



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Characteristics of Plant Growth and Development-I

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Characteristics of Plant Growth and Development

Plant Growth: Irreversible change in size and biomass of a plant

- ***Cell division***
- ***Cell elongation***



Growth &
Development
→

Plant Development: Irreversible change in state to achieve a specified structure and function

- ***Cell division***
- ***Cell differentiation***

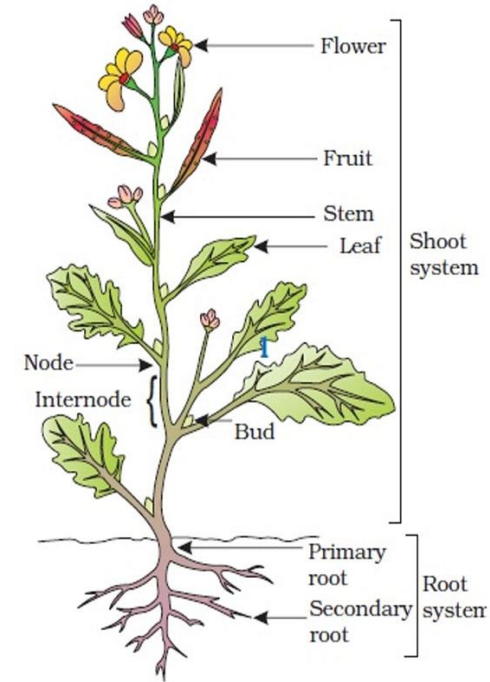
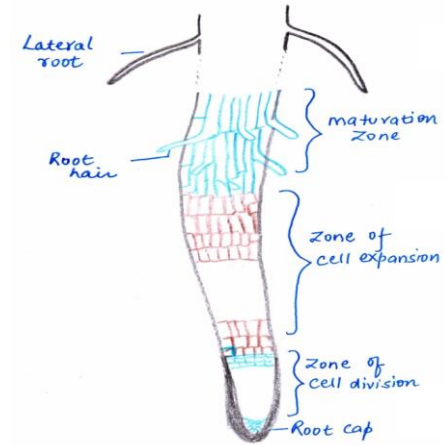
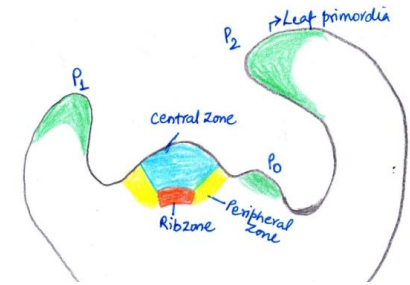


Image Source: NCERT,
Class XI, Biology

Characteristics of Plant Growth and Development

Plant Growth and Development: (Essential and highly coordinated)

- **Organization & maintenance of meristem**
(cell division; population of stem cells)
- **Organogenesis** (cell differentiation)
 - Cell fate determination (identity acquisition)
 - Organ/tissue specification (specialization)
 - Organ/tissue patterning (arrangement)
 - Organ/tissue polarity (shape/structure)
 - Organ determinacy (continuity)



Characteristics of Plant Growth and Development

Plant Growth and Development:

➤ *Establishment of plant architecture (3-D)*

- Apical-basal axis
- Central-peripheral axis
- Proximal-distal axis
- Adaxial-abaxial axis

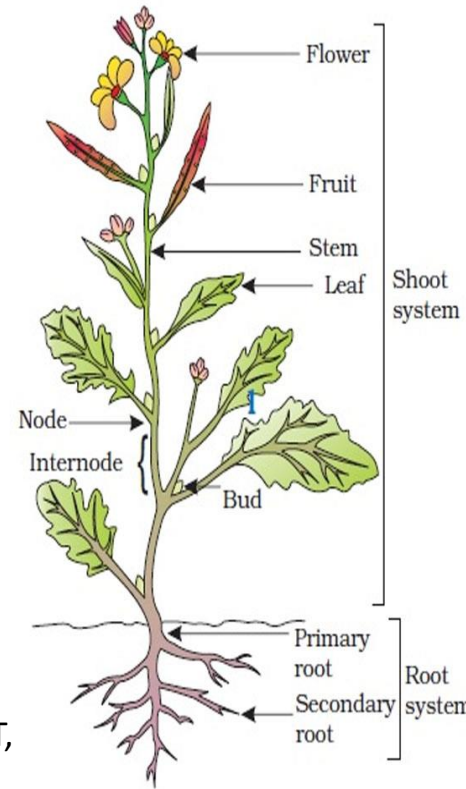
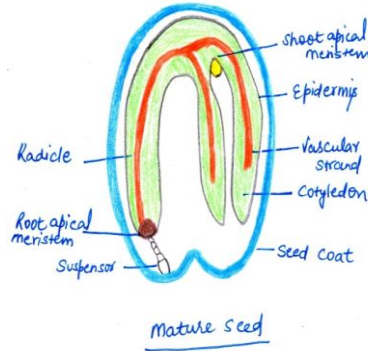


Image Source: NCERT,
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Characteristics of Plant Growth and Development

➤ **Post-embryonic & continuous development:**

- Mostly post-embryonic
- Post-germination
- Indeterminate (e.g. SAM)
- Determinate (e.g. flower)



Mature seed

Post-embryogenesis

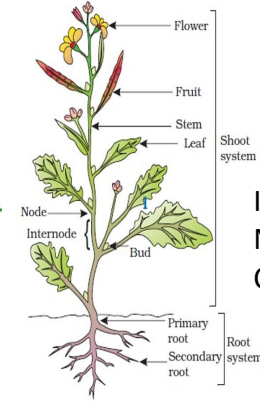
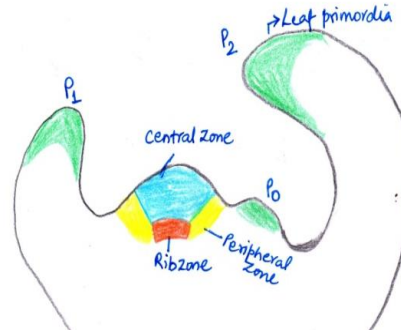


Image Source:
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Class XI, Biology



Determinacy

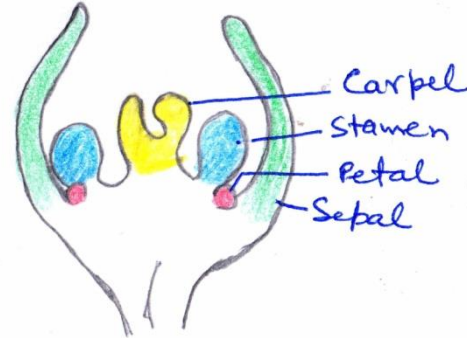




Image Source: Benlloch et al (2015), Front. Plant Sci., 6, 543.

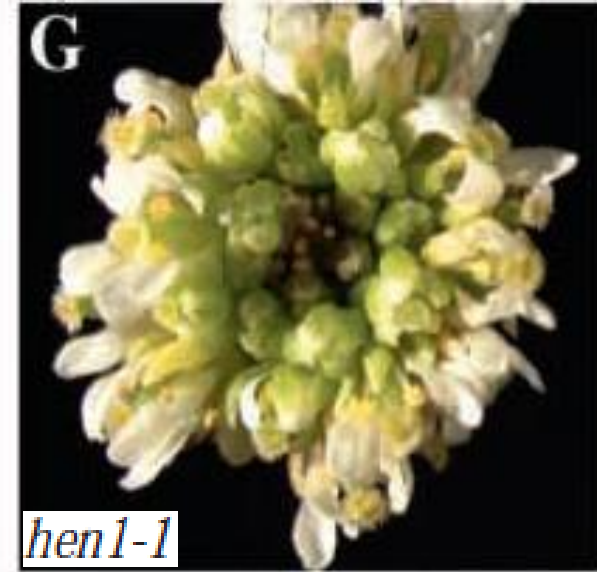
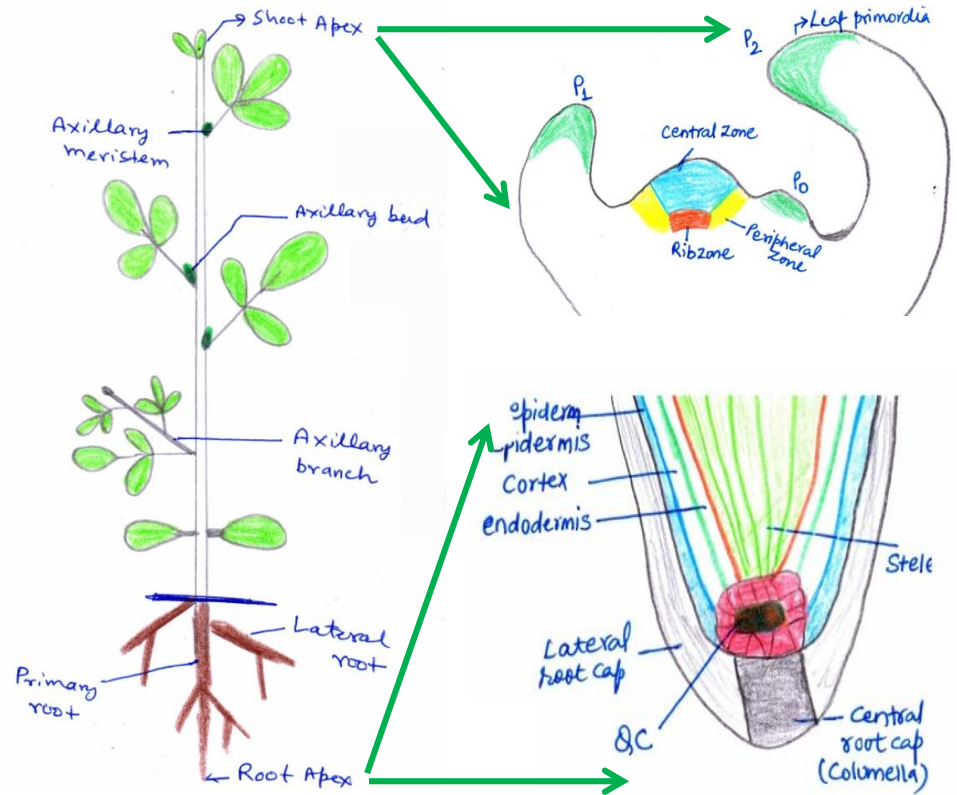


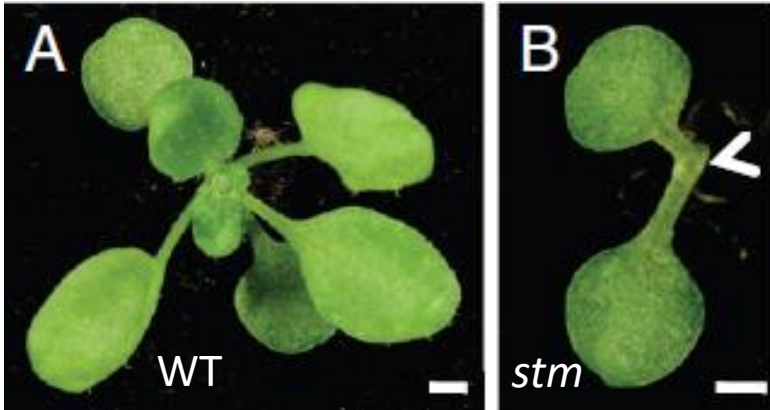
Image Source: Chen et al (2002), Development, 129, 1085-94.

Characteristics of Plant Growth and Development

➤ **Primary growth & Development:**

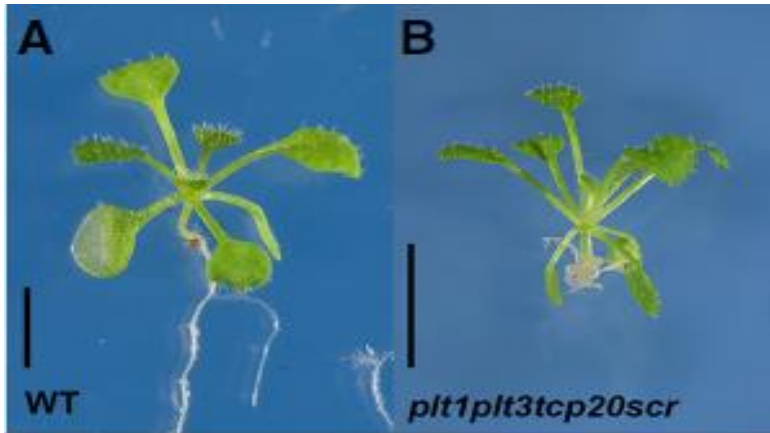
- Increase in the length of shoot and the root
- Apical-basal axis
- Apical meristems (SAM and RAM)
- Critical balance between meristem maintenance & organogenesis





STM- SHOOT MERISTEMLESS

Image Source: Hay and Tsiantis;
Development (2010), 137; 3153-65



PLT- PLETHORA

Image Source: Shimotohno et al;
Genes & Development (2018), 32; 1085-1100

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➤ **Secondary growth & development:**

- Increase in the diameter
- Central-peripheral (radial) axis
- Lateral meristem (cambium)

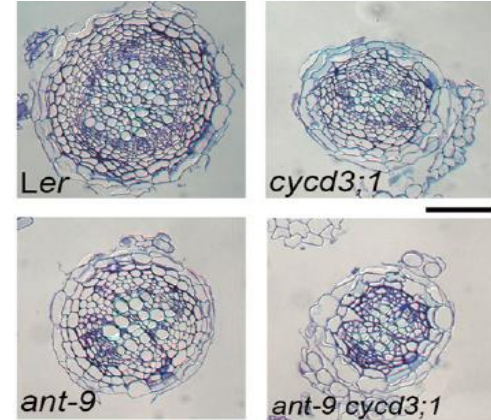
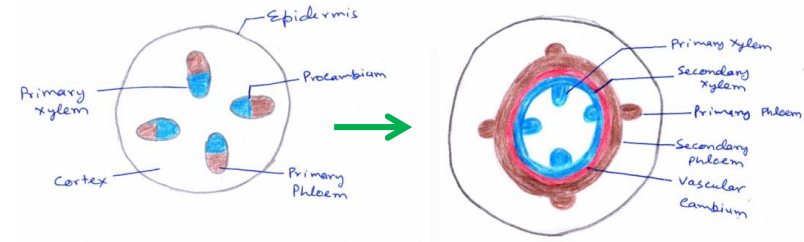
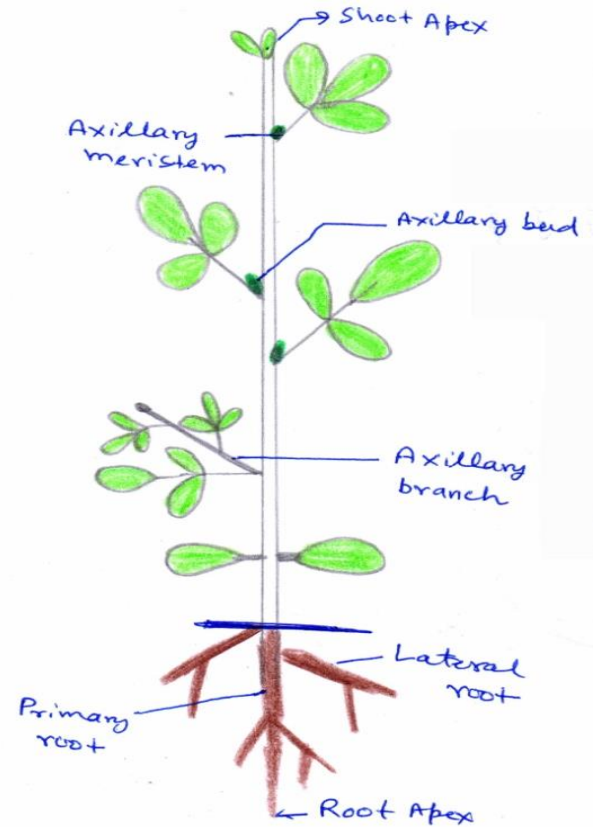


Image Source: Randall, Miyashima et al (2015),
Biology Open, 00, 1-8.

Characteristics of Plant Growth and Development

➤ ***Lateral Growth & development:***

- Branching and plant architecture
- Proximal-distal axis
- Adaxial-abaxial axis
- Axillary meristem



Characteristics of Plant Growth and Development

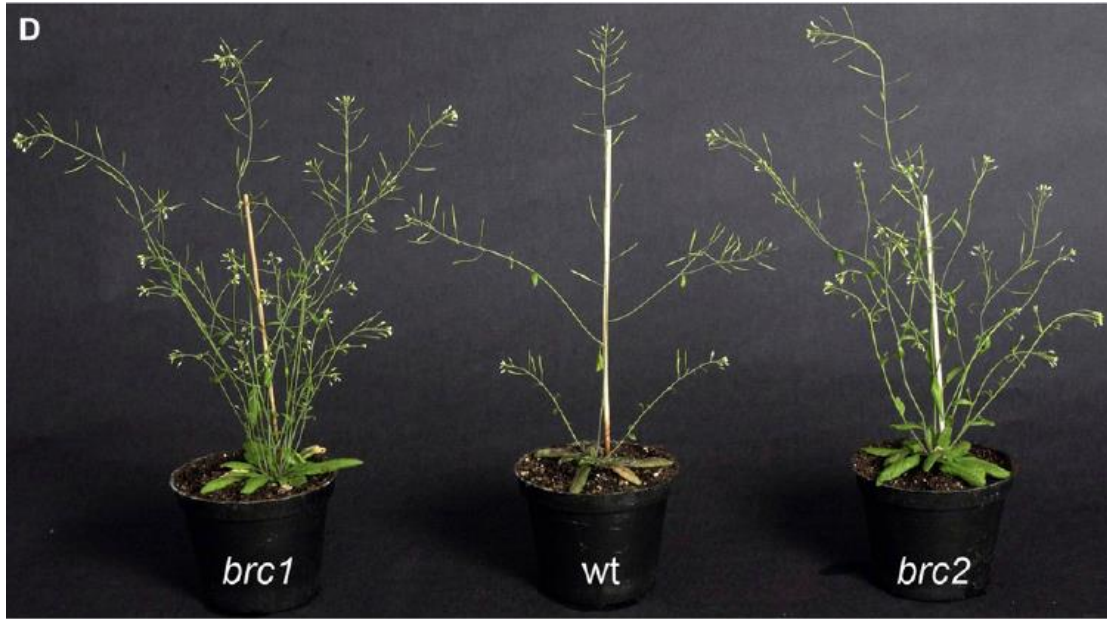


Image Source: Aguilar-Martinez et al (2007), Plant Cell, 19, 458-72.

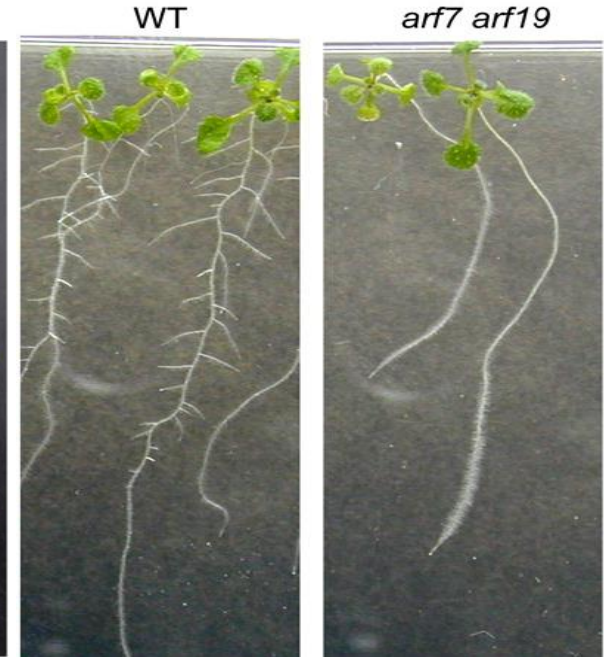


Image Source: Okushima et al. (2007), Plant Cell, 19, 118-30.