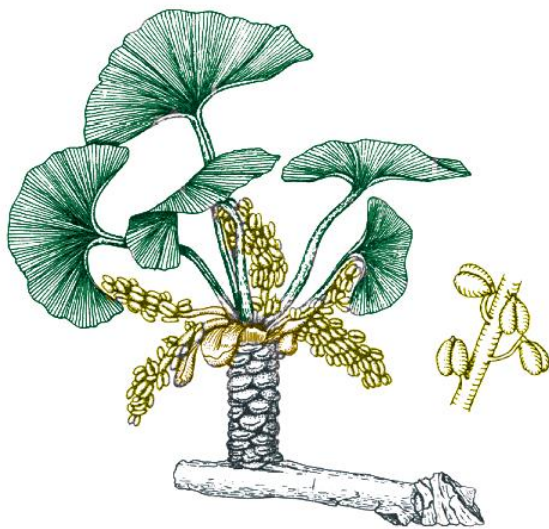


GINKGO

DIOECIOUS

“MALE” PLANT

MICROSPORANGIA



“FEMALE” PLANT

MEGASPORANGIA

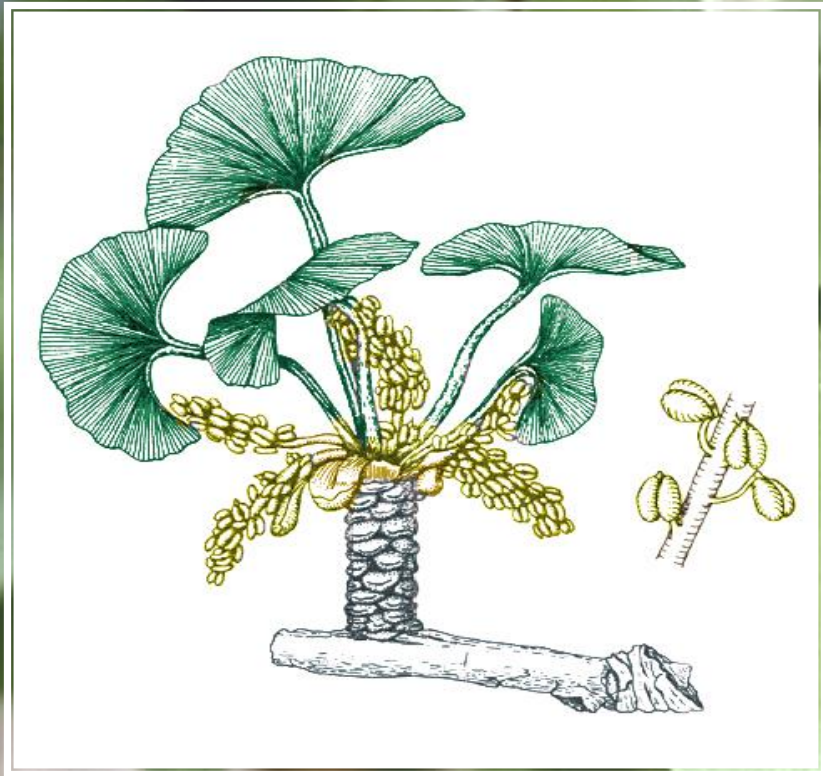




MICROSTROBILUS

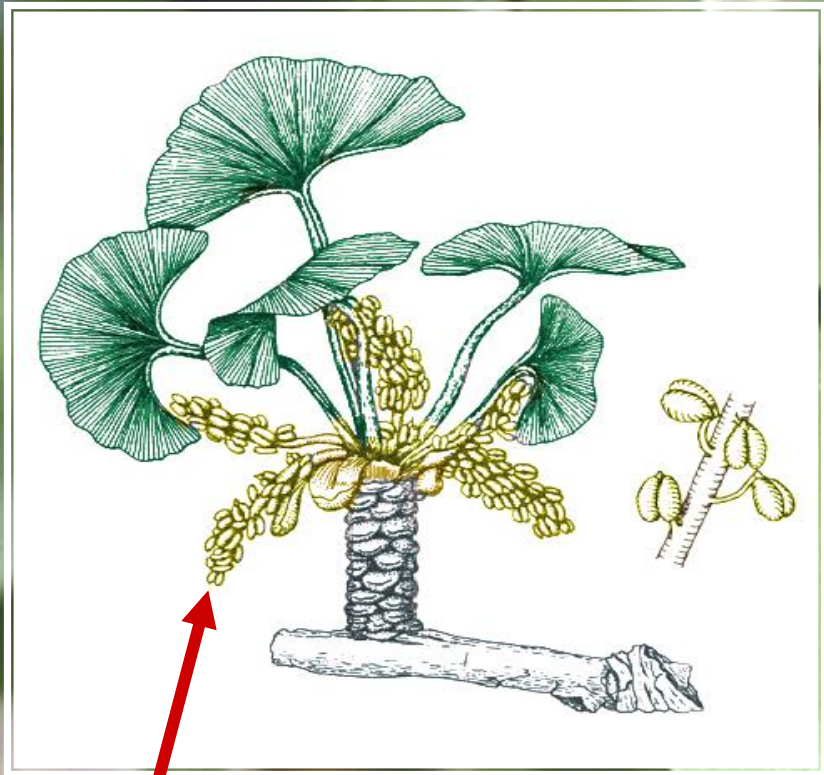
PLANT

“MALE PLANT”



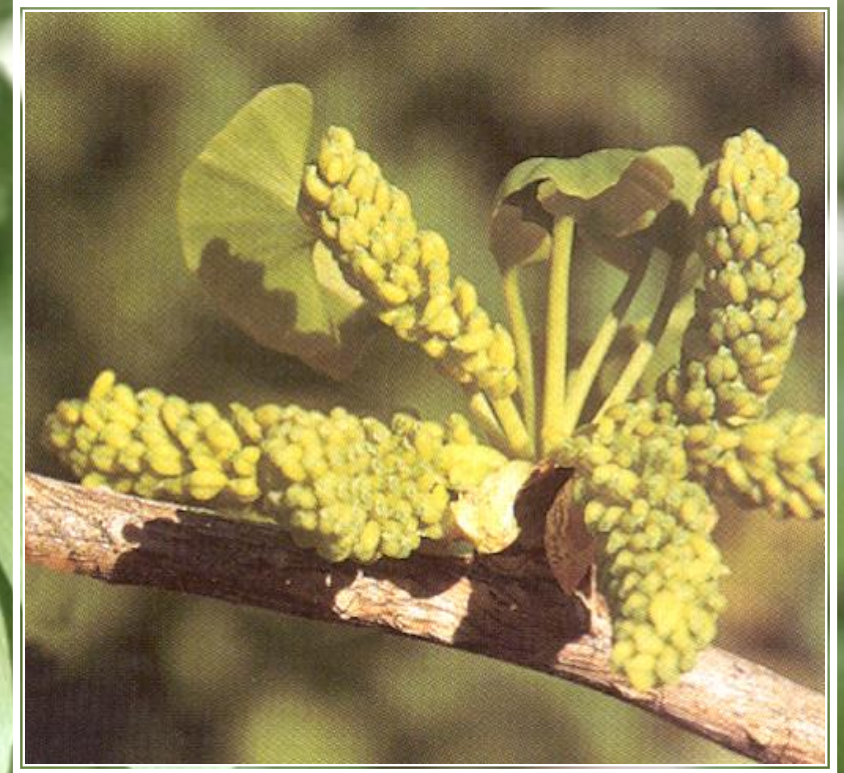
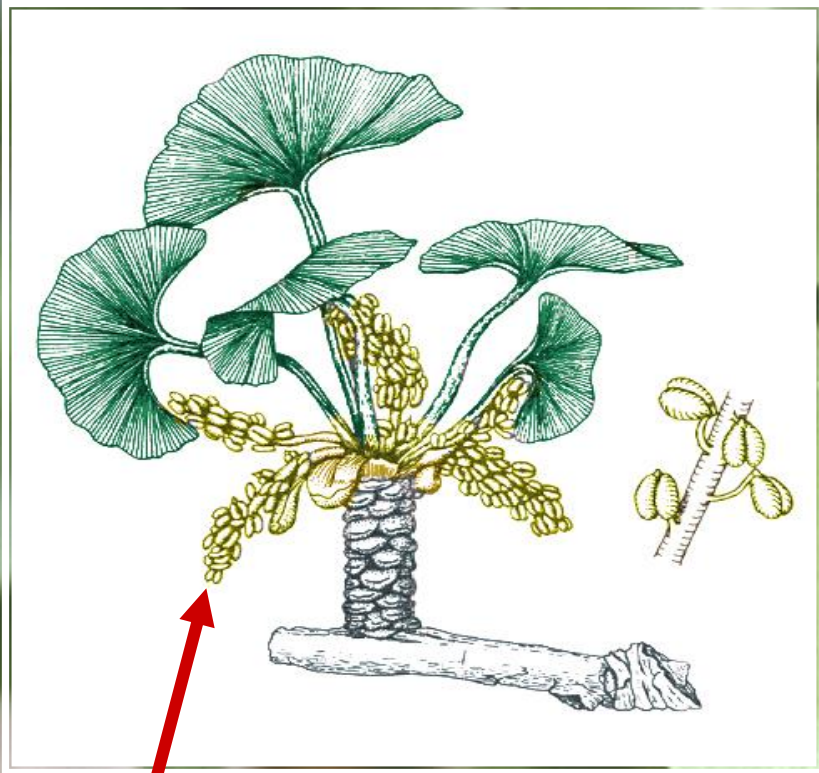
“MALE PLANT”

GINKGO



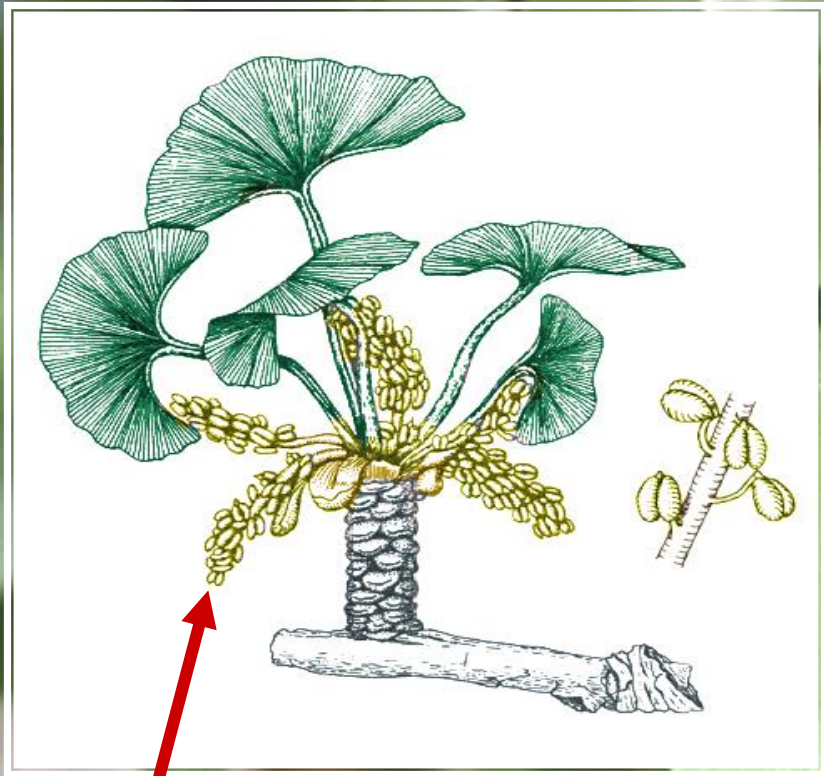
MICROSTROBILUS

GINKGO



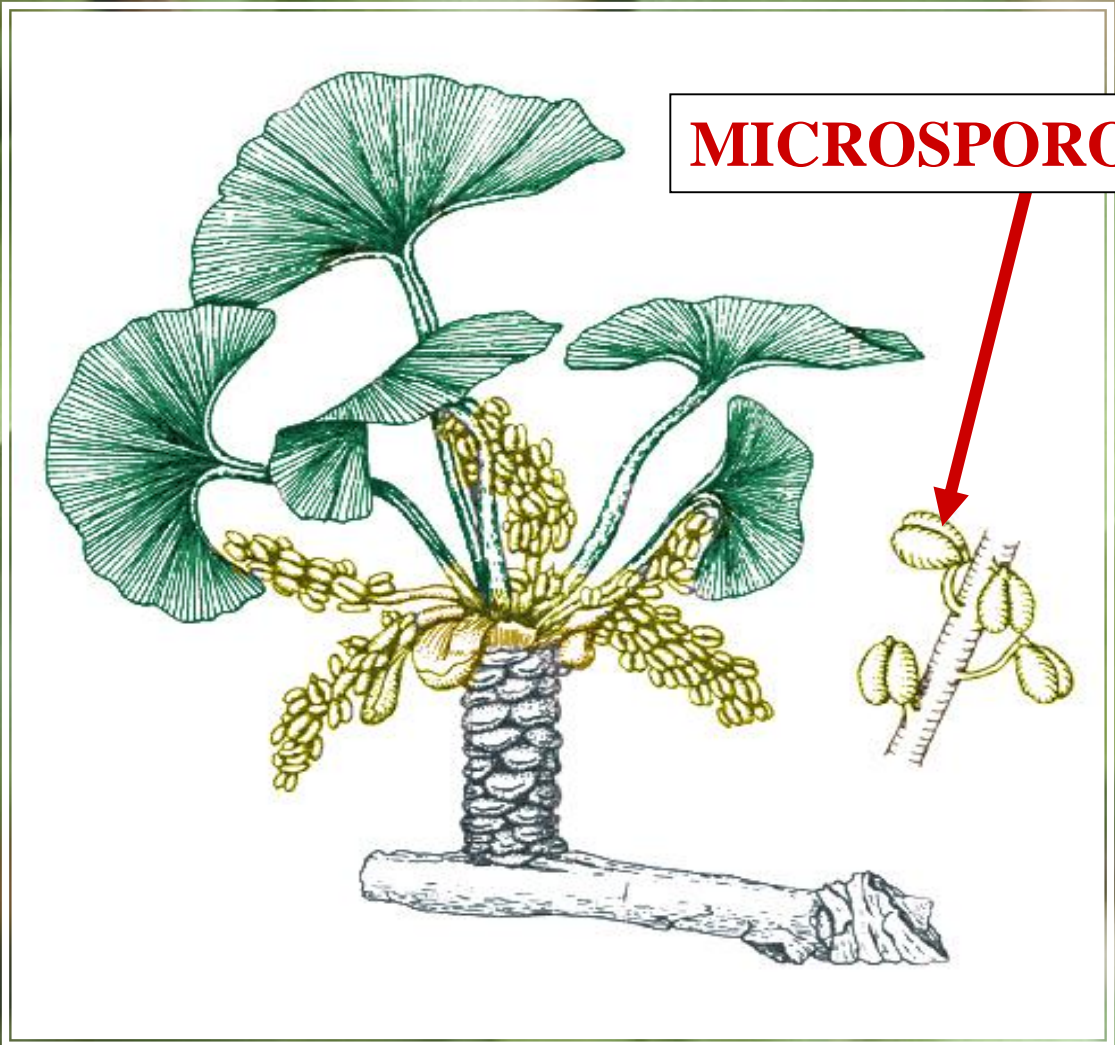
MICROSTROBILUS LAX

GINKGO



MICROSPOROPHYLLS

GINKGO

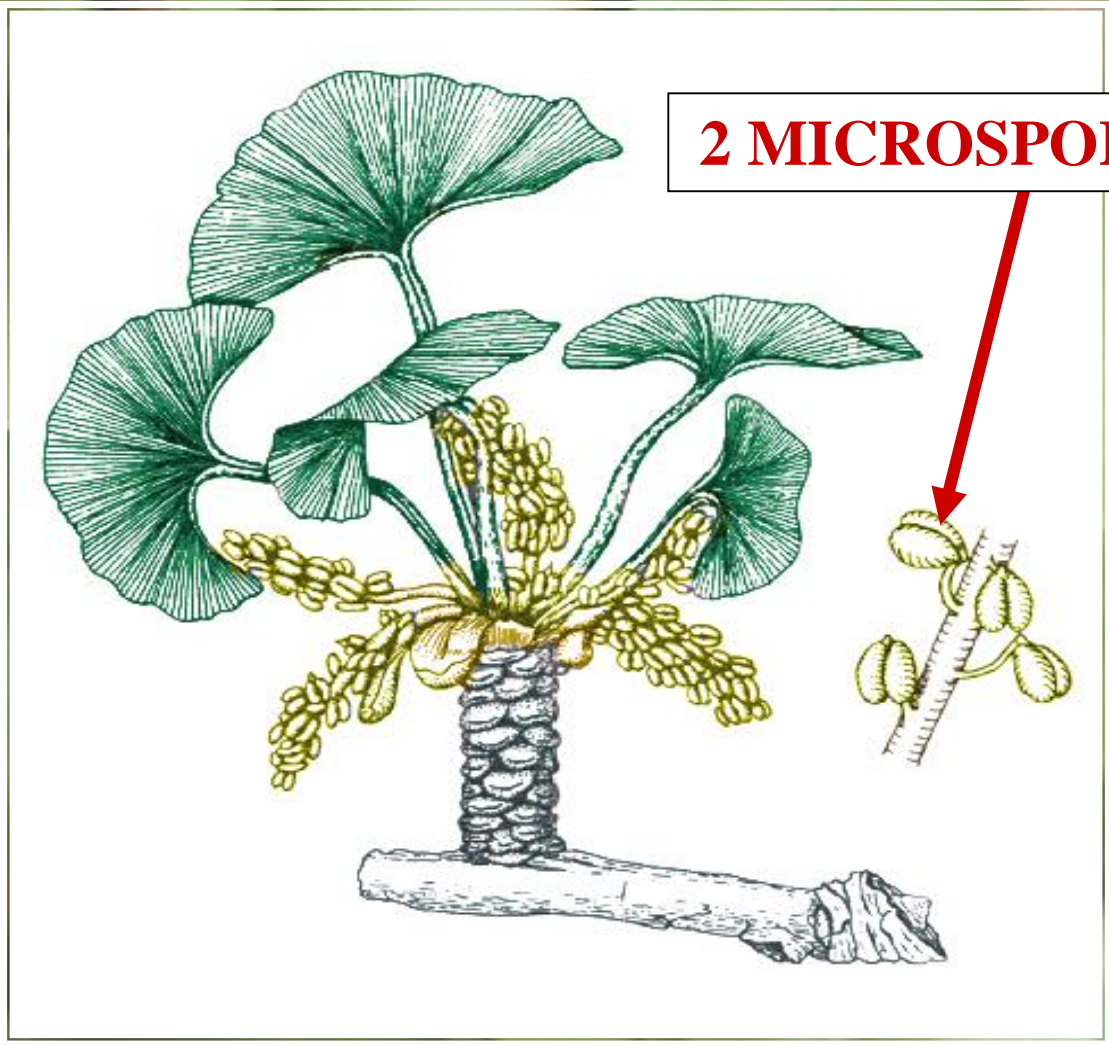


MICROSPOROPHYLL

GINKGO



2 MICROSPORANGIA



GINKGO

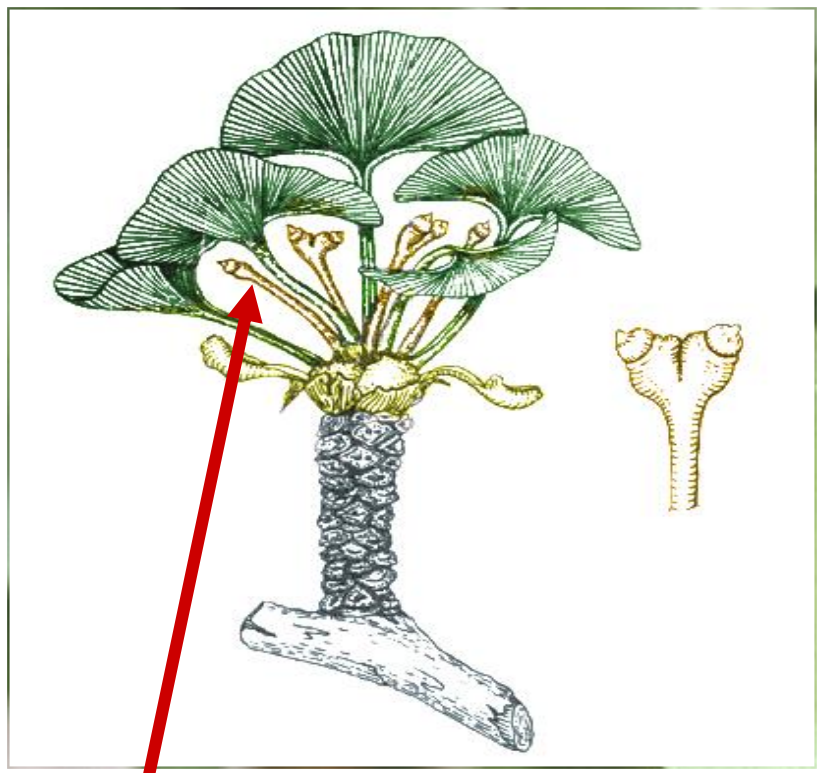


MEGASTROBILUS
PLANT
“FEMALE PLANT”



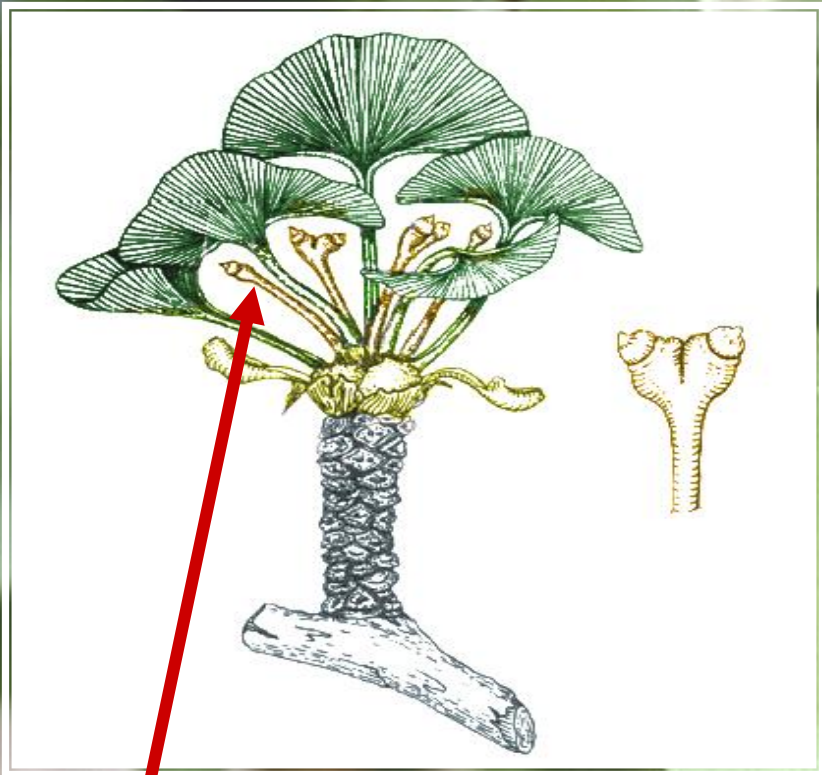
“FEMALE PLANT”

GINKGO



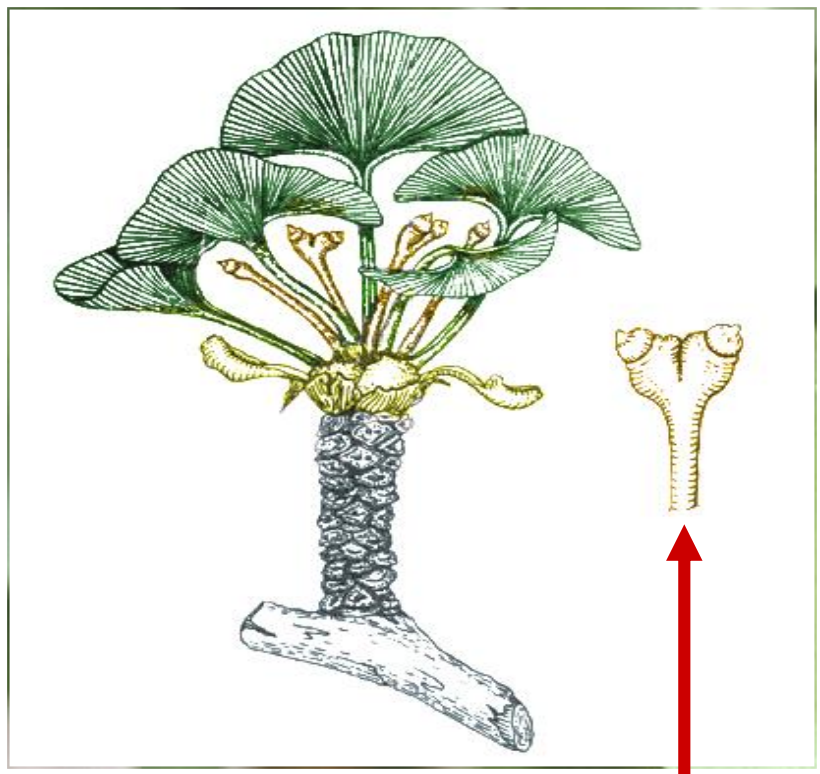
MEGASTROBILUS

GINKGO



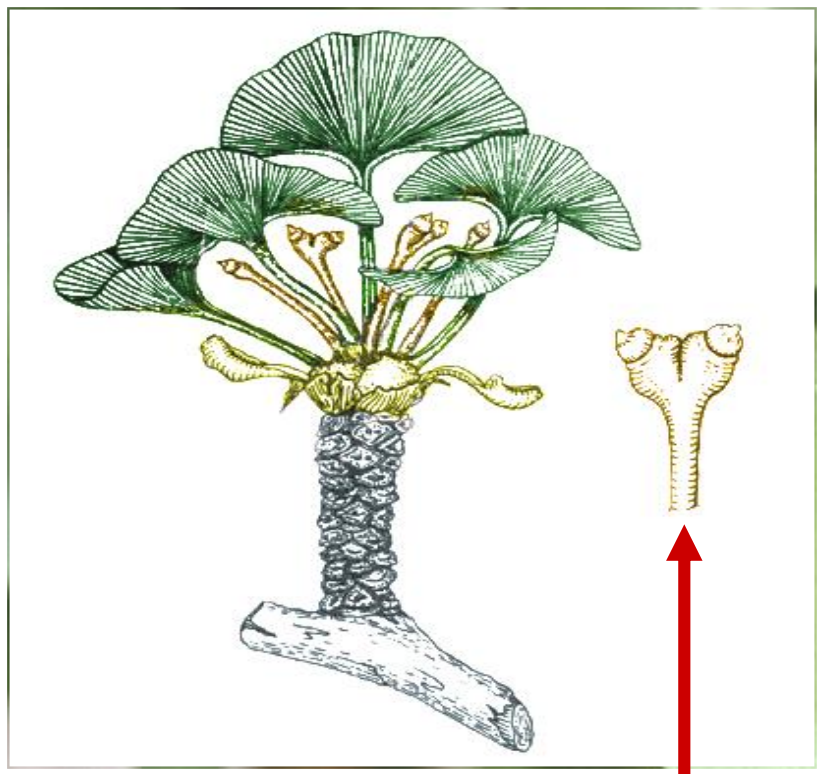
MEGASTROBILUS ERECT

GINKGO

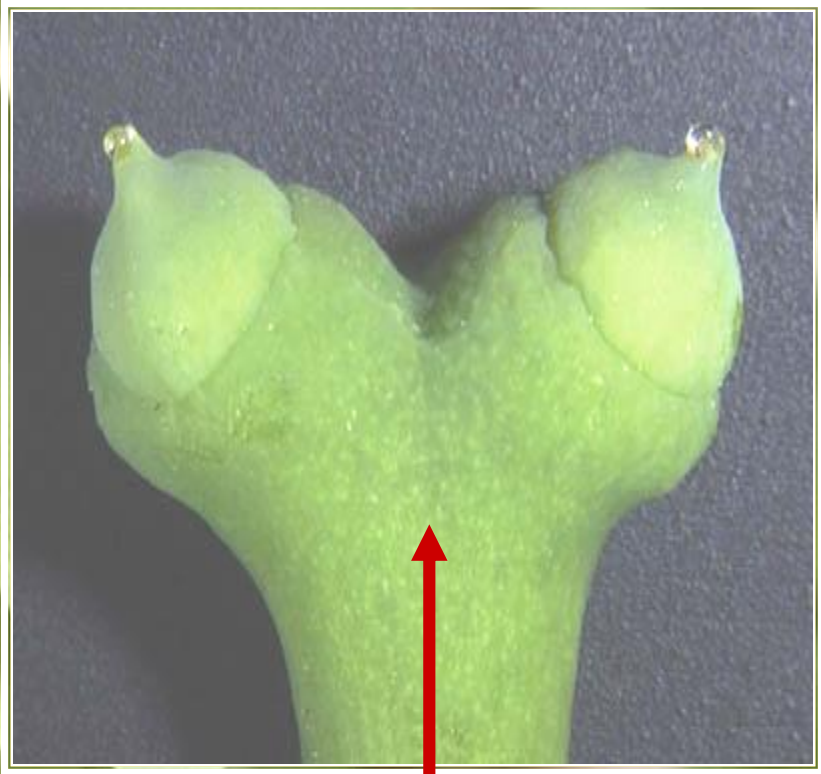


1 MEGASPOROPHYLL

GINKGO



2 OVULES



2 OVULES

GINKGO



POLLINATION

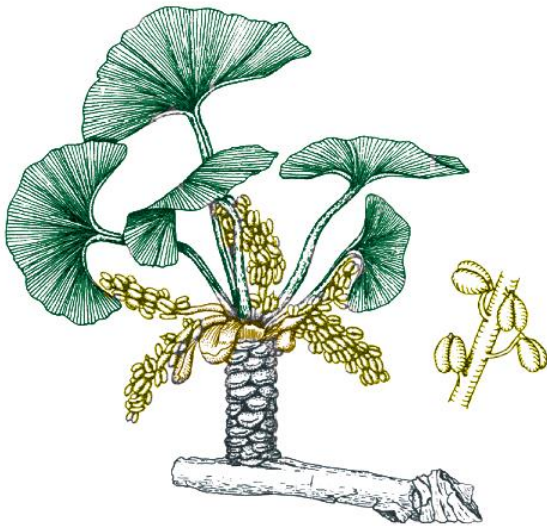
GINKGO

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POLLINATION

“MALE PLANT”

MICROSTROBILI



“FEMALE PLANT”

MEGASTROBILI

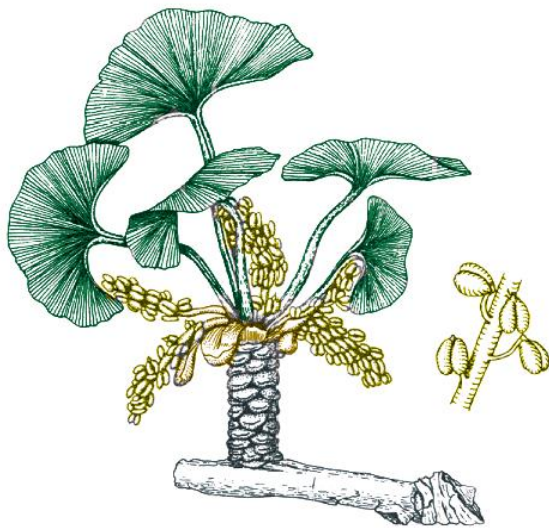


GINKGO

ANEMOPHILOUS

“MALE PLANT”

MICROSTROBILI



WIND

“FEMALE PLANT”

MEGASTROBILI

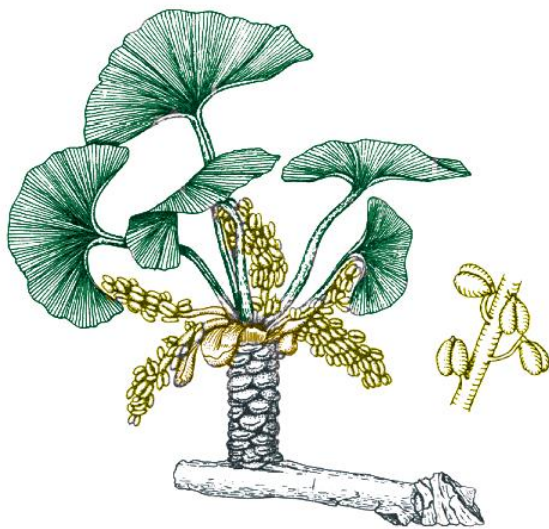


GINKGO

ANEMOPHILOUS

“MALE PLANT”

MICROSTROBILI



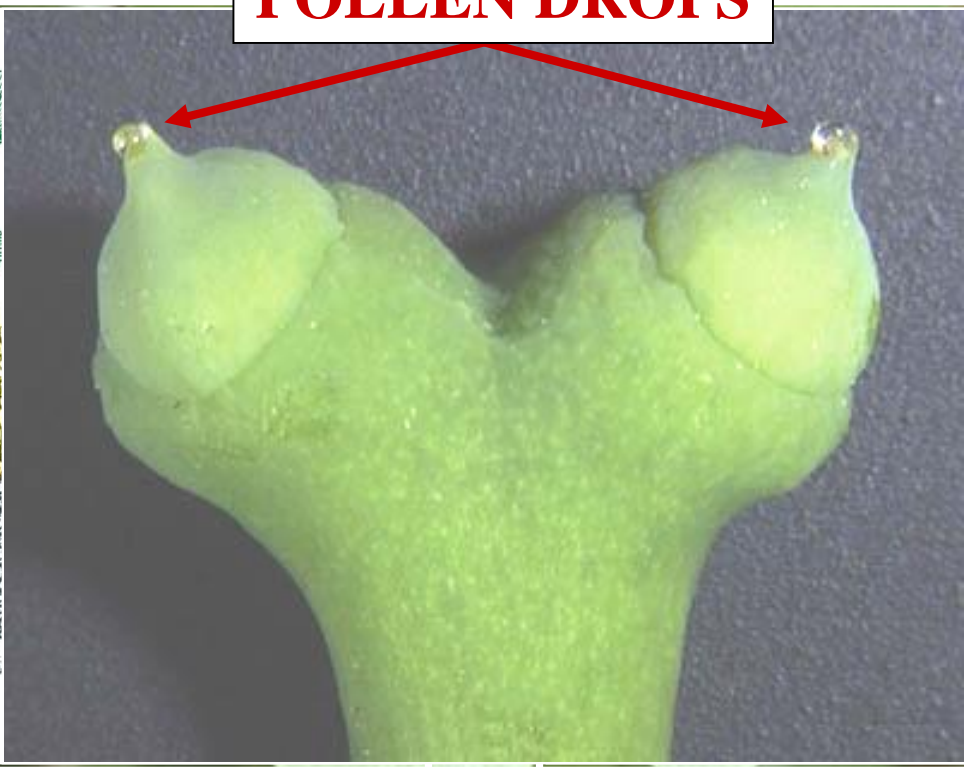
“FEMALE PLANT”

MEGASTROBILI



GINKGO

POLLEN DROPS



GINKGO

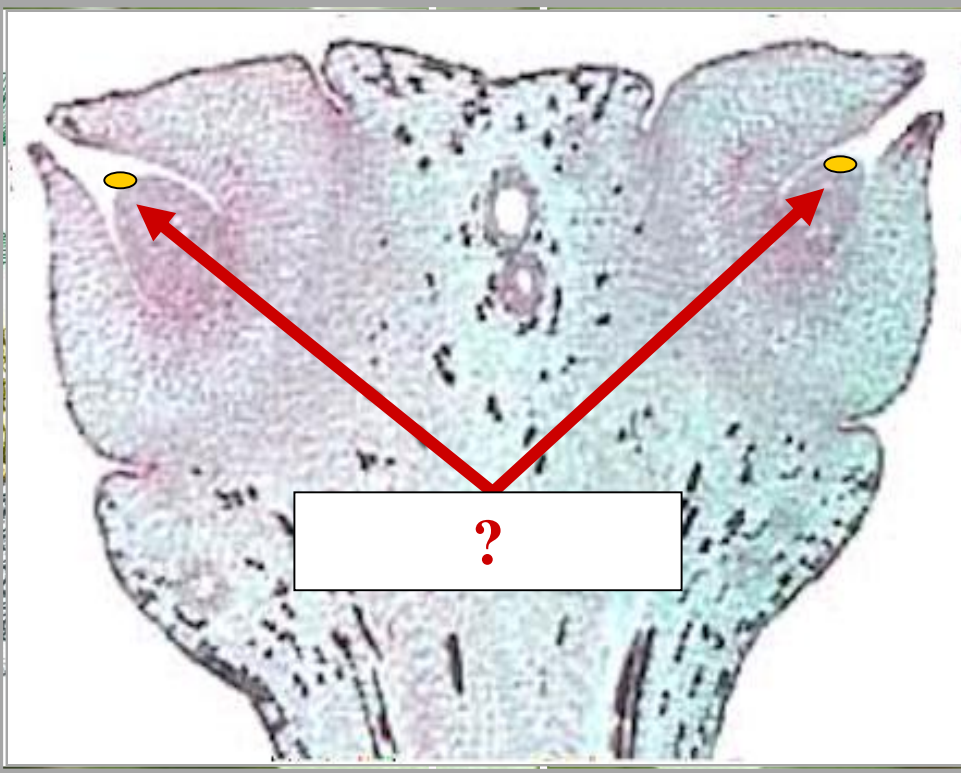


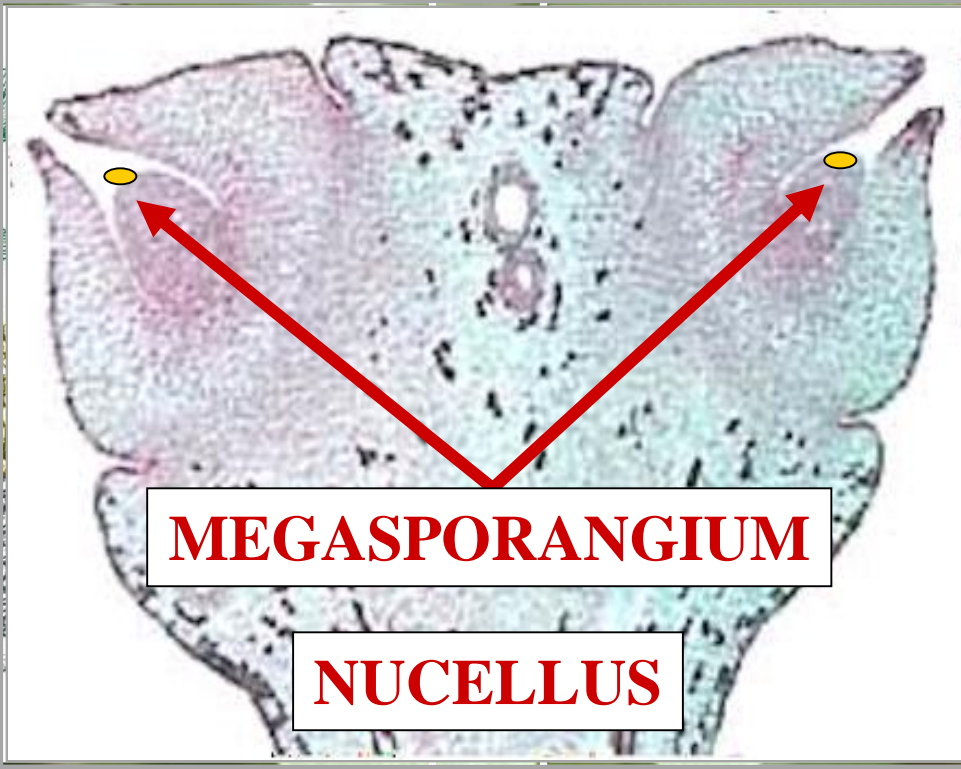
GINKGO



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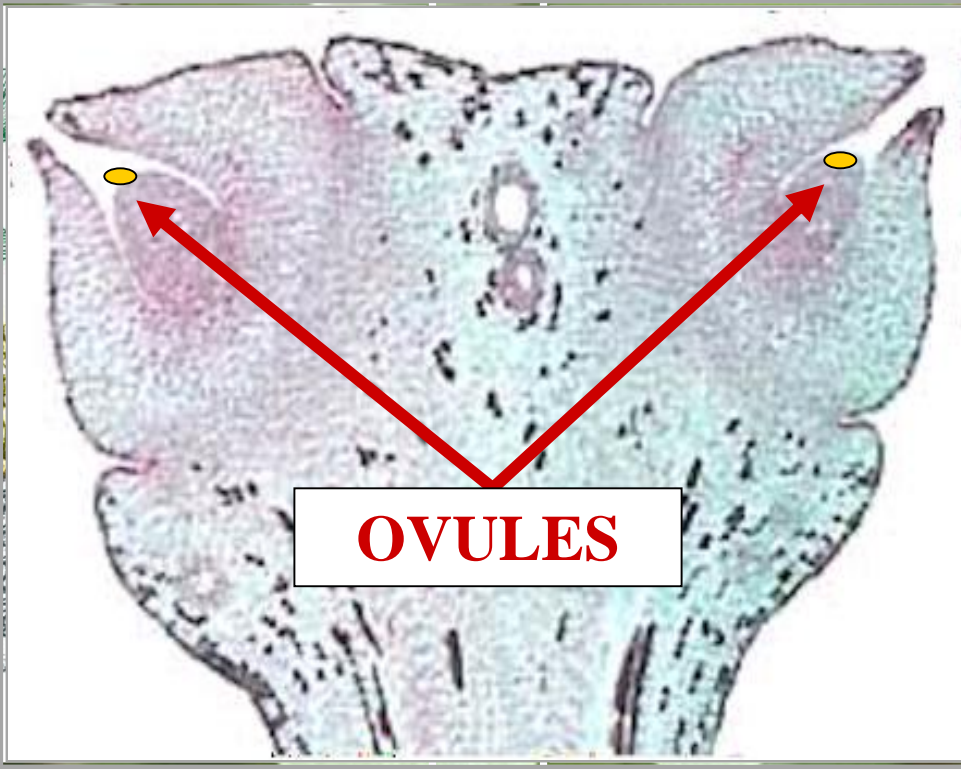
GINKGO





POLLINATION

GINKGO



20

POLLINATION



SE

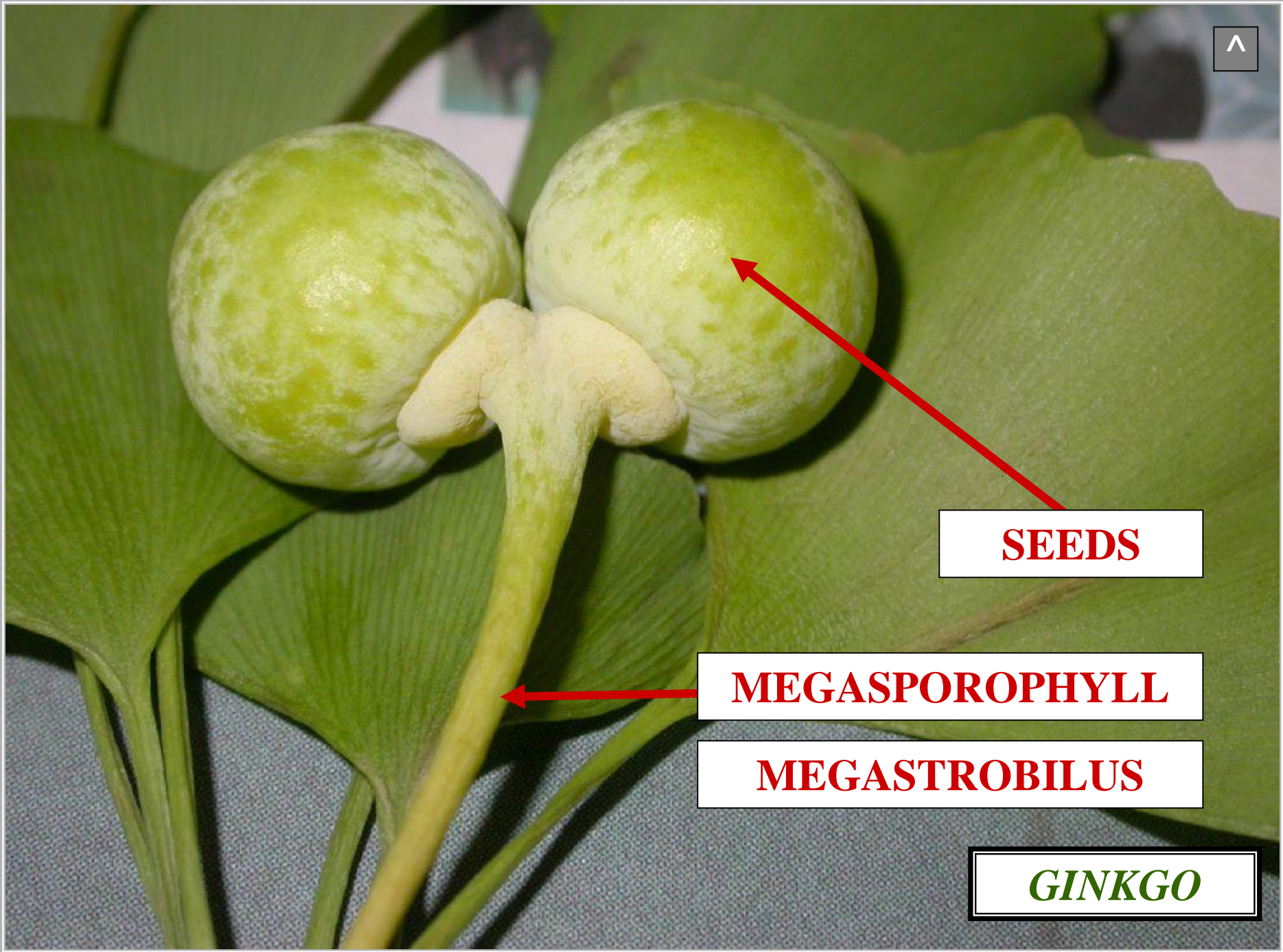


OVULES

MEGASPOROPHYLL

MEGASTROBILUS

GINKGO



SEEDS

MEGASPOROPHYLL

MEGASTROBILUS

GINKGO



SEED

GINKGO

“B”



OVULES / SEEDS



GINKGO

SEEDS

F

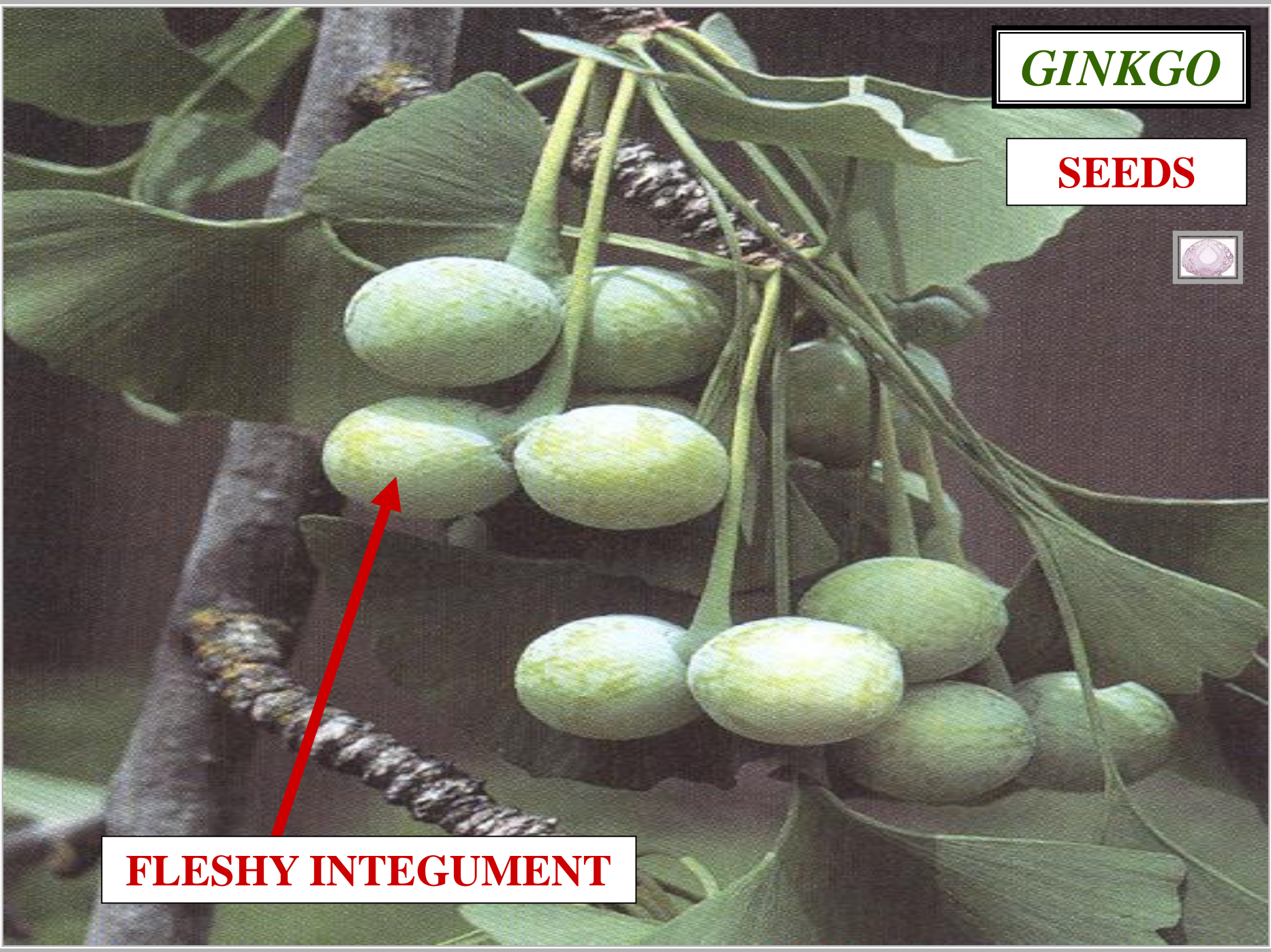
“BERRY-LIKE” APPEARANCE

GINKGO

SEEDS



FLESHY INTEGUMENT

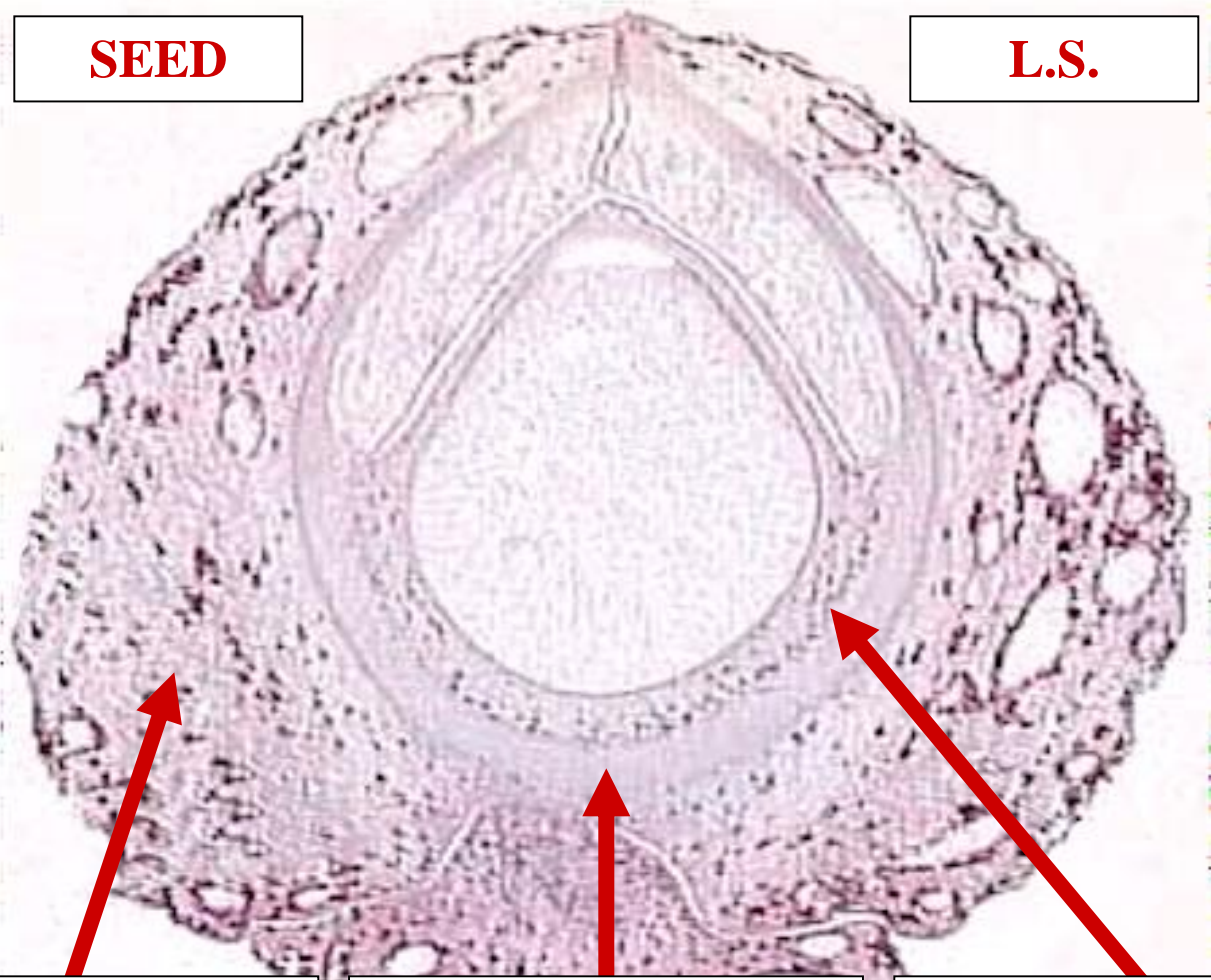




F

SEED

L.S.



**SARCOTESTA
INTEGUMENT**

**SCLEROTESTA
INTEGUMENT**

**ENDOTESTA
INTEGUMENT**

A close-up photograph of two Ginkgo nuts (seeds) resting on a bed of yellow, fan-shaped leaves. The nuts are round and have a reddish-brown, fleshy outer layer. The leaves are bright yellow and have a distinct fan shape with a central vein. The lighting is bright, creating strong shadows.

GINKGO

SEEDS

D

FLESHY INTEGUMENT

A close-up photograph of two Ginkgo nuts (seeds) resting on a bed of yellow, fan-shaped leaves. The nuts are round and have a reddish-brown, textured surface. One nut is positioned slightly higher and to the right of the other. The leaves are bright yellow, indicating autumn, and are scattered around the nuts. The lighting is bright, creating sharp shadows.

GINKGO

SEEDS

B

INTEGUMENT DECAYS

A close-up photograph of two ginkgo nuts (seeds) resting on a bed of yellow, fan-shaped ginkgo leaves. The nuts are round and have a reddish-brown, textured surface. The leaves are bright yellow and have a characteristic fan shape with a central vein. The lighting is bright, creating strong shadows.

GINKGO

SEEDS

R

BUTYRIC ACID ORDER



GINKGO

SEEDS

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RANCID ODOR

“FEMALE PLANT”

GINKGO

SEEDS



POOR ORNAMENTAL

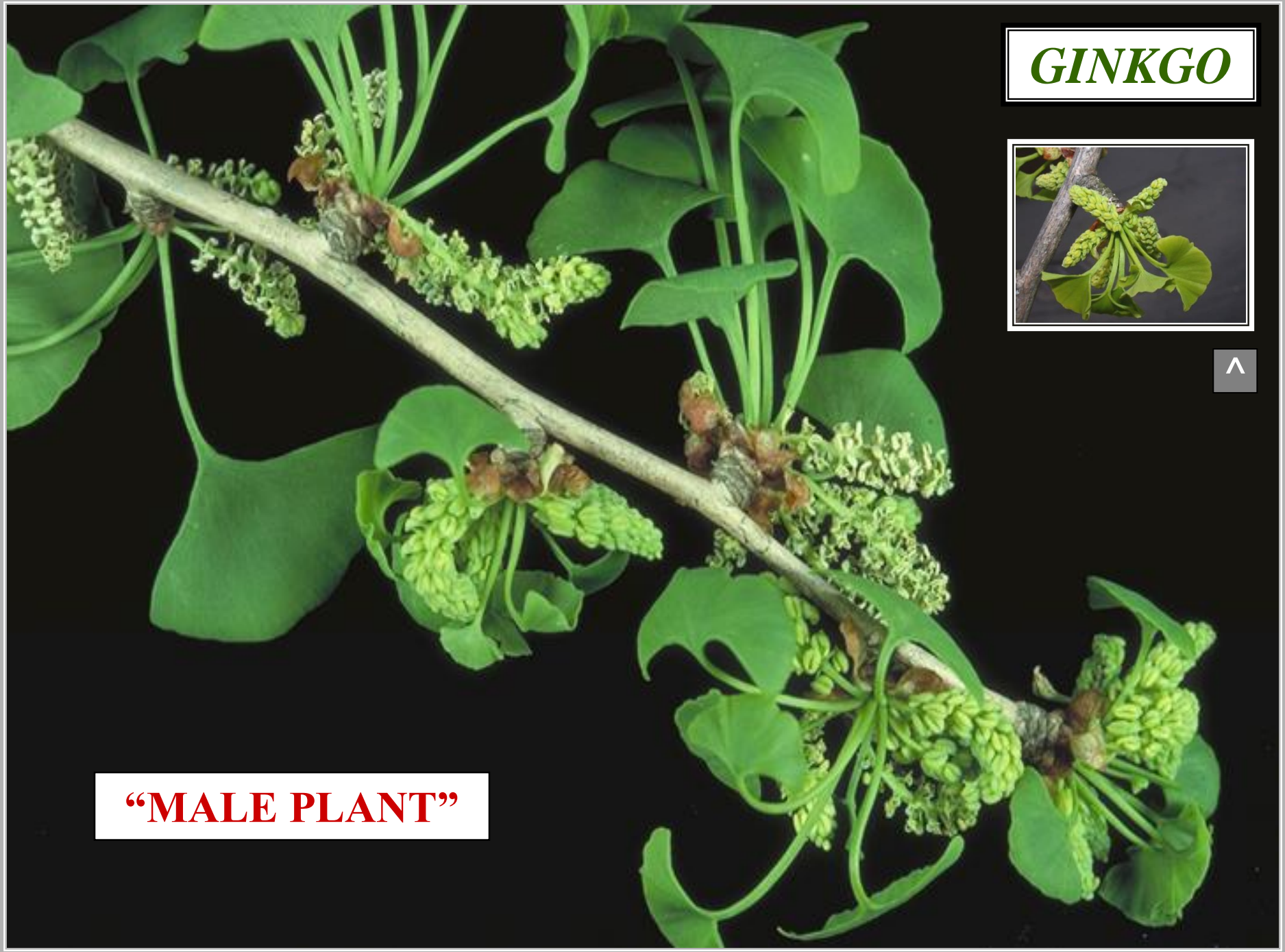


**GINKGO
POPULAR
URBAN
ORNAMENTAL**

GINKGO



“MALE PLANT”





SEED ANATOMY

L.S.

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GINKGO

OVULE



L.S.

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GINKGO

OVULE



L.S.

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INTEGUMENT

GINKGO

OVULE



L.S.

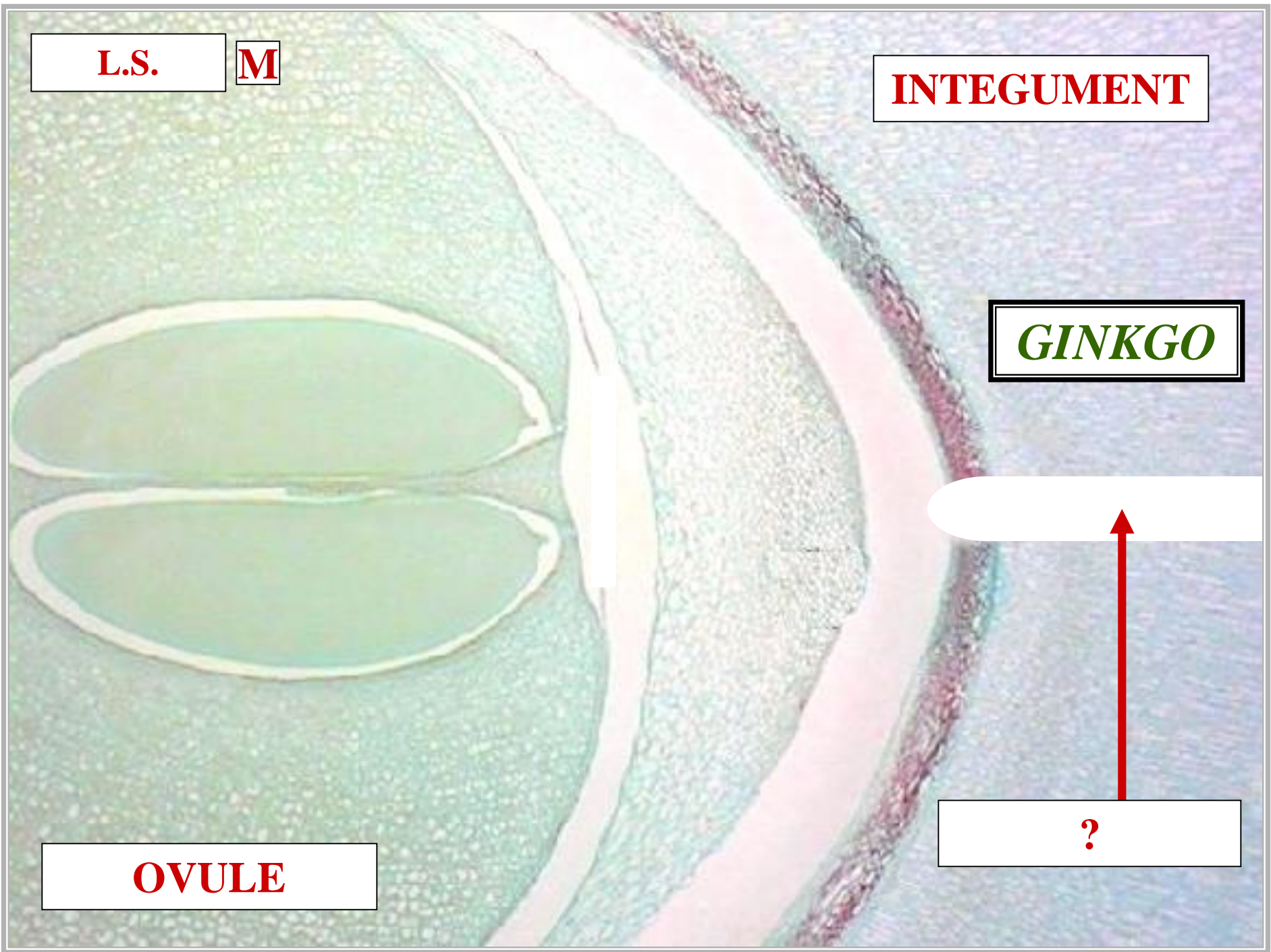
M

INTEGUMENT

GINKGO

OVULE

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L.S.

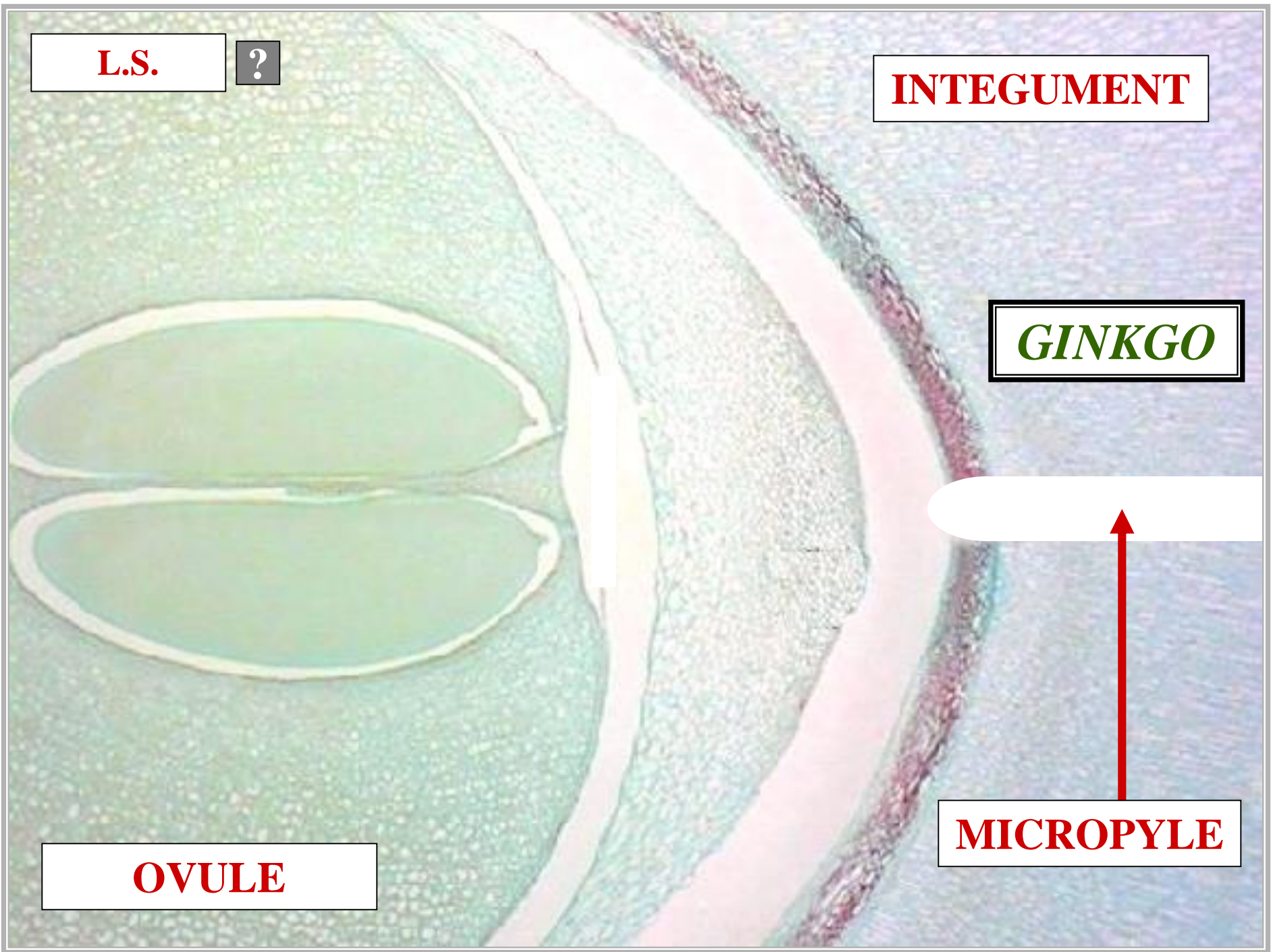
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INTEGUMENT

GINKGO

OVULE

MICROPYLE



L.S.

P

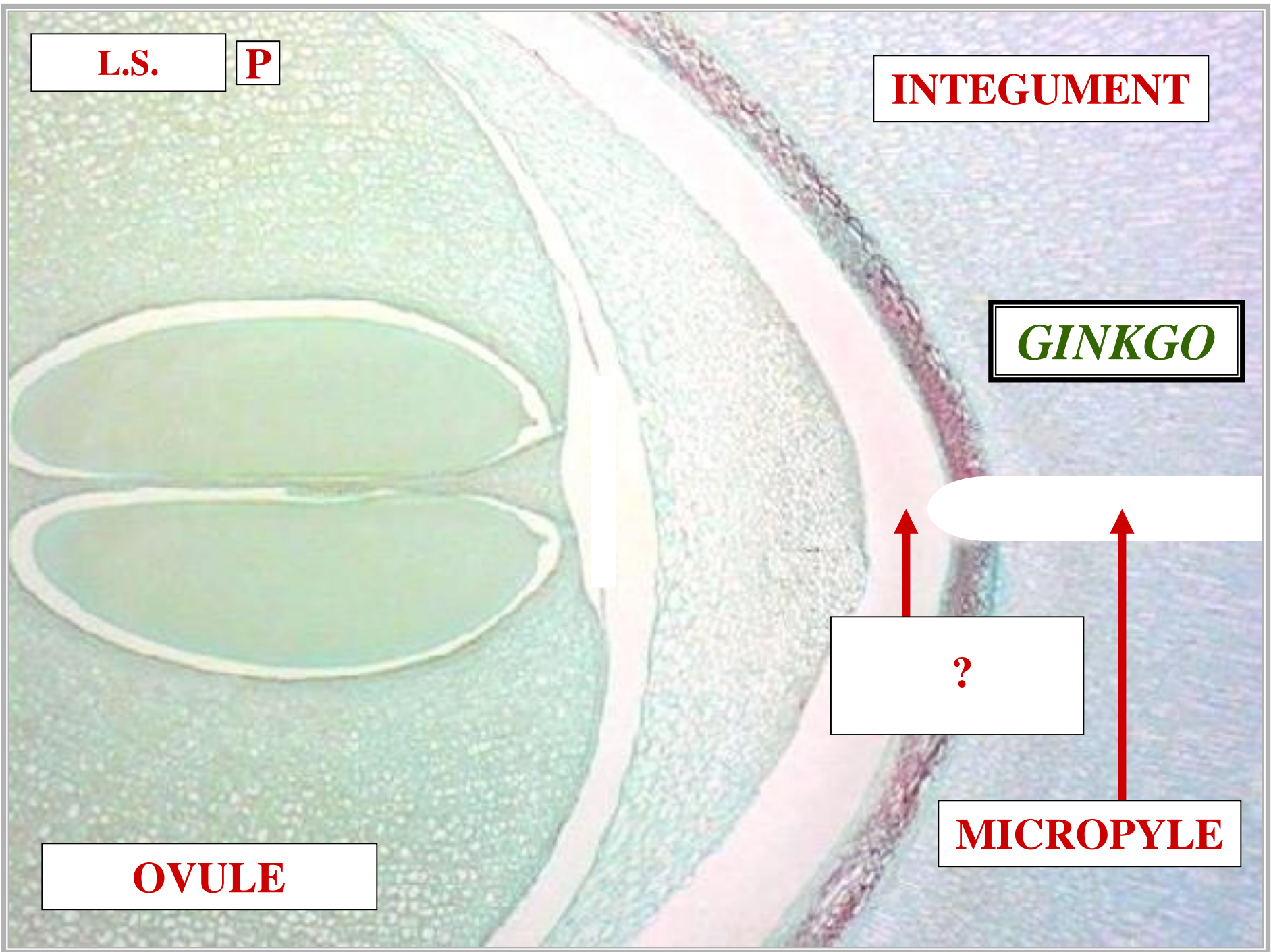
INTEGUMENT

GINKGO

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MICROPYLE

OVULE



L.S.

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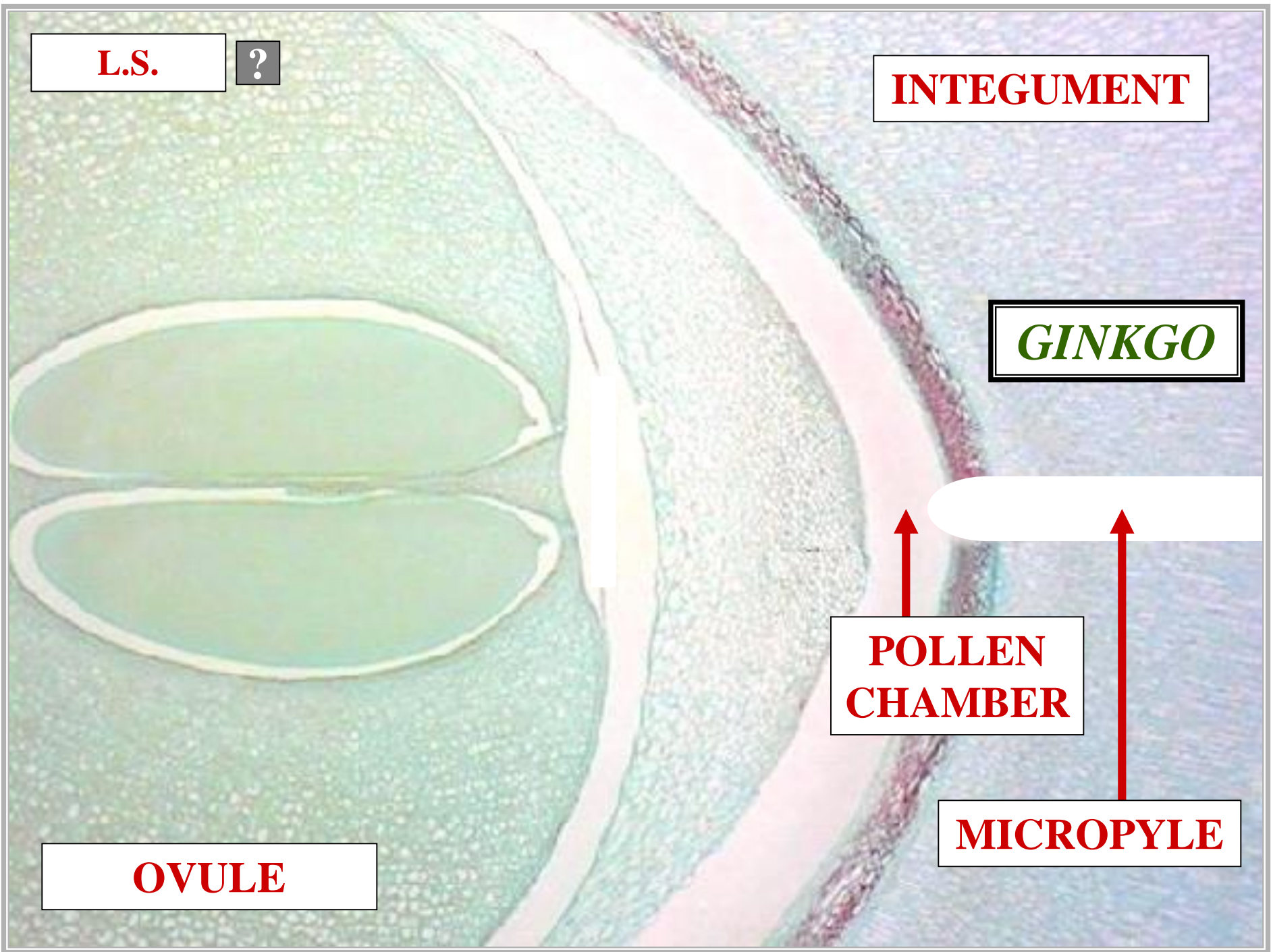
INTEGUMENT

GINKGO

**POLLEN
CHAMBER**

MICROPYLE

OVULE



L.S.

M

INTEGUMENT

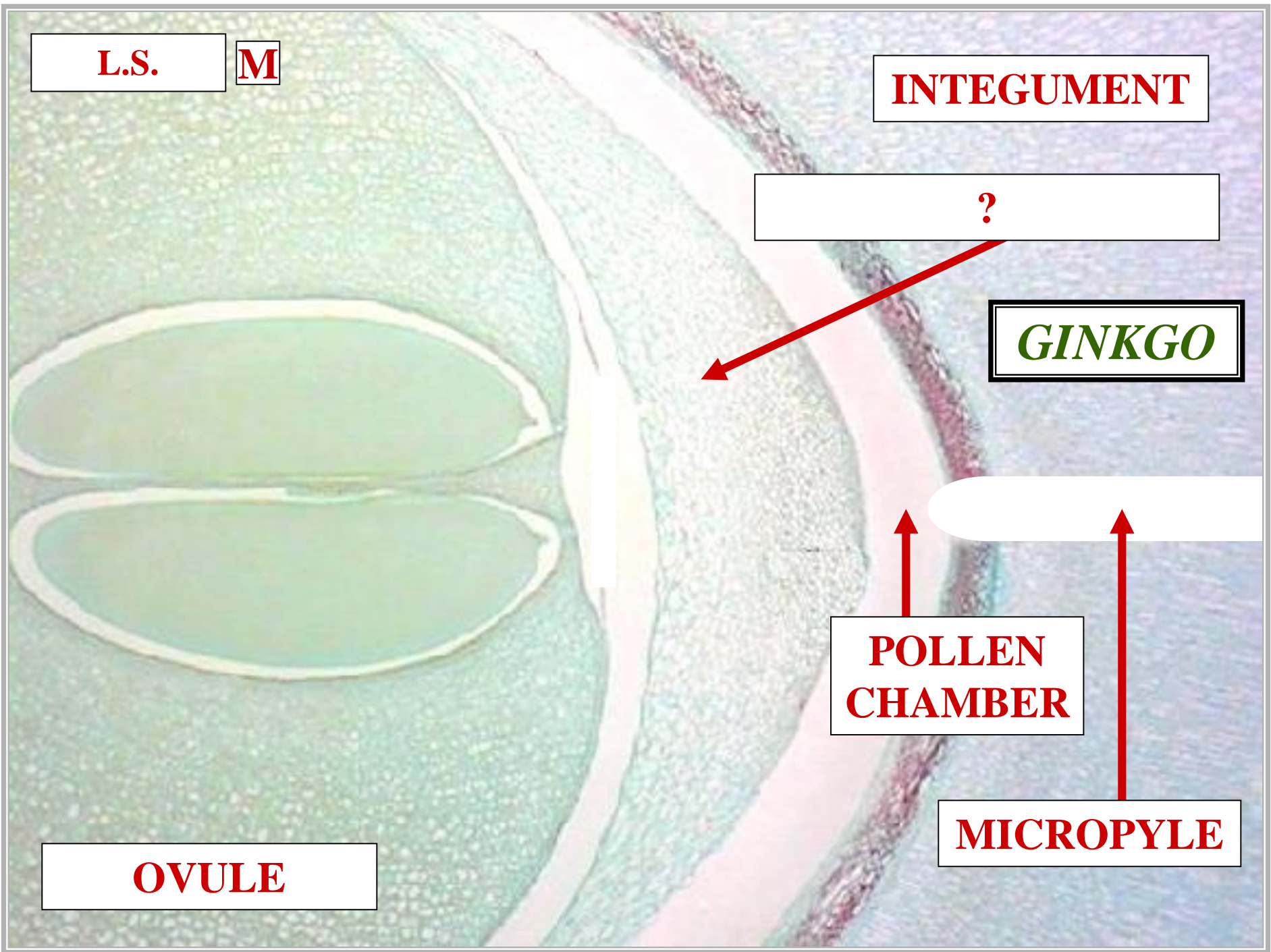
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GINKGO

**POLLEN
CHAMBER**

MICROPYLE

OVULE



L.S.

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INTEGUMENT

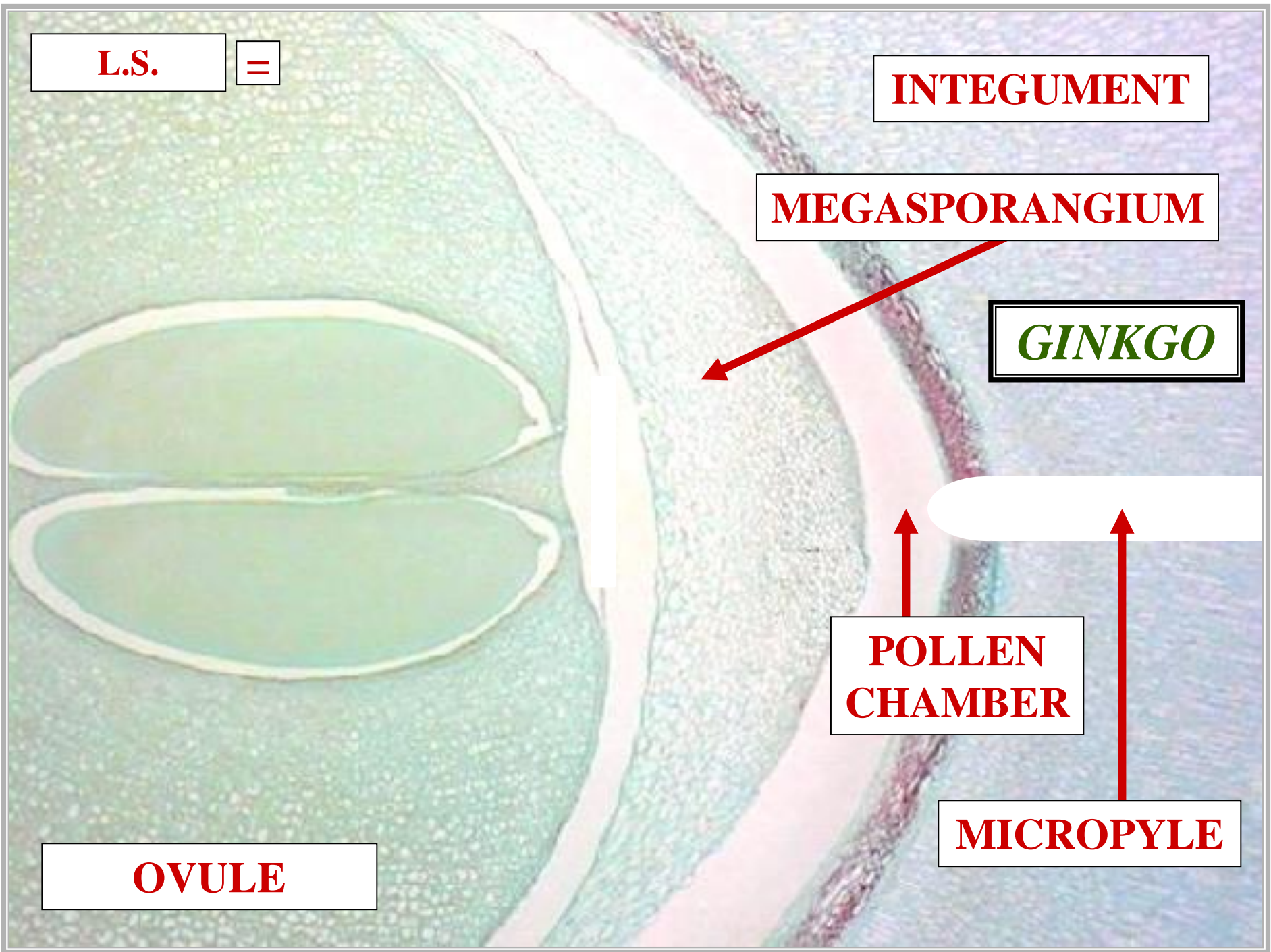
MEGASPORANGIUM

GINKGO

**POLLEN
CHAMBER**

MICROPYLE

OVULE



L.S.

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INTEGUMENT

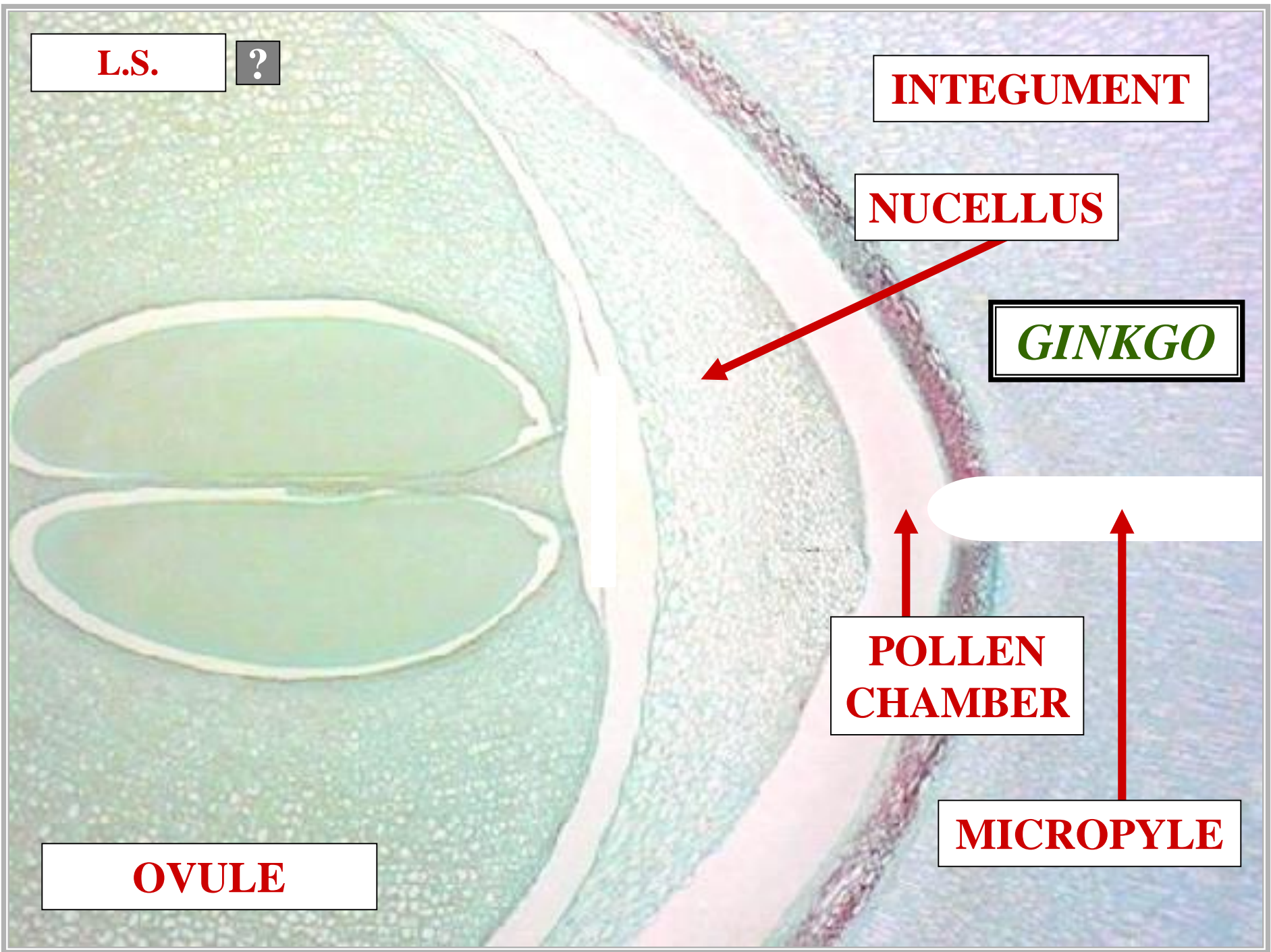
NUCELLUS

GINKGO

**POLLEN
CHAMBER**

MICROPYLE

OVULE



L.S.

M

INTEGUMENT

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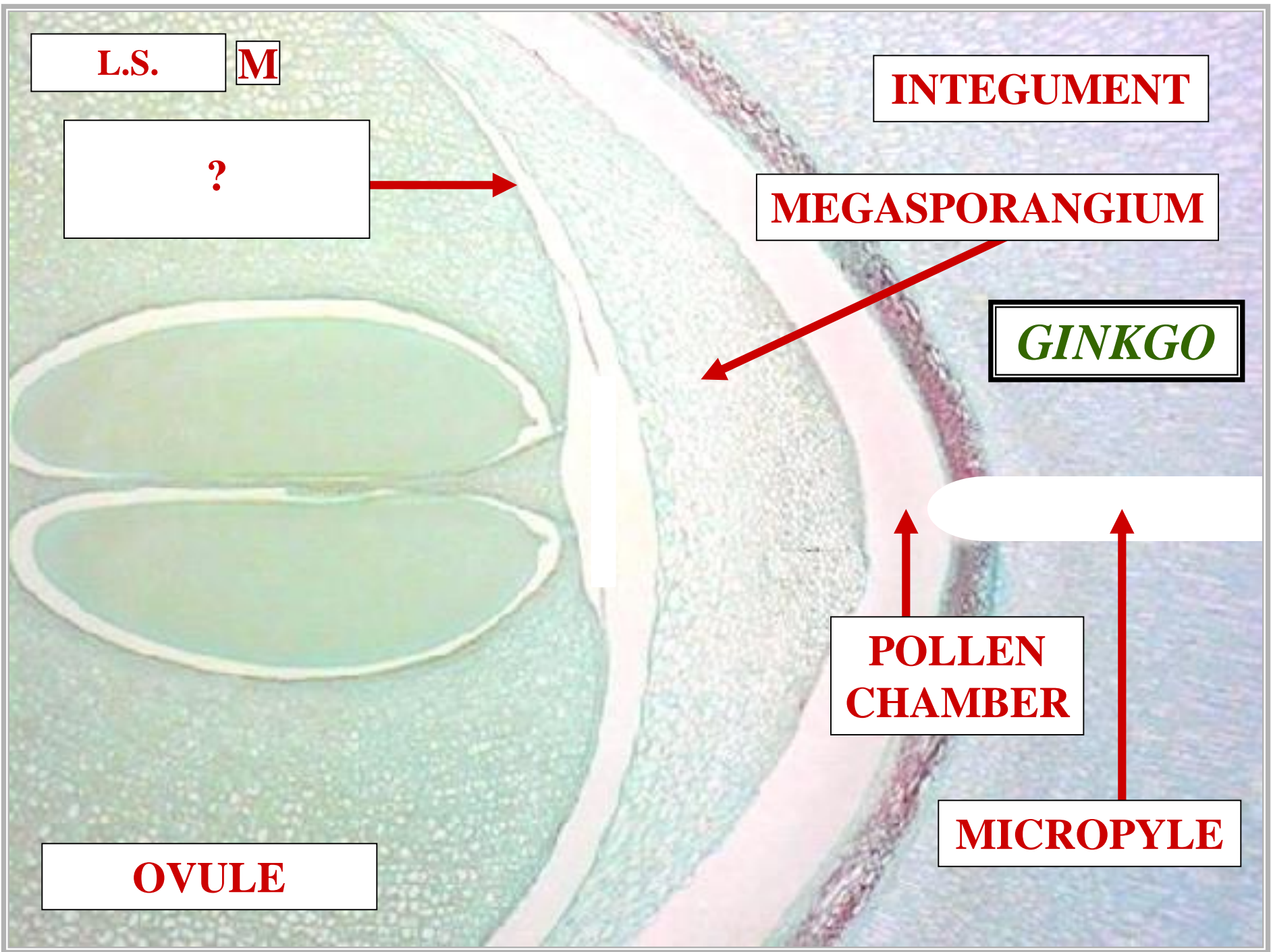
MEGASPORANGIUM

GINKGO

POLLEN CHAMBER

MICROPYLE

OVULE



L.S.

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INTEGUMENT

MEGASPORE
WALL

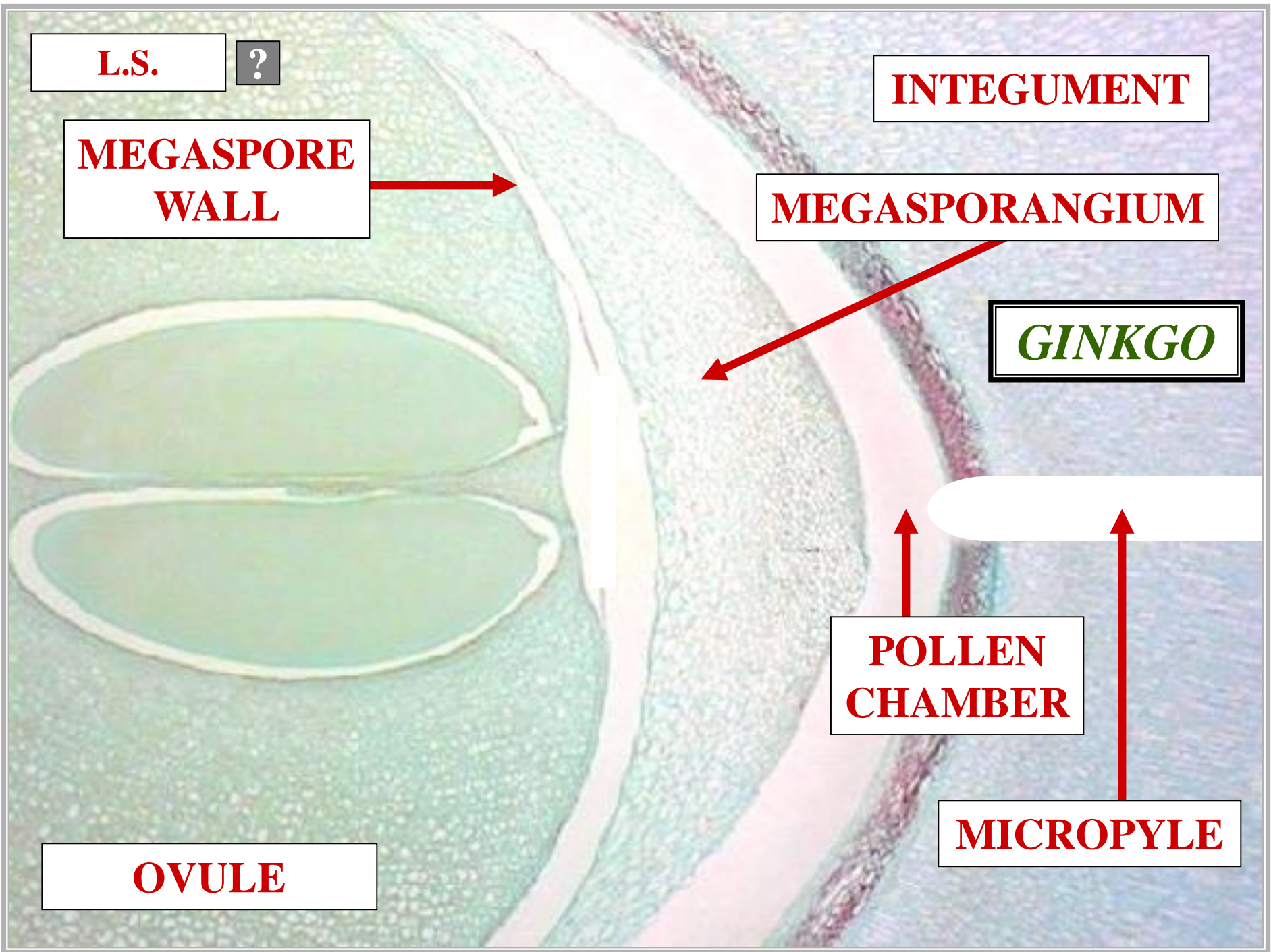
MEGASPORANGIUM

GINKGO

POLLEN
CHAMBER

MICROPYLE

OVULE



L.S.

M

INTEGUMENT

MEGASPORE
WALL

MEGASPORANGIUM

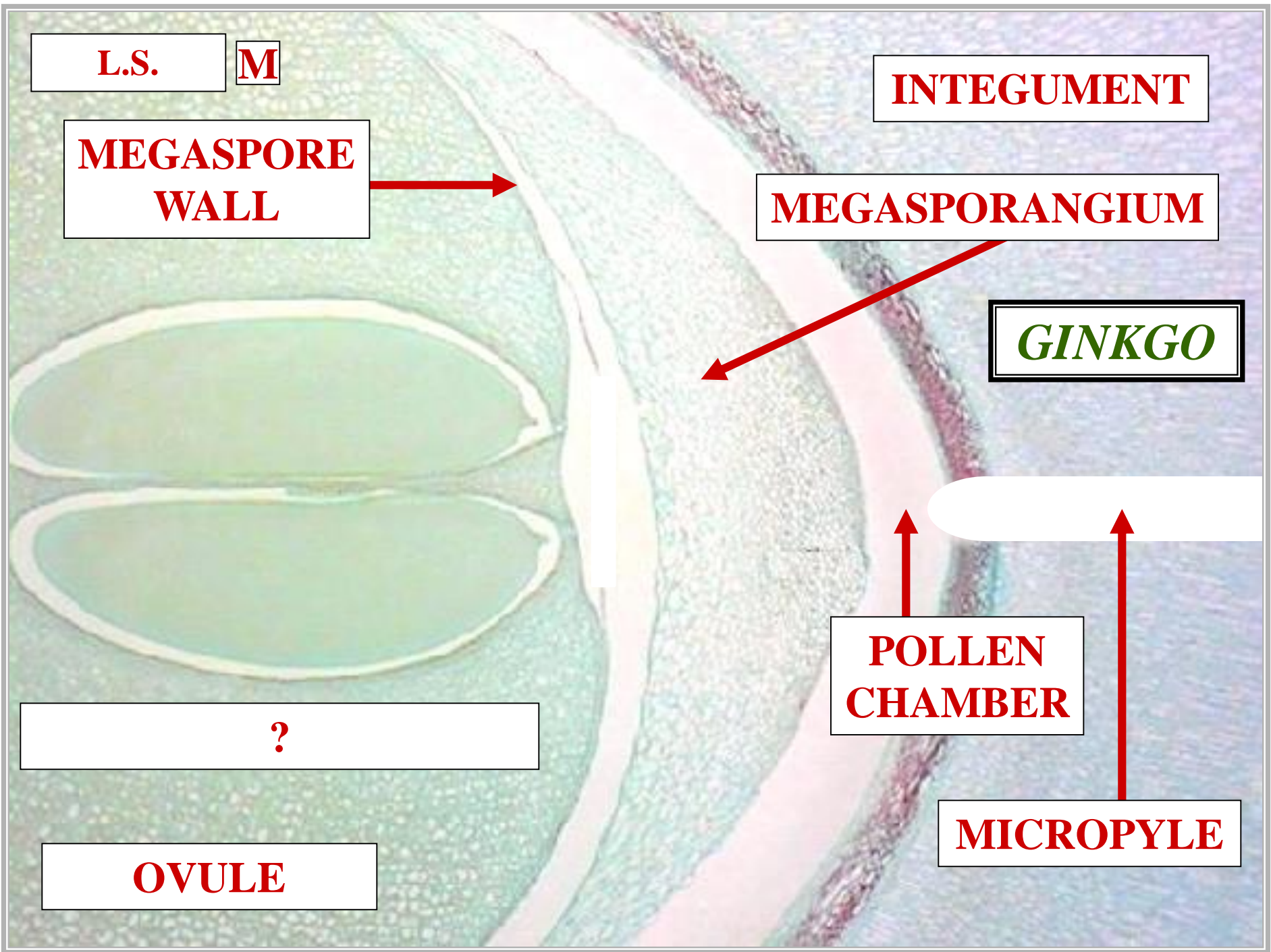
GINKGO

POLLEN
CHAMBER

?

MICROPYLE

OVULE



L.S.

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INTEGUMENT

**MEGASPORE
WALL**

MEGASPORANGIUM

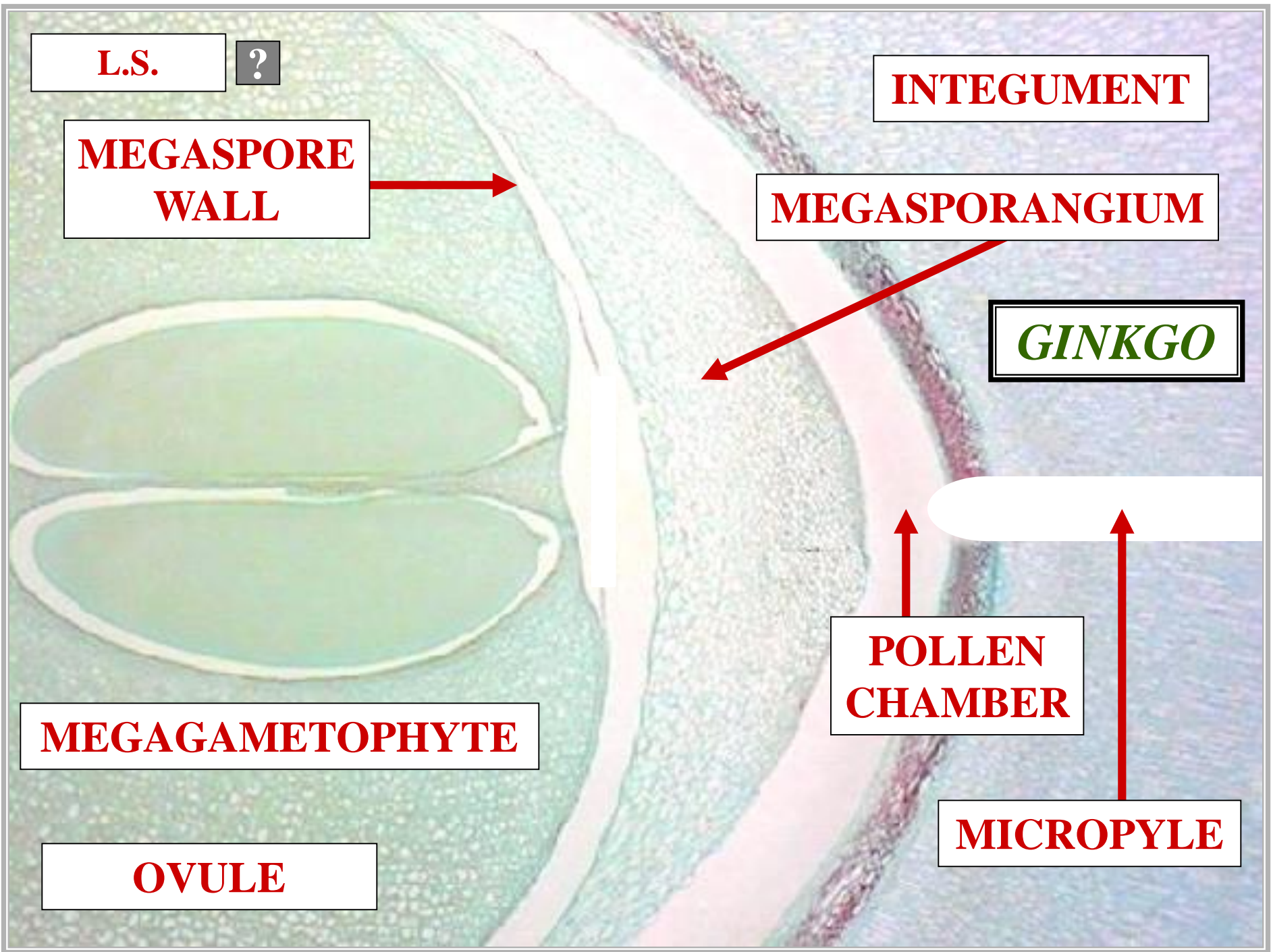
GINKGO

MEGAGAMETOPHYTE

**POLLEN
CHAMBER**

OVULE

MICROPYLE



L.S.

A

INTEGUMENT

MEGASPORE
WALL

MEGASPORANGIUM

GINKGO

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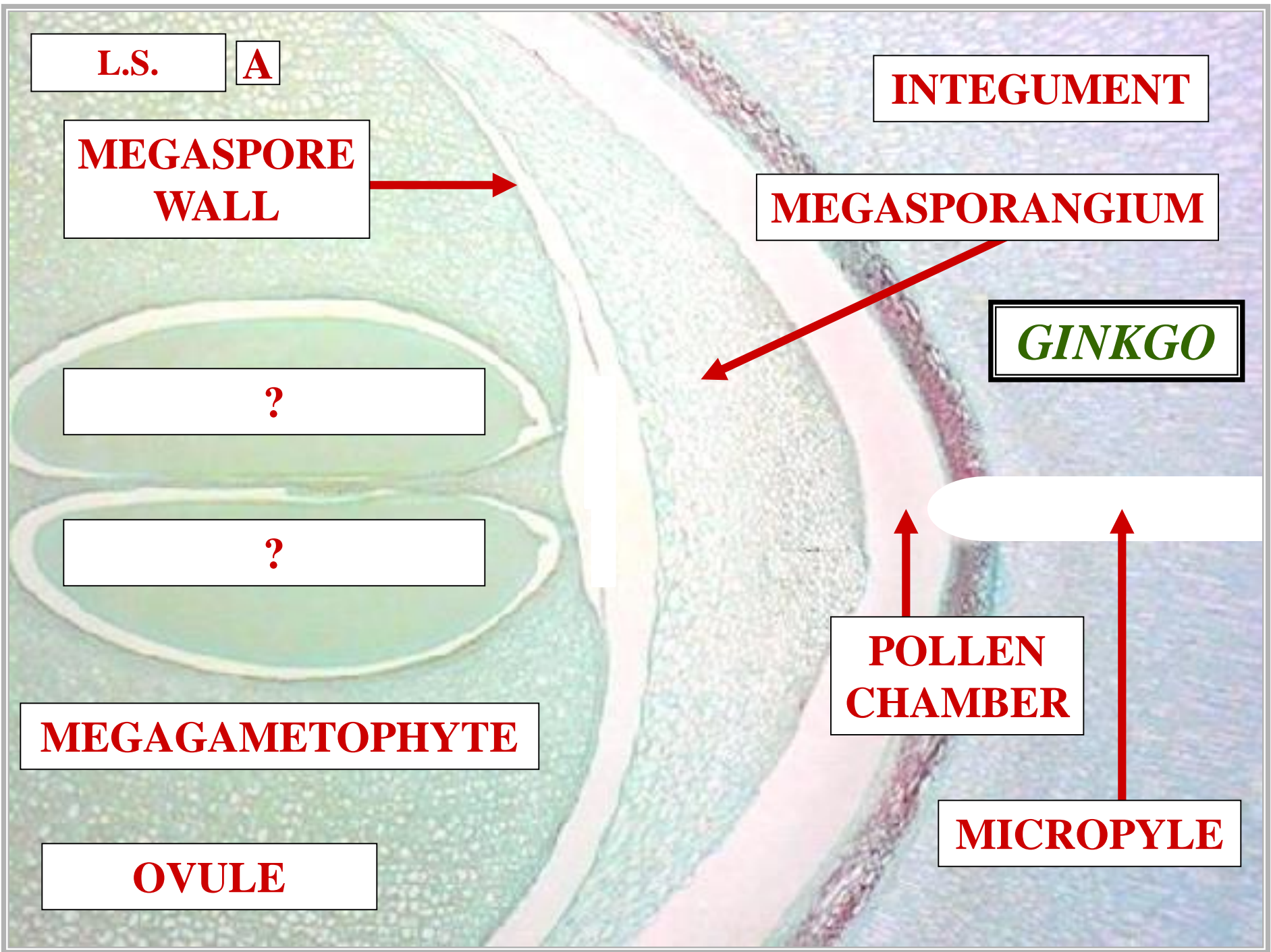
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POLLEN
CHAMBER

MEGAGAMETOPHYTE

MICROPYLE

OVULE



L.S.

?

INTEGUMENT

MEGASPORE
WALL

MEGASPORANGIUM

GINKGO

ARCHEGONIUM

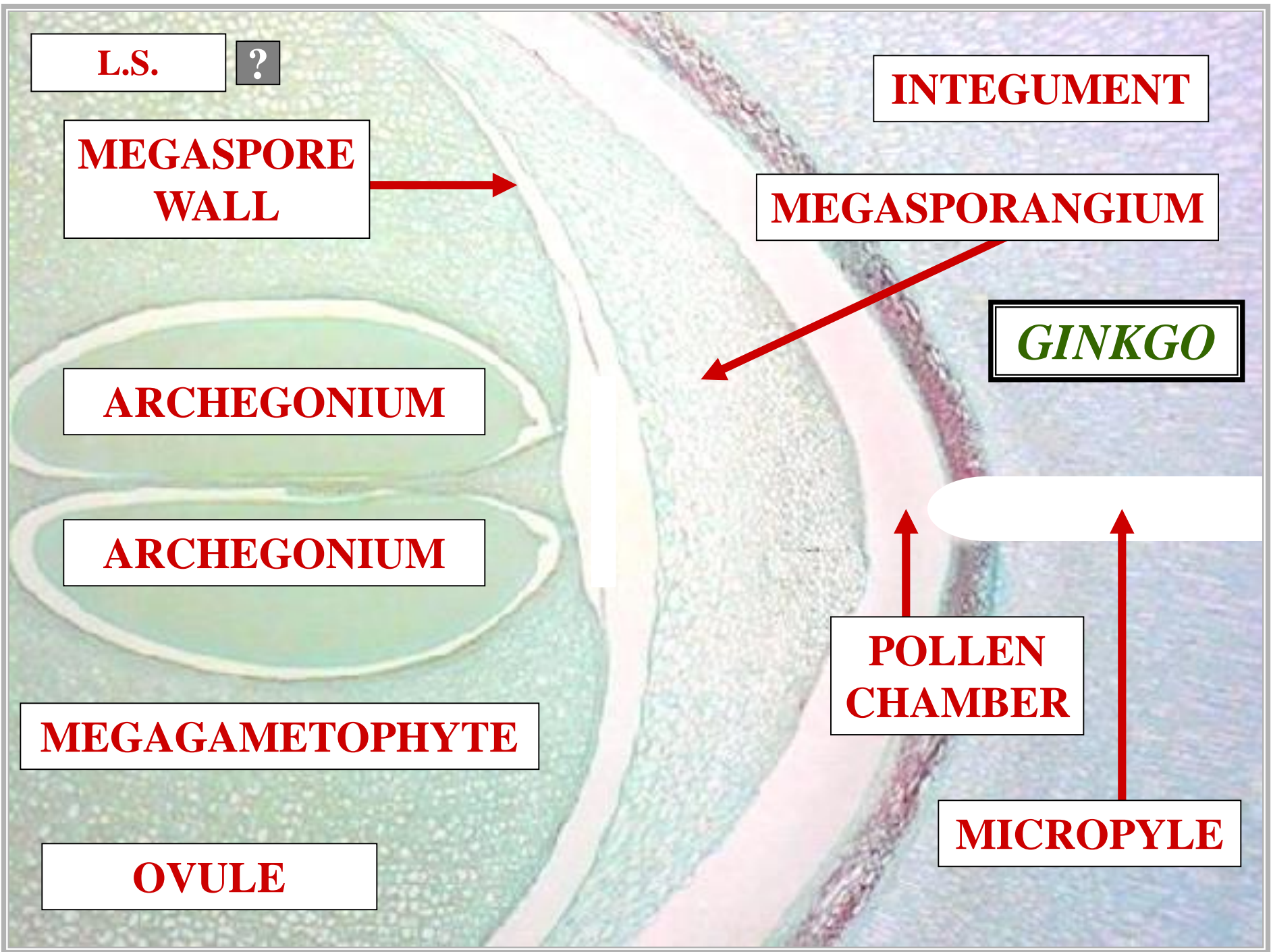
ARCHEGONIUM

MEGAGAMETOPHYTE

POLLEN
CHAMBER

OVULE

MICROPYLE



L.S.

A

INTEGUMENT

MEGASPORE
WALL

MEGASPORANGIUM

GINKGO

ARCHEGONIUM

ARCHEGONIUM

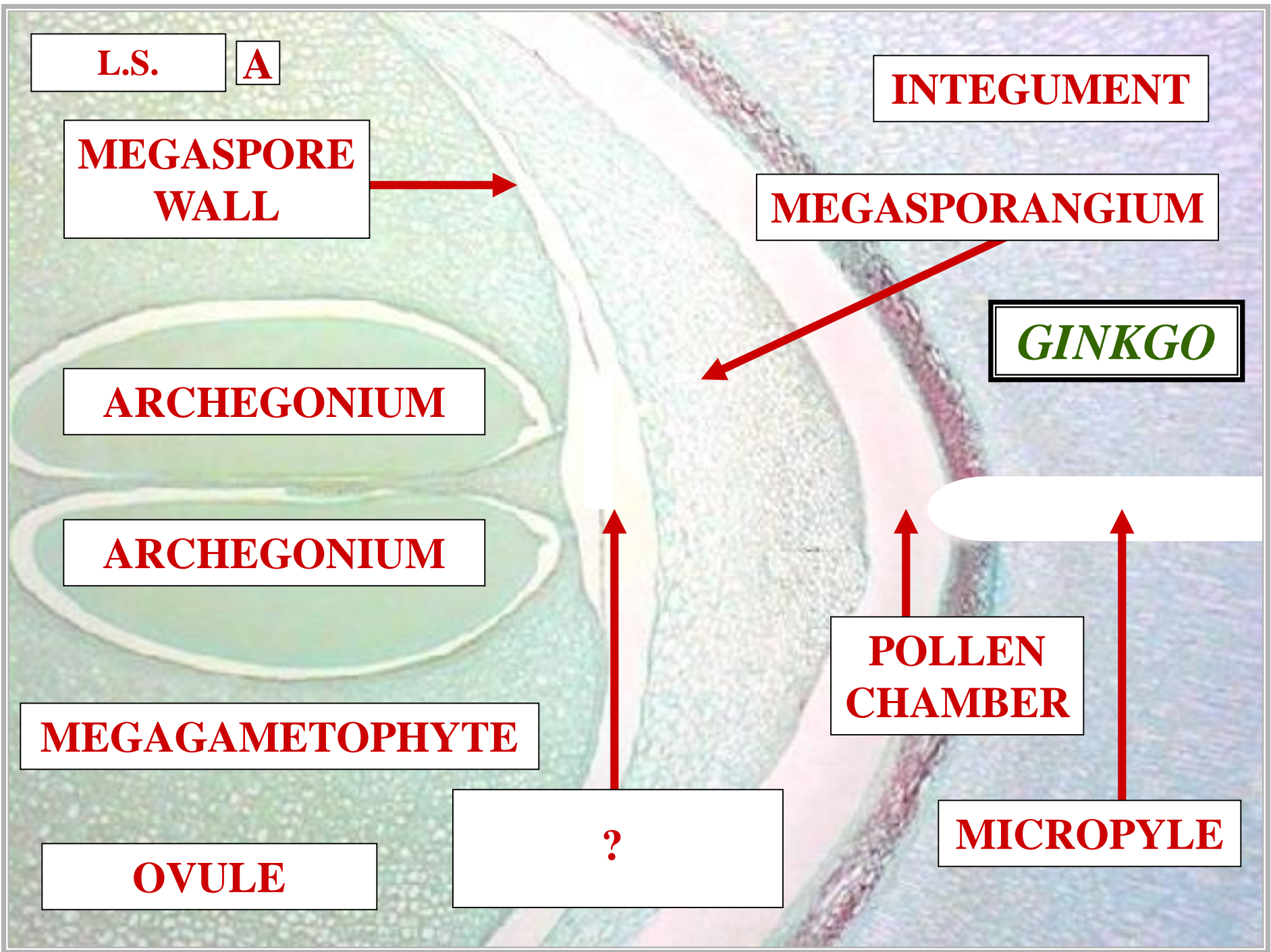
MEGAGAMETOPHYTE

POLLEN
CHAMBER

OVULE

?

MICROPYLE



L.S.



INTEGUMENT

MEGASPORE WALL

MEGASPORANGIUM

GINKGO

ARCHEGONIUM

ARCHEGONIUM

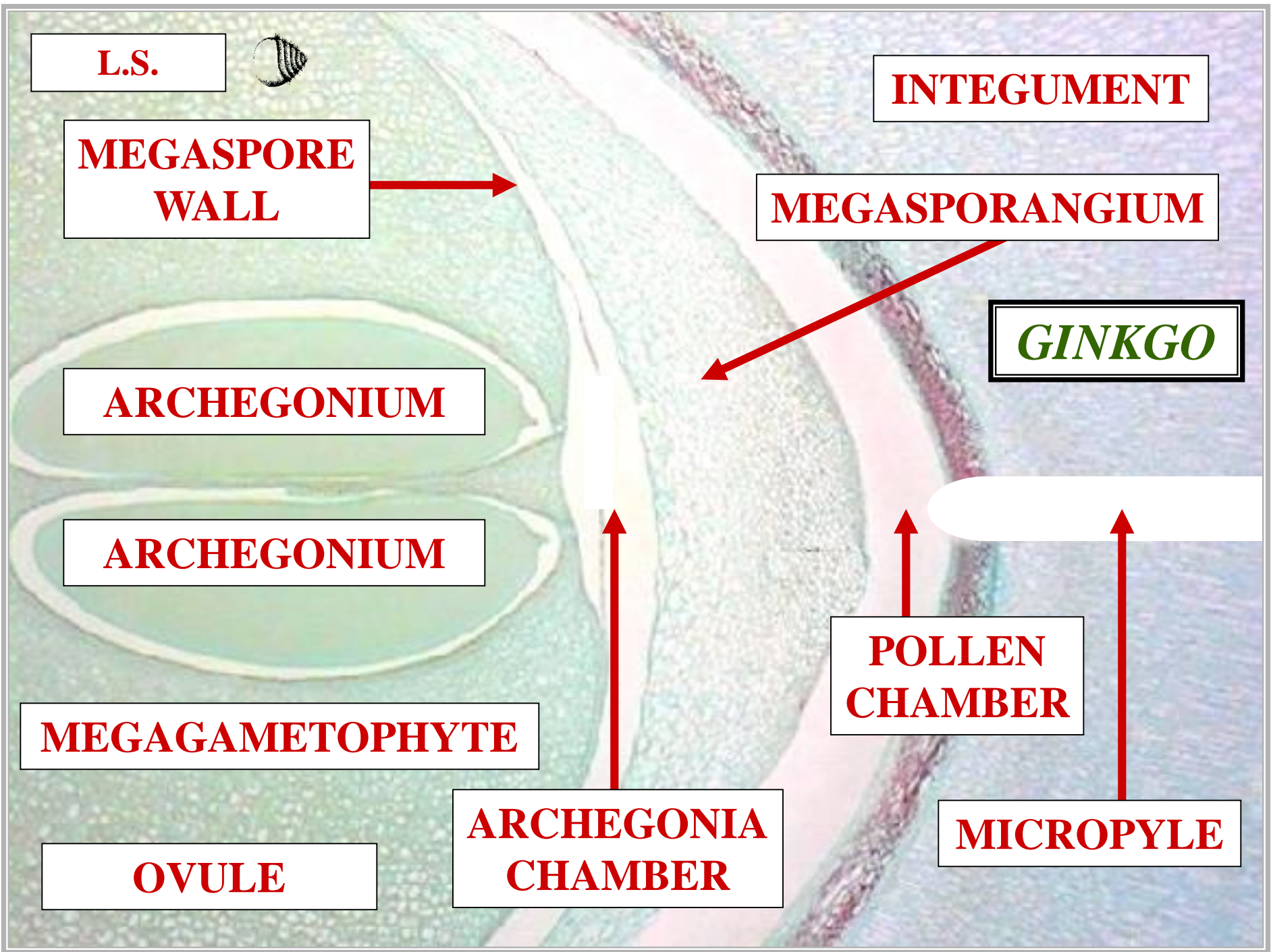
MEGAGAMETOPHYTE

POLLEN CHAMBER

OVULE

ARCHEGONIA CHAMBER

MICROPYLE



L.S.

?

INTEGUMENT

MEGASPORE
WALL

MEGASPORANGIUM

GINKGO

ARCHEGONIUM

SPERM

ARCHEGONIUM

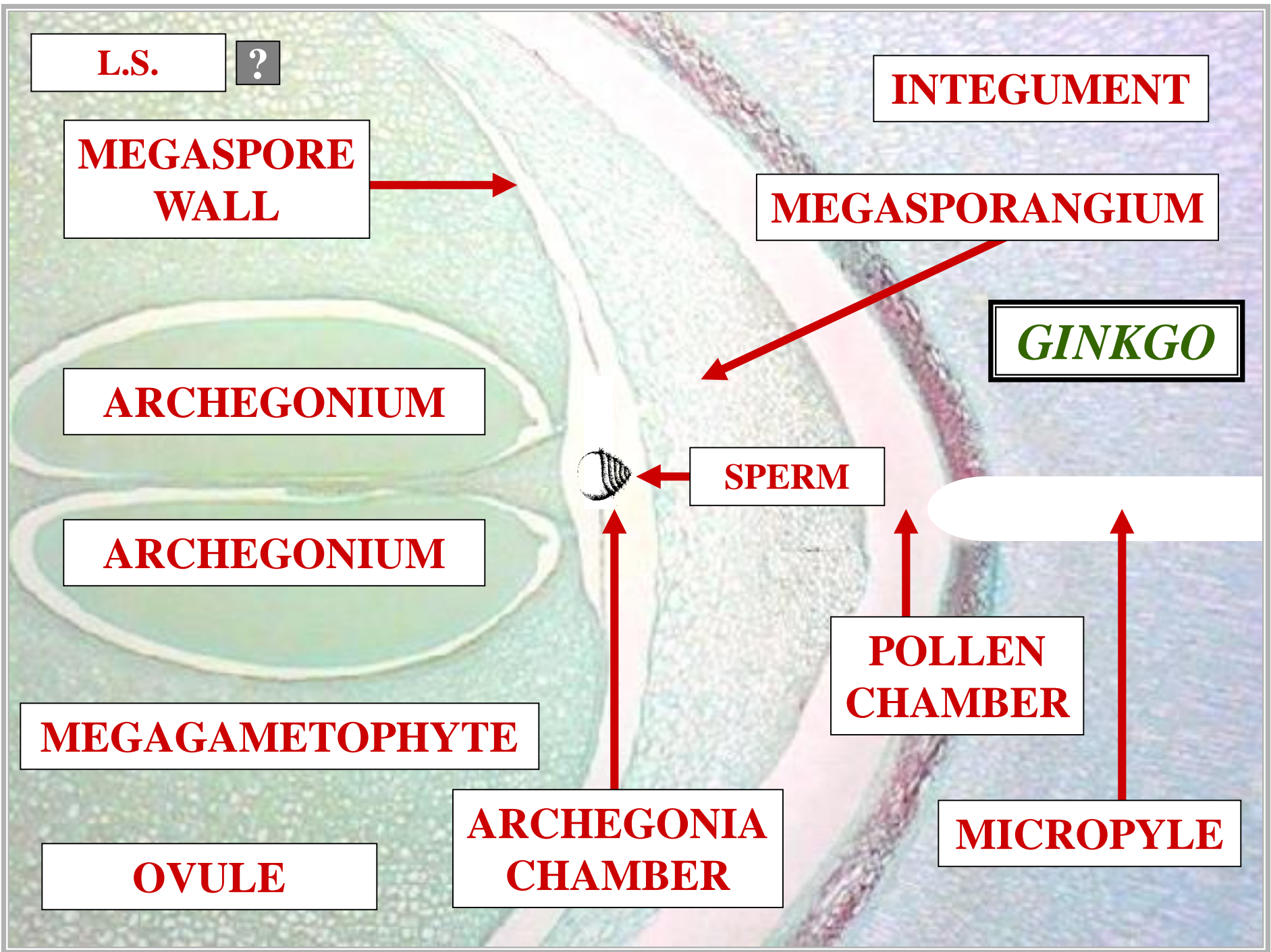
POLLEN
CHAMBER

MEGAGAMETOPHYTE

MICROPYLE

OVULE

ARCHEGONIA
CHAMBER



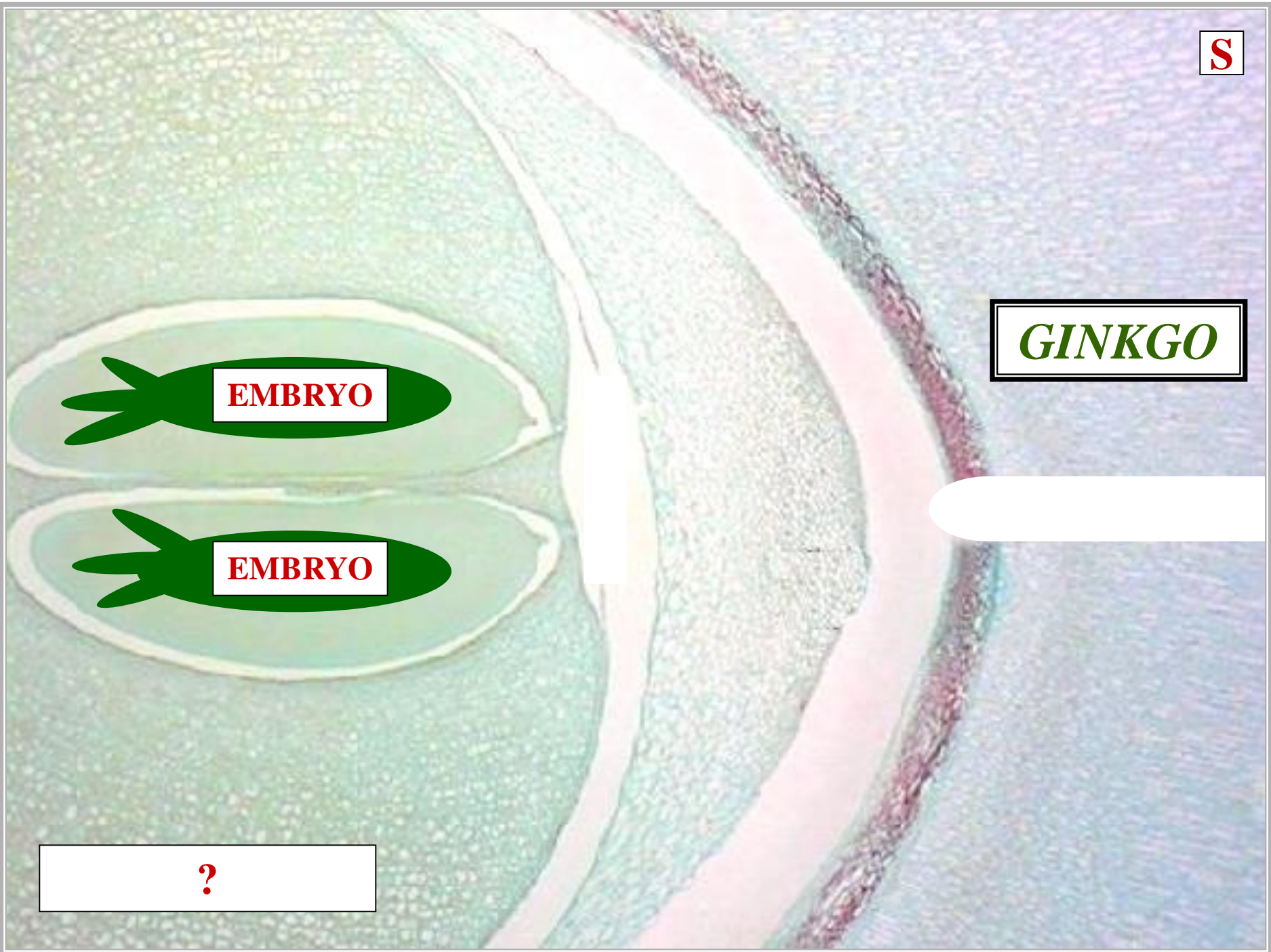
S

GINKGO

EMBRYO

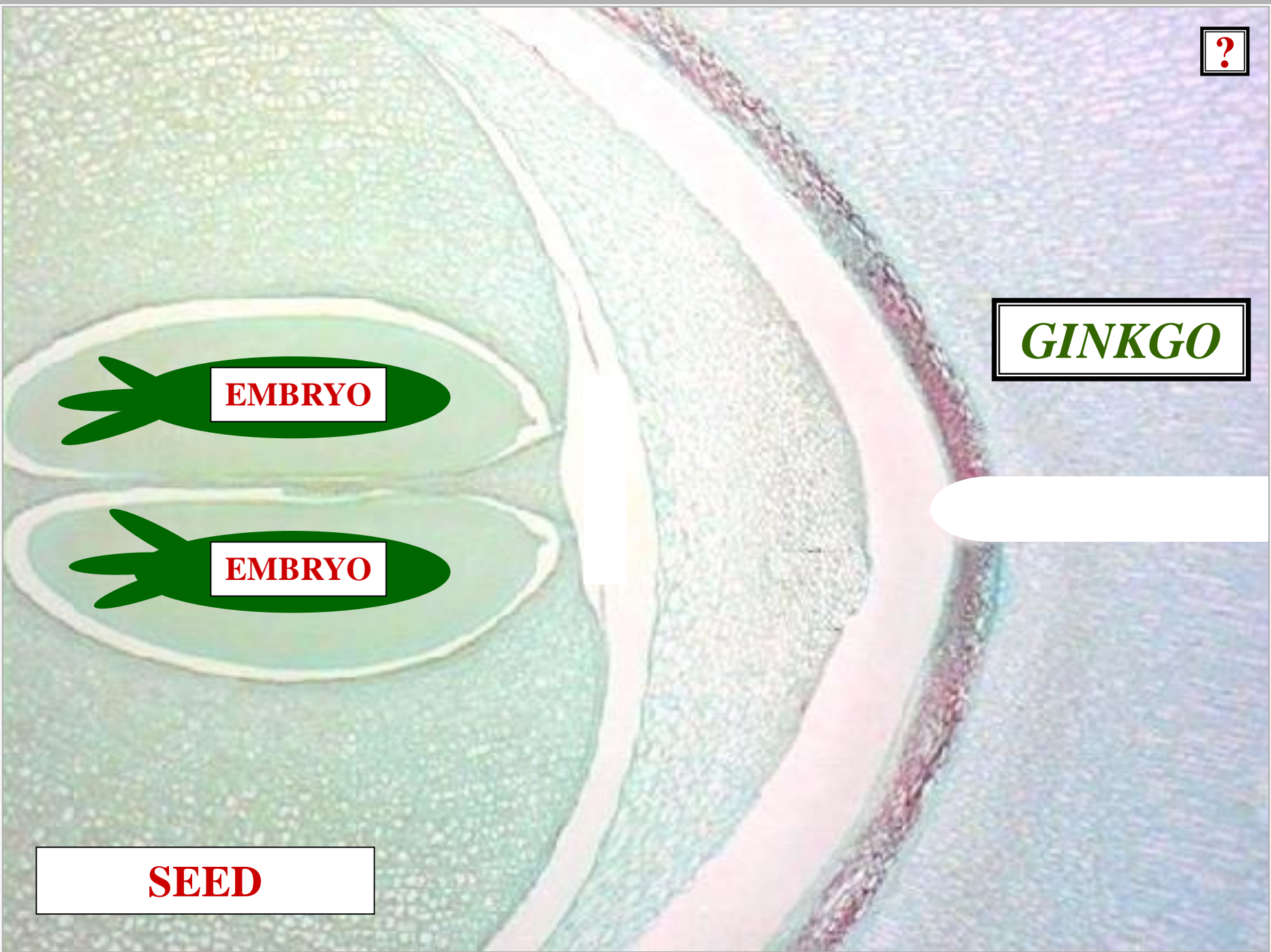
EMBRYO

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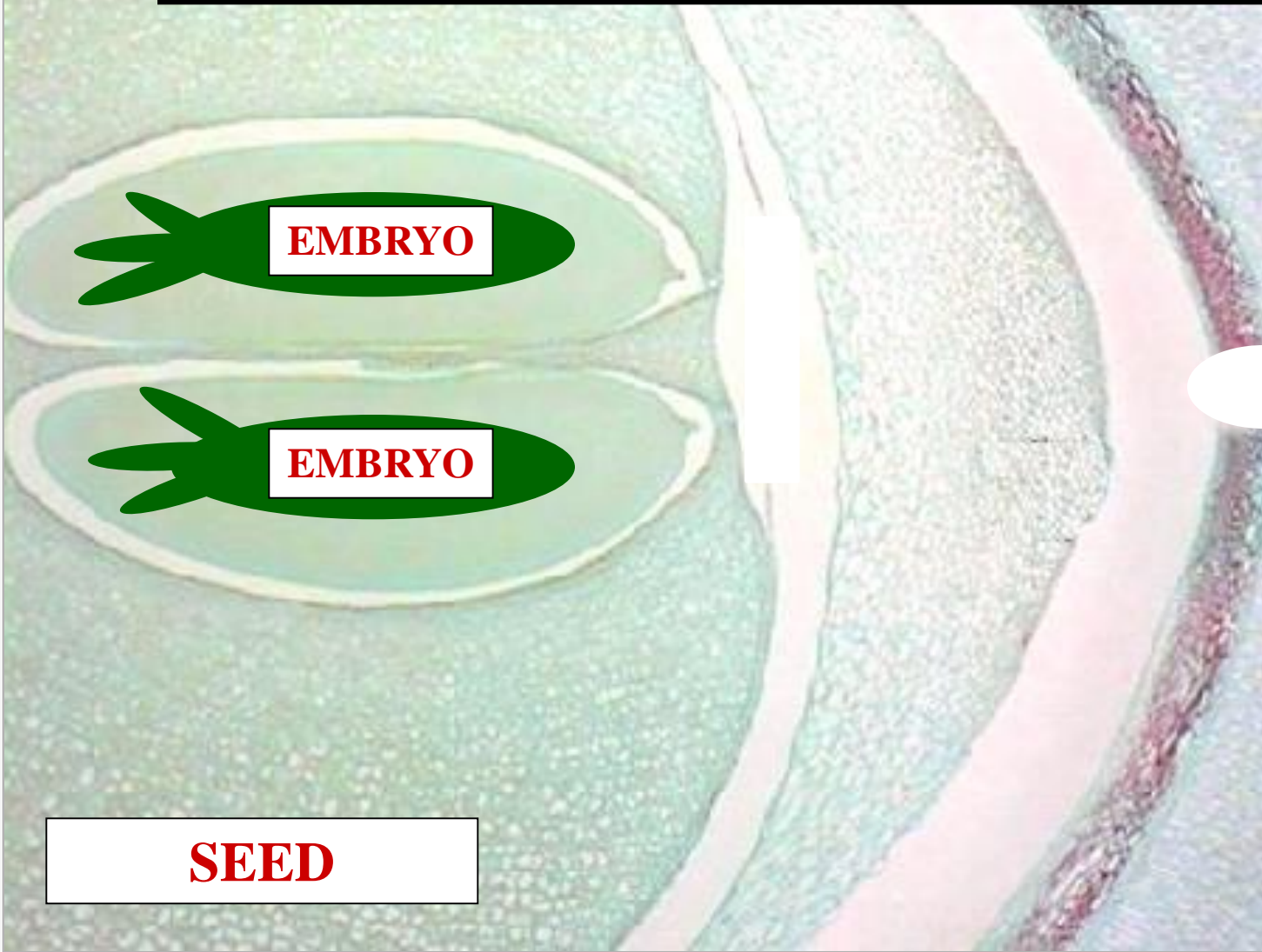
GINKGO



SEED

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GINKGO



EMBRYO

EMBRYO

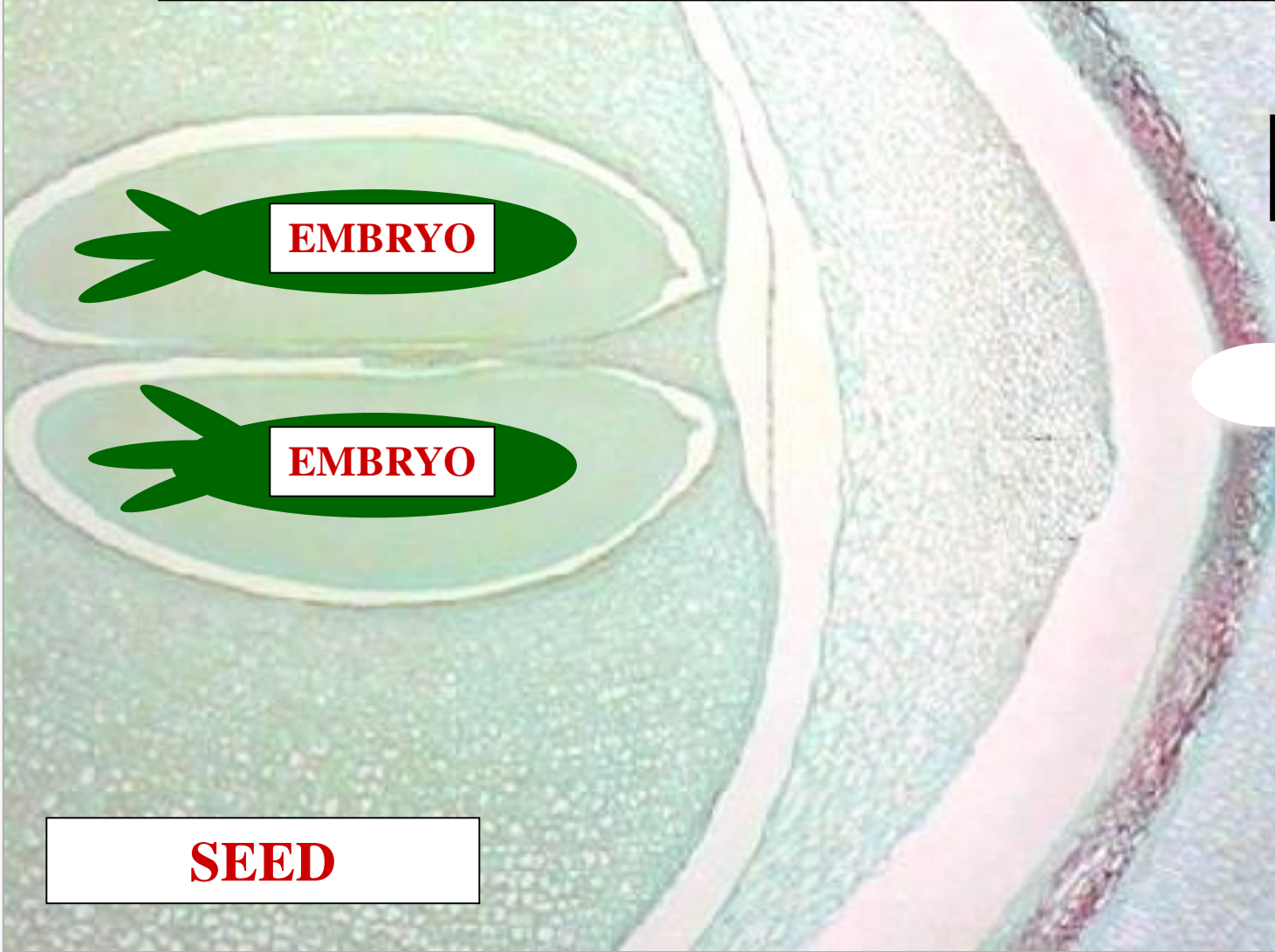
SEED



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POLYEMBRYONY

GINKGO



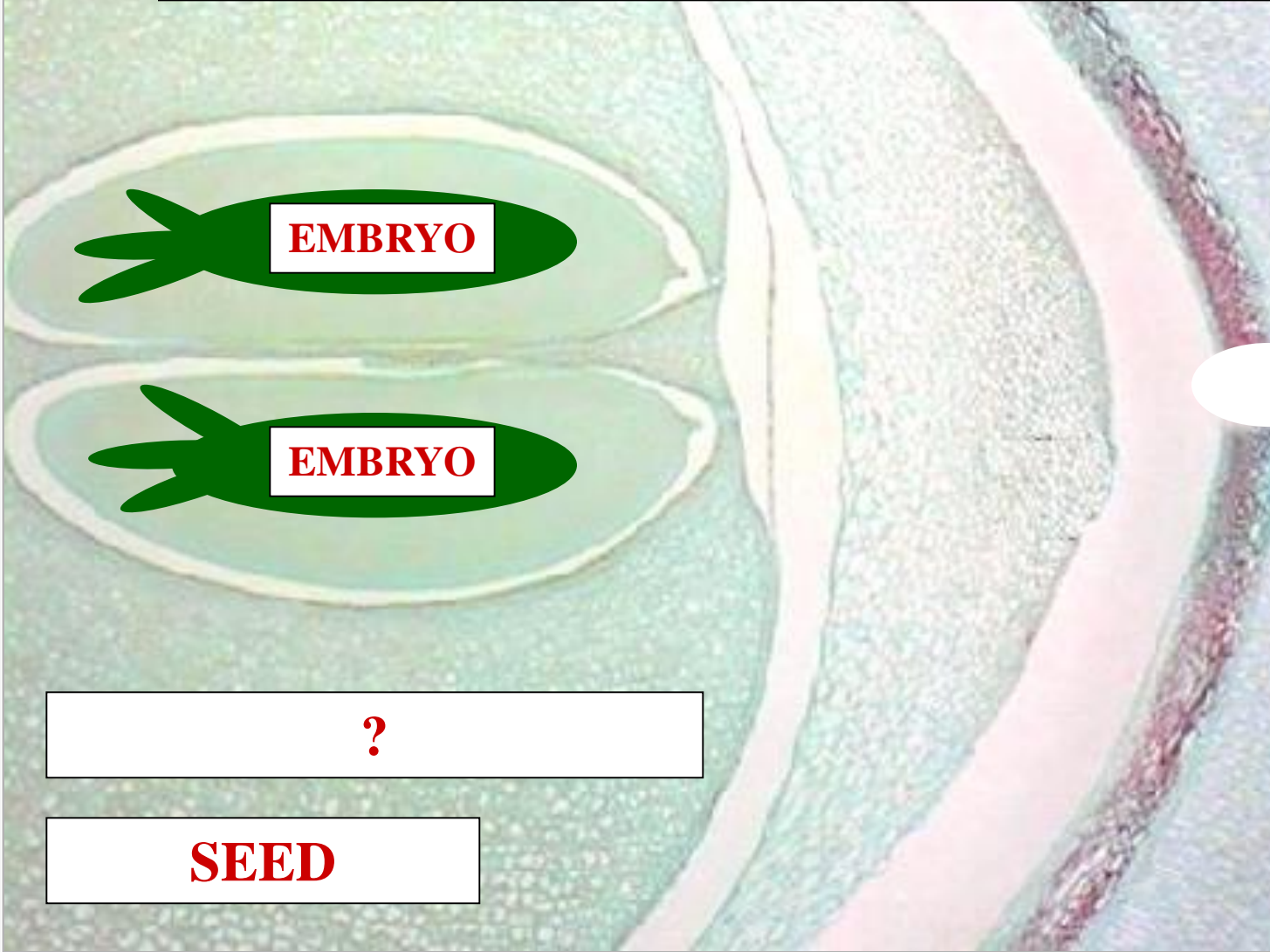
EMBRYO

EMBRYO

SEED

POLYEMBRYONY

GINKGO



EMBRYO

EMBRYO

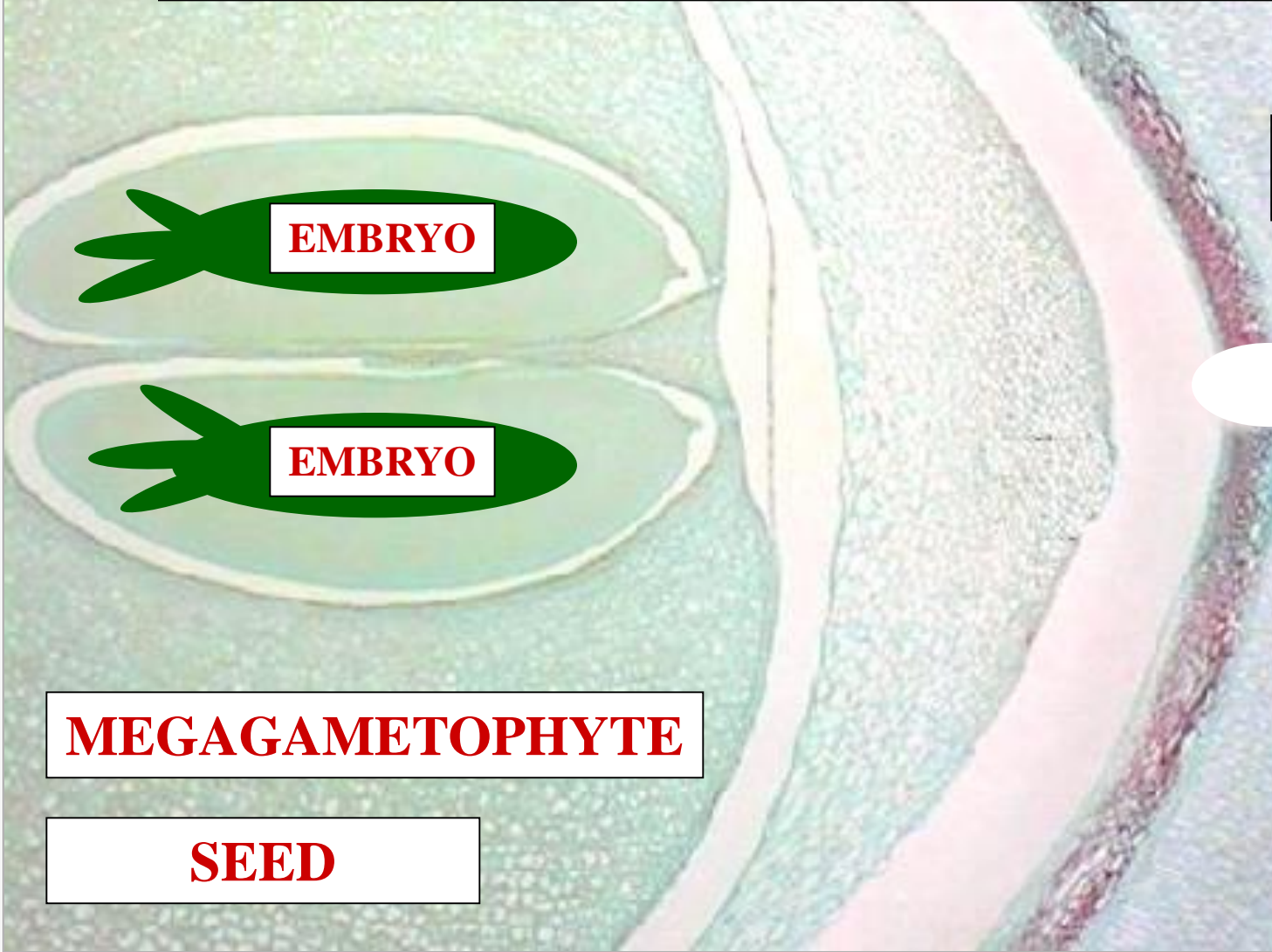
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SEED



POLYEMBRYONY

GINKGO



EMBRYO

EMBRYO

MEGAGAMETOPHYTE

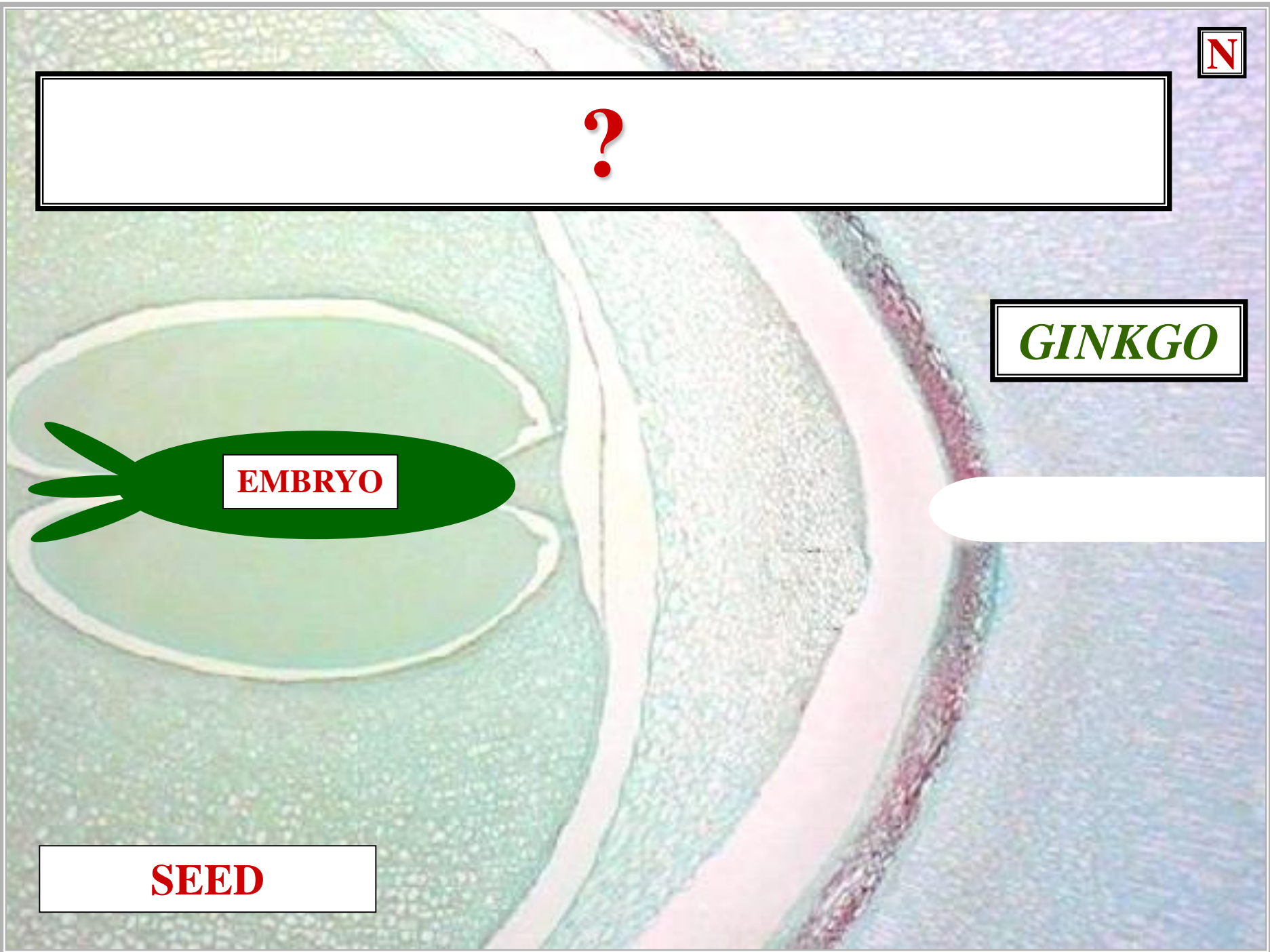
SEED

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GINKGO

EMBRYO

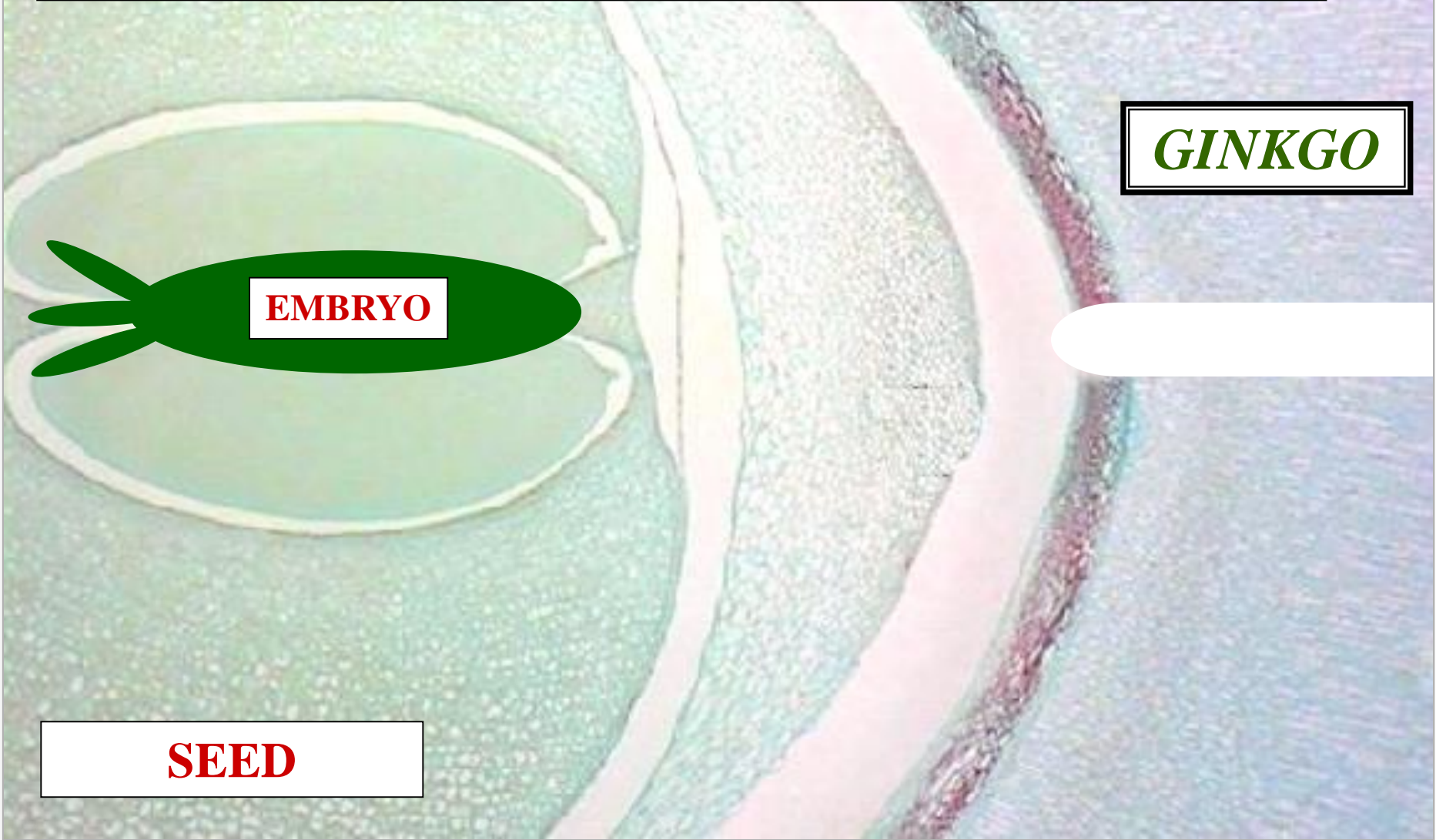
SEED





NATURAL SELECTION

GINKGO



EMBRYO

SEED



FOSSIL RECORD



~260

MILLION YEARS



?



P

TRIASSIC



JURASSIC



CRETACEOUS



PERMIAN



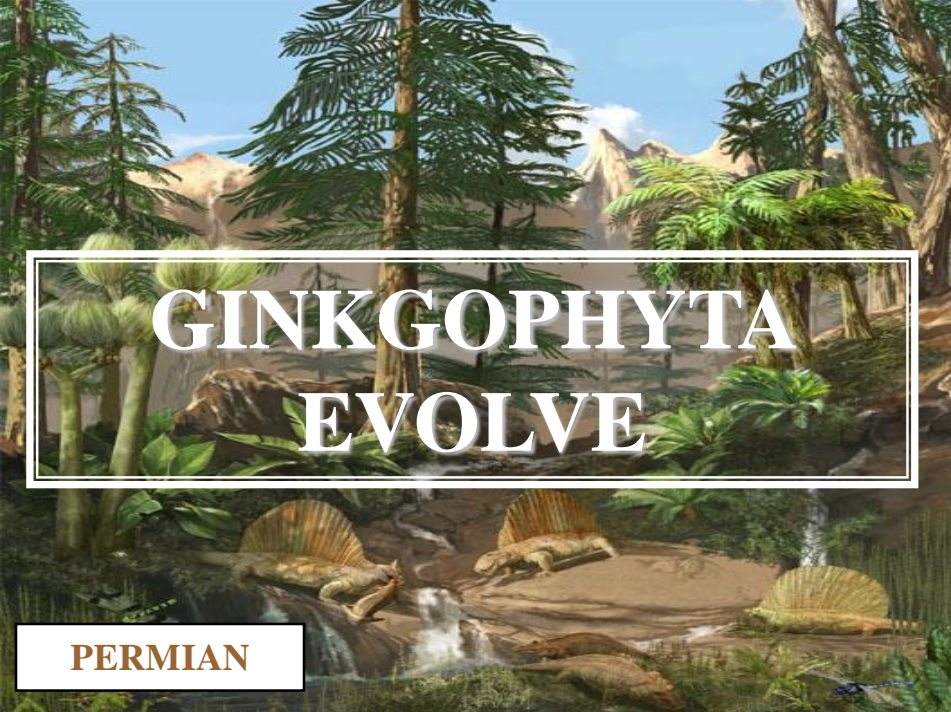
TRIASSIC



JURASSIC



CRETACEOUS



GINKGOPHYTA EVOLVE

PERMIAN



TRIASSIC



JURASSIC



CRETACEOUS



PERMIAN

TRICHOPITYS



~140

MILLION YEARS



PERMIAN



TRIASSIC



JURASSIC



?



PERMIAN



TRIASSIC



JURASSIC



CRETACEOUS



PERMIAN



TRIASSIC



D



JURASSIC



CRETACEOUS

**GINKGOPHYTA
ZENITH**



GINKGOPHYTA DIVERSITY DECLINING

EARTH

PYLOGENETIC RELATIONSHIP

PTERIDOSPERMOPHYTA

C



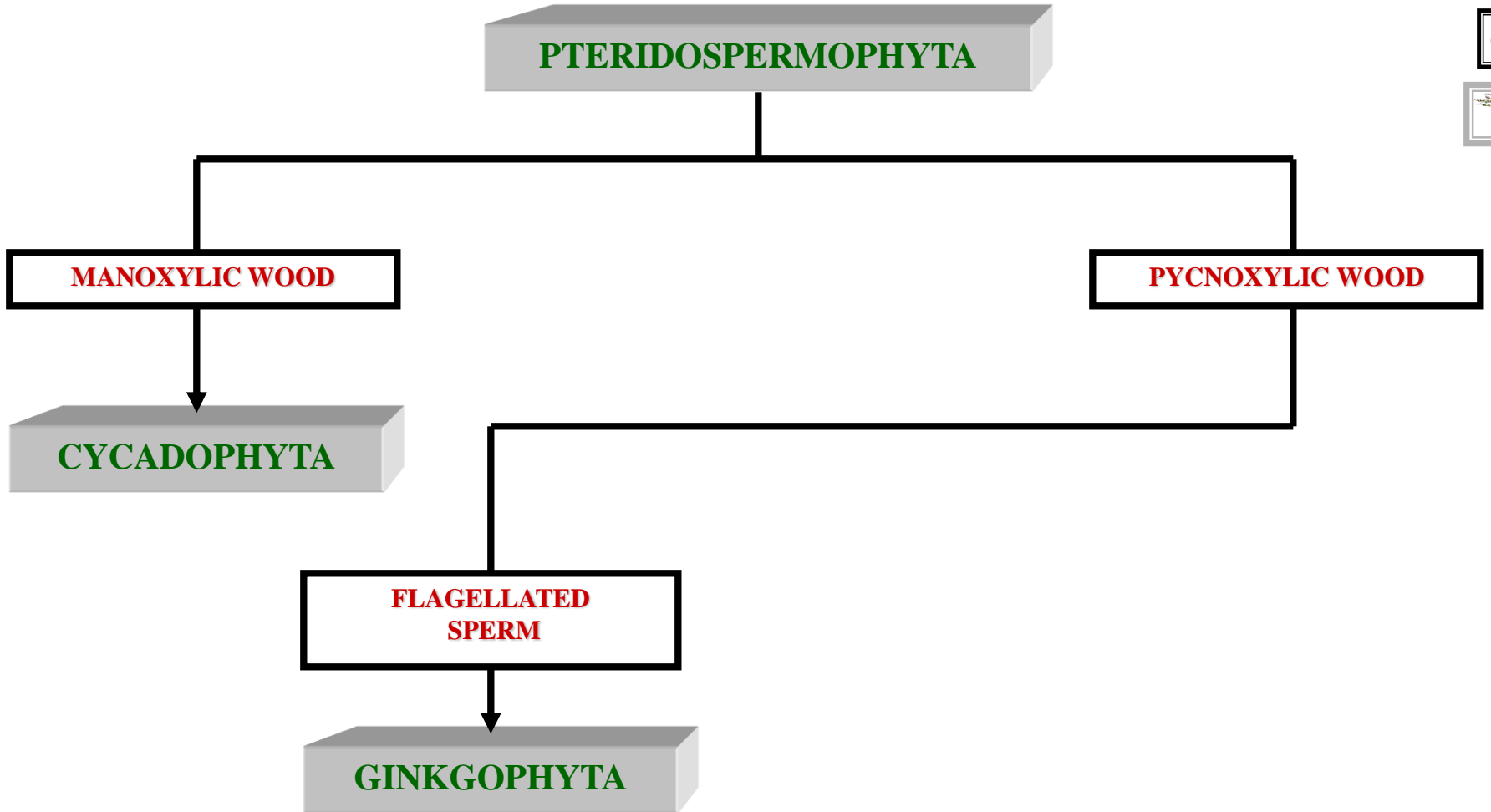
MANOXYLIC WOOD

PYCNOXYLIC WOOD

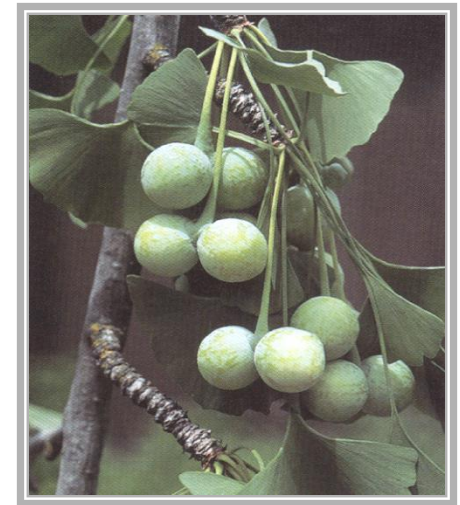
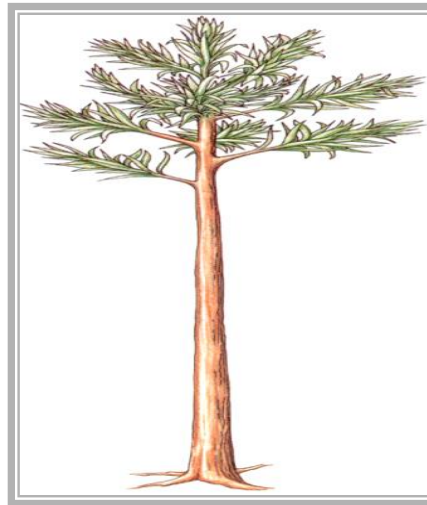
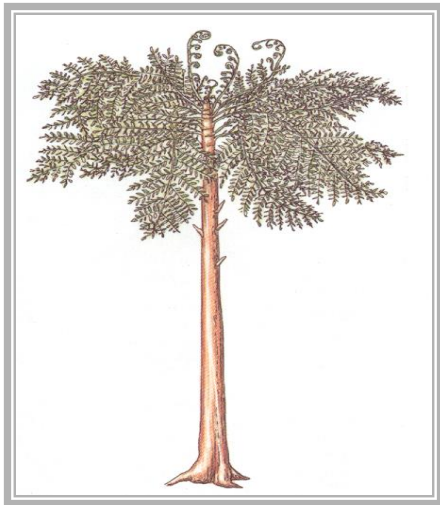
CYCADOPHYTA

**FLAGELLATED
SPERM**

GINKGOPHYTA



GINKGOPHYTA EVOLUTION



LYGINOPTERIS

CORDAITES

GINKGOPHYTA

PTERIDOSPERM

PTERIDOSPERM

PTERIDOSPERMOPHYTA

MANOXYLIC WOOD

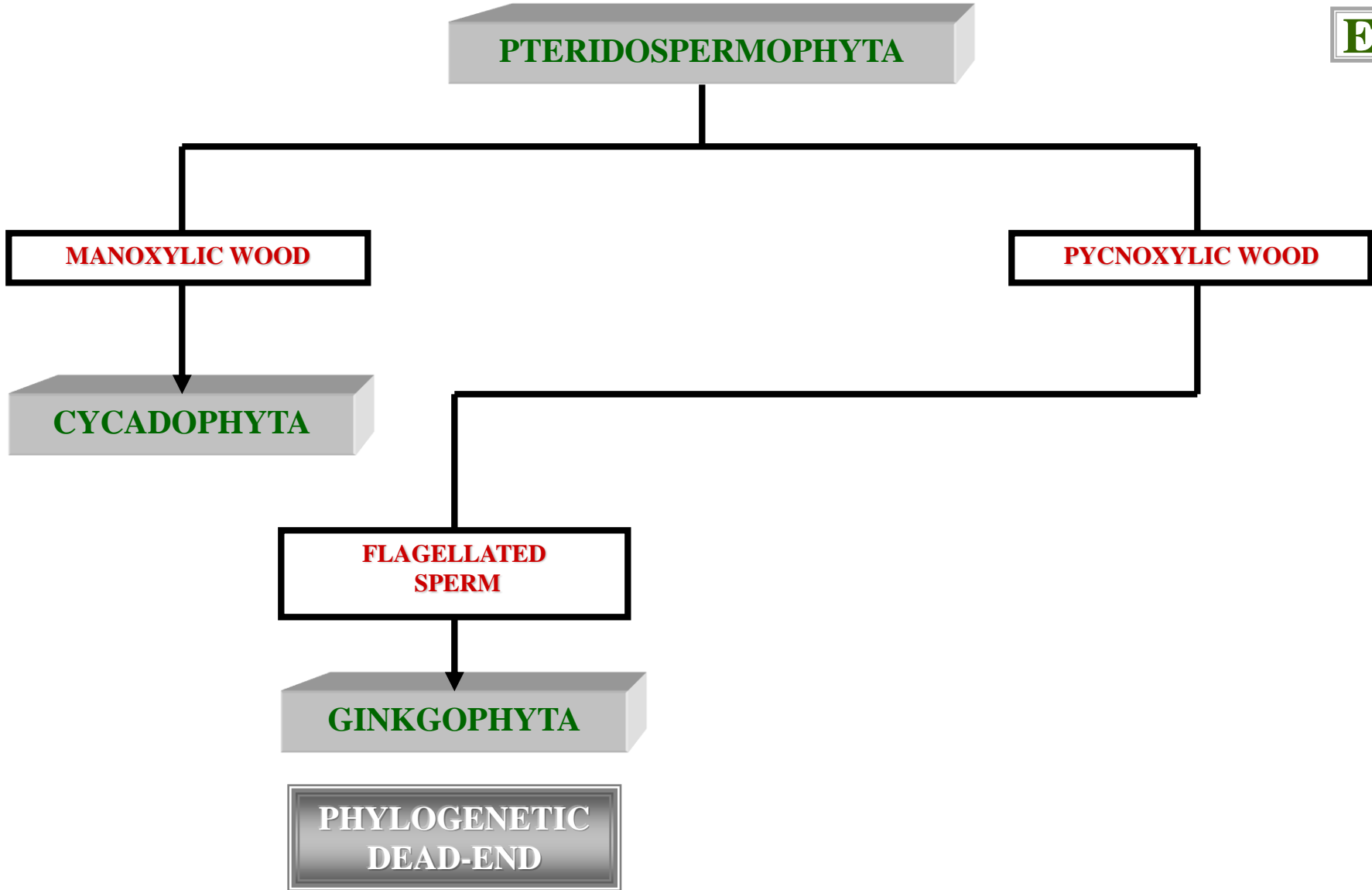
PYCNOXYLIC WOOD

CYCADOPHYTA

**FLAGELLATED
SPERM**

GINKGOPHYTA

**PHYLOGENETIC
DEAD-END**





VASCULAR PLANT EVOLUTION



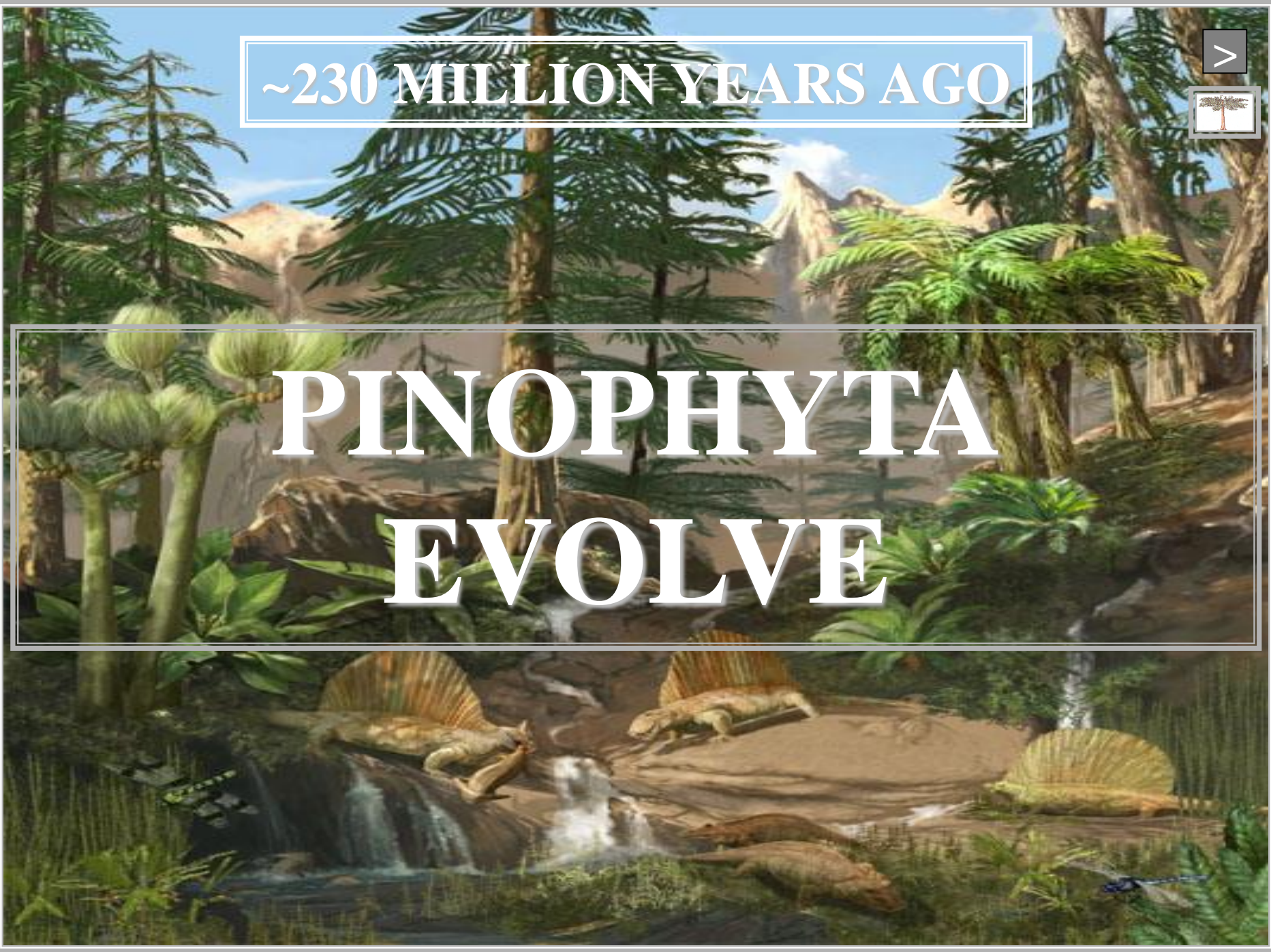
~230

MILLION YEARS

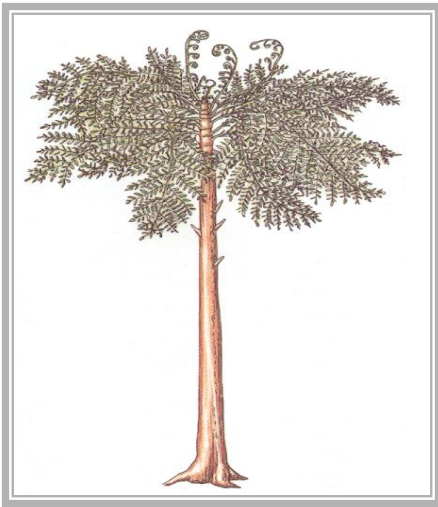
~230 MILLION YEARS AGO



PINOPHYTA EVOLVE

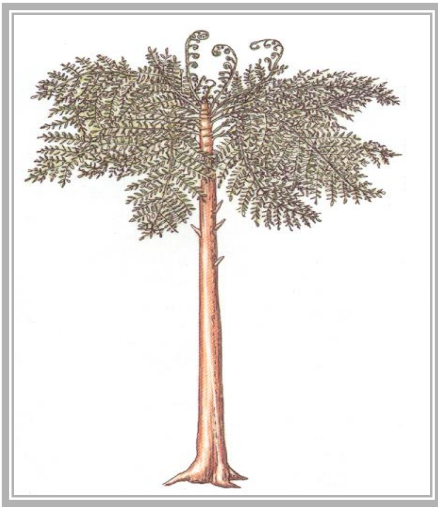


GINKGOPHYTA EVOLUTION



LYGINOPTERIS

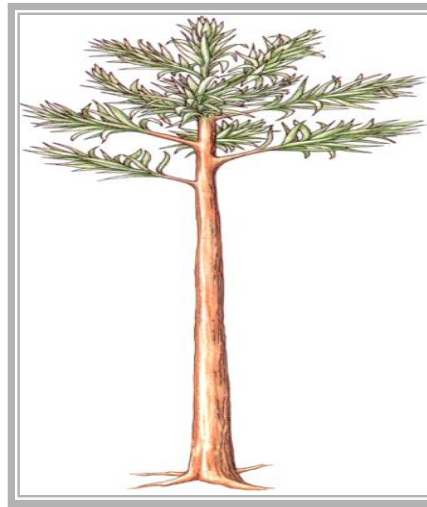
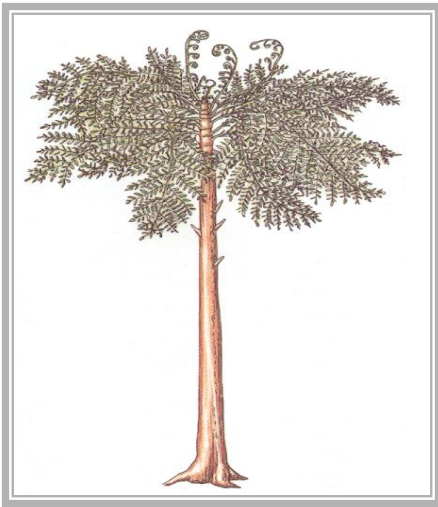
GINKGOPHYTA EVOLUTION



PTERIDOSPERM

GYMNOSPERM

GINKGOPHYTA EVOLUTION

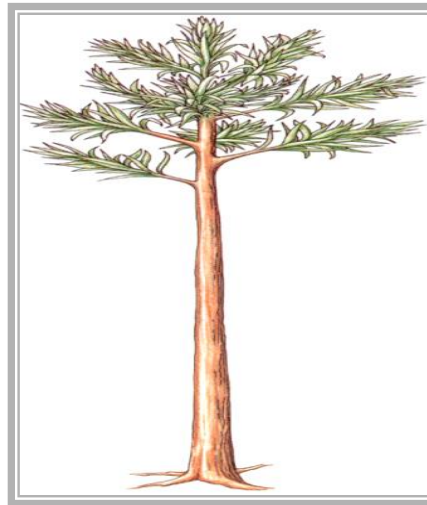
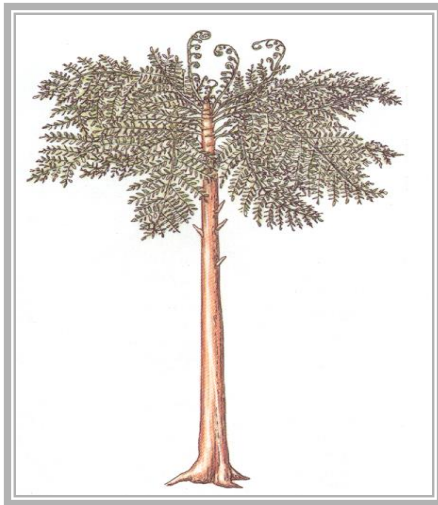


PTERIDOSPERM

CORDAITES

GYMNOSPERM

GINKGOPHYTA EVOLUTION



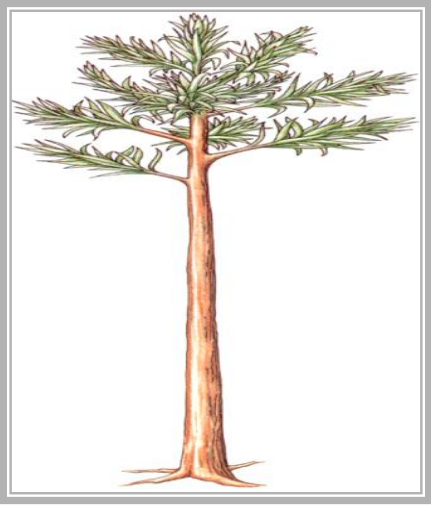
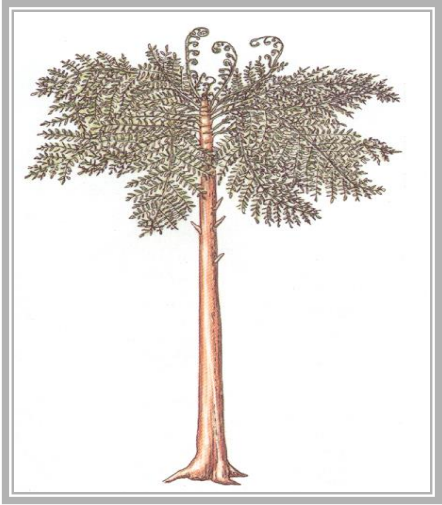
PTERIDOSPERM

GYMNOSPERM

PTERIDOSPERM

GYMNOSPERM

PINOPHYTA EVOLUTION



PTERIDOSPERM

PTERIDOSPERM

PINOPHYTA

GYMNOSPERM

GYMNOSPERM

**EXTANT
PHYLUM**

**PHYLUM
PINOPHYTA**

**EXTANT
PHYLUM**

SYNONYM



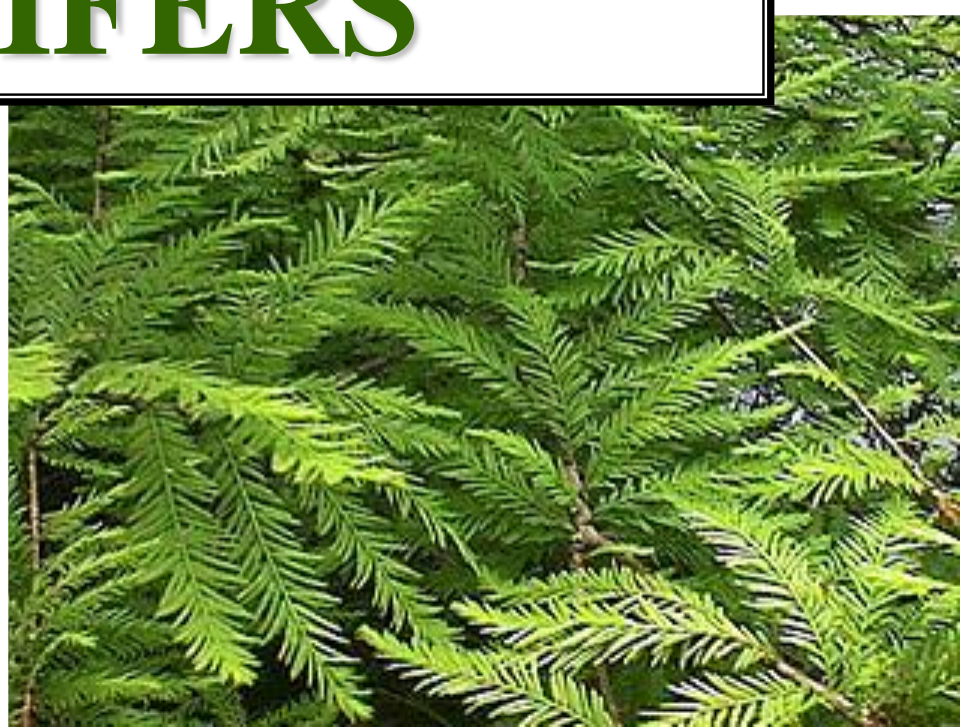
CONIFEROPHYTA



COMMON NAME



CONIFERS



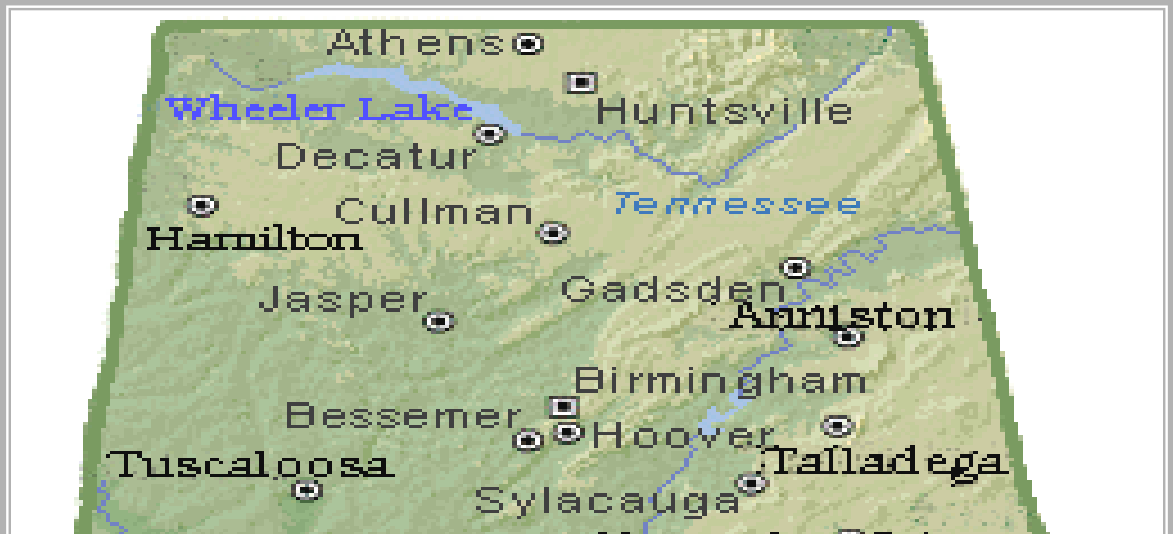


DIVERSITY

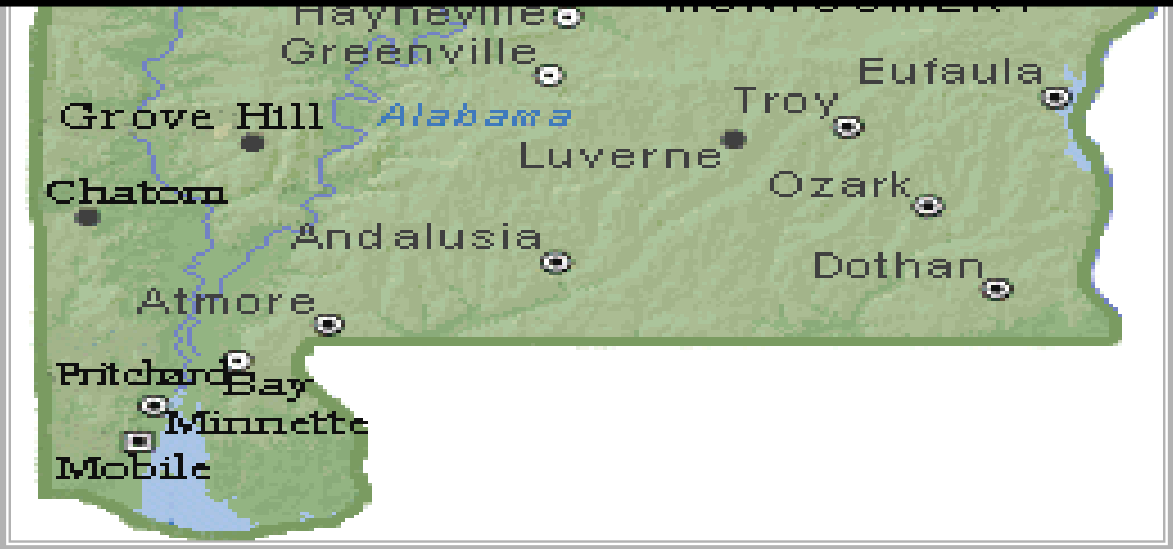


~650 SPECIES

EARTH



~12 SPECIES



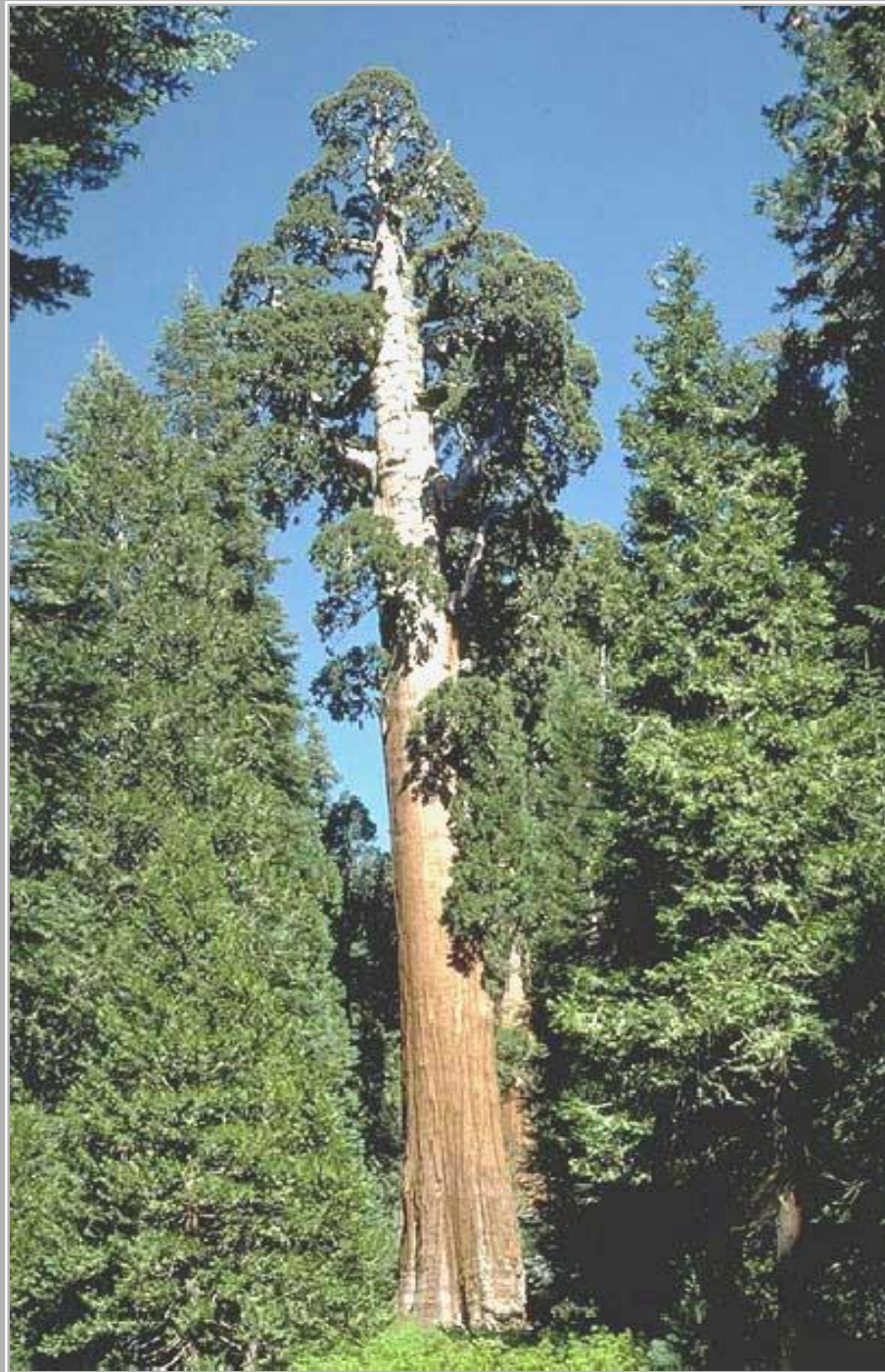


**PINOPHYTA
MOST DIVERSE
GYMNOSPERM
PHYLUM**

EARTH



LARGEST TRACHEOPHYTES



S

CALIFORNIA

