

Learning outcomes

Introduction – primary shoot growth

CHAPTER OUTLINE

- 1.1 Plant Kingdom
- 1.2 Angiosperms
- 1.3 Primary Growth
- 1.4 Apical meristem
- 1.5 Cambium
- 1.6 Vascular tissue: Xylem
- 1.7 Vascular tissue: Phloem
- 1.8 Secondary cell wall

Learning objectives & Science competencies

The students become familiarized with: Plant taxonomy, shoot development, cell differentiation, plant tissue development, primary and secondary meristems, primary shoot development, vascular tissue, tracheids, sieve elements, pith, pits, secondary cell wall.

Secondary growth

CHAPTER OUTLINE

- 2.1 Cambium function- environmental effects
- 2.2 Growth rings
- 2.3 Dendrochronology
- 2.4 Secondary growth-Xylem
- 2.5 Early wood-Late wood / Sap wood-heart wood
- 2.6 Tree trunk
- 2.7 Wood structure

Learning objectives & Science competencies

Students learn about the secondary stem growth in perennial plants, xylem growth, the wood growth and structure, the dendrochronology or tree-ring dating. They learn how to differentiate primary and secondary growth, the roles of apical vs lateral meristems in plant growth, the function and organization of woody stems derived from secondary growth

Perennial Plant Adaptation and Hardening in low temperatures- Abiotic plant stresses

CHAPTER OUTLINE

- 3.1 Plant hardening
- 3.2 Changes in plant metabolism during hardening
- 3.3 Frost
- 3.4 Thermal analysis
- 3.5 Abiotic Plant stress factors
- 3.6 Stress responses
- 3.7 Avoidance/Escape/Tolerance
- 3.8 The role of hormones
- 3.9 Plant Dormancy
- 3.10 Water movement in trees

Learning objectives & Science competencies

The students learn how perennial plants survive through the winter low temperatures, the different plant mechanisms and responses to abiotic plant stresses, plant dormancy, and how water moves up to the trees

Perennial Plant Evolution

CHAPTER OUTLINE

- 4.1 Evolution of life
- 4.2 Plant Phylogenetics
- 4.3 Plant Evolution
- 4.4 Speciation
- 4.5 Angiosperm Domination

Learning objectives & Science competencies

Students learn about perennial plant evolution and speciation and the domination of Angiosperms

Data Bases

CHAPTER OUTLINE

- 5.1 Utilization of Data Bases
- 5.2 Plant genomics and transcriptomics annotation
- 5.3 Ontologies
- 5.4 Functional annotation/ gene percentage with plant annotation
- 5.5 Protein families' data base

Learning objectives & Science competencies

The students learn about utilization of data bases in plants, plant genomics and transcriptomics annotation, functional annotation.

Structure and Biology of Perennial Plant

CHAPTER OUTLINE

- 6.1 Genomics-Structure - function of perennial plants
- 6.2 Conservation-resilience-value
- 6.3 Protein Structure
- 6.4 Epigenetics

Learning objectives & Science competencies

Students learn about genomics, structure, function and epigenetics in perennial plants