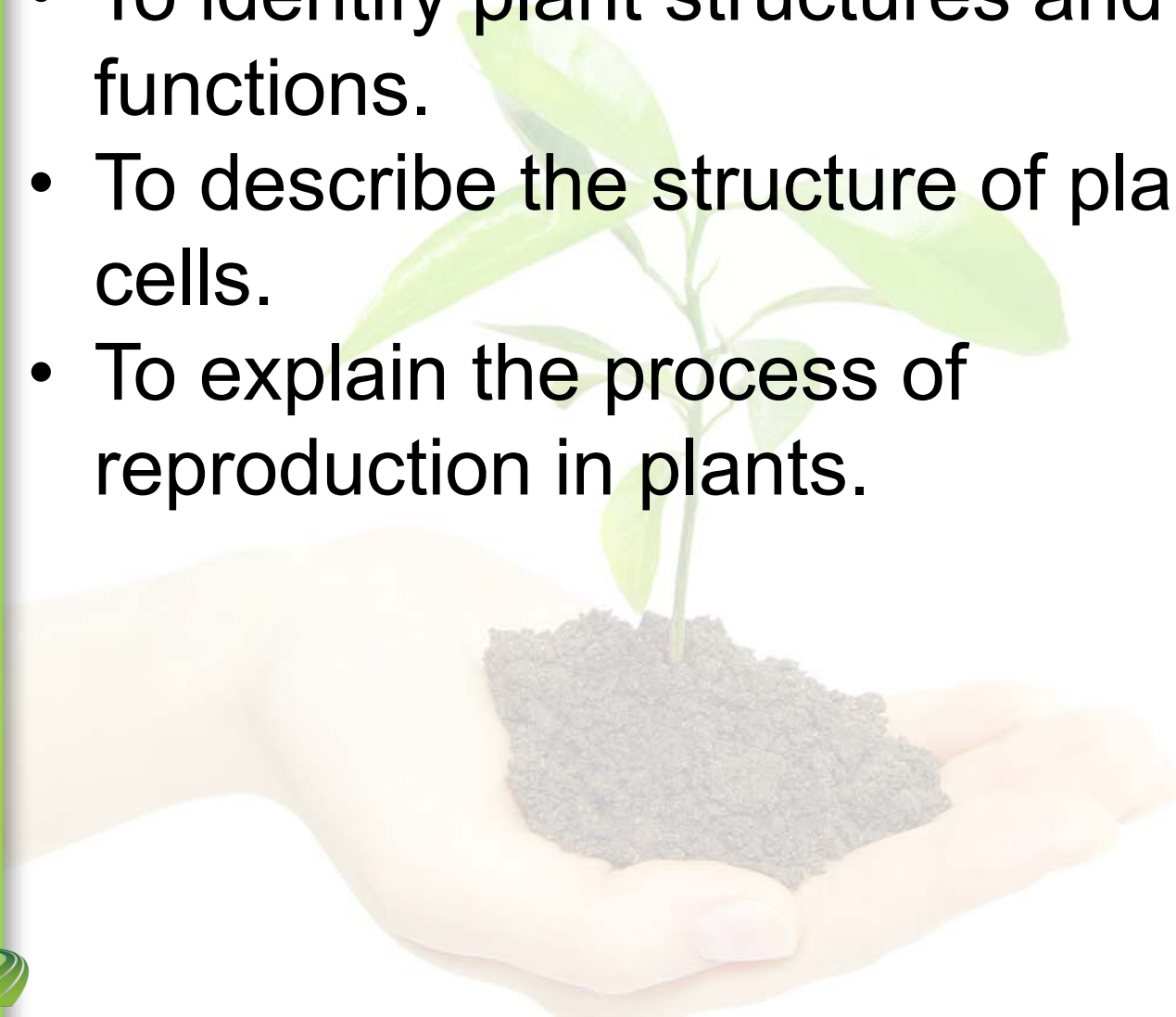


Anatomy of Plants



Objectives

- To identify plant structures and functions.
- To describe the structure of plant cells.
- To explain the process of reproduction in plants.



Main Menu

 Plant Cell Biology

 Plant Structures

 Roots

 Stems

 Flowers

 Leaves

 Fruit

 Seeds



Anatomy of Plants

Plant Cell Biology



Plants

- Plants
 - are multicellular organisms
 - are incapable of movement
 - produce food through photosynthesis



Animals

- Animals
 - are multicellular organisms
 - are capable of movement, on their own
 - cannot produce their own “food”
 - Ingest food from surroundings



Cell Types

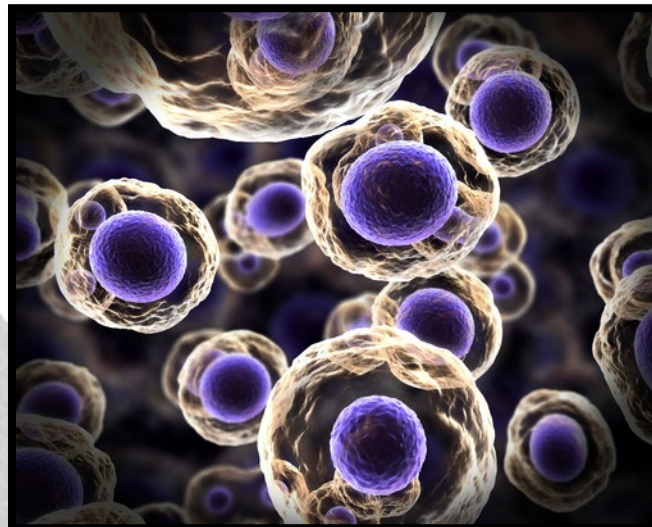
- Include:
 - Prokaryotic
 - pro = before; karyon = nucleus
 - found in bacteria
 - do not contain a nuclei
 - lack membrane-bound organelles



Fun Fact: Since viruses are acellular – they contain no organelles and cannot grow and divide – they are considered neither prokaryotic or eukaryotic.

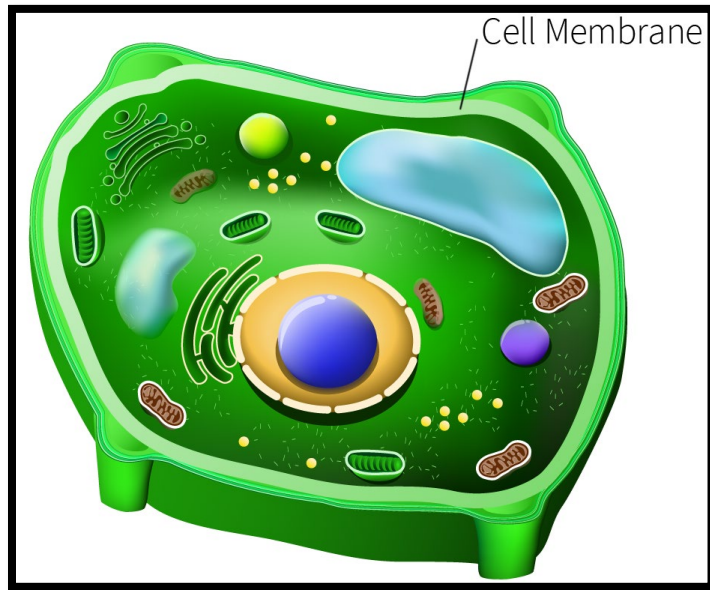
Cell Types

- Include:
 - Eukaryotic
 - eu = good; karyon = nucleus
 - found in plants and animals
 - contain a nucleus
 - contain membrane-bound organelles



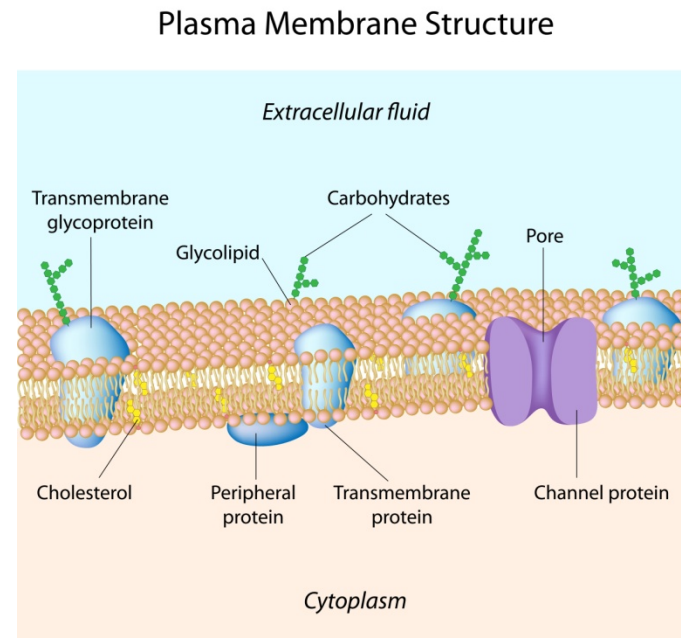
Cell Membrane

- Surrounds the cell as a thin layer of protein (about eight-millionths of a millimeter thick)
- Can be found inside the cell wall
- Allows some substances to pass into the cell while blocking others



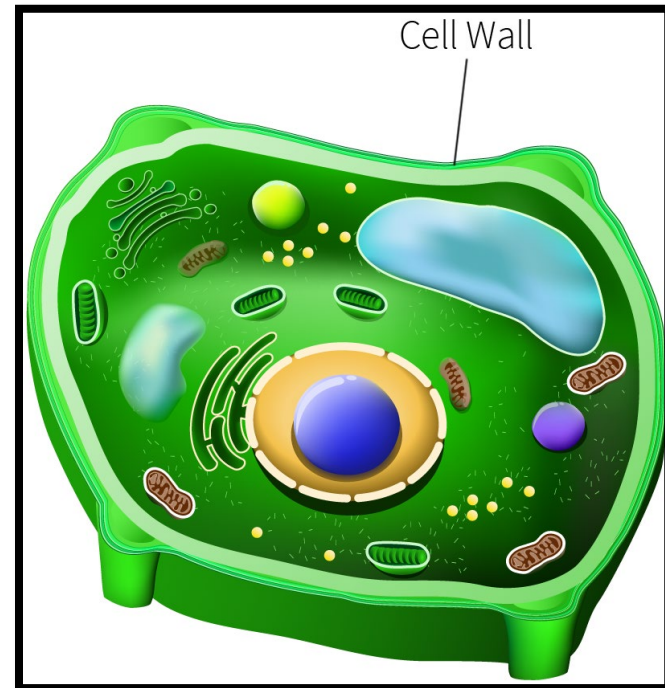
Cell Membrane

- Is also known as the plasma membrane
- Is involved in cellulose production for the assembly of cell walls
- Is composed of highly structured proteins and phospho-lipids



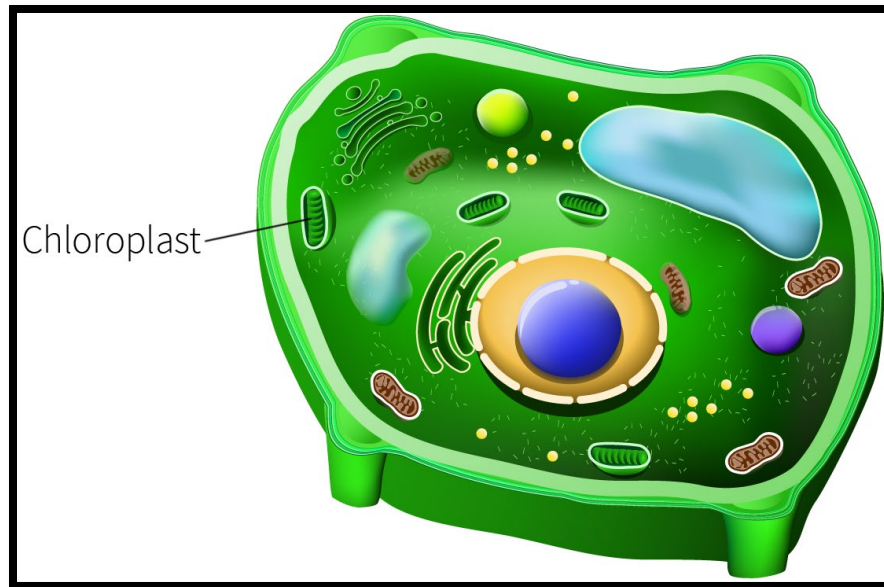
Cell Wall

- Are found only in plants
- Surrounds the cell
- Provides structural support and protection
- Bonds with other cell walls to create plant structure



Chloroplast

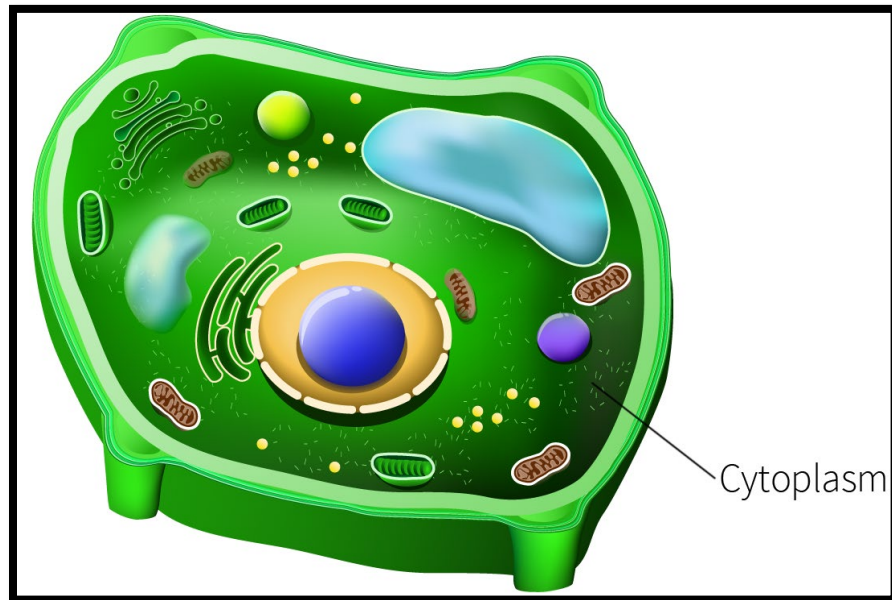
- Is an elongated organelle containing chlorophyll
- Converts light and carbon dioxide to usable energy



Organelle: specialized part of a cell which has a specific function

Cytoplasm

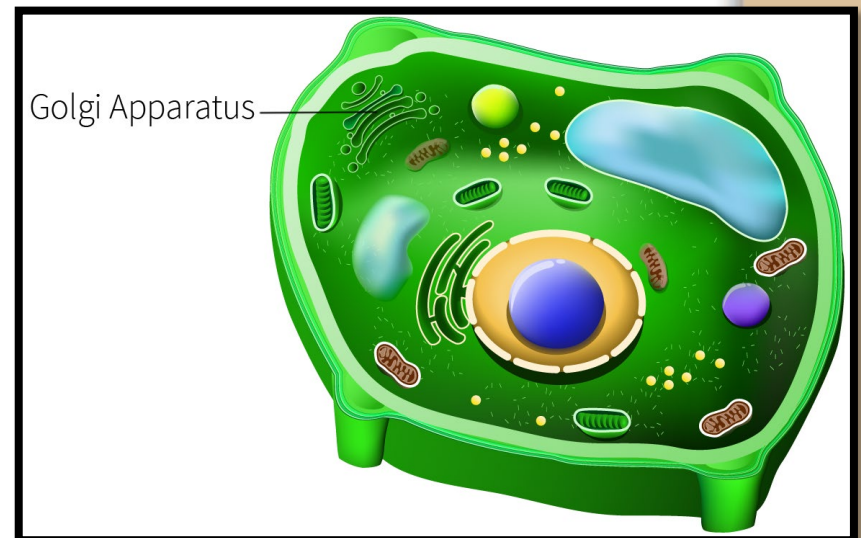
- Is a gel-like material outside the nucleus, but inside cell membrane
- Contains the cytoskeleton, cytosol and the organelles



Fun Fact: substance of a living cell, including the cytoplasm and nucleus, is known as the protoplasm.

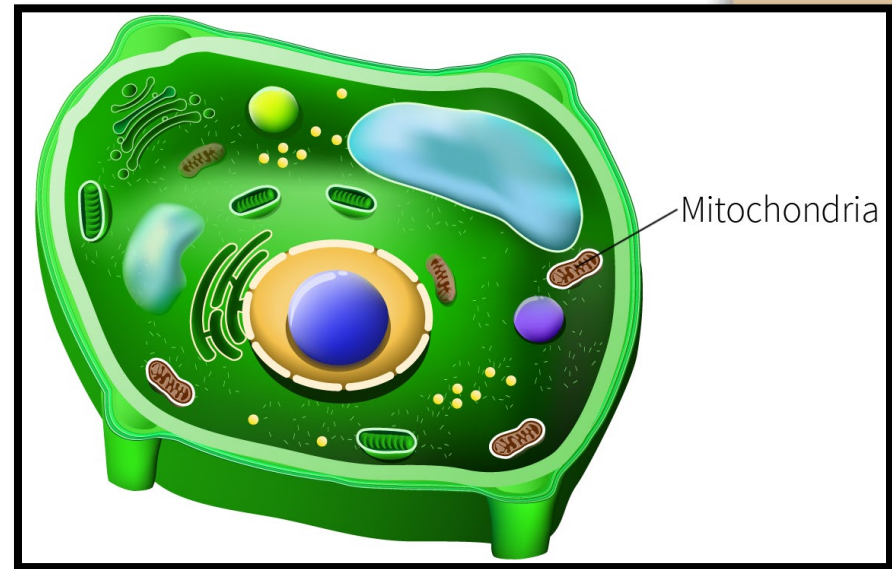
Golgi Apparatus

- Is a flat, layered organelle (dictyosomes) which resembles a stack of pancakes
- Is located near the nucleus
- Packages proteins and carbohydrates for export from the cell
- Modifies proteins and lipids before distributing them



Mitochondria

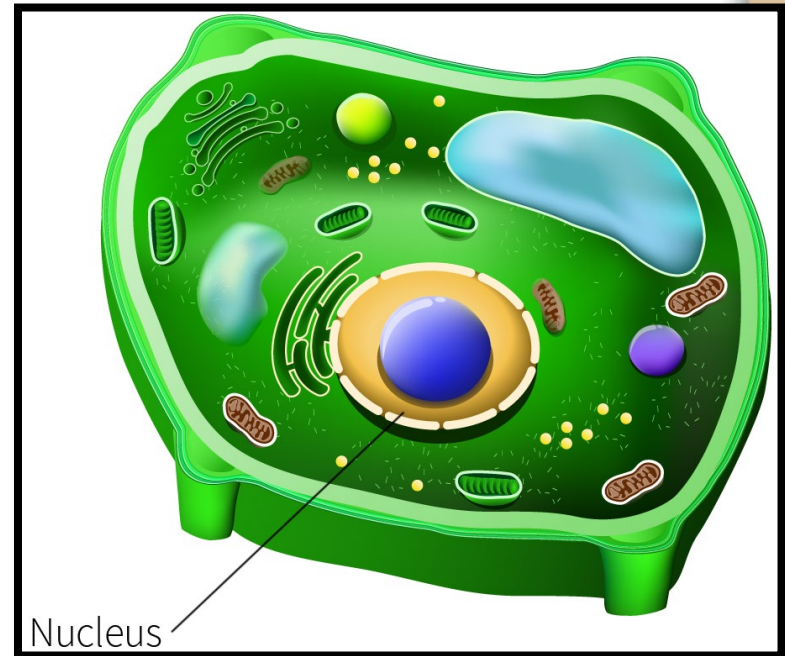
- Is the powerhouse of the cell
- Are spherical, rod-shaped organelles
- Have a double membrane
- Converts energy stored in glucose to ATP for the cell (Respiration)



ATP: adenosine triphosphate, the molecule which provides the energy in the cells of all living things

Nucleus

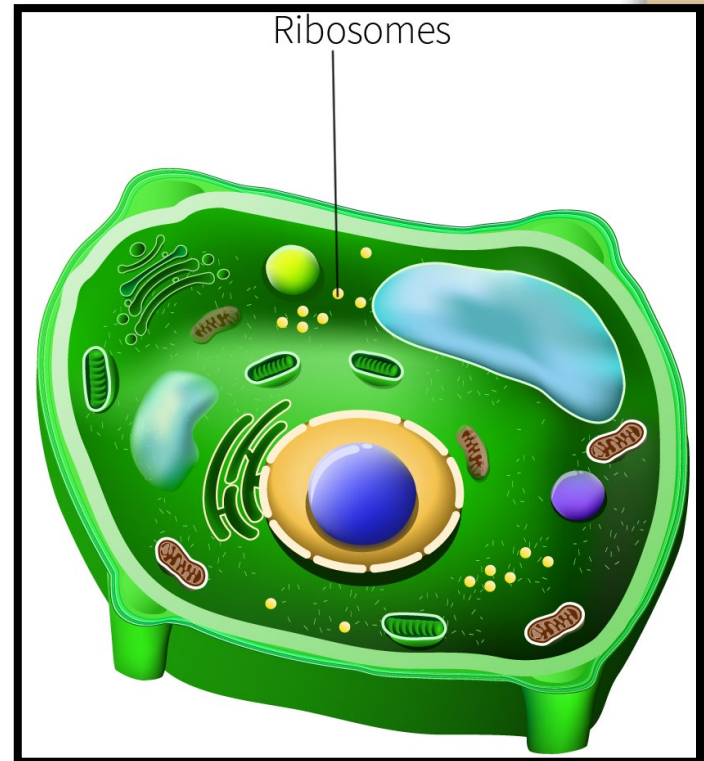
- Controls functions of the cell
- Contains DNA in chromosomes
- Is surrounded by the nuclear membrane



Chromosome: structure of nucleic acids and proteins which carries genetic information in the form of genes

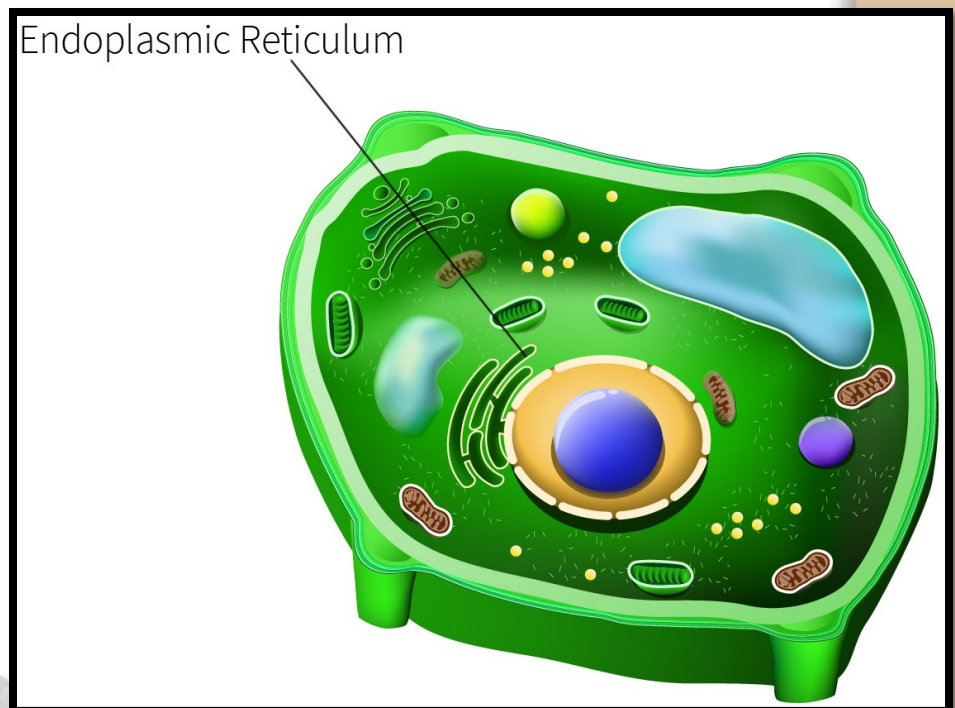
Ribosomes

- Are small organelles found in large numbers in the cytoplasm
- Create proteins from amino acids
- Can only be seen with an electron microscope
- Composed of two subunits containing RNA and proteins



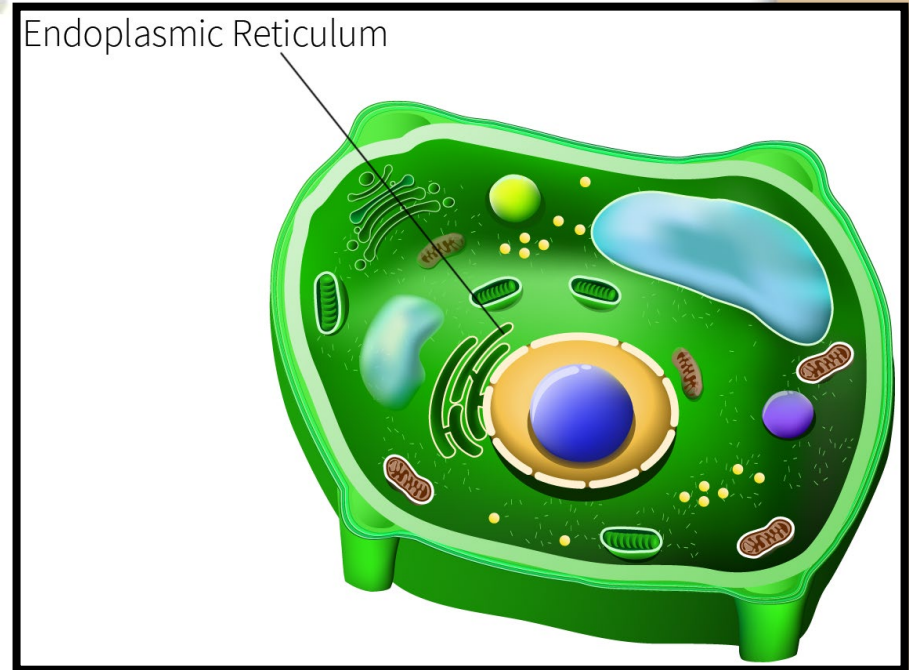
Rough Endoplasmic Reticulum

- Is located in the cytoplasm
- Is covered with ribosomes which give it a rough appearance
- Transports materials through the cell, secretes, stores and creates proteins



Smooth Endoplasmic Reticulum

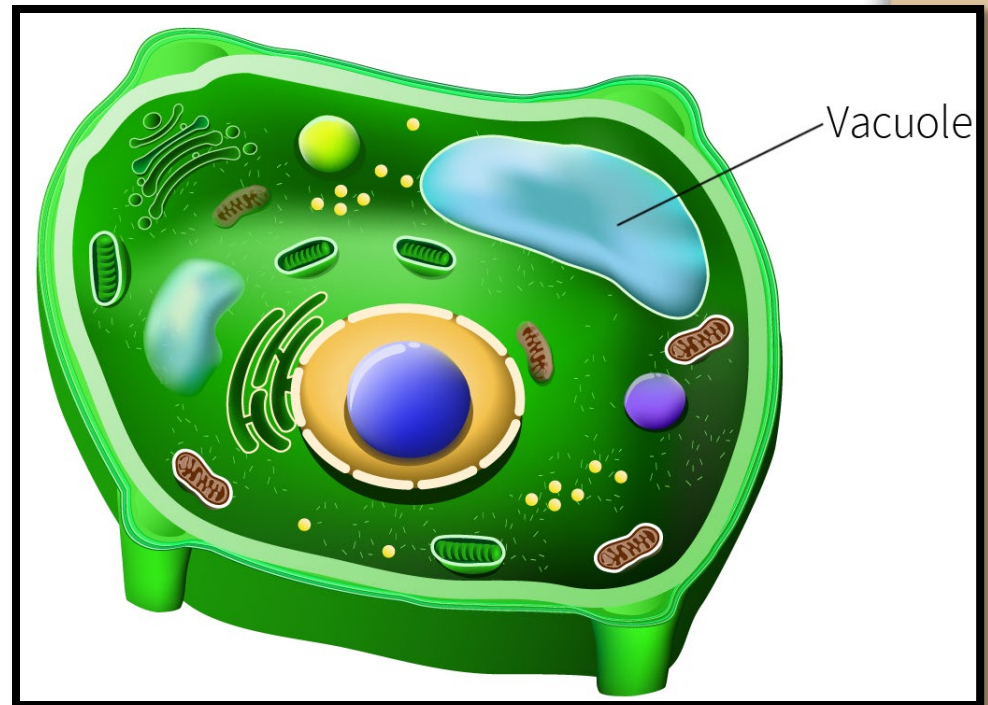
- Is located in the cytoplasm
- Transports materials through the cell
- Contains enzymes
- Produces and digests lipids and membrane proteins



Enzymes: proteins which assist chemical reactions in living cells

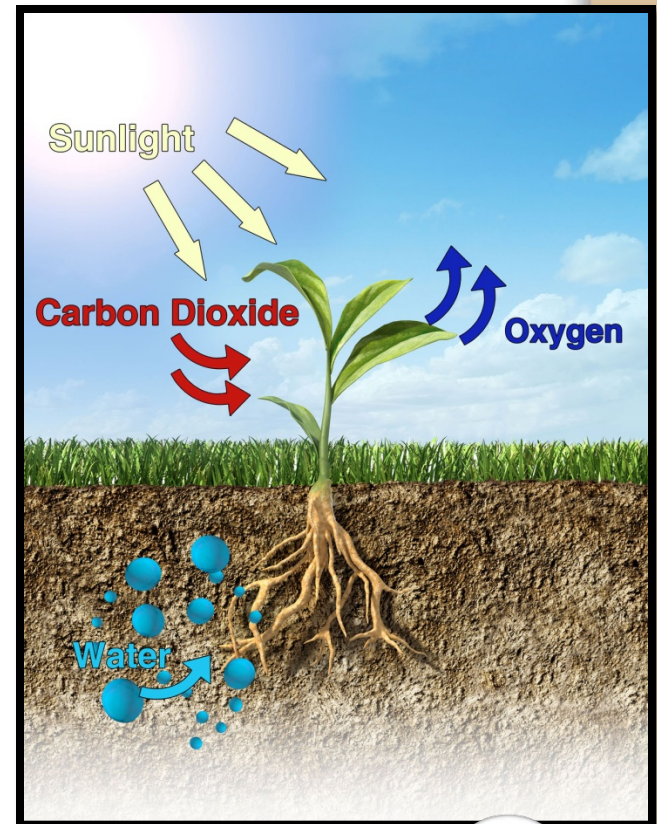
Vacuole

- Is surrounded by a membrane
- Is filled with fluid
- Takes up most of the cell
- Maintains the shape of the cell
- Is the “cell trash can”



Photosynthesis

- Is the process of converting light energy to chemical energy
- Takes place in the chloroplasts using chlorophyll



Anatomy of Plants

Plant Structures



Plant Structures: Roots



Roots

- Are usually underground
- Anchor plants in soil
- Absorb water and nutrients
- Can store food for plant



Root Tissues

- Include:
 - epidermis
 - cortex
 - vascular cylinder or stele



Root Systems

- Includes:
 - two major types:
 - taproot system
 - fibrous root system



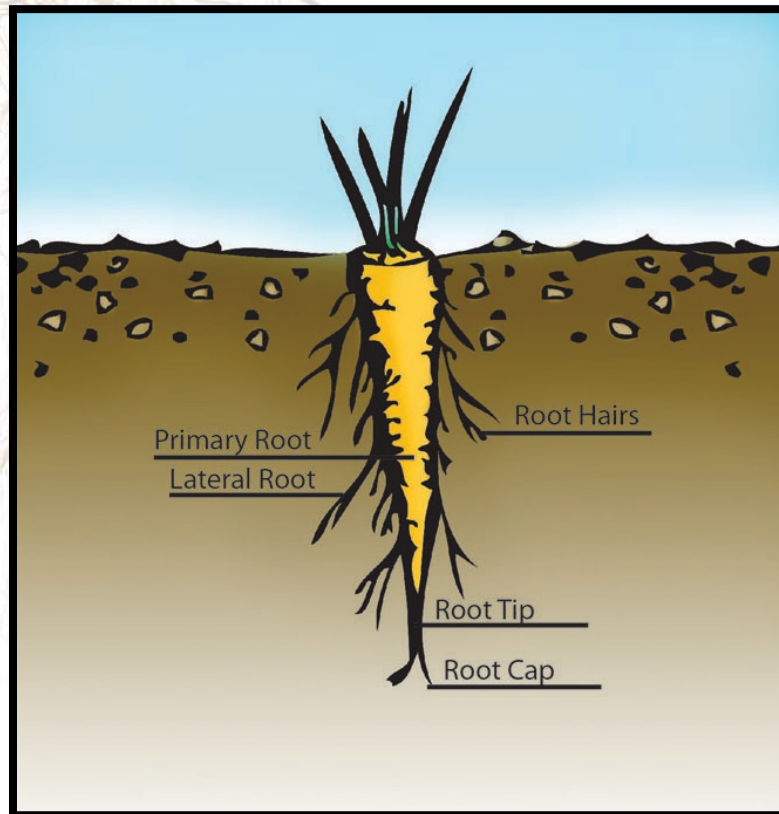
Taproot System

- Is found in many dicotyledons such as carrots and beets
- Is derived directly from the first root emerging from the seed

Dicotyledons: flowering plants with two seed cotyledons

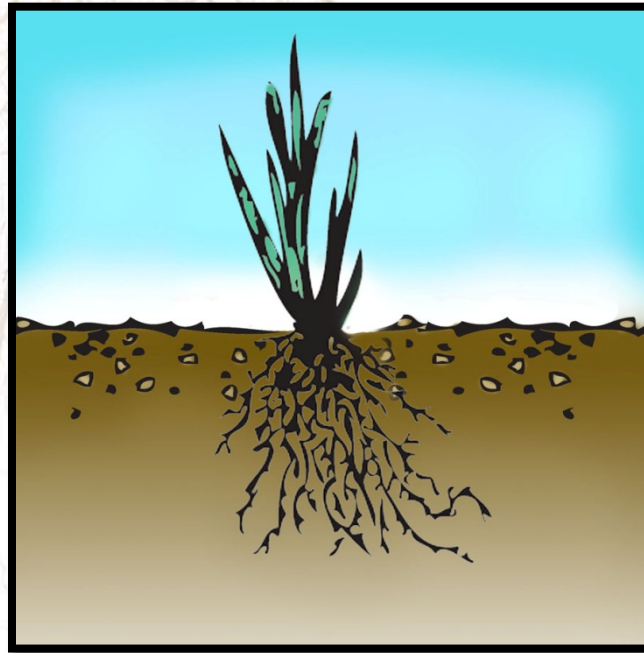
Taproot System

- Has one prominent root known as the taproot or primary root



Fibrous Root System

- Are found in most monocots
- Consists of an extensive mass of smaller, widely spread roots



Monocots: flowering plants with only one seed cotyledon

Root Types

- Include:
 - taproots
 - lateral roots
 - adventitious roots
 - fibrous roots



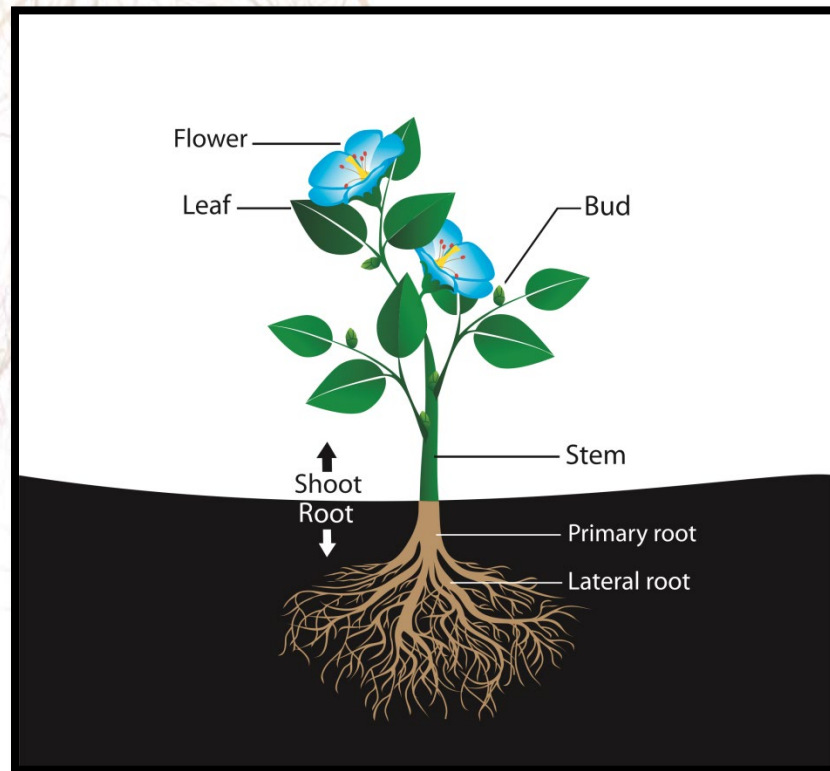
Taproot

- Characteristics are:
 - Single, dominant roots
 - Grow directly downward
 - Sprout other fibrous roots
 - Can be modified for food and water storage and uptake



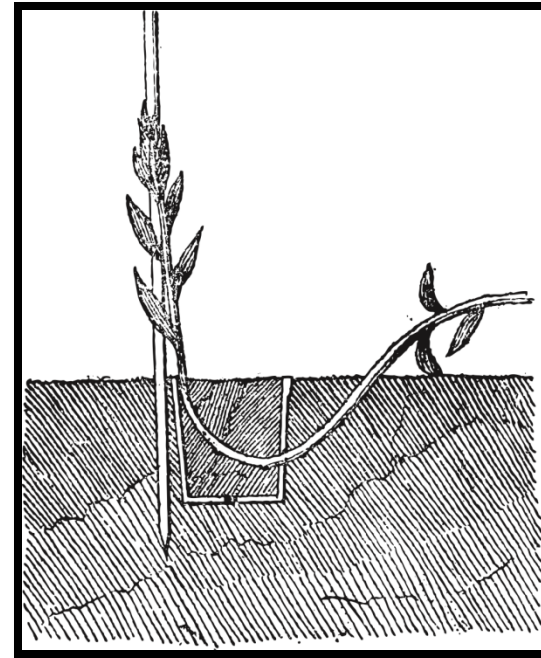
Lateral Roots

- Extend horizontally from the taproot
- Extract nutrients and water from the soil



Adventitious Roots

- Form from shoot tissues
- Arise in stems and leaves
- Are used when cloning plants from cuttings



Fibrous Roots

- Are thin, slender roots
- Collect water and nutrients close to the soil surface
- Sprout from primary roots



Grasses are considered to have fibrous root systems.



A close-up photograph of several green bamboo stalks. The stalks are covered in numerous small, clear water droplets, giving them a fresh and vibrant appearance. The bamboo leaves are also visible, some showing signs of being eaten, with small holes and torn edges. The background is a plain, light color, making the green of the bamboo stand out.

Plant Structures: Stems

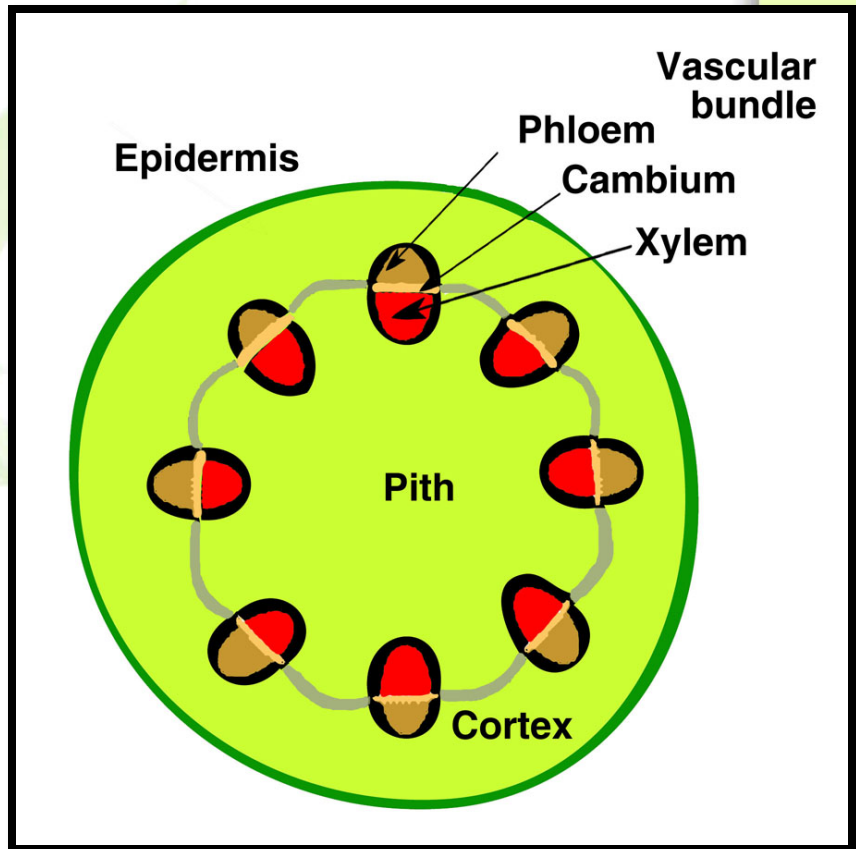
Stems

- Support the leaves, flowers and fruits of plants
- Conduct movement of water and nutrients to and from the roots and leaves
- Store water



Stem Tissues

- Include:
 - epidermis
 - cortex
 - xylem
 - phloem
 - cambium



Stem Types

- Include:
 - aerial
 - grow above ground
 - subterranean
 - grow below ground
 - acaulescent
 - no obvious stem above or below ground



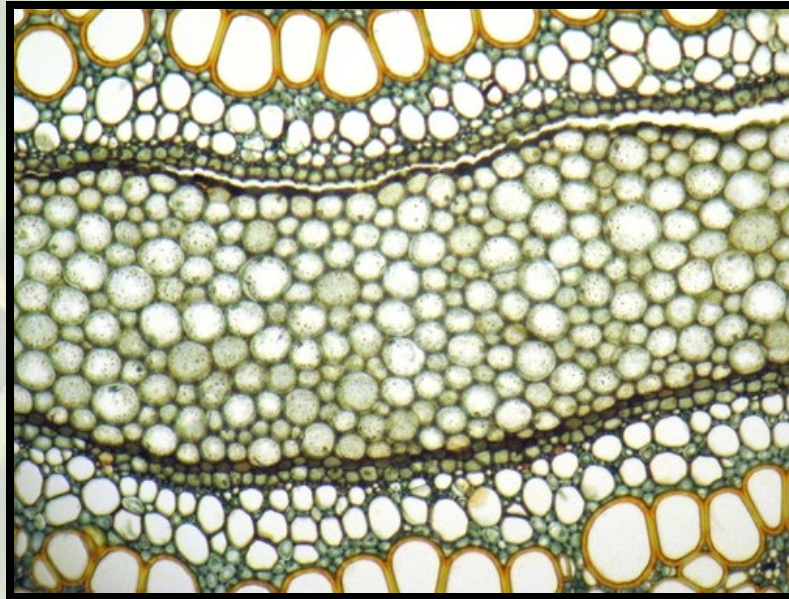
Xylem

- Transports water from the roots up the plant
- Provides structure and support in the stem

Fun Fact: In trees, new xylem tissues are produced each year. As these new tissues are added, older xylem tissues die and create the “rings” that can be seen in tree trunks.

Phloem

- Transports sugars and other molecules made during photosynthesis
- Is always alive



Plant Structures: Flowers



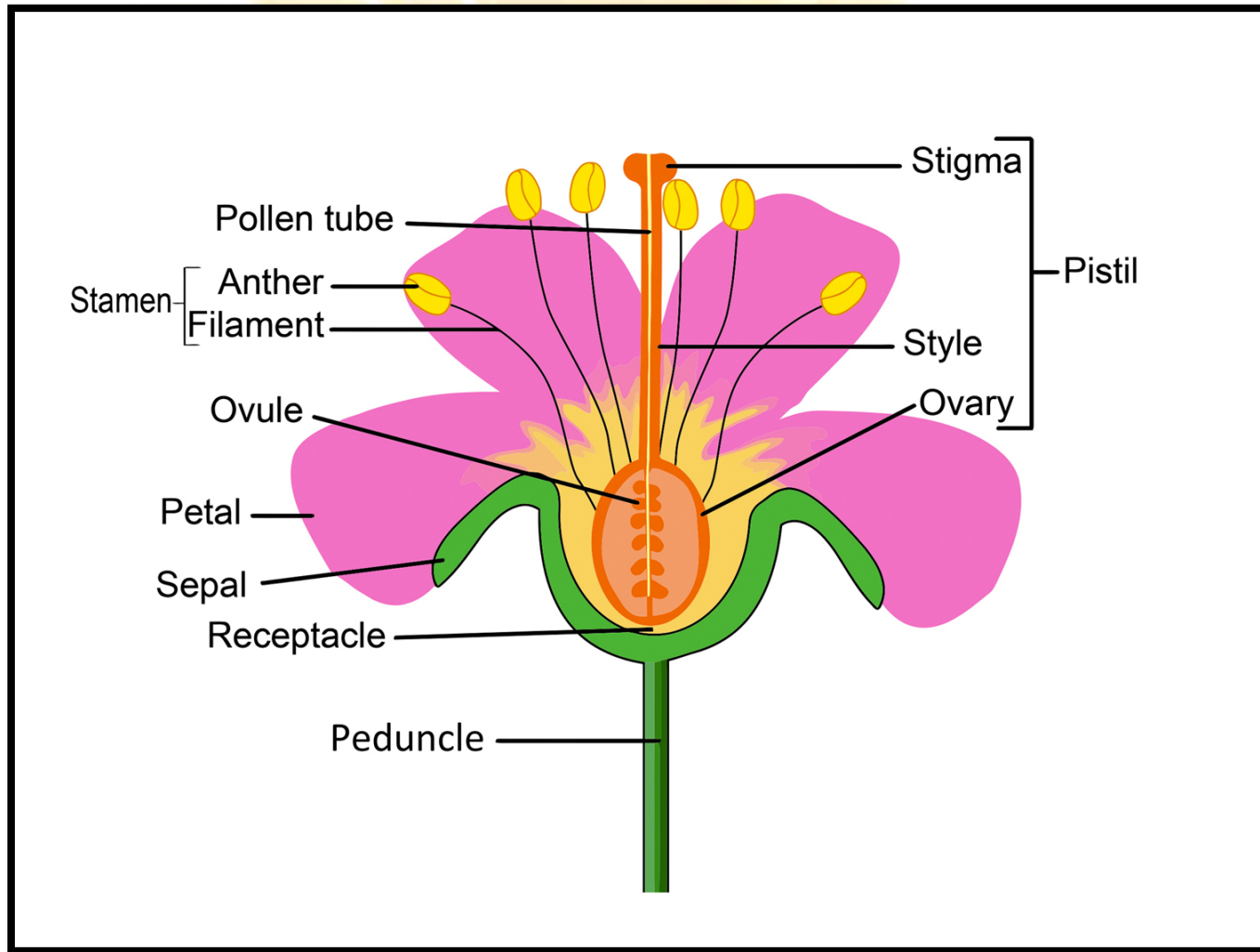
Flowers

- Are organs for sexual reproduction
- Produce gametes
- Play a key role in pollination



Gamete: mature male or female sex cell which is able to unite with another of the opposite sex in sexual reproduction

Flower Parts



Flower Parts

- Include:
 - peduncle
 - flower stalk
 - receptacle
 - part of flower stalk bearing floral organs
 - sepal
 - leaf structures at flower base, protects young buds, all together known as calyx



Flower Parts

- Include:
 - petal
 - located in and above the sepals, attracts pollinators, all together known as corolla
 - stamen
 - male part of the flower, makes pollen grains
 - filament
 - stalk of the stamen, contains the anther



Flower Parts

- Include:
 - anther
 - bears pollen
 - pollen
 - grains containing the male sex cells
 - pistil
 - female part of the flower



Flower Parts

- Include:
 - stigma
 - sticky top of pistil, receptive surface for pollen grains
 - style
 - stalk of the pistil, where pollen tube grows



Flower Parts

- Include:
 - ovary
 - base of the pistil, matures to become fruit
 - ovule
 - located in the ovary, carries female sex cells



Flower Types

- Include:
 - complete
 - has stamen, pistil, petals and sepals
 - incomplete
 - one part missing



Flower Types

- Include:
 - perfect
 - both stamen and pistil are present and functioning
 - imperfect
 - stamen or pistil is missing

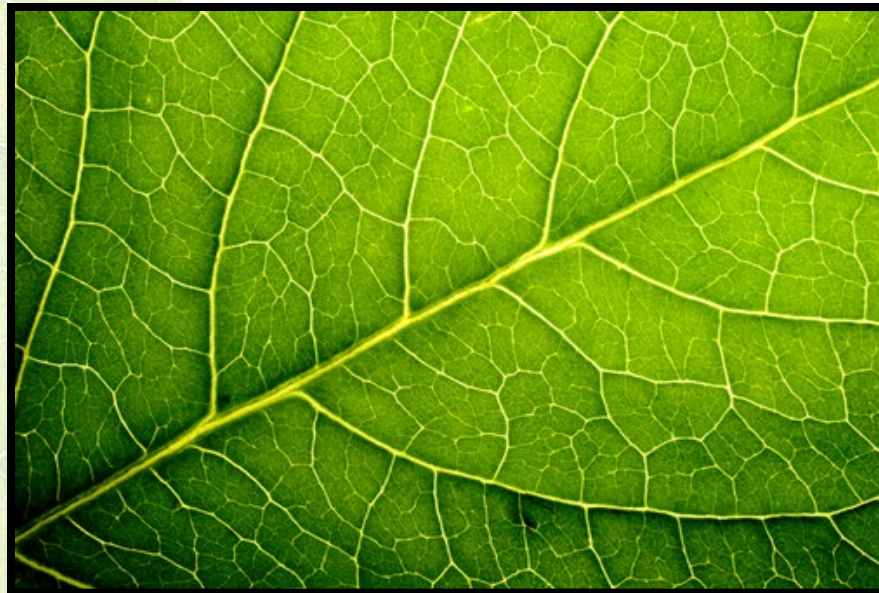


Plant Structures: Leaves



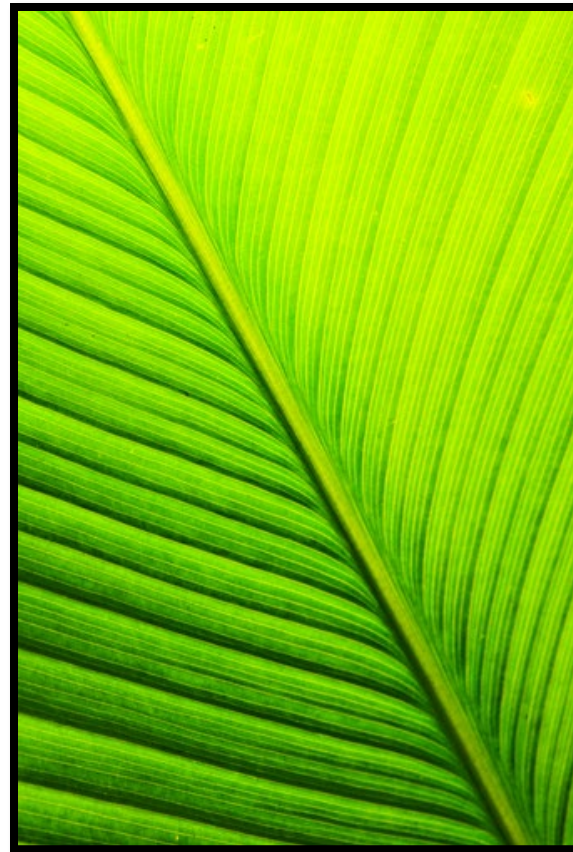
Leaves

- Are the major site of food production for the plant (chloroplasts)
- Contain structures which convert sunlight to chemical energy (photosynthesis)

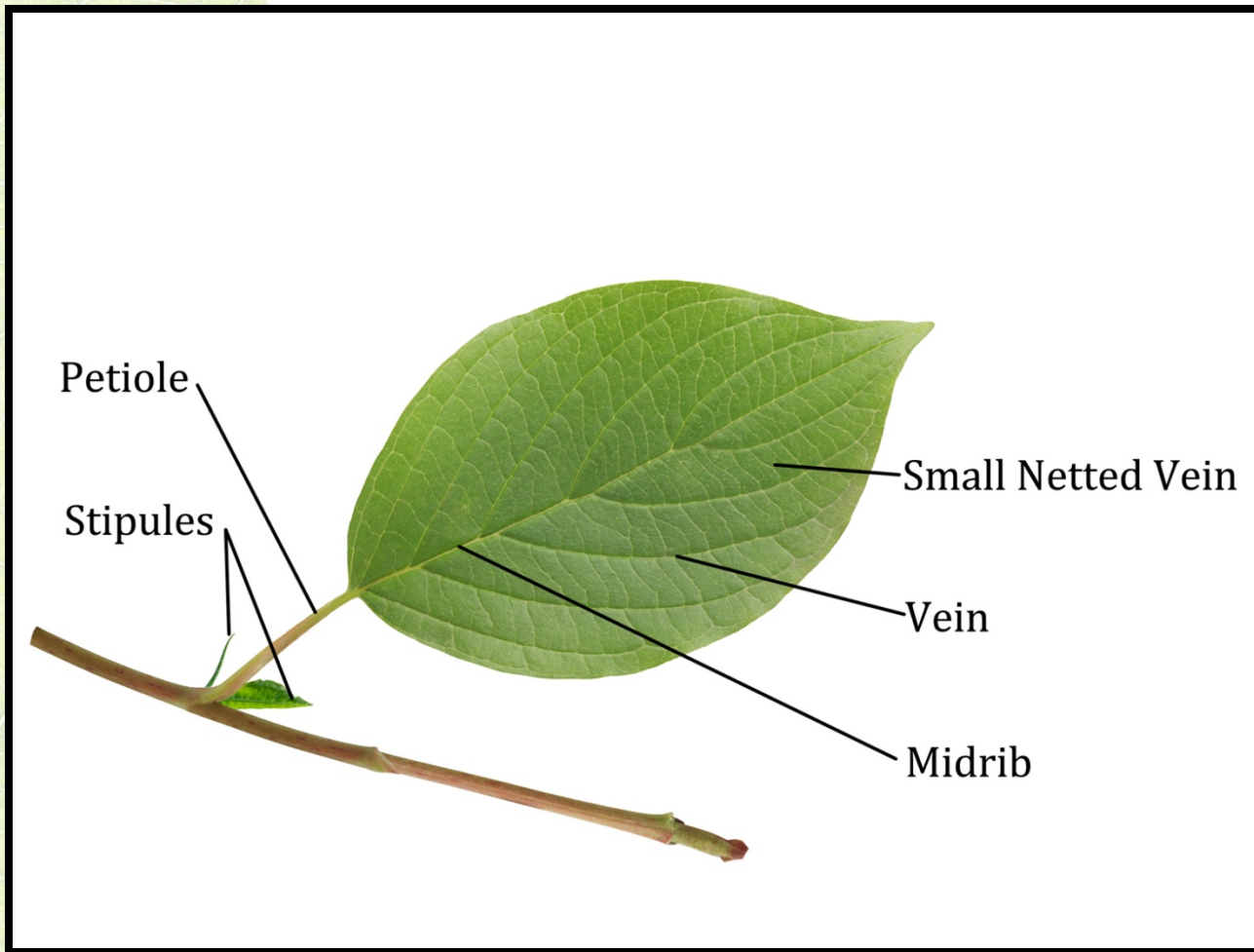


Leaf Tissues

- Include:
 - epidermis
 - mesophyll
 - veins

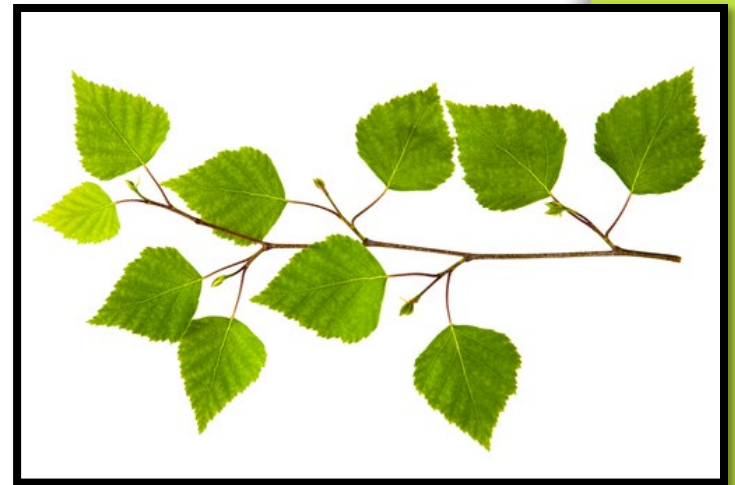


Leaf Parts



Leaf Parts

- Include:
 - midrib
 - main, central vein of a leaf
 - petiole
 - leaf stalk which attaches the leaf to the plant
 - stem
 - main support of the plant



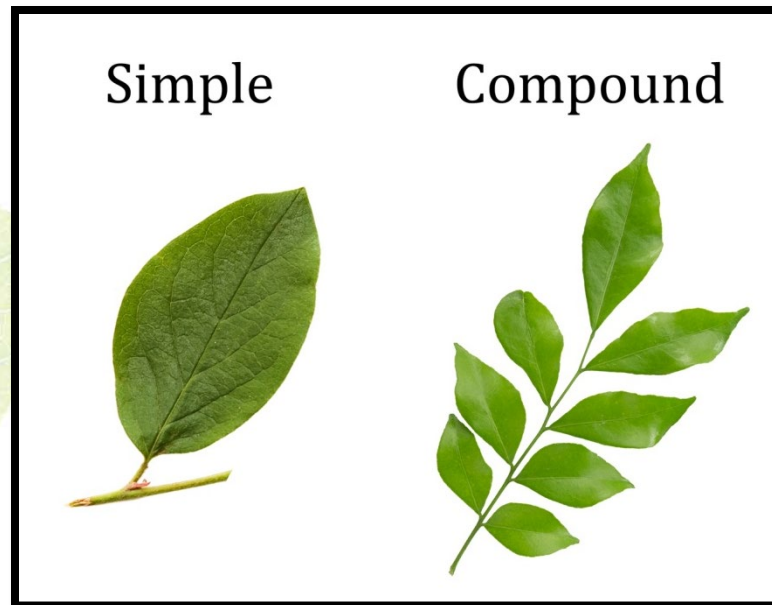
Leaf Parts

- Include:
 - stipule
 - small, leaf-like appendages at the base of the petiole
 - vein
 - transports water, minerals and food energy throughout the plant



Leaf Types

- Include:
 - simple
 - not divided into separate units
 - compound
 - leaflets arranged on both sides of an axis



Leaf Vein Patterns

- Include:
 - parallel
 - several large veins run alongside each other from the base of the blade to the tip (monocots)
 - palmate
 - several main veins of about equal size, all of which extend from a common point at the base of the leaf (dicots)



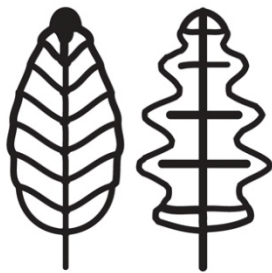
Leaf Vein Patterns

- Include:
 - pinnate
 - one large, central vein, the midrib, with other large veins branching from the sides

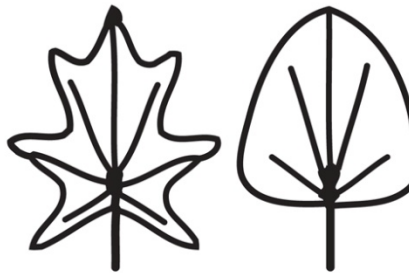


Leaf Vein Patterns

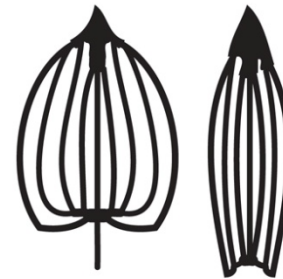
Pinnate



Palmate



Parallel



Leaf Arrangements

- Include:
 - alternate
 - one leaf produced at each node
 - opposite
 - leaves in pairs at nodes
 - whorled
 - three or more leaves per node

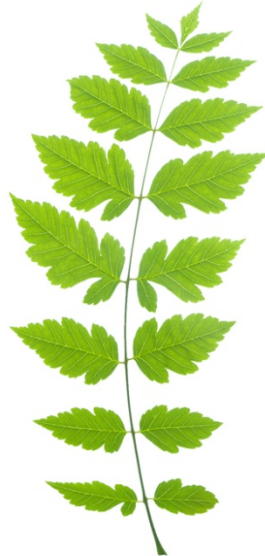


Leaf Arrangements

Alternate



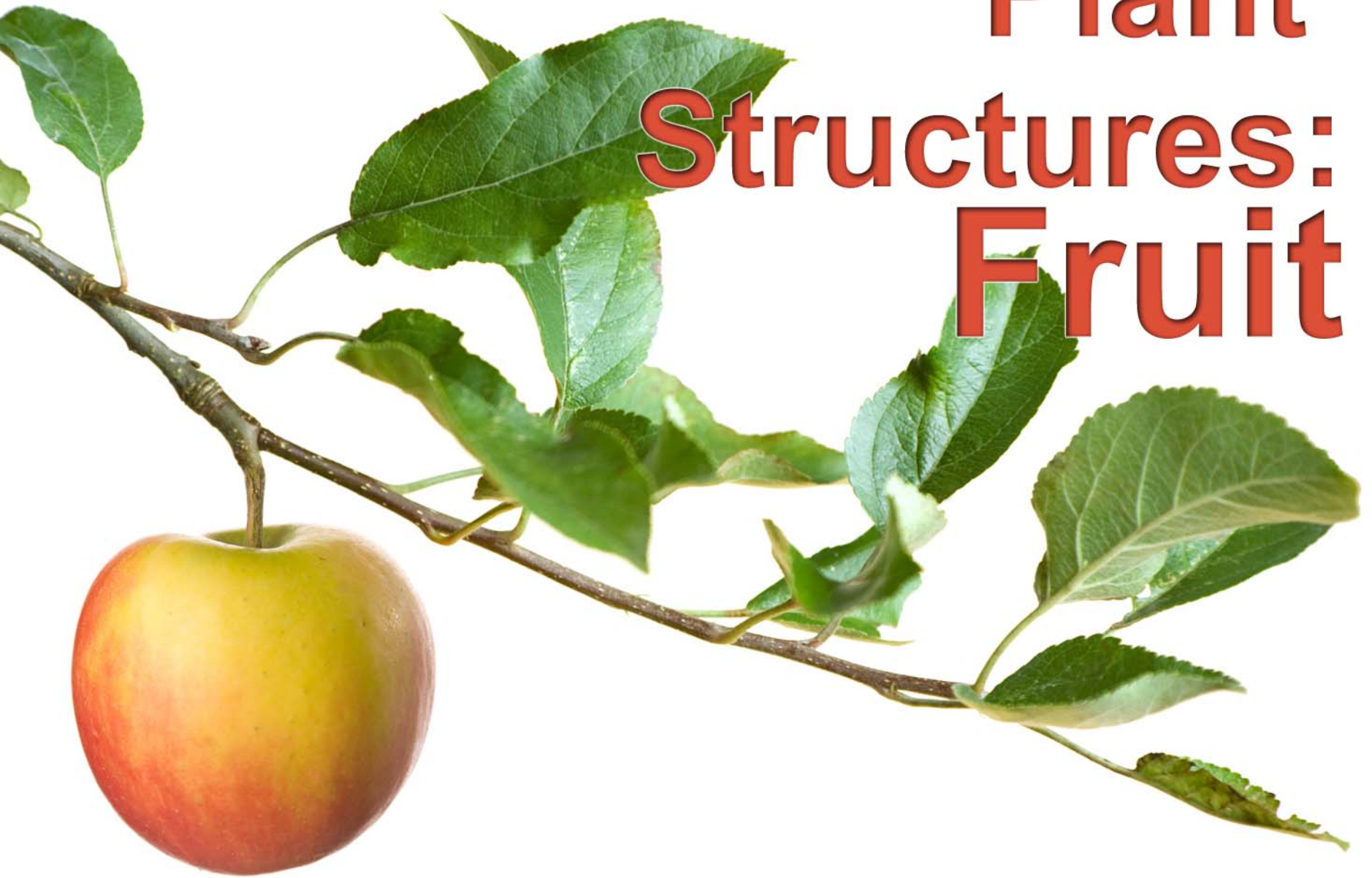
Opposite



Whorled



Plant Structures: Fruit



Fruit

- Evolves from the maturing ovary after pollination and fertilization
- May be either fleshy or dry in appearance
- Plants produce fruit to protect and disseminate seeds
- Contains one or more seeds



Fruit Types

- Include:
 - simple
 - formed from one ovary
 - aggregate
 - formed from a single flower with many ovaries
 - multiple
 - developed from a fusion of separate flowers on a single structure



Plant Structures: Seeds



Seeds

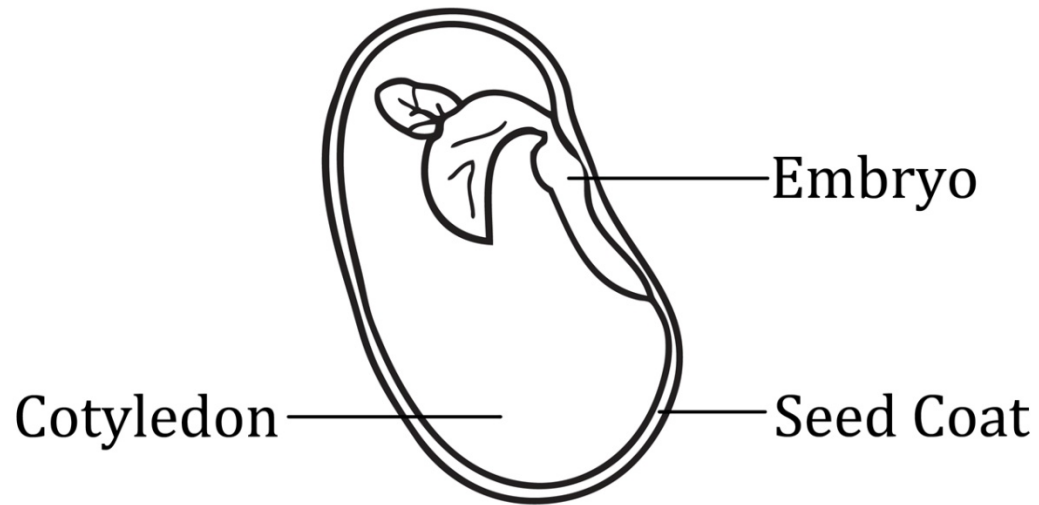
- Primary function is reproduction
- Are used in the process of plant propagation
 - plant propagation is the creation of new plants through cuttings, seed, bulbs or other plant parts
- Serve as a dispersal unit for many plants
 - dispersal is the transportation of seeds away from the parent plant in order to create new plants

Seeds

- Contain three parts:
 - seed coat
 - protects the embryo
 - cotyledon
 - temporary food supply, also known as seed leaf
 - embryo
 - an undeveloped plant inside a seed



Seeds



Monocots

- Are embryos with a single cotyledon
- Contain flower parts in multiples of three
- Have adventitious roots
- Store nutrients in endosperm



Dicots

- Are embryos with two cotyledons
- Contain flower parts in multiples of four or five
- Have roots which form from the radical



Resources

- *Plant Parts*. The Great Plant Escape, Urban Programs Resource Network, University of Illinois Extension. Retrieved from <http://urbanext.illinois.edu/gpe/case1/c1facts2e.html>
- (2008). *NY/NJ Trails + Rutgers Invasive Plant Monitoring Project*. Rutgers School of Environmental and Biological Sciences. Rutgers, The State University of New Jersey. Retrieved from <http://trails.rutgers.edu/identify.html>
- (2003) *Plant Structure and Function*. Andromeda Botanic Gardens. The University of the West Indies. Retrieved from http://andromeda.cavehill.uwi.edu/flower_structure_and_function.htm
- Stern., Bidlack & Jansky, (2008). *Introductory plant biology*. (Eleventh Edition ed.). McGraw Hill.

Acknowledgements

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Plant Reproduction & Propagation

Directions:

1. Using all available resources, research and describe the structure and function of different seed components and summarize their roles in plant reproduction and propagation.
2. After completing your research, write a brief paragraph on the information you found.
3. Cite all sources used.

3-D Diagram

Directions:

1. Create a 3-D diagram of a plant cell using only household items to construct it.
2. Label all organelles within the cell.
3. Display your diagram to the class.

Leaf Structure

Directions:

1. Gather five different types of leaves. Depending on when this lesson is taught you can use photographs of leaves if no leaves are available.
2. Attach each leaf specimen to a sturdy sheet of paper.
3. Using the information from the presentation or the Internet, label each specimen.
4. Each leaf specimen should have the following clearly labeled:
 - A. Leaf parts
 - B. Leaf type
 - C. Leaf vein pattern
 - D. Leaf arrangement
5. Write a summary paragraph detailing your findings and citing all sources to turn in with your specimens.