



**HIGHLY
TAPPED
END WALL**

**LESS
TAPPED
END WALL**

**VESSEL
MEMBER**

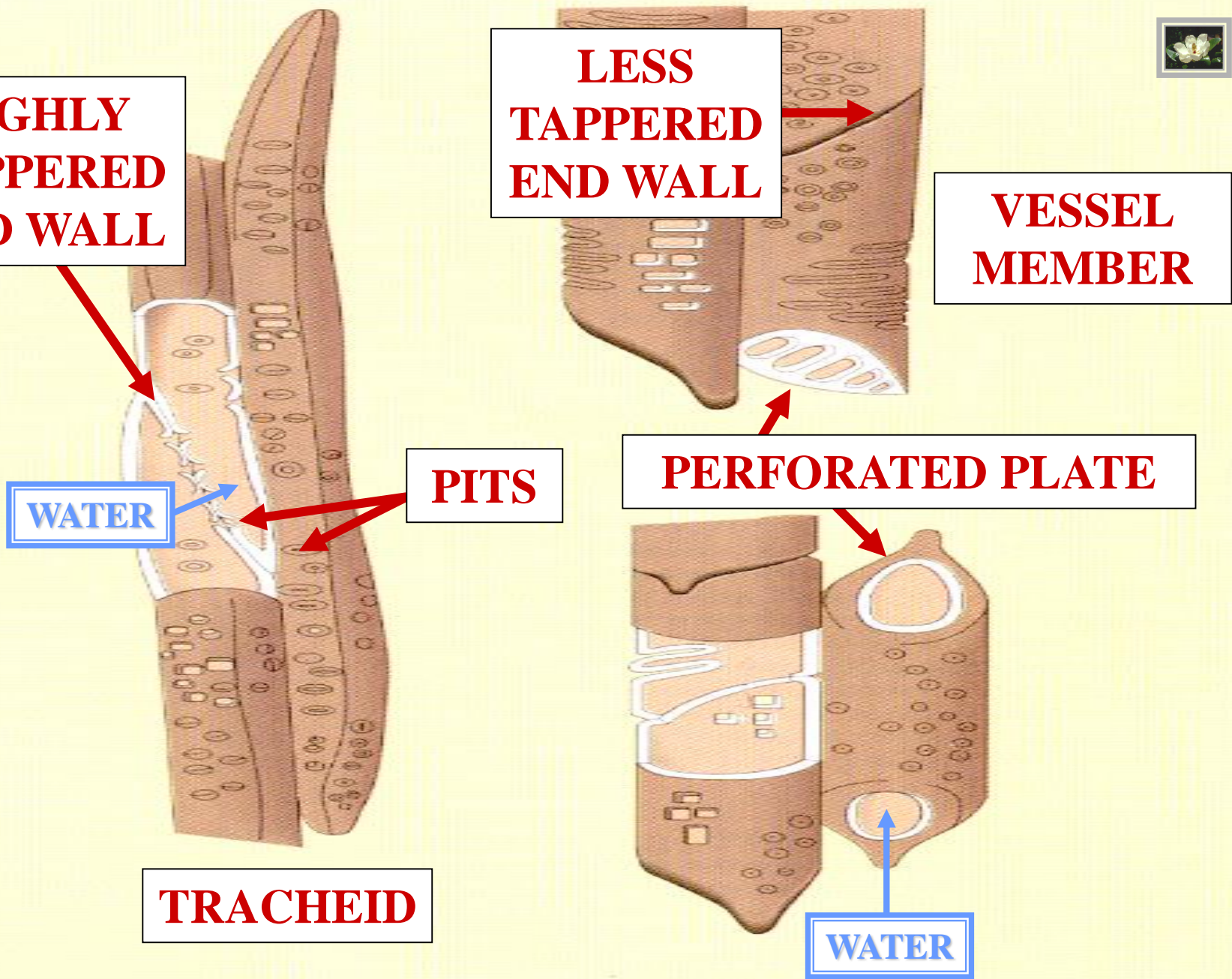
WATER

PITS

PERFORATED PLATE

TRACHEID

WATER





TRACHEIDS & VESSEL MEMBERS



PHLOEM

NUCLEUS

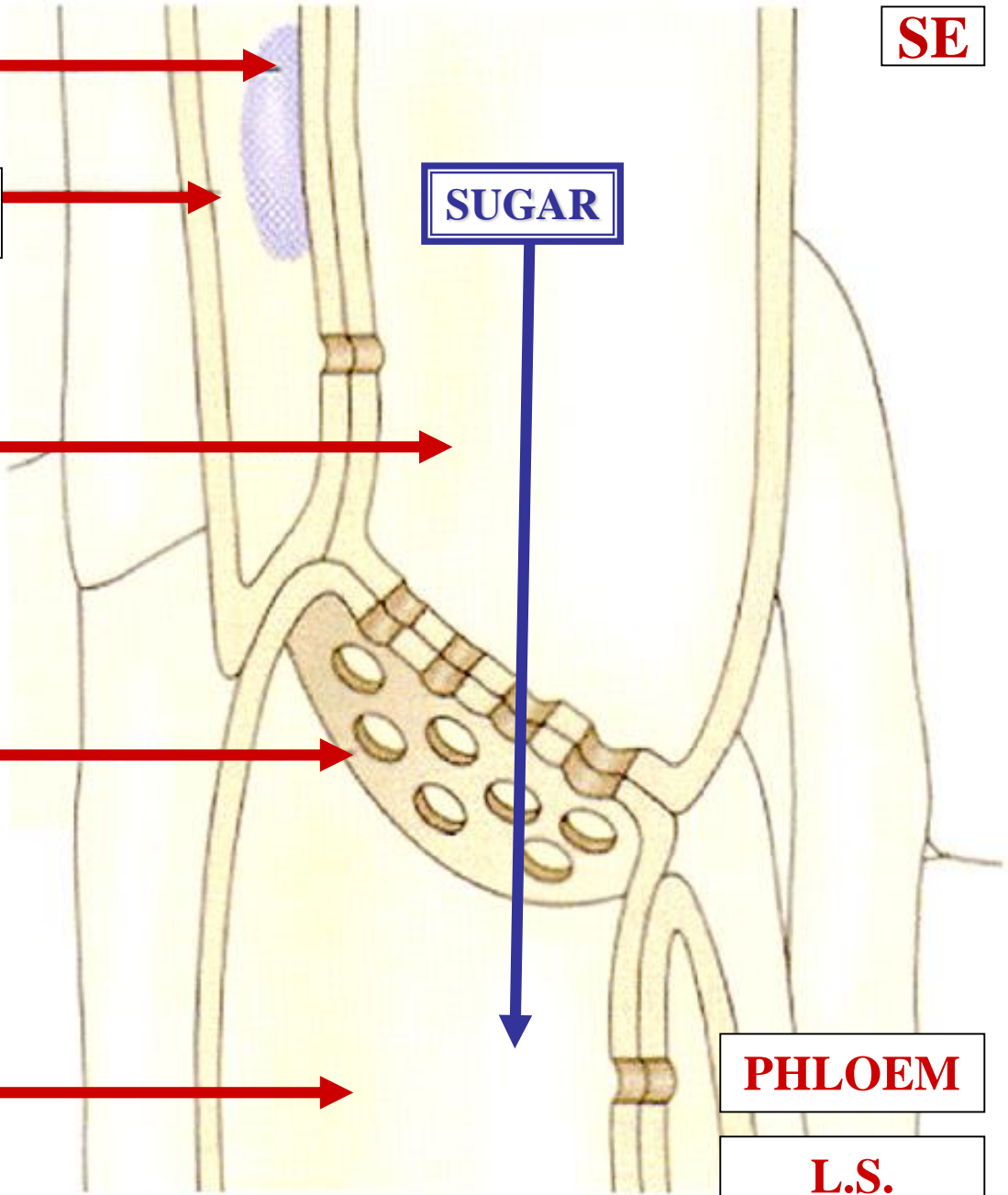
SE

SUGAR

END WALL

PHLOEM

L.S.



NUCLEUS

SC

SUGAR

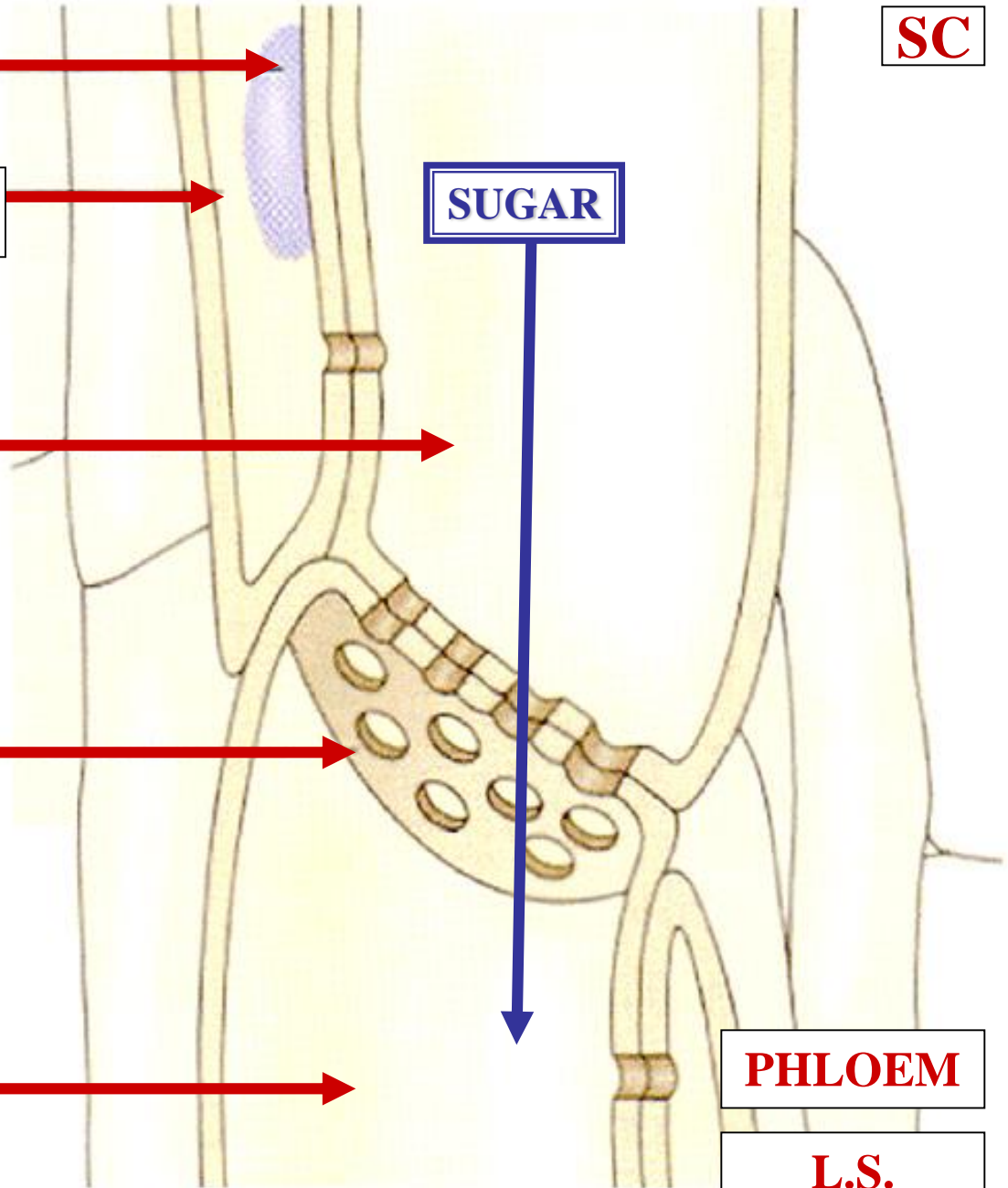
SIEVE ELEMENTS

END WALL

SIEVE ELEMENTS

PHLOEM

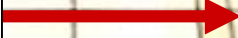
L.S.



NUCLEUS



ALBUMINOUS CELL



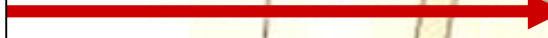
SUGAR



SIEVE CELL



**SIEVE AREA
SMALL PORES**



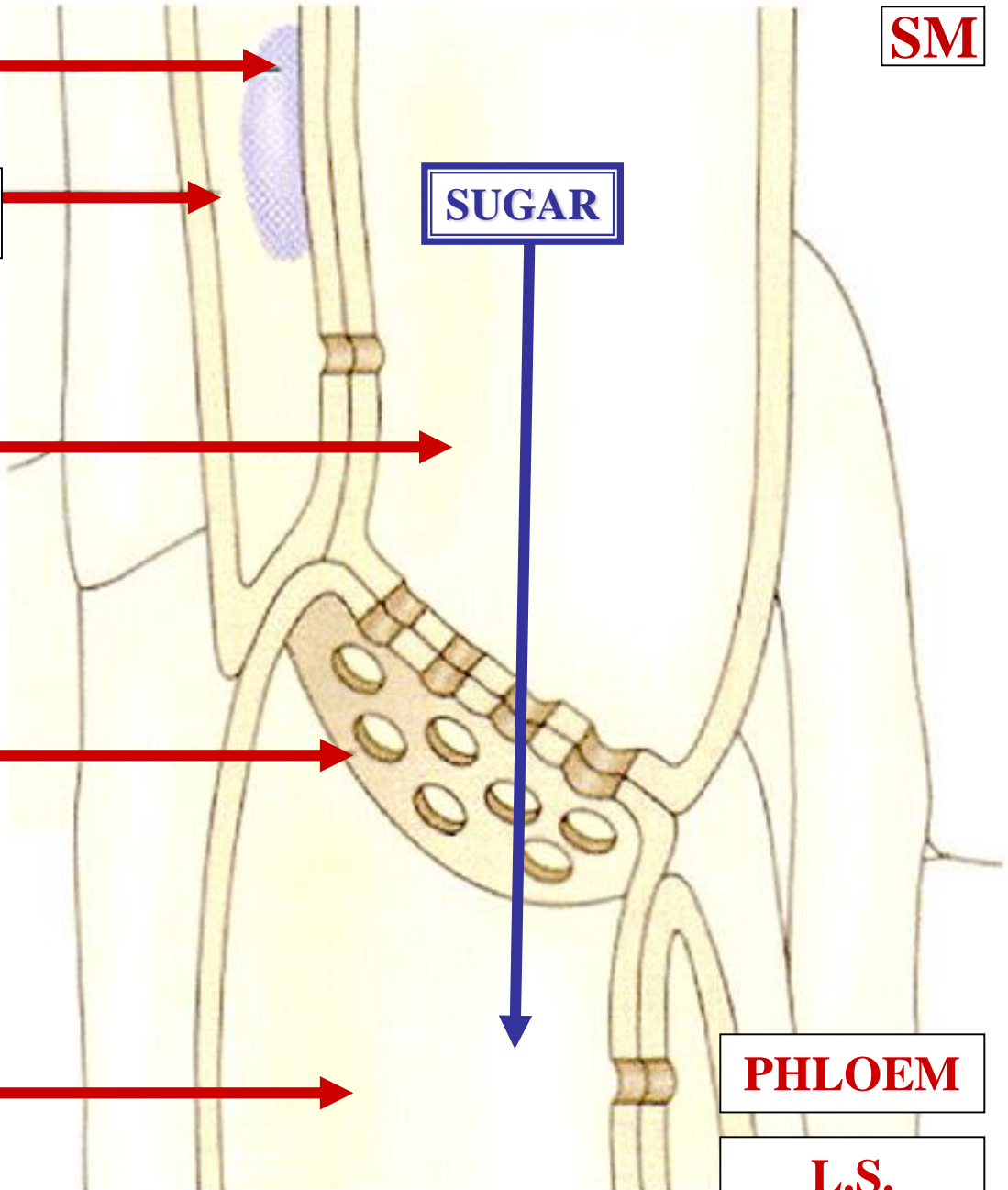
SIEVE CELL



PHLOEM

L.S.

SM





NUCLEUS



CAMPANION CELL



SUGAR



SIEVE MEMBER



**SIEVE PLATE
LARGE PORES**

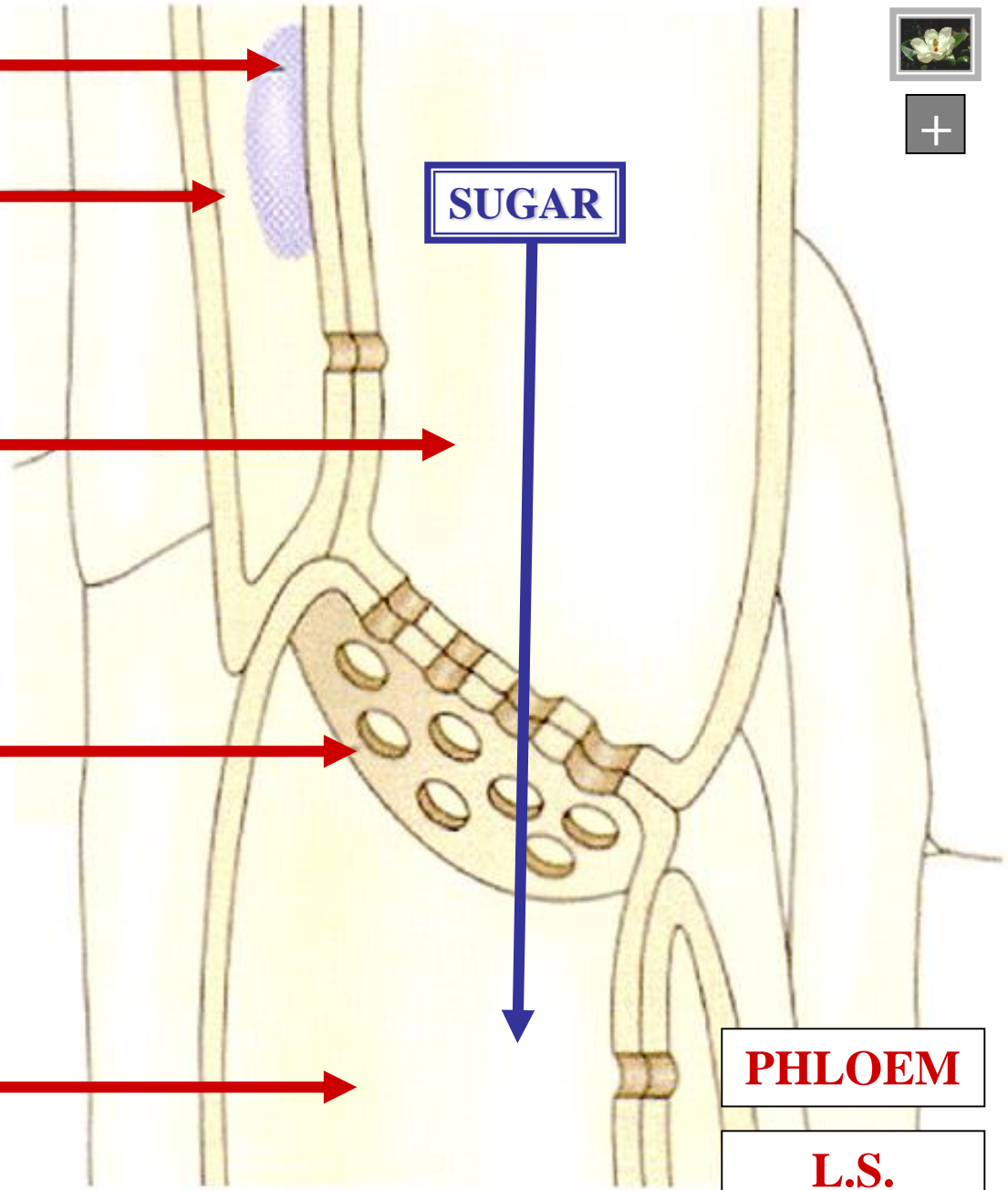


SIEVE MEMBER



PHLOEM

L.S.







SIEVE MEMBERS & COMPANION CELLS

DIAGNOSTIC TO ANGIOSPERMS



SIEVE MEMBERS & COMPANION CELLS



GROWTH



GROWTH TYPE



HERBACEOUS PLANTS



PERIDERM

**VASCULAR
CAMBIUM**

**CORK
CAMBIUM**

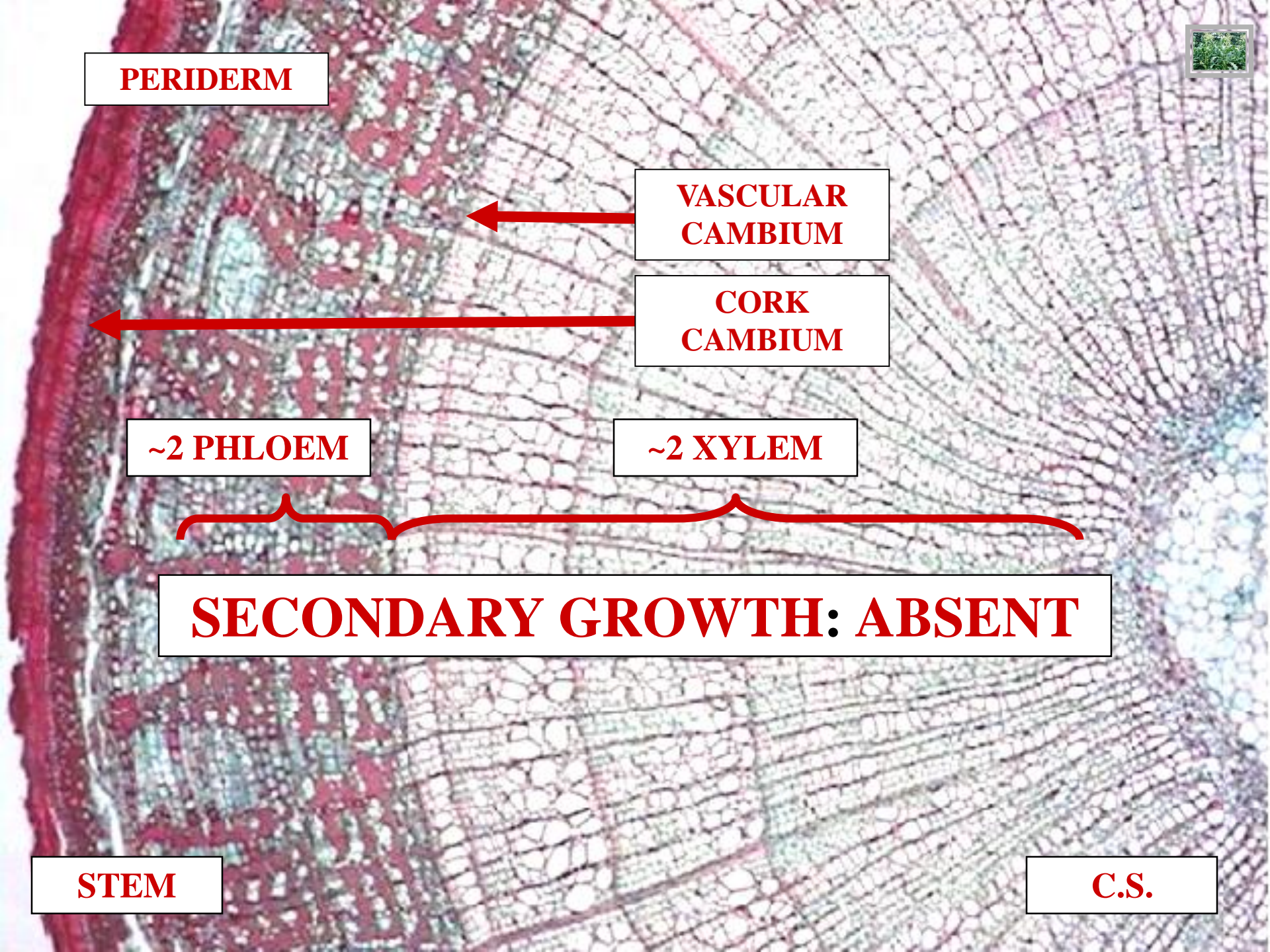
~2 PHLOEM

~2 XYLEM

SECONDARY GROWTH: ABSENT

STEM

C.S.





**HERBACEOUS
PLANT**



WOODY PLANTS



PERIDERM

**VASCULAR
CAMBIUM**

**CORK
CAMBIUM**

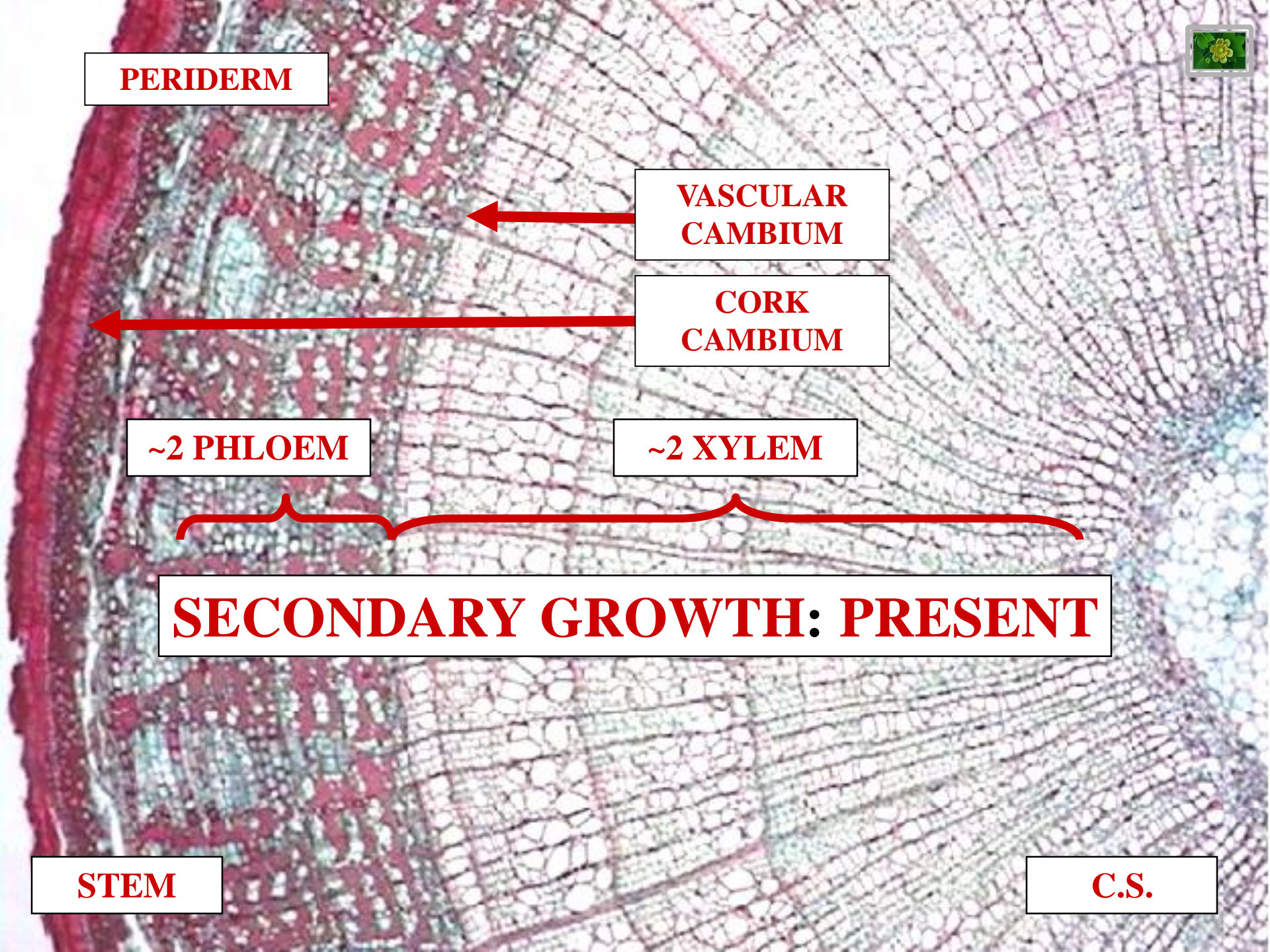
~2 PHLOEM

~2 XYLEM

SECONDARY GROWTH: PRESENT

STEM

C.S.





WOODY PLANT





GROWTH HABIT

ANNUAL PLANT

ANNUAL PLANT

GROWTH HABIT
ANNUAL



EG

COMPLETES
LIFE CYCLE
1 SEASONS

GROWTH HABIT
ANNUAL



ANNUAL PLANT



BIENNIAL PLANT

BIENNIAL PLANT

GROWTH HABIT
BIENNIAL

COMPLETES
LIFE CYCLE
2 SEASONS

GROWTH HABIT
BIENNIAL



EG

BIENNIAL PLANT FIRST SEASON

BASAL LEAF ROSSETTE

2



STORAGE ROOT



EG

BIENNIAL PLANT SECOND SEASON



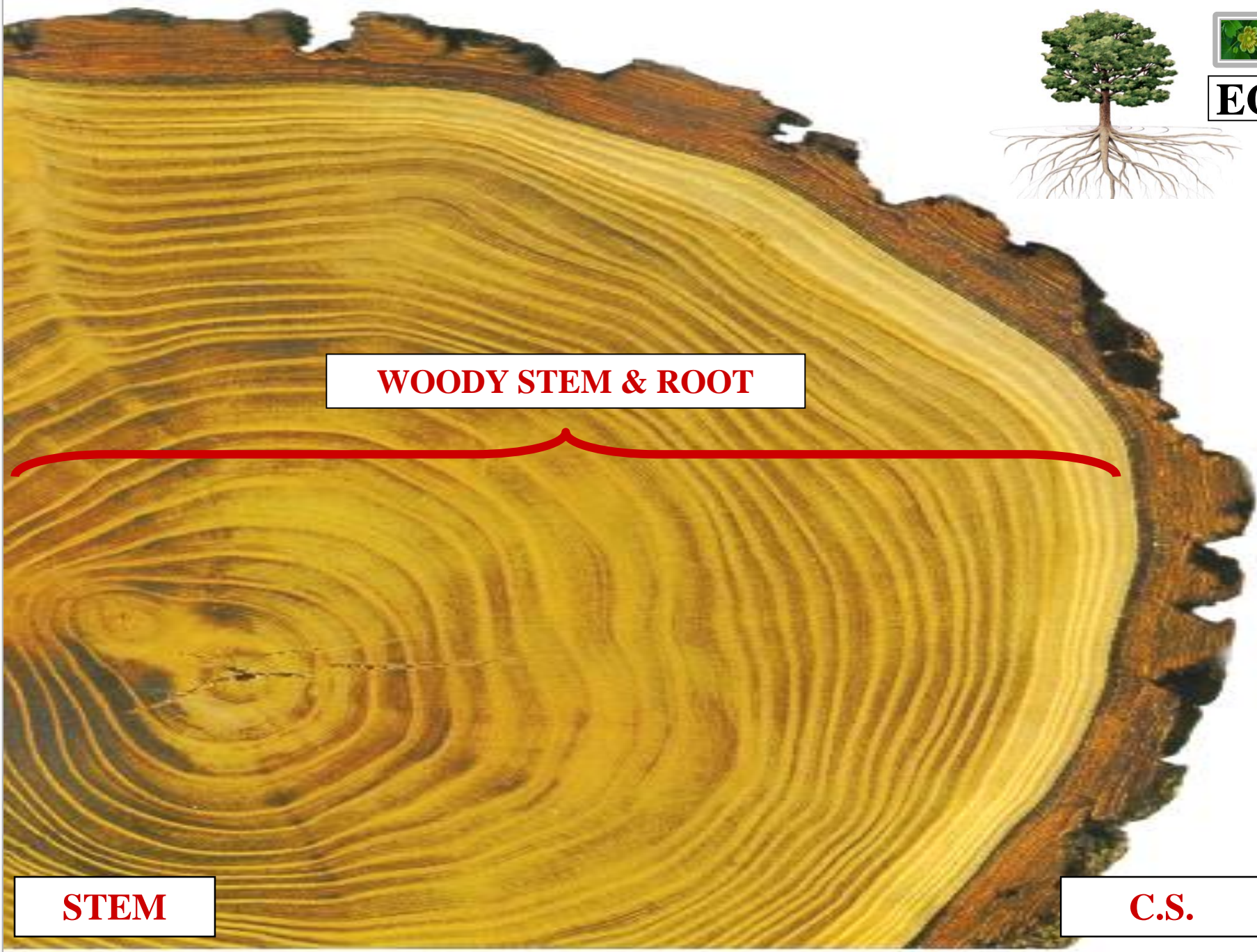
PERENNIAL PLANT

PERENNIAL PLANT

**GROWTH HABIT
PERENNIAL**

**COMPLETES
LIFE CYCLE
3+ SEASONS**

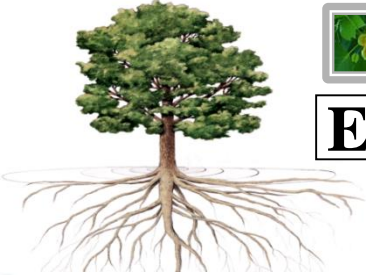
**GROWTH HABIT
PERENNIAL**



WOODY STEM & ROOT

STEM

C.S.



EG



WOODY PLANT



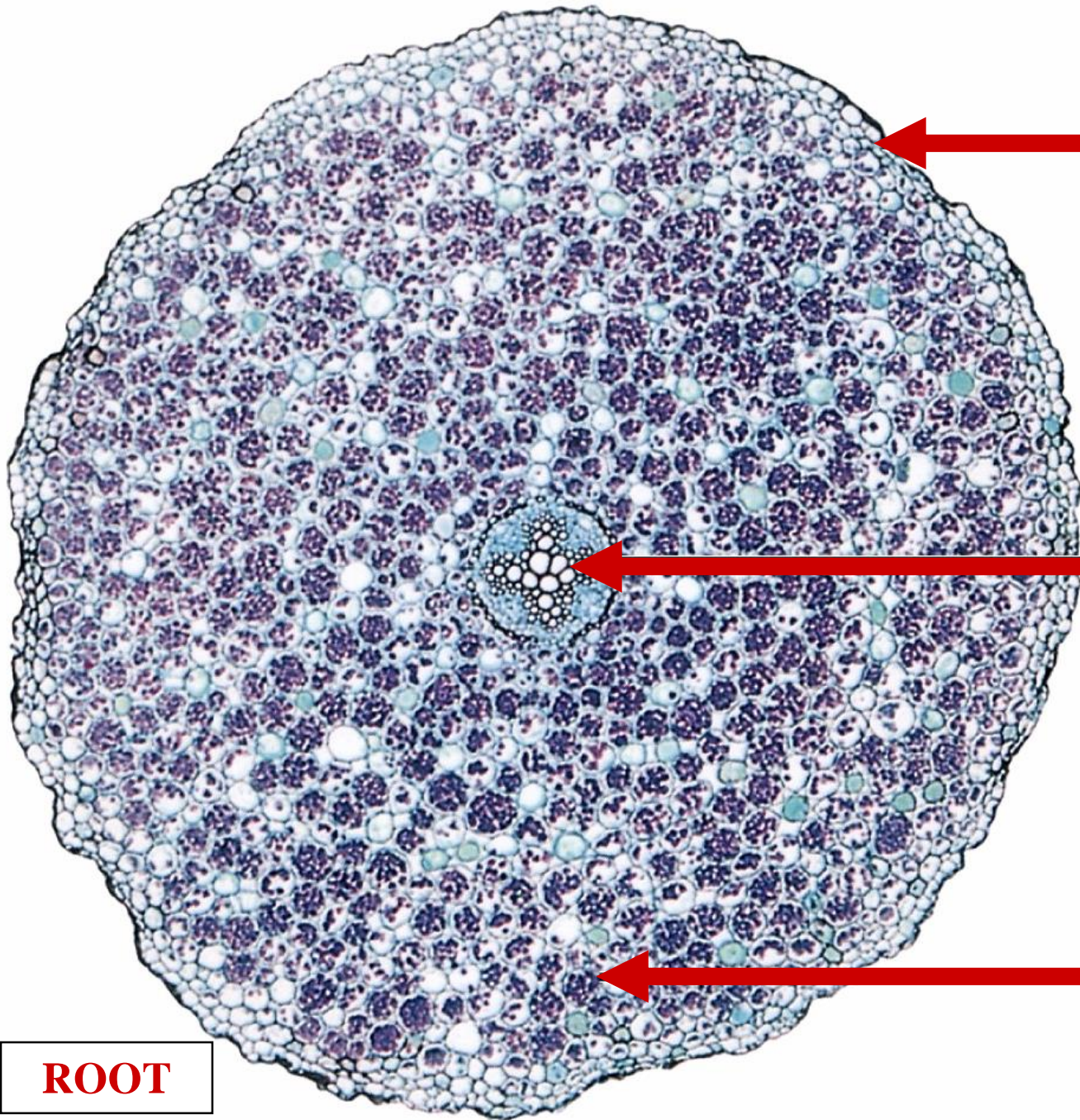


DICOT ANATOMY



DICOT PRIMARY ROOT ANATOMY

?



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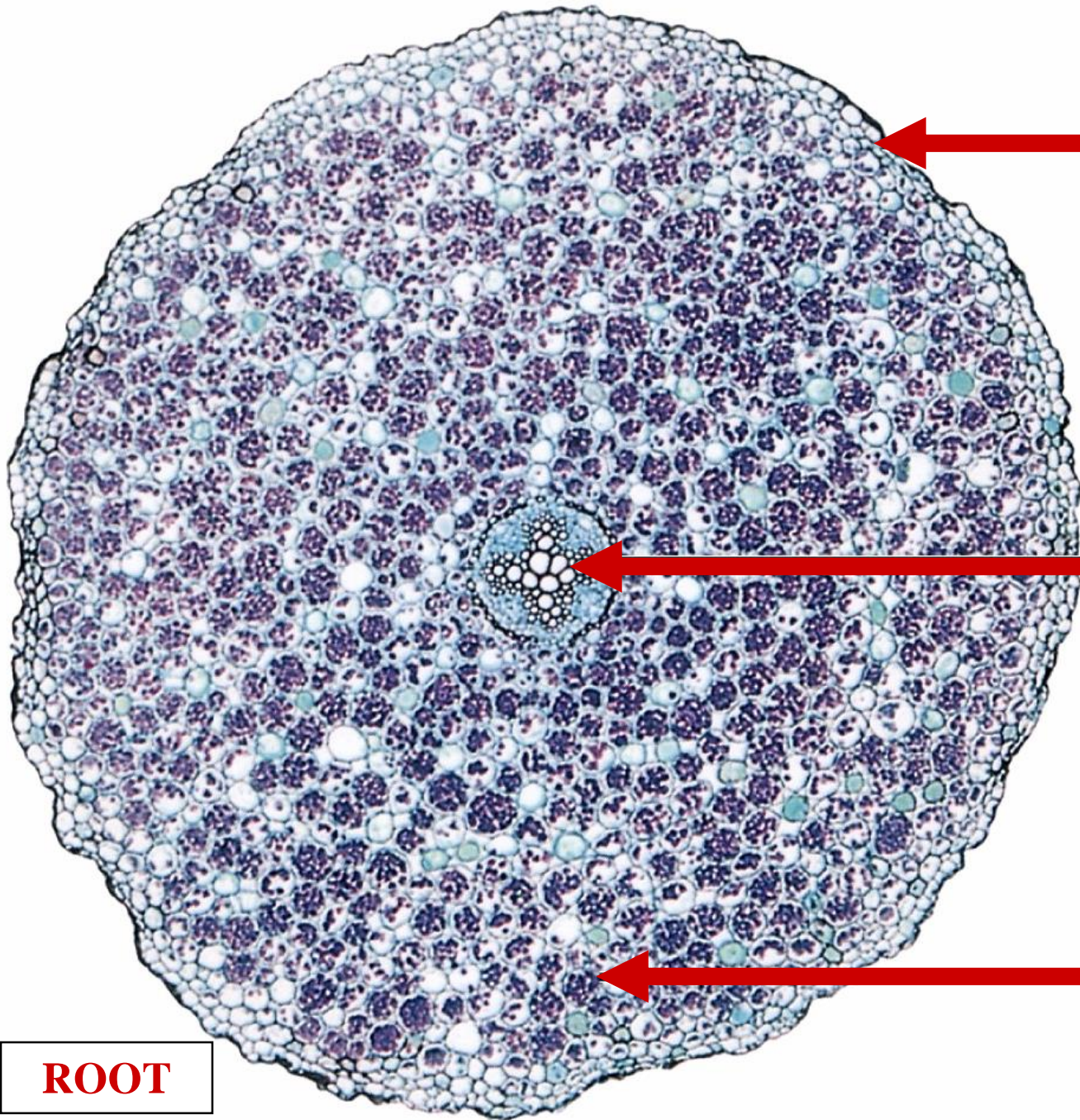
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ROOT

C.S.

E



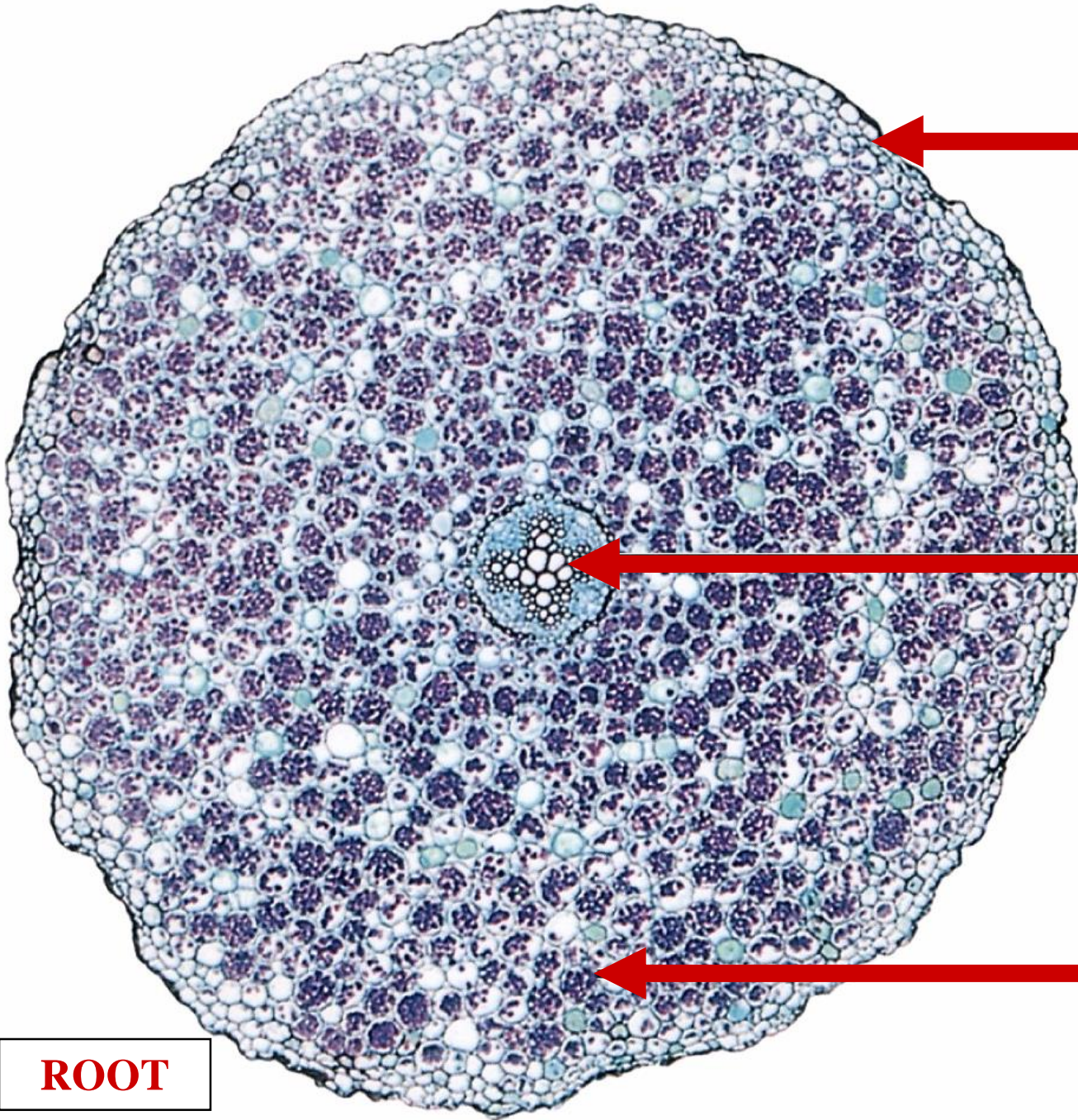
?

ROOT

C.S.

?

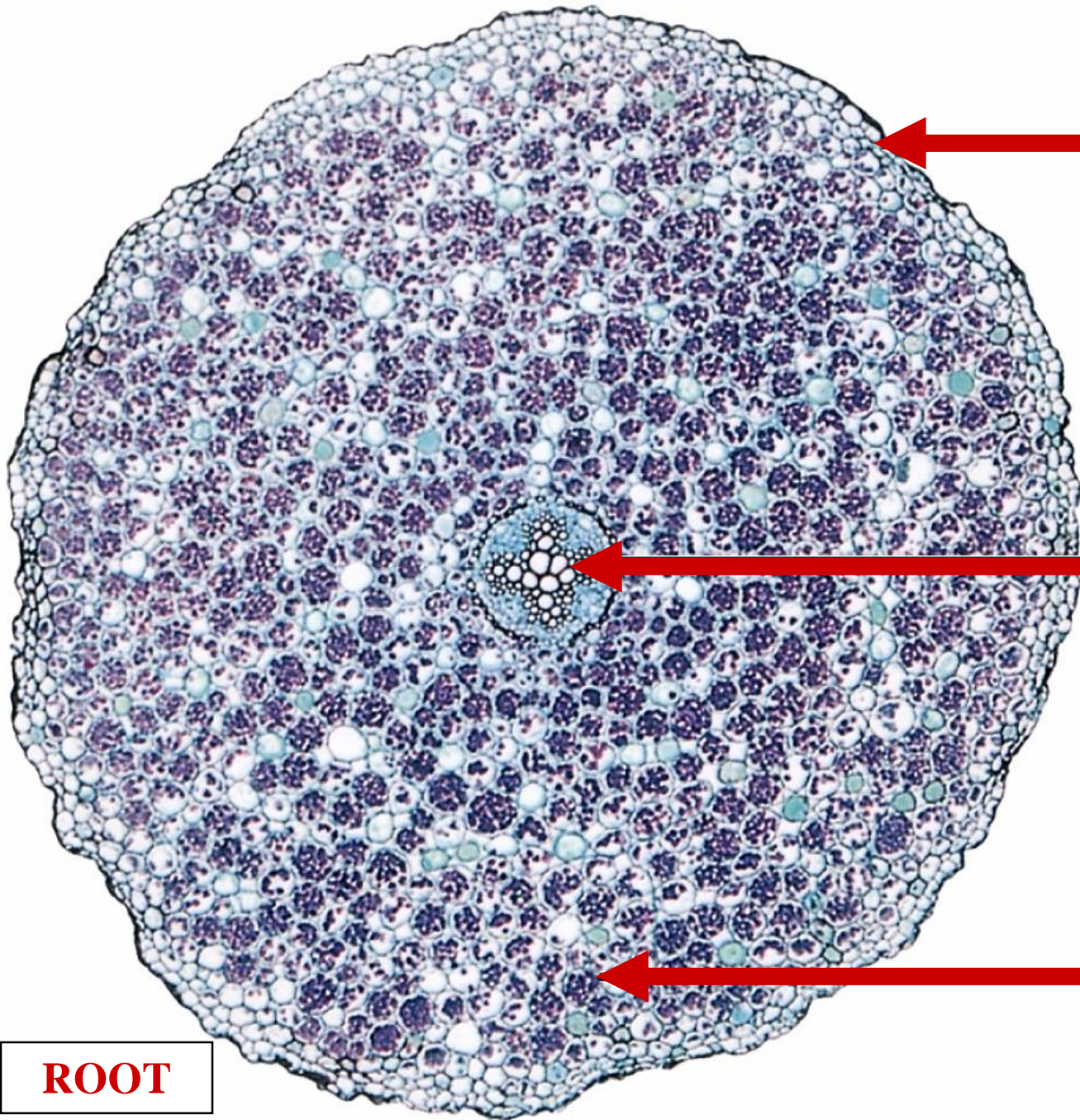
EPIDERMIS



ROOT

C.S.

C



EPIDERMIS

?

ROOT

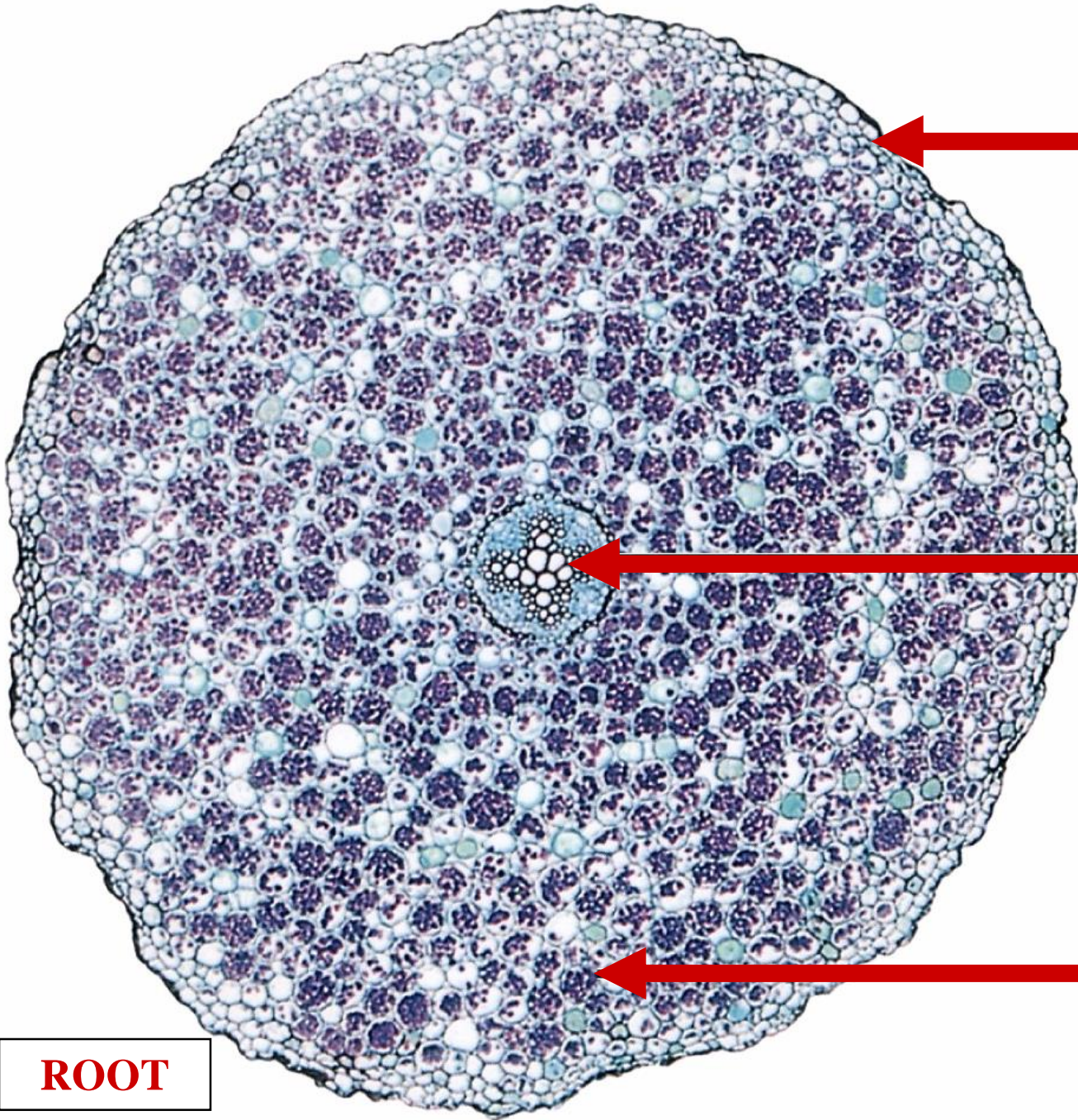
C.S.

SR

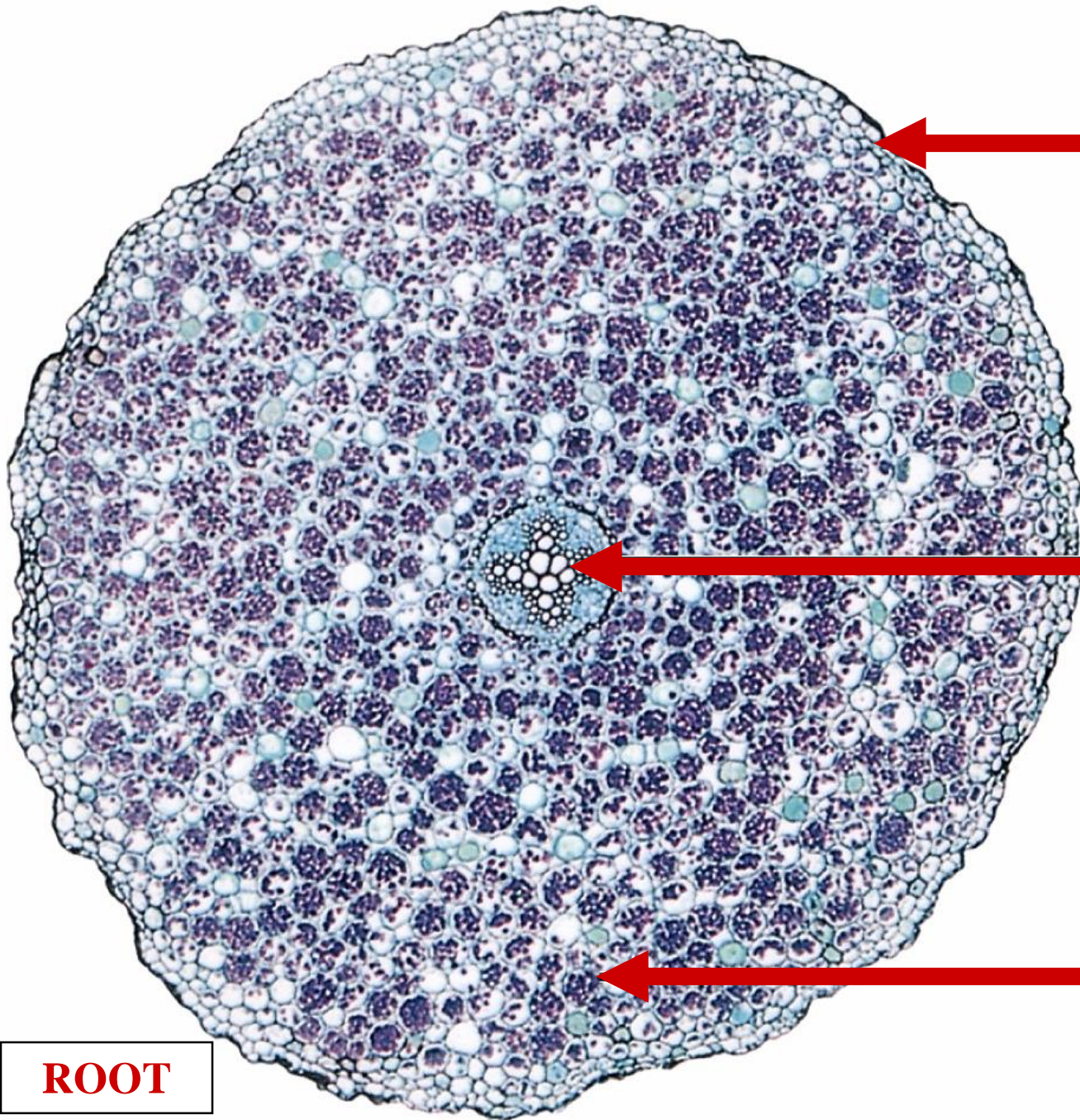
EPIDERMIS

CORTEX

C.S.



ROOT



EPIDERMIS

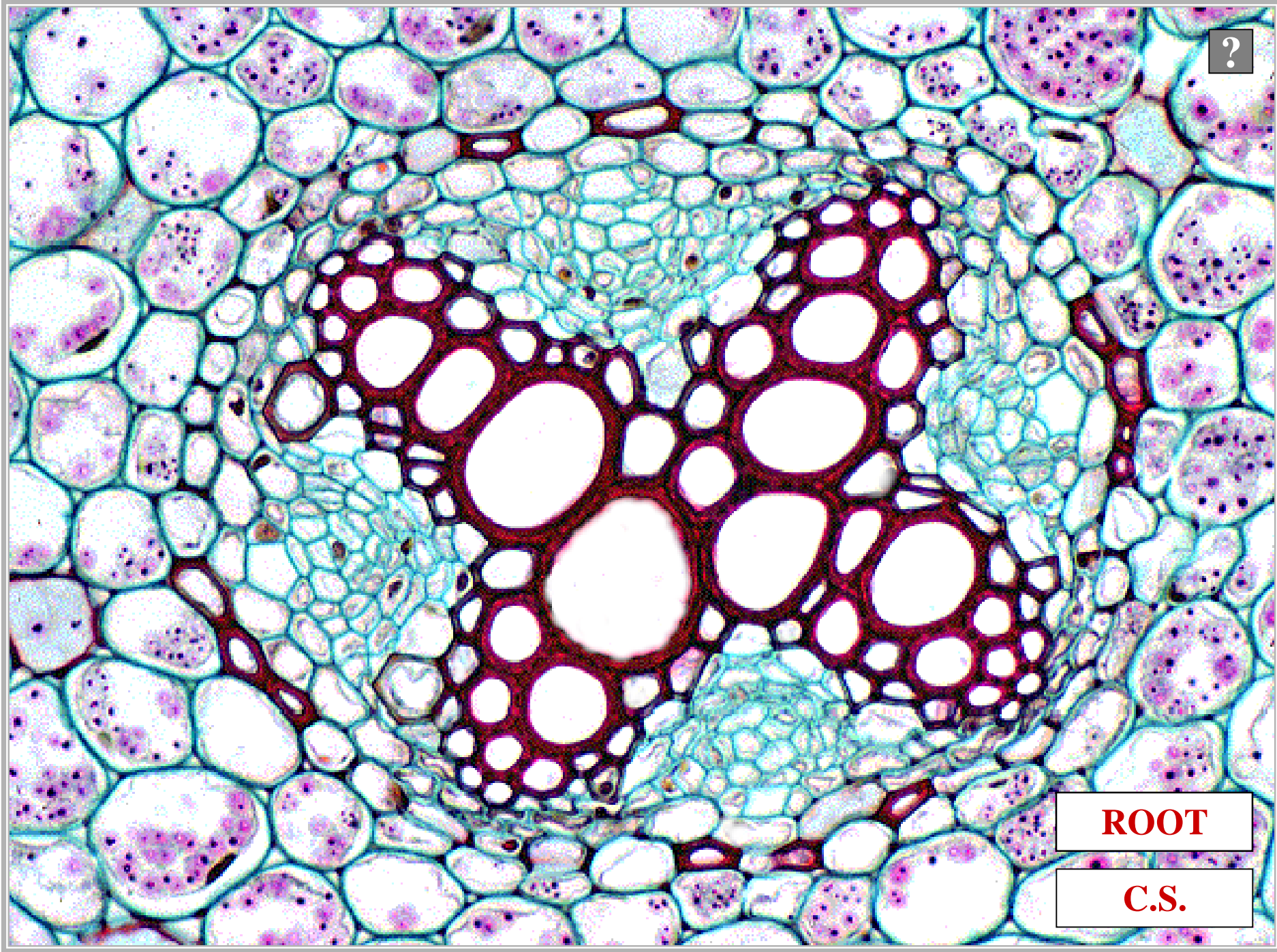
**STELE
REGION**

CORTEX

ROOT

C.S.

?

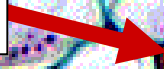


ROOT

C.S.

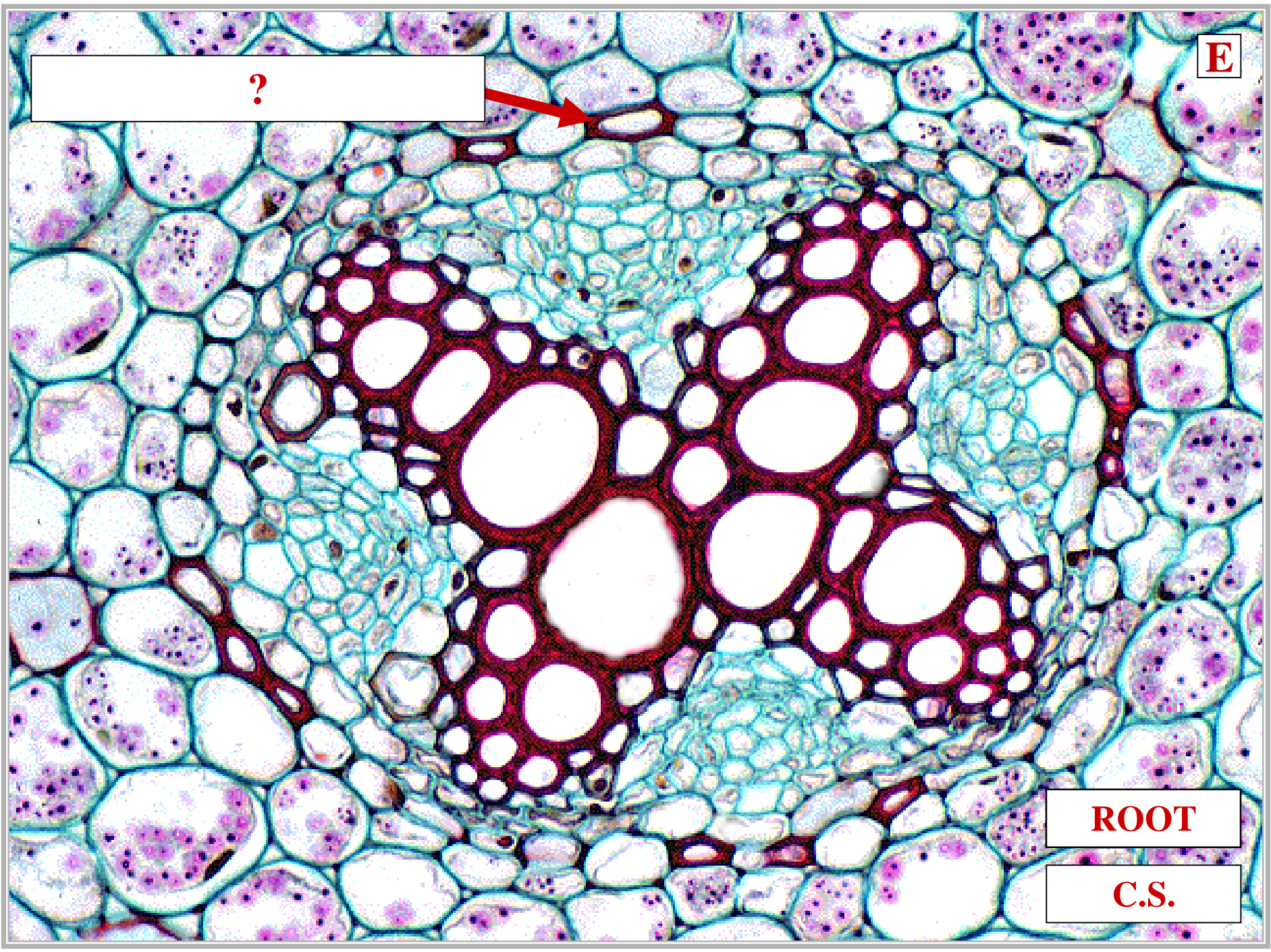
E

?



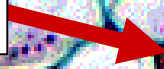
ROOT

C.S.



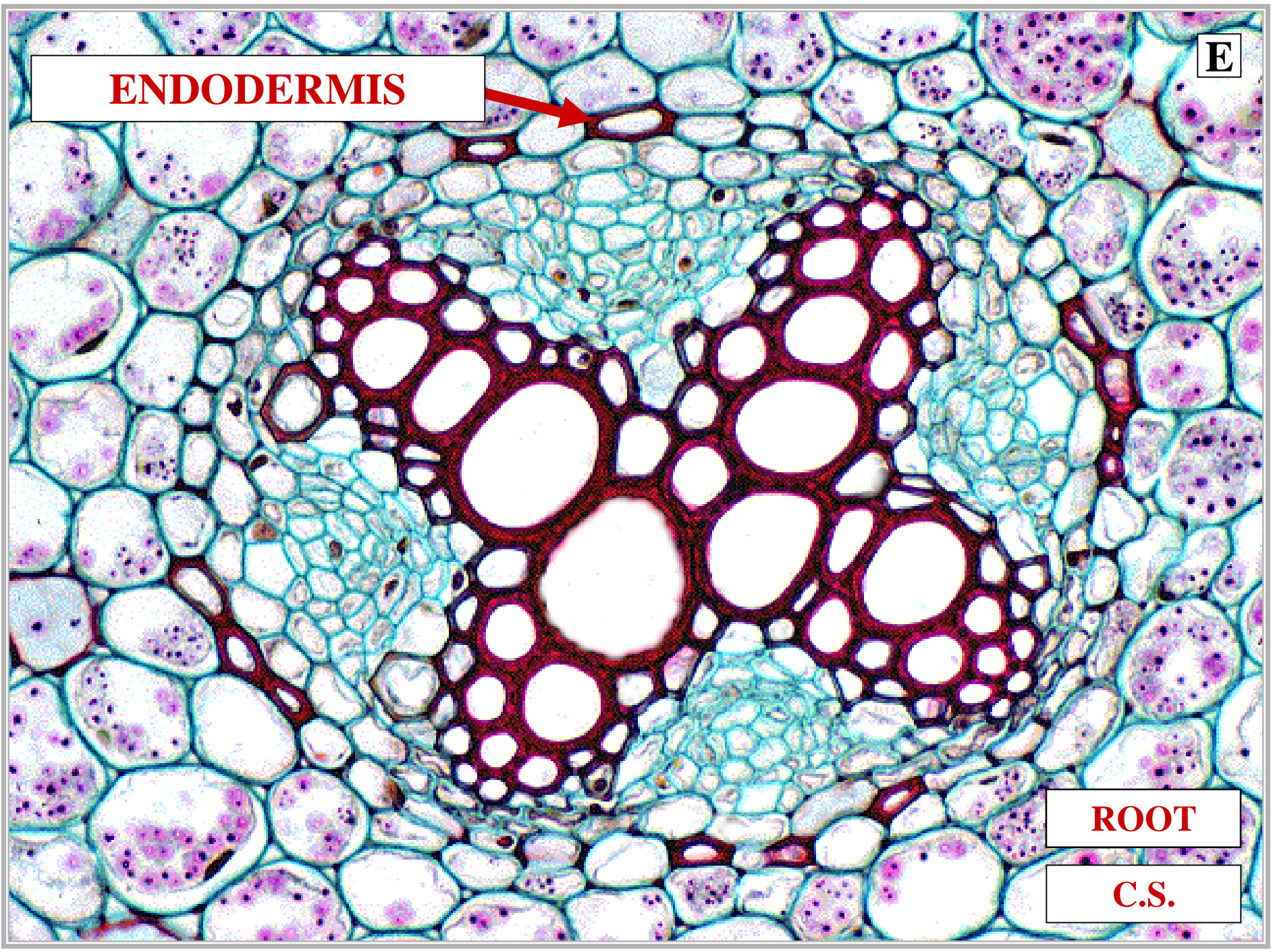
E

ENDODERMIS



ROOT

C.S.



ENDODERMIS

ENDODERMIS

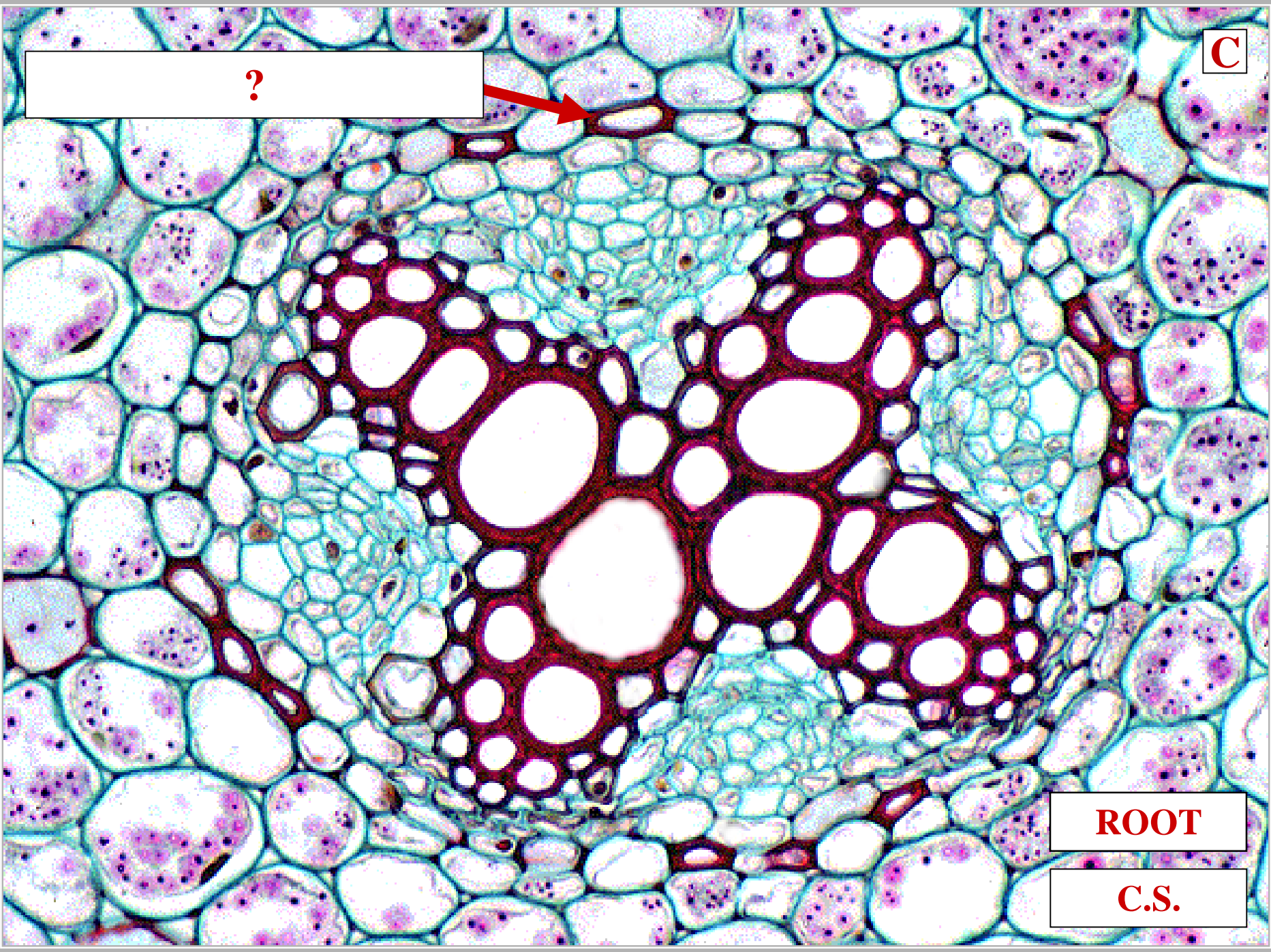


**INNERMOST
CORTEX CELLS**

ENDODERMIS

C

?

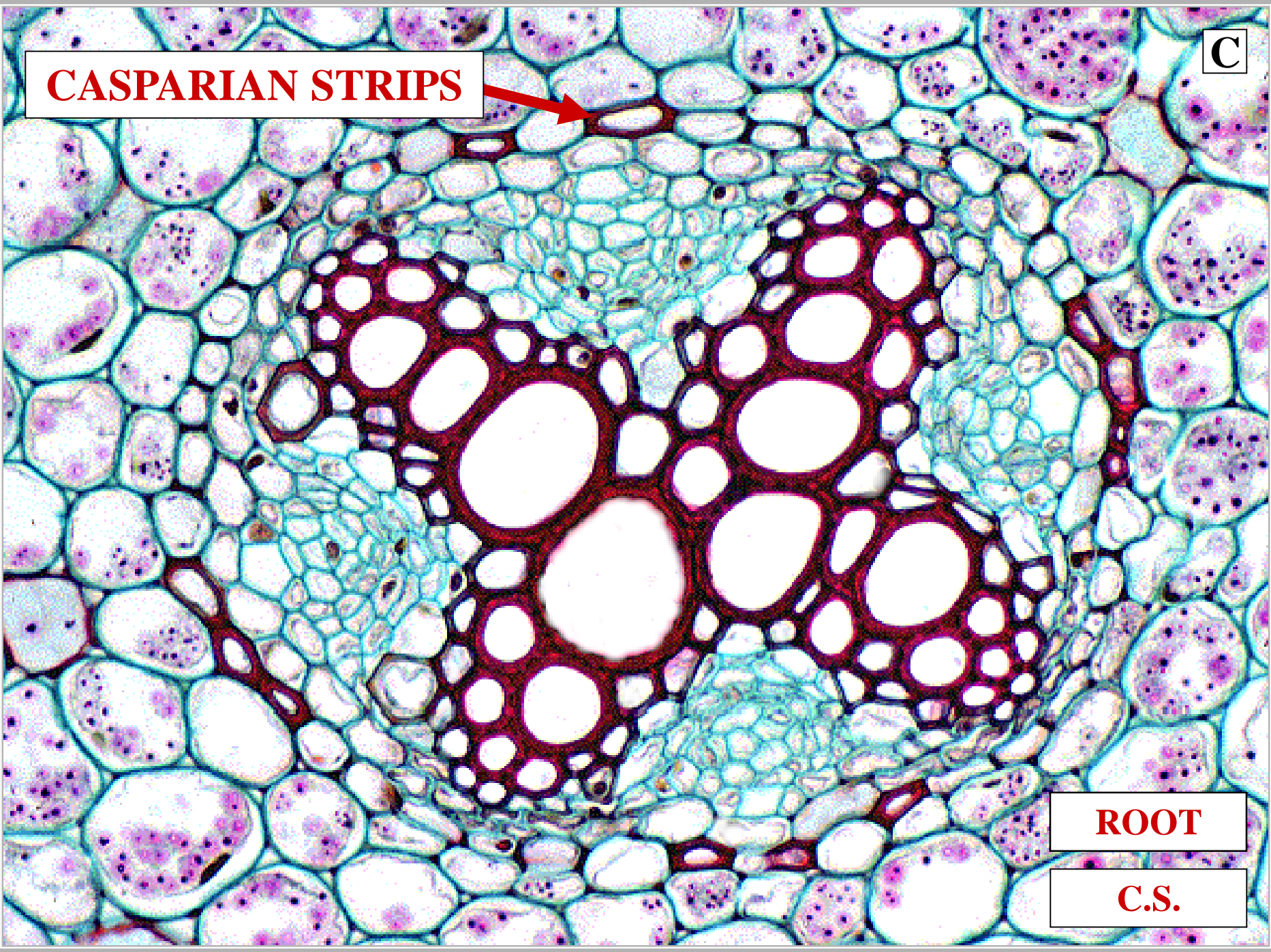


ROOT

C.S.

C

CASPARIAN STRIPS



ROOT

C.S.

CASPARIAN STRIPS

CASPARIAN STRIPS



STRIPS BETWEEN
ENDODERMIS CELLS

CASPARIAN STRIPS

P

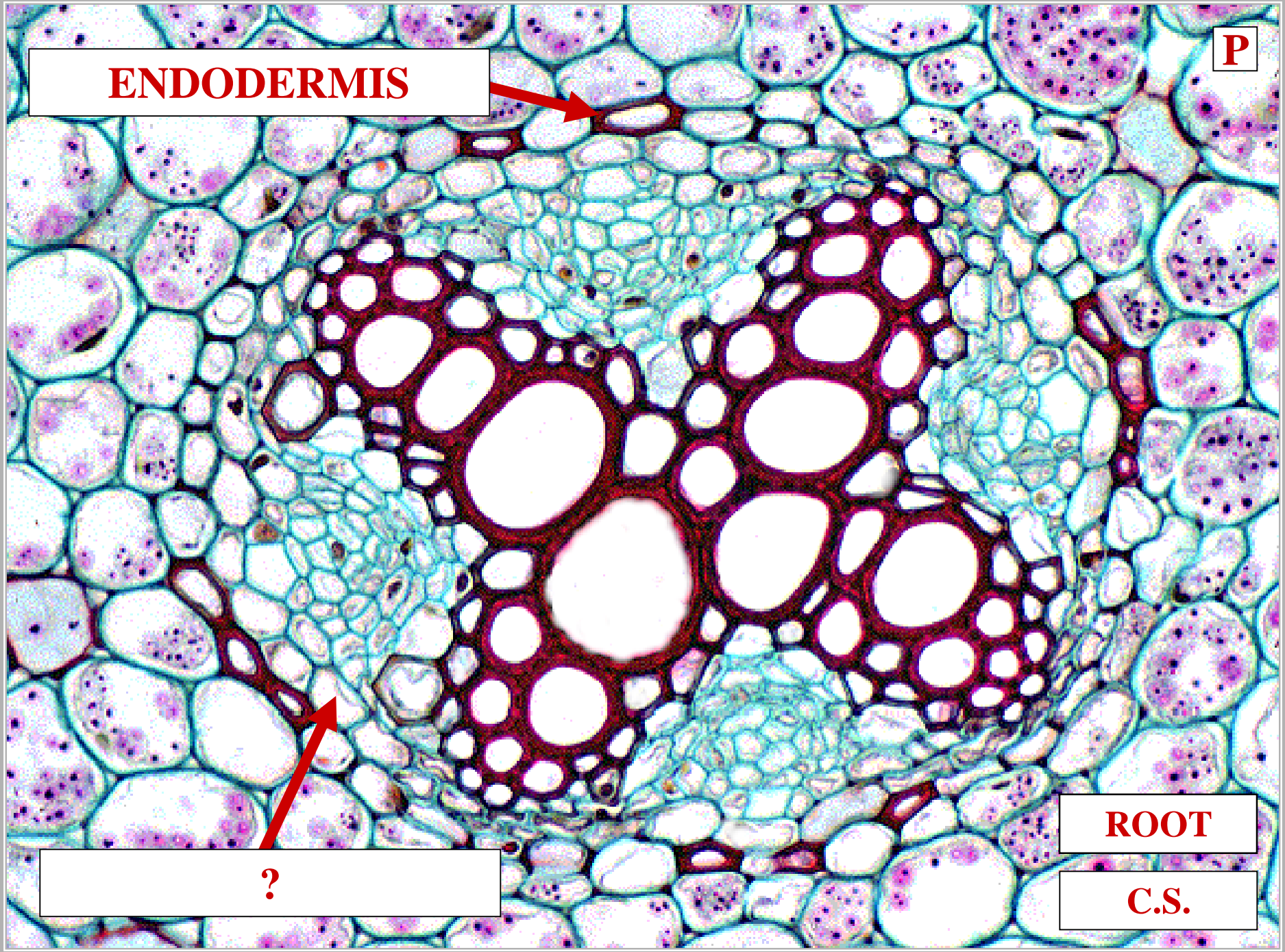
ENDODERMIS



?

ROOT

C.S.



P

ENDODERMIS

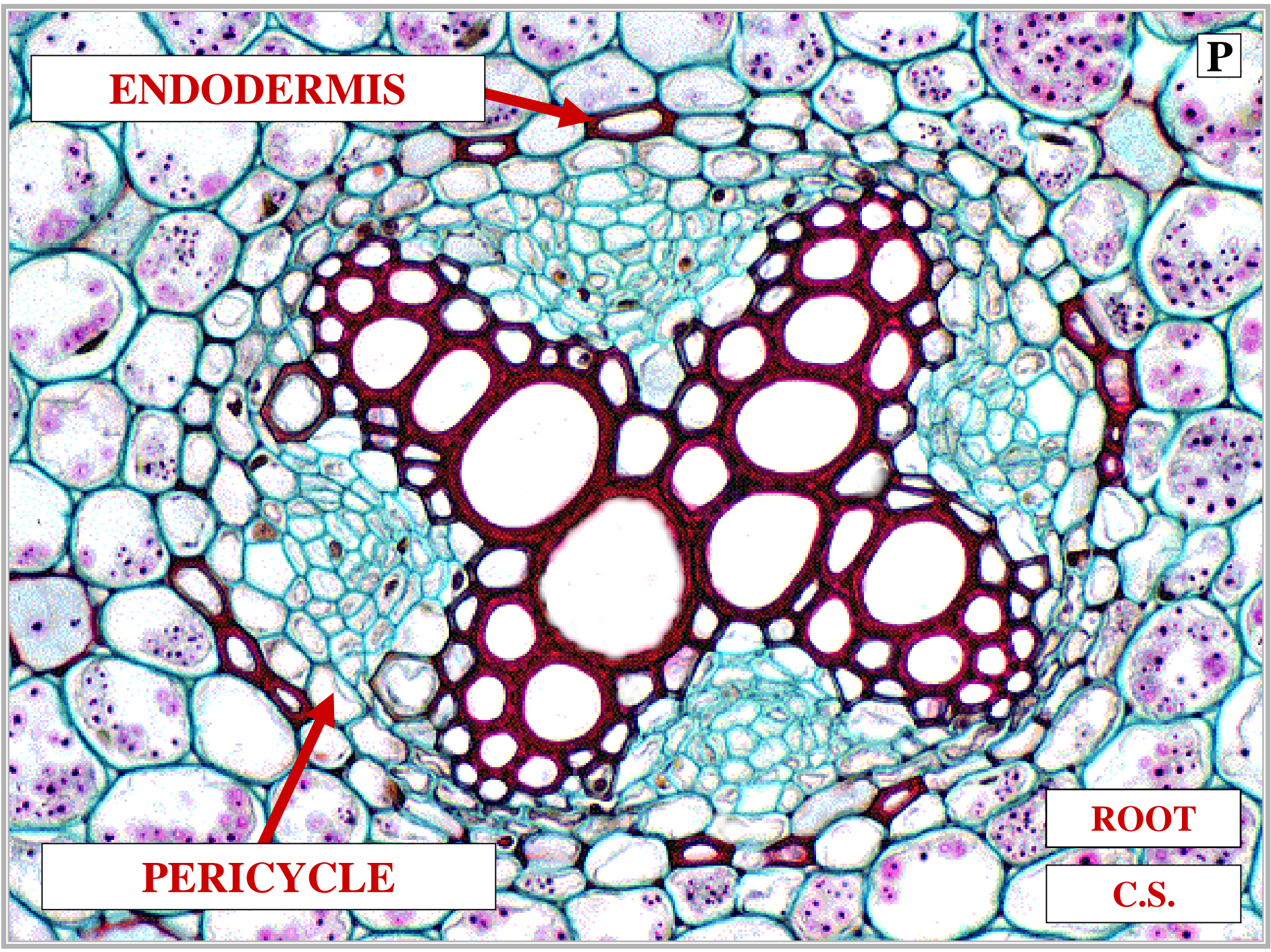


PERICYCLE



ROOT

C.S.



PERICYCLE



PERICYCLE

ORIGIN

LATERAL ROOTS

PERICYCLE

ENDODERMIS

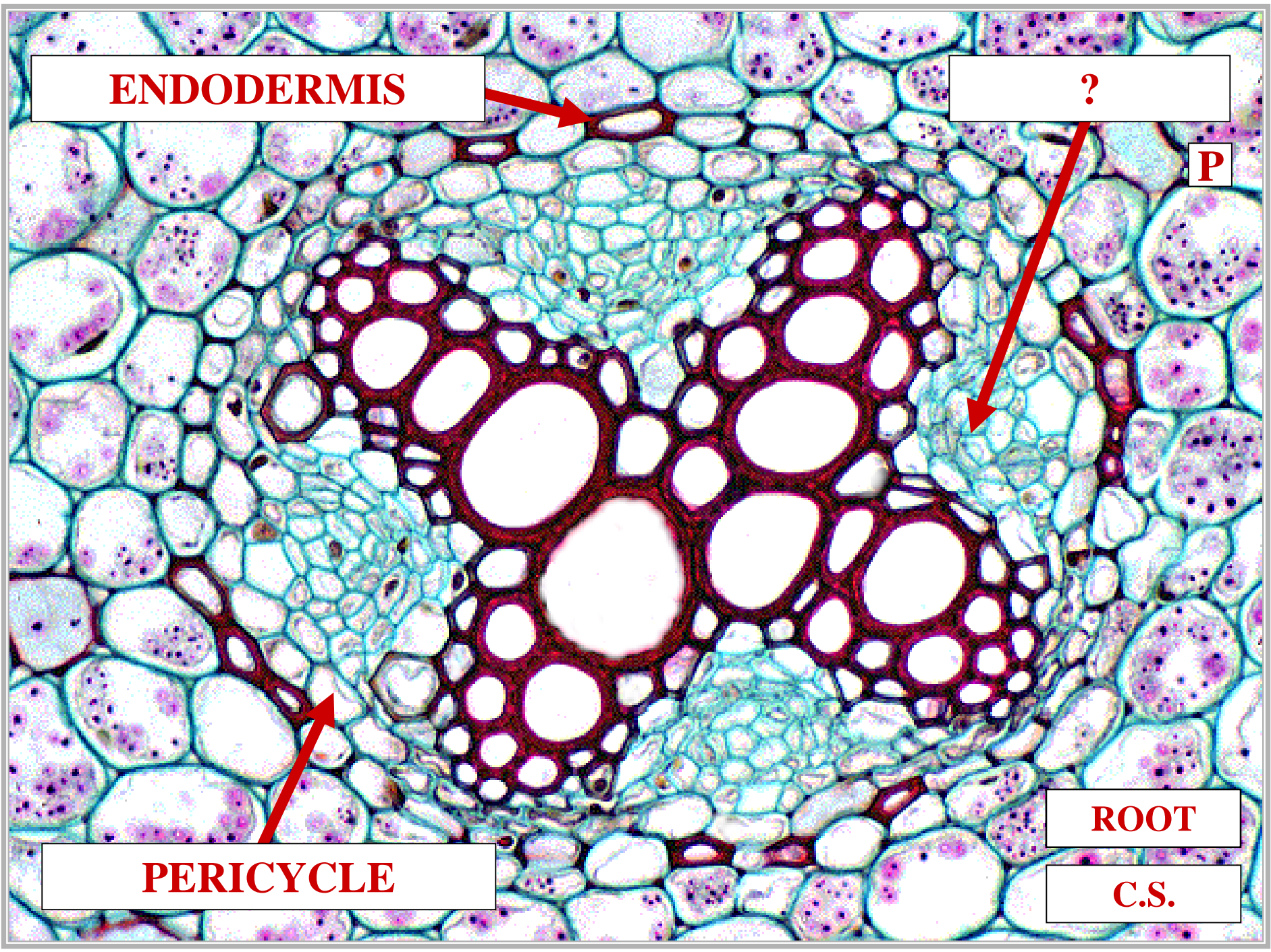
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P

PERICYCLE

ROOT

C.S.



ENDODERMIS

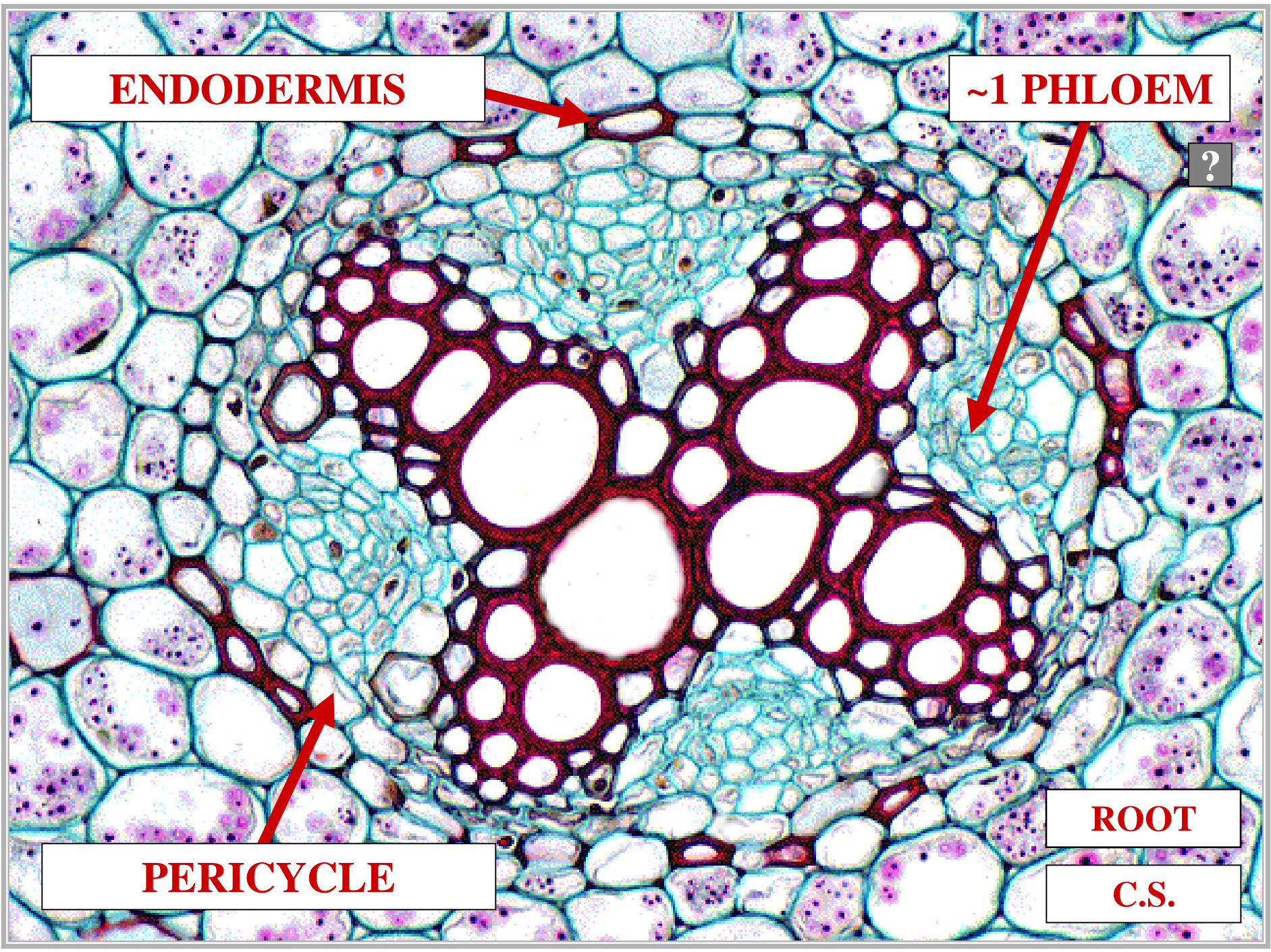
~1 PHLOEM

?

PERICYCLE

ROOT

C.S.



ENDODERMIS

~1 PHLOEM

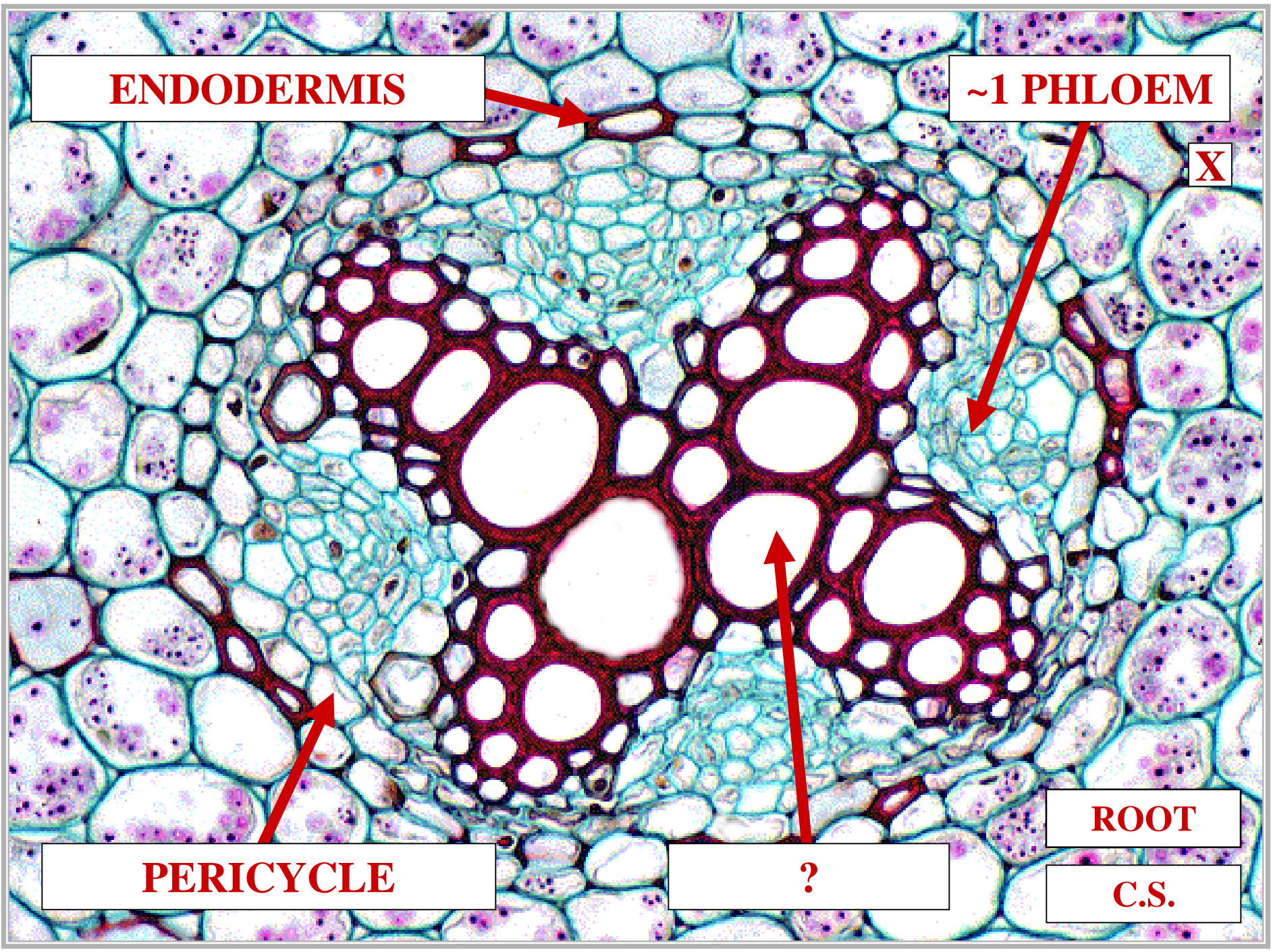
X

PERICYCLE

?

ROOT

C.S.



ENDODERMIS

~1 PHLOEM

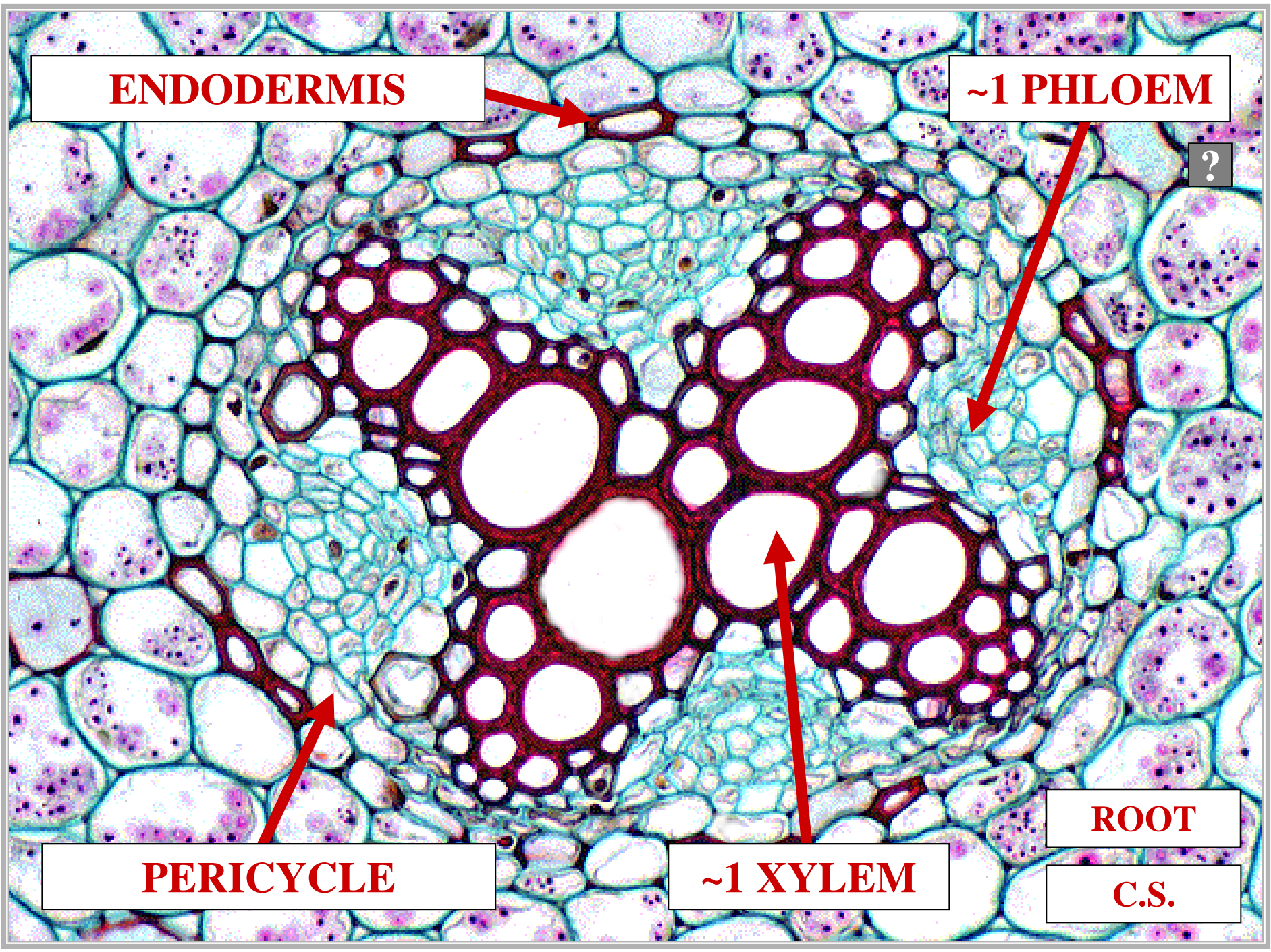
?

PERICYCLE

~1 XYLEM

ROOT

C.S.



ENDODERMIS

~1 PHLOEM

V

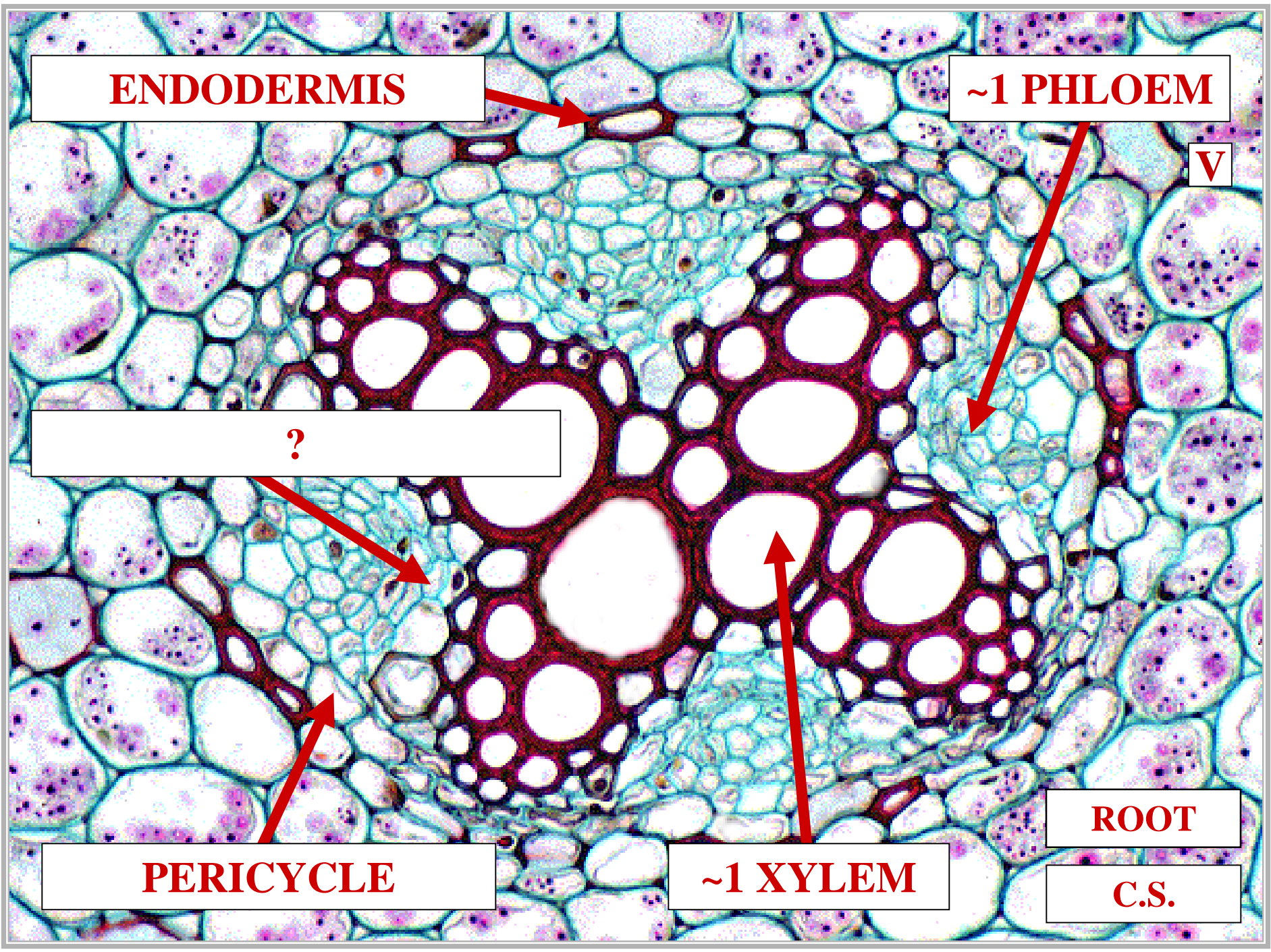
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PERICYCLE

~1 XYLEM

ROOT

C.S.



ENDODERMIS

~1 PHLOEM

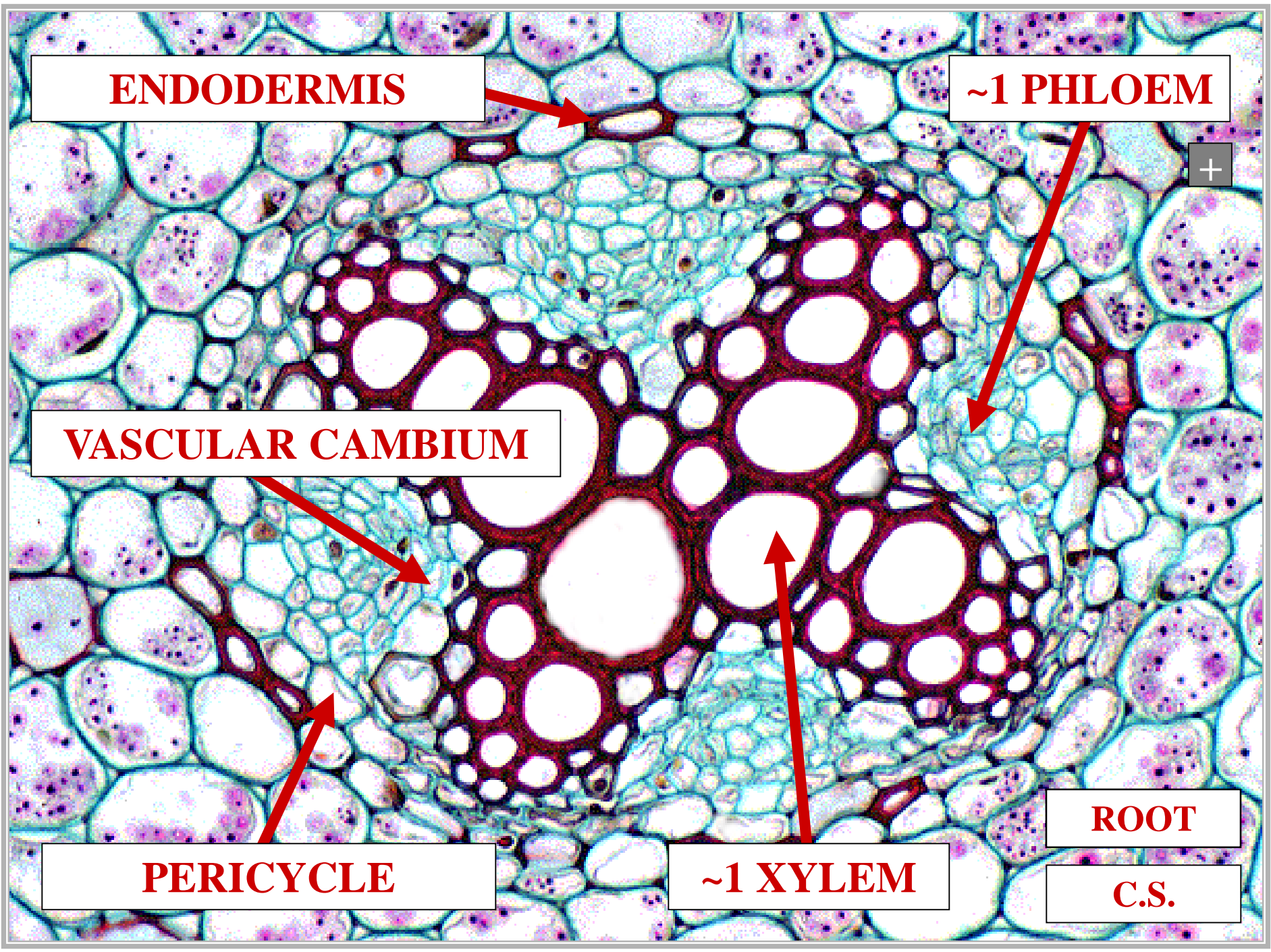
VASCULAR CAMBIUM

PERICYCLE

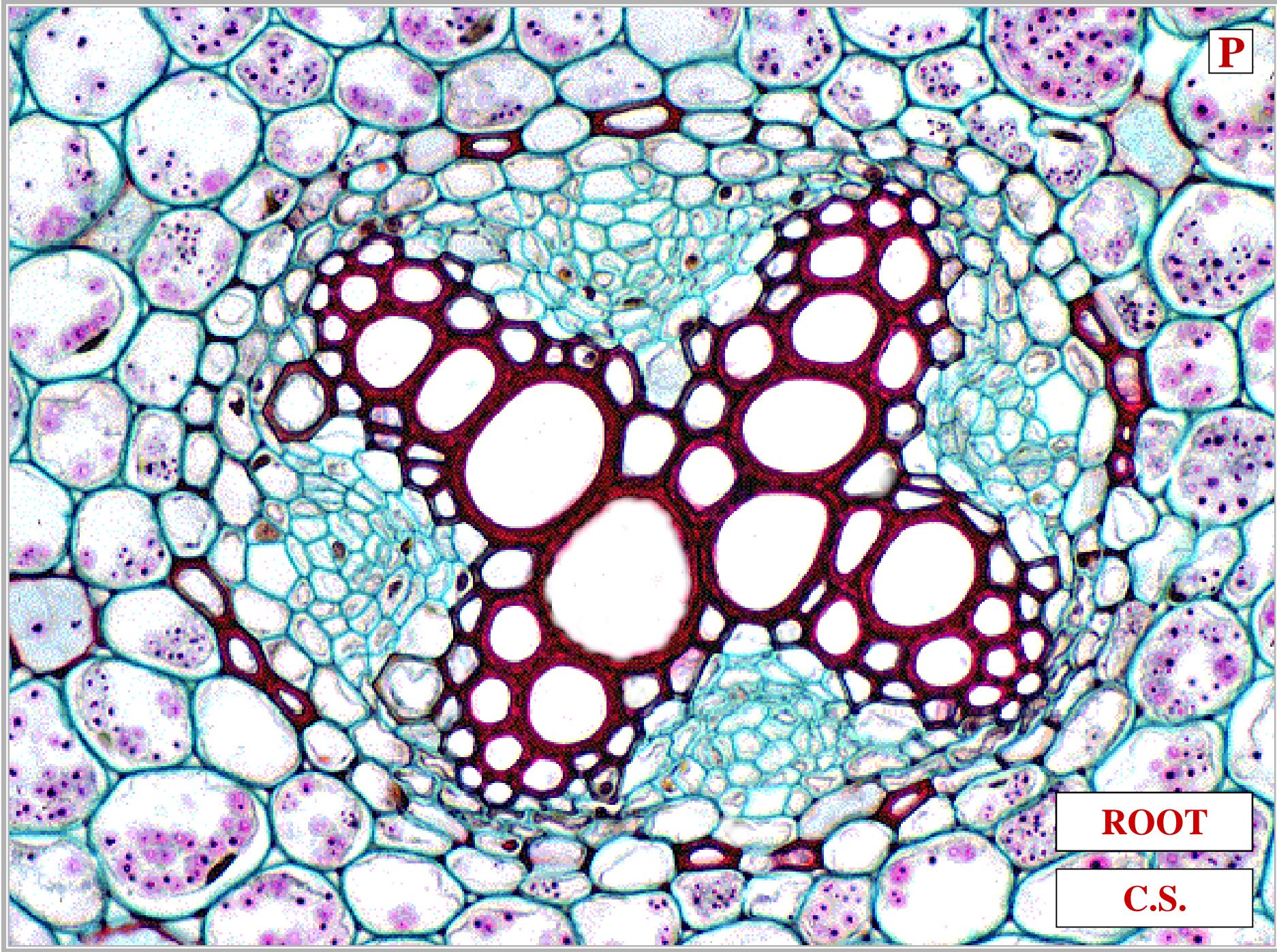
~1 XYLEM

ROOT

C.S.



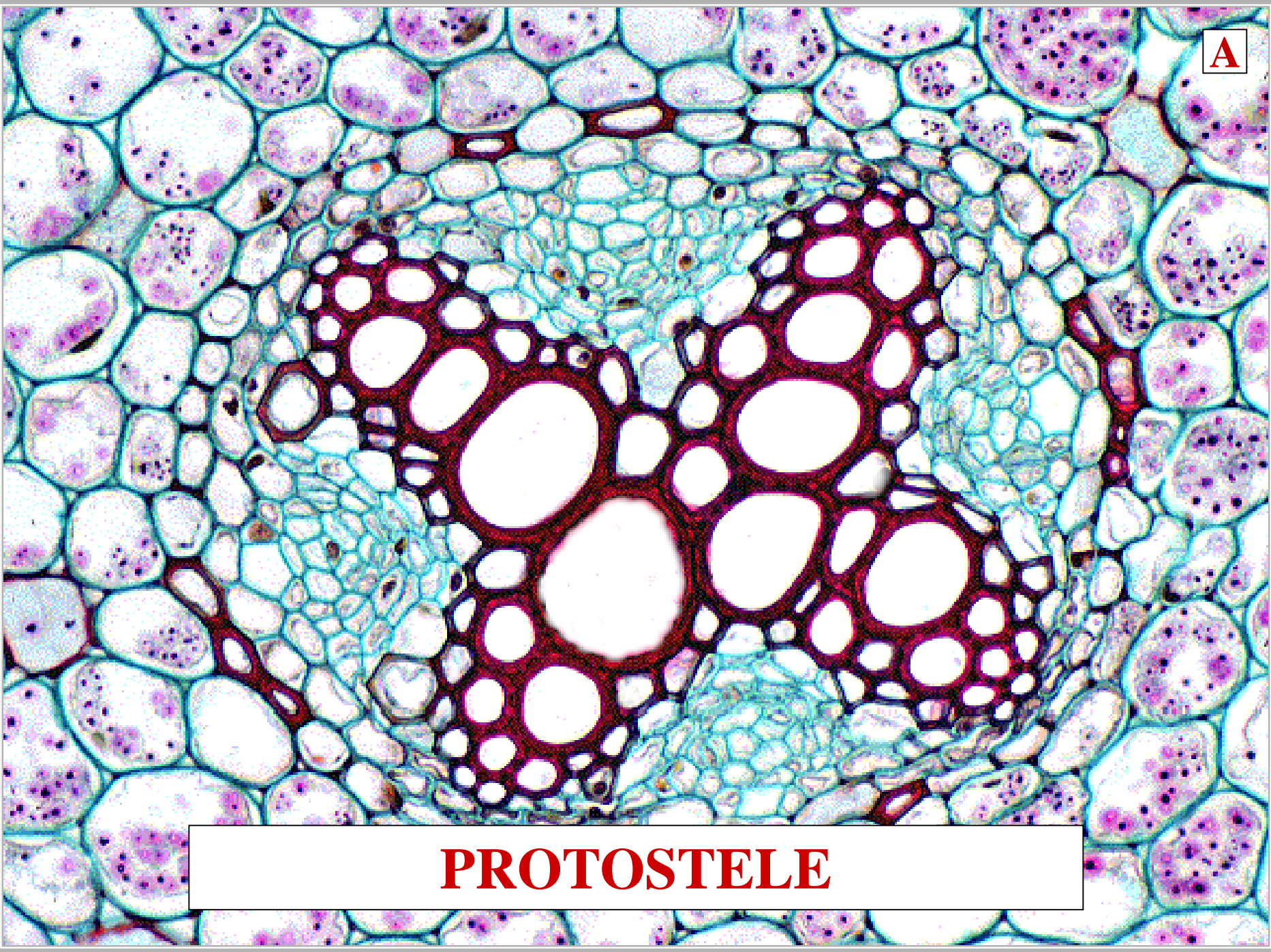
P



ROOT

C.S.

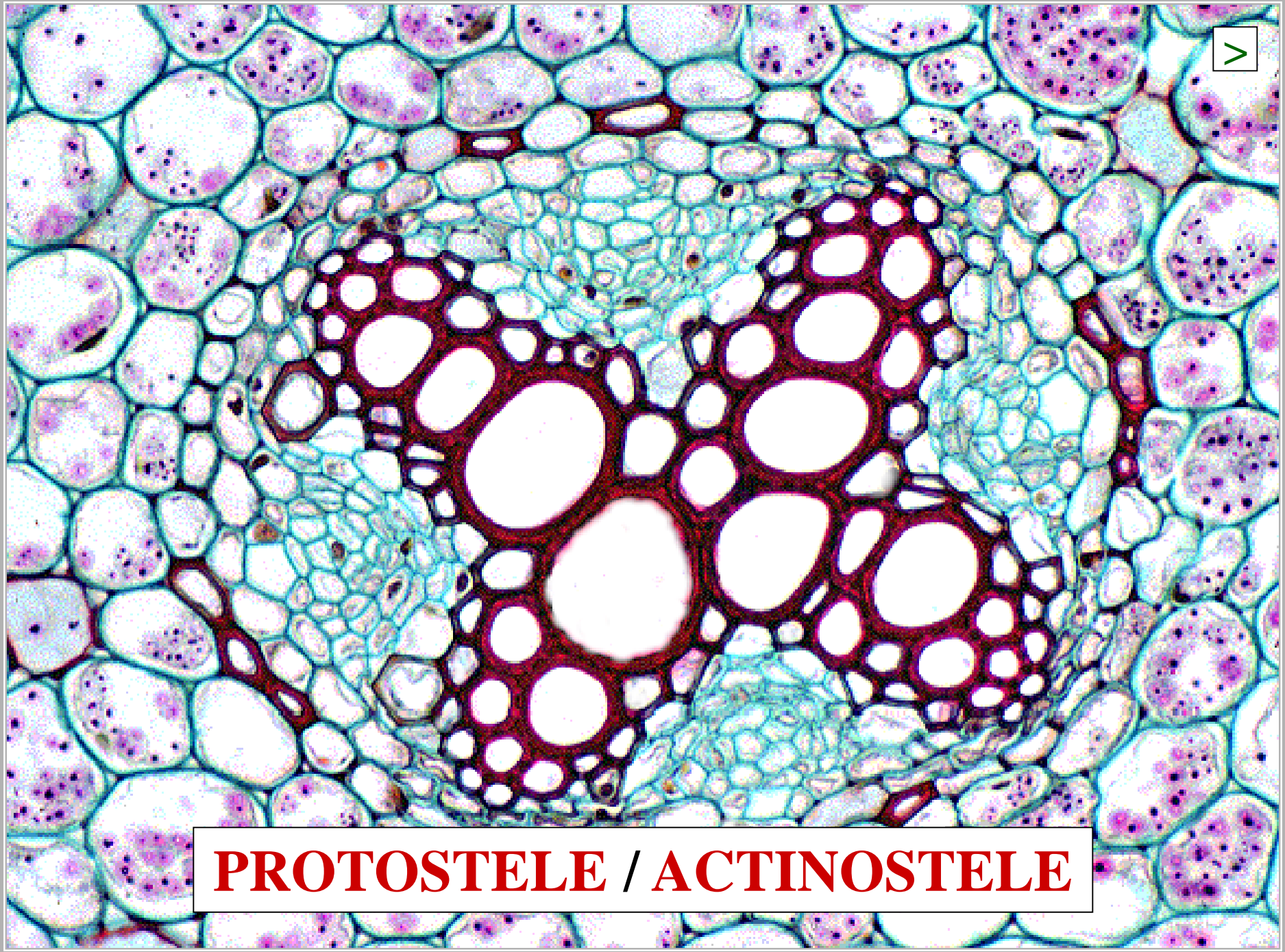
A



PROTOSTELE

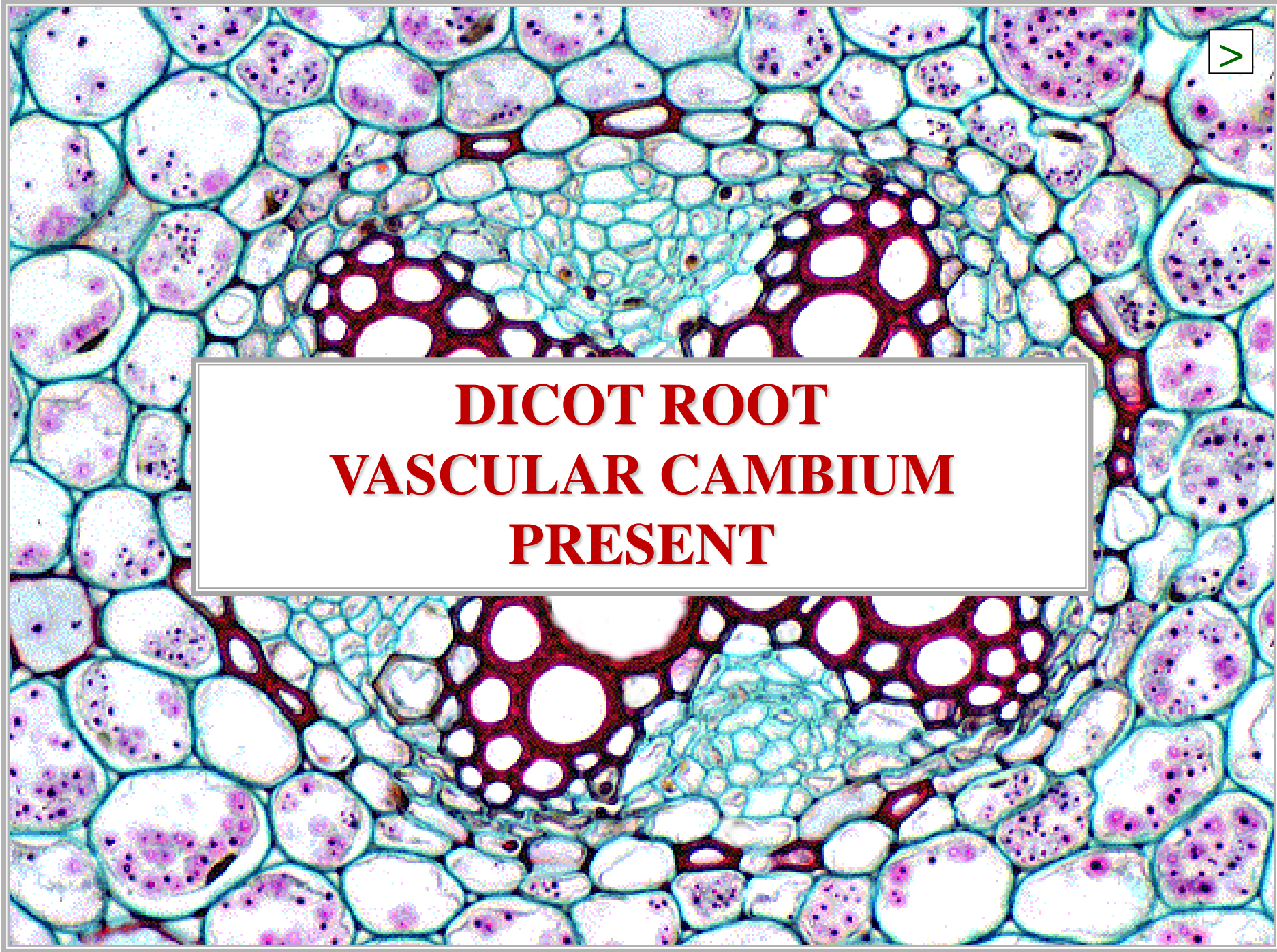


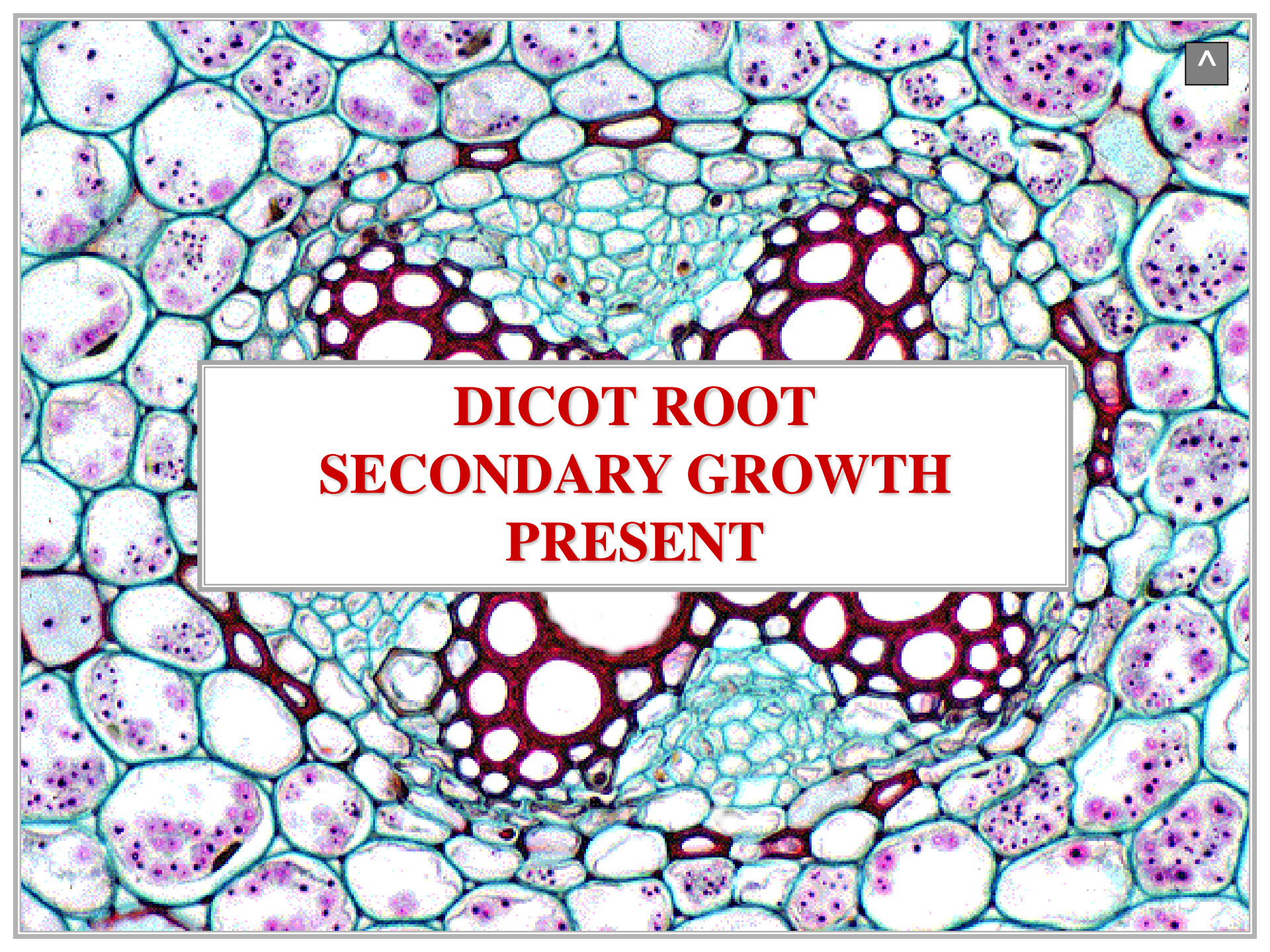
PROTOSTELE / ACTINOSTELE





**DICOT ROOT
VASCULAR CAMBIUM
PRESENT**





**DICOT ROOT
SECONDARY GROWTH
PRESENT**

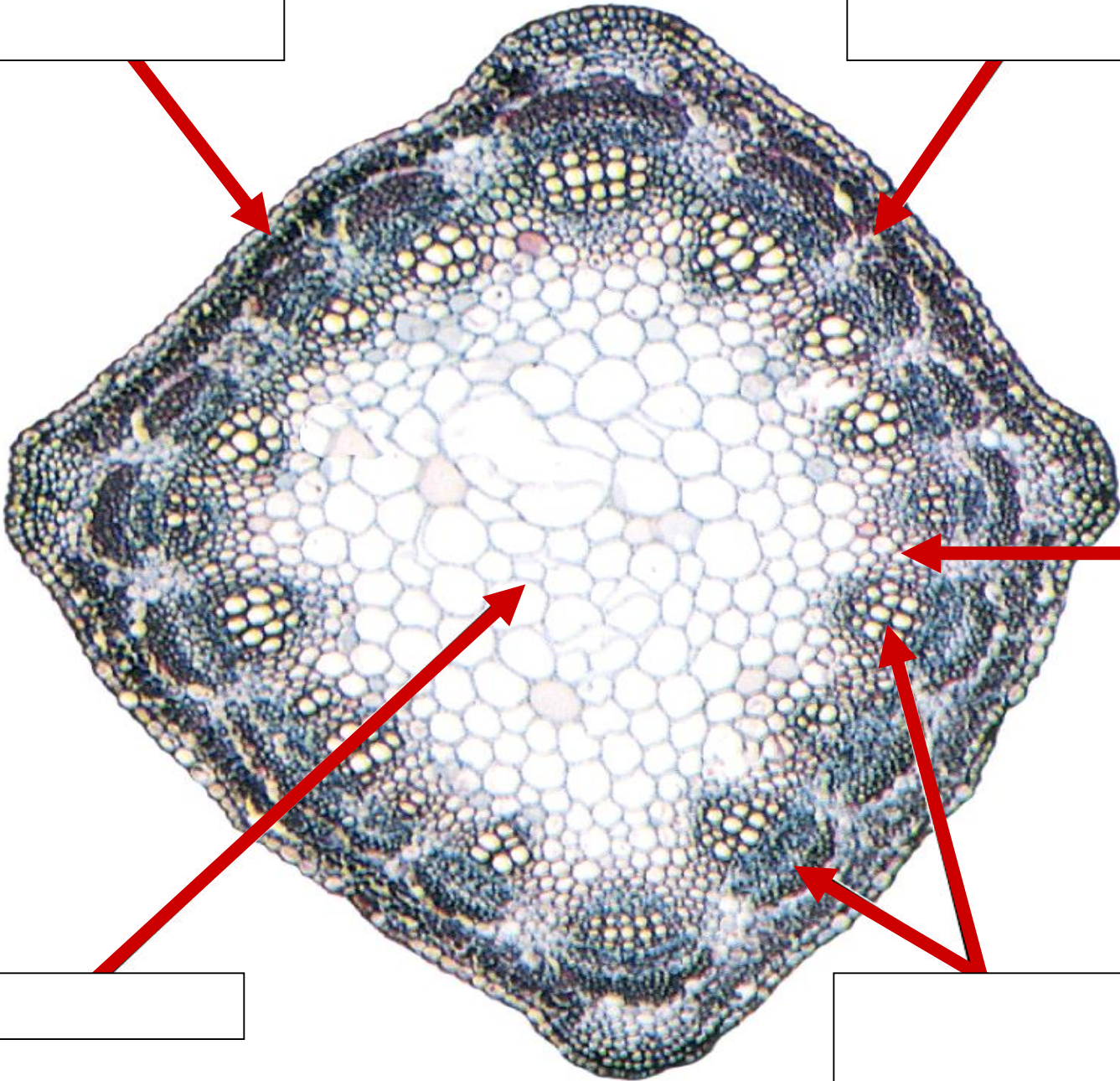


DICOT PRIMARY STEM ANATOMY

?

[]

[]



[]

STEM

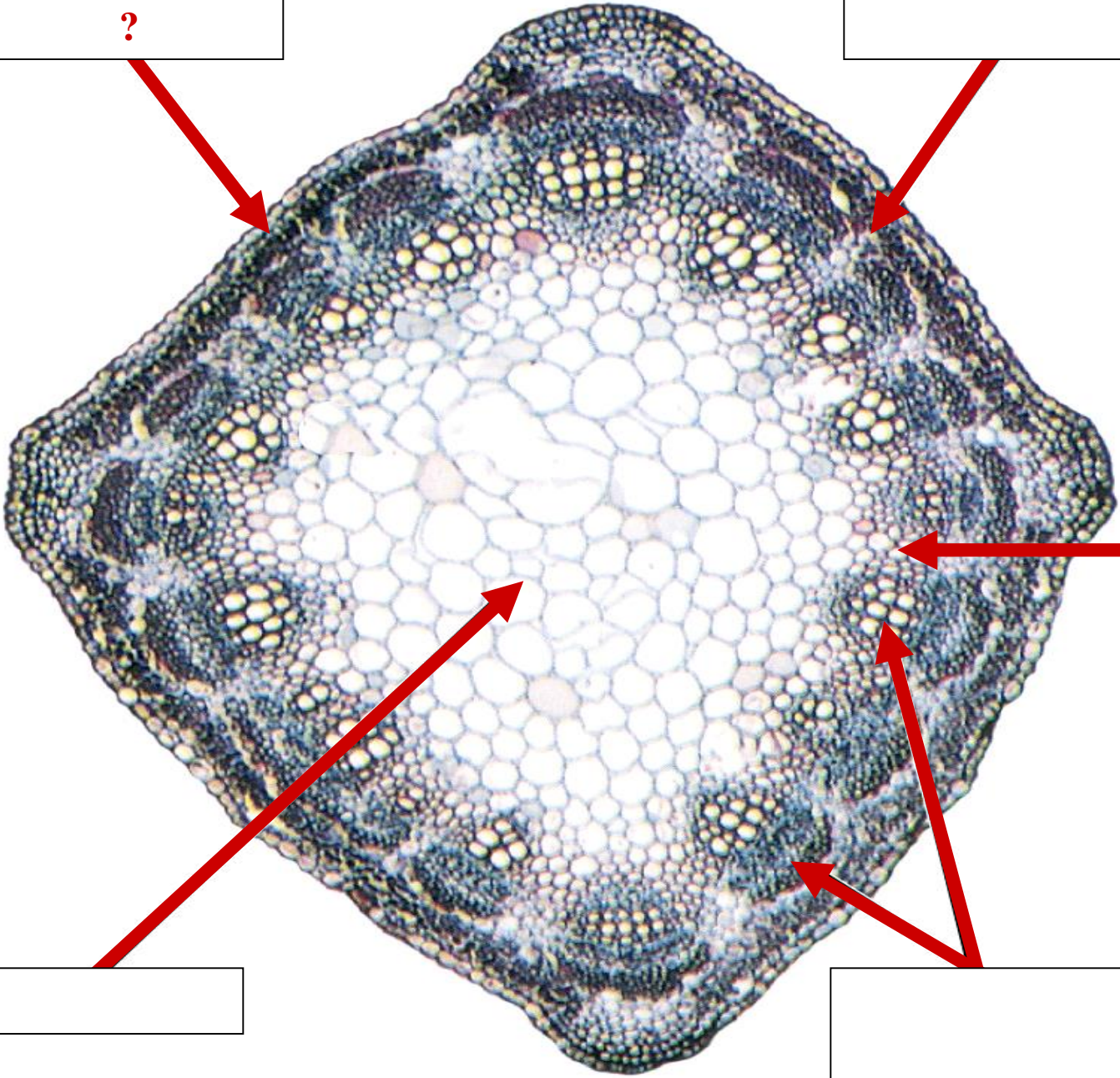
C.S.

[]

[]

C

?

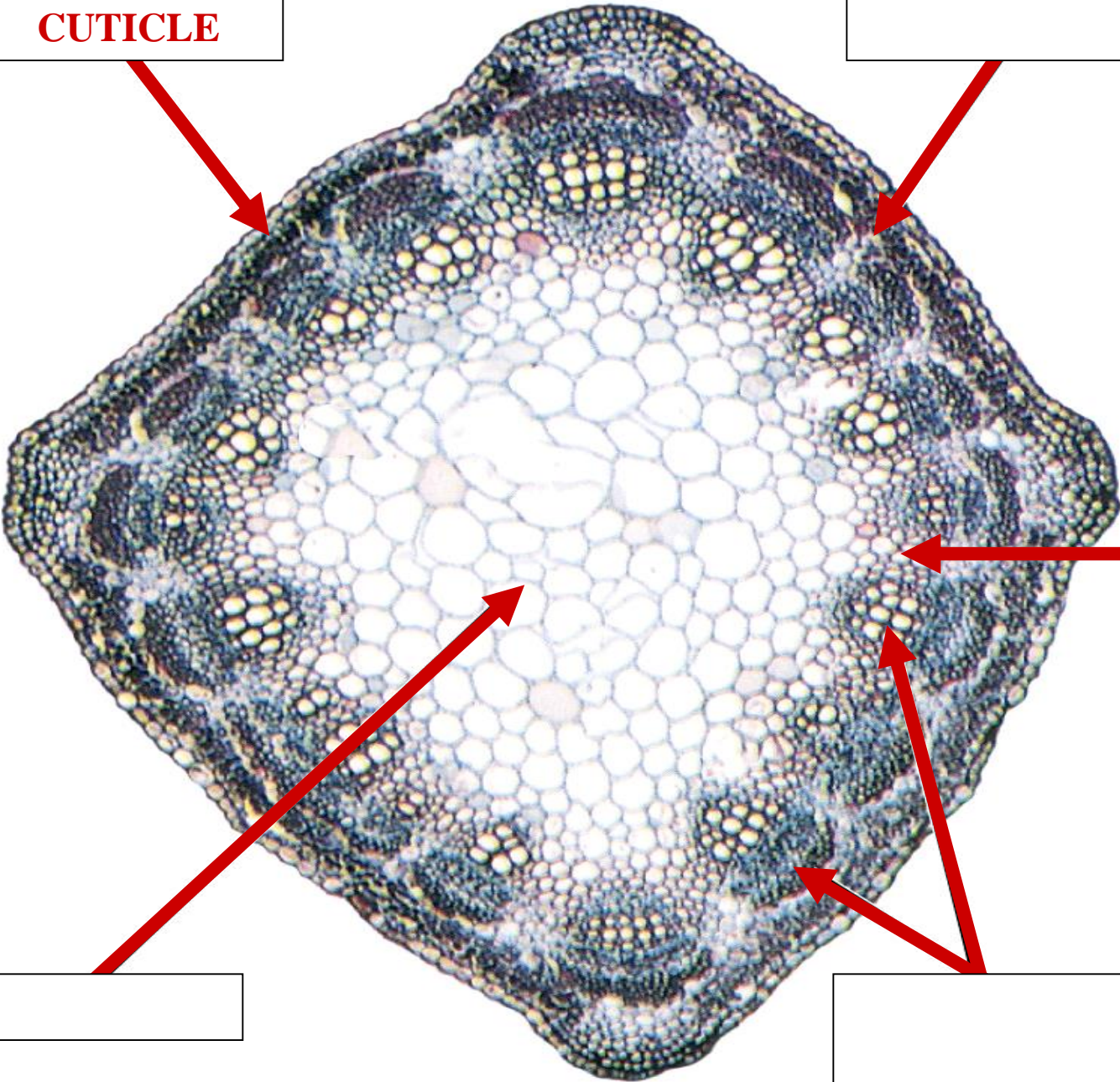


STEM

C.S.

?

CUTICLE

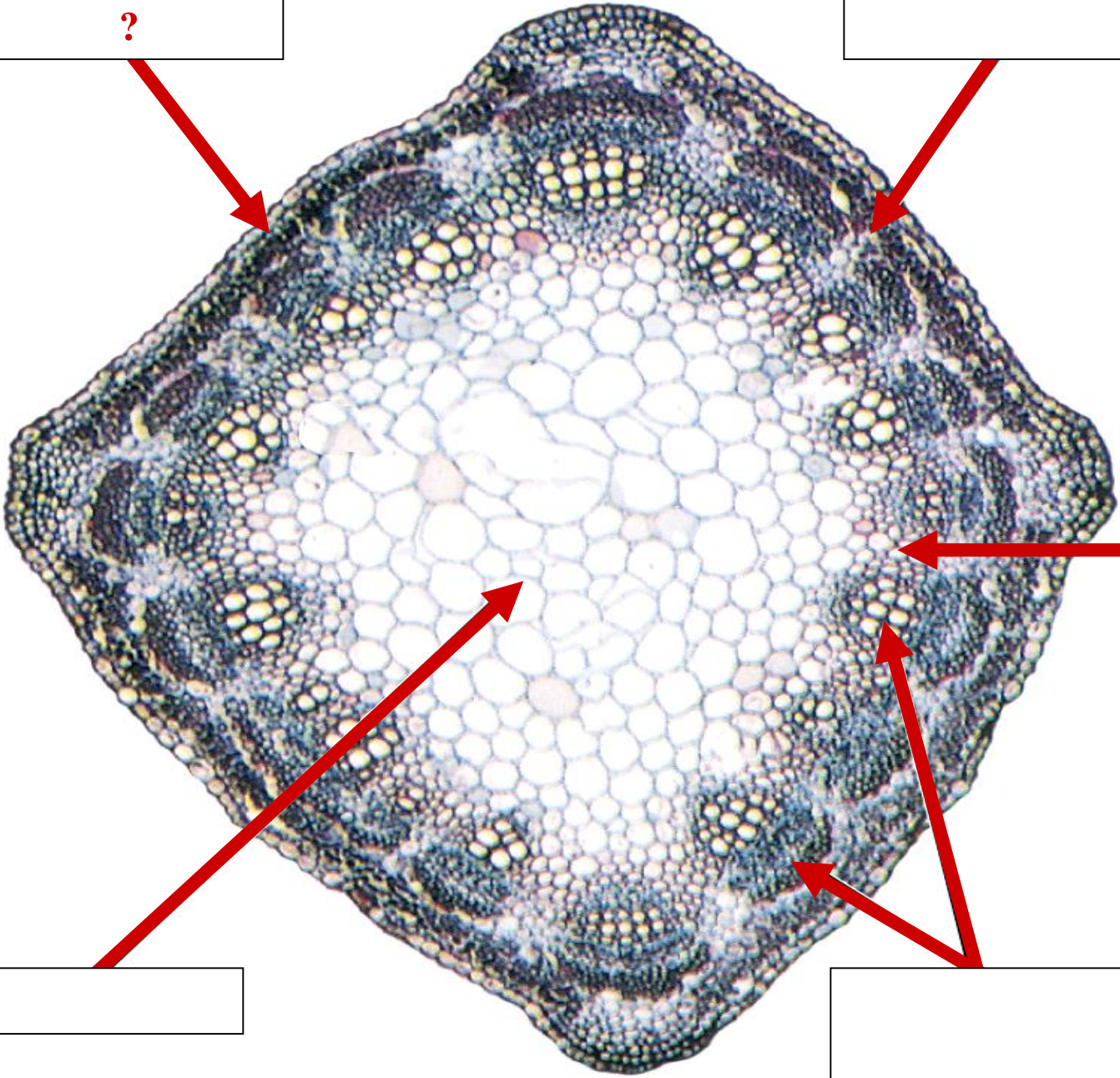


STEM

C.S.

E

?

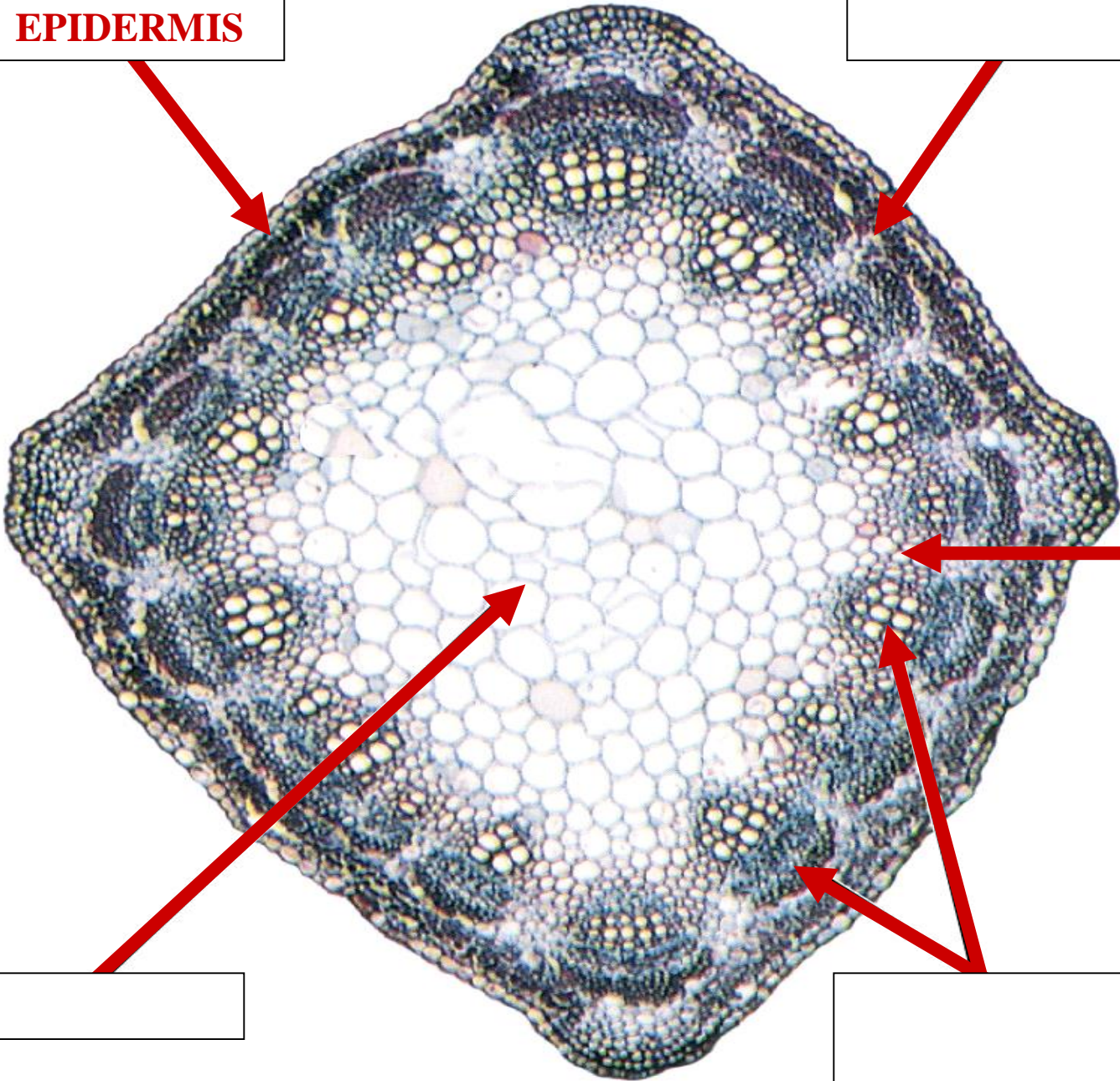


STEM

C.S.

?

EPIDERMIS



STEM

C.S.

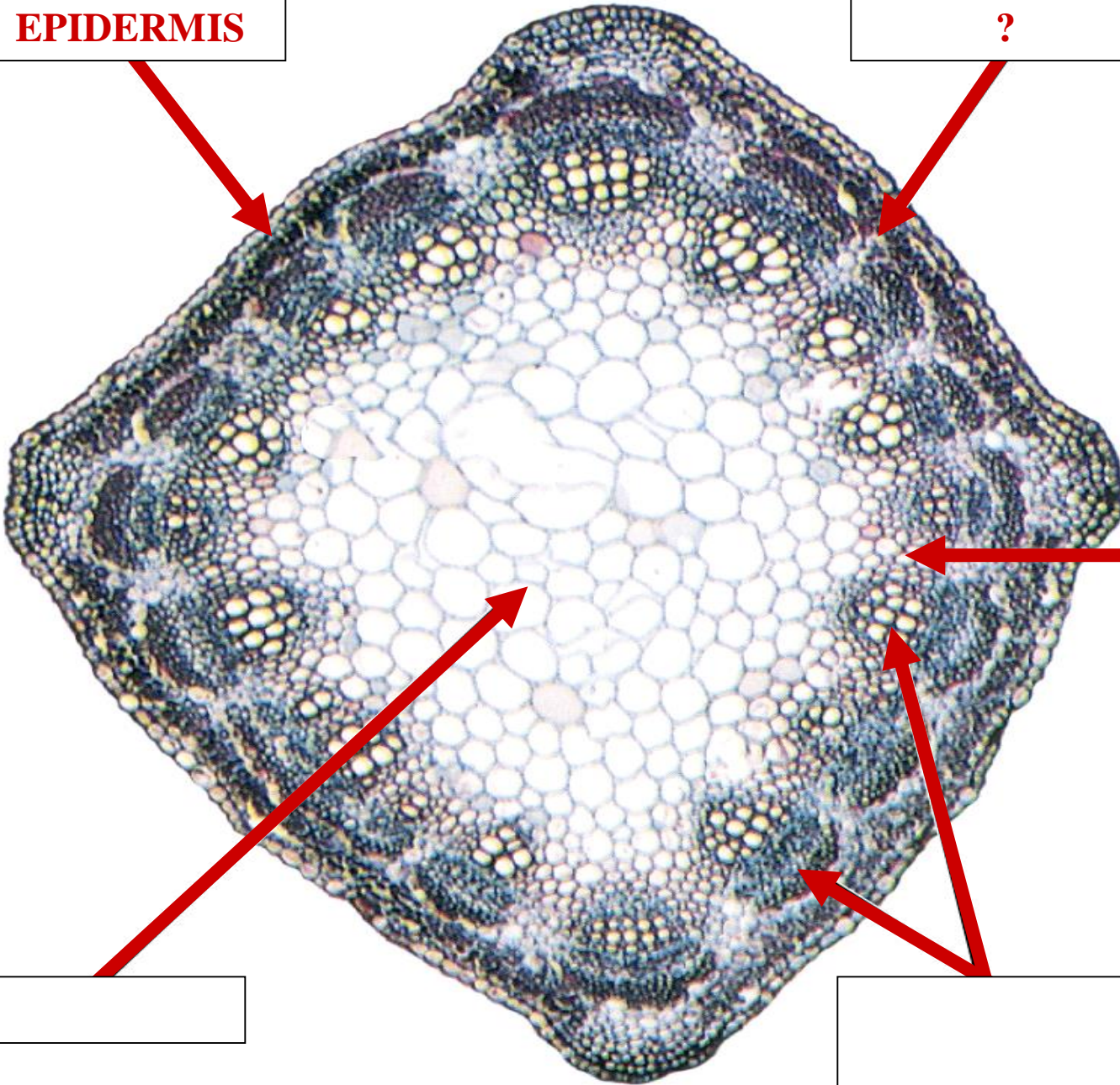
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EPIDERMIS

?

STEM

C.S.



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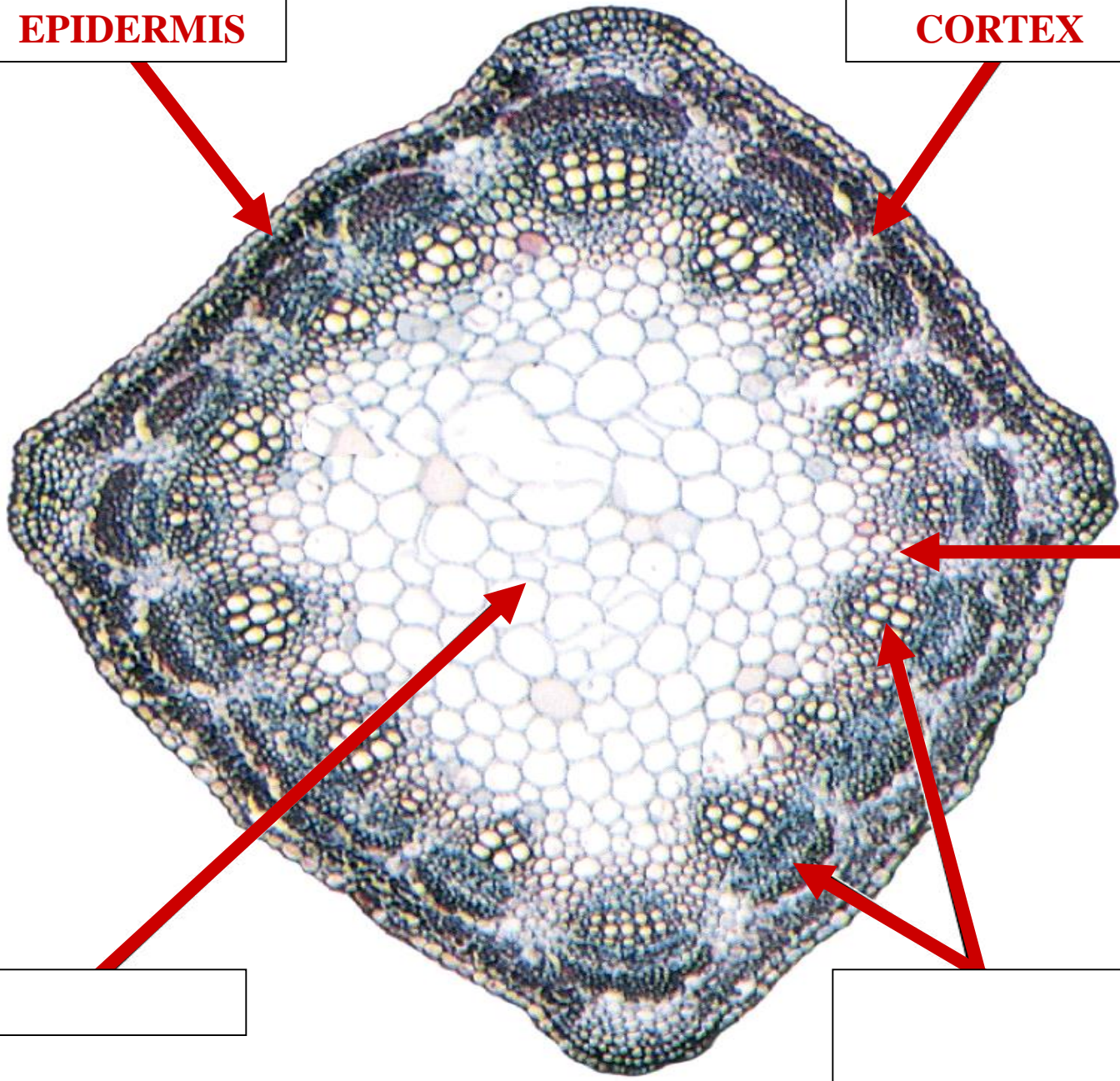
C

EPIDERMIS

CORTEX

STEM

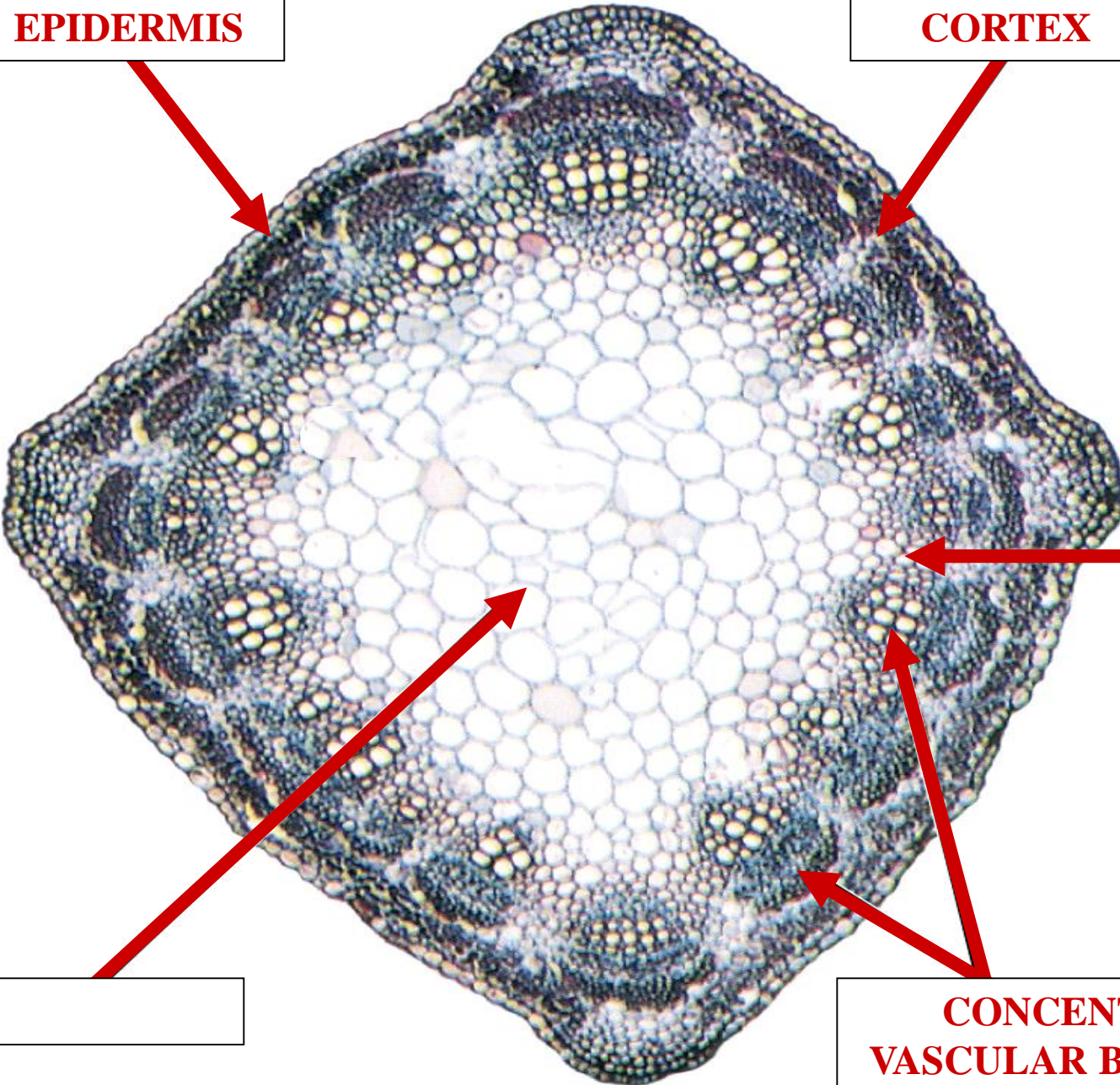
C.S.





EPIDERMIS

CORTEX

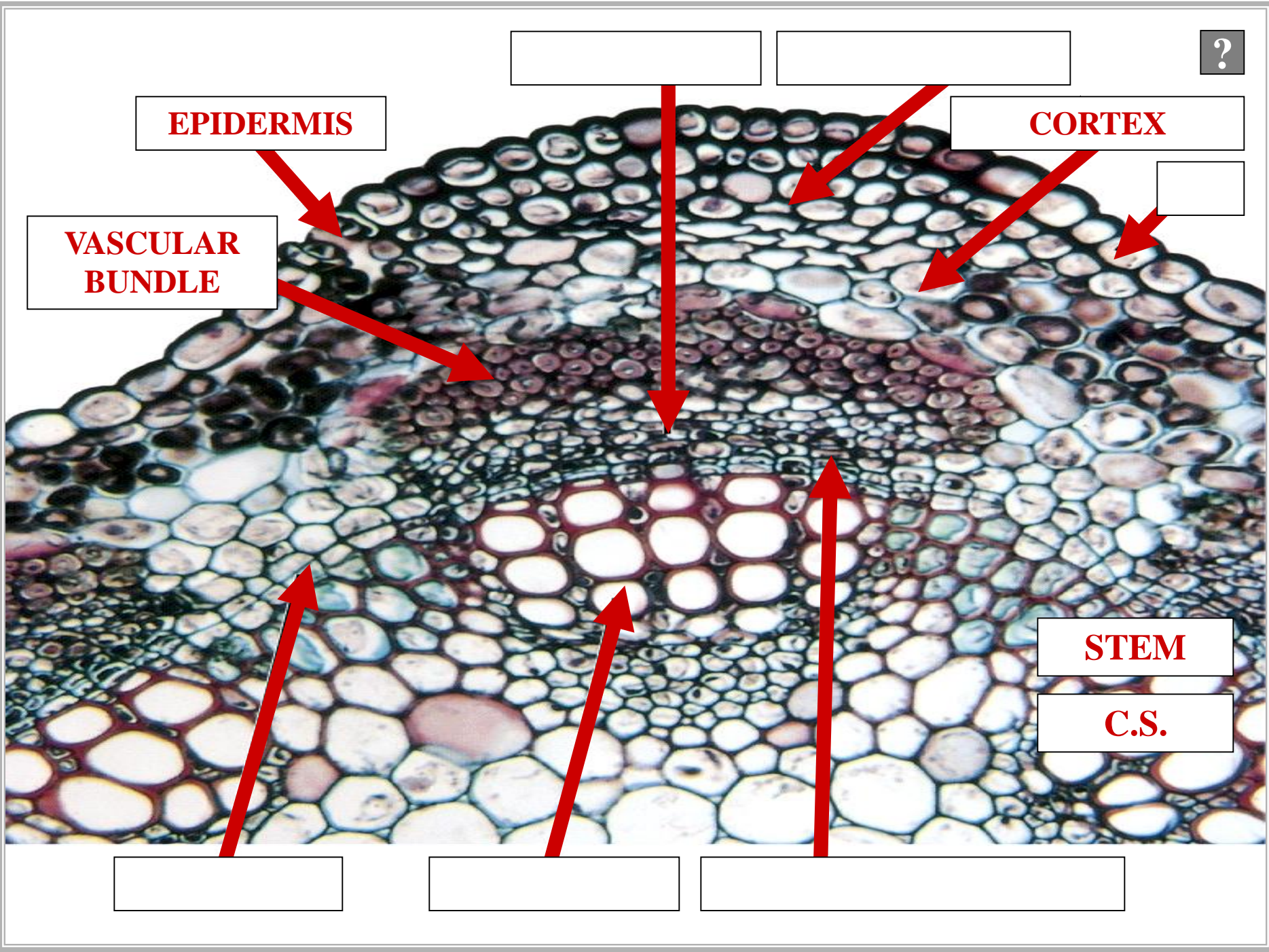


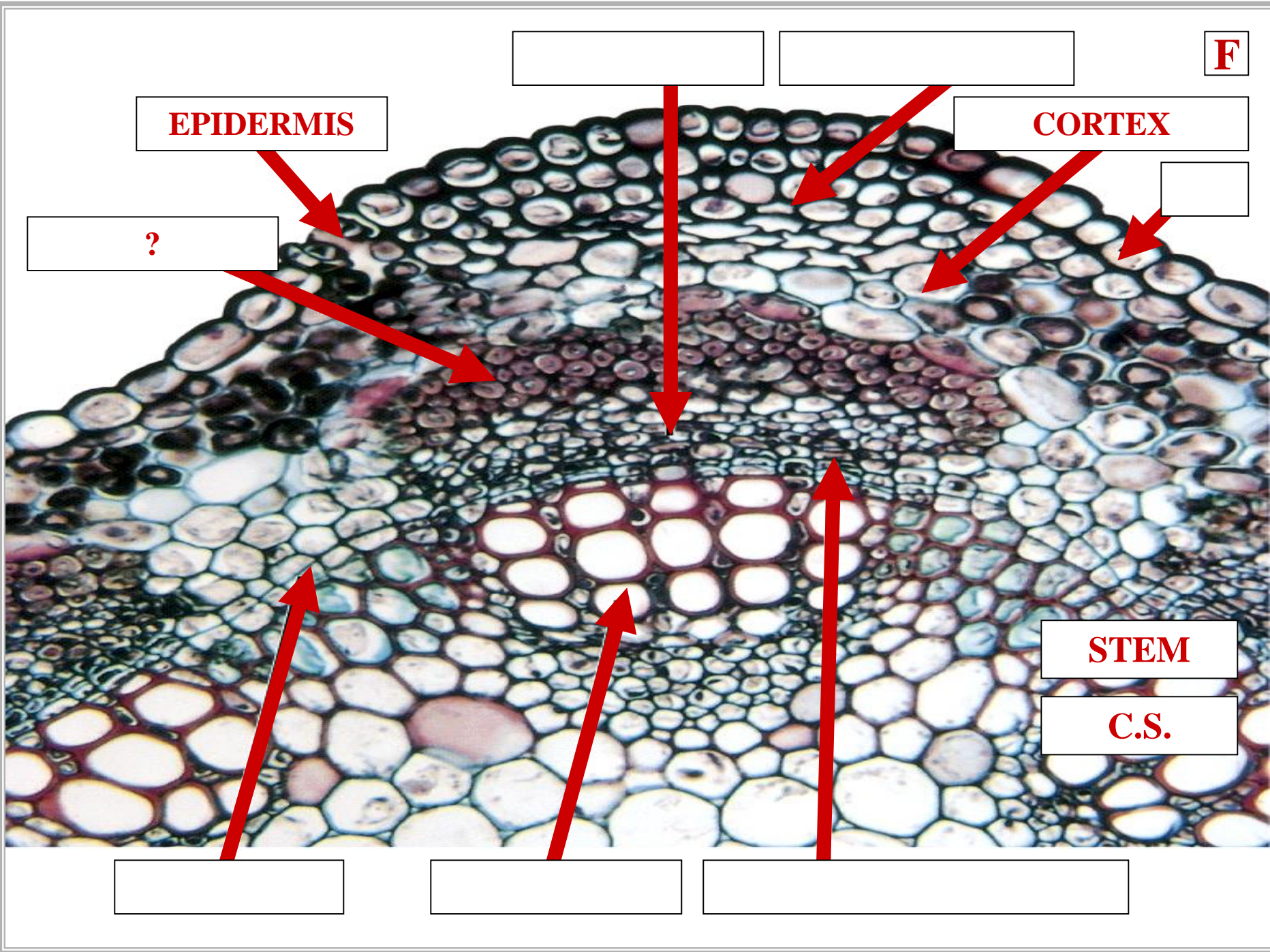
STEM

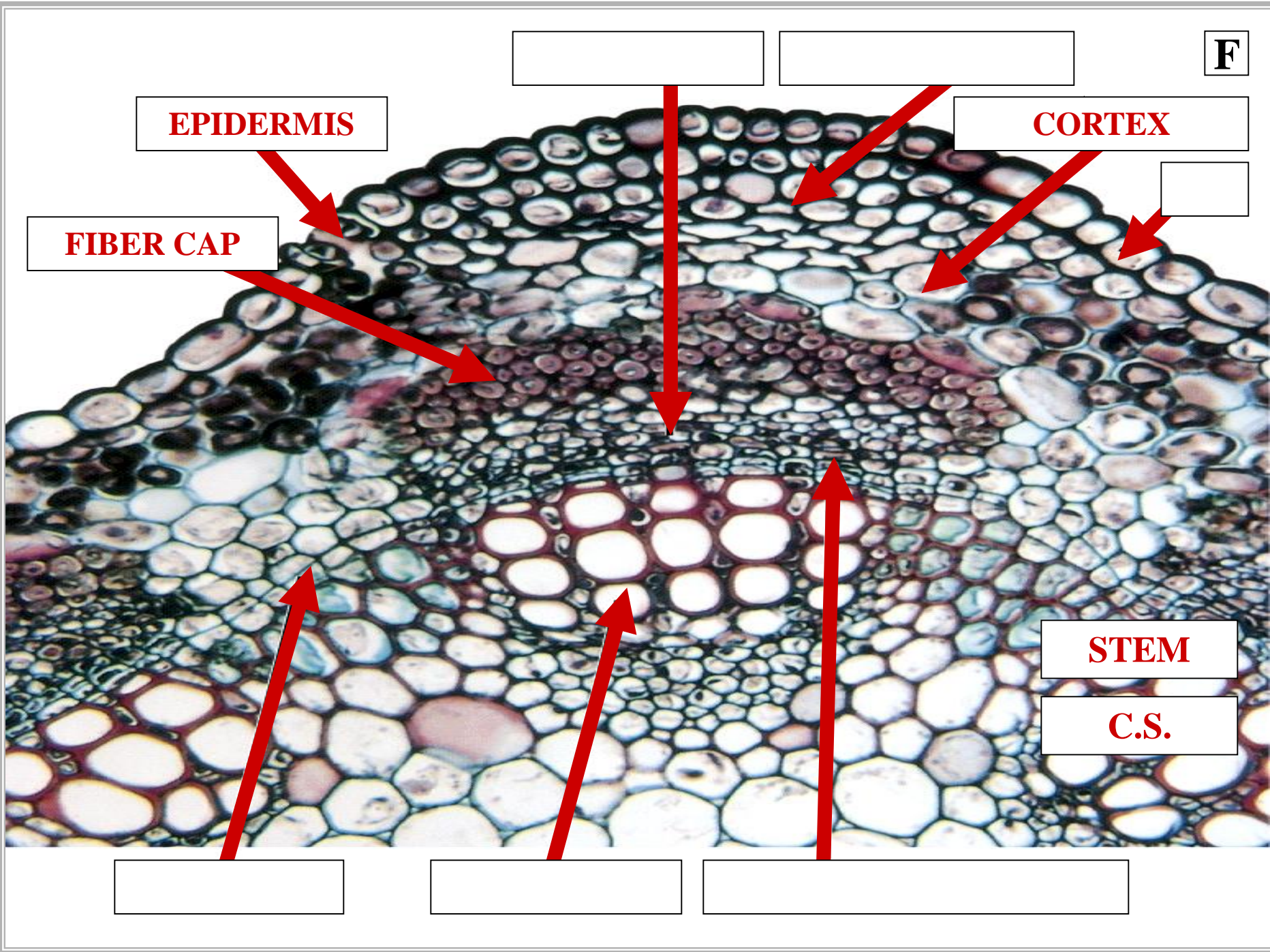
C.S.

**CONCENTRIC
VASCULAR BUNDLES**









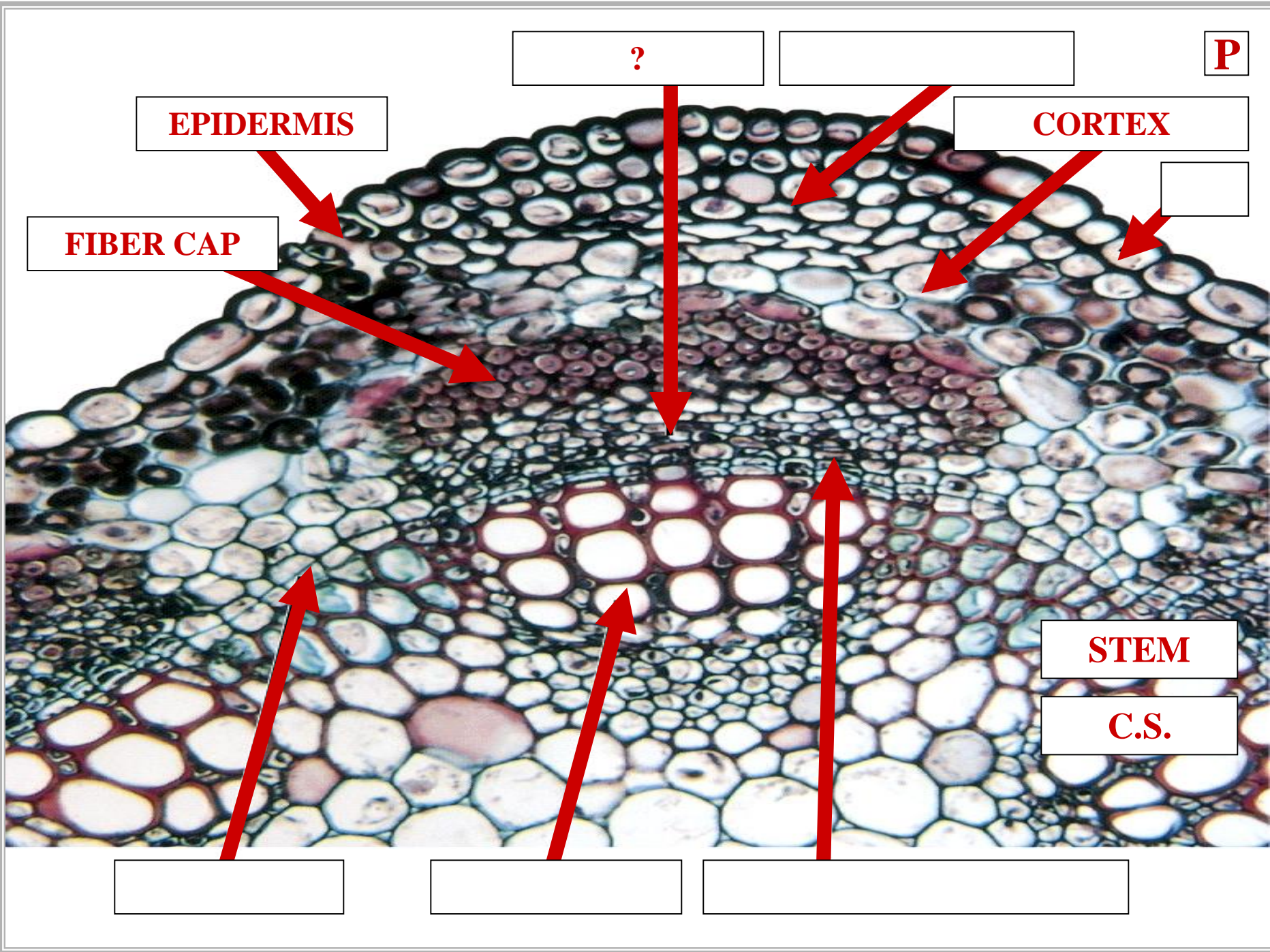
FIBER CAP

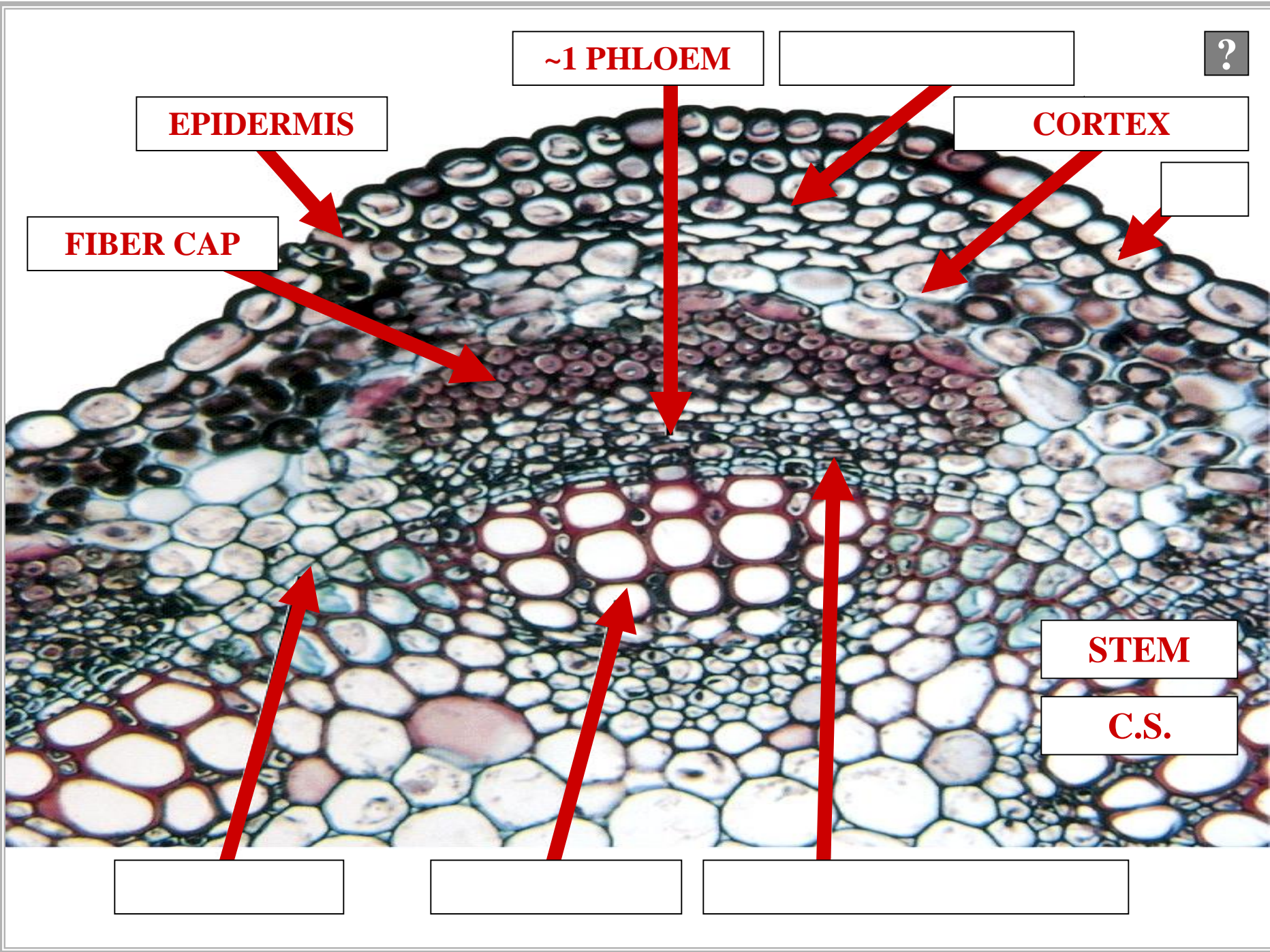


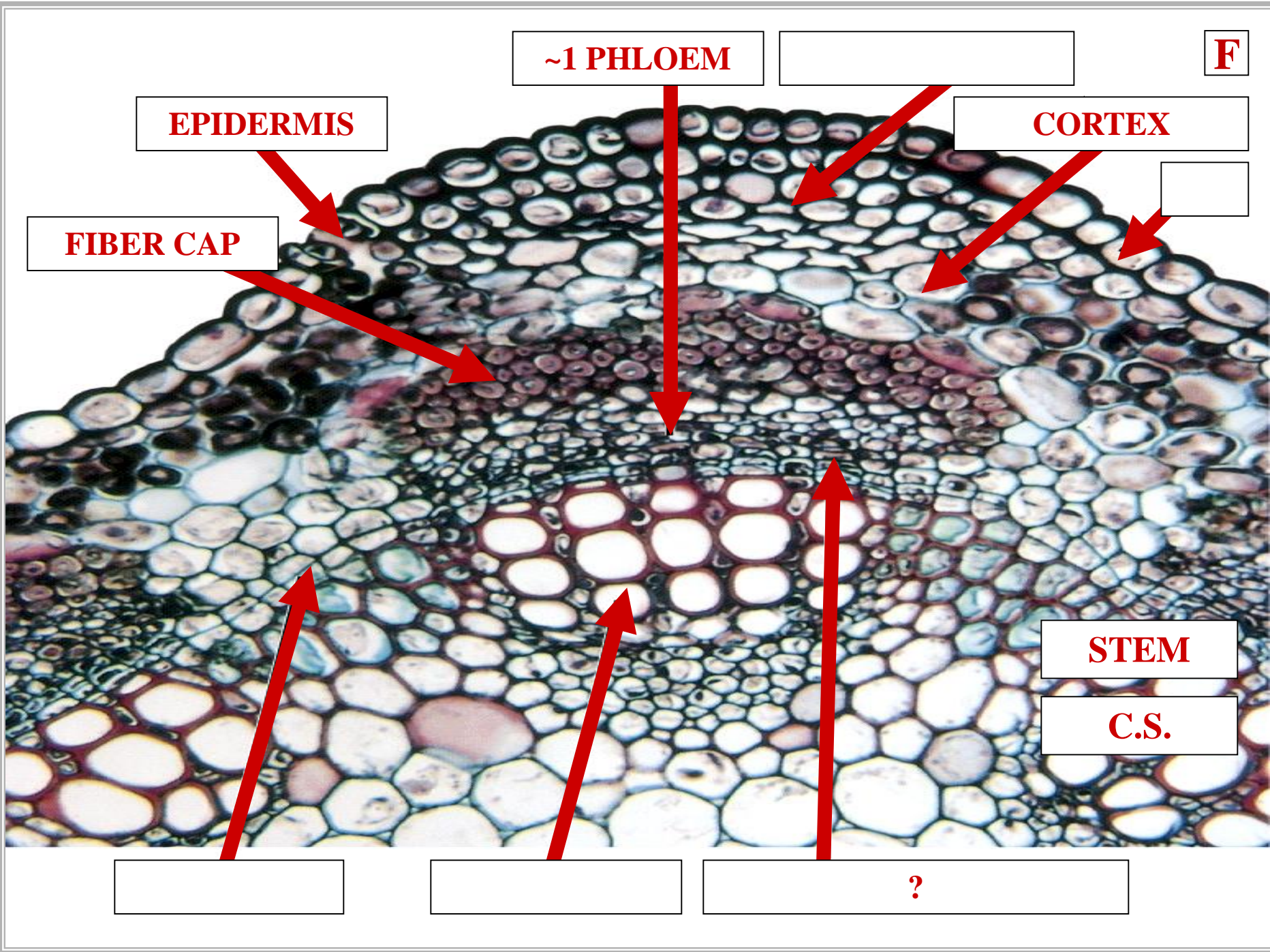
FIBER CAP

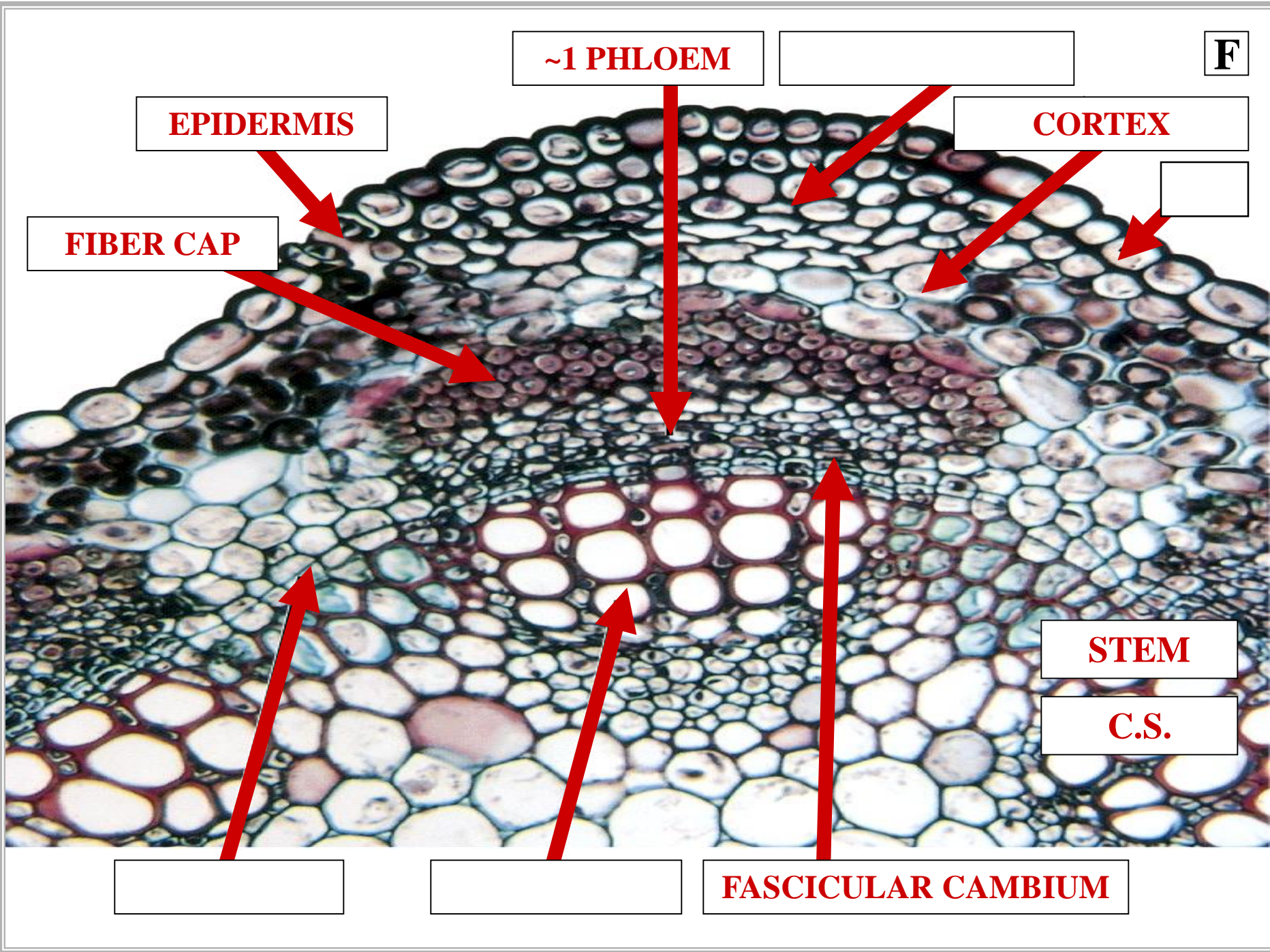
**PROVIDES BUNDLE
SUPPORT**

FIBER CAP









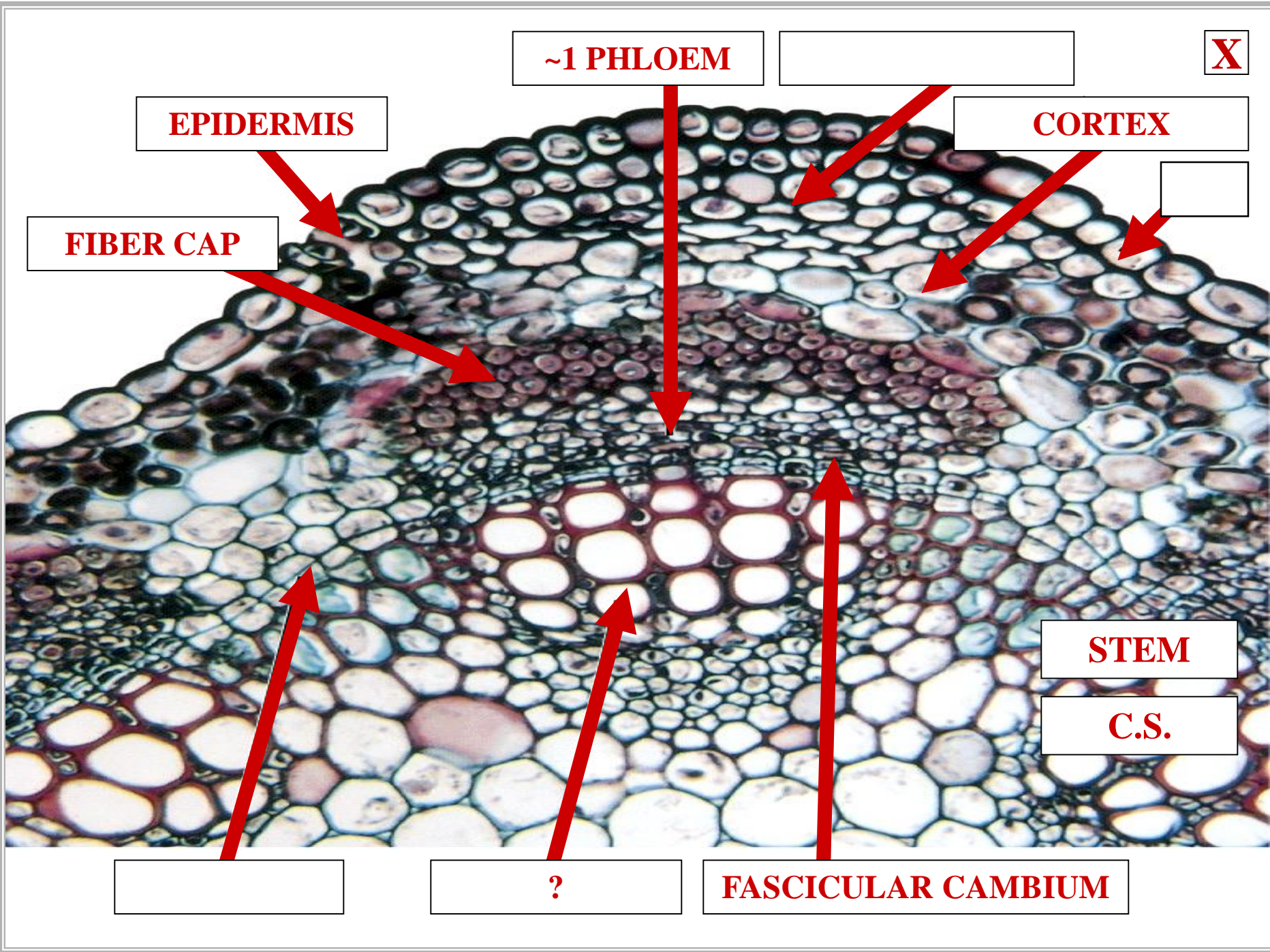
FASCICULAR CAMBIUM

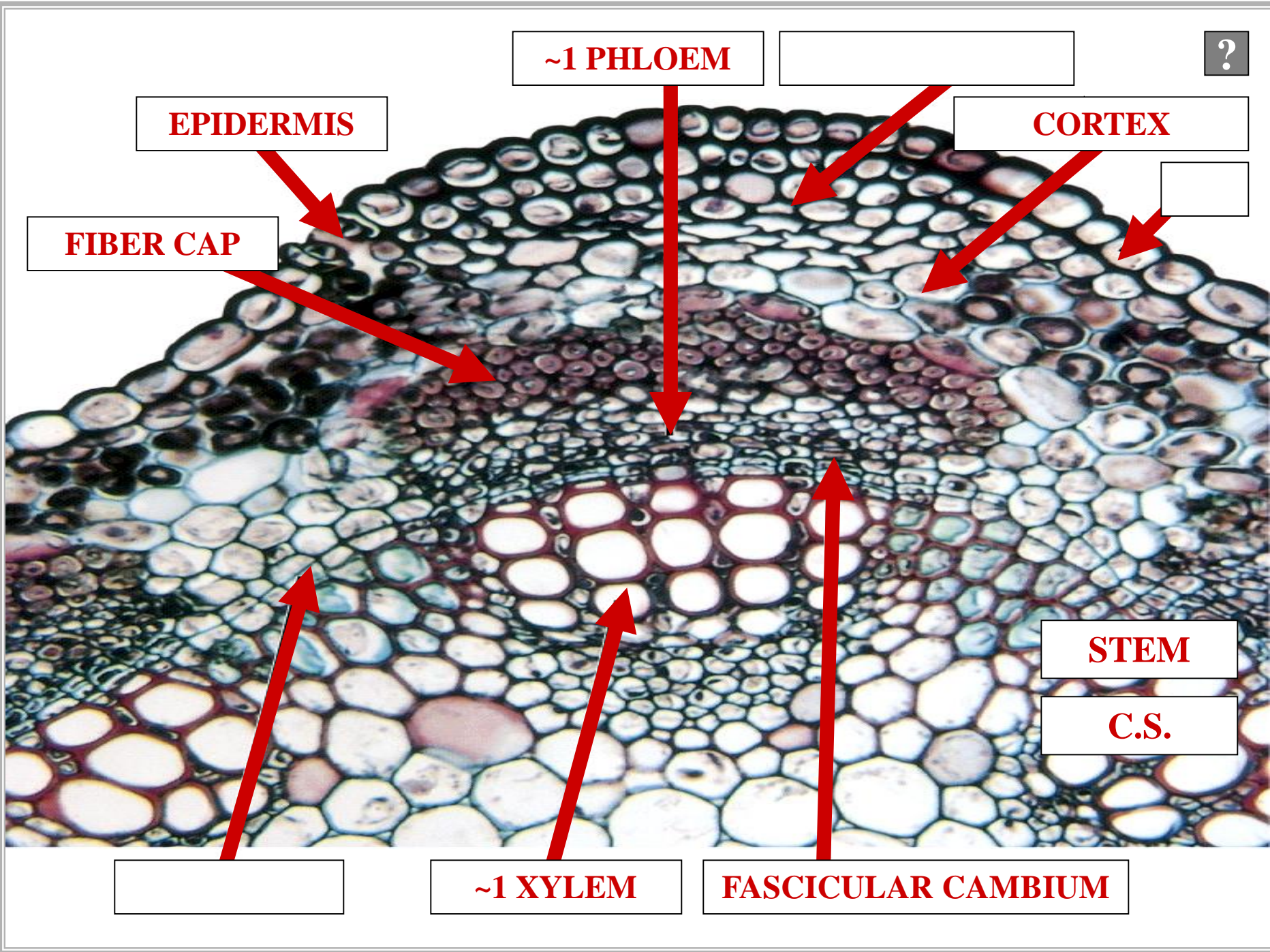


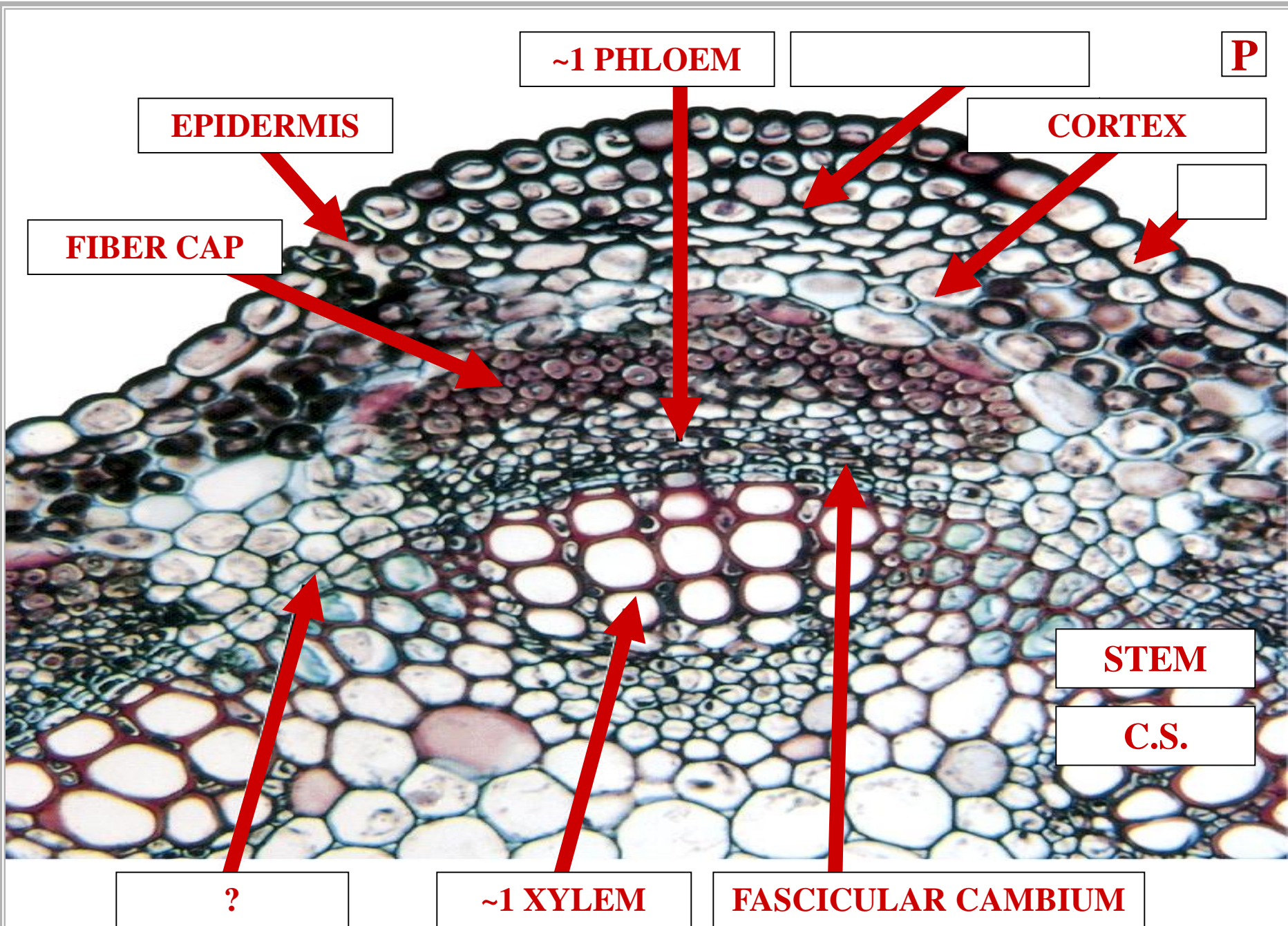
FASCICULAR CAMBIUM

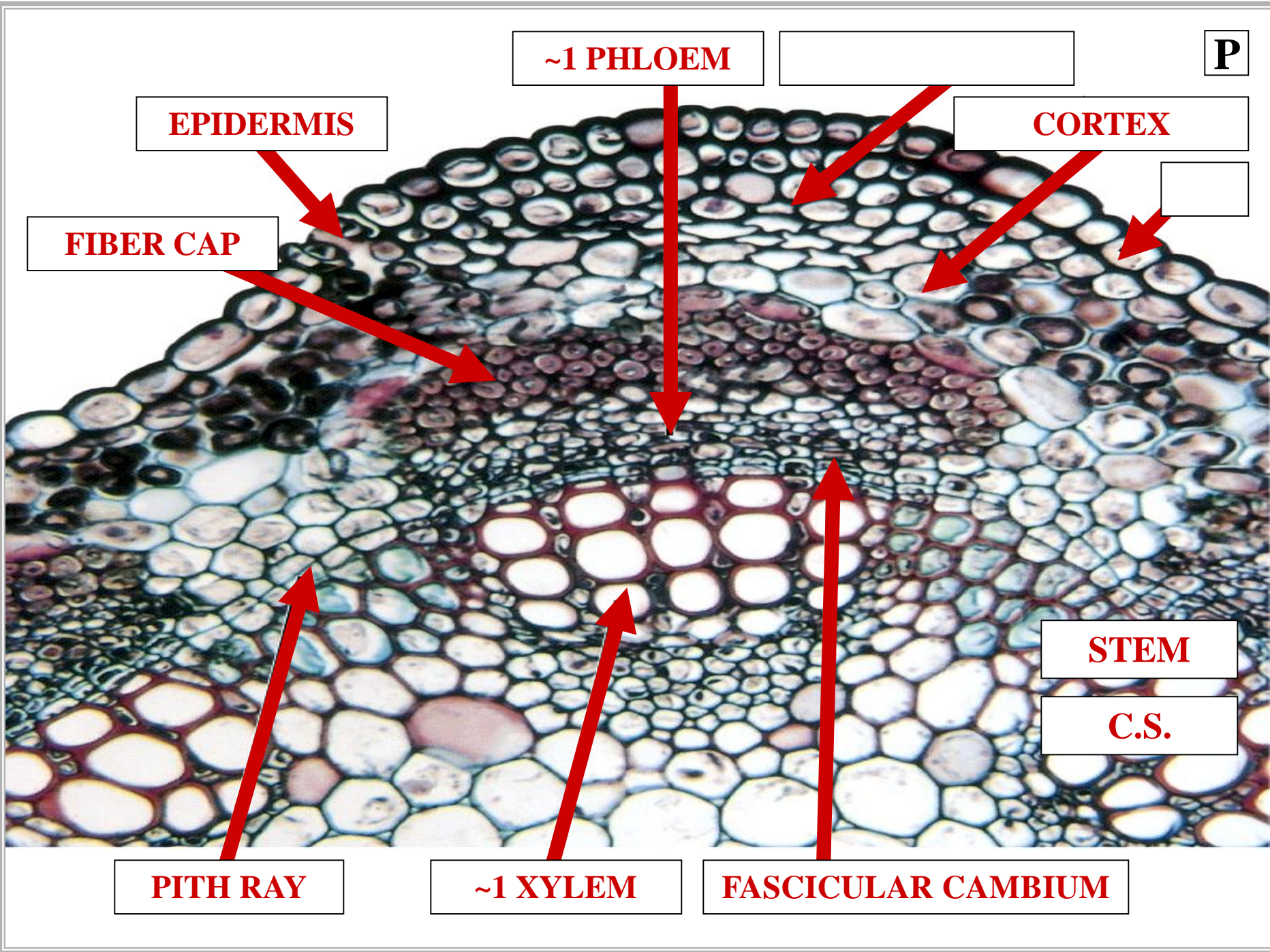
GROWTH REGION

FASCICULAR CAMBIUM









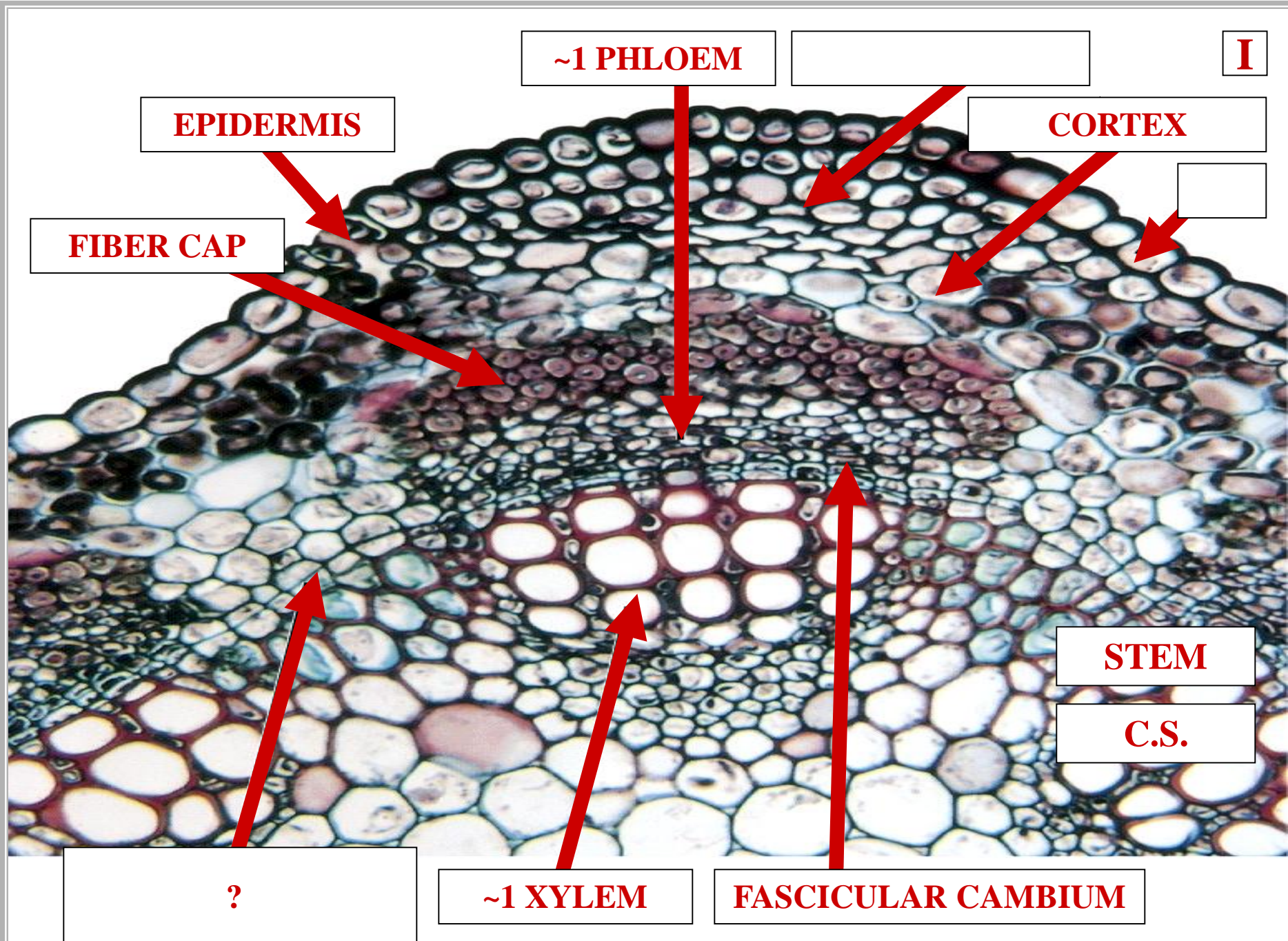
PITH RAY

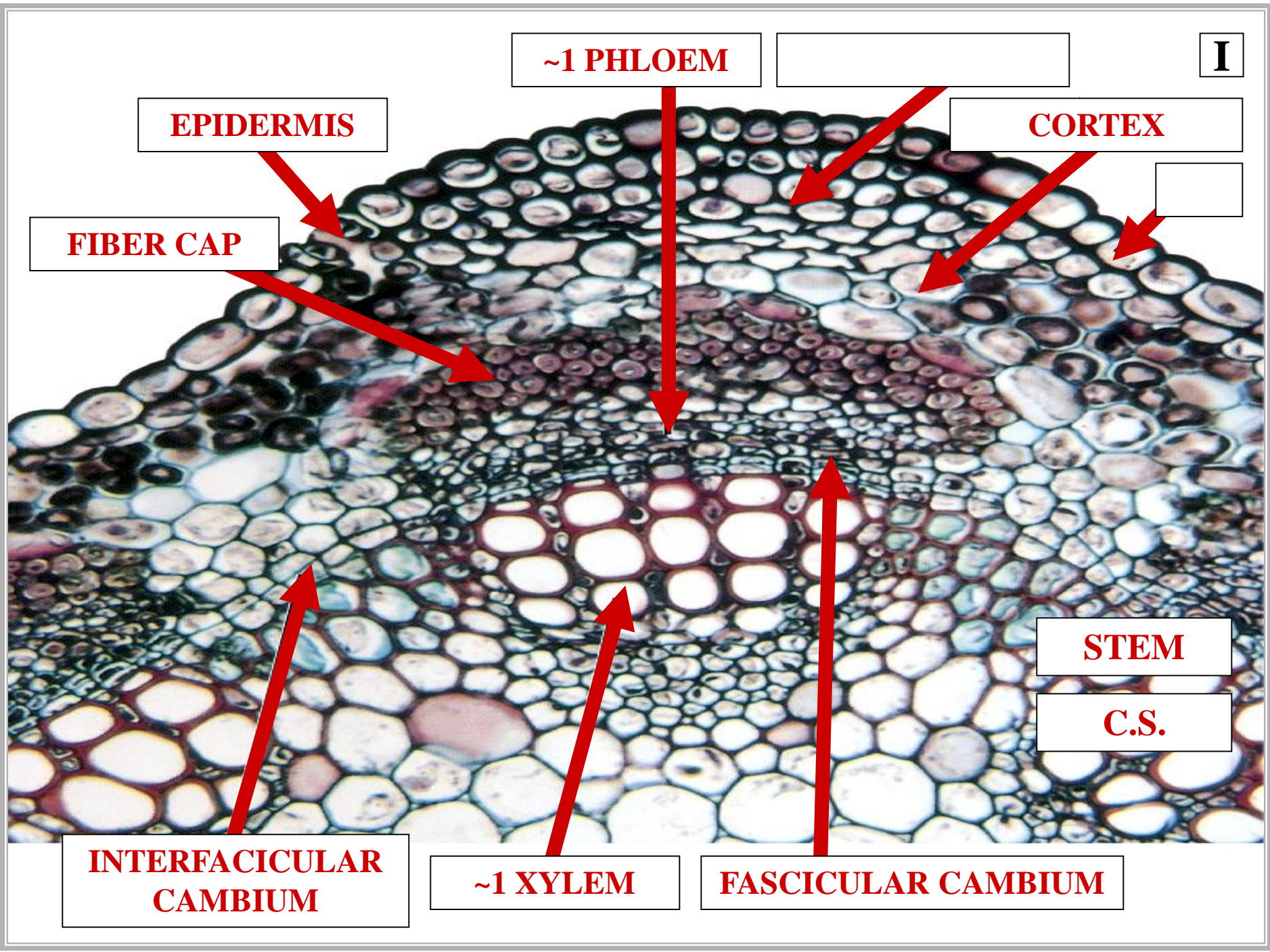


PITH RAY

**CORTEX TO PITH
CONDUIT**

PITH RAY





~1 PHLOEM

I

EPIDERMIS

CORTEX

FIBER CAP

STEM

C.S.

INTERFASCICULAR CAMBIUM

~1 XYLEM

FASCICULAR CAMBIUM

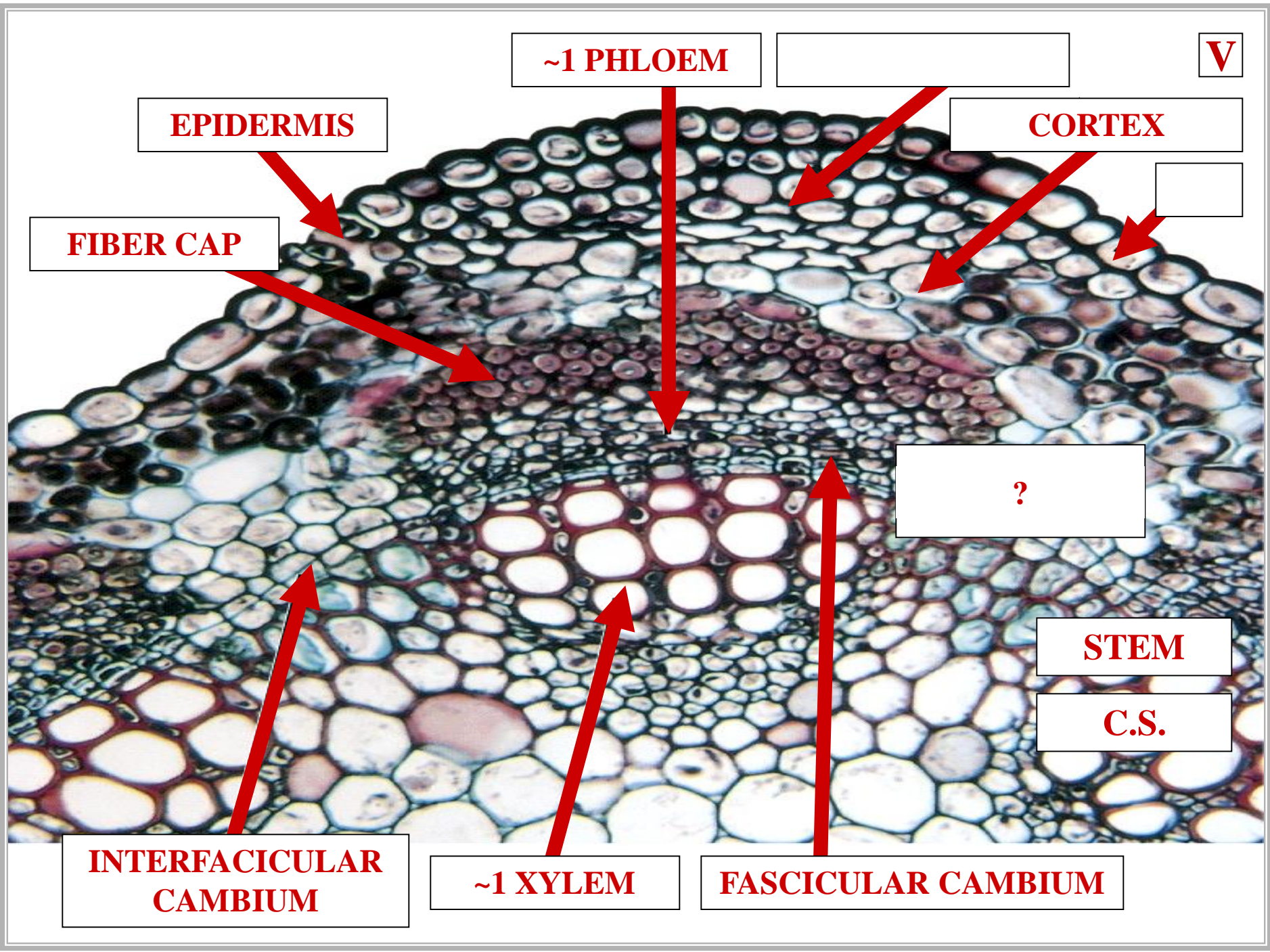
INTERFASCICULAR CAMBIUM

**INTERFASCICULAR
CAMBIUM**



GROWTH REGION

**INTERFASCICULAR
CAMBIUM**



~1 PHLOEM

V

EPIDERMIS

CORTEX

FIBER CAP

?

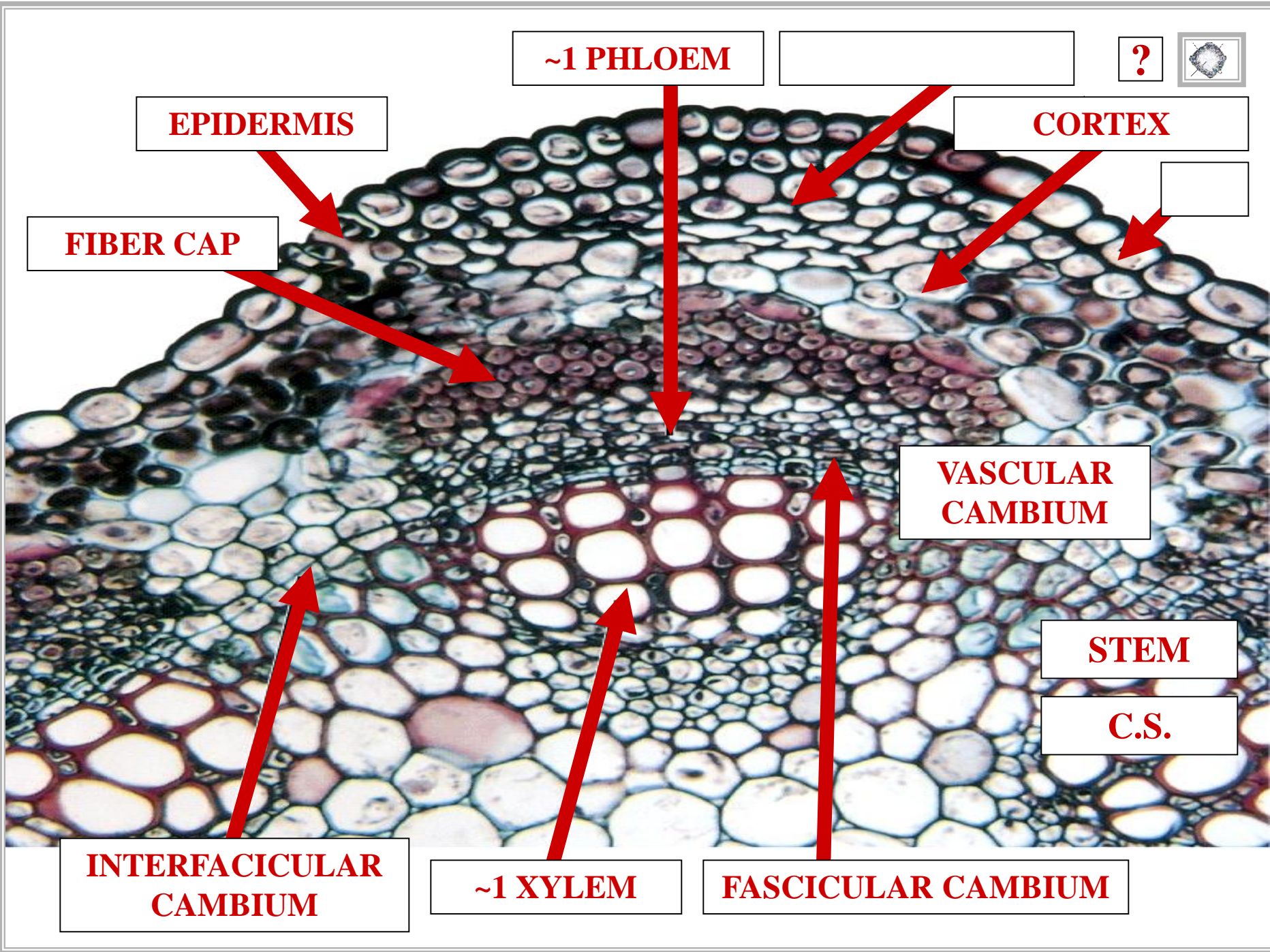
STEM

C.S.

INTERFASCICULAR CAMBIUM

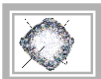
~1 XYLEM

FASCICULAR CAMBIUM



~1 PHLOEM

?



EPIDERMIS

CORTEX

FIBER CAP

VASCULAR CAMBIUM

STEM

C.S.

INTERFASCICULAR CAMBIUM

~1 XYLEM

FASCICULAR CAMBIUM

EPIDERMIS

CORTEX

PITH RAY

STEM

C.S.

CONCENTRIC VASCULAR BUNDLES

?

