Grade 11 Biology

Plants – Anatomy, Growth and Function

Class 14

Overall Expectations

- Evaluate the importance of sustainable use of plants to Canadian society and other cultures
- Investigate the structures and functions of plant tissues, and factors affecting plant growth
- Demonstrate an understanding of the diversity of vascular plants, including their structures, internal transport systems, and their role in maintaining biodiversity

Basic Needs of Plants

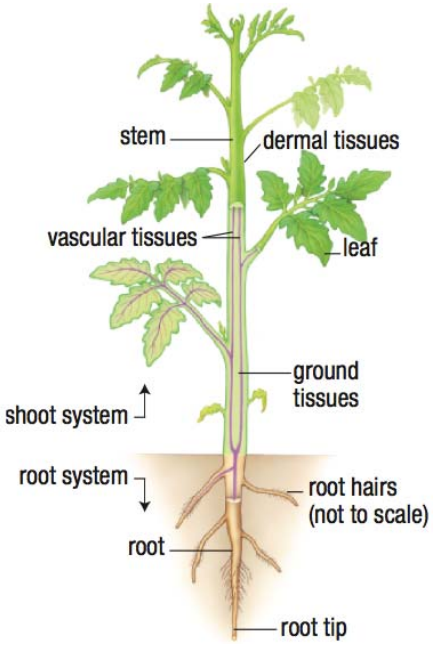
- Plants require:
  - Energy
  - Nutrients
  - Water
  - Gas exchange
  - Protection
  - Reproduction
- Plants are unable to move but still manage to obtain all of its needs

Photosynthesis

$$\text{carbon dioxide} + \text{water} \xrightarrow{\text{solar energy}} \text{glucose} + \text{oxygen}$$

- Glucose is a carbohydrate which is the chemical energy for the plant to grow and develop
- Plants are a food source for many organisms

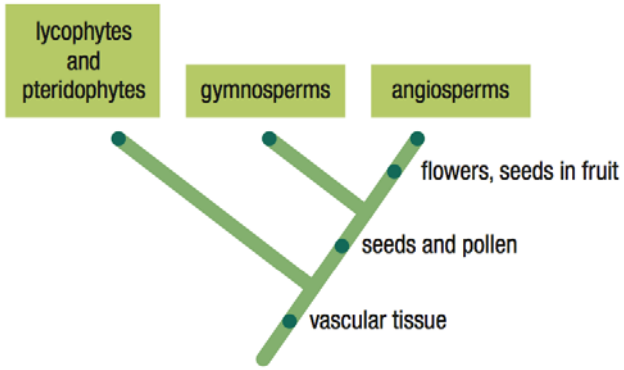
Vascular Plant Body



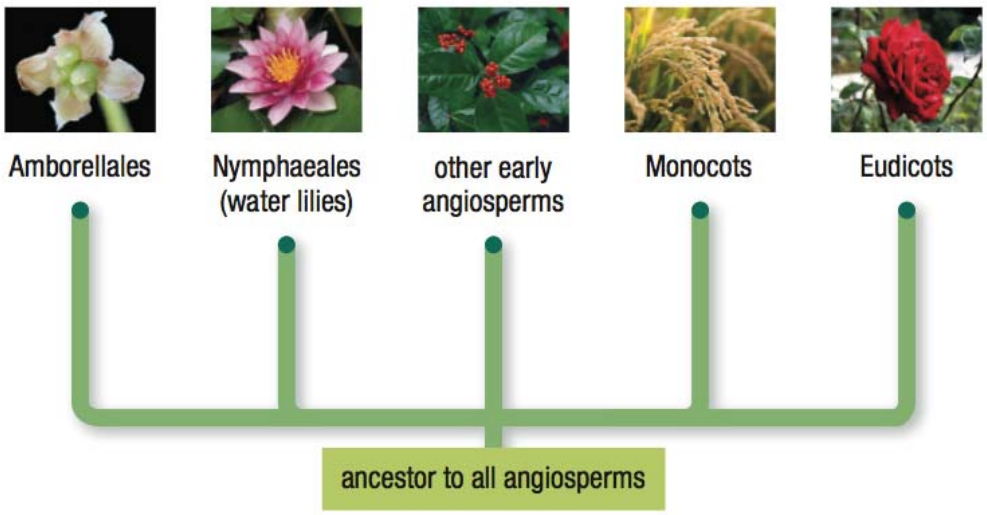
- Tissue Types:
  - Dermal Tissue – outermost cell layers to protect the plant and prevent water loss
  - Vascular Tissue –transports water, nutrients and support the plant
  - Ground Tissue – stores carbohydrates
  - Meristematic Tissue – area of cell differentiation

Tissue	Description	Role
Dermal tissues	• two tissue types: epidermis and periderm • outermost cell layers • often have thicker cell walls • covered with a waxy cuticle	• protect against injury, herbivores, disease, and water loss
Vascular tissues	• two tissue types: xylem and phloem • xylem—thick-walled cells, dead at maturity • phloem—thin-walled cells, living at maturity	• transport water and nutrients • support the plant body
Ground tissues	• three tissue types: • parenchyma—thin-walled cells, living at maturity • collenchyma—thick-walled cells, living at maturity • sclerenchyma—cells with lignin in their cells walls, dead at maturity	• perform cellular processes to support growth and development (parenchyma and collenchyma) • store carbohydrate, especially starch (parenchyma) • support and protect plant body (collenchyma and sclerenchyma)

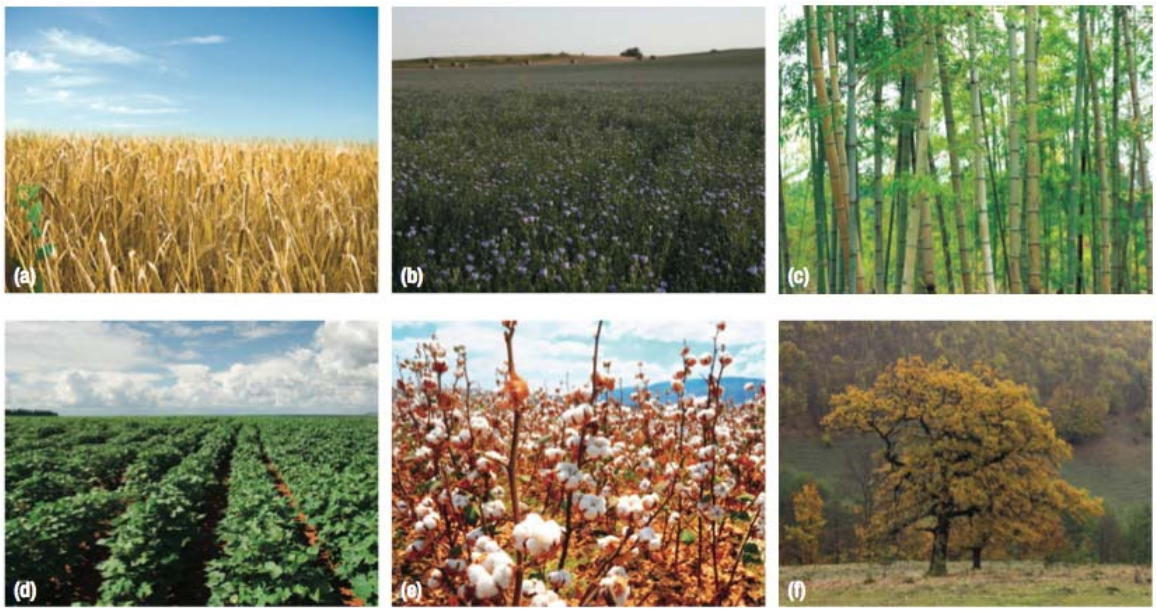
Phylogeny of Vascular Plants



- Lycophytes and Pteridophytes – club mosses, ferns)
- Gymnosperms – conifers
- Angiosperms – flowering plants



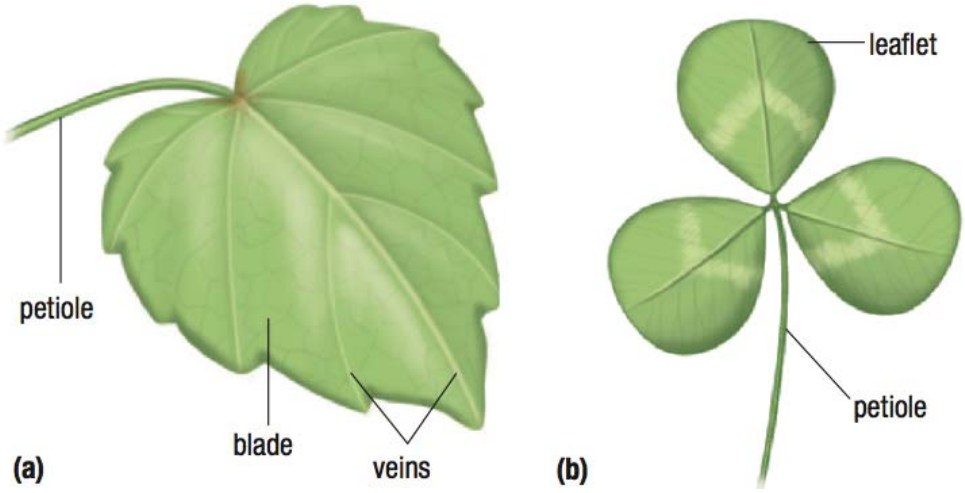
- Seeds of angiosperm species may contain one or two cotyledons – supply nutrients to the plant
- Roughly 25% of all angiosperm species are monocots and 66% are eudicots



Leaves

- Functions:
  - Photosynthesis – occurs in chloroplast which contains photopigments that absorb wavelengths of certain colours
  - Gas exchange – Both photosynthesis and cellular respiration require gas exchange to occur
  - Storage
  - Protection from predators – sharp spines and toxins deter herbivores

- Blade – flattened area of the leaf
- Petiole – attaches the blade to the plant stem



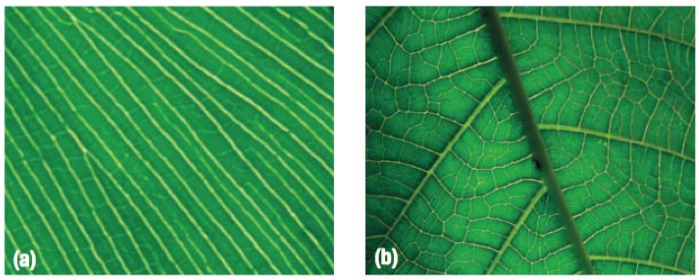
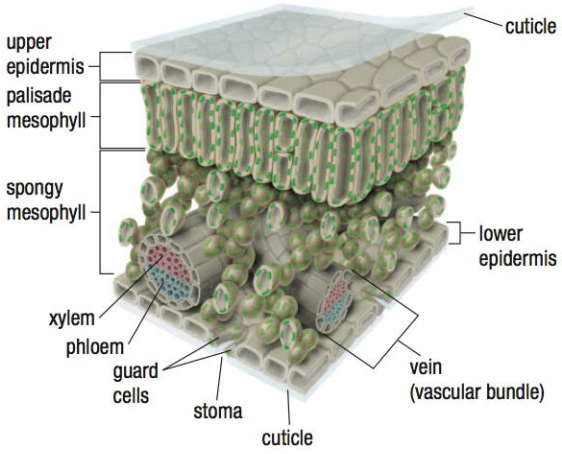


Figure 5 (a) This monocot leaf has veins running parallel to each other. (b) This eudicot leaf has a network of veins.

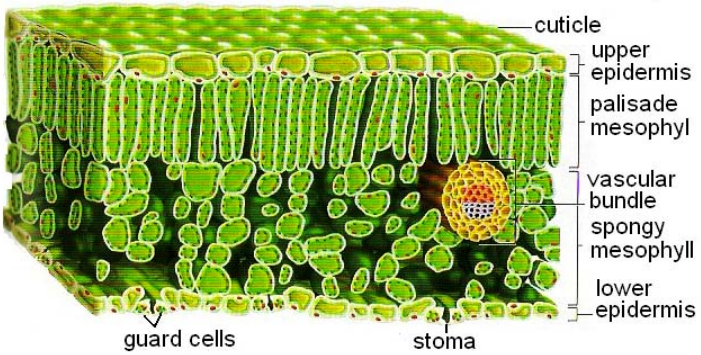
- Venation – the arrangement of veins within a leaf
  - Monocots – parallel venation
  - Eudicots – branching venation

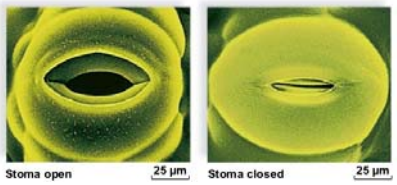
Internal Leaf Structure



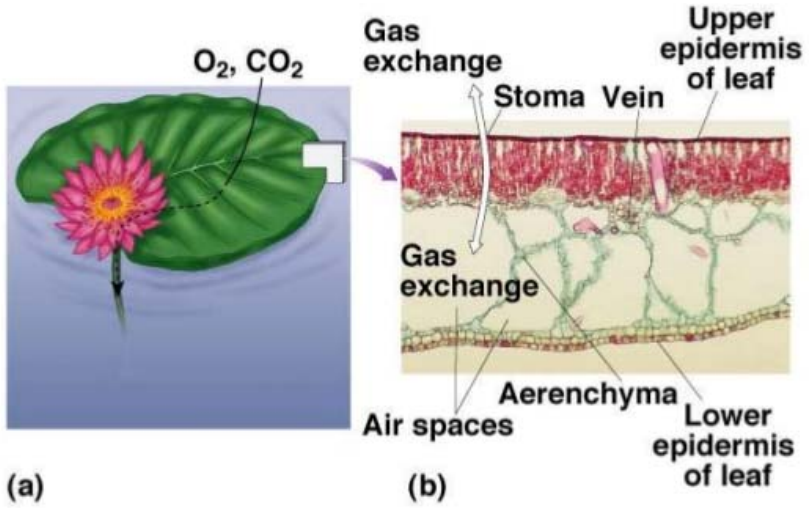
- Epidermal cells are transparent and covered by the waxy cuticle
- Palisade mesophyll cells are elongated, closely-packed and contain many chloroplasts

- Spongy mesophyll cells are loosely packed to allow gas exchange
- Stomata – openings in the epidermis of the leaf to allow gases to pass in and out
- Guard cells – control opening and closing of stomata





- In aquatic plants, aerenchyma replaces the spongy mesophyll
- Aerenchyma contains large pores to help leaves float on the surface of water



Leaf Specializations

- Leaves can be specialized to store water and carbohydrates or to protect the plant from herbivores or low temperatures

Human Use of Leaves

- Fragrant leaves add flavour to food (parsley, basil, sage, mint, etc.)
- Used in teas and other traditional foods
- Dark-green leafy vegetables contain important minerals, nutrients and antioxidants
- Waxes from the cuticles are used in polishes, lipsticks, surfboard waxes

Leaves and Chemicals

- Many leaf chemicals are poisonous to humans
  - Hydrangea leaves can cause vomiting, diarrhea and coma
  - Rhubarb leaves can cause kidney damage
- Some plant toxins are used for diseases
  - Digitalis from foxglove treat heart disease
  - Vincristine and vinblastine from the rosy periwinkle can kill cancer cells

- Some plants produce deterrent chemicals that affect the nervous system (psychotropic drugs)
  - Marijuana produces the compound tetrahydrocannabinol (THC) which when used medically can increase appetite and reduce nausea and muscle spasms
  - Marijuana can impair coordination, perception, cause problems with learning and memory
  - Leaves of coca plant produce cocaine which suppresses hunger, pain and fatigue; produces euphoria, talkativeness and alertness