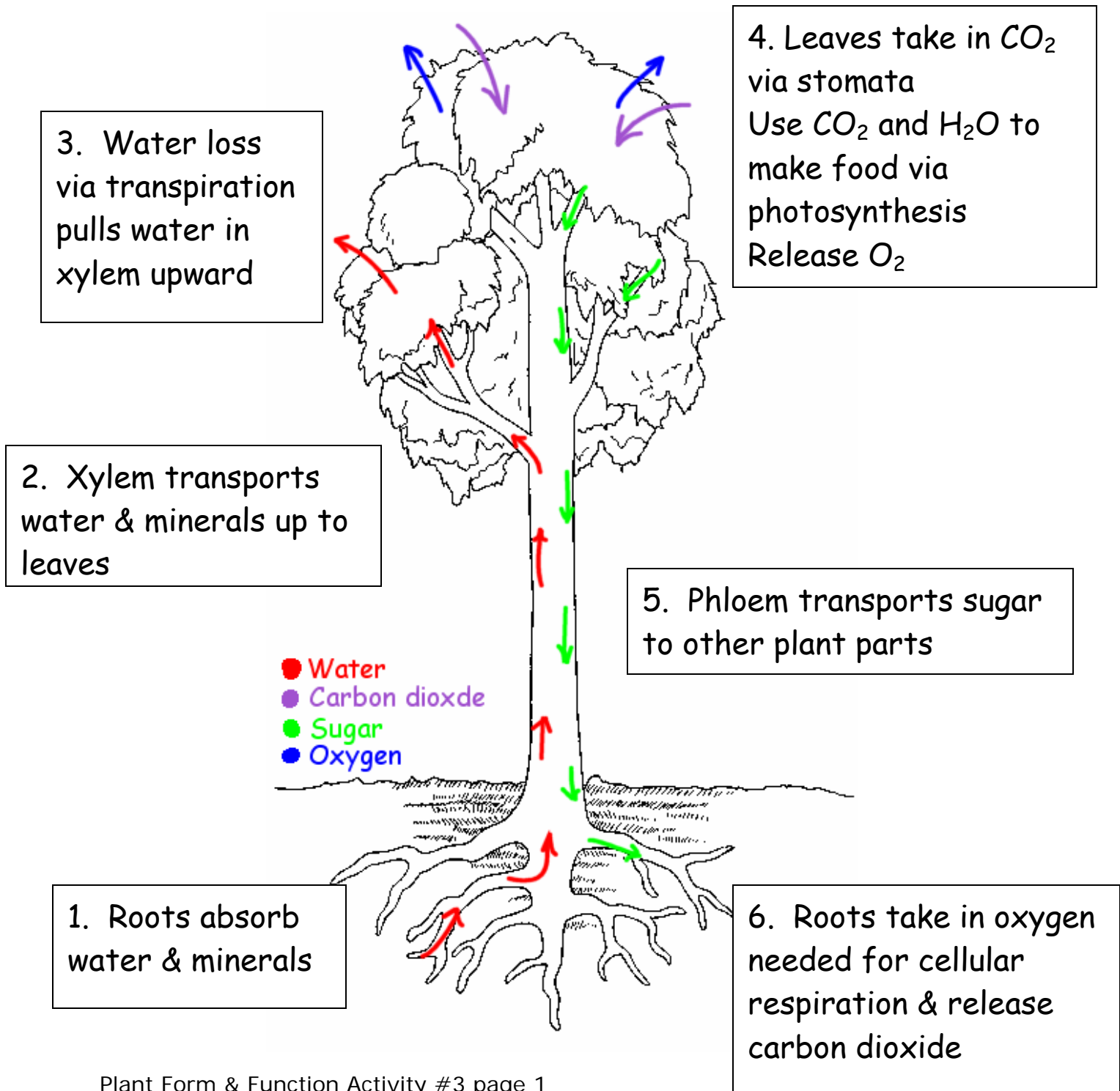


## TRANSPORT IN PLANTS

### OVERVIEW OF TRANSPORT IN PLANTS



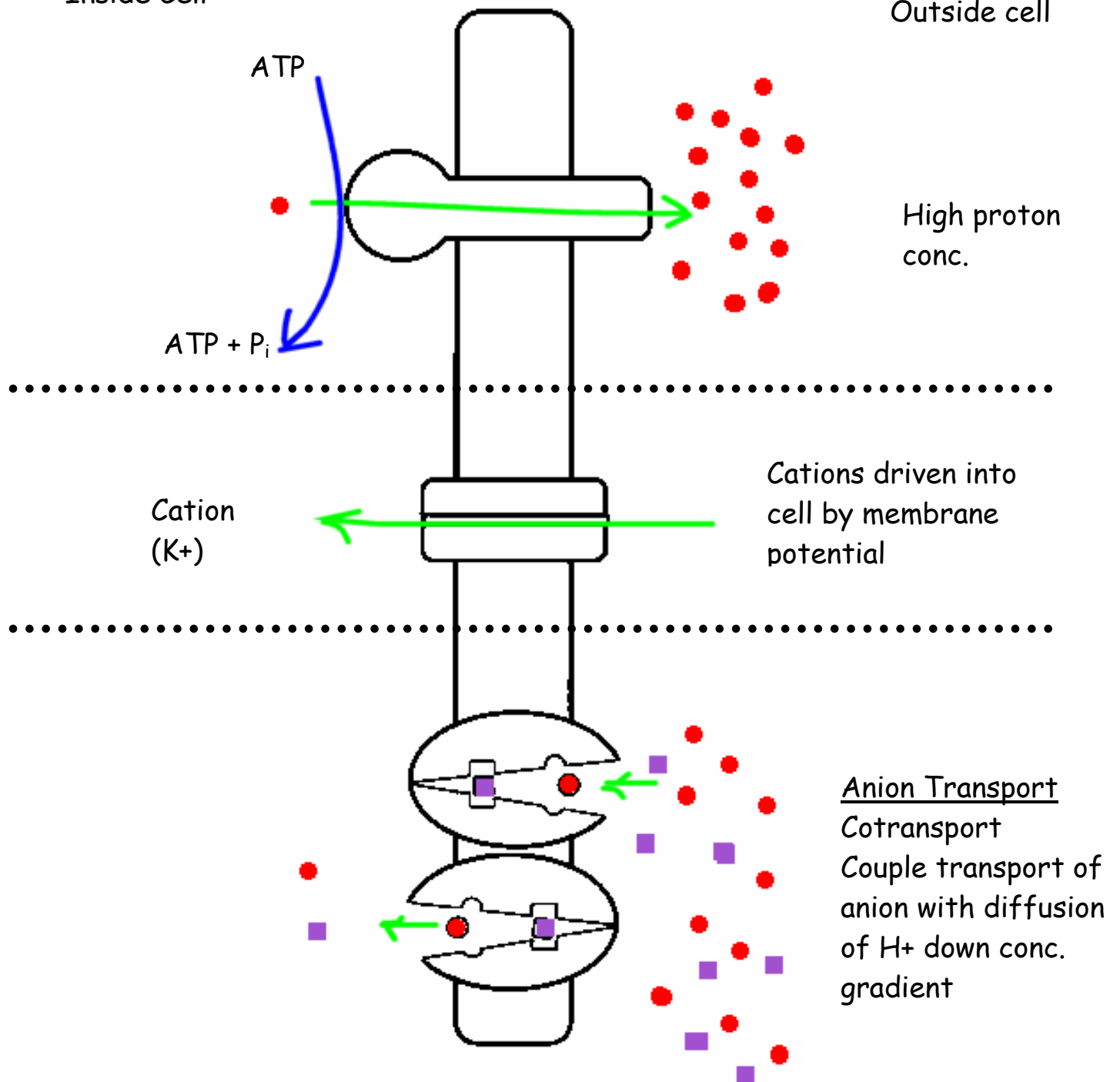
● Proton (H<sup>+</sup>)

■ Anion

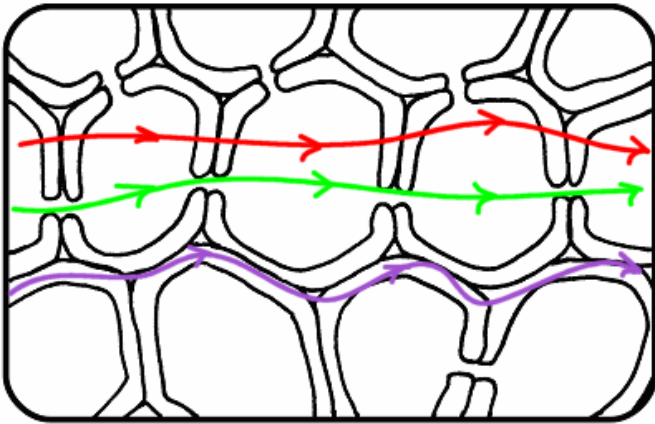
## PROTON PUMPS

Inside Cell

Outside cell



## LATERAL TRANSPORT ROUTES IN PLANTS



**Transmembrane transport**

Across cell membrane, through cell wall, across cell membrane, through cell, across cell membrane, etc.

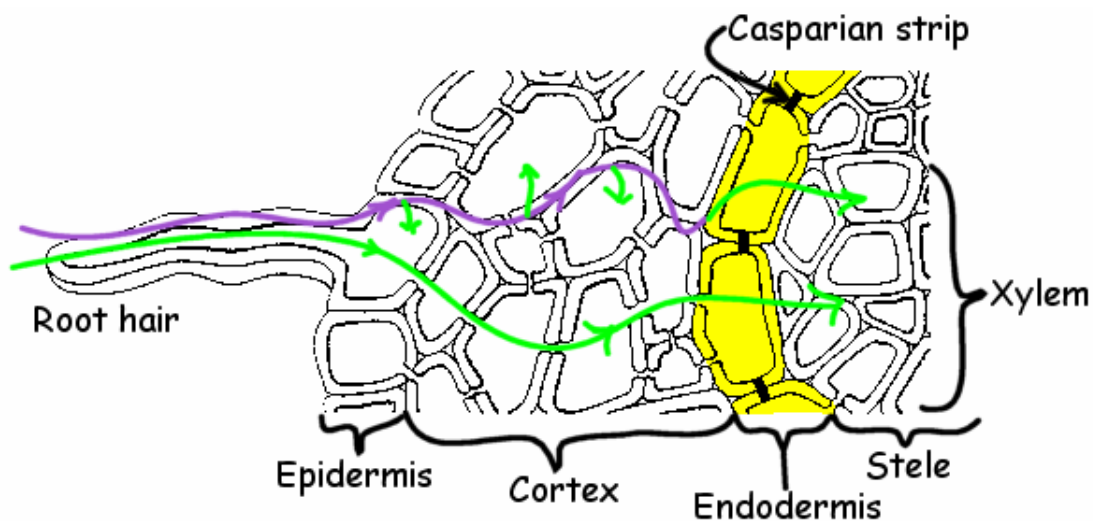
**Symplast**

From cell to cell via plasmodesmata

**Apoplast**

Transport through cell wall matrix  
Substance never enters cell

## LATERAL TRANSPORT IN ROOTS

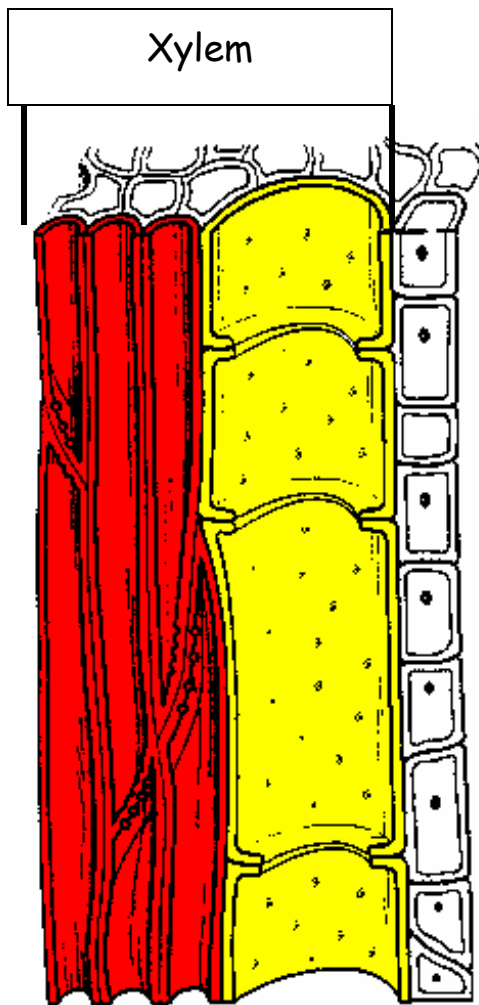


**Symplast**

**Apoplast**

Materials cannot enter stele until they pass through living cell; Casparian strip prevents apoplastic transport into stele

## WATER TRANSPORT IN STEM



### Transport of Water

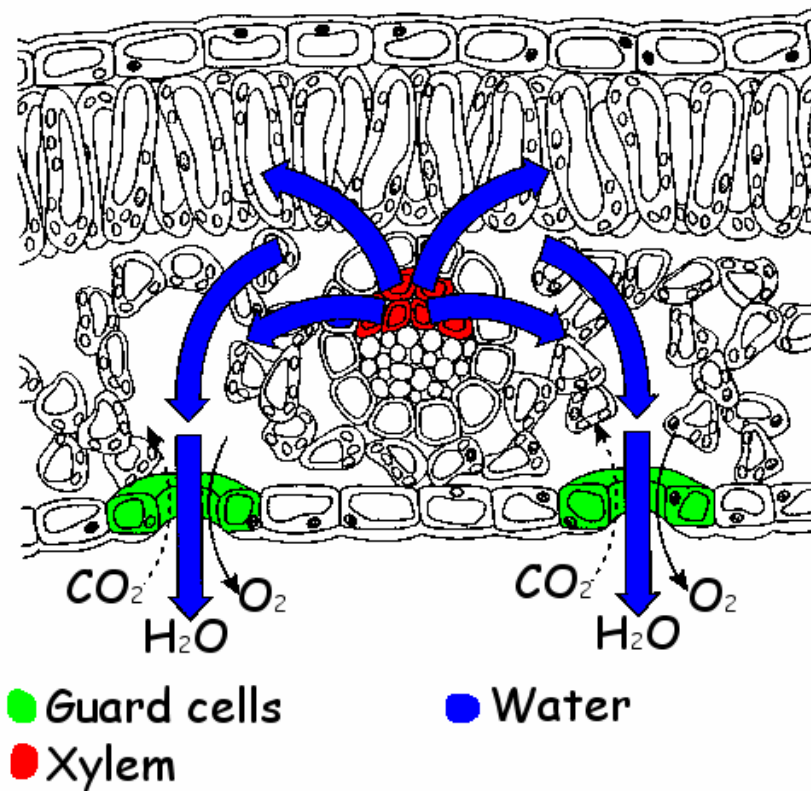
Adhesion of water to cell wall keeps column of water from falling

Cohesion between water molecules forms column of water

### **Types of Cells**

|  |   |
|--|---|
| <b>Tracheids</b> <ul style="list-style-type: none"><li>• Dead at functional maturity</li><li>• Long, thin cells with tapered ends</li><li>• Water moves from cell to cell through pits</li><li>• Secondary cell walls thickened with lignin; provide support</li></ul> | <b>Vessel Element</b> <ul style="list-style-type: none"><li>• Wider, shorter cells with thinner cell walls</li><li>• Ends of cells perforated to allow water to flow freely between cells</li><li>• Dead at functional maturity</li></ul> |
|--|---|

TRANSPIRATION = Evaporation of water from leaf

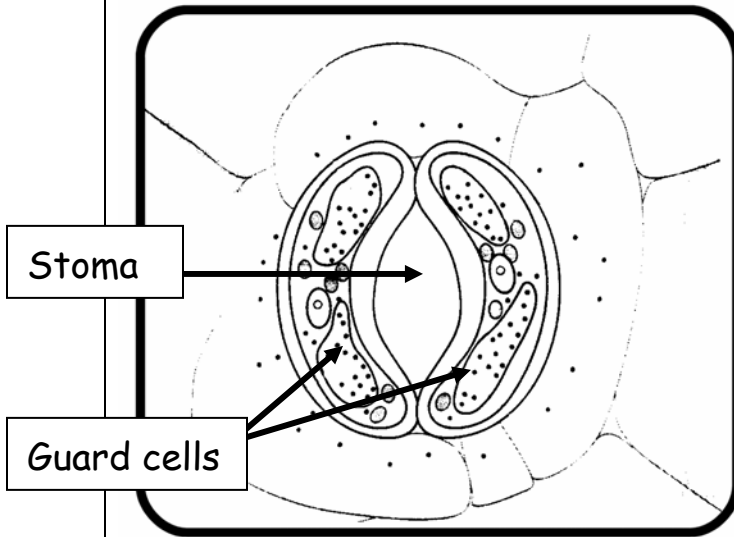


- Water exits leaf via stomata
- Water potential in air spaces decreases
- Water pulled from mesophyll cells
- Water potential inside mesophyll cells decreases
- Water pulled from top of xylem
- Water potential at top of xylem decreases
- Water pulled up xylem from roots

## GUARD CELLS

### Control of stomata

#### Stomata open (day)



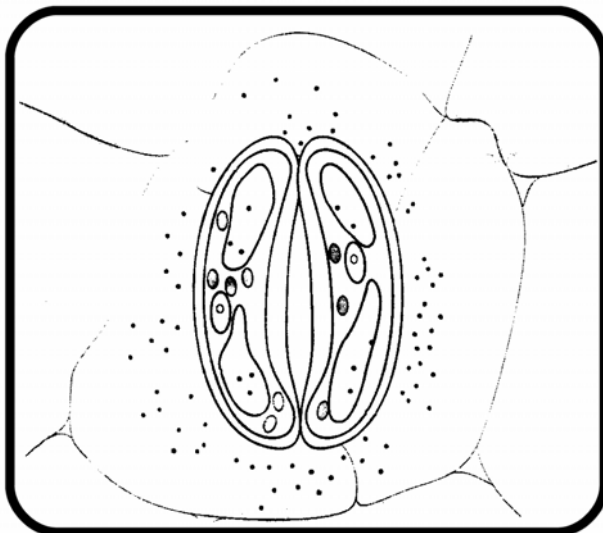
- Guard cells accumulate  $K^+$
- Water potential inside guard cells becomes more negative
- Water enters guard cells
- Guard cells swell
- Stoma opens

.....

#### Triggers

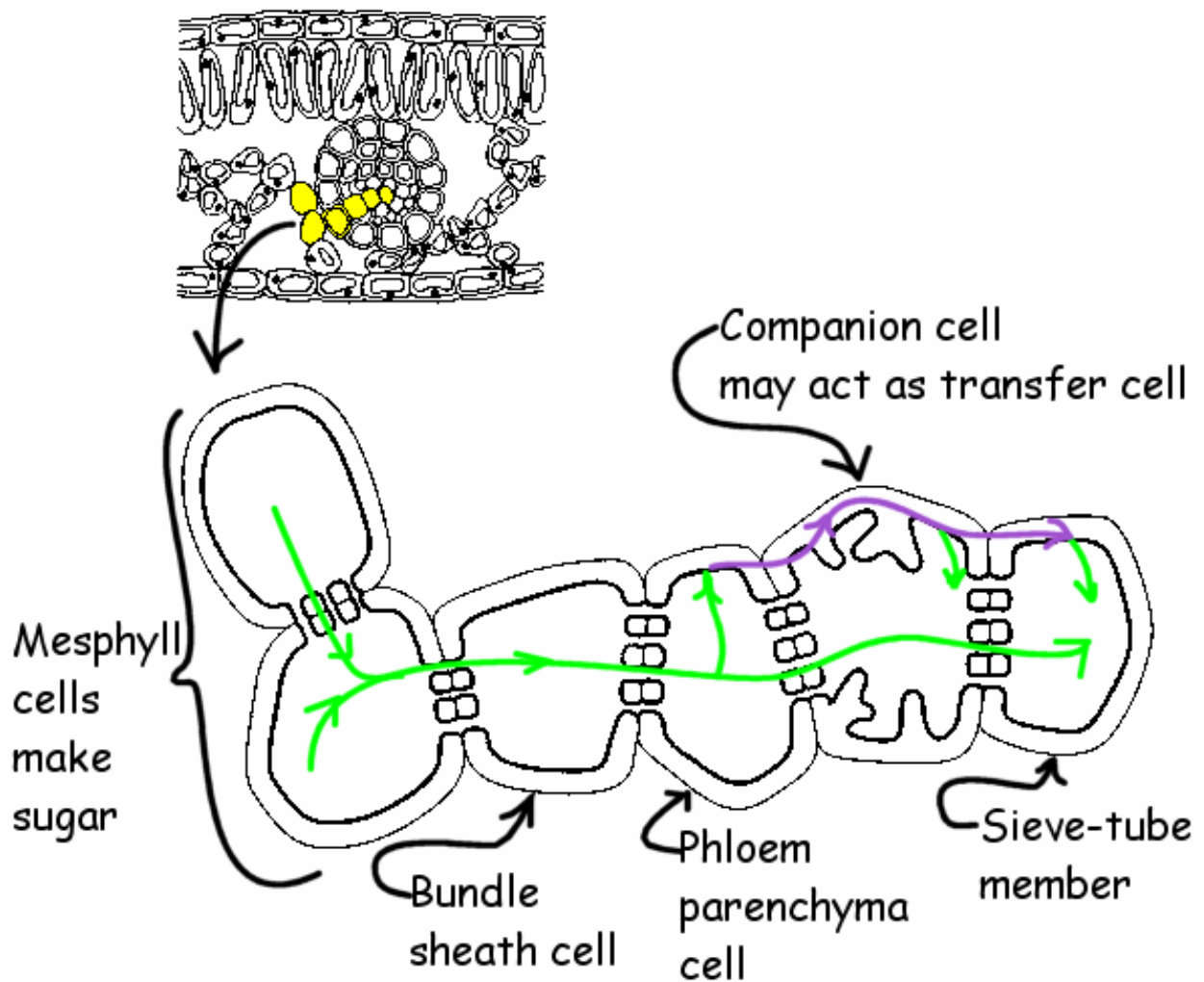
1. light triggers blue-light receptor
2. Depletion of  $CO_2$  in air spaces
3. Internal clock

#### Stomata close (night)



- Guard cells lose  $K^+$
- Water potential inside guard cells becomes less negative
- Water exits
- Guard cells become flaccid
- Stoma closes

## PHLOEM LOADING



|  |   |
|--|---|
|  | Symplast  |
|  | Apoplast  |
|  | <ul style="list-style-type: none"><li>• Requires active transport into companion cells &amp; sieve-tube members</li><li>• Proton pumps used</li></ul> |

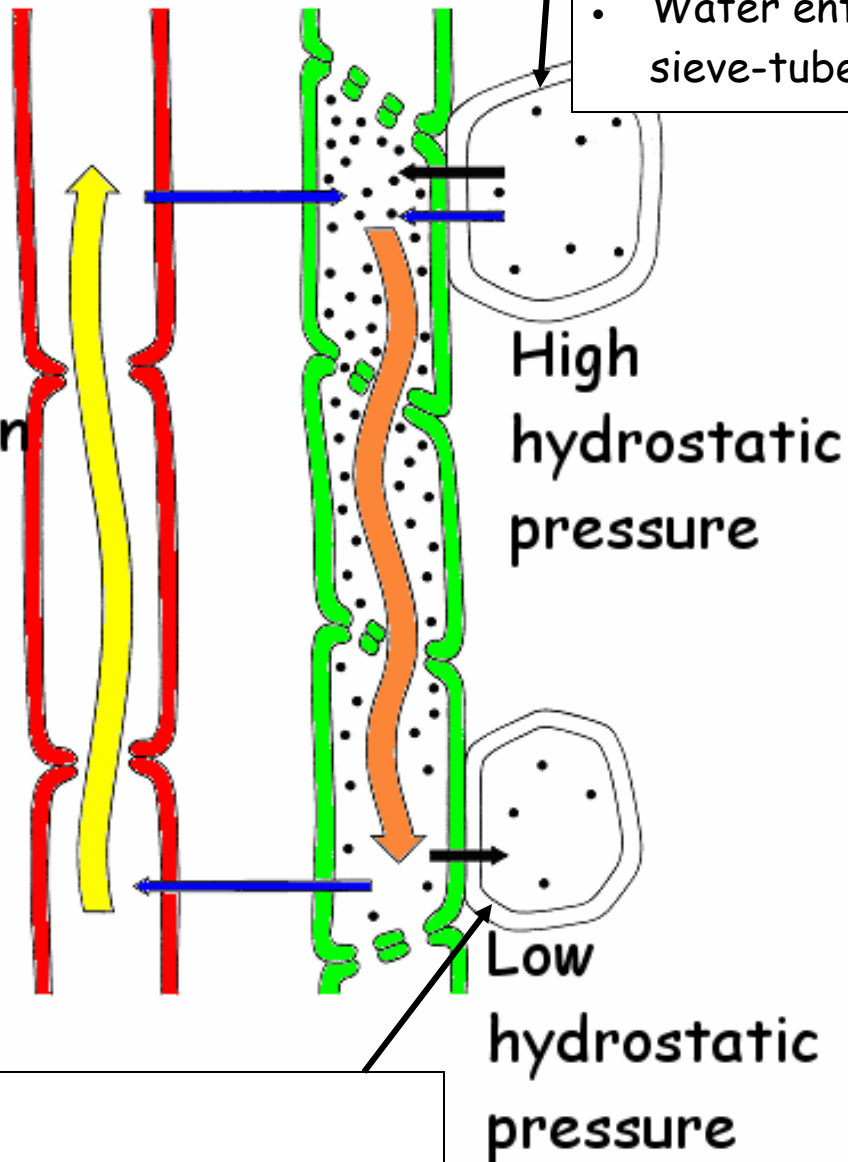
## BULK TRANSPORT IN PHLOEM

Phloem sap flows from high hydrostatic pressure to low (from source to sink)

### Source cell

- Sucrose enters sieve-tube member
- Water potential becomes more negative
- Water enters sieve-tube member

- Xylem
- Phloem
- Water
- Sucrose
- Transpiration flow
- Pressure flow



### Sink Cell

- Removes sucrose
- Water potential in sieve-tube member becomes less negative
- Water enters sieve-tube member