

S

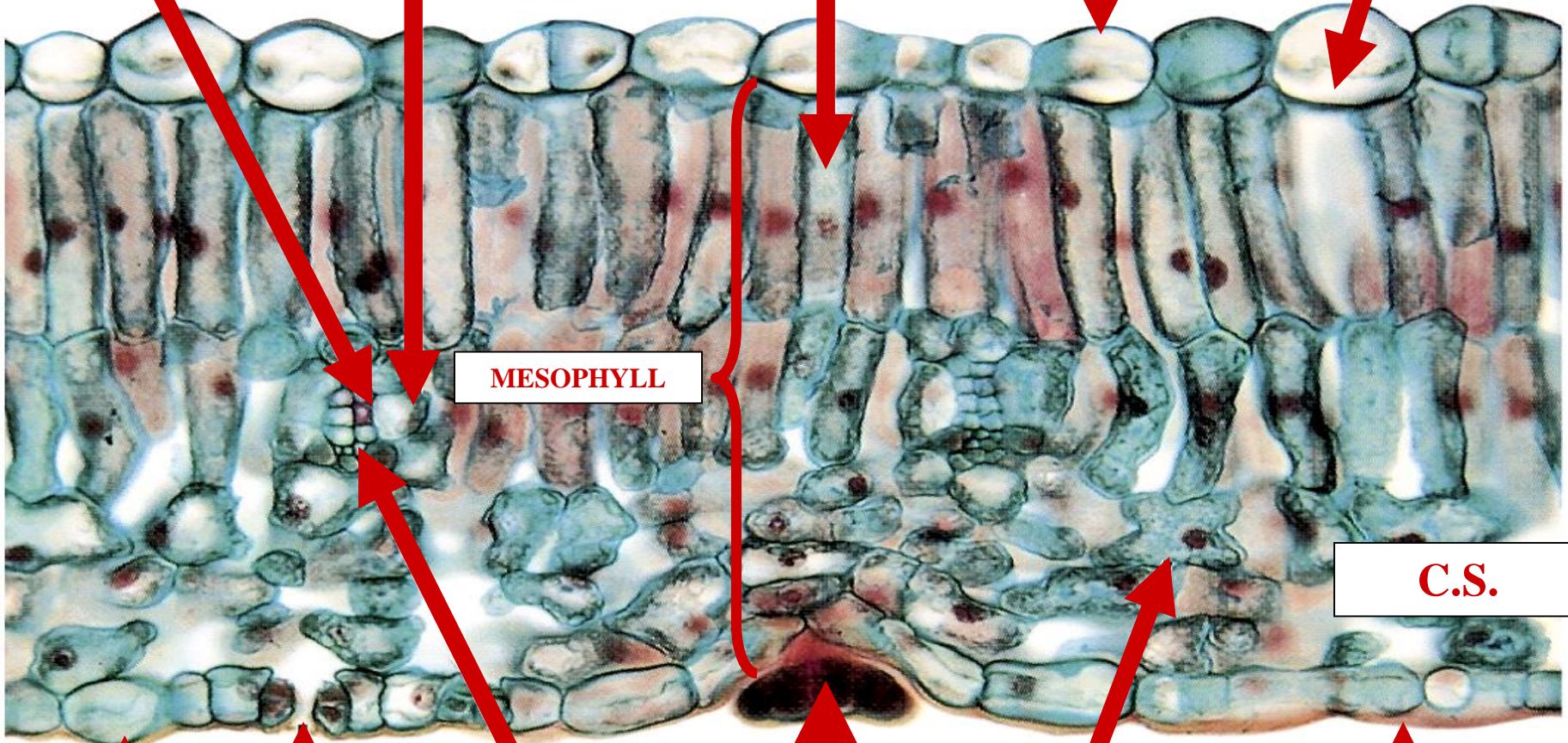
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



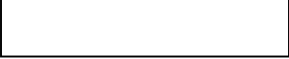
MESOPHYLL

C.S.

PHLOEM

ABAXIAL EPIDERMIS

SPONGY LAYER



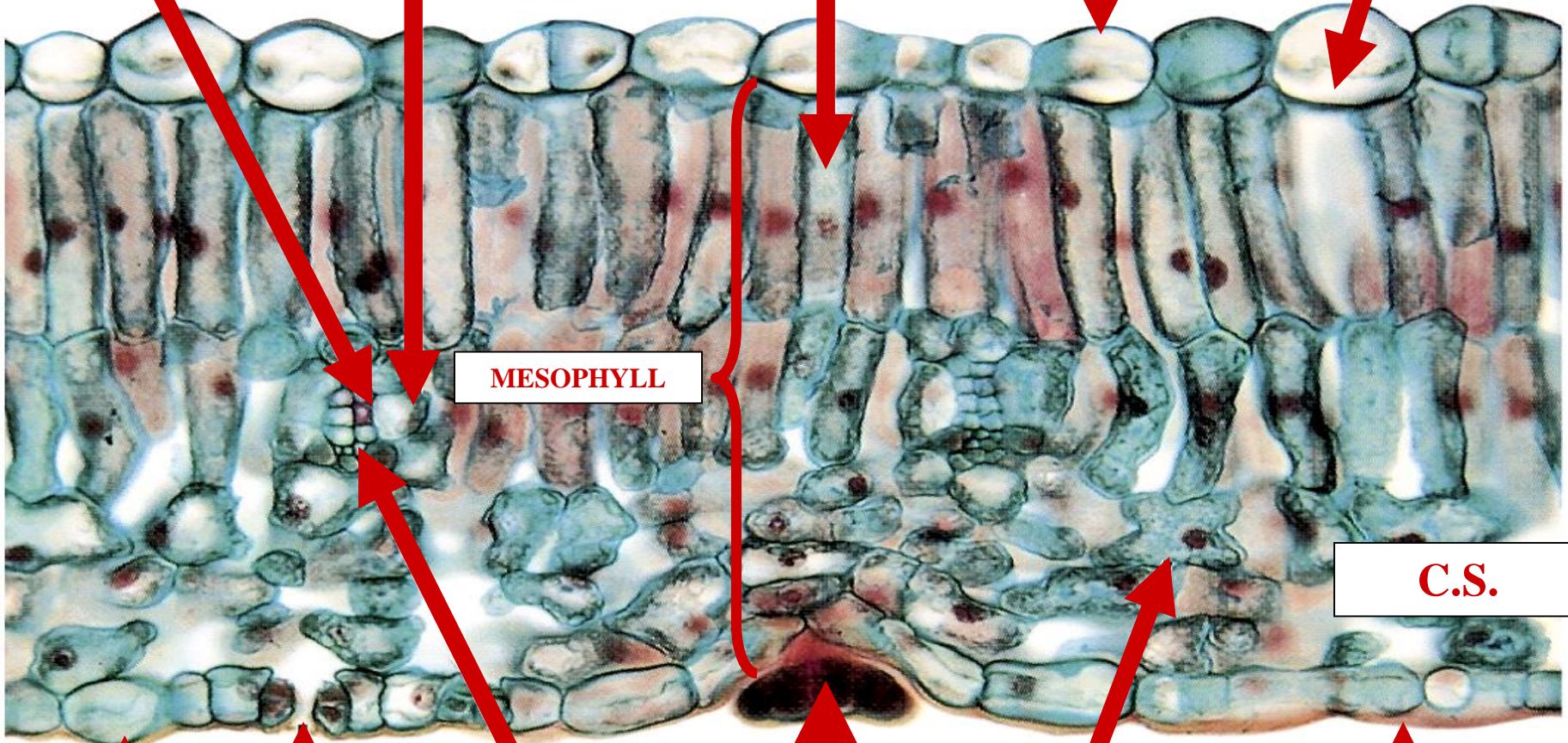
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYLL

C.S.

PHLOEM

ABAXIAL EPIDERMIS

STOMATES PRESENT

SPONGY LAYER

[Empty box]

[Empty box]

?

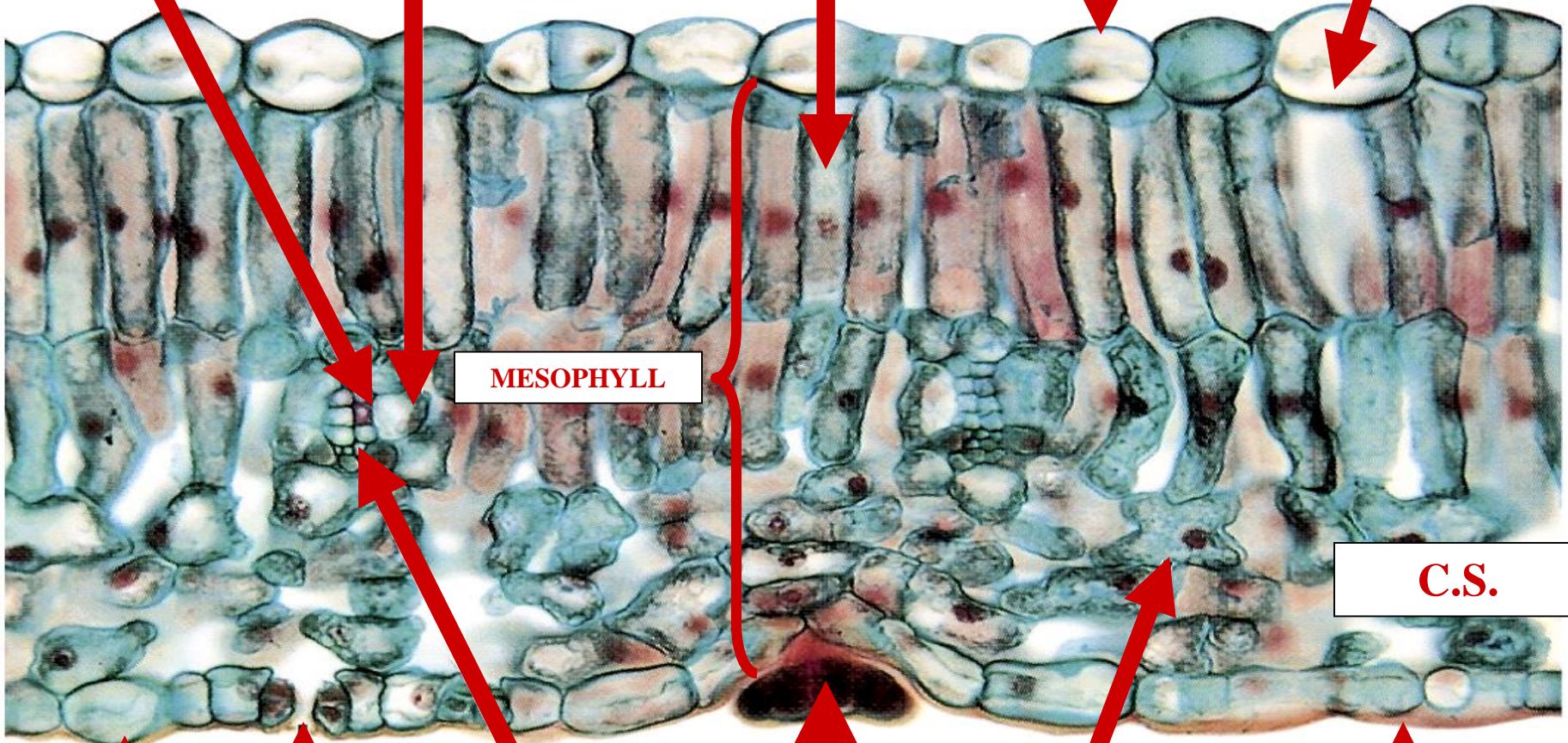
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYLL

C.S.

PHLOEM

ABAXIAL EPIDERMIS

STOMATES PRESENT

SPONGY LAYER

MODERATE CUTICLE

T

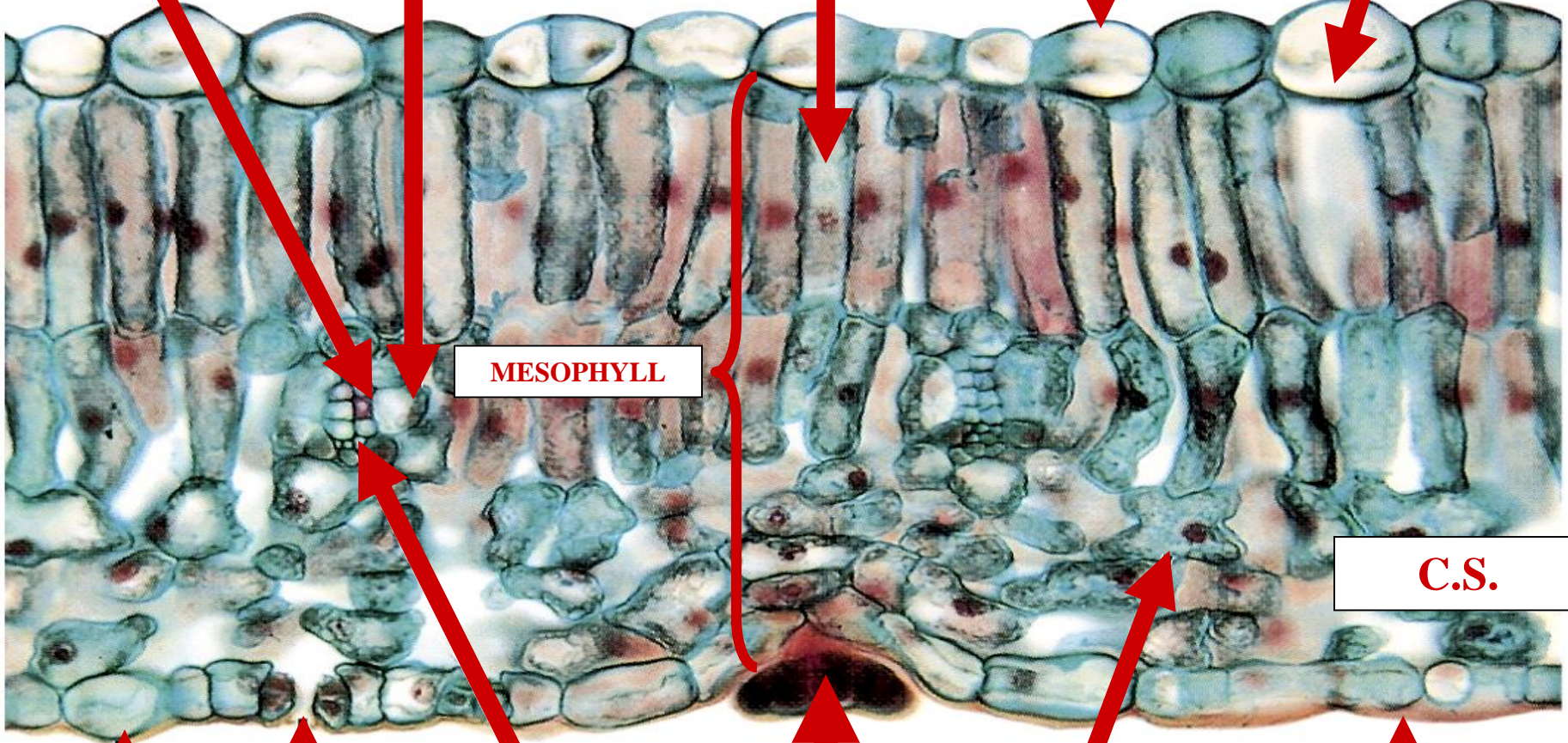
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYLL

C.S.

ABAXIAL EPIDERMIS

STOMATES PRESENT

?

SPONGY LAYER

MODERATE CUTICLE

PHLOEM



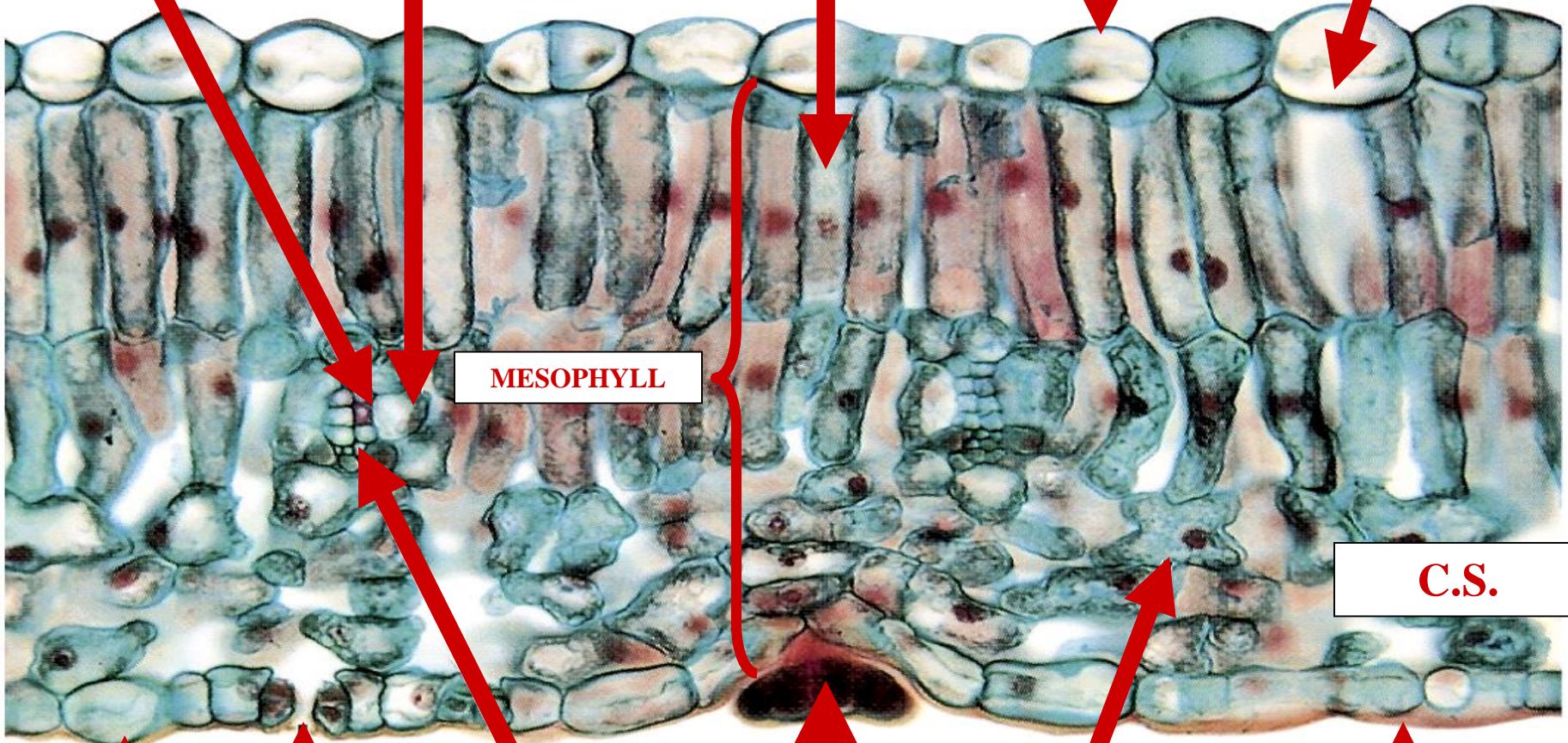
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYLL

C.S.

PHLOEM

ABAXIAL EPIDERMIS

STOMATES PRESENT

TRICHOME

SPONGY LAYER

MODERATE CUTICLE

XEROPHYTE LEAF

XEROPHYTE LEAF

DICOT LEAF ANATOMY

XEROPHYTE



ADAPTED
LOW MOISTURE
HABITAT

DICOT LEAF ANATOMY

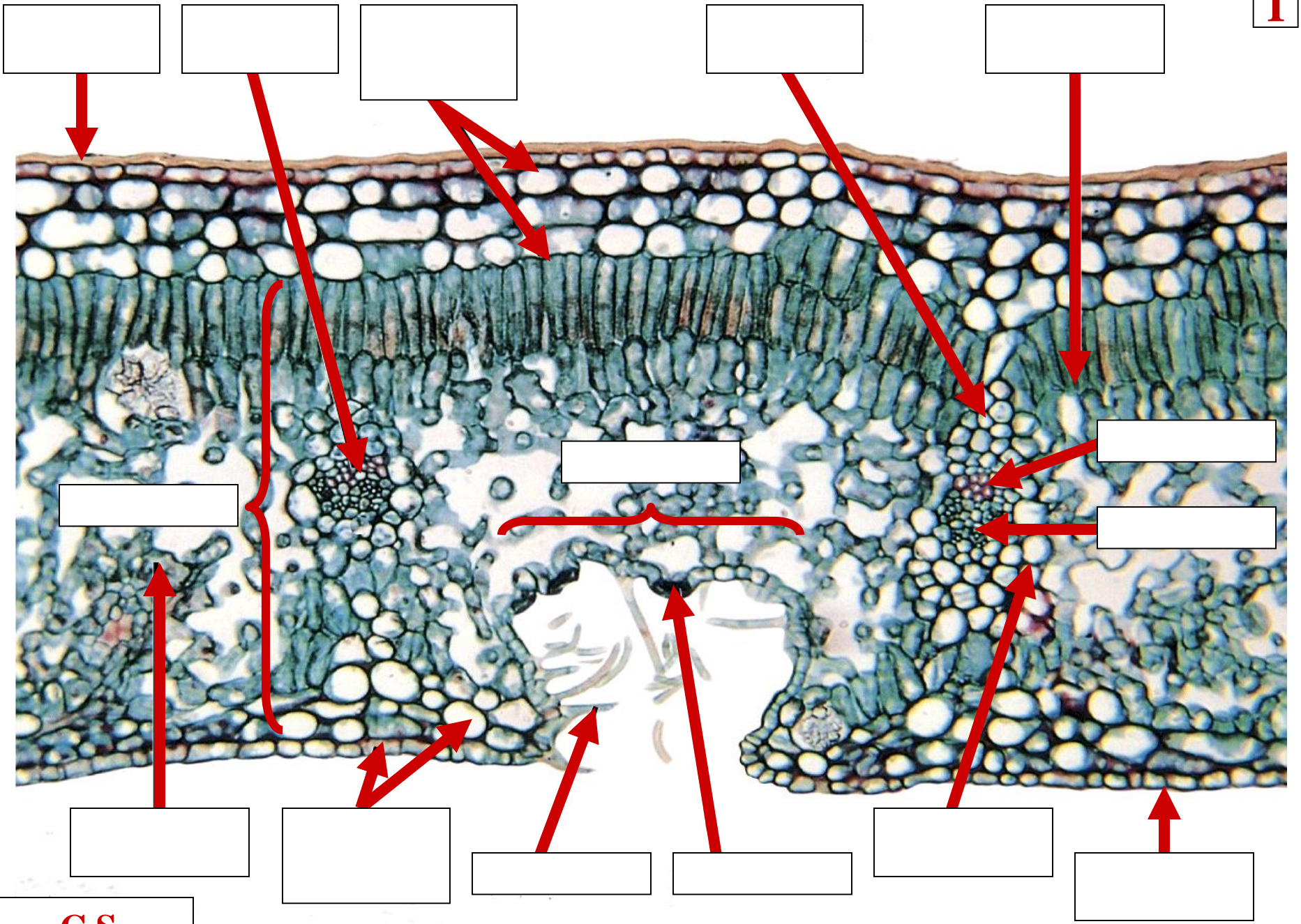
XEROPHYTE

DESERT XERIC HABITAT



NERIUM





[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

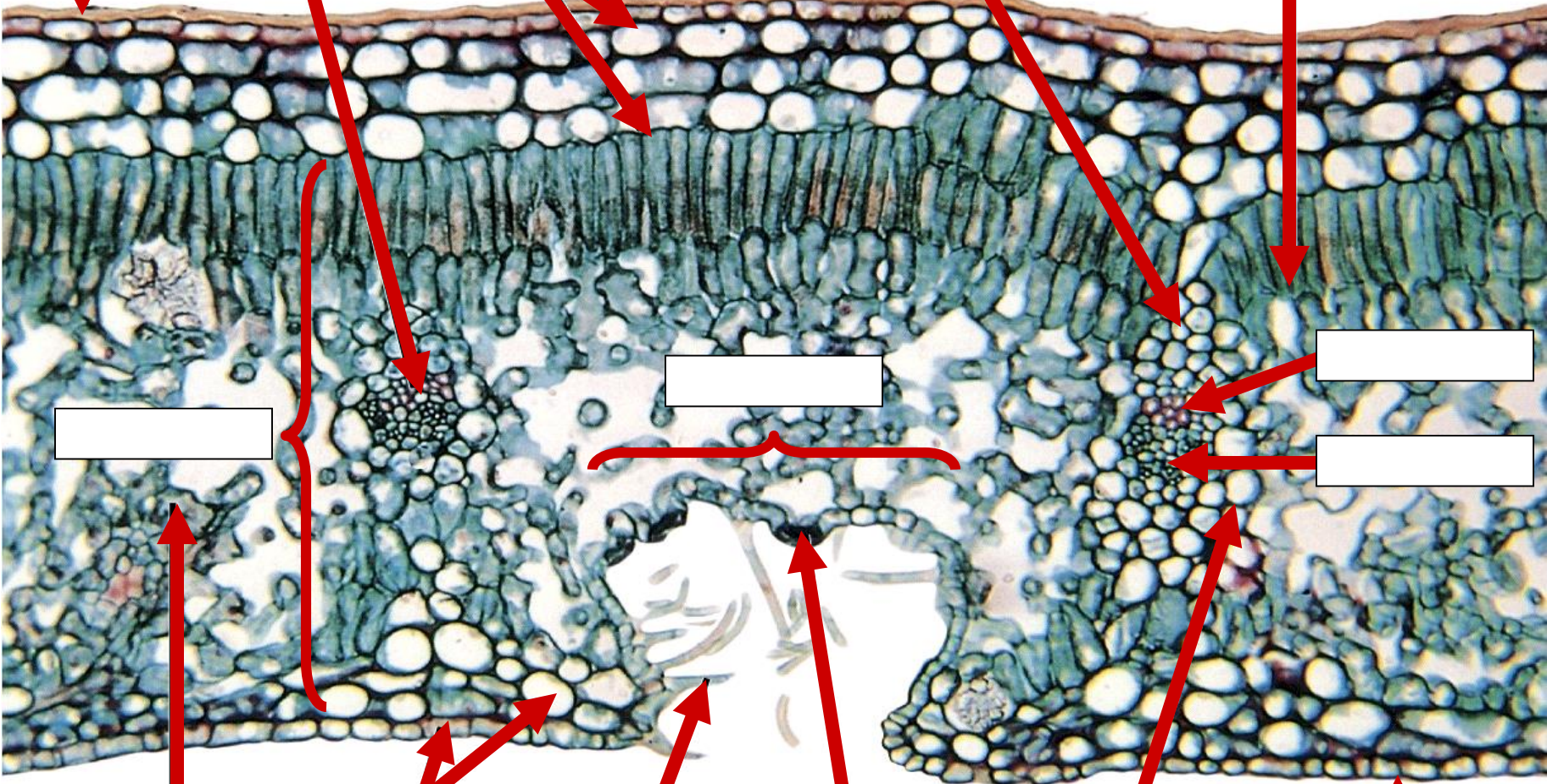
[]

[]

[]

C.S.

THICK CUTICLE



[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

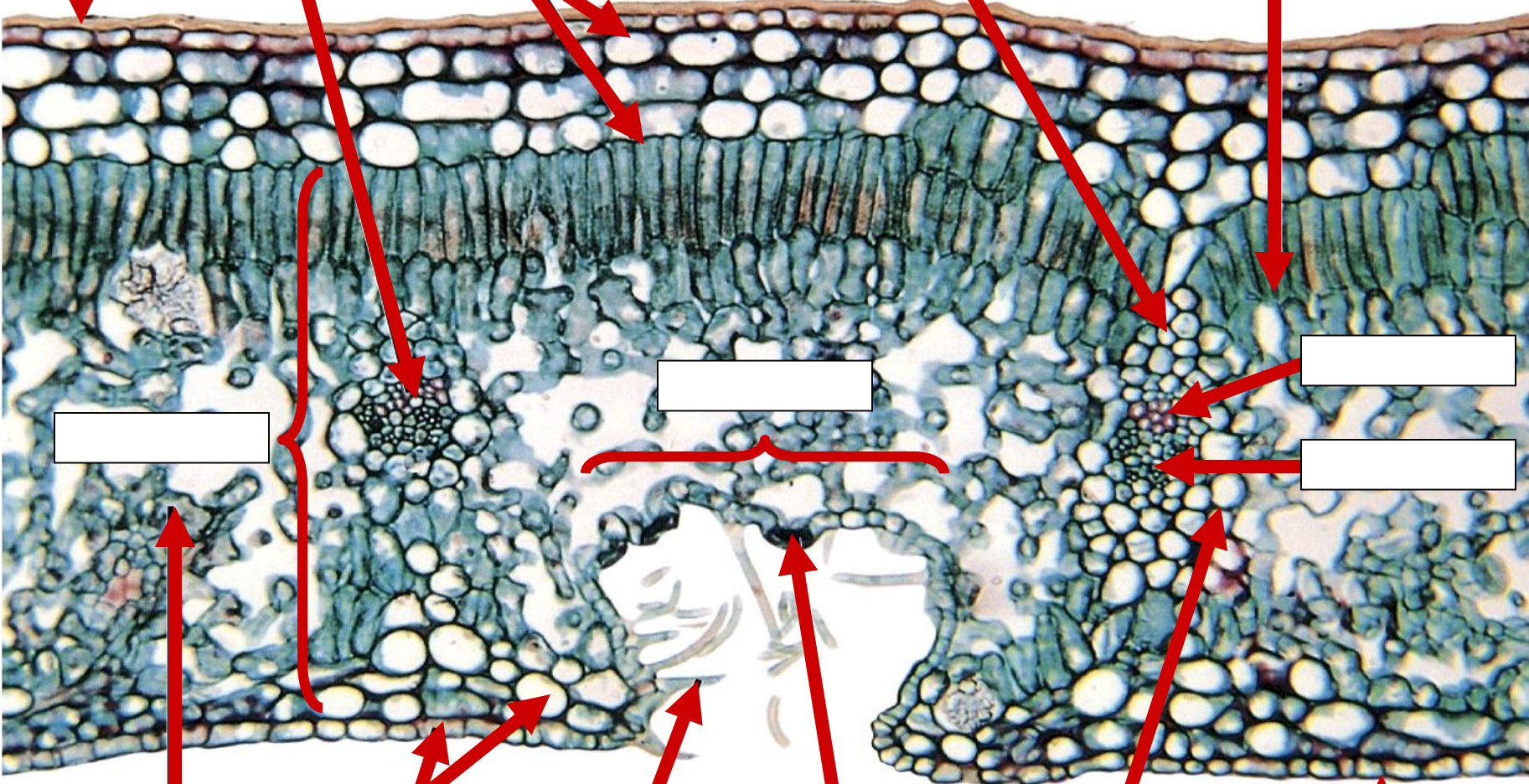
[Empty box]

[Empty box]

C.S.

THICK CUTICLE

?



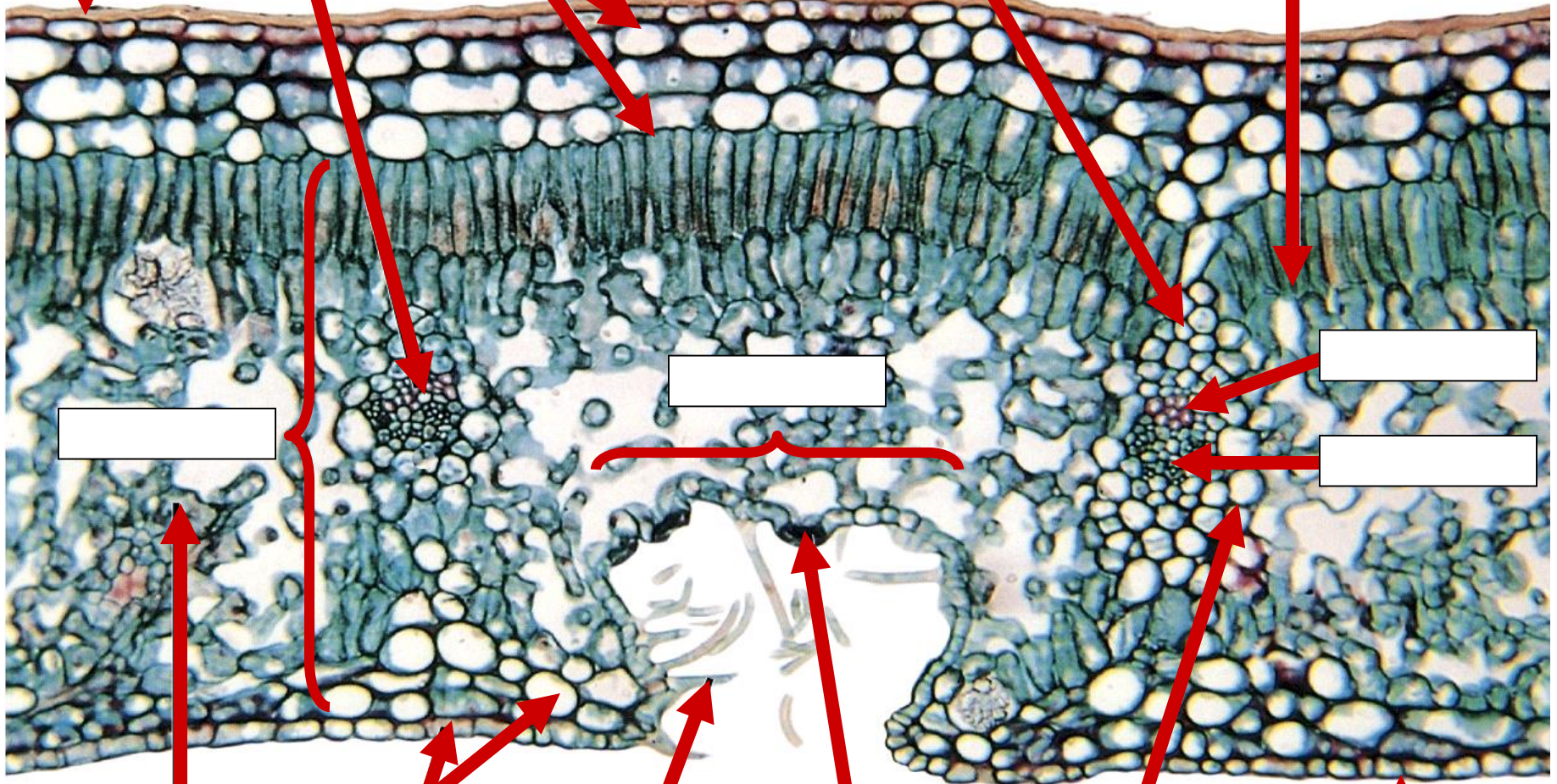
C.S.

S

AB

THICK CUTICLE

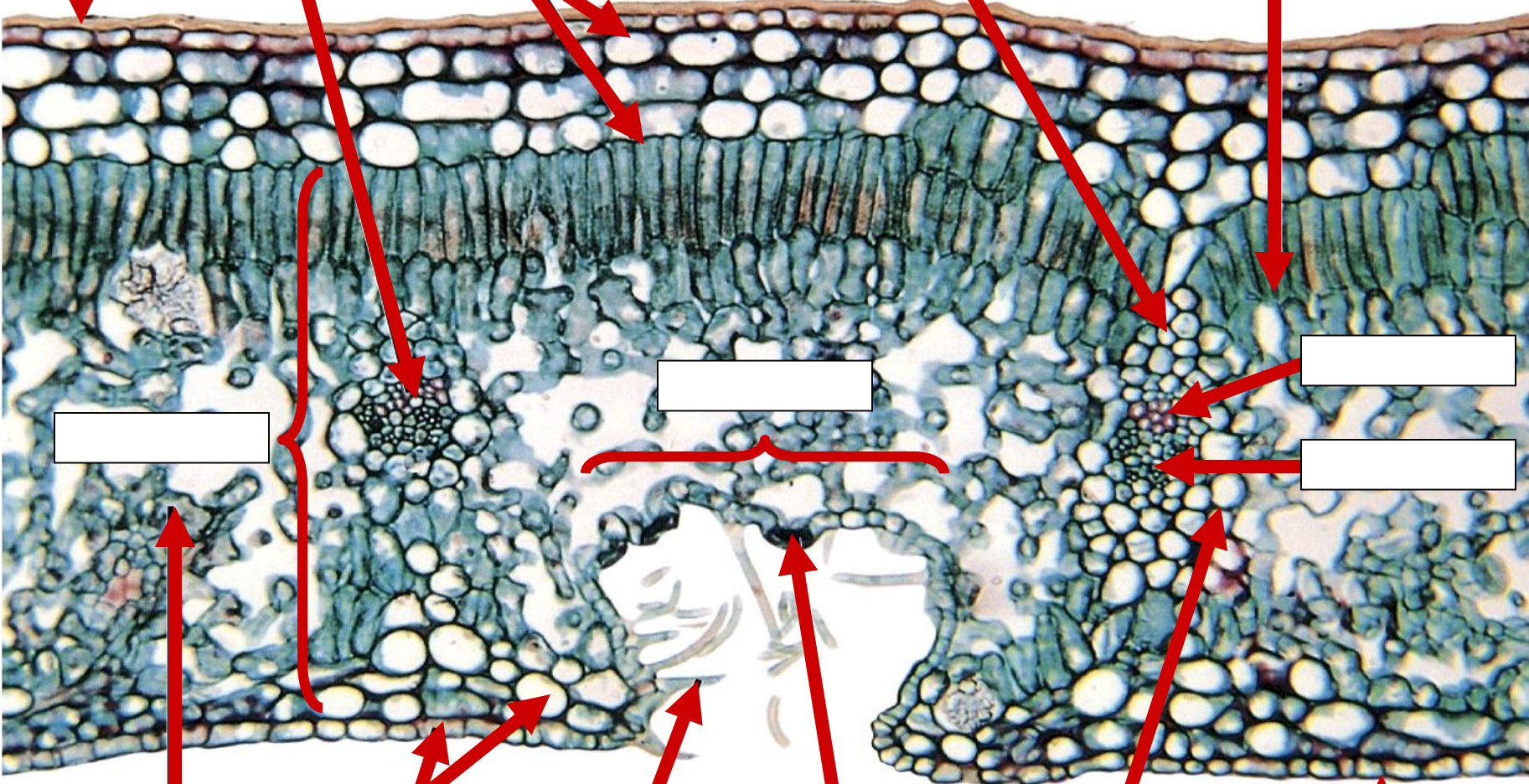
ADAXIAL MULTIPLE EPIDERMIS



C.S.

THICK CUTICLE

STOMATES ABSENT



C.S.

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

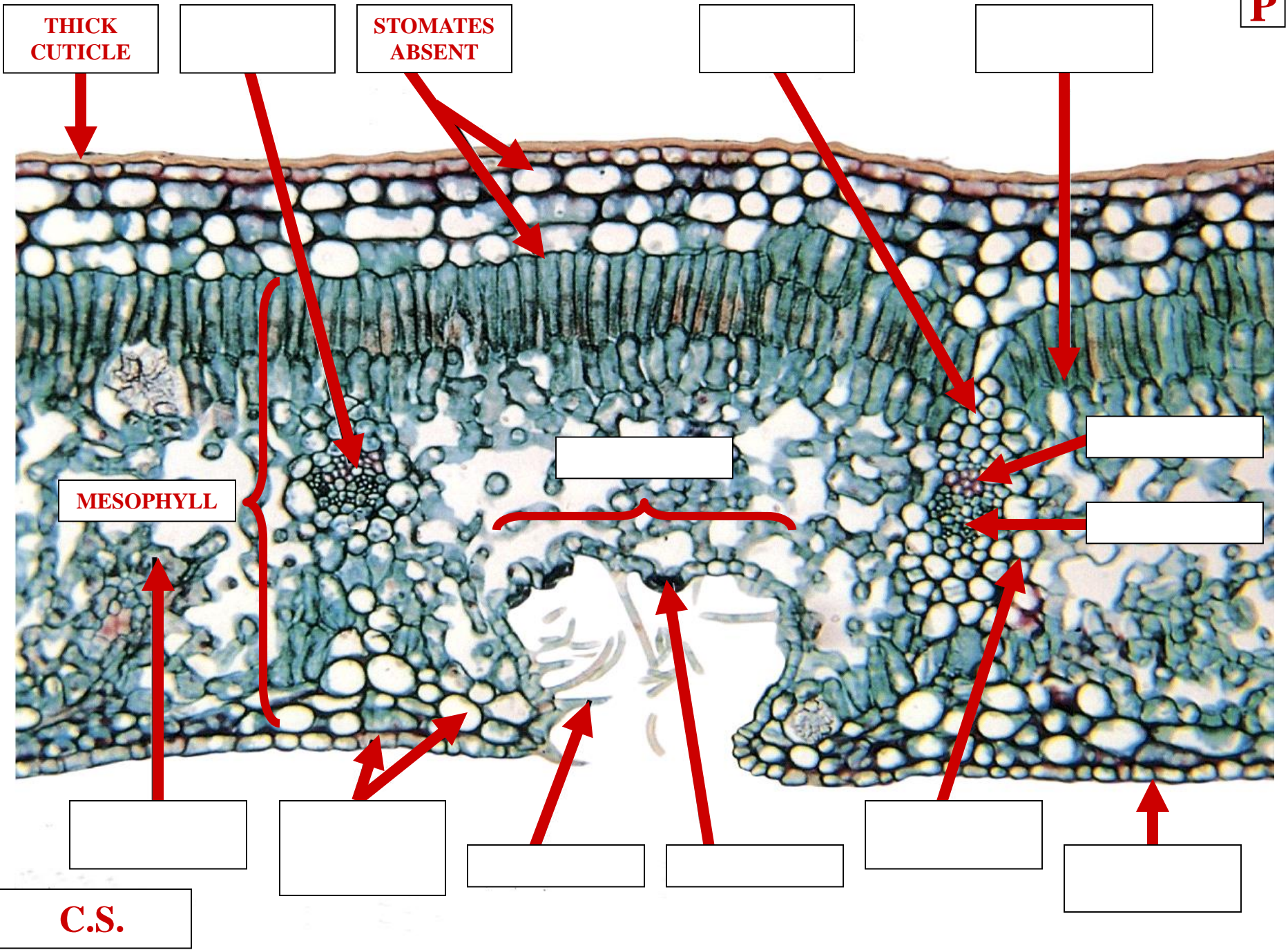
[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]



THICK CUTICLE

STOMATES ABSENT

MESOPHYLL

C.S.

[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

[]

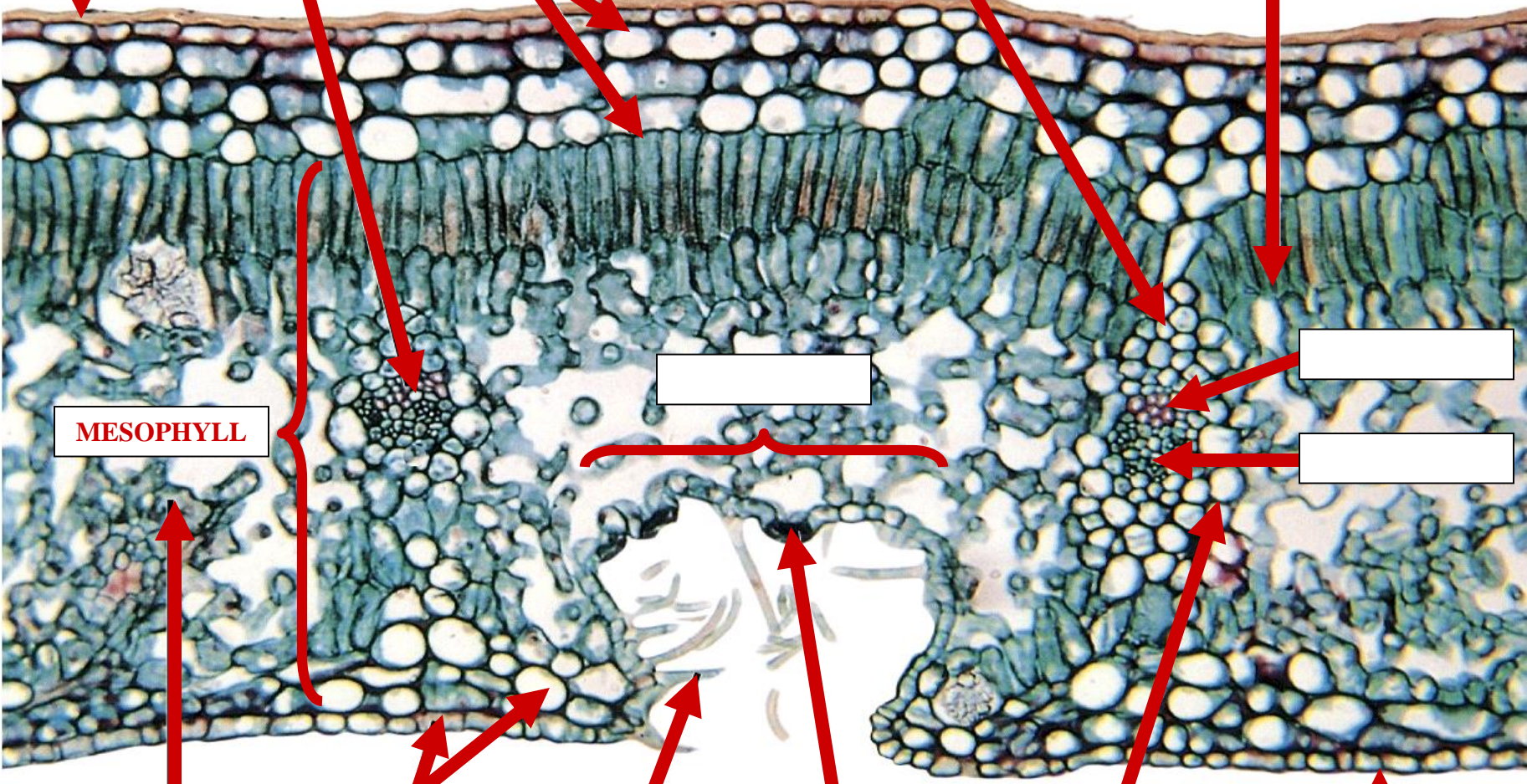
[]

[]

THICK CUTICLE

STOMATES ABSENT

PALISADE LAYER



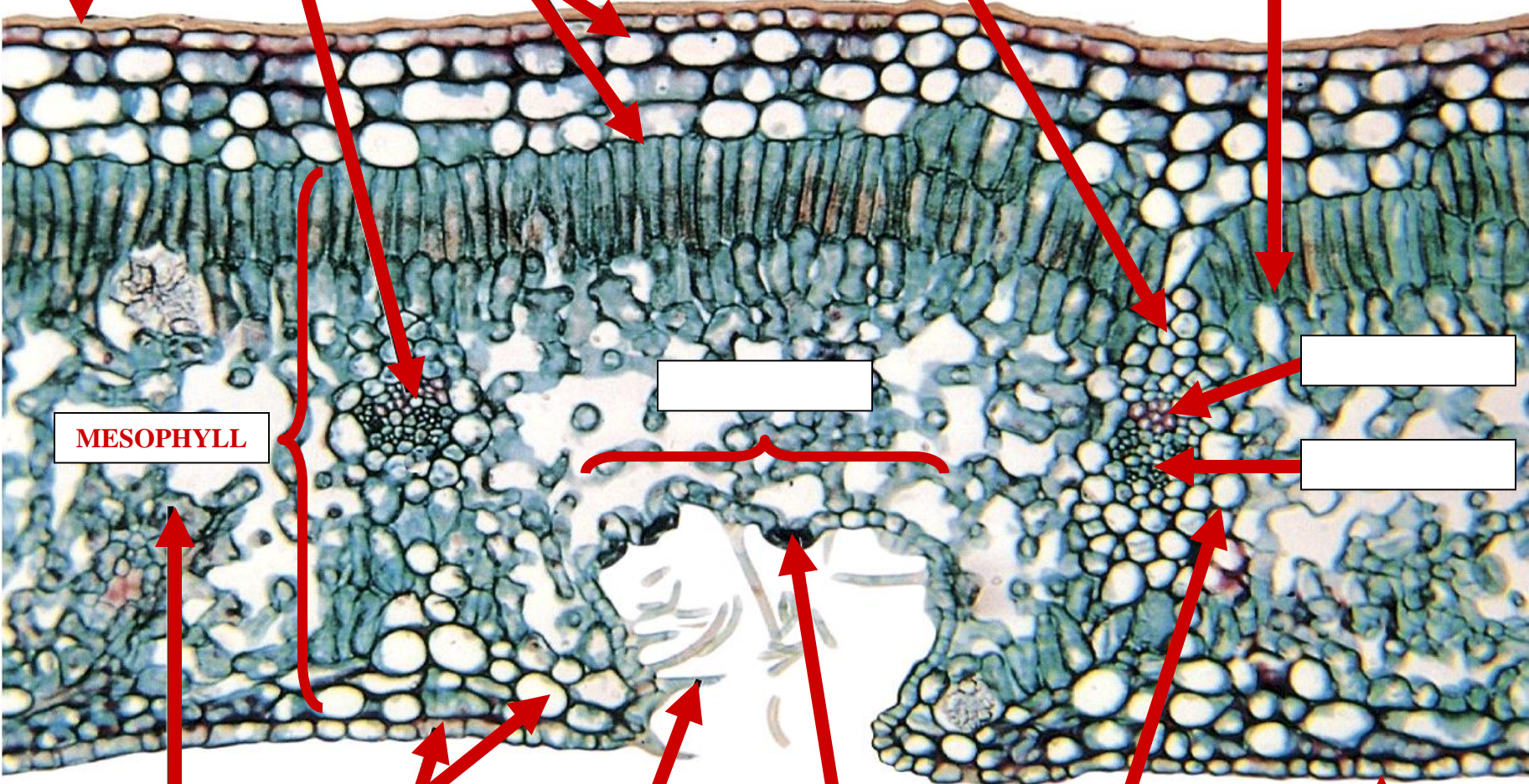
MESOPHYLL

C.S.

THICK CUTICLE

STOMATES ABSENT

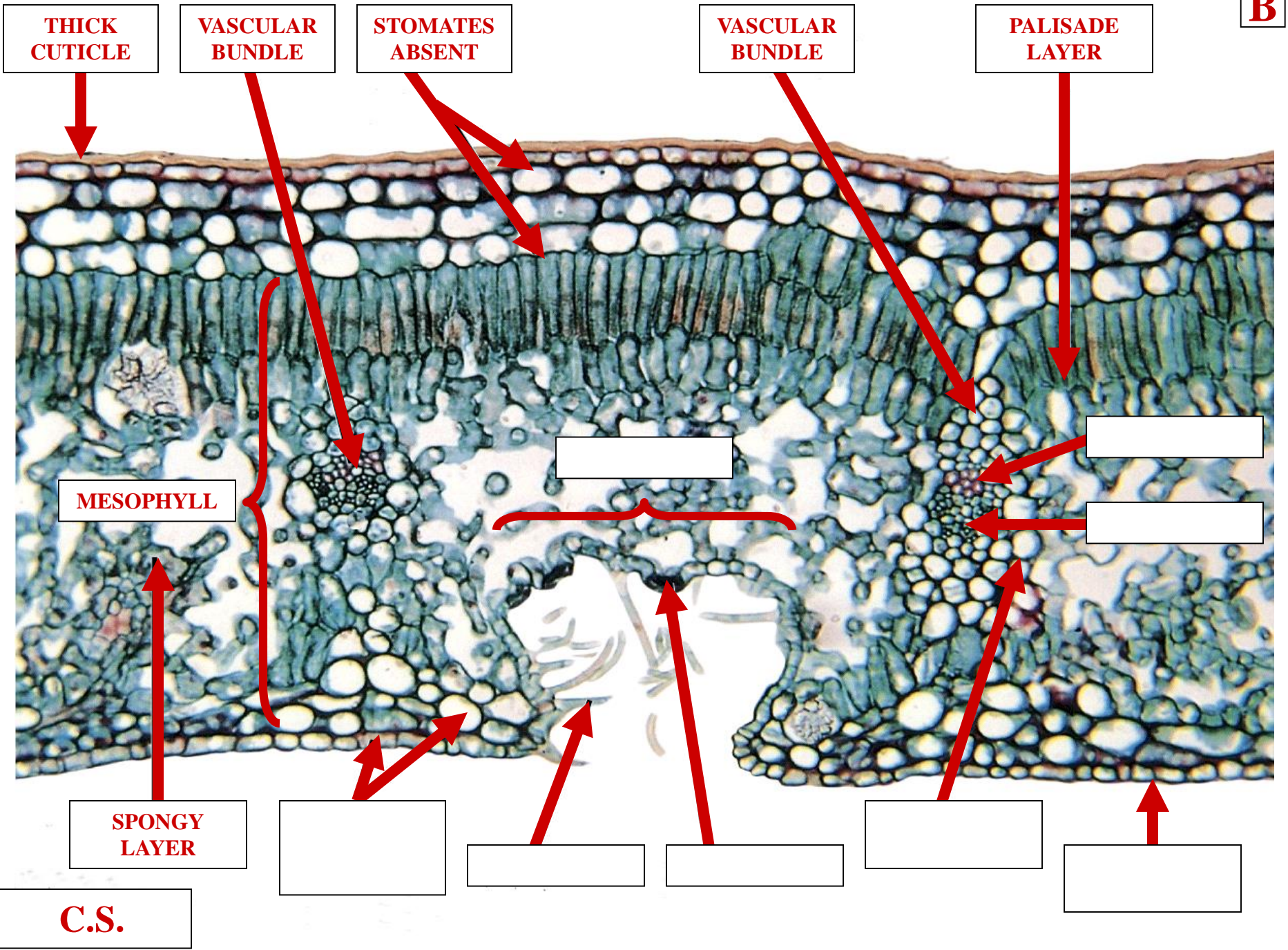
PALISADE LAYER



MESOPHYLL

SPONGY LAYER

C.S.



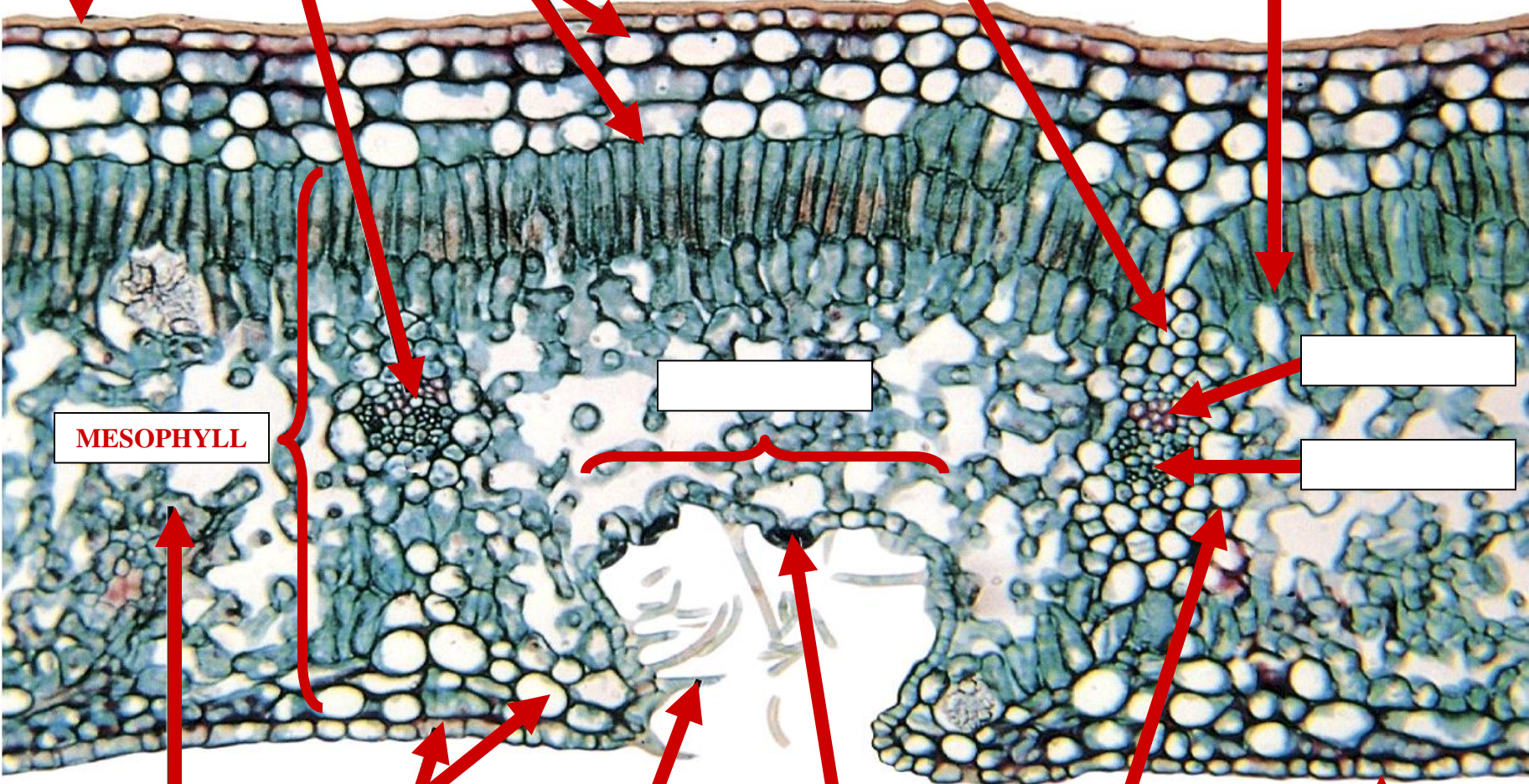
THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER



MESOPHYLL

[Empty box]

[Empty box]

[Empty box]

SPONGY LAYER

[Empty box]

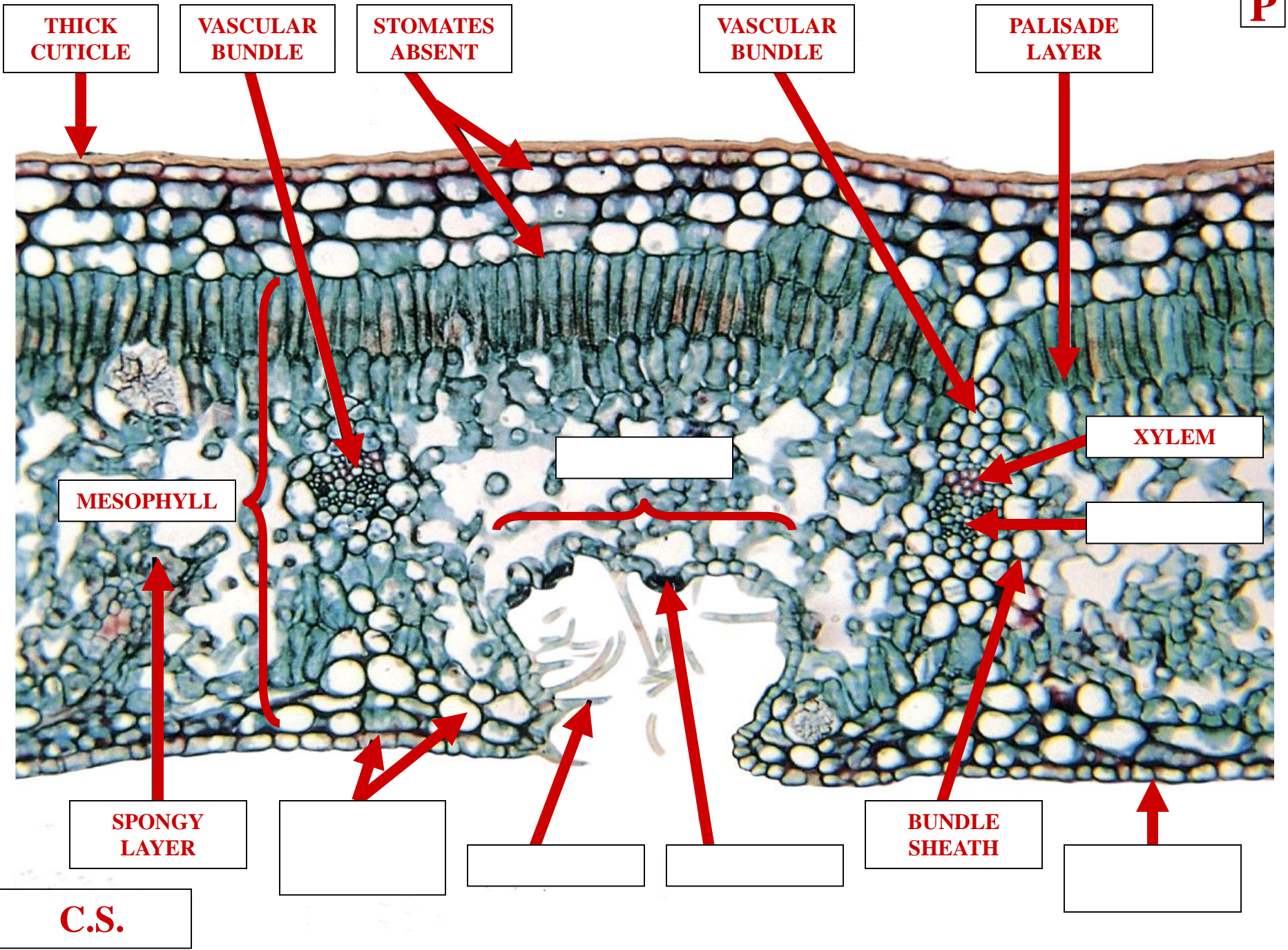
[Empty box]

[Empty box]

BUNDLE SHEATH

[Empty box]

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

XYLEM

MESOPHYLL

SPONGY LAYER

C.S.

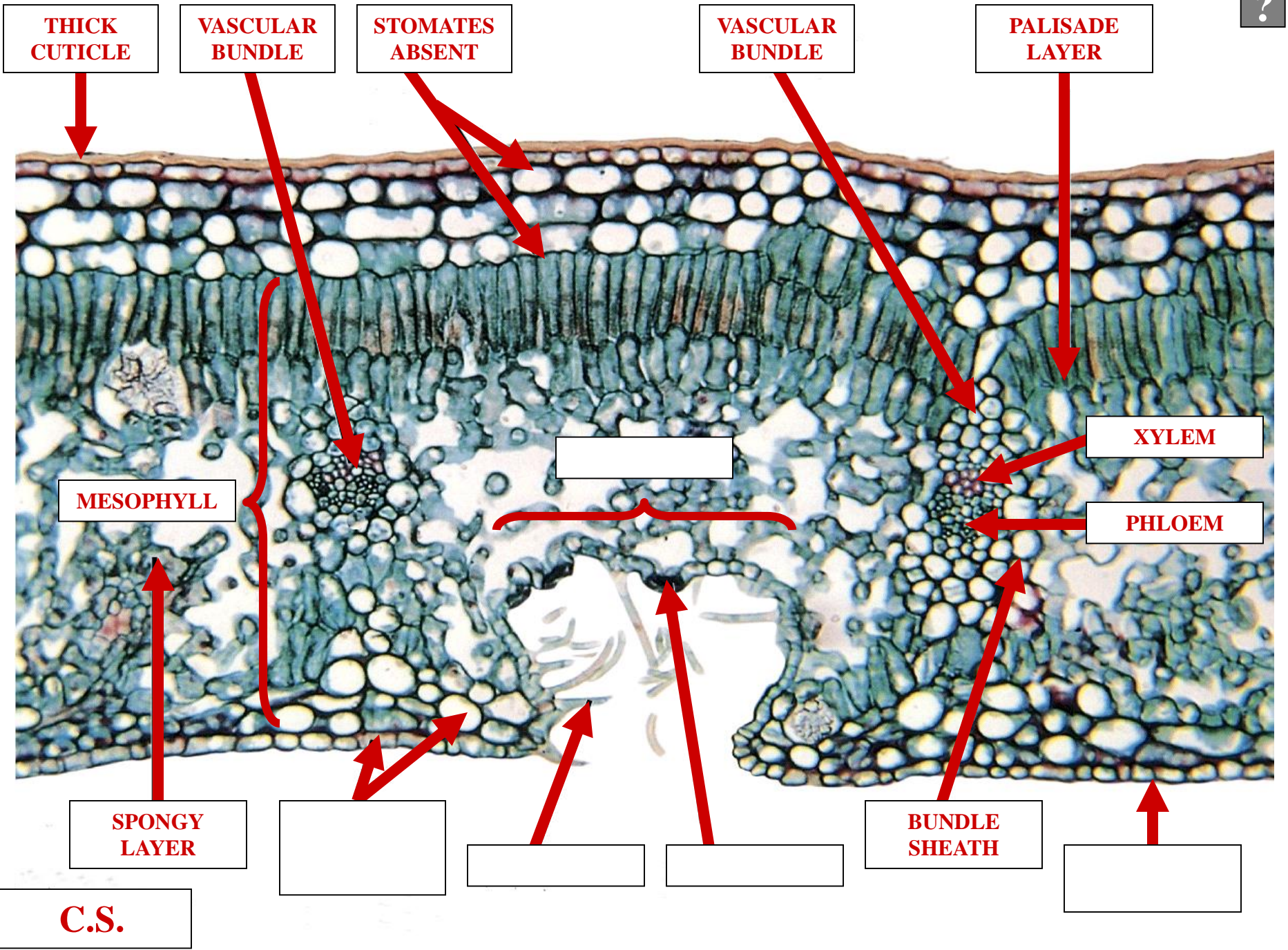
BUNDLE SHEATH

[Empty box]

[Empty box]

[Empty box]

[Empty box]



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

XYLEM

PHLOEM

MESOPHYLL

SPONGY LAYER

BUNDLE SHEATH

C.S.

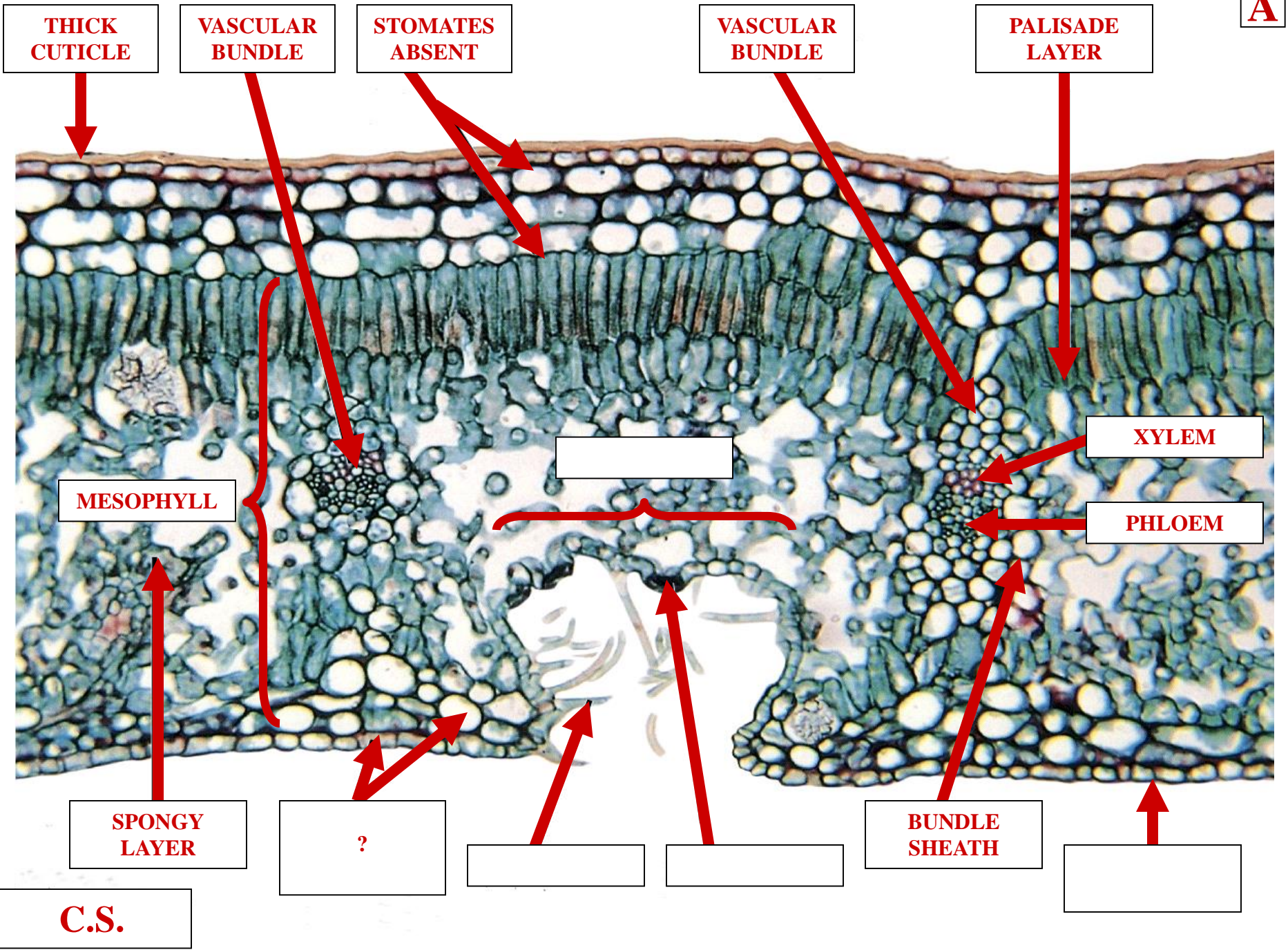
[Empty box]

[Empty box]

[Empty box]

[Empty box]

A



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

XYLEM

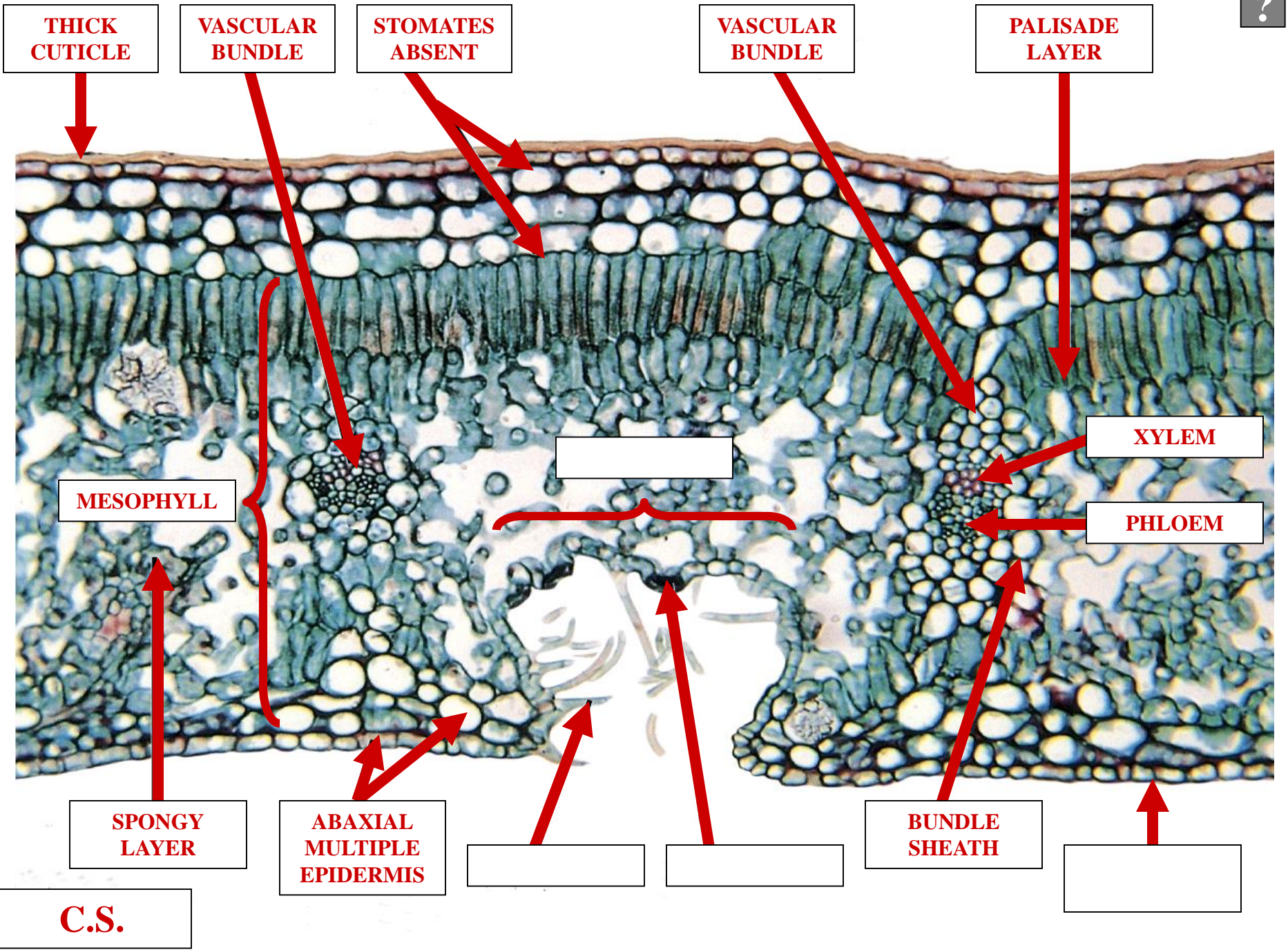
PHLOEM

SONGY LAYER

?

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

XYLEM

MESOPHYLL

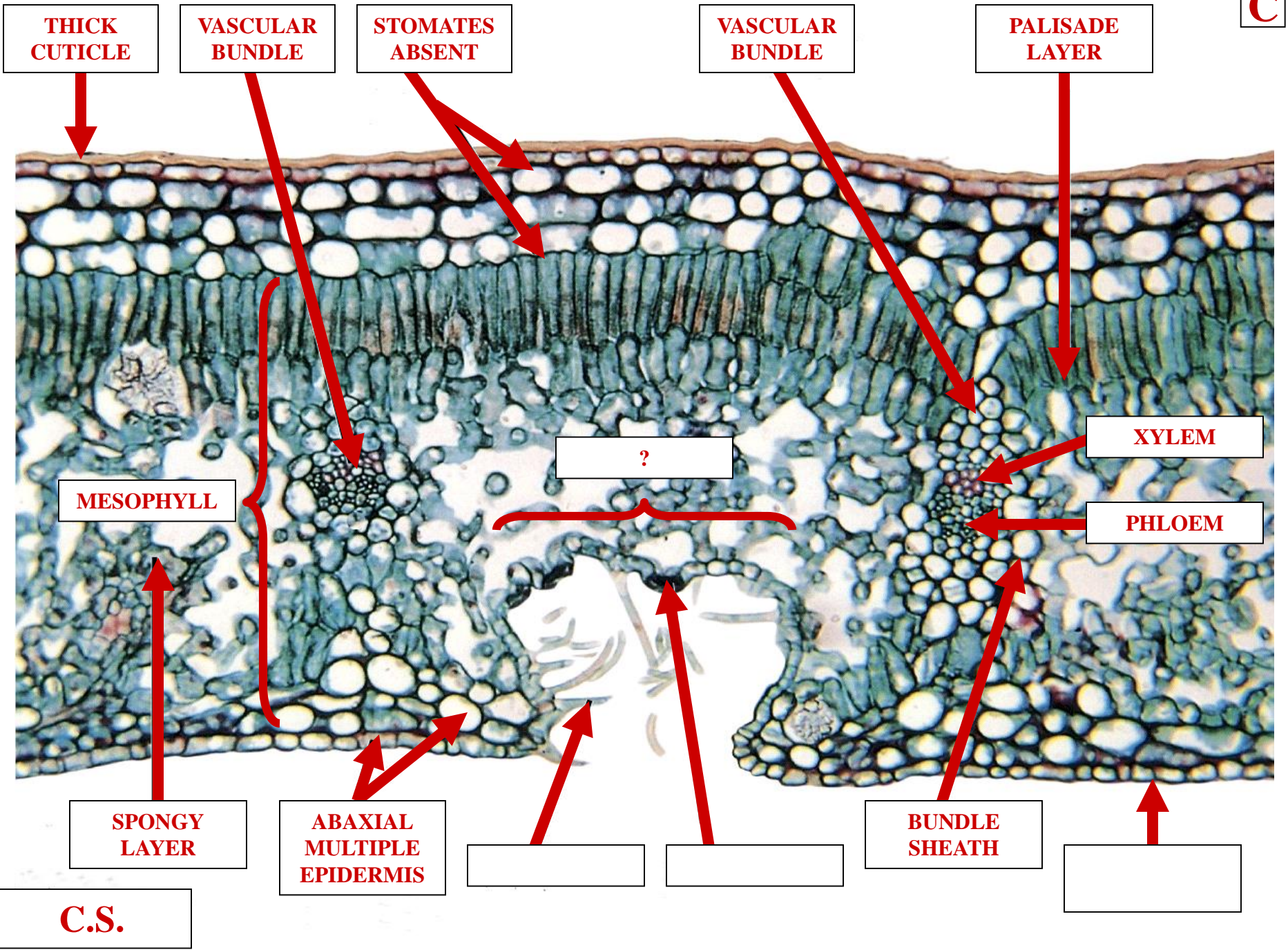
PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

?

XYLEM

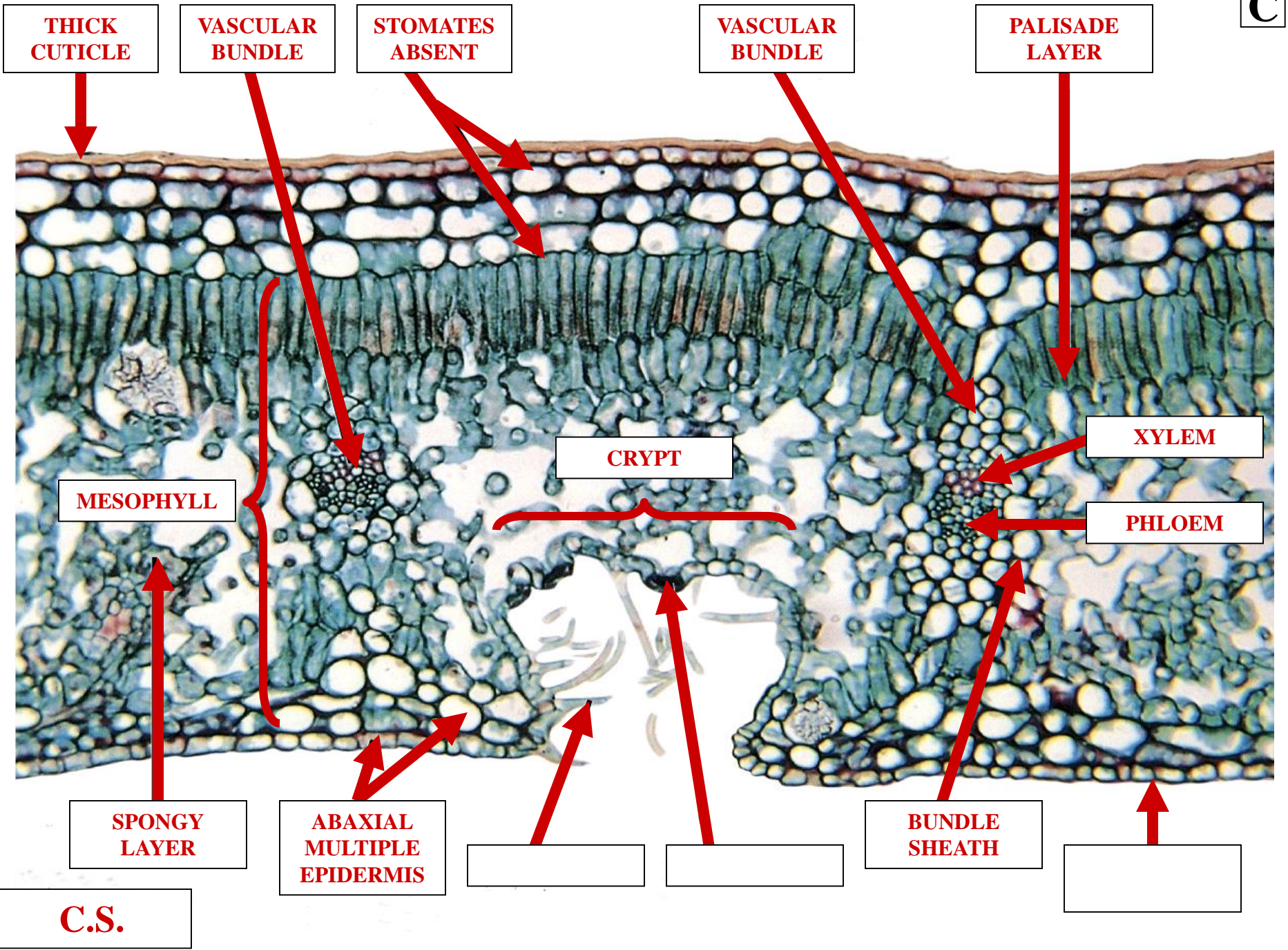
PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

CRYPT

XYLEM

PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

BUNDLE SHEATH

C.S.

CRYPT

DICOT LEAF ANATOMY

XEROPHYTE CRYPT



CAVITY

DICOT LEAF ANATOMY

XEROPHYTE CRYPT

DICOT LEAF ANATOMY

XEROPHYTE CRYPT



CAVITY

ABAXIAL EPIDERMIS ONLY

DICOT LEAF ANATOMY

XEROPHYTE CRYPT

DICOT LEAF ANATOMY

XEROPHYTE CRYPT



CAVITY

ABAXIAL EPIDERMIS ONLY

STOMATES CRYPT RESTRICTED

DICOT LEAF ANATOMY

XEROPHYTE CRYPT

DICOT LEAF ANATOMY



XEROPHYTE CRYPT

CAVITY

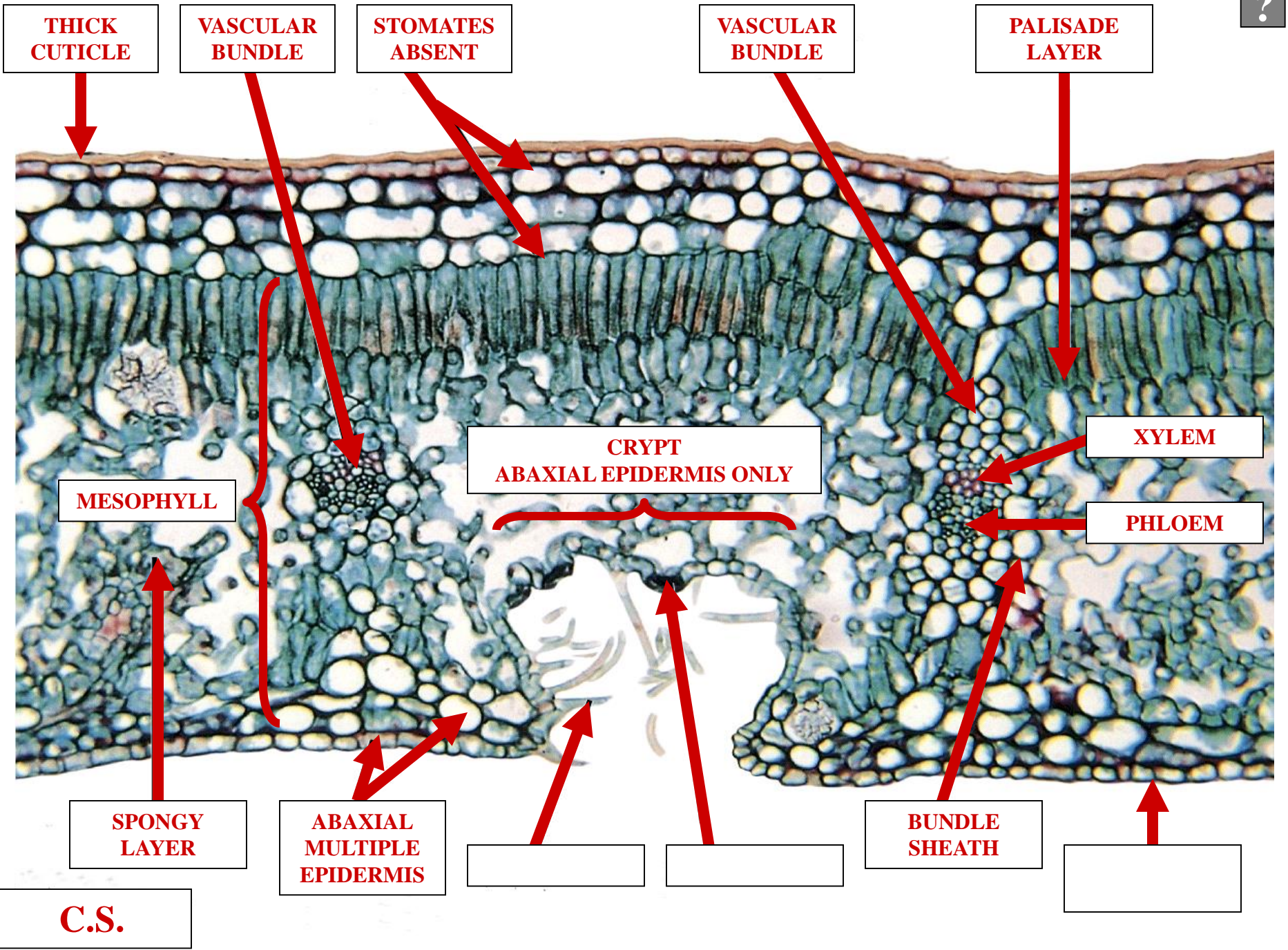
ABAXIAL EPIDERMIS ONLY

STOMATES CRYPT RESTRICTED

TRICHOMES PRESENT

DICOT LEAF ANATOMY

XEROPHYTE CRYPT



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

**CRYPT
ABAXIAL EPIDERMIS ONLY**

XYLEM

PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

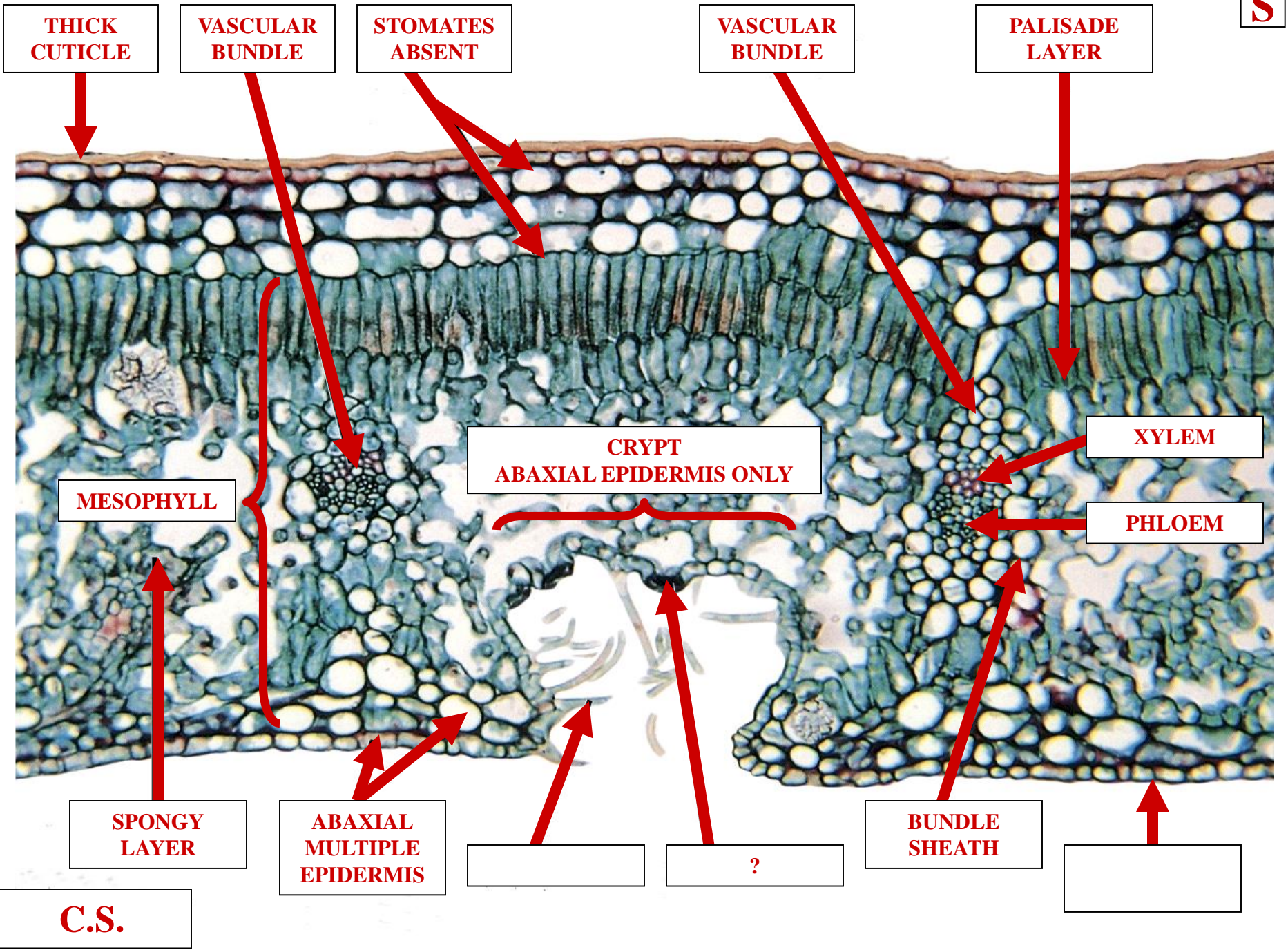
BUNDLE SHEATH

C.S.

[Empty box]

[Empty box]

[Empty box]



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

CRYPT ABAXIAL EPIDERMIS ONLY

XYLEM

PHLOEM

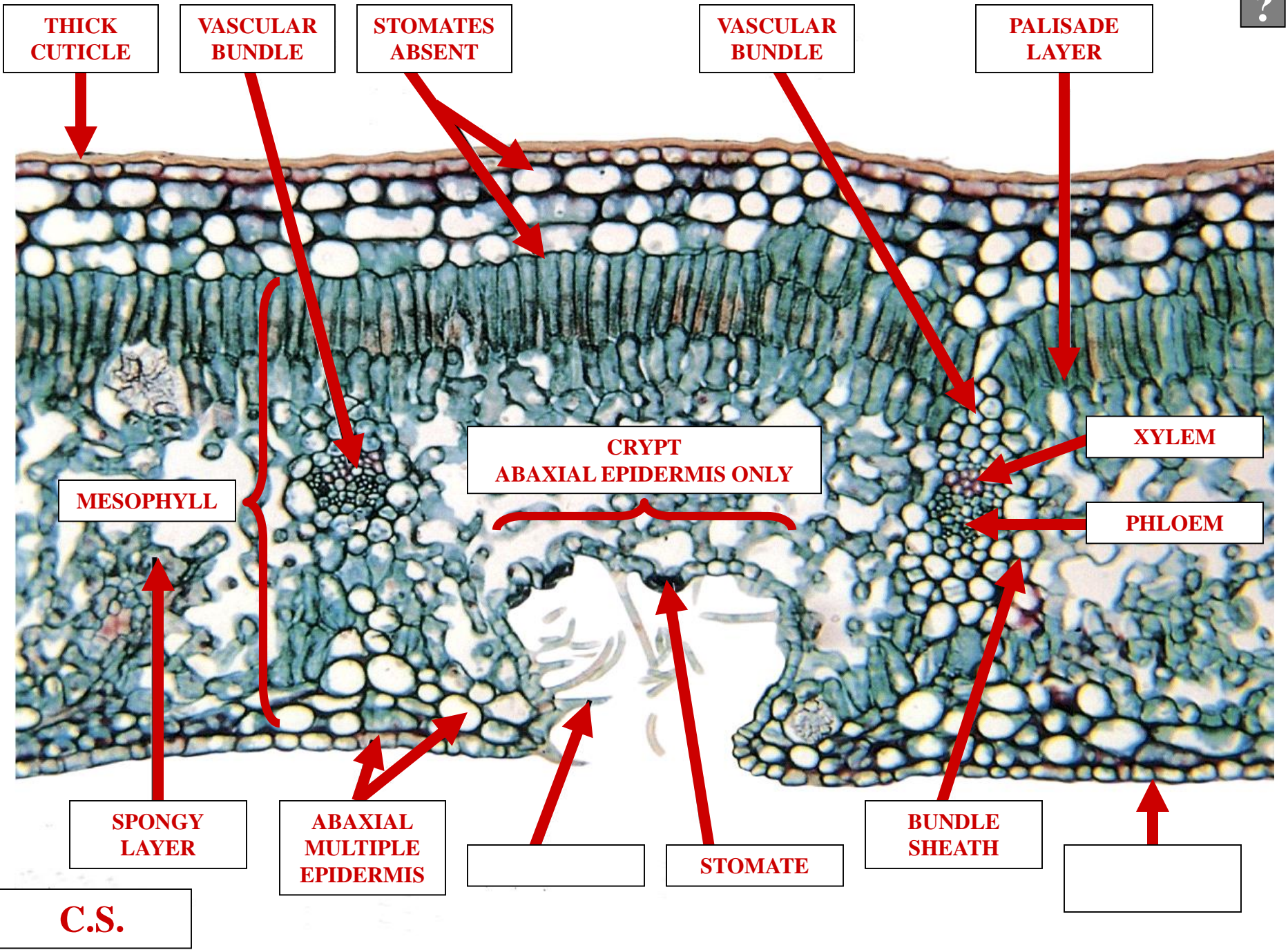
SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

BUNDLE SHEATH

?

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

CRYPT
ABAXIAL EPIDERMIS ONLY

XYLEM

PHLOEM

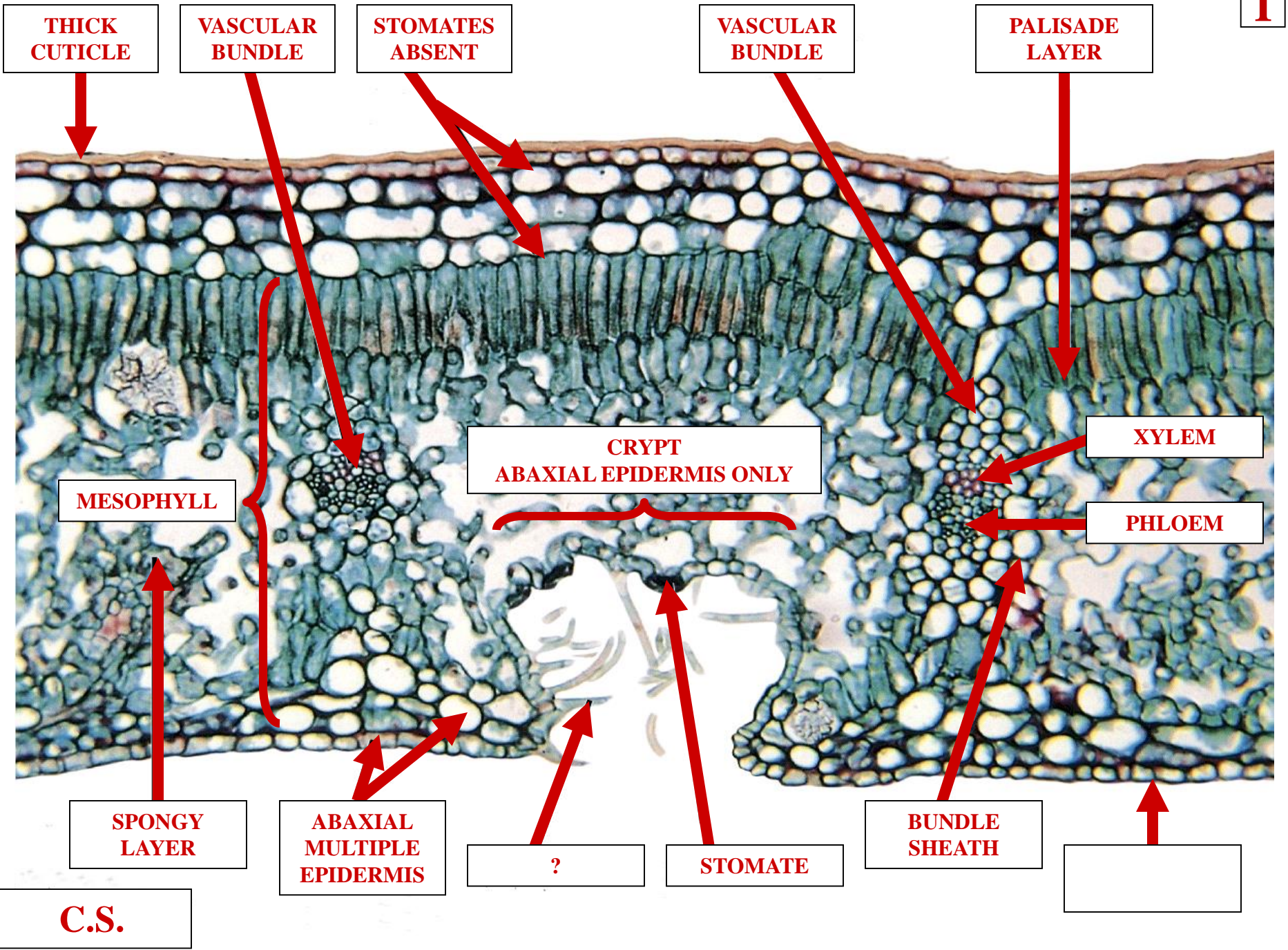
SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

STOMATE

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

CRYPT ABAXIAL EPIDERMIS ONLY

XYLEM

PHLOEM

SPONGY LAYER

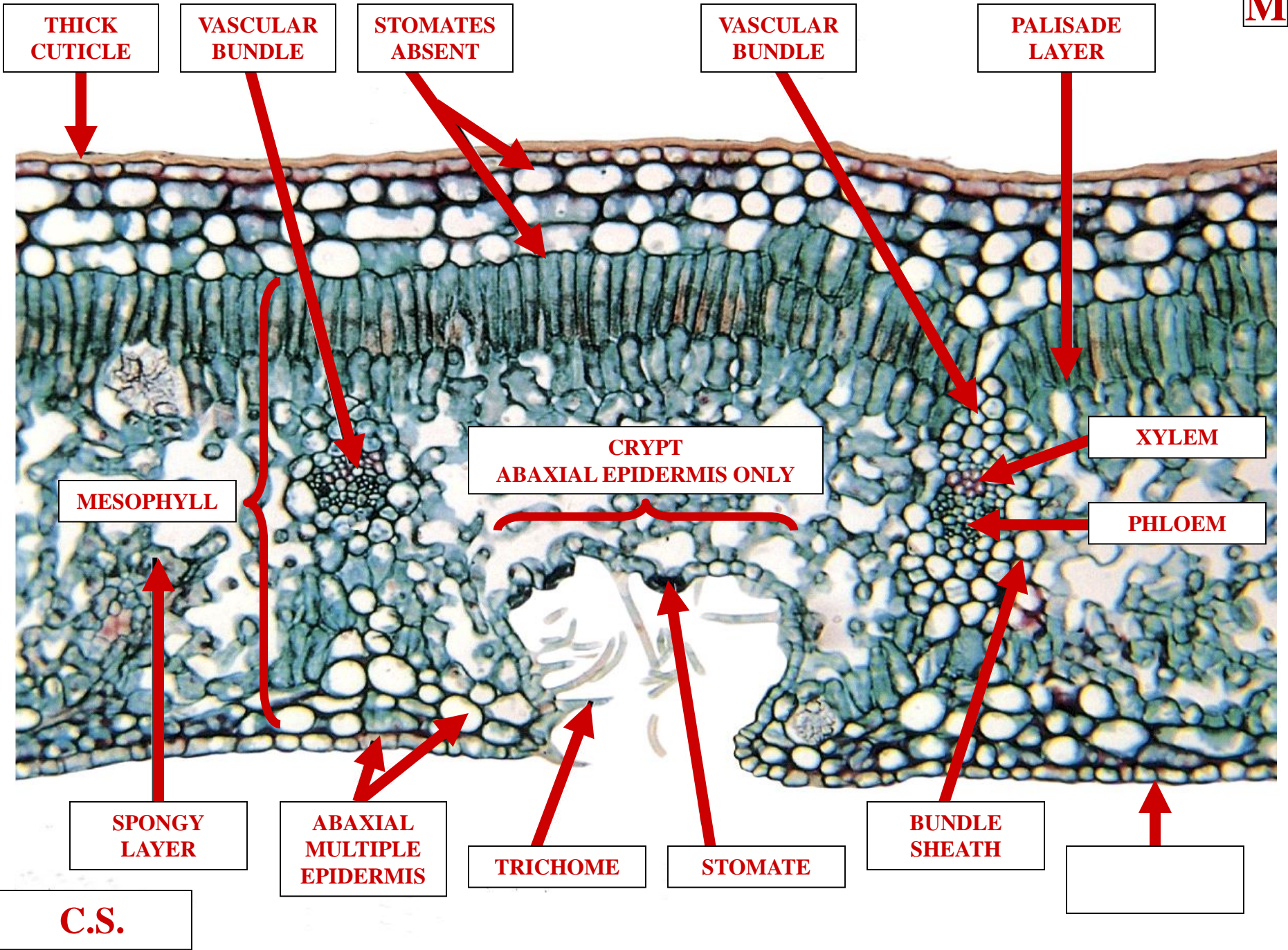
ABAXIAL MULTIPLE EPIDERMIS

?

STOMATE

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

CRYPT ABAXIAL EPIDERMIS ONLY

XYLEM

PHLOEM

SPONGY LAYER

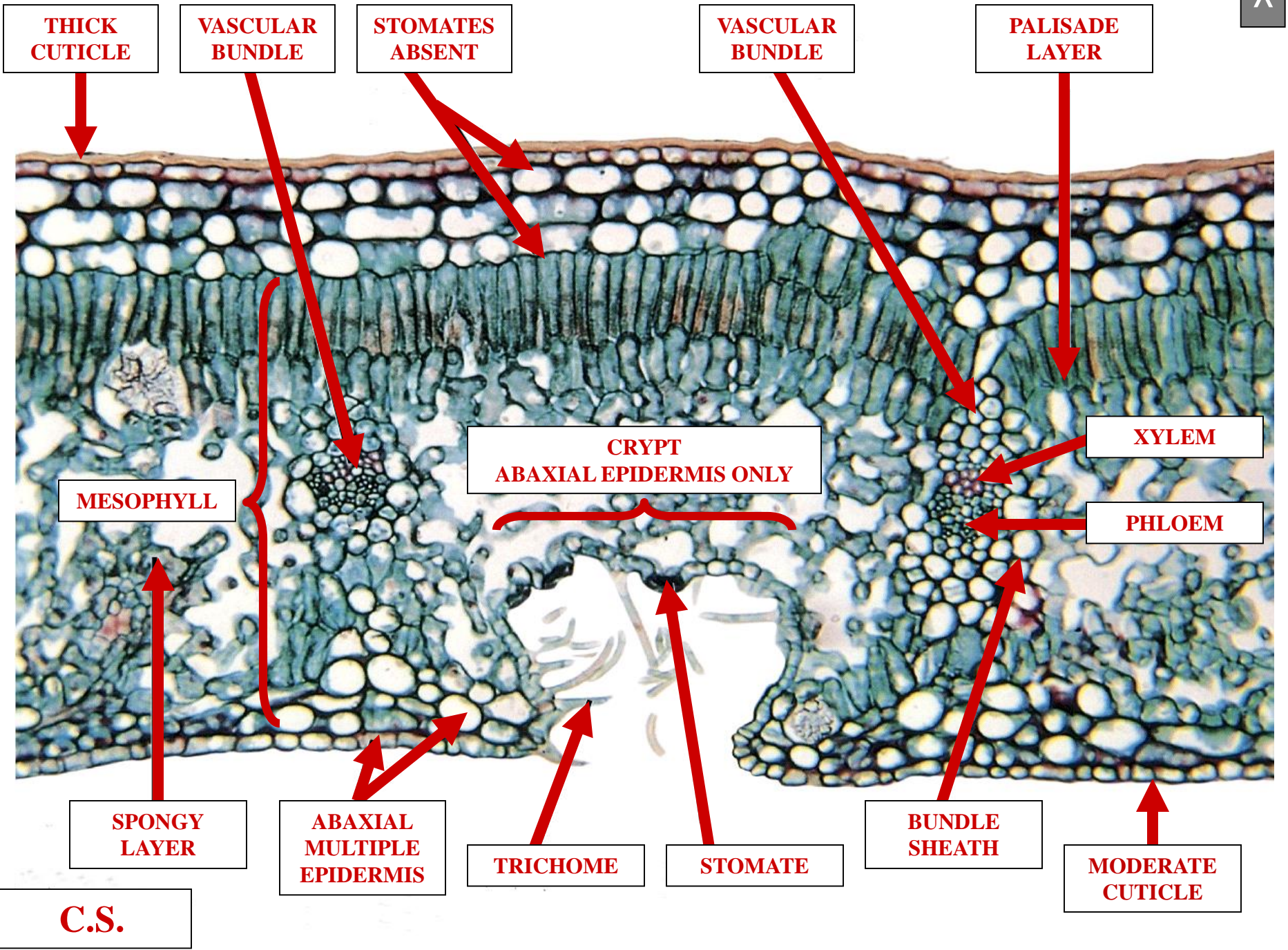
ABAXIAL MULTIPLE EPIDERMIS

TRICHOME

STOMATE

BUNDLE SHEATH

C.S.



THICK CUTICLE

VASCULAR BUNDLE

STOMATES ABSENT

VASCULAR BUNDLE

PALISADE LAYER

MESOPHYLL

**CRYPT
ABAXIAL EPIDERMIS ONLY**

XYLEM

PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

TRICHOME

STOMATE

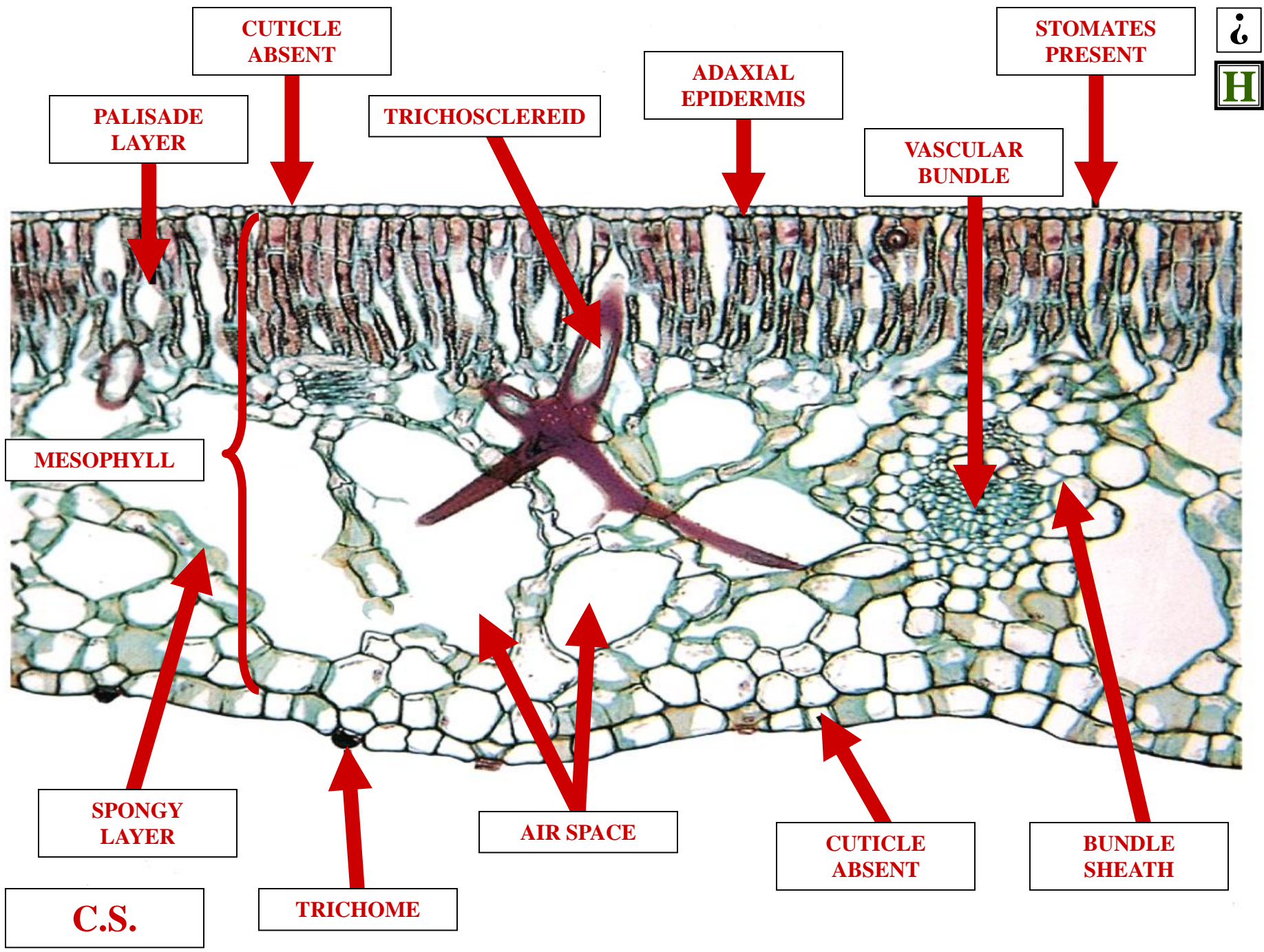
BUNDLE SHEATH

MODERATE CUTICLE

C.S.



DICOT LEAF ANATOMY SUMMARY



CUTICLE
ABSENT

STOMATES
PRESENT

PALISADE
LAYER

TRICHOSCLEREID

ADAXIAL
EPIDERMIS

VASCULAR
BUNDLE

MESOPHYLL

SPONGY
LAYER

C.S.

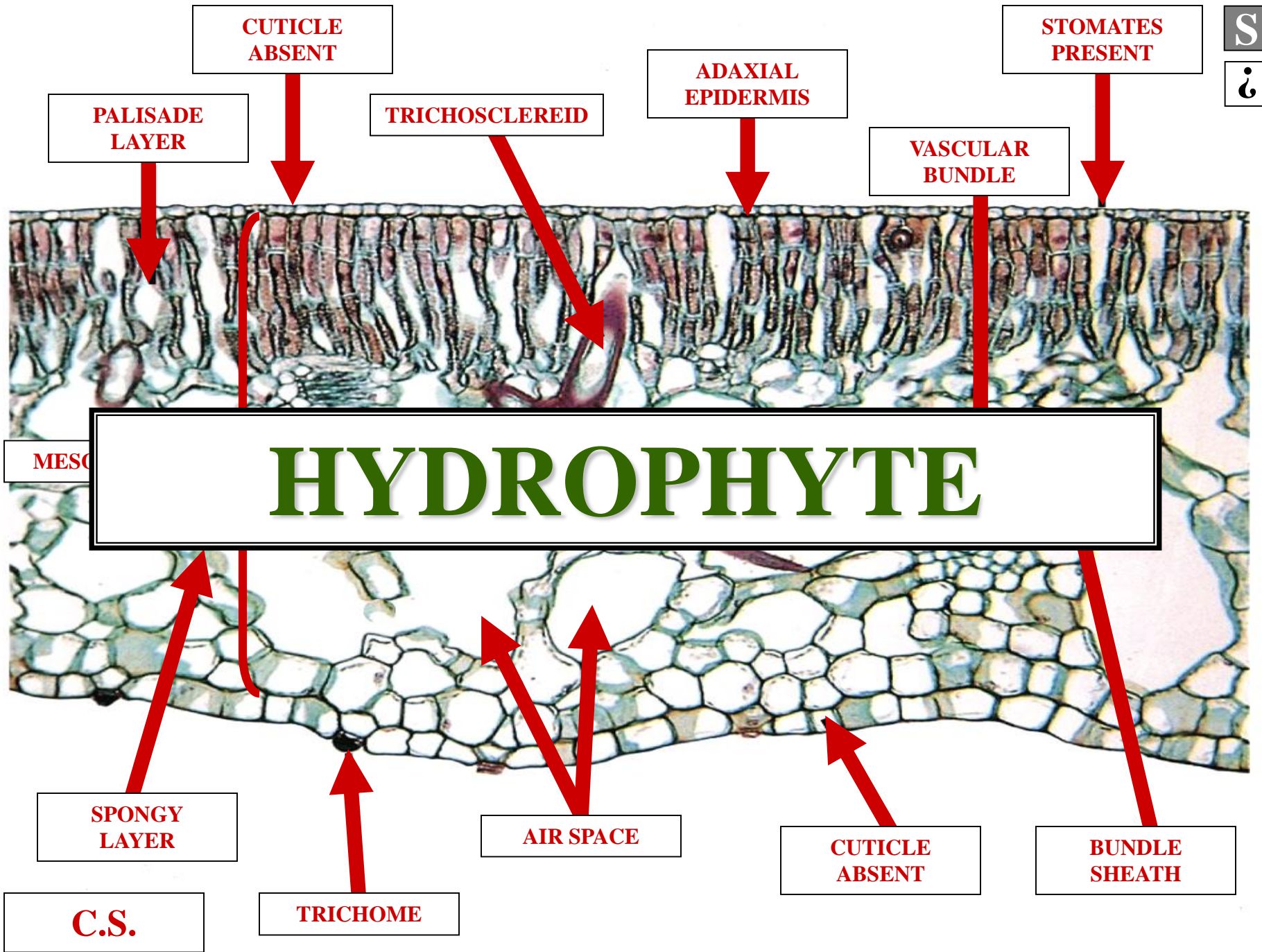
TRICHOME

AIR SPACE

CUTICLE
ABSENT

BUNDLE
SHEATH

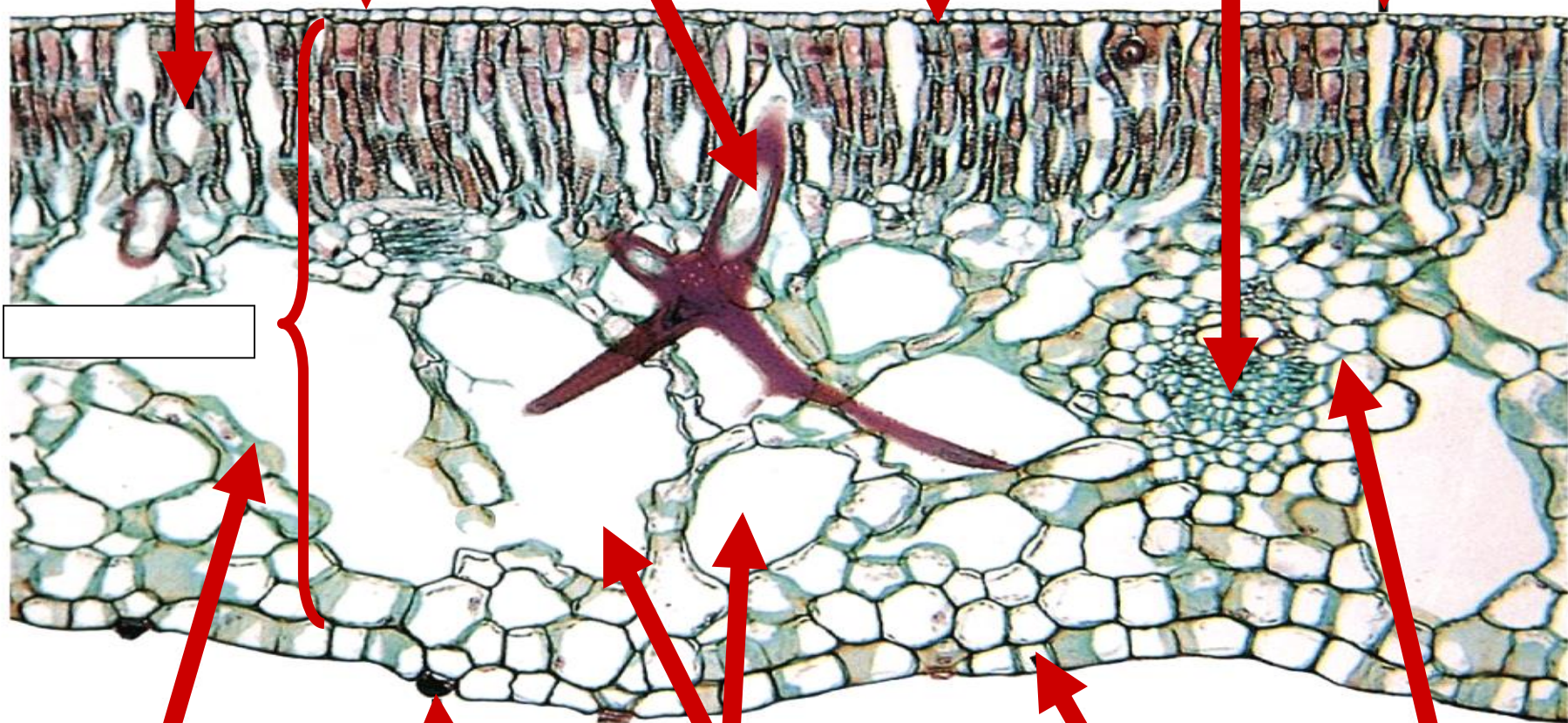




CUTICLE
ABSENT

ADAXIAL
STOMATES

^



[]

[]

C.S.

[]

[]

[]

[]

[]

[]

[]

[]



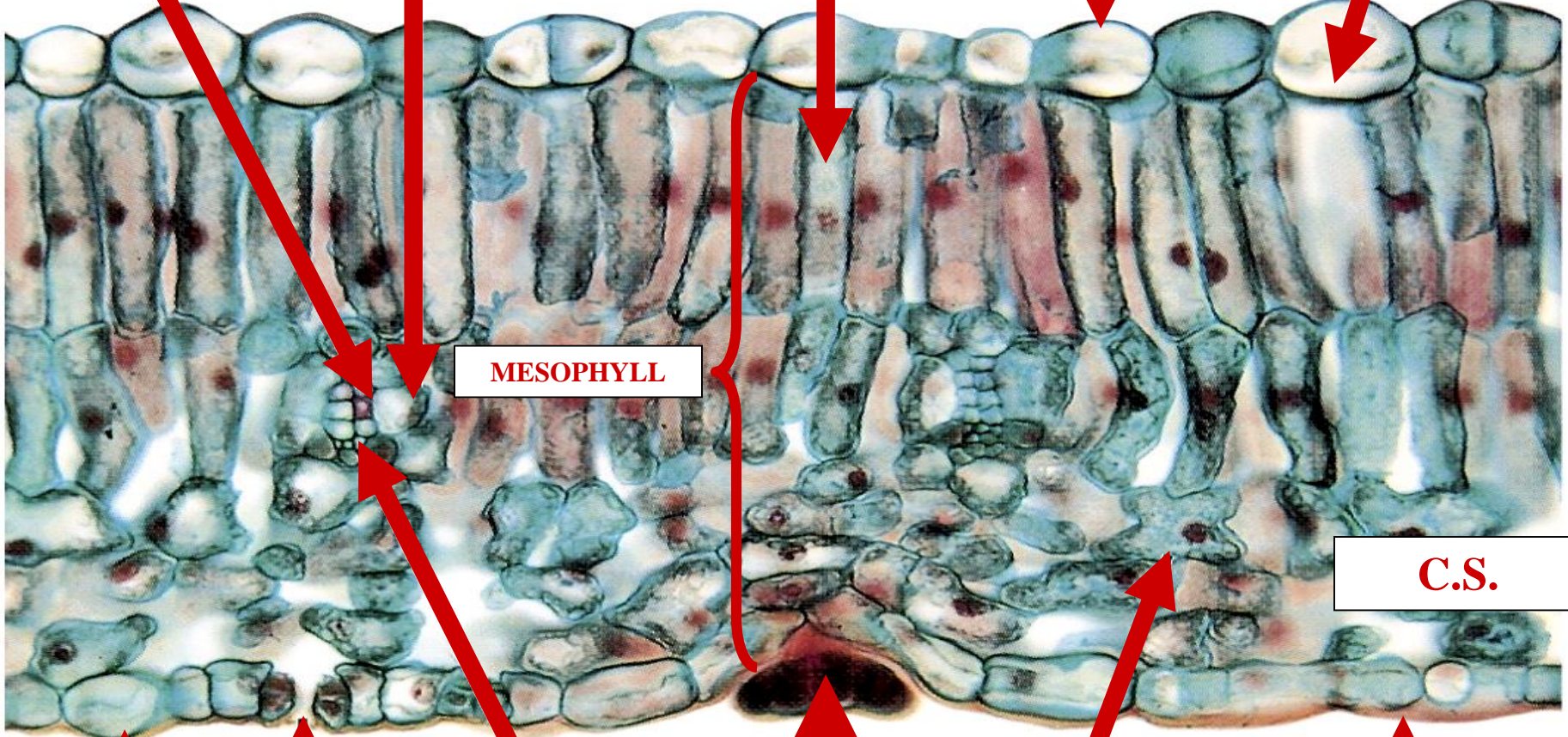
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYLL

C.S.

PHLOEM

ABAXIAL EPIDERMIS

STOMATES PRESENT

TRICHOME

SPONGY LAYER

MODERATE CUTICLE

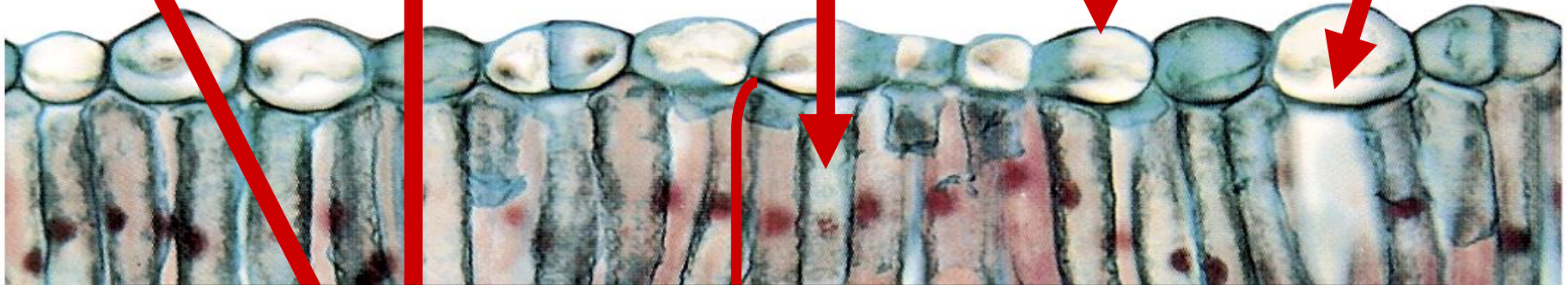
XYLEM

VASCULAR BUNDLE

PALISADE LAYER

MODERATE CUTICLE

STOMATES ABSENT



MESOPHYTE

C.S.



ABAXIAL EPIDERMIS

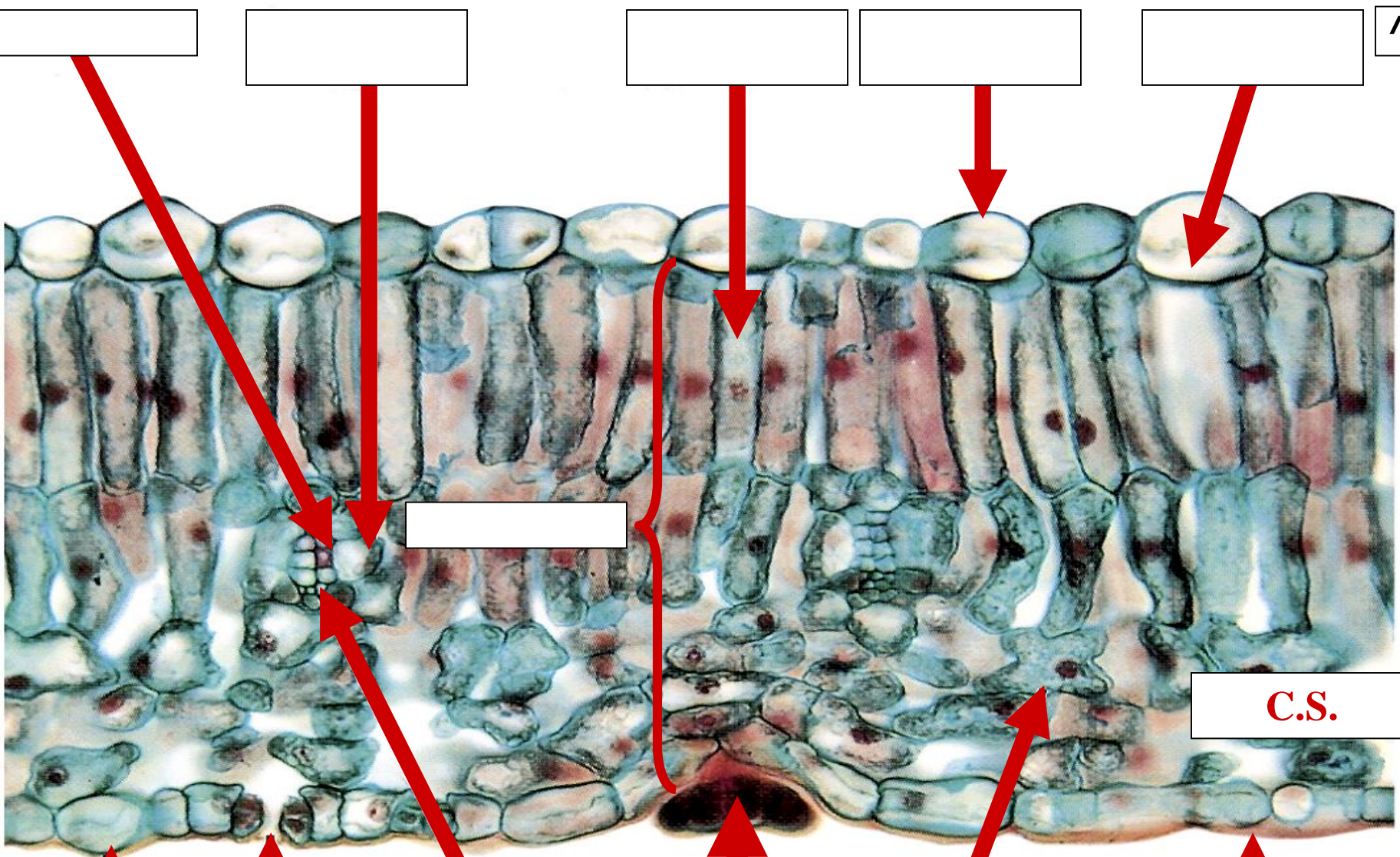
STOMATES PRESENT

PHLOEM

TRICHOME

SPONGY LAYER

MODERATE CUTICLE



[]

[]

[]

[]

[]

[]

C.S.

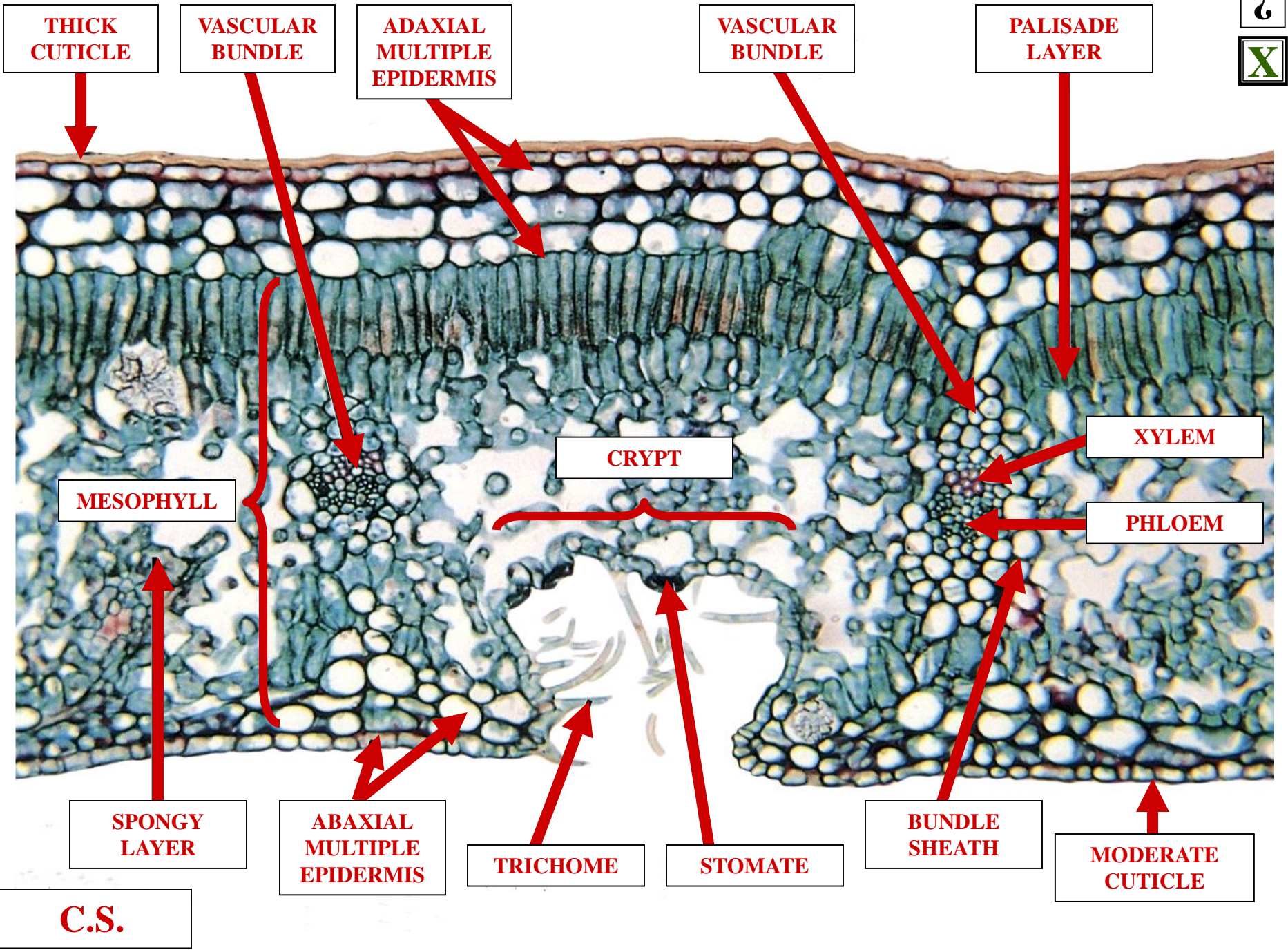
[]

ABAXIAL STOMATES

[]

[]

MODERATE CUTICLE



THICK CUTICLE

VASCULAR BUNDLE

ADAXIAL MULTIPLE EPIDERMIS

VASCULAR BUNDLE

PALISADE LAYER

XYLEM

PHLOEM

CRYPT

MESOPHYLL

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

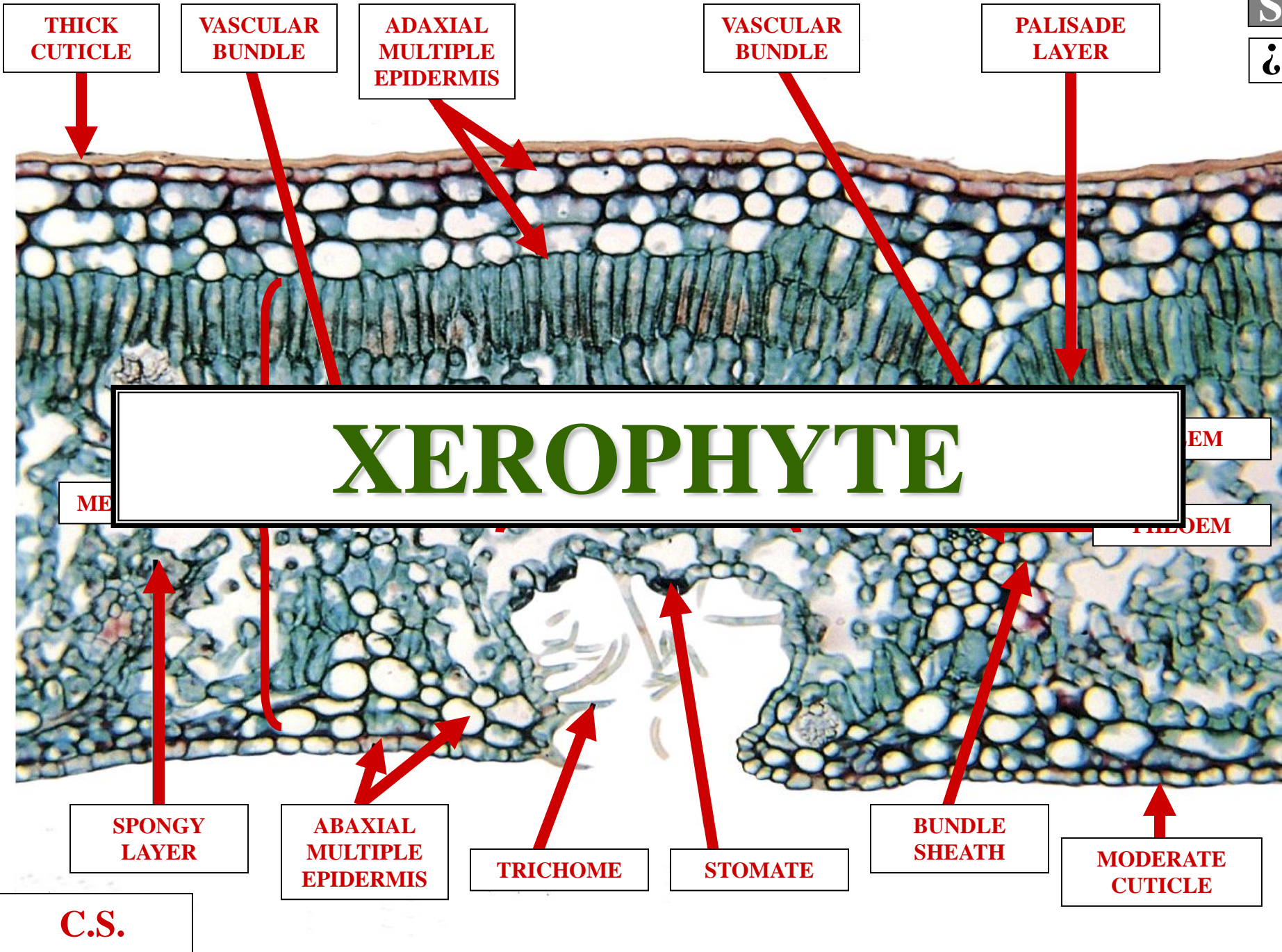
TRICHOME

STOMATE

BUNDLE SHEATH

MODERATE CUTICLE

C.S.



THICK CUTICLE

VASCULAR BUNDLE

ADAXIAL MULTIPLE EPIDERMIS

VASCULAR BUNDLE

PALISADE LAYER

XEROPHYTE

ME

EM

PHLOEM

SPONGY LAYER

ABAXIAL MULTIPLE EPIDERMIS

TRICHOME

STOMATE

BUNDLE SHEATH

MODERATE CUTICLE

C.S.



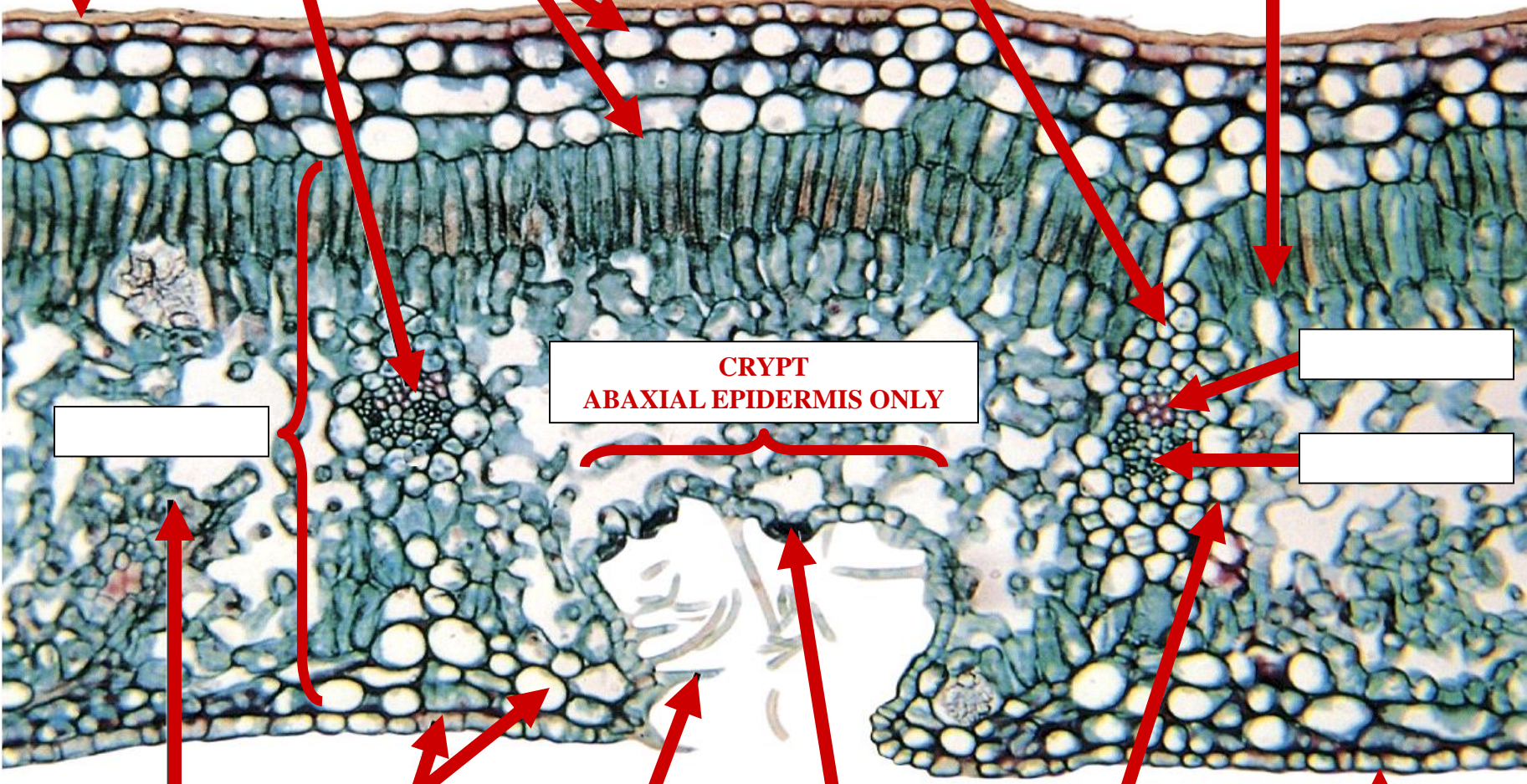
THICK CUTICLE

[]

ADAXIAL MULTIPLE EPIDERMIS

[]

[]



[]

CRYPT ABAXIAL EPIDERMIS ONLY

[]

[]

[]

ABAXIAL MULTIPLE EPIDERMIS

[]

STOMATE

[]

[]

C.S.



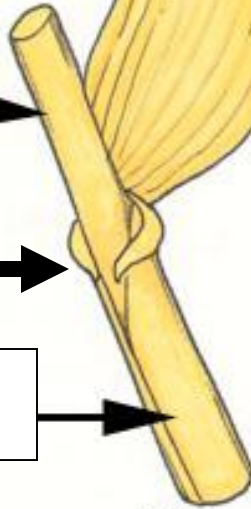
MONOCOT LEAF MORPHOLOGY



ZEA



STEM

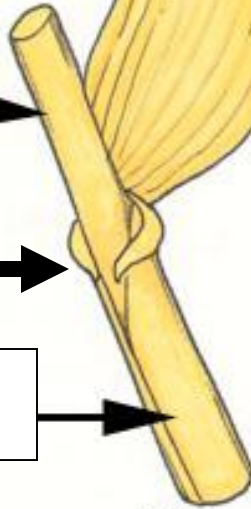


ZEA

LEAF



STEM



?

ZEA

LEAF

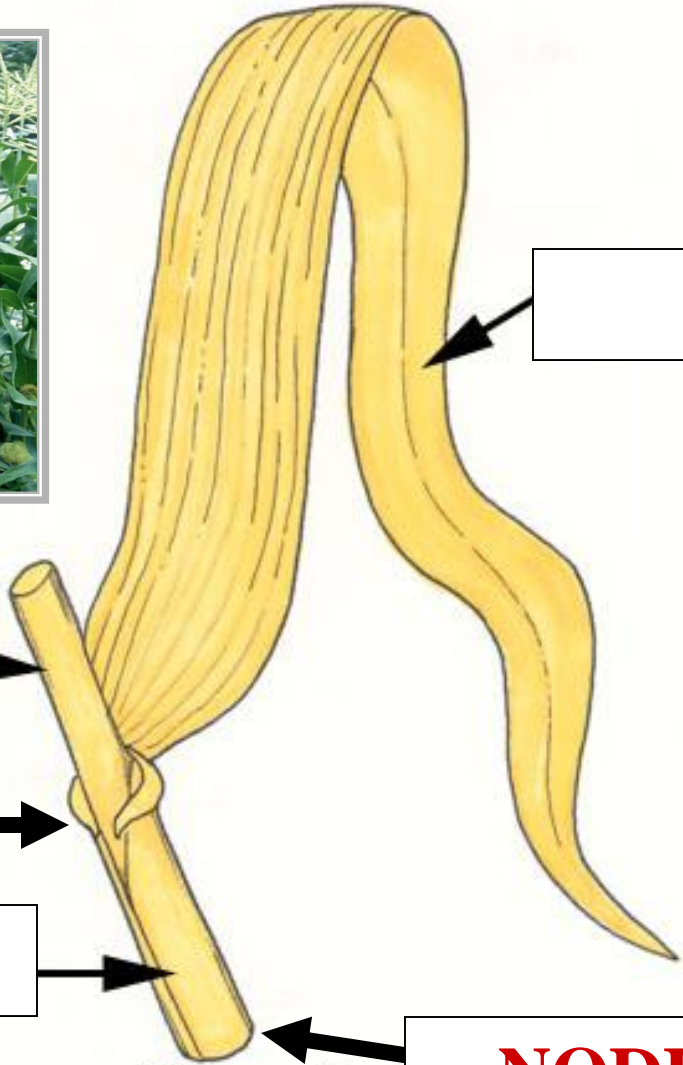


STEM

NODE

ZEA

LEAF





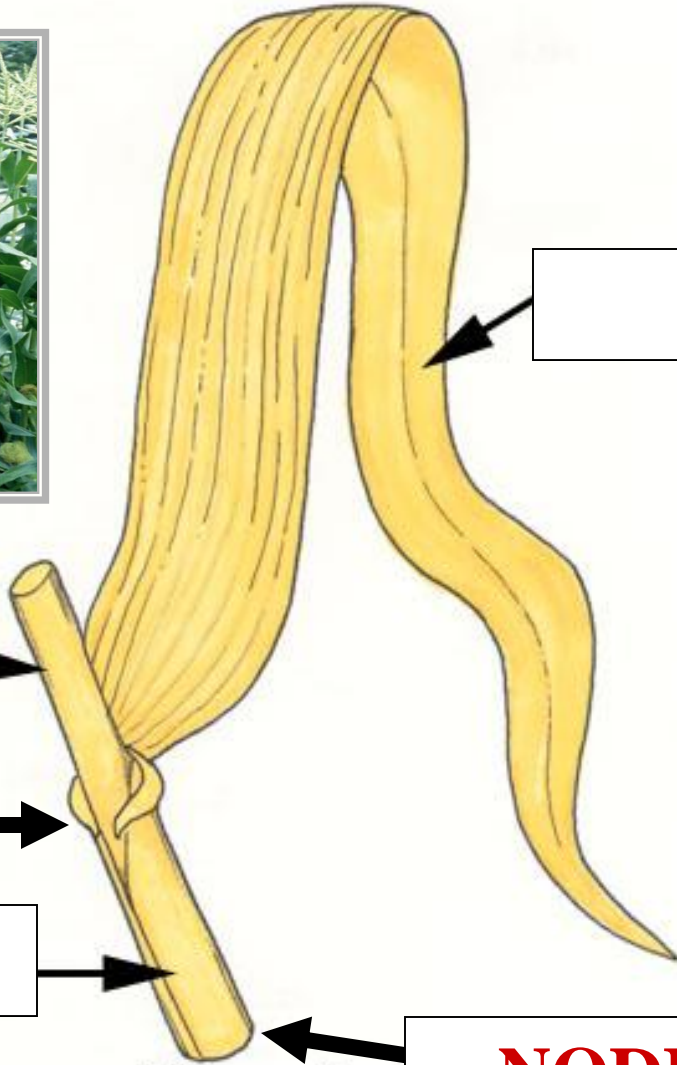
STEM

SHEATH

NODE

ZEA

LEAF



SHEATH



MONOCOT LEAF MORPHOLOGY SHEATH

ENCIRCLES STEM

MONOCOT LEAF MORPHOLOGY SHEATH



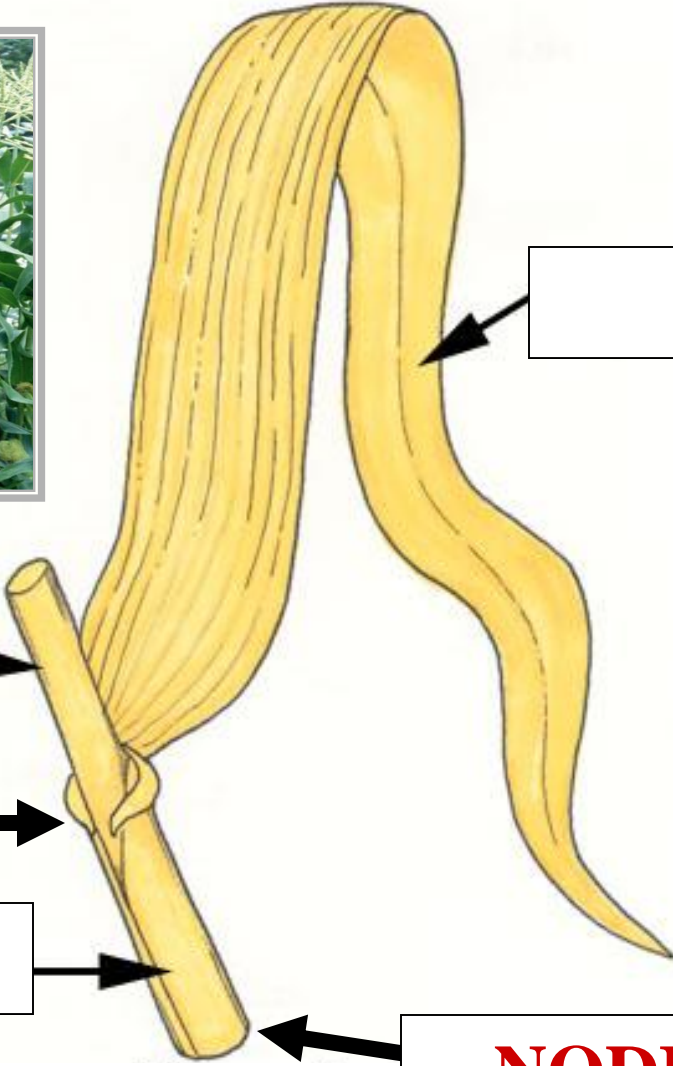
STEM

SHEATH

NODE

ZEA

LEAF





STEM

LIGULE

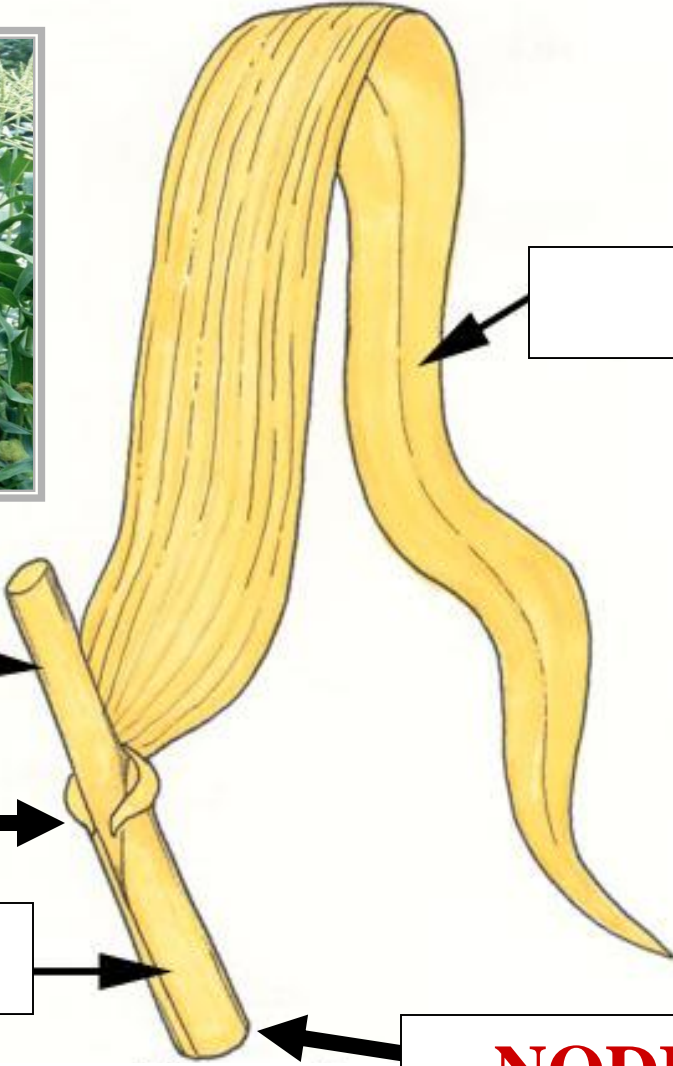
SHEATH

NODE

[Empty box]

ZEA

LEAF



LIGULE



**MONOCOT LEAF
MORPHOLOGY
LIGULE**

**JUNCTION POINT
BETWEEN
SHEATH AND LAMINA**

**MONOCOT LEAF
MORPHOLOGY
LIGULE**



STEM

LIGULE

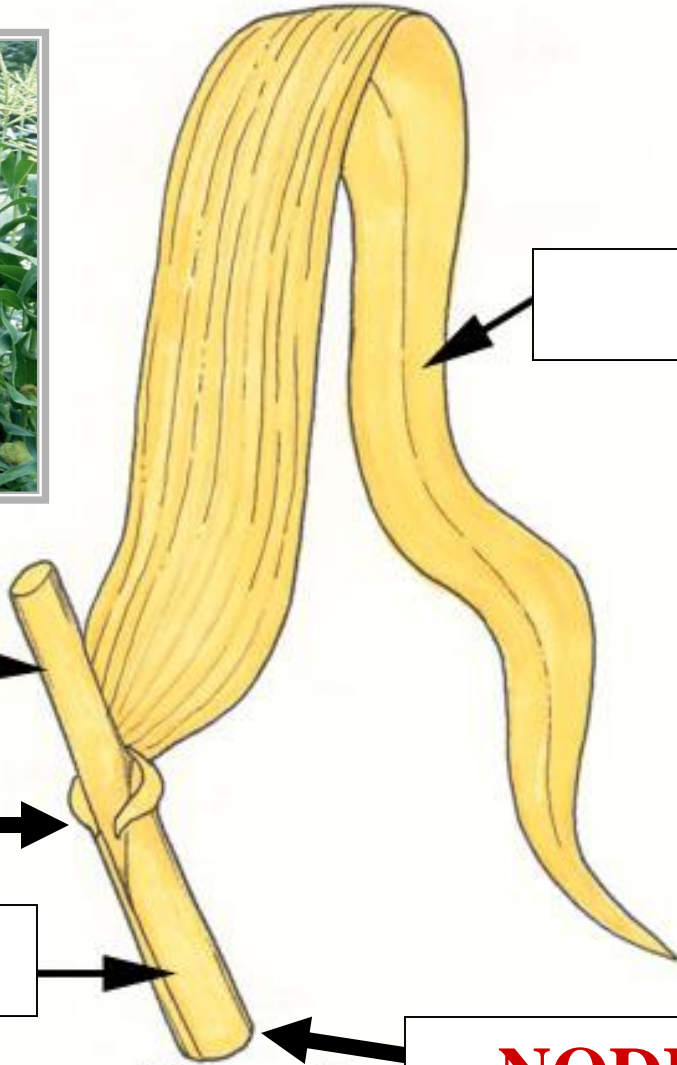
SHEATH

NODE

[Empty box]

ZEA

LEAF





STEM

LIGULE

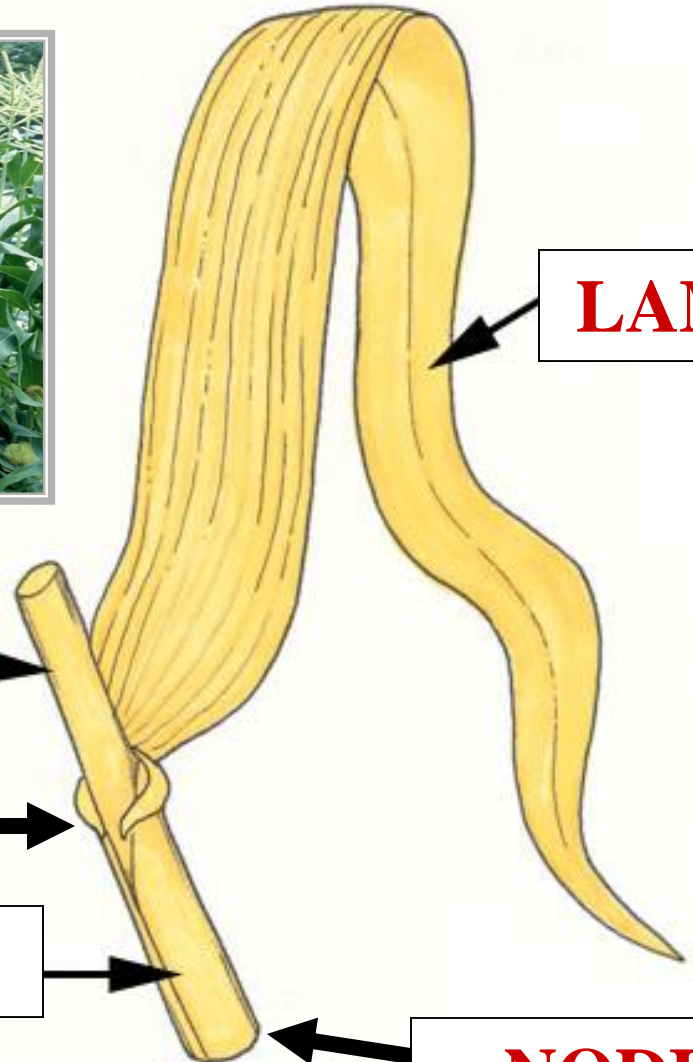
SHEATH

NODE

LAMINA

ZEA

LEAF





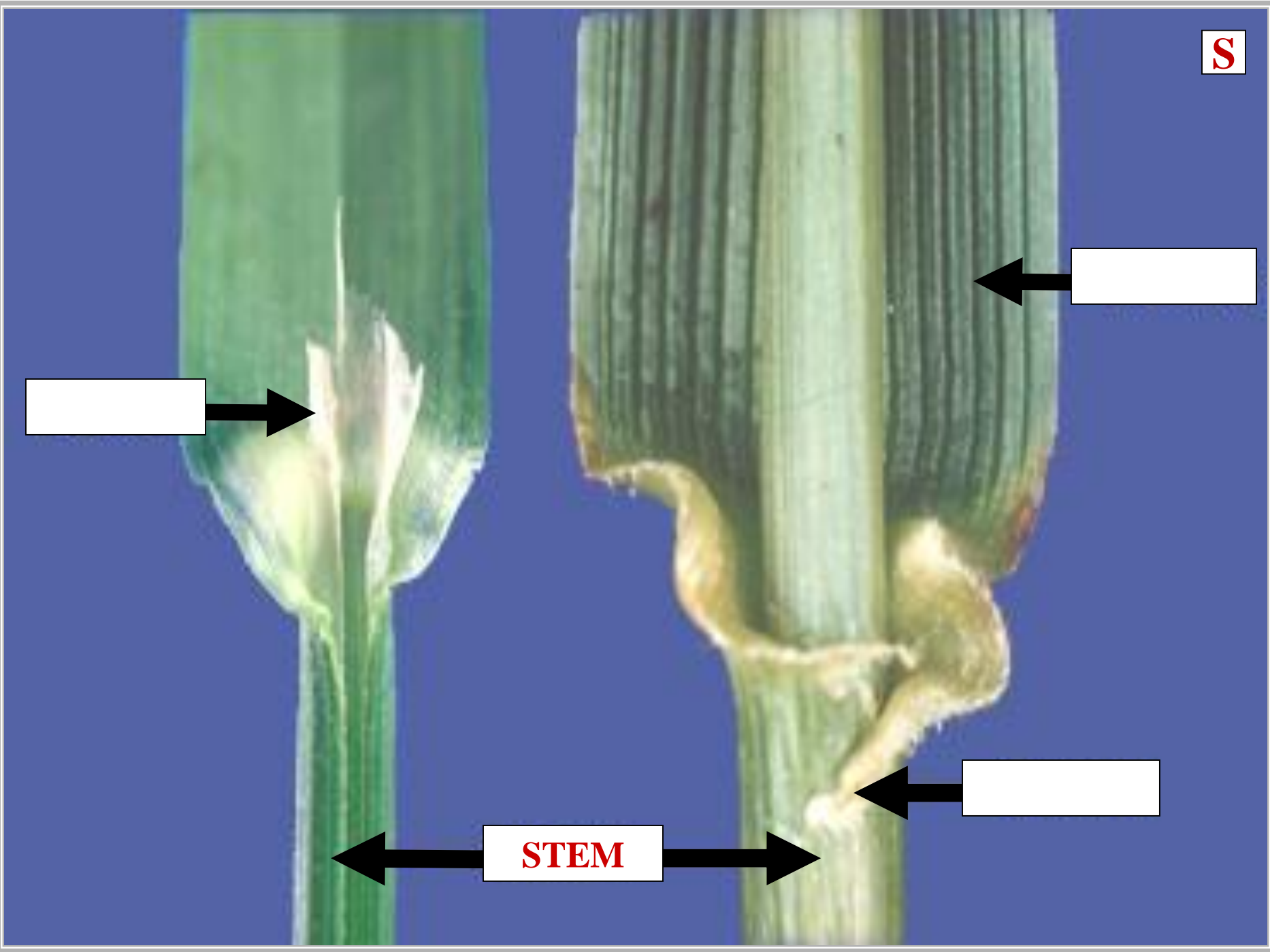
MONOCOT LEAF MORPHOLOGY

SUMMARY

S



STEM



L



SHEATH



STEM



L

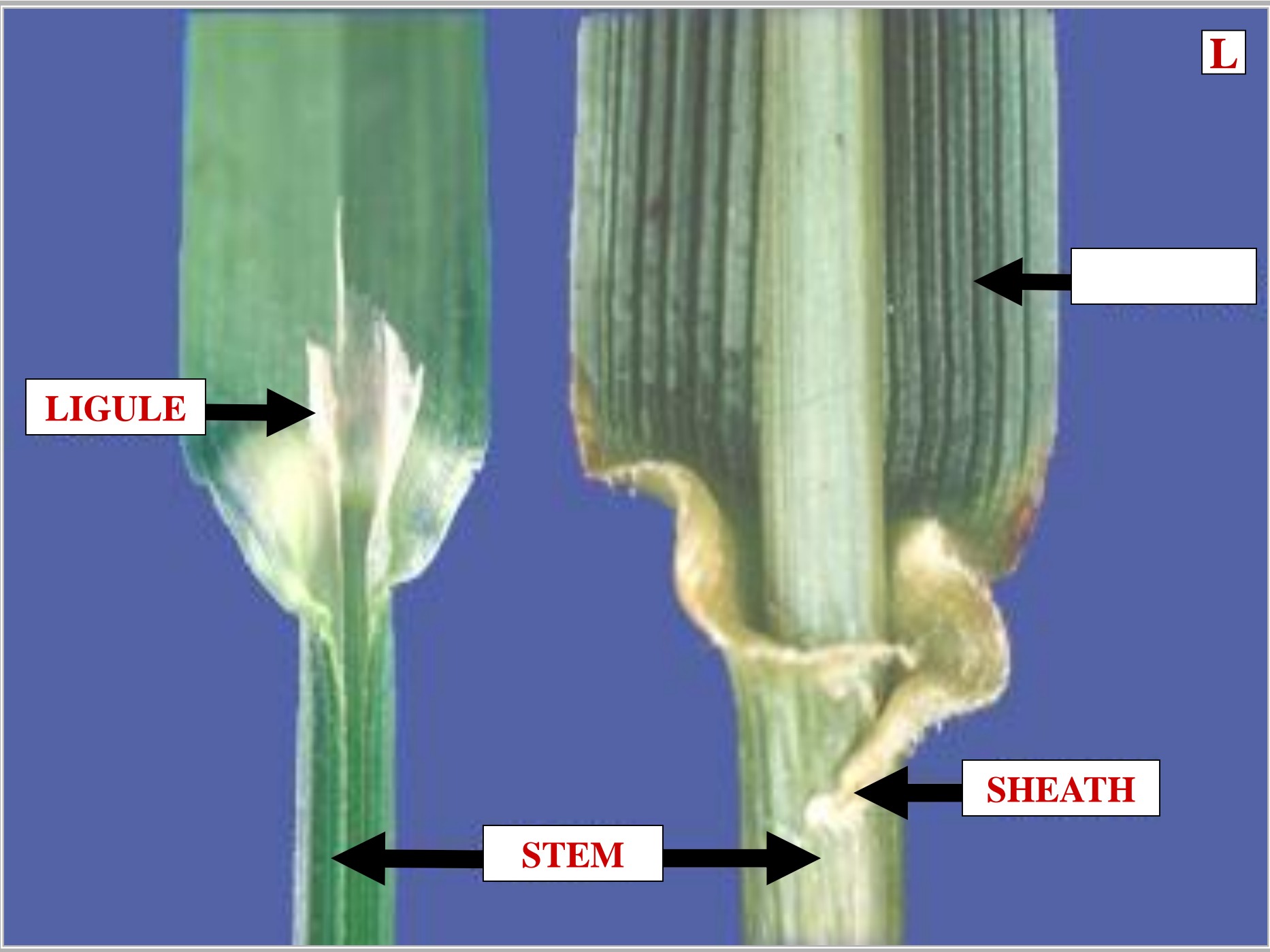
LIGULE



SHEATH



STEM





LIGULE



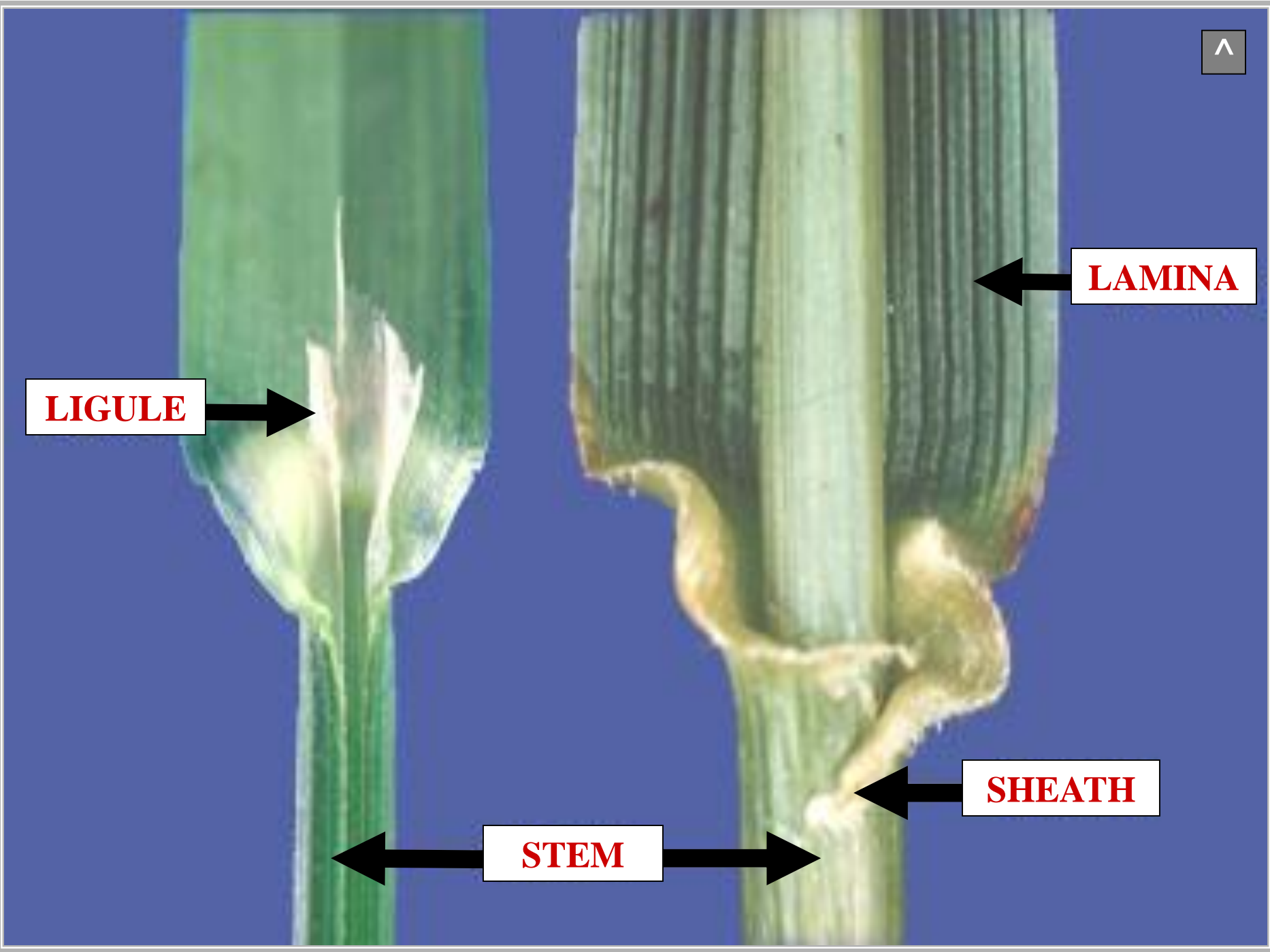
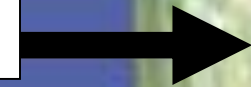
LAMINA



SHEATH



STEM



MONOCOT LEAF VENATION

PARALLEL VENATION

MONOCOT LEAF PARALLEL VENATION



**MAJORS VEINS NOT NETTED
MAJOR VEINS PARALLEL**

**MONOCOT LEAF
PARALLEL VENATION**



P

RETICULATE VENATION

DICOT LEAF VENATION



PARALLEL VENATION

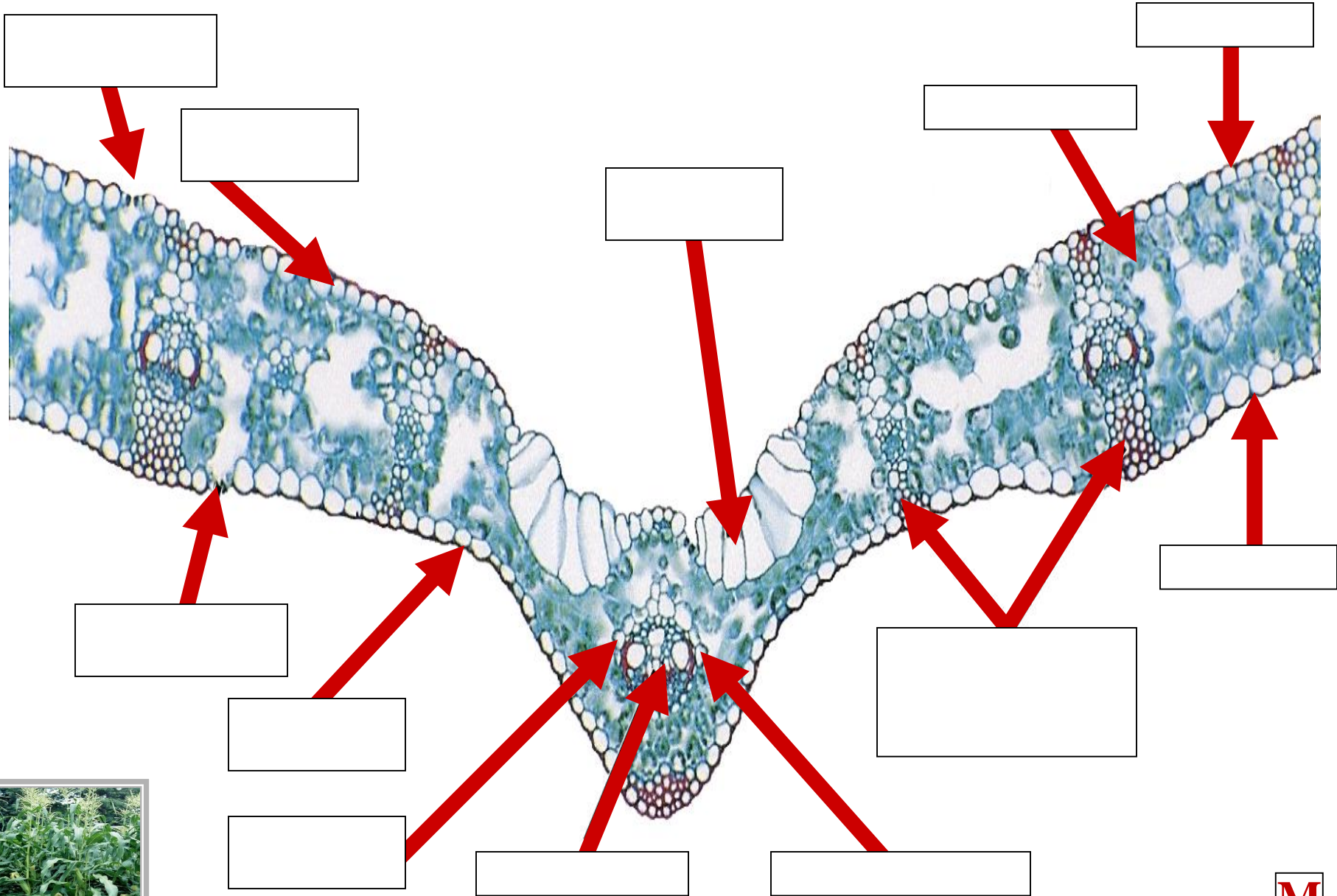
MONOCOT LEAF VENATION



MONOCOT LEAF ANATOMY



ZEA



ZEA

C.S.

M

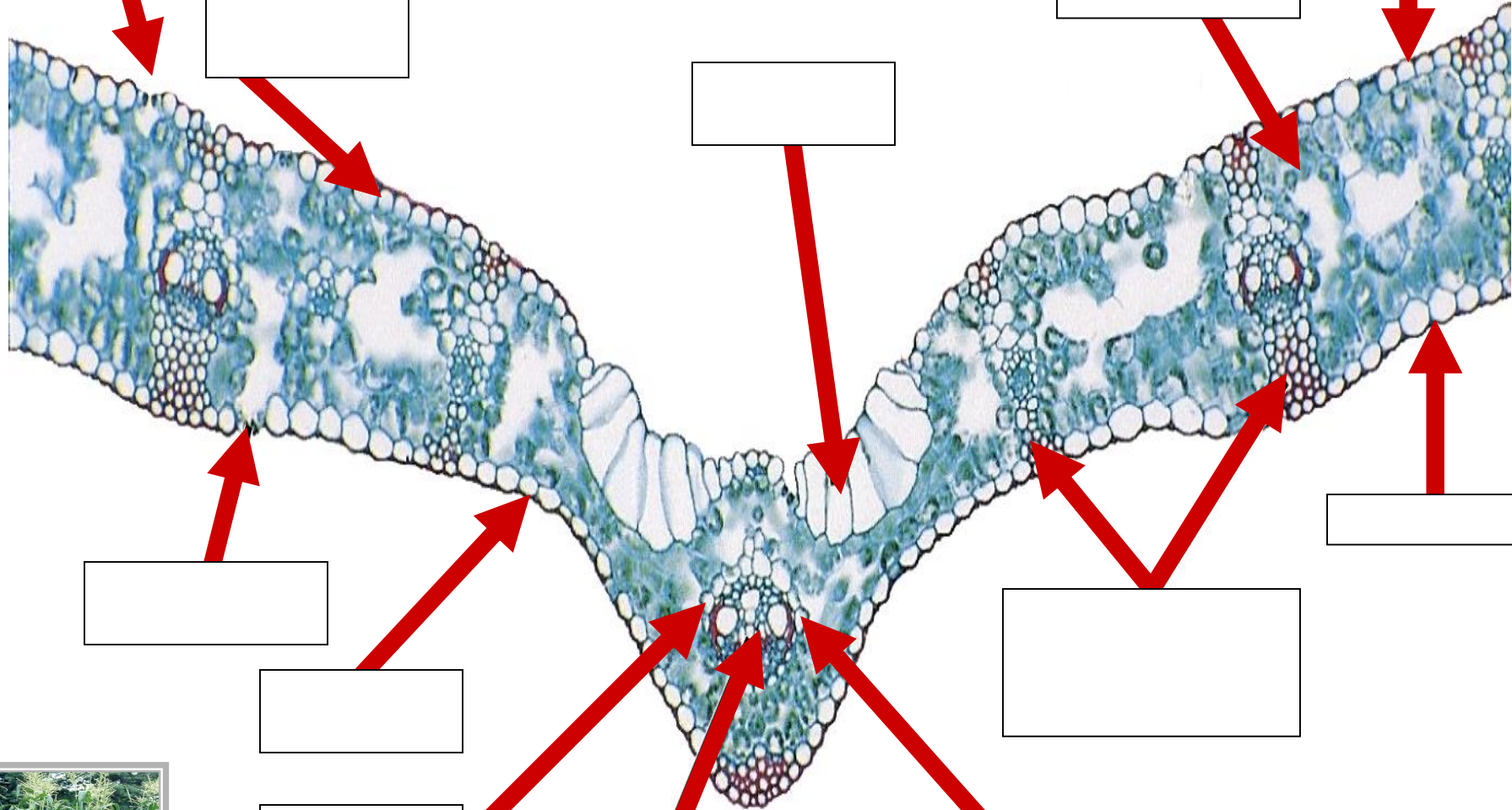
[]

MODERATE CUTICLE

[]

[]

[]



[]

[]

[]

[]

[]

[]

[]



ZEA

A

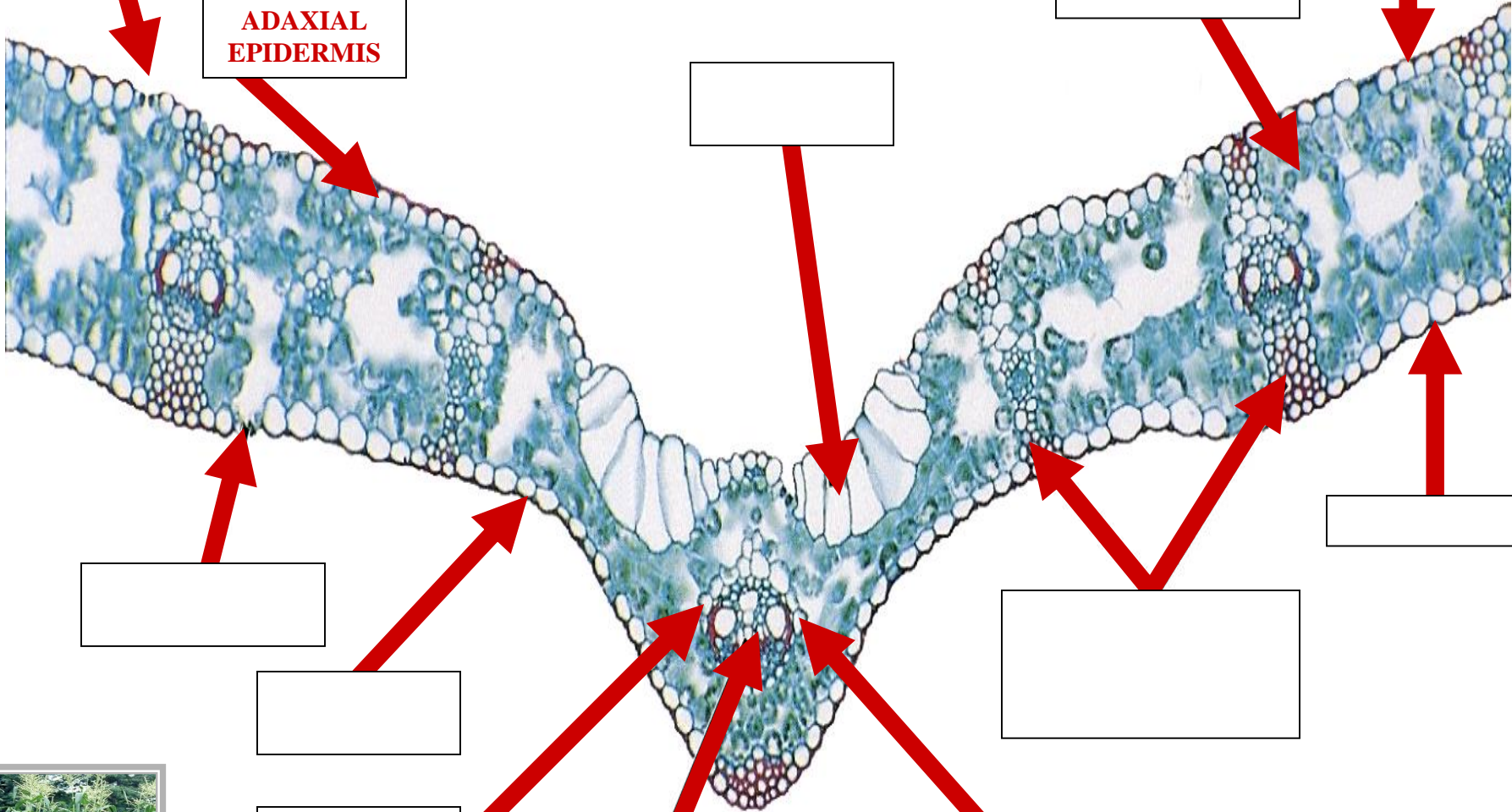
C.S.

[]

MODERATE CUTICLE

ADAXIAL EPIDERMIS

[]



[]

[]

[]



[]

[]

[]

[]

[]

ZEA

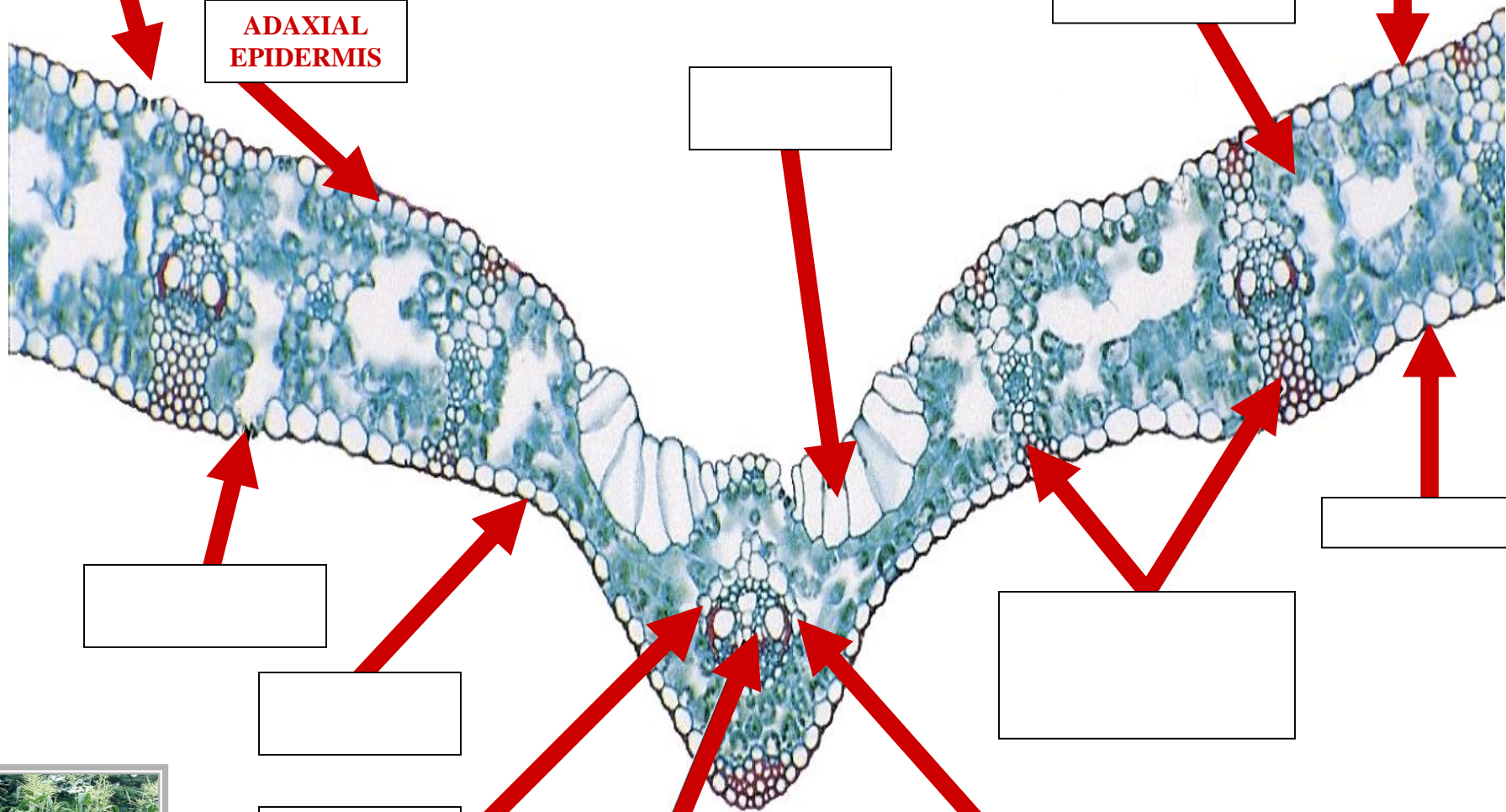
S

C.S.

**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**MODERATE
CUTICLE**



ZEA

C.S.

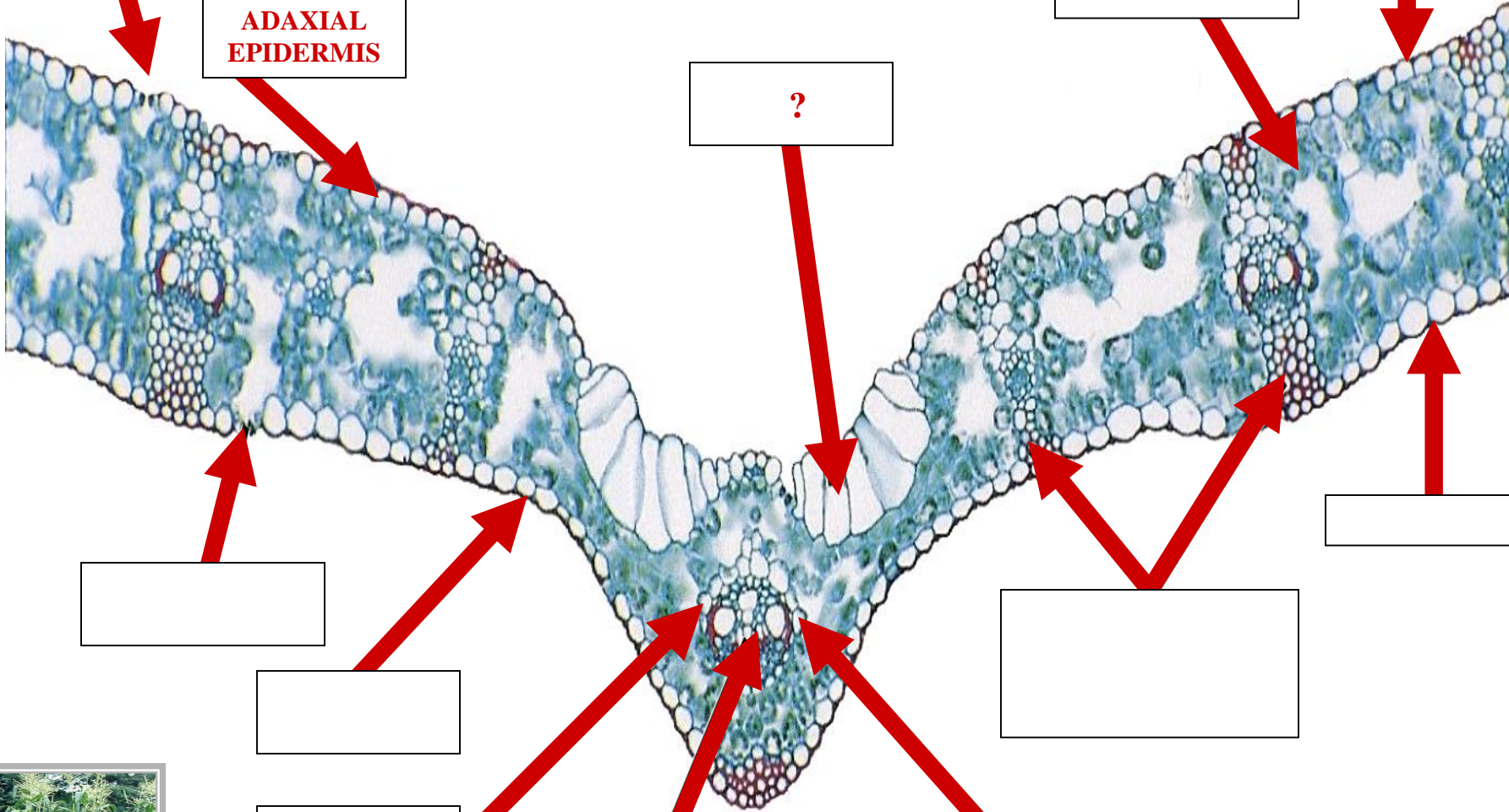
?

**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**MODERATE
CUTICLE**

?



ZEA

C.S.

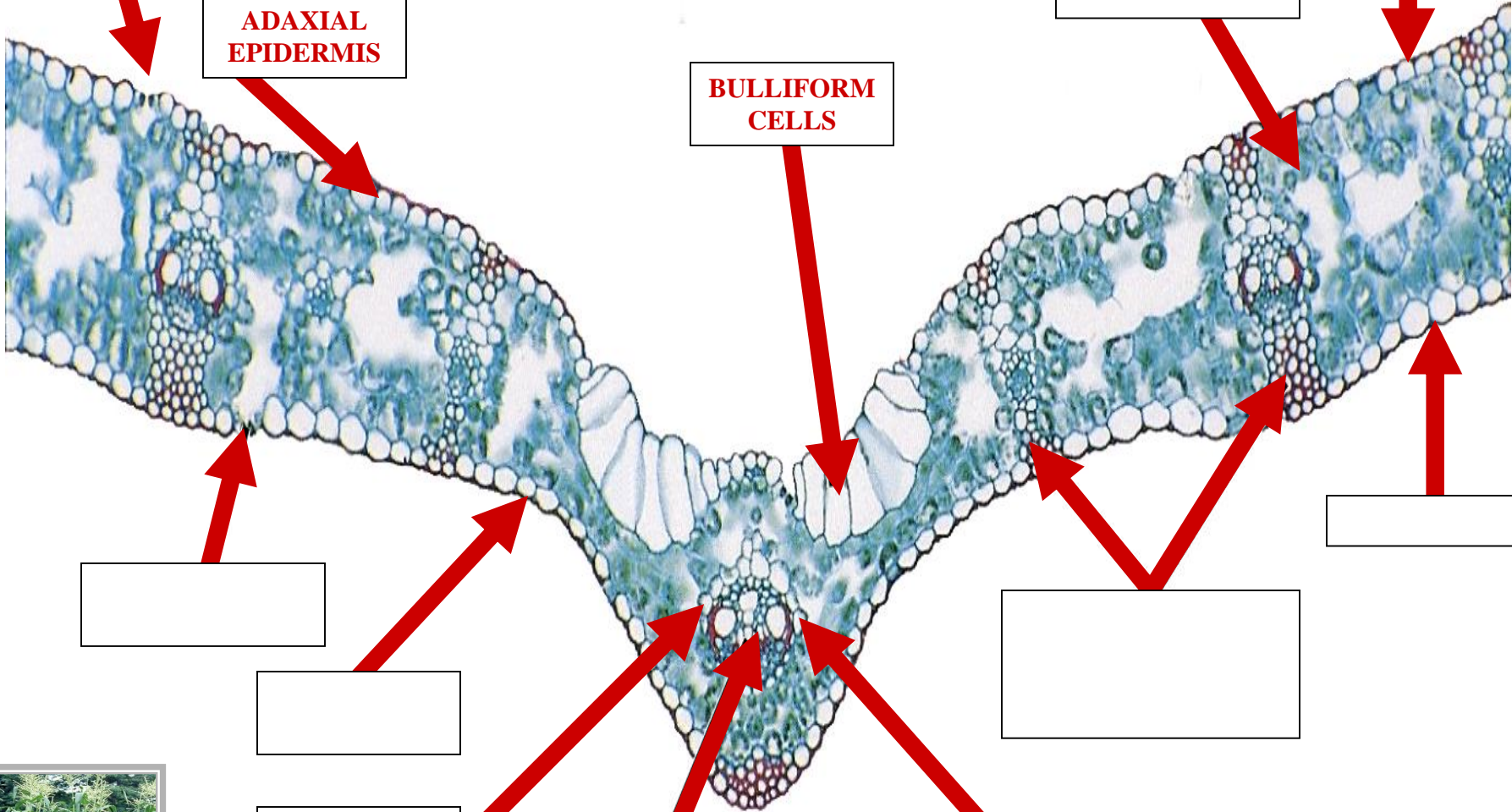
B

**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**MODERATE
CUTICLE**

**BULLIFORM
CELLS**



[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]



ZEA

B

C.S.

BULLIFORM CELLS

MONOCOT LEAF ANATOMY

BULLIFORM CELLS



EPIDERMIS CELLS

MONOCOT LEAF ANATOMY

BULLIFORM CELLS

MONOCOT LEAF ANATOMY

BULLIFORM CELLS

EPIDERMIS CELLS

CONTRACT WITH WATER LOSS

MONOCOT LEAF ANATOMY

BULLIFORM CELLS

MONOCOT LEAF ANATOMY

BULLIFORM CELLS



EPIDERMIS CELLS

CONTRACT WITH WATER LOSS

REDUCE LEAF SURFACE AREA

MONOCOT LEAF ANATOMY

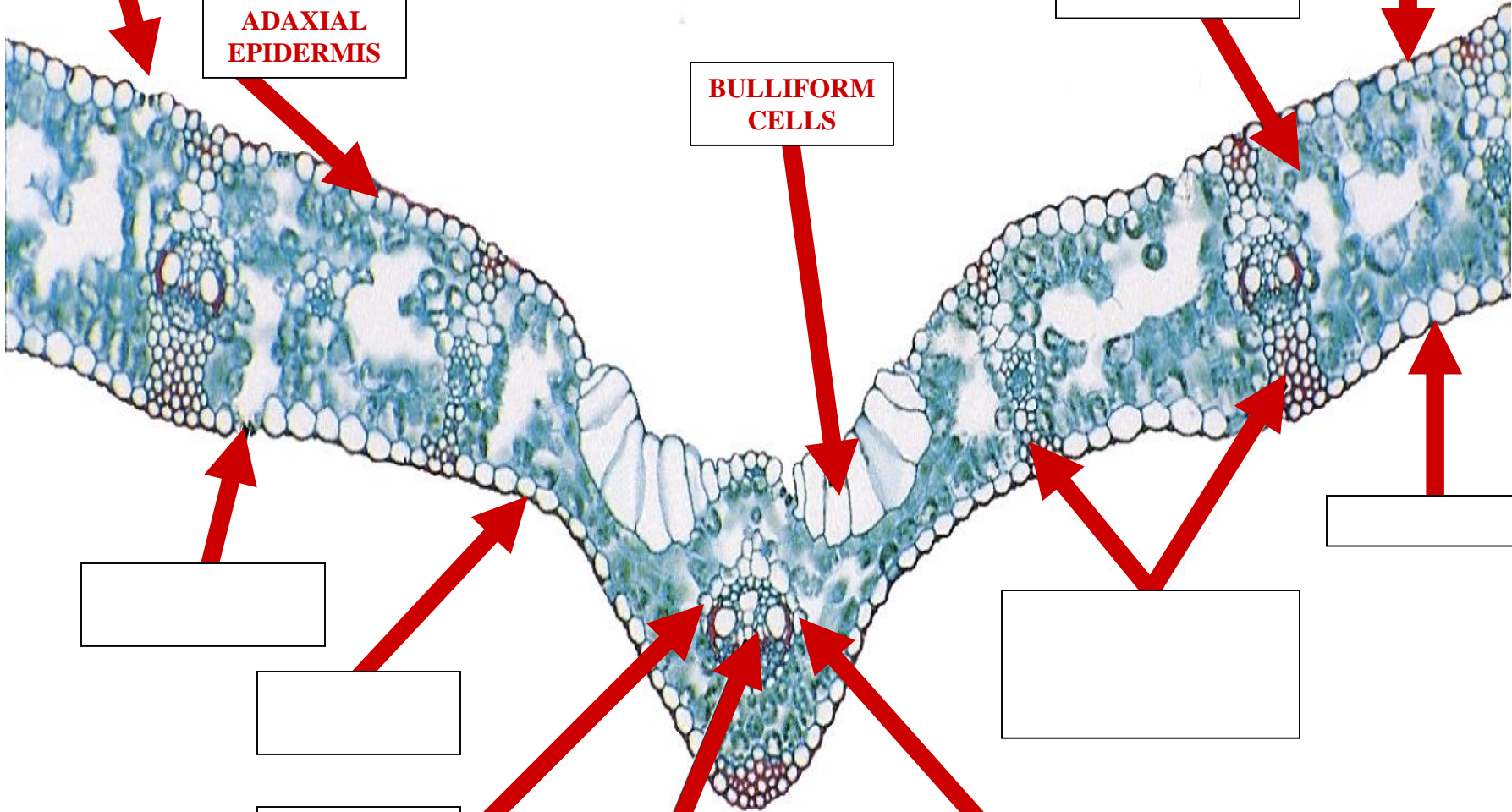
BULLIFORM CELLS

**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**MODERATE
CUTICLE**

**BULLIFORM
CELLS**



[]

[]

[]

[]

[]

[]

[]

ZEA

C.S.

M

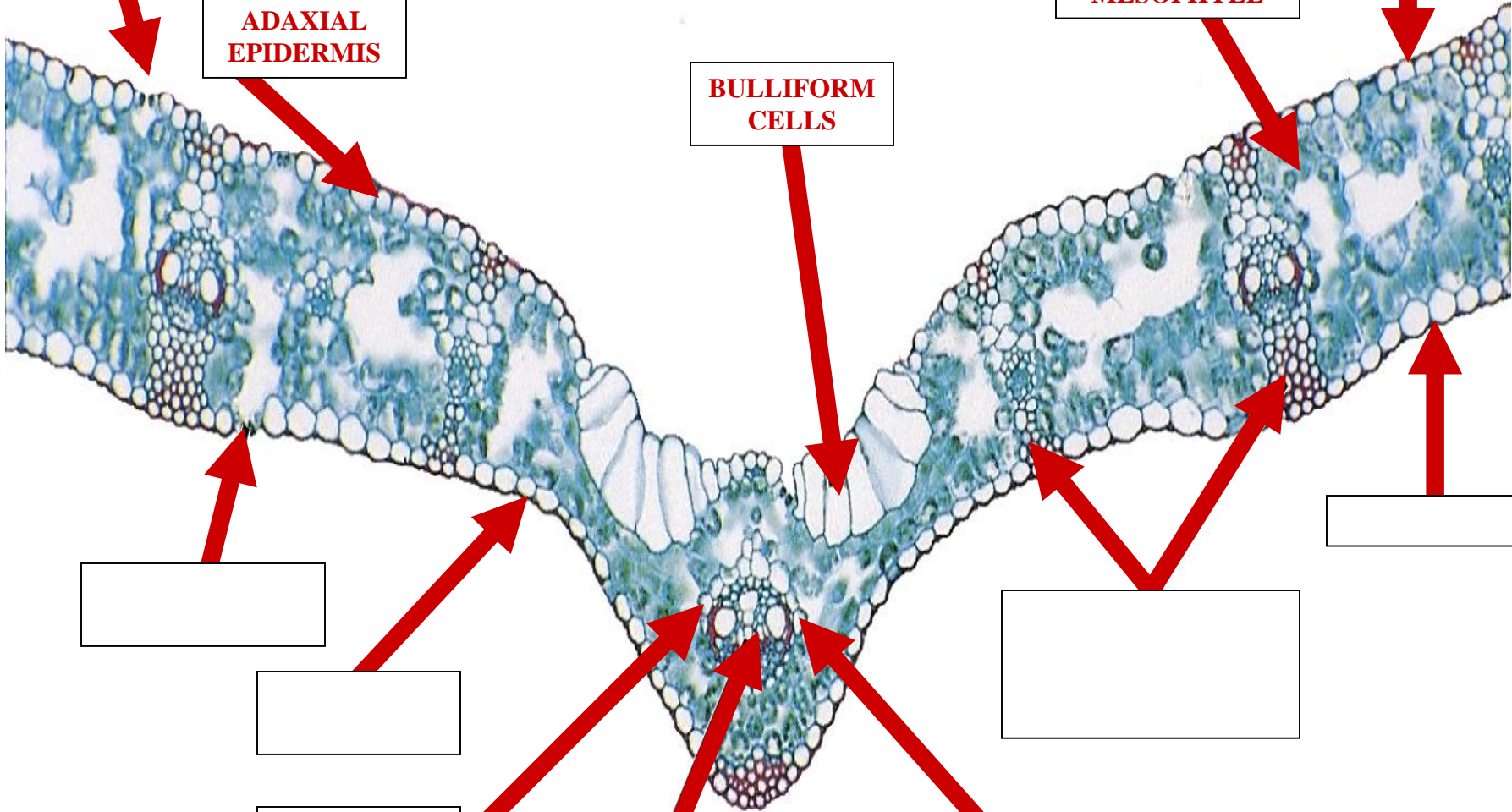
**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**BULLIFORM
CELLS**

MESOPHYLL

**MODERATE
CUTICLE**



[]

[]

[]

[]

[]

[]

[]

ZEA

P

C.S.

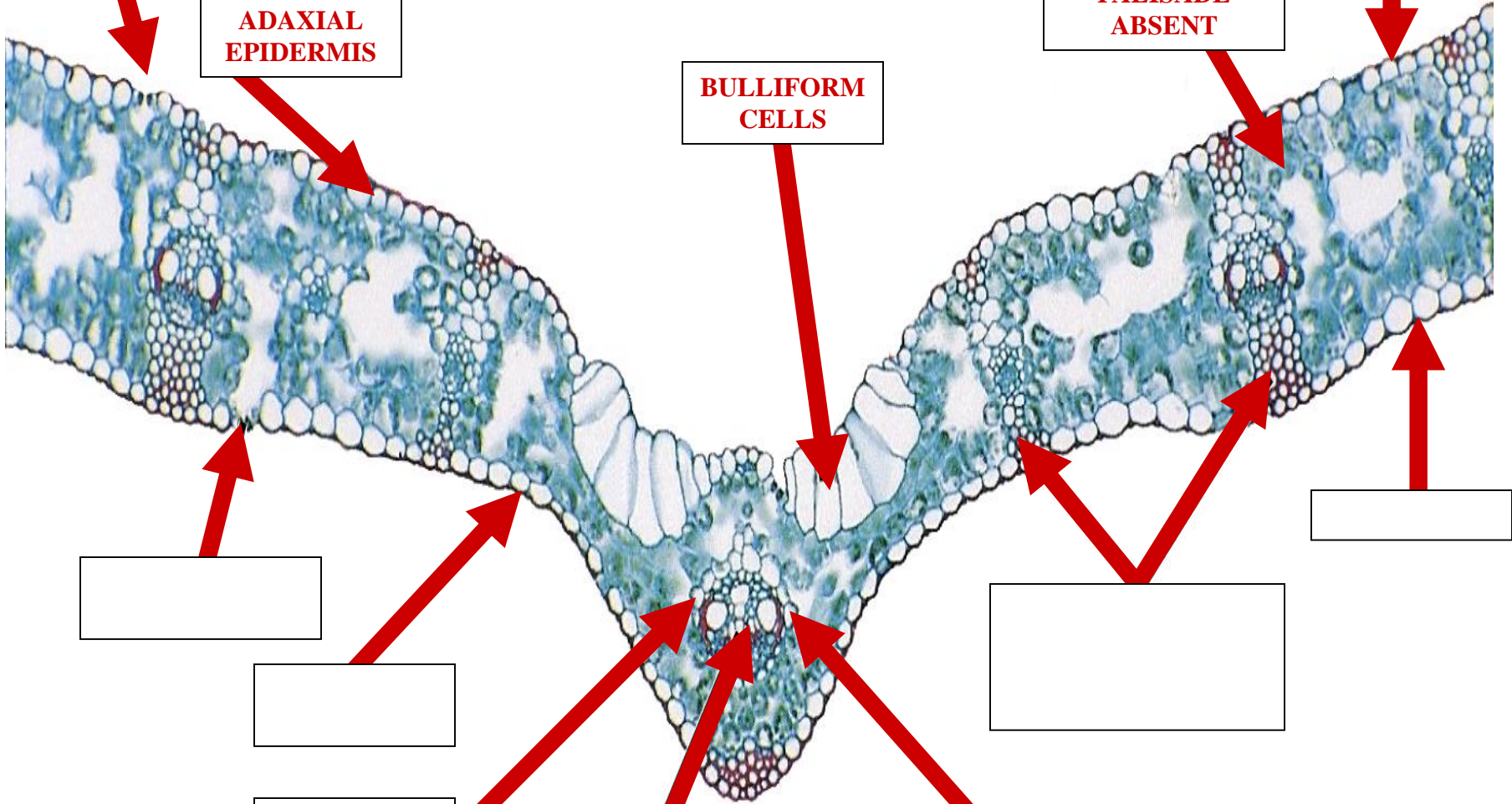
**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**BULLIFORM
CELLS**

**PALISADE
ABSENT**

**MODERATE
CUTICLE**



[]

[]

[]

[]

[]

[]

[]

ZEA

S

C.S.

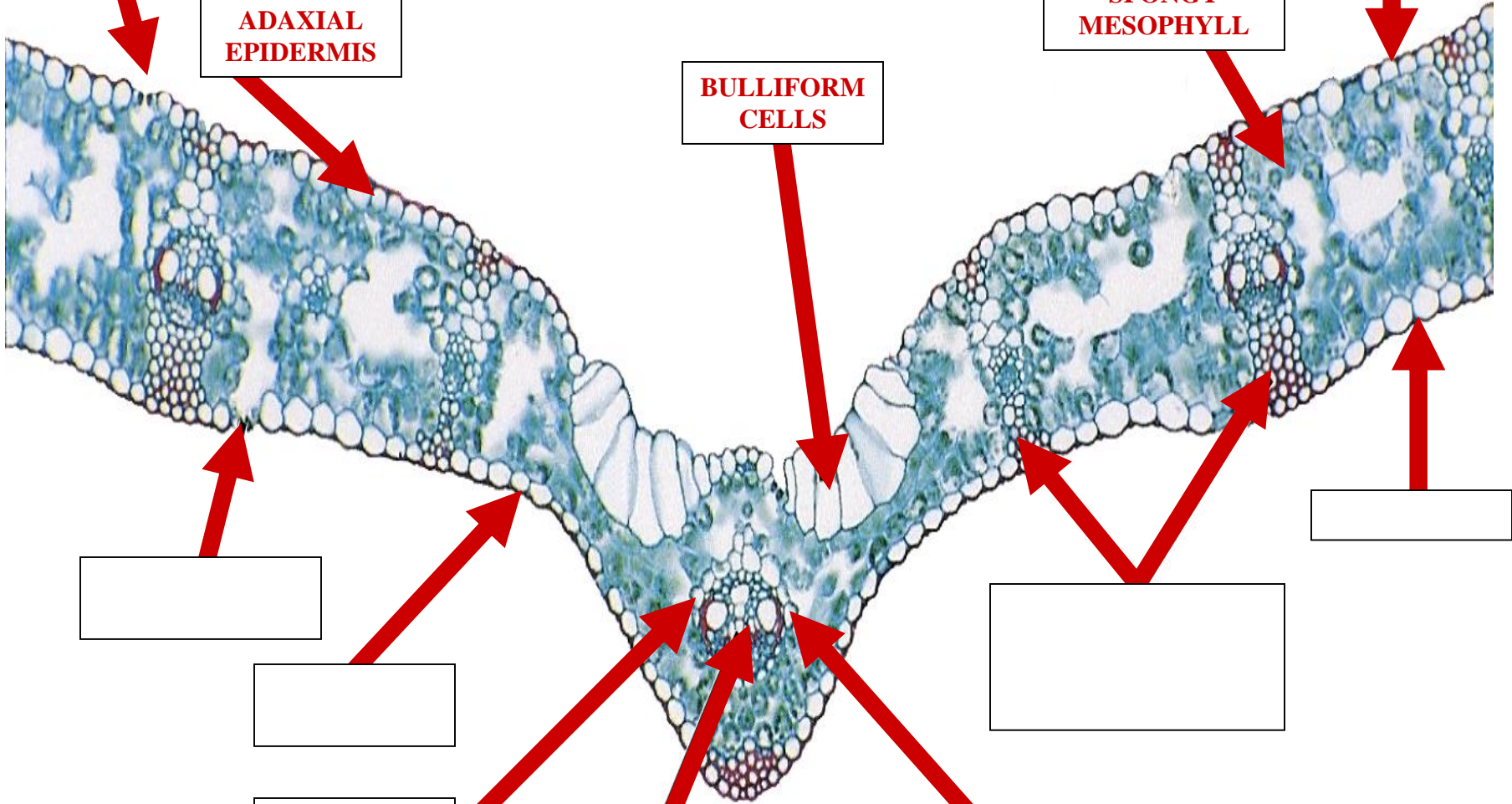
**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**BULLIFORM
CELLS**

**SPONGY
MESOPHYLL**

**MODERATE
CUTICLE**



[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

[Empty box]

ZEA

V

C.S.

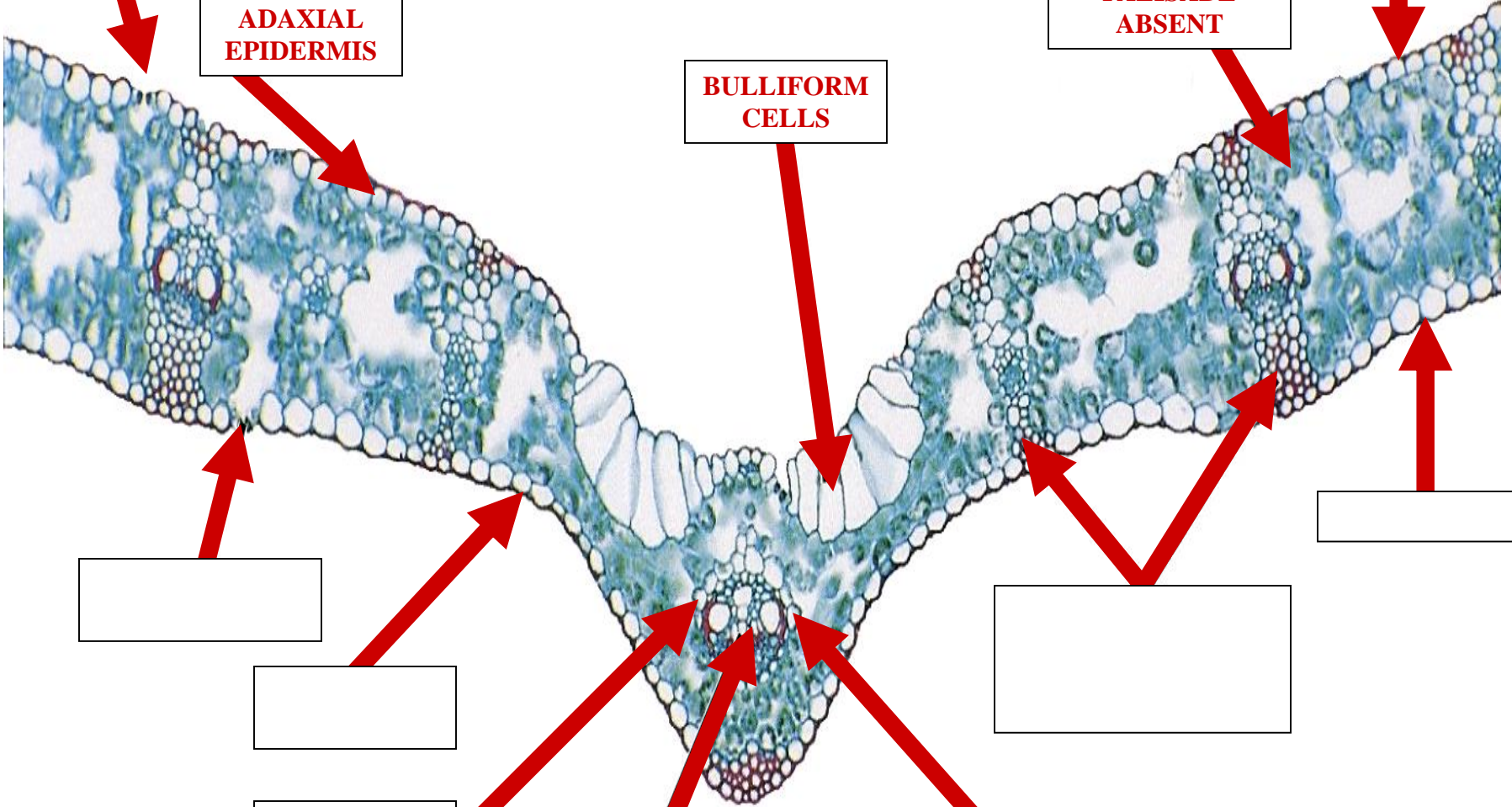
**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**BULLIFORM
CELLS**

**PALISADE
ABSENT**

**MODERATE
CUTICLE**



[Empty box]

[Empty box]

**VASCULAR
BUNDLE**

[Empty box]

[Empty box]

[Empty box]

[Empty box]

ZEA

B

C.S.

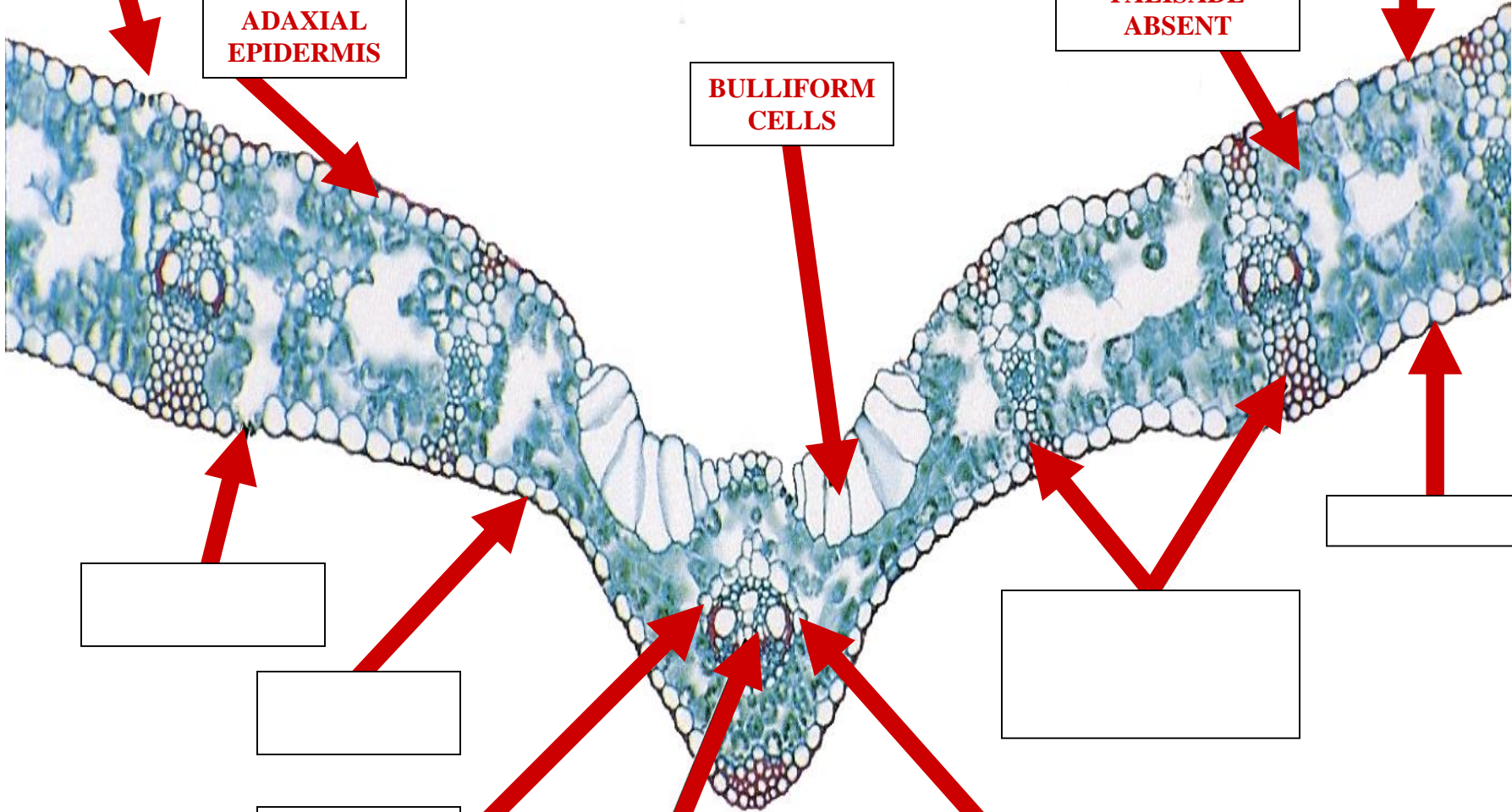
**STOMATES
PRESENT**

**ADAXIAL
EPIDERMIS**

**BULLIFORM
CELLS**

**PALISADE
ABSENT**

**MODERATE
CUTICLE**



[Empty box]

[Empty box]

[Empty box]

**VASCULAR
BUNDLE**

[Empty box]

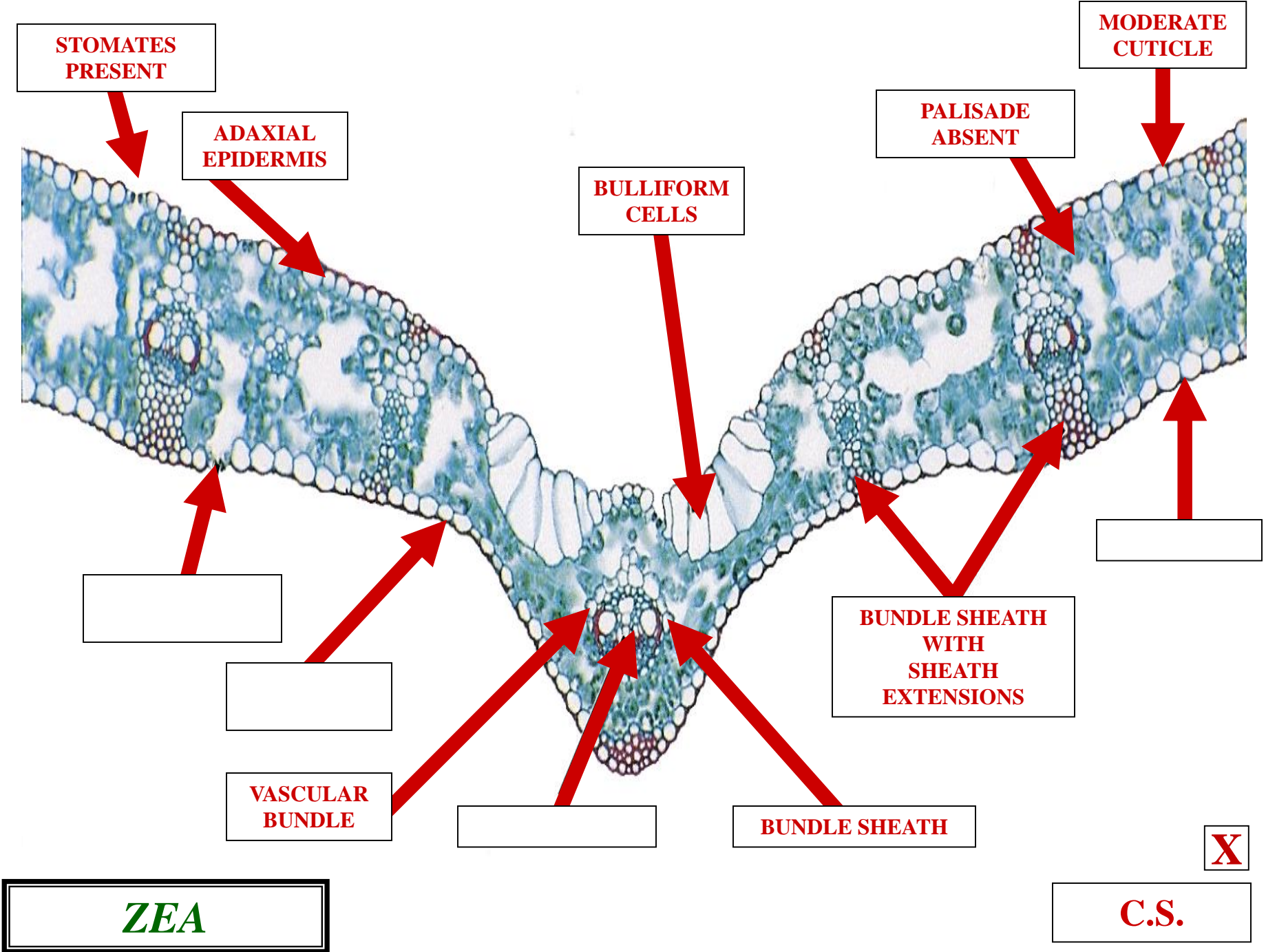
BUNDLE SHEATH

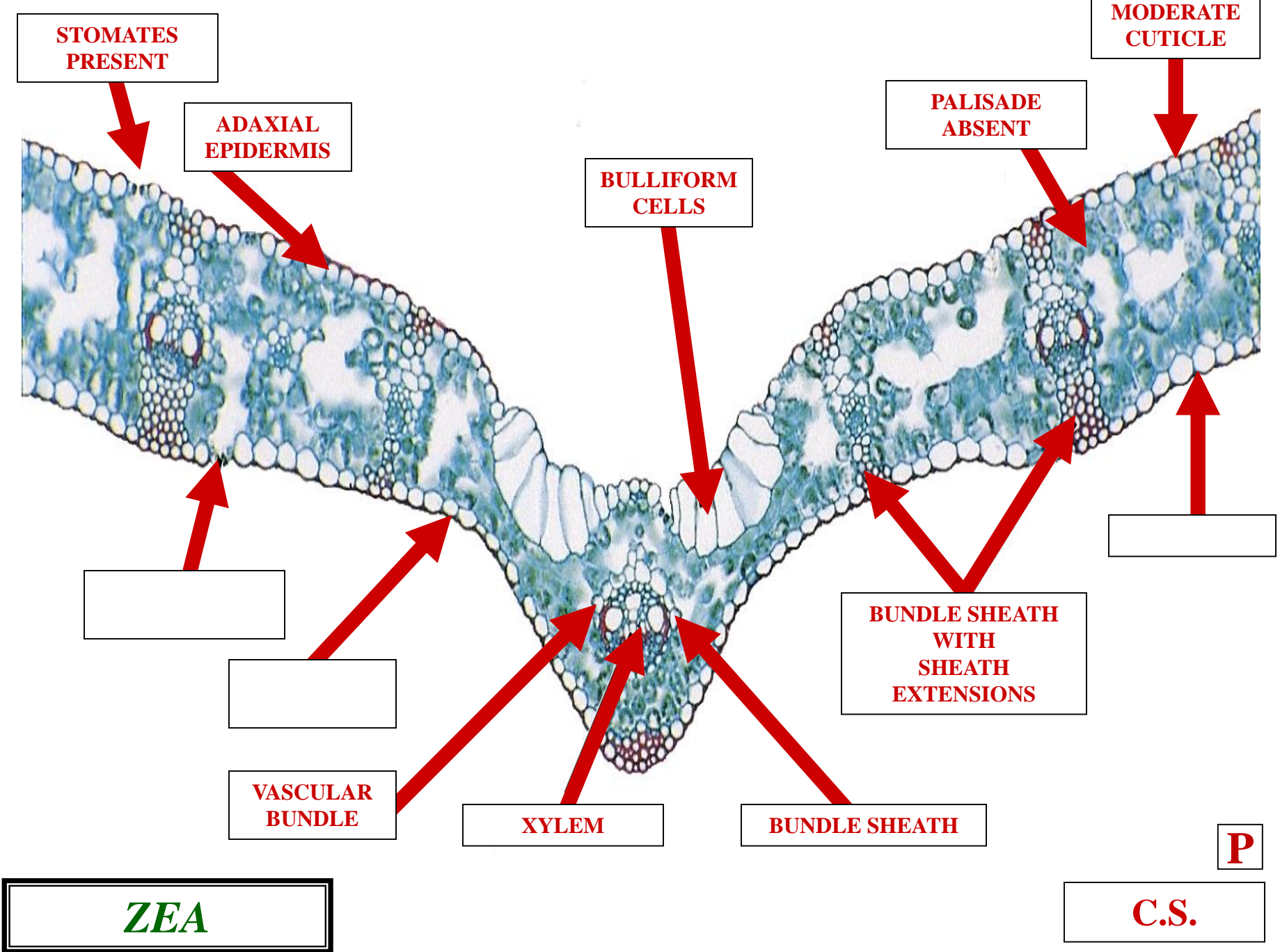
[Empty box]

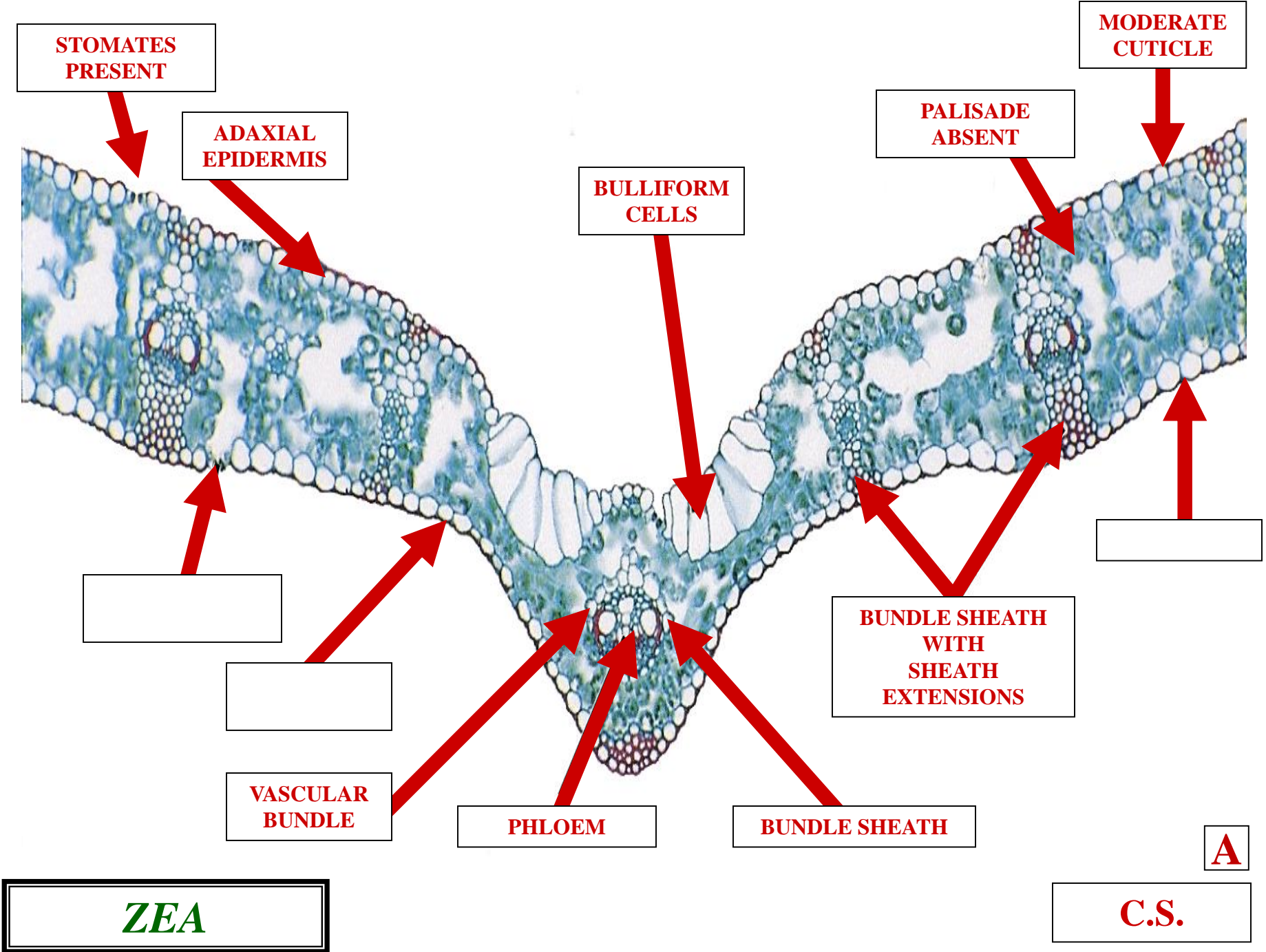
ZEA

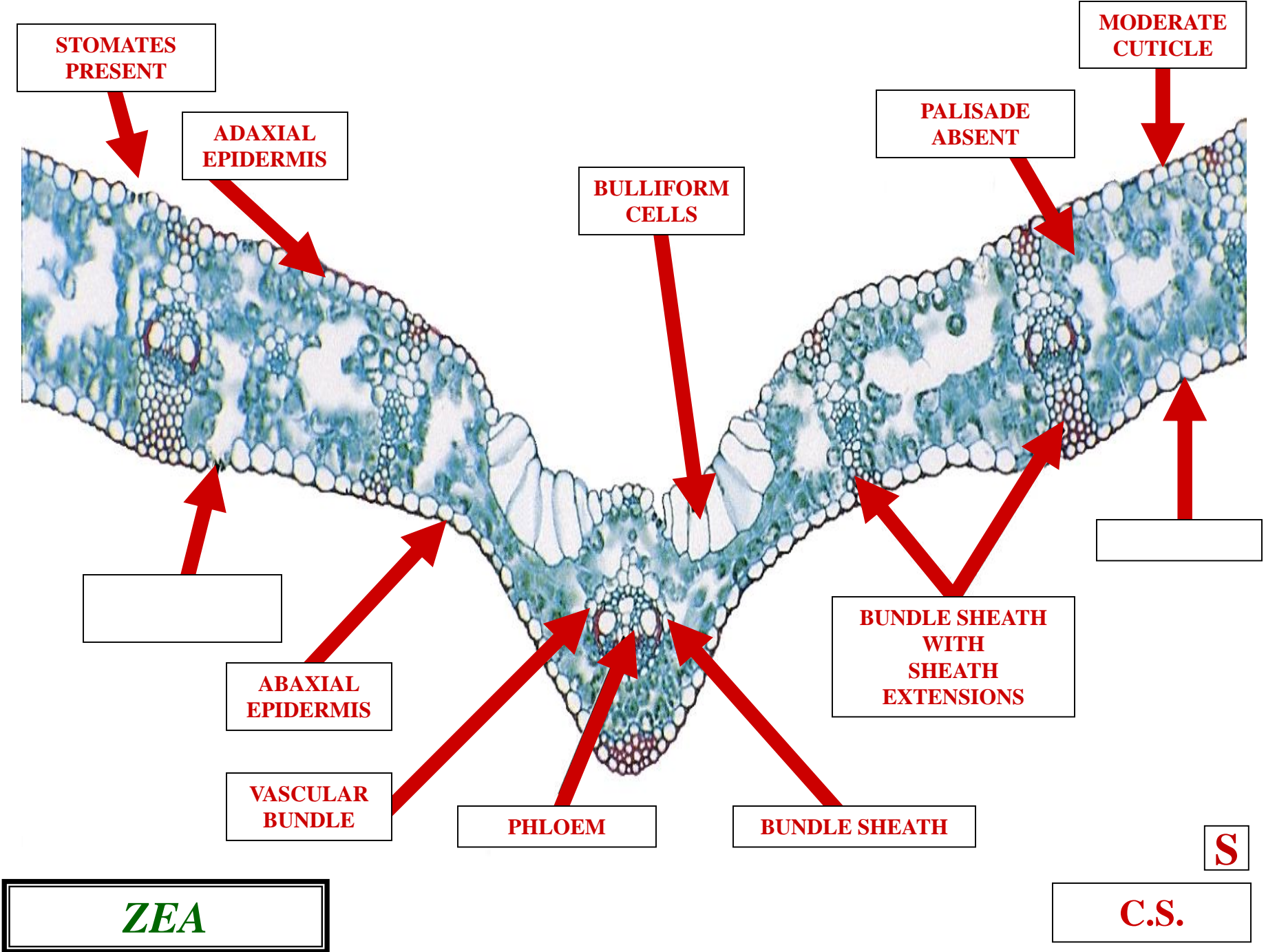
B

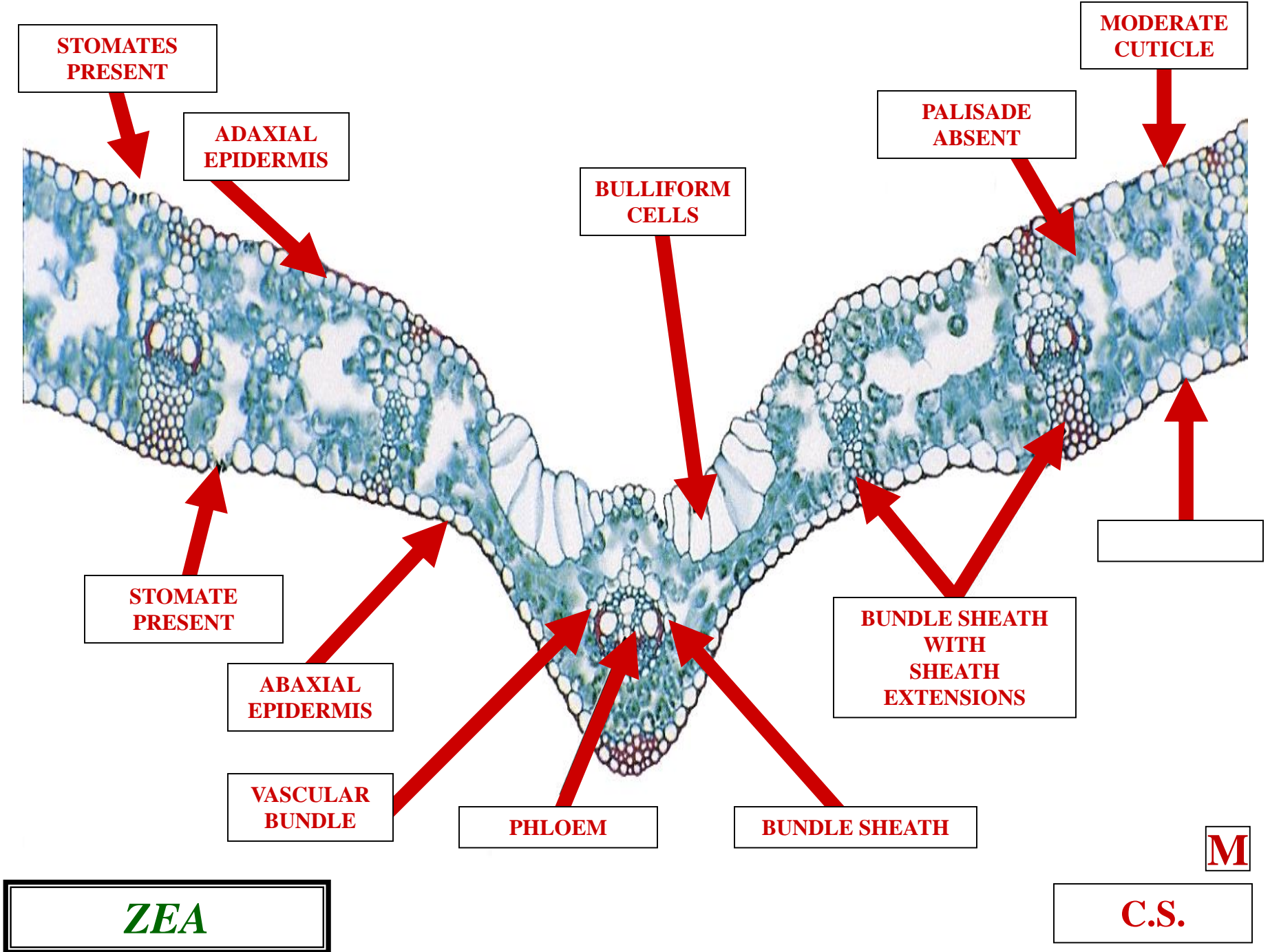
C.S.











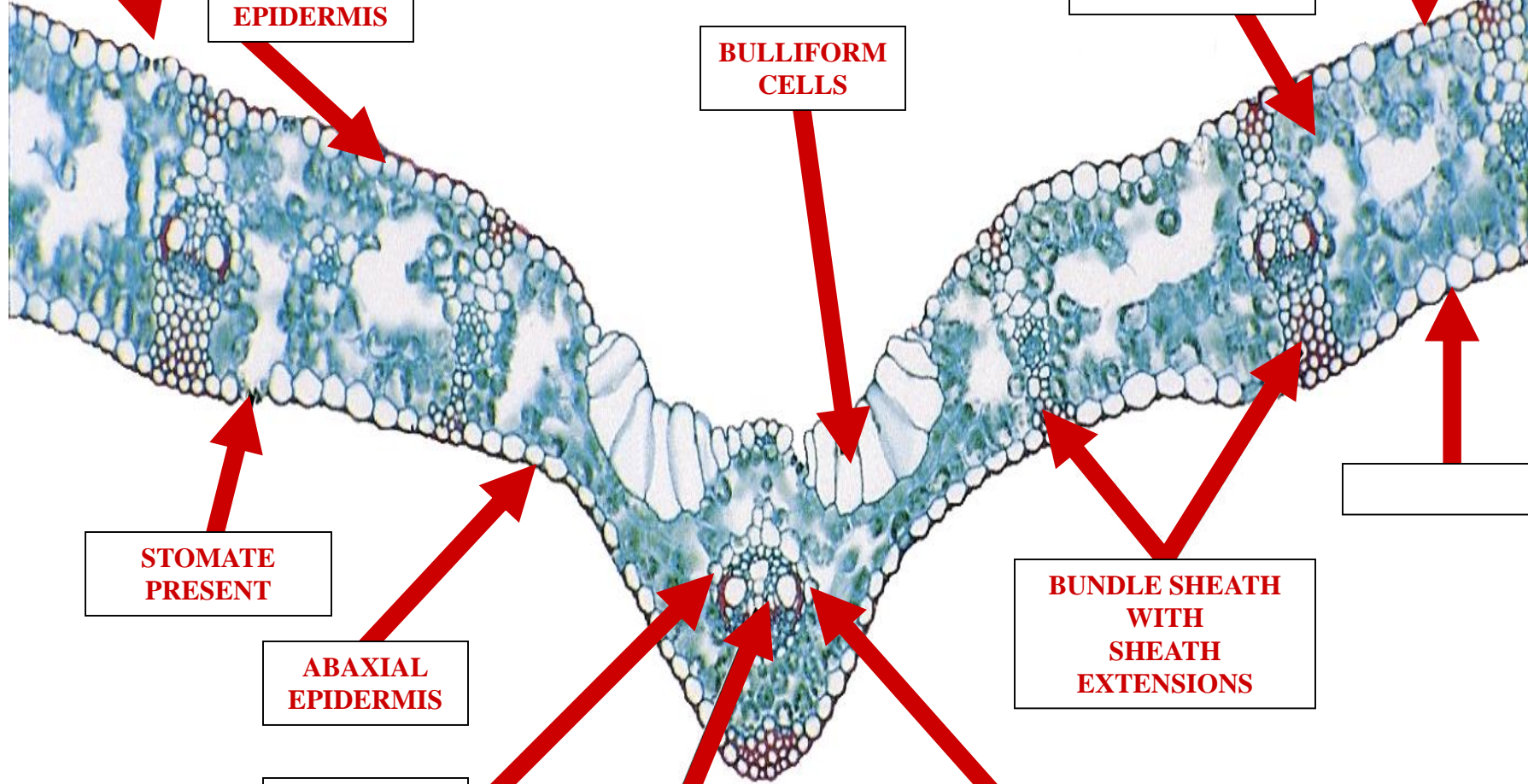
**STOMATES
PRESENT**

**MODERATE
CUTICLE**

**ADAXIAL
EPIDERMIS**

**PALISADE
ABSENT**

**BULLIFORM
CELLS**



**STOMATE
PRESENT**

[Empty box]

**ABAXIAL
EPIDERMIS**

**BUNDLE SHEATH
WITH
SHEATH
EXTENSIONS**

**VASCULAR
BUNDLE**

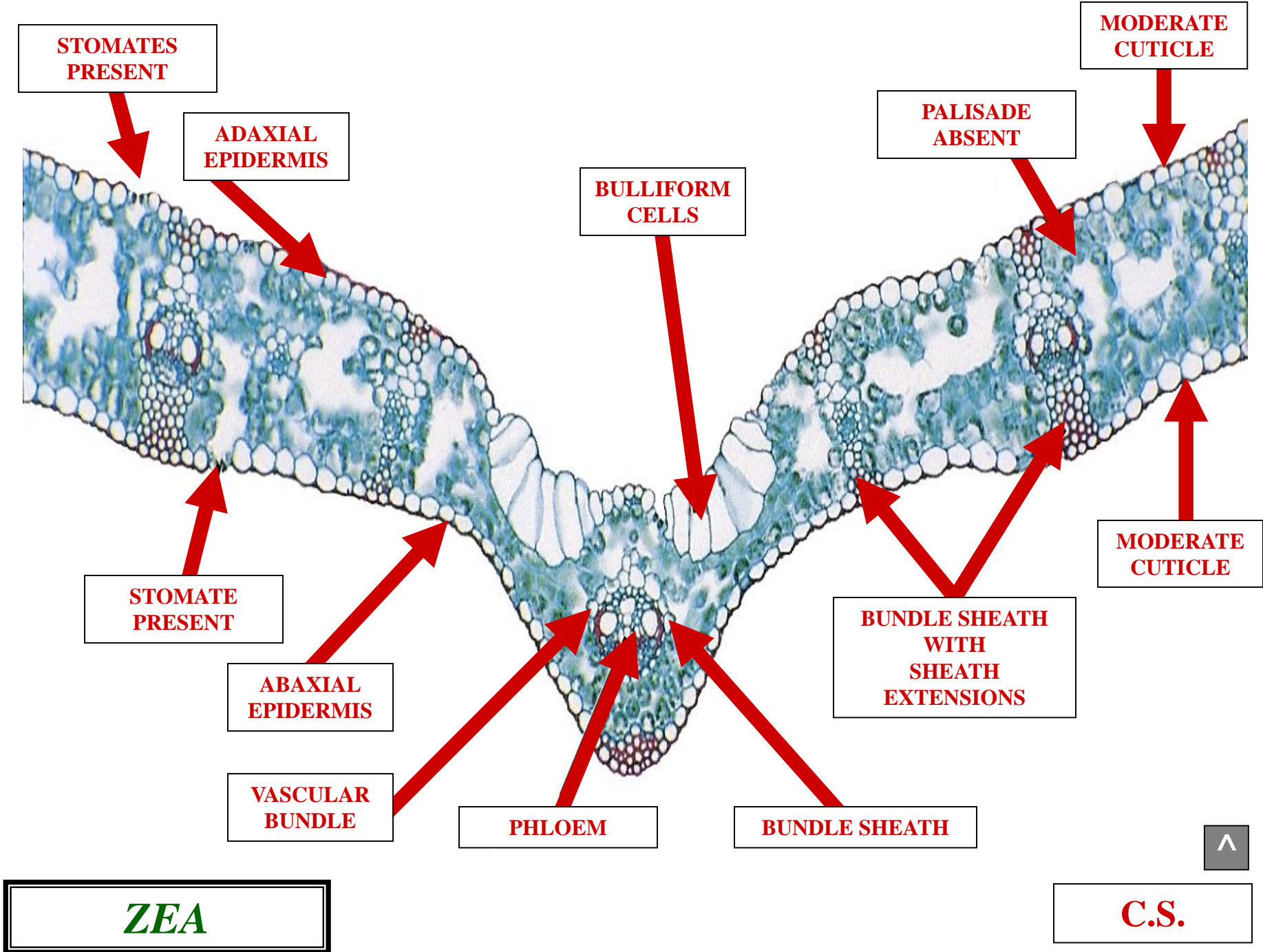
PHLOEM

BUNDLE SHEATH

ZEA

M

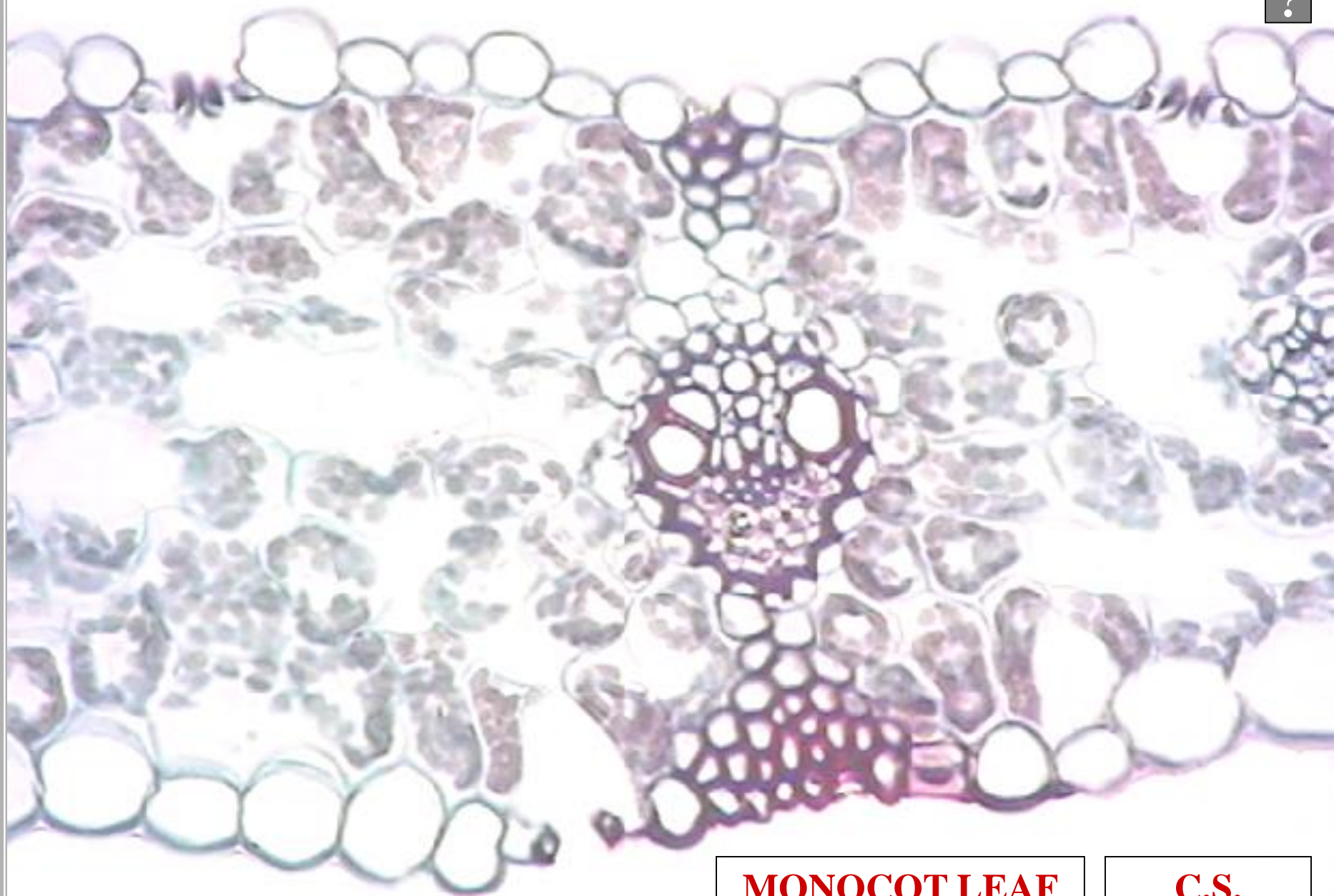
C.S.





MONOCOT LEAF ANATOMY SUMMARY

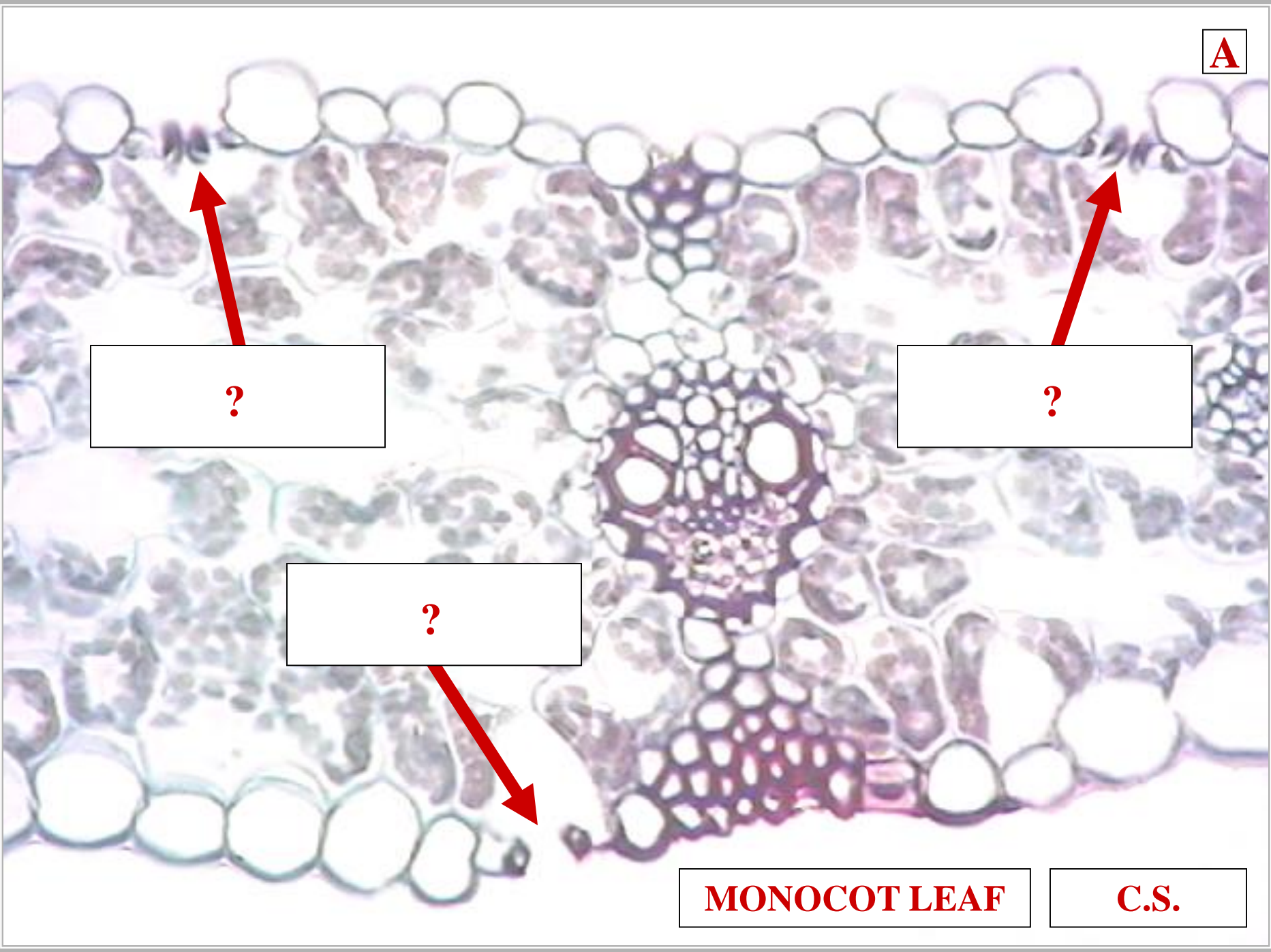
?



MONOCOT LEAF

C.S.

A



?

?

?

MONOCOT LEAF

C.S.

?



ADAXIAL
STOMATES

A detailed micrograph of a monocot leaf cross-section. The upper surface (top) shows a single layer of epidermal cells with several stomata. The middle part of the leaf contains a vascular bundle with a central vascular cylinder. The lower surface (bottom) also shows a single layer of epidermal cells with stomata. The internal air spaces are filled with spongy mesophyll cells. Red arrows point from the text labels to the corresponding stomata.

ADAXIAL
STOMATES

ABAXIAL
STOMATES

MONOCOT LEAF

C.S.

B

?

?

MONOCOT LEAF

C.S.

