



TESTA



OVULE

HILUM SCAR

OVARY



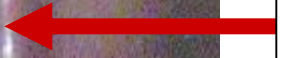
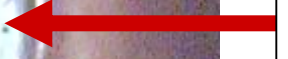
SEED

M

RAPHE

HILUM SCAR

RAPHE



MICROPYLE SCAR



**ANGIOSPERM
SEED MORPHOLOGY**

**MICROPYLE
SCAR**

=

**POLLEN TUBE
SCAR**

**ANGIOSPERM
SEED MORPHOLOGY**



TESTA

SEED

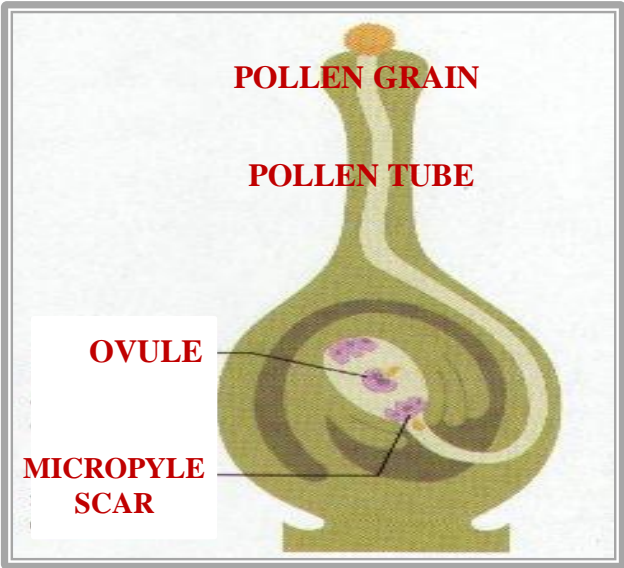


RAPHE

MICROPYLE SCAR

HILUM SCAR

RAPHE



POLLEN GRAIN

POLLEN TUBE

OVULE

MICROPYLE SCAR



SEED ANATOMY



DICOT SEED ANATOMY

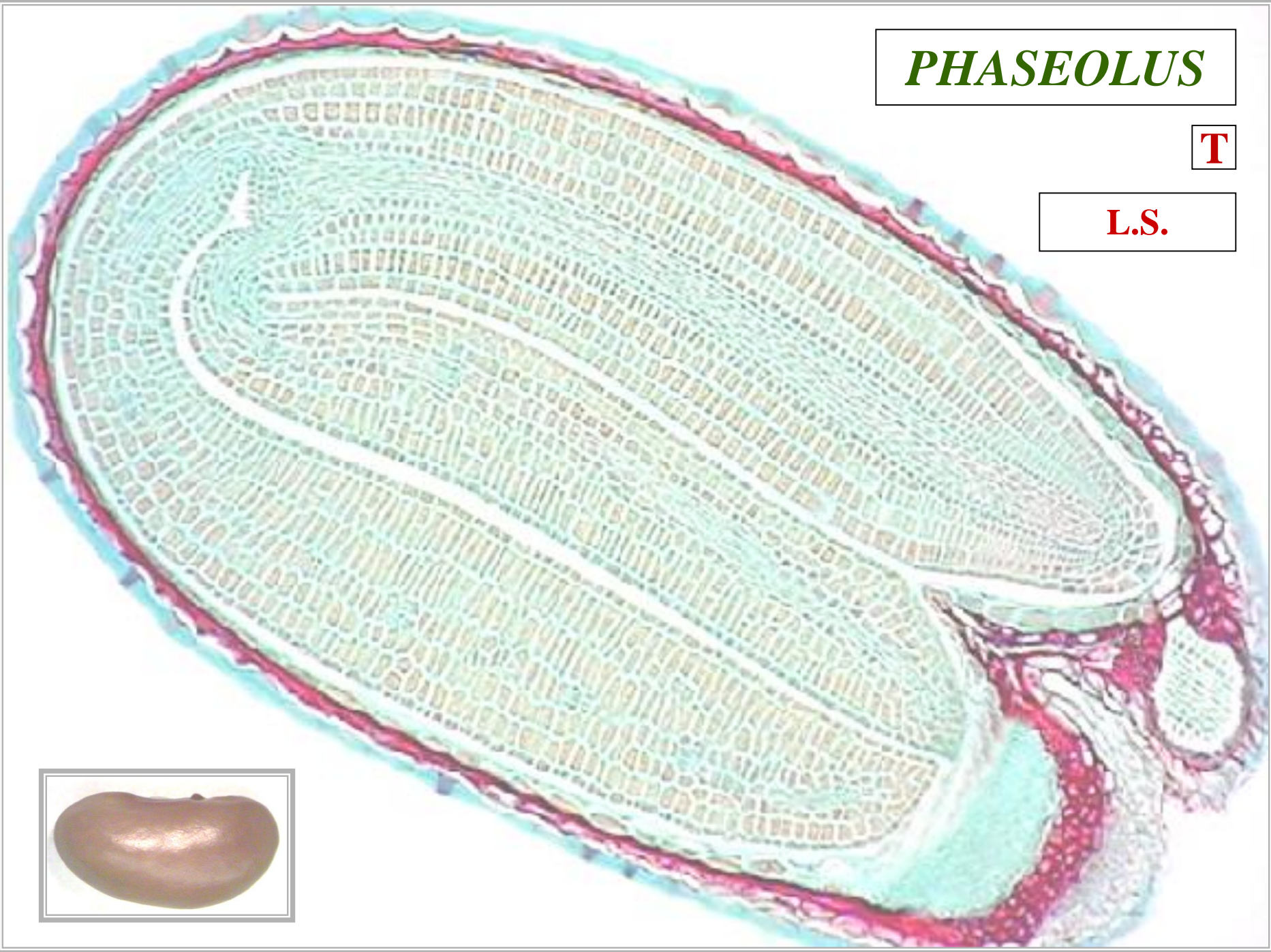


PHASEOLUS

PHASEOLUS

T

L.S.

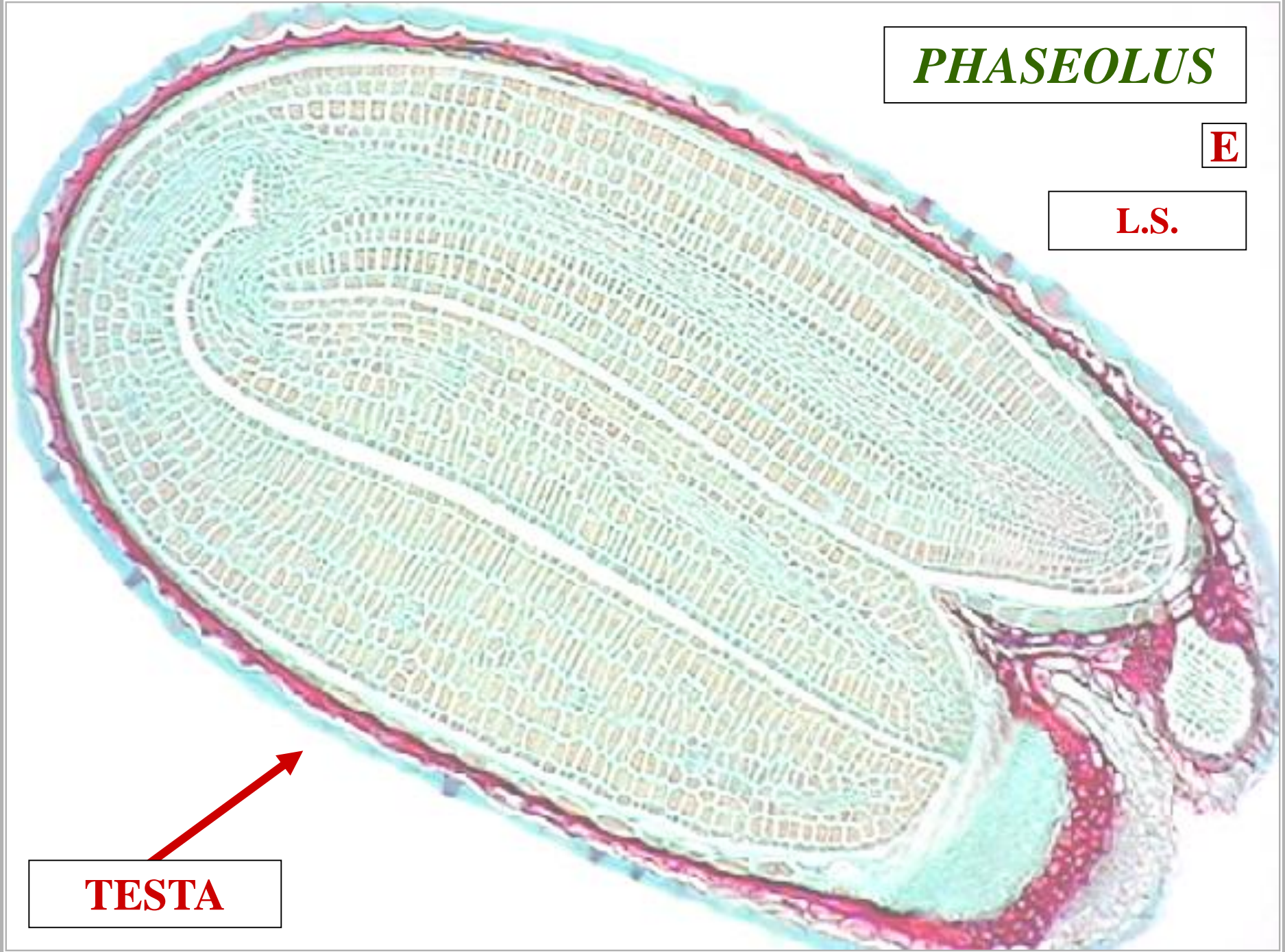


PHASEOLUS

E

L.S.

TESTA



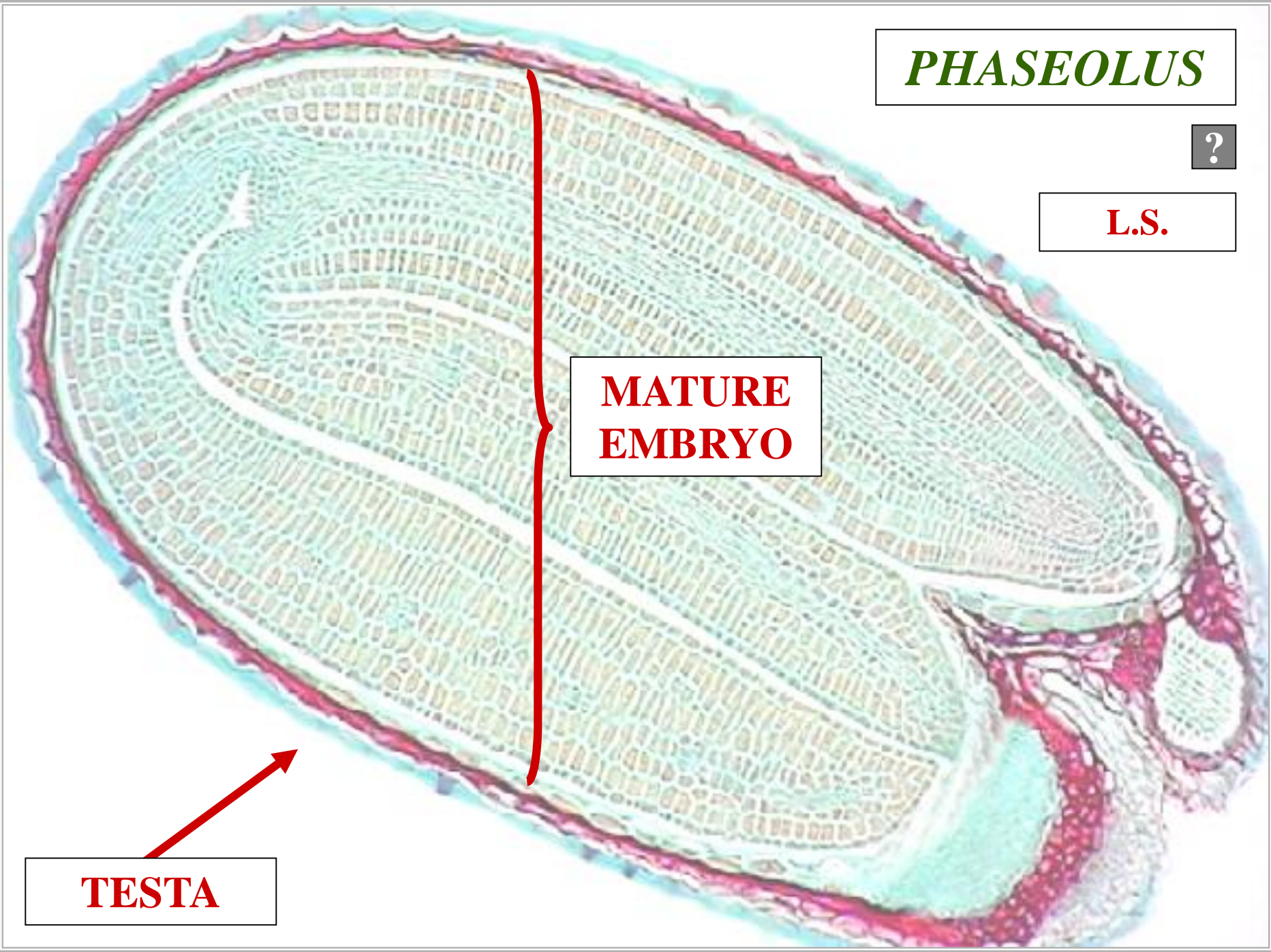
PHASEOLUS

?

L.S.

MATURE
EMBRYO

TESTA



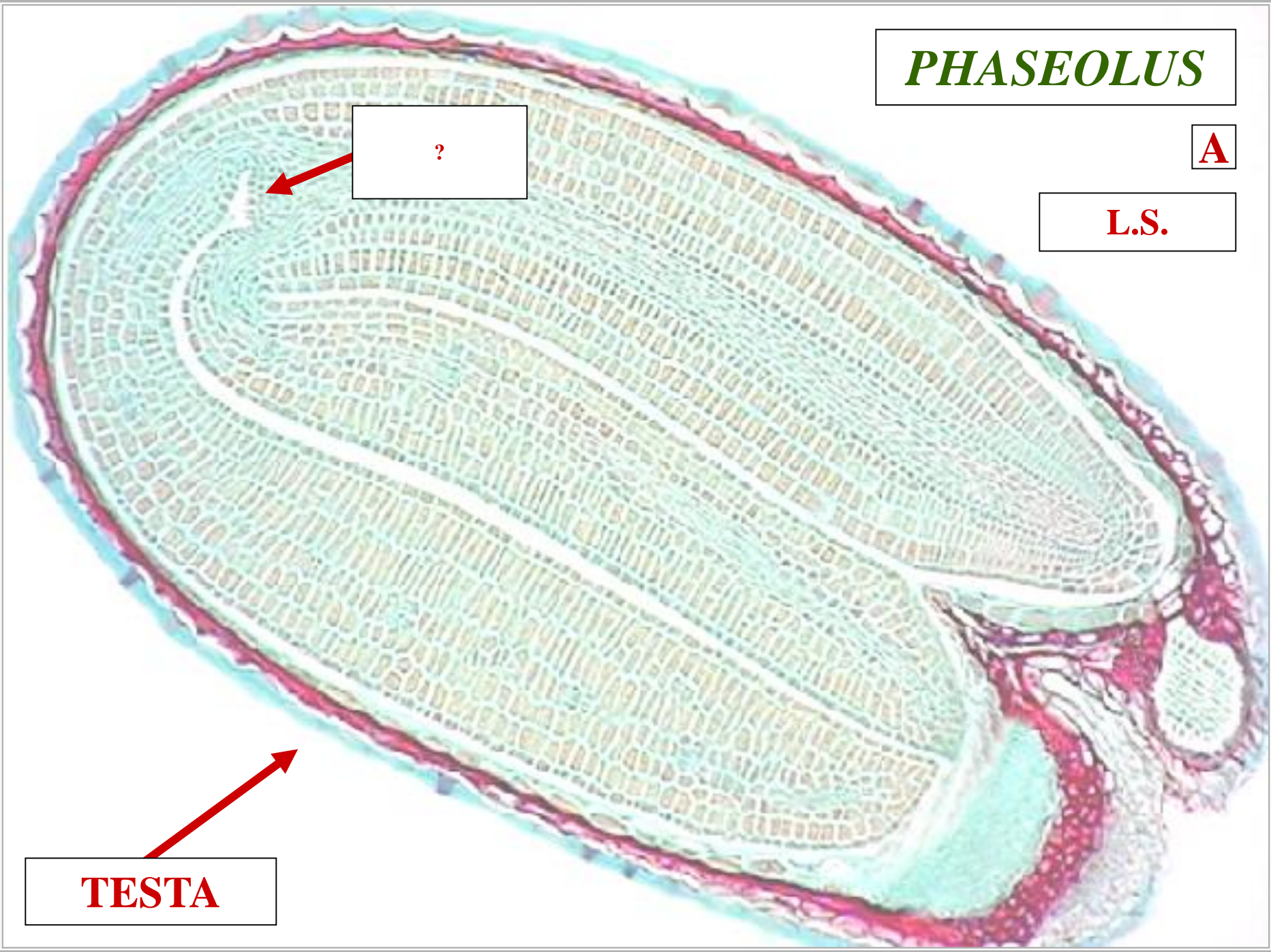
PHASEOLUS

A

L.S.

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TESTA



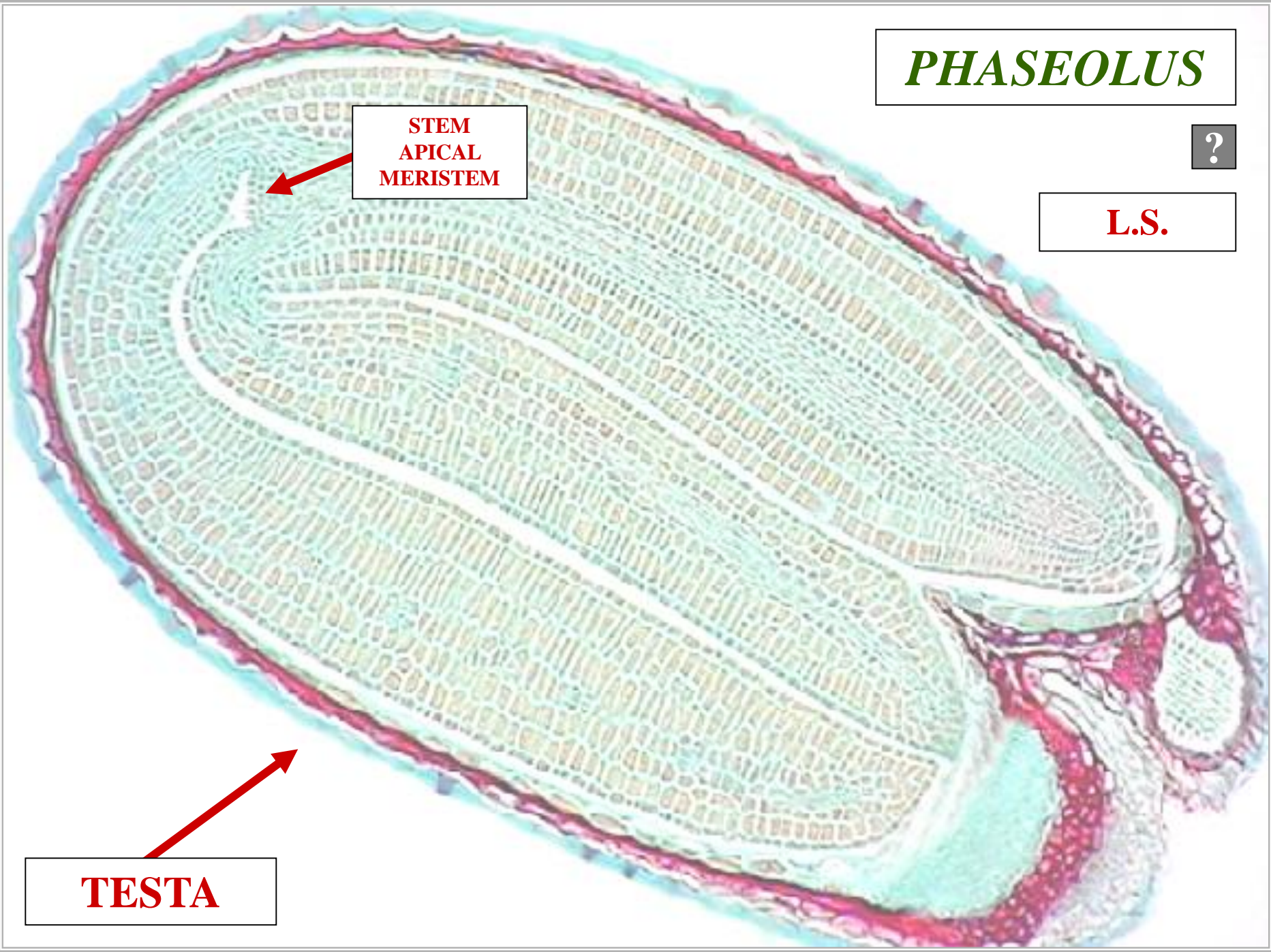
PHASEOLUS

?

L.S.

**STEM
APICAL
MERISTEM**

TESTA



PHASEOLUS

C

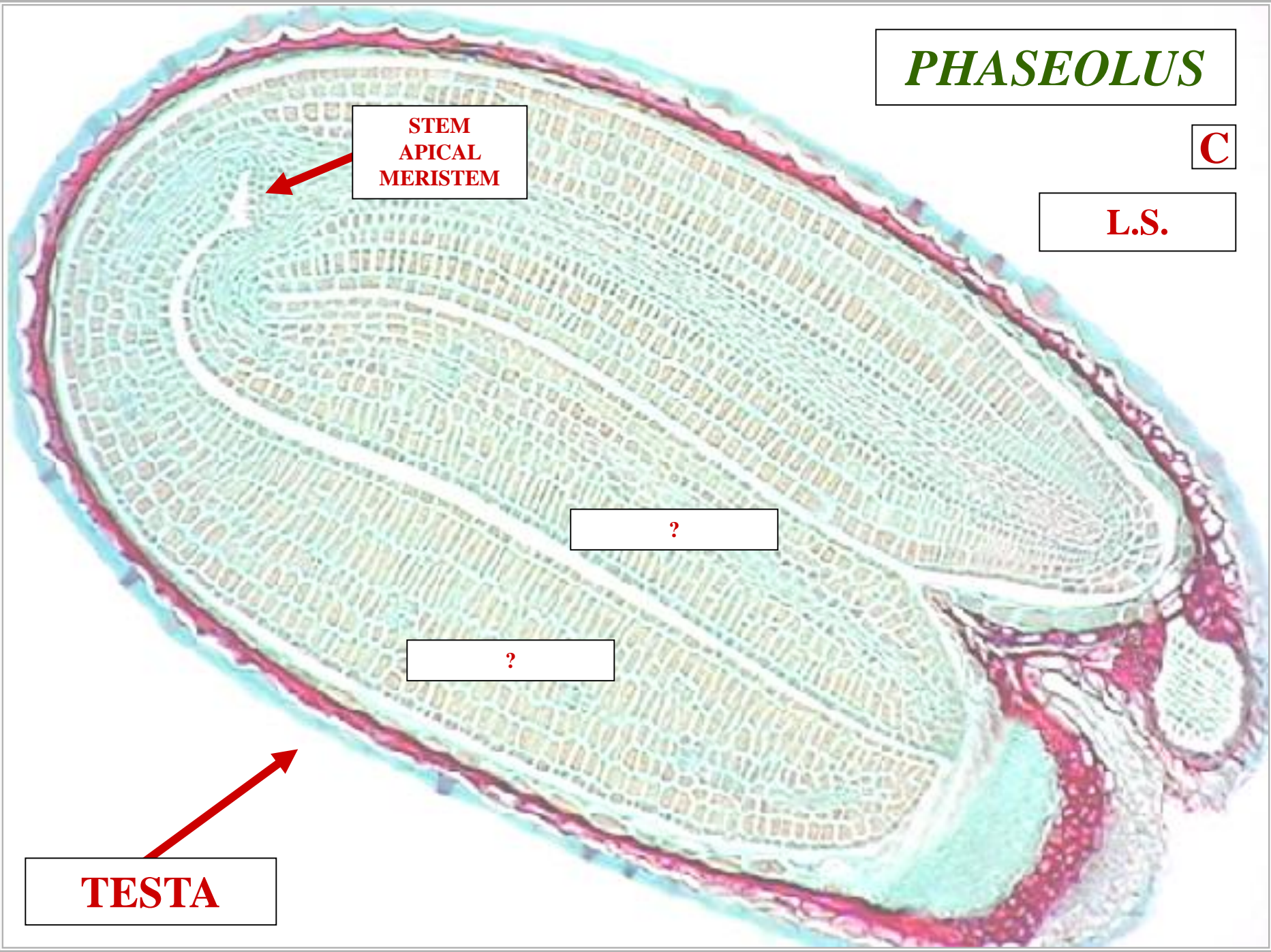
L.S.

STEM
APICAL
MERISTEM

?

?

TESTA



PHASEOLUS

?

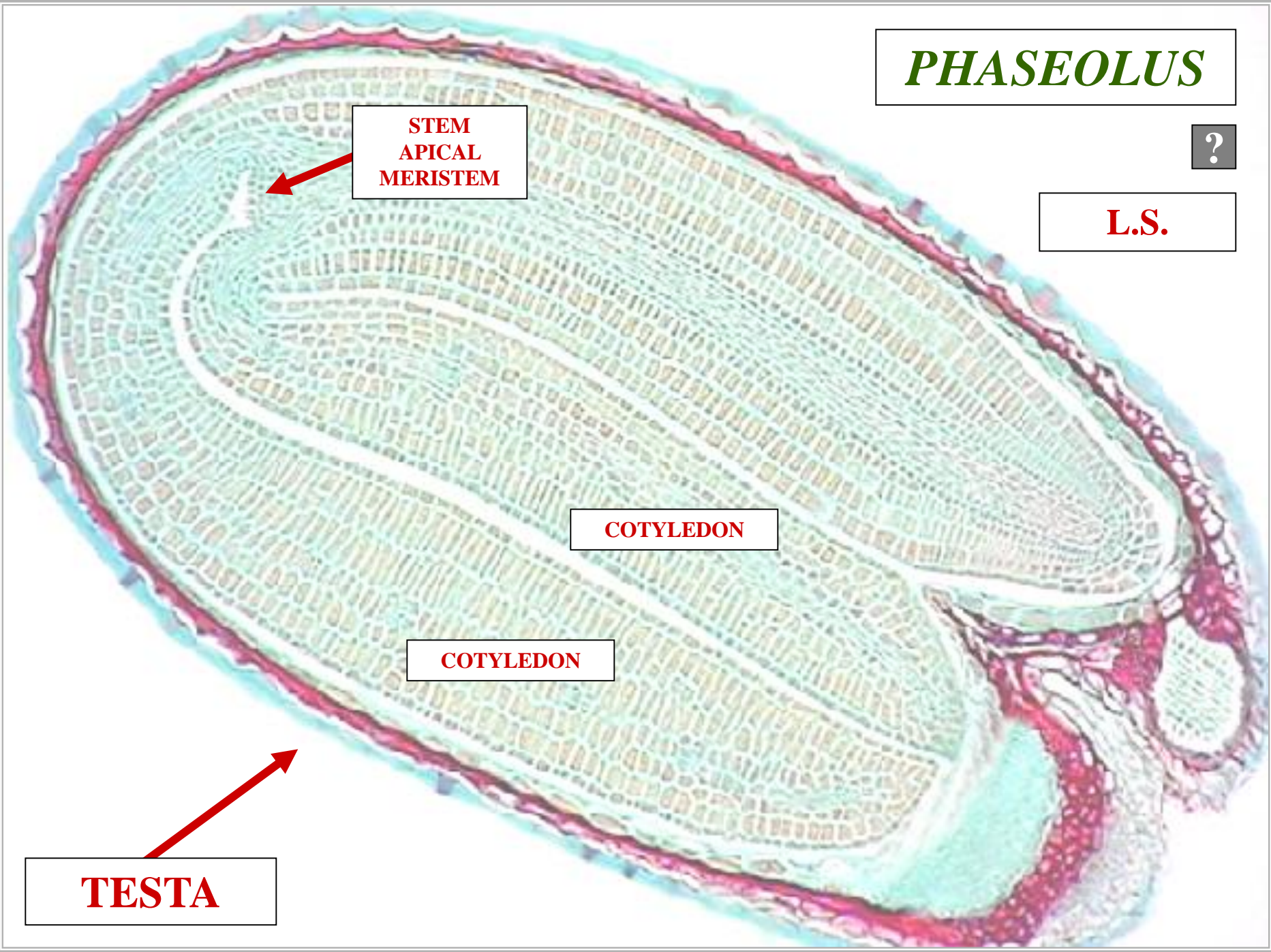
L.S.

**STEM
APICAL
MERISTEM**

COTYLEDON

COTYLEDON

TESTA



PHASEOLUS

H

L.S.

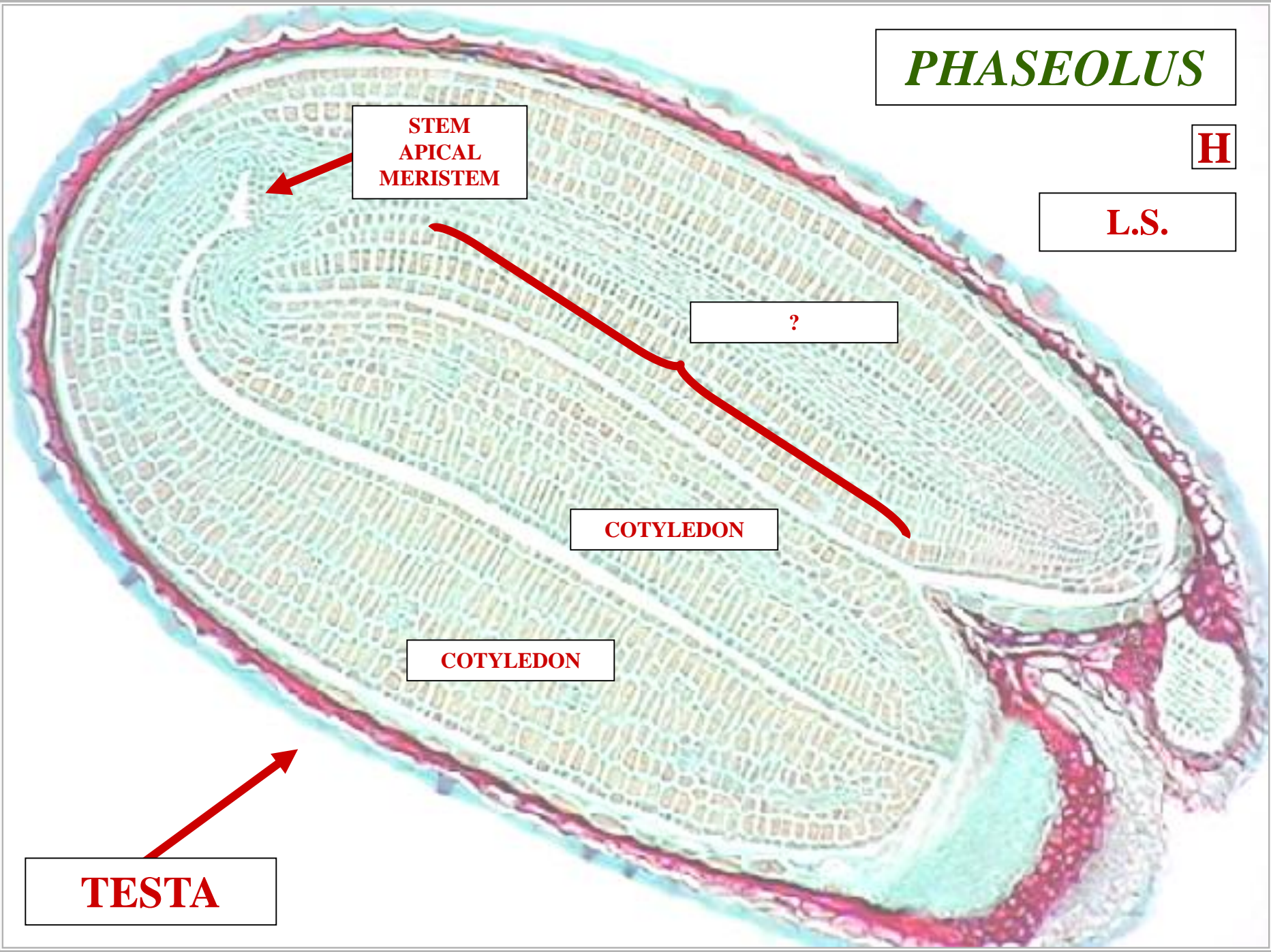
STEM
APICAL
MERISTEM

?

COTYLEDON

COTYLEDON

TESTA



PHASEOLUS

?

L.S.

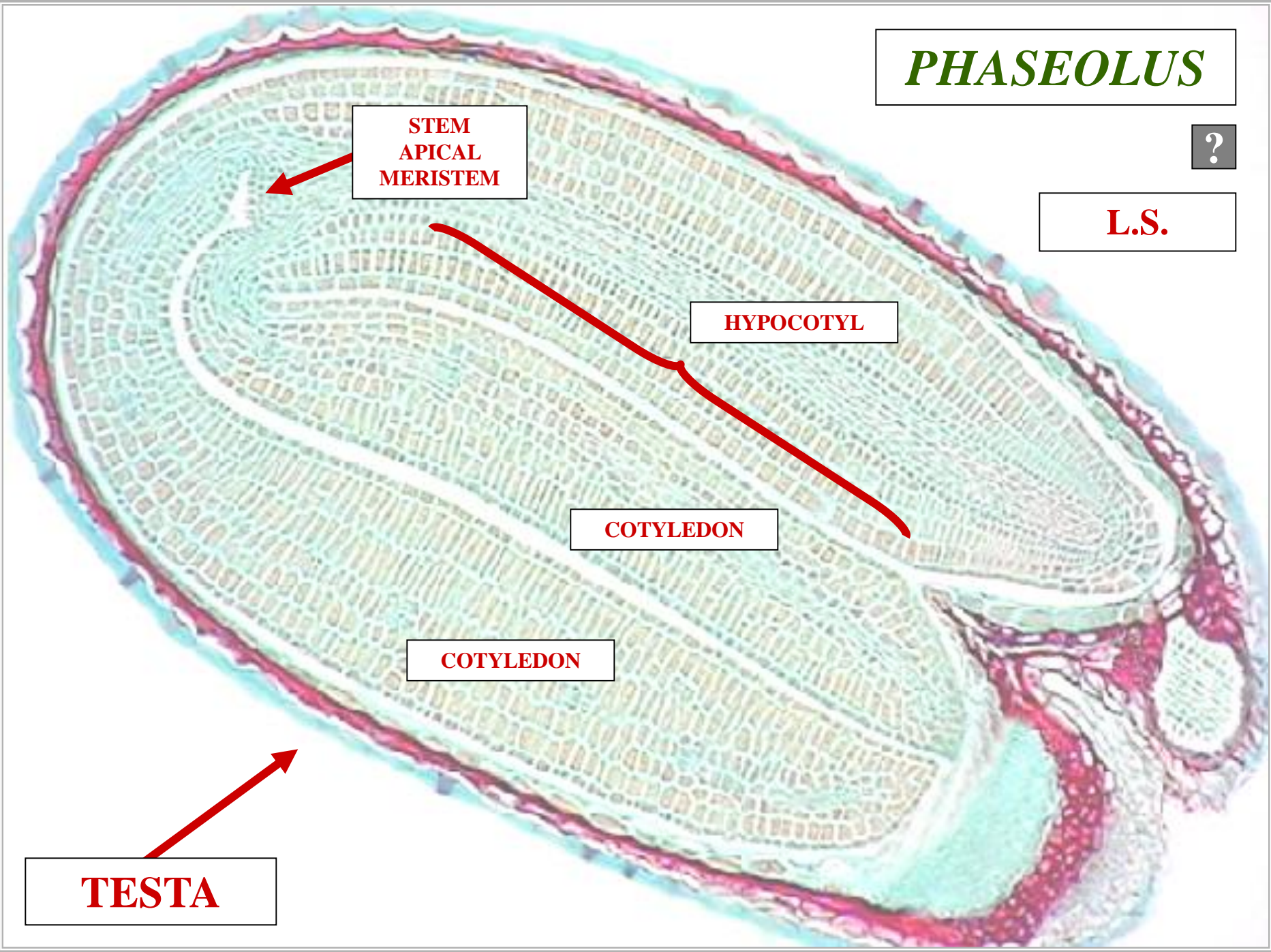
**STEM
APICAL
MERISTEM**

HYPOCOTYL

COTYLEDON

COTYLEDON

TESTA



PHASEOLUS

R

L.S.

**STEM
APICAL
MERISTEM**

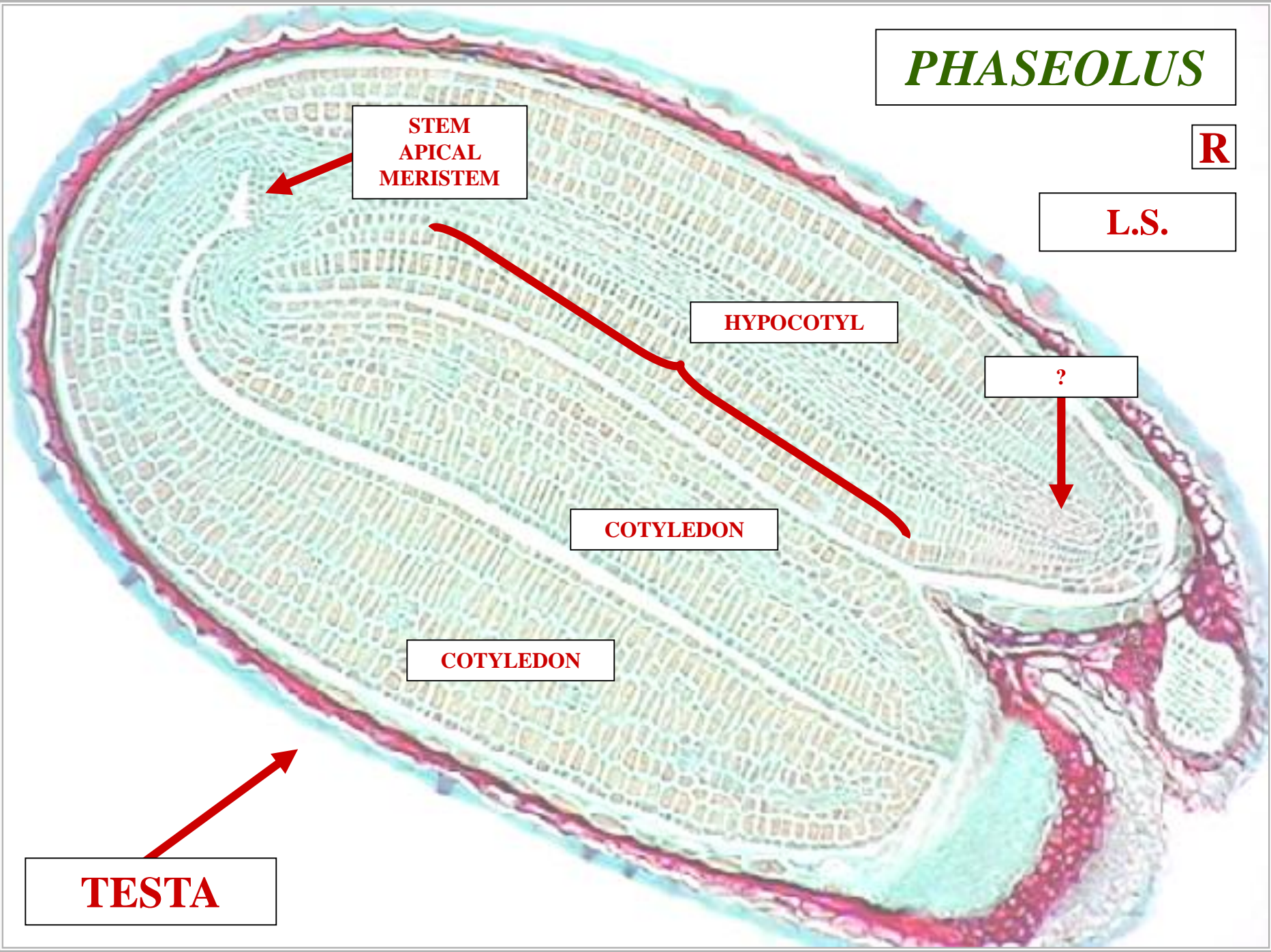
HYPOCOTYL

COTYLEDON

COTYLEDON

?

TESTA



PHASEOLUS

?

L.S.

STEM
APICAL
MERISTEM

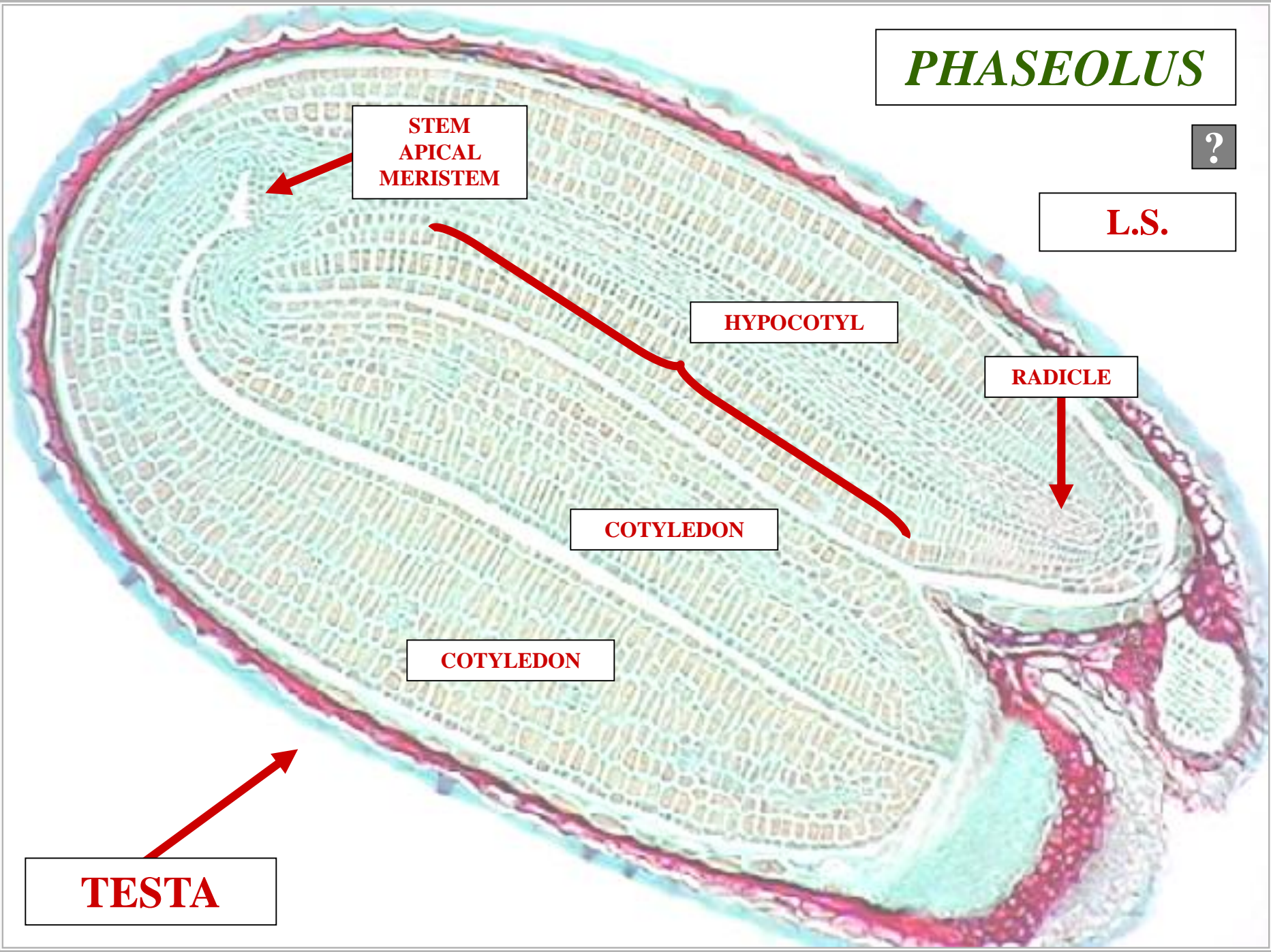
HYPOCOTYL

RADICLE

COTYLEDON

COTYLEDON

TESTA



PHASEOLUS

R

L.S.

**STEM
APICAL
MERISTEM**

HYPOCOTYL

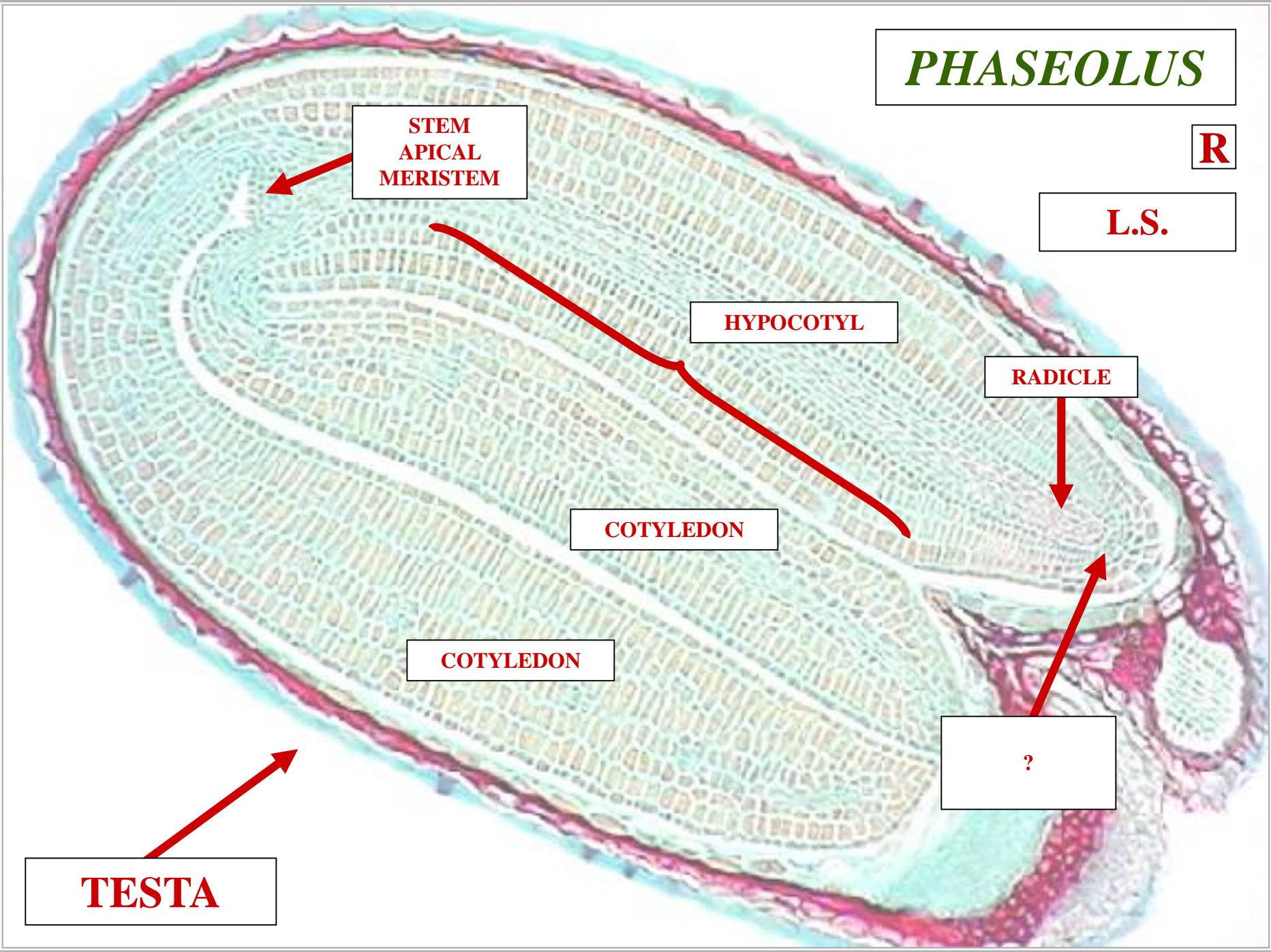
RADICLE

COTYLEDON

COTYLEDON

?

TESTA



PHASEOLUS



L.S.

**STEM
APICAL
MERISTEM**

HYPOCOTYL

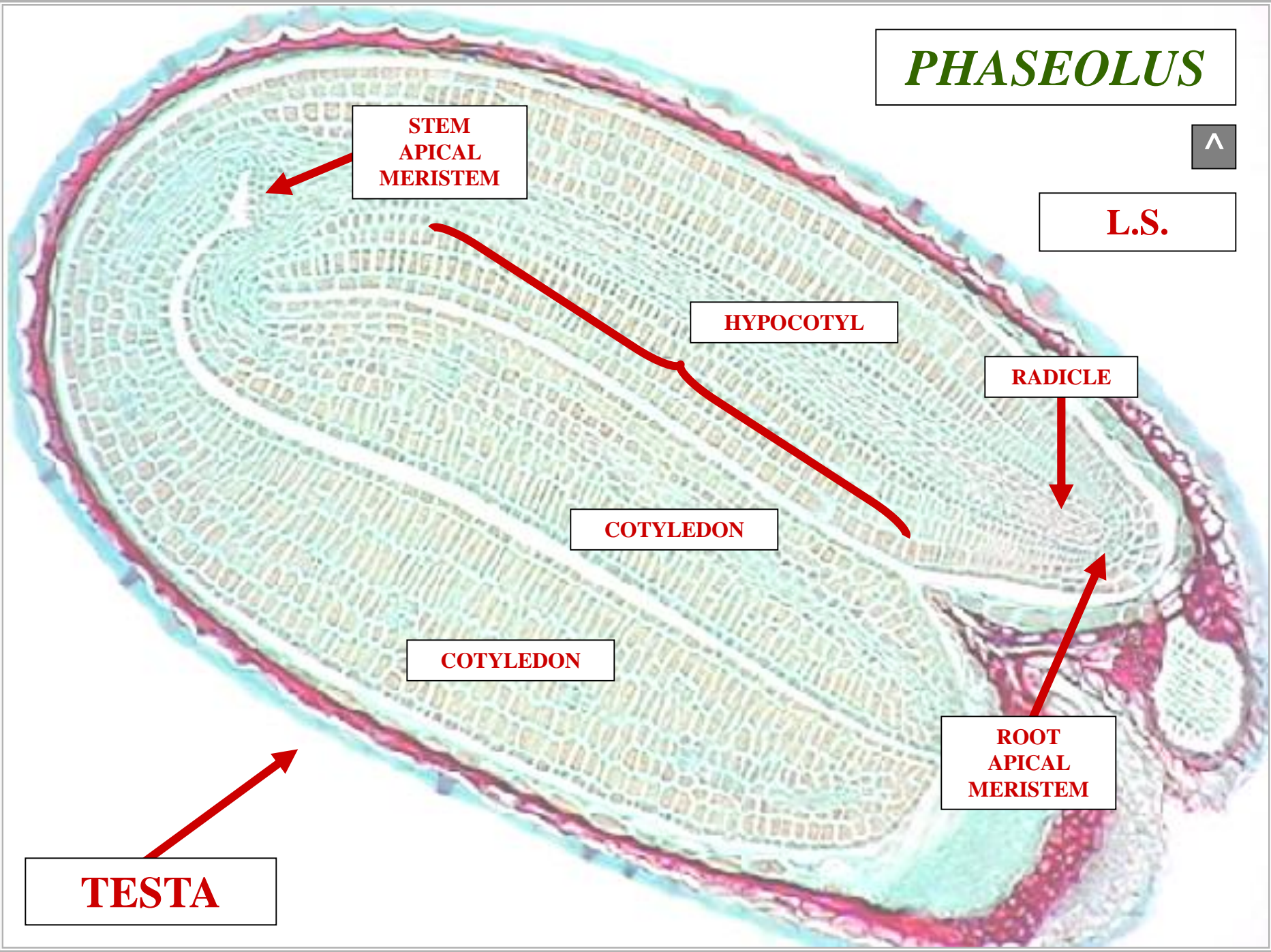
RADICLE

COTYLEDON

COTYLEDON

**ROOT
APICAL
MERISTEM**

TESTA





MONOCOT SEED ANATOMY



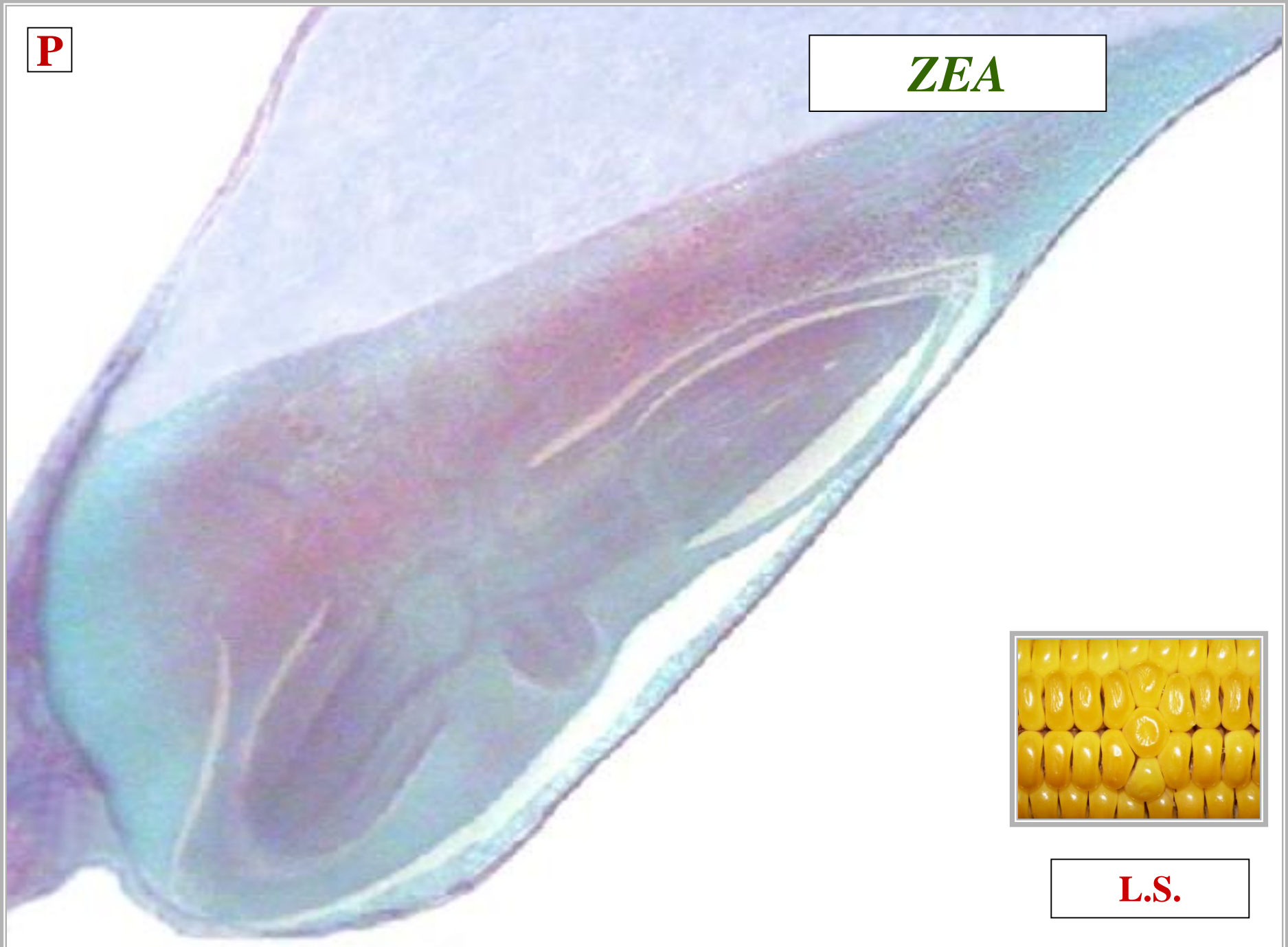
ZEA



ZEA

P

ZEA



L.S.

?

ZEA

PERICARP



L.S.

E

ZEA

PERICARP



?



L.S.

E

ZEA

PERICARP

ENDOSPERM



L.S.

?

ZEA

PERICARP

ENDOSPERM

MATURE
EMBRYO



L.S.

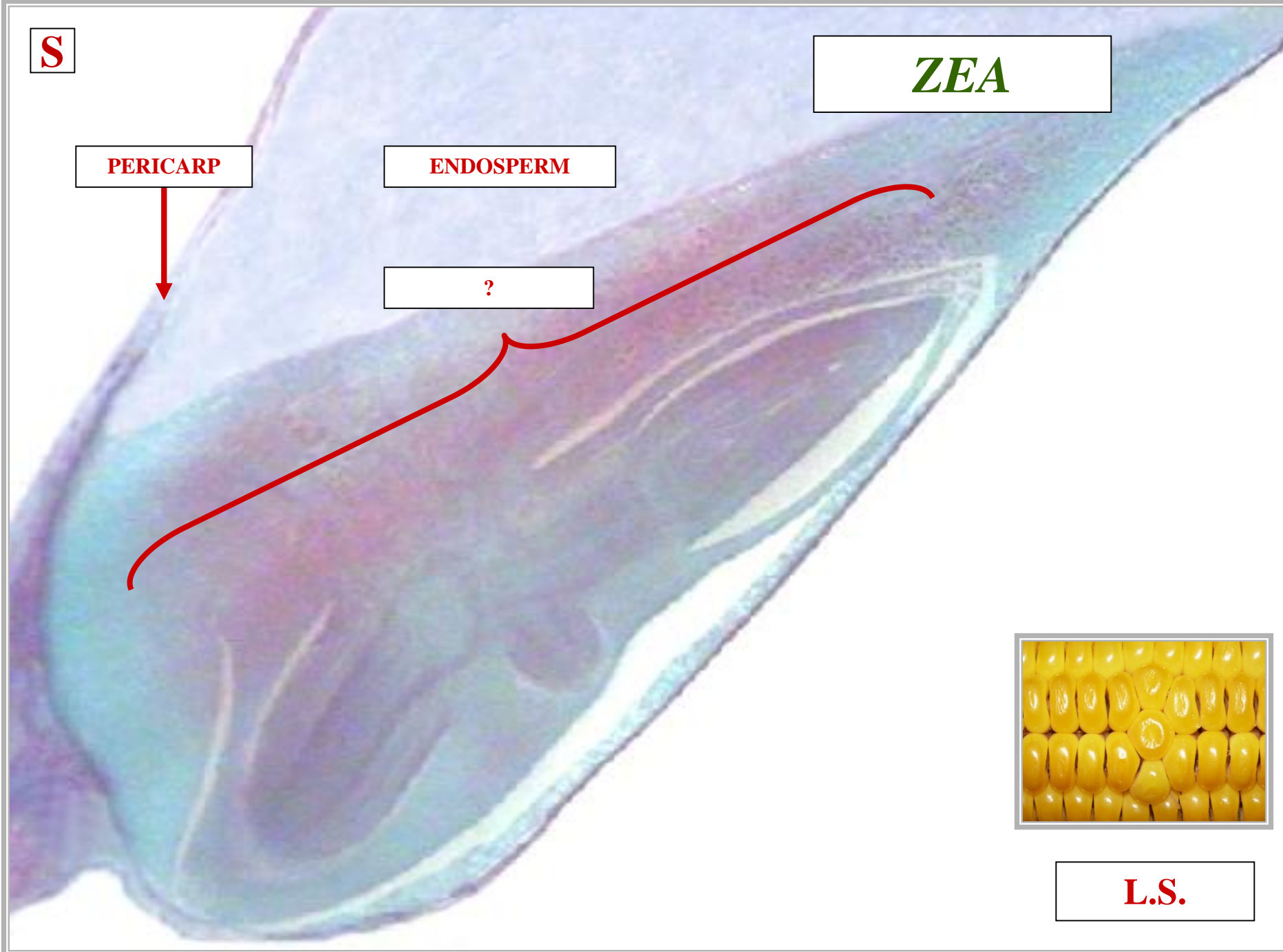
S

ZEA

PERICARP

ENDOSPERM

?



L.S.

S

ZEA

PERICARP

ENDOSPERM

SCUTELLUM



L.S.

SCUTELLUM



**ANGIOSPERM
MONOCOT SEED**

COTYLEDON

ABSORBS

ENDOSPERM

**ANGIOSPERM
MONOCOT SEED**

C

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

?



L.S.

C

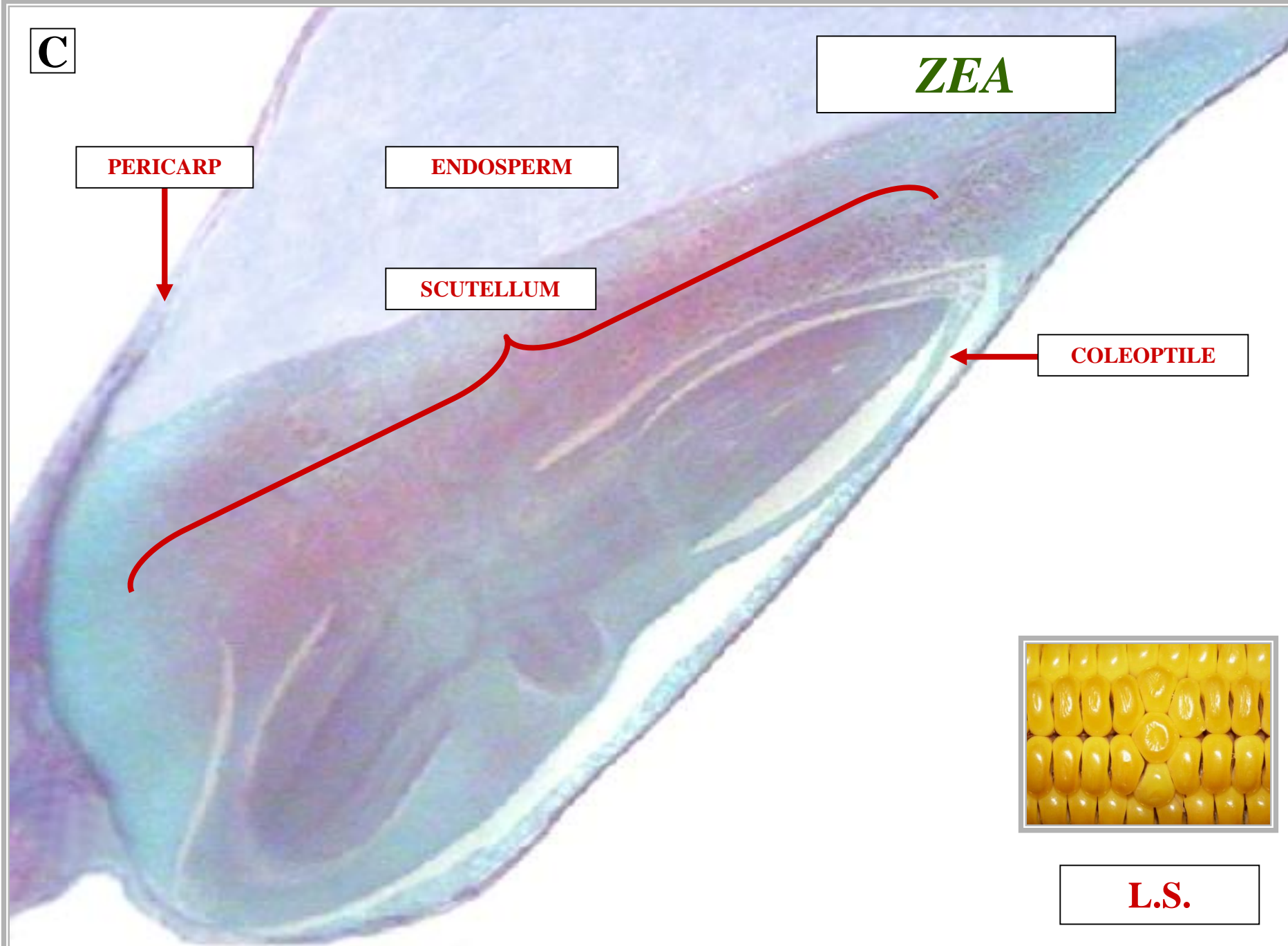
ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE



L.S.

COLEOPTILE



**ANGIOSPERM
MONOCOT SEED**

**SHEATH
PROTECTS
PLUMULE**

**ANGIOSPERM
MONOCOT SEED**

P

ZEA

PERICARP

ENDOSPERM

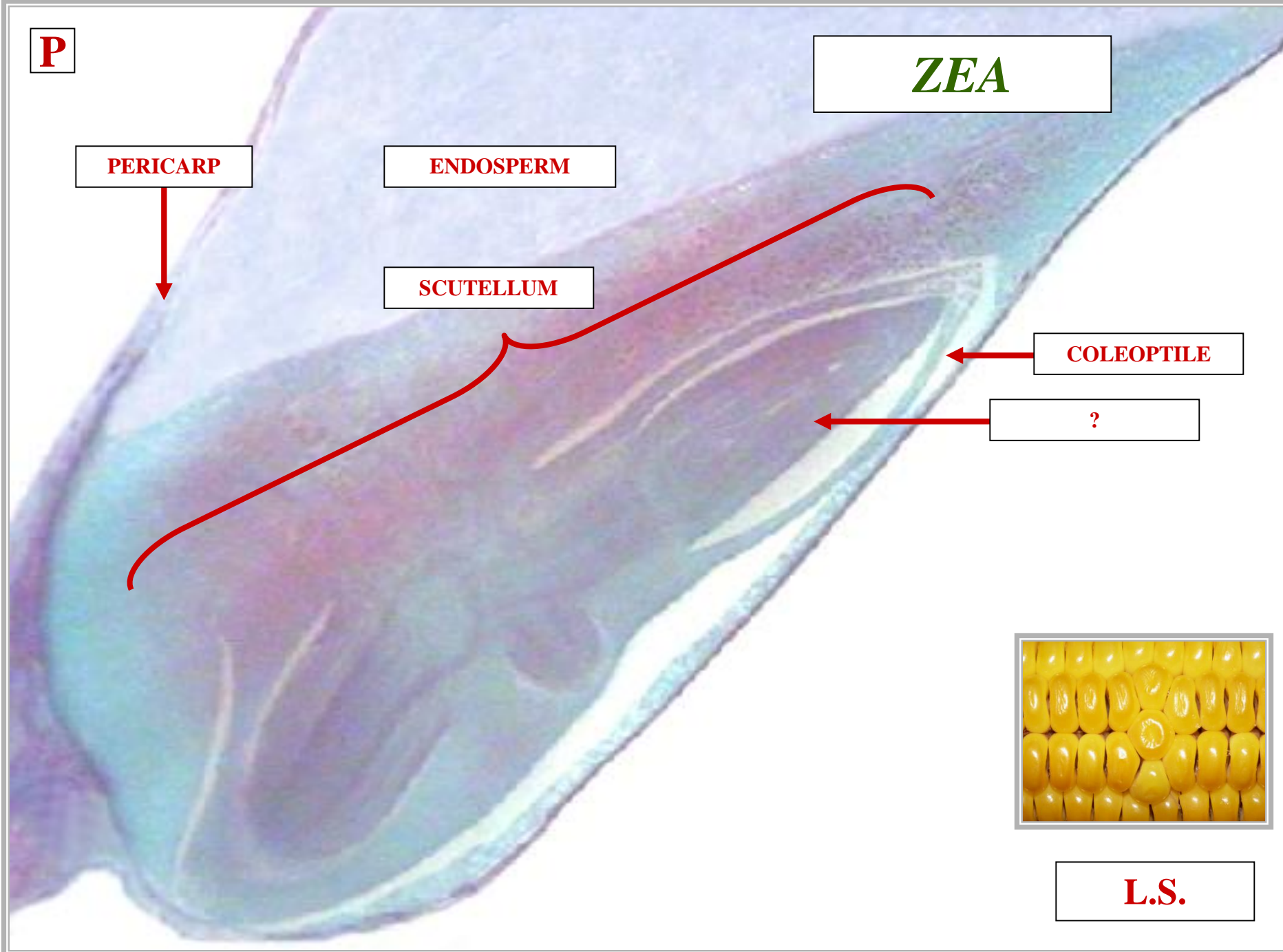
SCUTELLUM

COLEOPTILE

?



L.S.



P

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE



L.S.

PLUMULE



**ANGIOSPERM
MONOCOT SEED**

**EMBRYO
SHOOT / STEM**

**ANGIOSPERM
MONOCOT SEED**

S

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

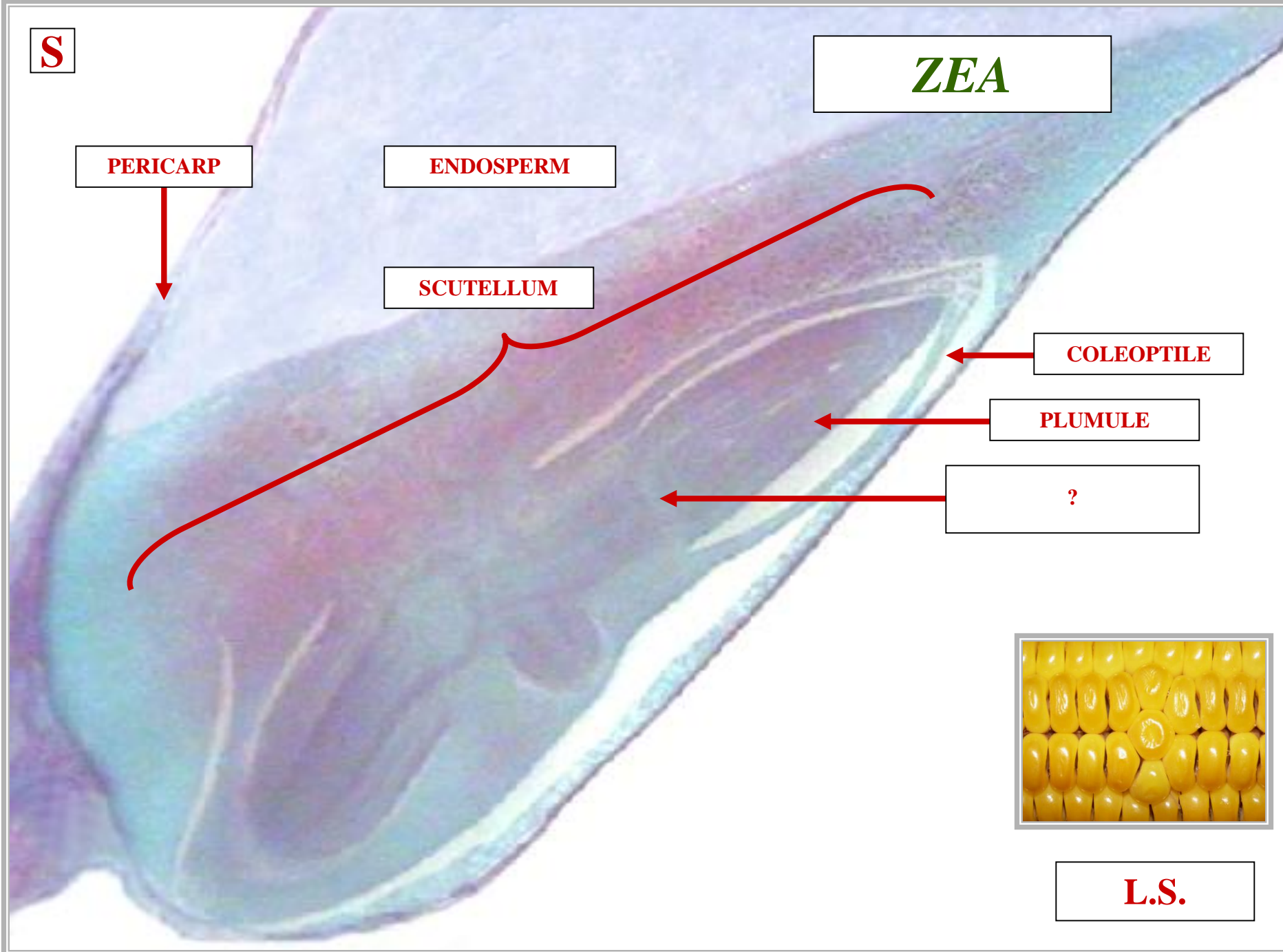
COLEOPTILE

PLUMULE

?



L.S.



?

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

STEM
APICAL MERISTEM



L.S.

M

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

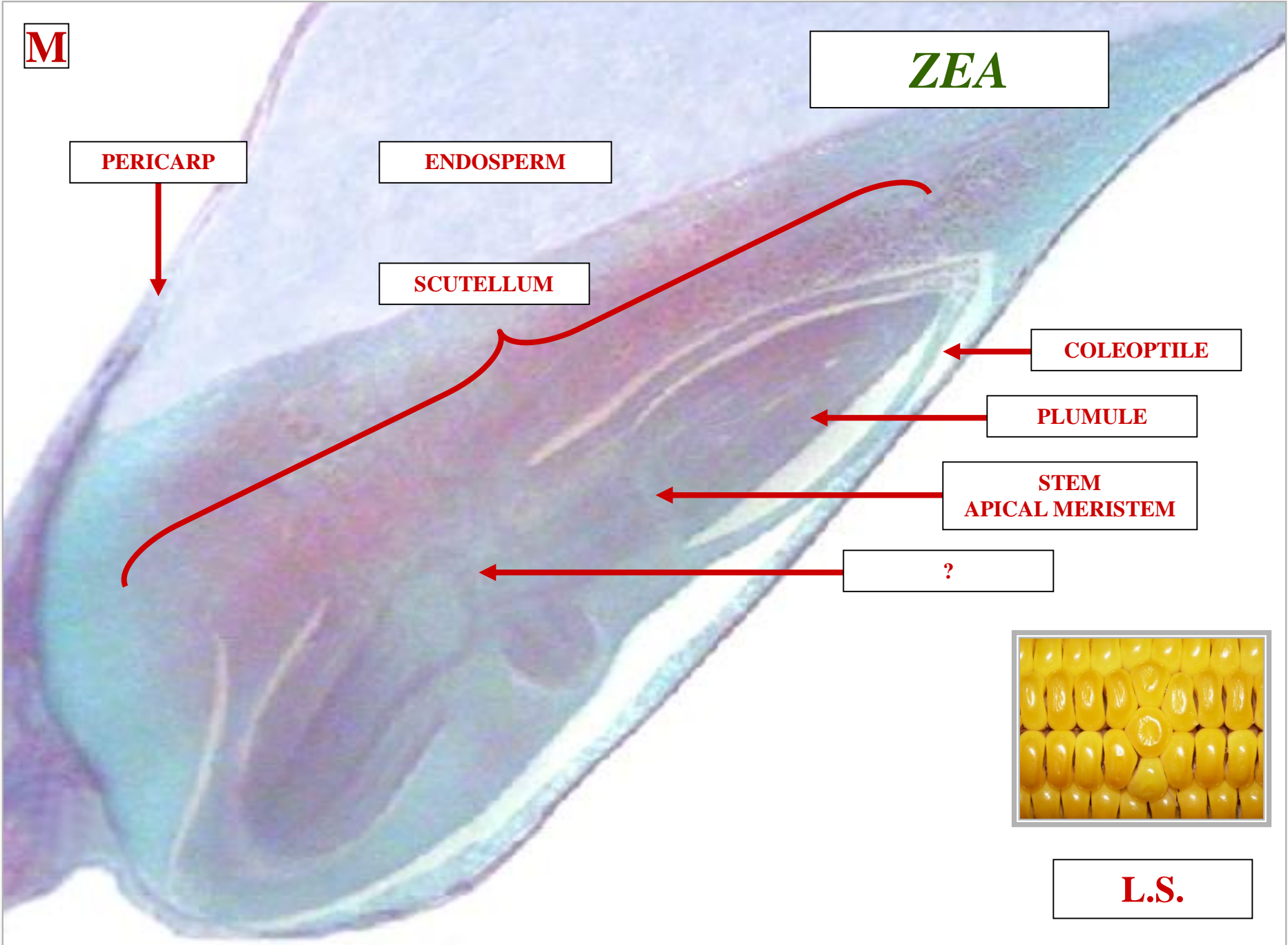
PLUMULE

**STEM
APICAL MERISTEM**

?



L.S.



M

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

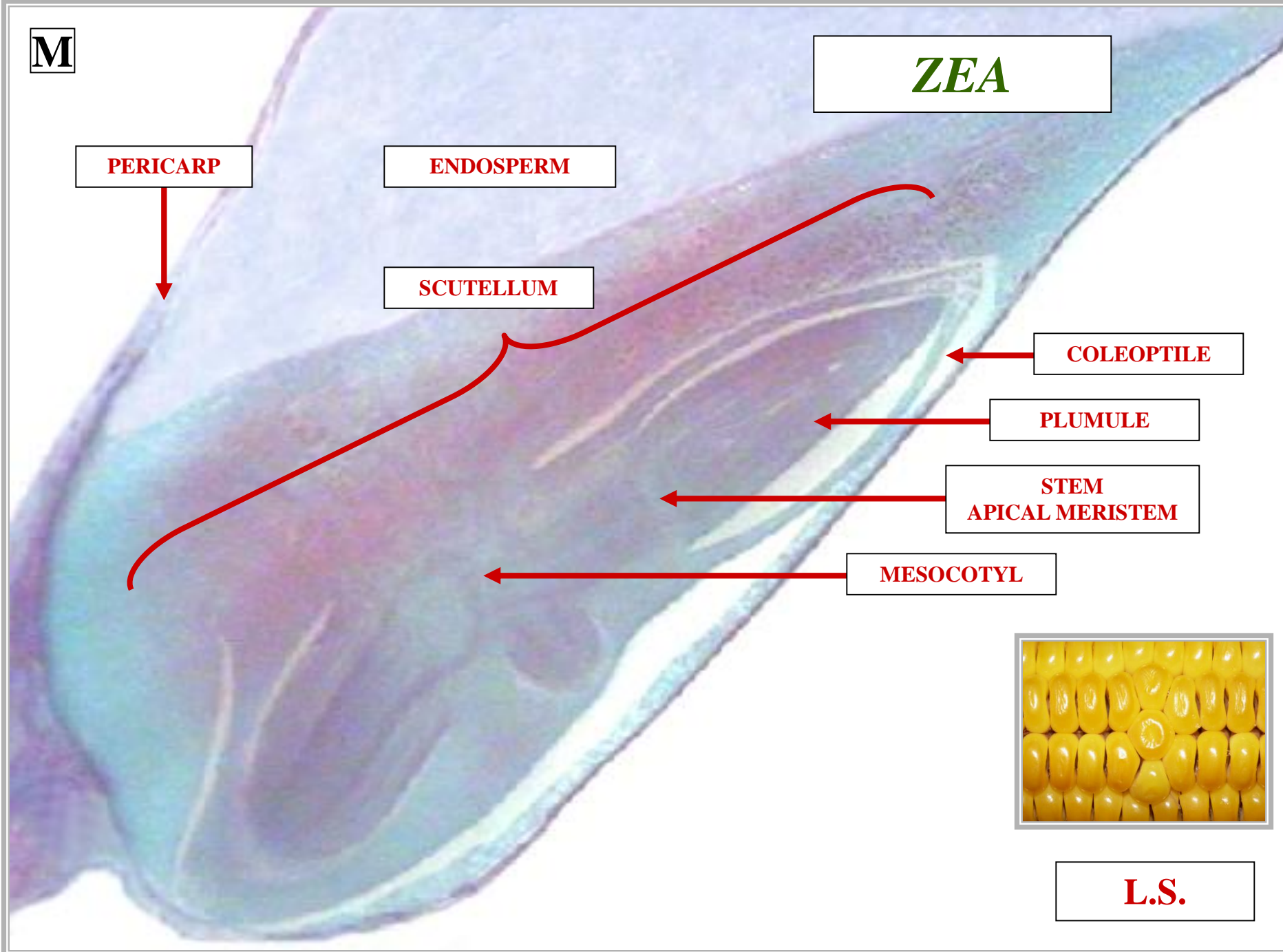
PLUMULE

**STEM
APICAL MERISTEM**

MESOCOTYL



L.S.



MESOCOTYL



**ANGIOSPERM
MONOCOT SEED**

**SCUTELLUM
ATTACHMENT
POINT TO EMBRYO**

**ANGIOSPERM
MONOCOT SEED**

R

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

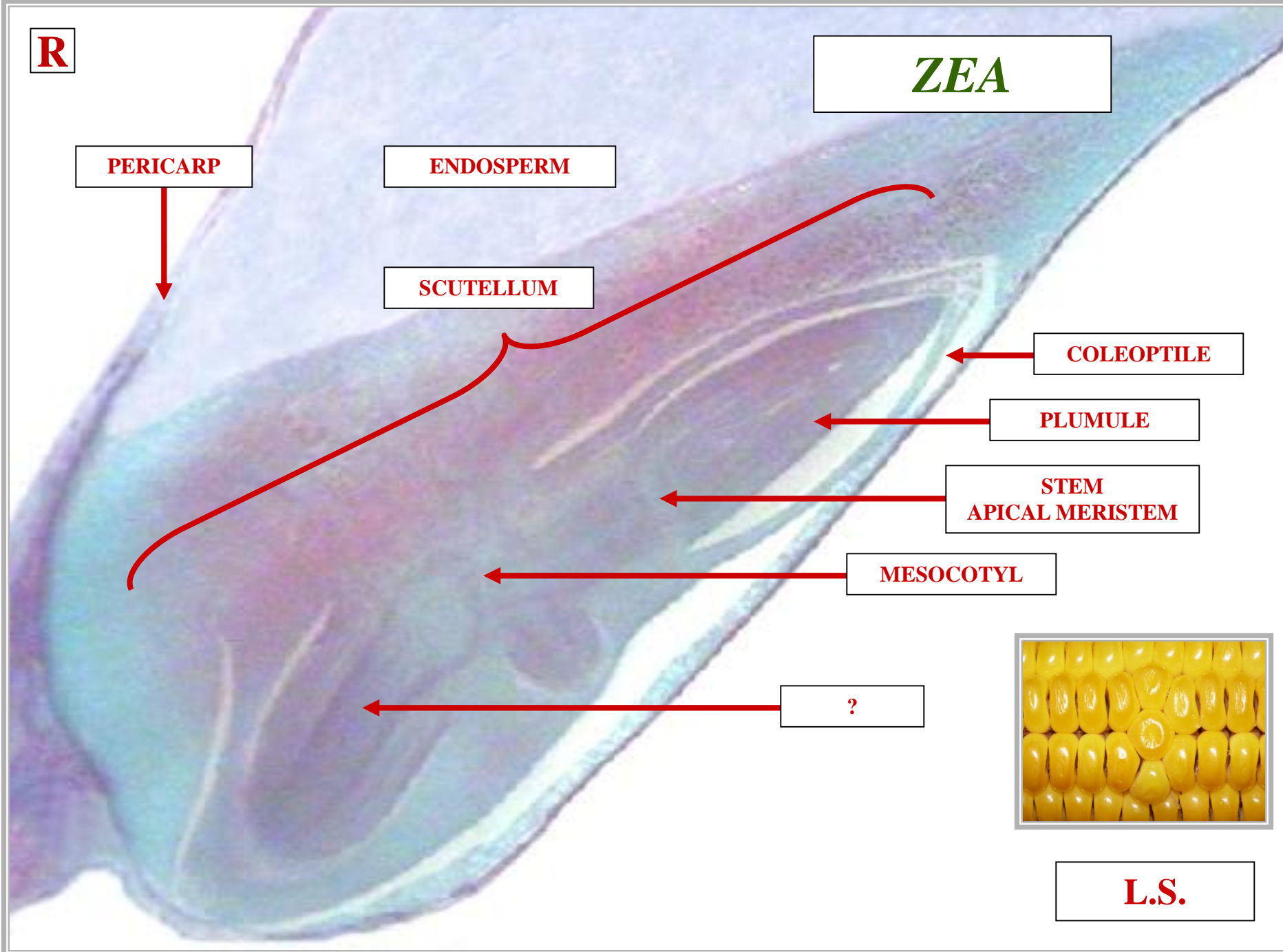
**STEM
APICAL MERISTEM**

MESOCOTYL

?



L.S.



?

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

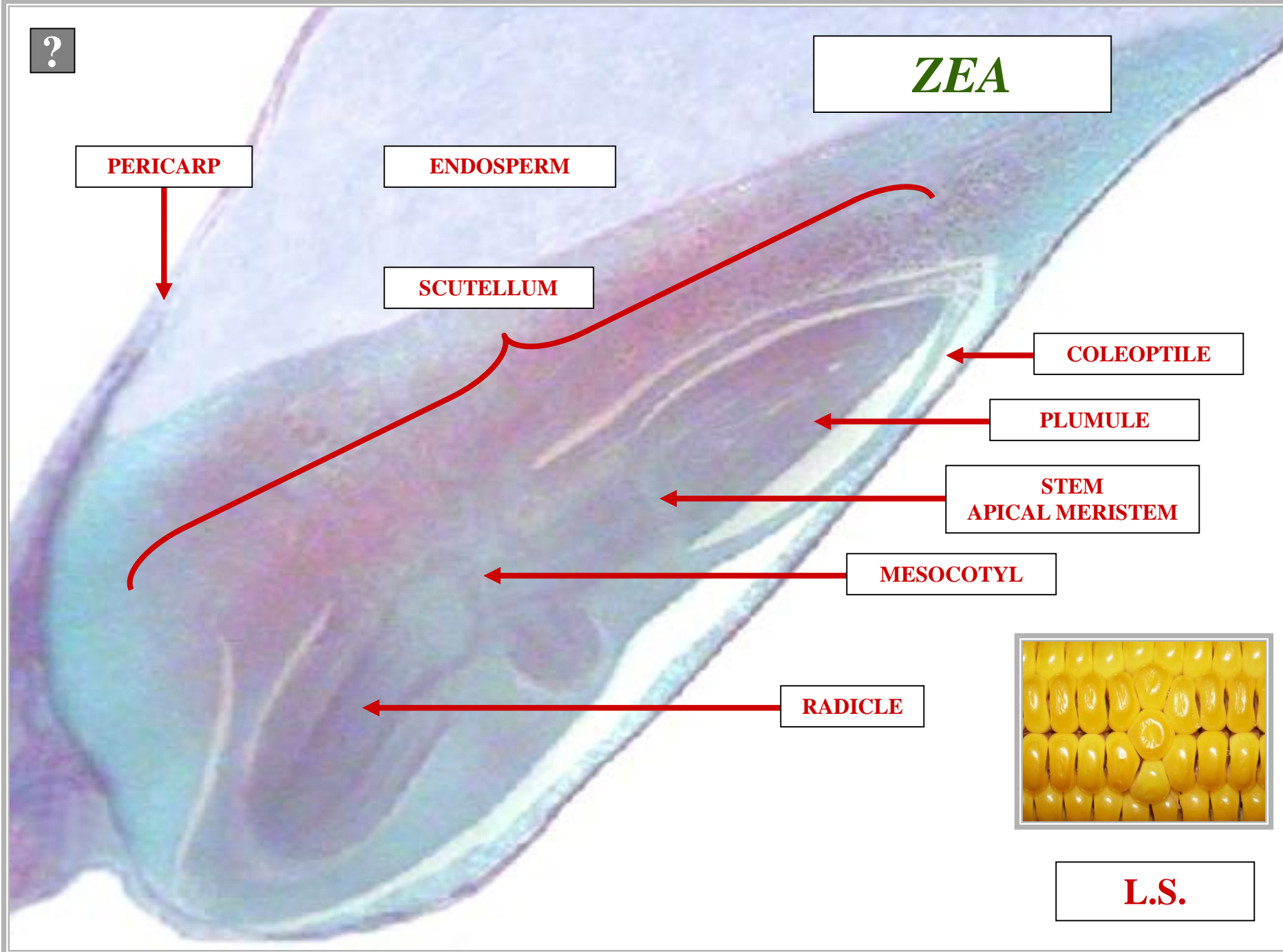
STEM
APICAL MERISTEM

MESOCOTYL

RADICLE



L.S.



R

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

**STEM
APICAL MERISTEM**

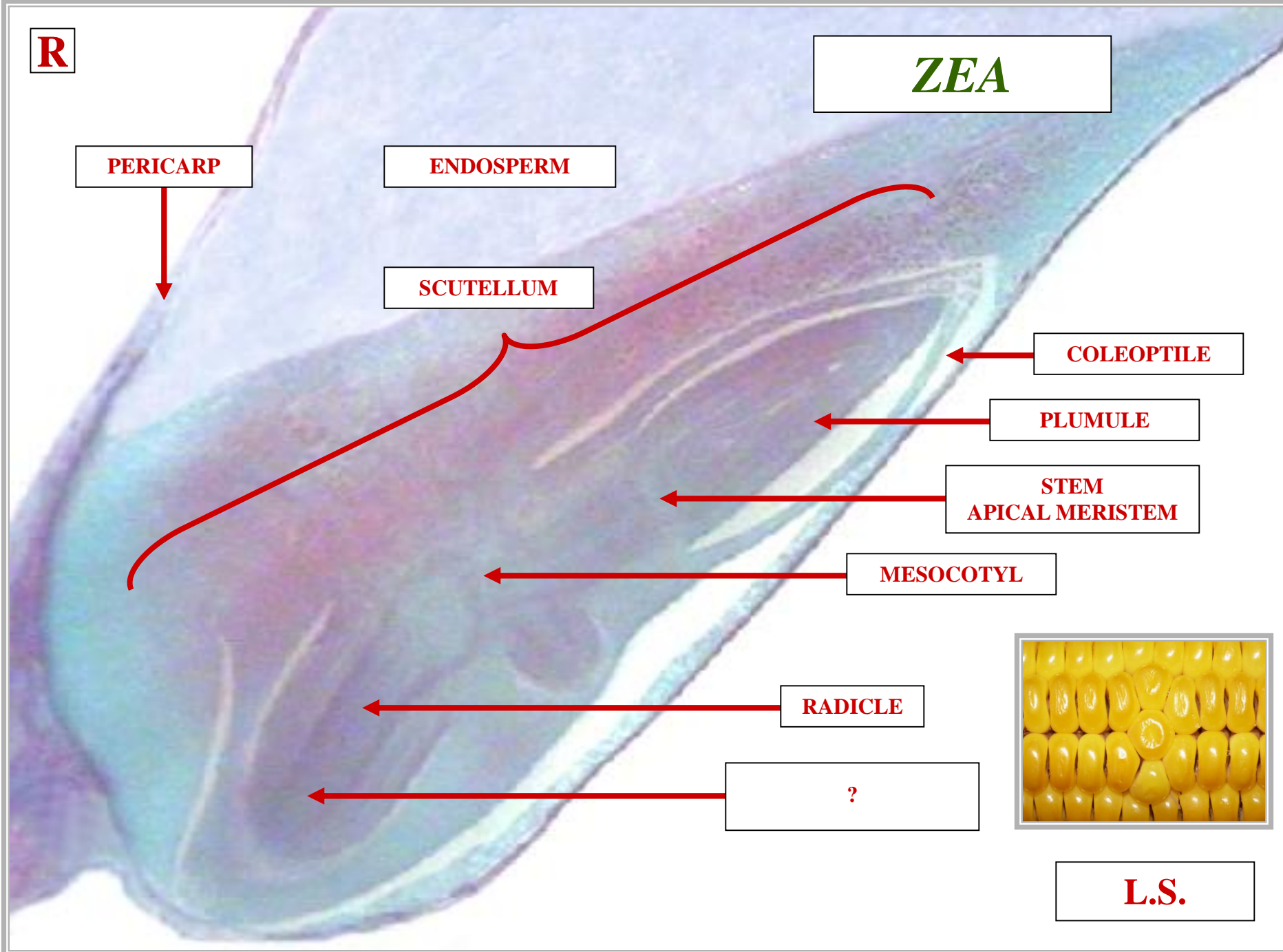
MESOCOTYL

RADICLE

?



L.S.



?

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

STEM
APICAL MERISTEM

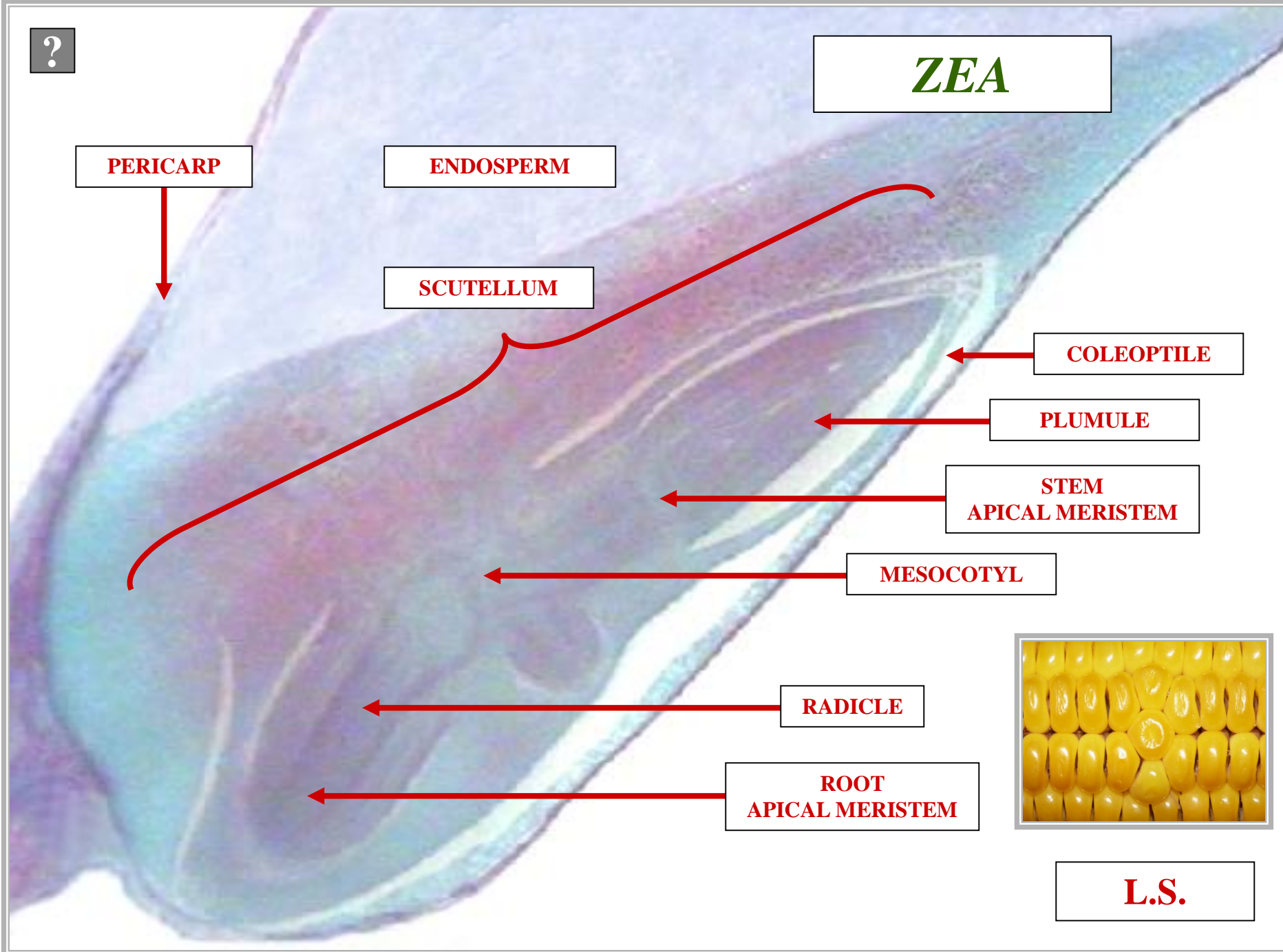
MESOCOTYL

RADICLE

ROOT
APICAL MERISTEM



L.S.



C

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

**STEM
APICAL MERISTEM**

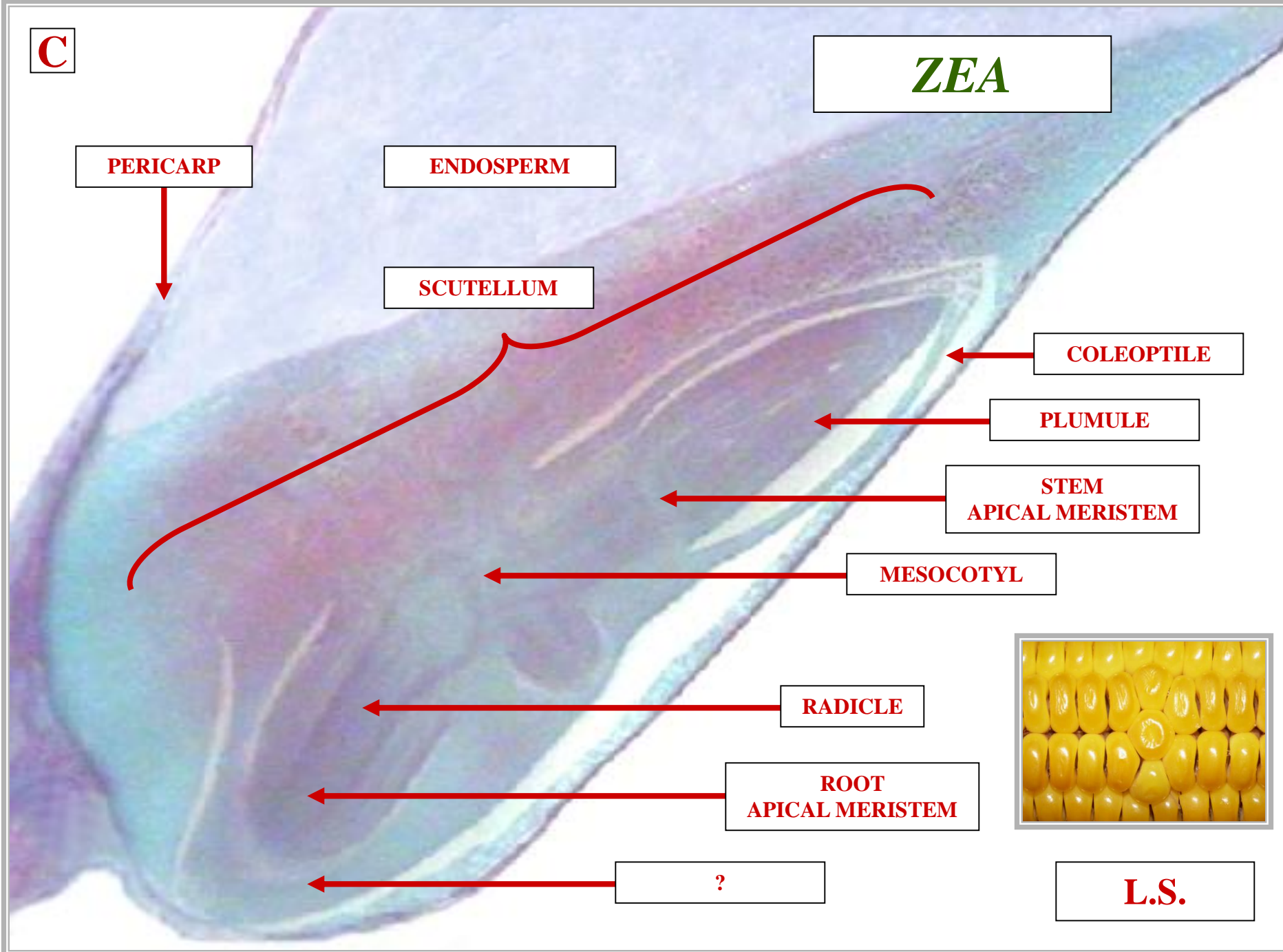
MESOCOTYL

RADICLE

**ROOT
APICAL MERISTEM**

?

L.S.



C

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

**STEM
APICAL MERISTEM**

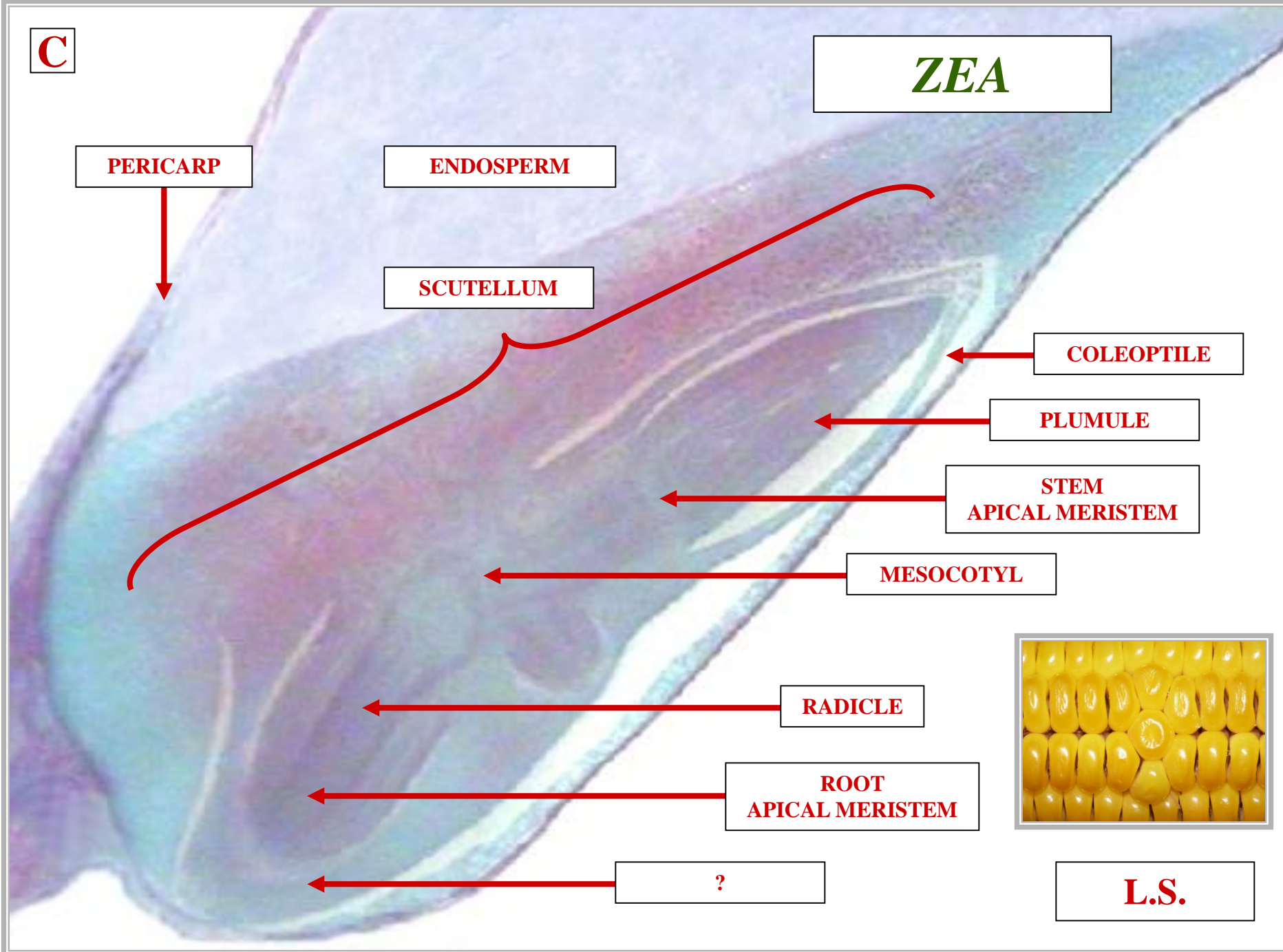
MESOCOTYL

RADICLE

**ROOT
APICAL MERISTEM**

?

L.S.



C

ZEA

PERICARP

ENDOSPERM

SCUTELLUM

COLEOPTILE

PLUMULE

**STEM
APICAL MERISTEM**

MESOCOTYL

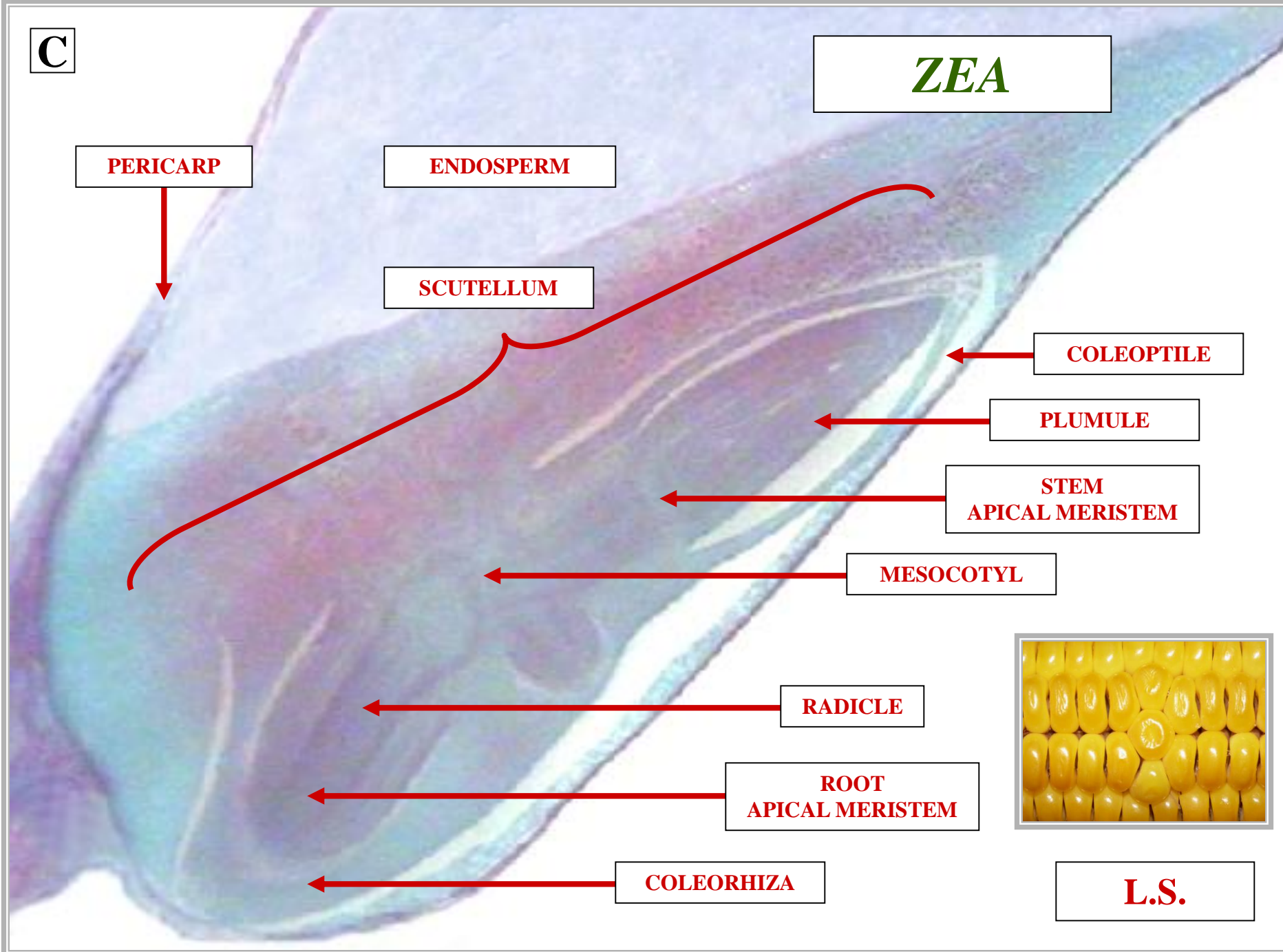
RADICLE

**ROOT
APICAL MERISTEM**

COLEORHIZA



L.S.



COLEORHIZA

**ANGIOSPERM
MONOCOT SEED**



**SHEATH
PROTECTS RADICLE**

**ANGIOSPERM
MONOCOT SEED**



FOSSIL RECORD



~130

MILLION YEARS



PERMIAN



C

TRIASSIC



JURASSIC



?



PERMIAN



TRIASSIC

A



JURASSIC



CRETACEOUS



PERMIAN



TRIASSIC



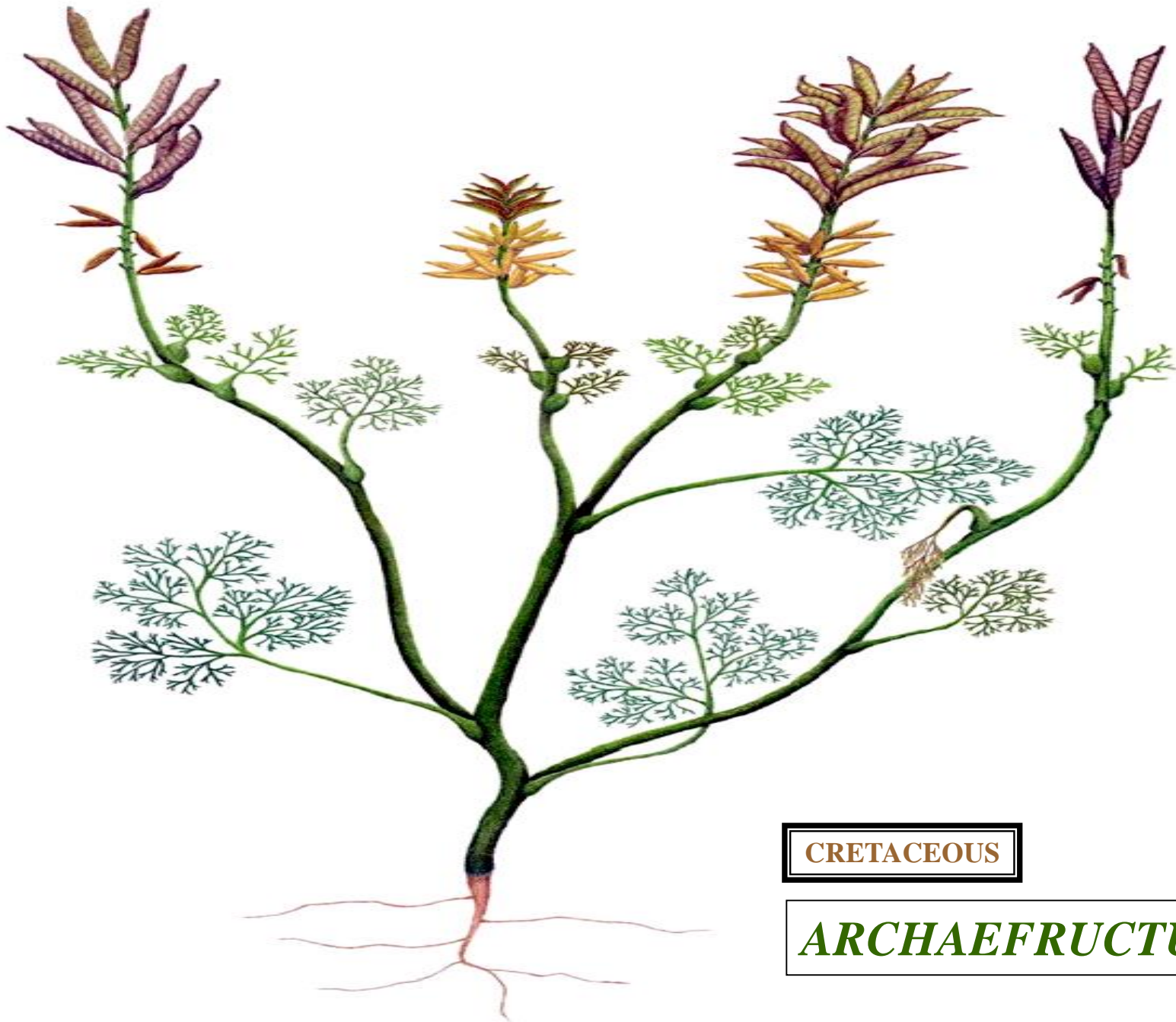
JURASSIC



CRETACEOUS

**ANGIOSPERMS
EVOLVE**





CRETACEOUS

ARCHAEFRUCTUS



OLDEST ANGIOSPERM

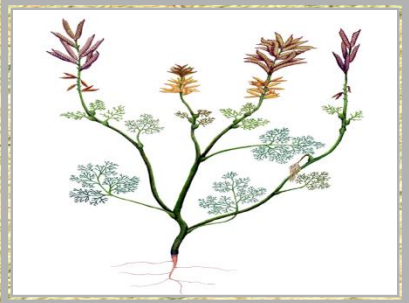
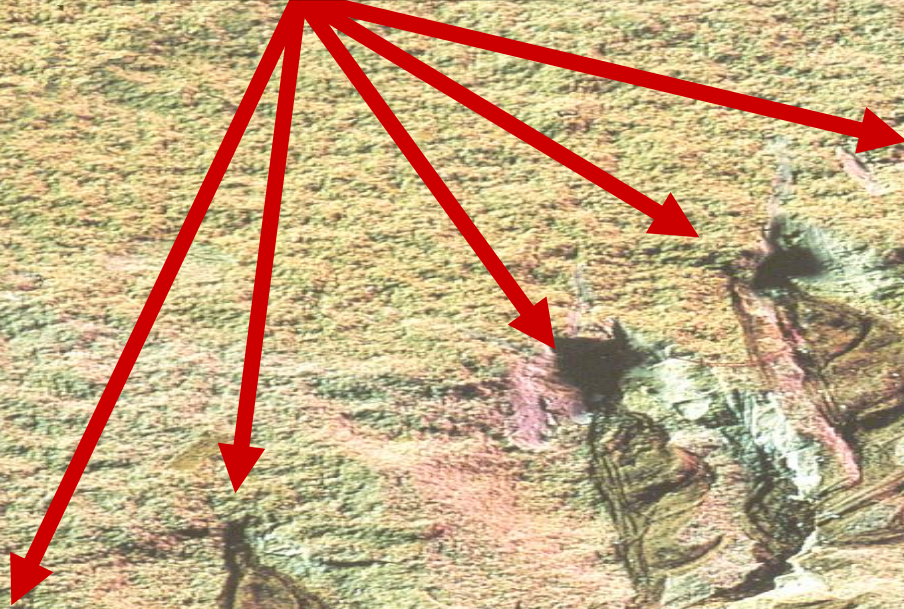
CRETACEOUS

ARCHAEFRUCTUS



A

FRUITS



ARCHAEFRUCTUS



**ANGIOSPERMS
ABRUPT & DIVERSE
CRETACEOUS
FOSSIL RECORD**

**END
MATERIAL
FINAL
EXAM**