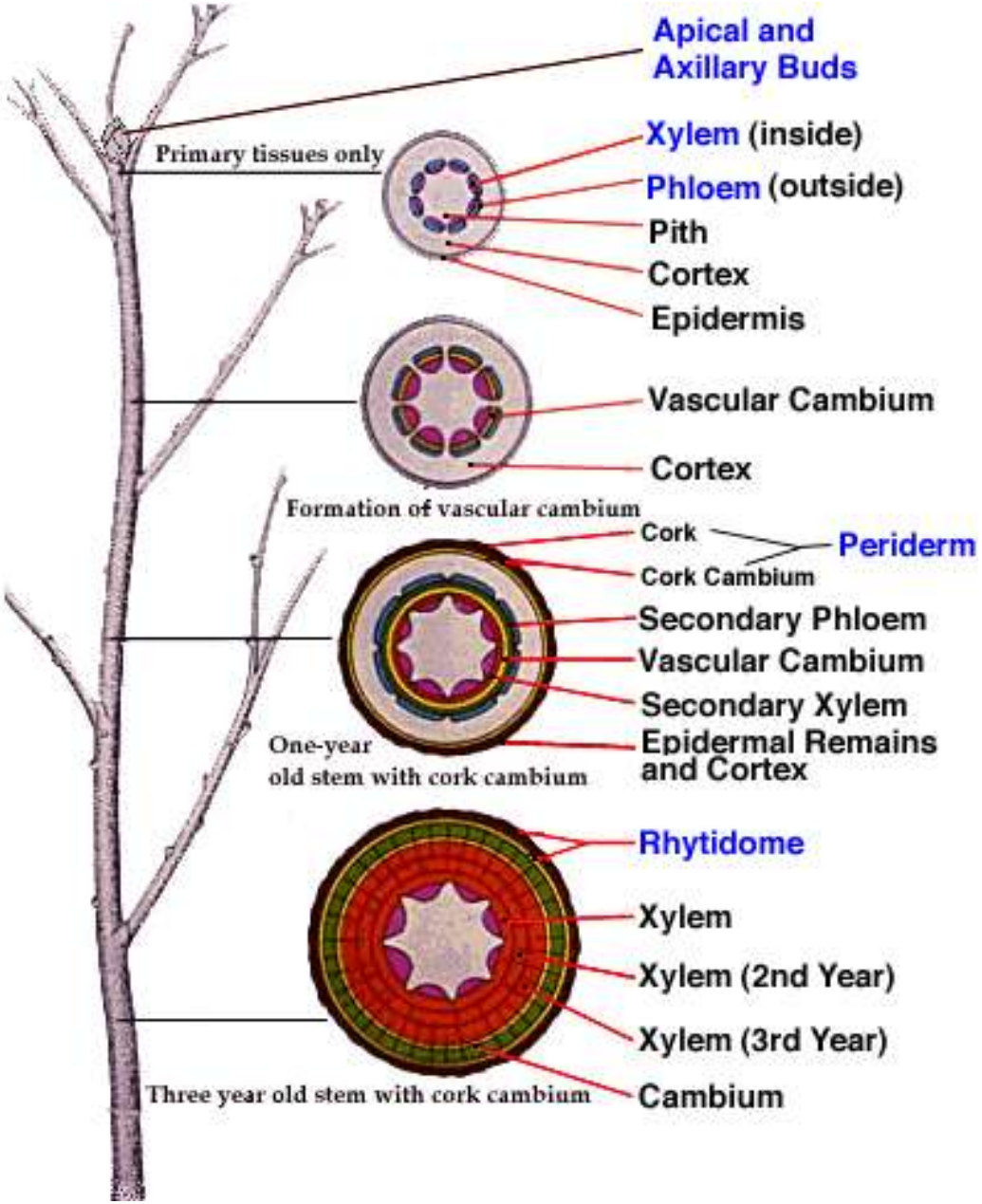
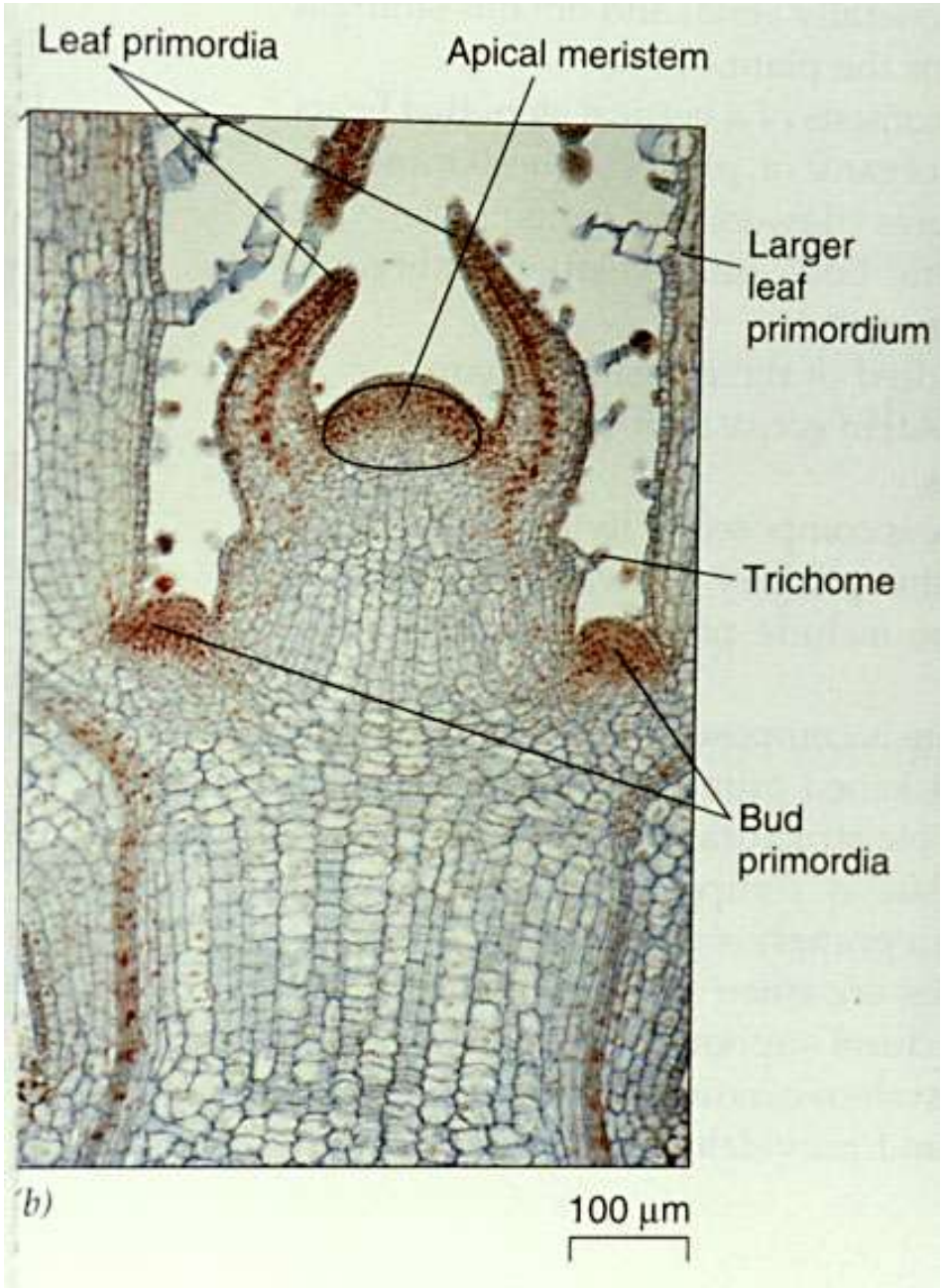
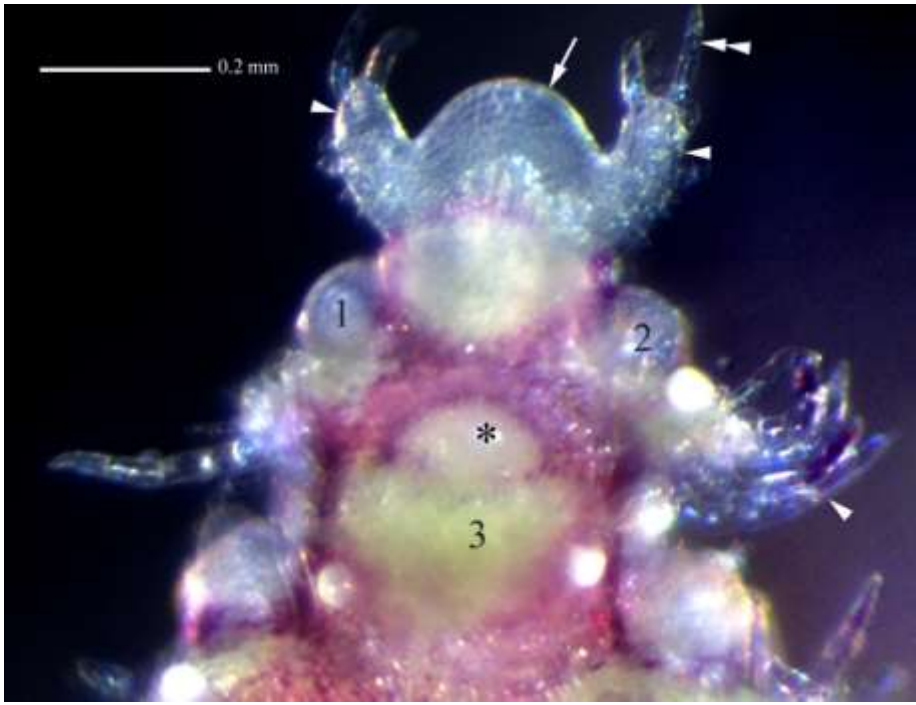
Primary Stem



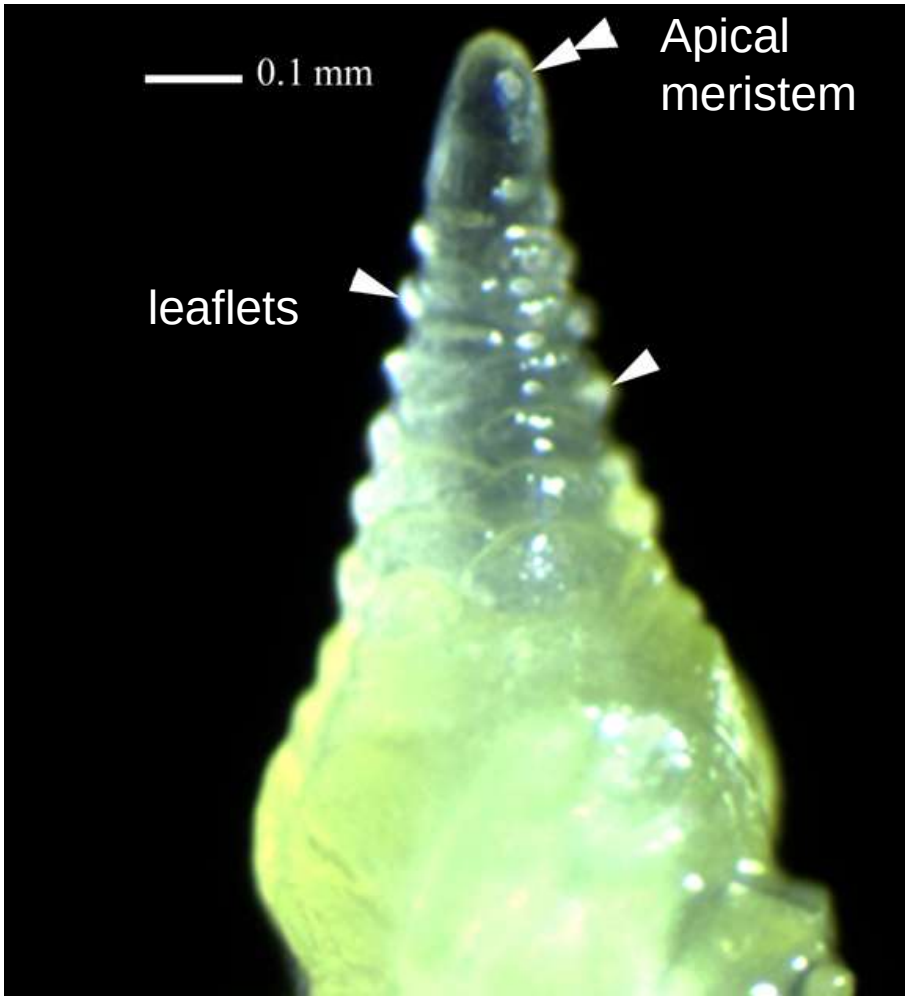
Apical Meristems



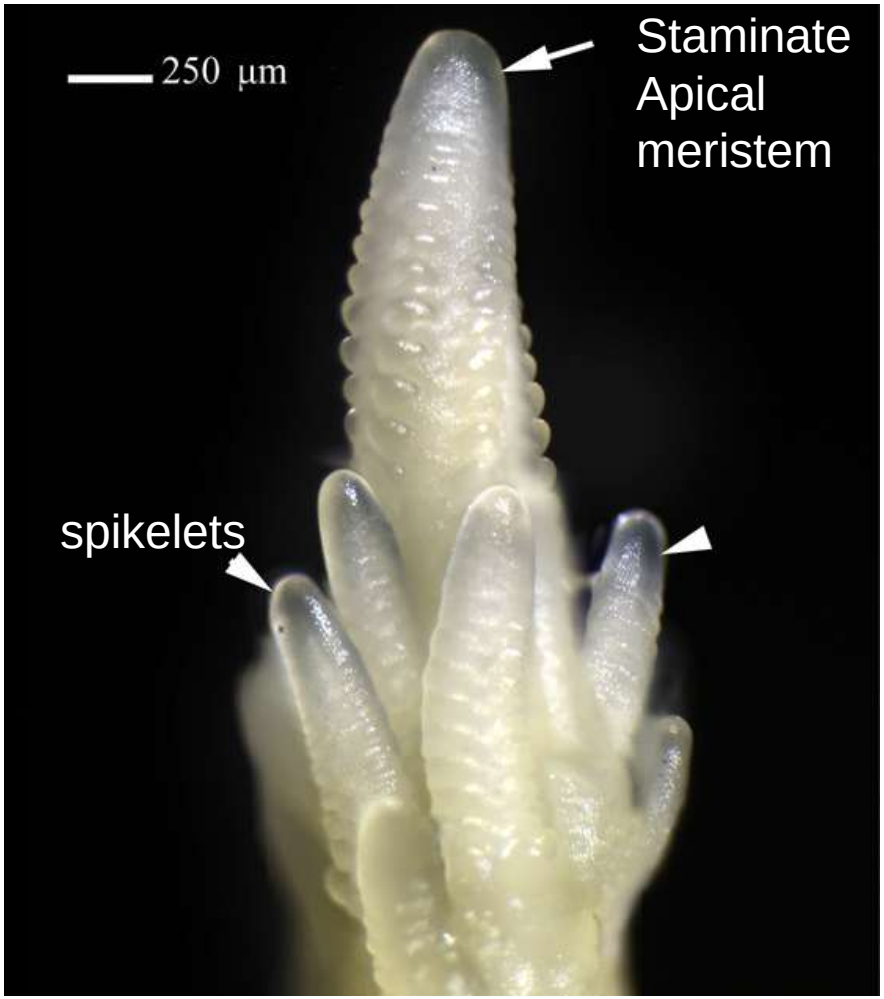


Apical Meristems

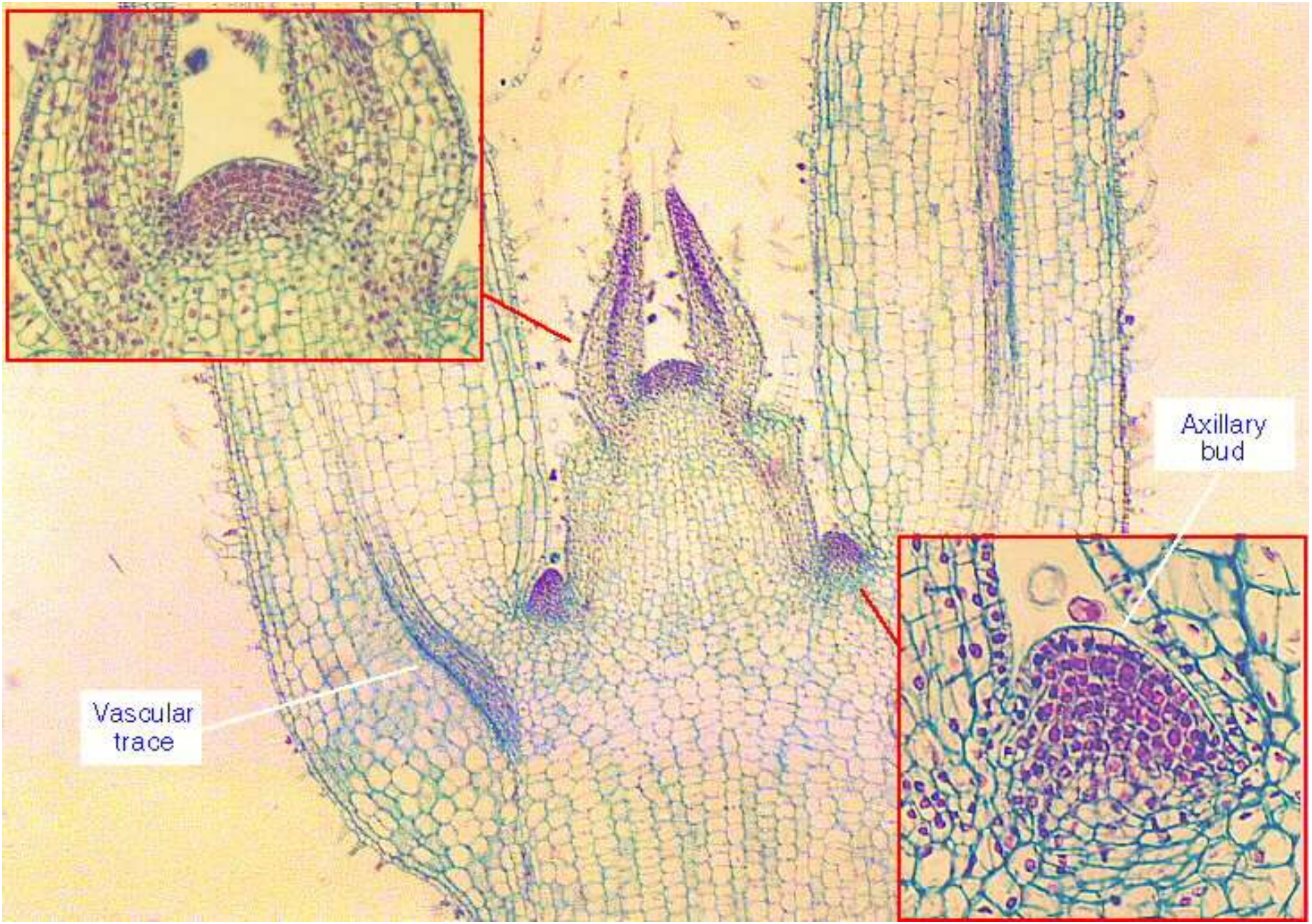
Elodea canadensis



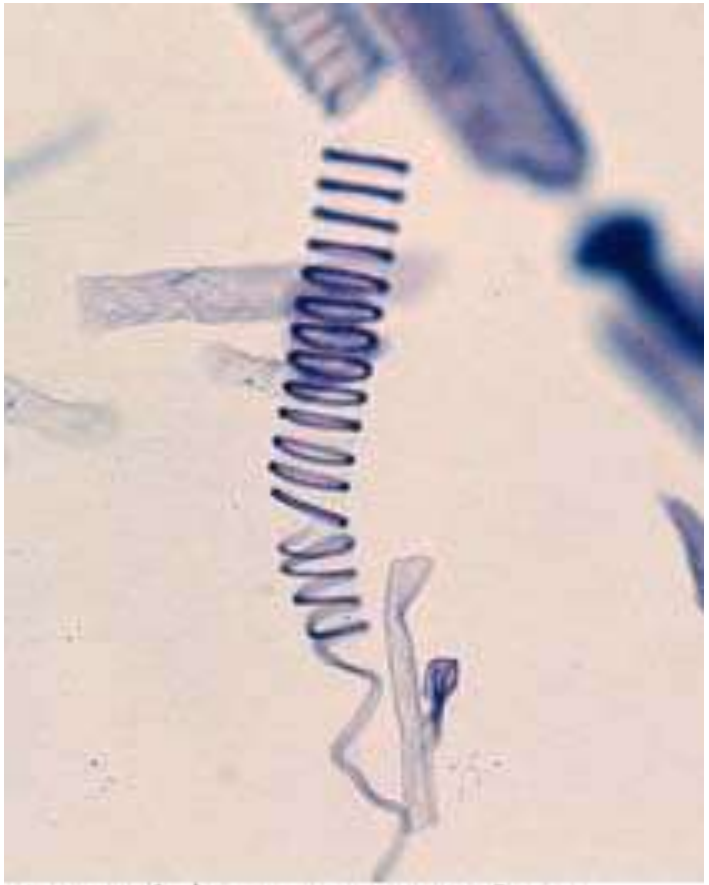
Zea mays



Coleus – apical meristem

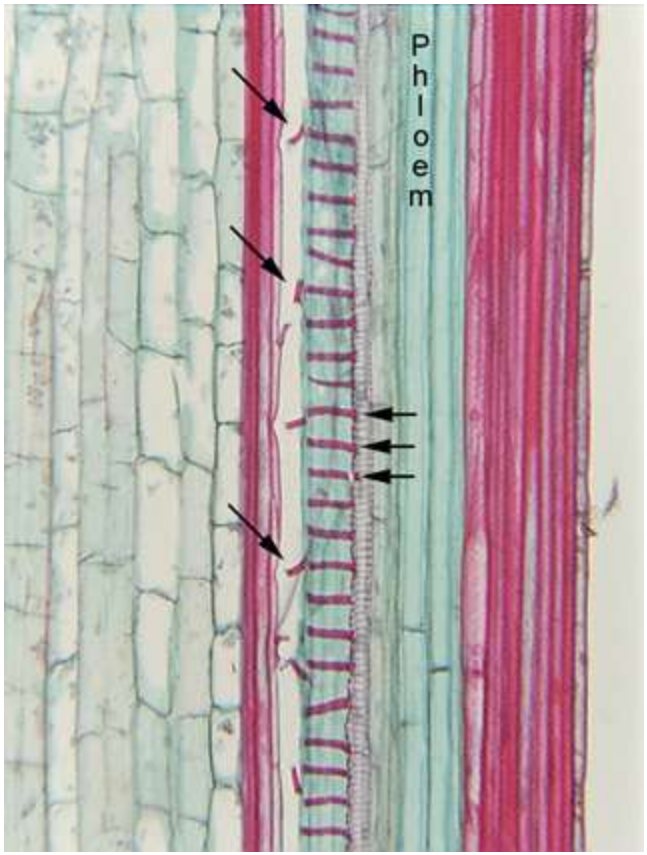


Protoxylem

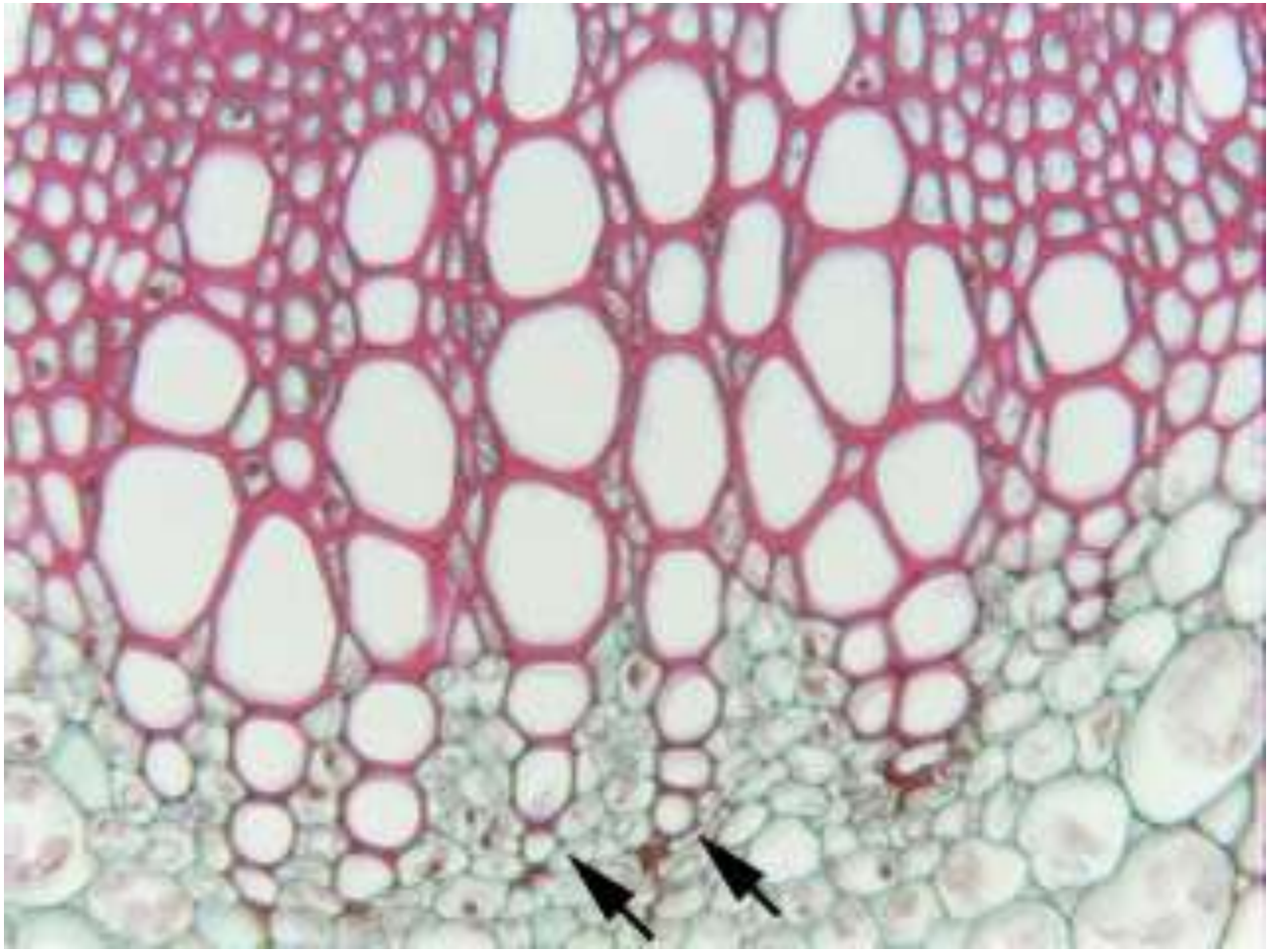


Cucurbita protoxylem with spiral and annular thickenings.

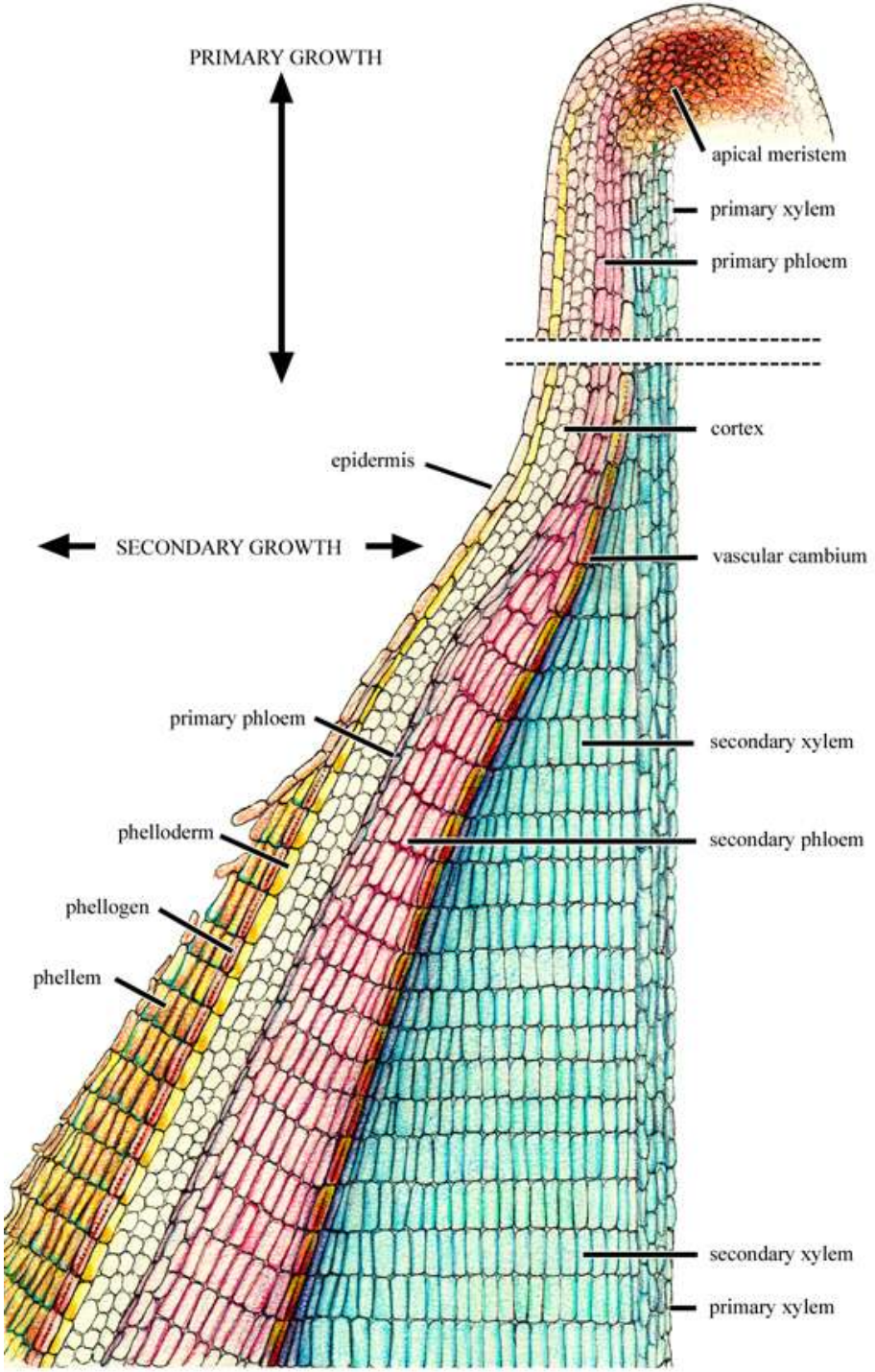
Early Vessel



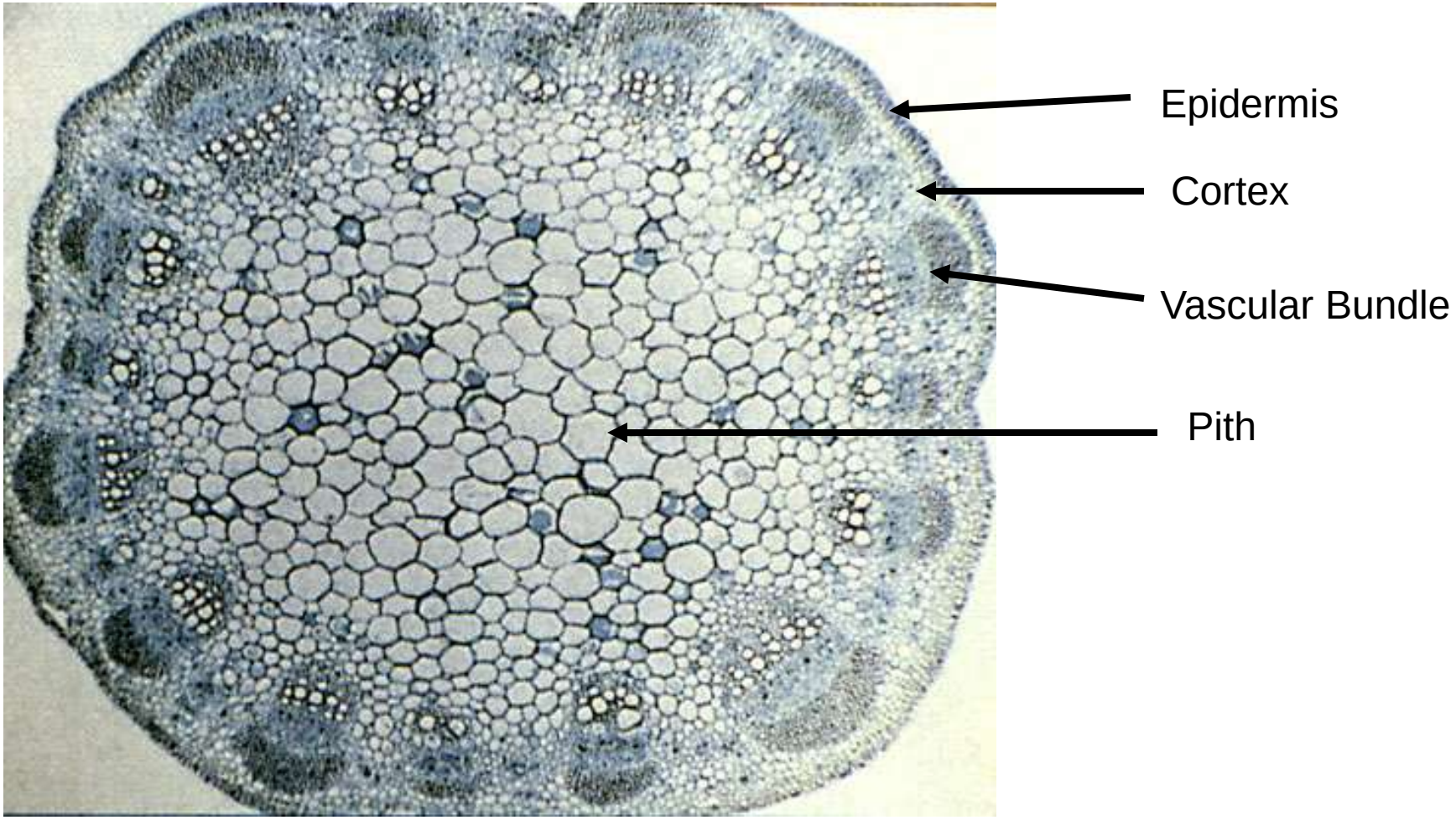
Protoxylem and Metaxylem in *Euphorbia*



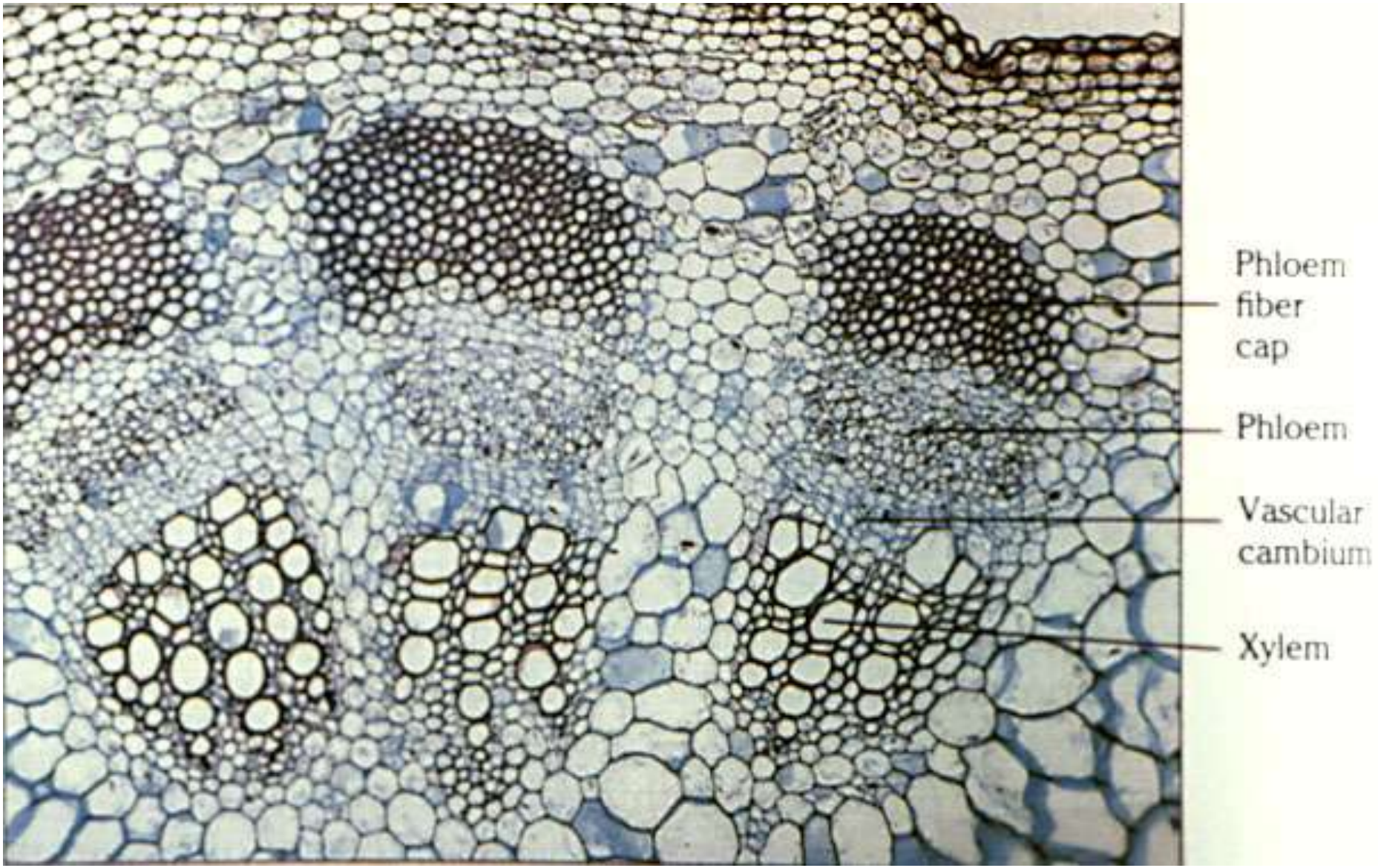
Primary Growth
vs.
Secondary Growth



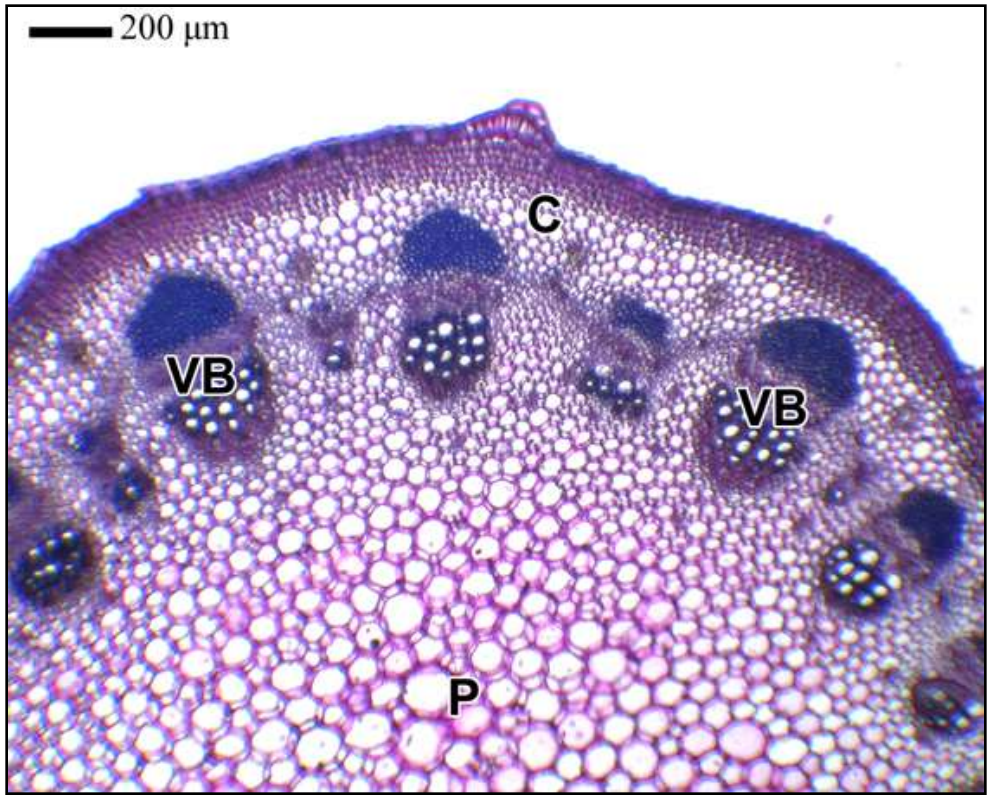
Dicot – Young Stem

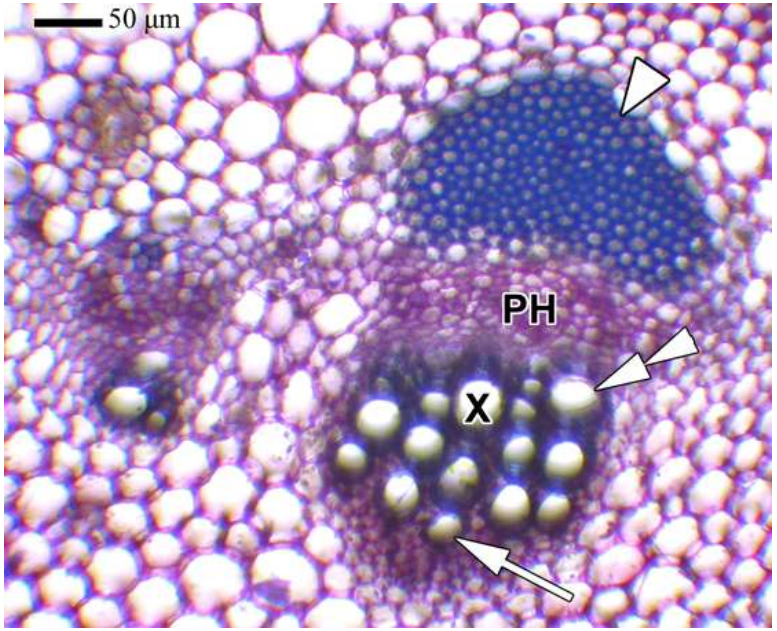


Vascular Bundles

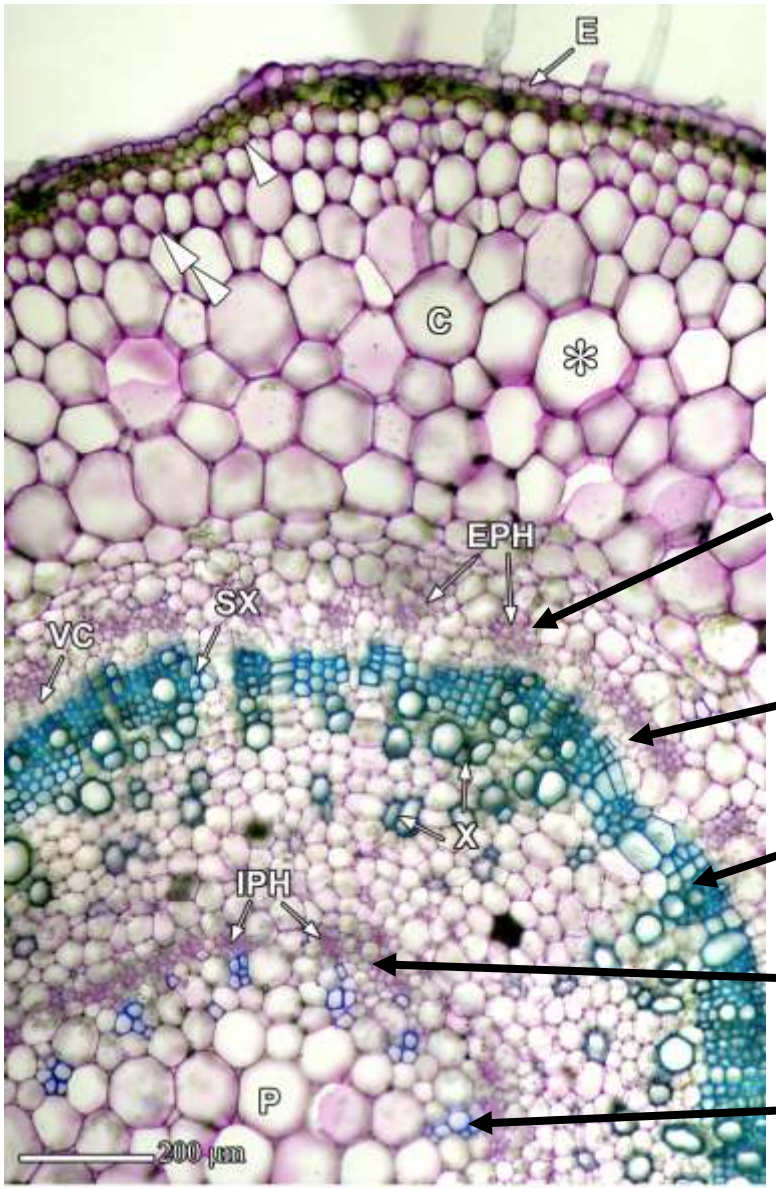


Stem Structure - *Helianthus annuus* - TBO





Solanum lycopersicon – Tomato = TBO



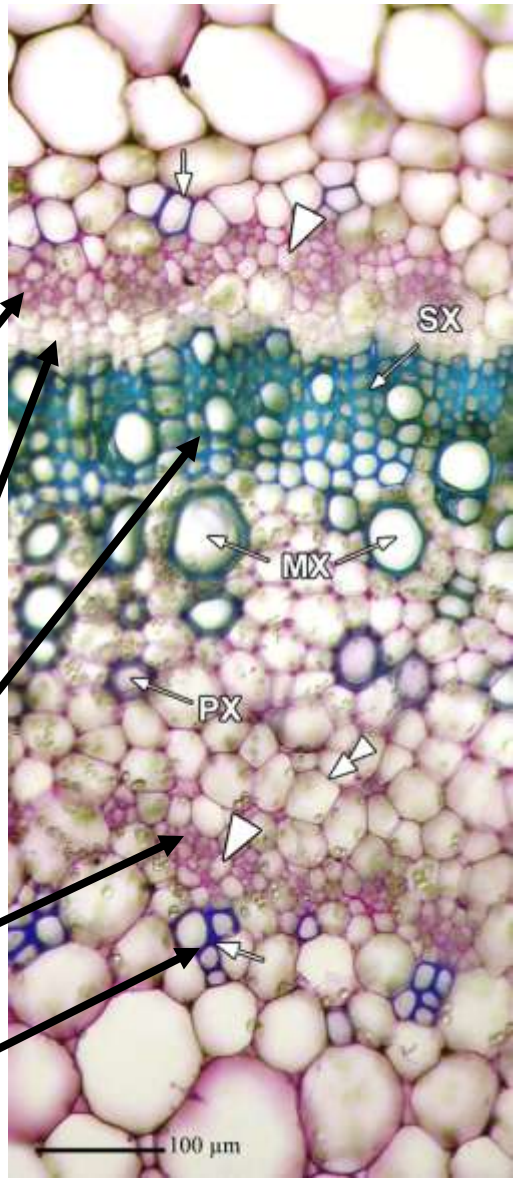
External phloem

Vascular cambium

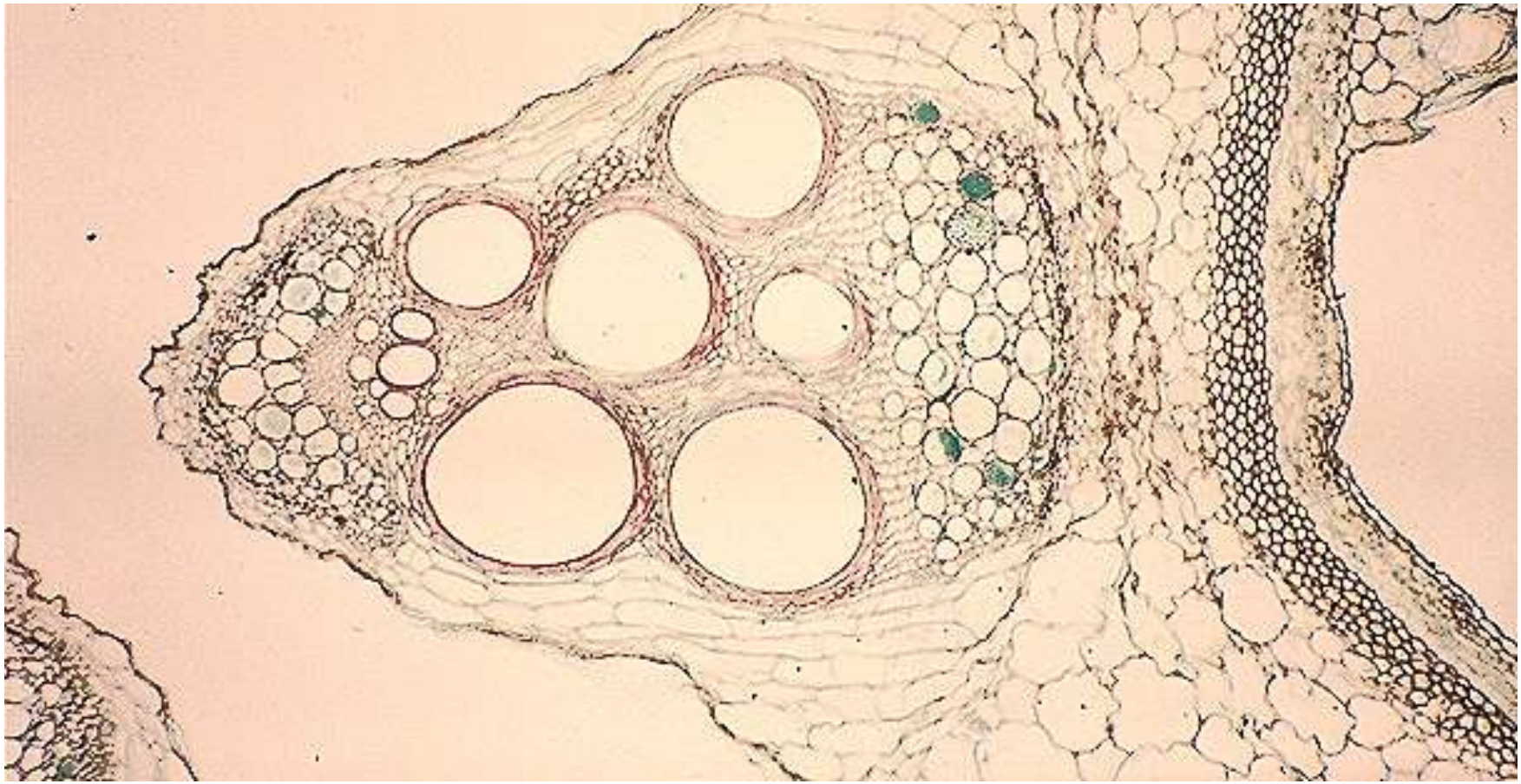
Xylem

Internal phloem

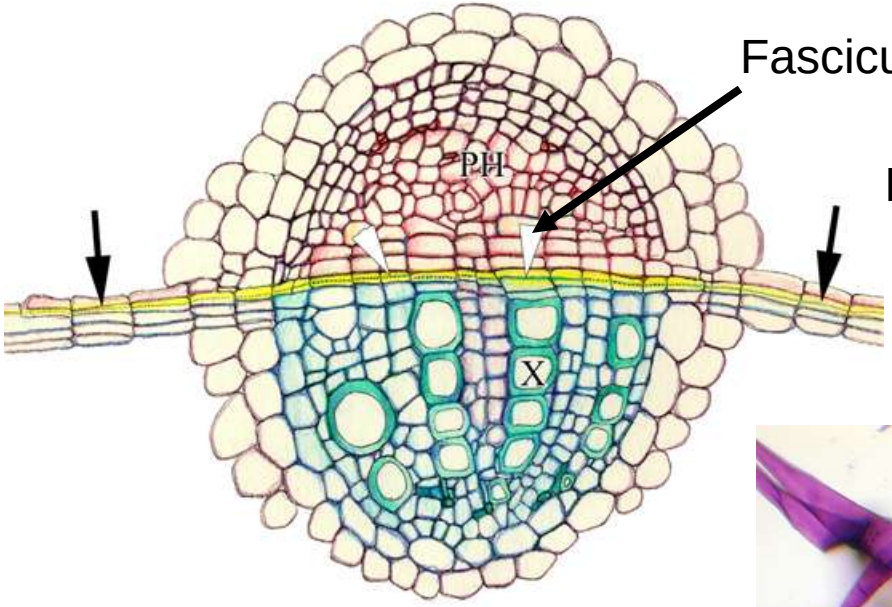
Fibers



Cucurbita – bicollateral bundle, internal and external phloem

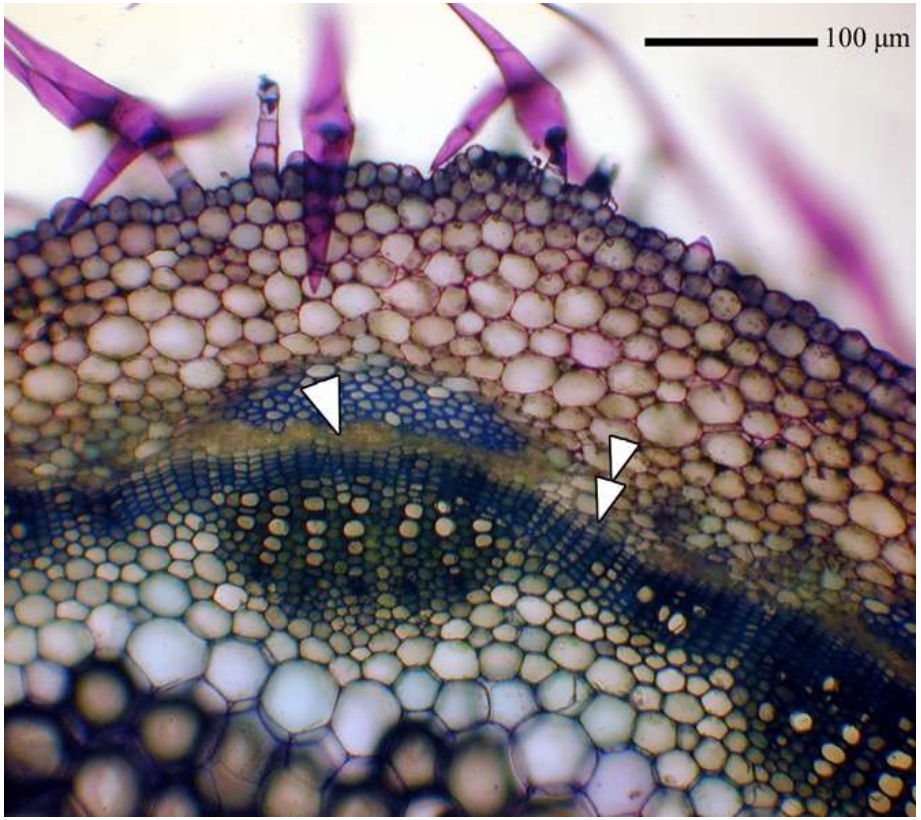


Vascular Cambium



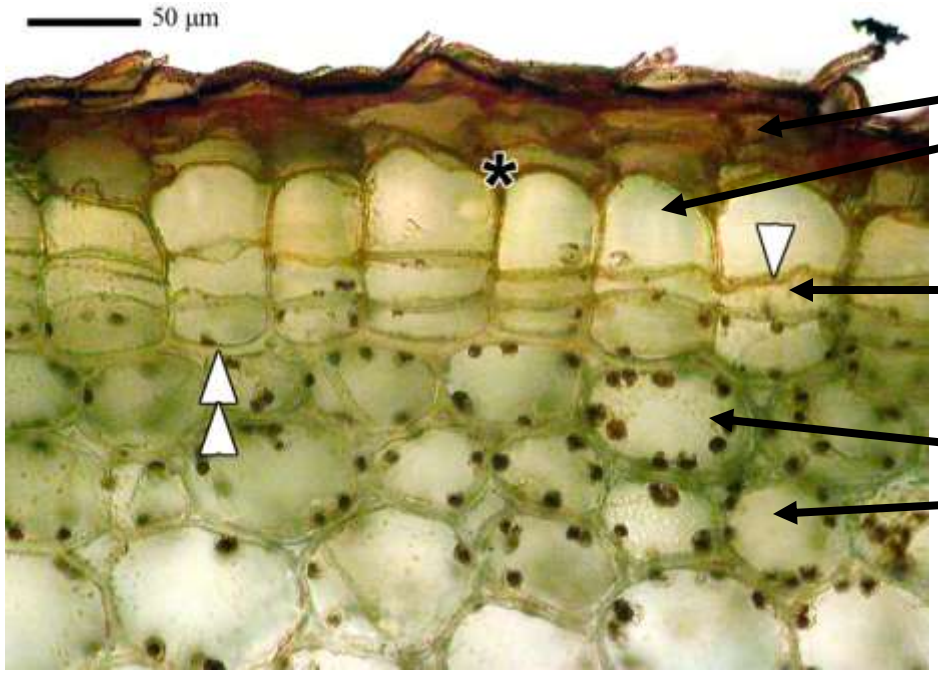
Fascicular cambium

Interfascicular cambium



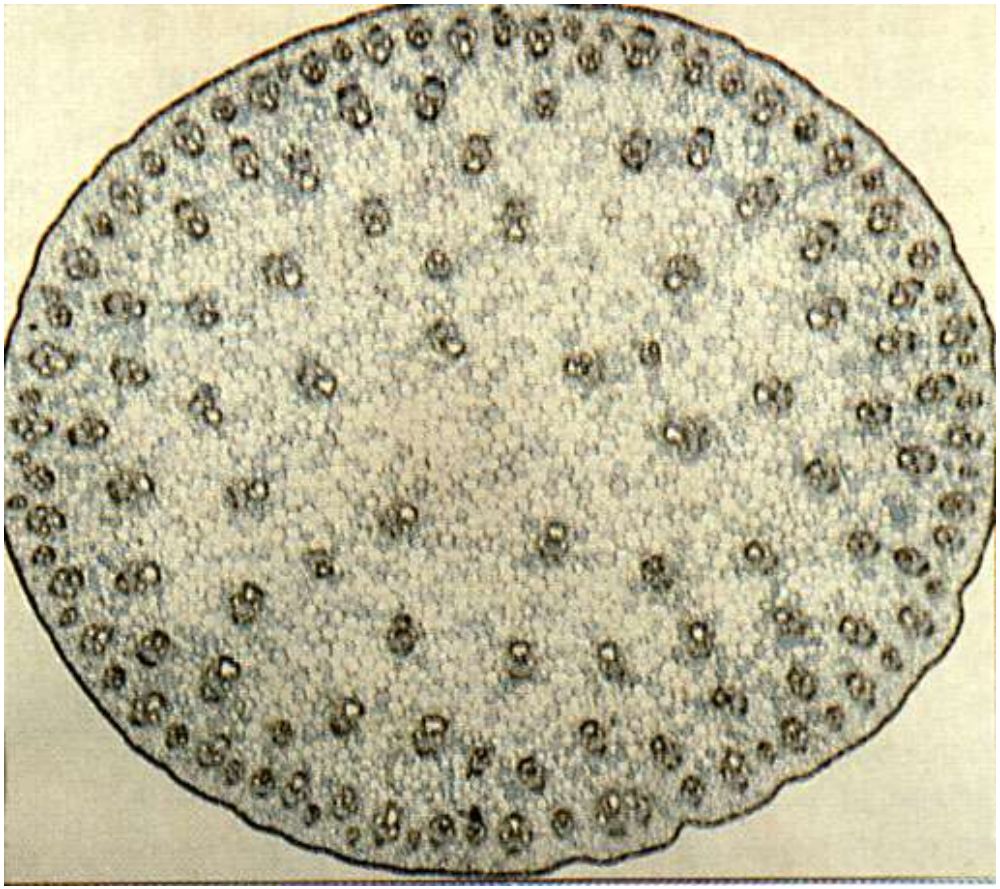
Chrysanthemum – TBO
Interfascicular cambium

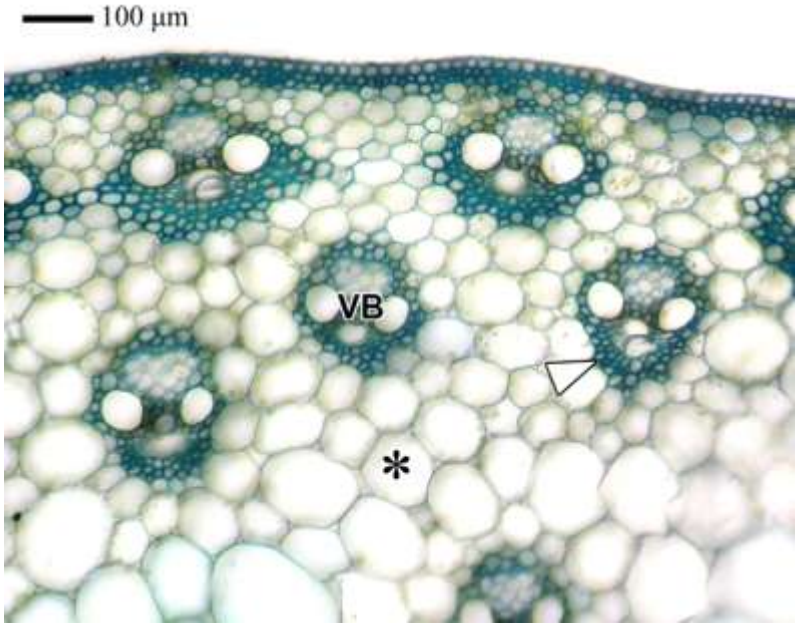
Pelargonium (Geranium) stem



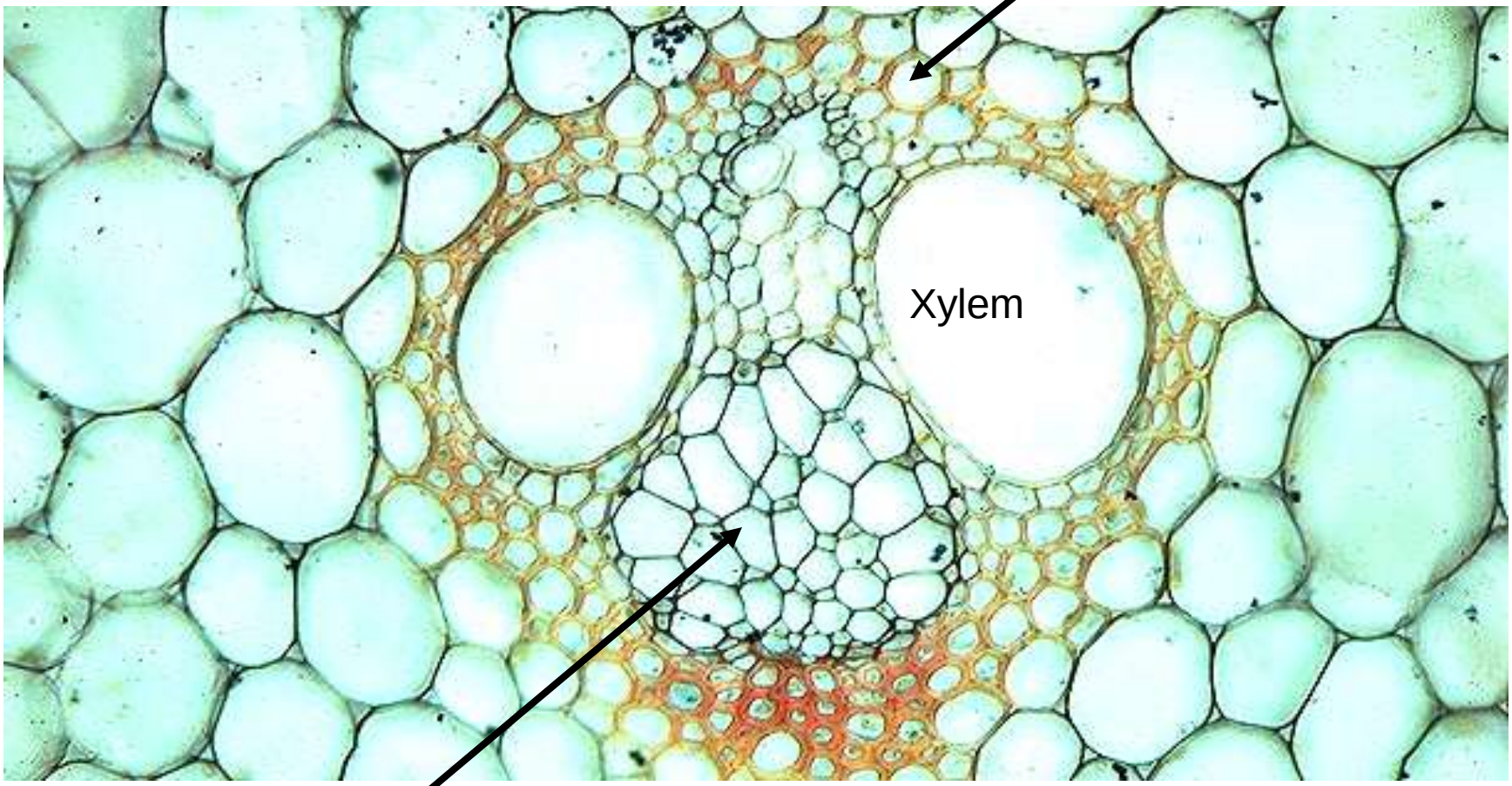
Monocot Stem

Zea mays

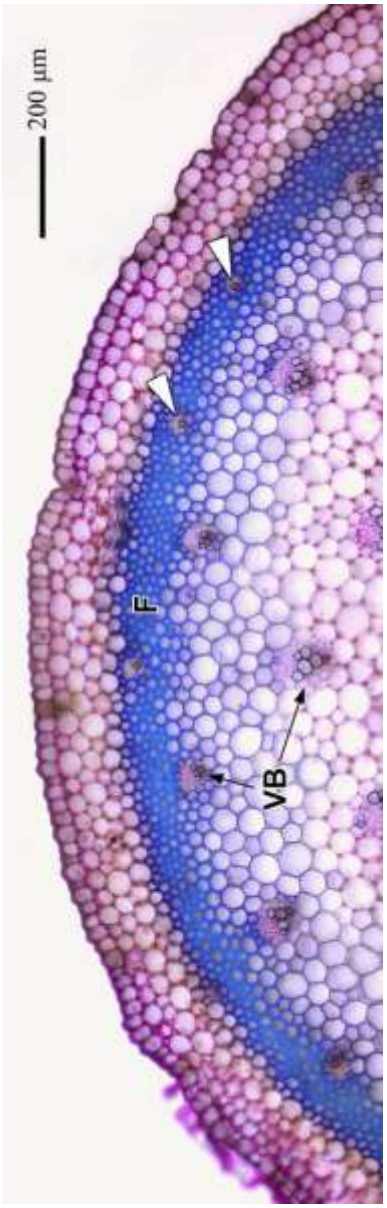


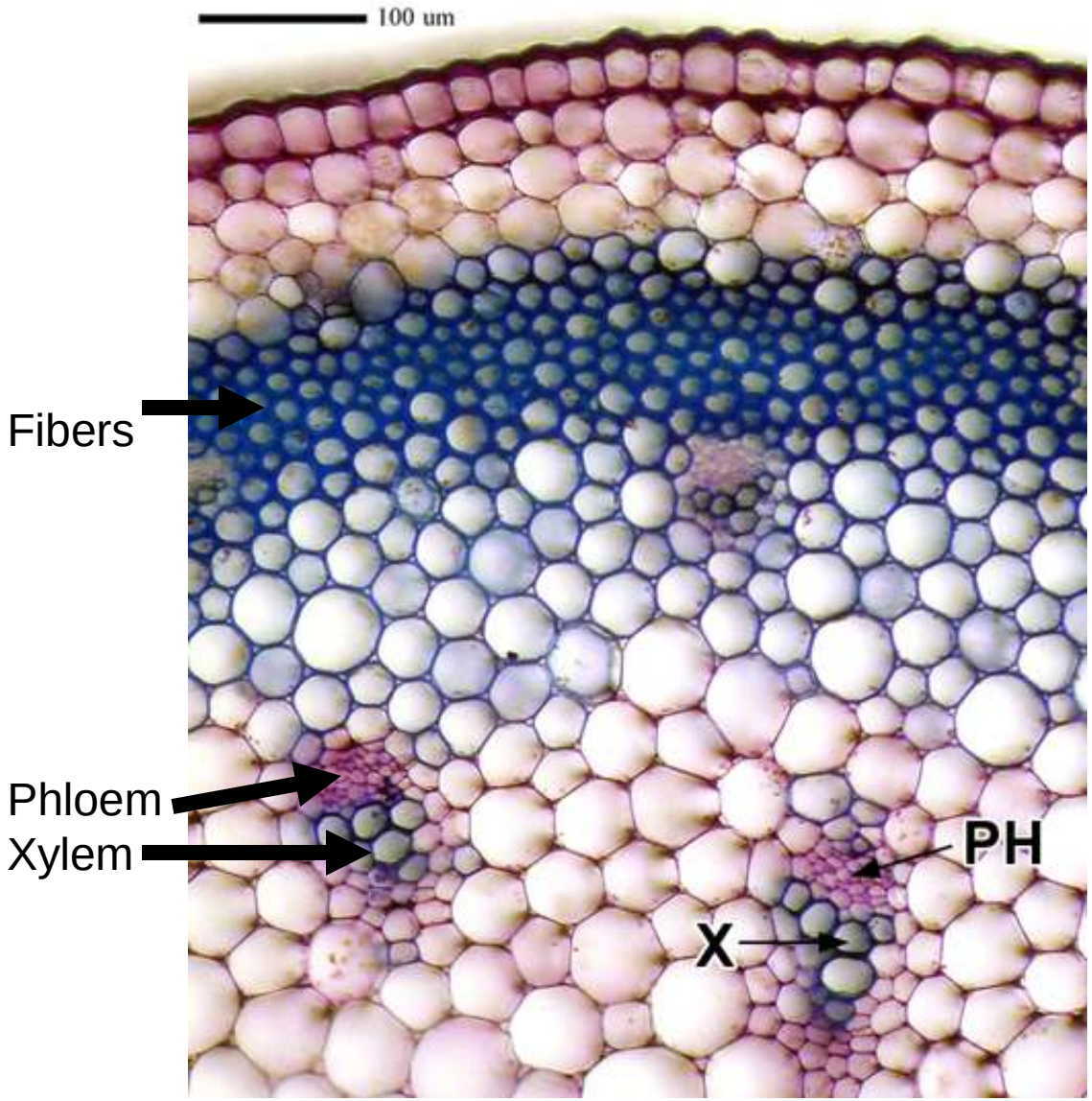


Zea mays – vascular bundle

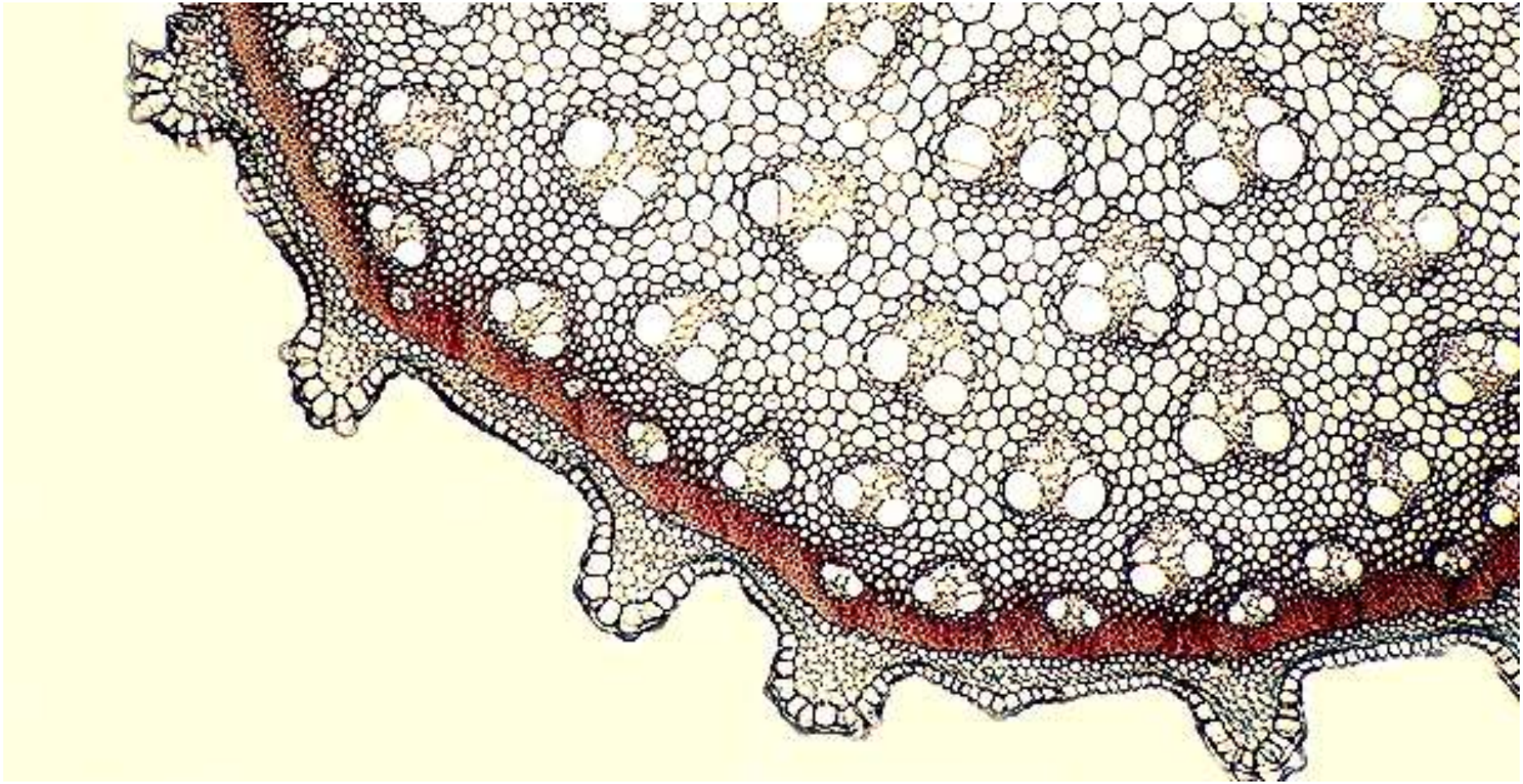


Spider plant – *Chlorophytum* – stained with TBO

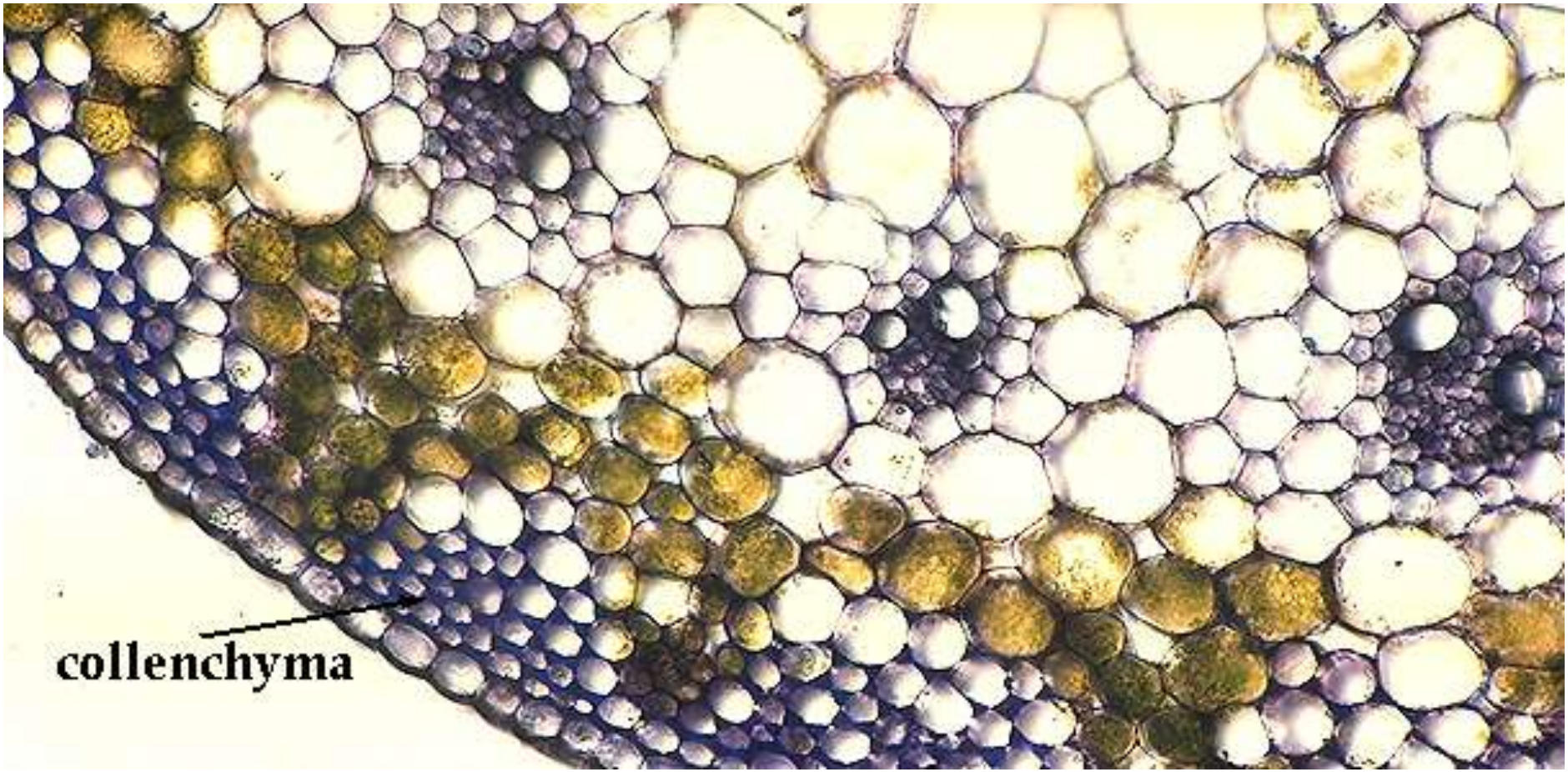




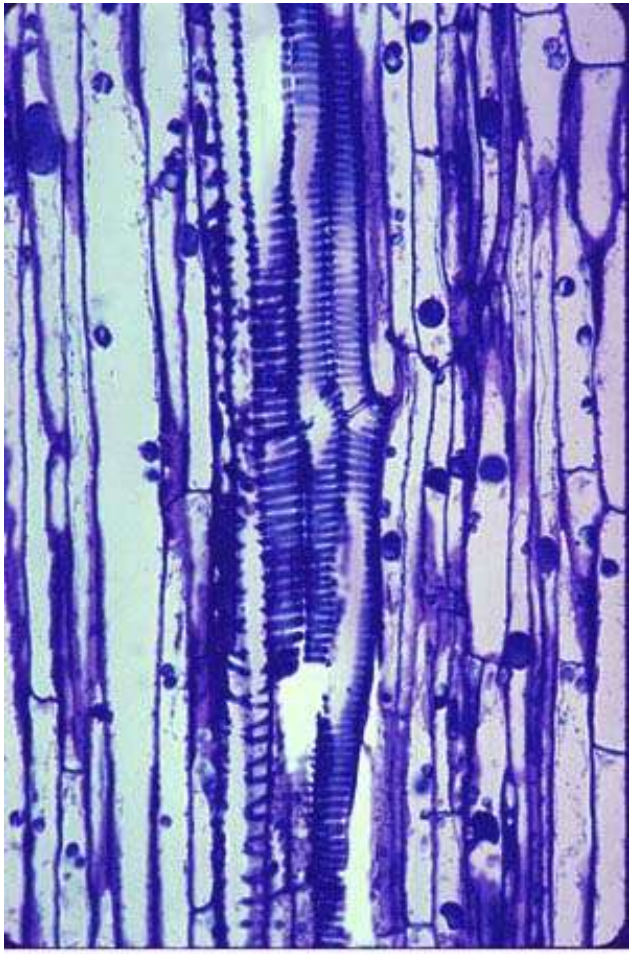
Asparagus – sclerenchyma forms support tissue



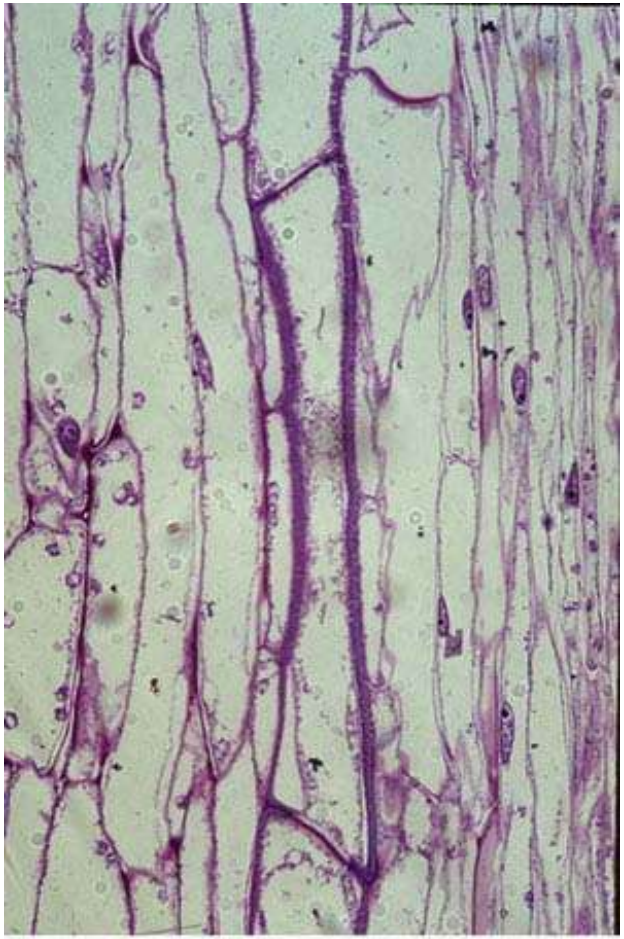
Tradescantia – collenchyma provides support tissue



Xylem development in *Eupatoium*



Eupatorium rugosum protoxylem.



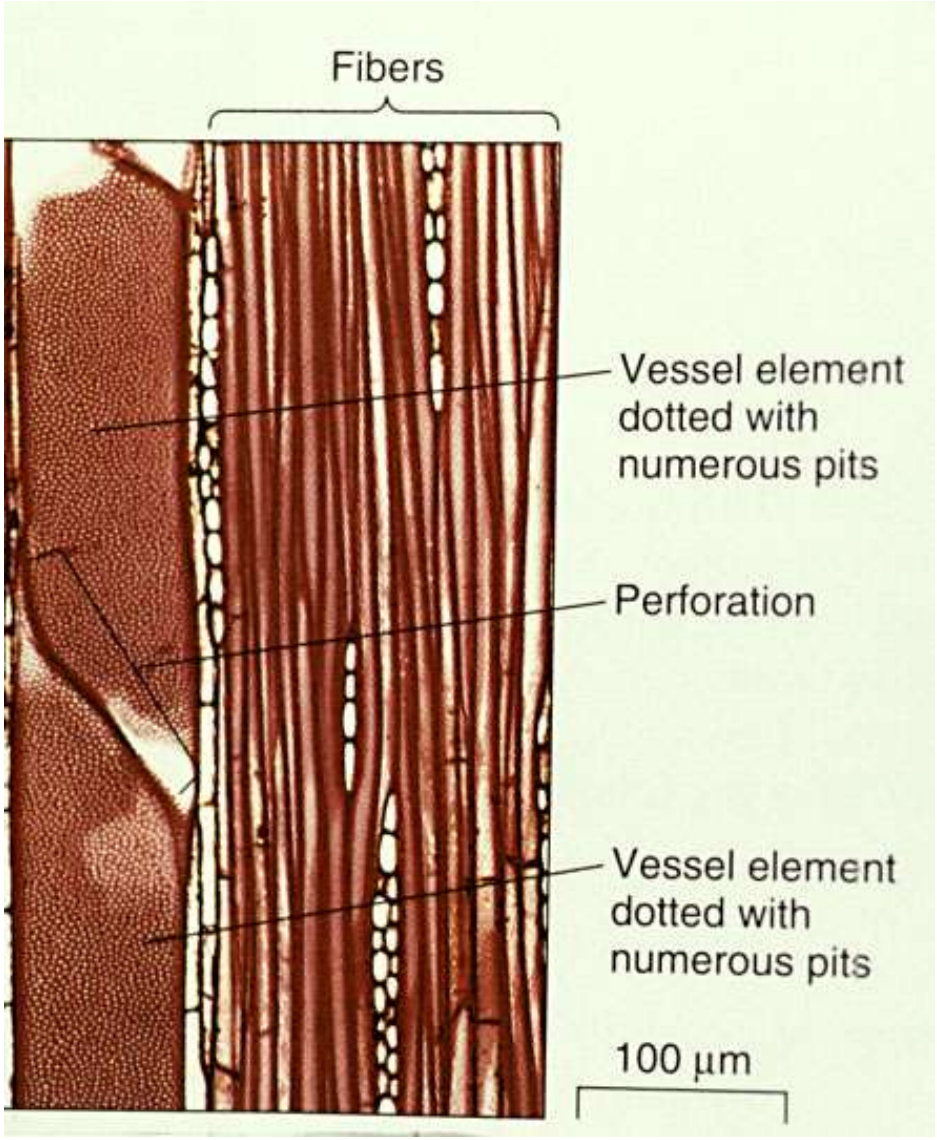
Eupatorium rugosum early xylem vessel development.

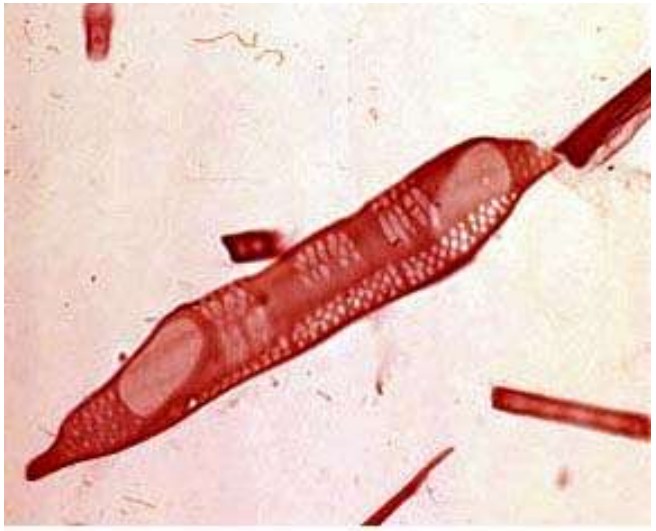
Eupatorium rugosum xylem vessel development.

Protoxylem

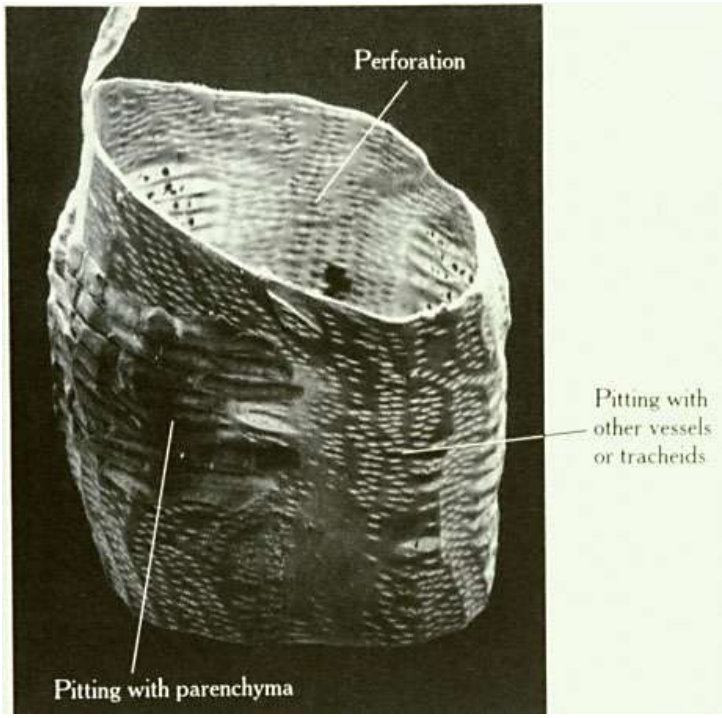
Vessel development

Xylem

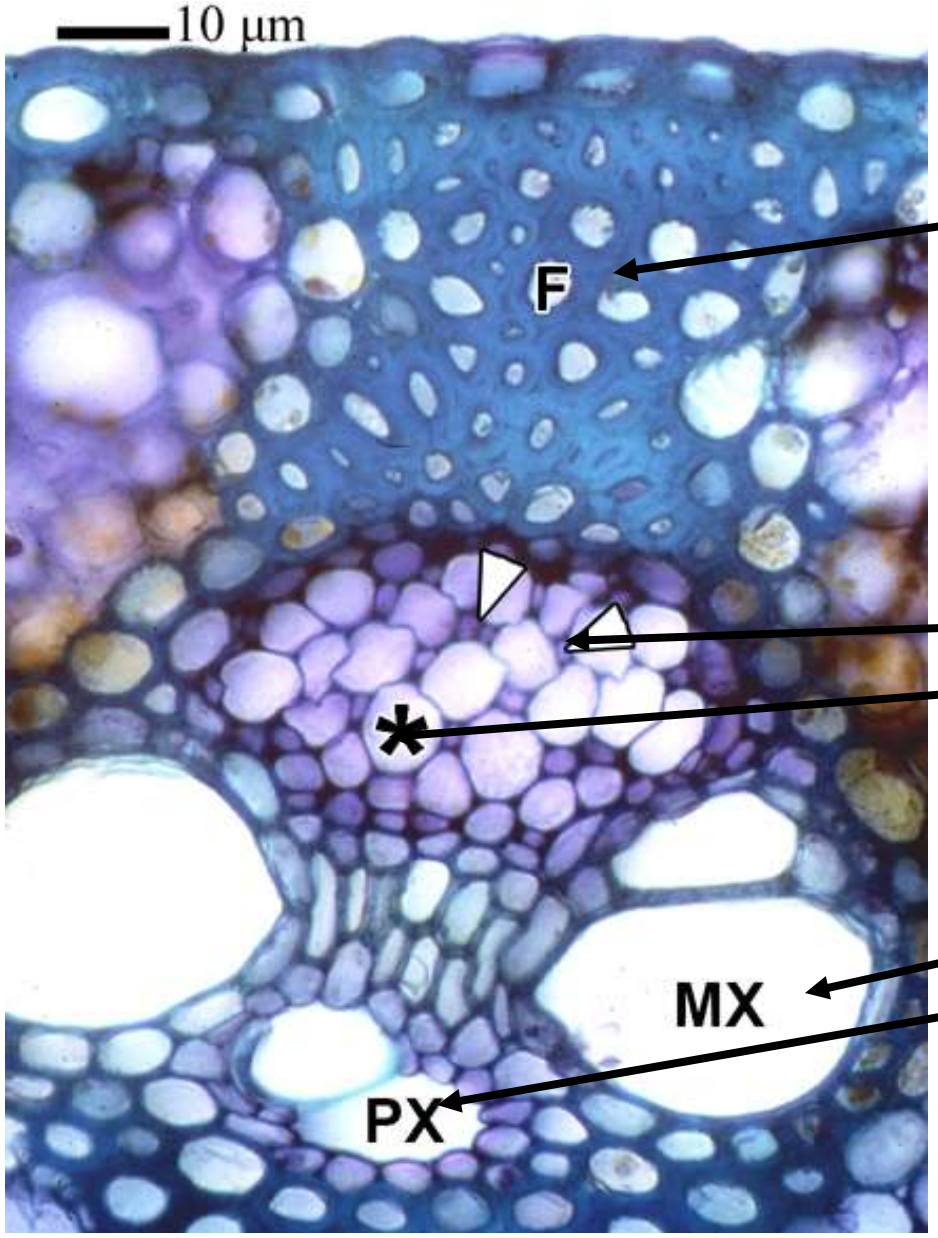




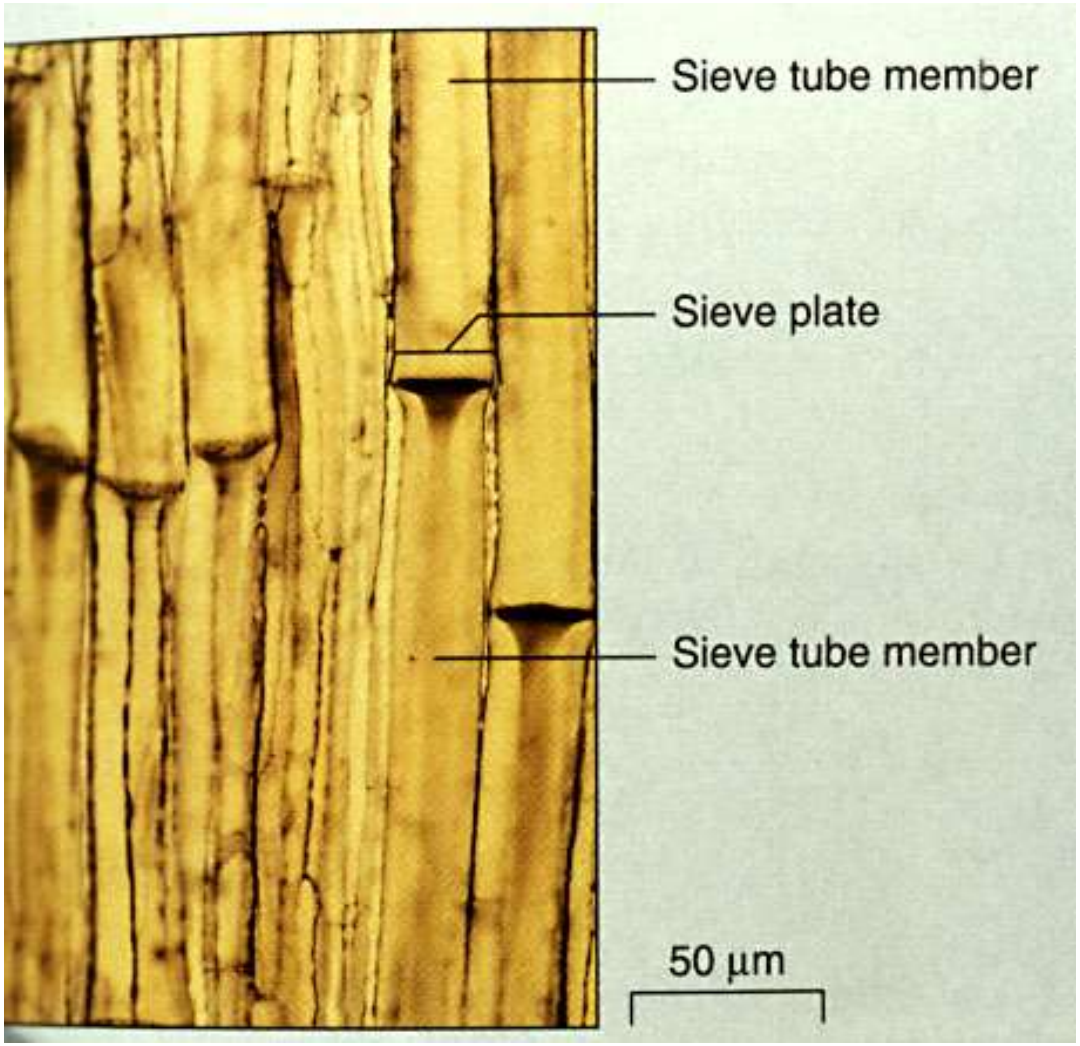
Salix vessel.

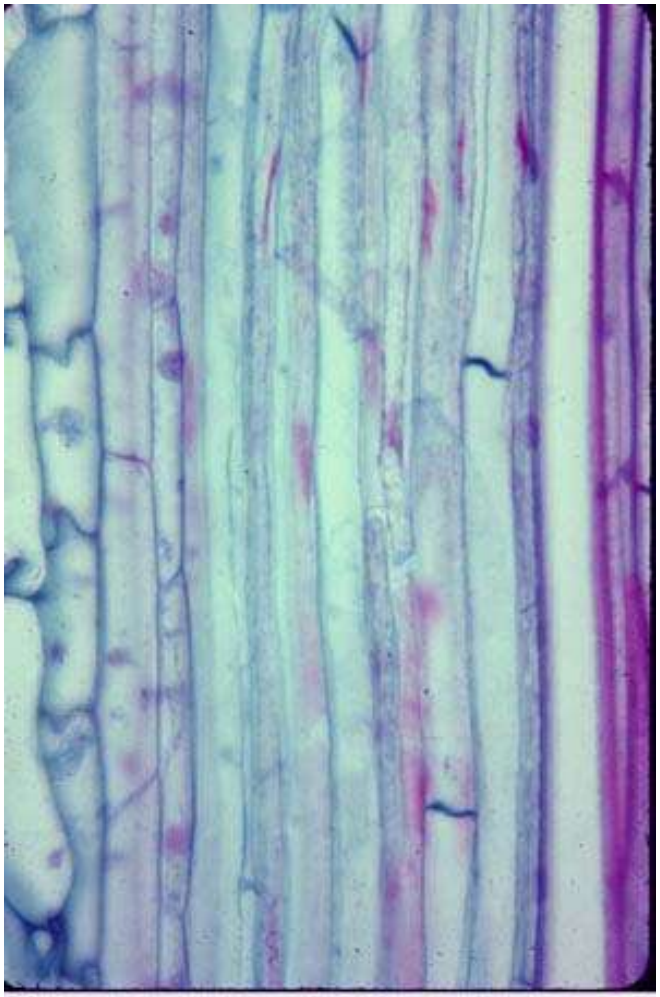


Zea mays – vascular bundle



Phloem

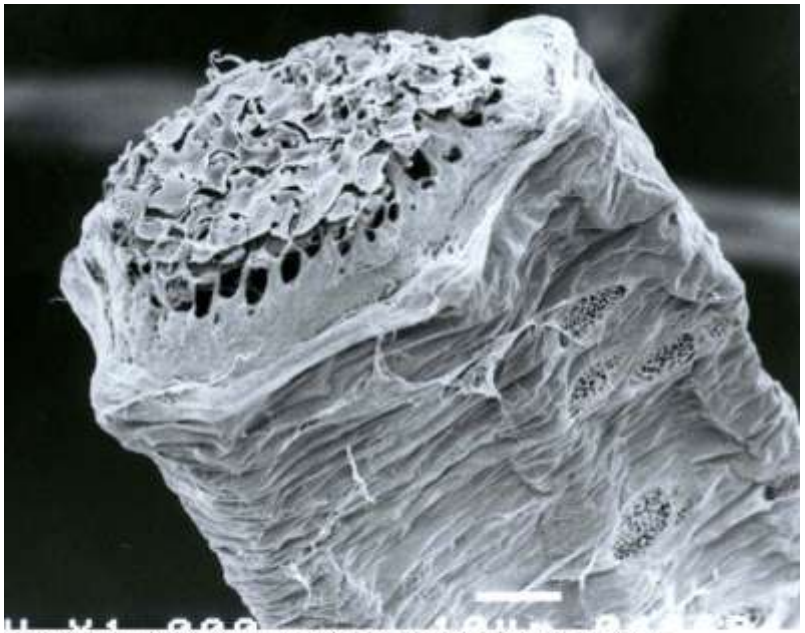




Zea stem longisection with sieve tube members, companion cells and sieve plates.

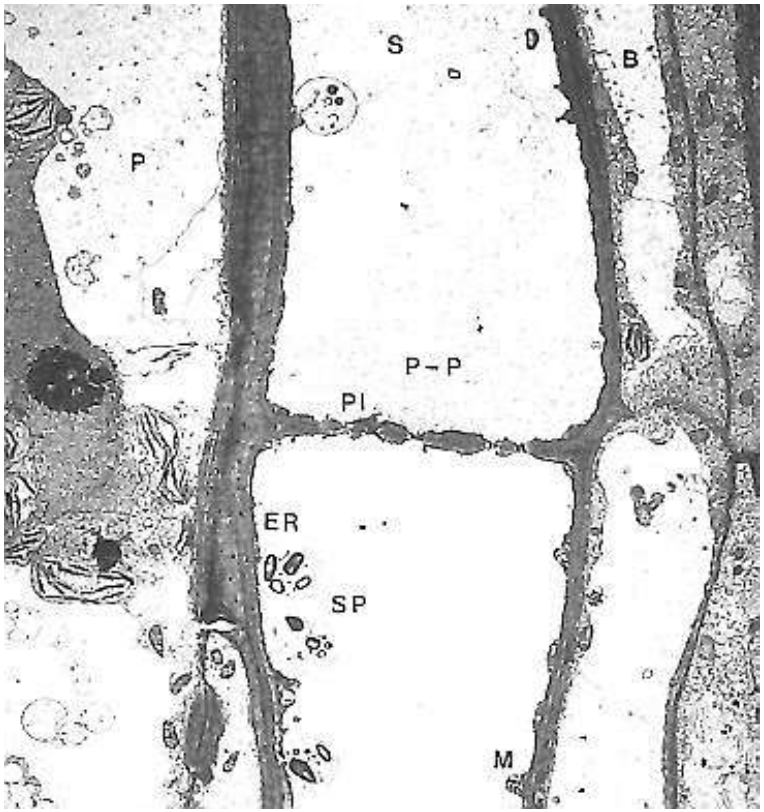
Sieve Plate

SEM

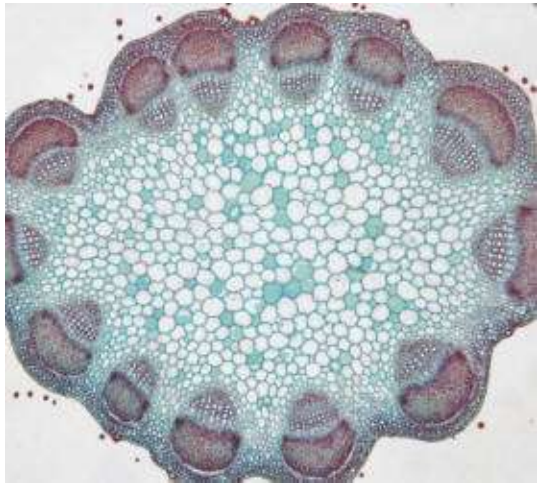


Cucurbita sieve plate partially blocked by slime plug.

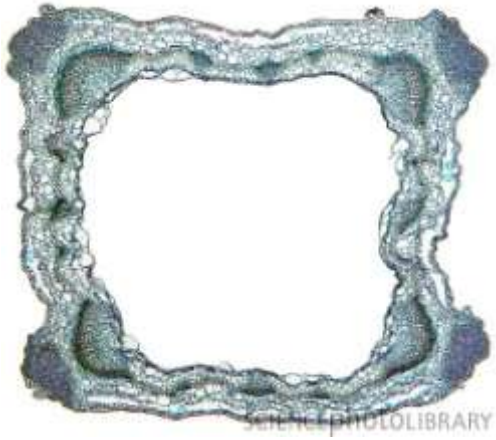
TEM



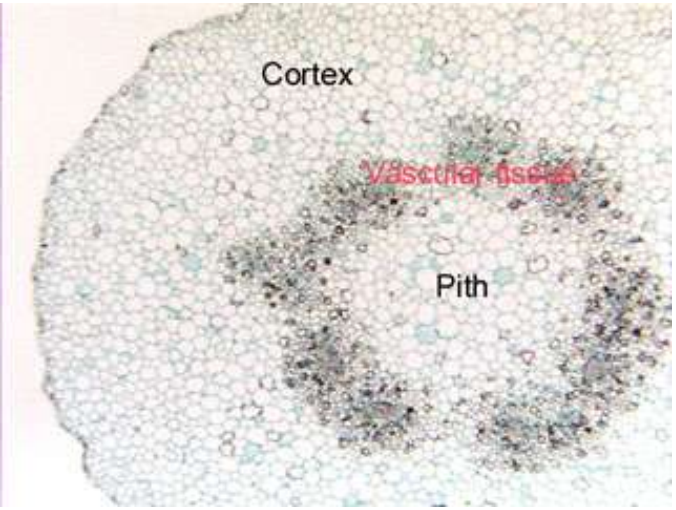
Pith



Trifolium



Mint

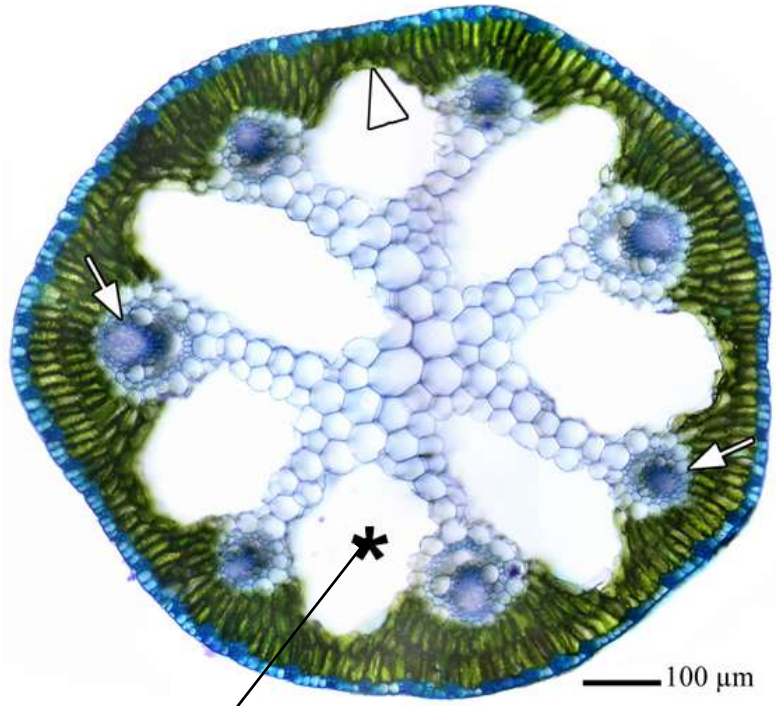


Monotropa (weak stem)

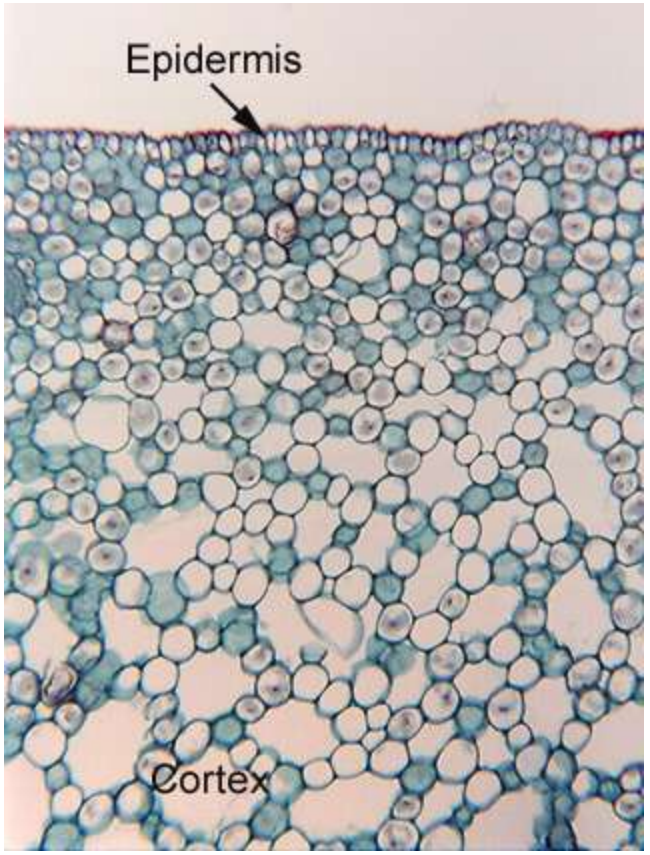
Juglans (chambered pith)

Stems of Aquatic Plants

Eleocharis parvula - Rush



Air lacunae



Acorus - aerenchyma

Milky Sap - Latex

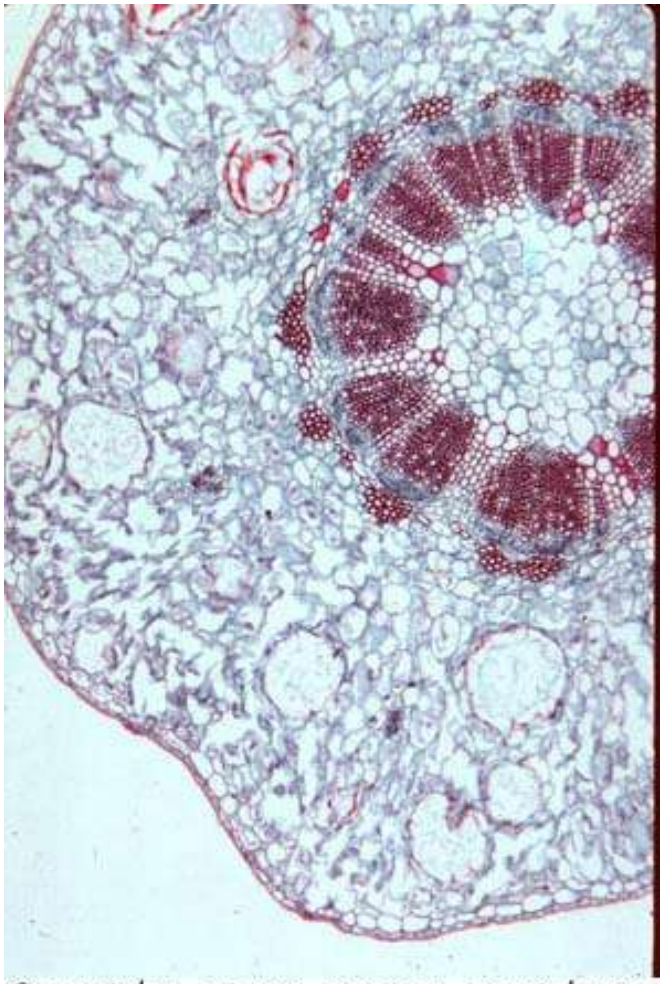
Euphorbia - Spurge

Opium

Hevea

Laticifers – latex containing cells

Euphorbia stem longisection with laticifers.



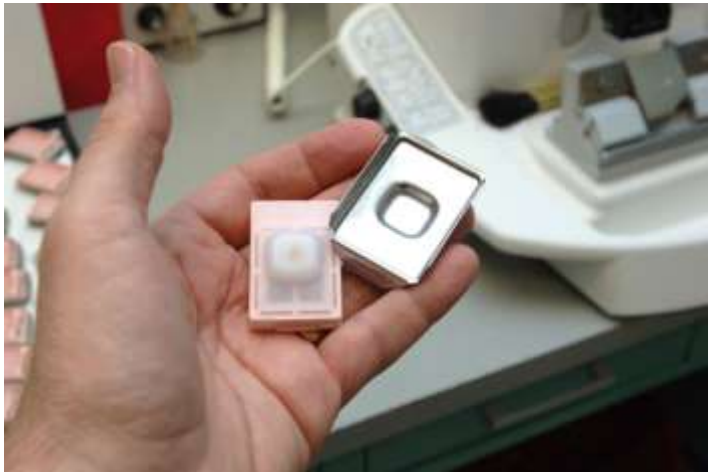
Opuntia stem cross section with laticifers in cortex.

Microtomes

Rotary

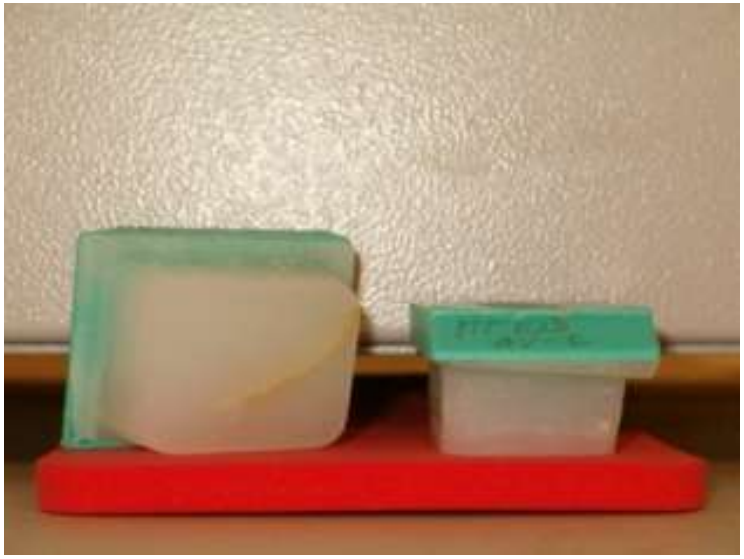
Sliding (Sledge)

Paraffin Embedding

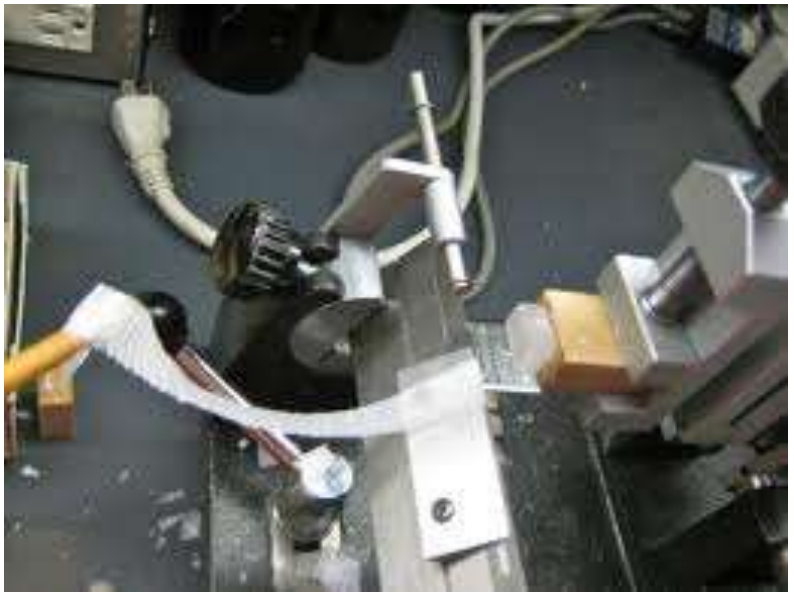


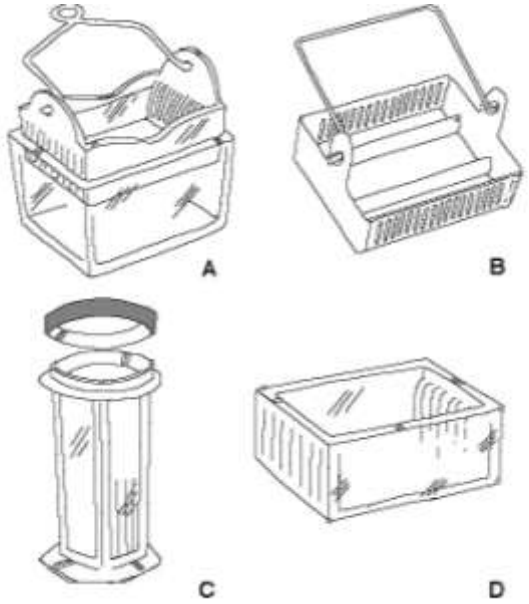
Paraffin Embedding

Section tissue in small pieces
Kill and Fix in FAA
Store in 70% EtOH
Dehydration in alcohol series
  t-butyl-alcohol (TBA)
Paraffin Infiltration
Embedding in block
Trim block
Microtome



Rotary Microtome




A
B
C
D

An example of a double stain procedure

1	Xylol 1	5min
2	Xylol 2	5 min
3	Xylol/abs. ETOH	3min
4	Abs. ETOH	3 min
5	95% ETOH	3 min
6	70% ETOH	2 min
7	Safranin O	MINIMUM 1 hour
8	70% ETOH	1 min
9	Crystal violet	1 min maximum
10	70% ETOH	rinse, 30 sec
11	90% ETOH rinse	rinse, 30 sec
12	95% ETOH + Picric acid	'Dip and drain'
13	95% Ammoniacal alcohol	'dip and drain'
14	100 % ETOH	2 minutes
15	100 % ETOH	2 minutes
16	Fast Green	30 sec to 1 min maximum
17	Clove oil	30 sec
18	Clove oil: Abs ETOH:Xylol (1:1:1)	'dip and drain'
19	Xylol 1	1 min
21	Xylol 2	2 min
22	Xylol 3	2 min
23	Mount in DPX/Canada Balsam	
24		**Remove from here, but only as coverslips are applied!**