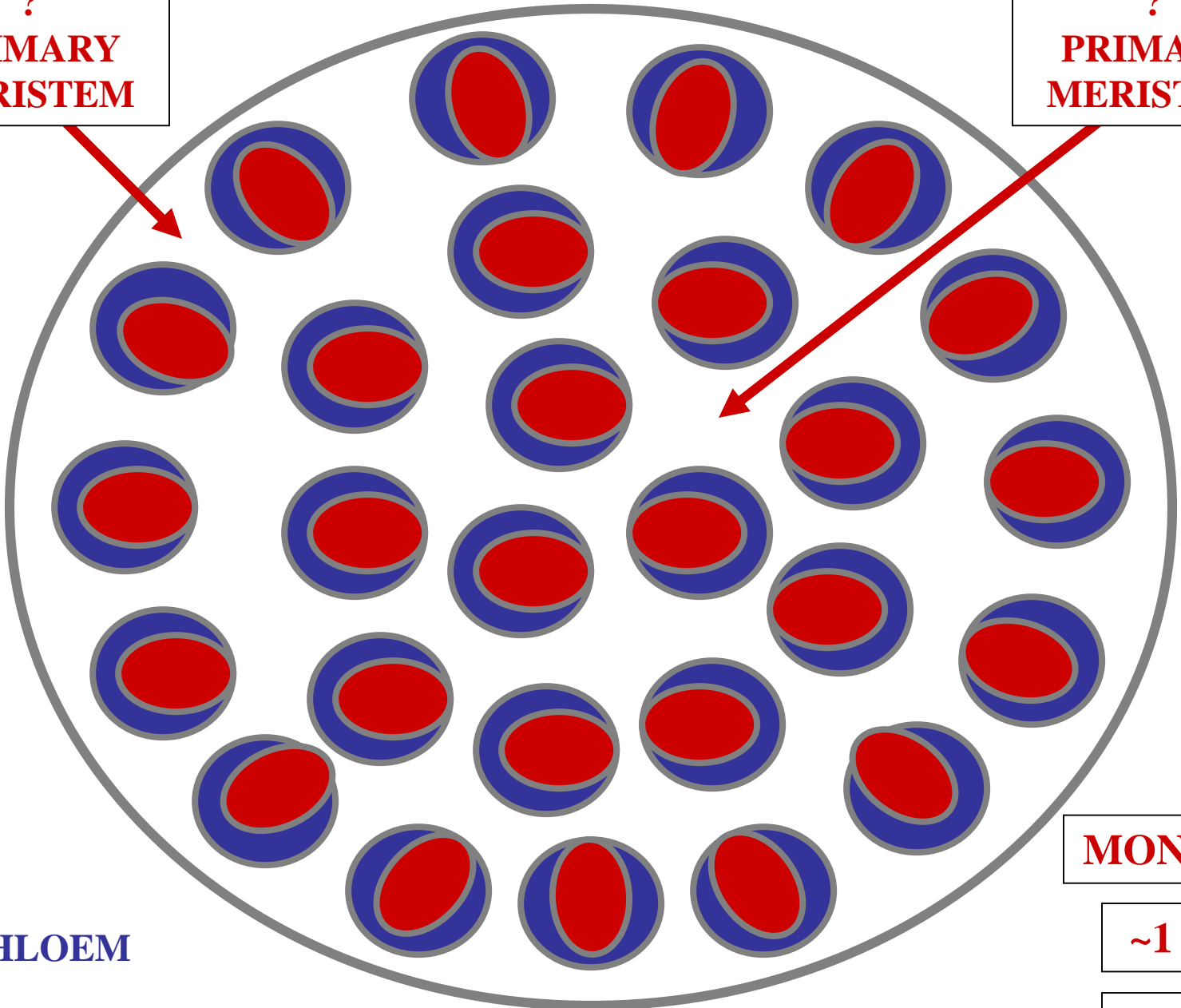


?
**PRIMARY
MERISTEM**

?
**PRIMARY
MERISTEM**

G



● = PHLOEM

● = XYLEM

MONOCOT

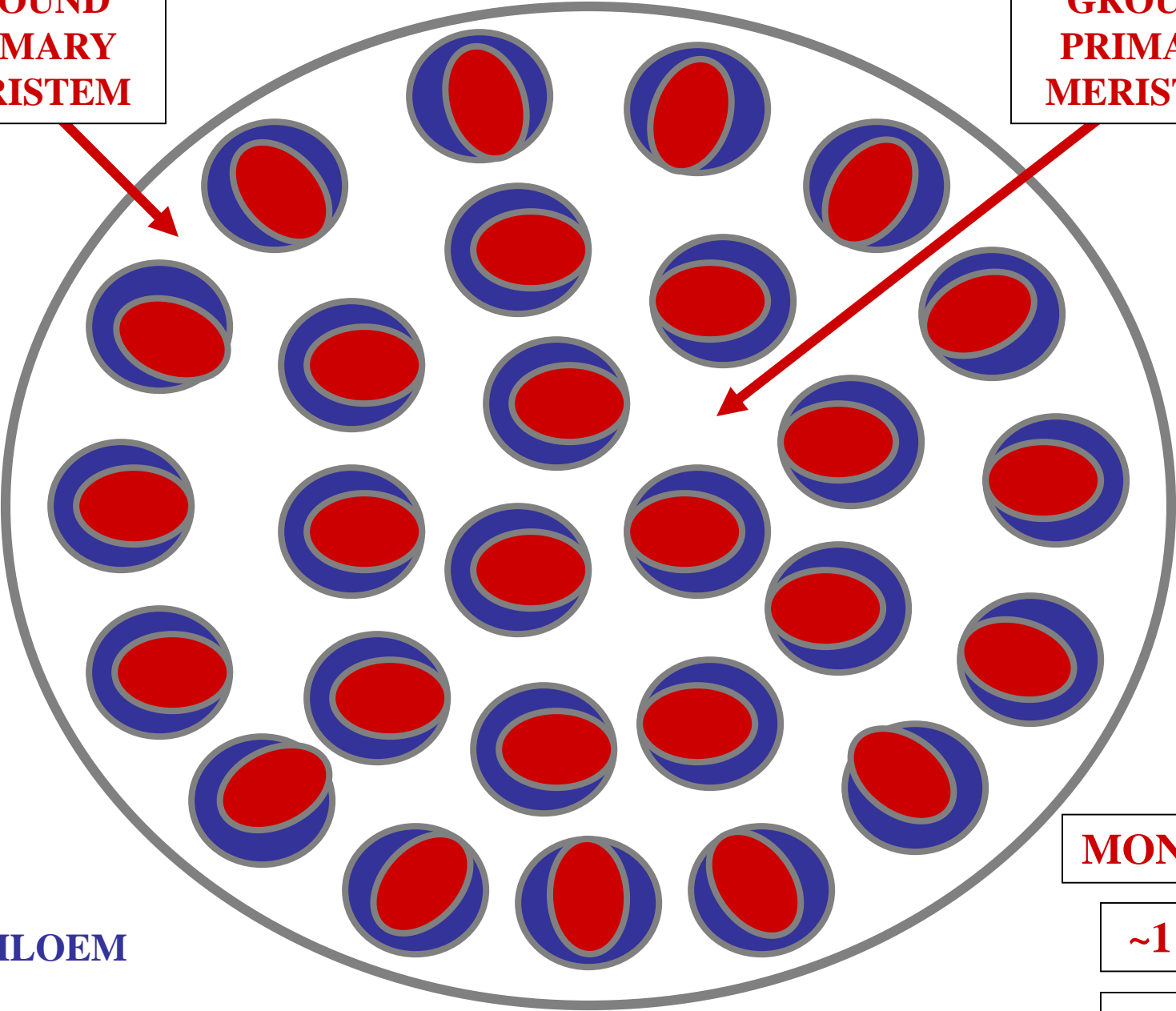
~1 STEM

C.S.

**GROUND
PRIMARY
MERISTEM**

**GROUND
PRIMARY
MERISTEM**

~



● = PHLOEM

● = XYLEM

MONOCOT

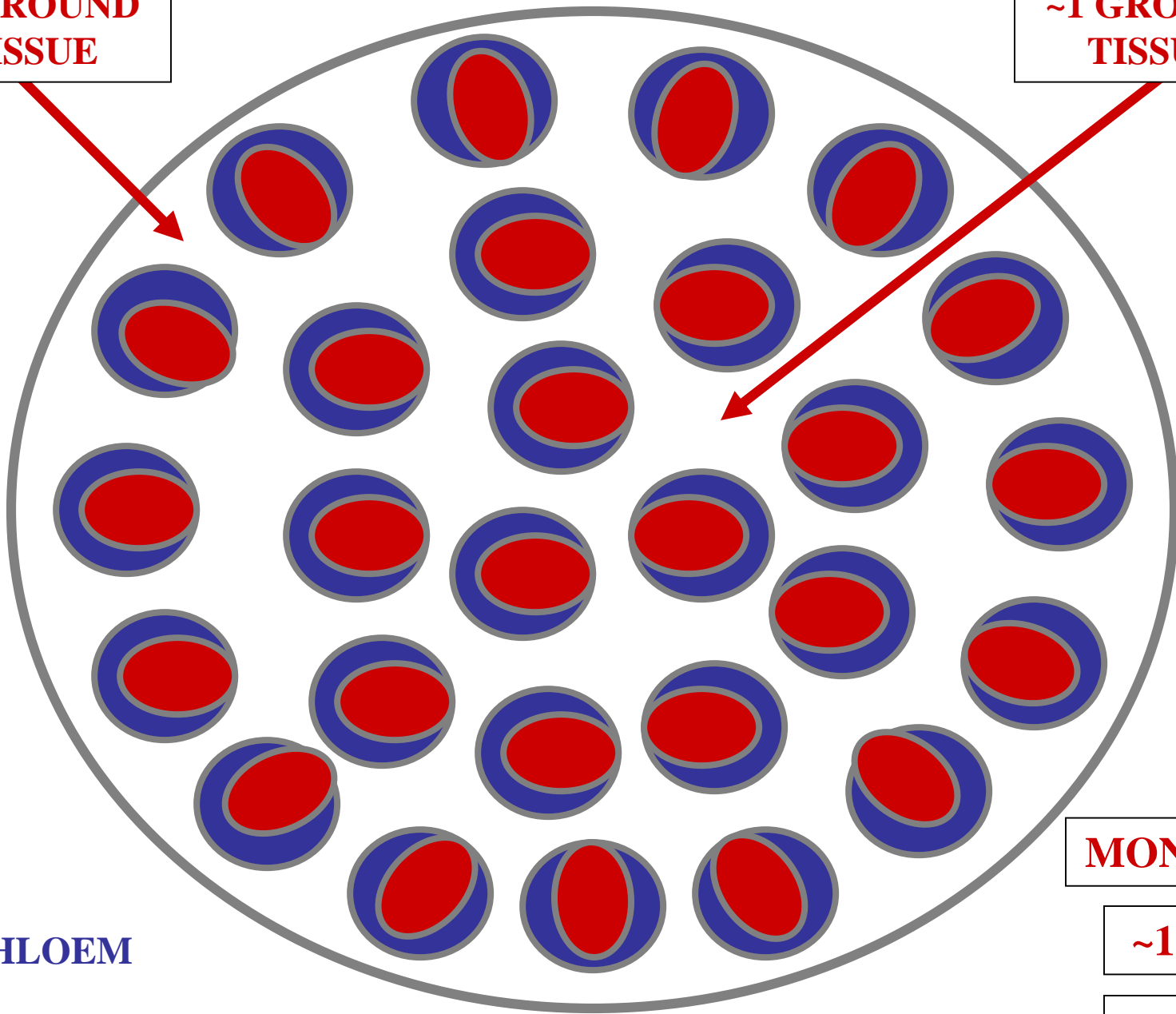
~1 STEM

C.S.

**~1 GROUND
TISSUE**

**~1 GROUND
TISSUE**

C



● = PHLOEM

● = XYLEM

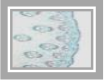
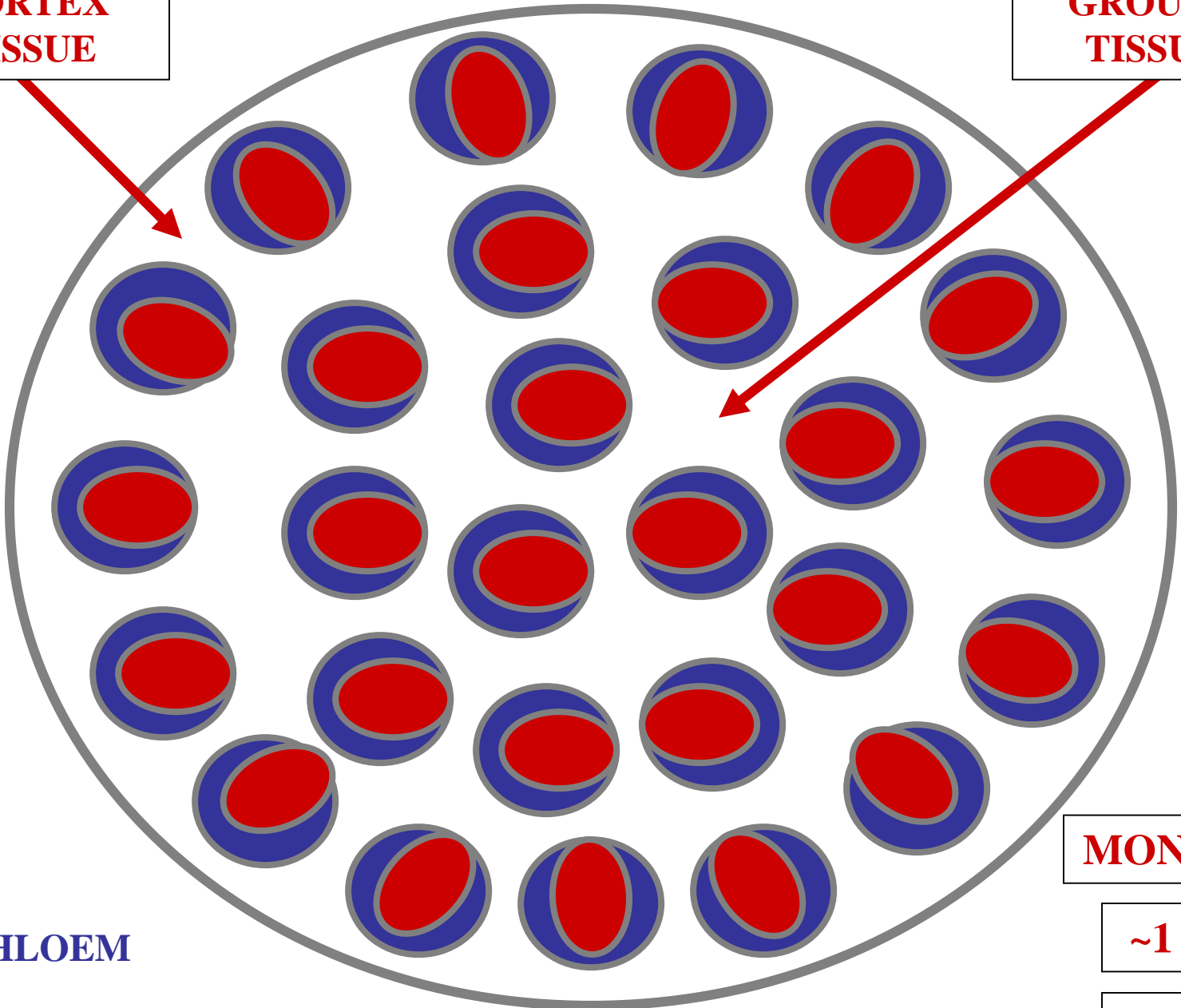
MONOCOT

~1 STEM

C.S.

**CORTEX
TISSUE**

**GROUND
TISSUE**



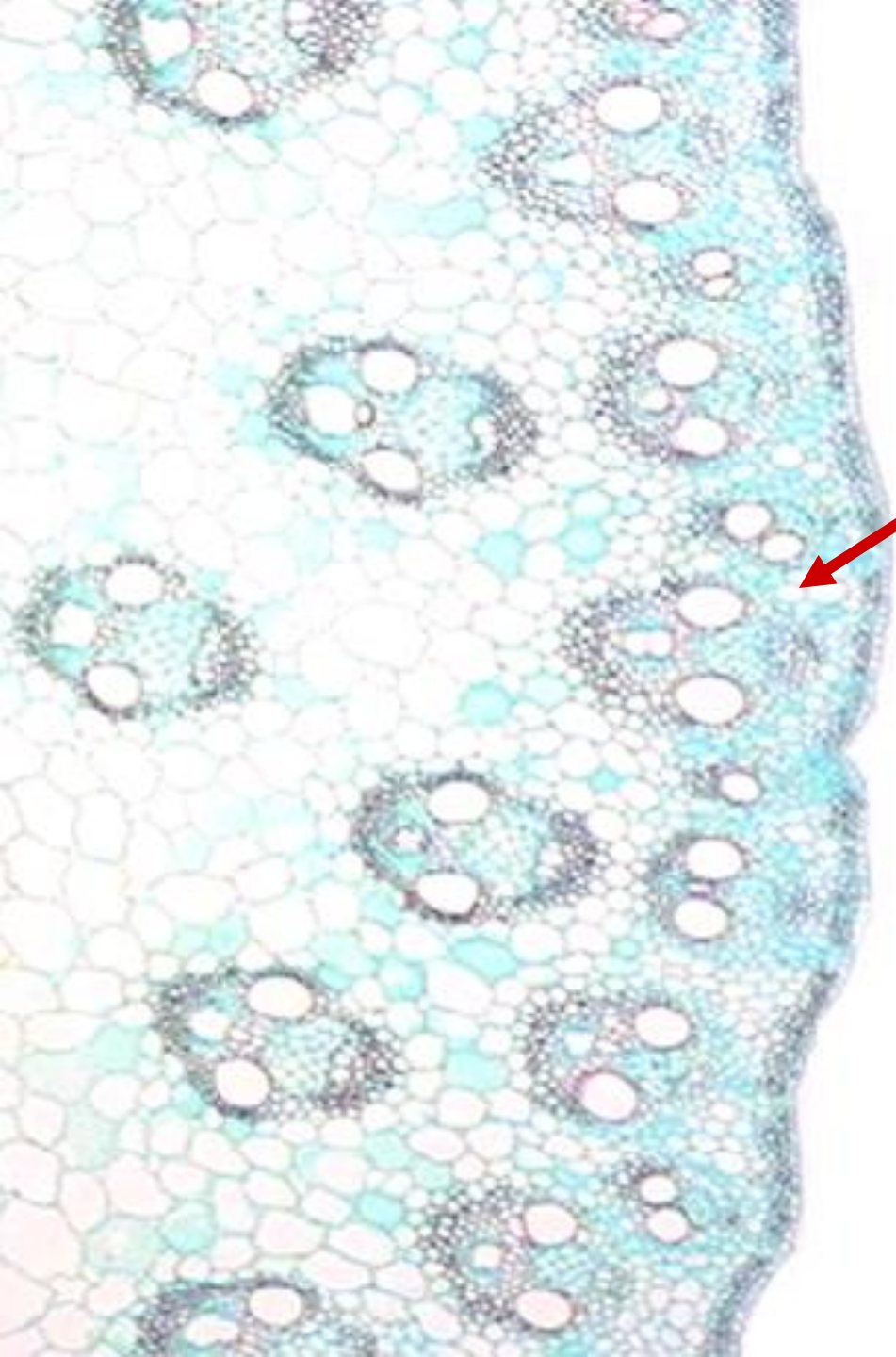
● = PHLOEM

● = XYLEM

MONOCOT

~1 STEM

C.S.



MONOCOT



CORTEX

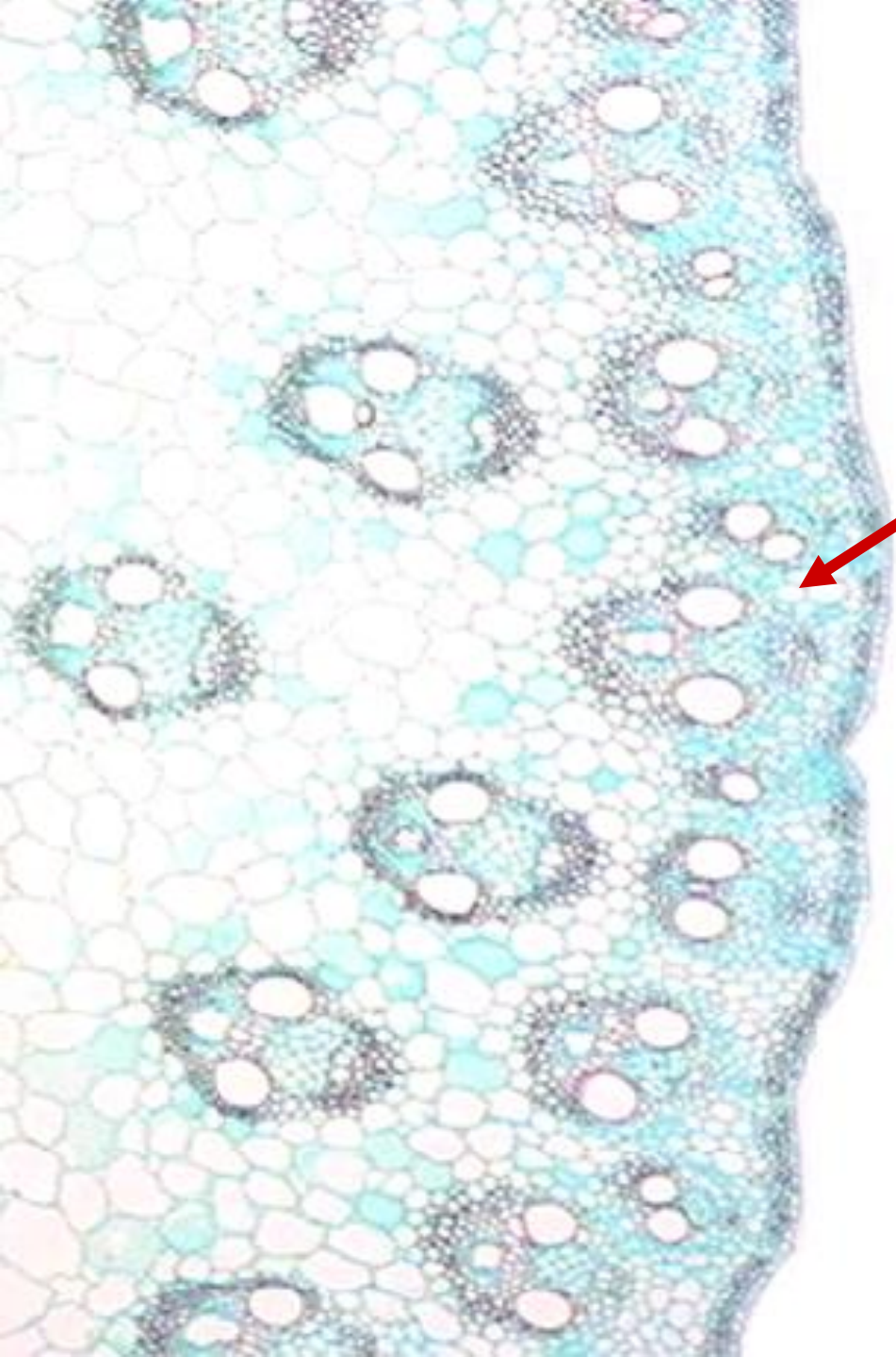


~1 STEM

C.S.



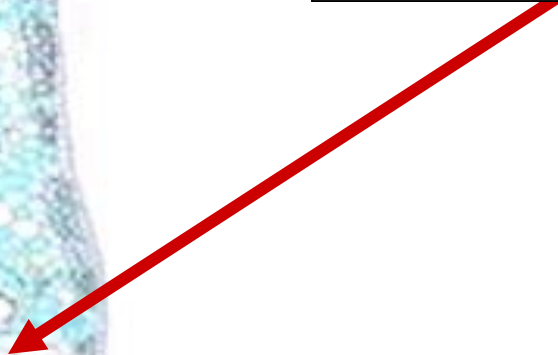
MONOCOT STEM CORTEX



MONOCOT



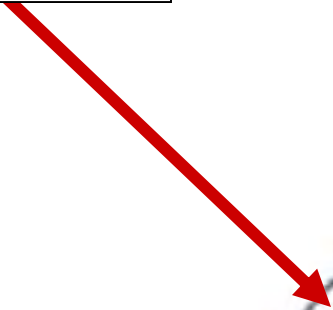
CORTEX



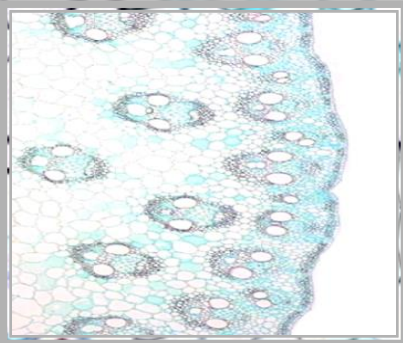
~1 STEM

C.S.

EPIDERMIS



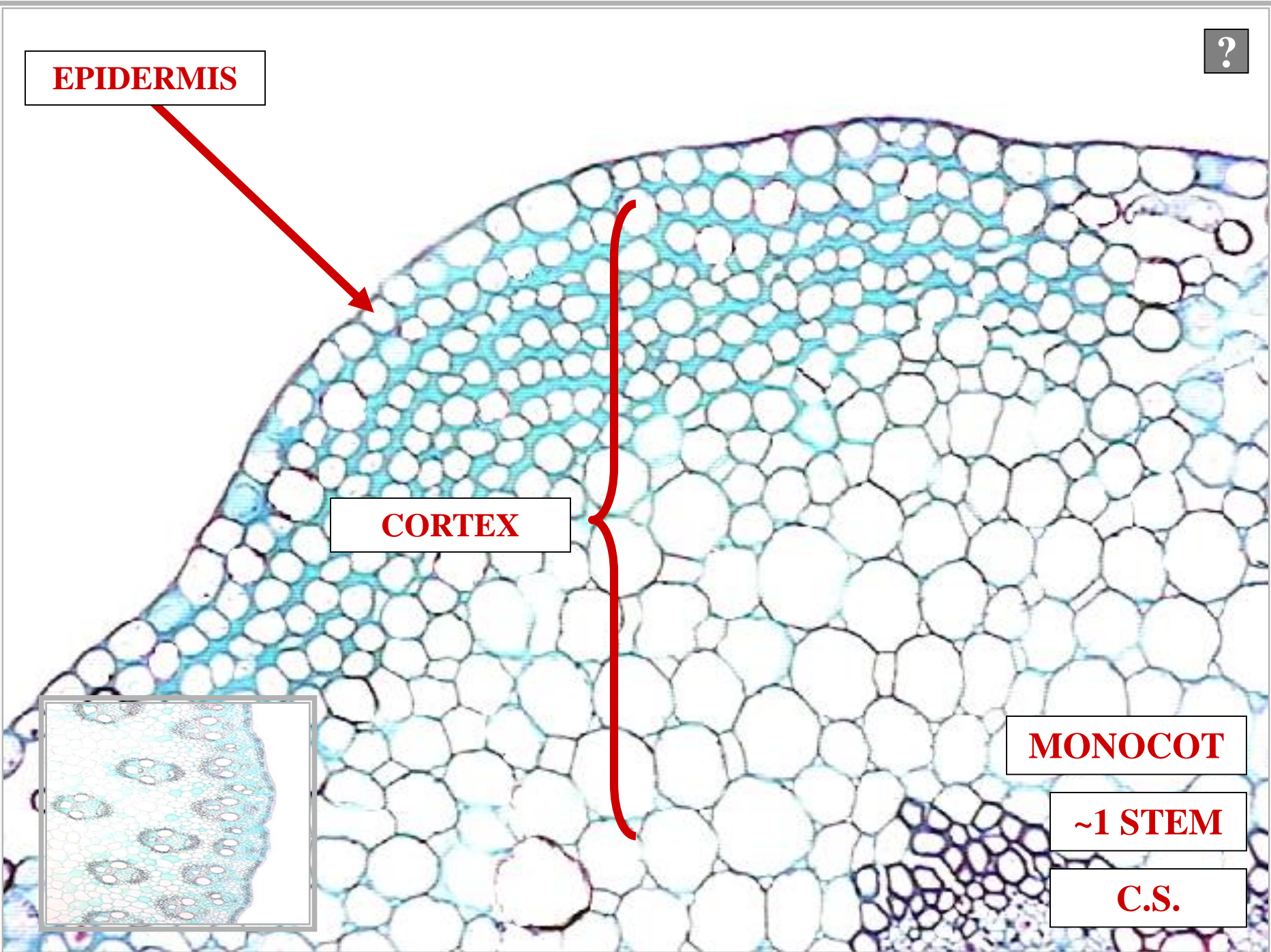
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MONOCOT

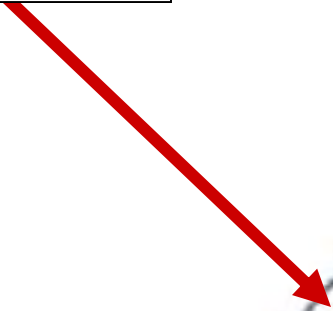
~1 STEM

C.S.



CC

EPIDERMIS



?



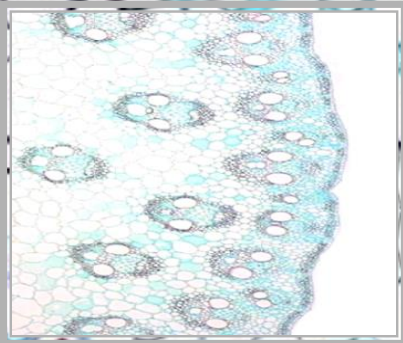
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MONOCOT

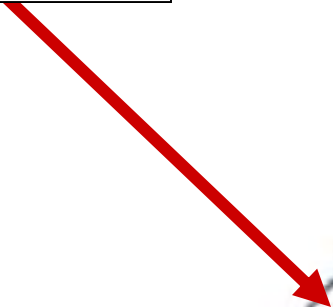
~1 STEM

C.S.



PS

EPIDERMIS



**COLLENCHYMA
CELLS**



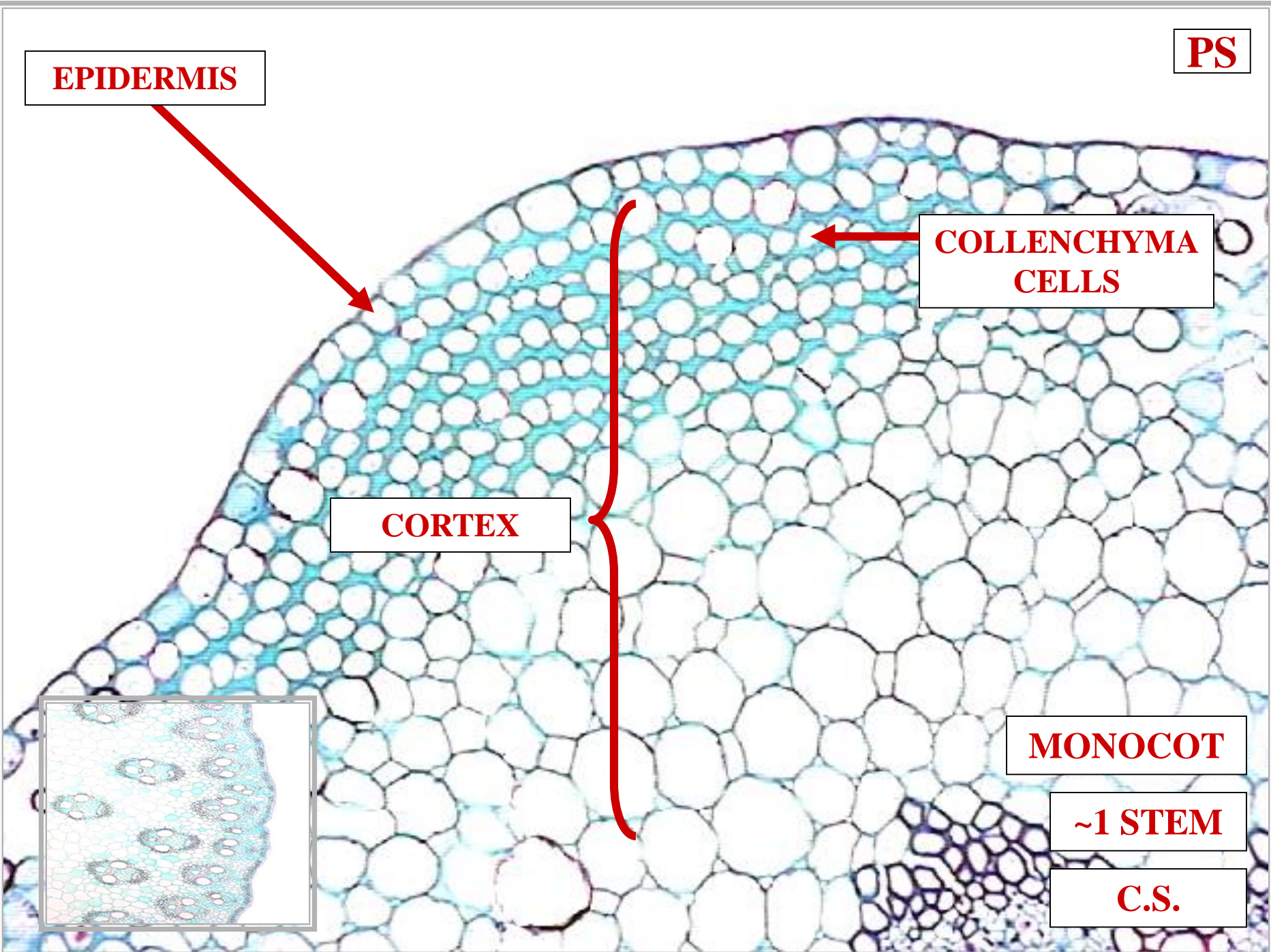
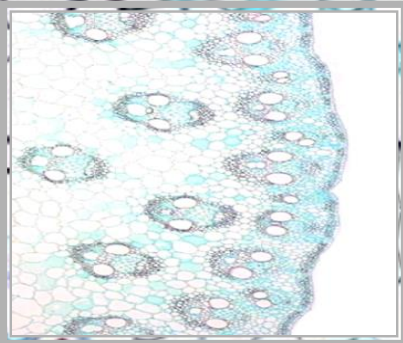
CORTEX



MONOCOT

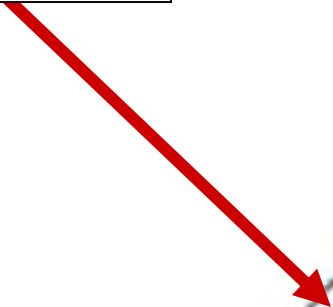
~1 STEM

C.S.





EPIDERMIS



**FUNCTION
PERIPHERAL
STEM SUPPORT**



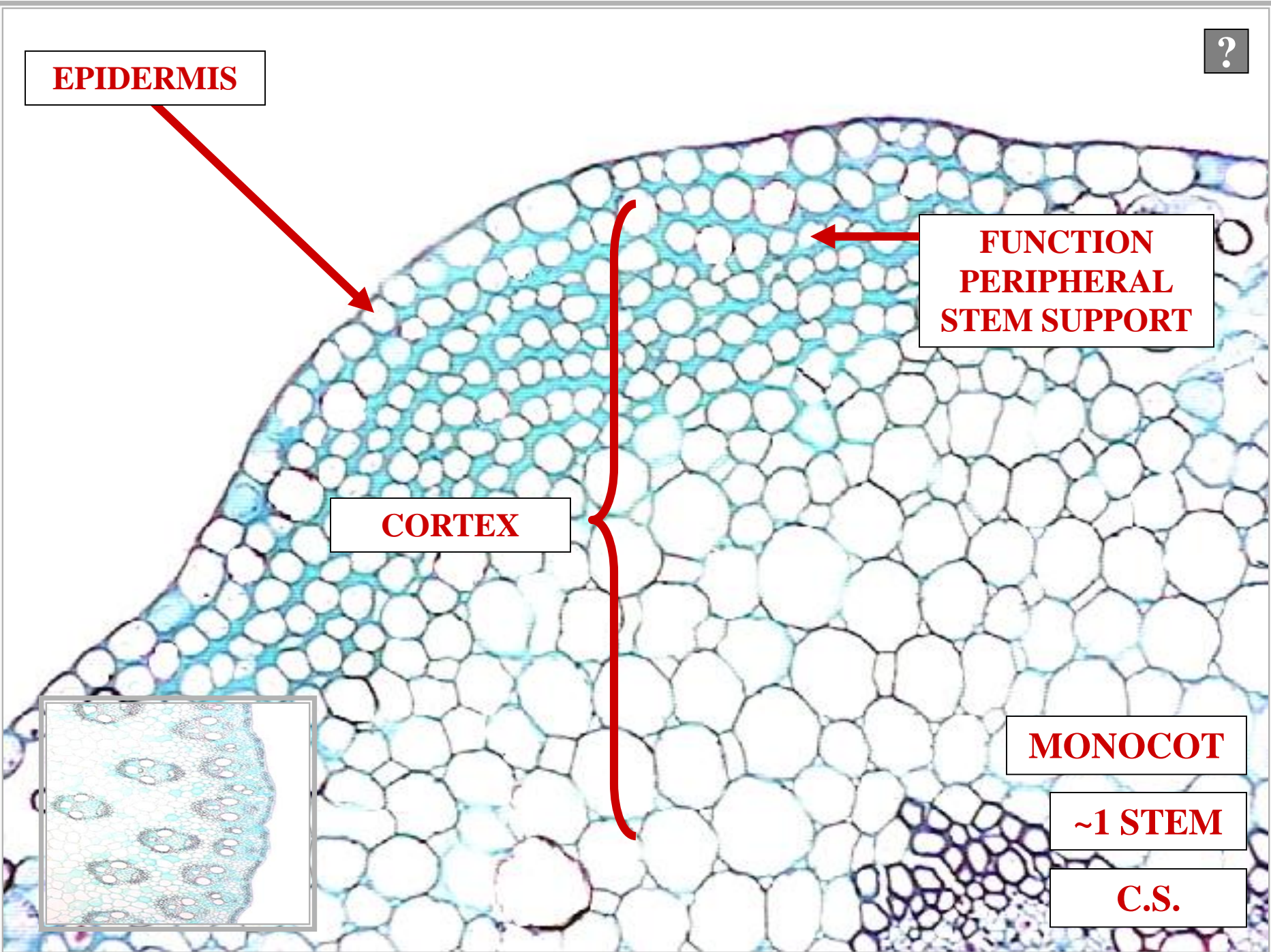
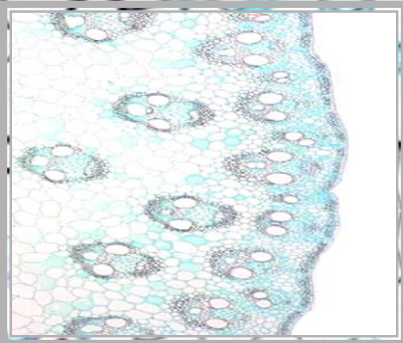
CORTEX



MONOCOT

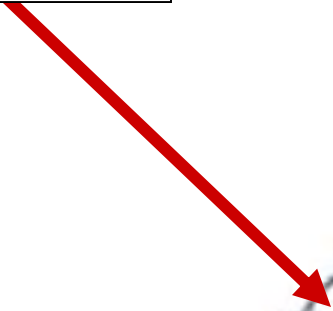
~1 STEM

C.S.



PC

EPIDERMIS



**COLLENCHYMA
CELLS**



CORTEX



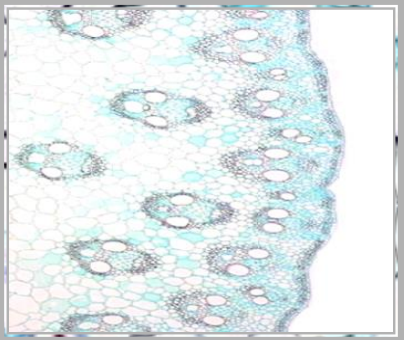
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MONOCOT

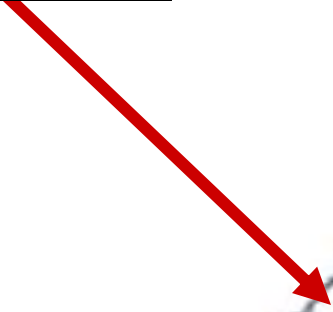
~1 STEM

C.S.



F

EPIDERMIS



**COLLENCHYMA
CELLS**



CORTEX



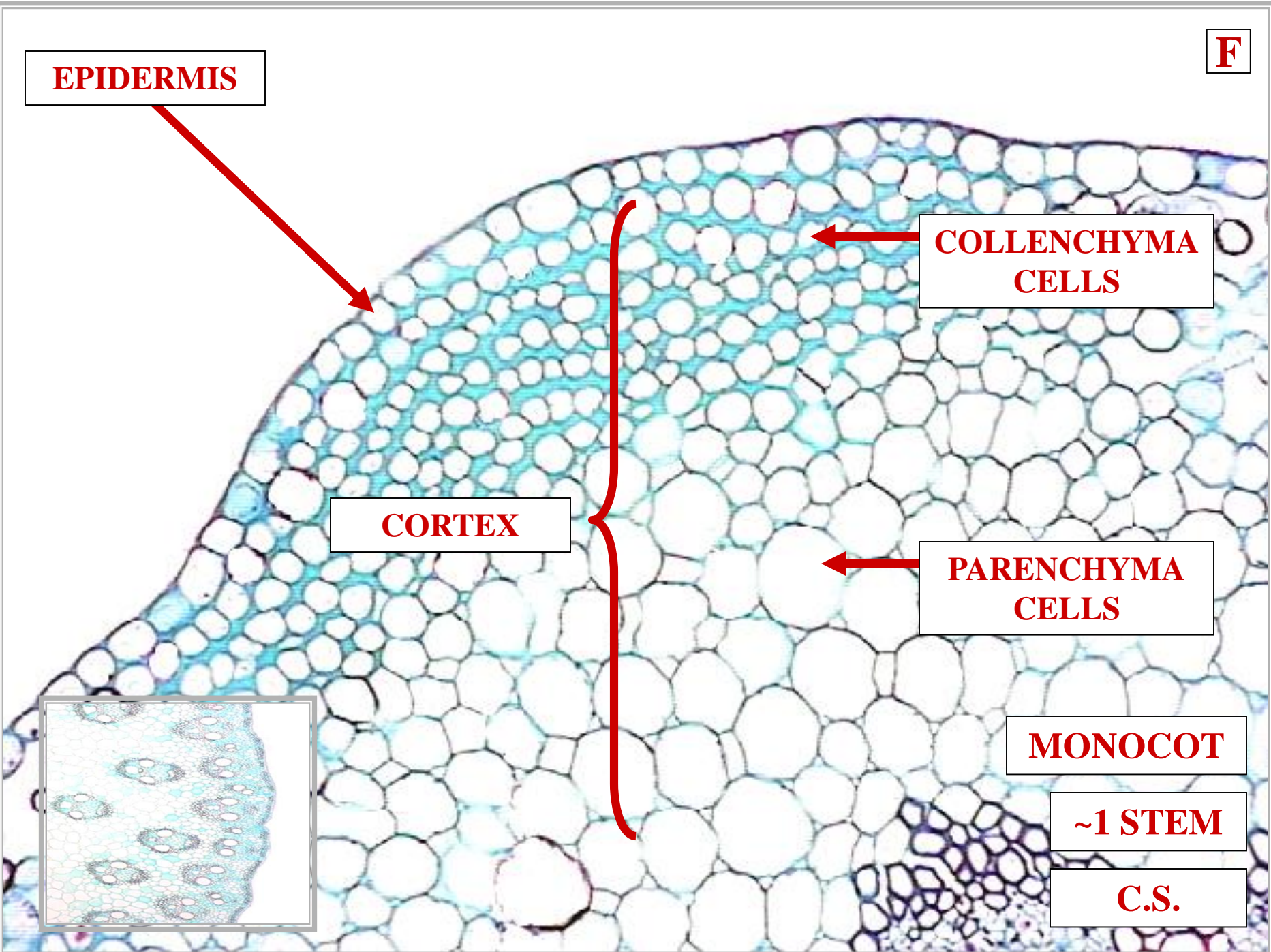
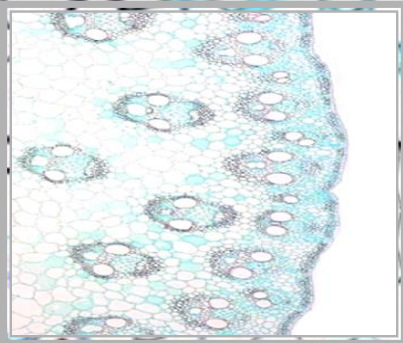
**PARENCHYMA
CELLS**



MONOCOT

~1 STEM

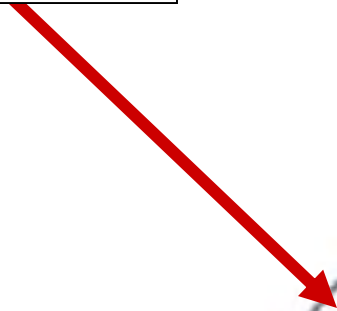
C.S.





PC

EPIDERMIS



**COLLENCHYMA
CELLS**



CORTEX



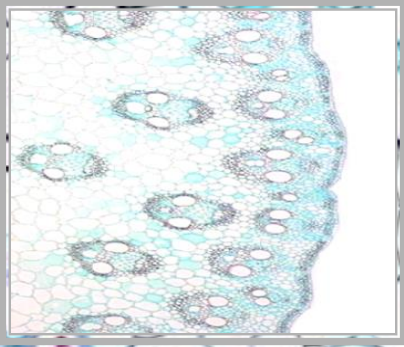
**FUNCTION
STEM STORAGE**



MONOCOT

~1 STEM

C.S.



F

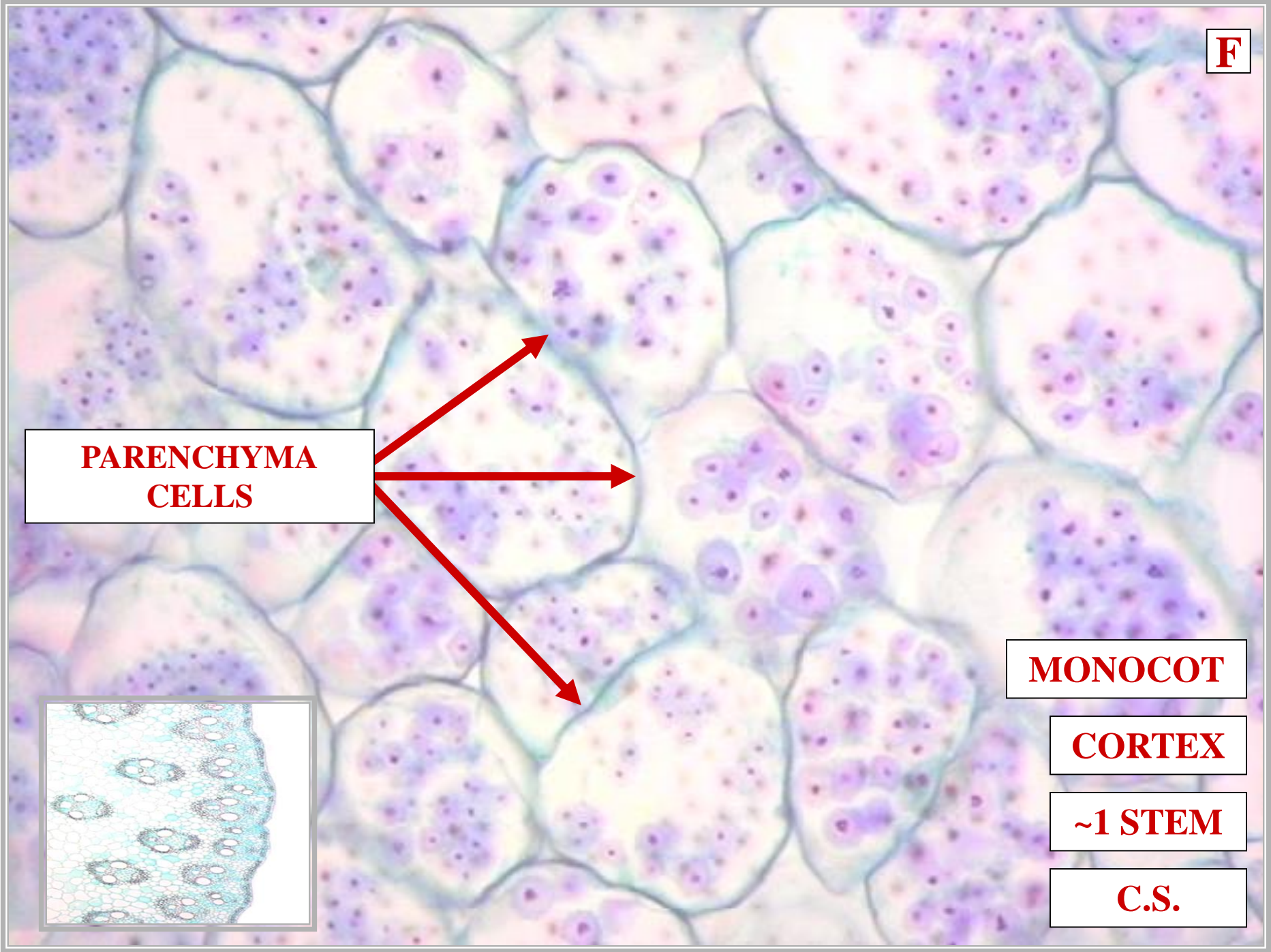
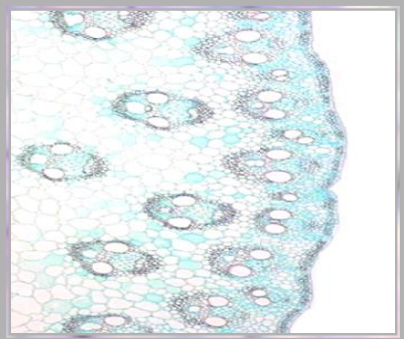
**PARENCHYMA
CELLS**

MONOCOT

CORTEX

~1 STEM

C.S.



SG

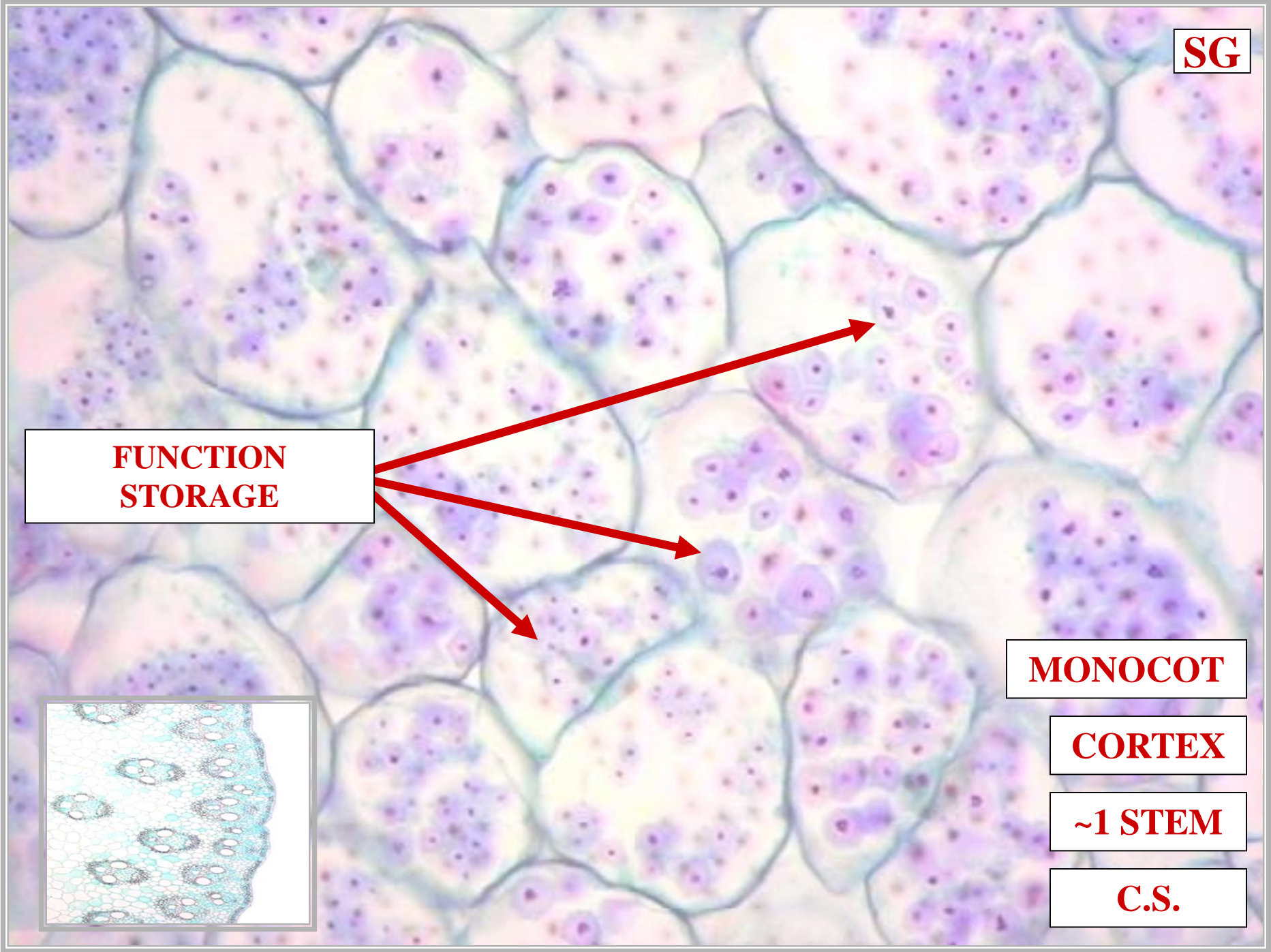
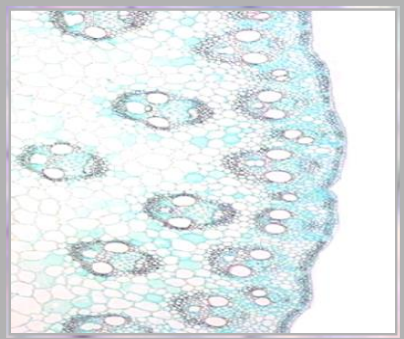
**FUNCTION
STORAGE**

MONOCOT

CORTEX

~1 STEM

C.S.



MW

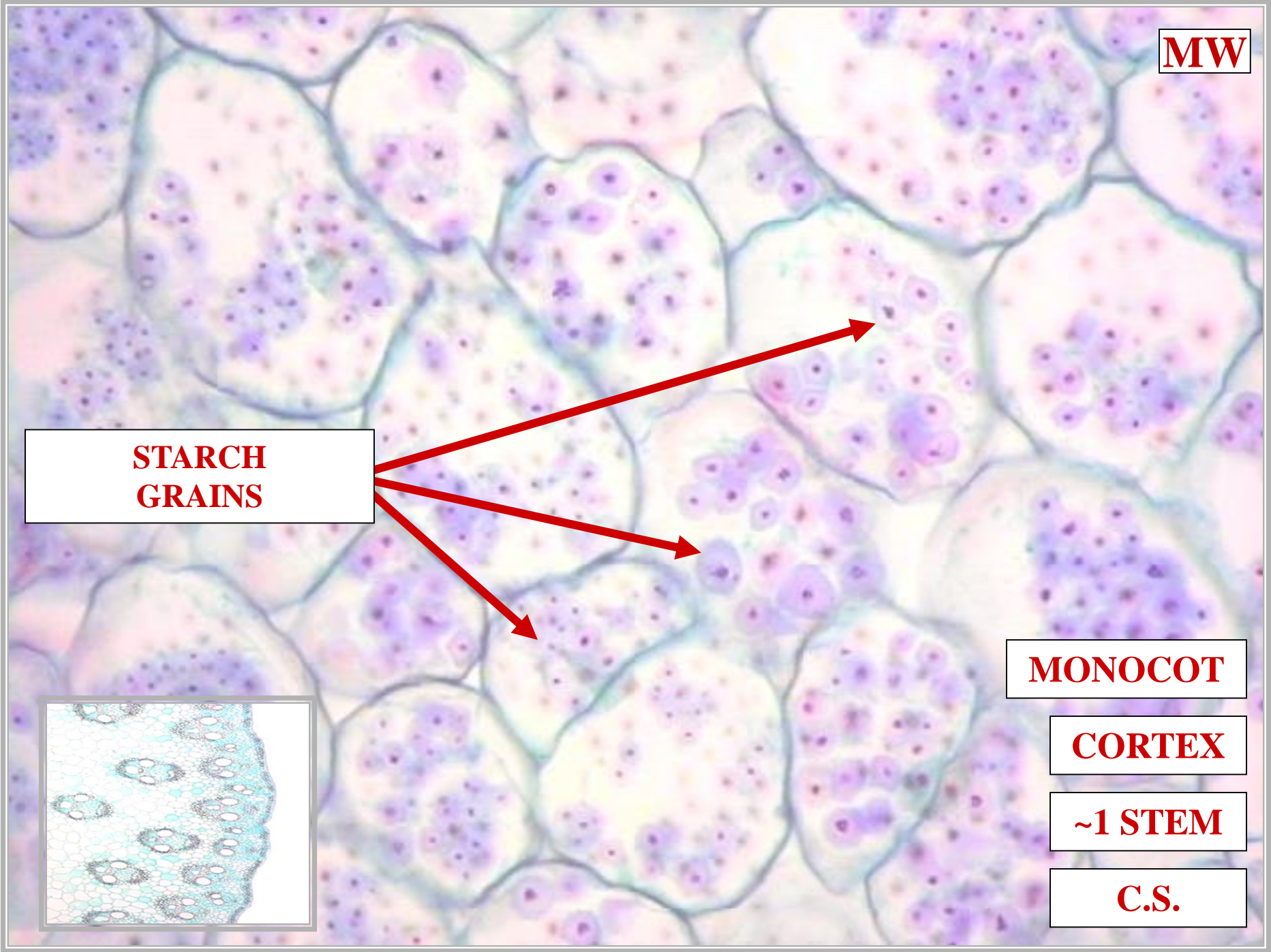
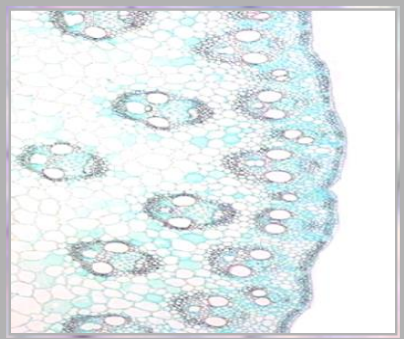
**STARCH
GRAINS**

MONOCOT

CORTEX

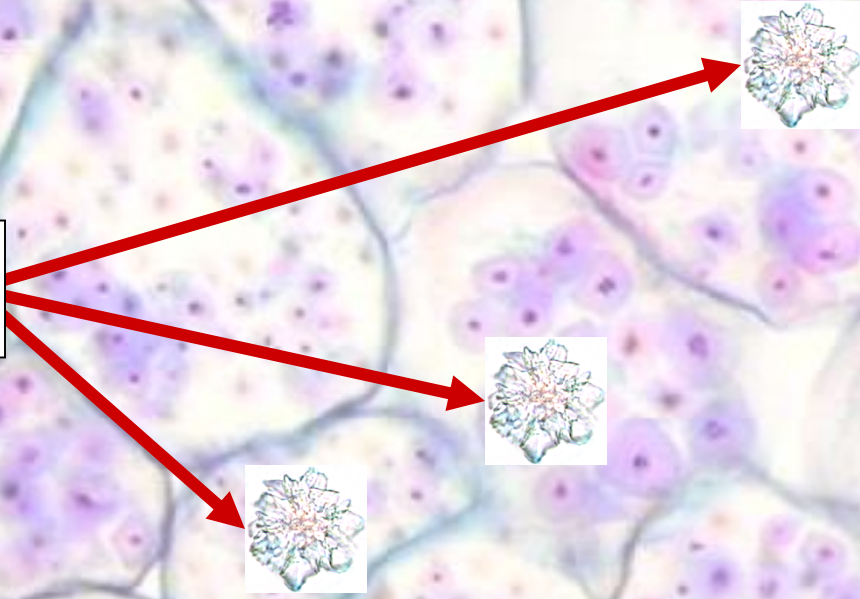
~1 STEM

C.S.





**METABOLIC
WASTE**

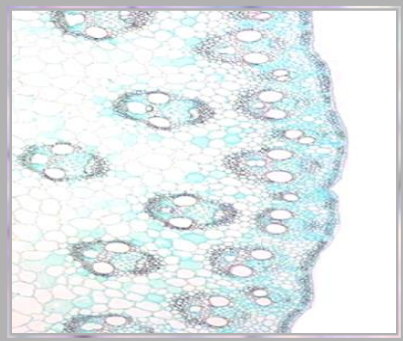


MONOCOT

CORTEX

~1 STEM

C.S.





MONOCOT STEM VASCULAR TISSUE

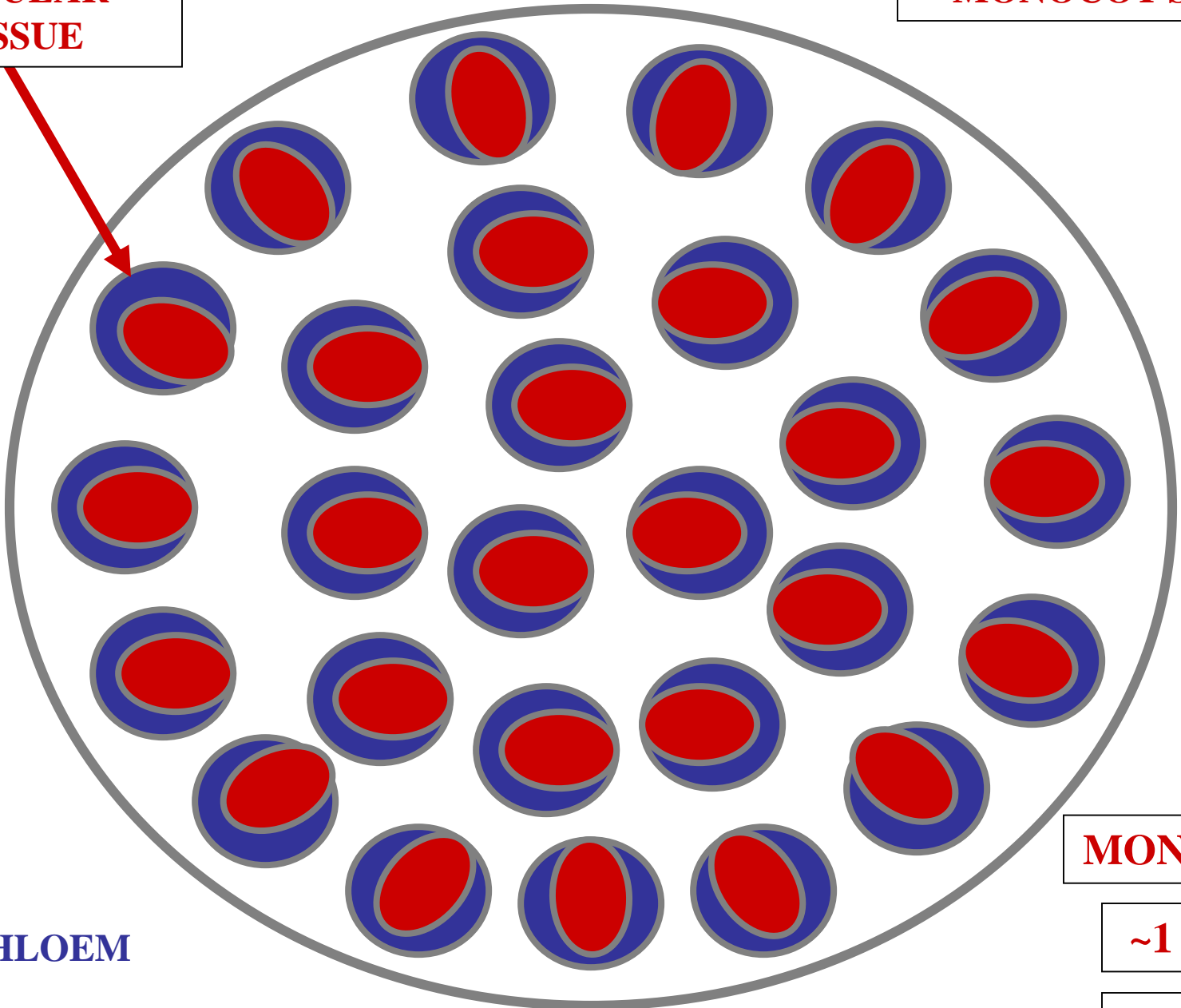


**MONOCOT STEM
VASCULAR TISSUE
PRIMARY
MERISTEM**

**VACULAR
TISSUE**

MONOCOT STEM

?



● = PHLOEM

● = XYLEM

MONOCOT

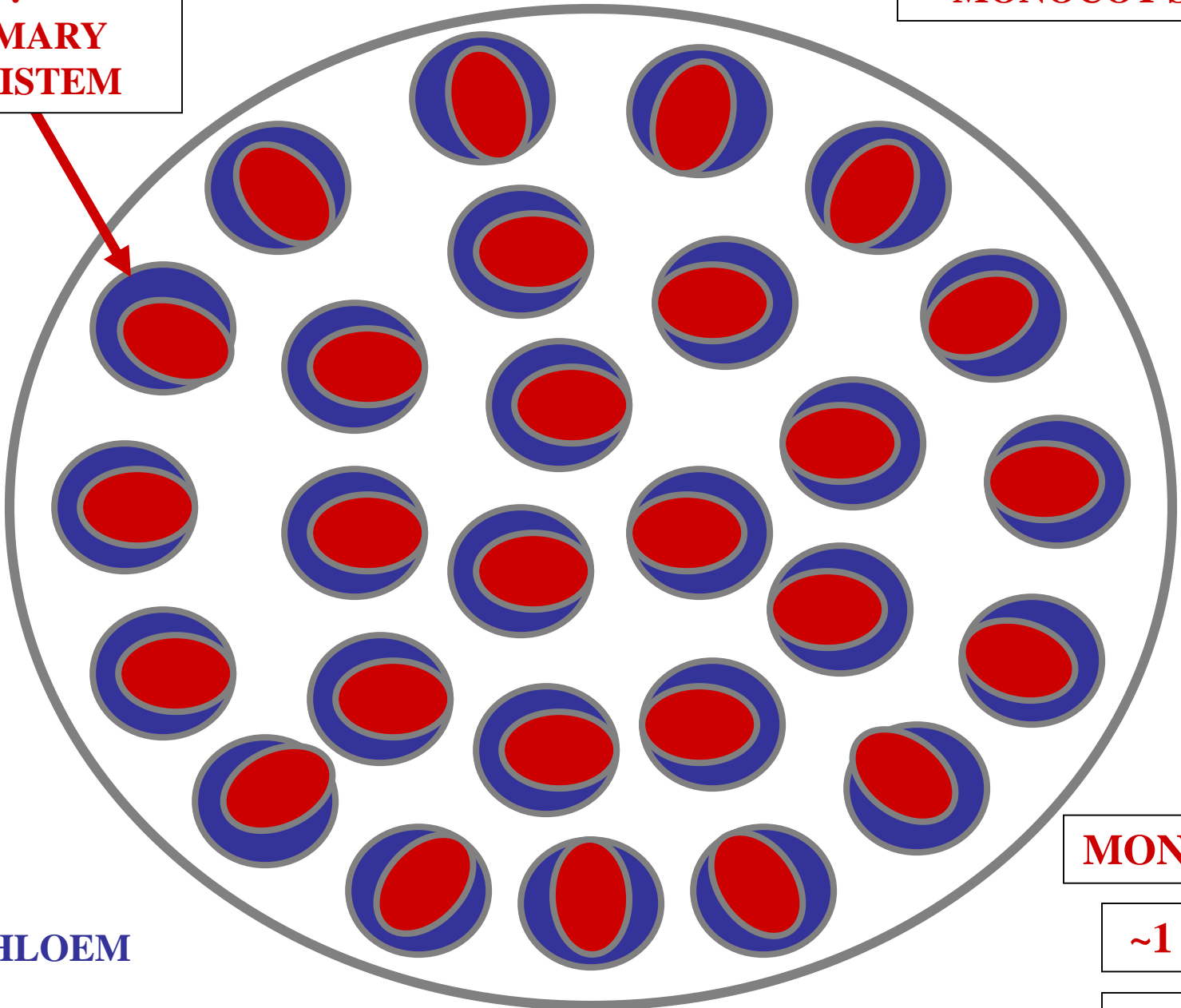
~1 STEM

C.S.

**?
PRIMARY
MERISTEM**

MONOCOT STEM

P



● = PHLOEM

● = XYLEM

MONOCOT

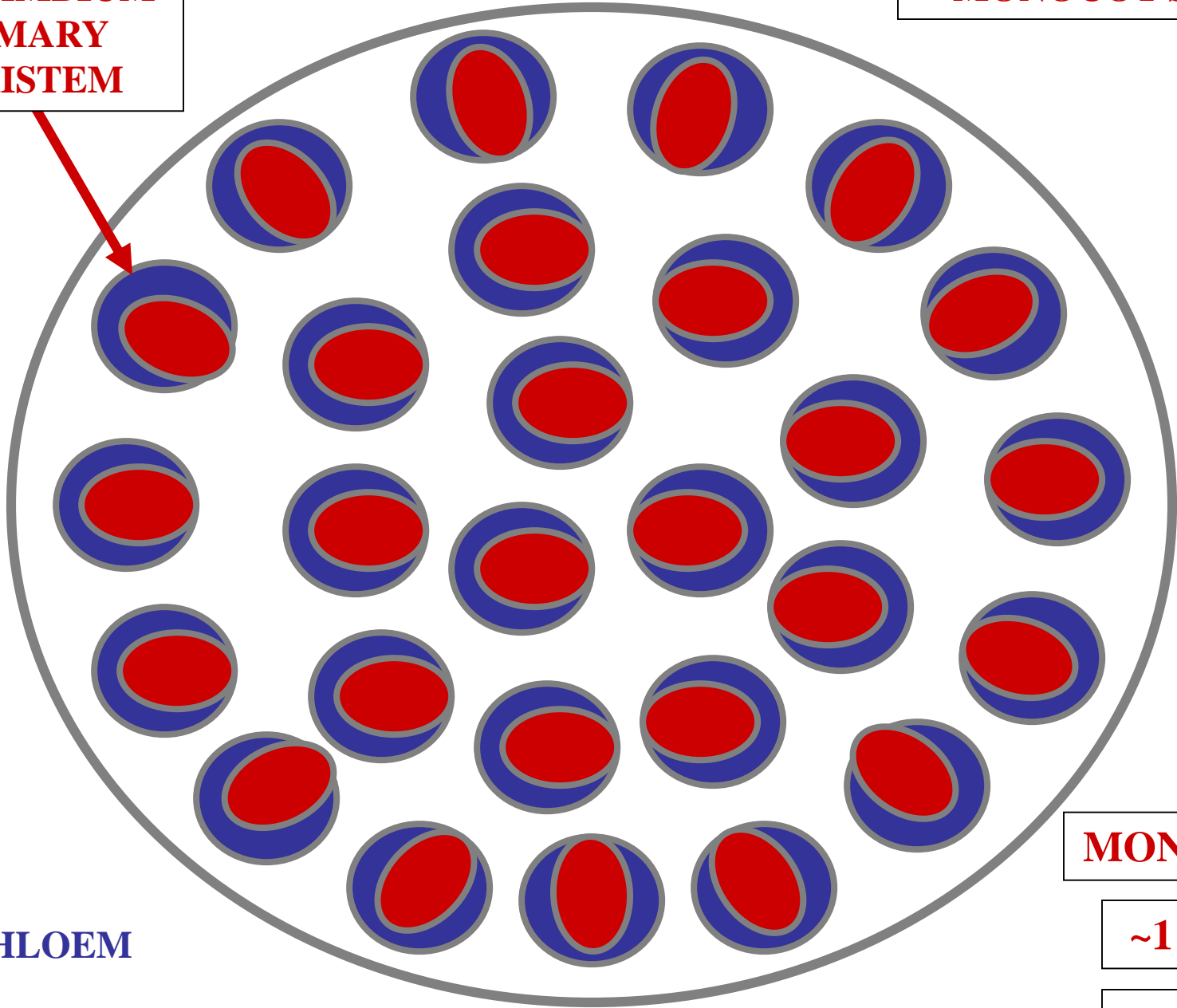
~1 STEM

C.S.

**PROCAMBIUM
PRIMARY
MERISTEM**

MONOCOT STEM

VT



● = PHLOEM

● = XYLEM

MONOCOT

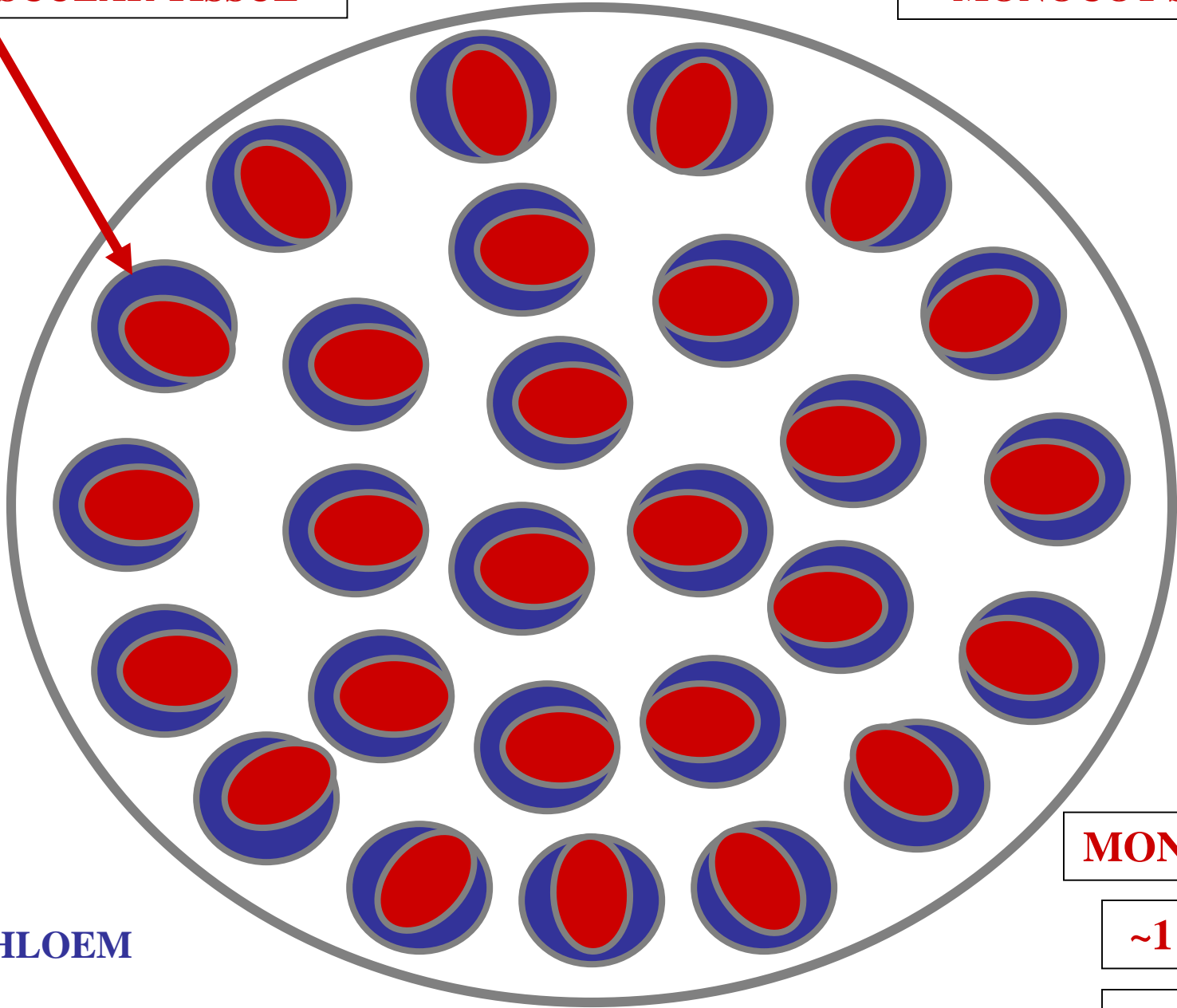
~1 STEM

C.S.

~1 VASCULAR TISSUE

MONOCOT STEM

VB



● = PHLOEM

● = XYLEM

MONOCOT

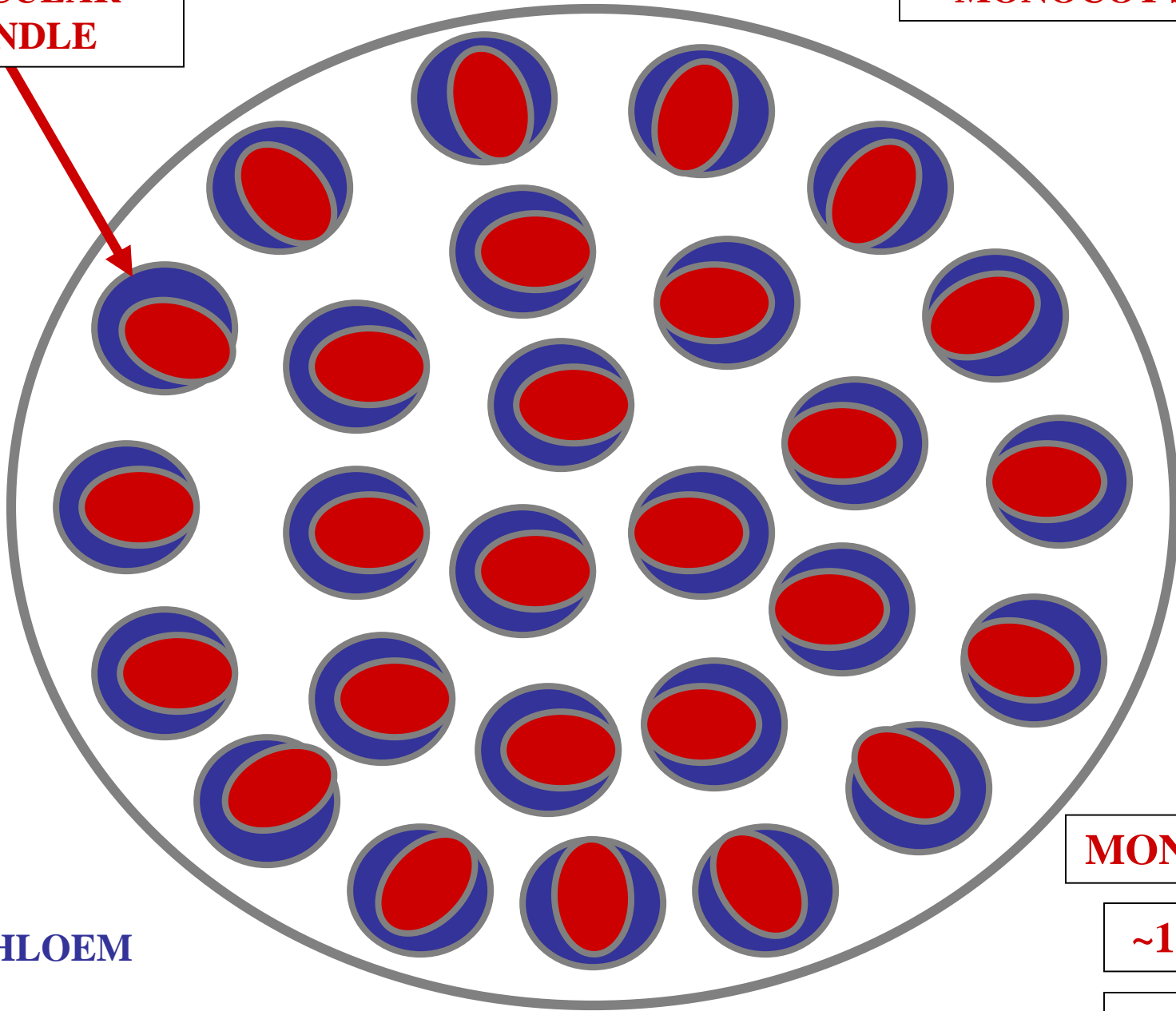
~1 STEM

C.S.

**VASCULAR
BUNDLE**

MONOCOT STEM

^



● = PHLOEM

● = XYLEM

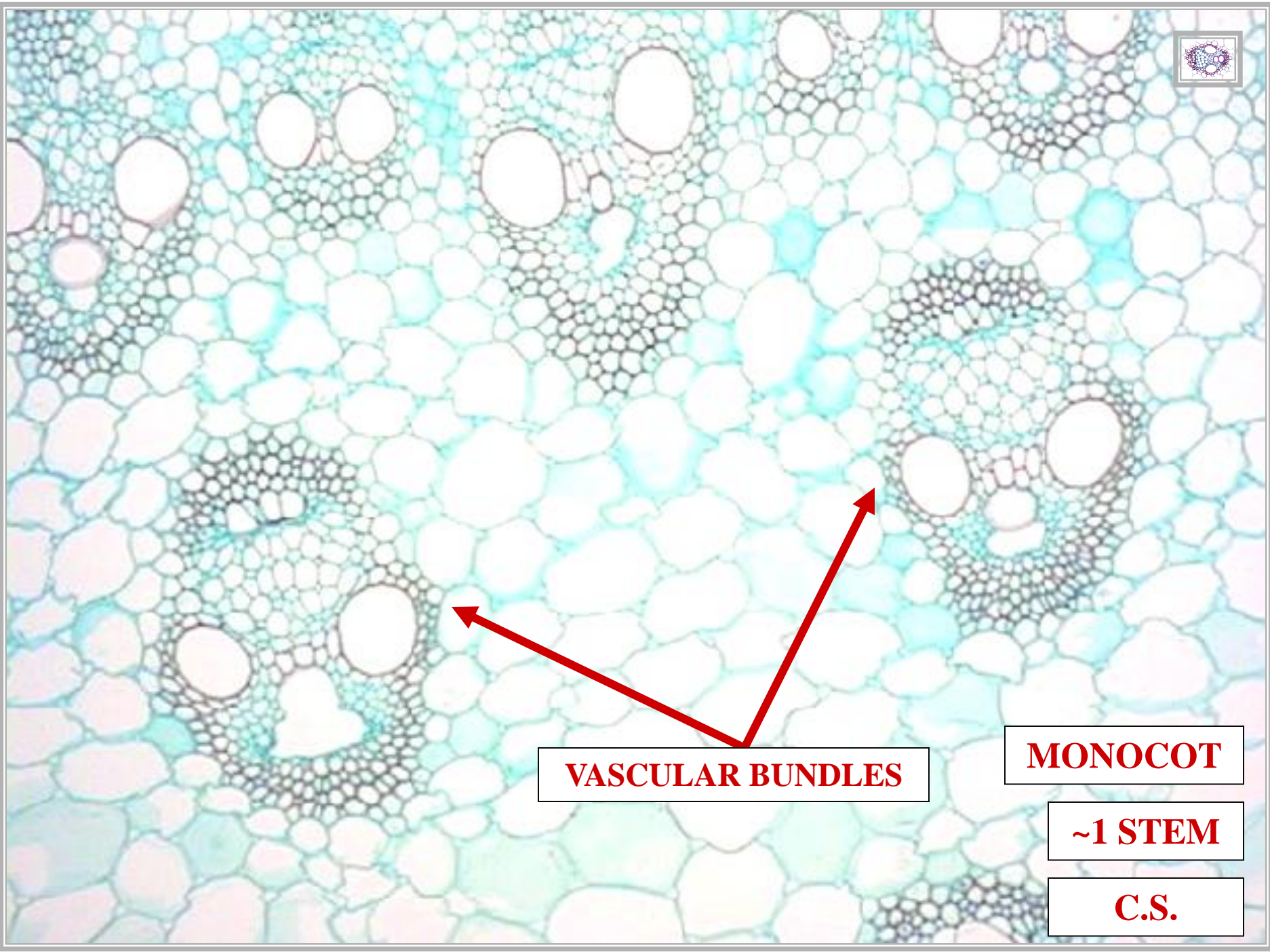
MONOCOT

~1 STEM

C.S.



MONOCOT STEM TYPICAL VASCULAR BUNDLE



VASCULAR BUNDLES

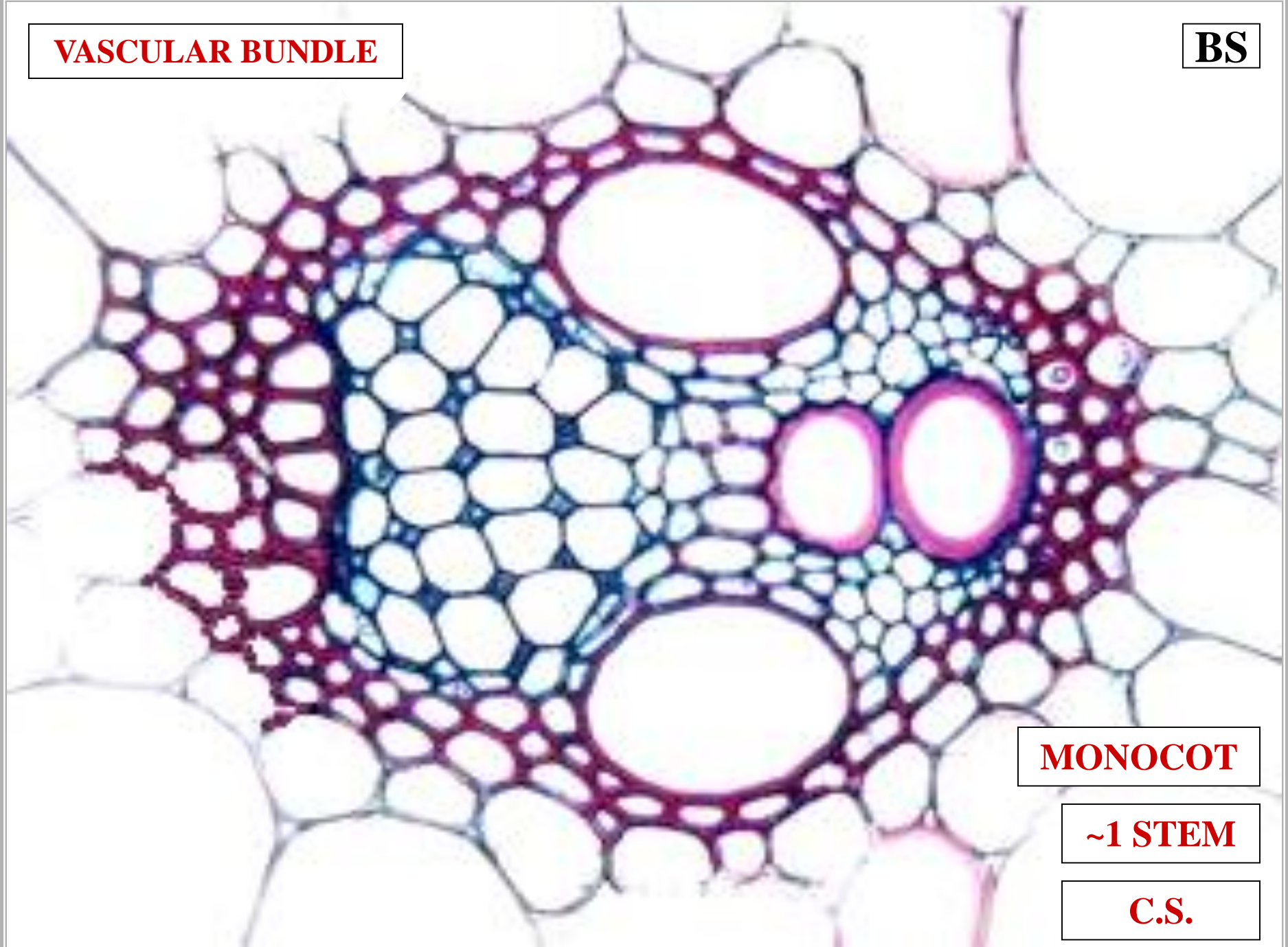
MONOCOT

~1 STEM

C.S.

VASCULAR BUNDLE

BS



MONOCOT

~1 STEM

C.S.

BUNDLE SHEATH

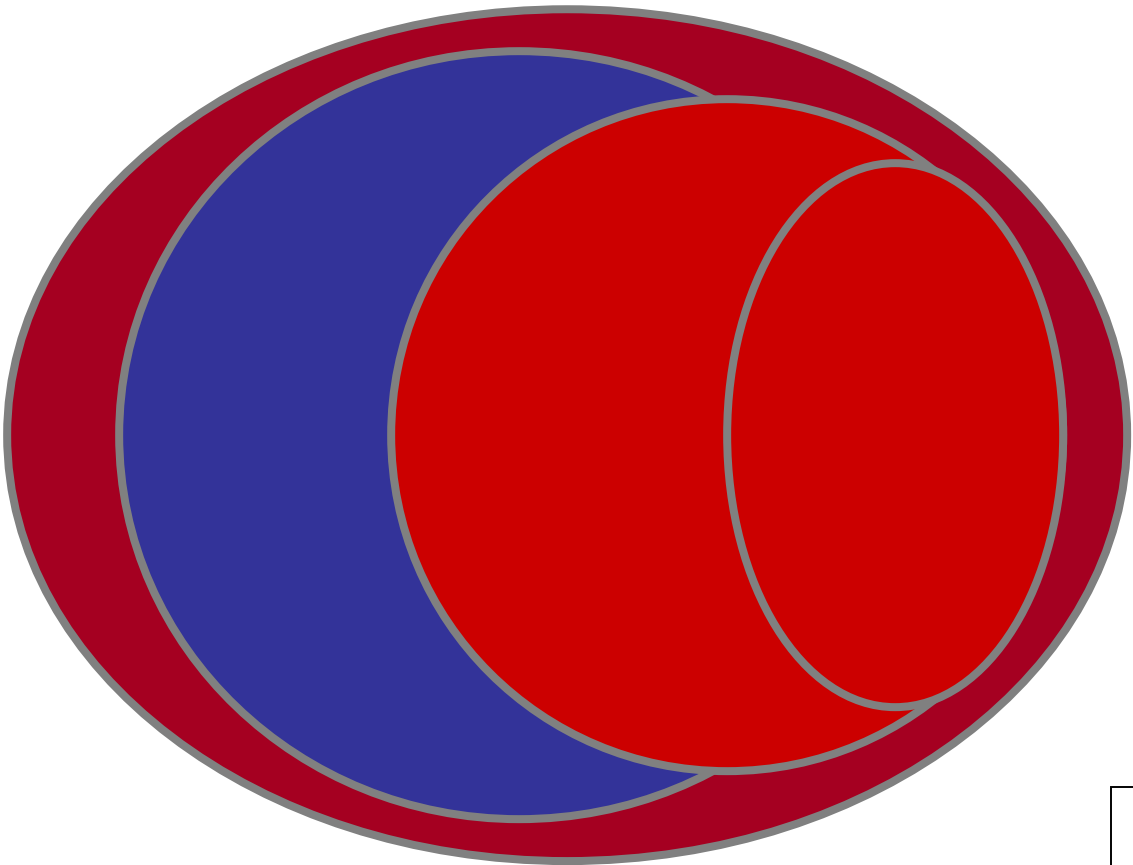
**MONOCOT
VASCULAR BUNDLE
BUNDLE SHEATH**

SUPPORT FIBERS

**MONOCOT
VASCULAR BUNDLE
BUNDLE SHEATH**



MONOCOT VASCULAR BUNDLE



MONOCOT

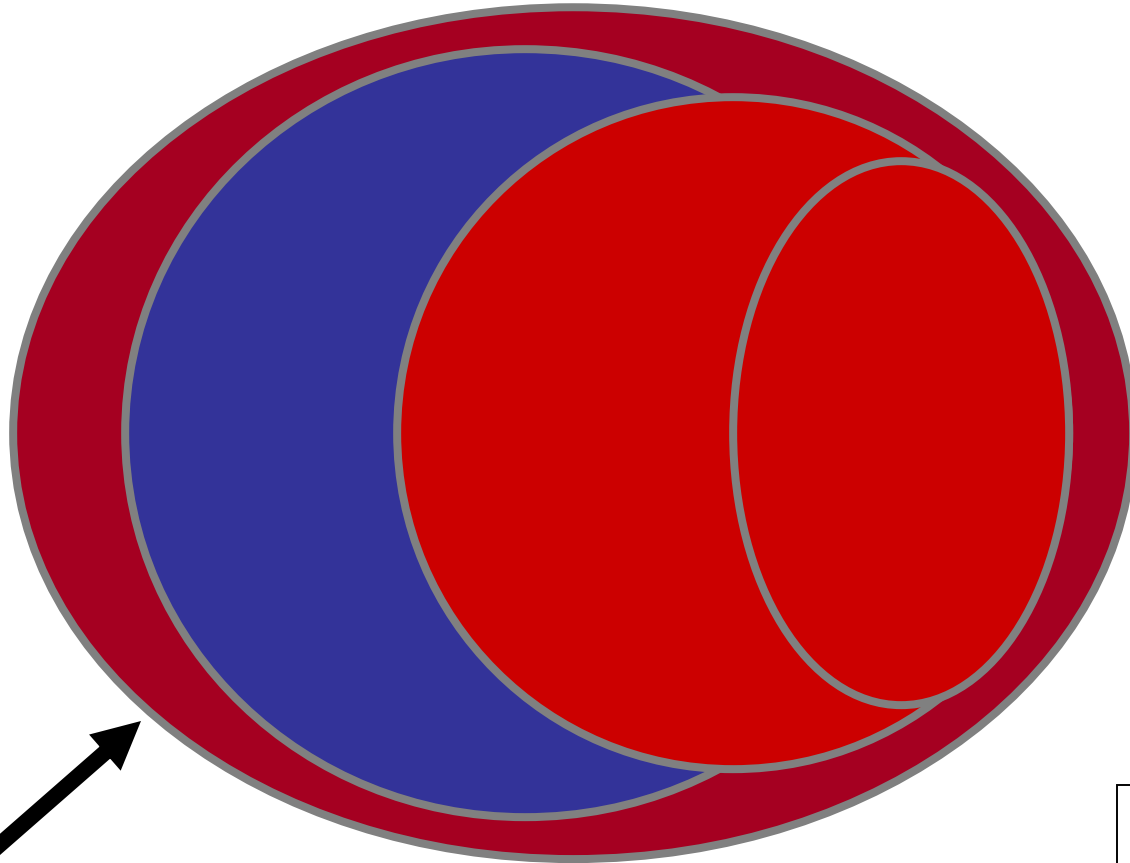
~1 STEM

C.S.

MONOCOT VASCULAR BUNDLE



BS



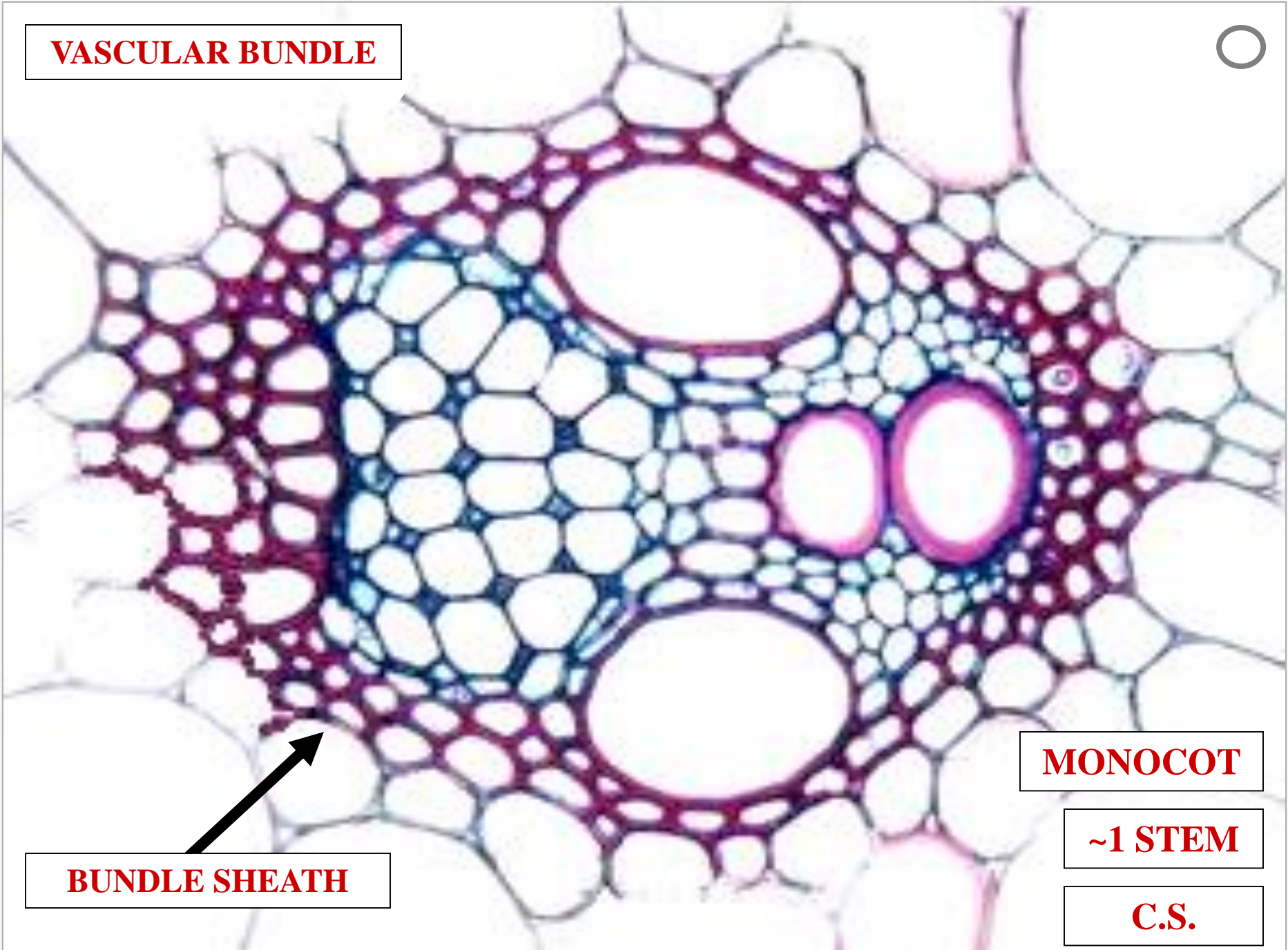
BUNDLE SHEATH

MONOCOT

~1 STEM

C.S.

VASCULAR BUNDLE



BUNDLE SHEATH



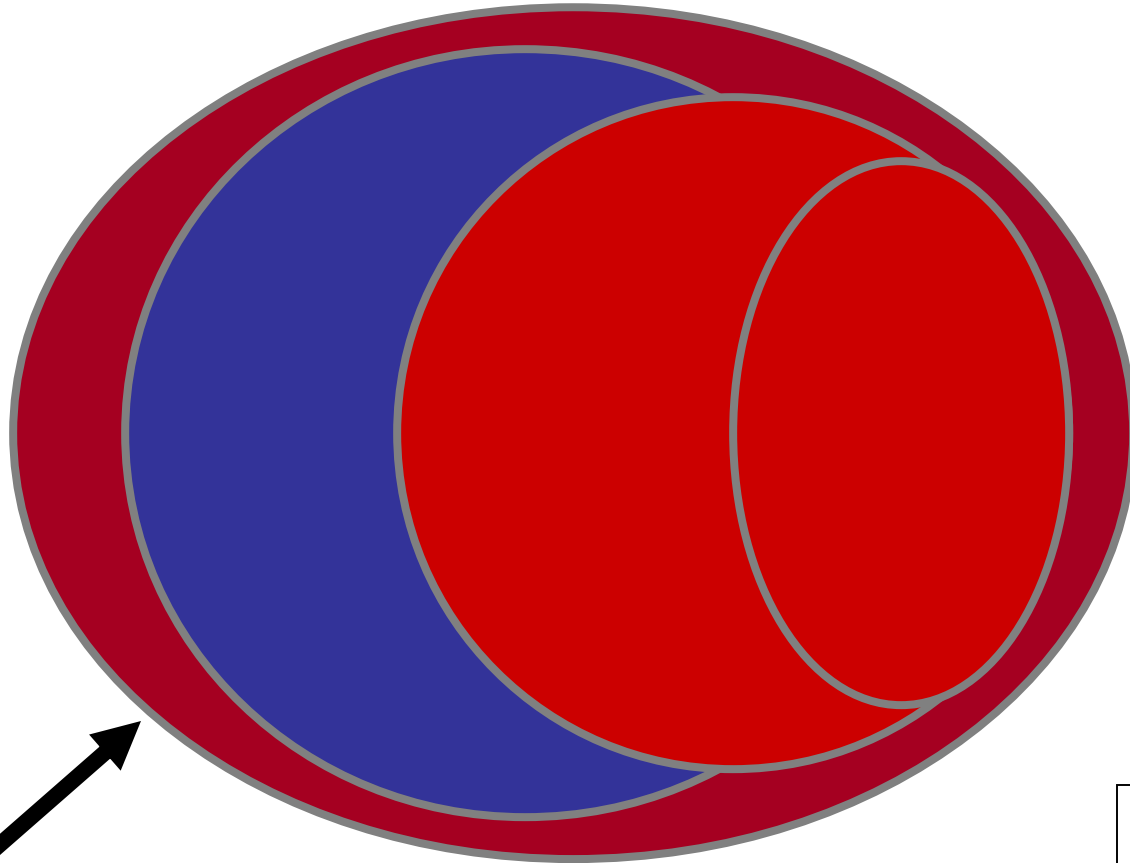
MONOCOT

~1 STEM

C.S.

MONOCOT VASCULAR BUNDLE

~P



BUNDLE SHEATH

MONOCOT

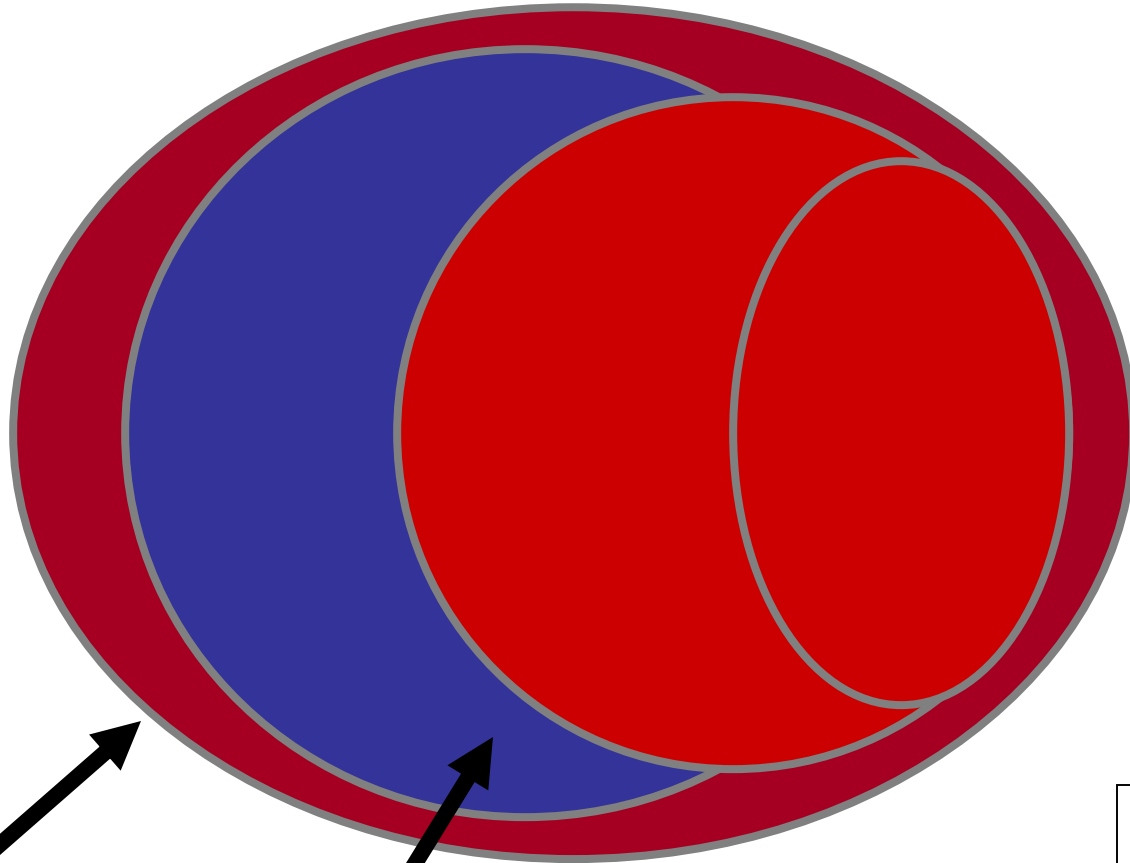
~1 STEM

C.S.

MONOCOT VASCULAR BUNDLE



~P



BUNDLE SHEATH

~1 PHLOEM

MONOCOT

~1 STEM

C.S.

VASCULAR BUNDLE

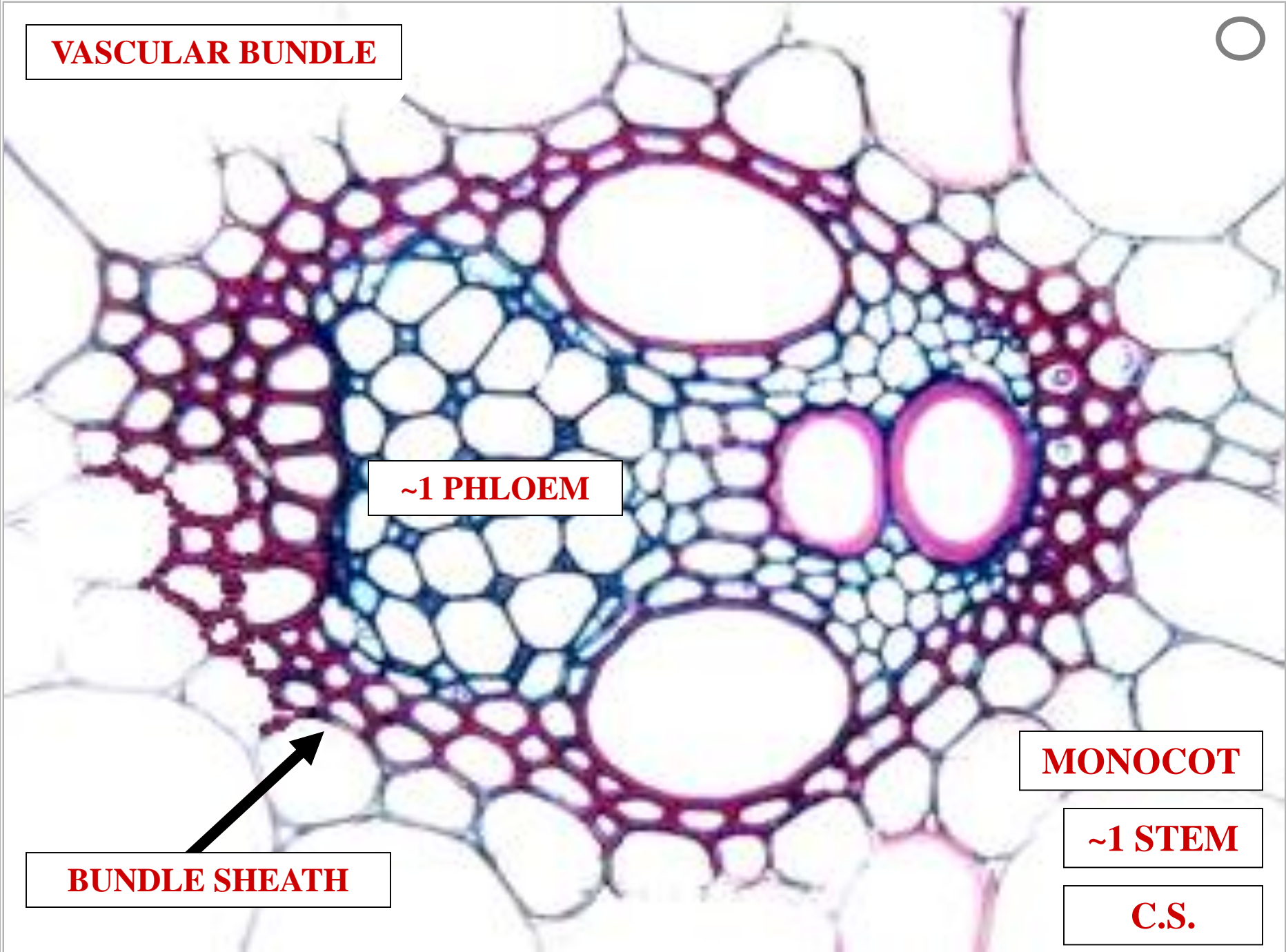
~1 PHLOEM

BUNDLE SHEATH

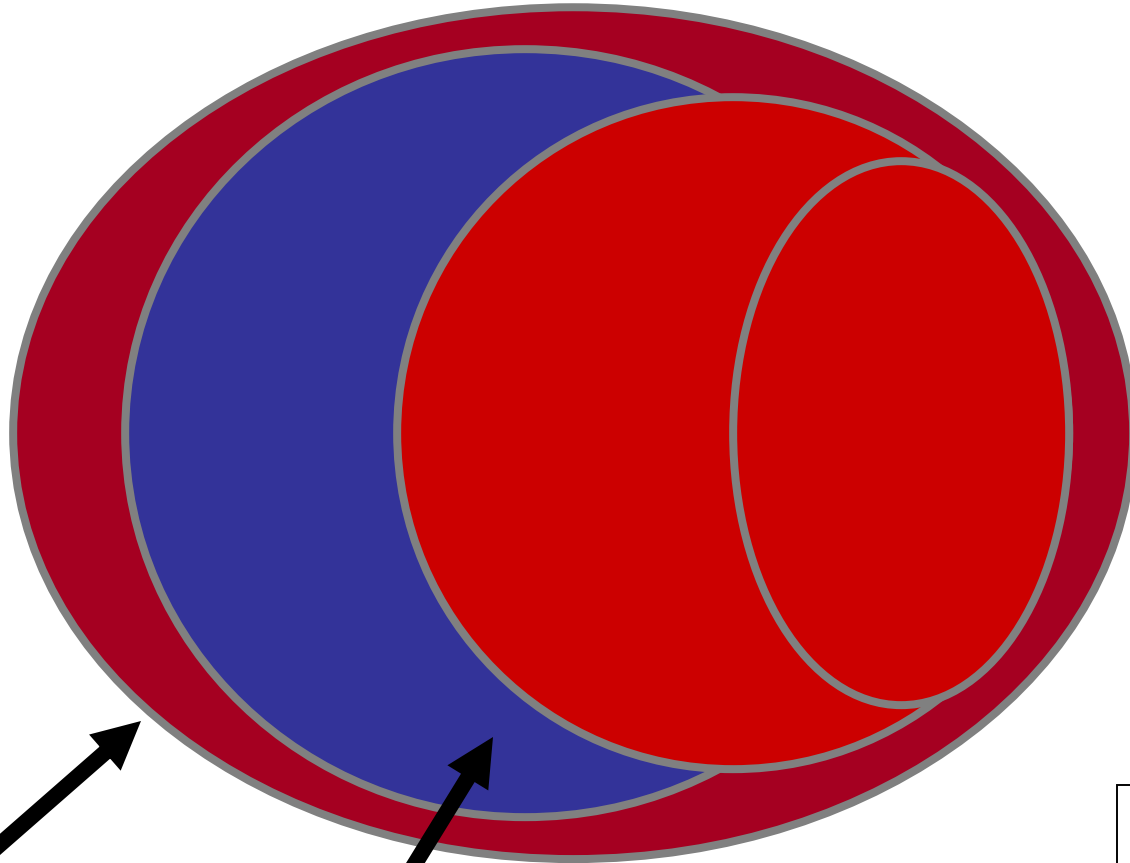
MONOCOT

~1 STEM

C.S.



MONOCOT VASCULAR BUNDLE



BUNDLE SHEATH

~1 PHLOEM

MONOCOT

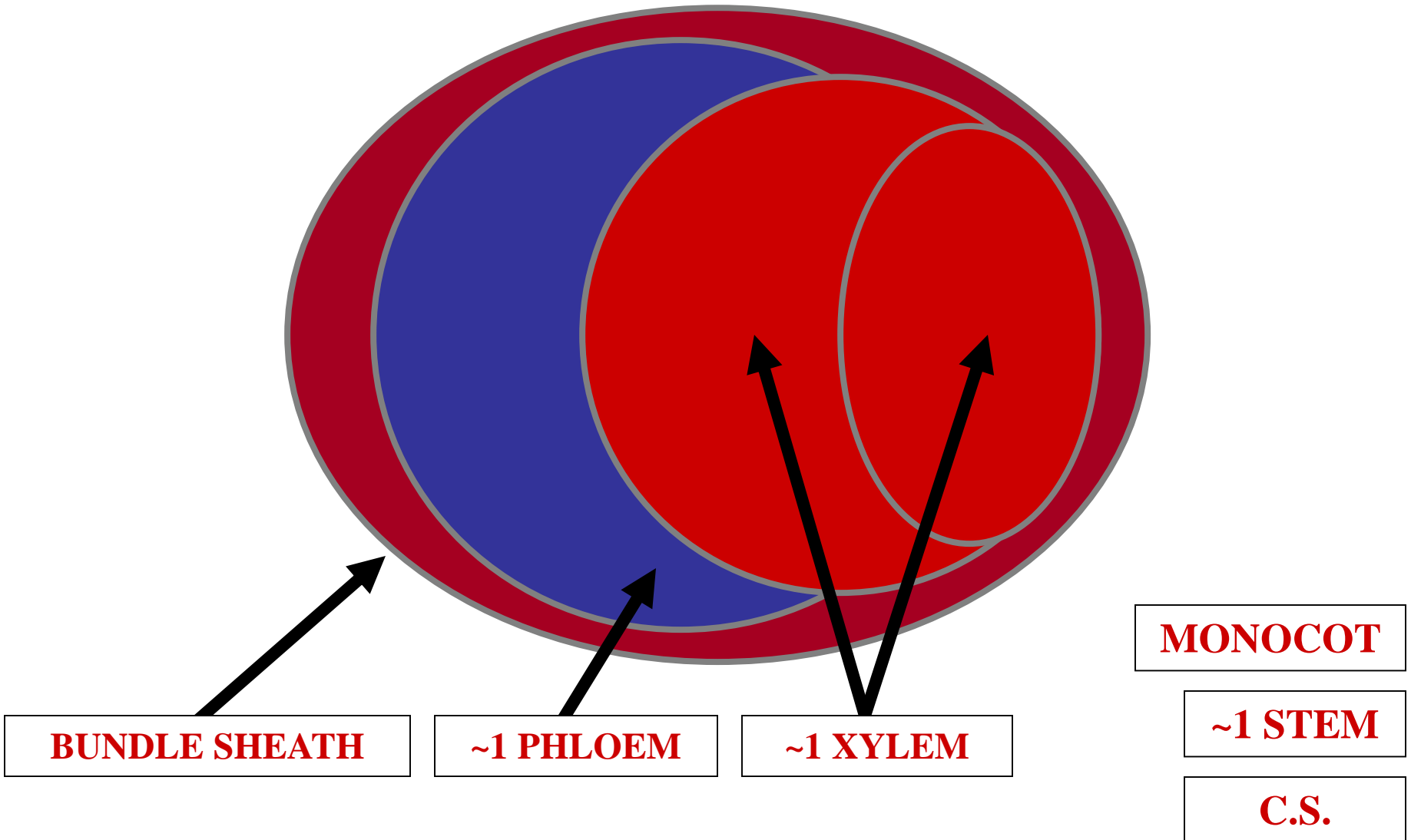
~1 STEM

C.S.

MONOCOT VASCULAR BUNDLE



~X



BUNDLE SHEATH

~1 PHLOEM

~1 XYLEM

MONOCOT

~1 STEM

C.S.

VASCULAR BUNDLE



~X

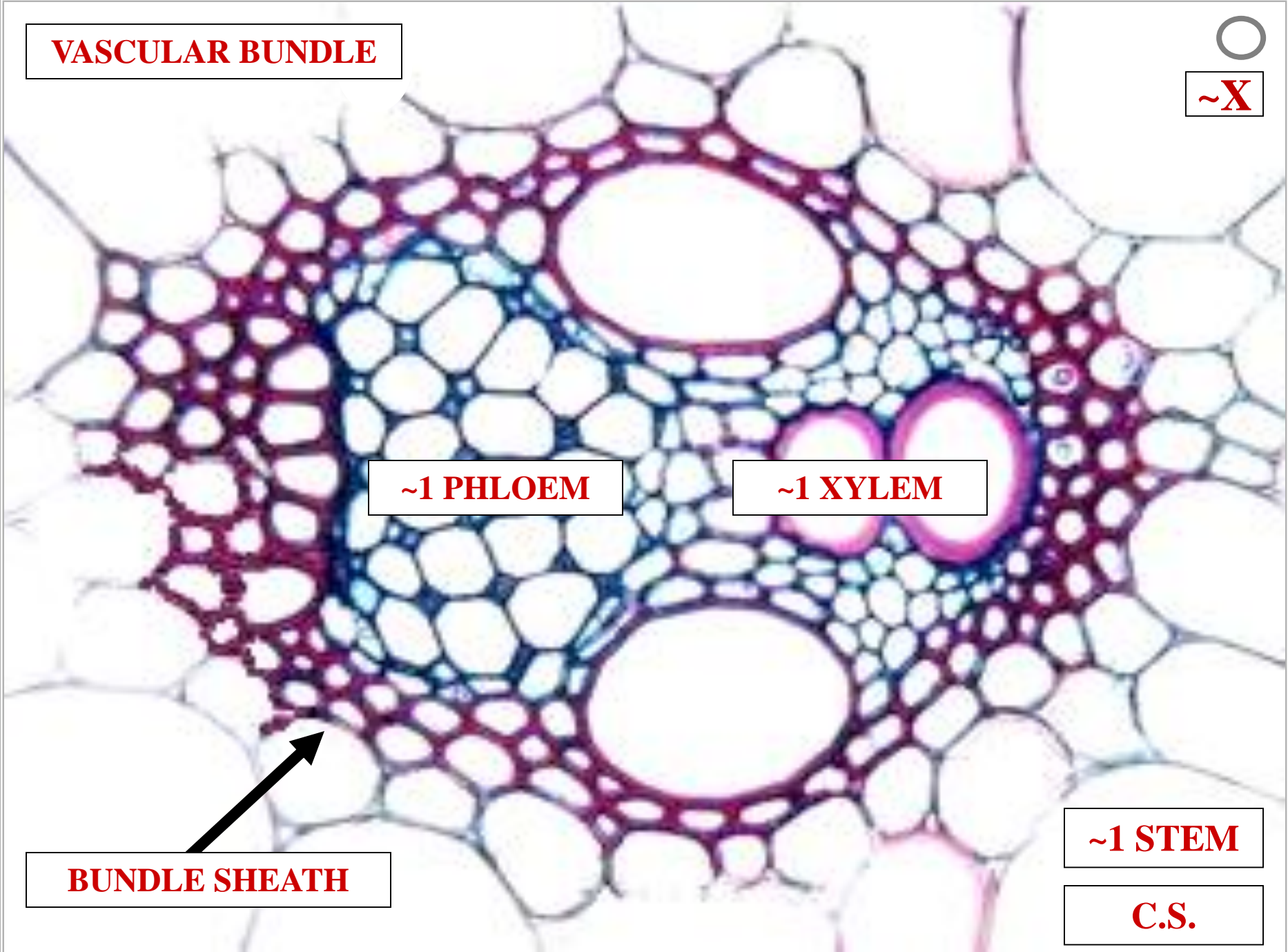
~1 PHLOEM

~1 XYLEM

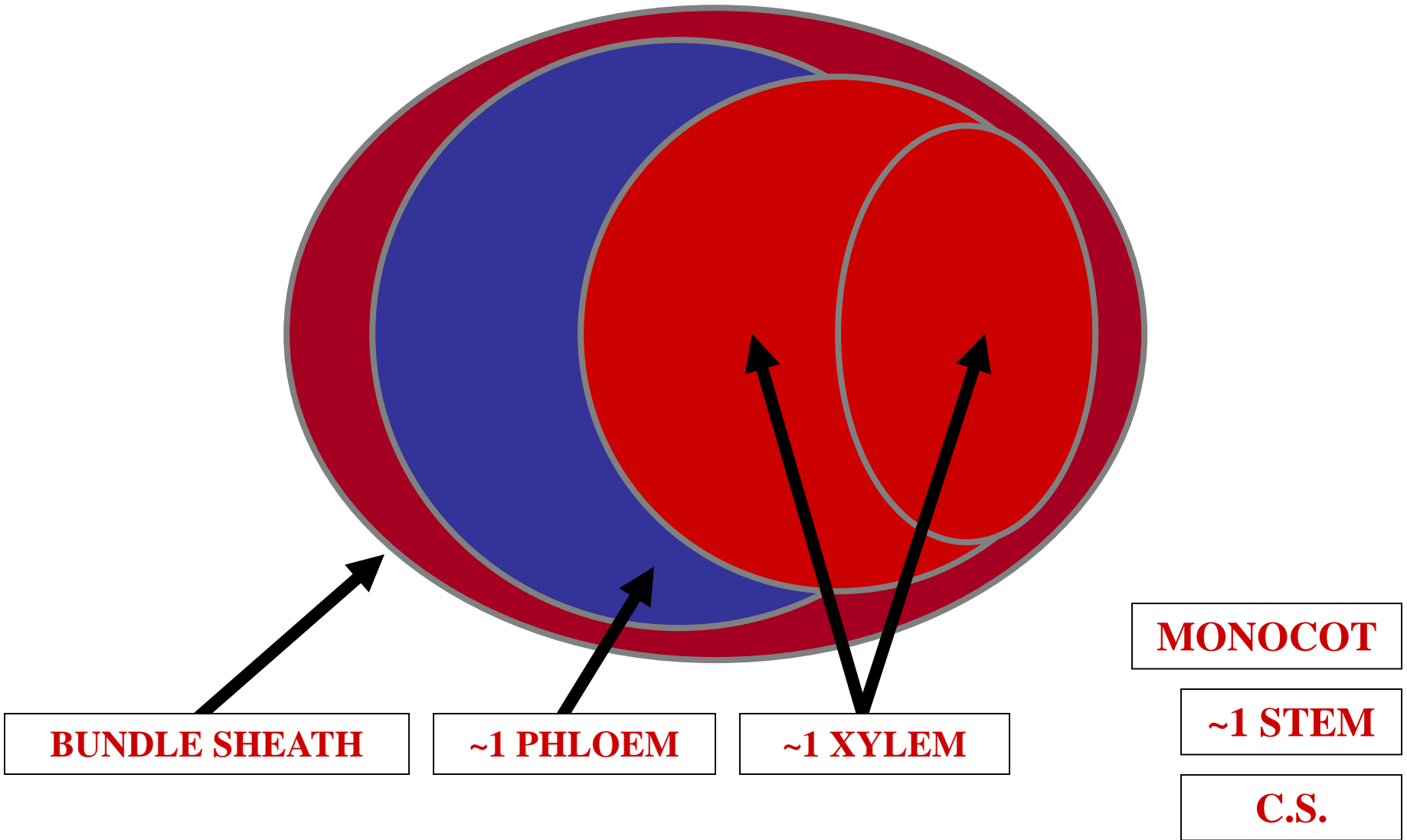
BUNDLE SHEATH

~1 STEM

C.S.



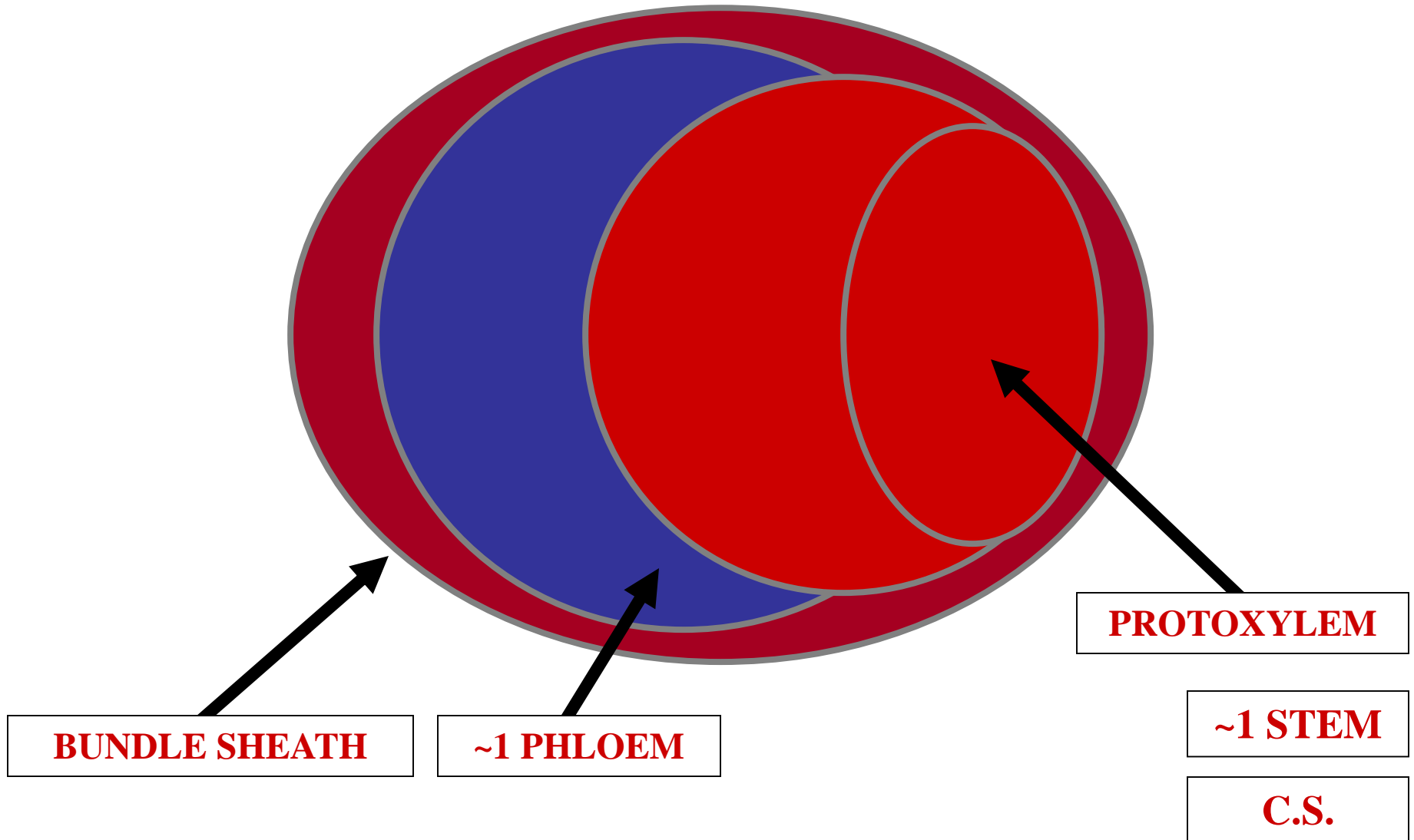
MONOCOT VASCULAR BUNDLE



MONOCOT VASCULAR BUNDLE



P



VASCULAR BUNDLE

PROTOXYLEM

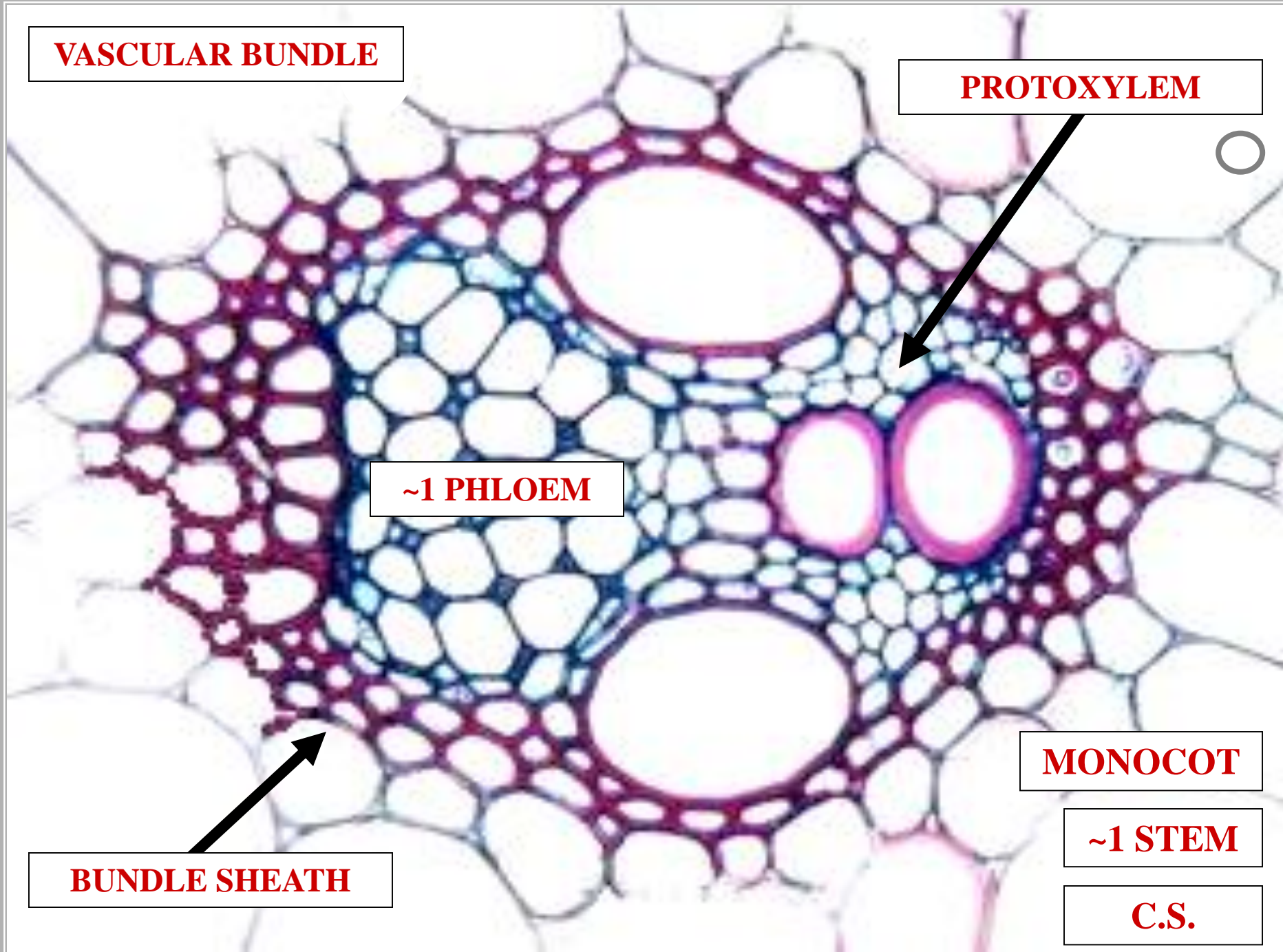
~1 PHLOEM

BUNDLE SHEATH

MONOCOT

~1 STEM

C.S.

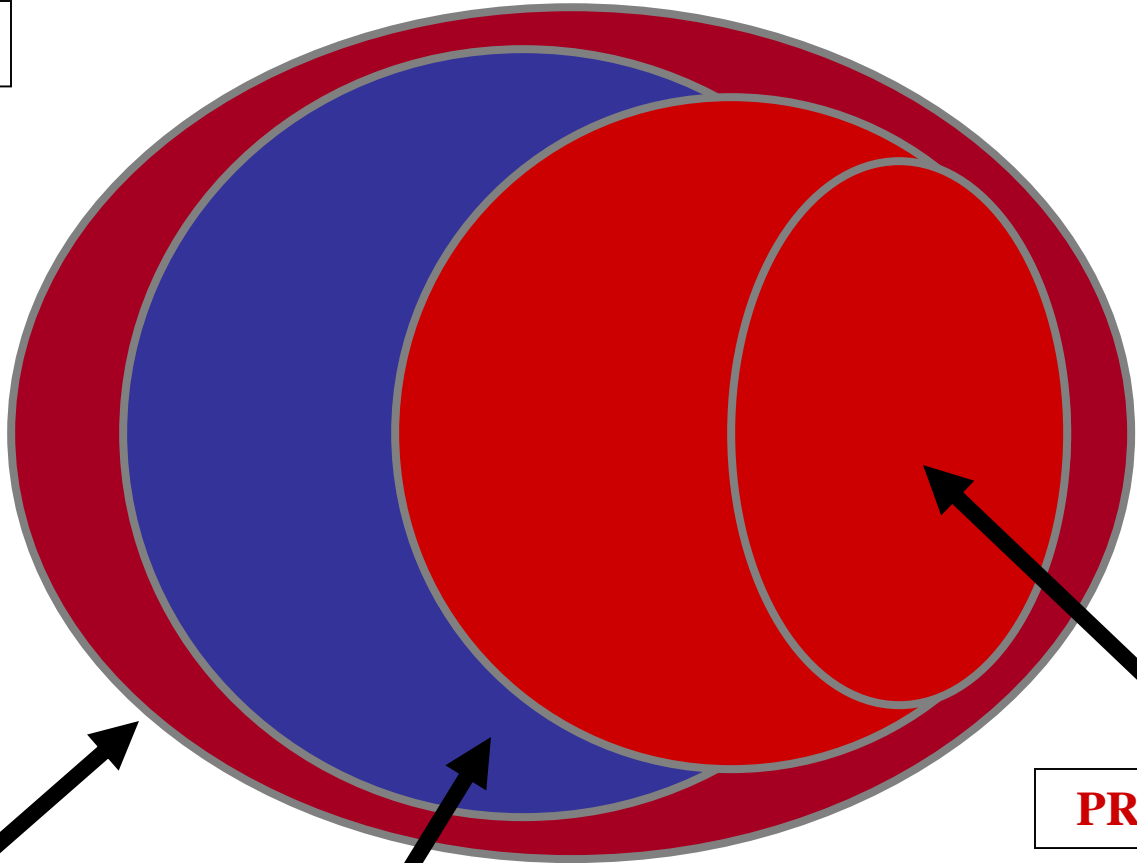


MONOCOT VASCULAR BUNDLE

MONOCOT

~1 STEM

C.S.



BUNDLE SHEATH

~1 PHLOEM

PROTOXYLEM

MONOCOT VASCULAR BUNDLE

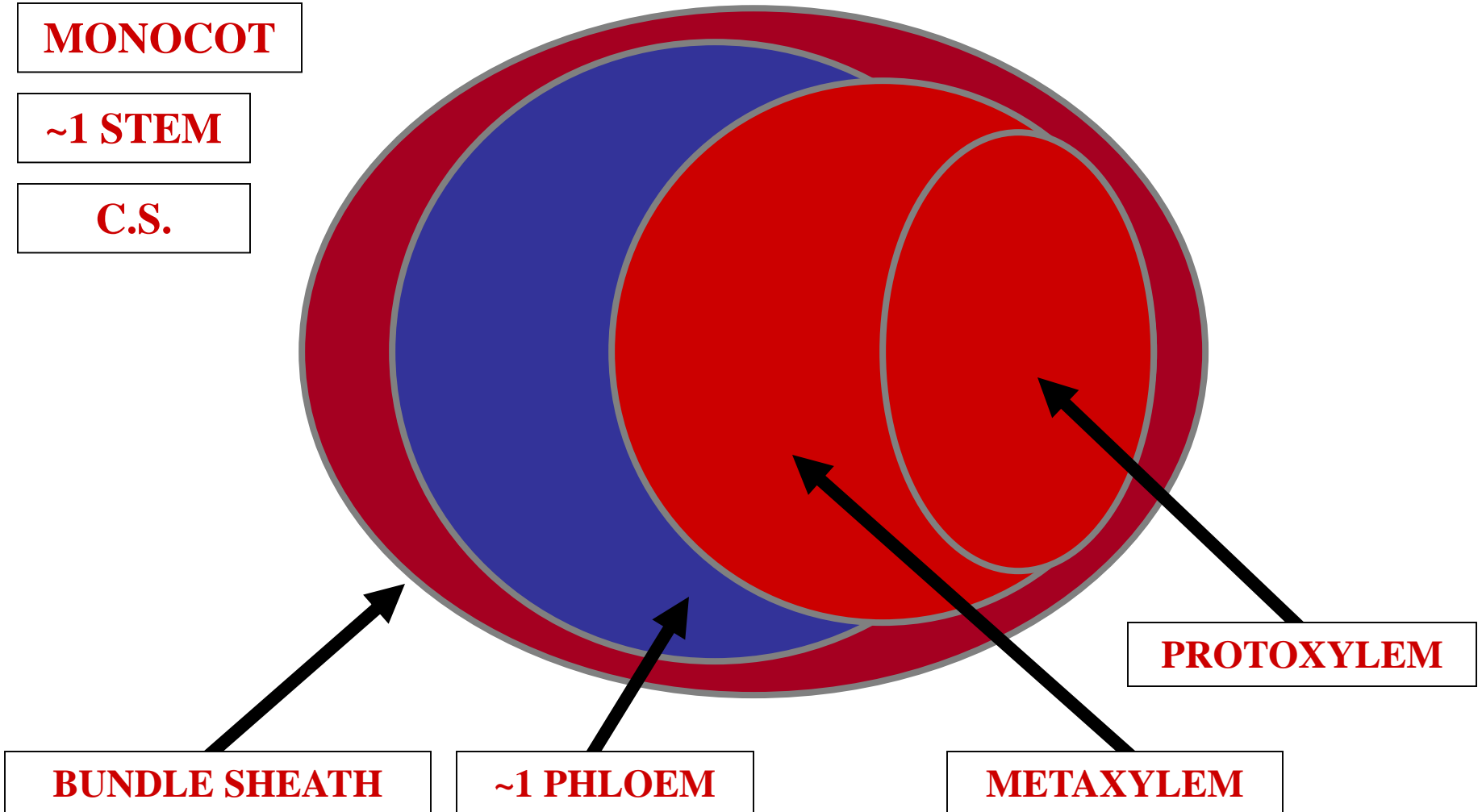


M

MONOCOT

~1 STEM

C.S.



VASCULAR BUNDLE

PROTOXYLEM

AS

~1 PHLOEM

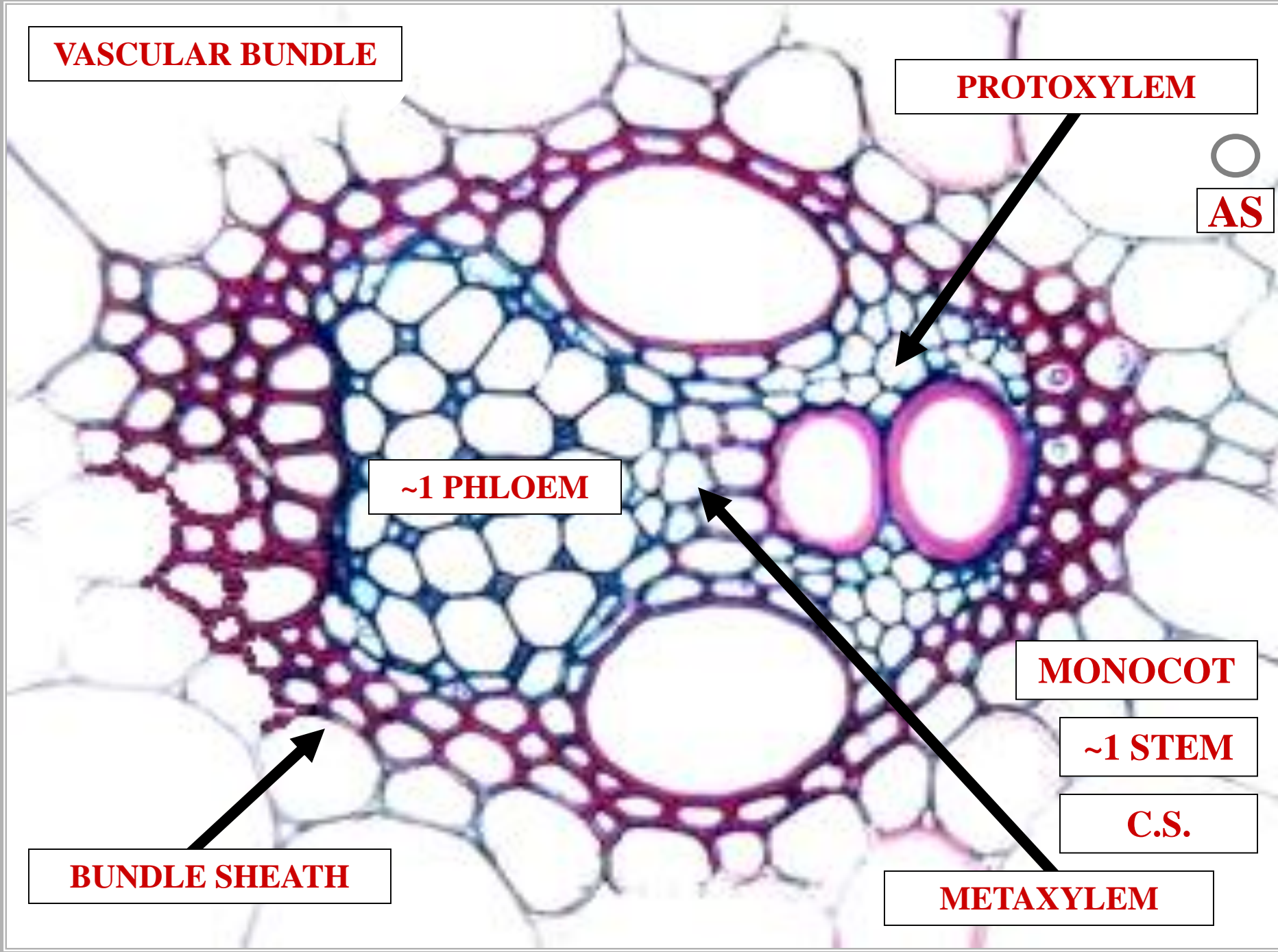
MONOCOT

~1 STEM

C.S.

BUNDLE SHEATH

METAXYLEM

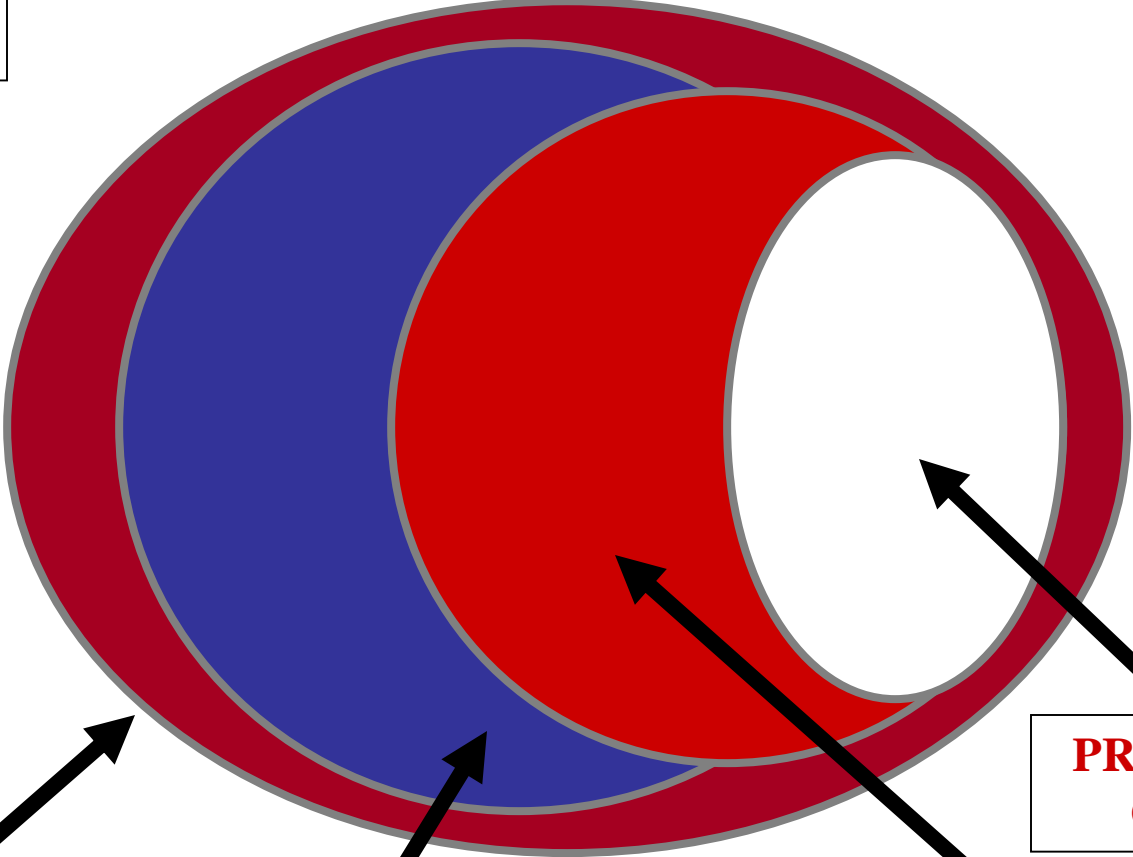


MONOCOT VASCULAR BUNDLE

MONOCOT

~1 STEM

C.S.



BUNDLE SHEATH

~1 PHLOEM

METAXYLEM

PROTOXYLEM
CRUSHED

MONOCOT VASCULAR BUNDLE

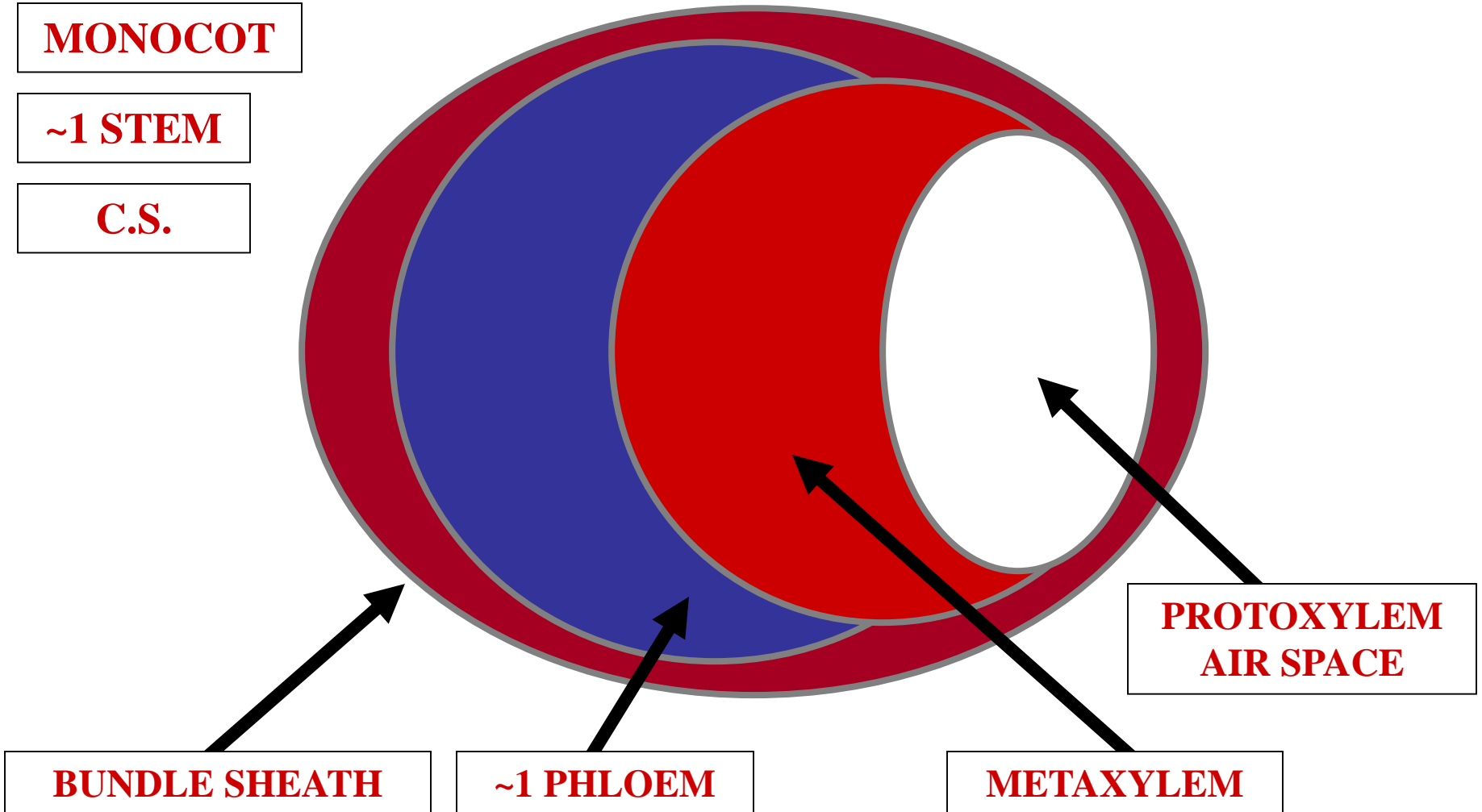


AS

MONOCOT

~1 STEM

C.S.



VASCULAR BUNDLE

**PROTOXYLEM
AIR SPACE**

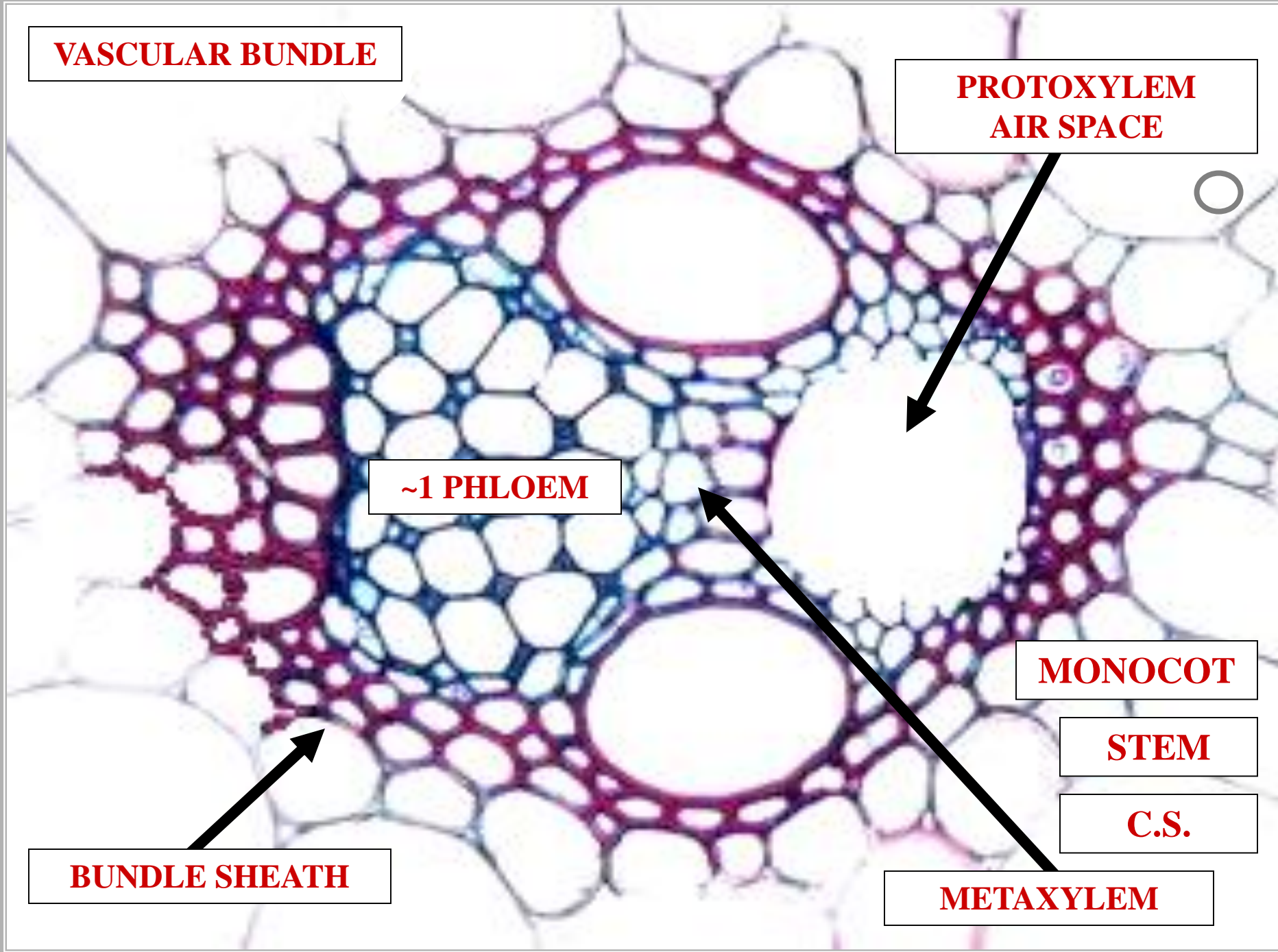
~1 PHLOEM

**MONOCOT
STEM**

C.S.

BUNDLE SHEATH

METAXYLEM



TYPICAL MONOCOT VASCULAR BUNDLE



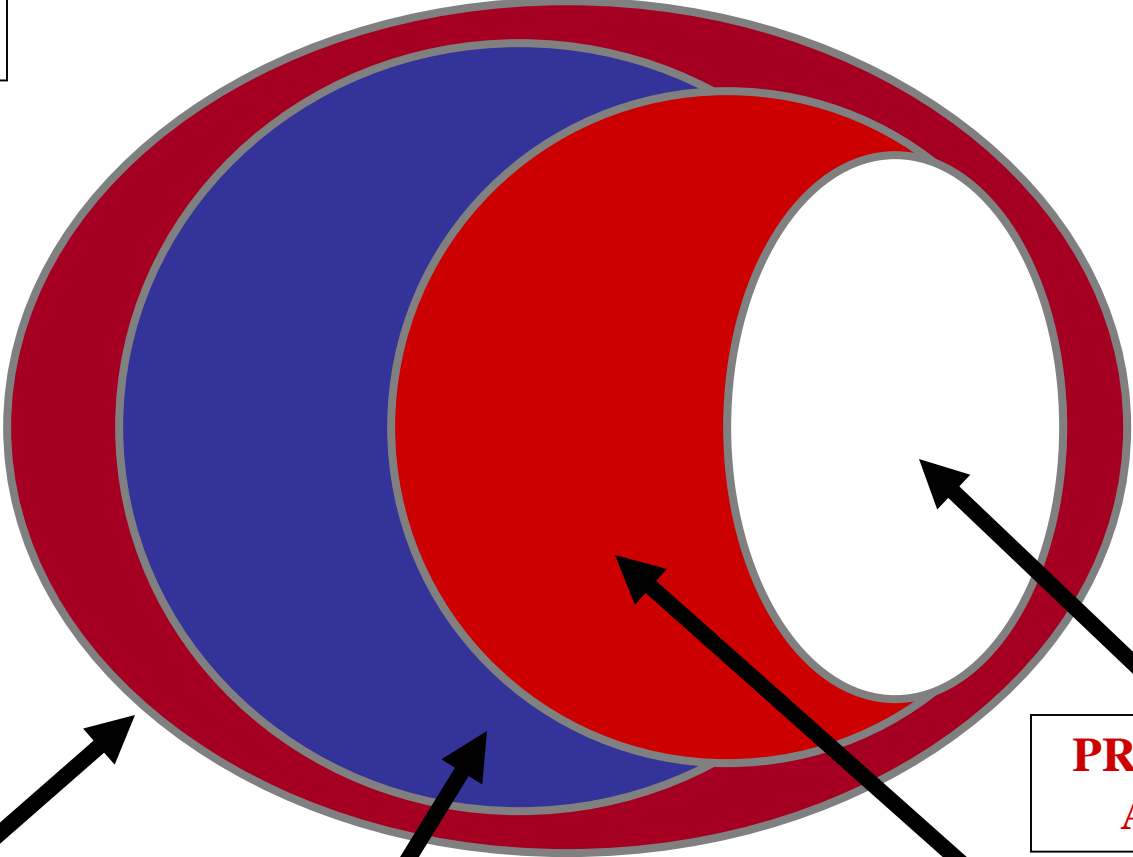
VB



MONOCOT

~1 STEM

C.S.



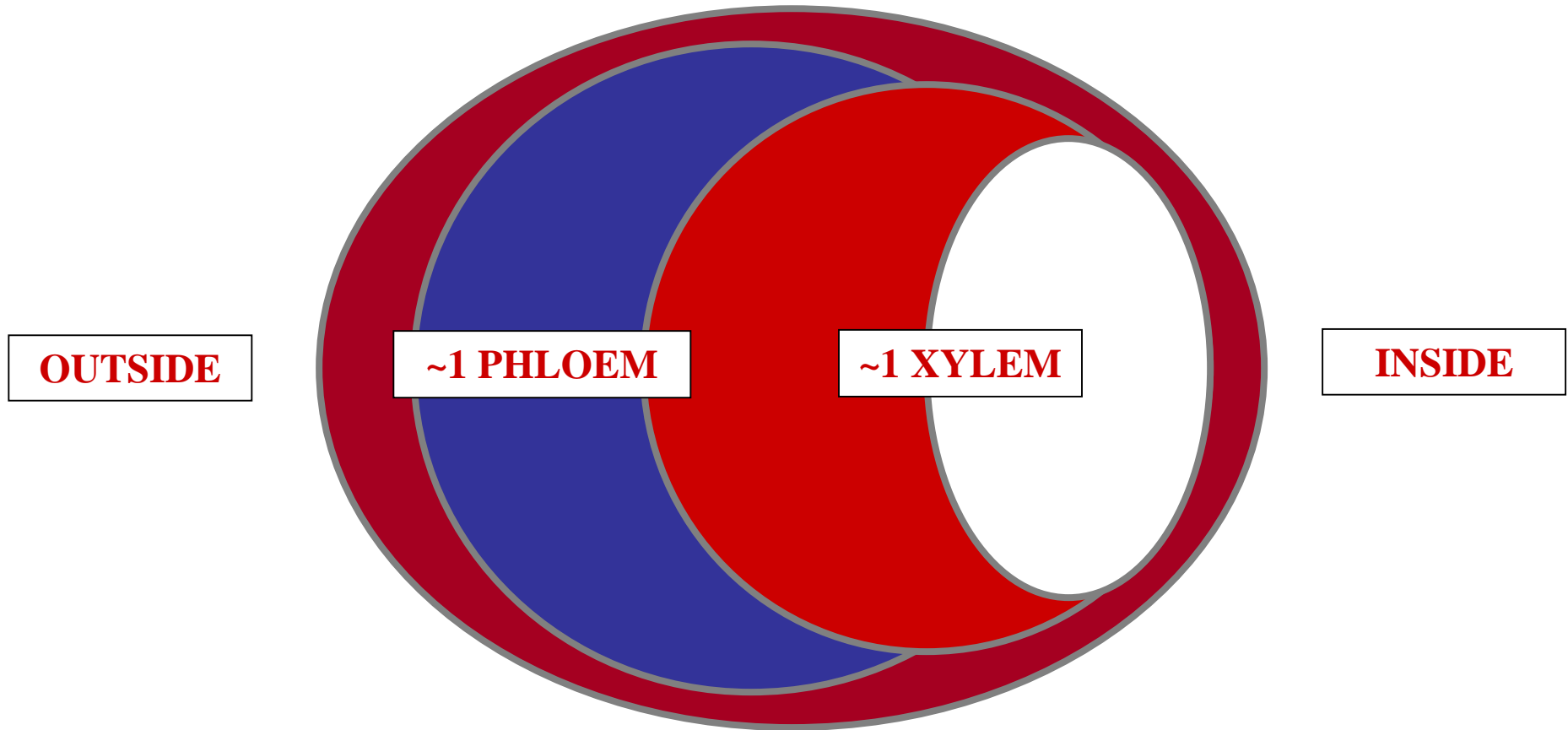
BUNDLE SHEATH

~1 PHLOEM

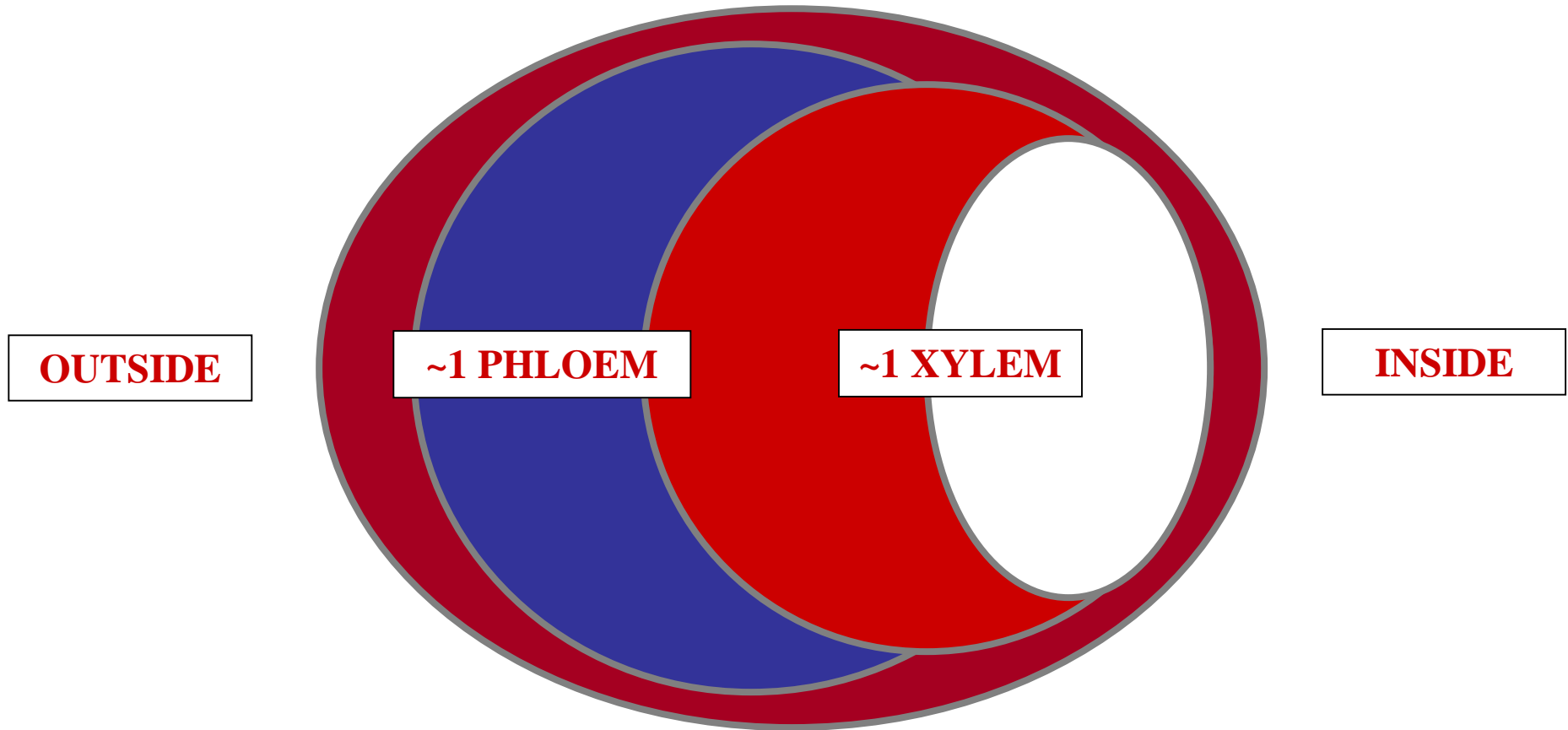
METAXYLEM

**PROTOXYLEM
AIR SPACE**

TYPICAL MONOCOT VASCULAR BUNDLE



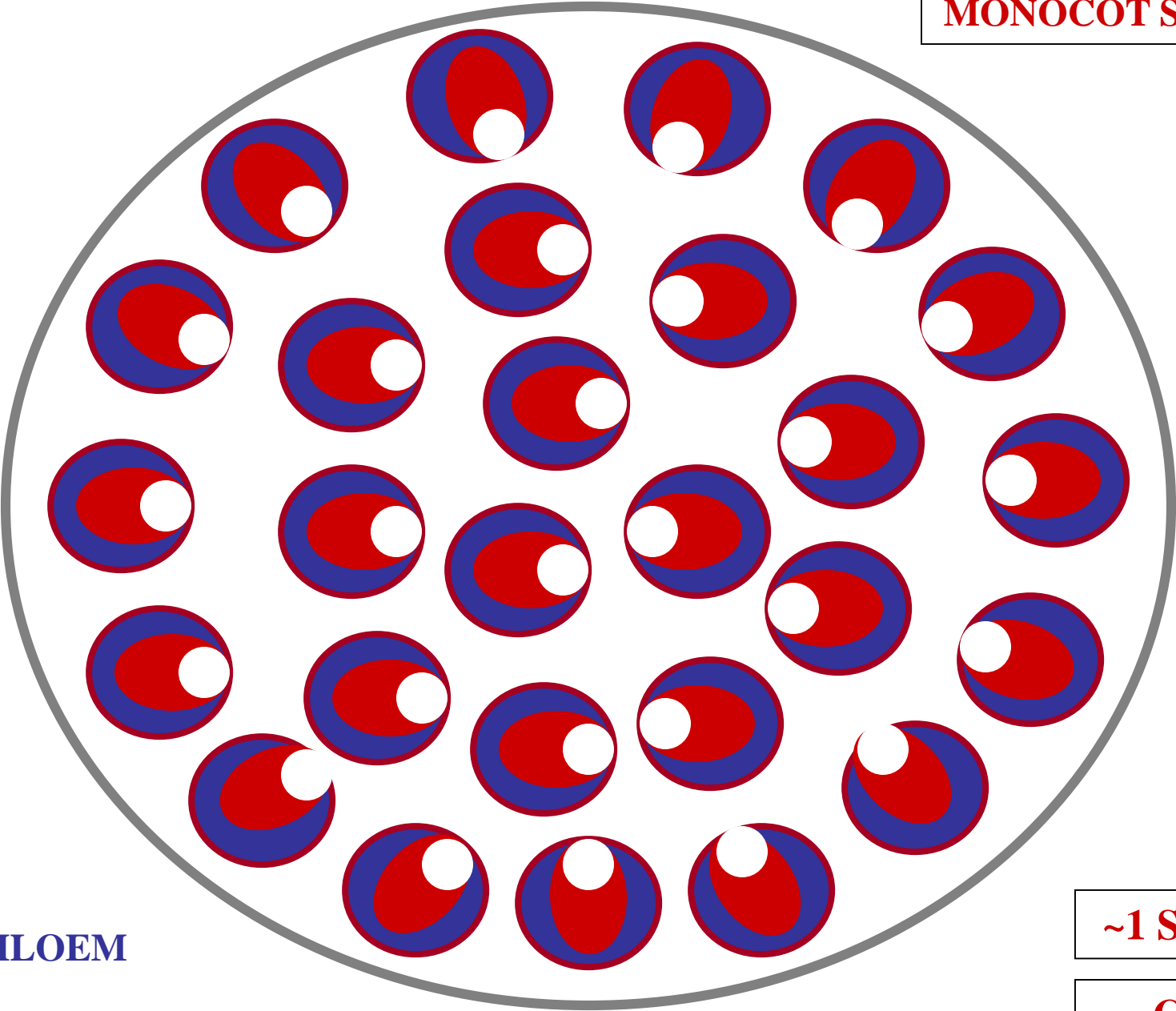
TYPICAL MONOCOT VASCULAR BUNDLE





MONOCOT STEM STELE

MONOCOT STELE



● = PHLOEM

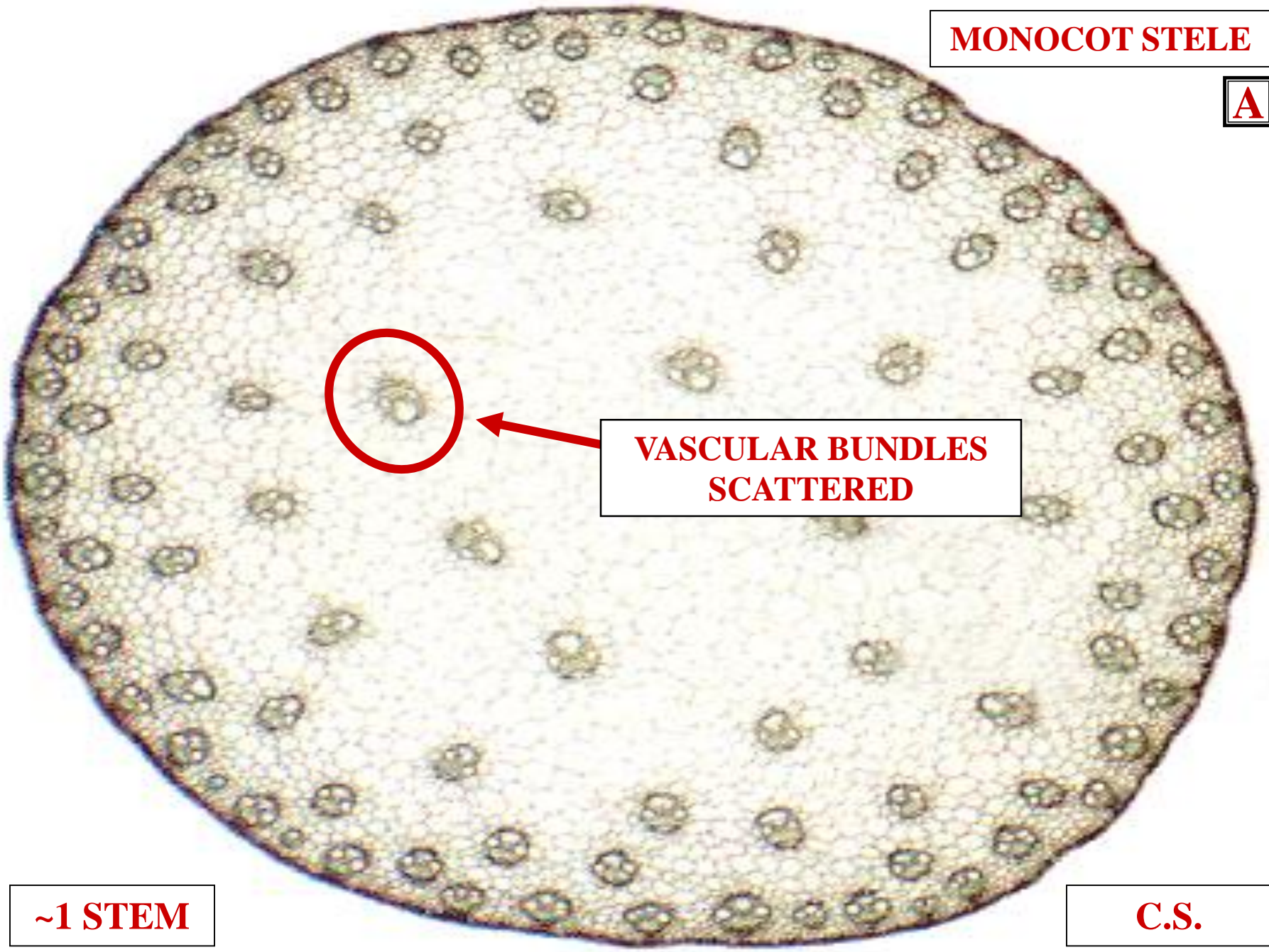
● = XYLEM

~1 STEM

C.S.

MONOCOT STELE

A



**VASCULAR BUNDLES
SCATTERED**

~1 STEM

C.S.

MONOCOT STELE

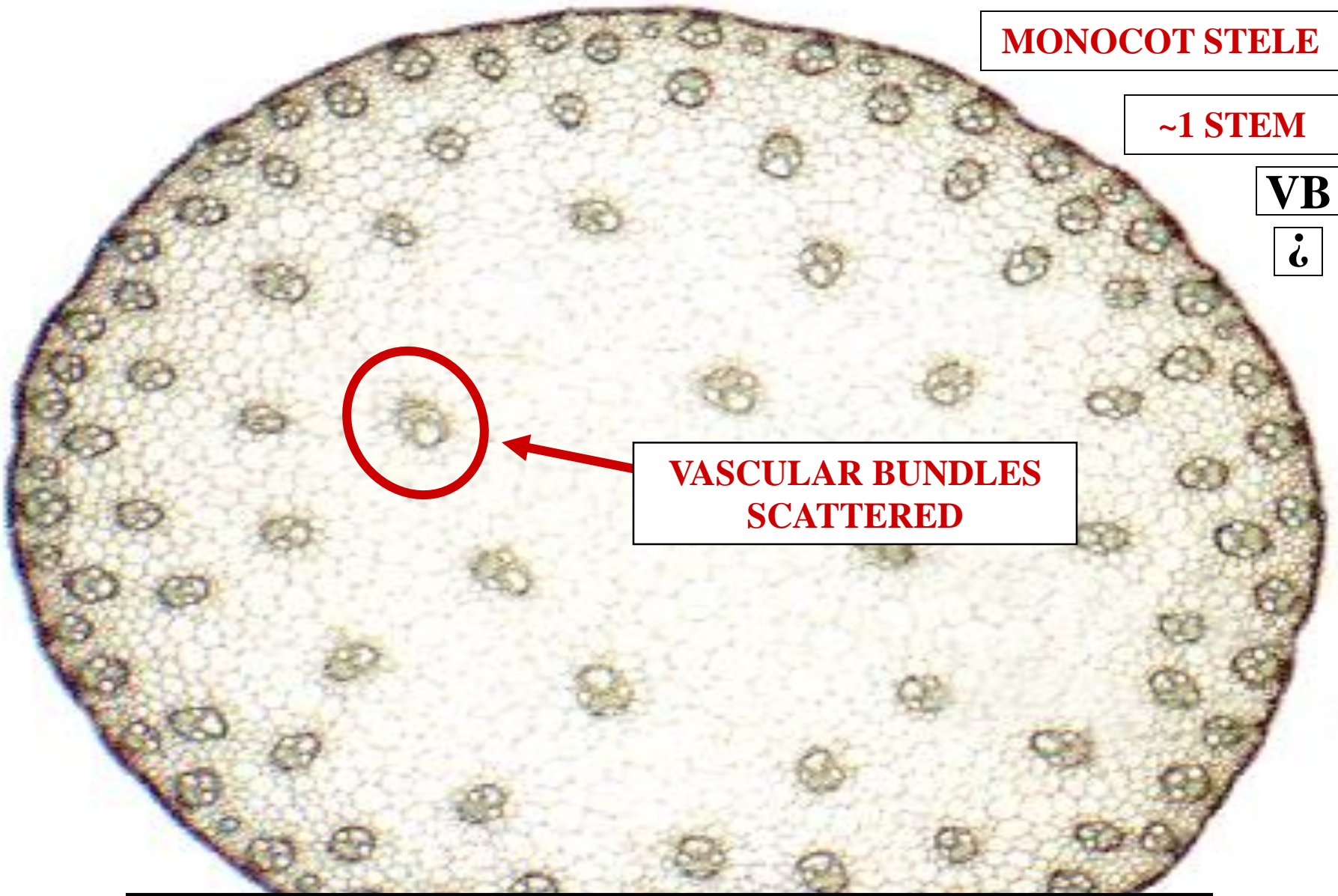
~1 STEM

VB

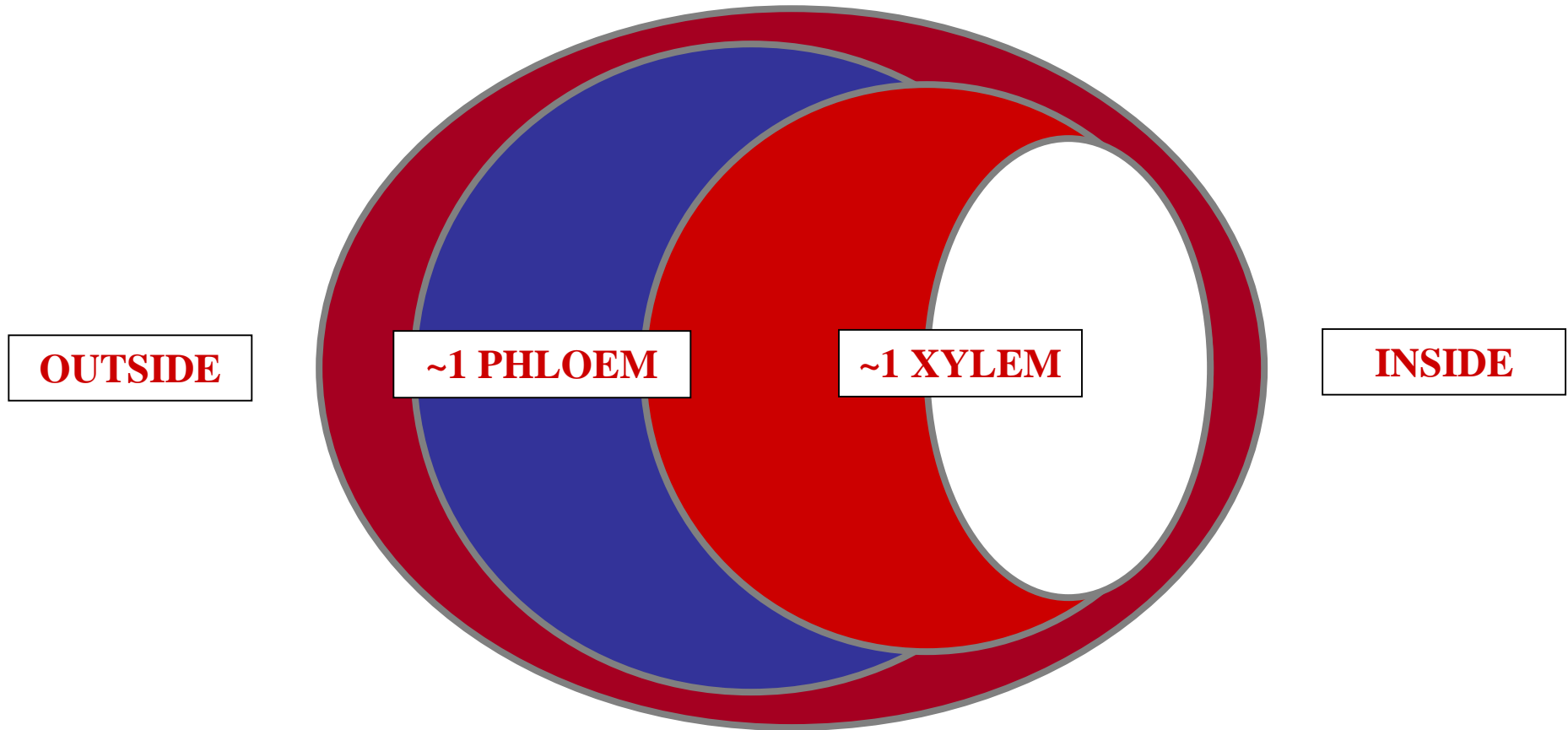
?

**VASCULAR BUNDLES
SCATTERED**

ATACTOSTELE



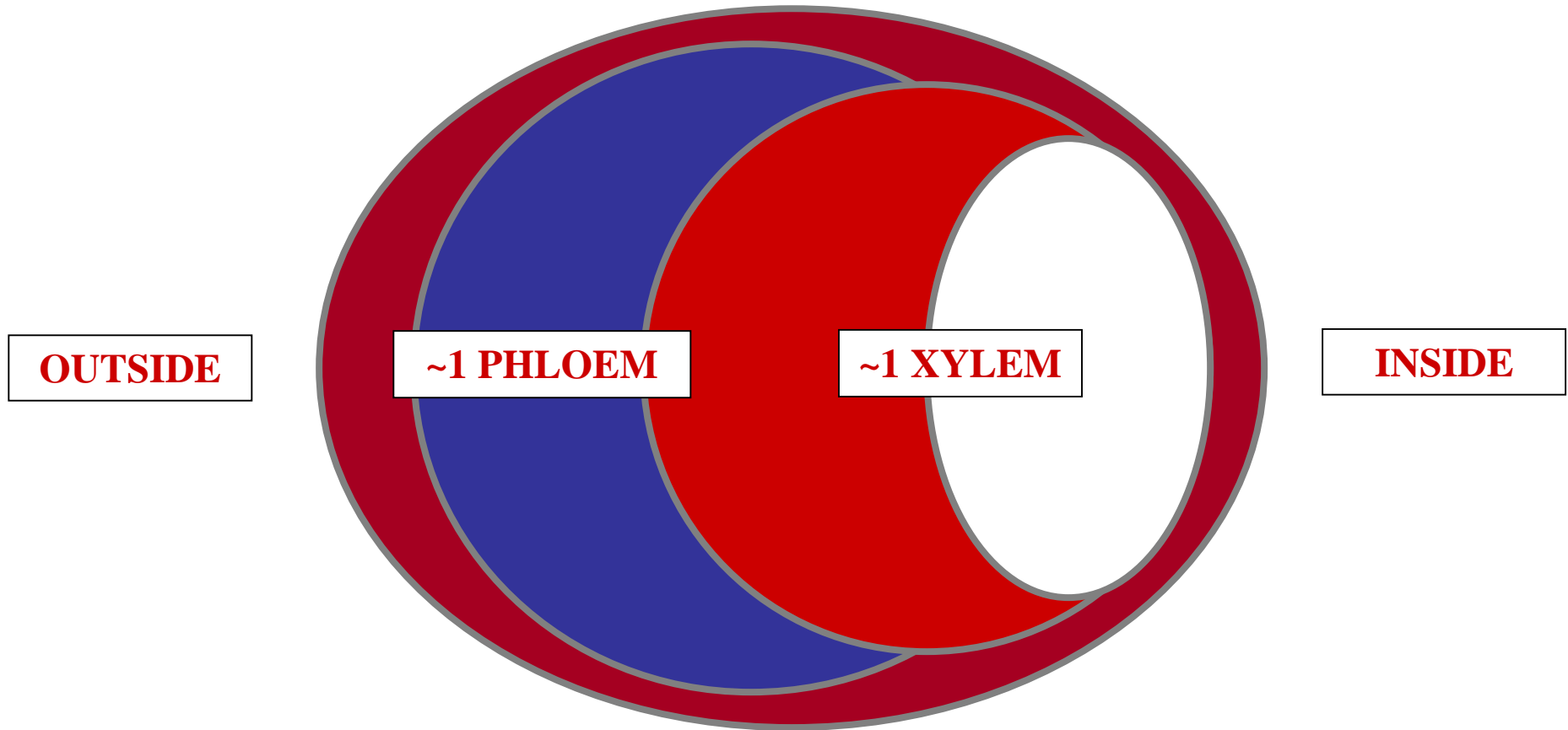
TYPICAL MONOCOT VASCULAR BUNDLE



TYPICAL MONOCOT VASCULAR BUNDLE

?

VC

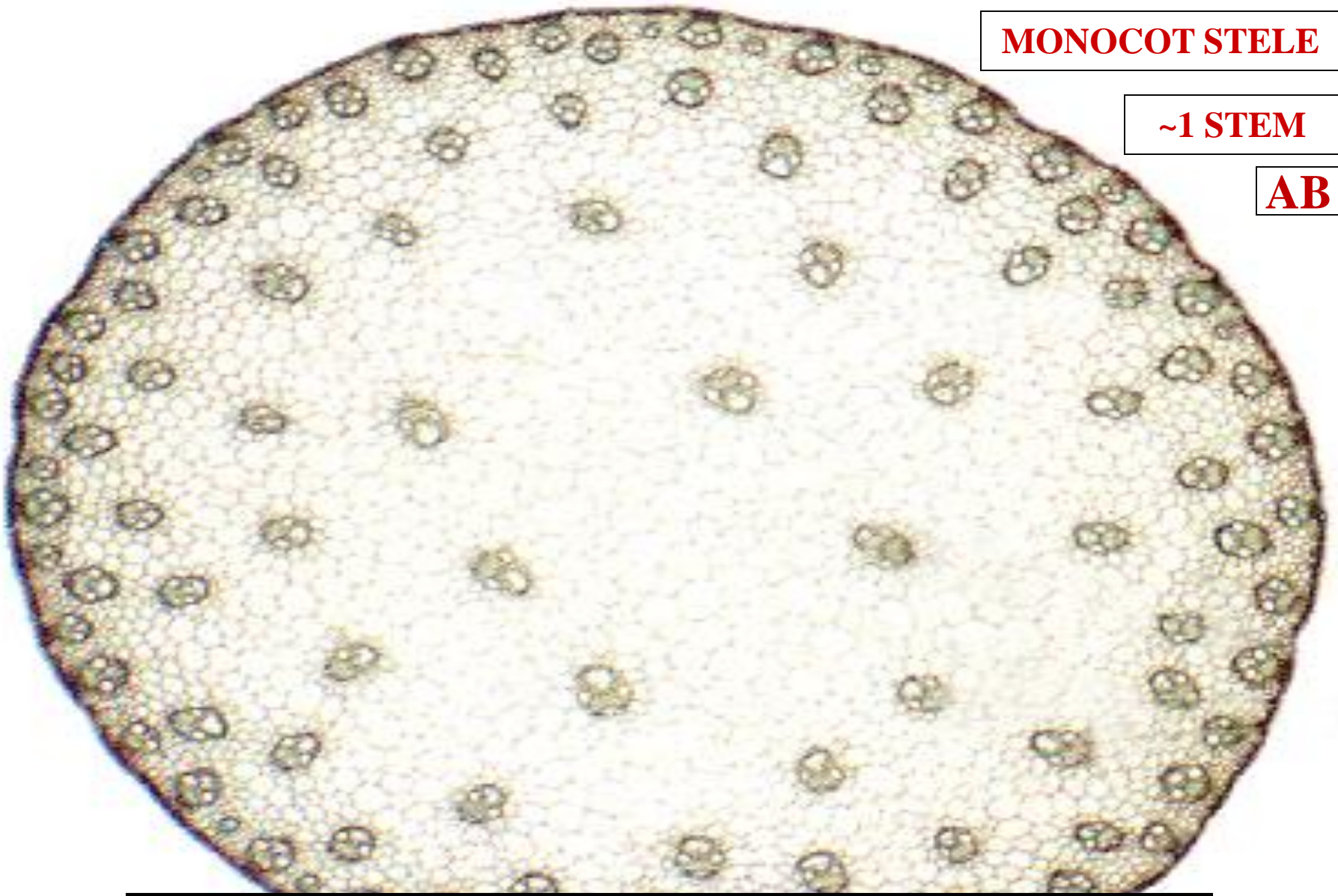


COLLATERAL

MONOCOT STELE

~1 STEM

AB



VASCULAR CAMBIUM: ?

MONOCOT STELE

~1 STEM

~2



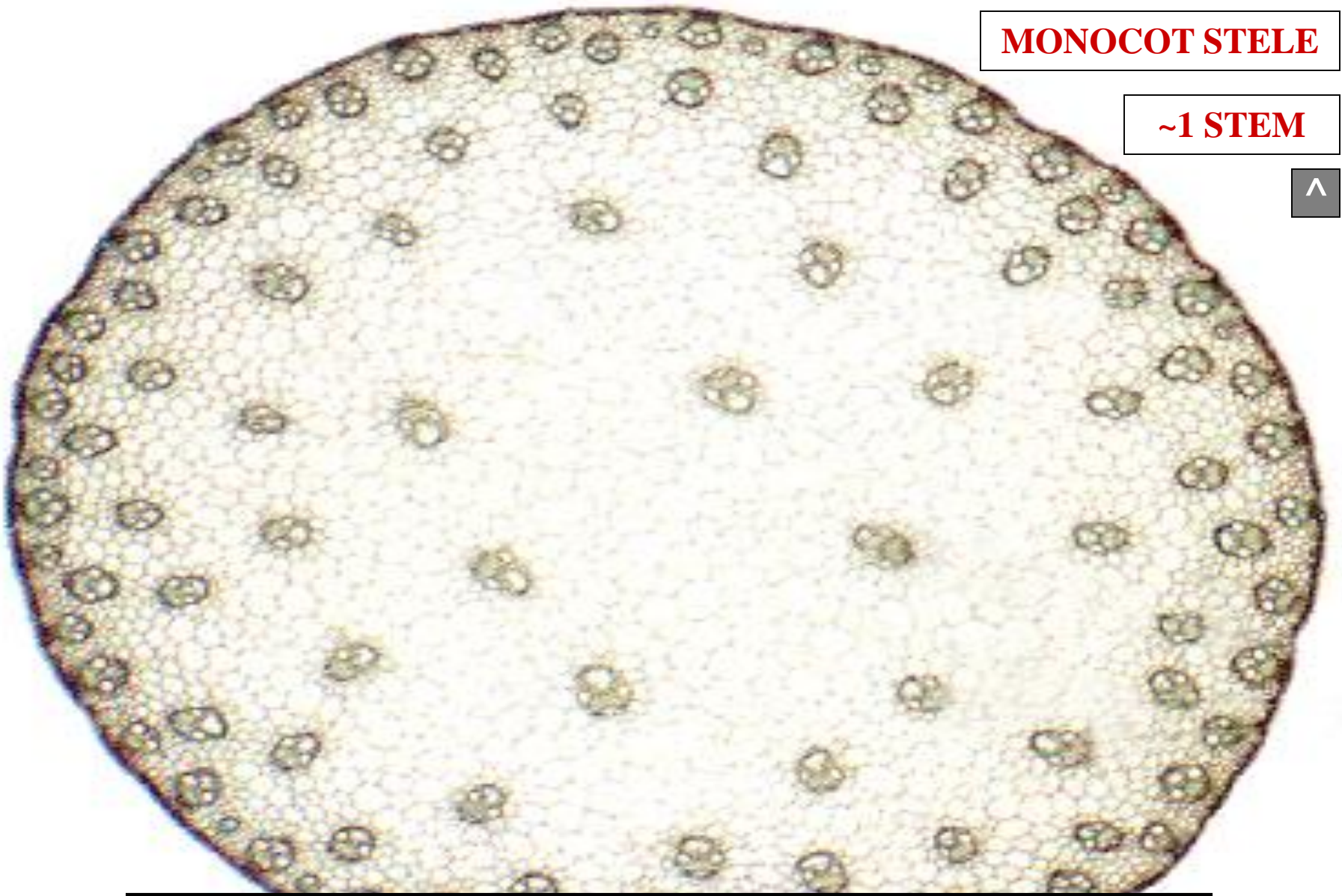
VASCULAR CAMBIUM: ABSENT

MONOCOT STELE

~1 STEM

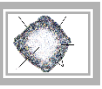
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~2 GROWTH: ABSENT



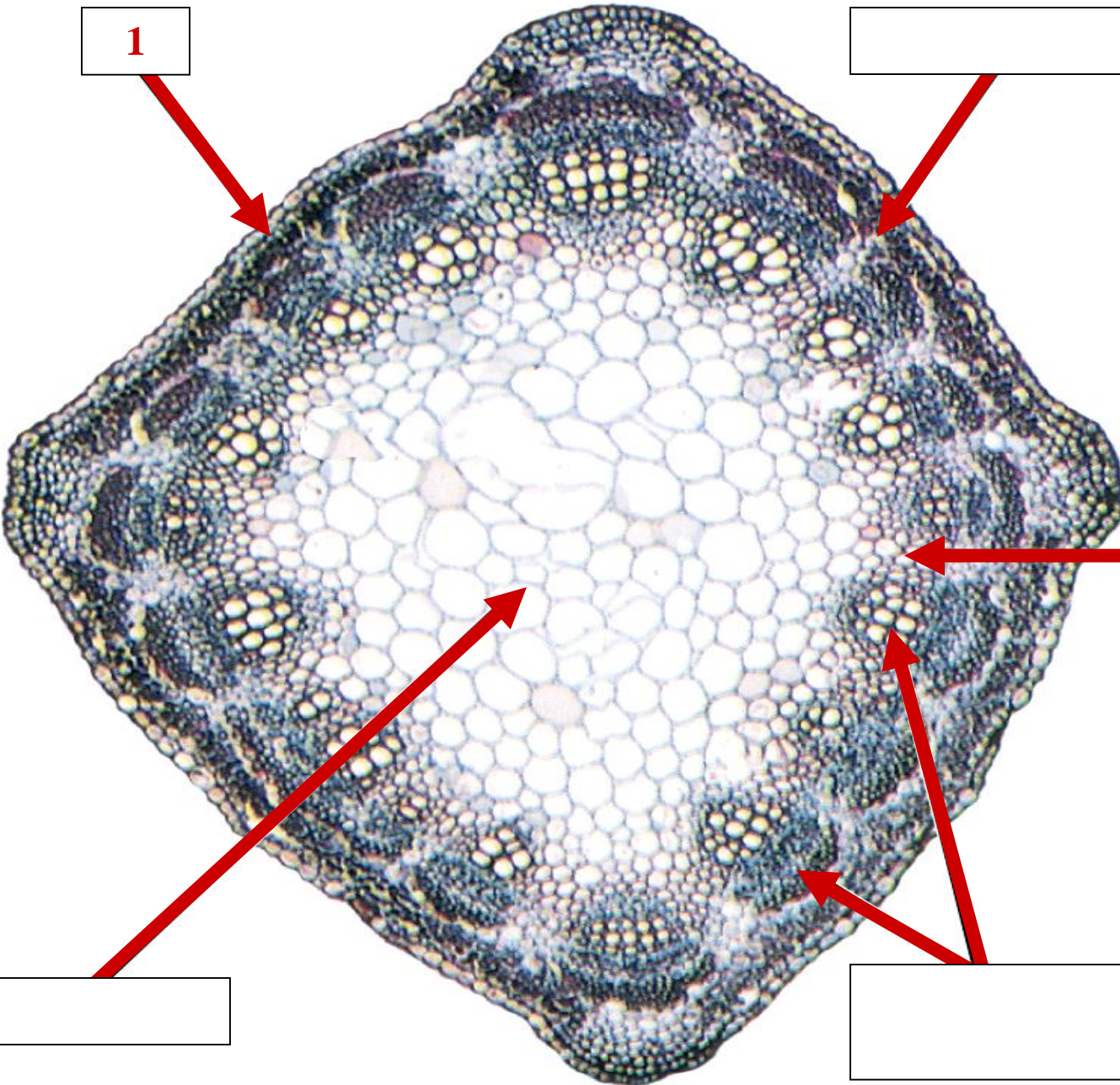


STEM PRIMARY GROWTH SUMMARY



DICOT STEM PRIMARY GROWTH SUMMARY

1

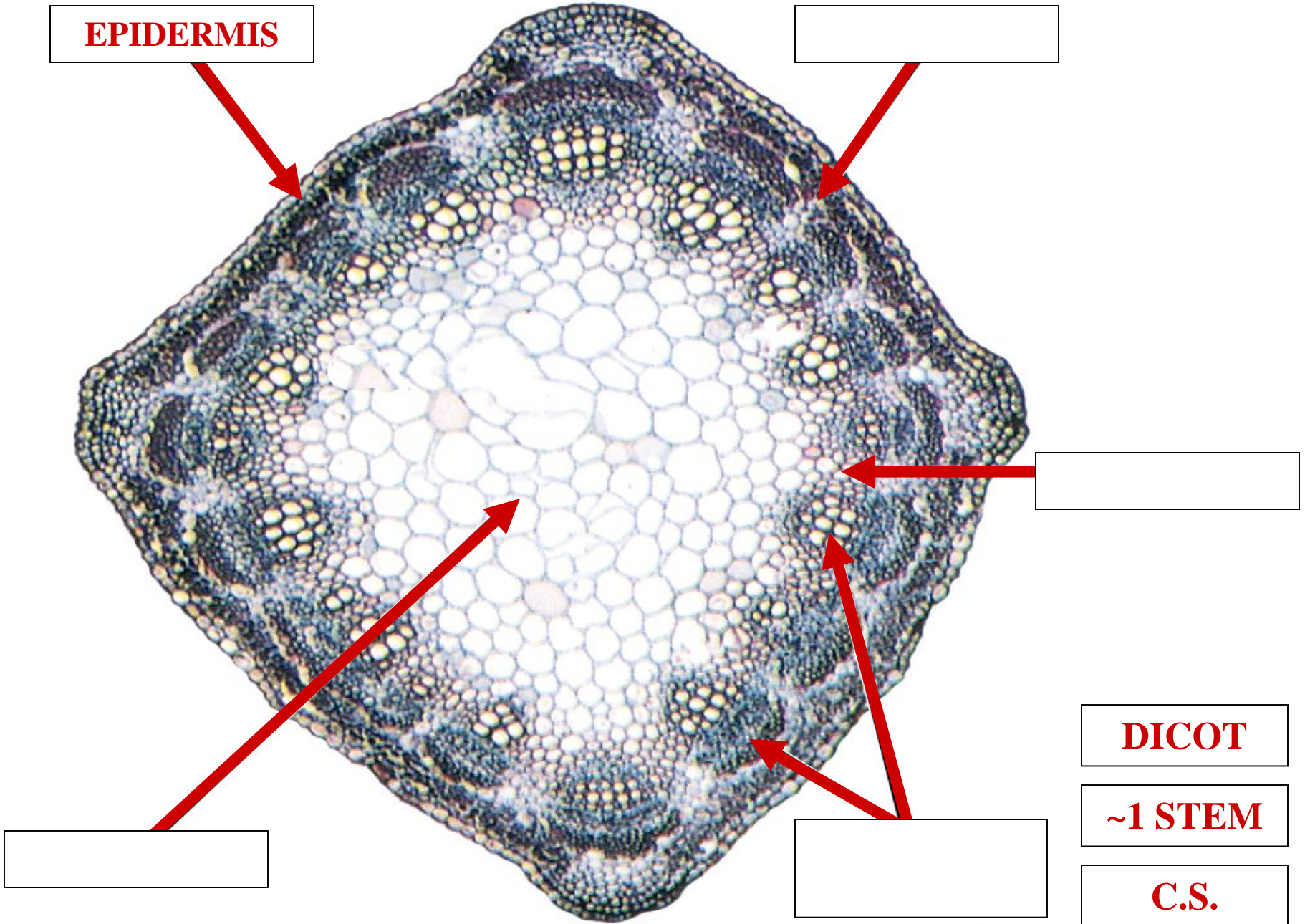


DICOT

~1 STEM

C.S.

EPIDERMIS



DICOT

~1 STEM

C.S.

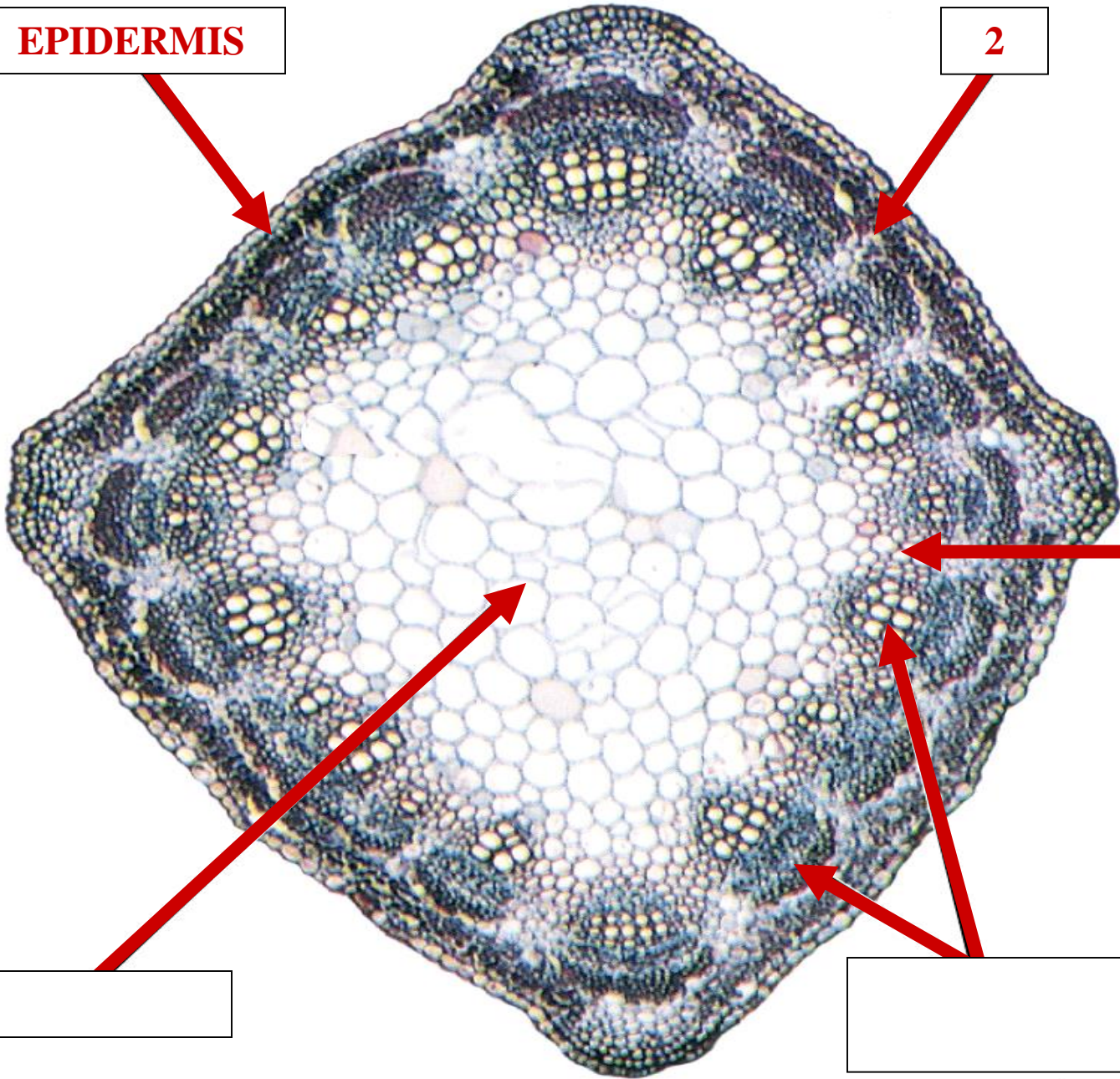
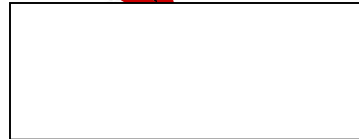
EPIDERMIS

2

DICOT

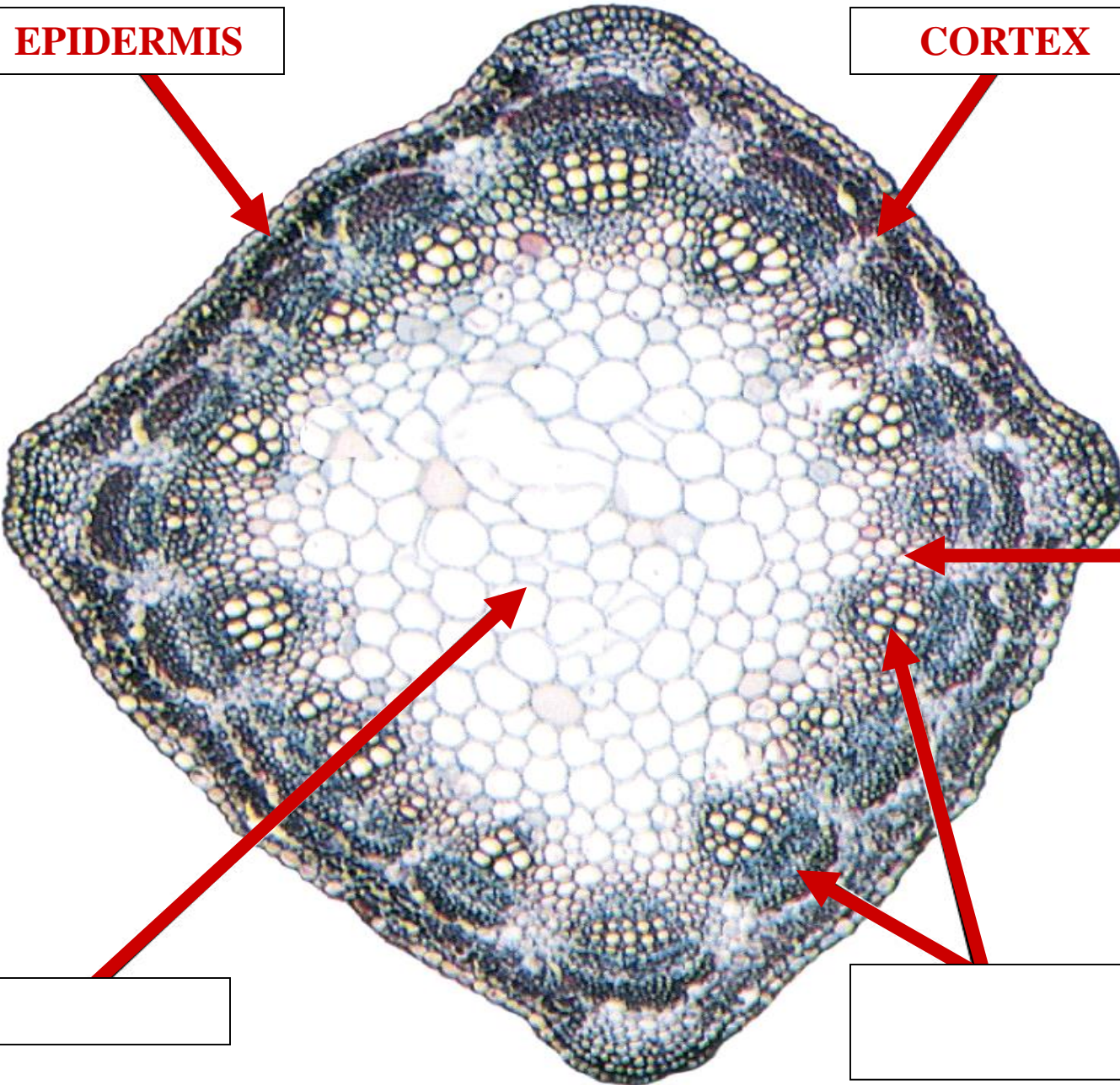
~1 STEM

C.S.



EPIDERMIS

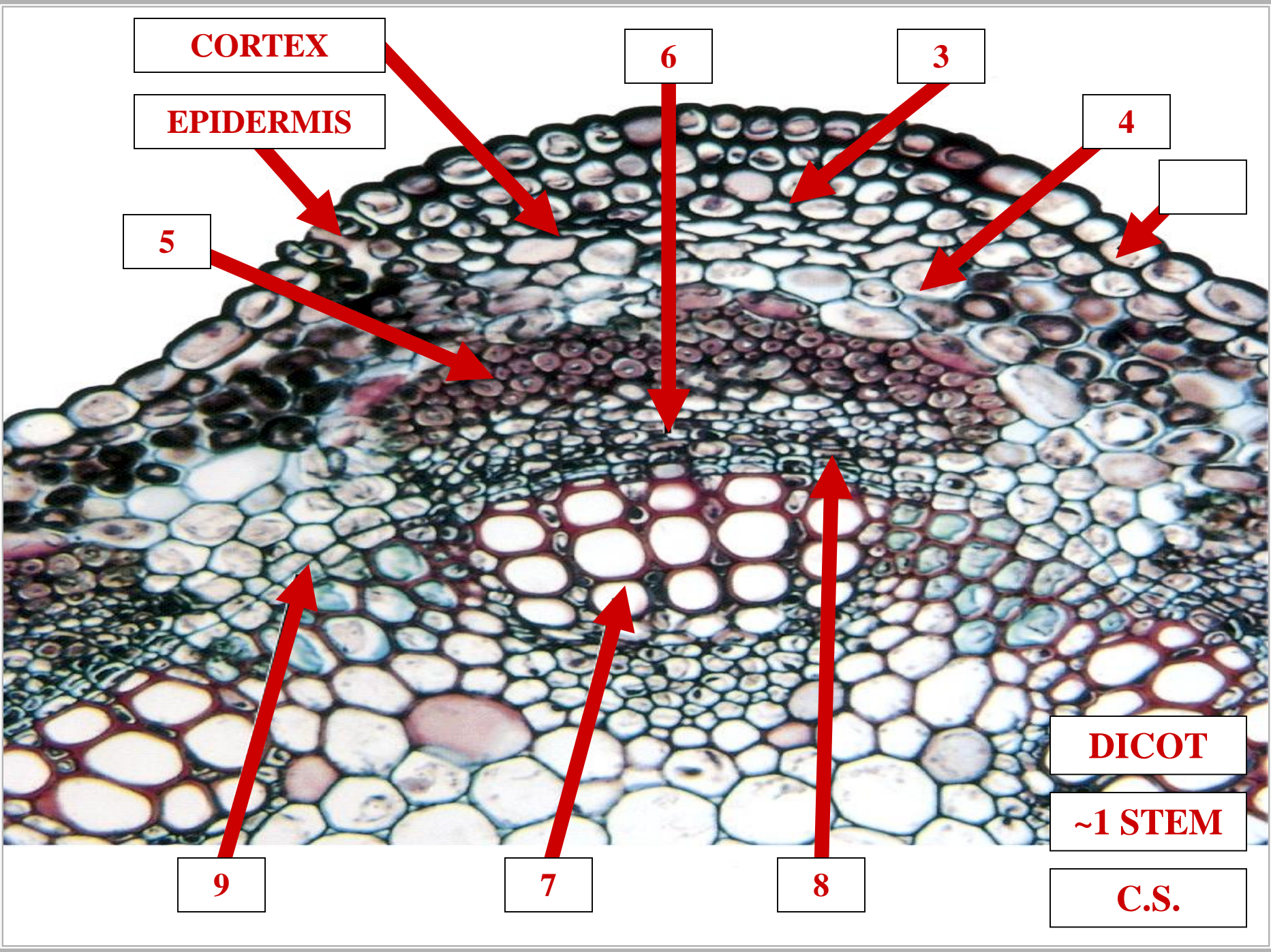
CORTEX



DICOT

~1 STEM

C.S.



CORTEX

EPIDERMIS

6

3

4

5

9

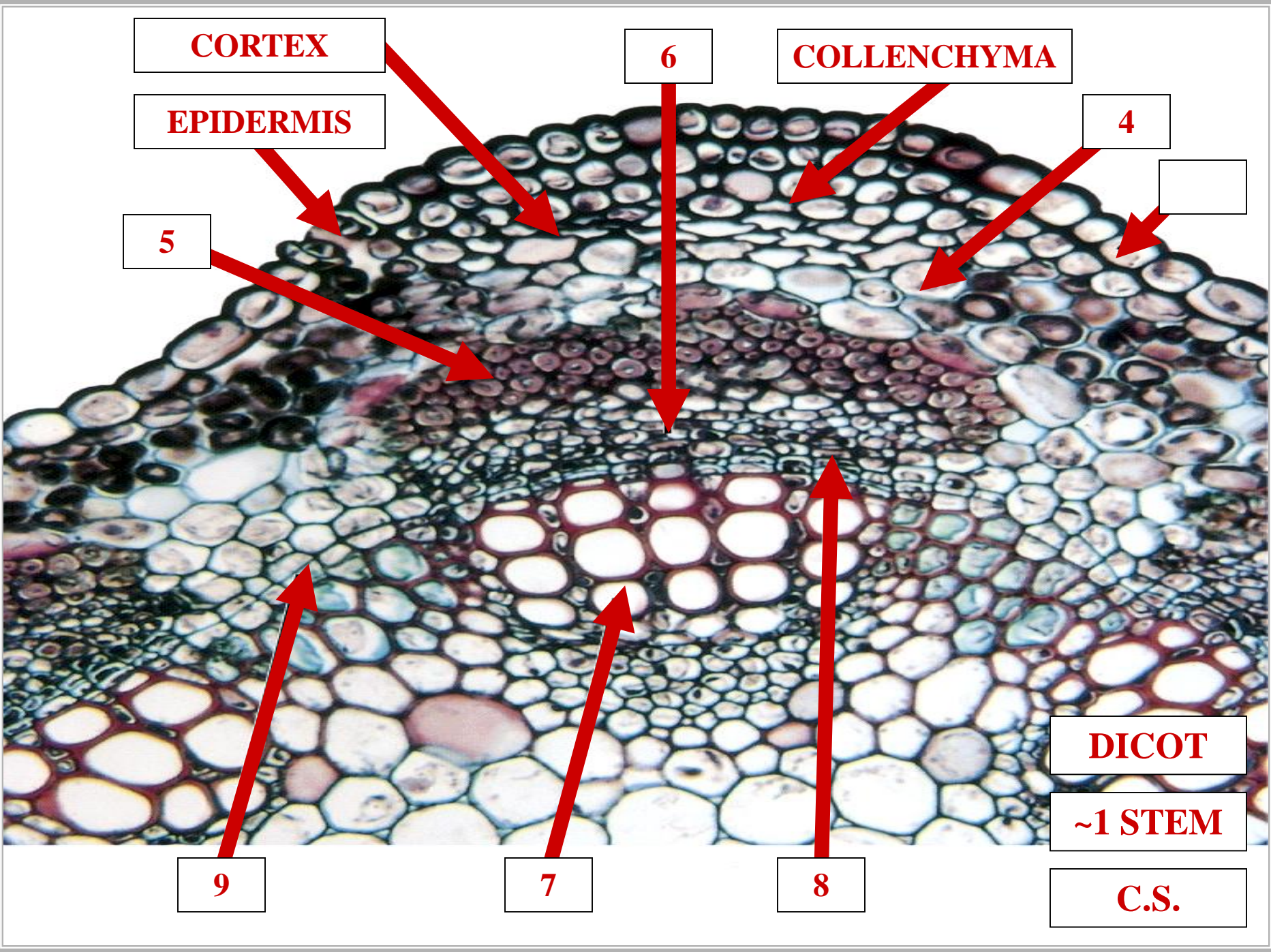
7

8

DICOT

~1 STEM

C.S.



CORTEX

EPIDERMIS

COLLENCHYMA

6

4

5

3

DICOT

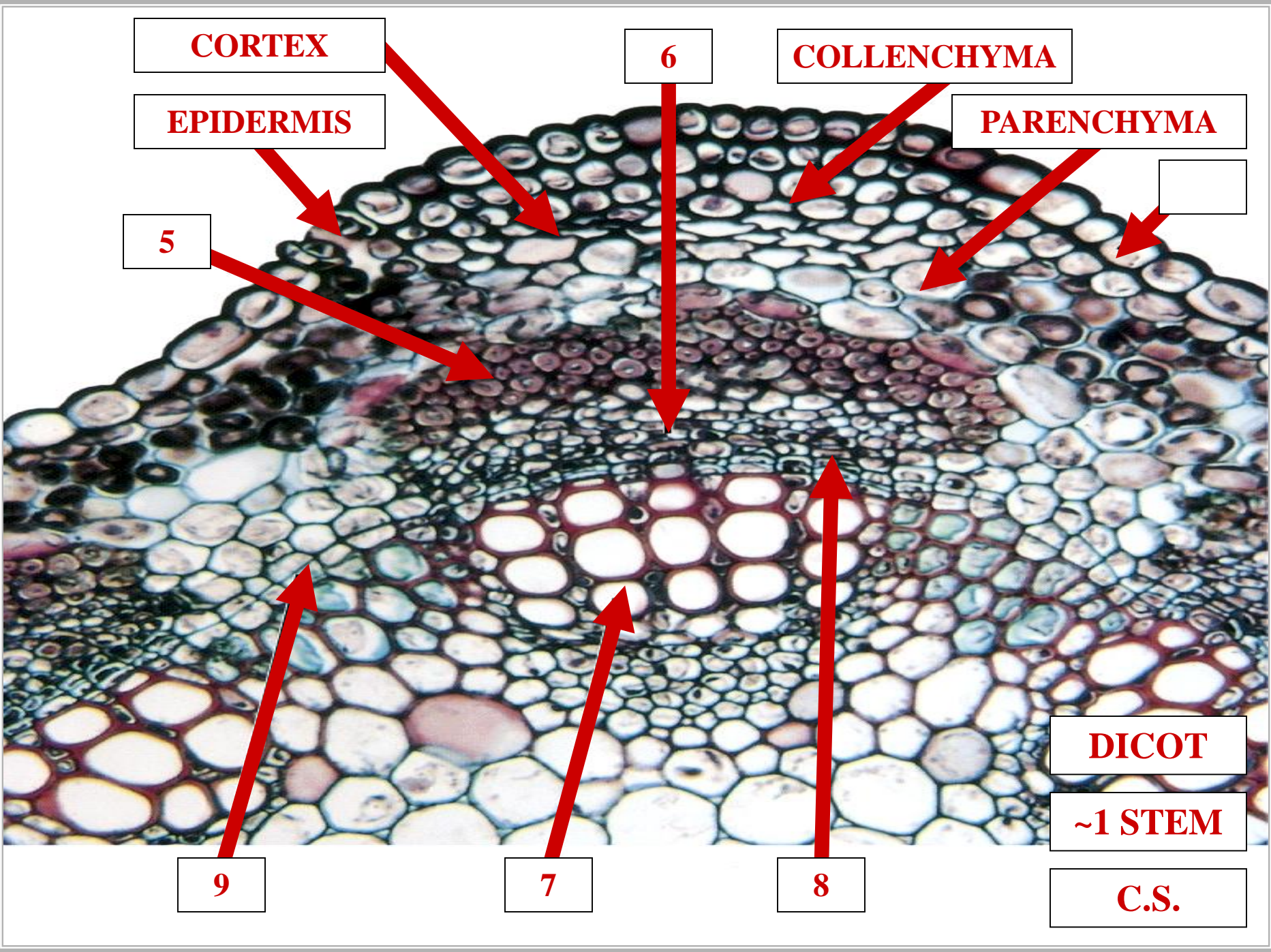
~1 STEM

9

7

8

C.S.



CORTEX

EPIDERMIS

6

COLLENCHYMA

PARENCHYMA

5

DICOT

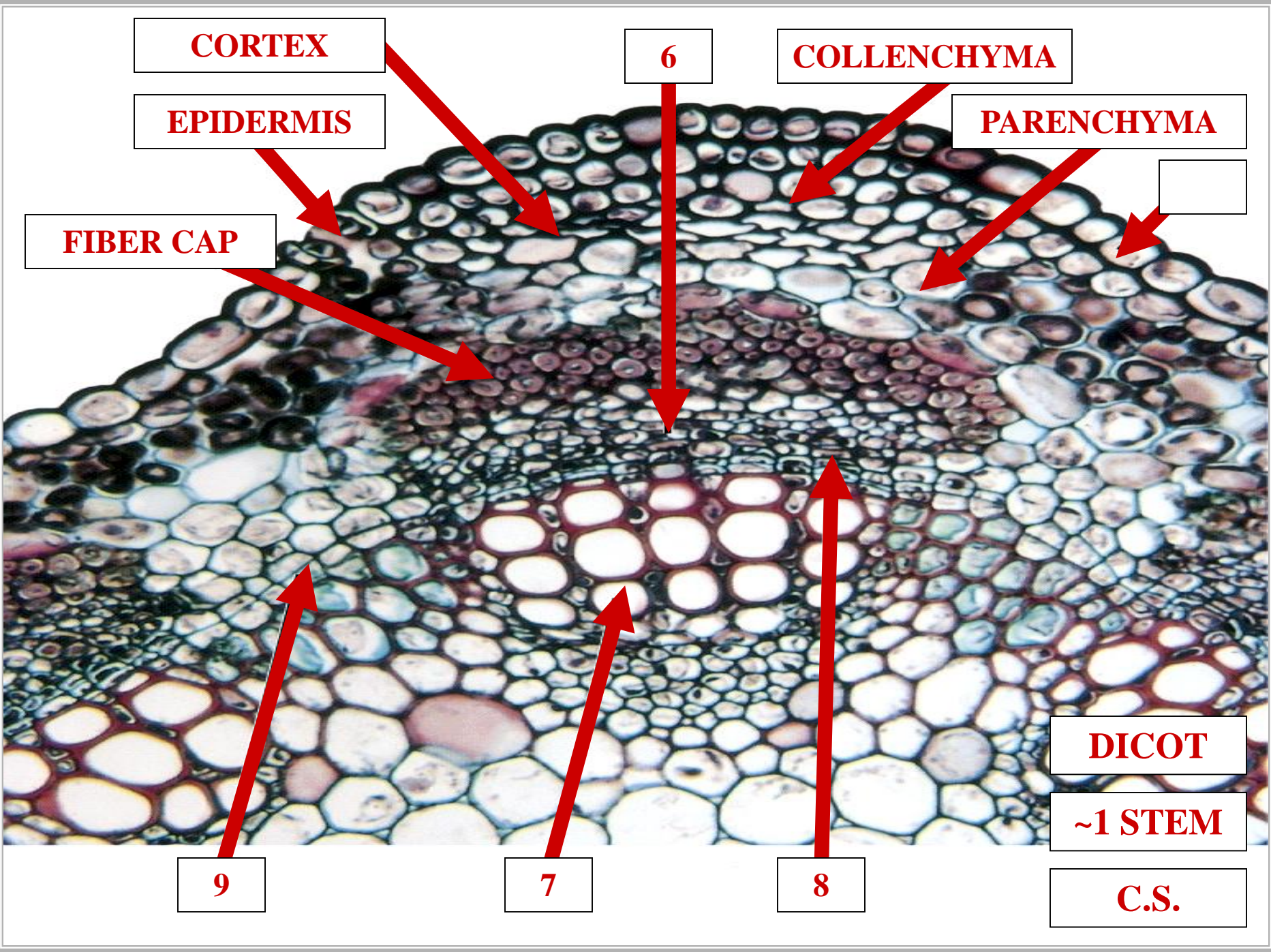
~1 STEM

9

7

8

C.S.



CORTEX

EPIDERMIS

FIBER CAP

6

COLLENCHYMA

PARENCHYMA

9

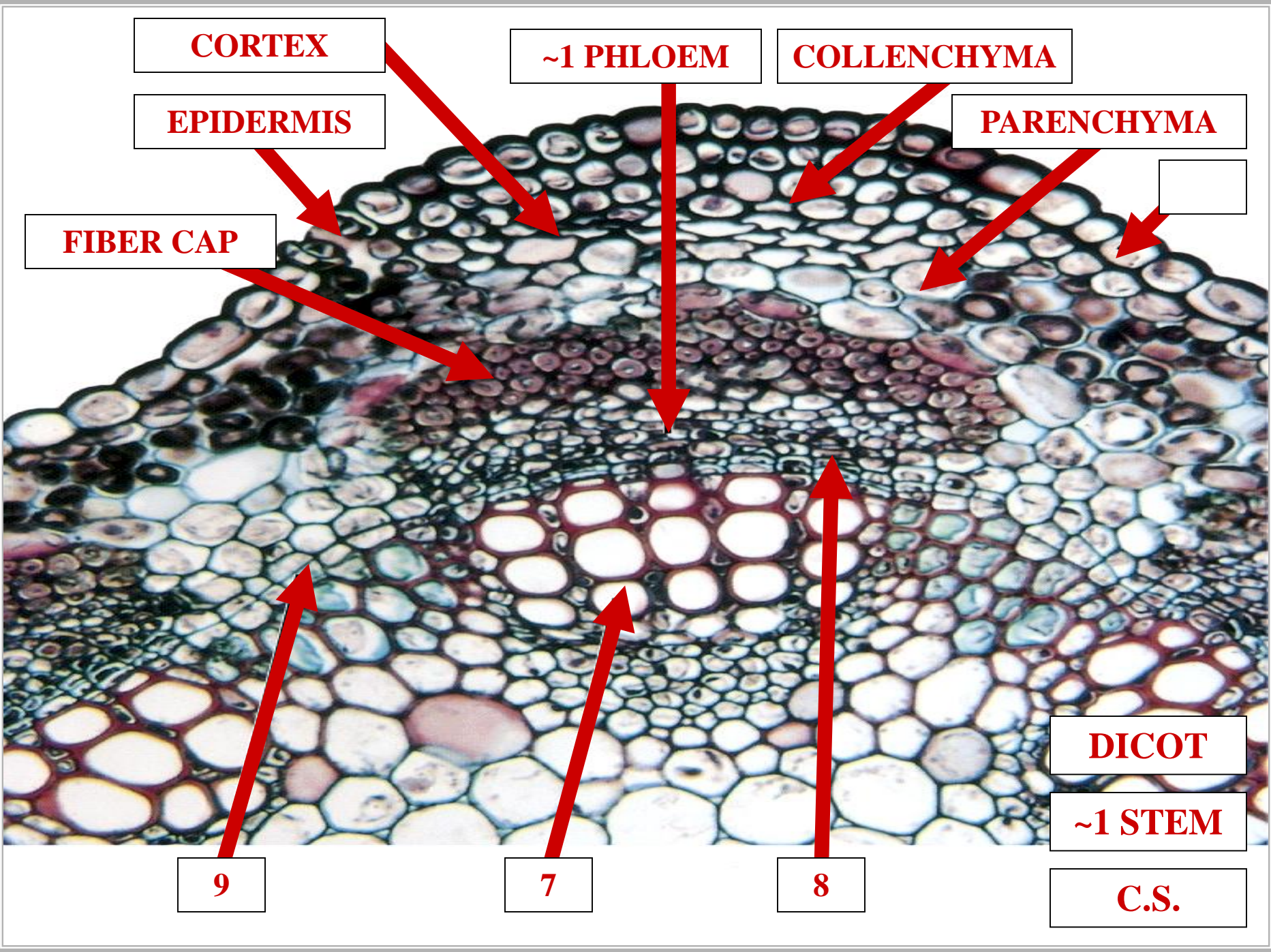
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8

DICOT

~1 STEM

C.S.



CORTEX

~1 PHLOEM

COLLENGHYMA

EPIDERMIS

PARENCHYMA

FIBER CAP

9

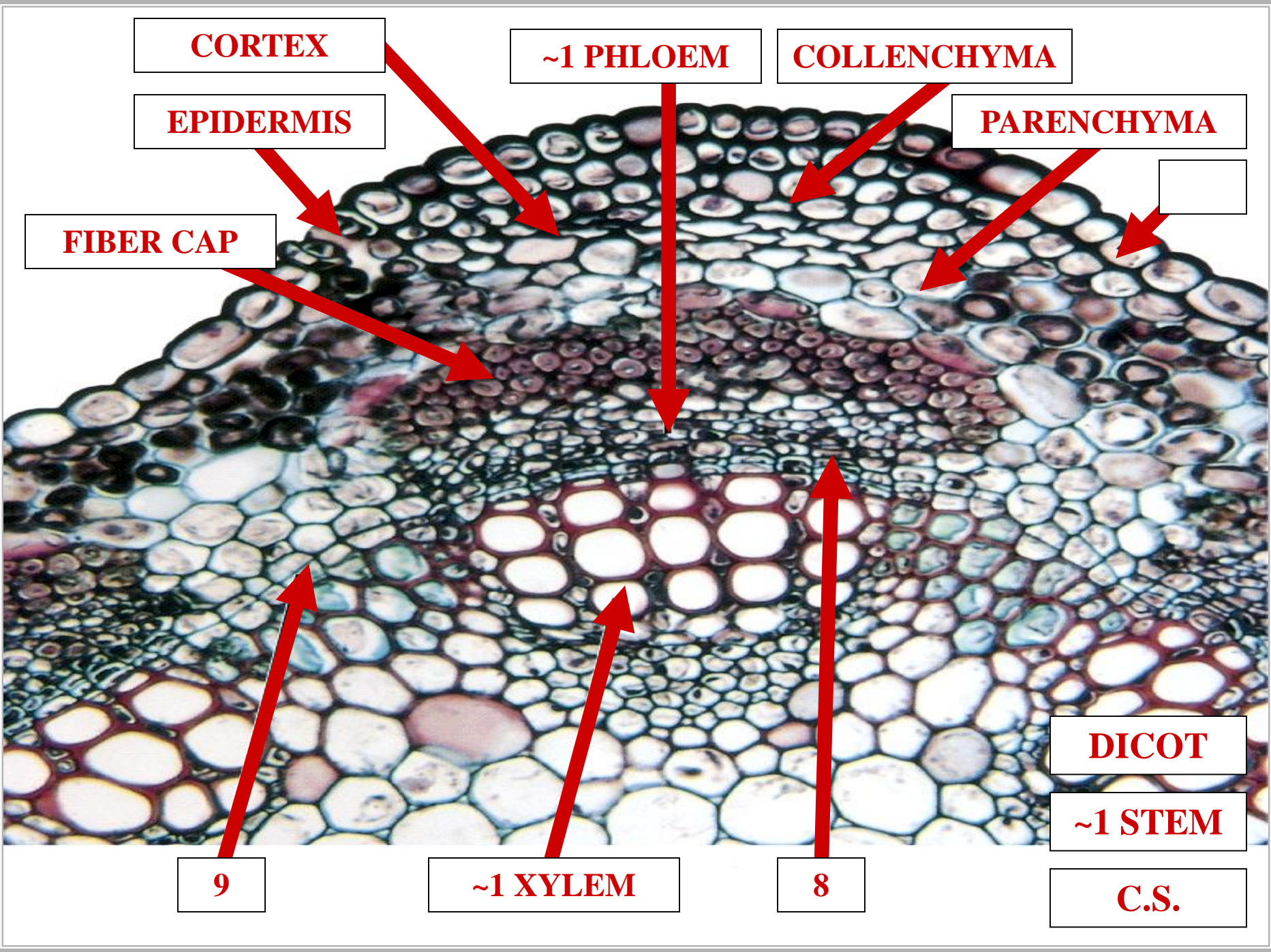
7

8

DICOT

~1 STEM

C.S.



CORTEX

~1 PHLOEM

COLLENCHYMA

EPIDERMIS

PARENCHYMA

FIBER CAP

9

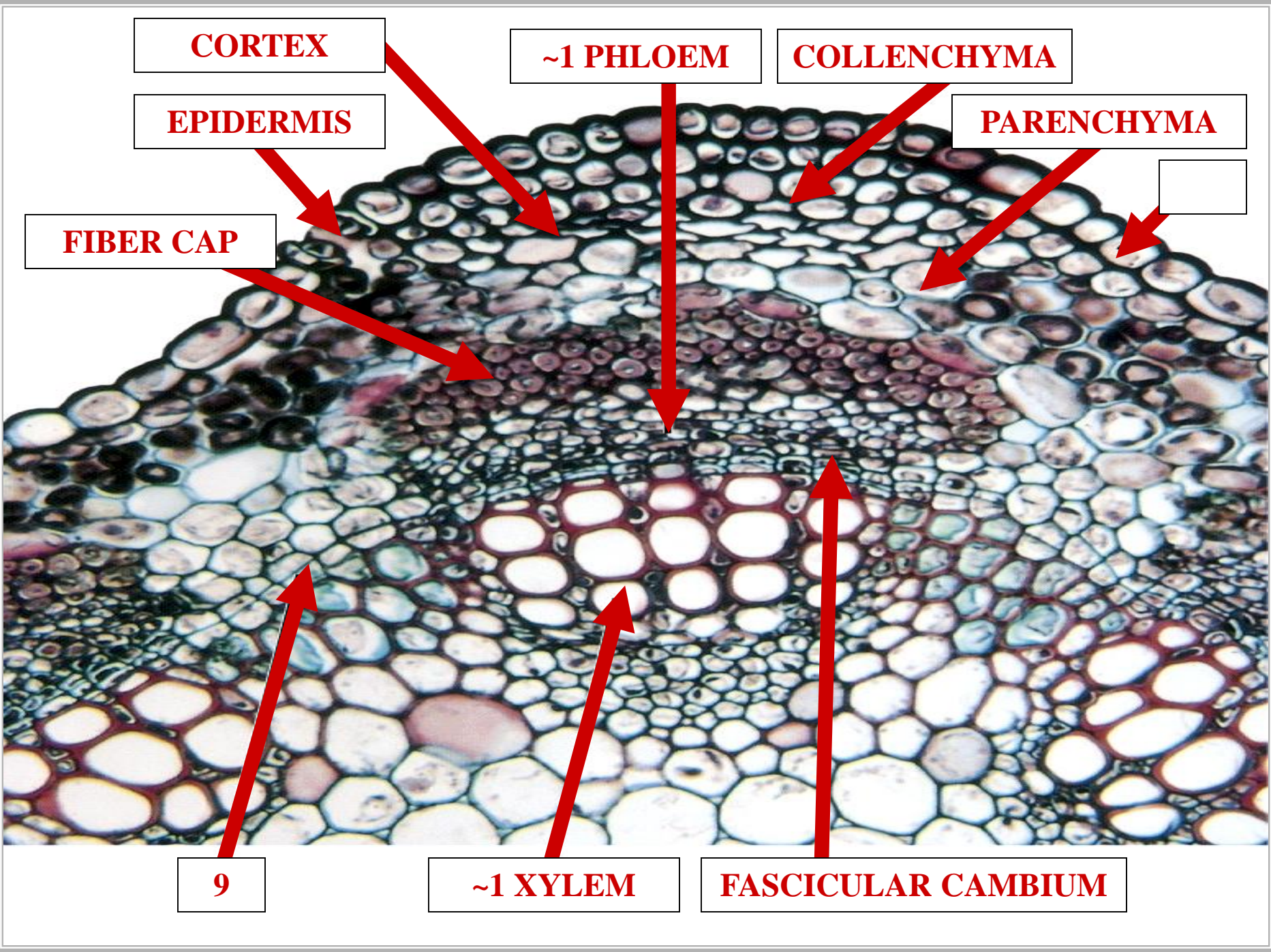
~1 XYLEM

8

DICOT

~1 STEM

C.S.



CORTEX

~1 PHLOEM

COLLENCHYMA

EPIDERMIS

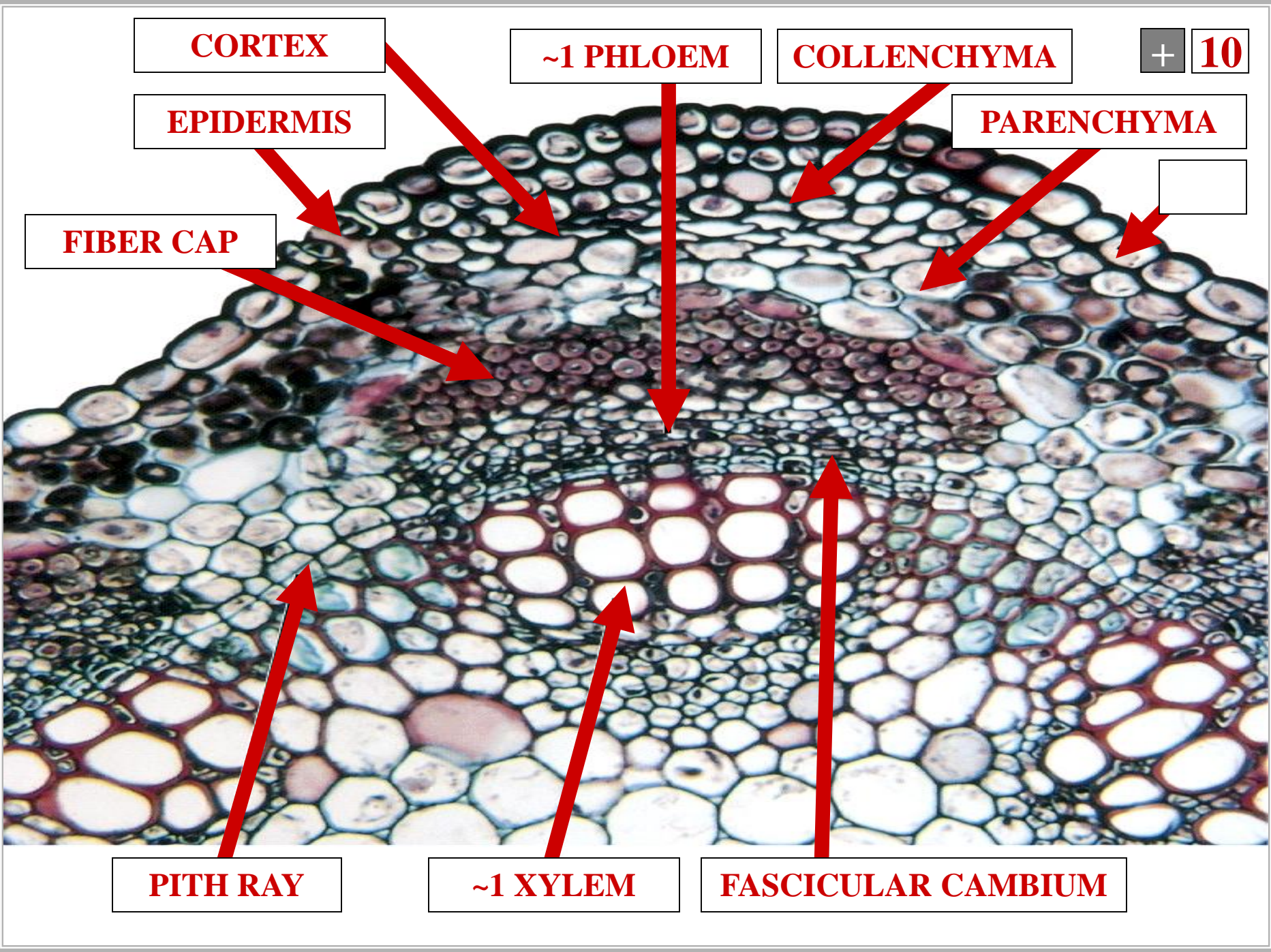
PARENCHYMA

FIBER CAP

9

~1 XYLEM

FASCICULAR CAMBIUM



CORTEX

~1 PHLOEM

COLLENCYMA

+ 10

EPIDERMIS

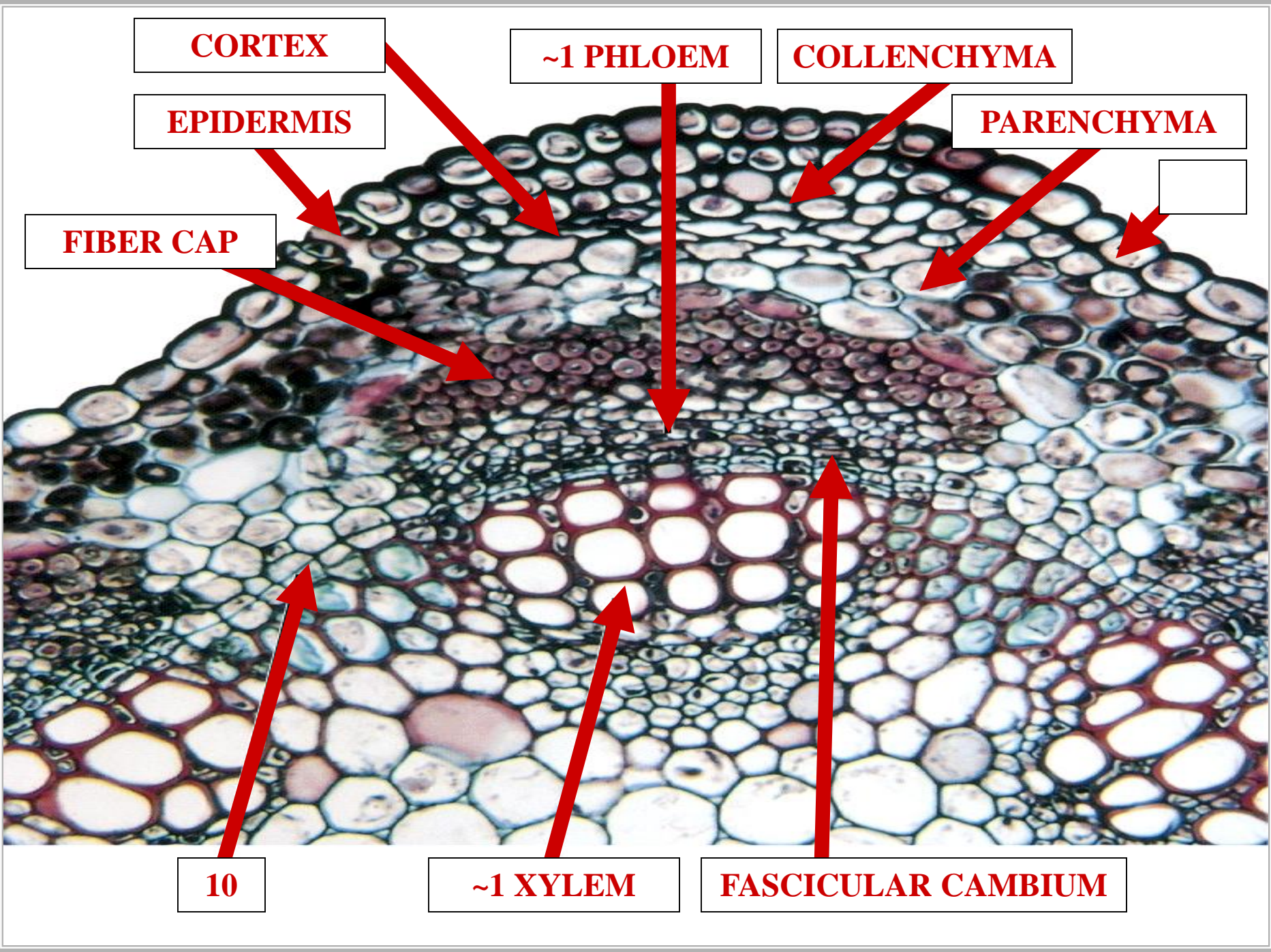
PARENCHYMA

FIBER CAP

PITH RAY

~1 XYLEM

FASCICULAR CAMBIUM



CORTEX

~1 PHLOEM

COLLENCYMA

EPIDERMIS

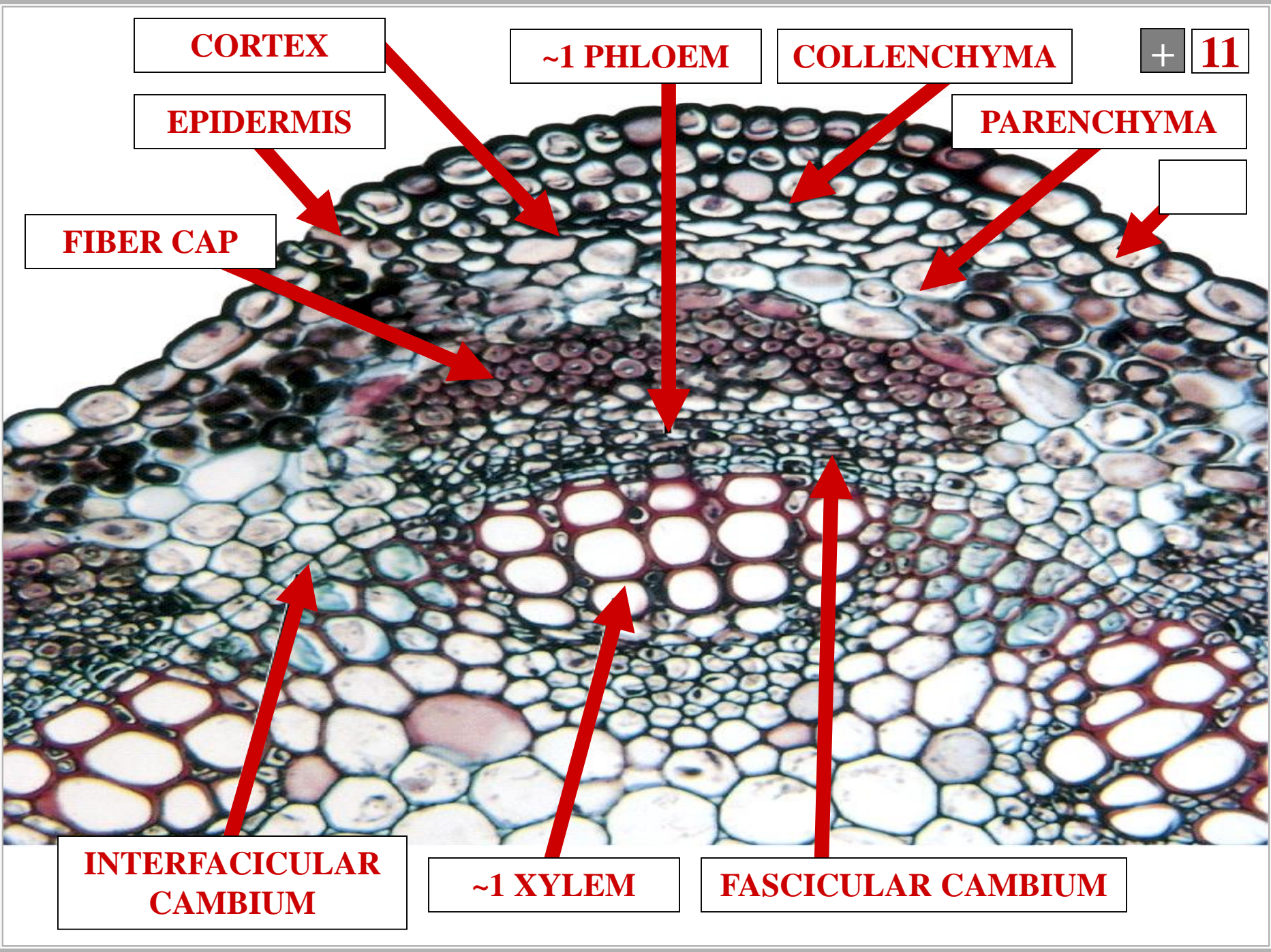
PARENCHYMA

FIBER CAP

10

~1 XYLEM

FASCICULAR CAMBIUM



CORTEX

~1 PHLOEM

COLLENCYMA

+ 11

EPIDERMIS

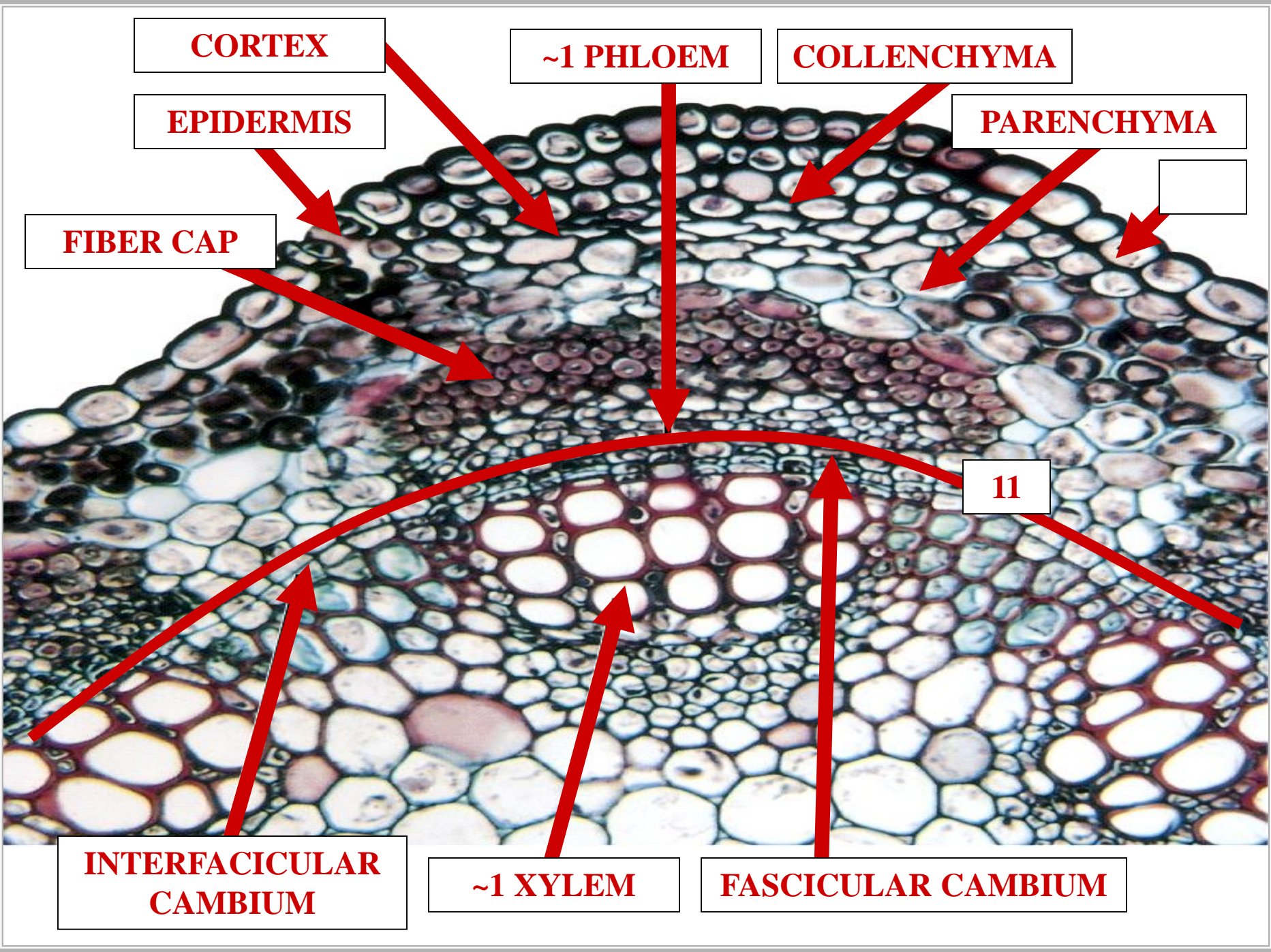
PARENCHYMA

FIBER CAP

**INTERFASCICULAR
CAMBIUM**

~1 XYLEM

FASCICULAR CAMBIUM



CORTEX

~1 PHLOEM

COLLENCYMA

EPIDERMIS

PARENCHYMA

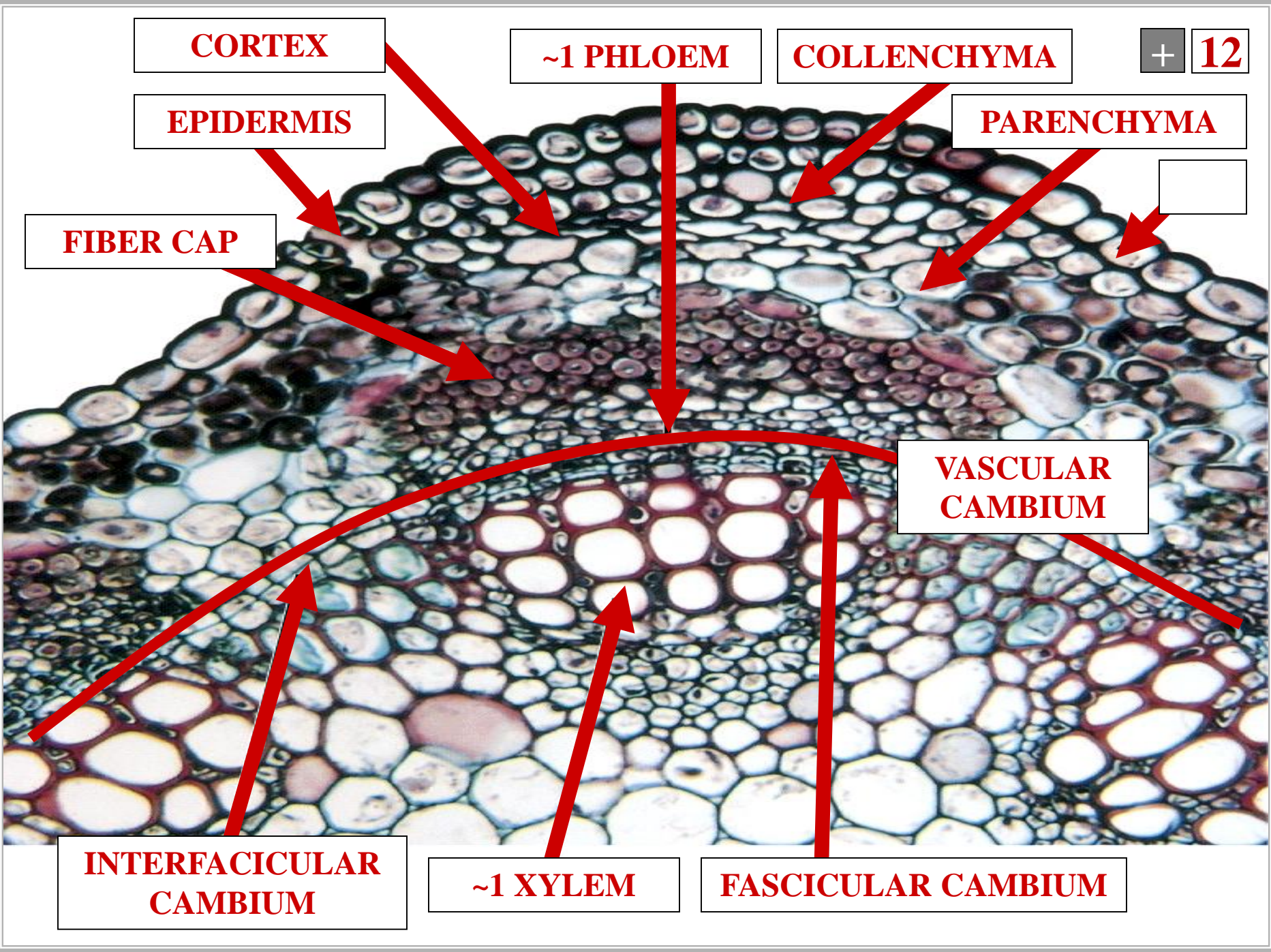
FIBER CAP

11

**INTERFASCICULAR
CAMBIUM**

~1 XYLEM

FASCICULAR CAMBIUM



CORTEX

~1 PHLOEM

COLLENCHYMA

+ 12

EPIDERMIS

PARENCHYMA

FIBER CAP

VASCULAR CAMBIUM

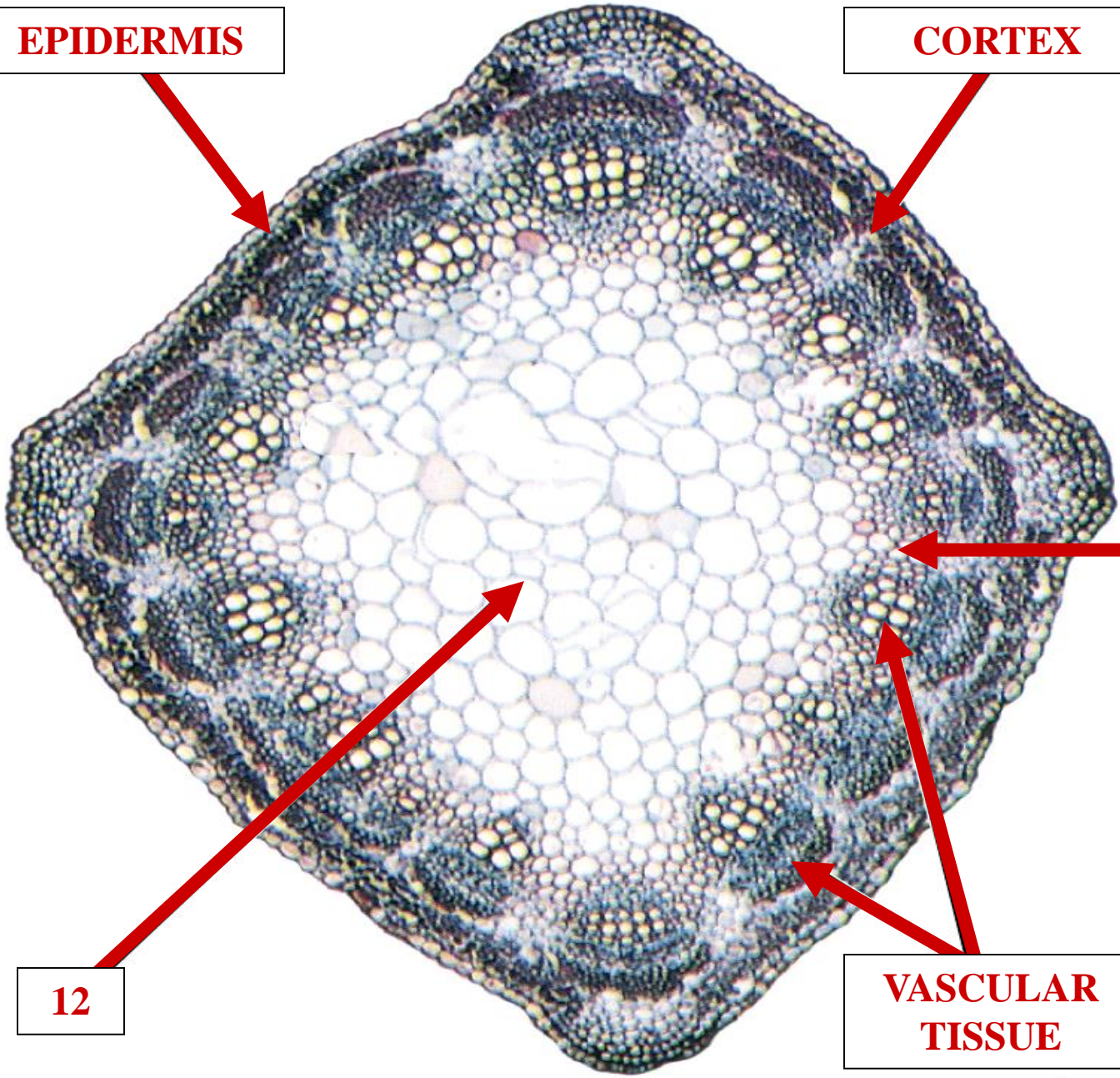
INTERFASCICULAR CAMBIUM

~1 XYLEM

FASCICULAR CAMBIUM

EPIDERMIS

CORTEX



PITH RAY

12

**VASCULAR
TISSUE**

DICOT

~1 STEM

C.S.

EPIDERMIS

CORTEX

PITH RAY

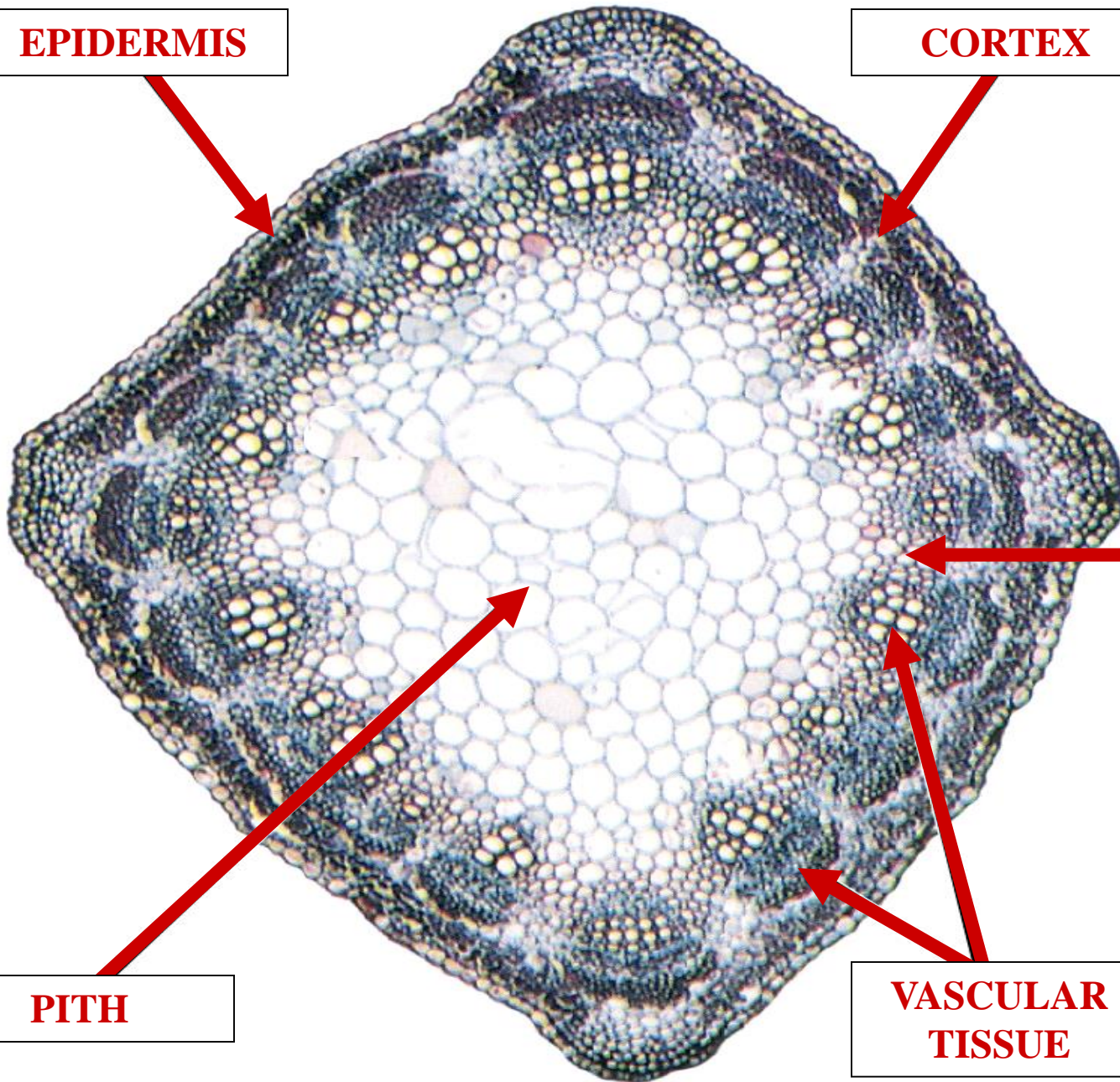
PITH

**VASCULAR
TISSUE**

DICOT

~1 STEM

C.S.

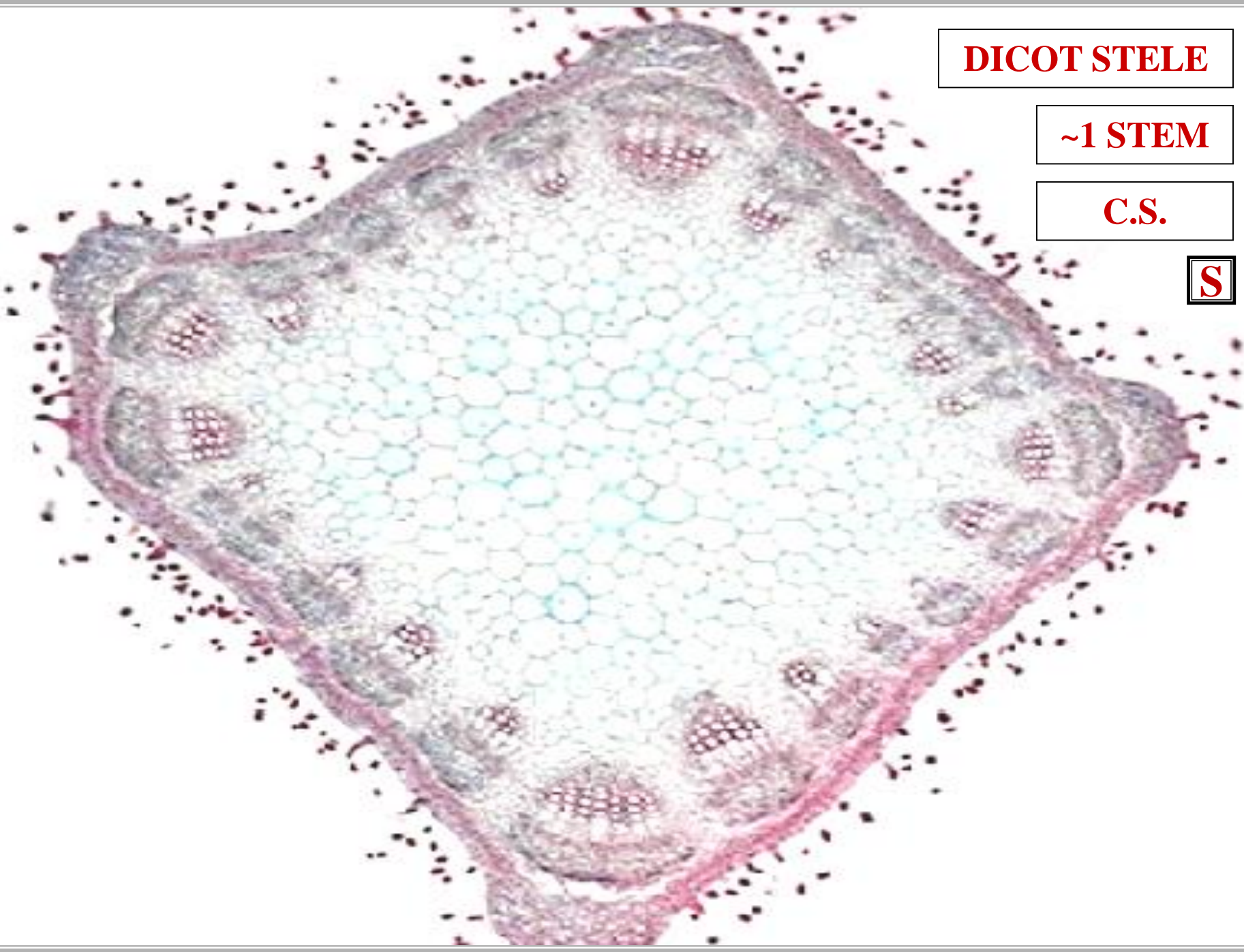


DICOT STELE

~1 STEM

C.S.

S



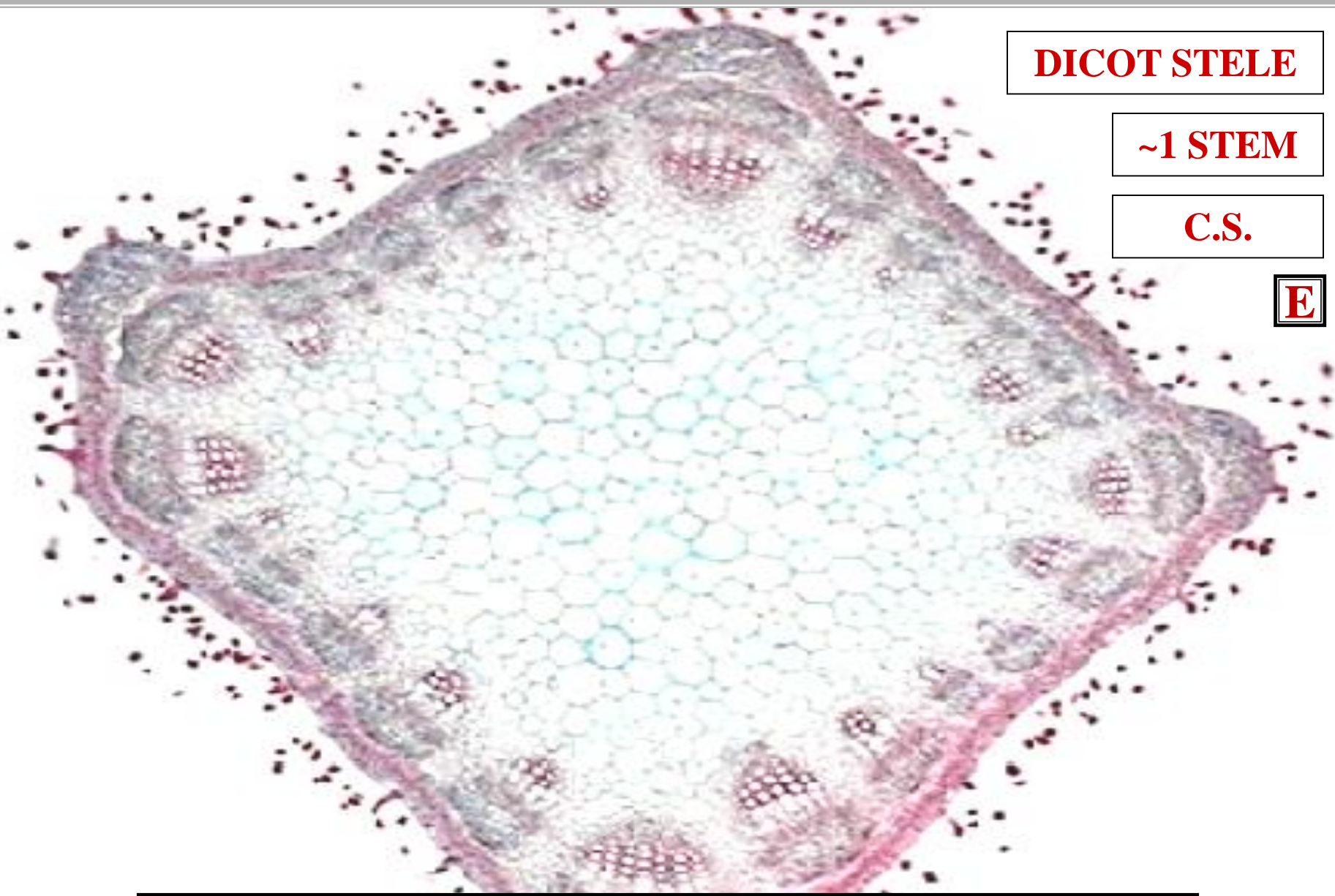
DICOT STELE

~1 STEM

C.S.

E

SIPHONOSTELE



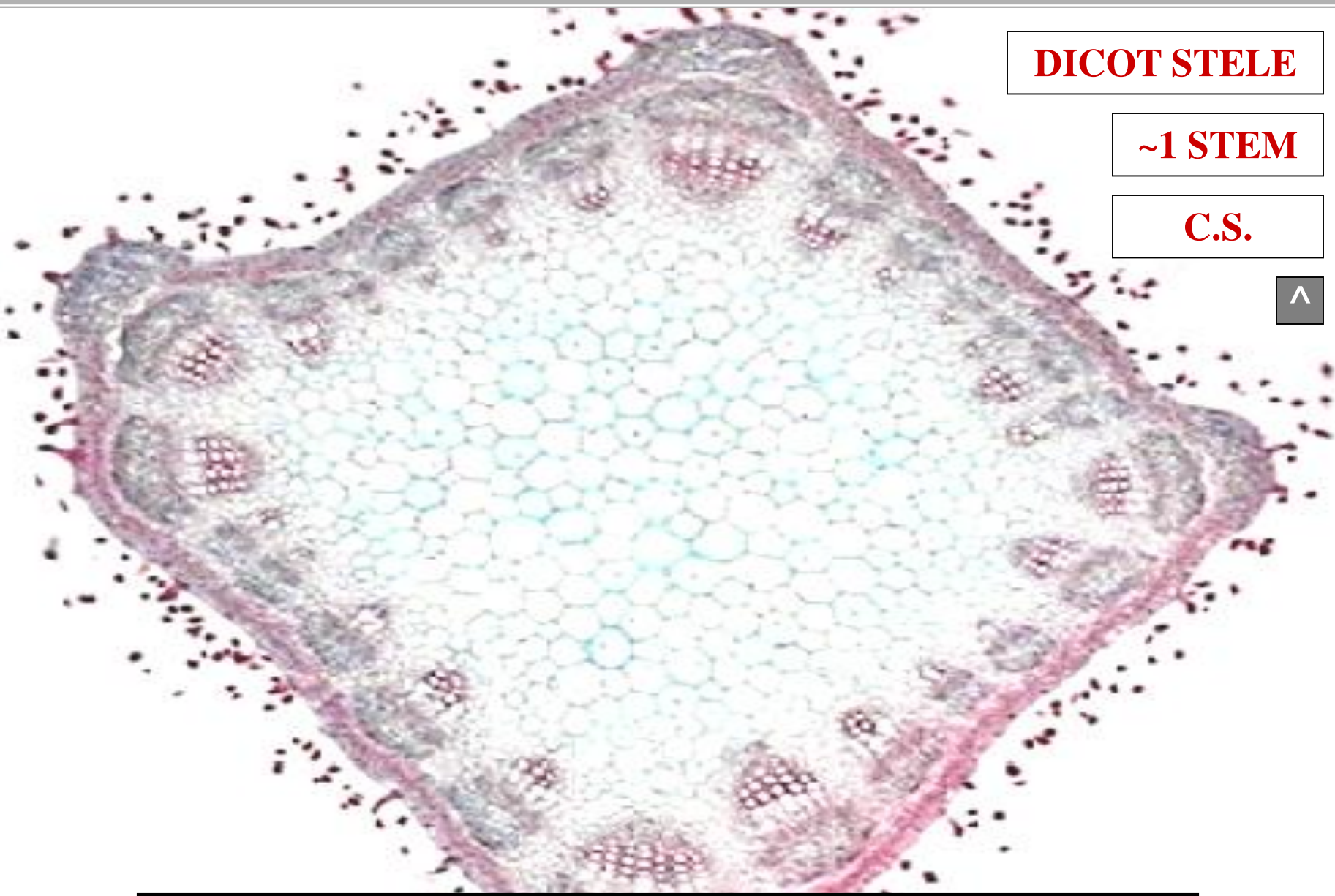
DICOT STELE

~1 STEM

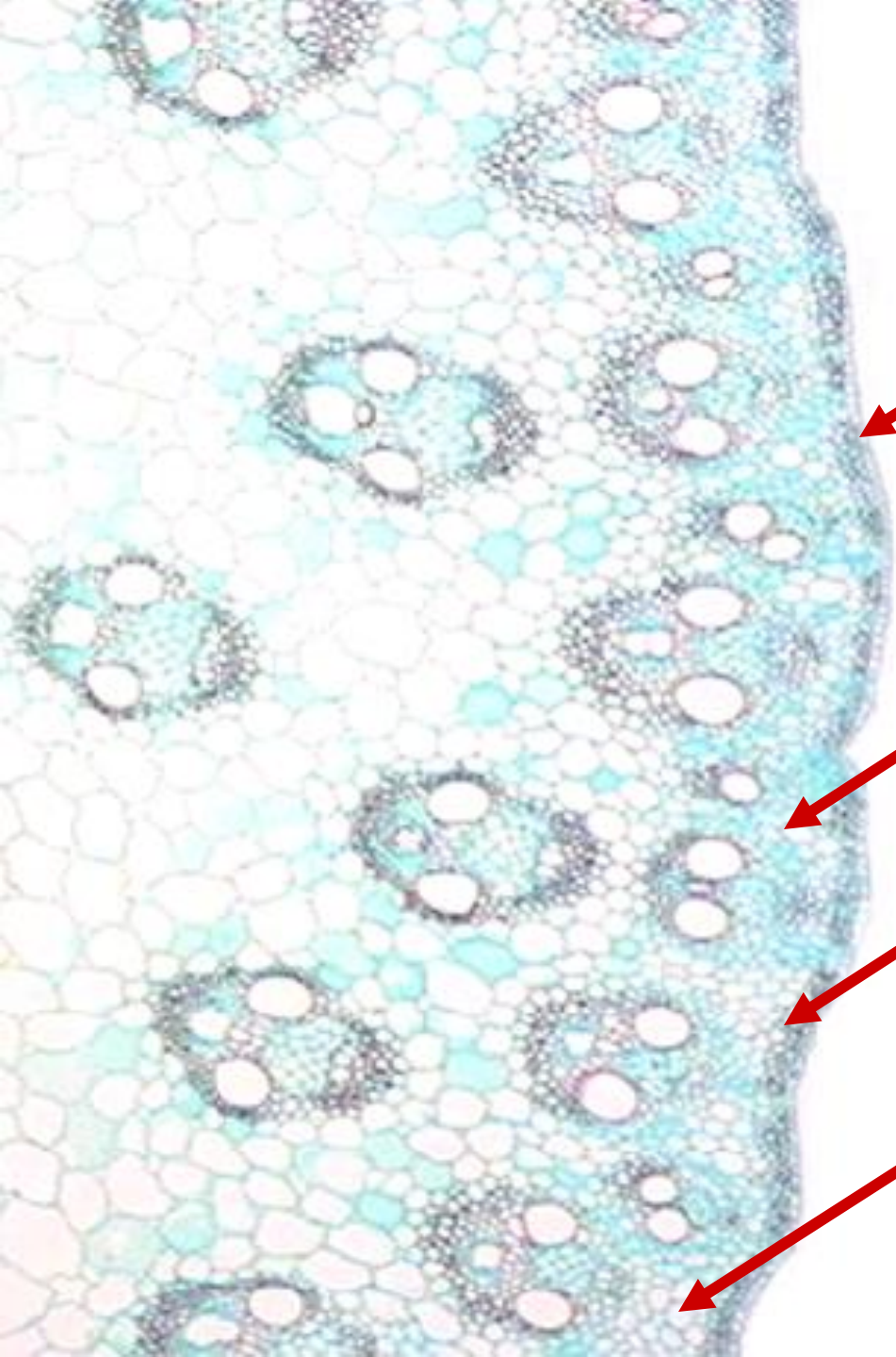
C.S.

^

SIPHONOSTELE / EUSTELE



**MONOCOT STEM
PRIMARY GROWTH
SUMMARY**



1

2

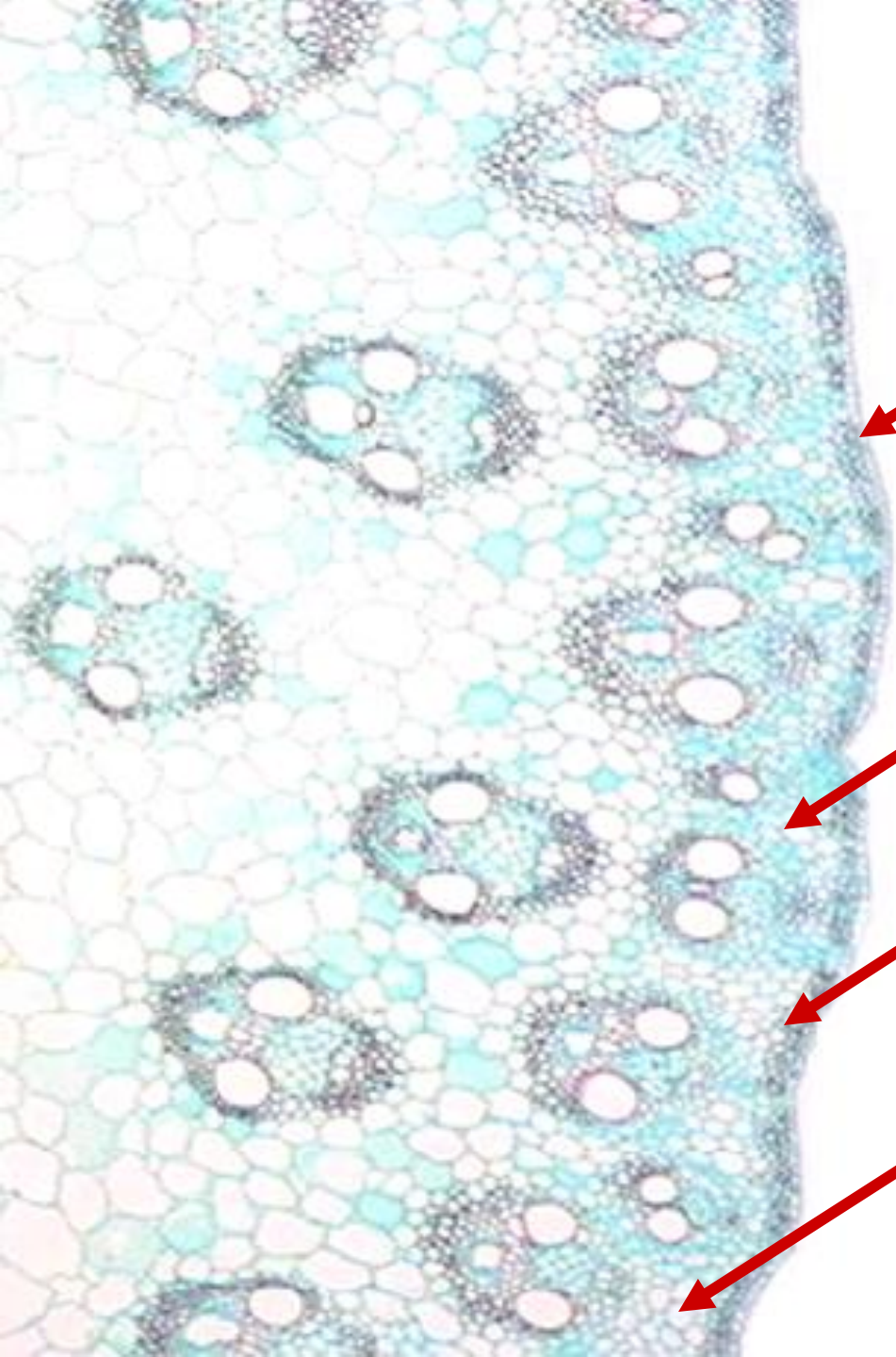
3

4

MONOCOT

~1 STEM

C.S.



EPIDERMIS

2

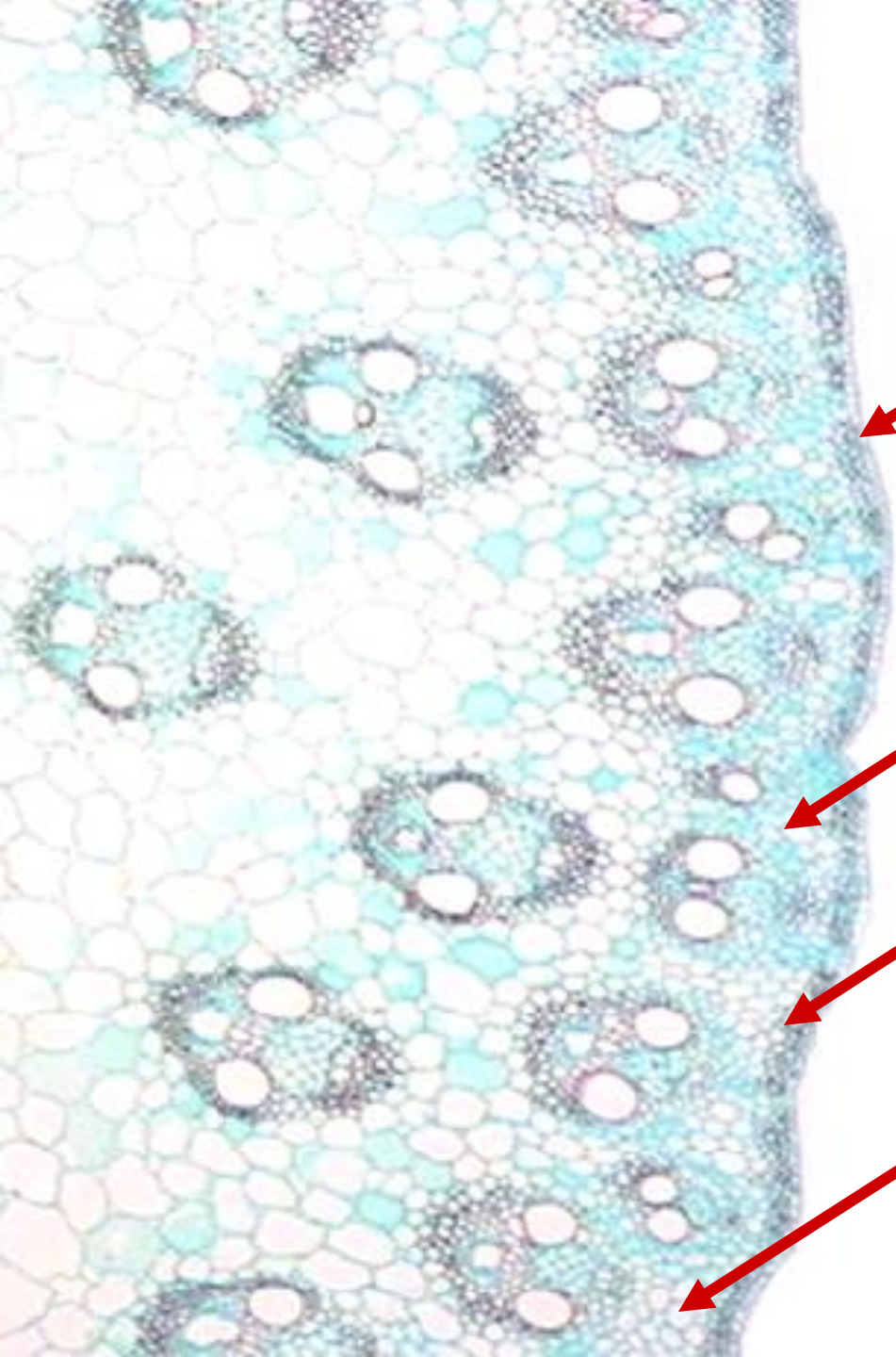
3

4

MONOCOT

~1 STEM

C.S.



EPIDERMIS

CORTEX

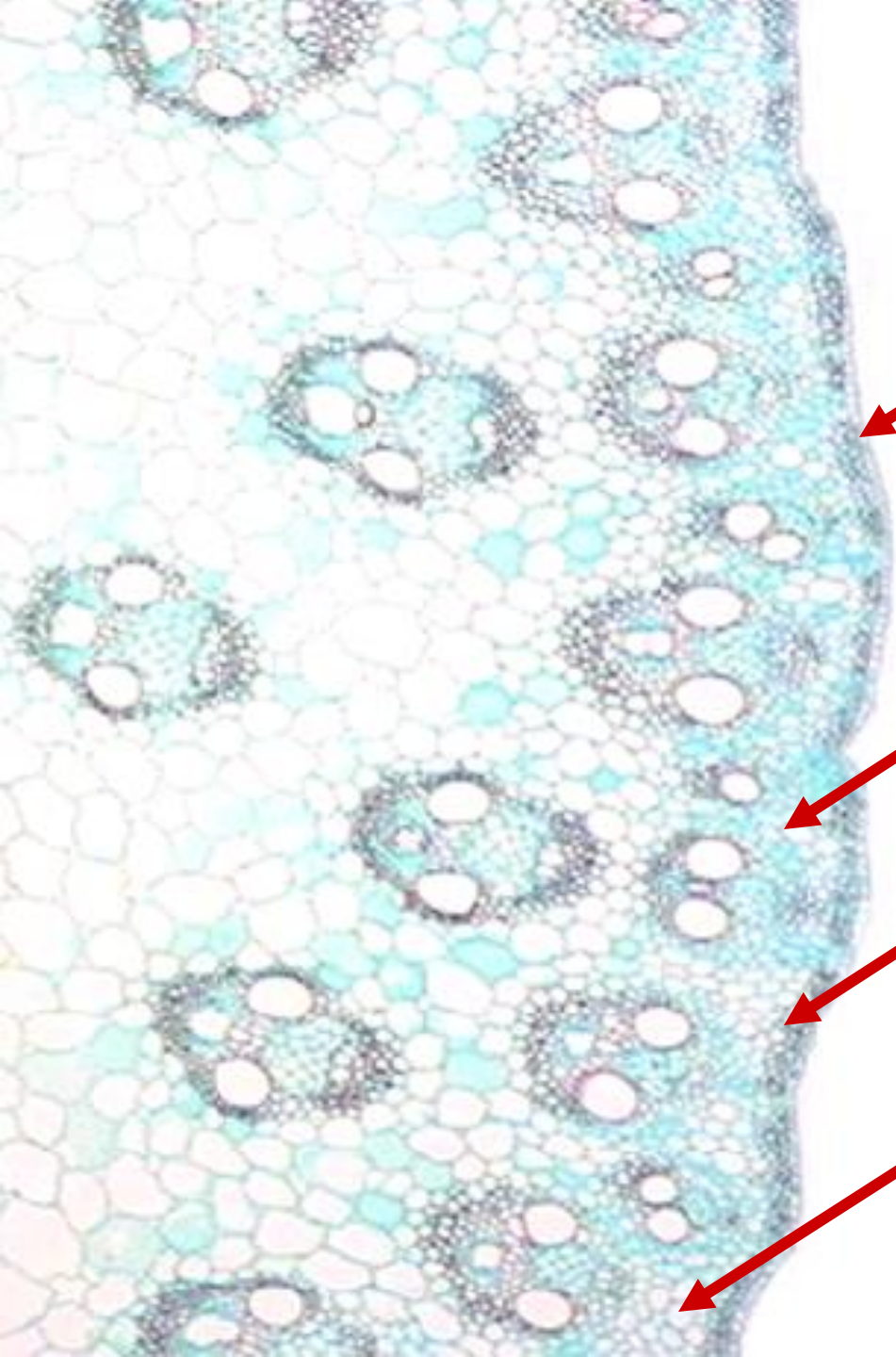
3

4

MONOCOT

~1 STEM

C.S.



EPIDERMIS

CORTEX

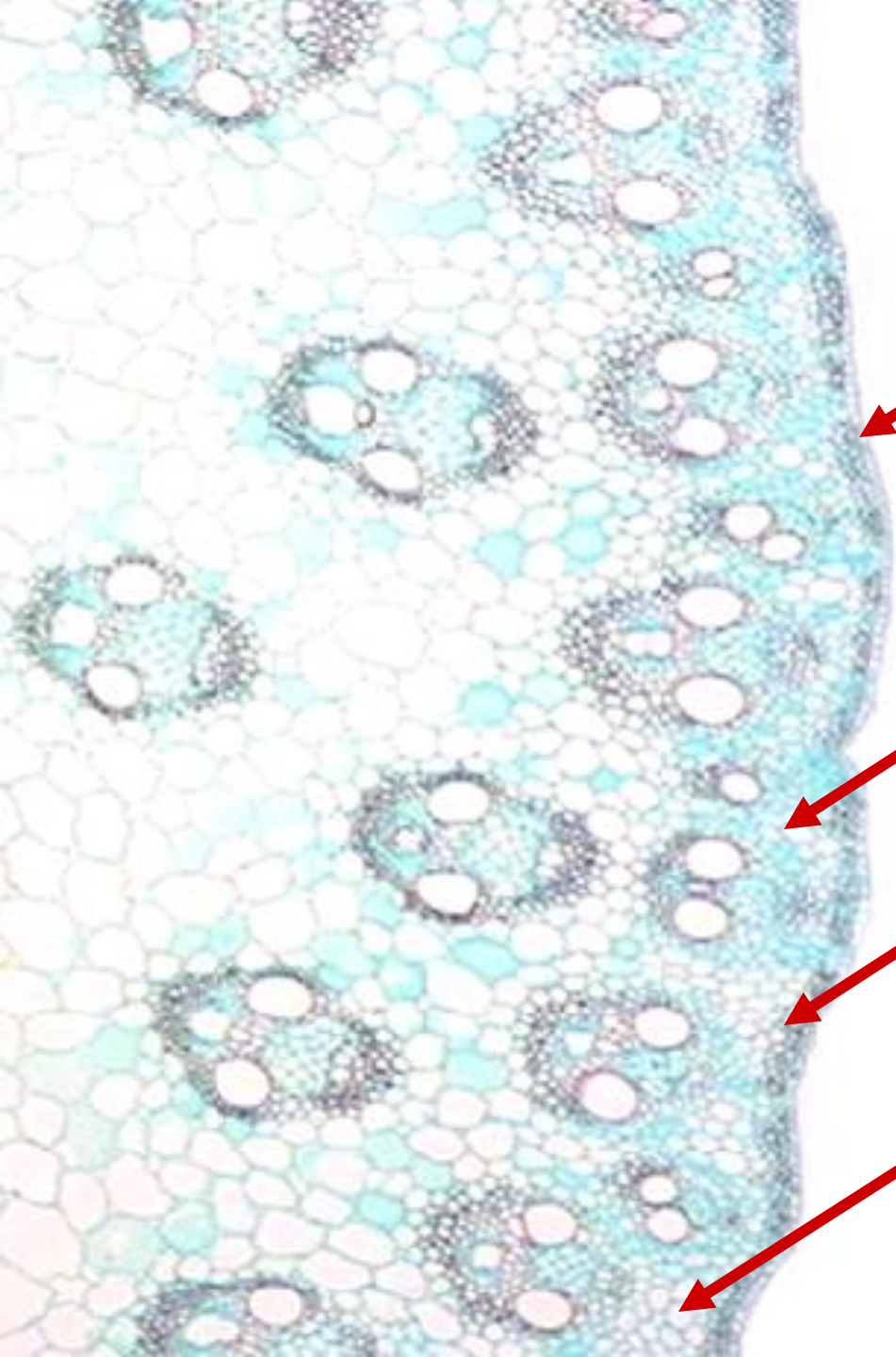
COLLENCHYMA

4

MONOCOT

~1 STEM

C.S.



EPIDERMIS

CORTEX

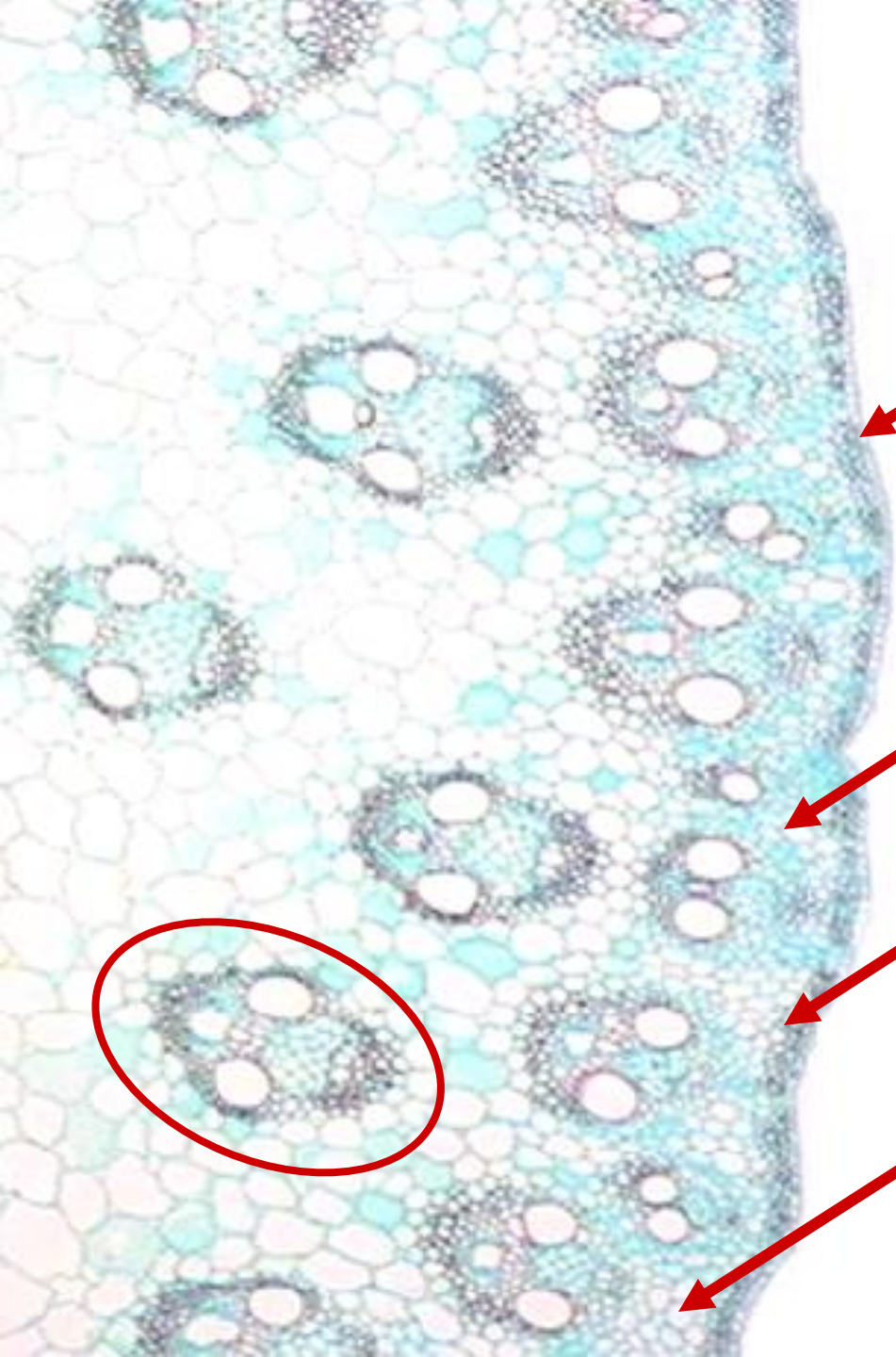
COLLENCHYMA

PARENCHYMA

MONOCOT

~1 STEM

C.S.



EPIDERMIS

CORTEX

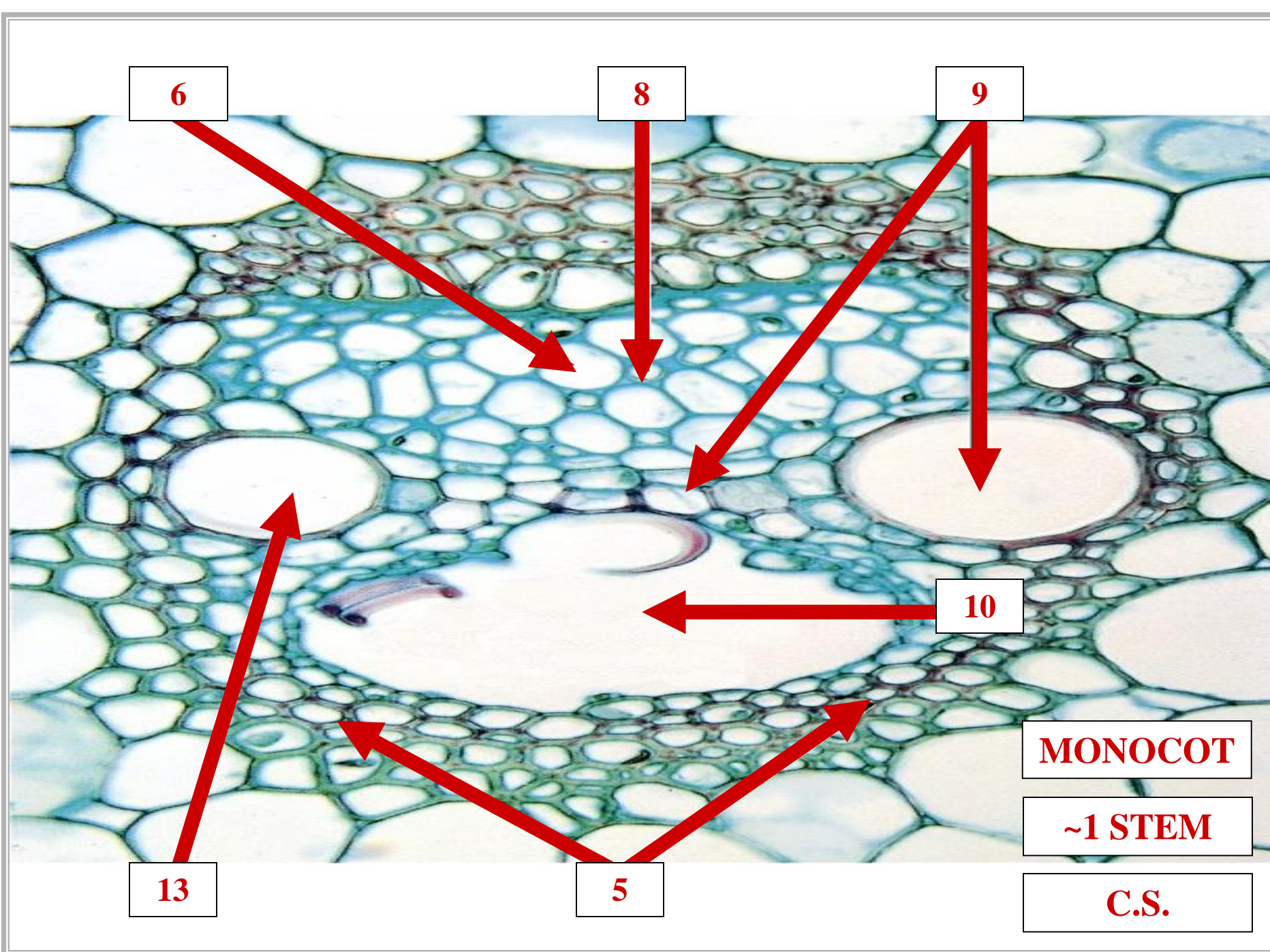
COLLENCHYMA

PARENCHYMA

MONOCOT

~1 STEM

C.S.



6

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10

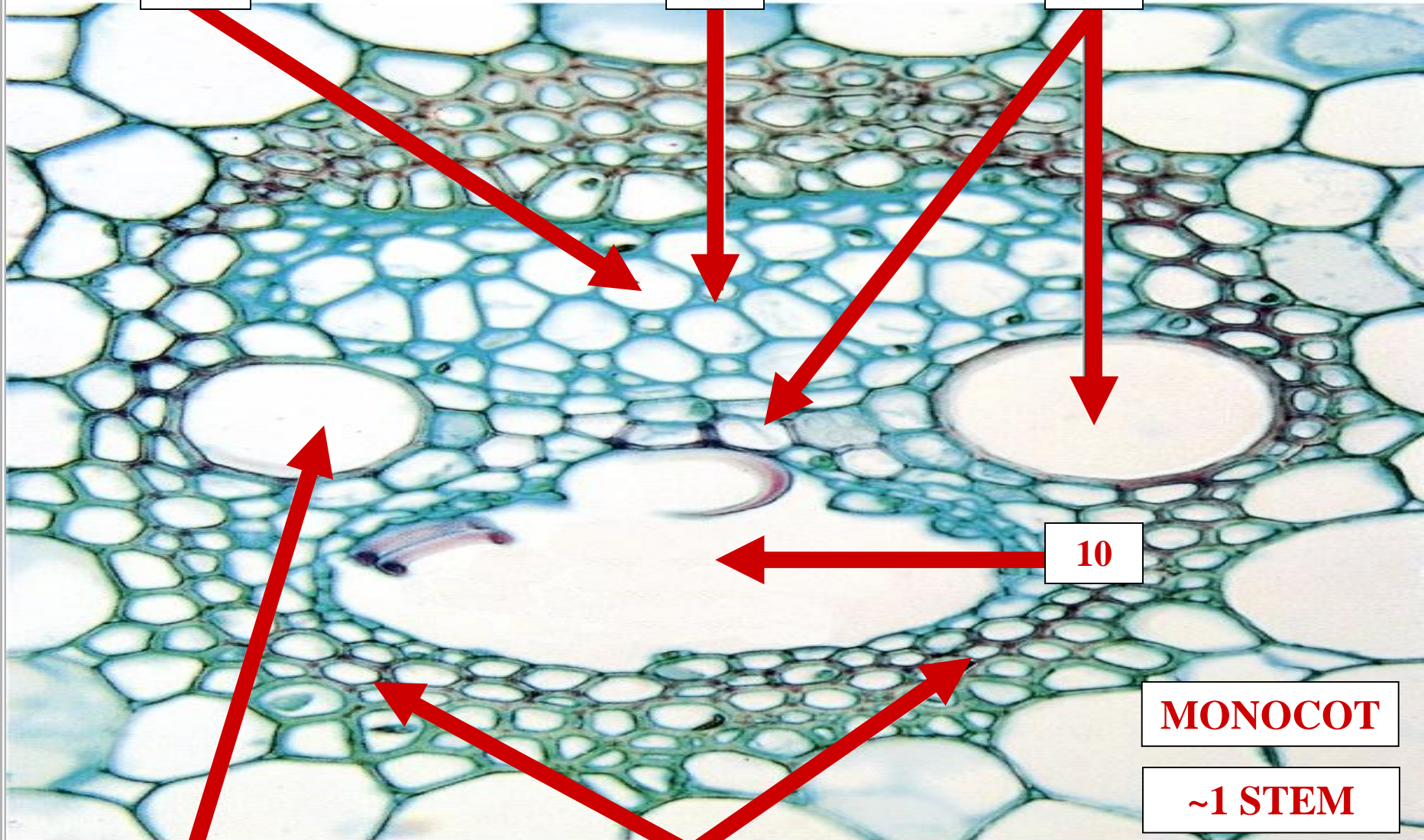
13

5

MONOCOT

~1 STEM

C.S.



6

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13

BUNDLE SHEATH

MONOCOT

~1 STEM

C.S.

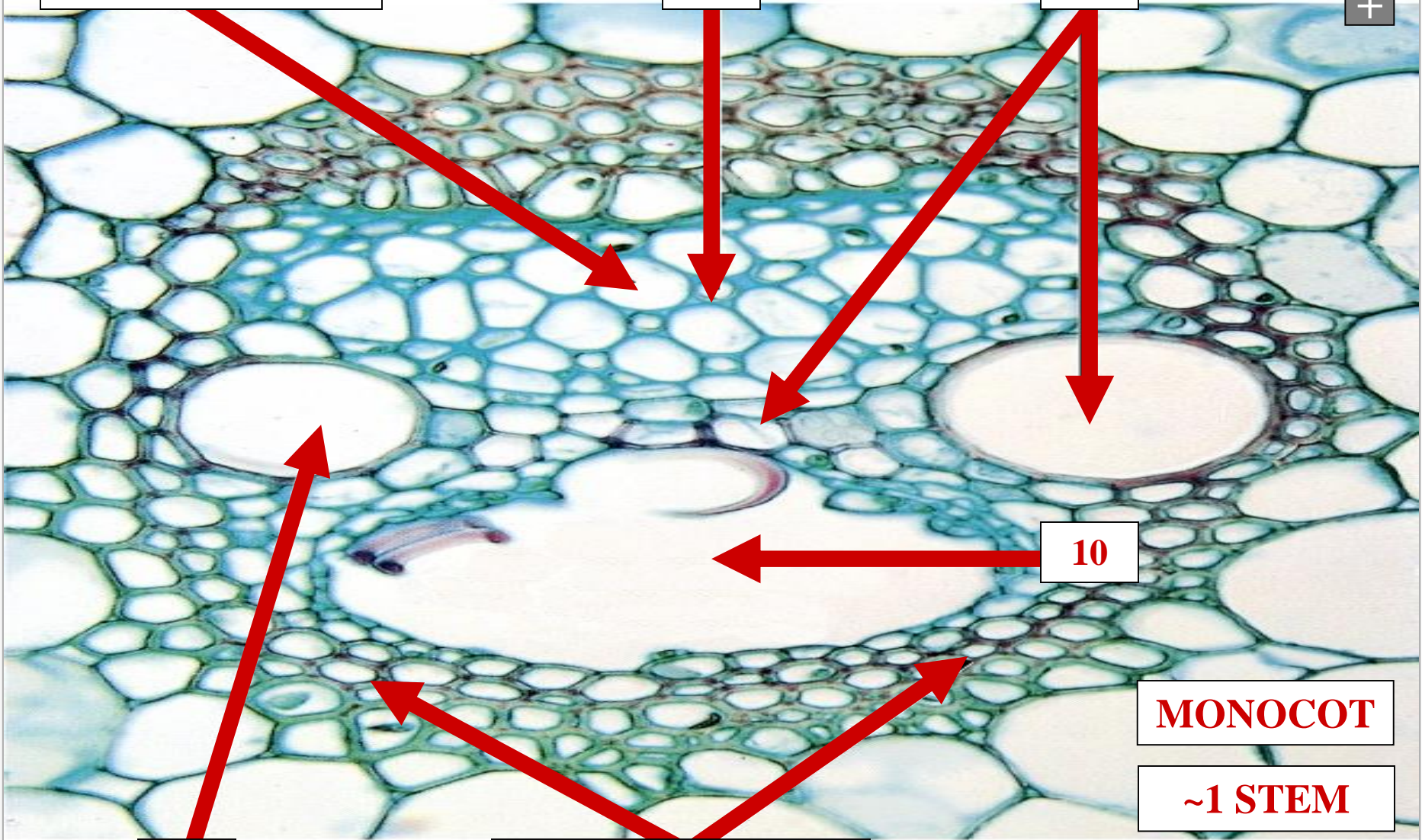
7

+

~1 PHLOEM

8

9



10

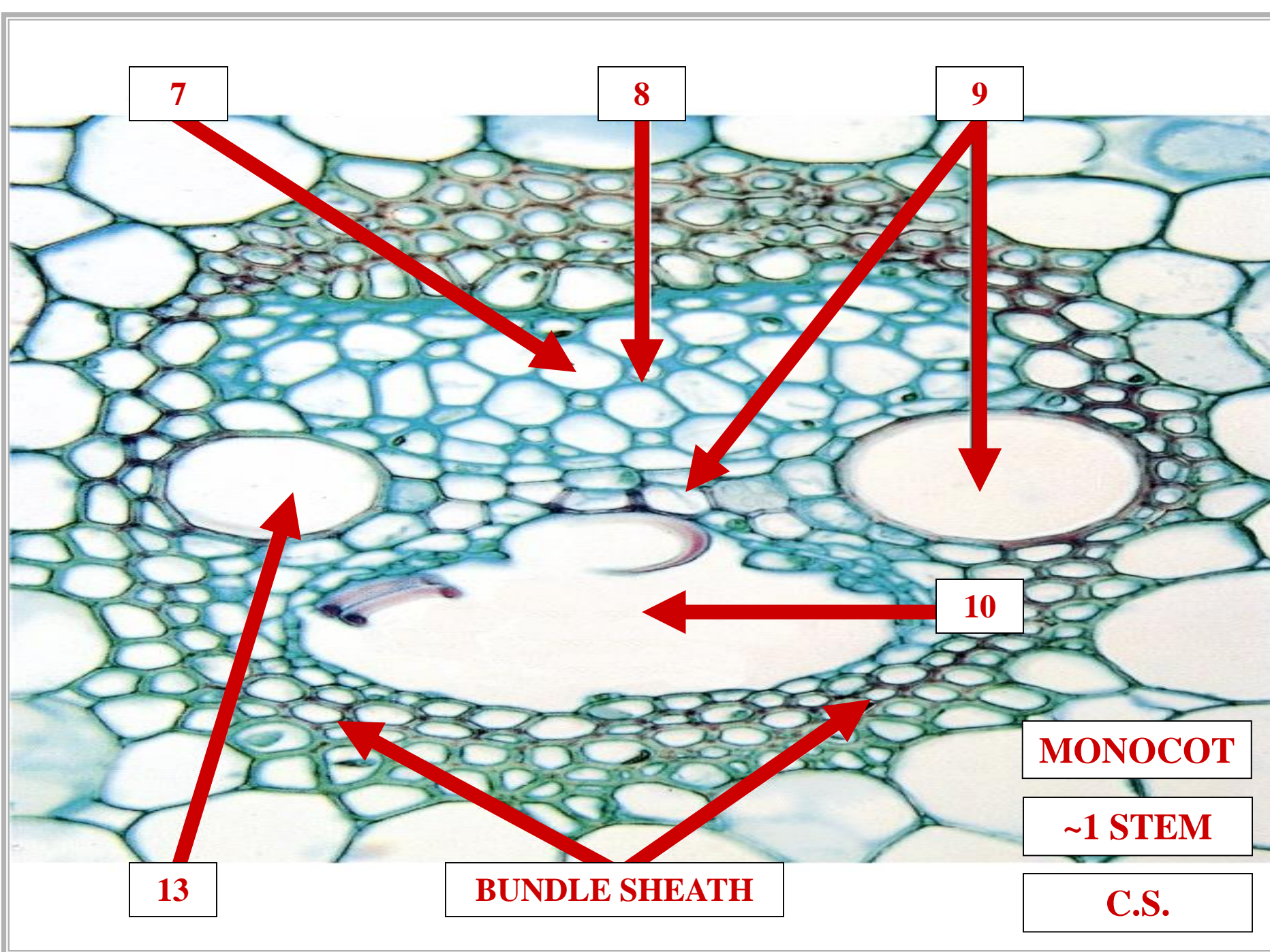
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BUNDLE SHEATH

MONOCOT

~1 STEM

C.S.



7

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9

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13

BUNDLE SHEATH

MONOCOT

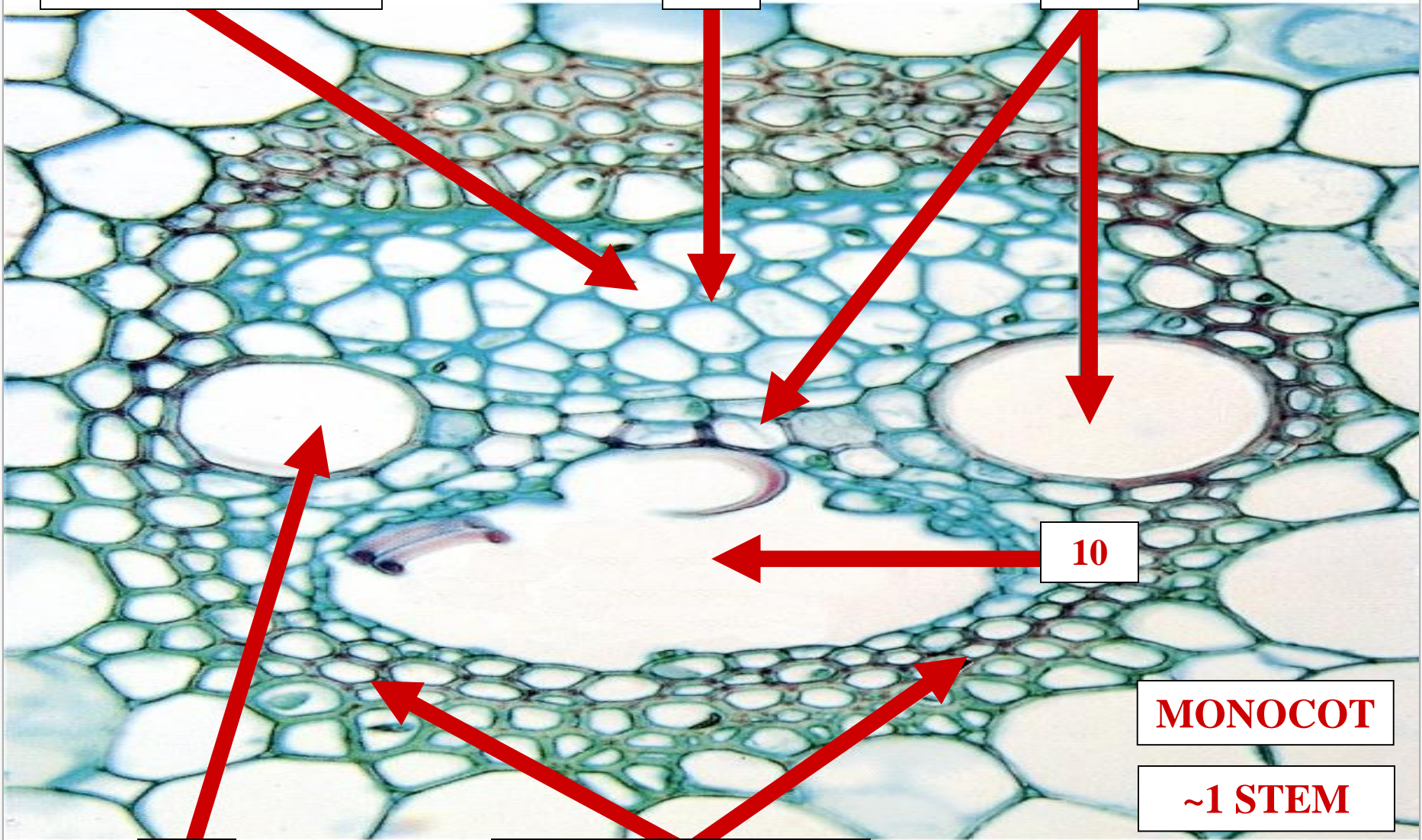
~1 STEM

C.S.

SIEVE MEMBER

8

9



10

13

BUNDLE SHEATH

MONOCOT

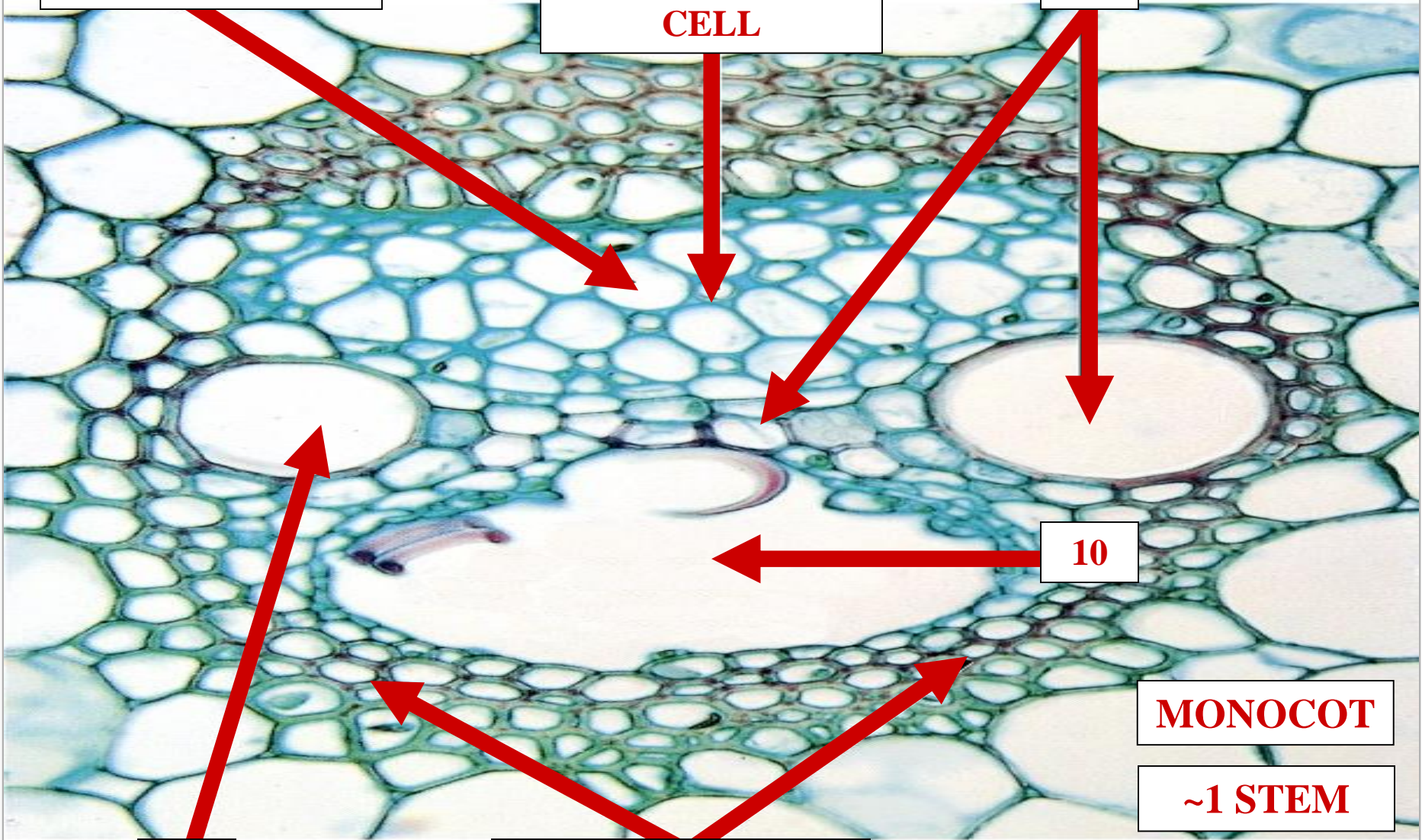
~1 STEM

C.S.

SIEVE MEMBER

**COMPANION
CELL**

9



10

MONOCOT

~1 STEM

C.S.

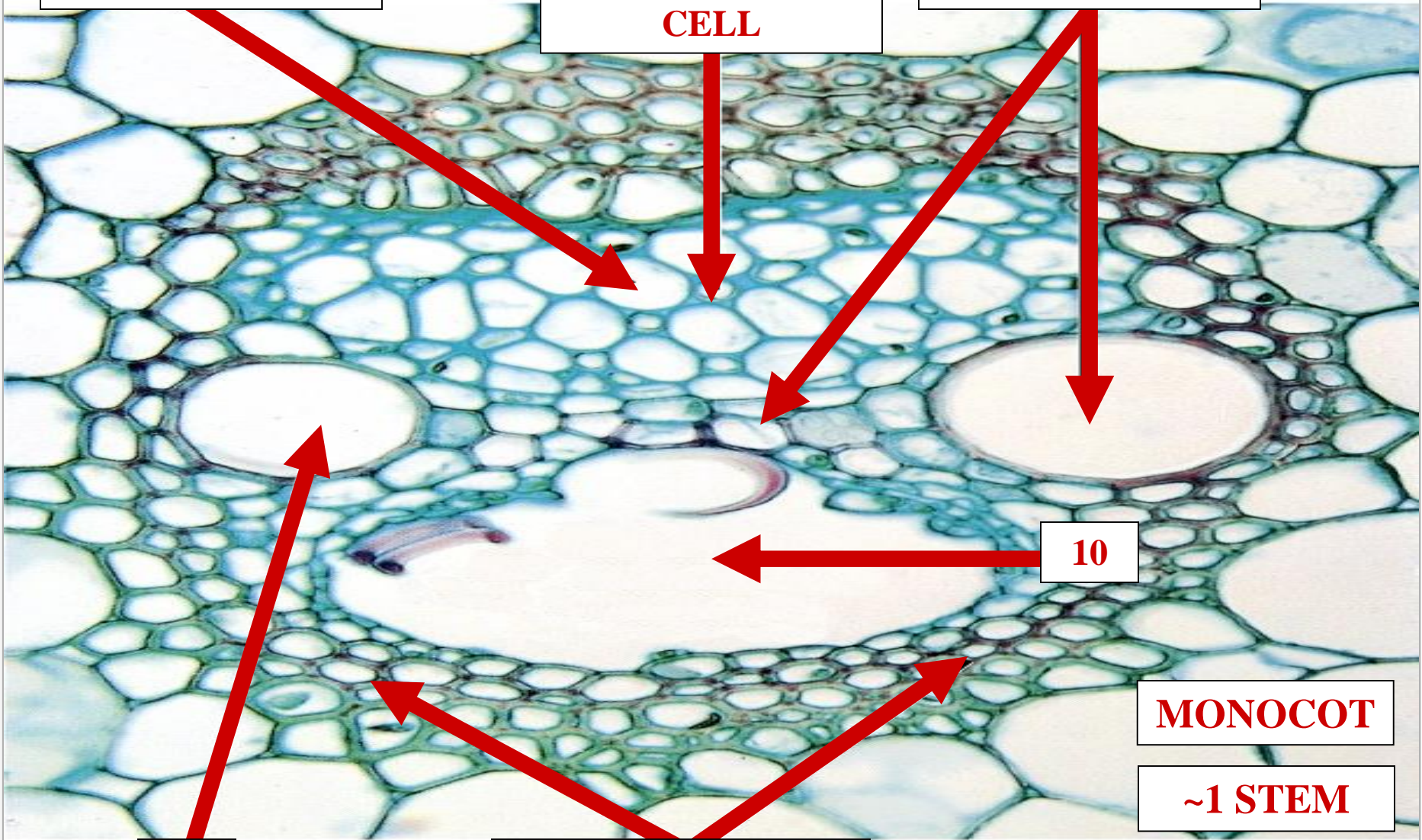
13

BUNDLE SHEATH

SIEVE MEMBER

COMPANION CELL

~1 XYLEM CELL



10

13

BUNDLE SHEATH

MONOCOT

~1 STEM

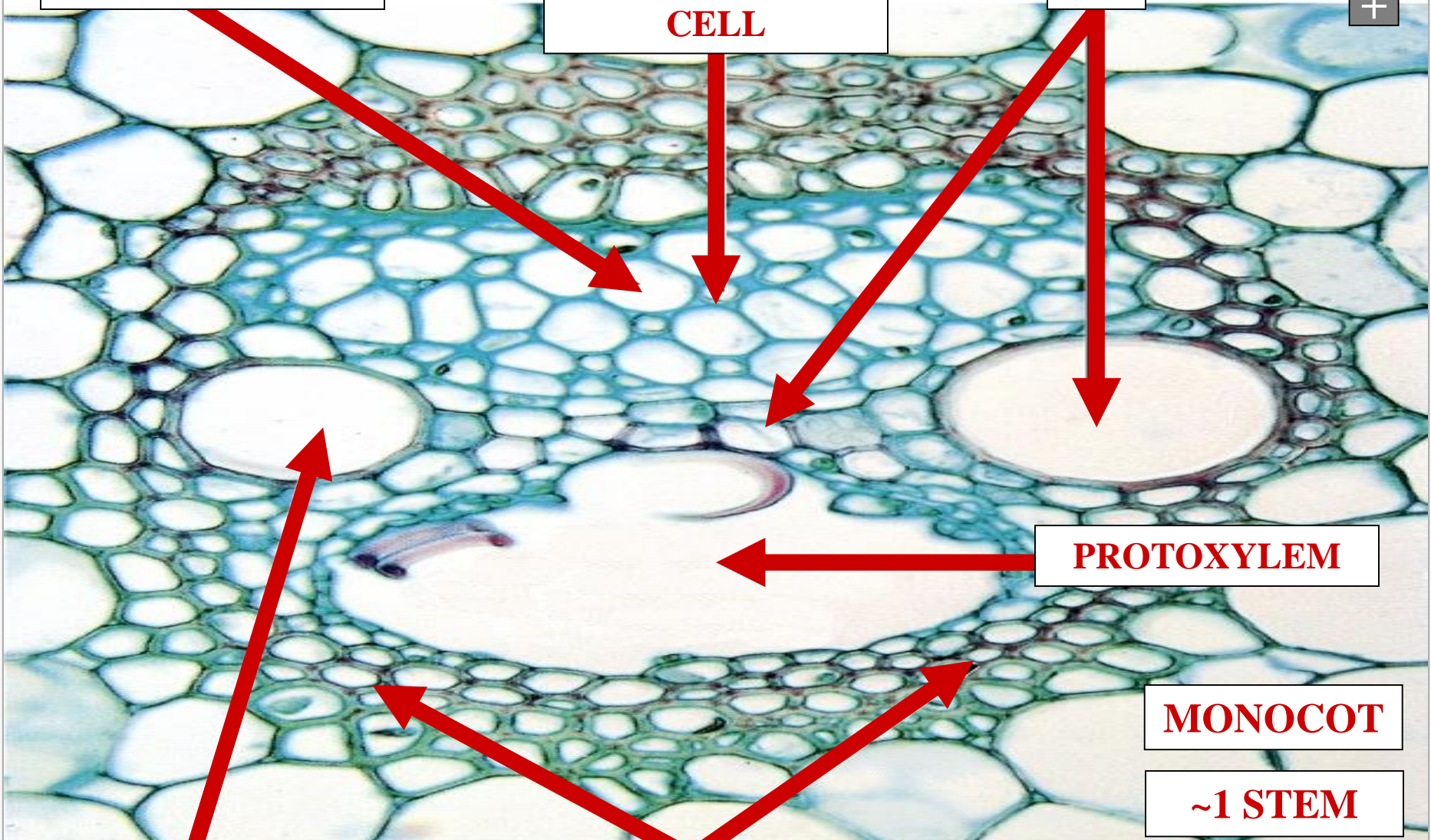
C.S.



SIEVE MEMBER

COMPANION CELL

12



PROTOXYLEM

MONOCOT

~1 STEM

13

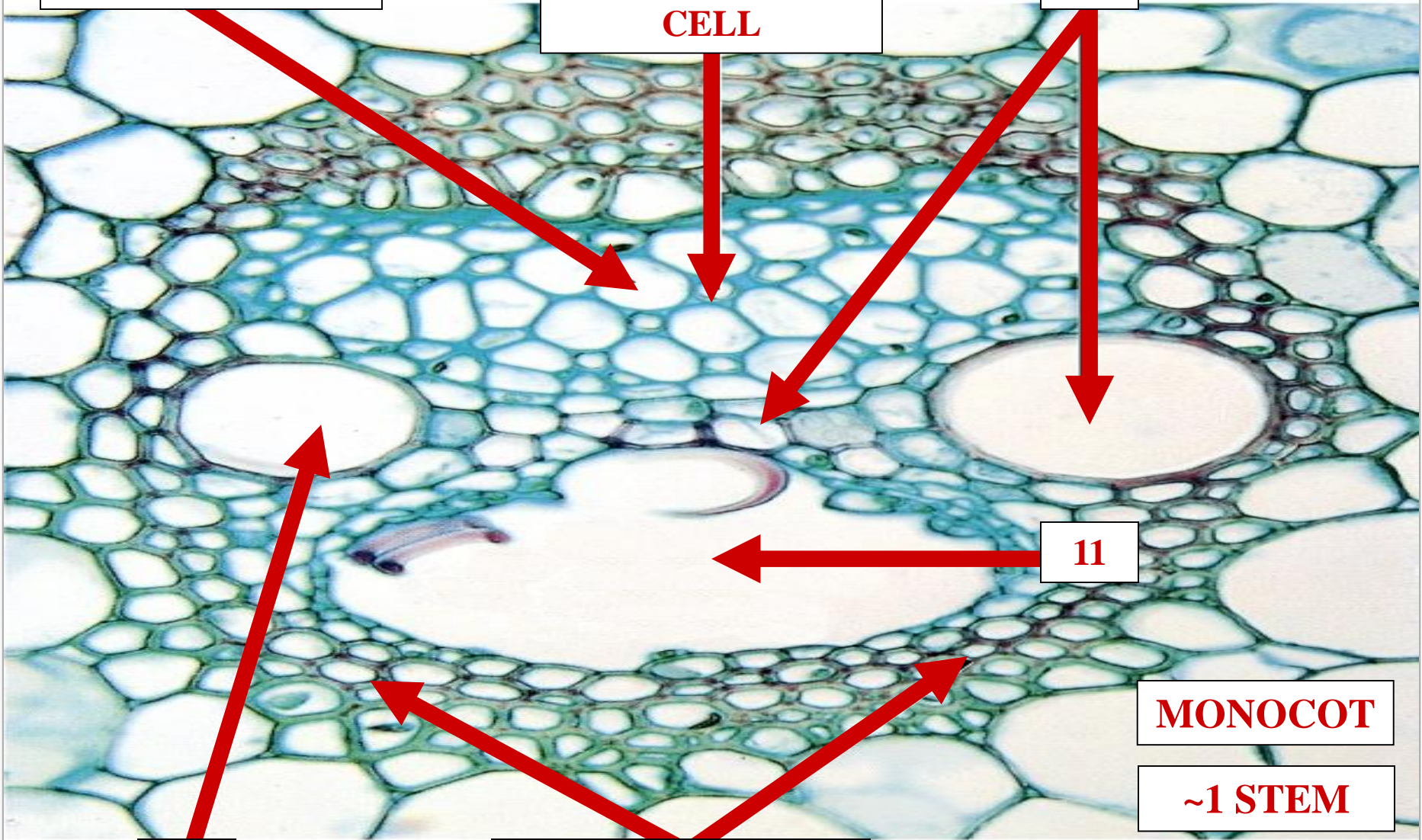
BUNDLE SHEATH

C.S.

SIEVE MEMBER

**COMPANION
CELL**

12



11

MONOCOT

~1 STEM

C.S.

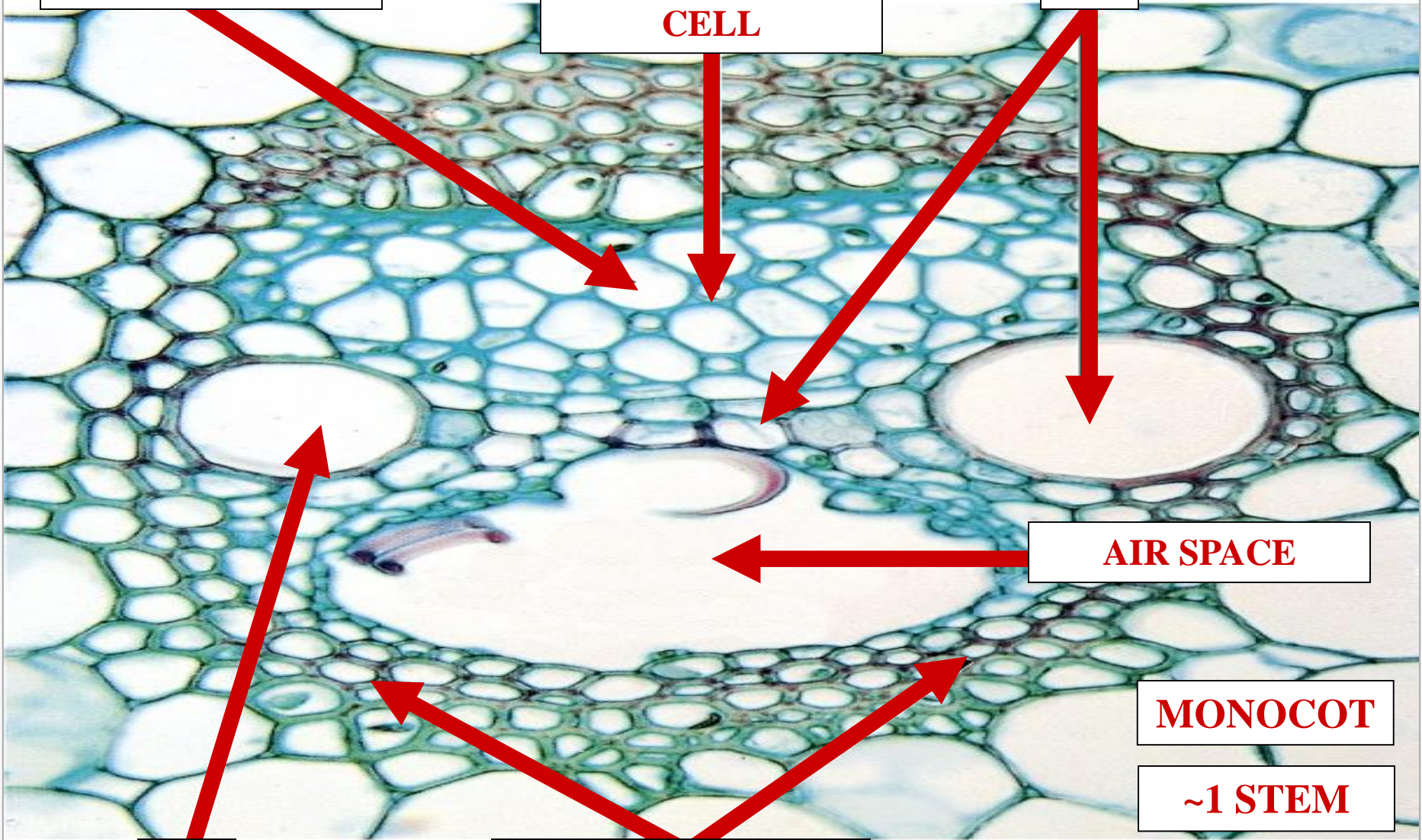
13

BUNDLE SHEATH

SIEVE MEMBER

COMPANION CELL

12



AIR SPACE

MONOCOT

~1 STEM

C.S.

13

BUNDLE SHEATH