

**SIEVE MEMBER**

**COMPANION CELL**

**METAXYLEM**

**AIR SPACE**

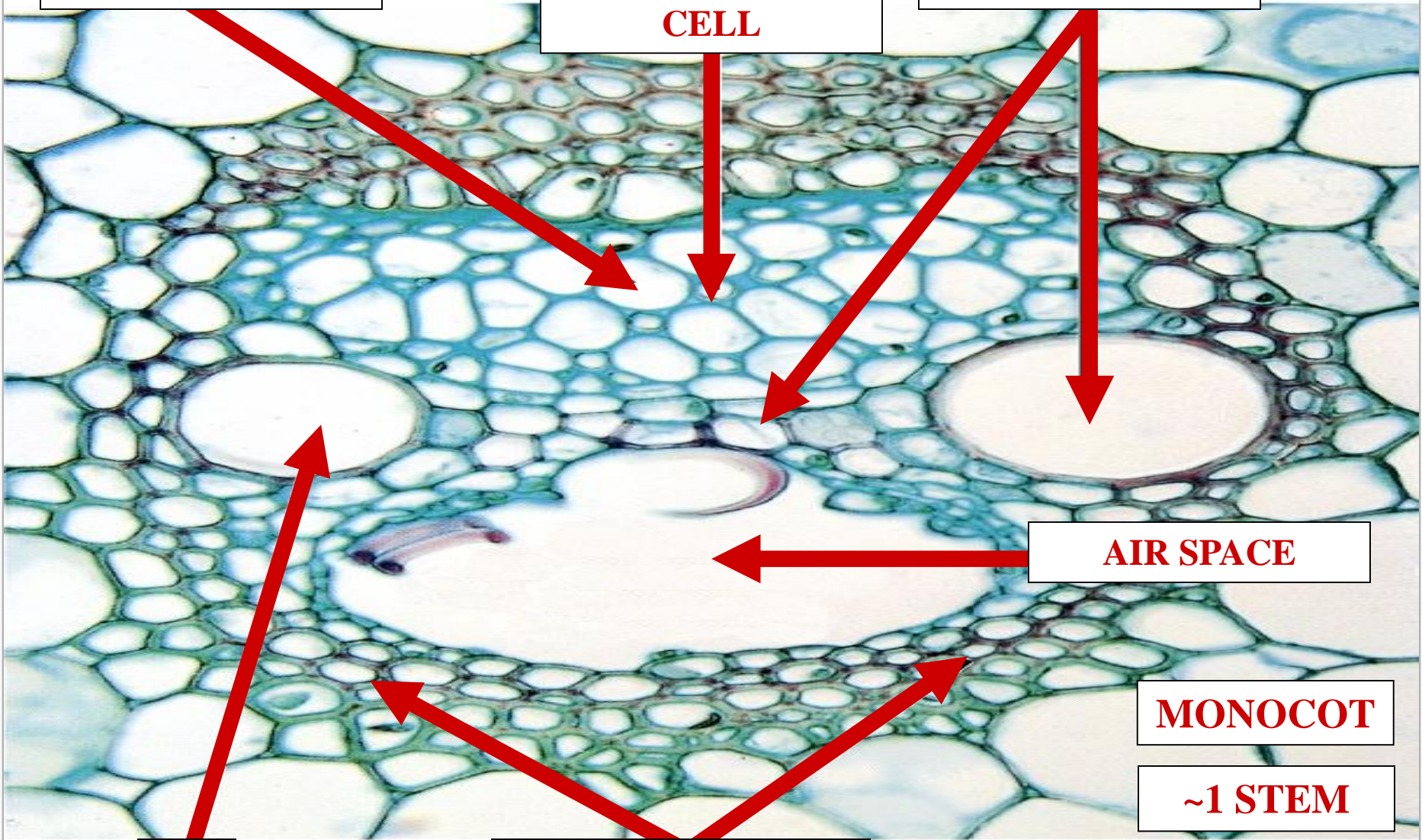
**MONOCOT**

**~1 STEM**

**C.S.**

**13**

**BUNDLE SHEATH**

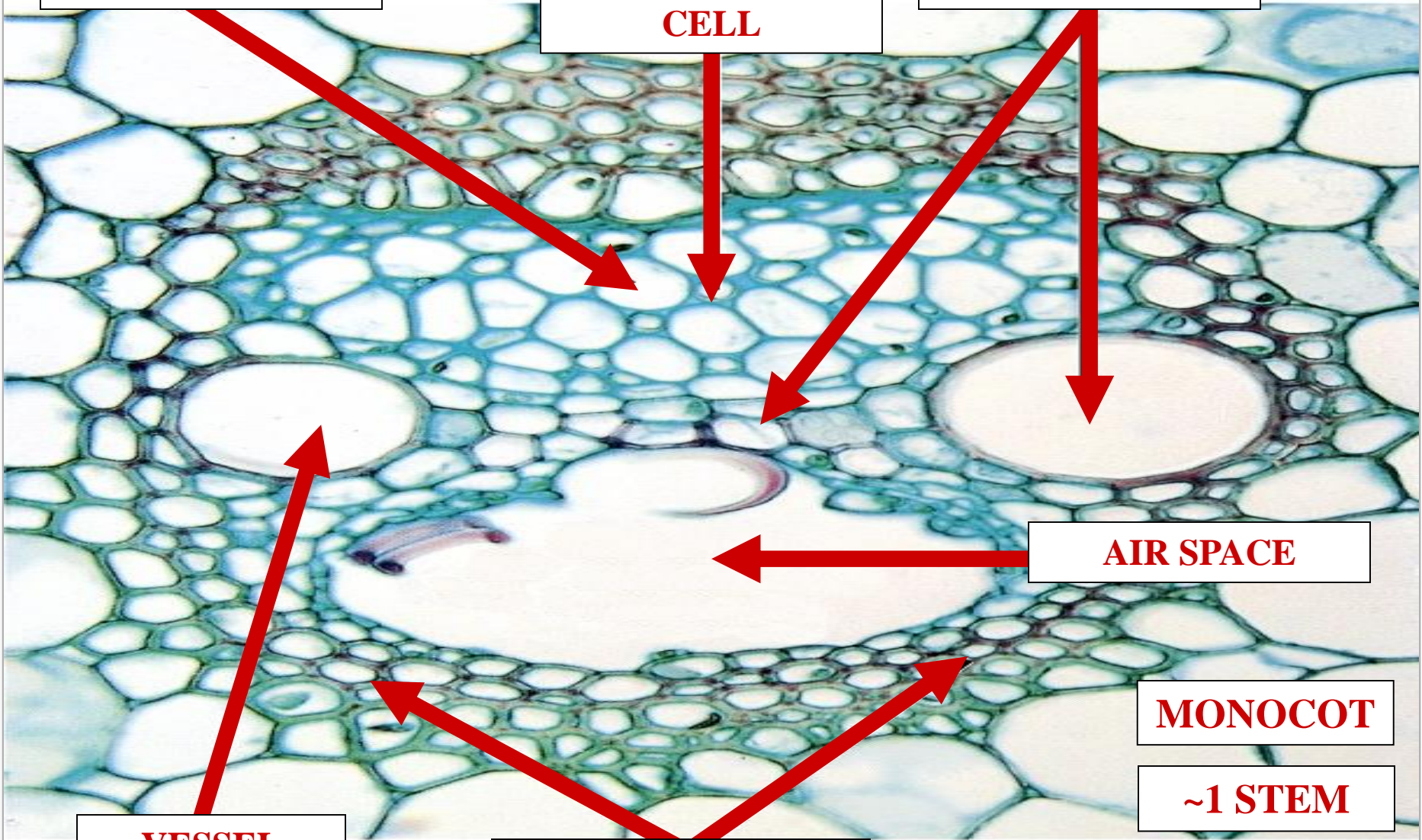




**SIEVE MEMBER**

**COMPANION CELL**

**METAXYLEM**



**AIR SPACE**

**MONOCOT**

**~1 STEM**

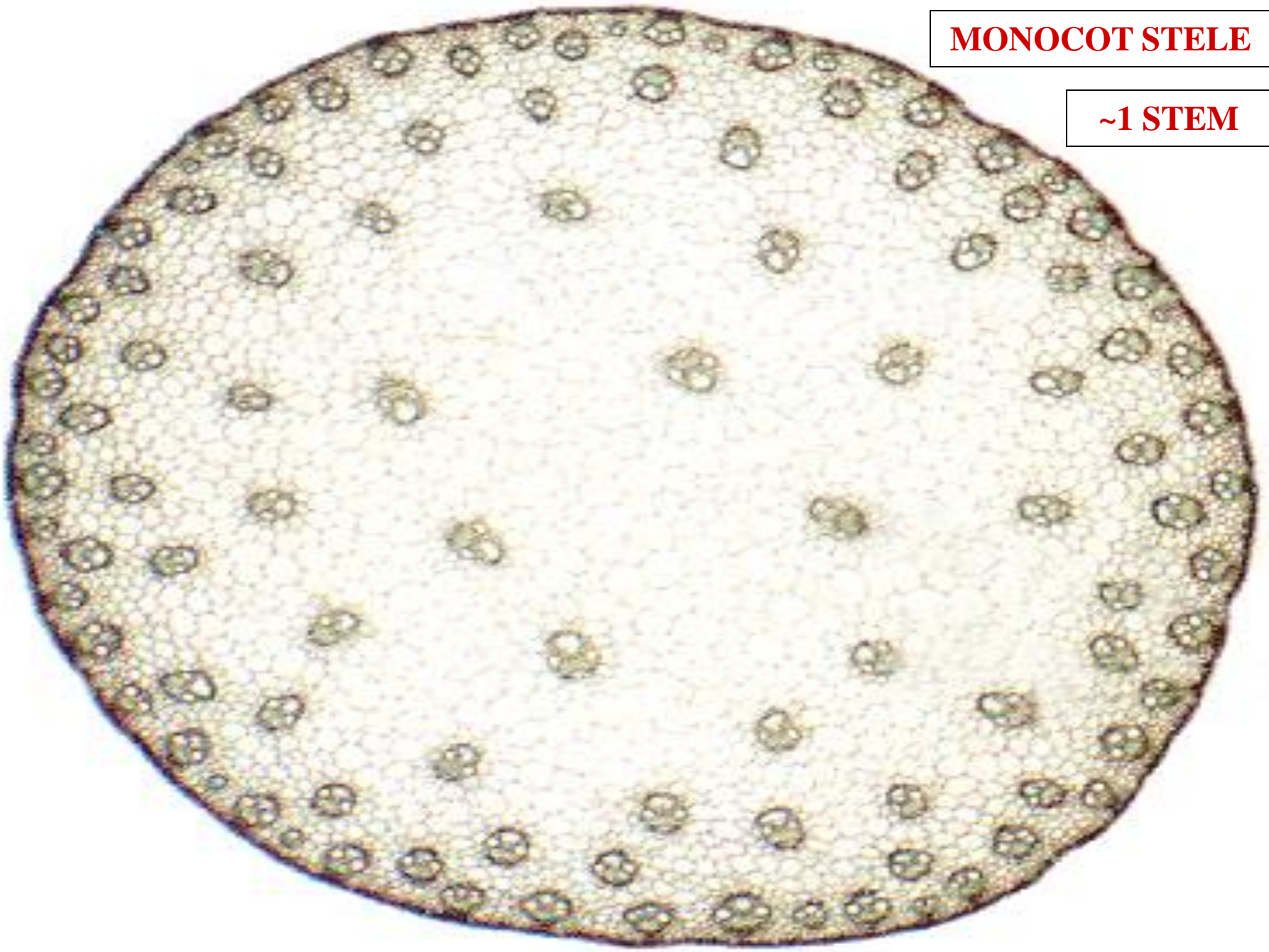
**VESSEL MEMBER**

**BUNDLE SHEATH**

**C.S.**

**MONOCOT STELE**

**~1 STEM**

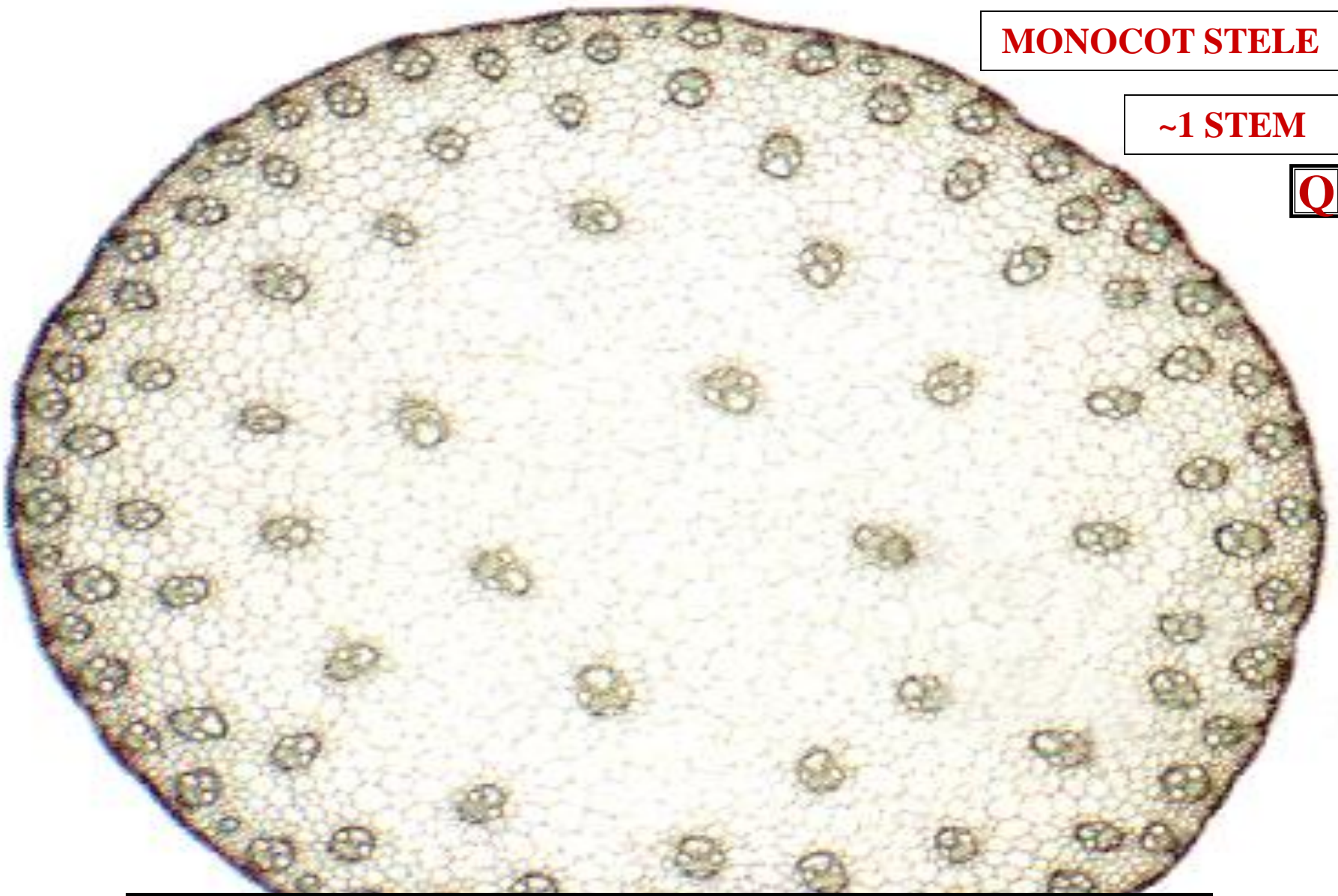


**MONOCOT STELE**

**~1 STEM**

**Q**

**ATACTOSTELE**



# **LECTURE QUIZ**

**DICOT & MONOCOT  
ROOT & STEM  
PRIMARY GROWTH**

# **LECTURE QUIZ**

**WEDNESDAY  
16 FEBRUARY**

# LECTURE QUIZ

FORMAT  
FILL IN  
QUESTIONS



# **LECTURE QUIZ**

**MUST  
SPELL CORRECTLY  
FOR FULL CREDIT**





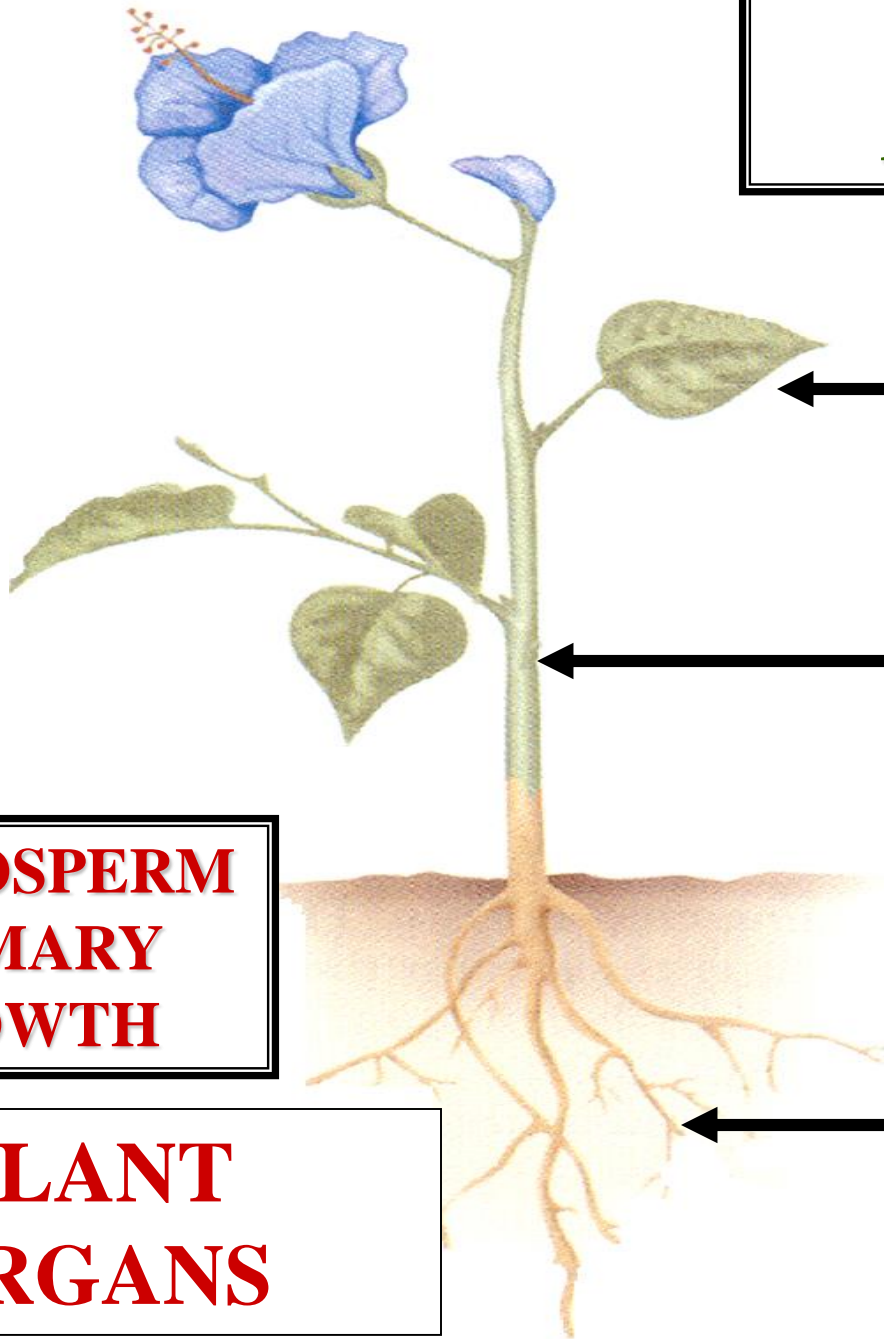
# ANGIOSPERM PRIMARY GROWTH



# PLANT ORGANS

# TYPICAL ANGIOSPERM

R

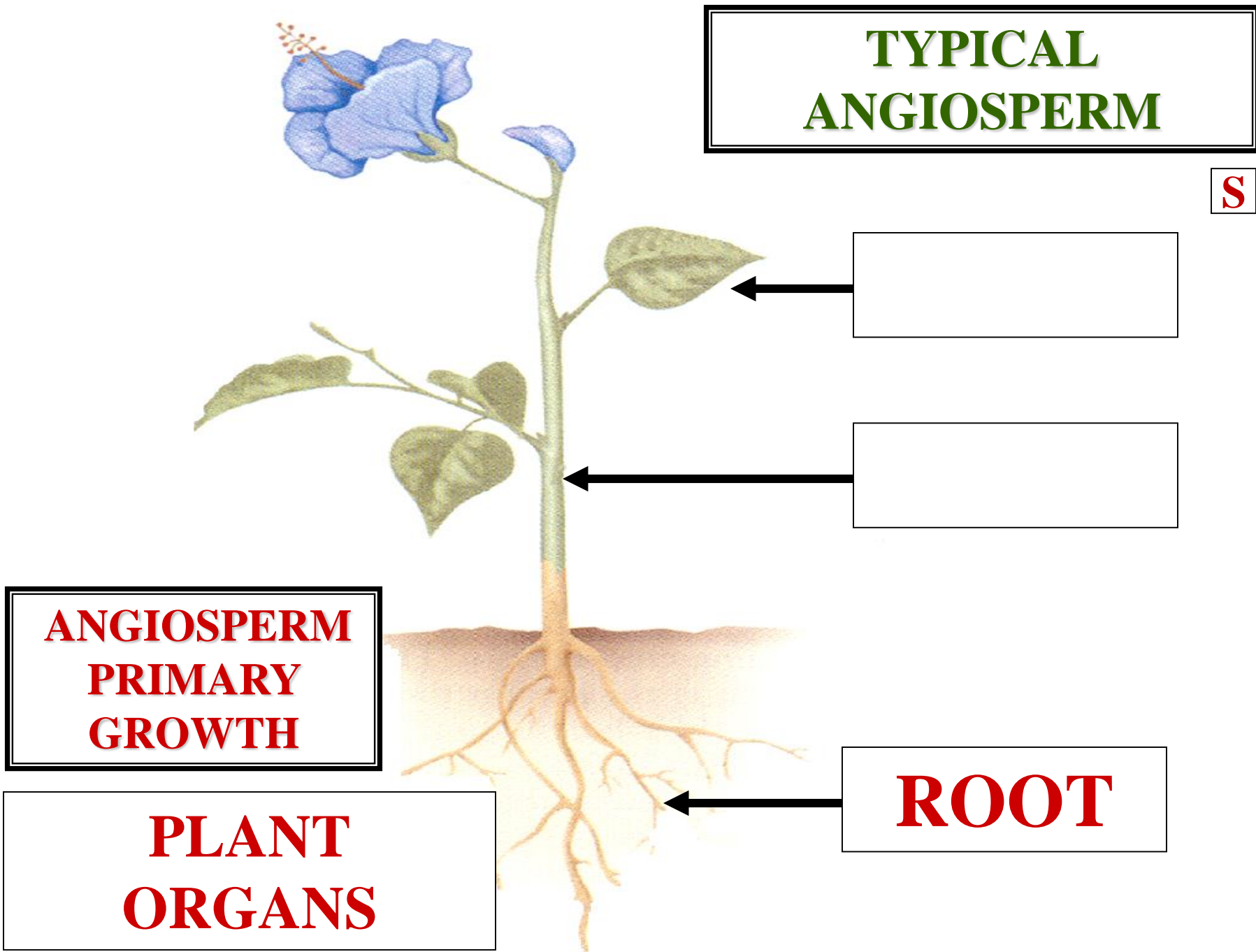


**ANGIOSPERM  
PRIMARY  
GROWTH**

**PLANT  
ORGANS**

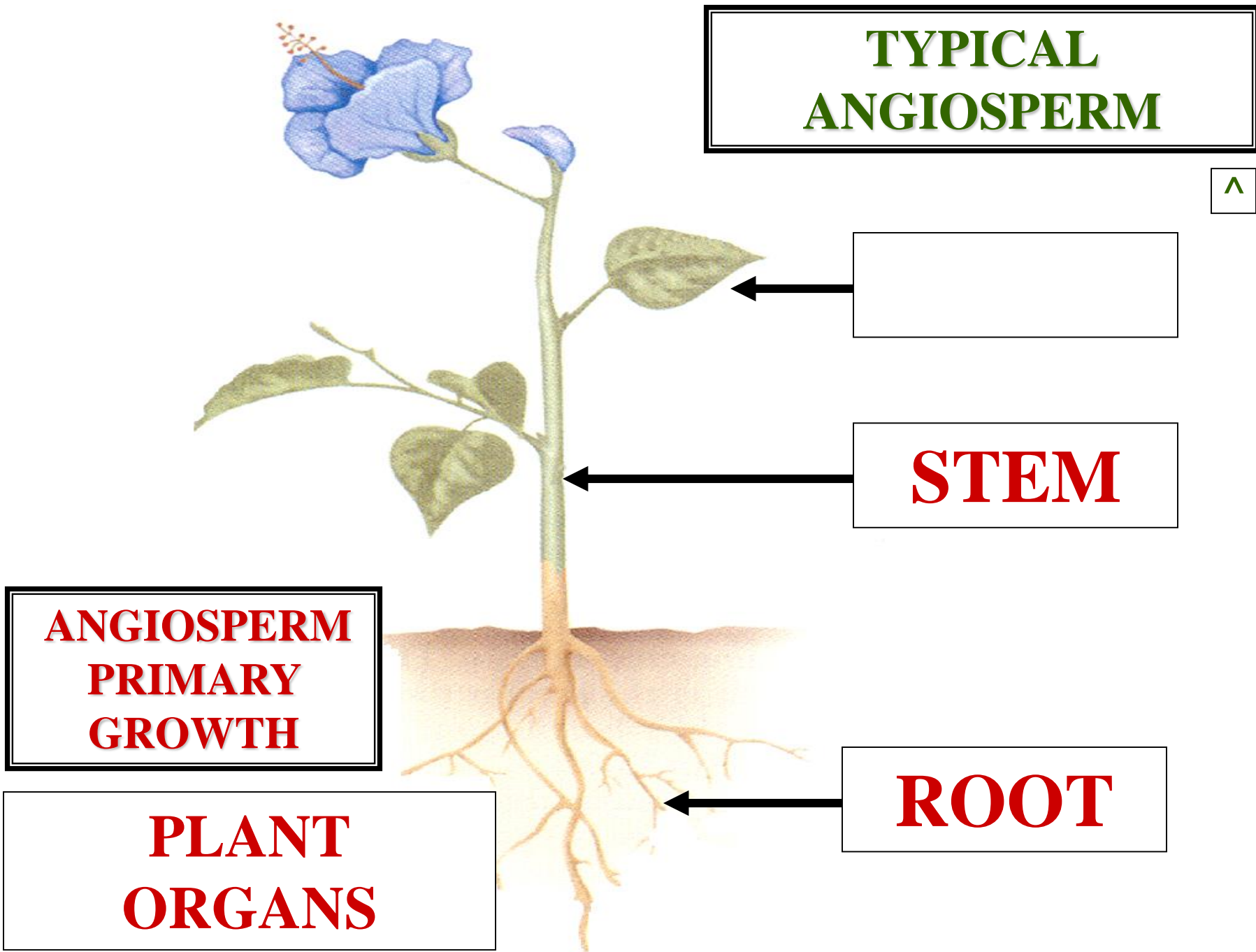
# TYPICAL ANGIOSPERM

S



# TYPICAL ANGIOSPERM

^



[Empty box]

**STEM**

**ANGIOSPERM  
PRIMARY  
GROWTH**

**PLANT  
ORGANS**

**ROOT**

# ANGIOSPERM SECONDARY GROWTH

# **SECONDARY GROWTH**



**ANGIOSPERM  
SECONDARY GROWTH**

**LATERAL MERISTEM  
DERIVED**

**ANGIOSPERM  
SECONDARY GROWTH**



# LATERAL MERISTEM

# **LATERAL MERISTEM**

# **SECONDARY GROWTH LATERAL MERISTEM**



**OCCUPY STEM & ROOT PERIPHERY**

**SECONDARY GROWTH  
LATERAL MERISTEM**

# SECONDARY GROWTH LATERAL MERISTEM



OCCUPY STEM & ROOT PERIPHERY

---

INCREASES PLANT GIRTH

SECONDARY GROWTH  
LATERAL MERISTEM

# **SECONDARY GROWTH LATERAL MERISTEM**



**OCCUPY STEM & ROOT PERIPHERY**

---

**INCREASES PLANT GIRTH**

---

**NOT HEIGHT**

**SECONDARY GROWTH  
LATERAL MERISTEM**

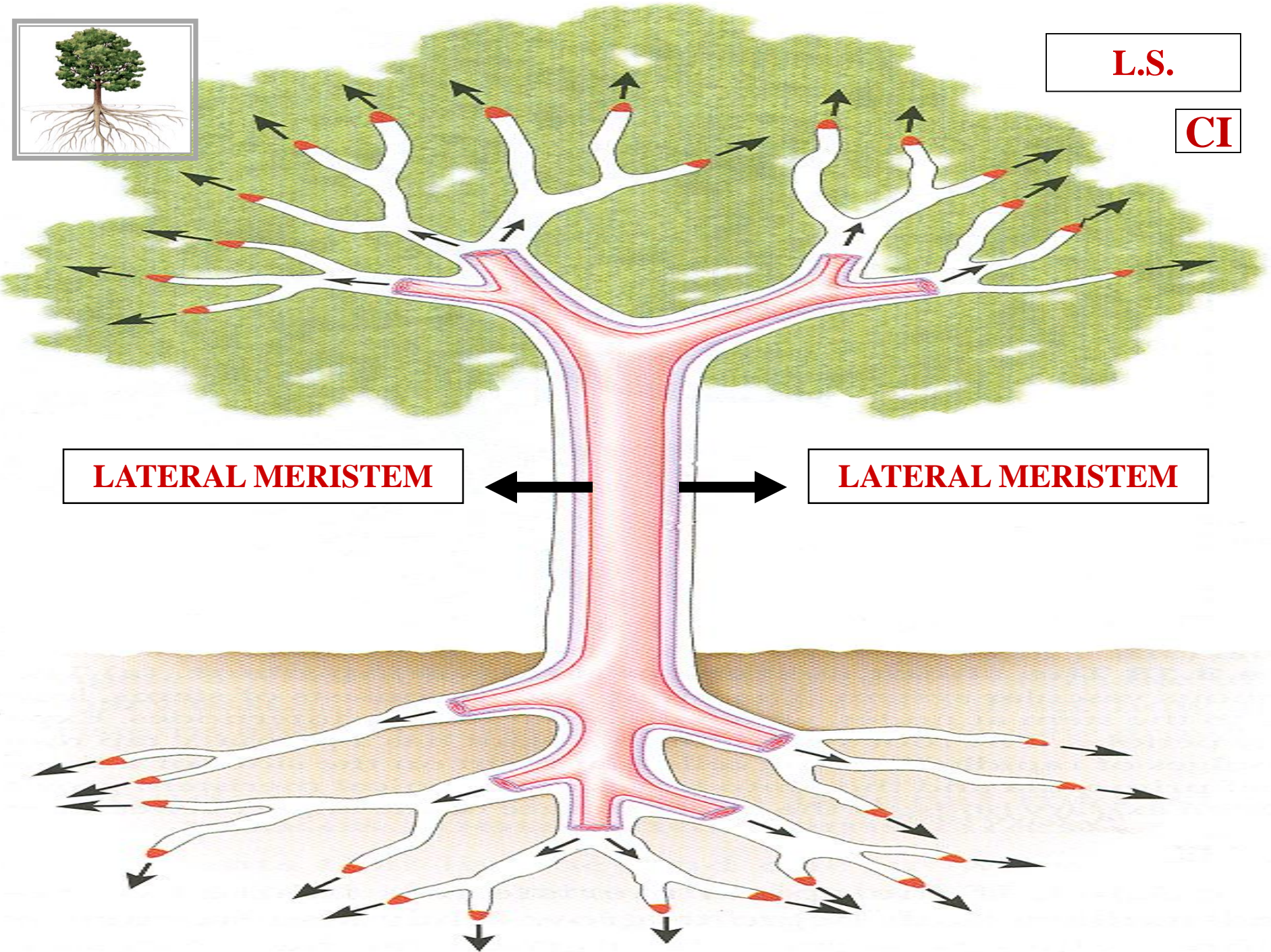


**L.S.**

**CI**

**LATERAL MERISTEM**

**LATERAL MERISTEM**



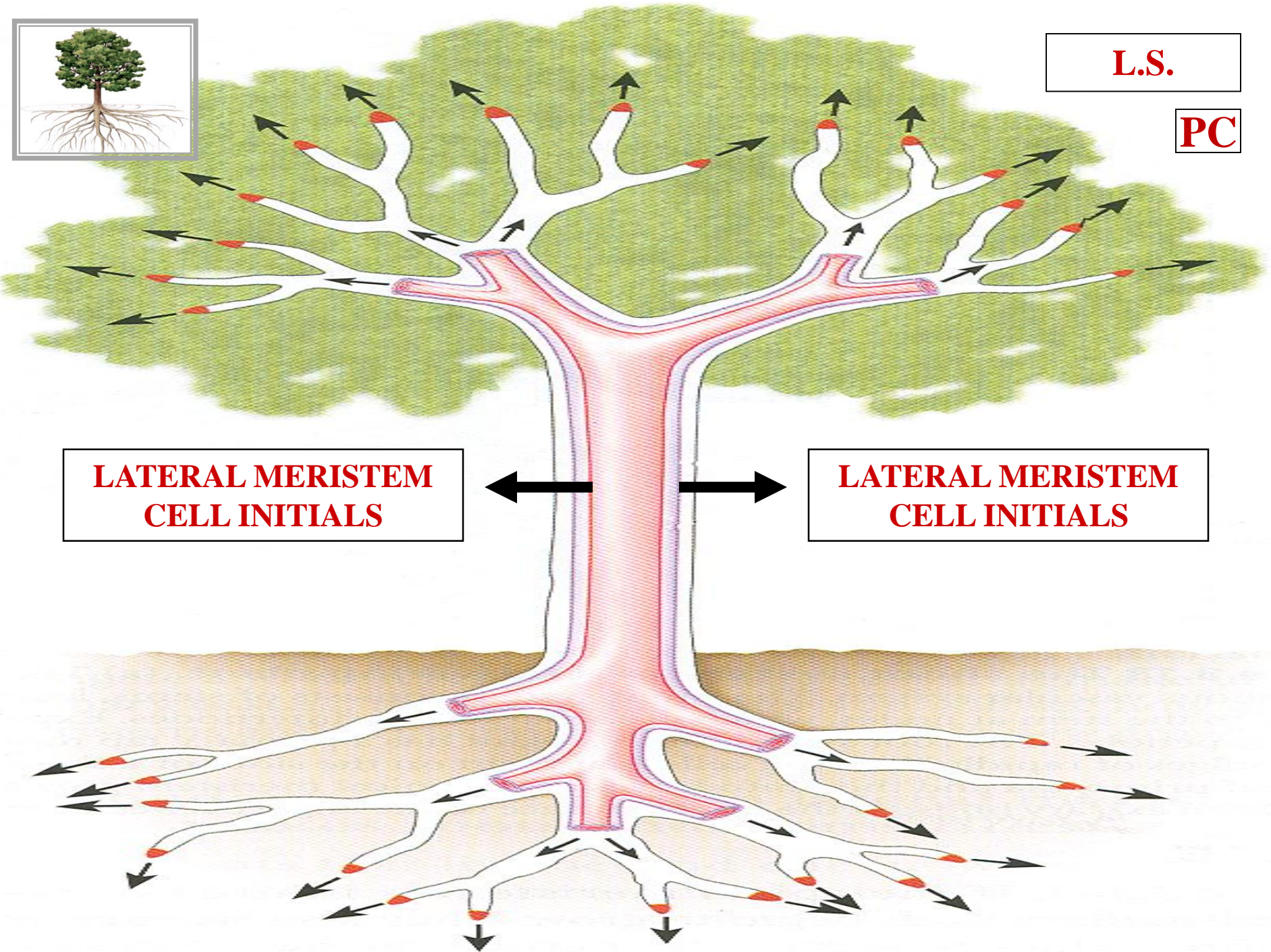


**L.S.**

**PC**

**LATERAL MERISTEM  
CELL INITIALS**

**LATERAL MERISTEM  
CELL INITIALS**



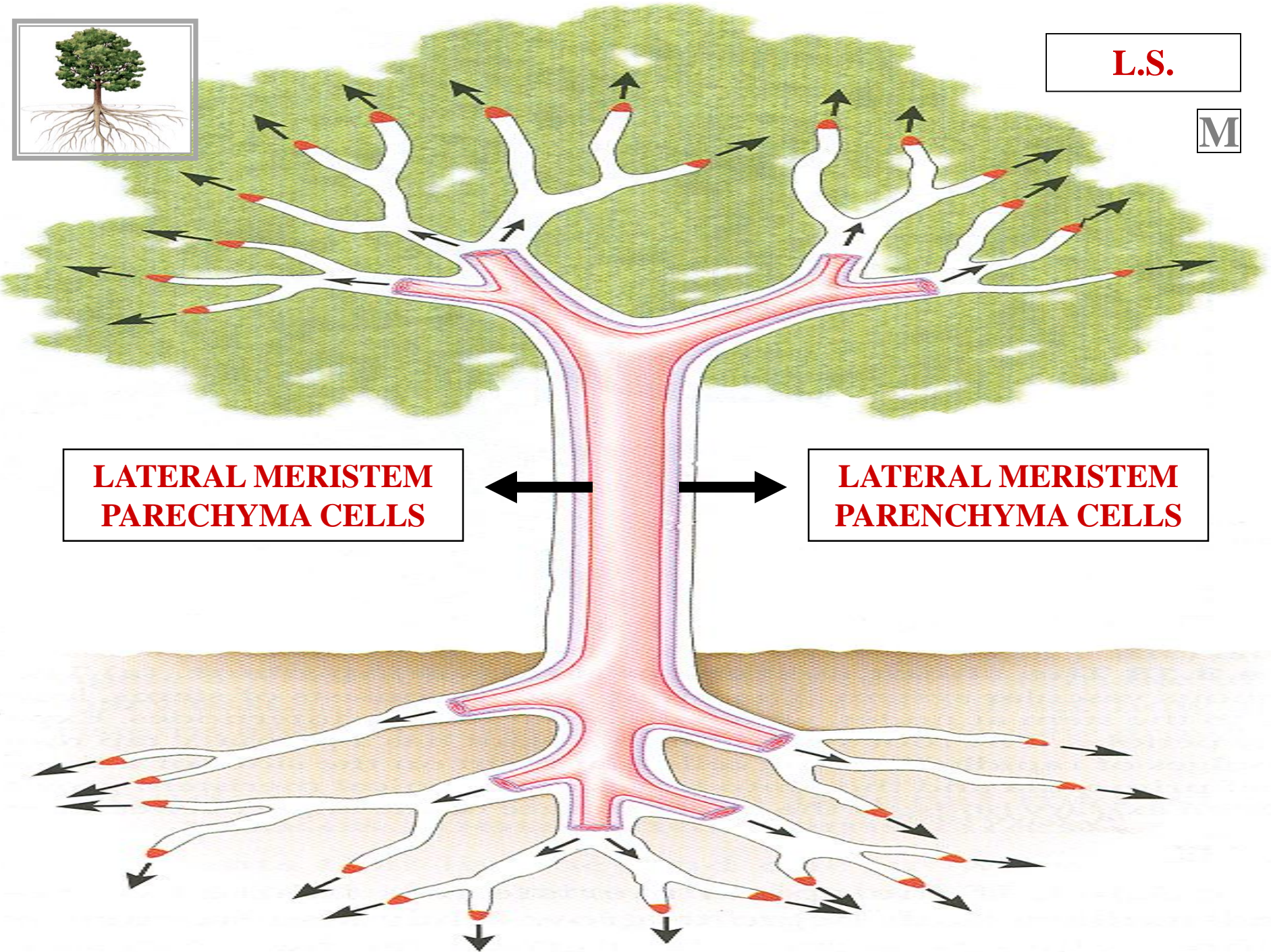


**L.S.**

**M**

**LATERAL MERISTEM  
PARENCHYMA CELLS**

**LATERAL MERISTEM  
PARENCHYMA CELLS**





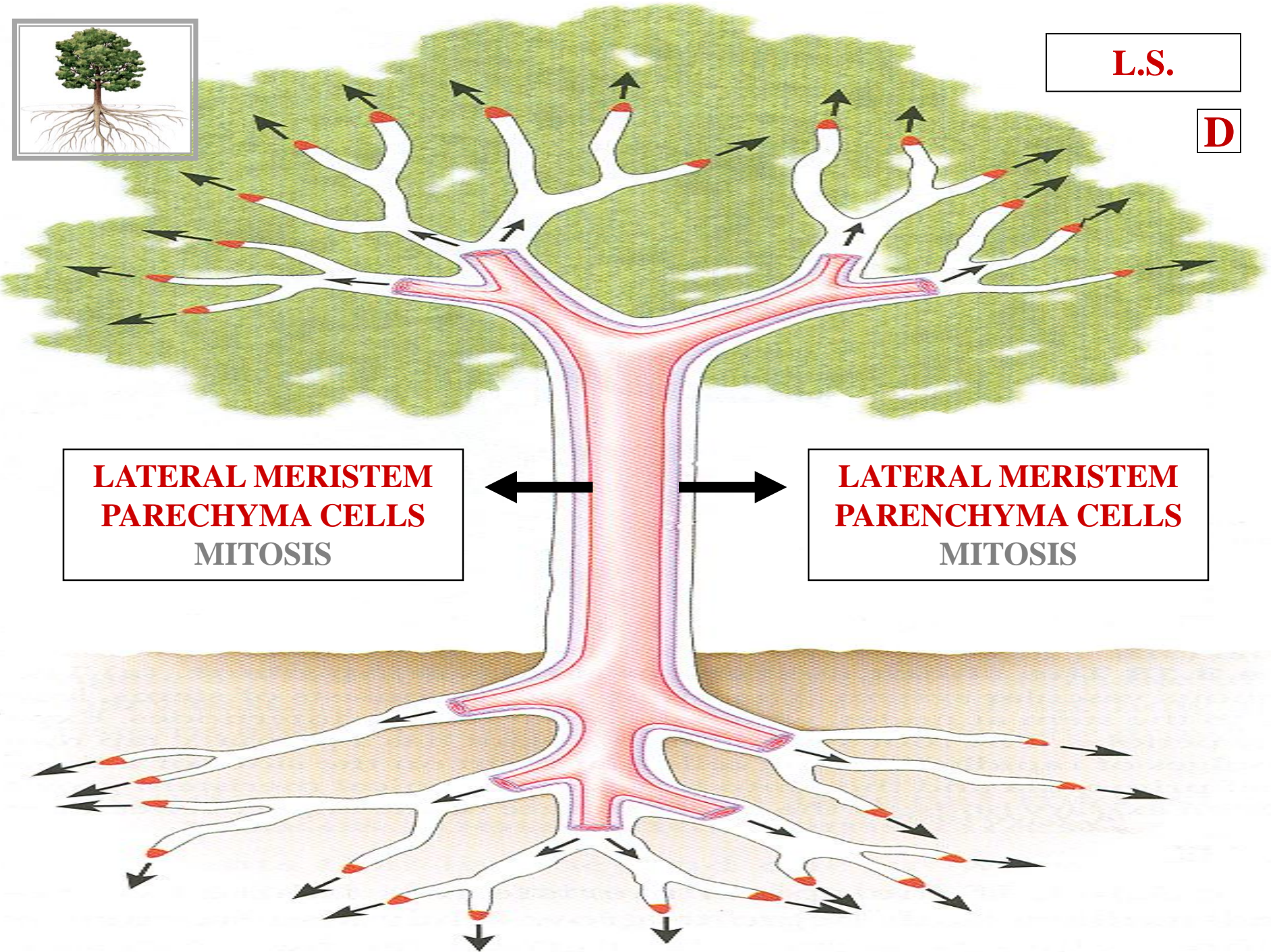


L.S.

D

LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS

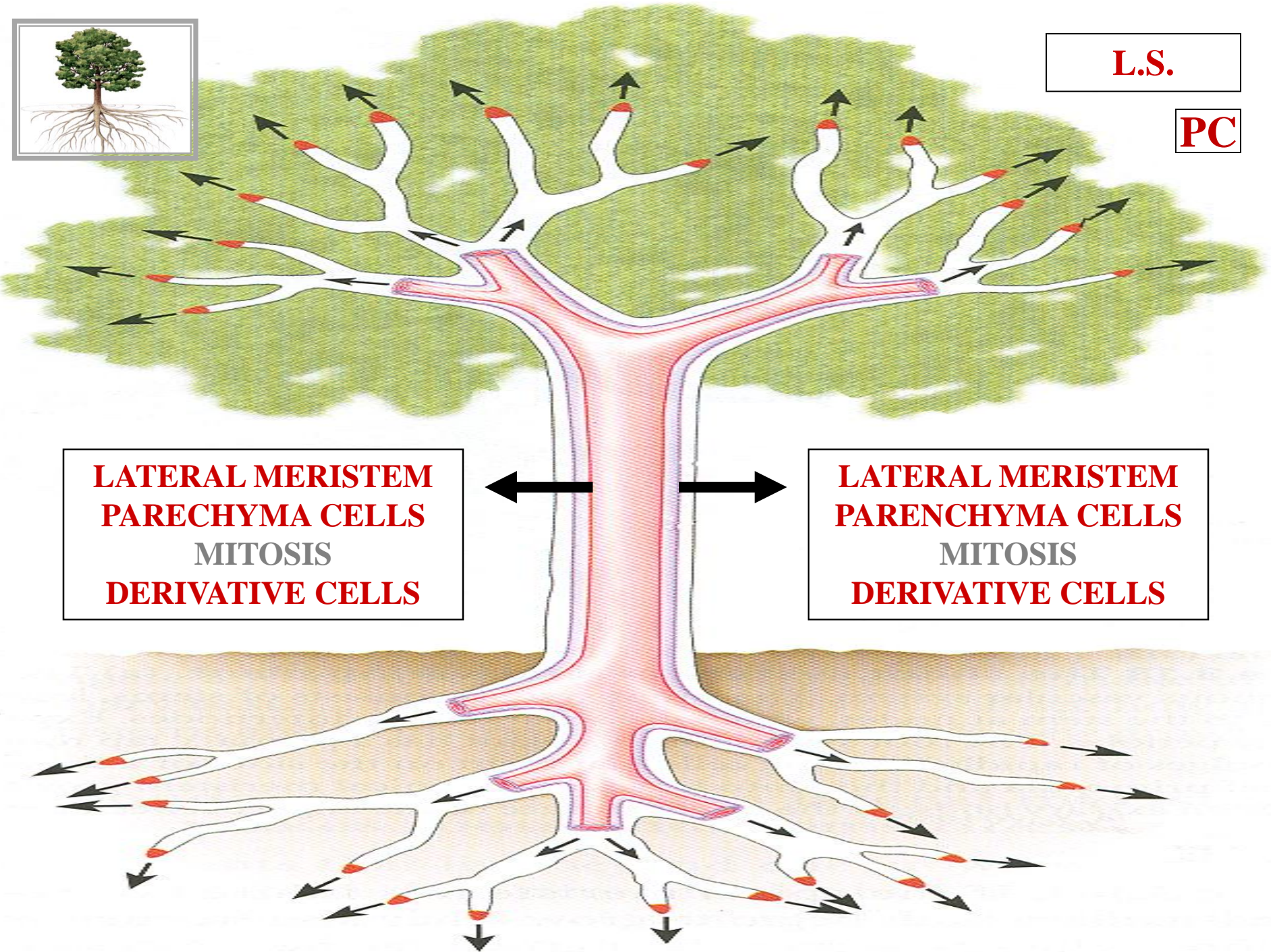
LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS





**L.S.**

**PC**



**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS**

**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS**

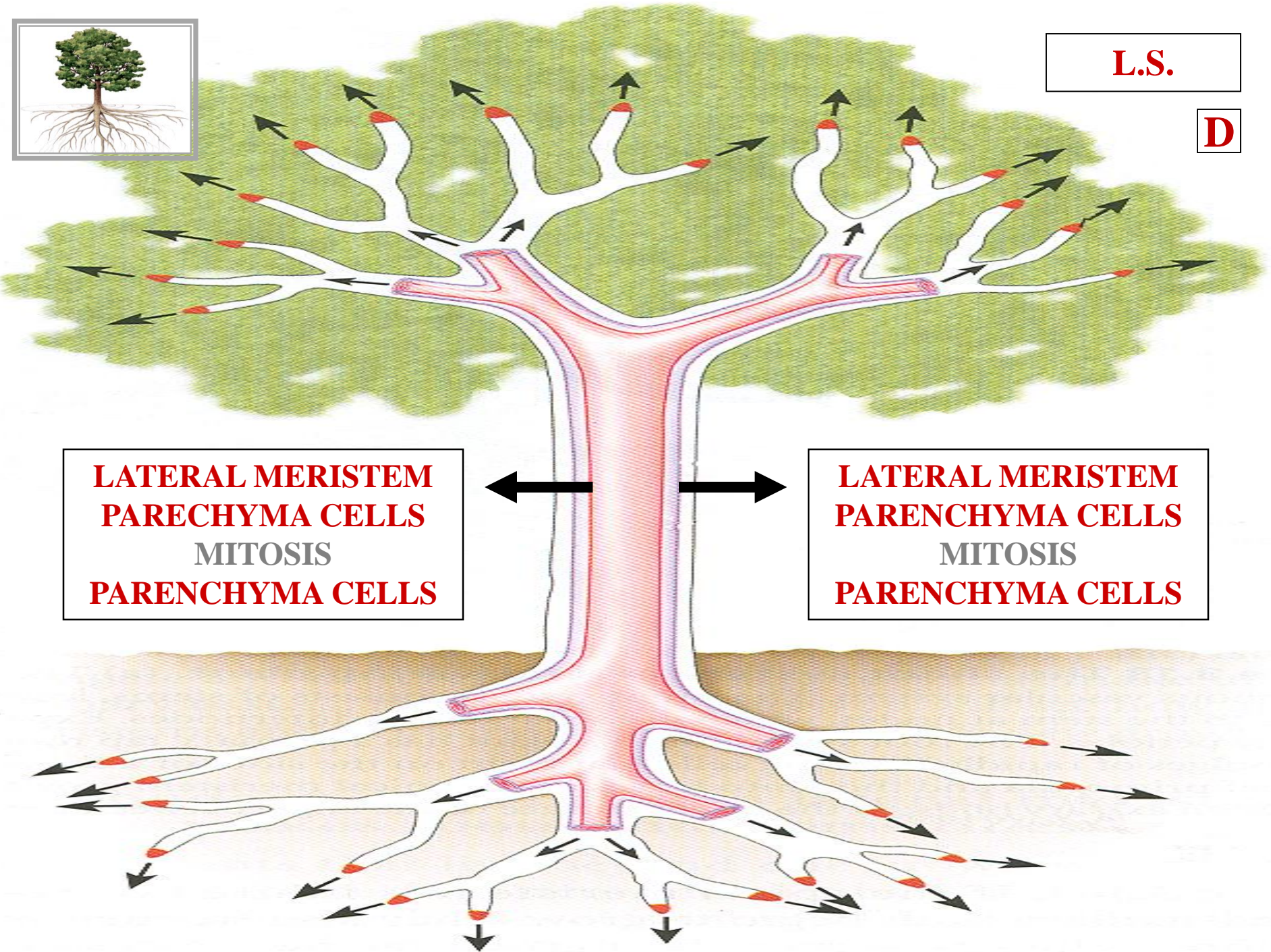


L.S.

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LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
PARENCHYMA CELLS

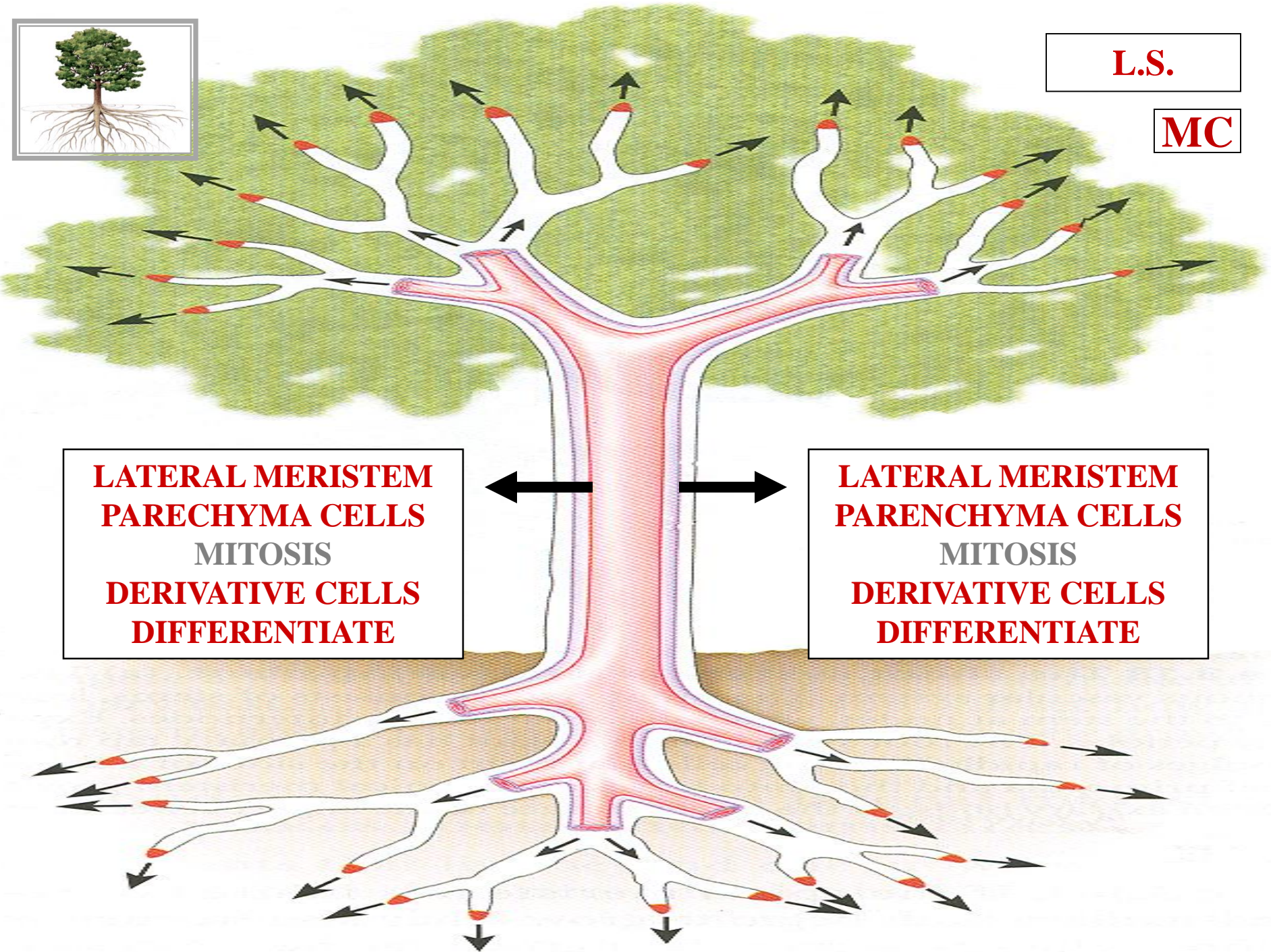
LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
PARENCHYMA CELLS





**L.S.**

**MC**



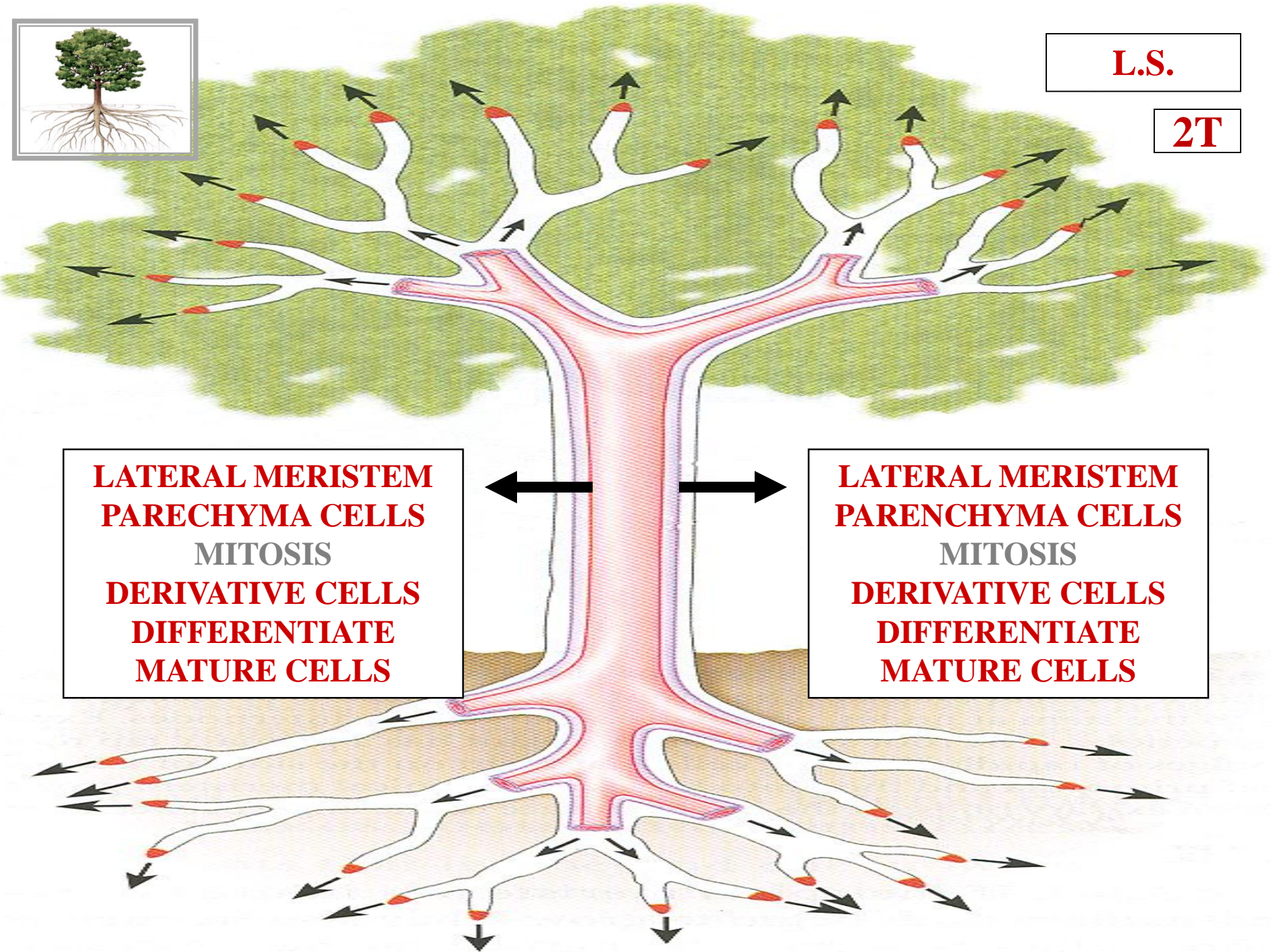
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PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE**

**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE**



**L.S.**

**2T**



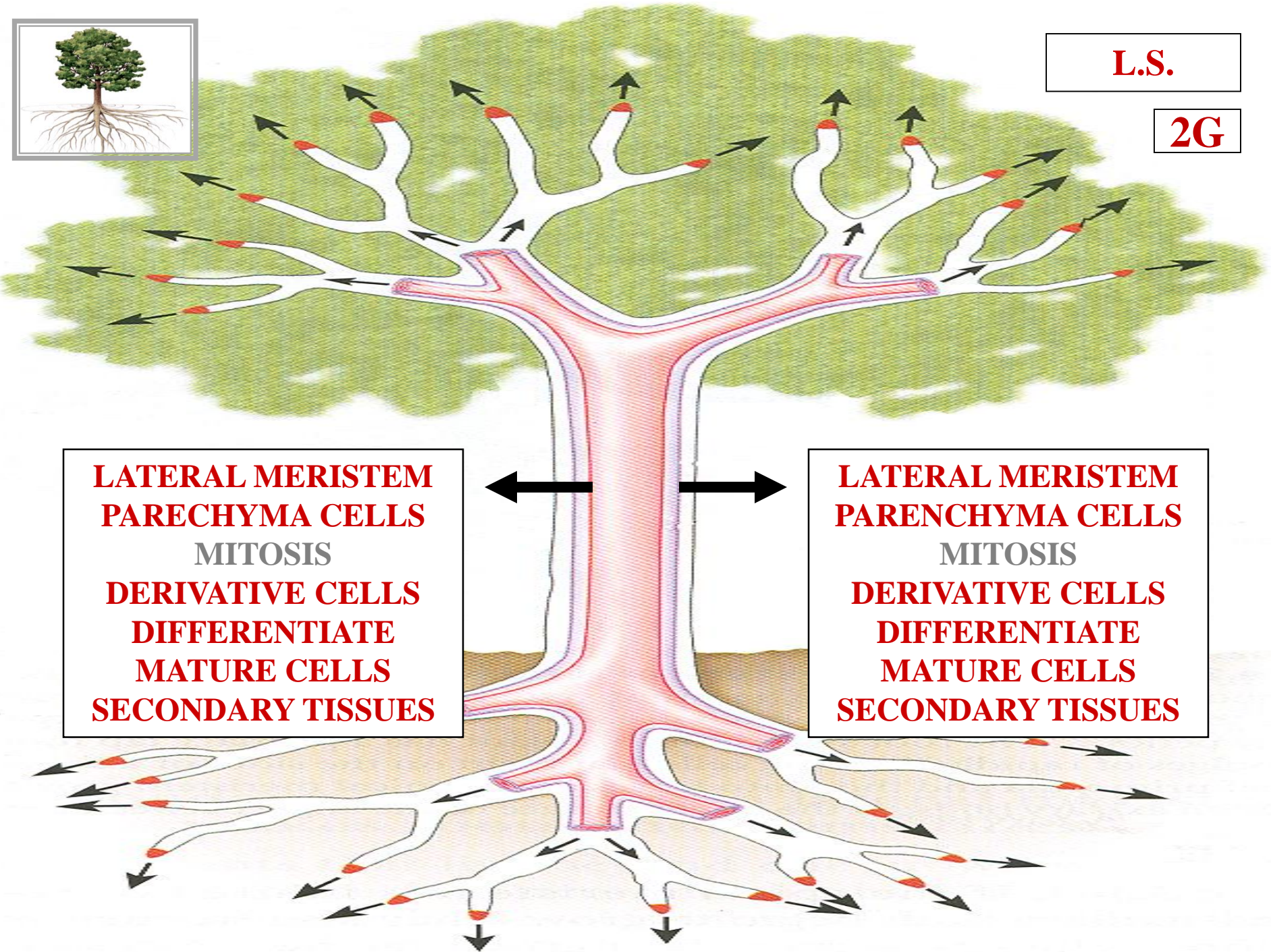
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PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE  
MATURE CELLS**

**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE  
MATURE CELLS**



**L.S.**

**2G**



**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE  
MATURE CELLS  
SECONDARY TISSUES**

**LATERAL MERISTEM  
PARENCHYMA CELLS  
MITOSIS  
DERIVATIVE CELLS  
DIFFERENTIATE  
MATURE CELLS  
SECONDARY TISSUES**



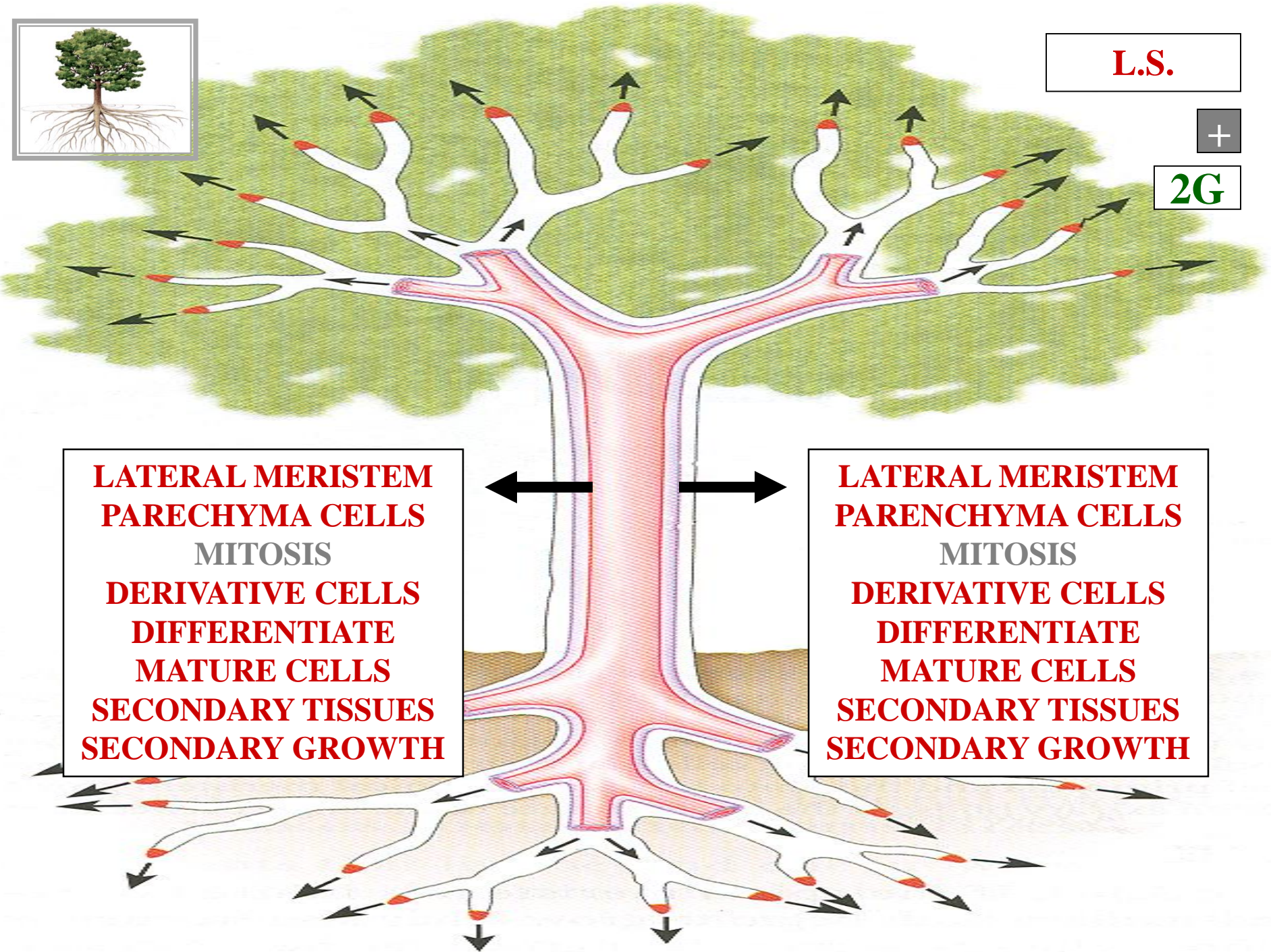
**L.S.**

+

**2G**

**LATERAL MERISTEM**  
**PARENCHYMA CELLS**  
MITOSIS  
**DERIVATIVE CELLS**  
**DIFFERENTIATE**  
**MATURE CELLS**  
**SECONDARY TISSUES**  
**SECONDARY GROWTH**

**LATERAL MERISTEM**  
**PARENCHYMA CELLS**  
MITOSIS  
**DERIVATIVE CELLS**  
**DIFFERENTIATE**  
**MATURE CELLS**  
**SECONDARY TISSUES**  
**SECONDARY GROWTH**



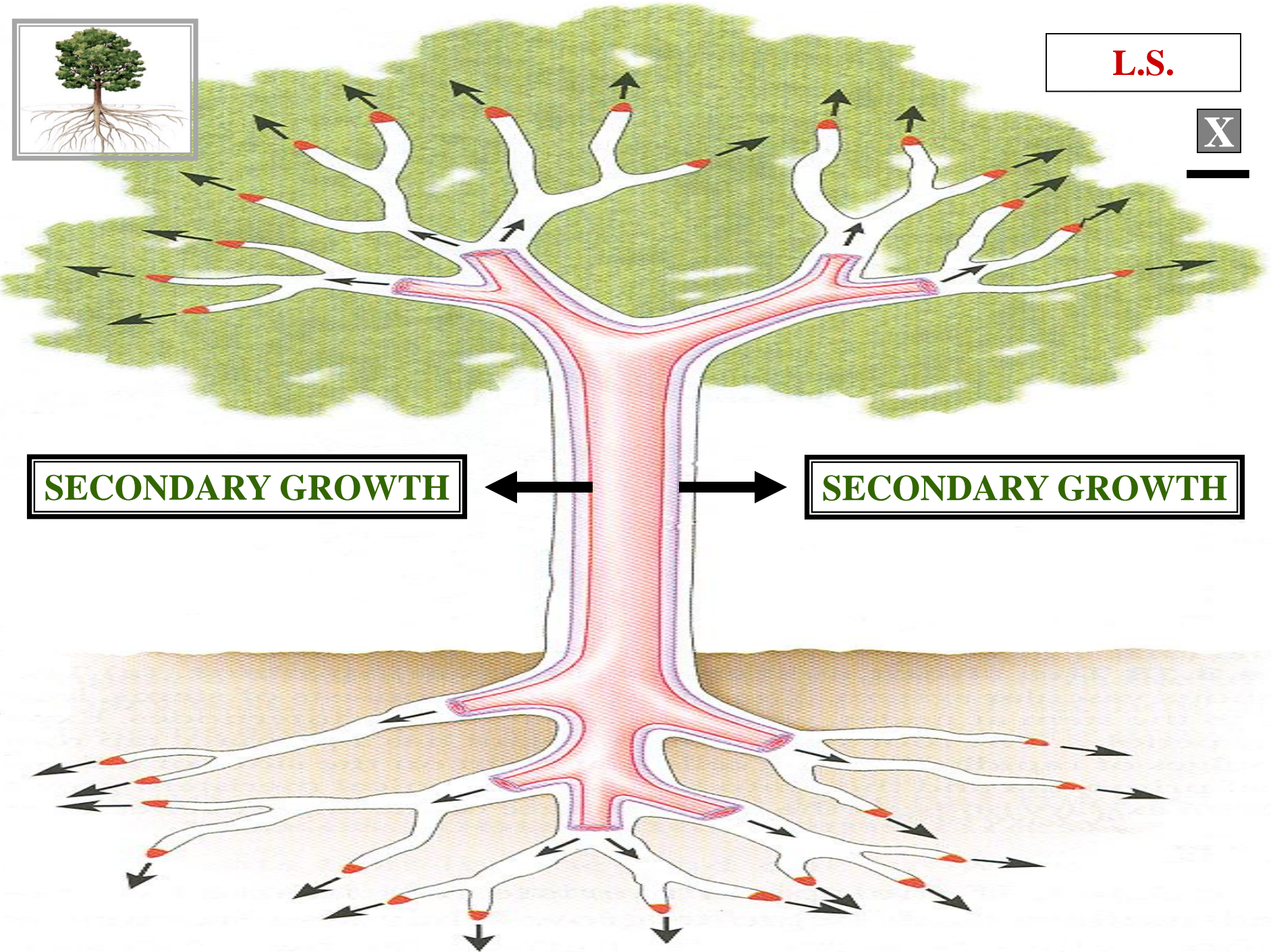


L.S.

X

SECONDARY GROWTH

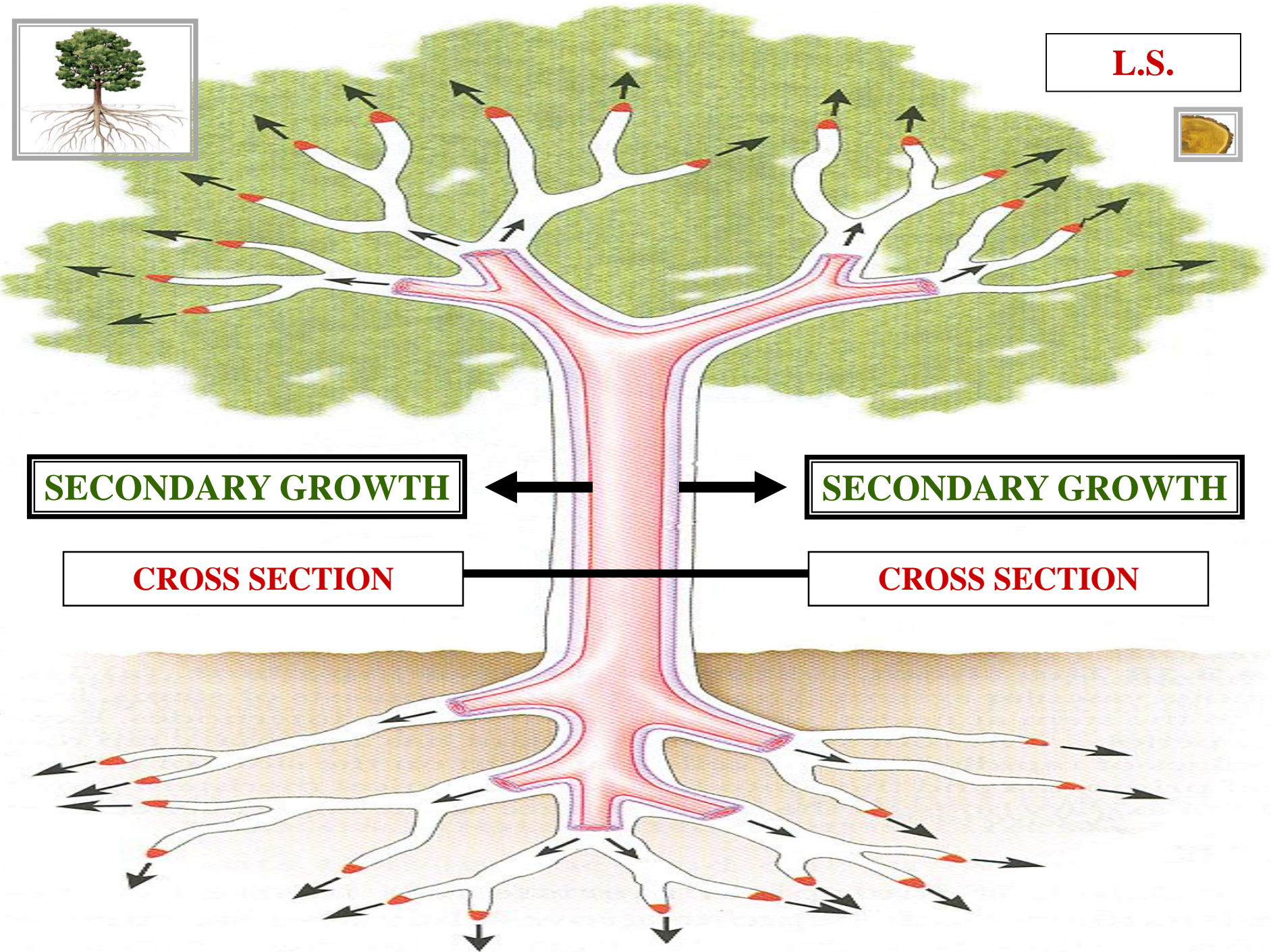
SECONDARY GROWTH







L.S.



SECONDARY GROWTH

SECONDARY GROWTH

CROSS SECTION

CROSS SECTION



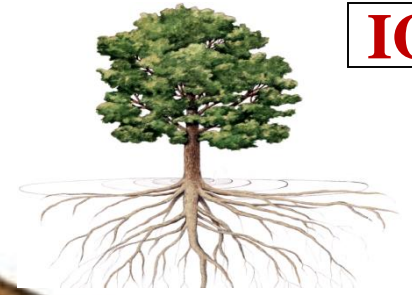
2G



DICOT ~2 STEM

C.S.

**IG**



**SECONDARY  
GROWTH**

**DICOT ~2 STEM**

**C.S.**

N



**SECONDARY  
GROWTH**

**INCREASES GIRTH**

**DICOT ~2 STEM**

**C.S.**



**SECONDARY  
GROWTH**

**INCREASES GIRTH**

**NOT HEIGHT**

**DICOT ~2 STEM**

**C.S.**

# LATERAL MERISTEM TYPES

# **LATERAL MERISTEM TYPES**

**VASCULAR CAMBIUM**

# **LATERAL MERISTEM TYPES**



# **LATERAL MERISTEM TYPES**

**VASCULAR CAMBIUM**  
**CORK CAMBIUM**

# **LATERAL MERISTEM TYPES**



# VASCULAR CAMBIUM

# VASCULAR CAMBIUM

# SECONDARY GROWTH VASCULAR CAMBIUM



DERIVES ~2 VASCULAR TISSUE

SECONDARY GROWTH  
VASCULAR CAMBIUM

# **SECONDARY GROWTH VASCULAR CAMBIUM**



**DERIVES ~2 VASCULAR TISSUE**

**---**

**CONSISTS PARENCHYMA INITIALS**

**SECONDARY GROWTH  
VASCULAR CAMBIUM**

# SECONDARY GROWTH VASCULAR CAMBIUM



DERIVES ~2 VASCULAR TISSUE

---

CONSISTS PARENCHYMA INITIALS

---

UNDERGO MITOSIS →

# SECONDARY GROWTH VASCULAR CAMBIUM

**SECONDARY GROWTH**

**VASCULAR CAMBIUM**

**DERIVES ~2 VASCULAR TISSUE**

---

**CONSISTS PARENCHYMA INITIALS**

---

**UNDERGO MITOSIS →**

---

**DERIVATIVES**

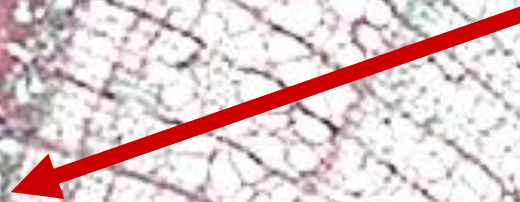
**SECONDARY GROWTH**

**VASCULAR CAMBIUM**





**VASCULAR  
CAMBIUM**

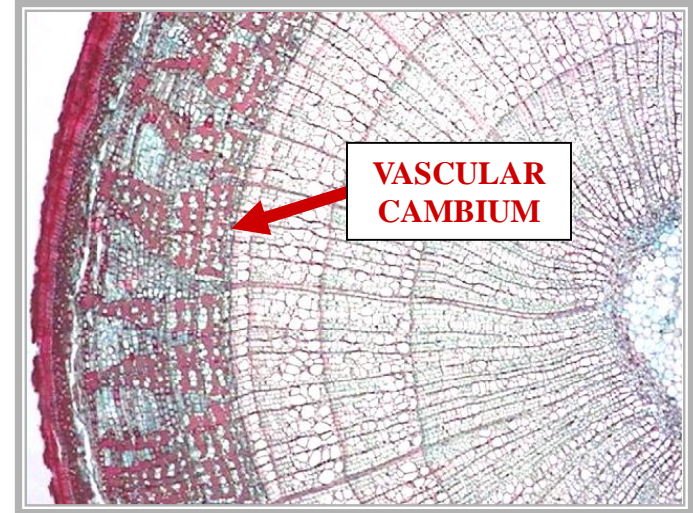


**DICOT ~2 STEM**

**C.S.**



**CELL**



**VASCULAR  
CAMBIUM**

**PC**

**VASCULAR  
CAMBIUM**

**VASCULAR  
CAMBIUM**

**DICOT ~2 STEM**

**C.S.**

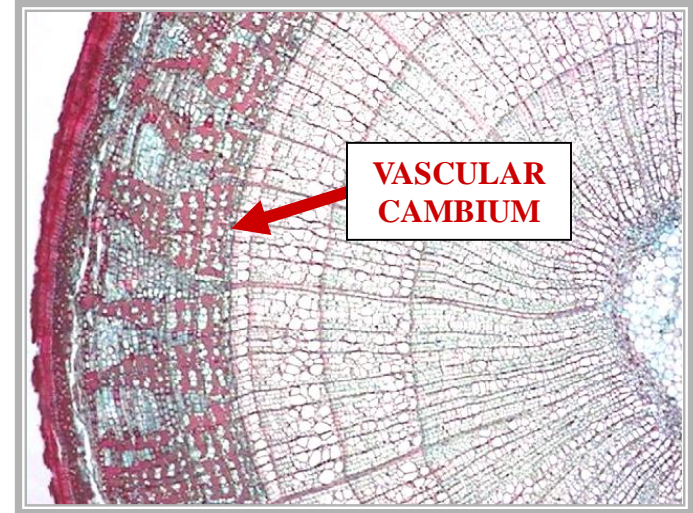




**CELL**

**PARENCHYMA  
CELL INITIALS**

**DICOT ~2 STEM**



**VASCULAR  
CAMBIUM**

**PARENCHYMA  
CELL INITIALS**

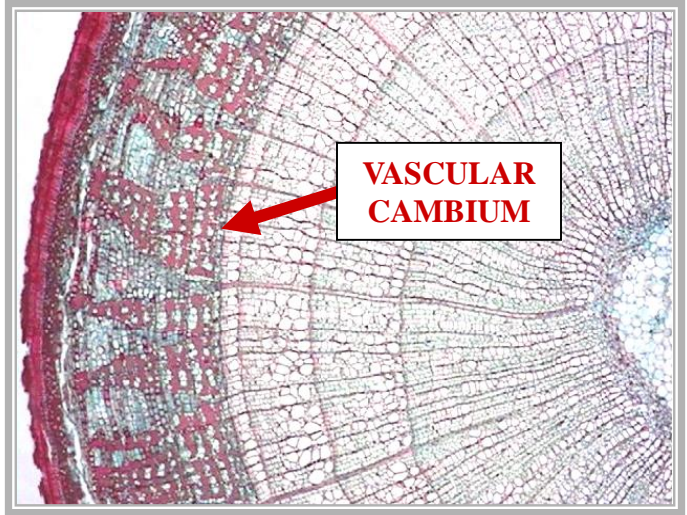
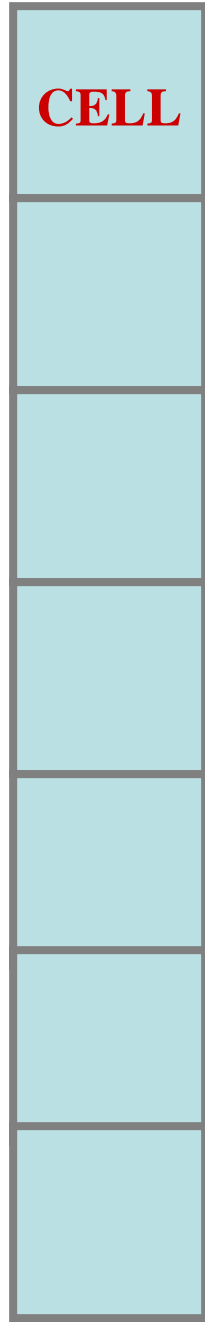
**M**

**C.S.**



MITOSIS

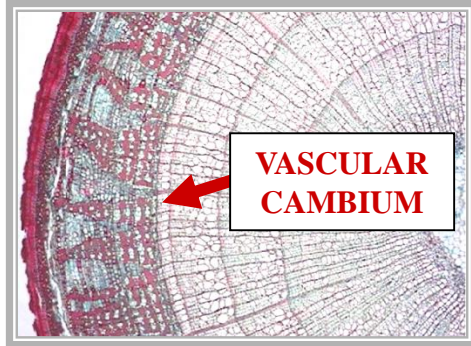
DICOT ~2 STEM



MITOSIS

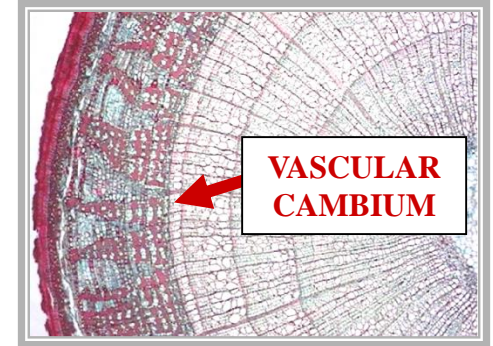
C.S.

**OUTSIDE  
VASCULAR  
CAMBIUM**



**CELL**

**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**MITOSIS**

**DERIVATIVE  
PARENCHYMA  
CELLS**

**DICOT ~2 STEM**

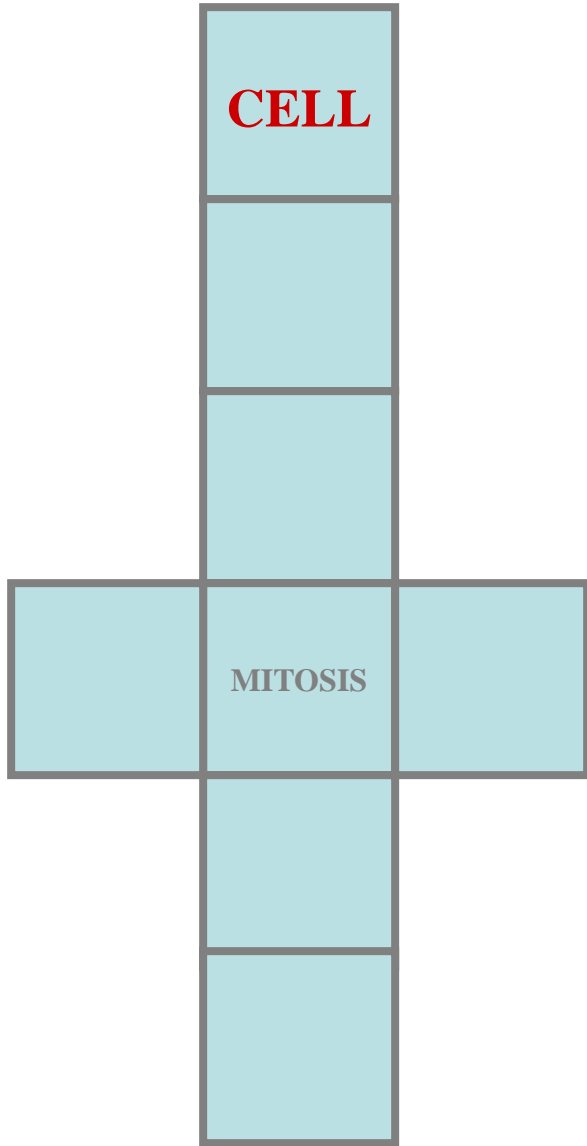
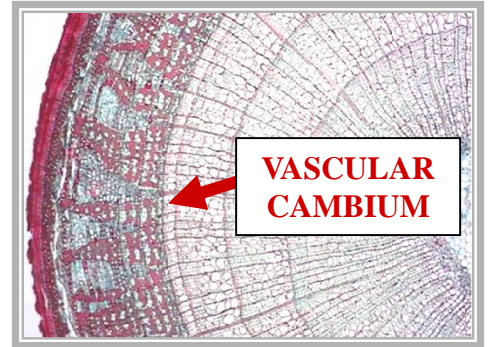
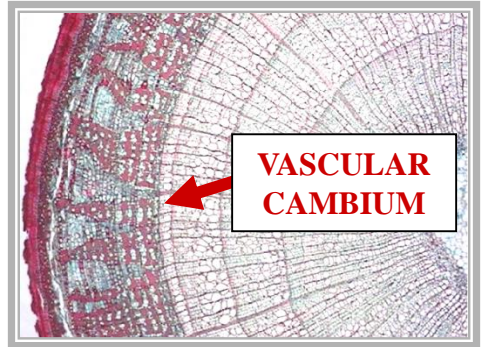
**VASCULAR  
CAMBIUM**

**C.S.**



**OUTSIDE  
VASCULAR  
CAMBIUM**

**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**INSIDE**

**DERIVATIVE  
PARENCHYMA  
CELLS**

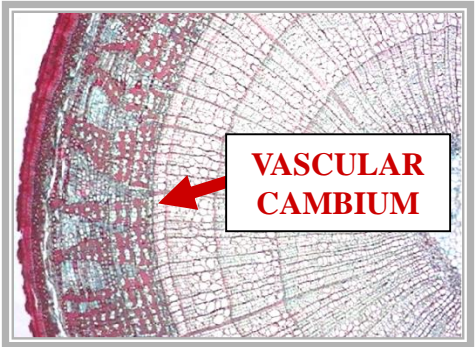
**DERIVATIVE  
PARENCHYMA  
CELLS**

**DICOT ~2 STEM**

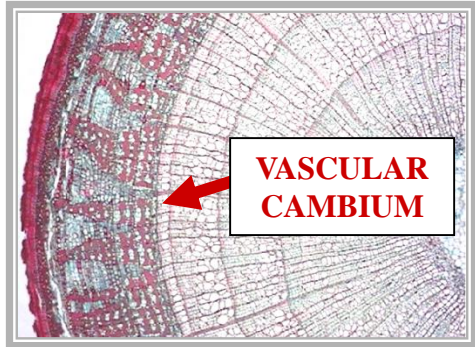
**VASCULAR  
CAMBIUM**

**C.S.**

**OUTSIDE  
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CAMBIUM**



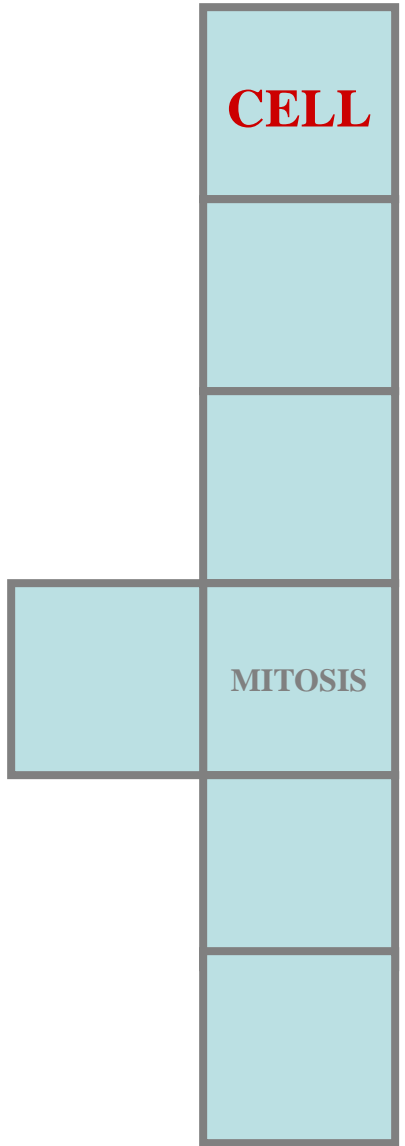
**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**DERIVATIVE  
PARENCHYMA  
CELLS**

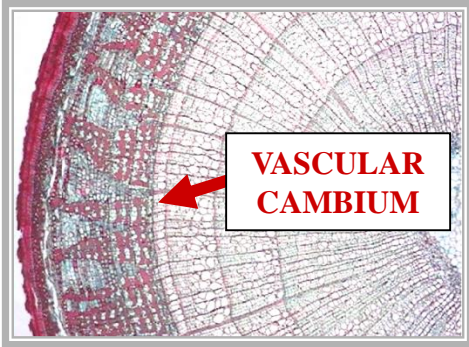
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**VASCULAR  
CAMBIUM**

**C.S.**

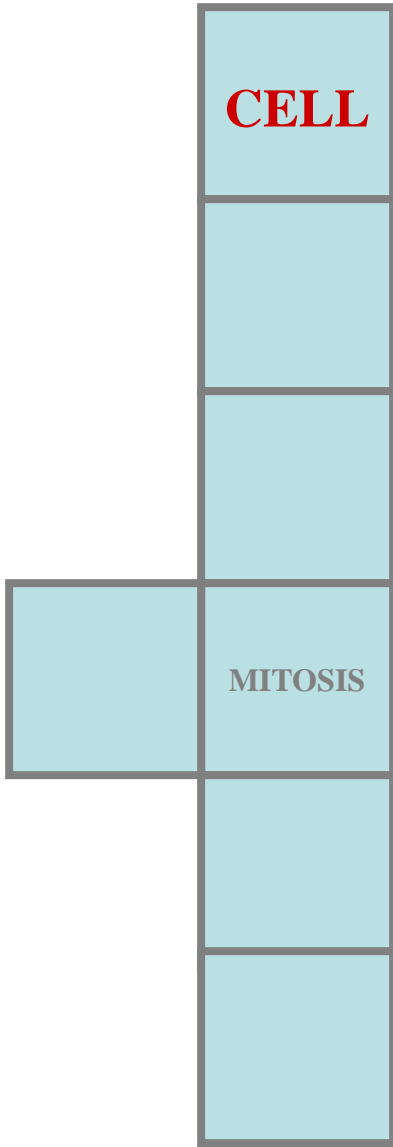
**OUTSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

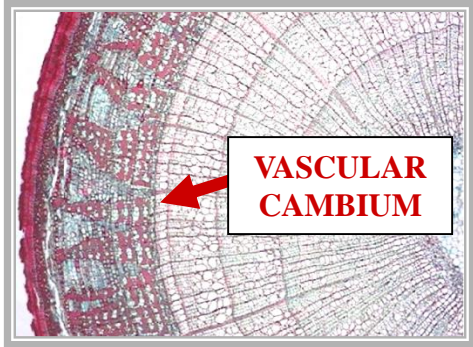
**DIFFERENTIATE**

**DICOT ~2 STEM**



**VASCULAR  
CAMBIUM**

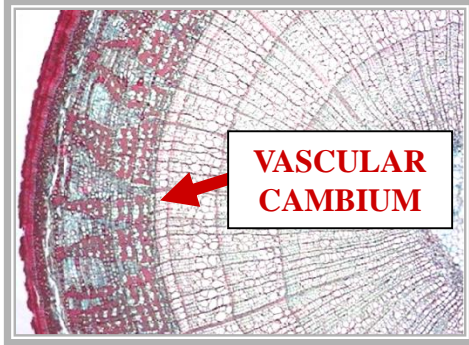
**INSIDE  
VASCULAR  
CAMBIUM**



**VASCULAR  
CAMBIUM**

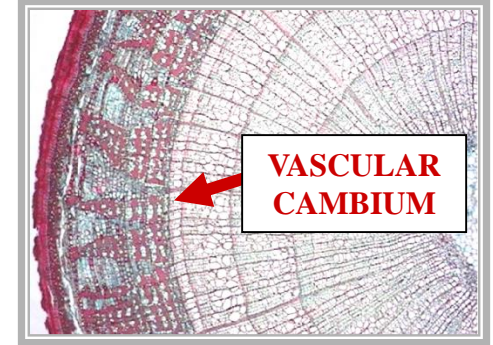
**C.S.**

**OUTSIDE  
VASCULAR  
CAMBIUM**



**CELL**

**INSIDE  
VASCULAR  
CAMBIUM**



**I**  
→

**MITOSIS**

**OUTSIDE**

**~2 PHLOEM**

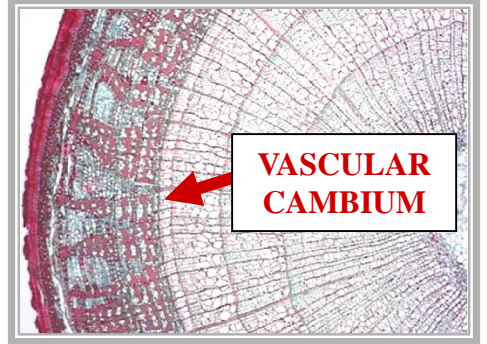
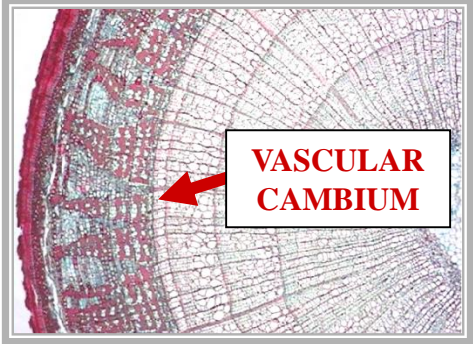
**DICOT ~2 STEM**

**VASCULAR  
CAMBIUM**

**C.S.**

**OUTSIDE  
VASCULAR  
CAMBIUM**

**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**INSIDE**

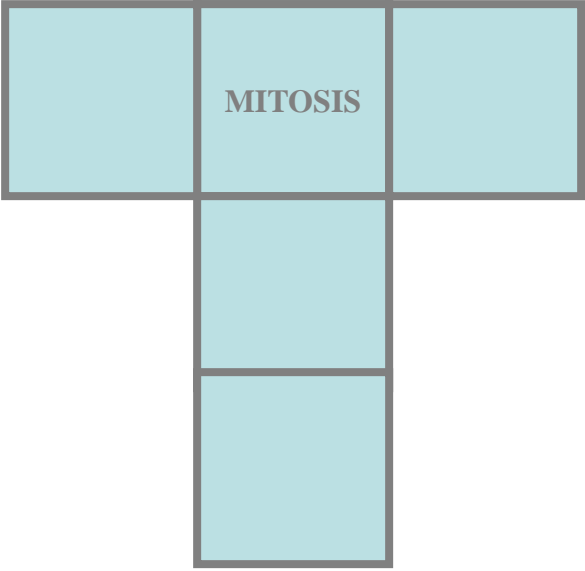
**~2 PHLOEM**

**DERIVATIVE  
PARENCHYMA  
CELLS**

**DICOT ~2 STEM**

**VASCULAR  
CAMBIUM**

**C.S.**



**CELL**

**CELL**

**CELL**

**MITOSIS**

**CELL**

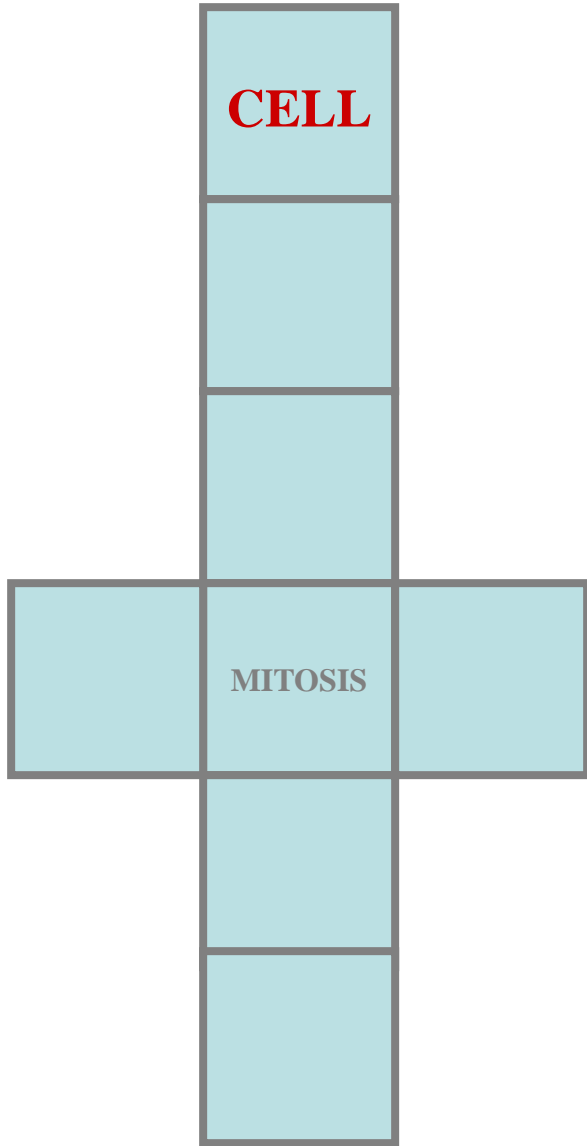
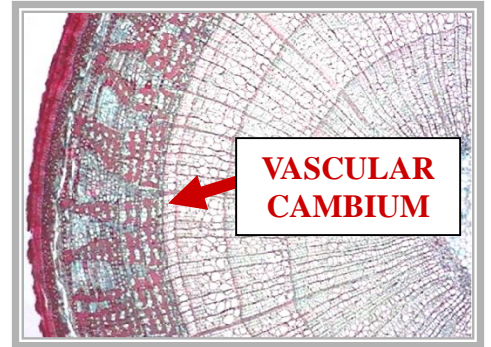
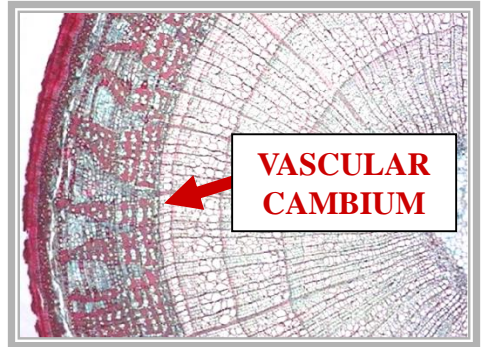
**CELL**



**2X**

**OUTSIDE  
VASCULAR  
CAMBIUM**

**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**INSIDE**

**~2 PHLOEM**

**DIFFERENTIATE**

**DICOT ~2 STEM**

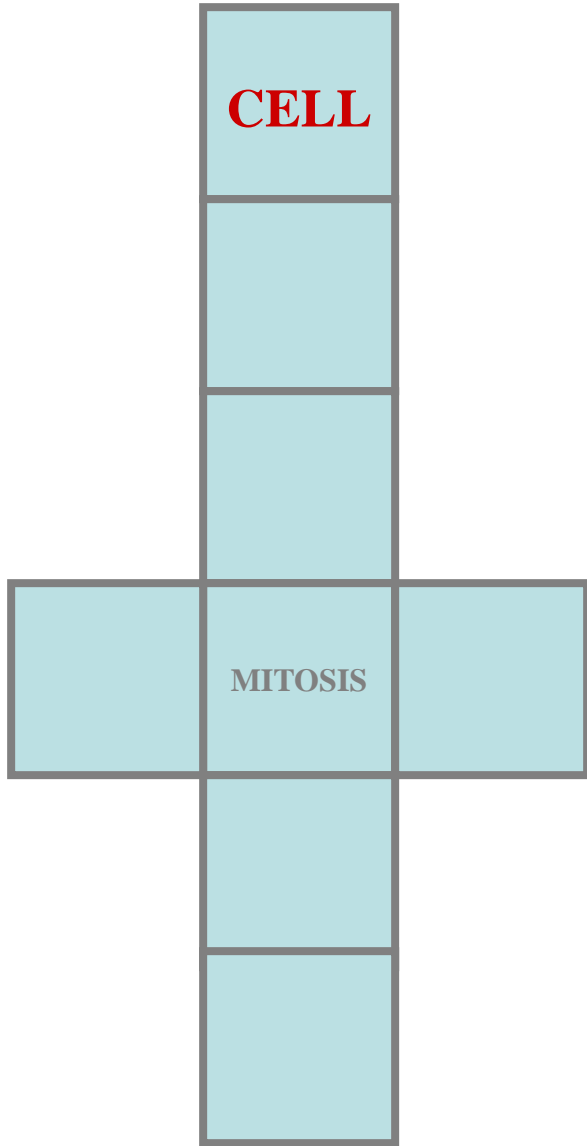
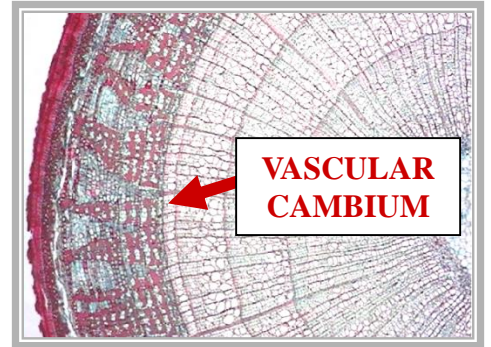
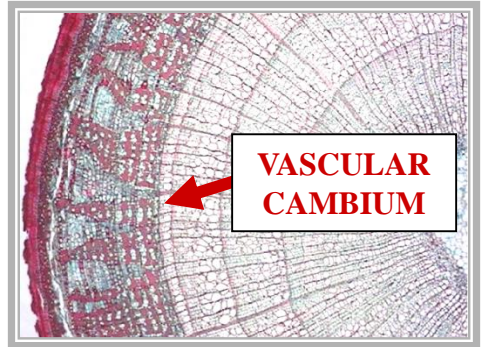
**VASCULAR  
CAMBIUM**

**C.S.**



**OUTSIDE  
VASCULAR  
CAMBIUM**

**INSIDE  
VASCULAR  
CAMBIUM**



**OUTSIDE**

**INSIDE**

**~2 PHLOEM**

**~2 XYLEM**

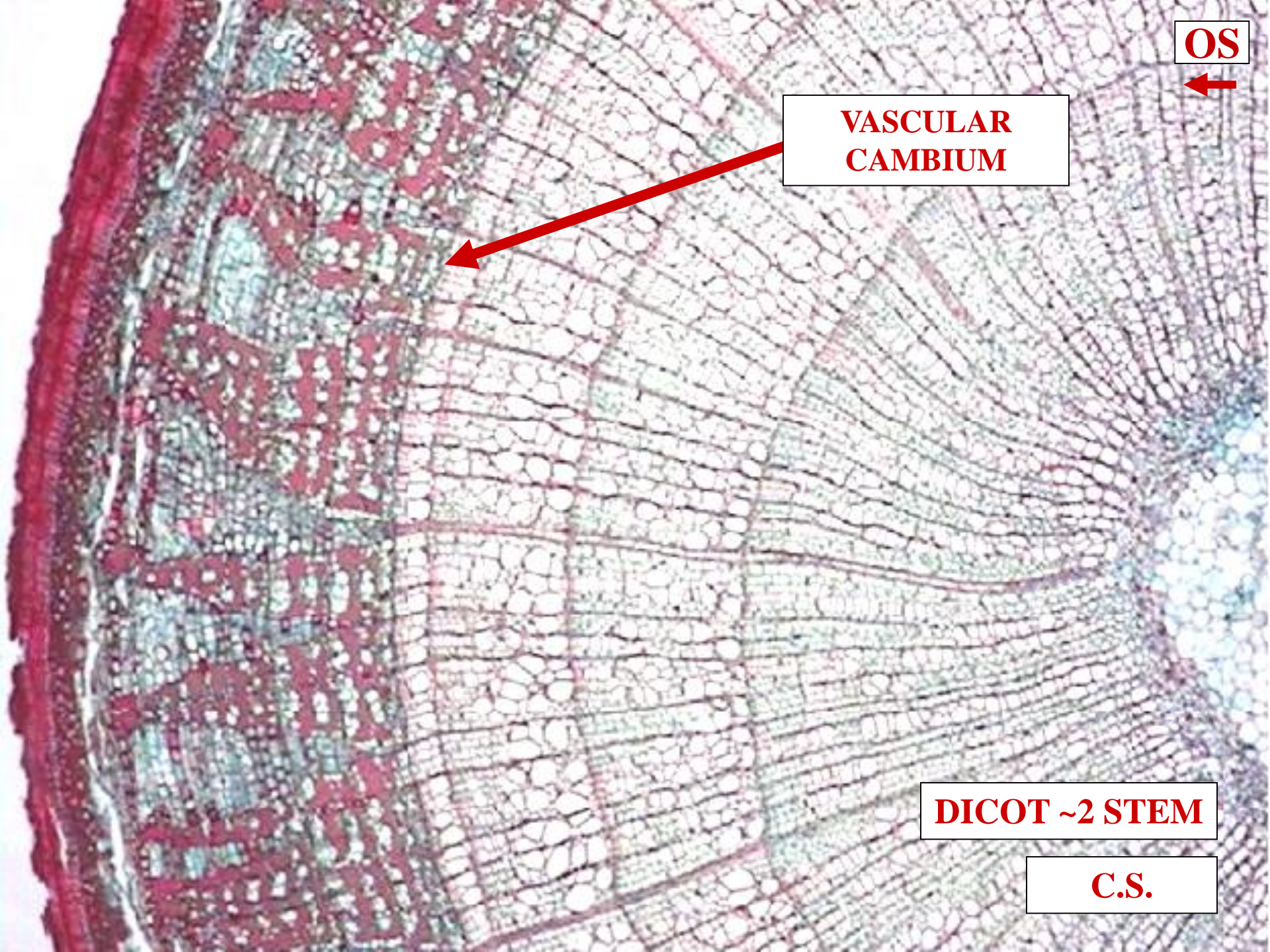
**DICOT ~2 STEM**

**VASCULAR  
CAMBIUM**

**C.S.**



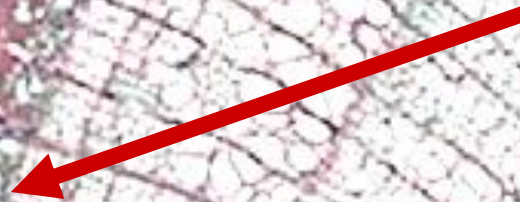
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**OS**

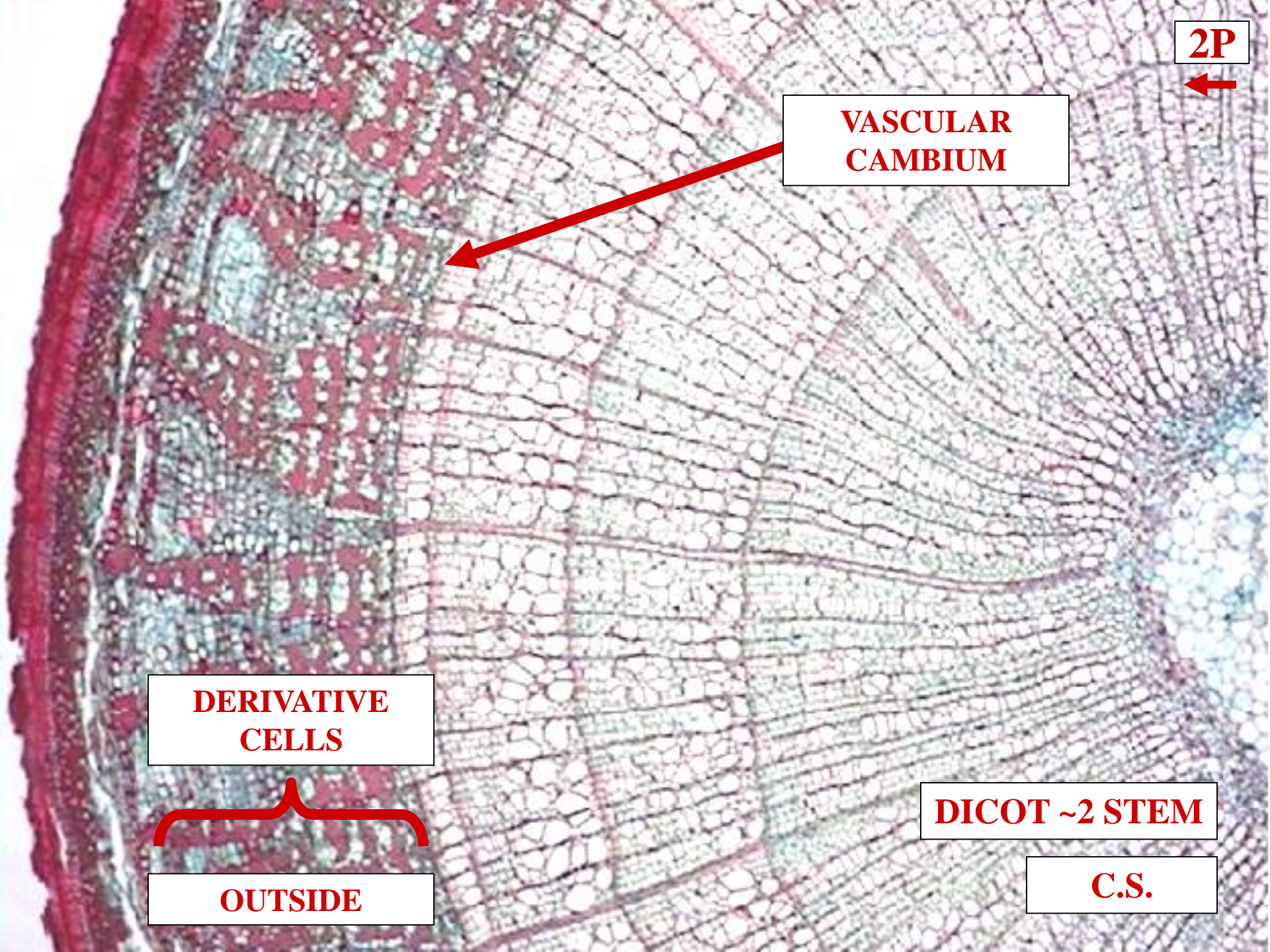


**VASCULAR  
CAMBIUM**



**DICOT ~2 STEM**

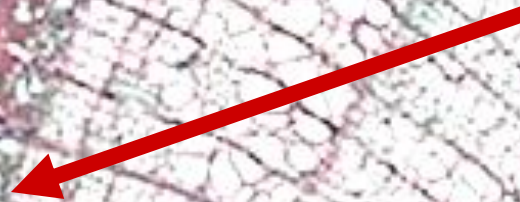
**C.S.**



**2P**



**VASCULAR  
CAMBIUM**



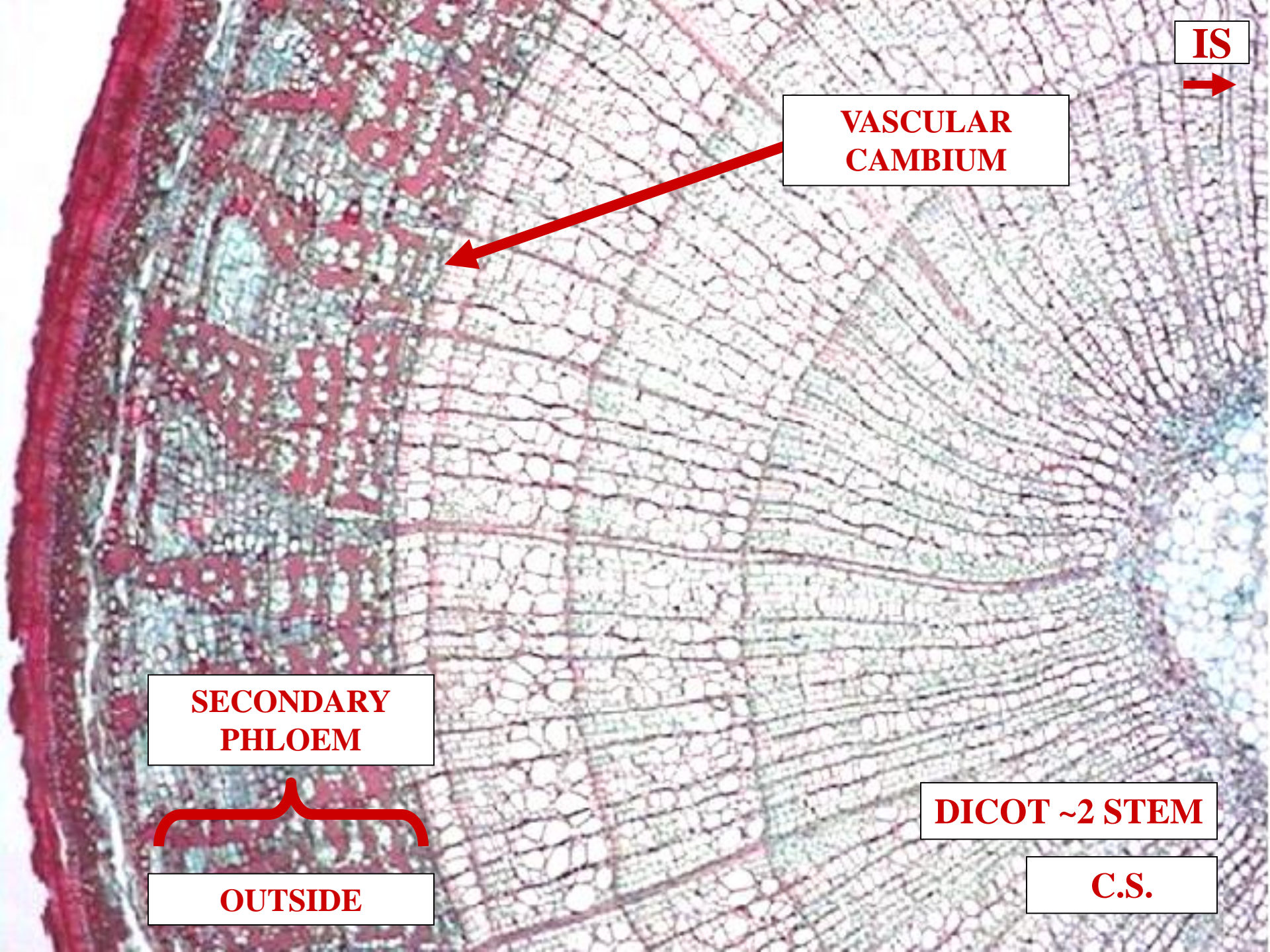
**DERIVATIVE  
CELLS**



**OUTSIDE**

**DICOT ~2 STEM**

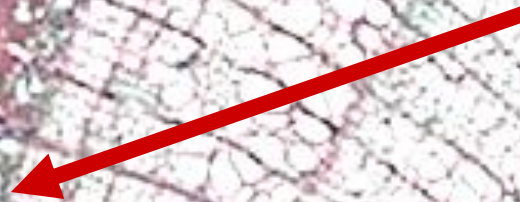
**C.S.**



**IS**



**VASCULAR  
CAMBIUM**



**SECONDARY  
PHLOEM**



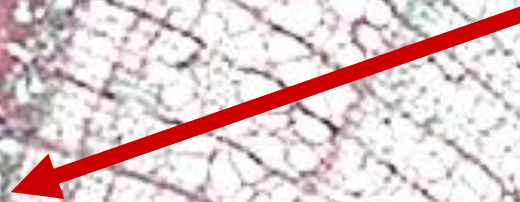
**OUTSIDE**

**DICOT ~2 STEM**

**C.S.**

**2X**

**VASCULAR  
CAMBIUM**



**DERIVATIVE  
CELLS**



**INSIDE**

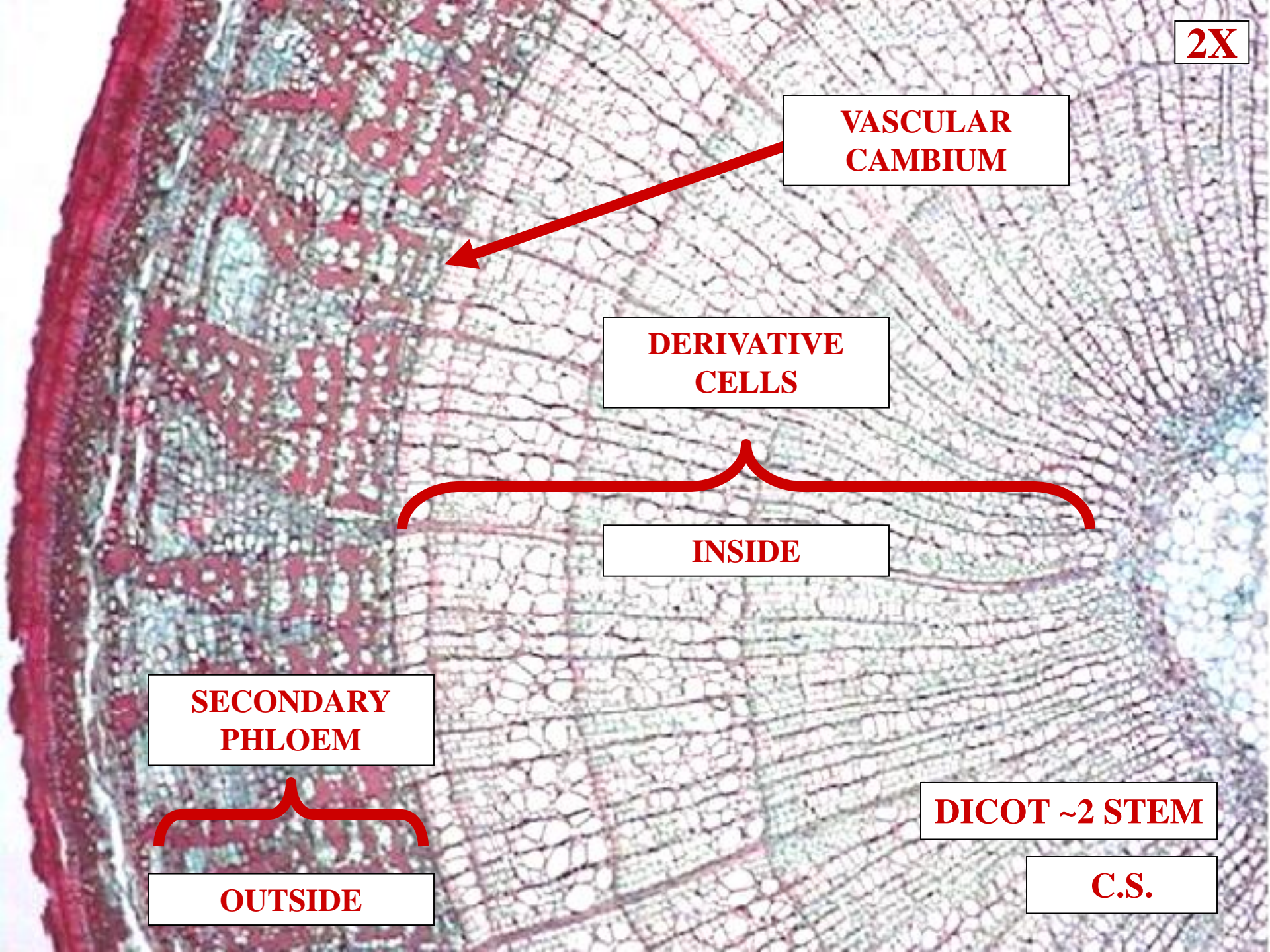
**SECONDARY  
PHLOEM**



**OUTSIDE**

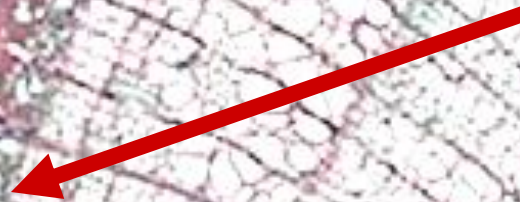
**DICOT ~2 STEM**

**C.S.**



**2G**

**VASCULAR  
CAMBIUM**



**SECONDARY  
XYLEM**



**INSIDE**

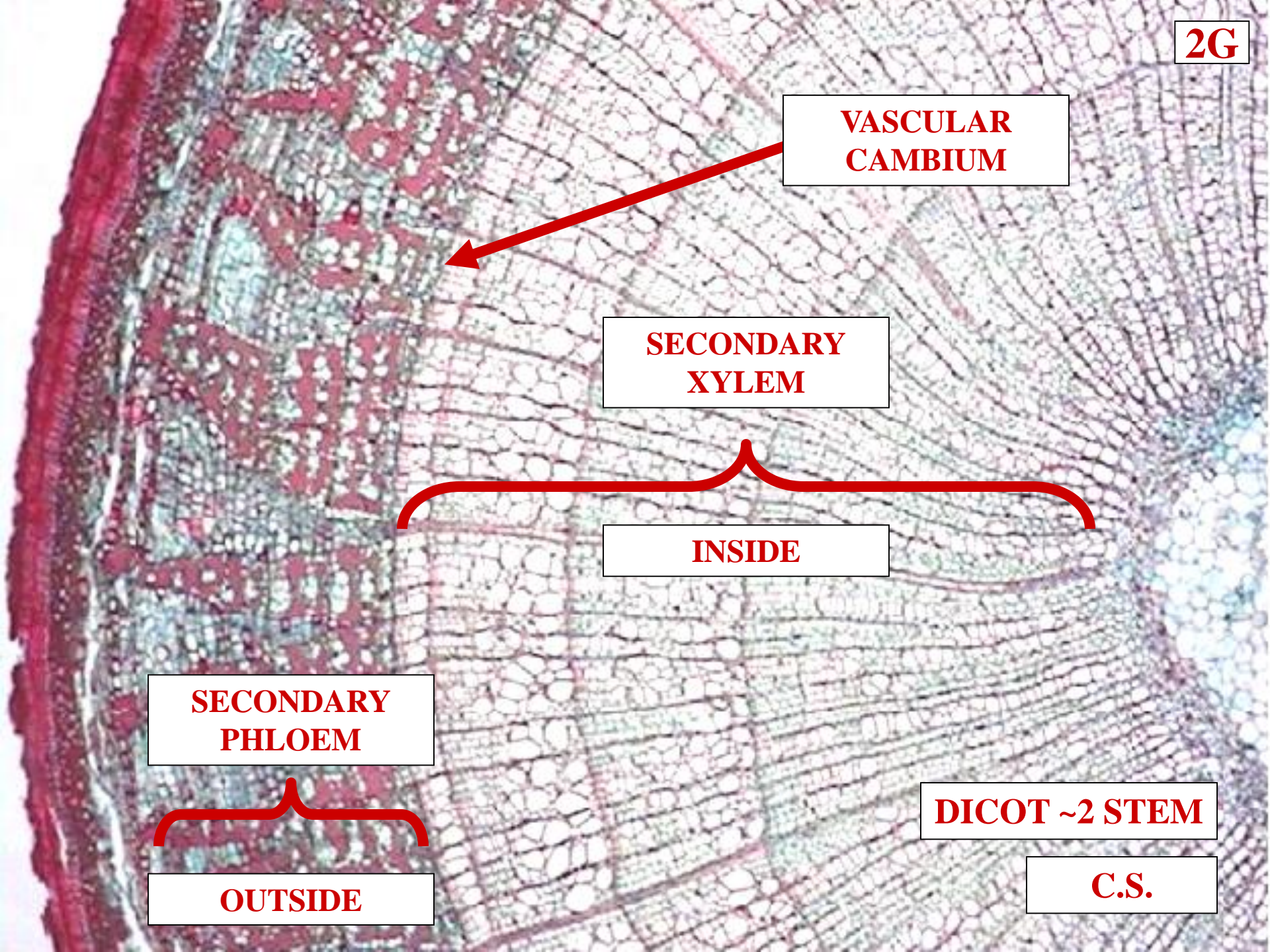
**SECONDARY  
PHLOEM**



**OUTSIDE**

**DICOT ~2 STEM**

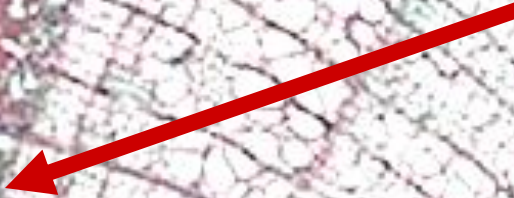
**C.S.**







**VASCULAR  
CAMBIUM**

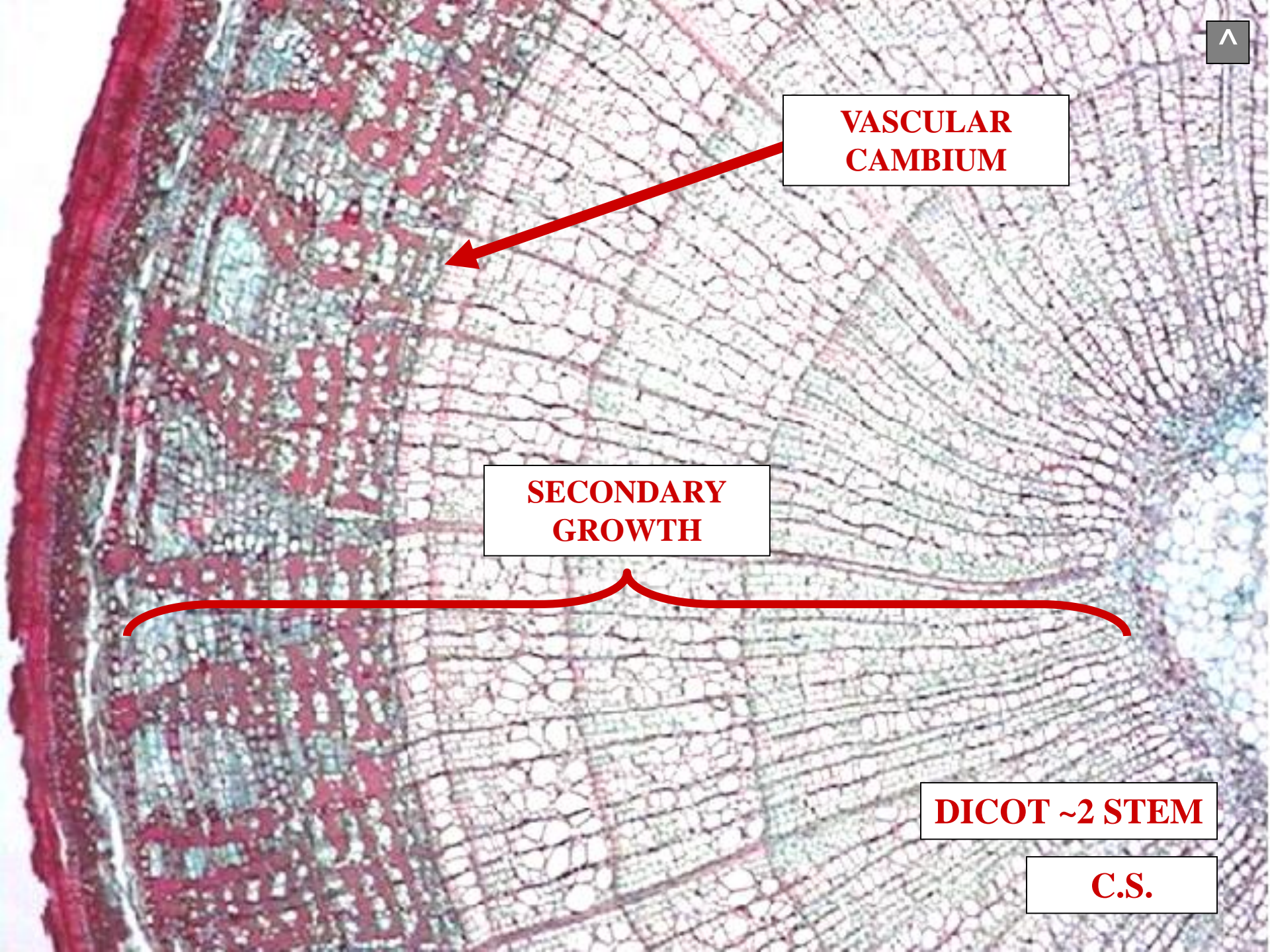


**SECONDARY  
GROWTH**



**DICOT ~2 STEM**

**C.S.**





# VASCULAR CAMBIUM INITIALS

**VASCULAR  
CAMBIUM  
INITIALS  
TYPES**

**VASCULAR CAMBIUM  
INITIALS  
TYPES**

**FUSIFORM INITIALS**

**VASCULAR CAMBIUM  
INITIALS  
TYPES**



**VASCULAR CAMBIUM  
INITIALS  
TYPES**

**FUSIFORM INITIALS  
RAY INITIALS**

**VASCULAR CAMBIUM  
INITIALS  
TYPES**

# FUSIFORM INITIAL

**FUSIFORM INITIAL**

**VASCULAR CAMBIUM  
FUSIFORM INITIAL**



**VERTICAL ORIENTATION**

**VASCULAR CAMBIUM  
FUSIFORM INITIAL**



**VASCULAR CAMBIUM  
FUSIFORM INITIAL**



**VERTICAL ORIENTATION**

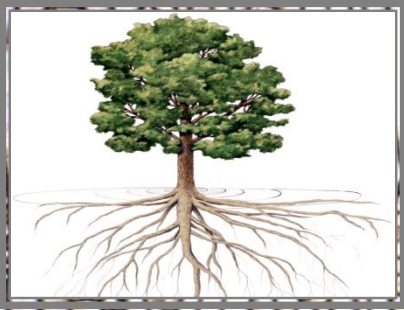
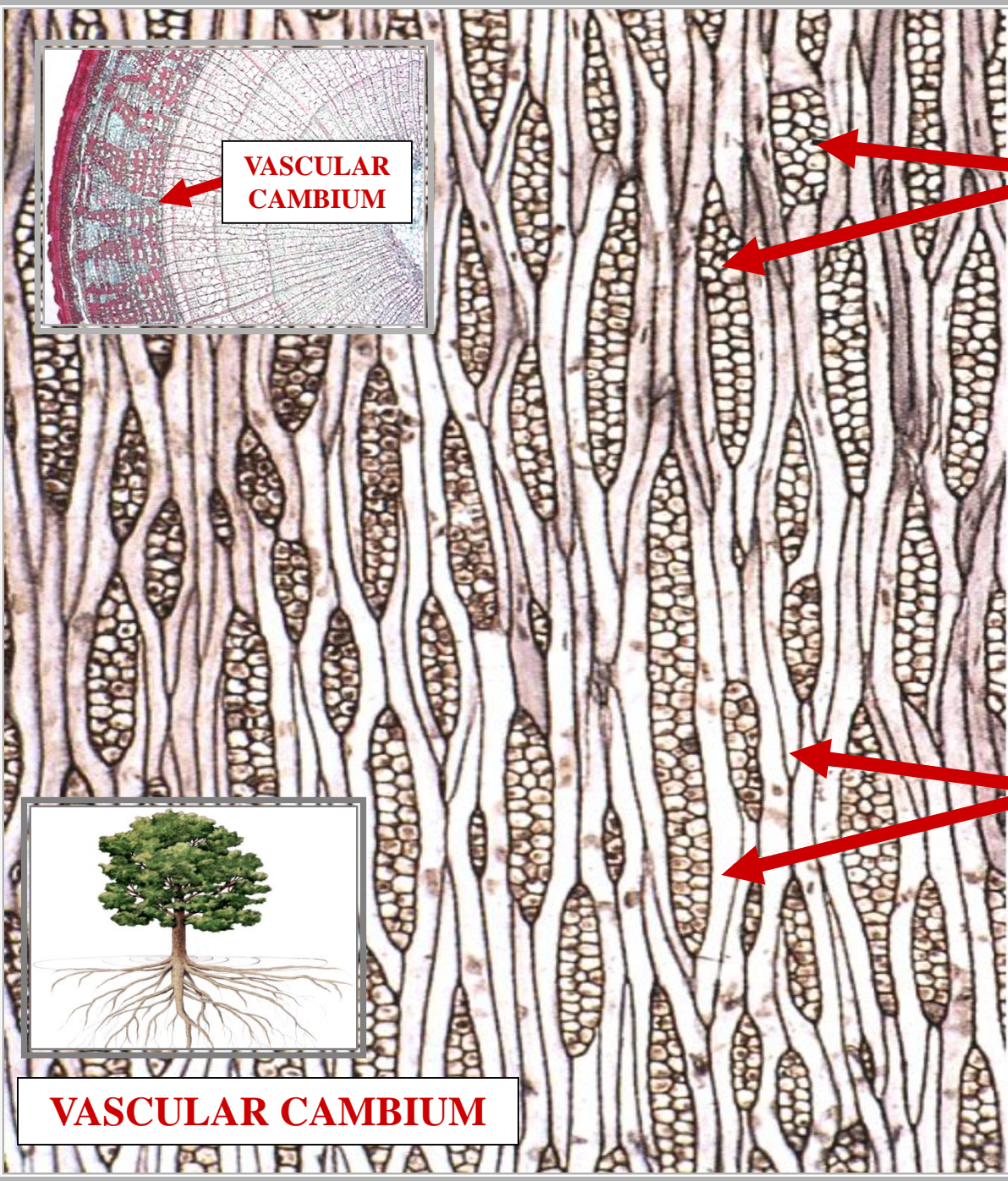
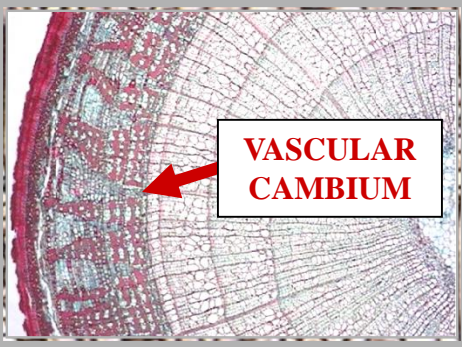
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**DERIVE AXIAL SYSTEM**

**VASCULAR CAMBIUM  
FUSIFORM INITIAL**

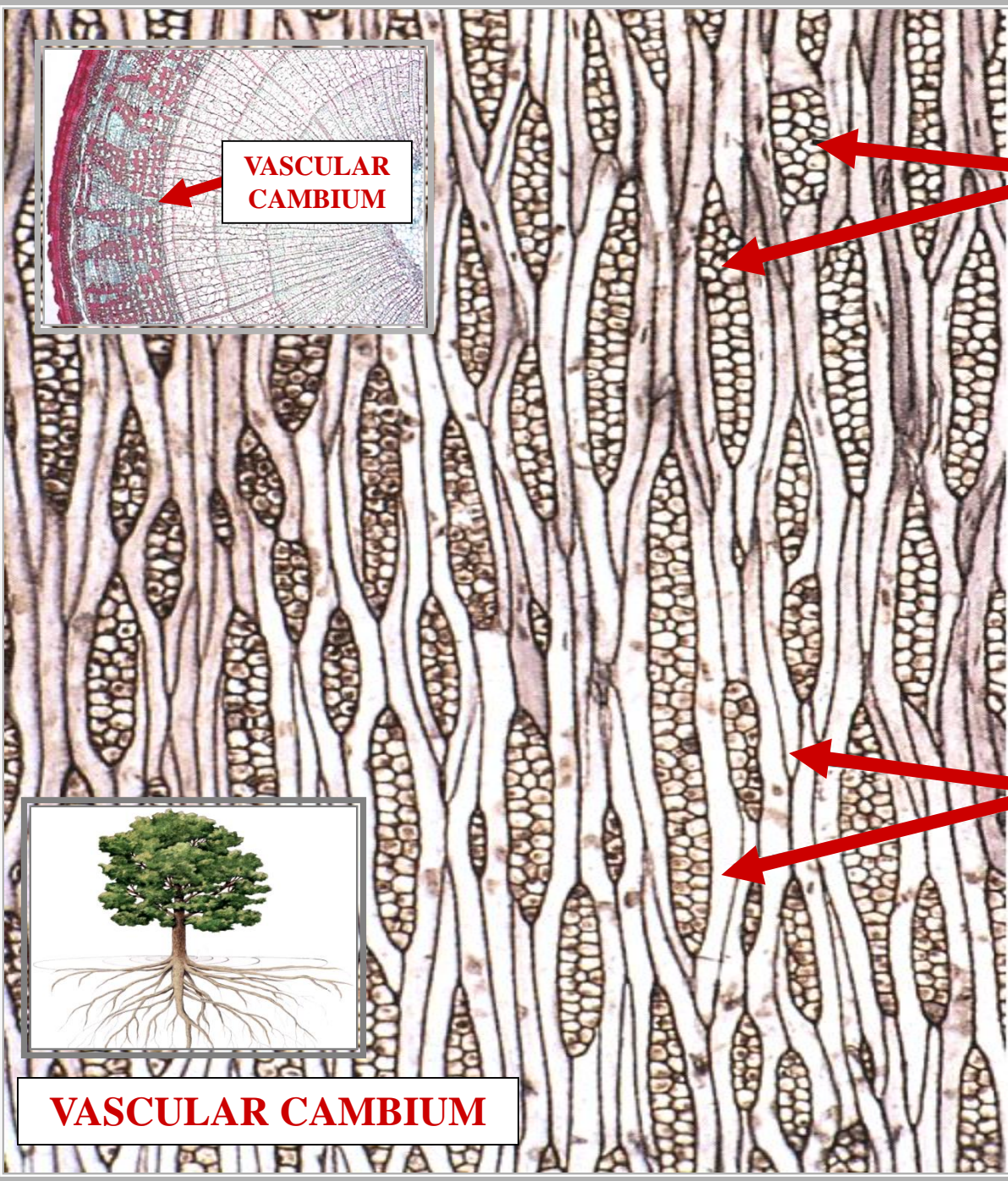
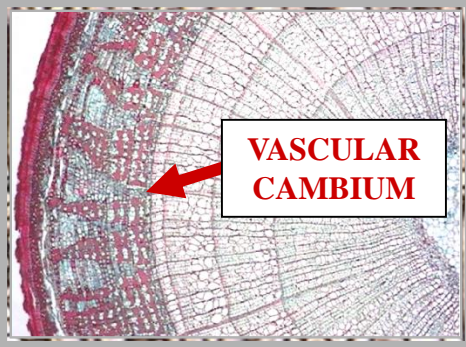


**VO**

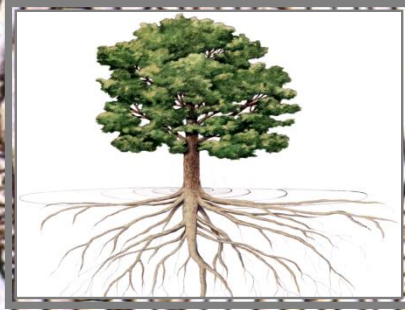


**DICOT ~2 STEM**

**L.S.**



**VERTICAL  
ORIENTATION**

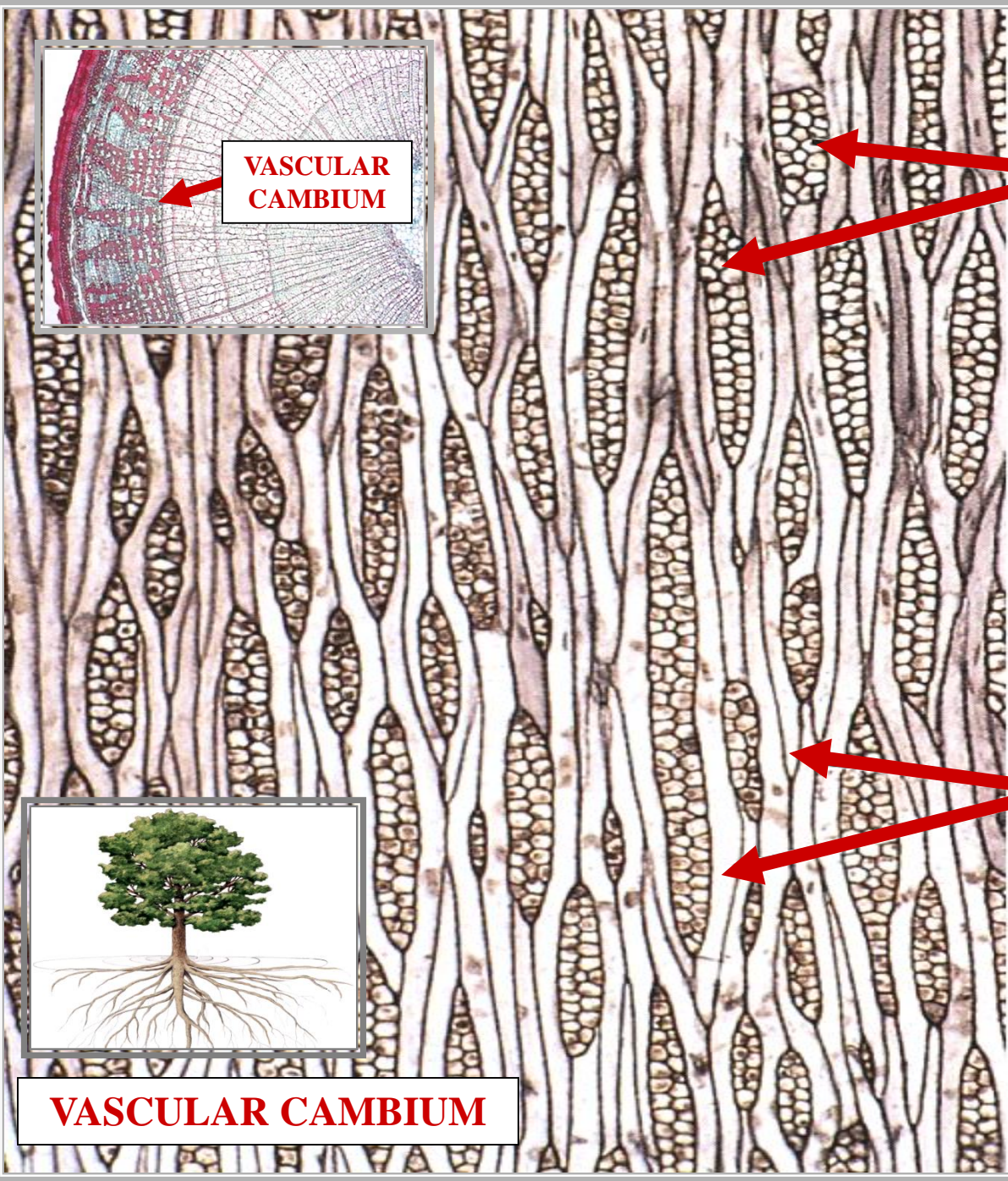
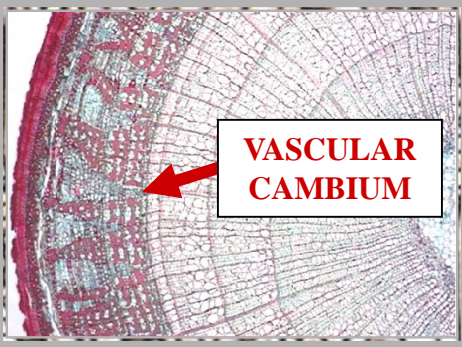


**VASCULAR CAMBIUM**

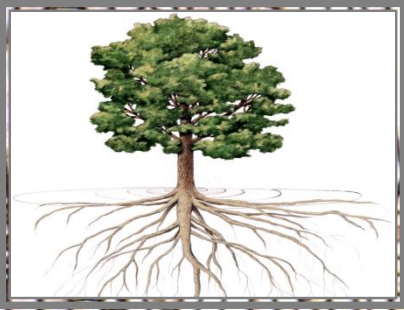
**DICOT ~2 STEM**

**L.S.**

**AS**



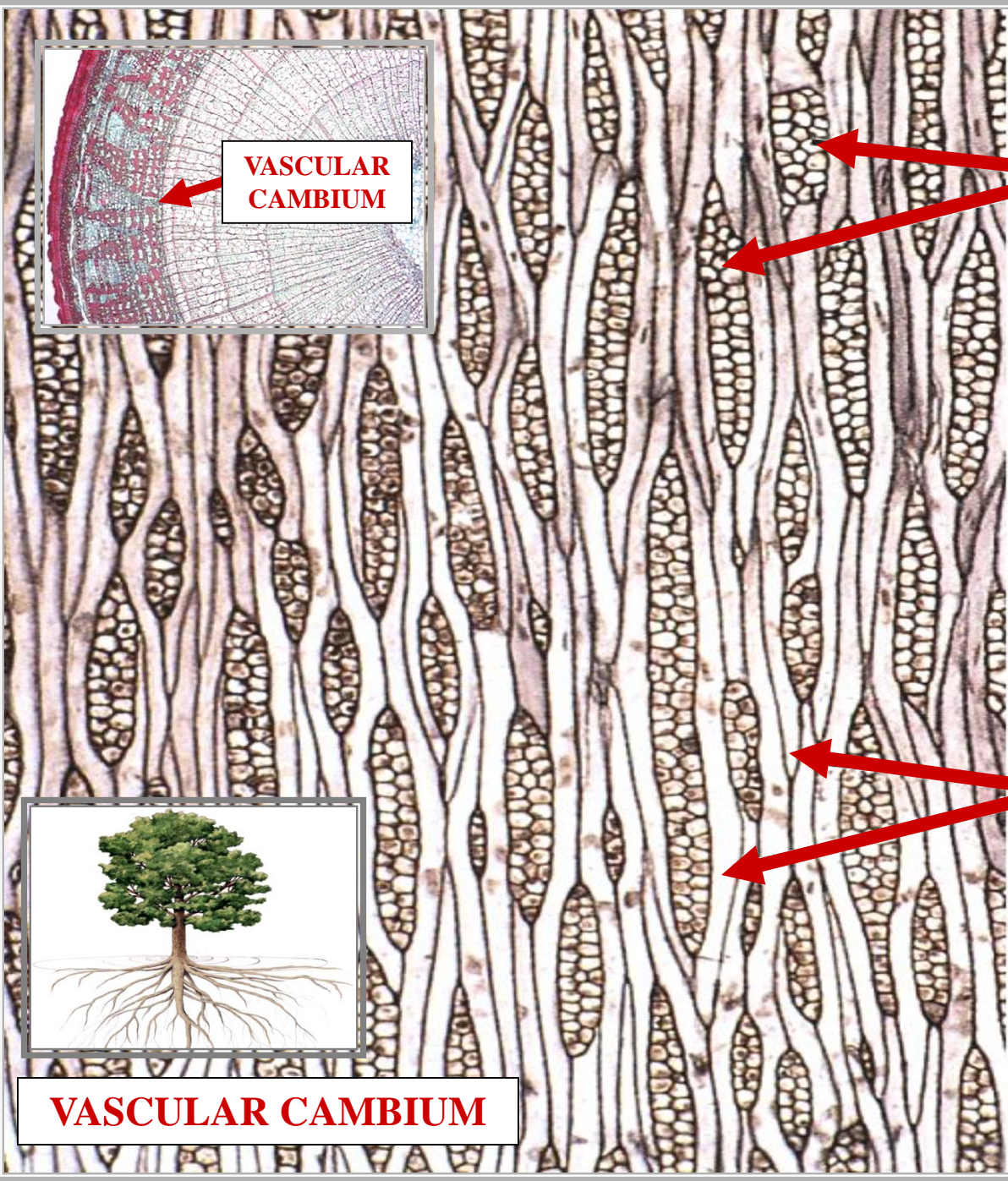
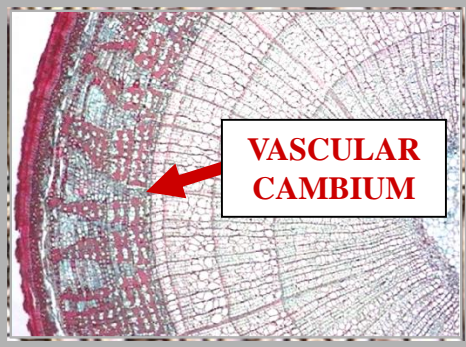
**MITOSIS**



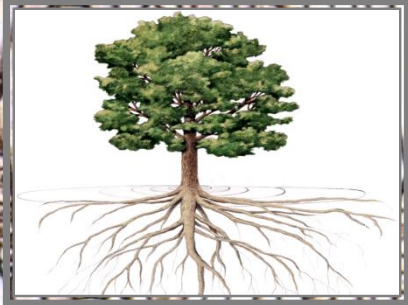
**VASCULAR CAMBIUM**

**DICOT ~2 STEM**

**L.S.**



**DERIVE  
AXIAL SYSTEM**



**VASCULAR CAMBIUM**

**DICOT ~2 STEM**

**L.S.**



# VASCULAR AXIAL SYSTEM



**VASCULAR  
AXIAL SYSTEM**

**PERMITS VERTICAL TRANSPORT**



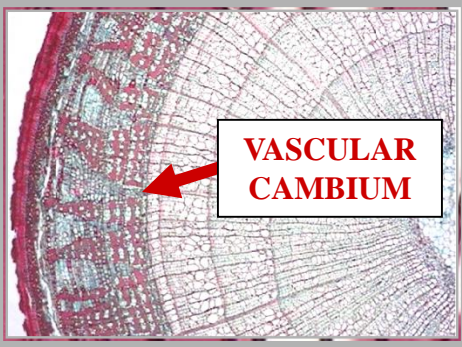
**DICOT ~2 STEM**



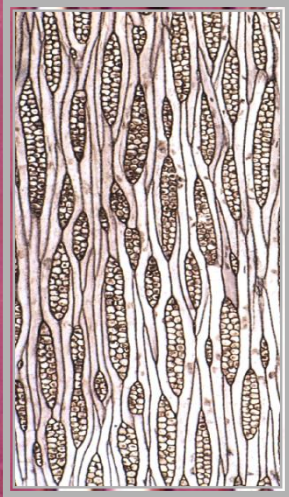


**XYLEM  
AXIAL SYSTEM  
CONSISTS:**

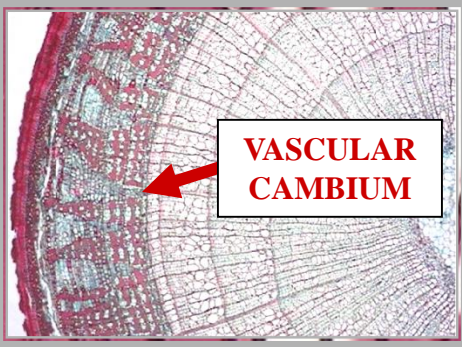
**TE**



**XYLEM  
AXIAL SYSTEM**

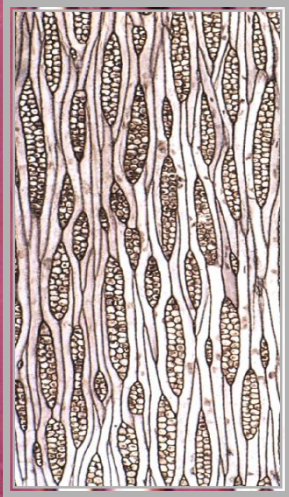


**L.S.**



TRACHEARY  
ELEMENTS

A red arrow points from this text label to a tracheary element in the main micrograph.



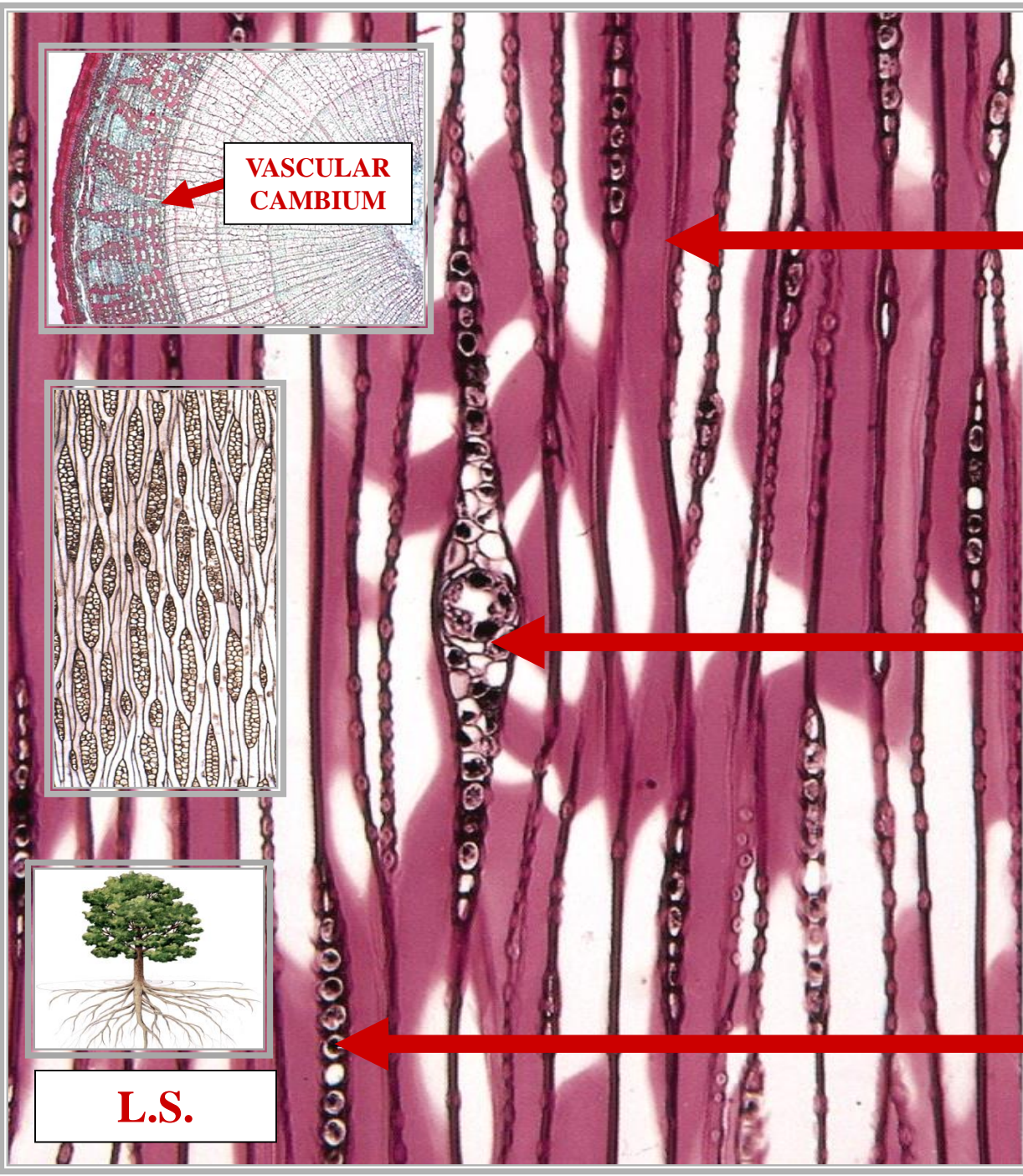
An empty rectangular box with a red arrow pointing from its center to a tracheary element in the main micrograph.



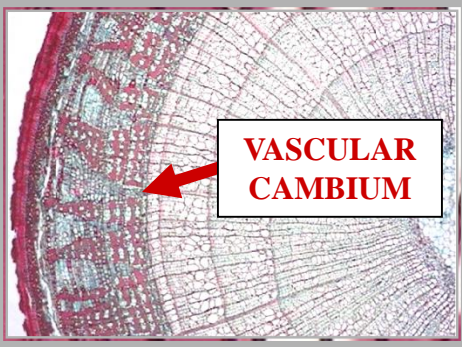
L.S.

A red arrow points from this text label to the longitudinal section of the tree trunk shown in the main micrograph.

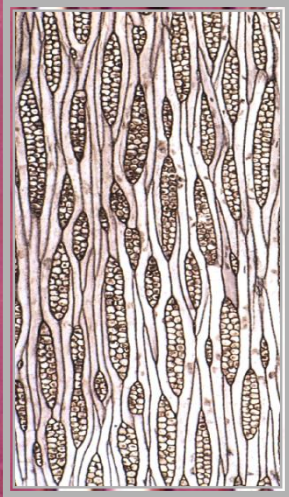
An empty rectangular box with a red arrow pointing from its center to the longitudinal section of the tree trunk in the main micrograph.



VM



VASCULAR CAMBIUM

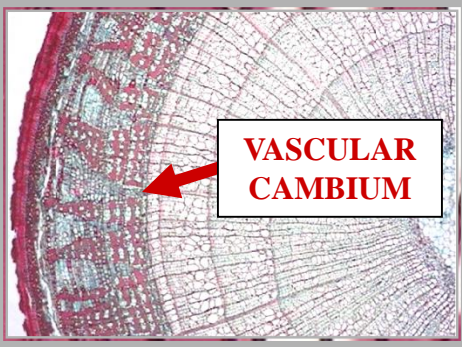


TRACHEIDS

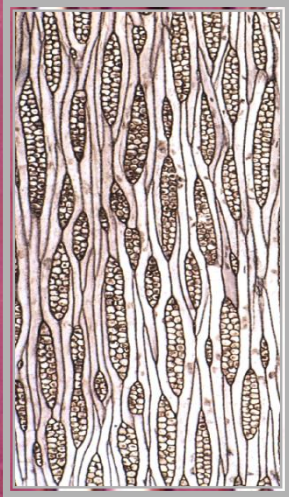


L.S.





**VESSEL MEMBERS**

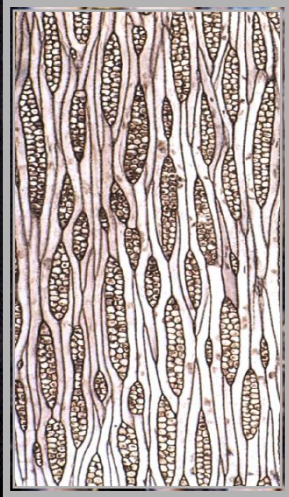
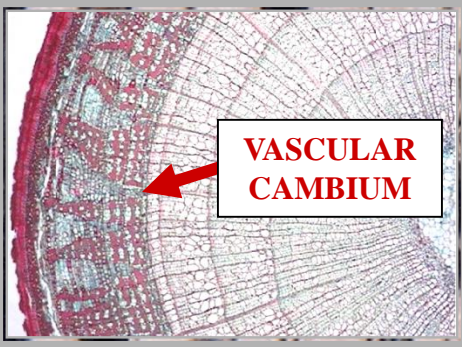


**L.S.**

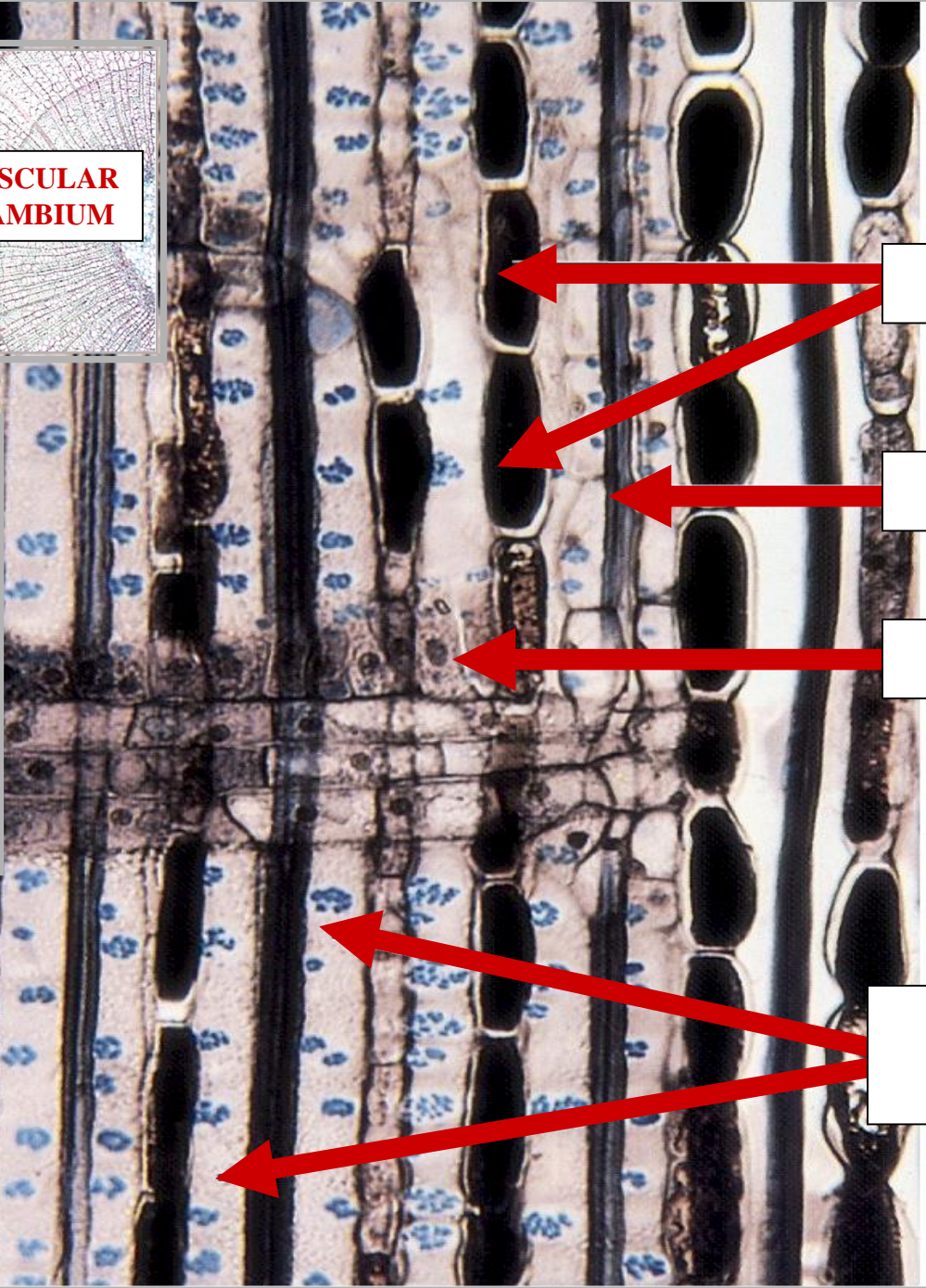


# **PHLOEM AXIAL SYSTEM CONSISTS:**

**SE**



**L.S.**



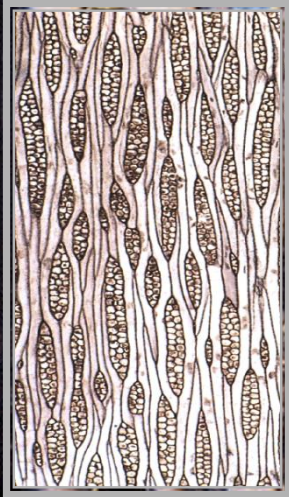
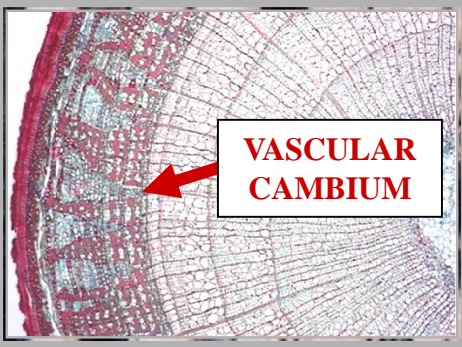
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**PHLOEM  
AXIAL SYSTEM**

**SC**



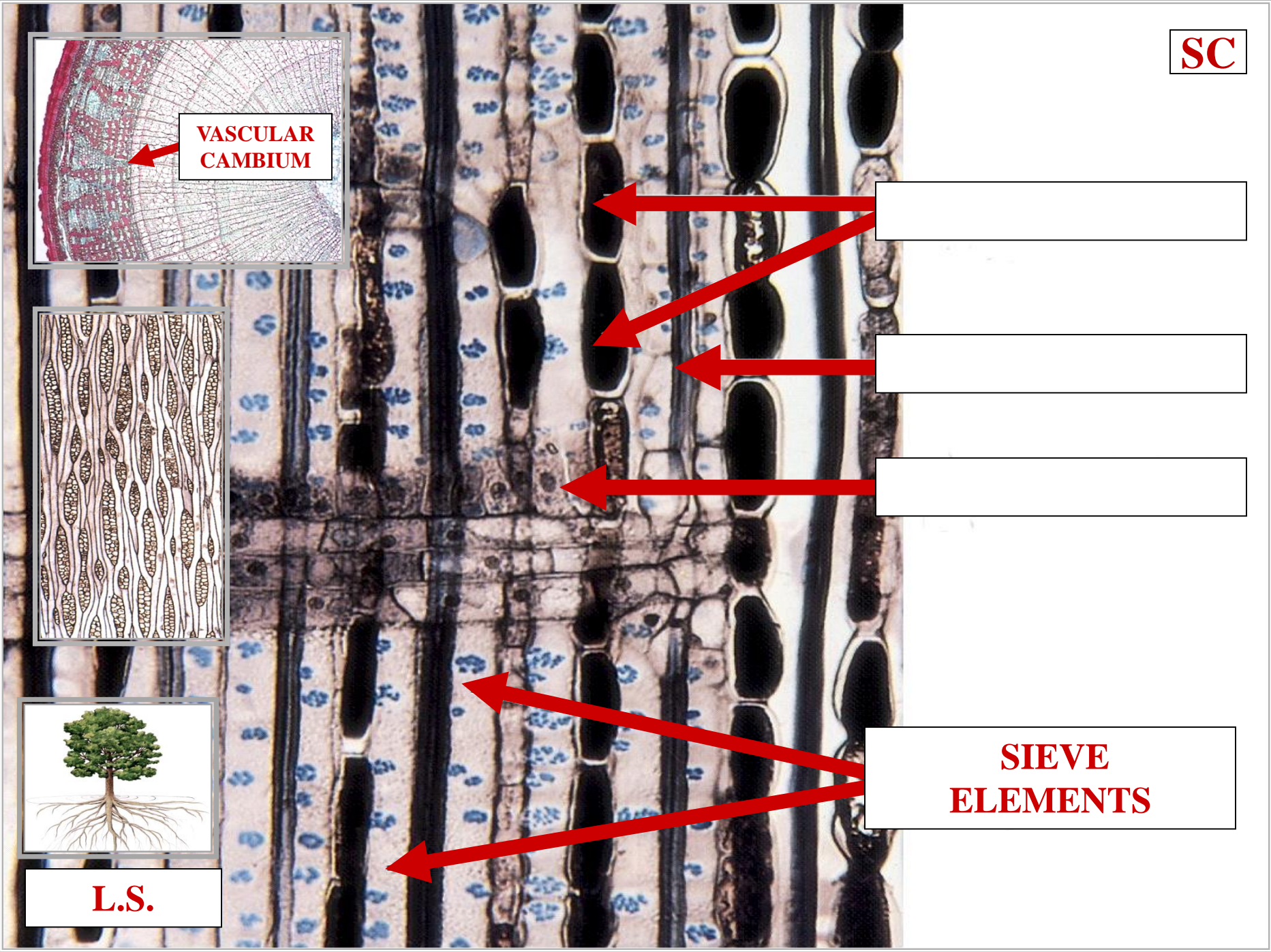
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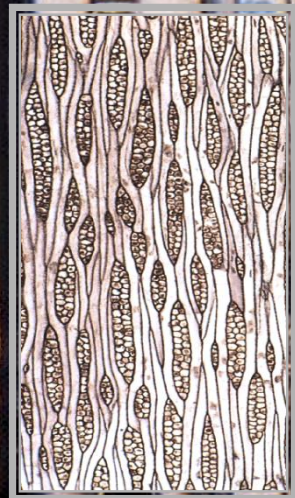
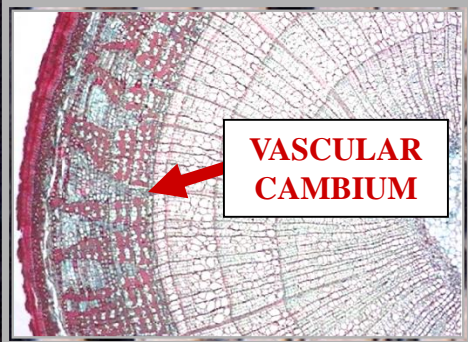
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**SIEVE ELEMENTS**





**SM**



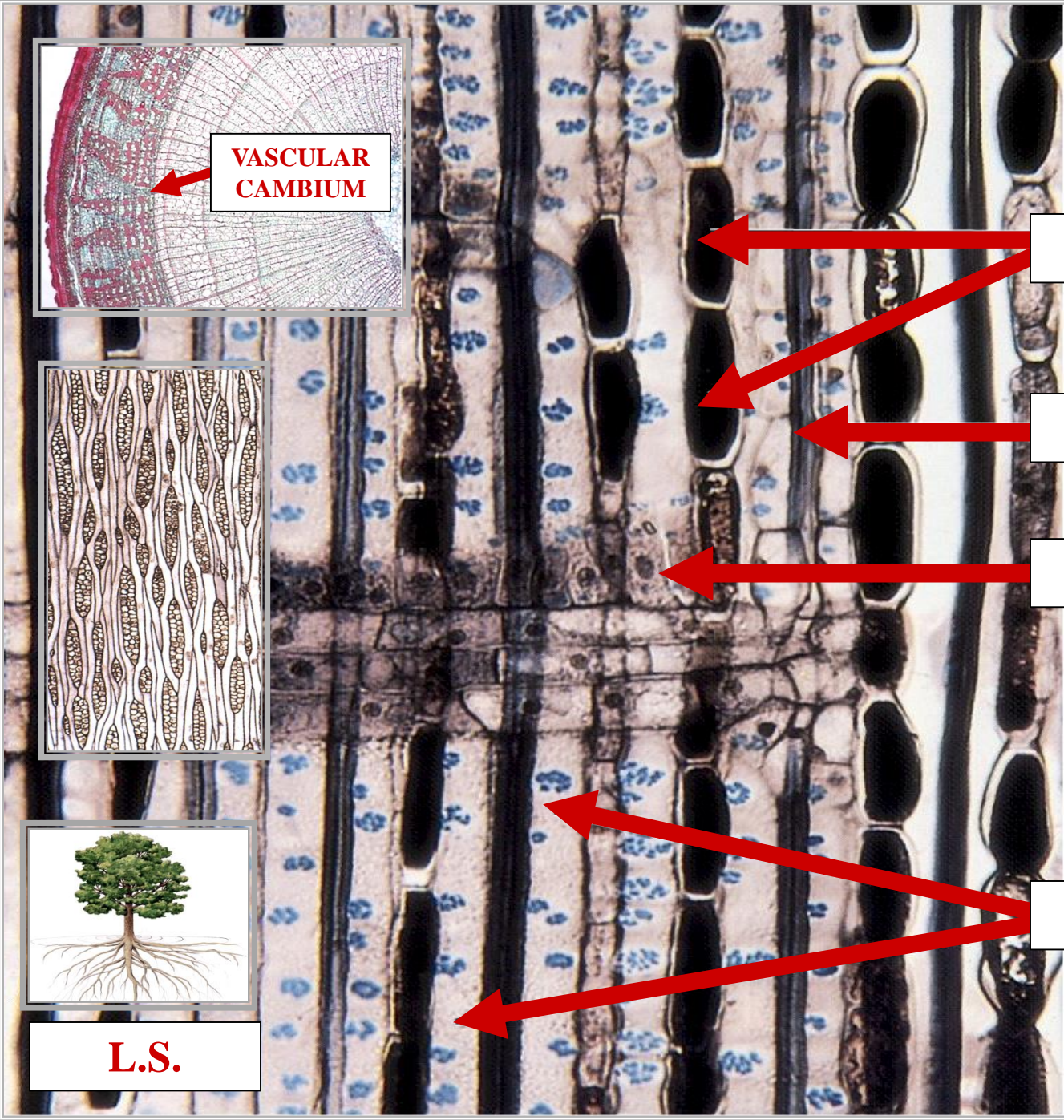
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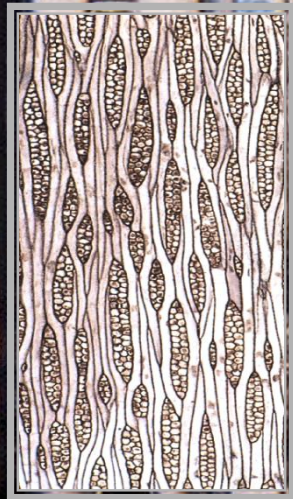
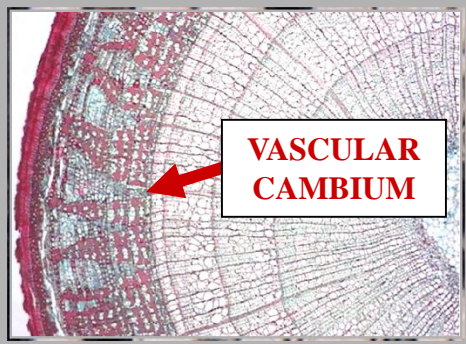
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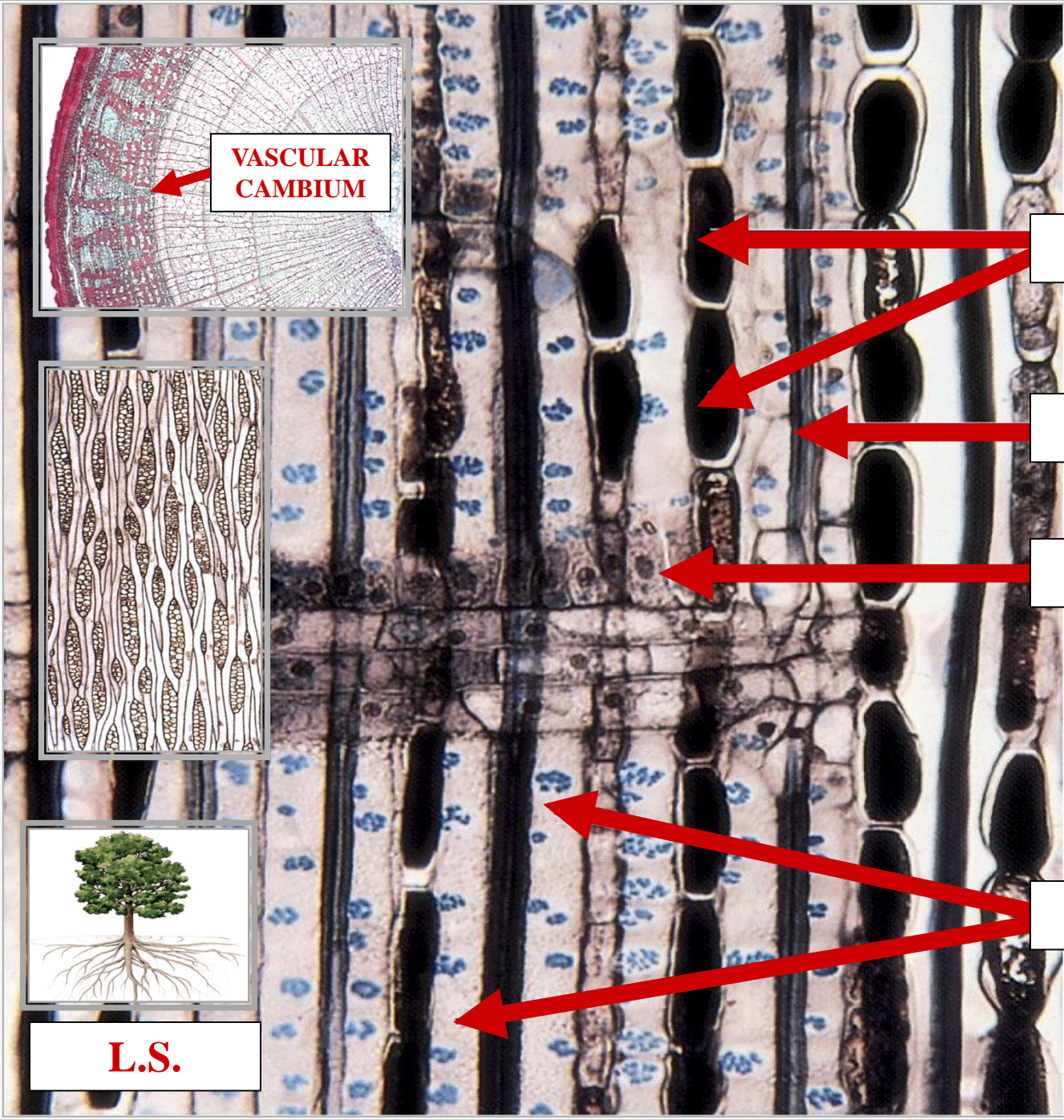
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**SIEVE CELLS**





**L.S.**



**SIEVE MEMBERS**

# RAY INITIAL

**RAY INITIAL**

**VASCULAR CAMBIUM**  
**RAY INITIAL**



**LATERAL ORIENTATION**

**VASCULAR CAMBIUM**  
**RAY INITIAL**

**VASCULAR CAMBIUM  
RAY INITIAL**



**LATERAL ORIENTATION**

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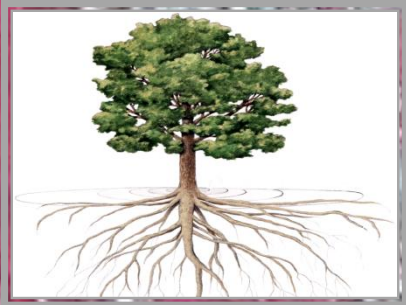
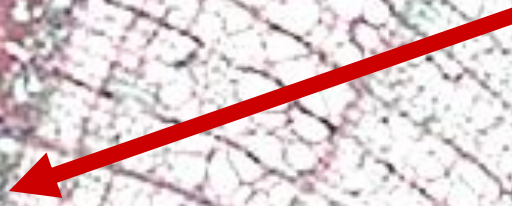
**DERIVE RAY SYSTEM**

**VASCULAR CAMBIUM  
RAY INITIAL**



**TS**

**VASCULAR  
CAMBIUM**



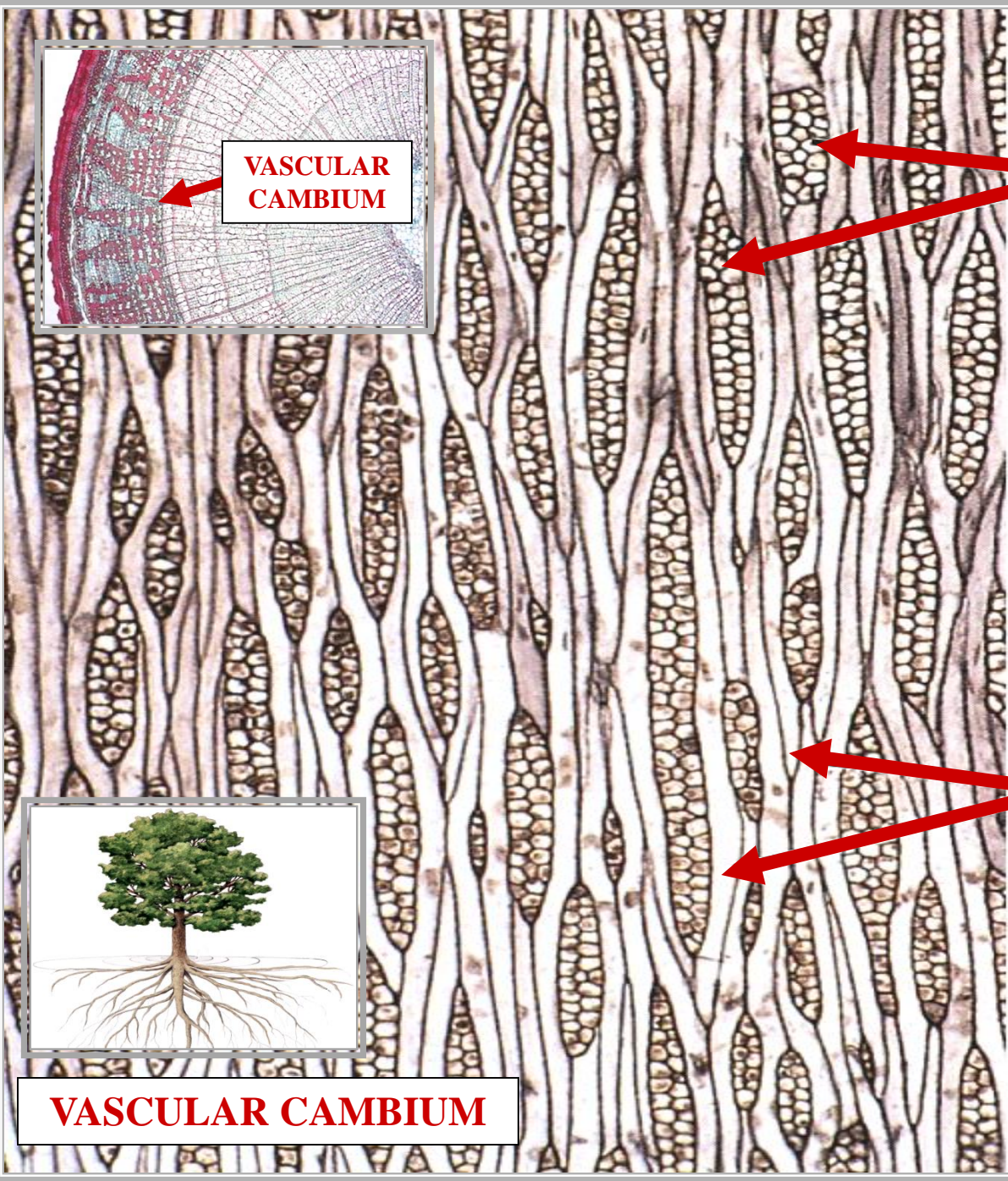
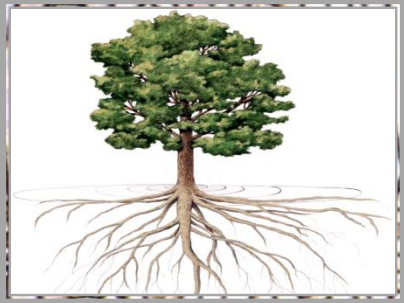
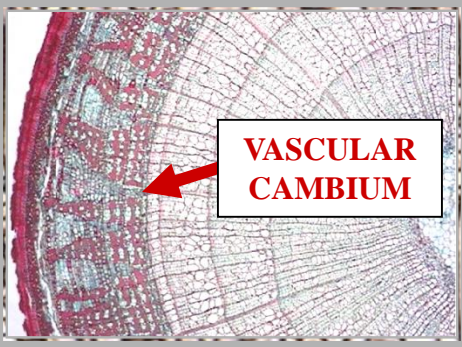
**DICOT ~2 STEM**

**C.S.**

**LO**

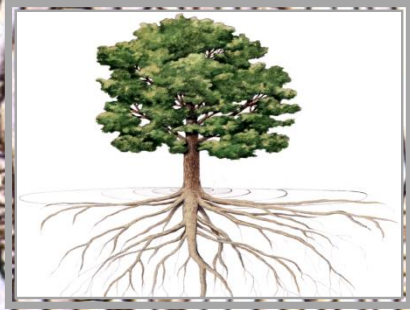
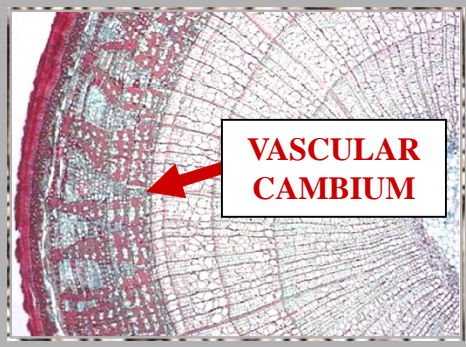
**RAY  
INITIALS**

**L.S.**



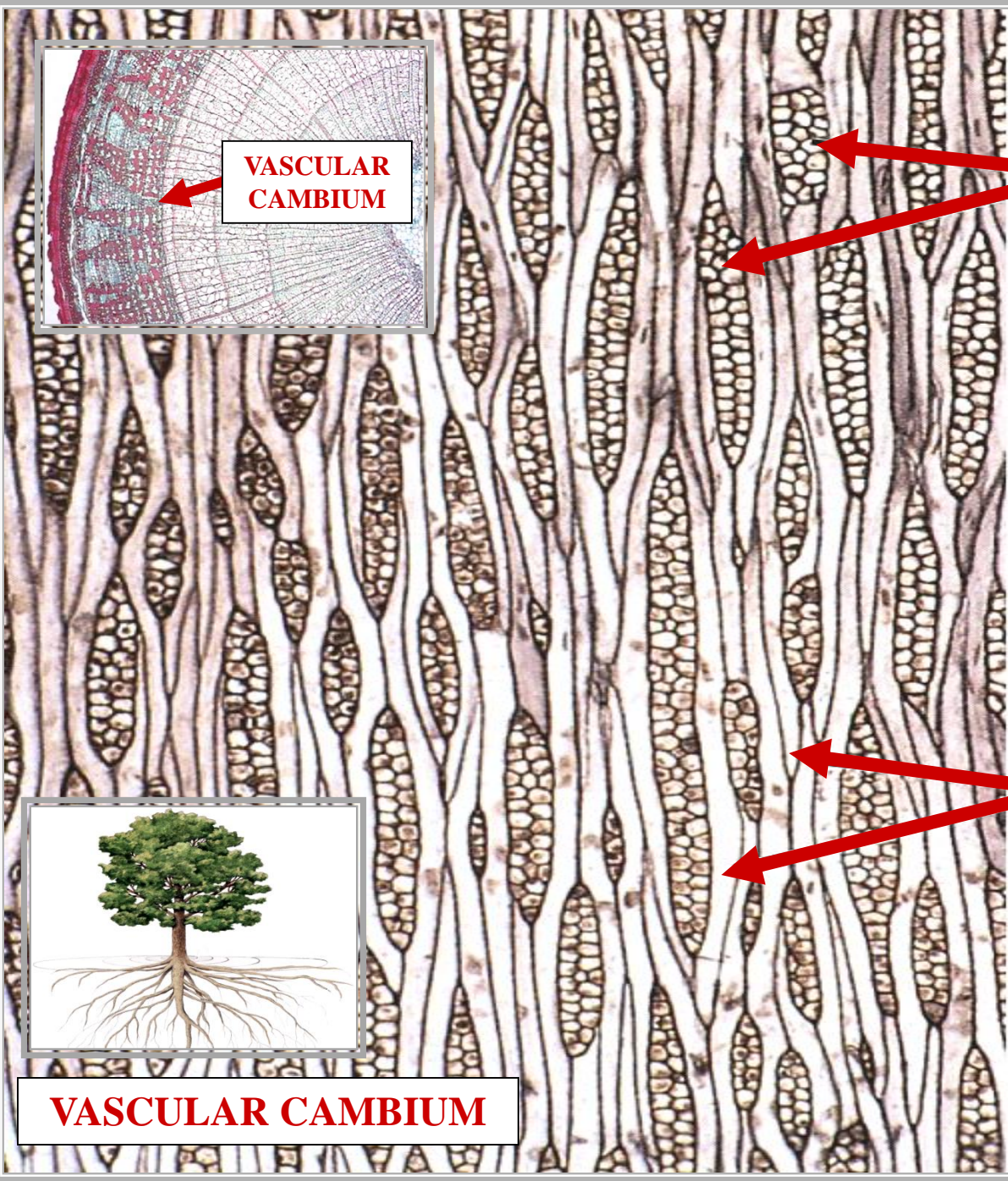


**LATERAL  
ORIENTATION**



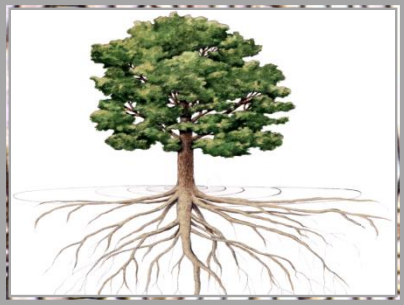
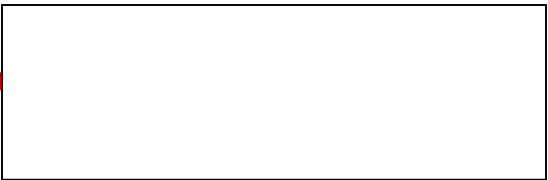
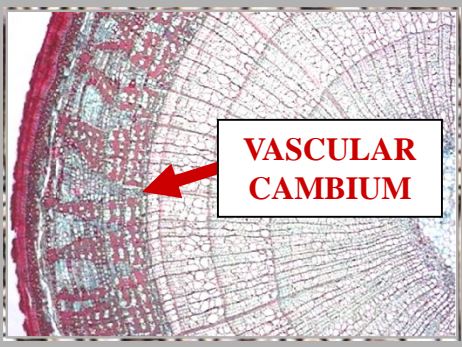
**VASCULAR CAMBIUM**

**L.S.**



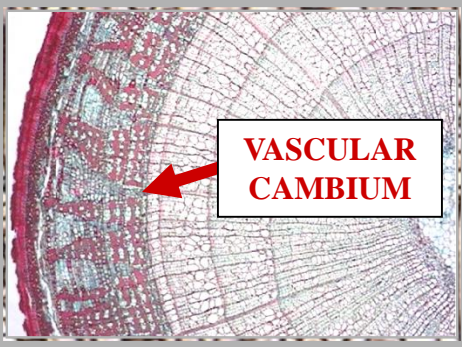
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**MITOSIS**



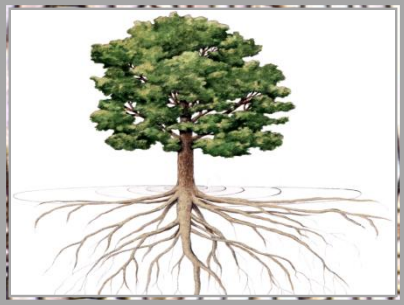
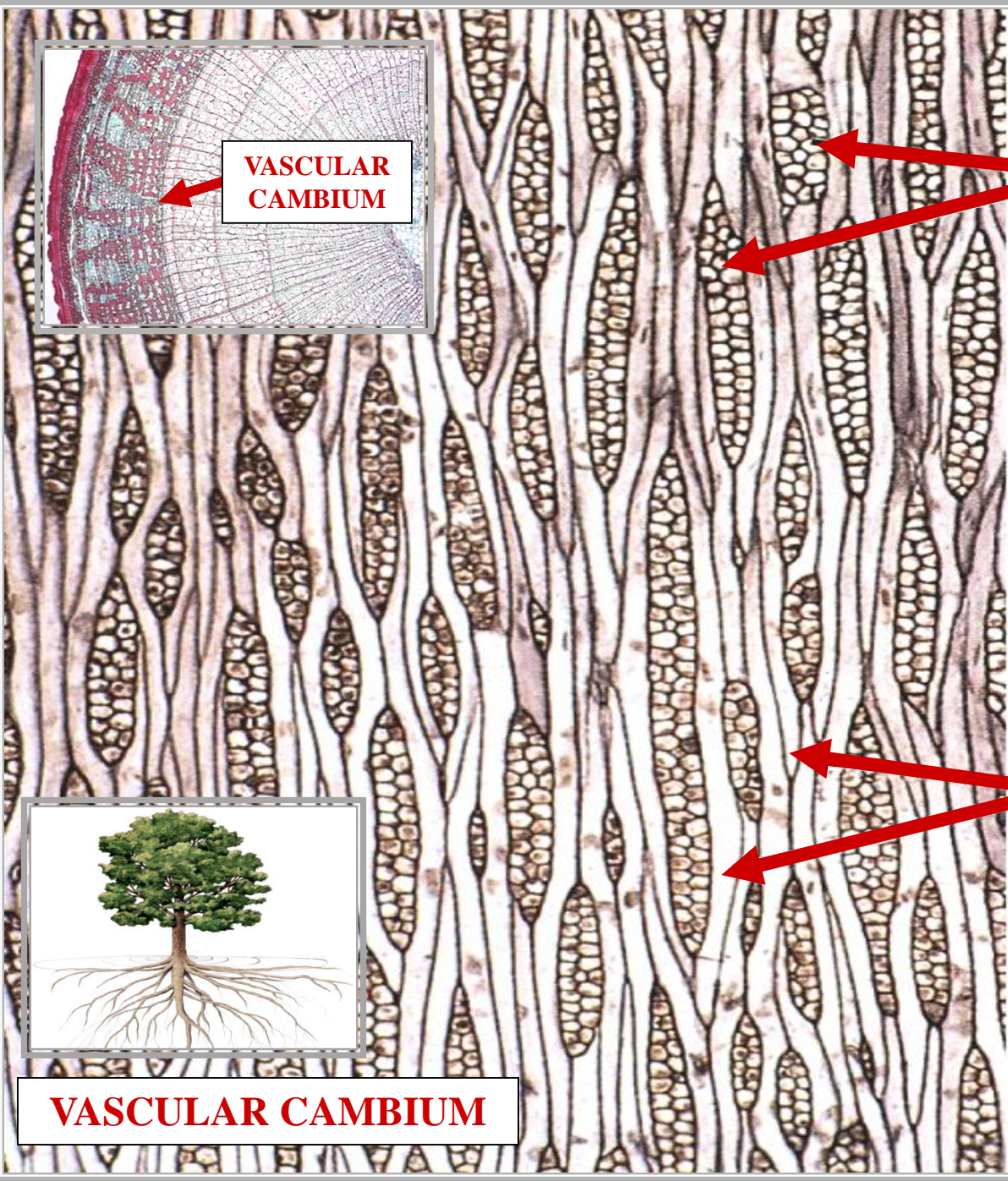
**VASCULAR CAMBIUM**

**L.S.**



**VASCULAR  
CAMBIUM**

**DERIVE  
RAY SYSTEM**



**VASCULAR CAMBIUM**

**L.S.**



# VASCULAR RAY SYSTEM