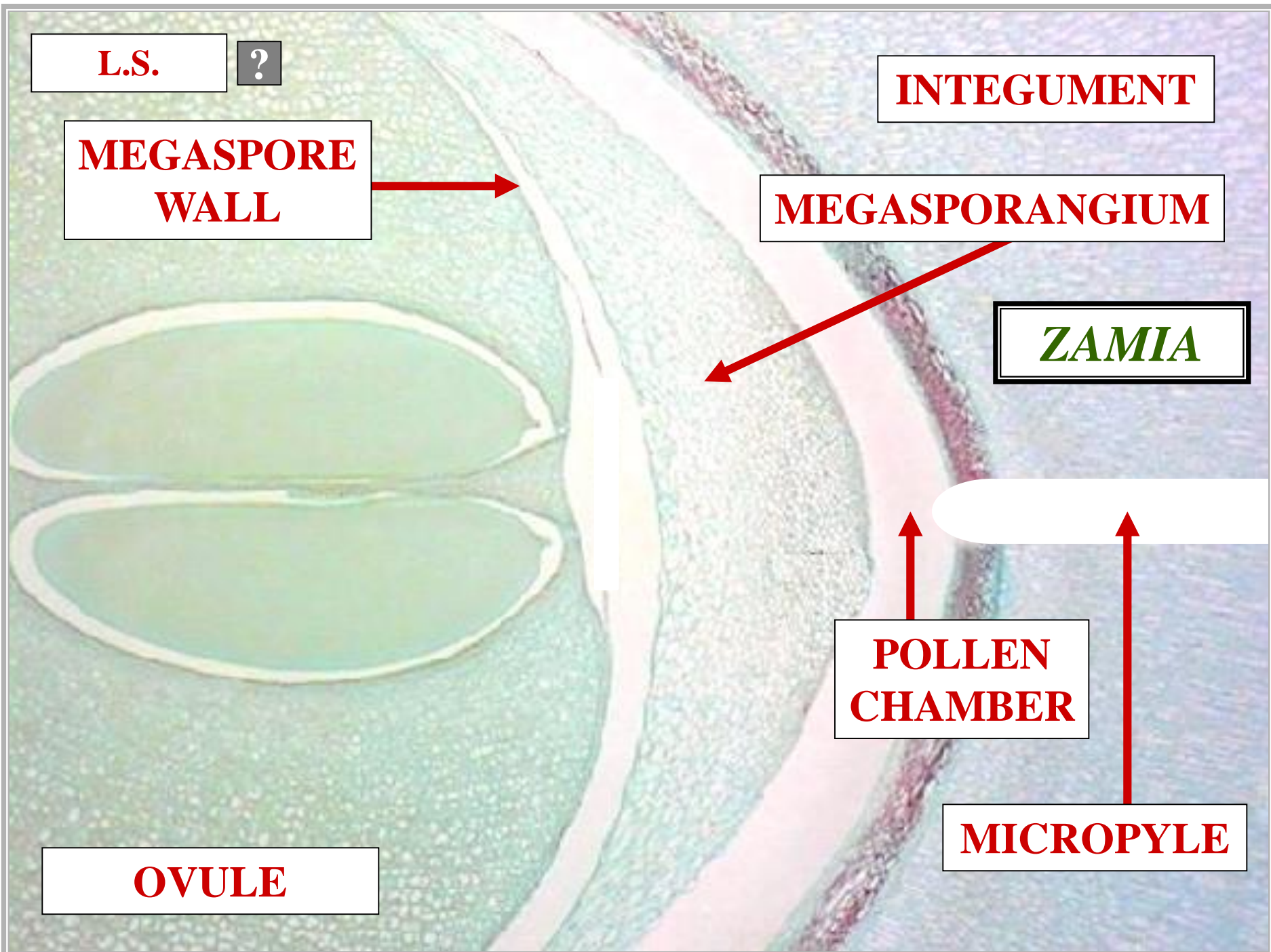
**MEGASPORANGIUM**

***ZAMIA***

**POLLEN  
CHAMBER**

**OVULE**

**MICROPYLE**



L.S.

M

INTEGUMENT

MEGASPORE  
WALL

MEGASPORANGIUM

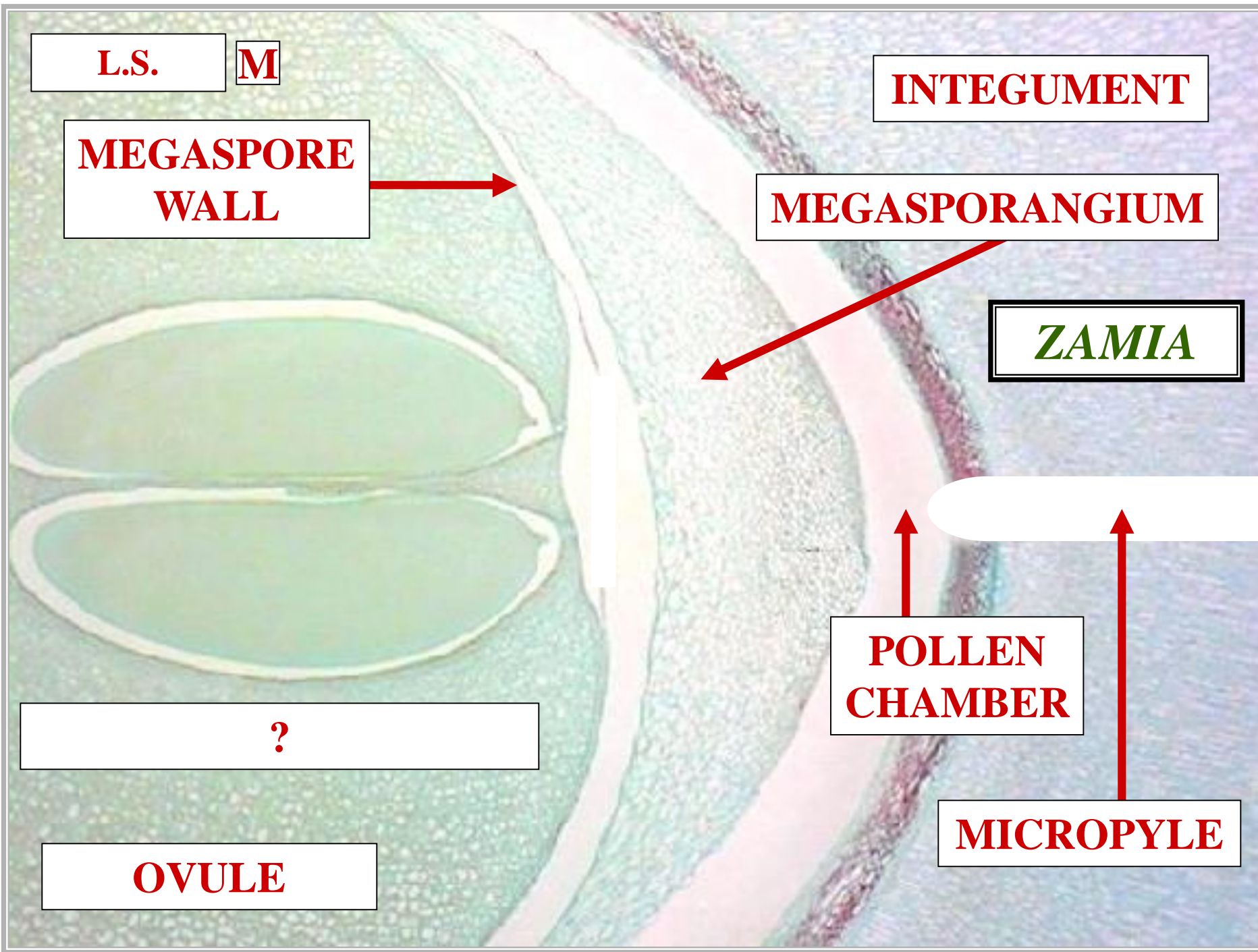
*ZAMIA*

POLLEN  
CHAMBER

?

OVULE

MICROPYLE





**L.S.**

**?**

**INTEGUMENT**

**MEGASPORE  
WALL**

**MEGASPORANGIUM**

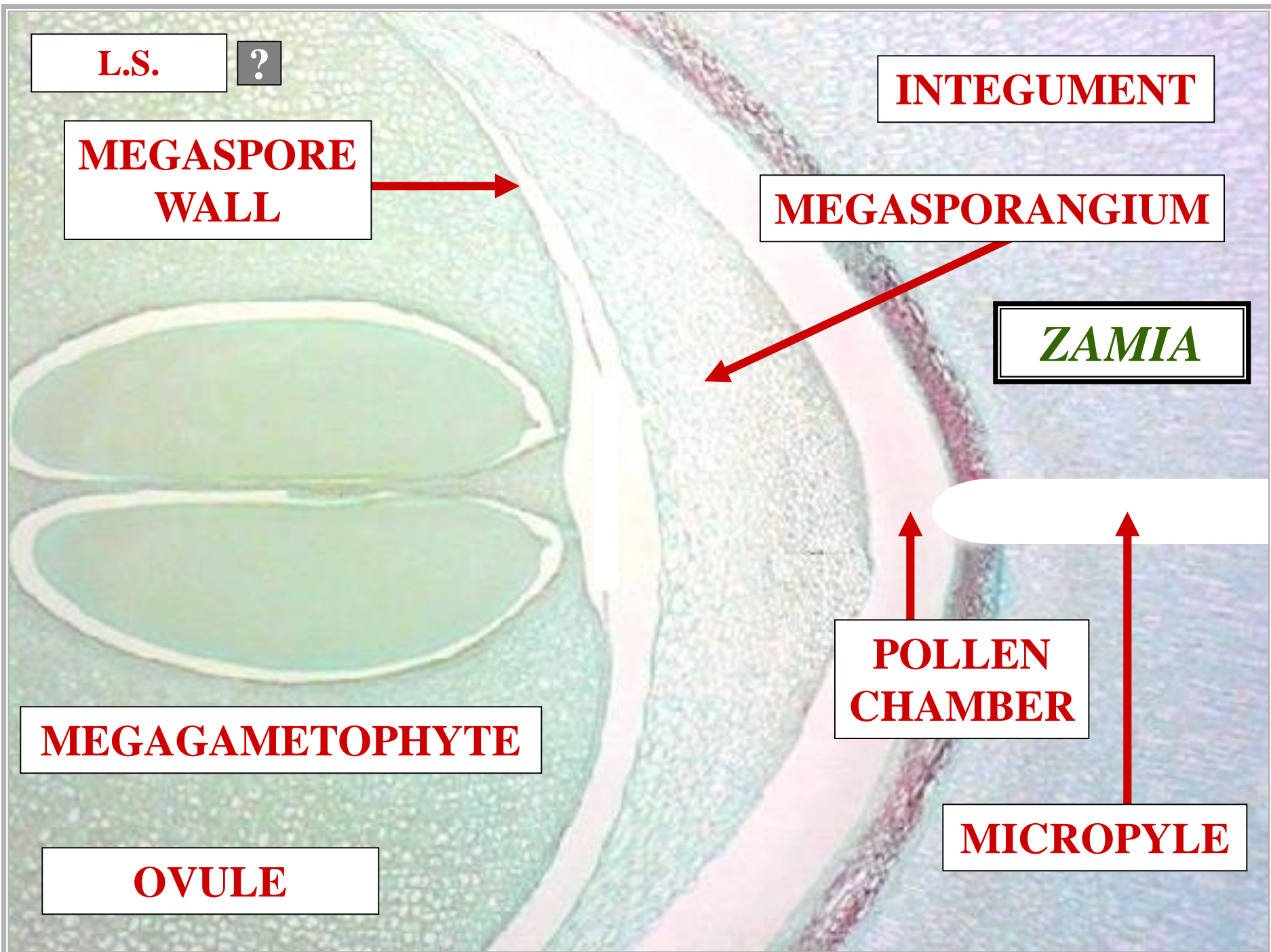
***ZAMIA***

**MEGAGAMETOPHYTE**

**POLLEN  
CHAMBER**

**OVULE**

**MICROPYLE**





L.S.

A

INTEGUMENT

MEGASPORE  
WALL

MEGASPORANGIUM

*ZAMIA*

?

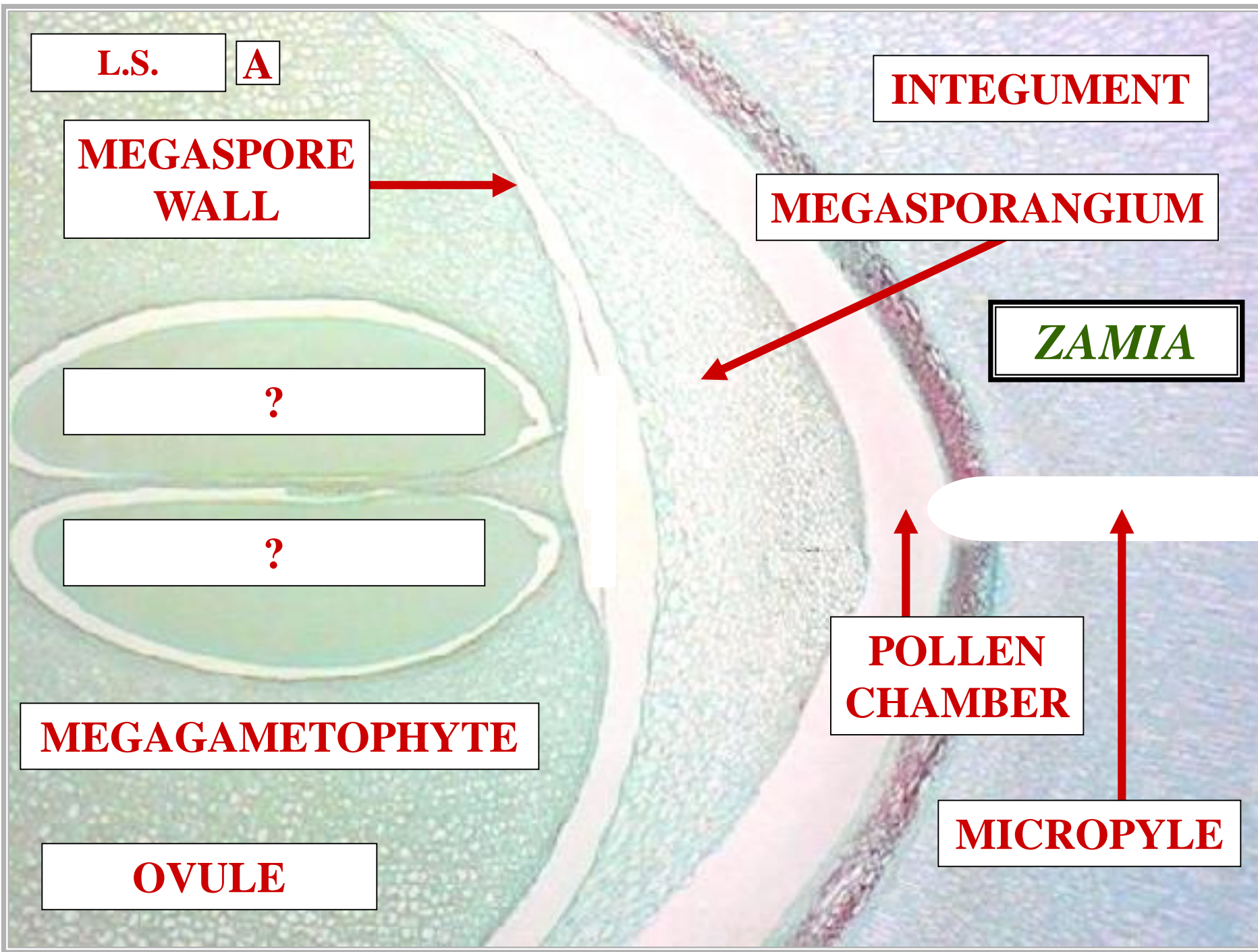
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MEGAGAMETOPHYTE

POLLEN  
CHAMBER

OVULE

MICROPYLE



**L.S.**

**?**

**INTEGUMENT**

**MEGASPORE  
WALL**

**MEGASPORANGIUM**

***ZAMIA***

**ARCHEGONIUM**

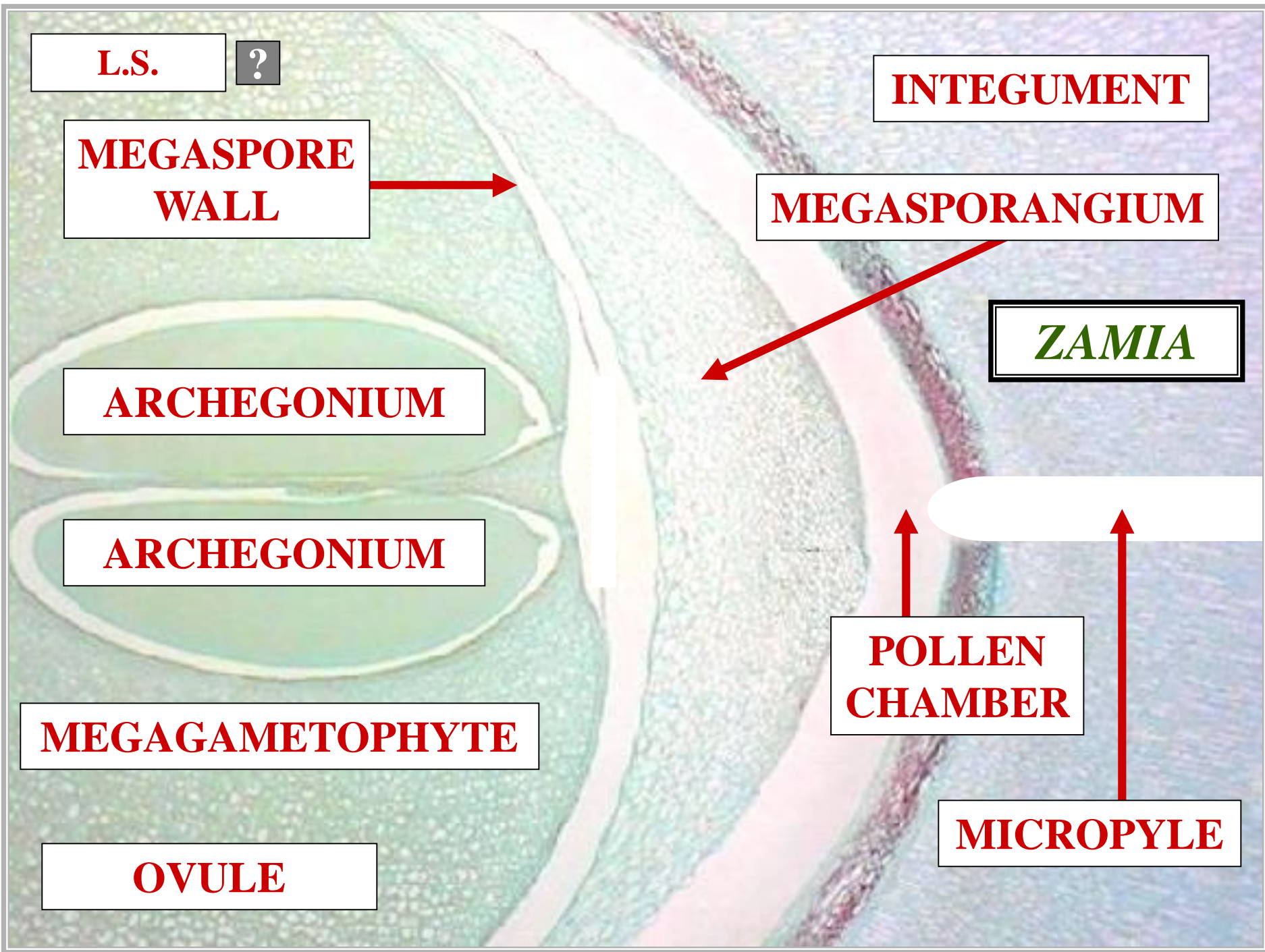
**ARCHEGONIUM**

**MEGAGAMETOPHYTE**

**POLLEN  
CHAMBER**

**OVULE**

**MICROPYLE**





**A**

# MEGASPORE WALL

# ZAMIA

# ARCHEGONIUM

?

# POLLEN CHAMBER

# MICROPYLE



**L.S.**



**MEGASPORE  
WALL**

**INTEGUMENT**

**MEGASPORANGIUM**

***ZAMIA***

**ARCHEGONIUM**

**ARCHEGONIUM**

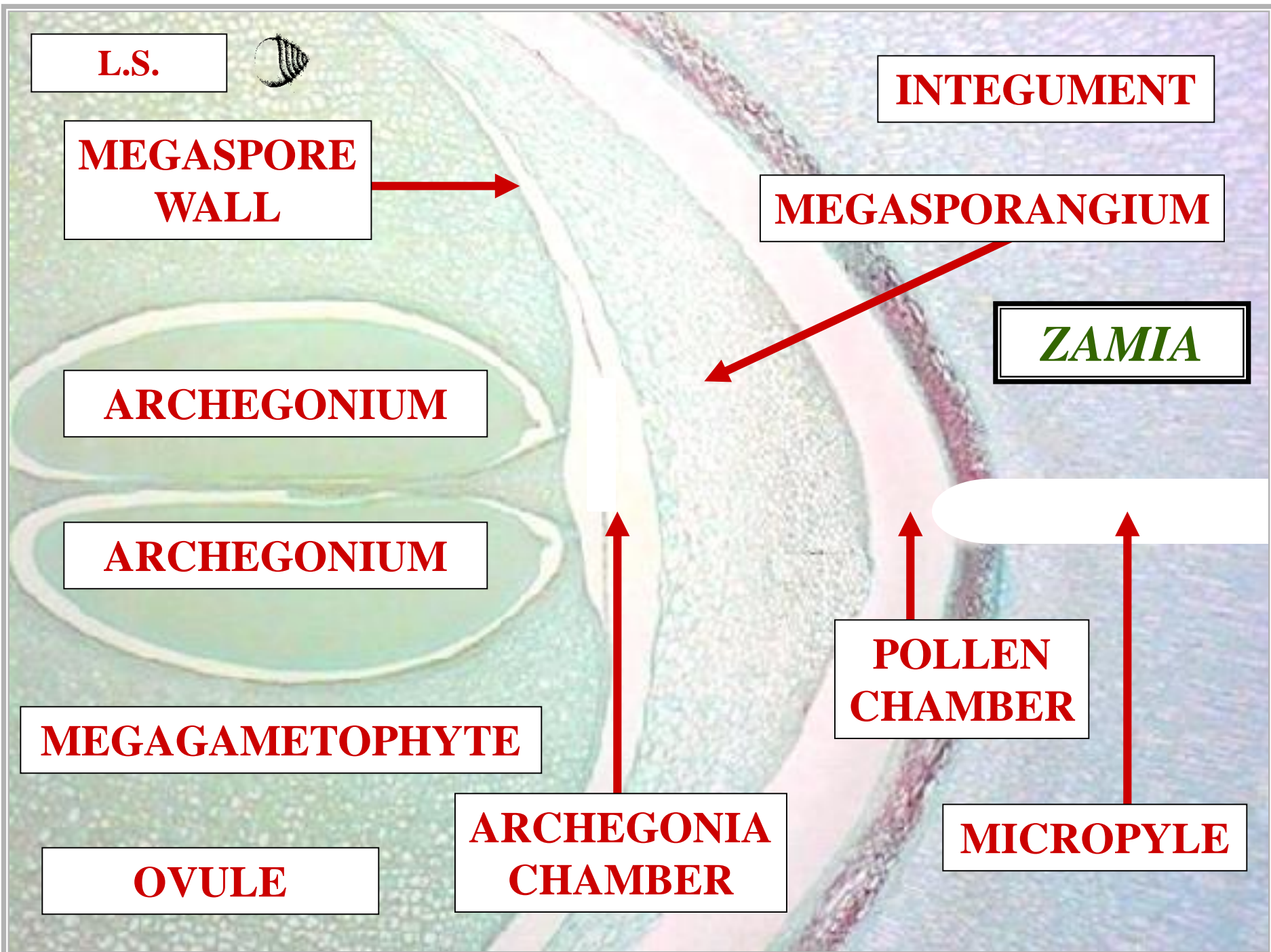
**MEGAGAMETOPHYTE**

**POLLEN  
CHAMBER**

**OVULE**

**ARCHEGONIA  
CHAMBER**

**MICROPYLE**



L.S.



INTEGUMENT

MEGASPORE  
WALL

MEGASPORANGIUM

*ZAMIA*

ARCHEGONIUM

ARCHEGONIUM

SPERM

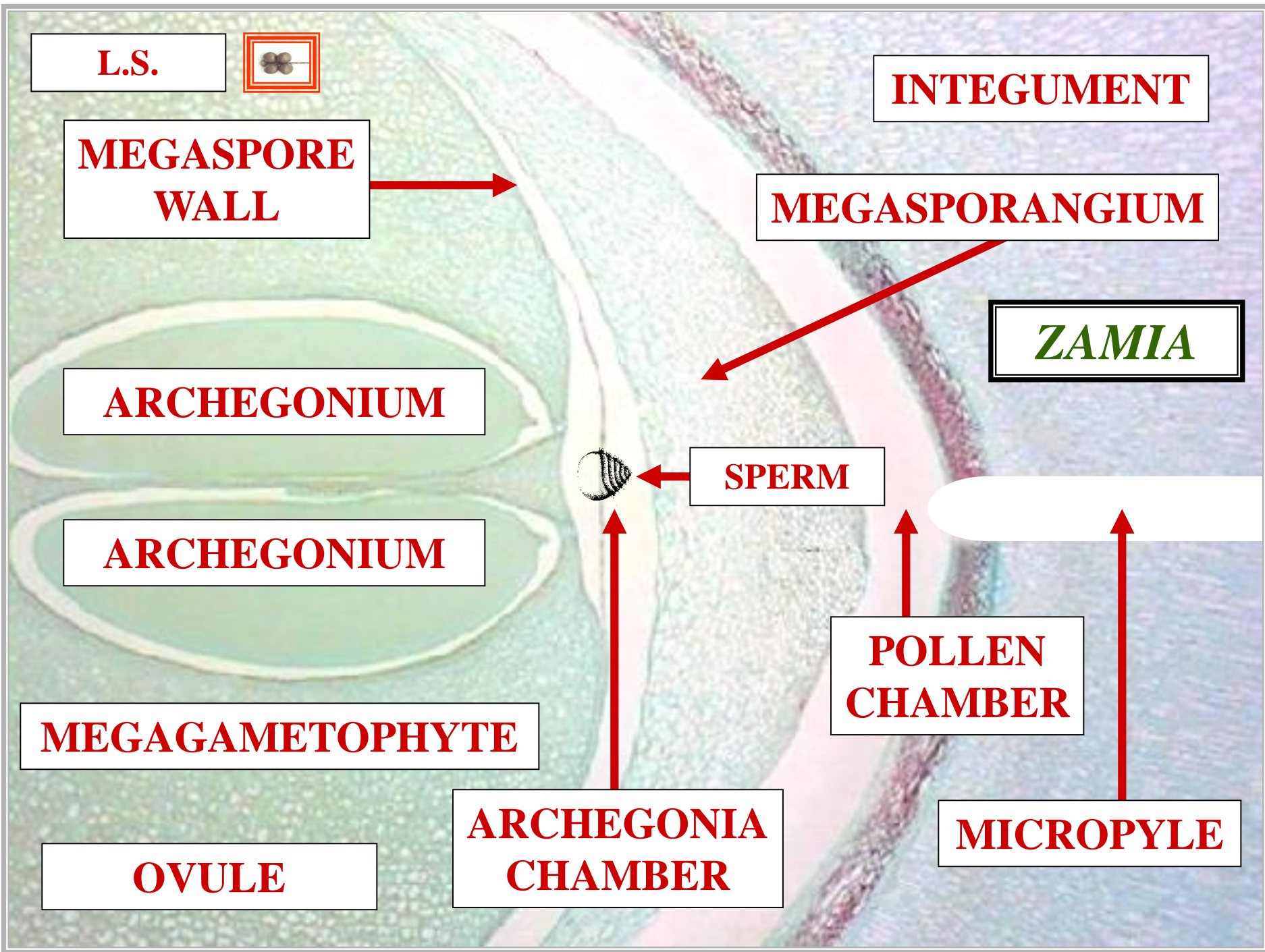
MEGAGAMETOPHYTE

POLLEN  
CHAMBER

OVULE

ARCHEGONIA  
CHAMBER

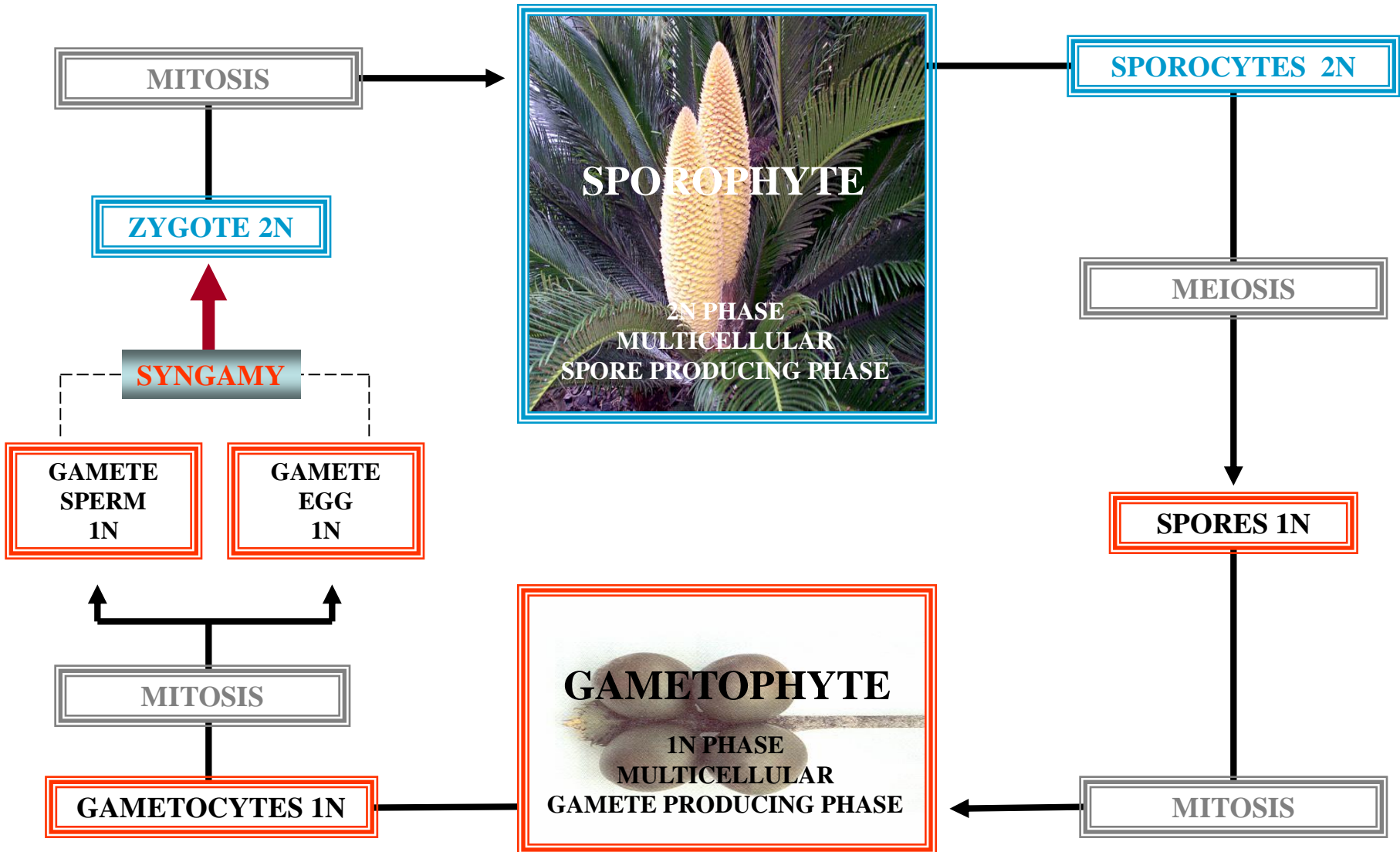
MICROPYLE





# CYCADOPHYTA

## LIFE CYCLE

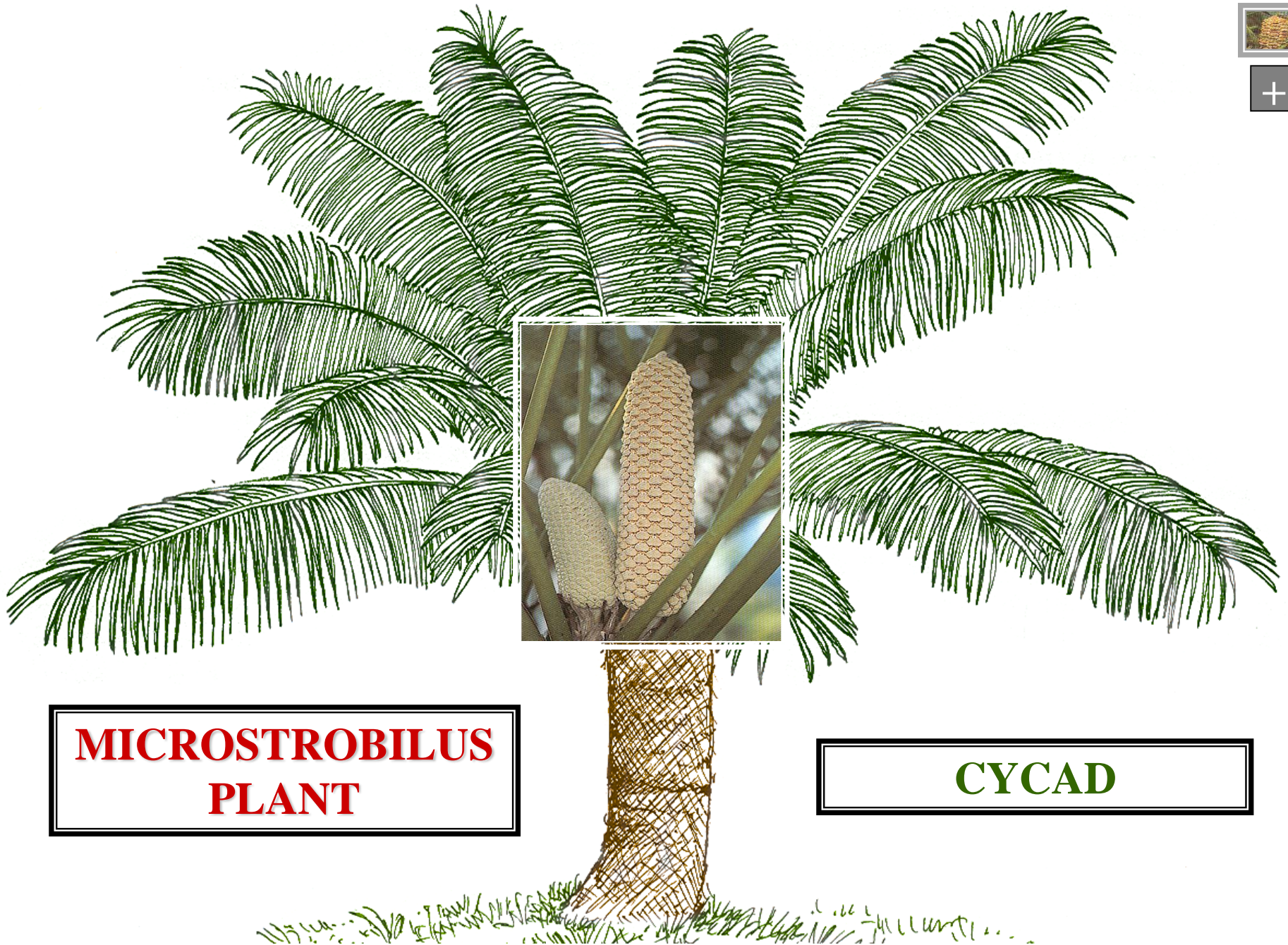


# REPRODUCTION





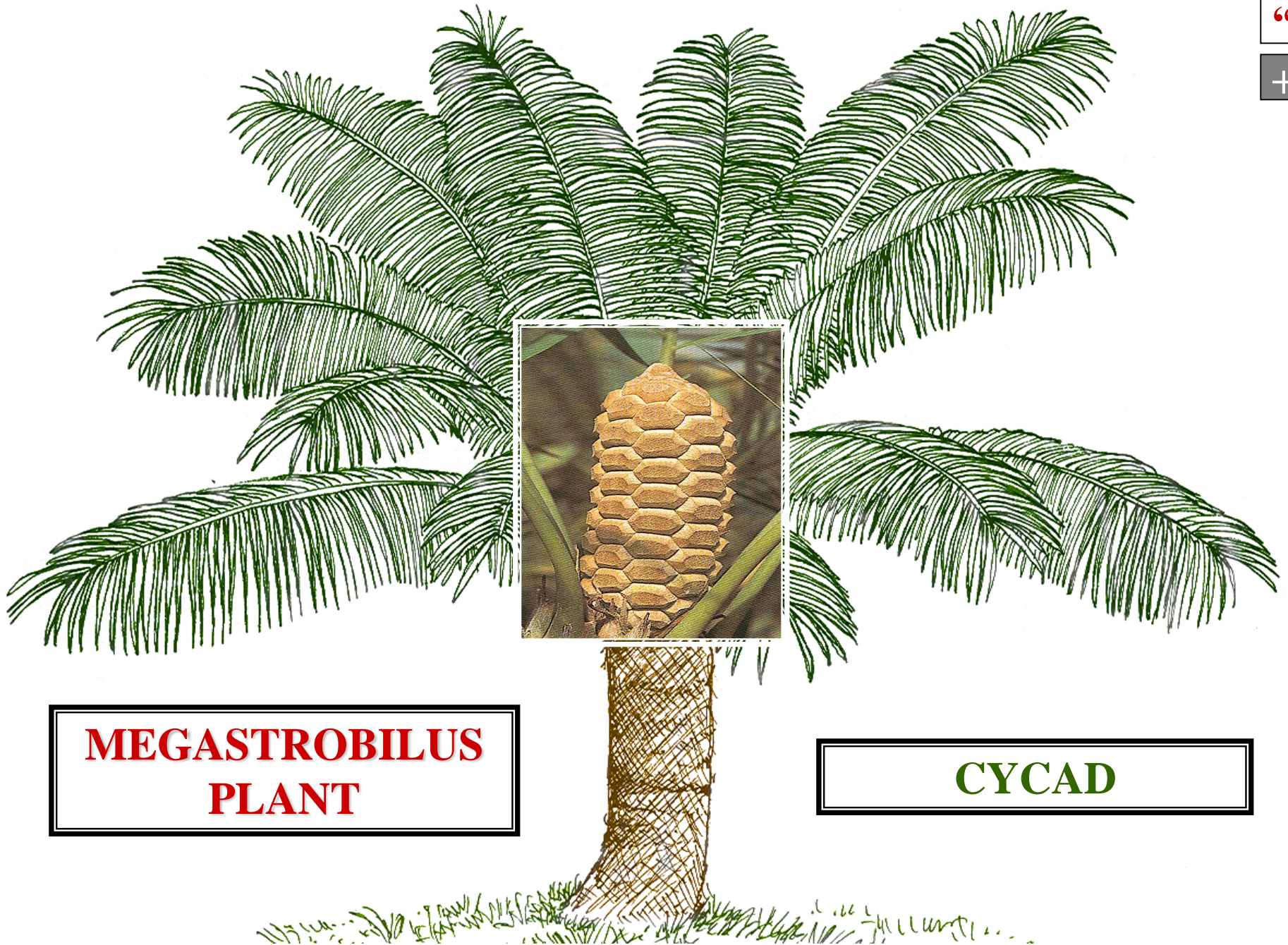
# SEX CONDITION



**MICROSTROBILUS  
PLANT**

**CYCAD**





**MEGASTROBILUS  
PLANT**

**CYCAD**



## MEGASTROBILUS PLANT



**“FEMALE” PLANT**

## MICROSTROBILUS PLANT



**“MALE” PLANT**

**CYCAD**

A detailed line drawing of a cycad tree. The tree has a thick, textured brown trunk with a cross-hatched pattern. The crown of the tree is composed of several large, feathery green fronds that spread out in all directions. At the base of the trunk, there is a small patch of green grass and some small, light-colored plants. A large white rectangular box with a black border is superimposed over the middle of the tree, containing the word "DIOECIOUS" in red capital letters. Another smaller white rectangular box with a black border is located to the right of the tree, containing the word "CYCAD" in green capital letters.

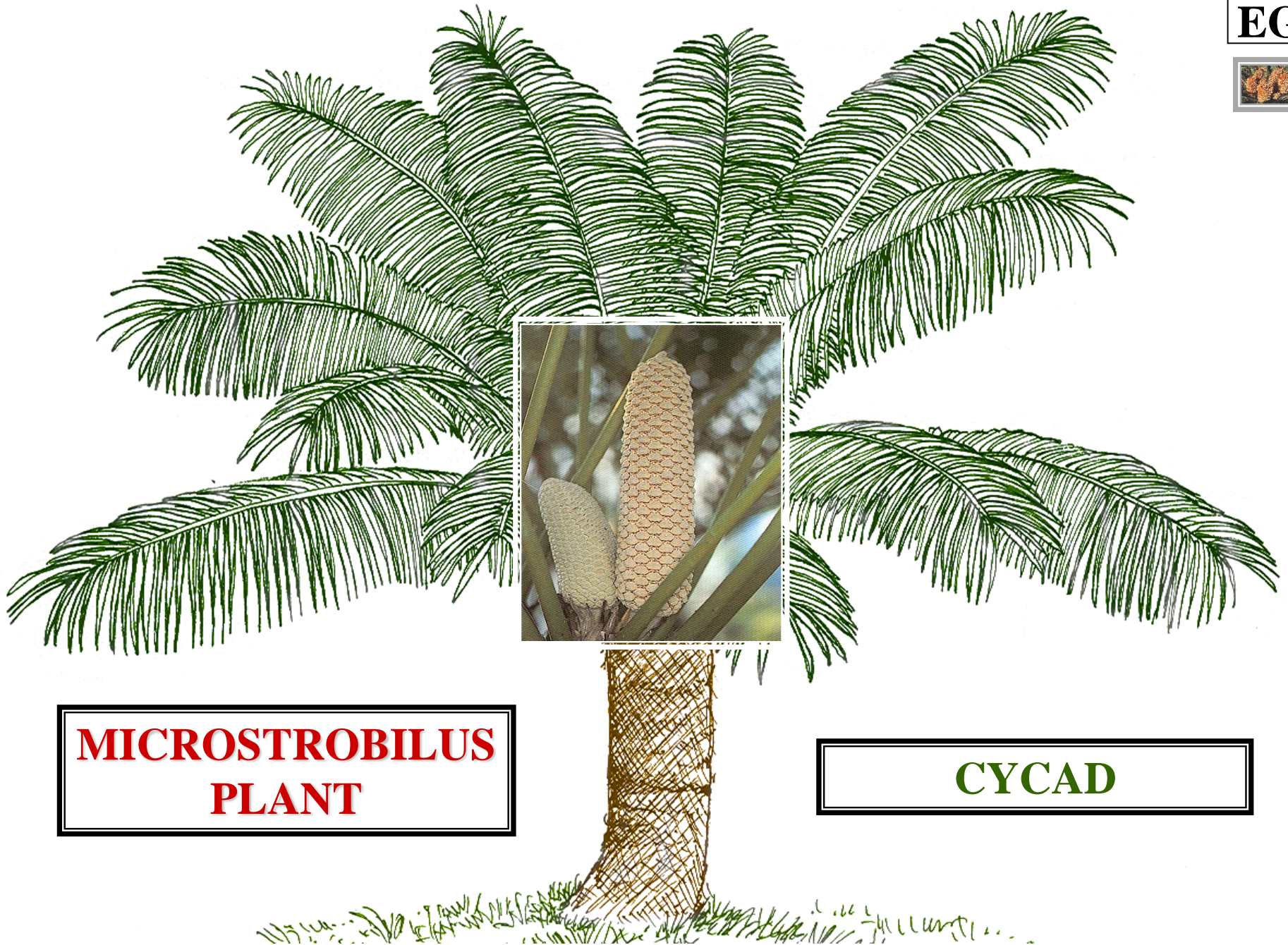
**DIOECIOUS**

**CYCAD**



# MICROSTROBILUS PLANT “MALE PLANT”

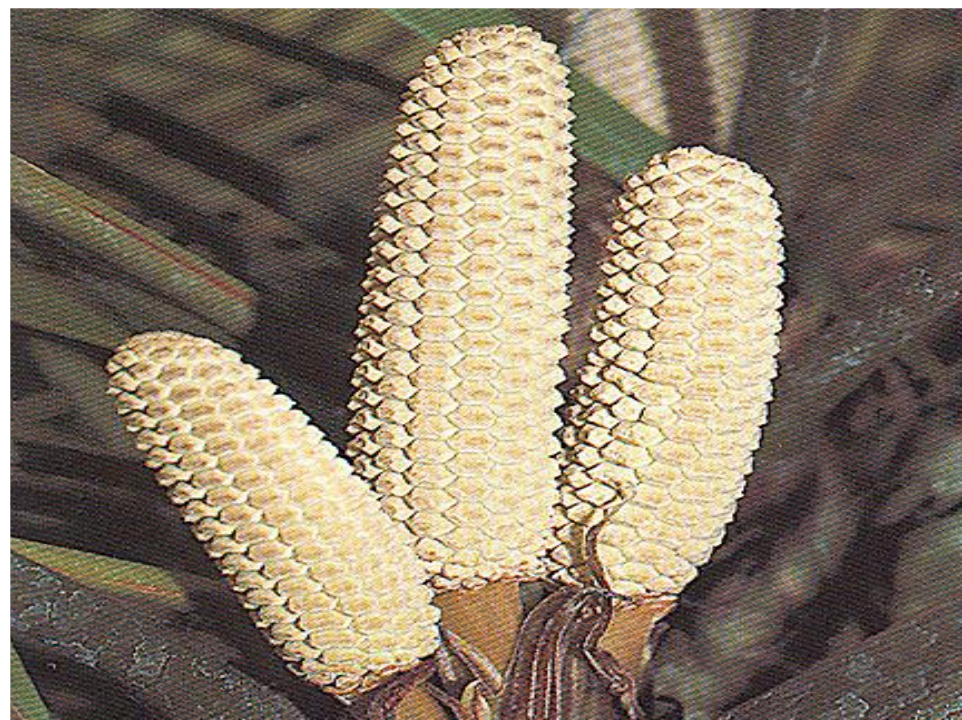
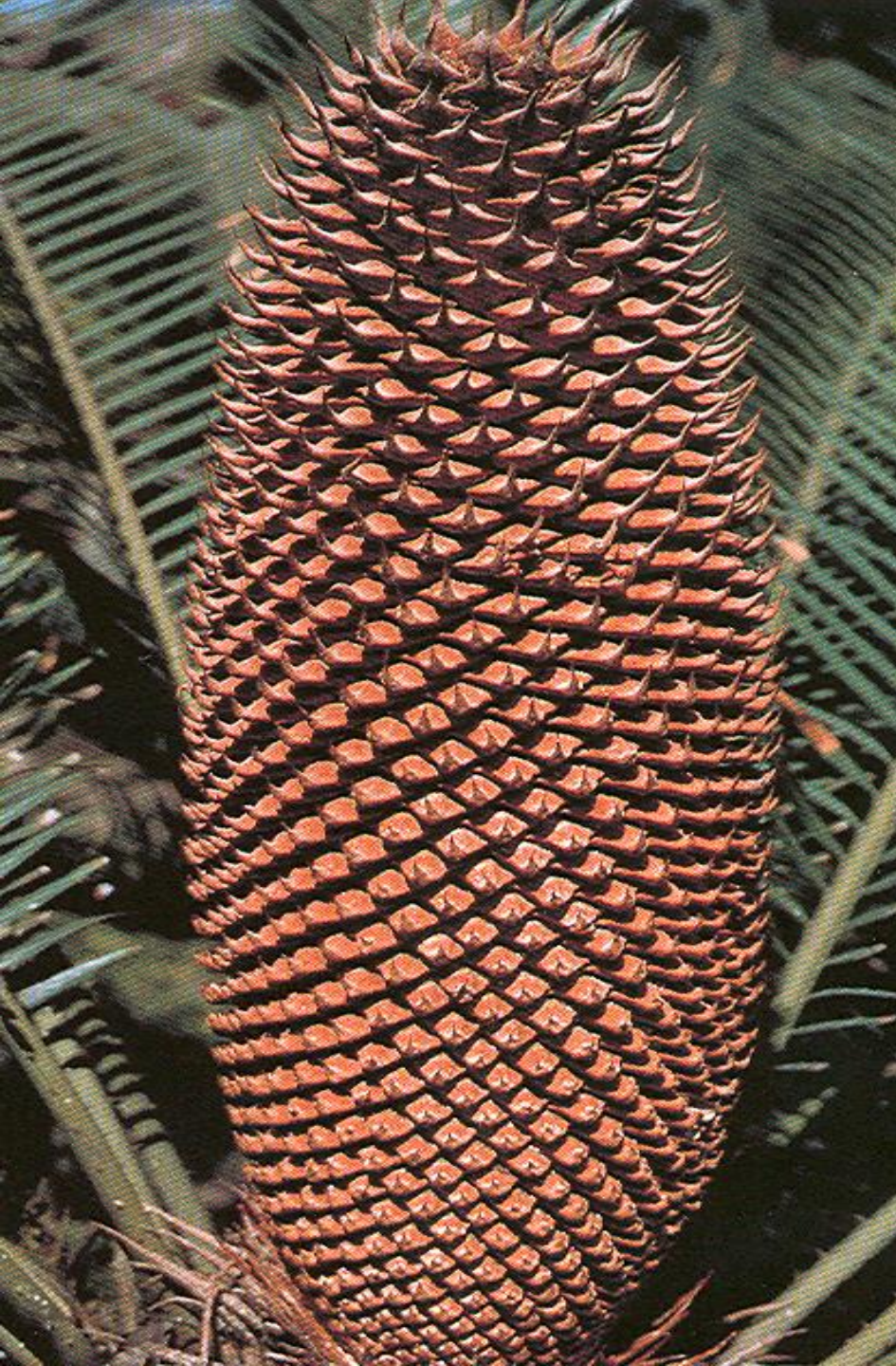




**MICROSTROBILUS  
PLANT**

**CYCAD**







**ZAMIA**

**MICROSTROBILUS**

**M**



**STROBILUS AXIS**

**?**

**C.S.**



**ZAMIA**

**MICROSTROBILUS**

**M**



**?**

**STROBILUS AXIS**

**MICROSPOROPHYLL**

**C.S.**



**ZAMIA**

**MICROSTROBILUS**



**MICROSPORANGIA**

**STROBILUS AXIS**

**MICROSPOROPHYLL**

**C.S.**





**MICROSTROBILUS**

“

**MICROSPORANGIA**

**STROBILUS AXIS**

**MICROSPOROPHYLL**

**C.S.**





# MICROSTROBILUS



**“SORUS”**

**STROBILUS AXIS**

**MICROSPOROPHYLL**

**C.S.**



**ZAMIA**



**MICROSTROBILUS**

?

**STROBILUS AXIS**

**C.S.**



**ZAMIA**



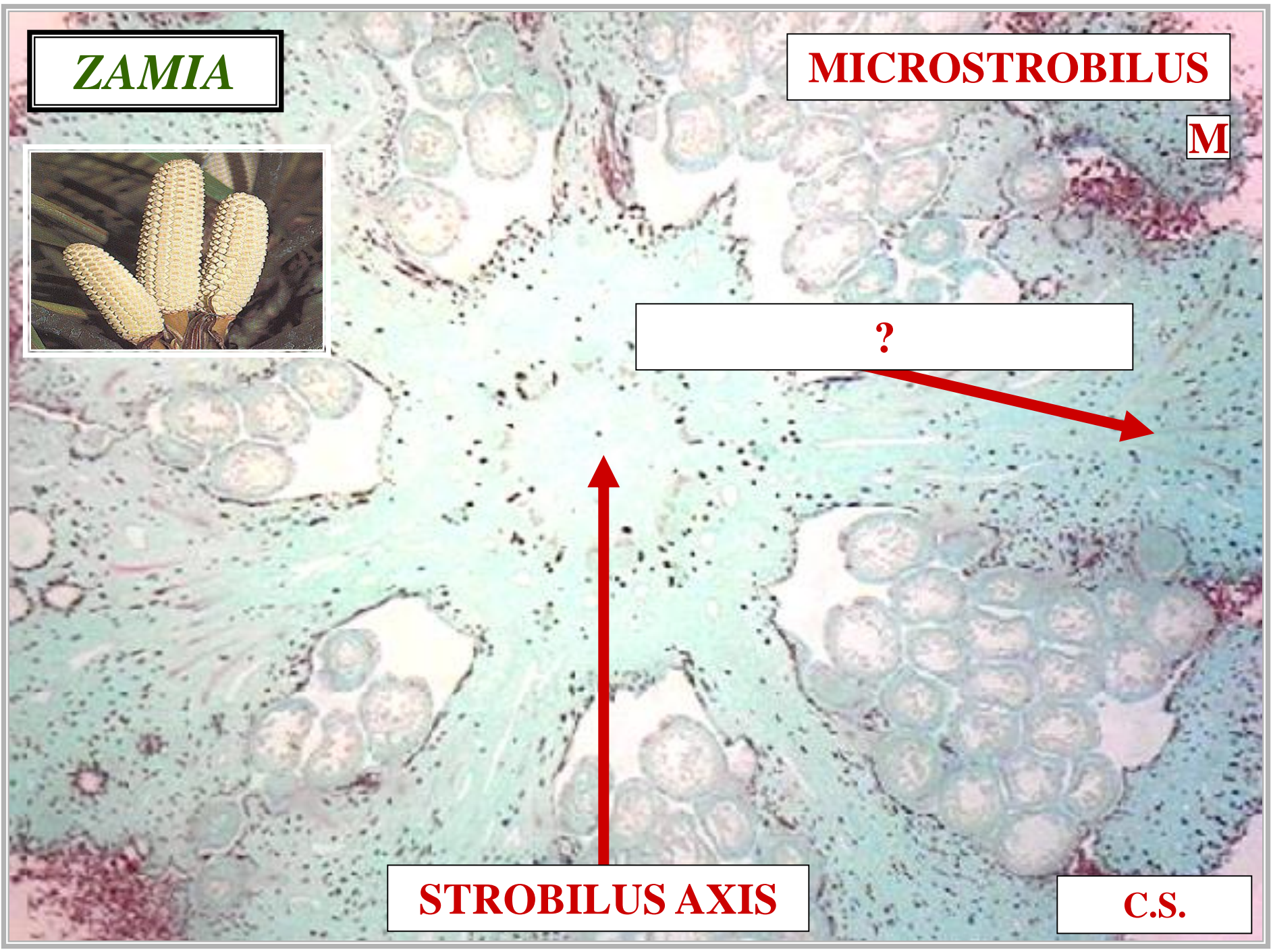
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**M**

**?**

**STROBILUS AXIS**

**C.S.**





**ZAMIA**



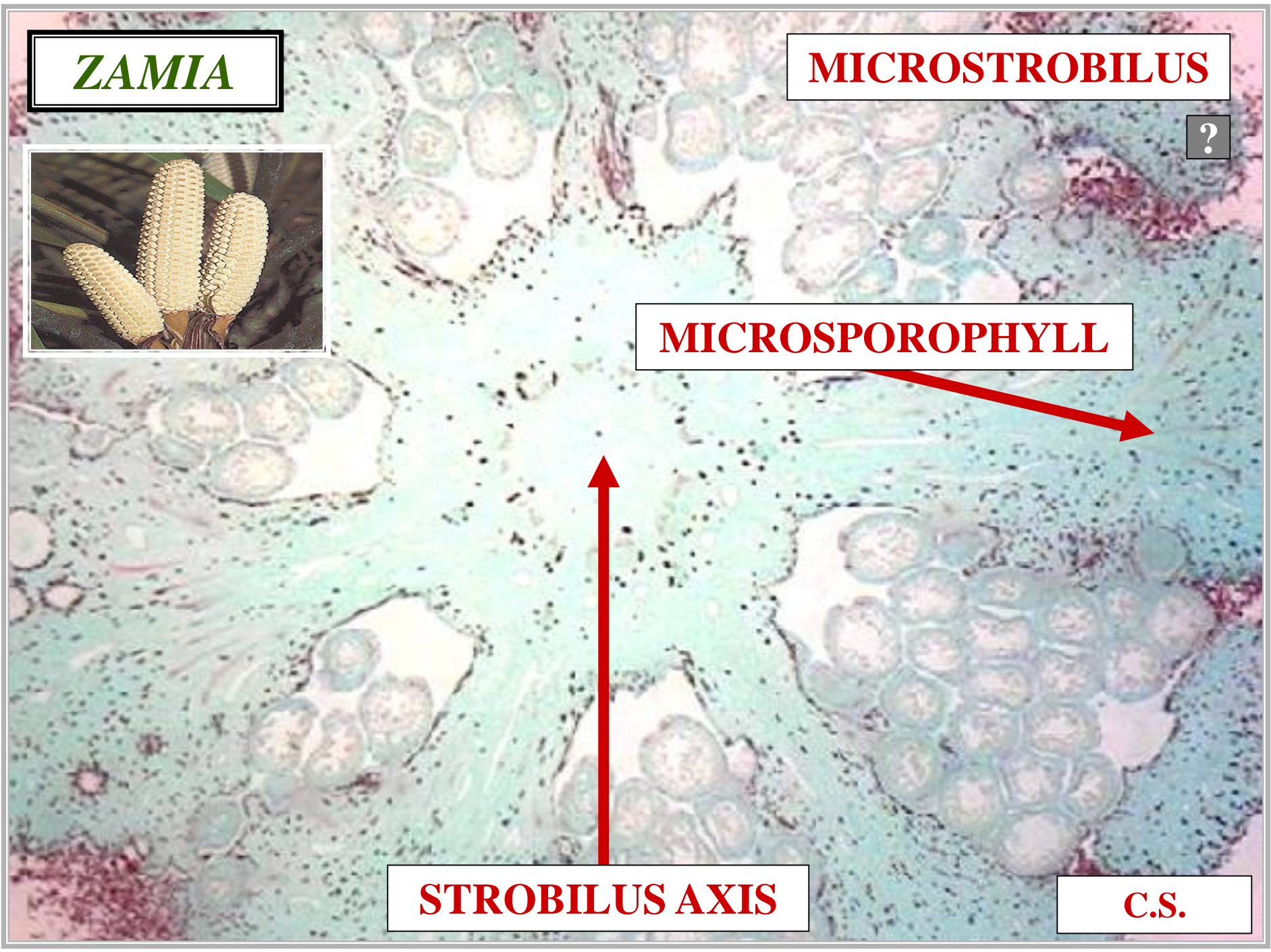
**MICROSTROBILUS**

?

**MICROSPOROPHYLL**

**STROBILUS AXIS**

**C.S.**





**ZAMIA**



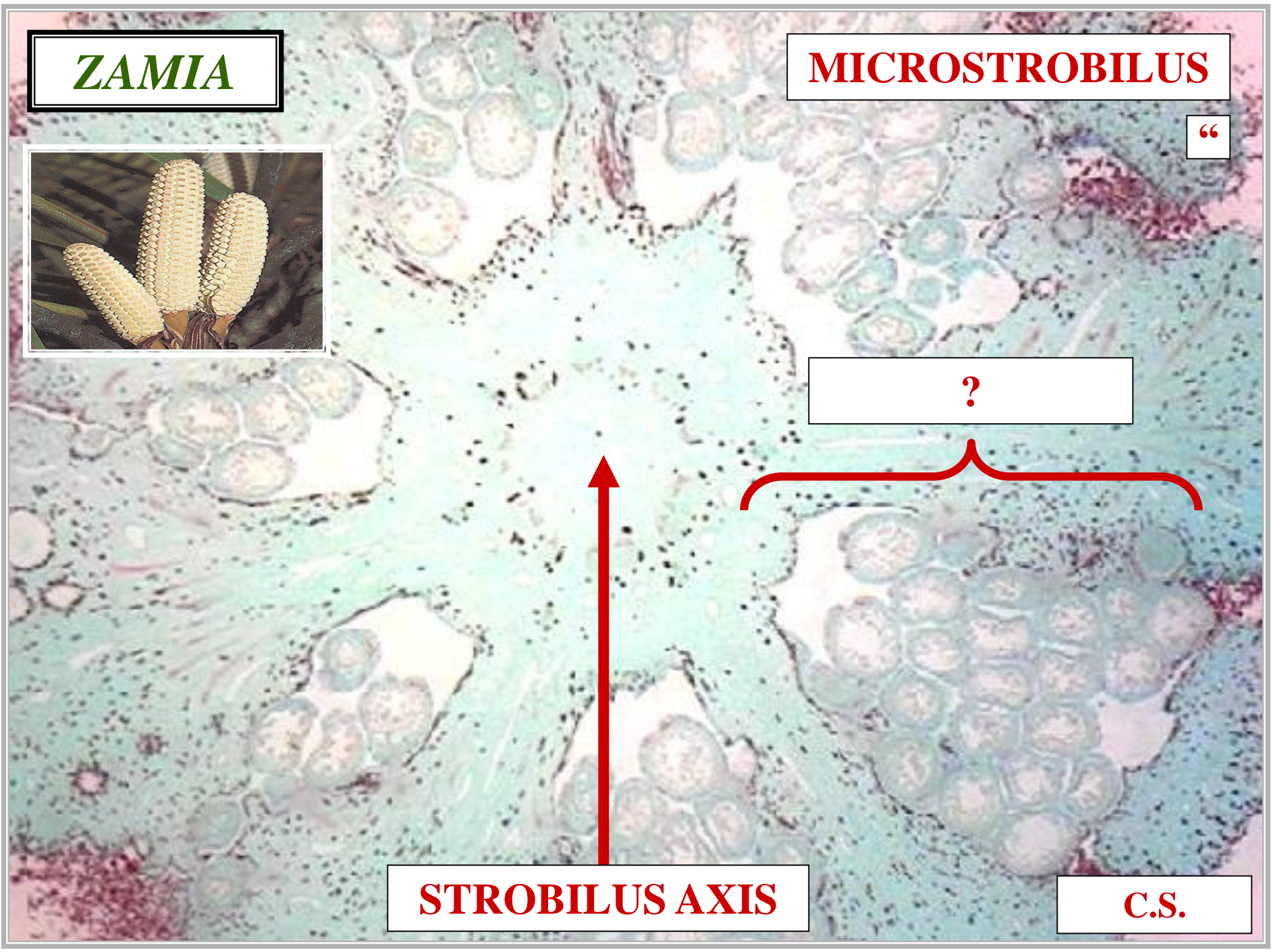
**MICROSTROBILUS**

“

?

**STROBILUS AXIS**

**C.S.**





**ZAMIA**



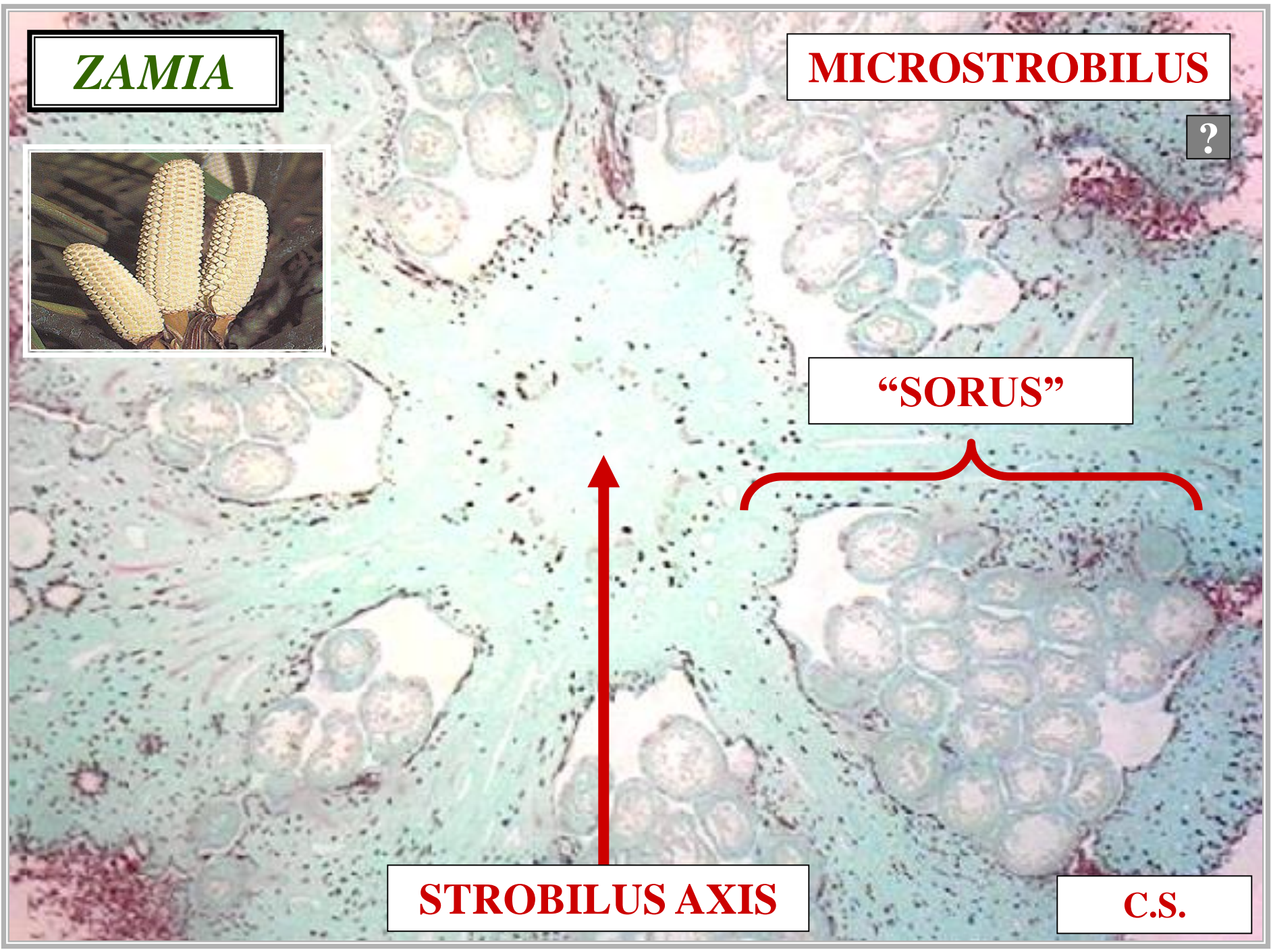
**MICROSTROBILUS**

?

**“SORUS”**

**STROBILUS AXIS**

**C.S.**



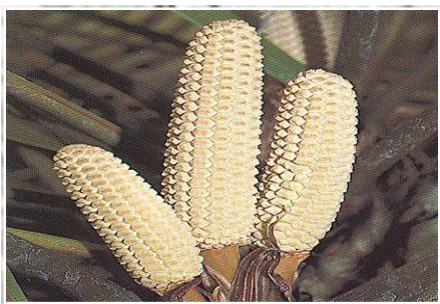


**ZAMIA**

**M**

**?**

**“SORUS”**



**MICROSTROBILUS**

**C.S.**



**ZAMIA**

**MICROSPORANGIUM**

**“SORUS”**



**MICROSTROBILUS**

**C.S.**





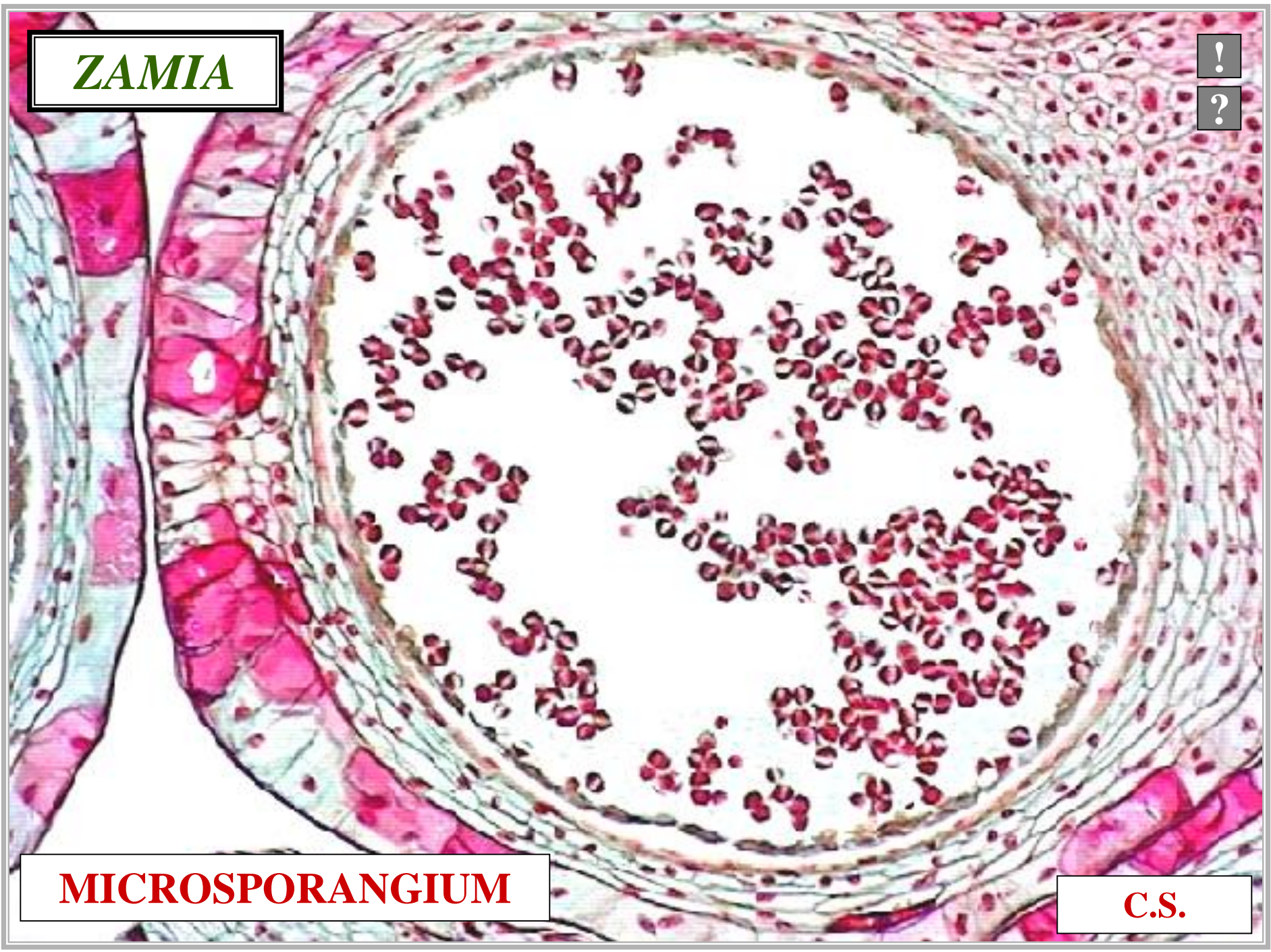
*ZAMIA*

!

?

**MICROSPORANGIUM**

**C.S.**





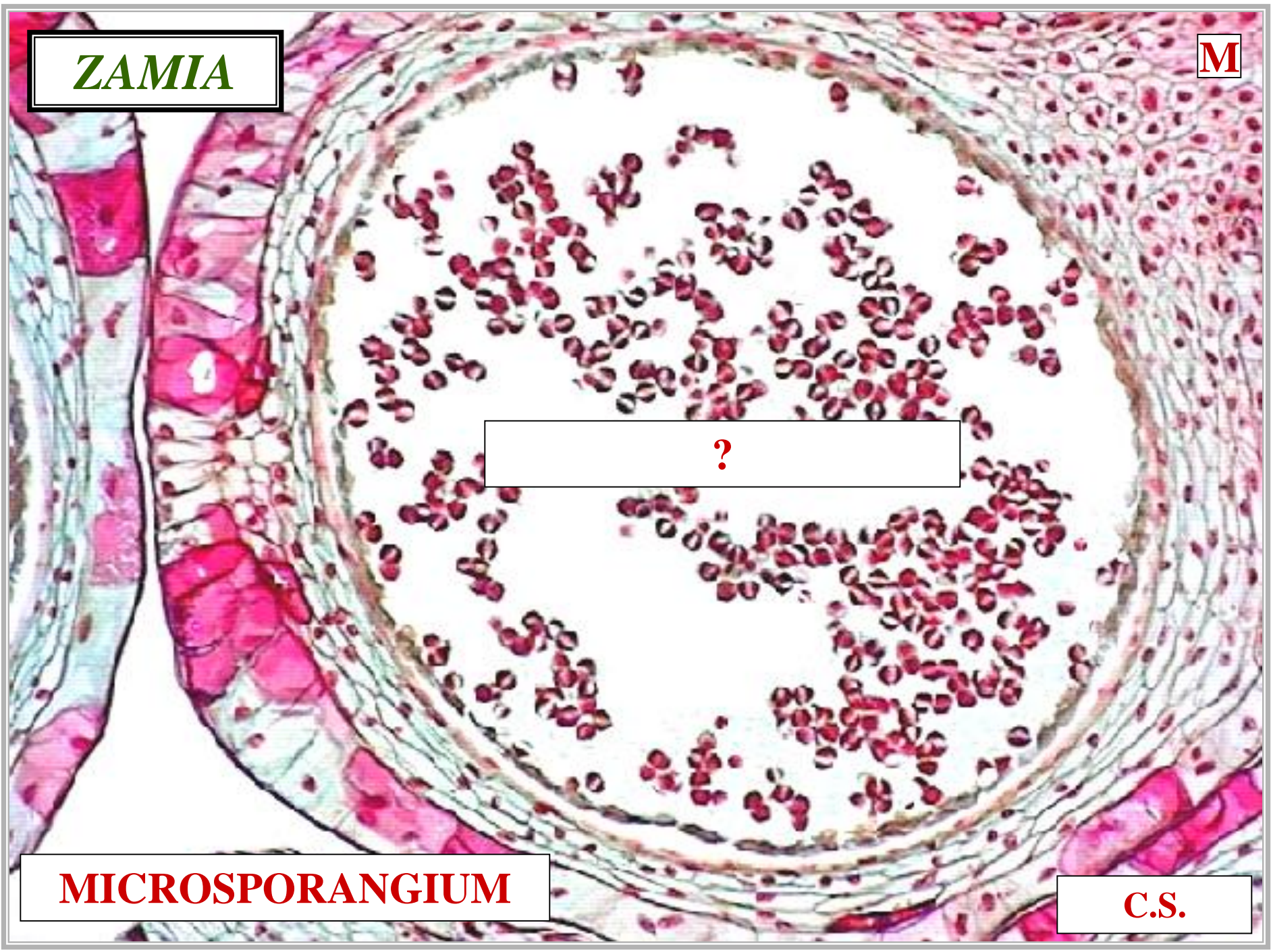
*ZAMIA*

M

?

**MICROSPORANGIUM**

C.S.





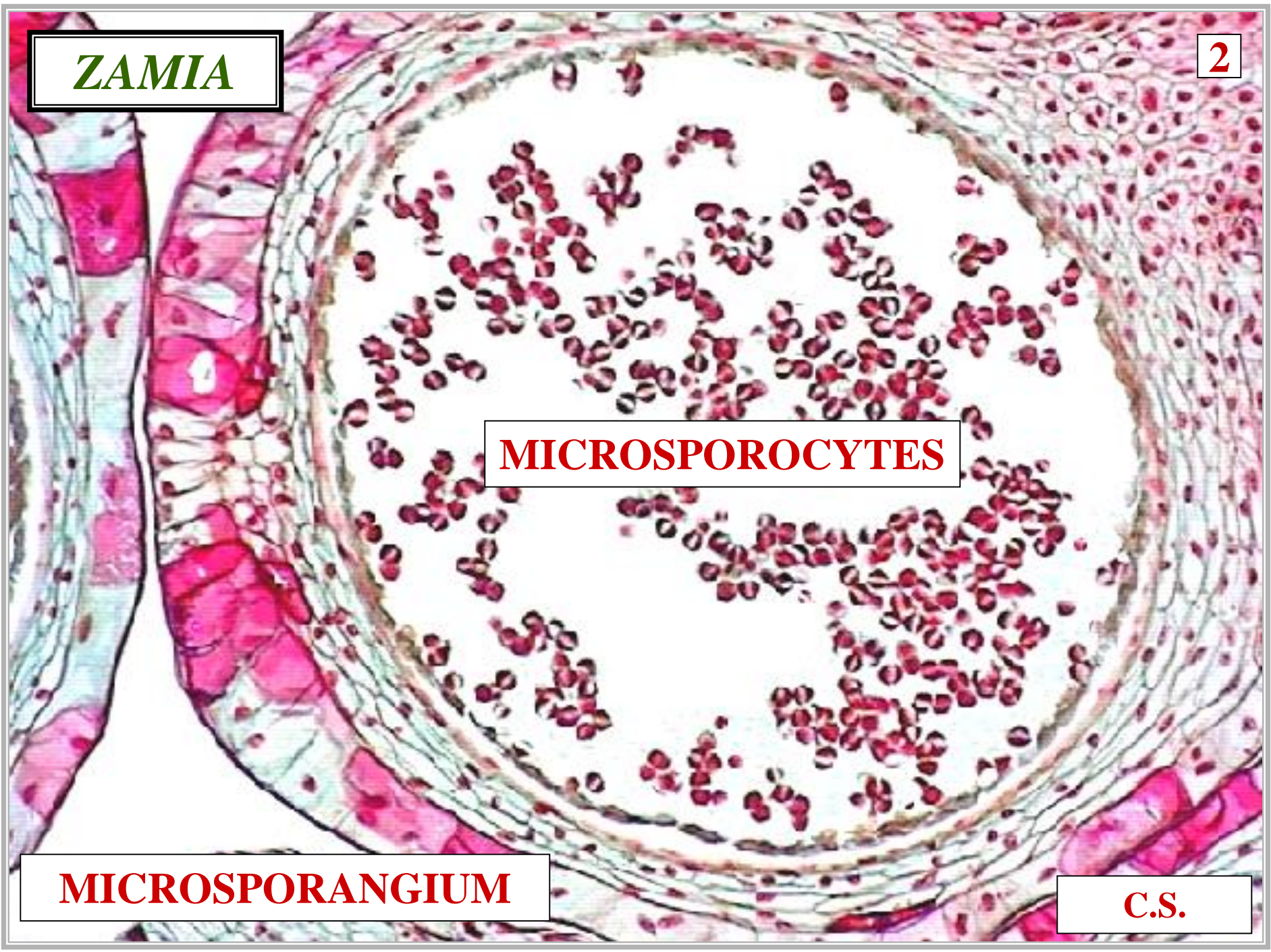
**ZAMIA**

2

**MICROSPOROCYTES**

**MICROSPORANGIUM**

**C.S.**





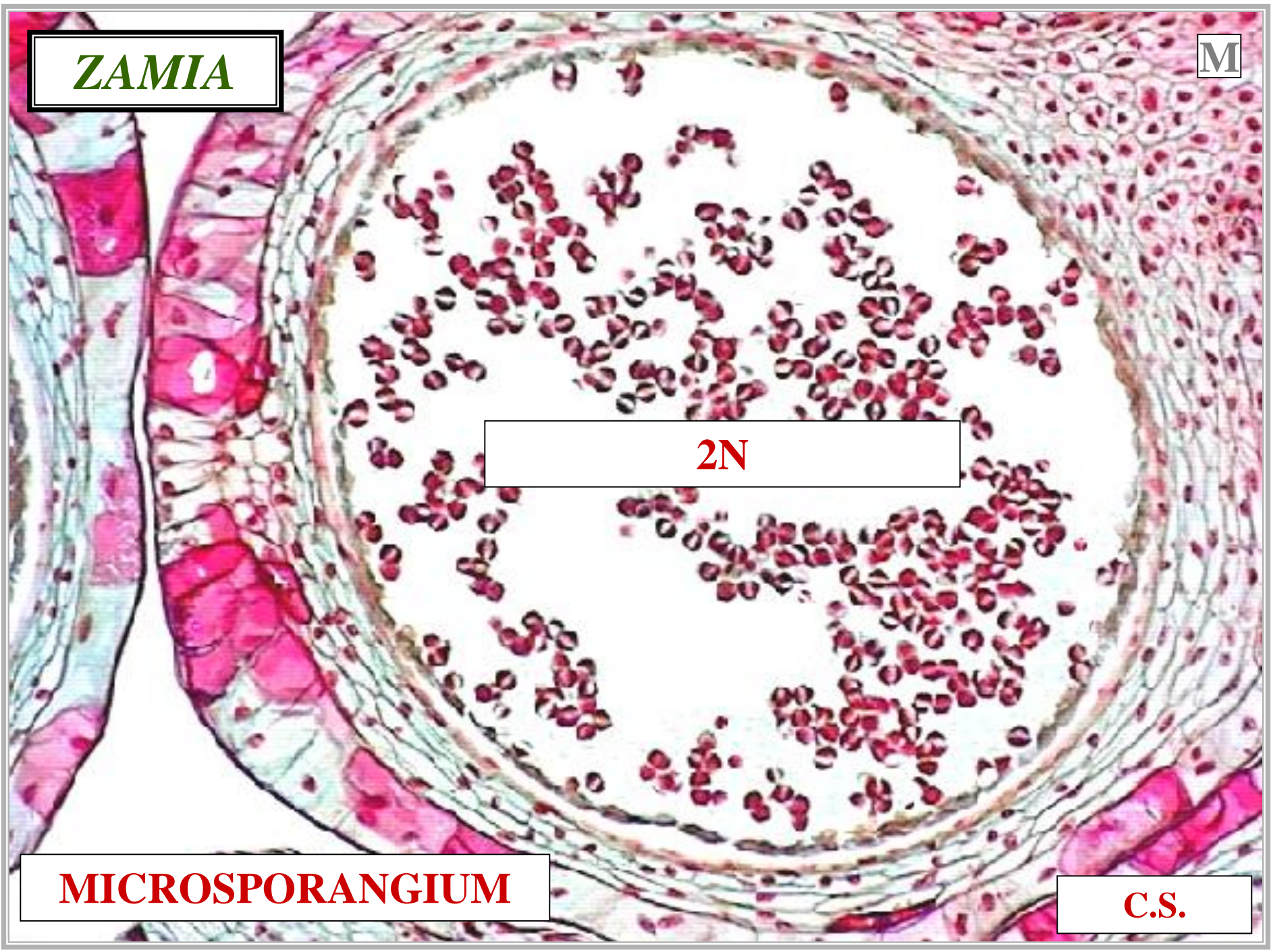
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M

**2N**

**MICROSPORANGIUM**

**C.S.**





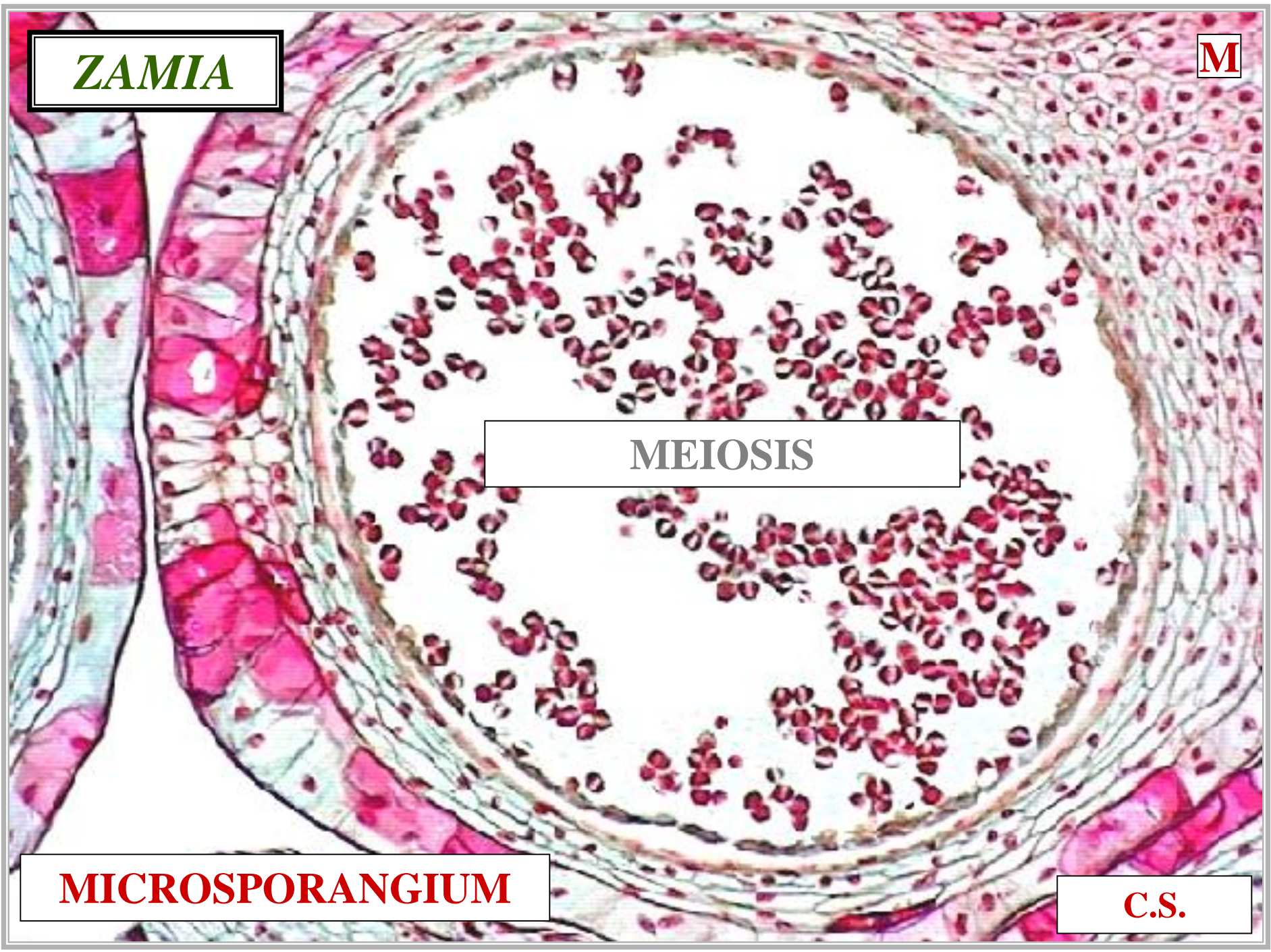
**ZAMIA**

**M**

**MEIOSIS**

**MICROSPORANGIUM**

**C.S.**





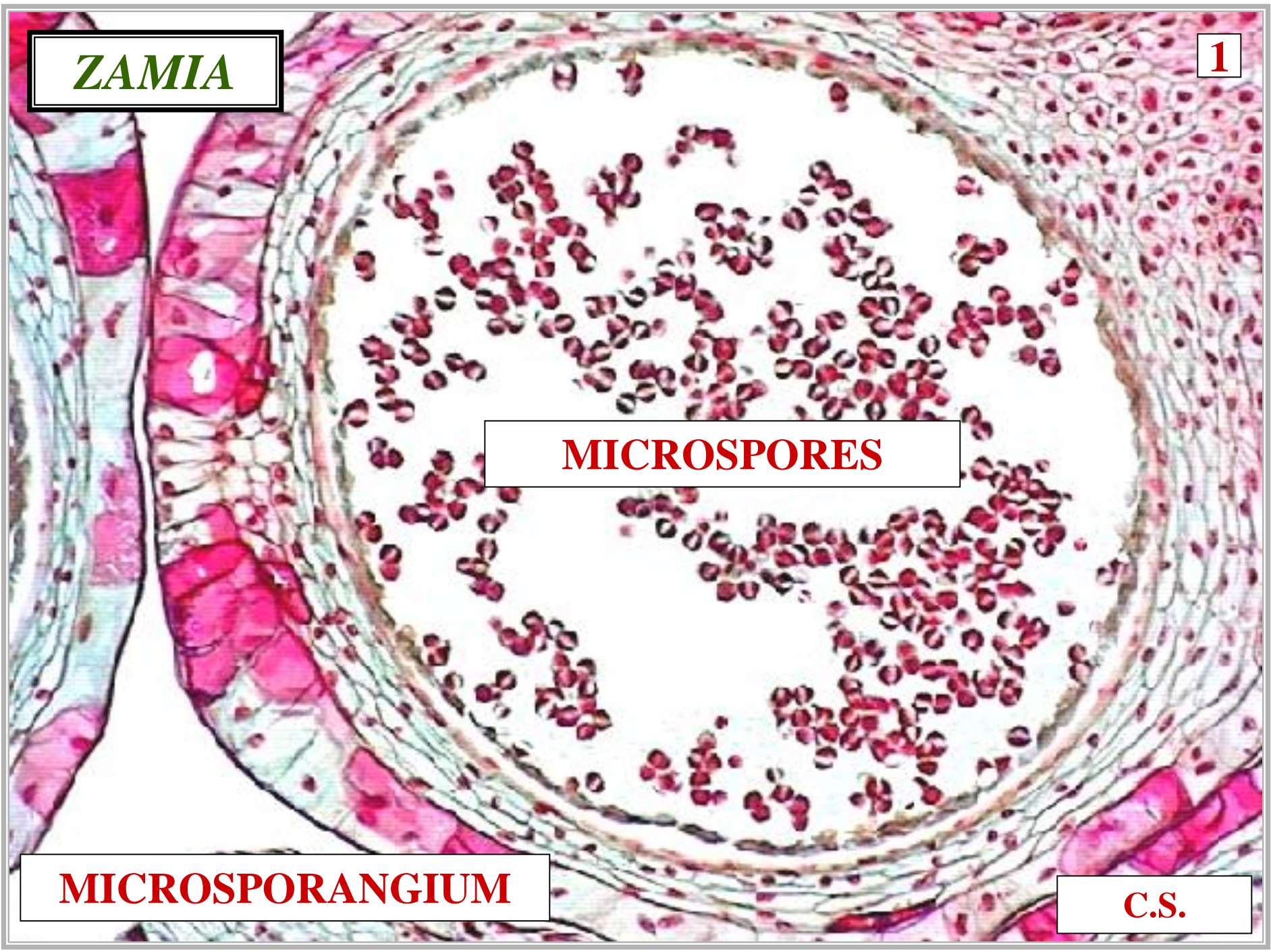
**ZAMIA**

**1**

**MICROSPORES**

**MICROSPORANGIUM**

**C.S.**





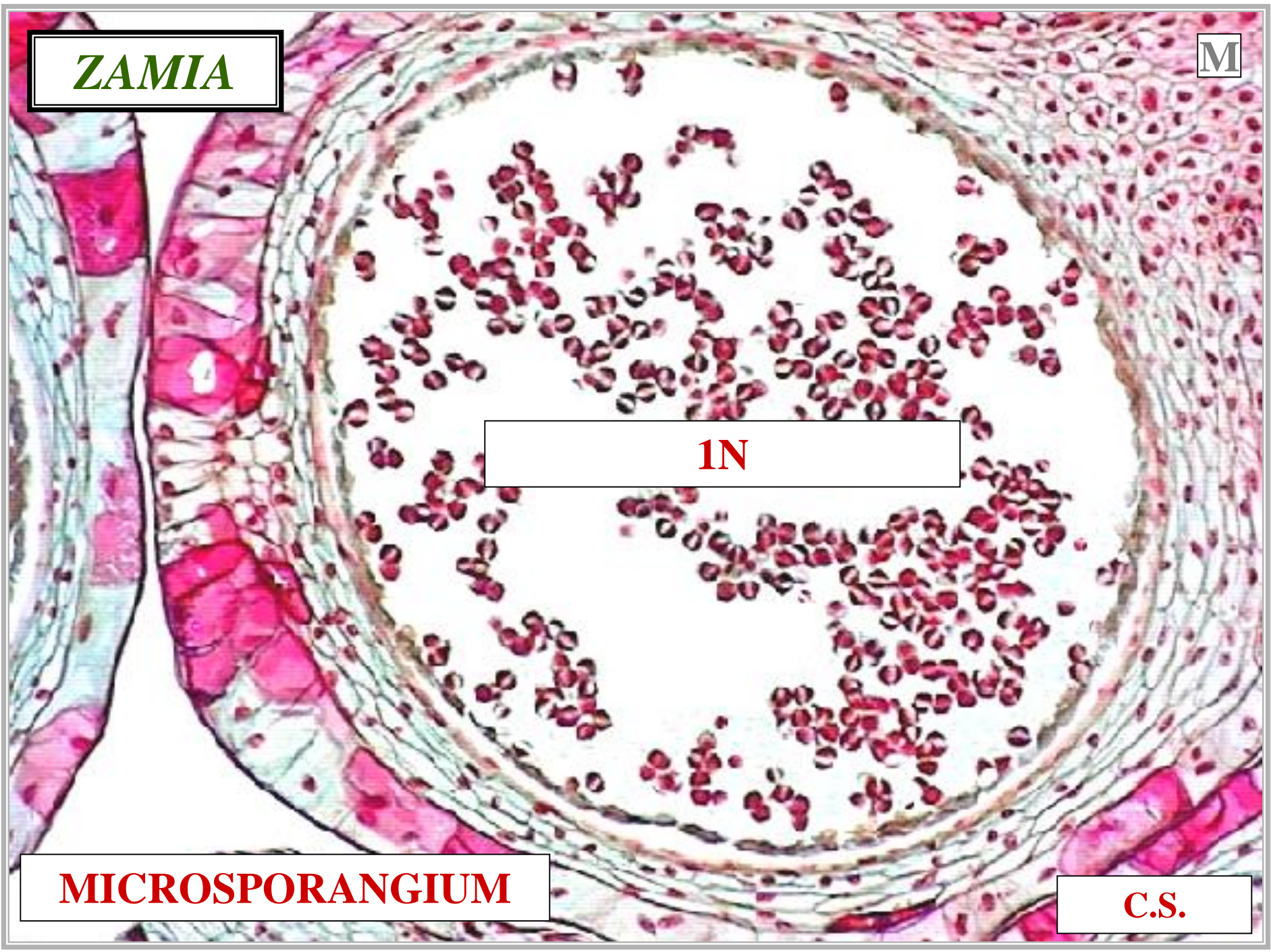
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M

**1N**

**MICROSPORANGIUM**

**C.S.**





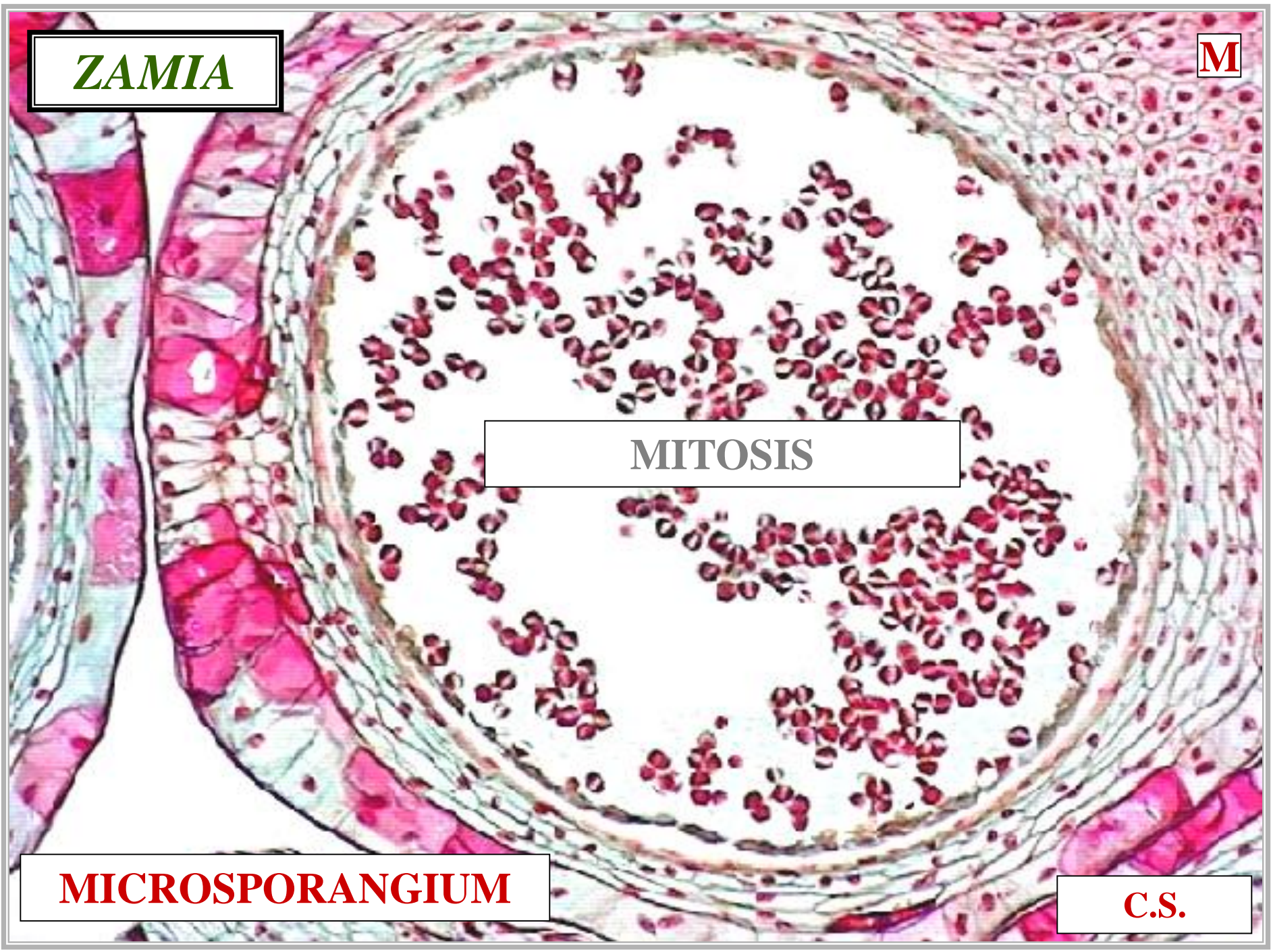
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**M**

**MITOSIS**

**MICROSPORANGIUM**

**C.S.**





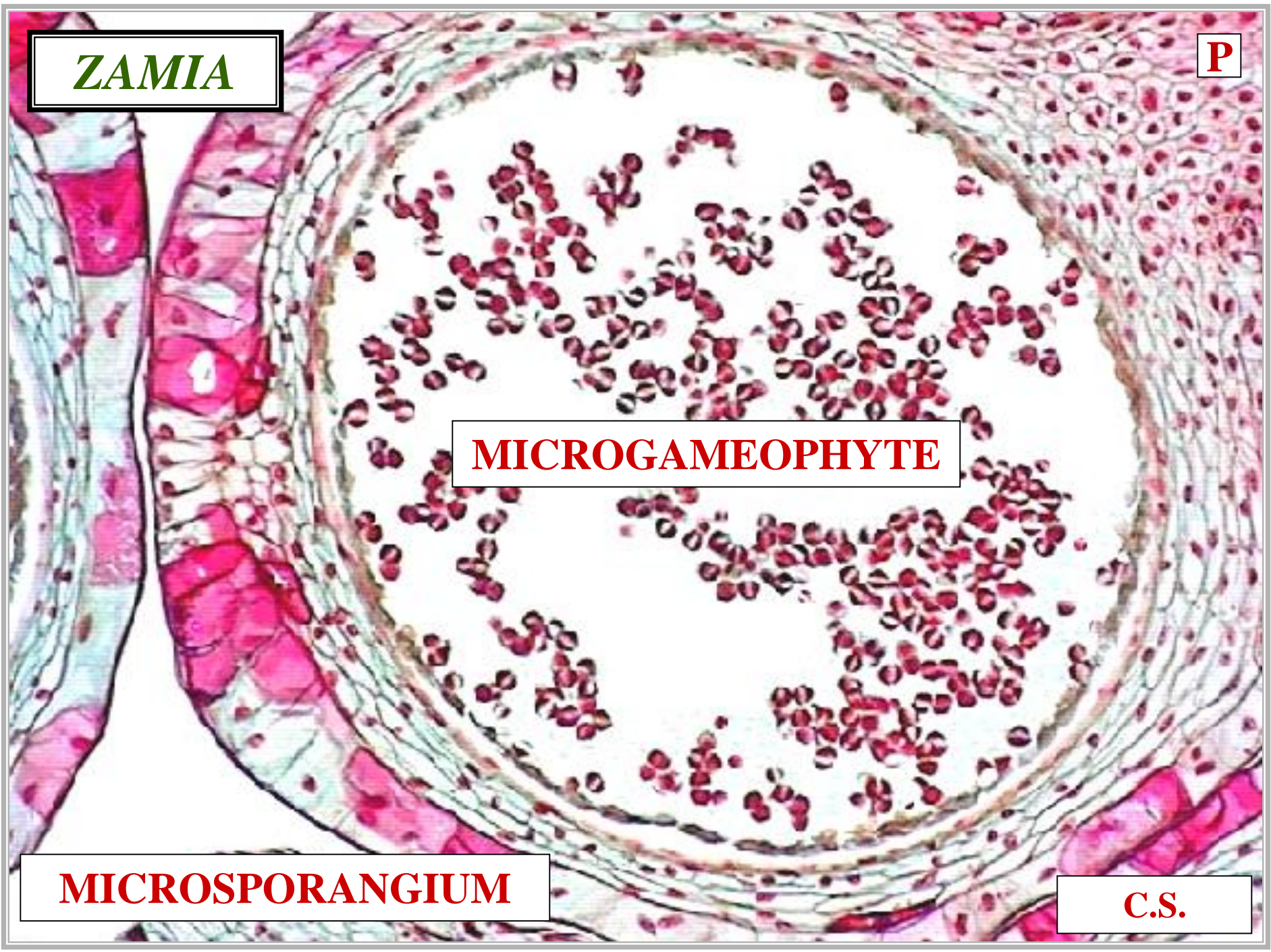
**ZAMIA**

**P**

**MICROGAMEOPHYTE**

**MICROSPORANGIUM**

**C.S.**





***ZAMIA***

**POLLEN GRAINS**

**MICROSPORANGIUM**

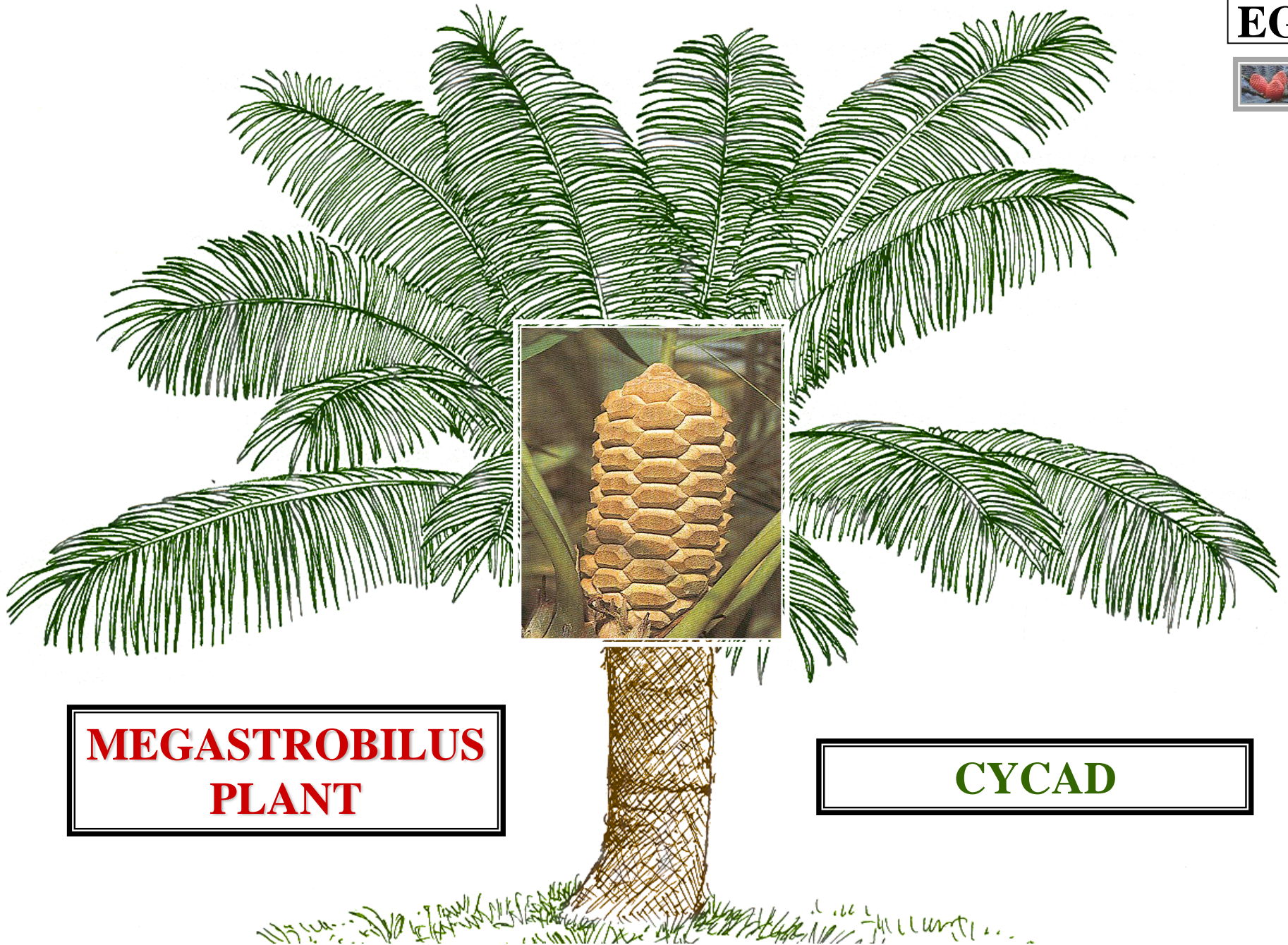
**C.S.**







# MEGASTROBILUS PLANT “FEMALE PLANT”



**MEGASTROBILUS  
PLANT**

**CYCAD**









?

**MEGASTROBILUS**





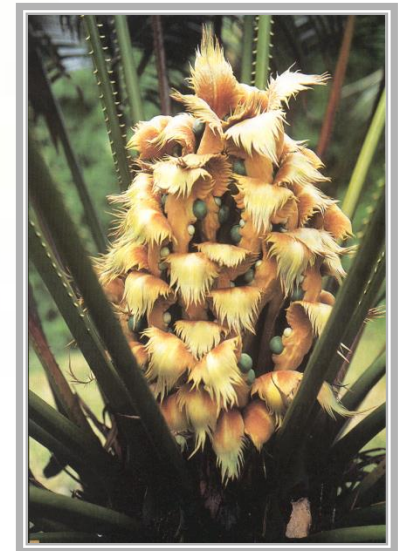
**MEGASPOROPHYLL**



**MEGASTROBILUS**



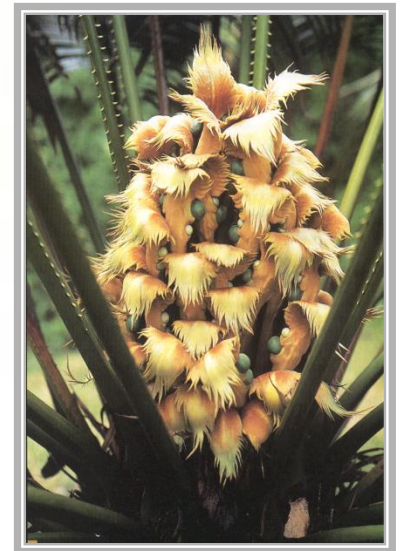
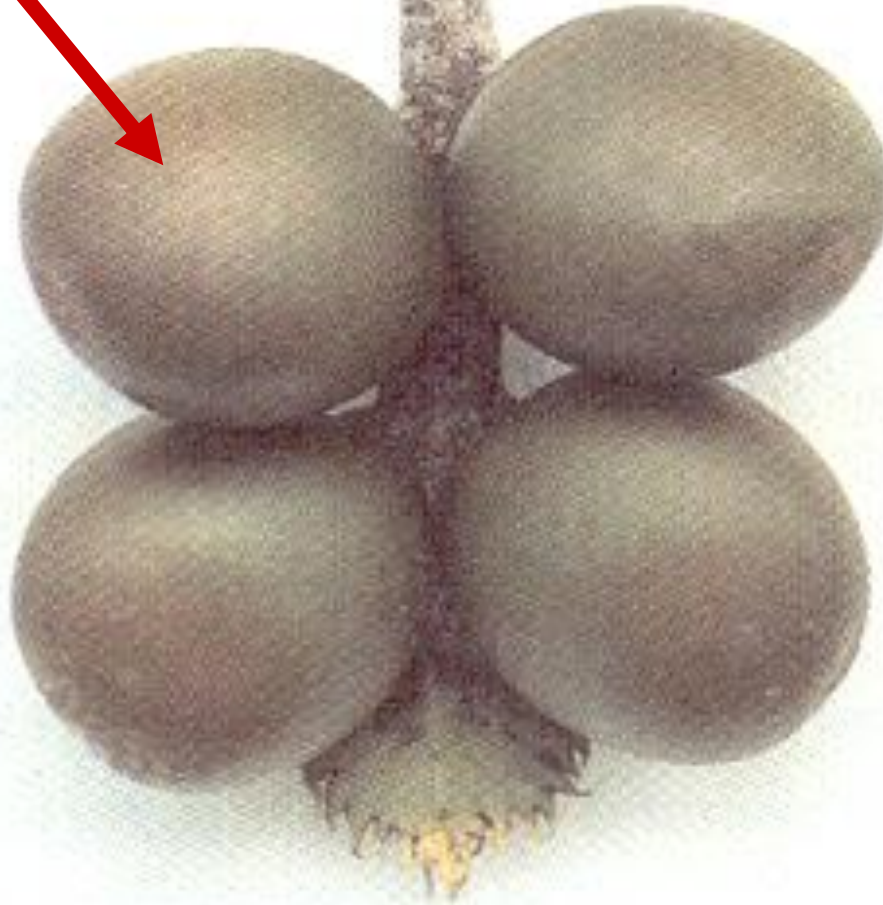
**MEGASPOROPHYLL**





MEGASPOROPHYLL

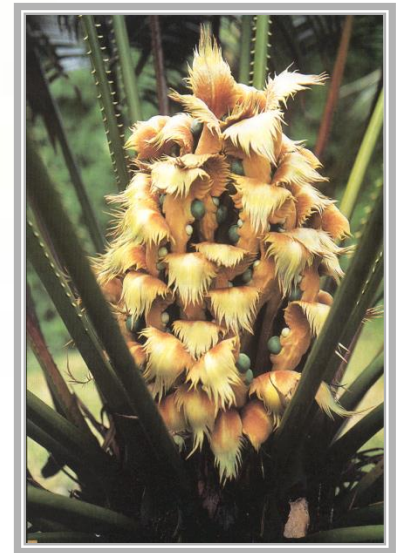
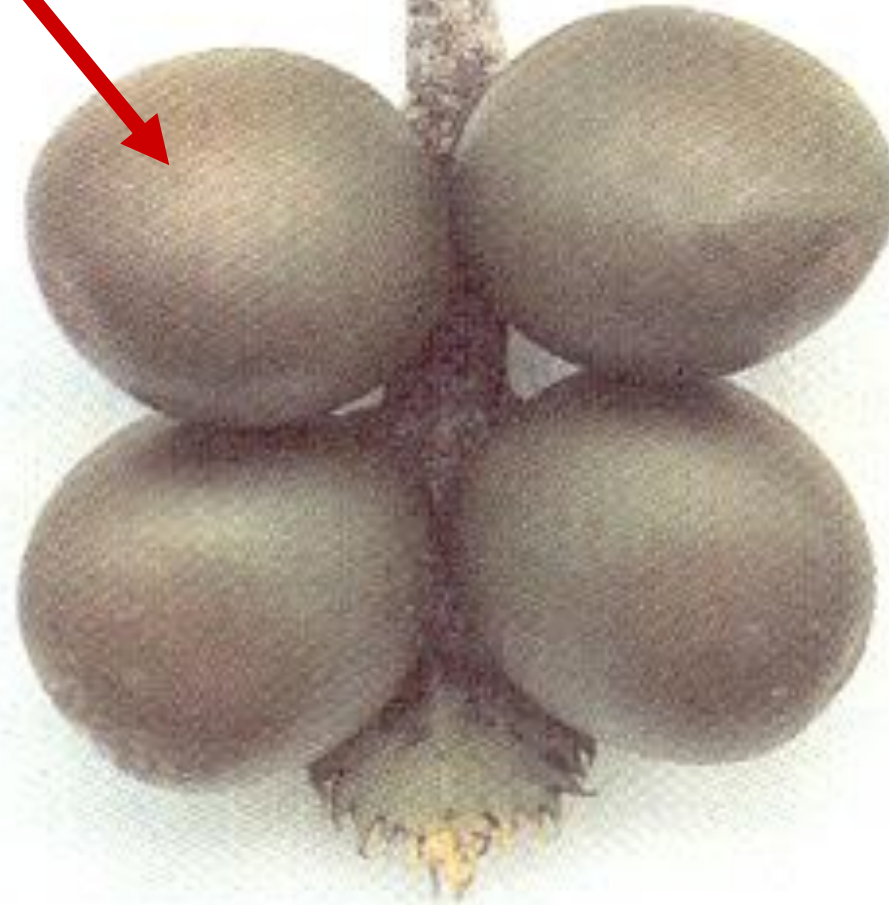
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**MEGASPOROPHYLL**

**2-8 OVULES**

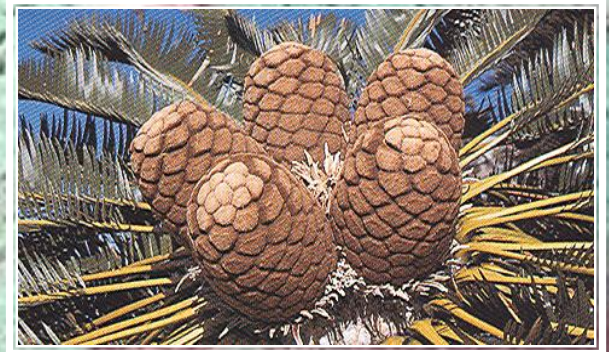




**ZAMIA**

?

**MEGASTROBILUS**



**C.S.**

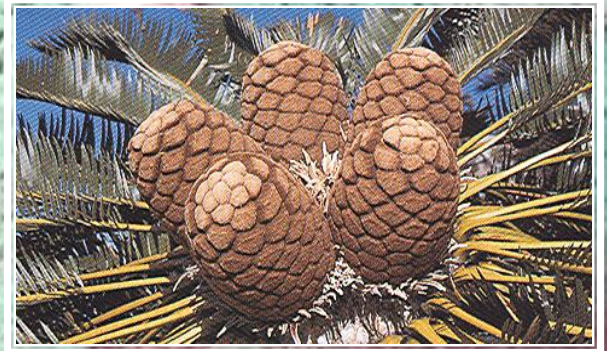


**ZAMIA**

**M**

**MEGASTROBILUS**

**?**



**C.S.**

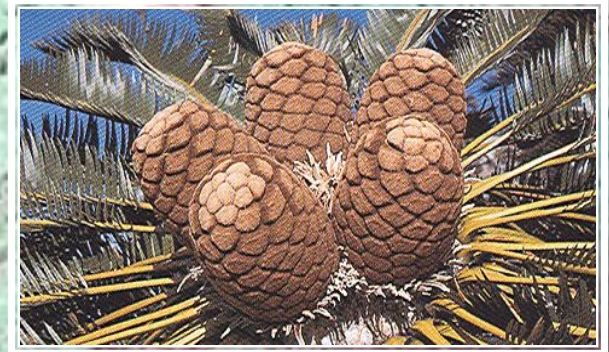


**ZAMIA**

?

**MEGASTROBILUS**

**MEGASPOROPHYLL**



**C.S.**

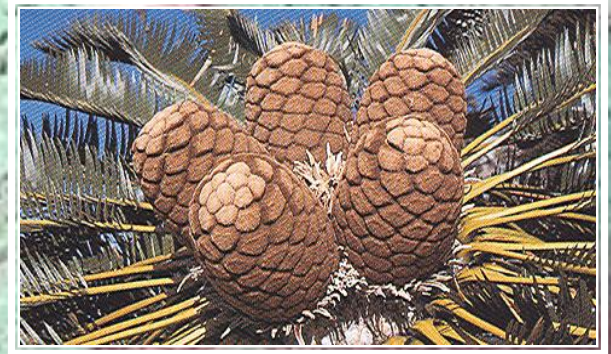


**ZAMIA**

**O**

**MEGASTROBILUS**

**MEGASPOROPHYLL**



**?**

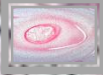
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**C.S.**

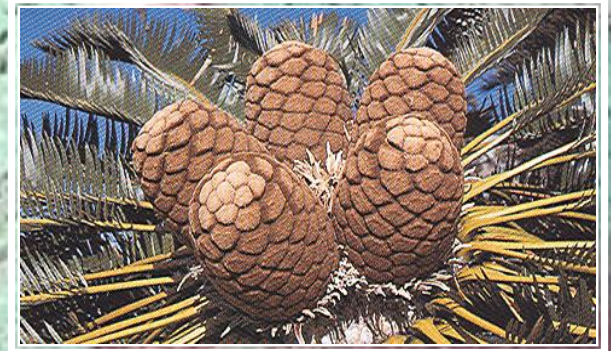


**ZAMIA**

?



**MEGASTROBILUS**



**MEGASPOROPHYLL**

**OVULE**

**OVULE**

**C.S.**



**ZAMIA**

**M**

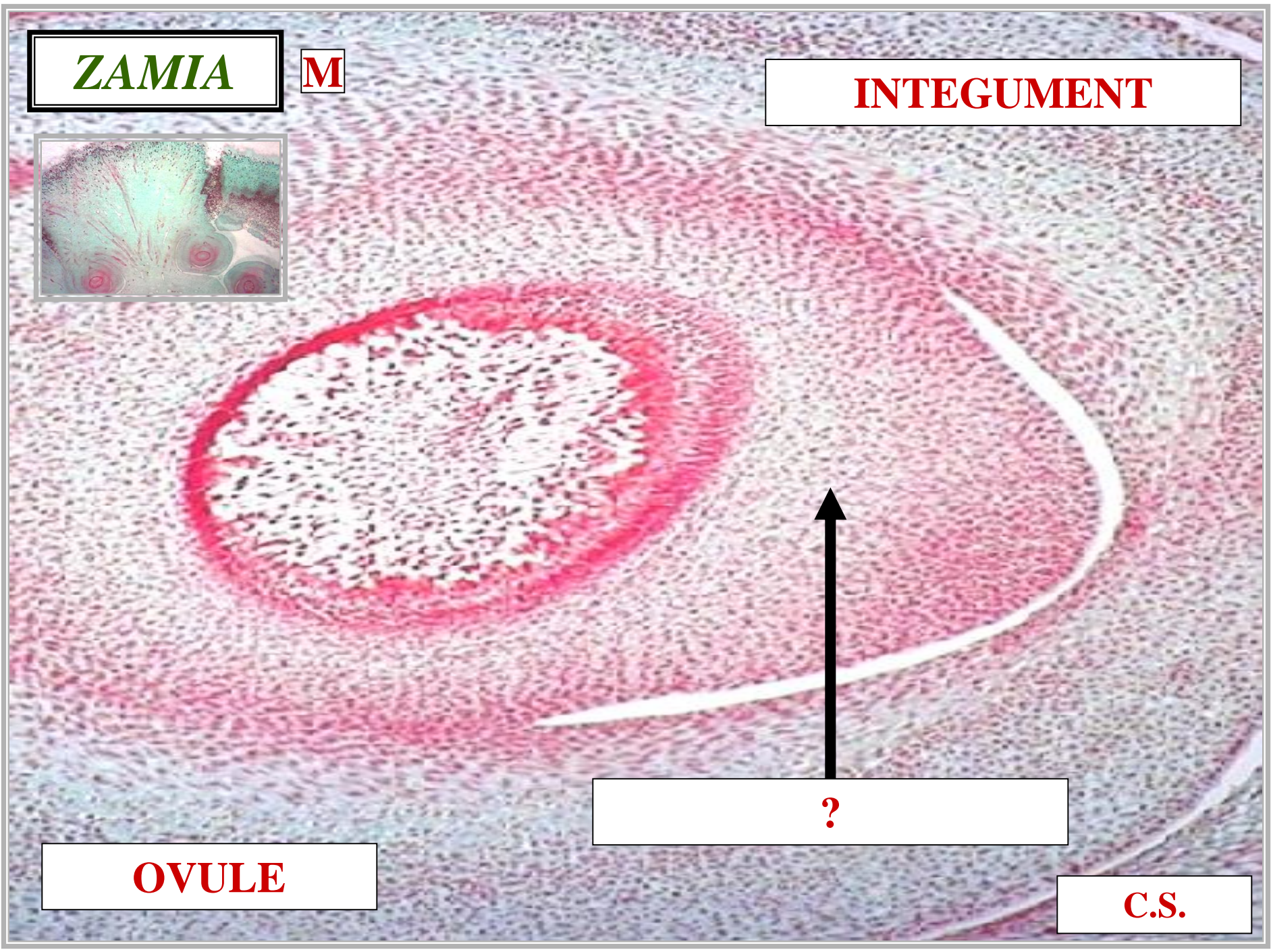
**INTEGUMENT**



**OVULE**

**?**

**C.S.**





**ZAMIA**

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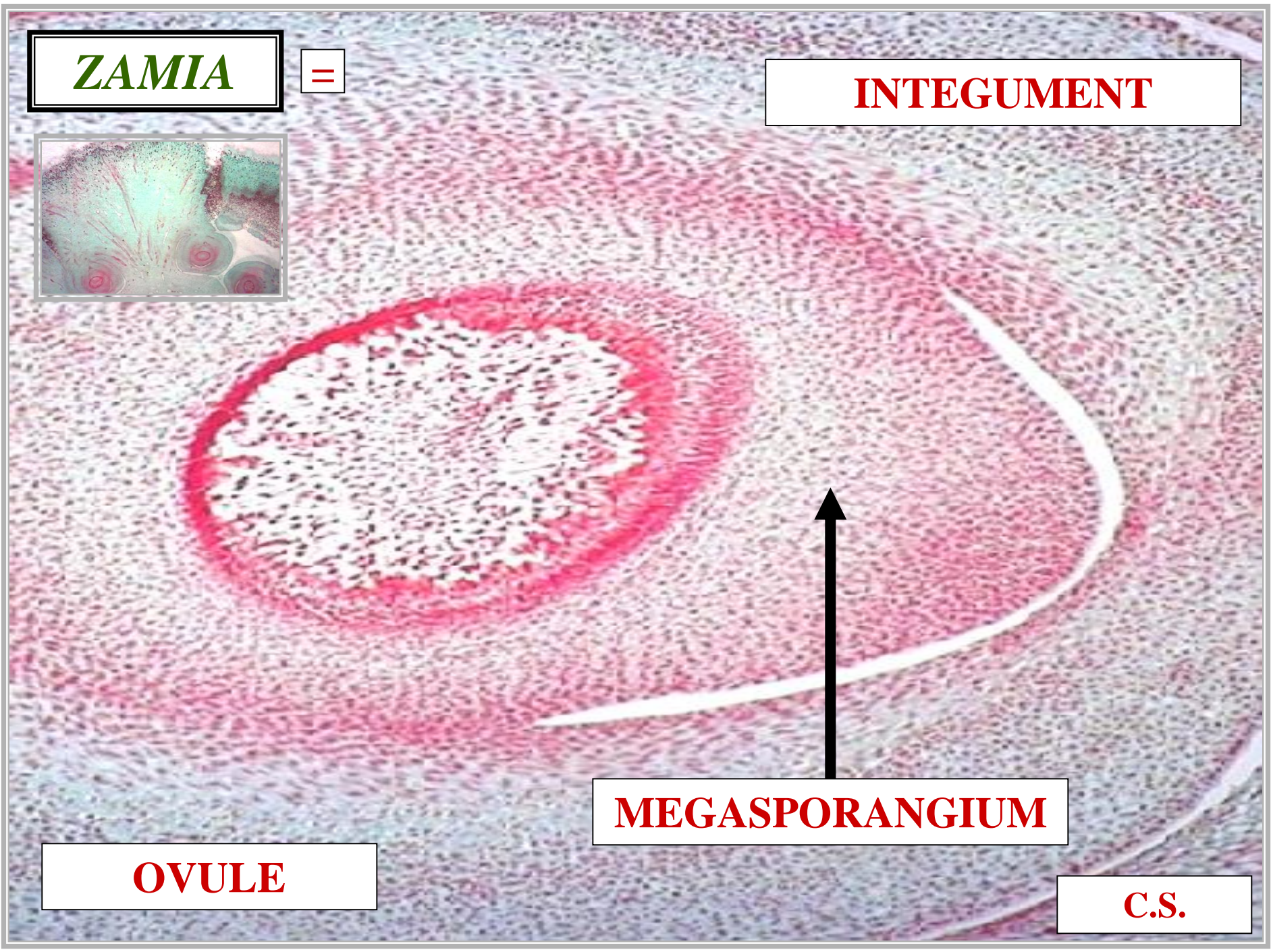
**INTEGUMENT**



**OVULE**

**MEGASPORANGIUM**

**C.S.**





**ZAMIA**

**?**

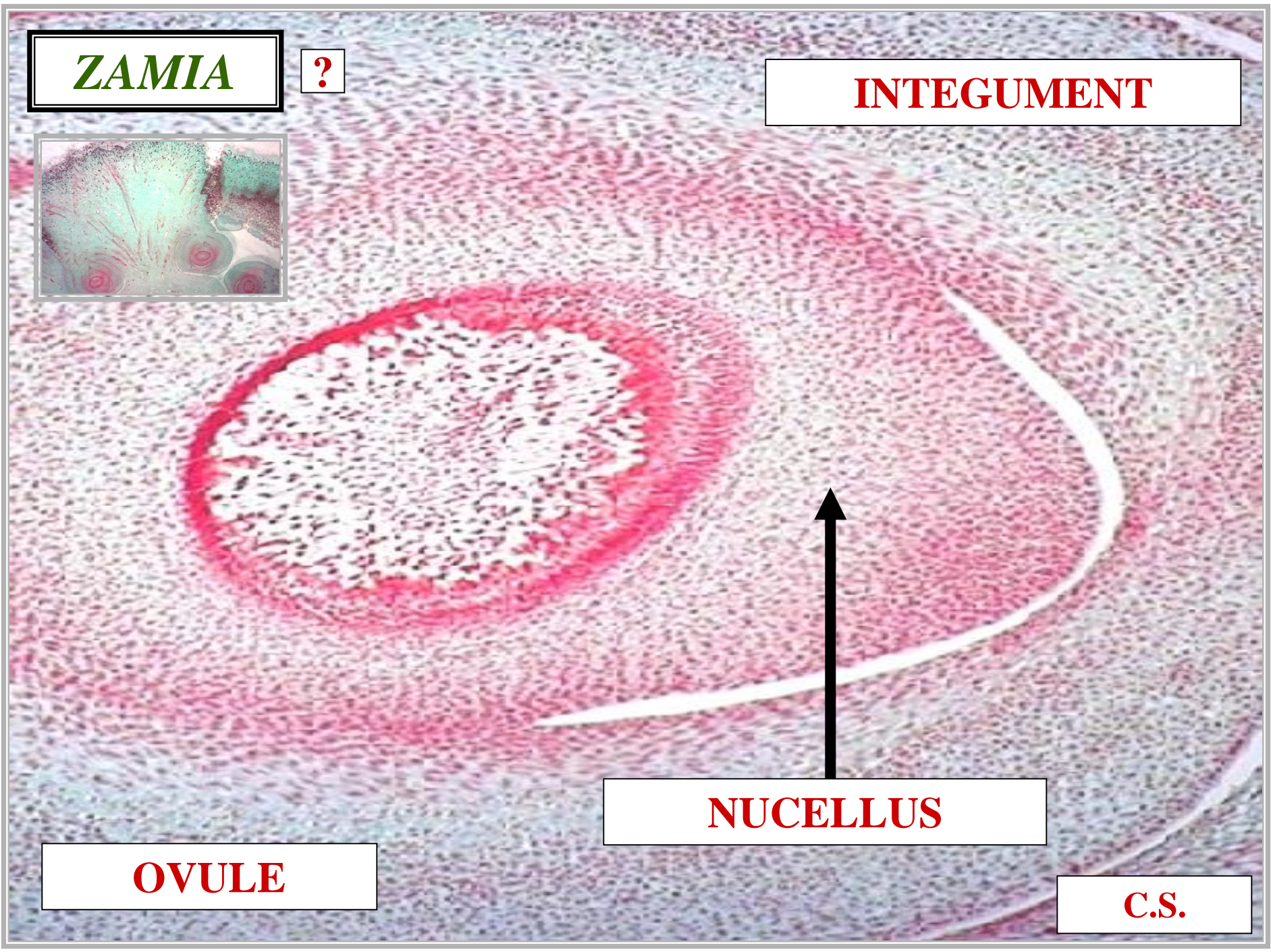
**INTEGUMENT**



**OVULE**

**NUCELLUS**

**C.S.**





**ZAMIA**

**M**

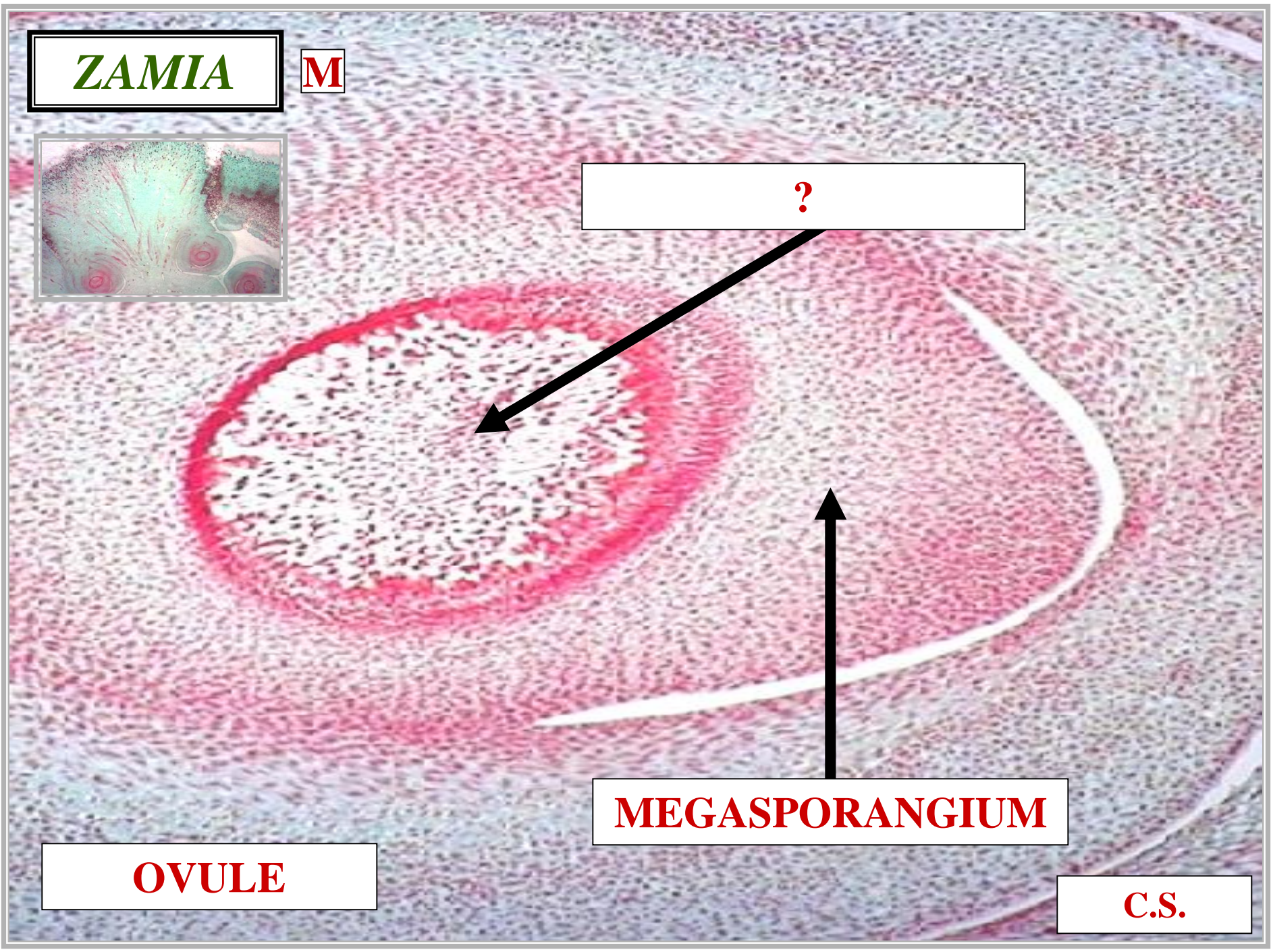


**?**

**MEGASPORANGIUM**

**OVULE**

**C.S.**





**ZAMIA**

**2**



**MEGASPOROCYTE**



**MEGASPORANGIUM**



**OVULE**

**C.S.**



**ZAMIA**

**M**

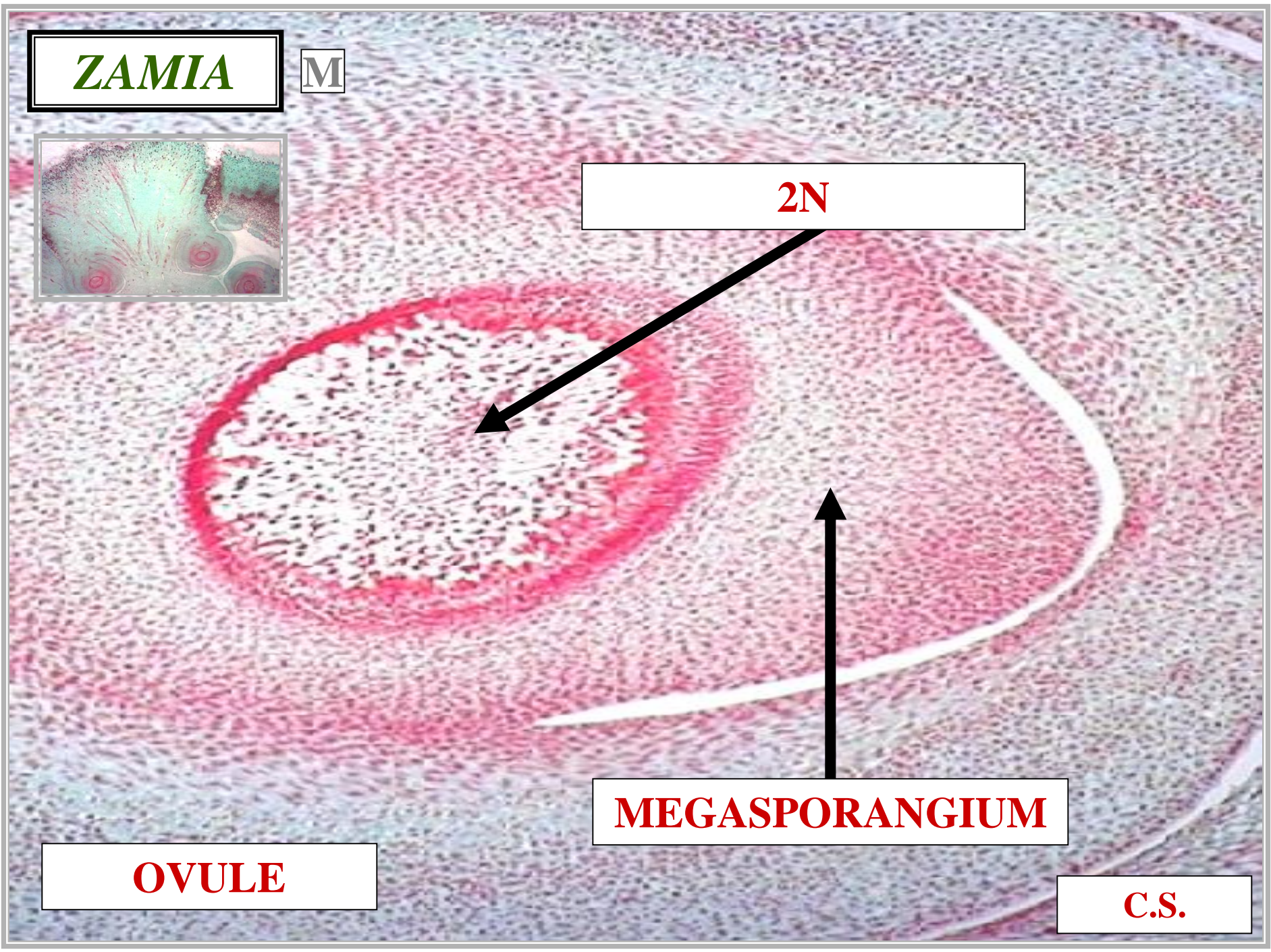


**2N**

**MEGASPORANGIUM**

**OVULE**

**C.S.**





**ZAMIA**

**M**



**MEIOSIS**



**MEGASPORANGIUM**

**OVULE**

**C.S.**



**ZAMIA**

**1**

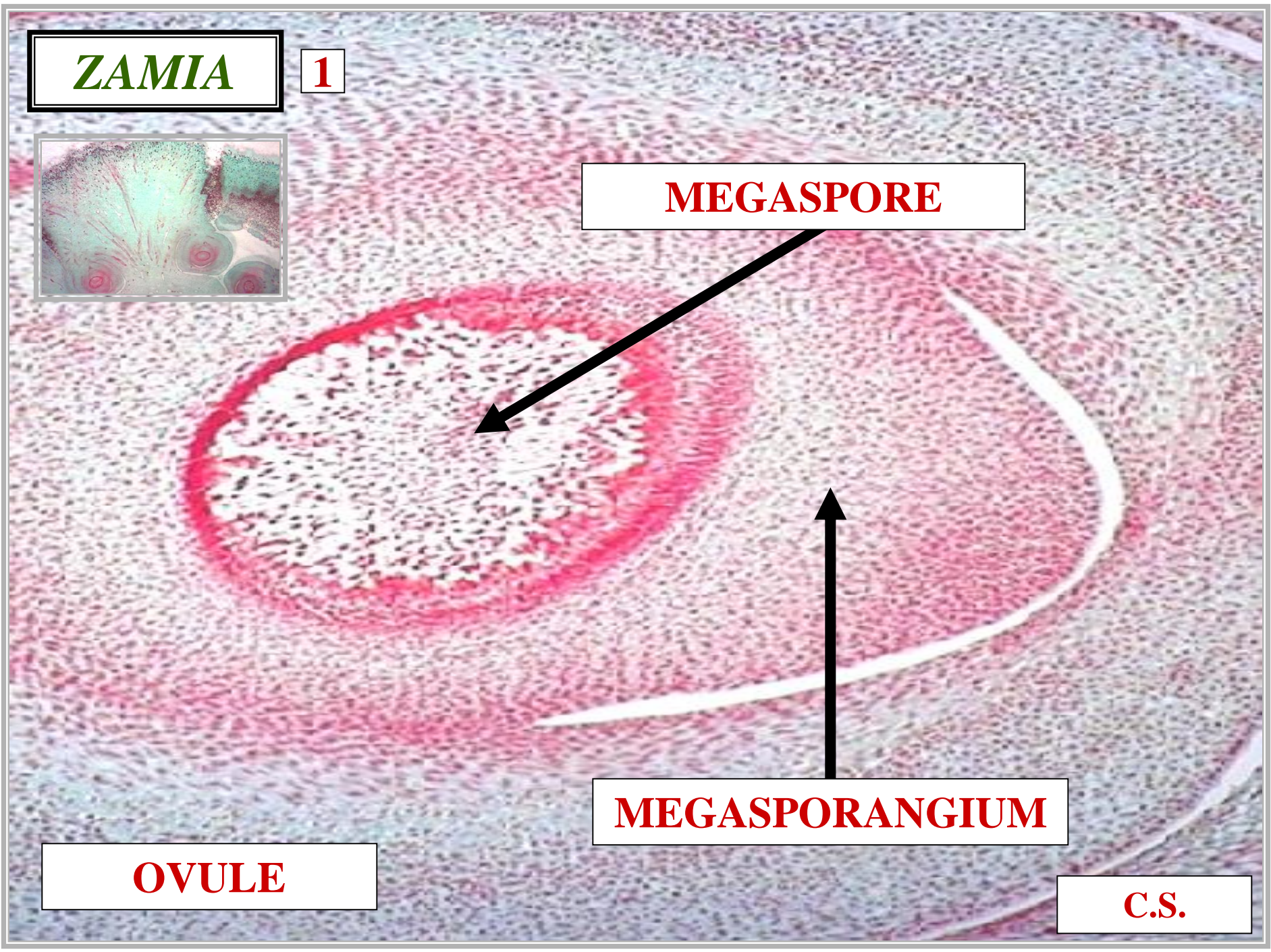


**MEGASPORE**

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**OVULE**

**C.S.**





**ZAMIA**

**M**

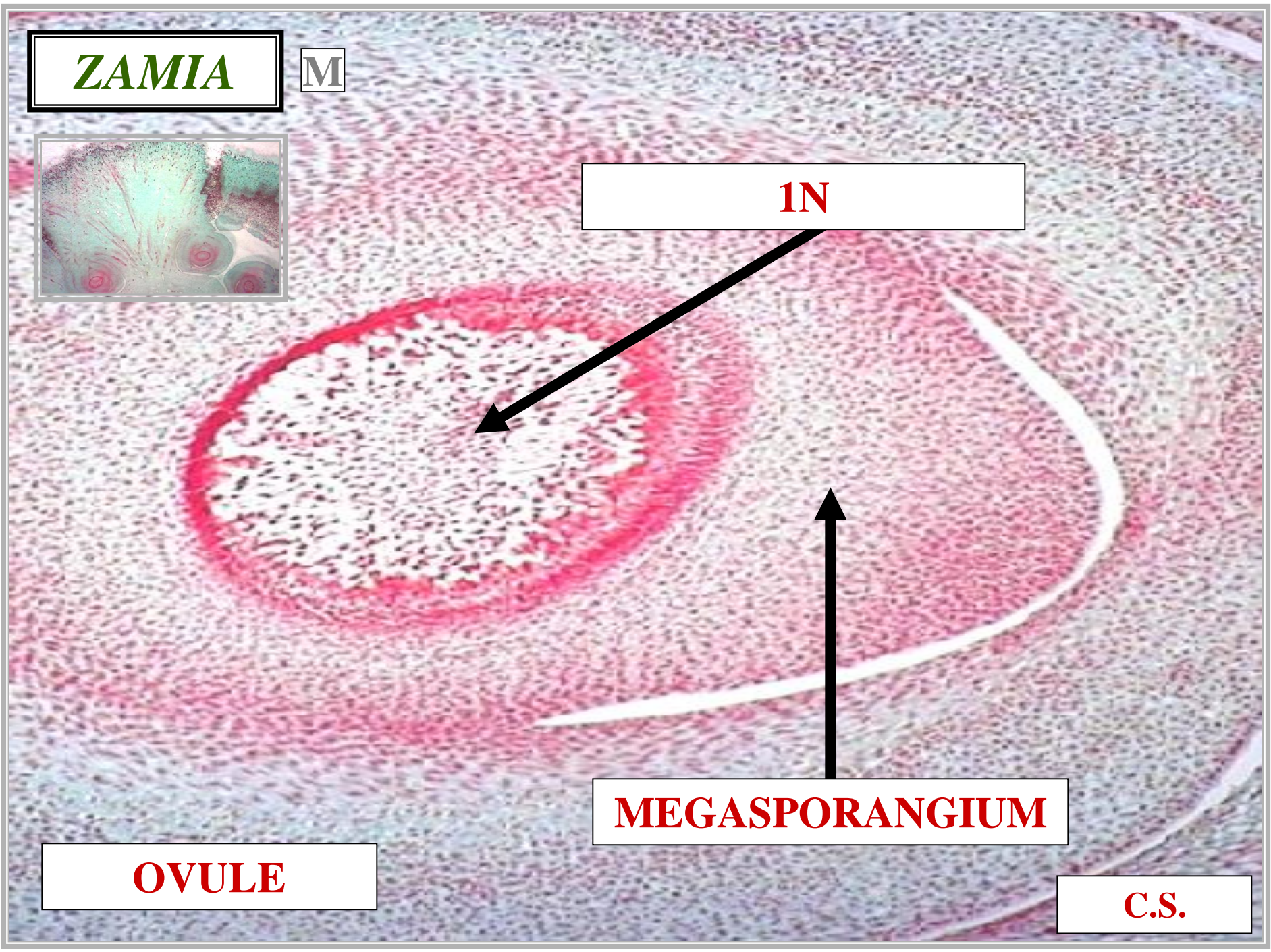


**1N**

**MEGASPORANGIUM**

**OVULE**

**C.S.**





**ZAMIA**

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**MITOSIS**



**MEGASPORANGIUM**

**OVULE**

**C.S.**



**M**

**INTEGUMENT**

**MEGASPORE  
WALL**

**NUCELLUS**

***ZAMIA***

**ARCHEGONIUM**

**ARCHEGONIUM**

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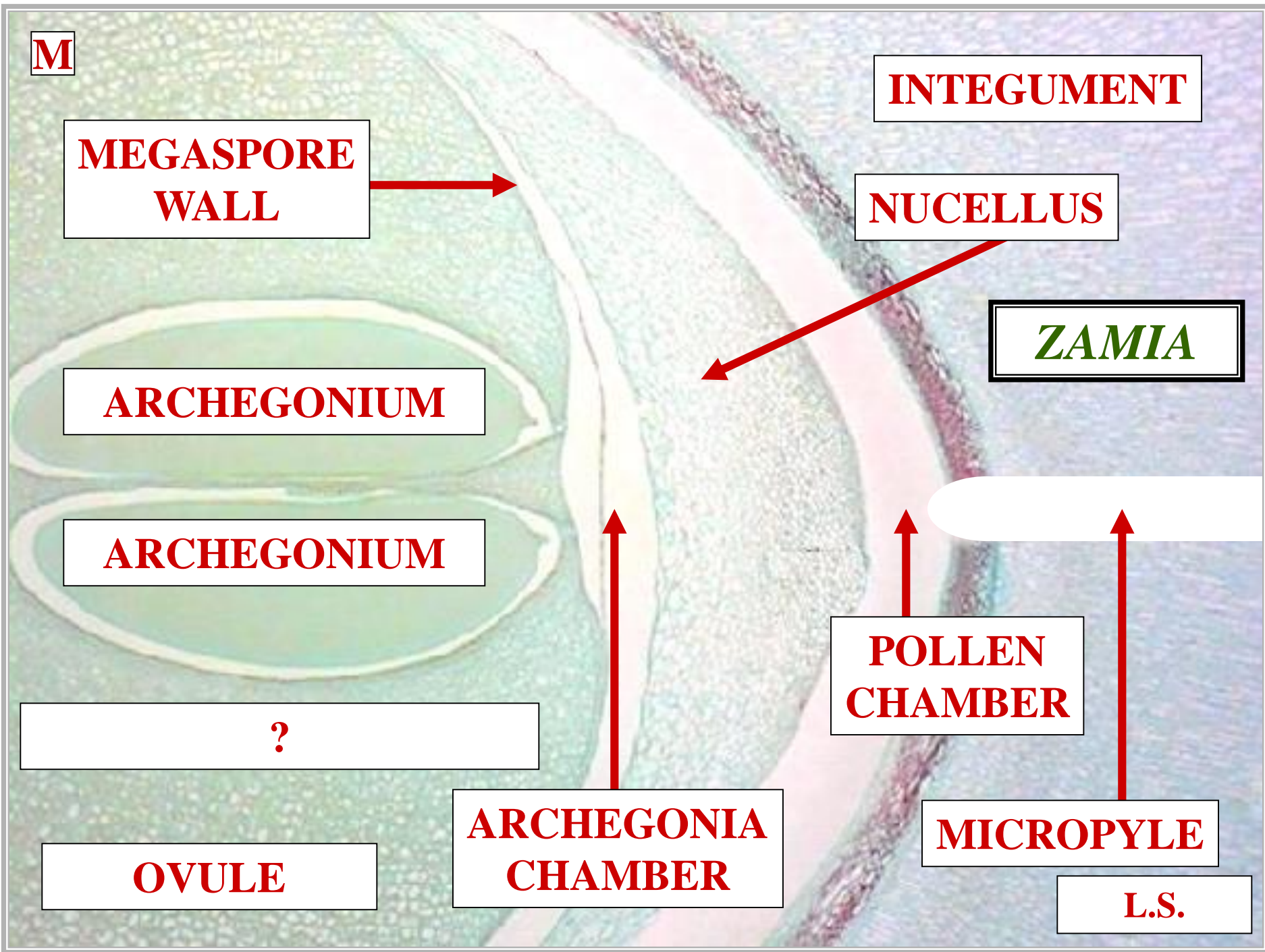
**POLLEN  
CHAMBER**

**OVULE**

**ARCHEGONIA  
CHAMBER**

**MICROPYLE**

**L.S.**





**S**

**+**

**INTEGUMENT**

**MEGASPORE  
WALL**

**NUCELLUS**

***ZAMIA***

**ARCHEGONIUM**

**ARCHEGONIUM**

**MEGAGAMETOPHYTE**

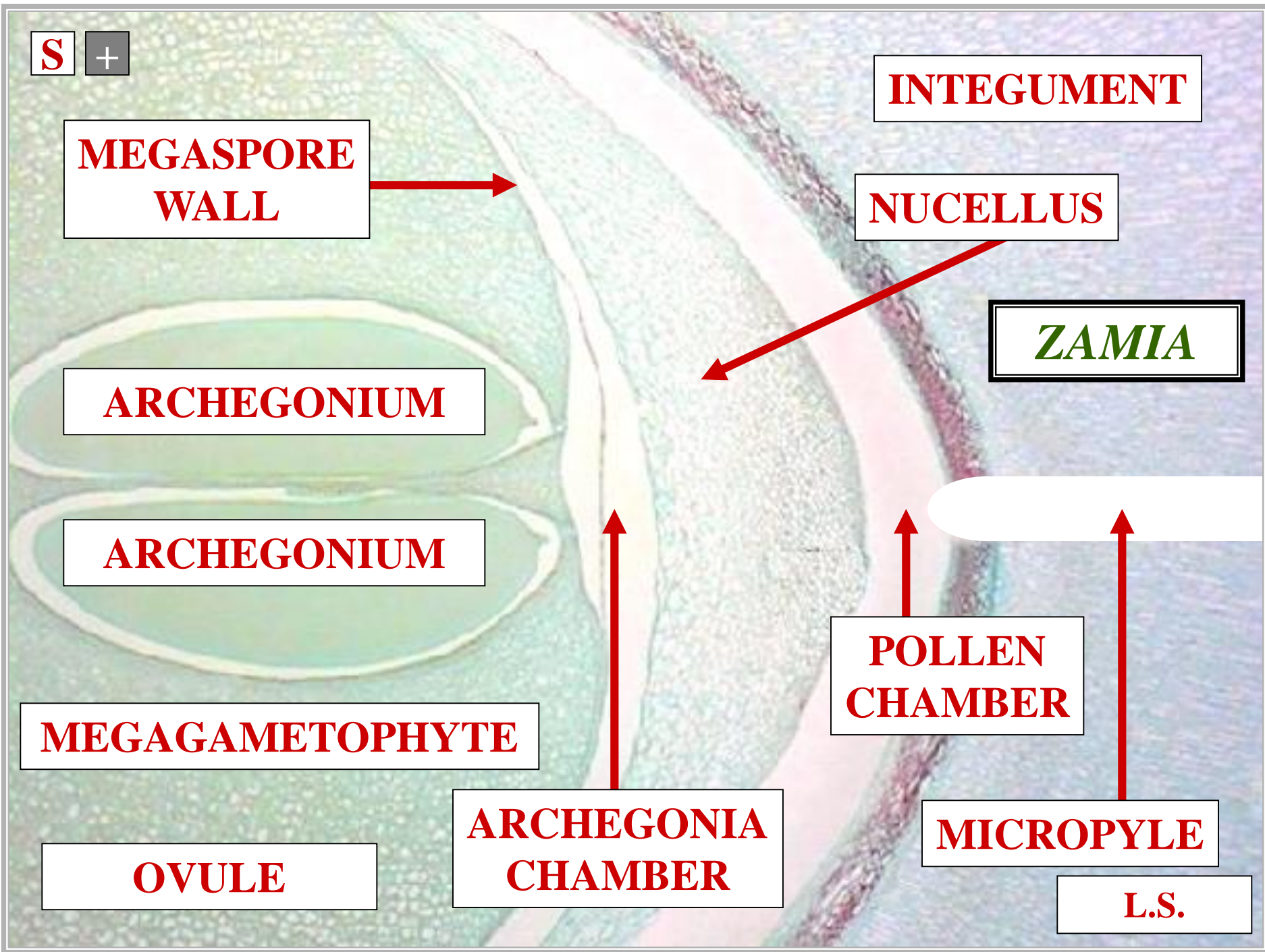
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CHAMBER**

**OVULE**

**ARCHEGONIA  
CHAMBER**

**MICROPYLE**

**L.S.**





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**MEGASPORE  
WALL**

**INTEGUMENT**

**NUCELLUS**

***ZAMIA***

**SYNGAMY**

**SYNGAMY**

**MEGAGAMETOPHYTE**

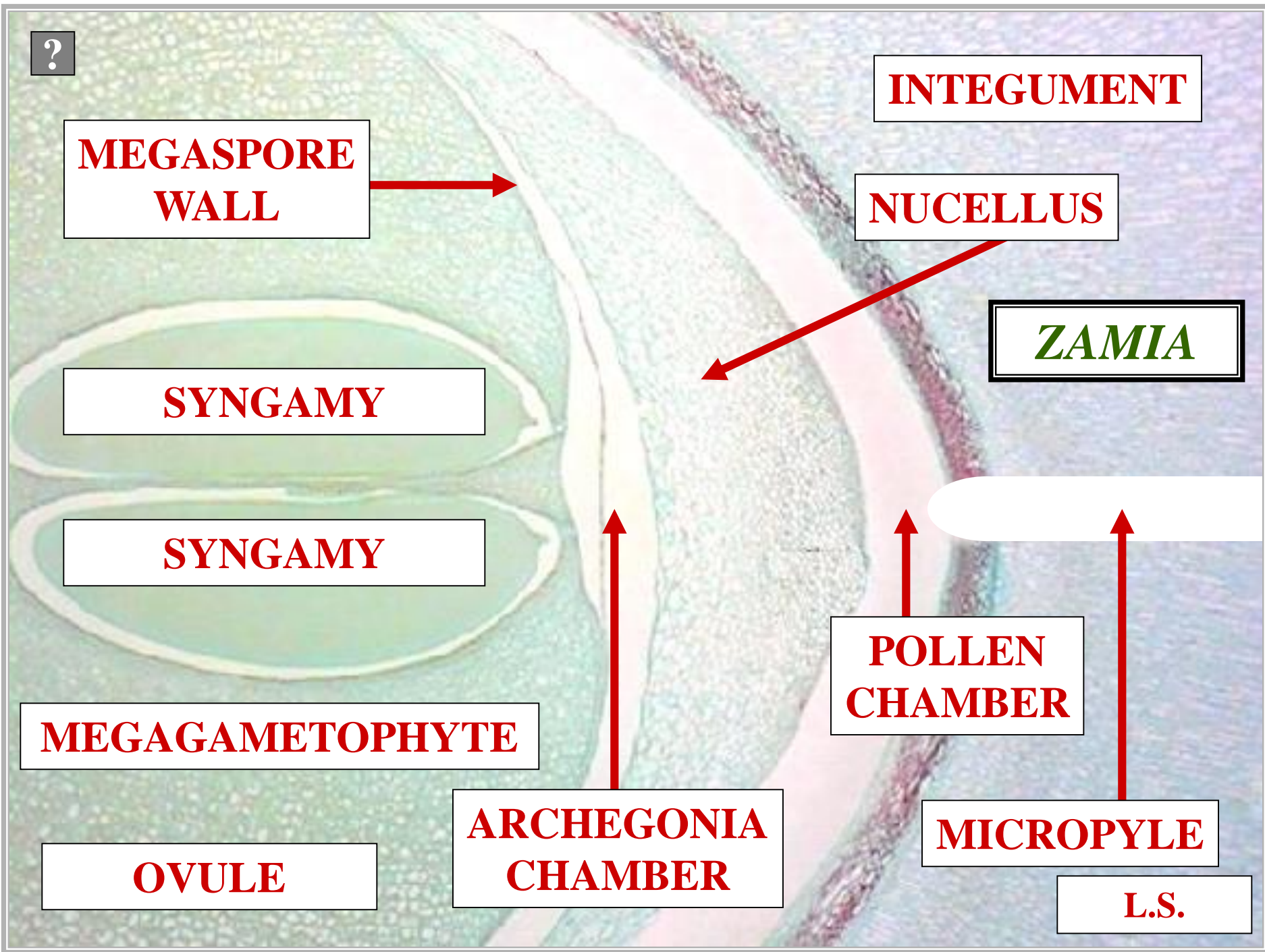
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**OVULE**

**ARCHEGONIA  
CHAMBER**

**MICROPYLE**

**L.S.**





**S**

**INTEGUMENT**

**MEGASPORE  
WALL**

**NUCELLUS**

**ZAMIA**

**EMBRYO**

**EMBRYO**

**MEGAGAMETOPHYTE**

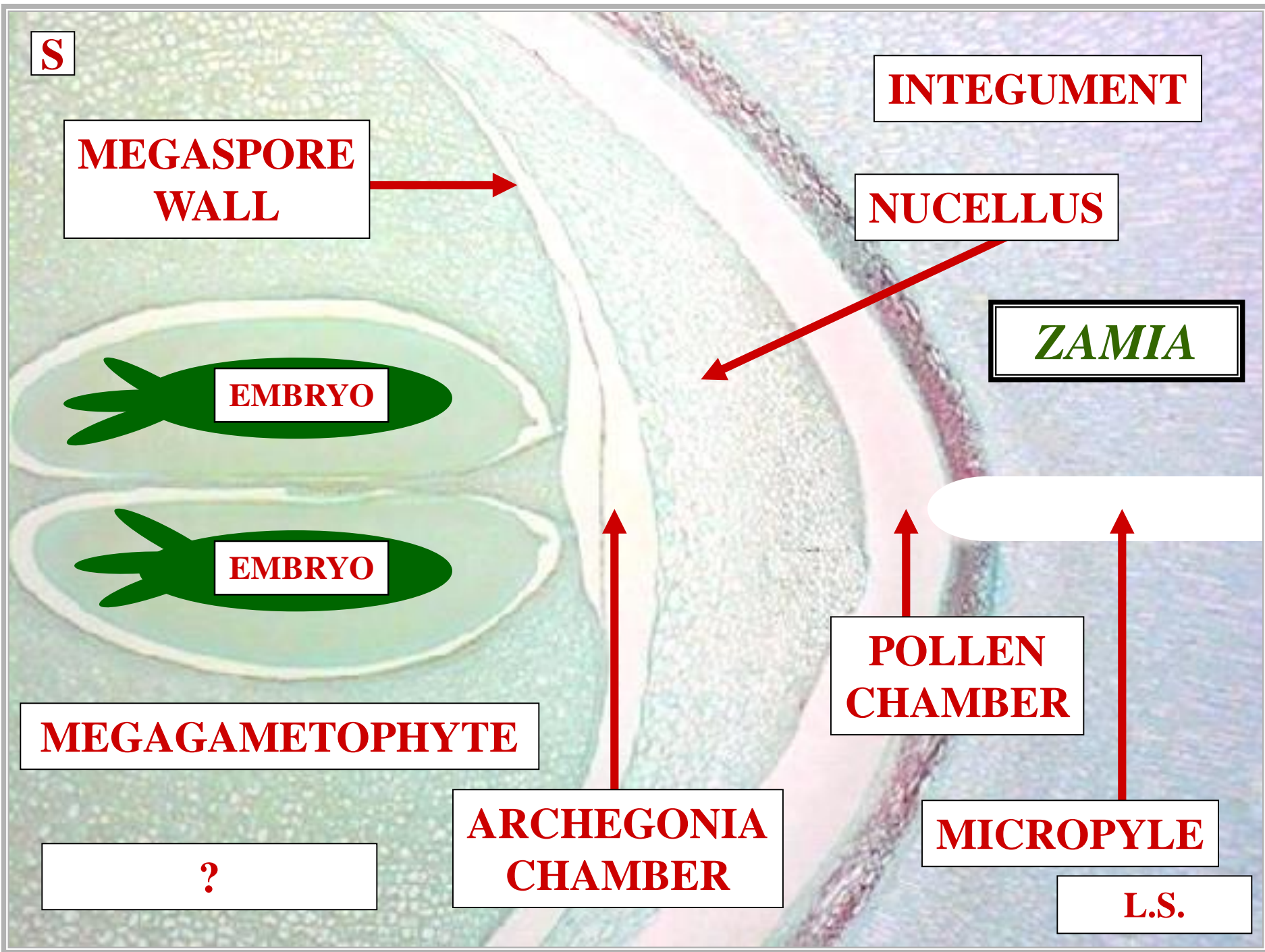
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**ARCHEGONIA  
CHAMBER**

**POLLEN  
CHAMBER**

**MICROPYLE**

**L.S.**







**INTEGUMENT**

**MEGASPORE  
WALL**

**NUCELLUS**

***ZAMIA***

**EMBRYO**

**EMBRYO**

**MEGAGAMETOPHYTE**

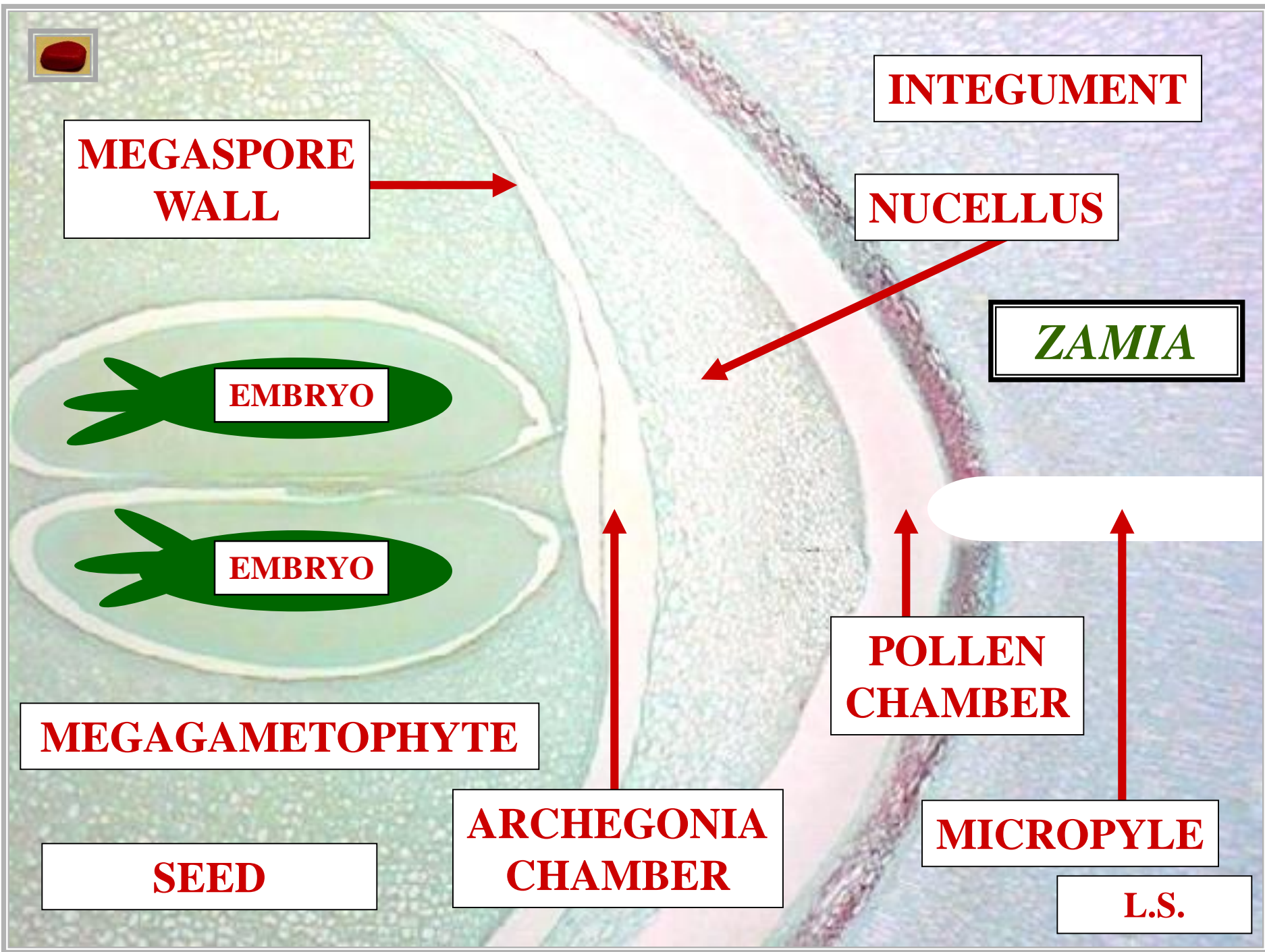
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CHAMBER**

**SEED**

**ARCHEGONIA  
CHAMBER**

**MICROPYLE**

**L.S.**







**EMBRYO**

**SEED**





**SEED**





# SEED ANATOMY



**L.S.**

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***ZAMIA***

**OVULE**





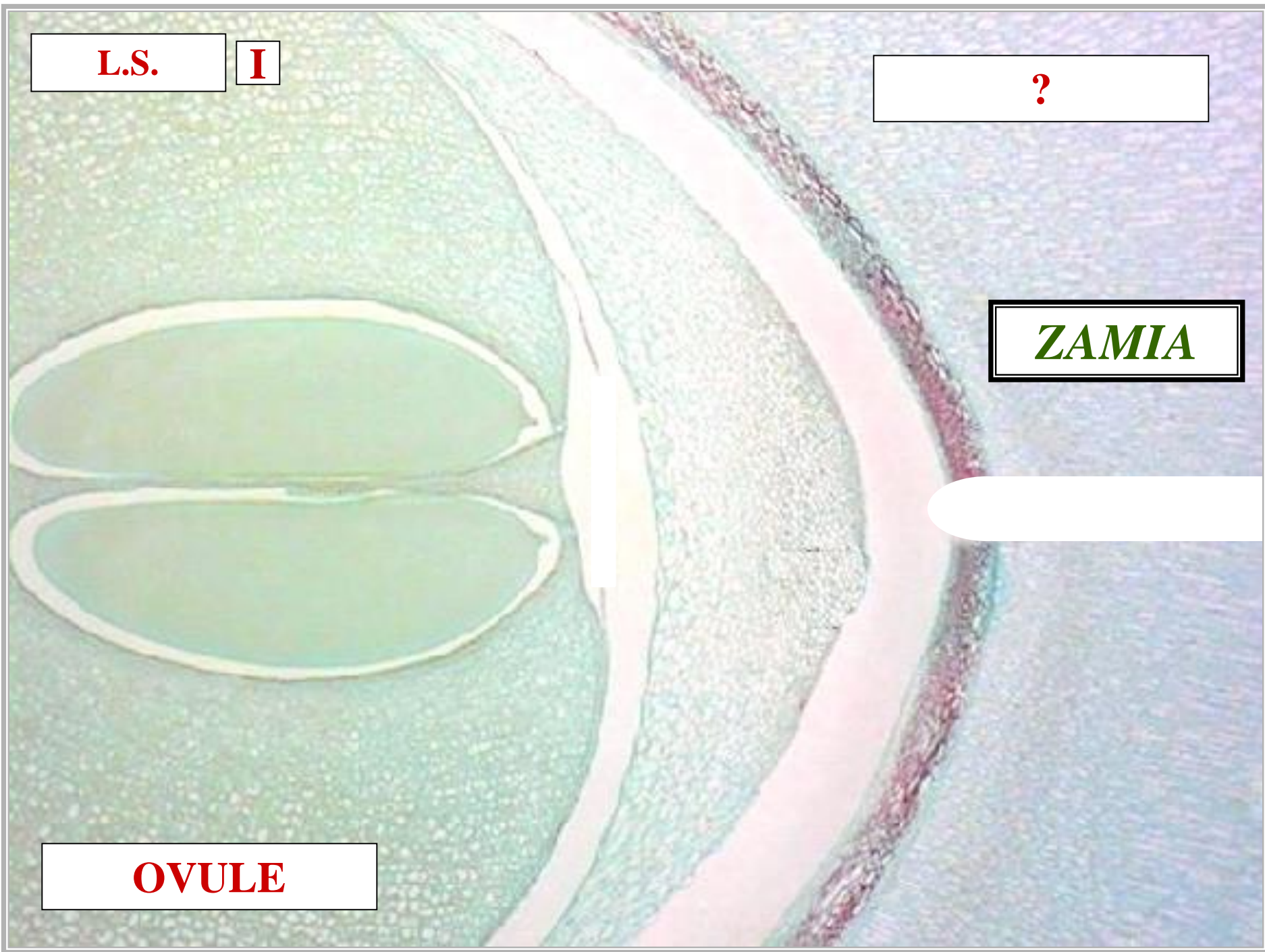
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**I**

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***ZAMIA***

**OVULE**





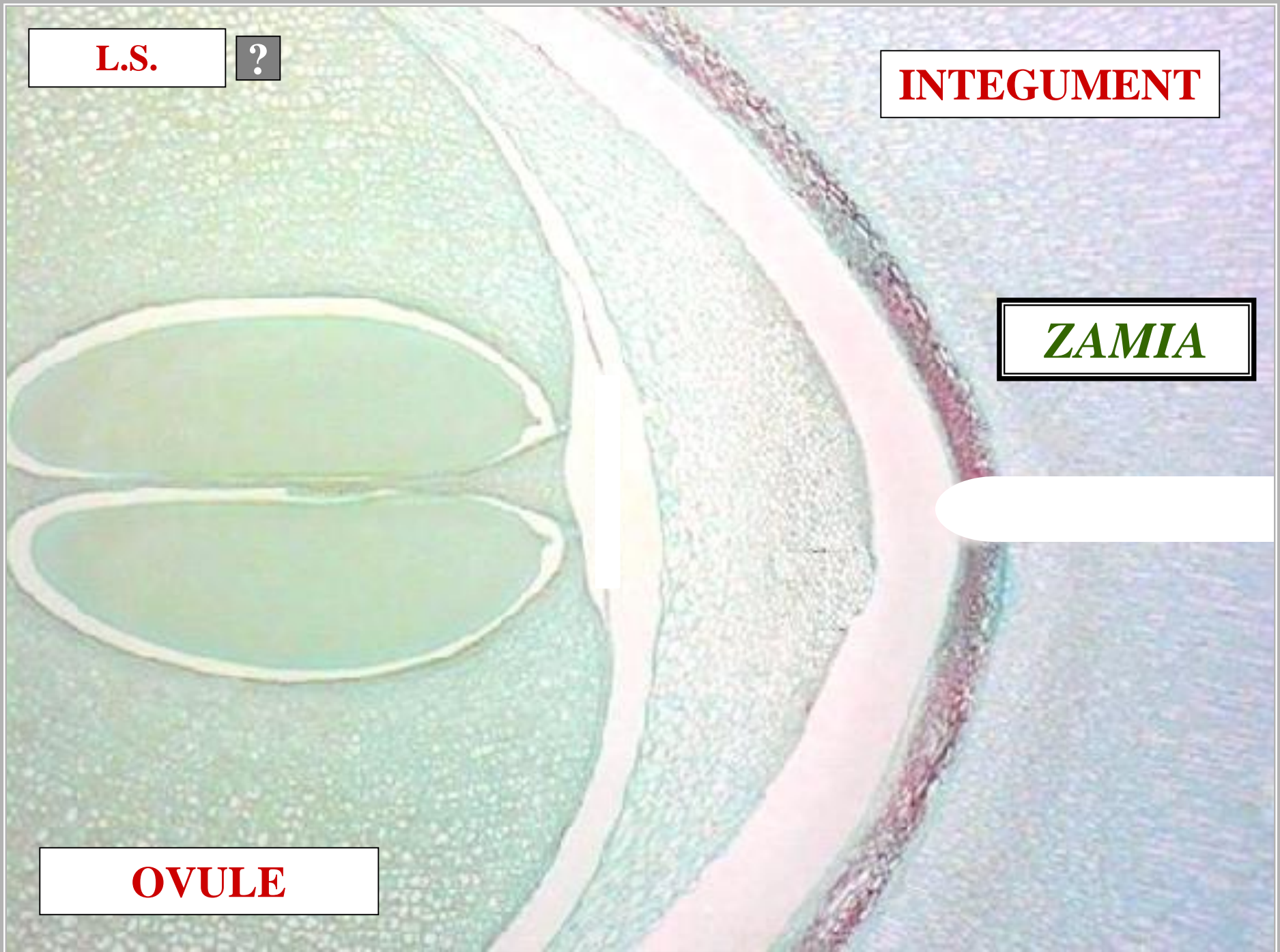
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**INTEGUMENT**

***ZAMIA***

**OVULE**





**L.S.**

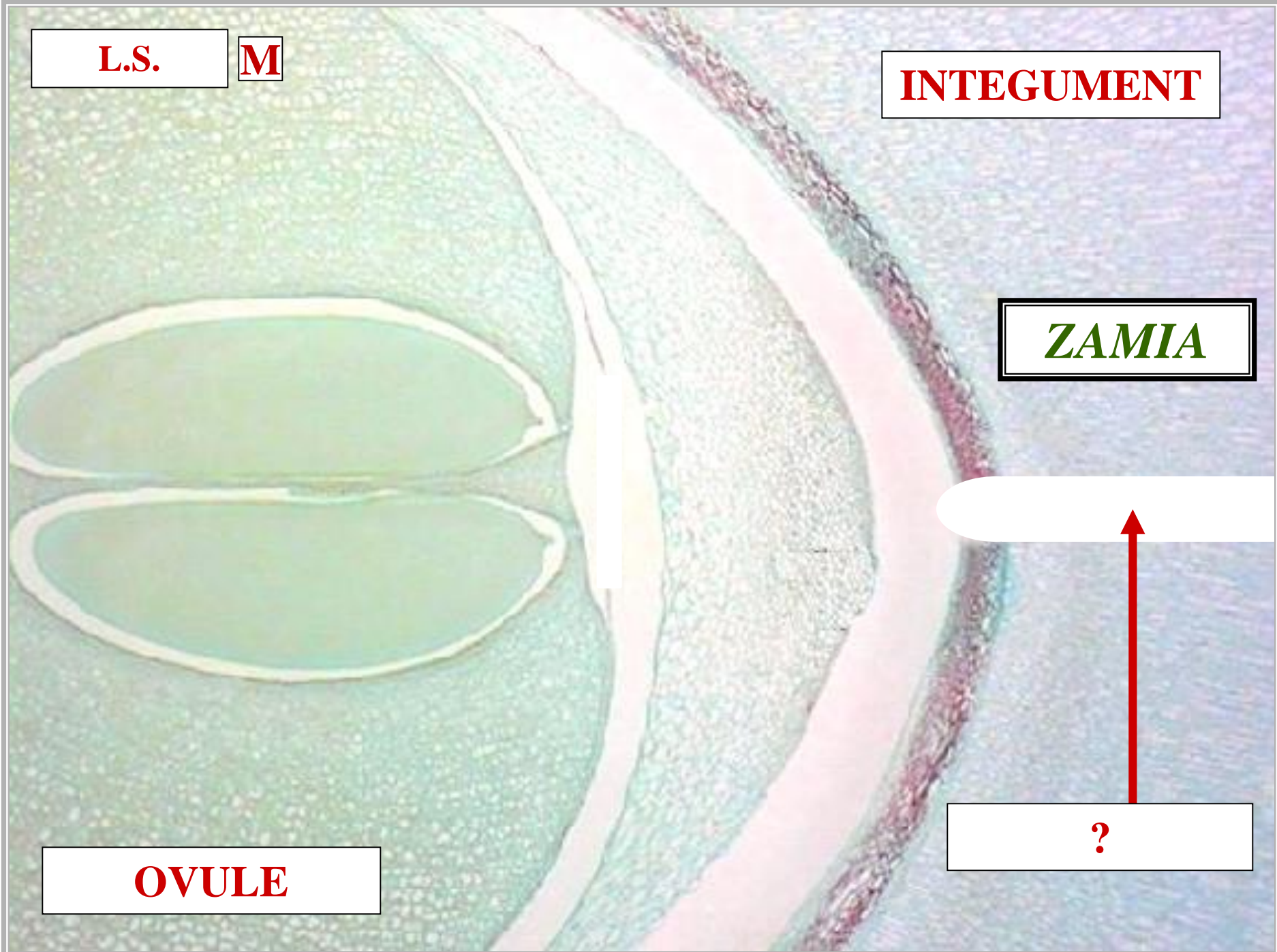
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**INTEGUMENT**

***ZAMIA***

**OVULE**

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**L.S.**

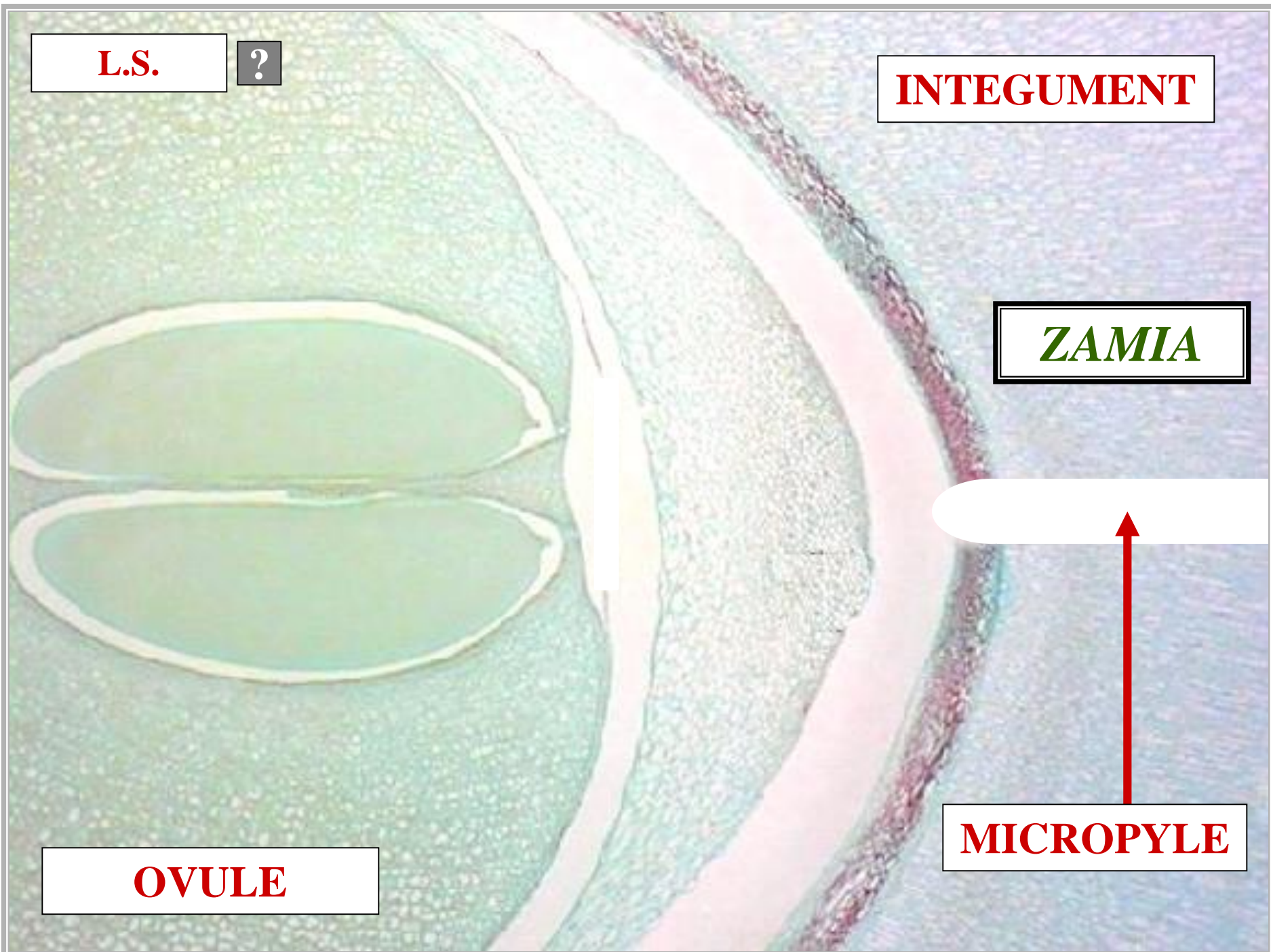
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**INTEGUMENT**

***ZAMIA***

**OVULE**

**MICROPYLE**





**L.S.**

**P**

**INTEGUMENT**

***ZAMIA***

**OVULE**

**?**

**MICROPYLE**

