



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Characteristics of Plant Growth and Development-II

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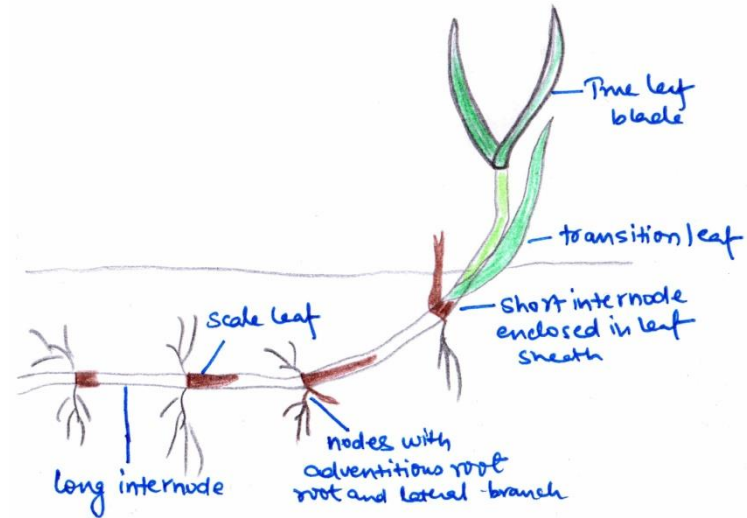
Characteristics of Plant Growth and Development

➤ **Plastic development:** Adaptability to prevailing environmental condition

- Example: couch grass (*Agropyrum repens*)

Underground shoot- long internodes, scale leaves
& adventitious roots

Aboveground shoot- short internodes, true leaves
& no root



Characteristics of Plant Growth and Development

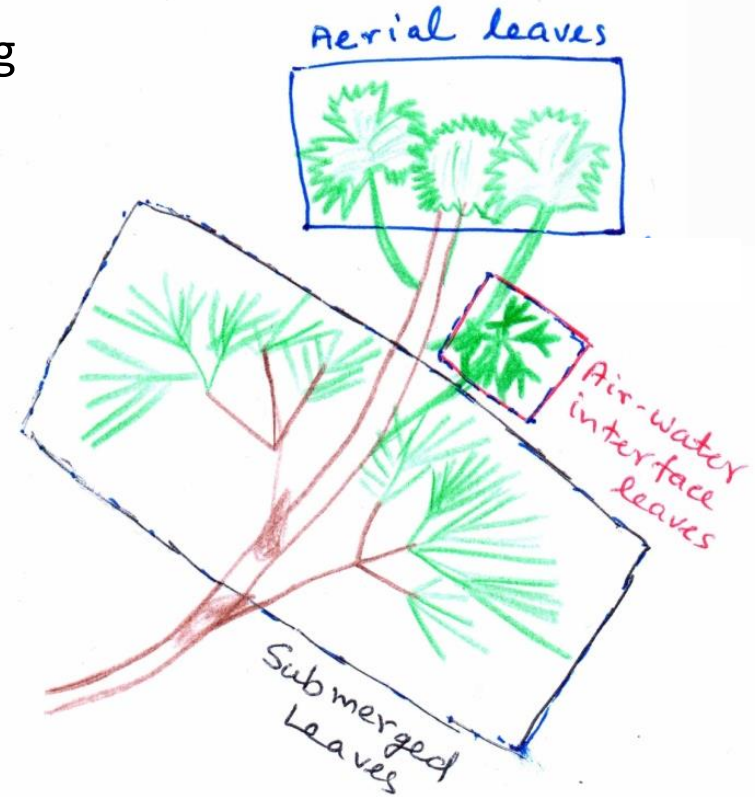
➤ **Plastic development:** Adaptability to prevailing environmental condition

- Example: water crowfoot (*Ranunculus aquatilis*)

Submerged leaves-

Air-water interface leaves-

Aerial leaves-



Characteristics of Plant Growth and Development

➤ **Cell fate determination:**

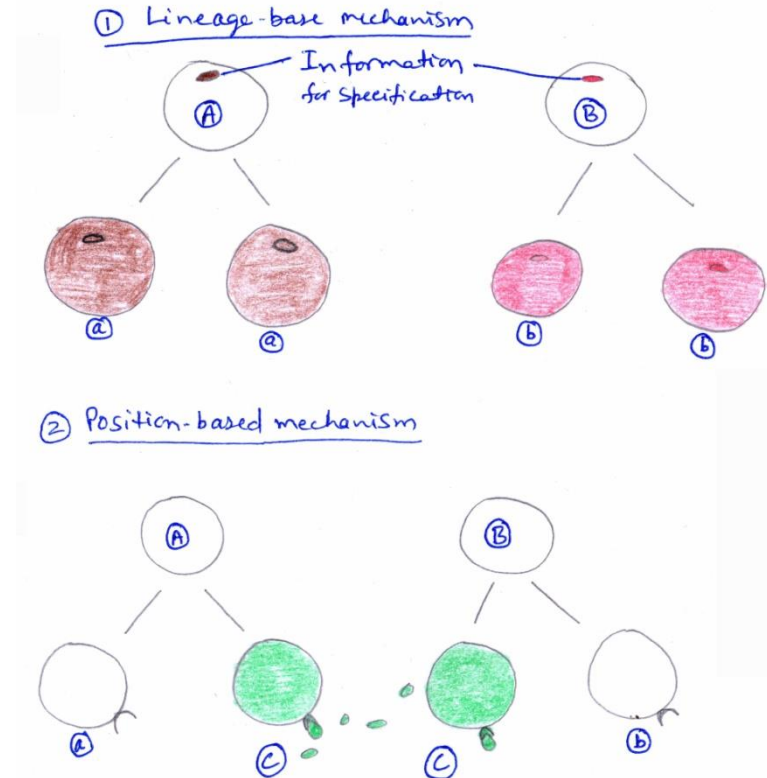
instructed by ancestors or neighbors

- **Lack of cell migration**

- **Cell lineage and position**

Cell-intrinsic (lineage-dependent)

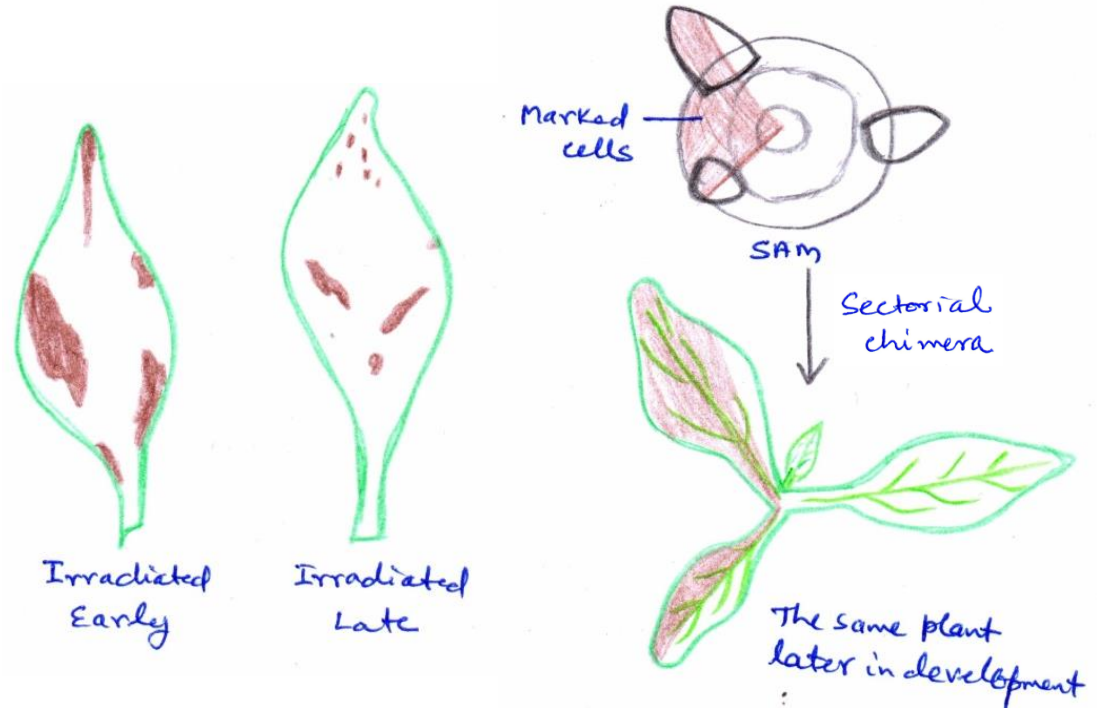
Cell-extrinsic (position-dependent)



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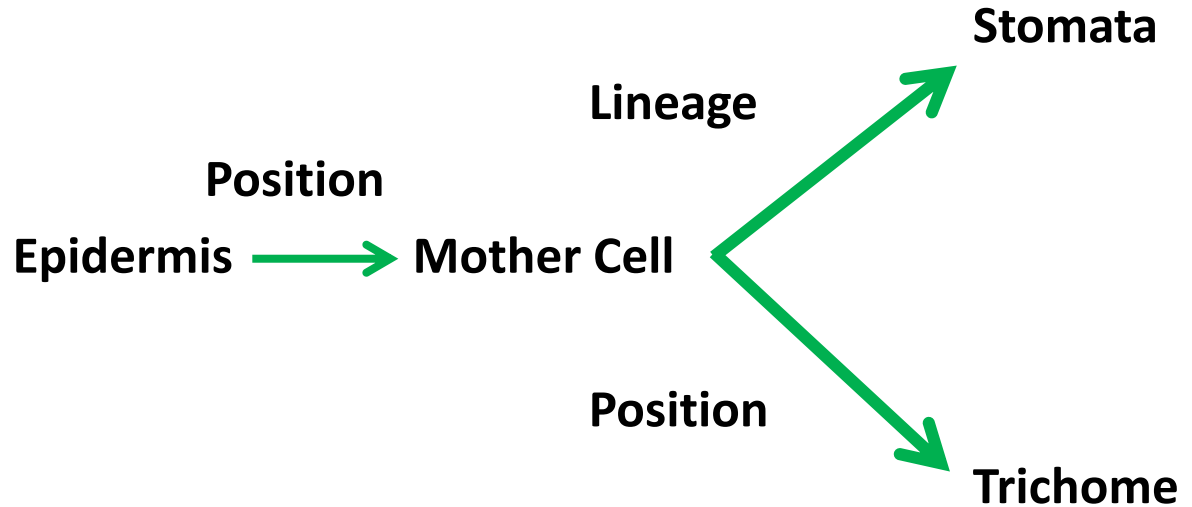
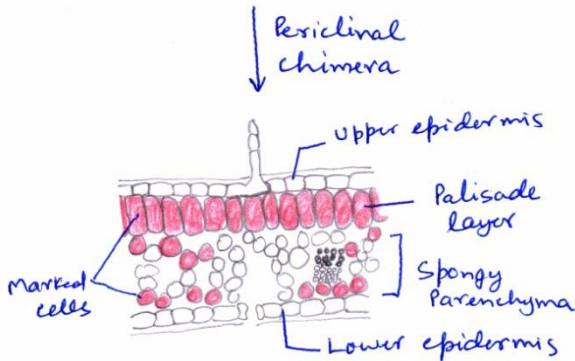
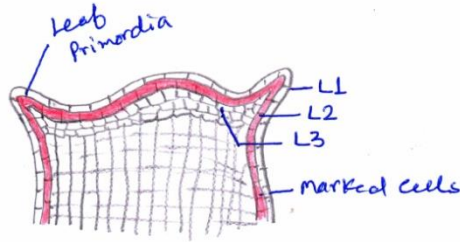
➤ *Lineage vs. Position Analysis*

- Clonal analysis
(heritable visible markers
such as pigment mutants)
- Chimera analysis
(two or more distinct
cell population)



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- **Cell lineage and position:** instructed by ancestors or neighbors

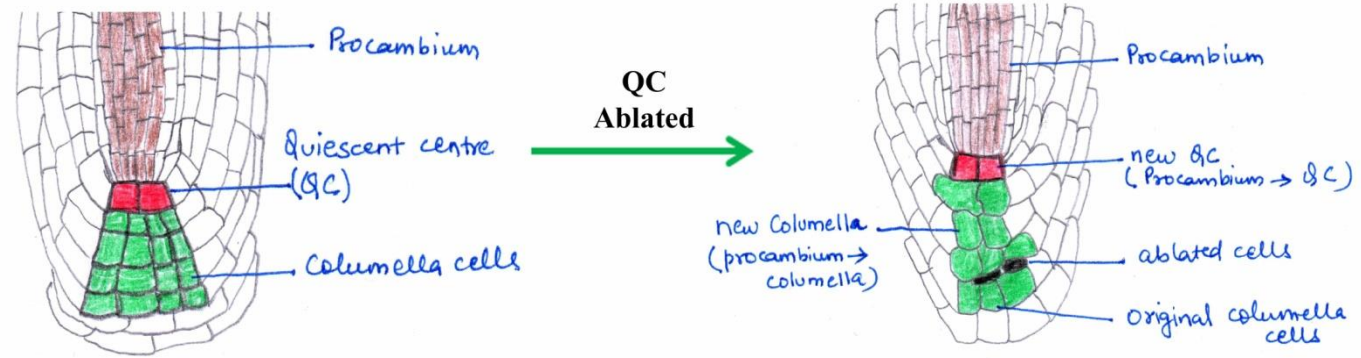


Glover, B. J. (2000), J. Exp. Bot., 51, 497-505.

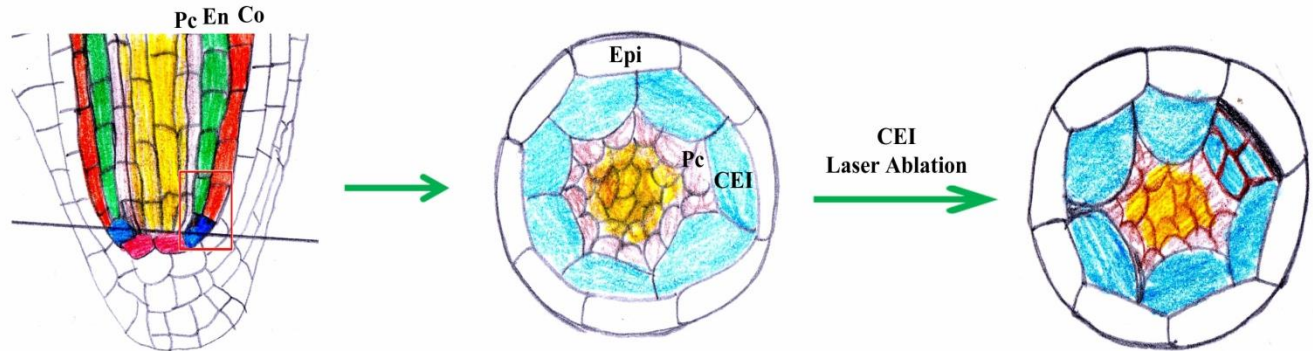
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➤ *Laser ablation*

➤ *Example 1: QC*



➤ *Example 2: CEI*



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➤ *Positional Signals:*

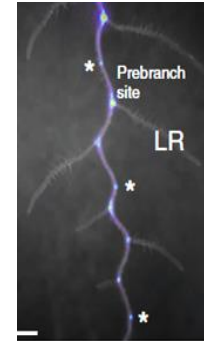


Image Source: Moreno-Risueno et al (2010), Science, 329, 1306-11.

- **Morphogen:** Auxin; gradient & maxima

- *Receptor-mediated signaling:*

Secreted ligands and membrane-associated receptors

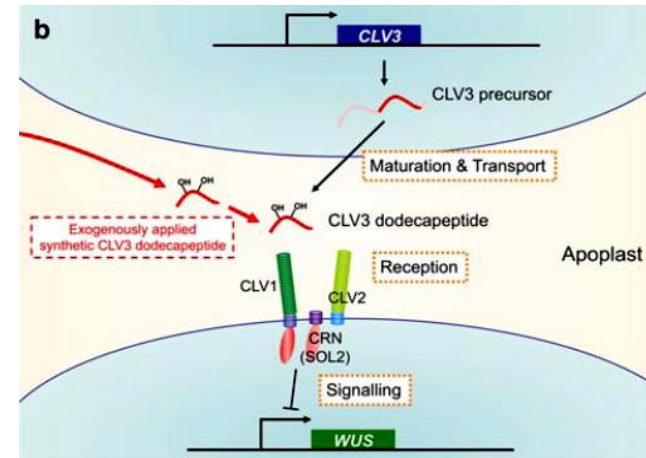


Image Source: Miwa et al (2009), J Plant Res, 122, 31-39.

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➤ *Positional Signals:*

- *Molecular trafficking:*

Short- & long-distance trafficking

Mobile molecules- Proteins, RNAs etc.

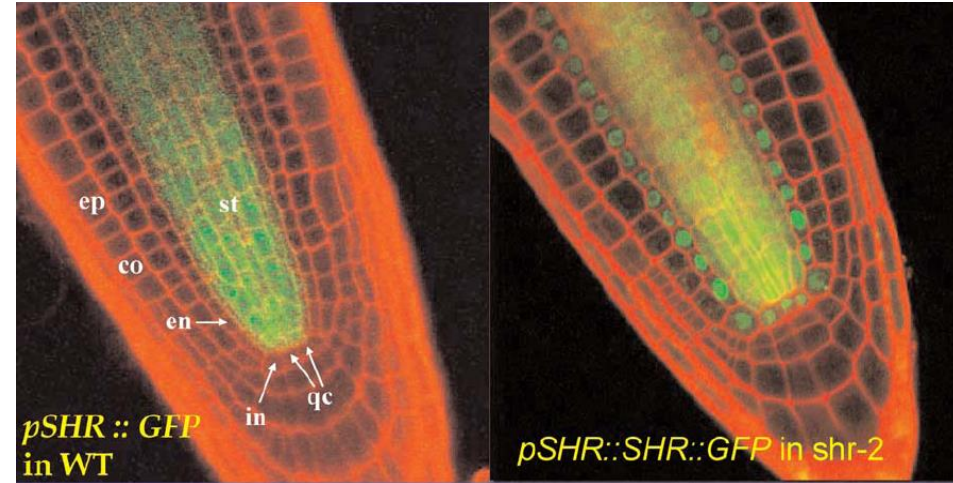


Image Source: Nakajima et al (2001), Nature, 413, 307-11;
Scheres et al. (2002), The Arabidopsis Book, e101; 1-18.

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➤ *Positional Signals:*

- *Molecular trafficking:*

Plasmodesmata

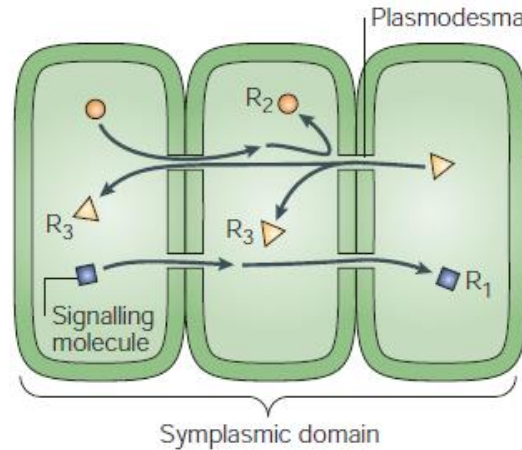


Image Source: Lucas & Lee (2004),
Nat Rev Mol Cell Biol., 5, 712-26.

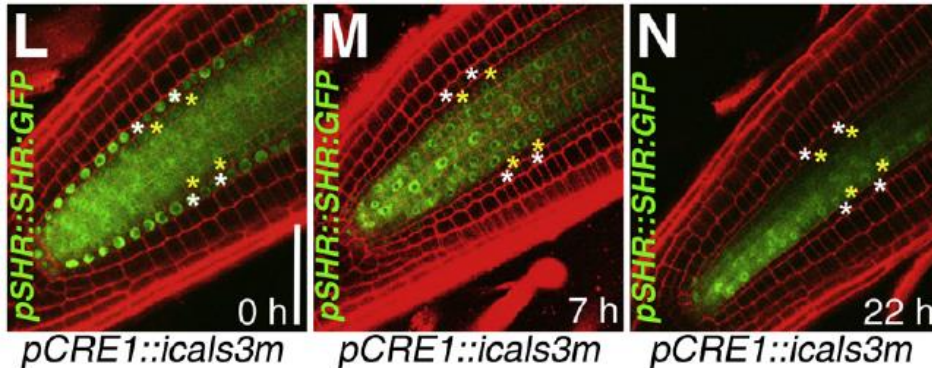


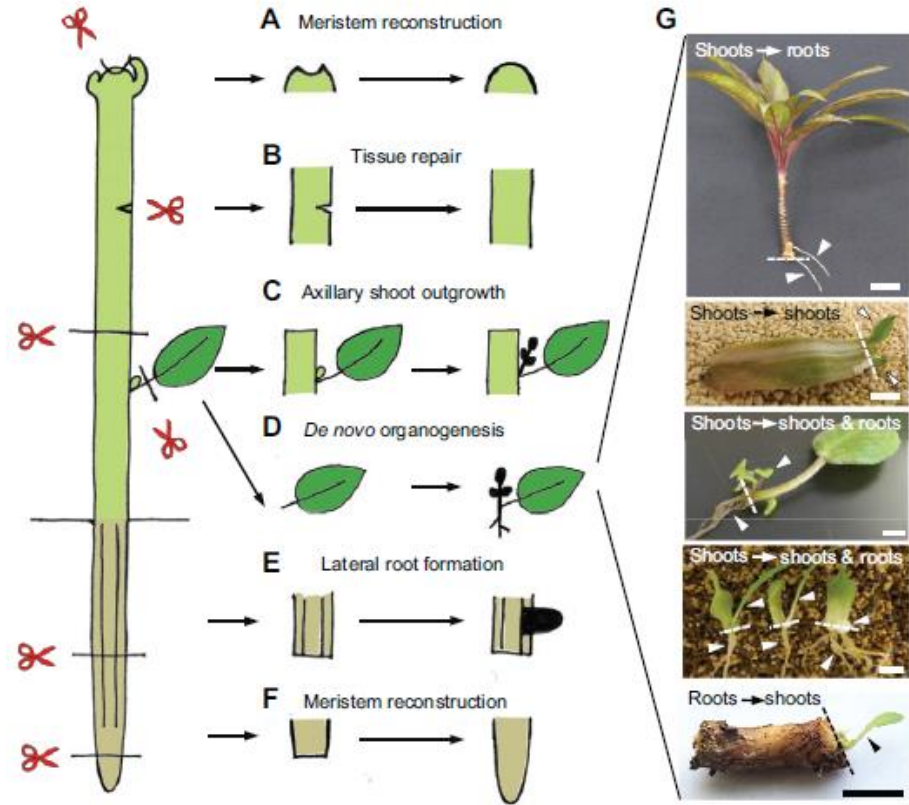
Image Source: Vaten et al. (2011),
Dev. Cell, 21, 1144-55.

Characteristics of Plant Growth and Development

➤ **Regeneration:** totipotency

- Differentiation
- De-differentiation
- Re-differentiation

Image Source: Ikeuchi et al (2016),
Development, 143, 1143-51.



Summary: Plant growth & Development

- Plants are sessile and prone to physical damage
- They have evolved developmental pattern that are continuous, responsive to environmental cues and regenerative nature
- These features are attained by exchange of information between the cells which can be local as well as long range
- The cell fate in a developing region is more dependent on the extrinsic information as compared to intrinsic information

