UNIT A: Basic Principles of Plant Science with a focus on Field Crops

Lesson 1: Examining Plant Structures and Functions

Terms

- Alternate leaf arrangement
- Bulb
- Cell
- Cell specialization
- Cladophyll
- Compound leaf
- Corm
- Cotyledon
- Dicotyledon
- Fibrous root system
- Flower
- Fruit
- Leaf
- Monocotyledon
- Multi-cellular organism

Terms

- Opposite leaf arrangement
- Organ
- Organ system
- Osmosis
- Phloem
- Reproductive parts
- Rhizome
- Root
- Seed
- Simple leaf
- Stem
- Stolon
- Taproot system
- Tendril
- Tissue

Terms

- Transpiration
- Tuber
- Vegetative parts
- Whorled leaf arrangement
- Xylem

What is the cellular structure of plants?

- Cells are the structural basis of all living organisms.
- A cell is a tiny structure that forms the basic building blocks of plants.

What is the cellular structure of plants?

- All organisms are made of one or more cells.
- Protoplasm in cells carries out life processes.

What is the cellular structure of plants?

- Plants are multi-cellular organisms, meaning that they have many cells.
  - Some cells have specific functions.

What is the cellular structure of plants?

- Cell specialization is the presence of cells that perform unique activities for a plant.
  - Flowers, leaves, roots, and stems are made of specialized cells.

What is the cellular structure of plants?

- Cells are formed into groups that work together.
  - Tissue is formed by groups of cells that are alike in activity and structure.
  - An organ is formed by tissues that work together to perform specific functions.
  - An organ system is a group of organs that works together to perform a function.

Cell structure is the organization of the material that forms a cell.

- Plant cells have three major parts: wall, nucleus, and cytoplasm.
- The cell wall surrounds the cell and controls the movement of materials into and out of the cell.

Cell structure is the organization of the material that forms a cell.

- The nucleus is near the center of a cell and contains protoplasm, chromosomes, and other structures that control cell activity.
- The cytoplasm is a thick solution inside the cell wall surrounding the nucleus.

Cell structure is the organization of the material that forms a cell

- Plant cells have many additional parts, including: chloroplasts, nucleolus, vacuole, mitochondria, and golgi body.

What are the major parts of plants?

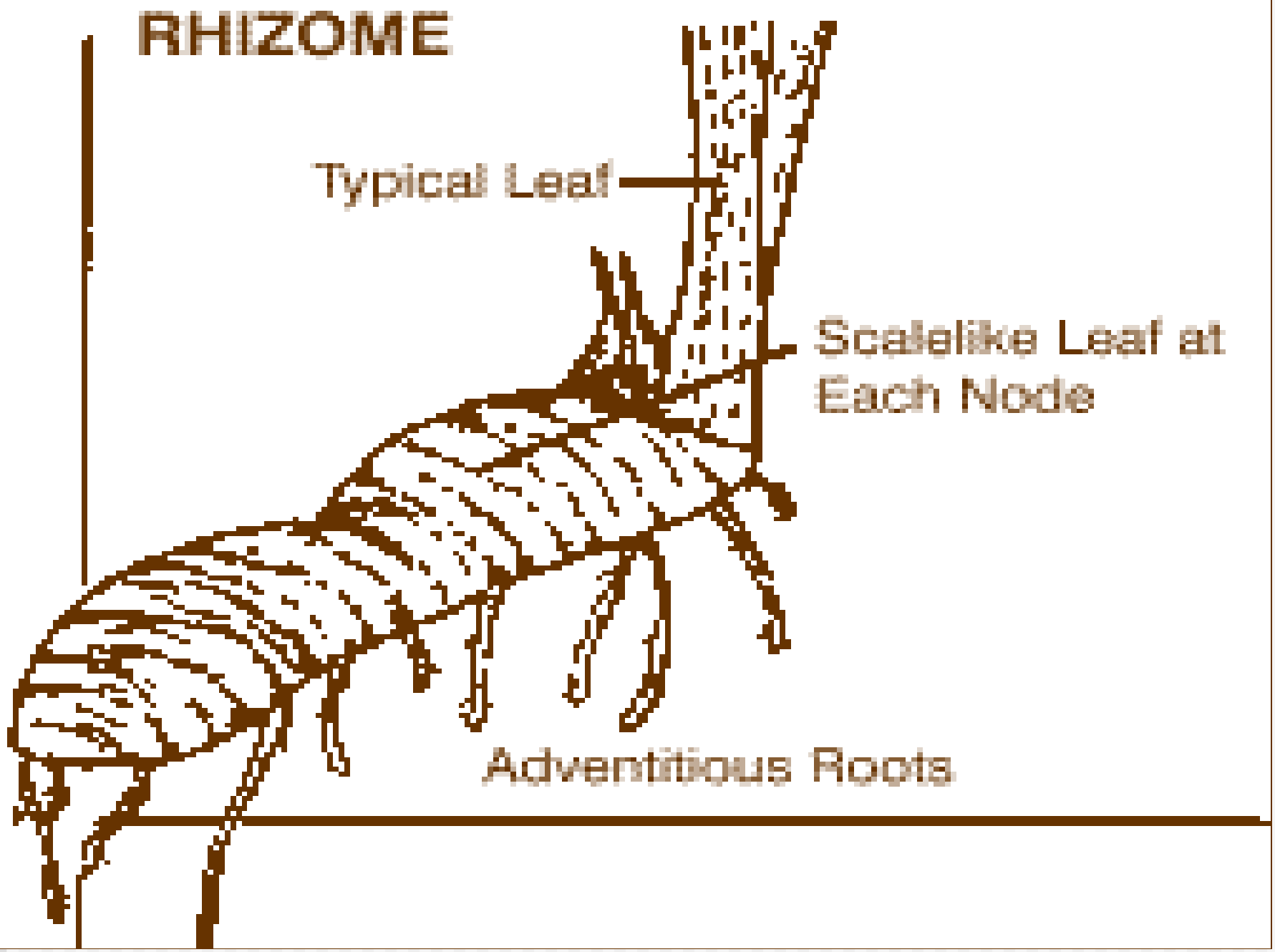
- Plants are comprised of vegetative and reproductive parts.
- The major vegetative parts of plants are stems, leaves, and roots.
- The major reproductive parts of plants are flowers, seed, and fruit.

The major vegetative parts of plants are stems

- A stem is the central axis that supports the leaves, connects them with the roots, and transports water and other materials between the leaves and roots.
  - Stems vary widely in appearance based on the species of plant.
  - Stems may be vertical or horizontal and modified for climbing and to store water and food.

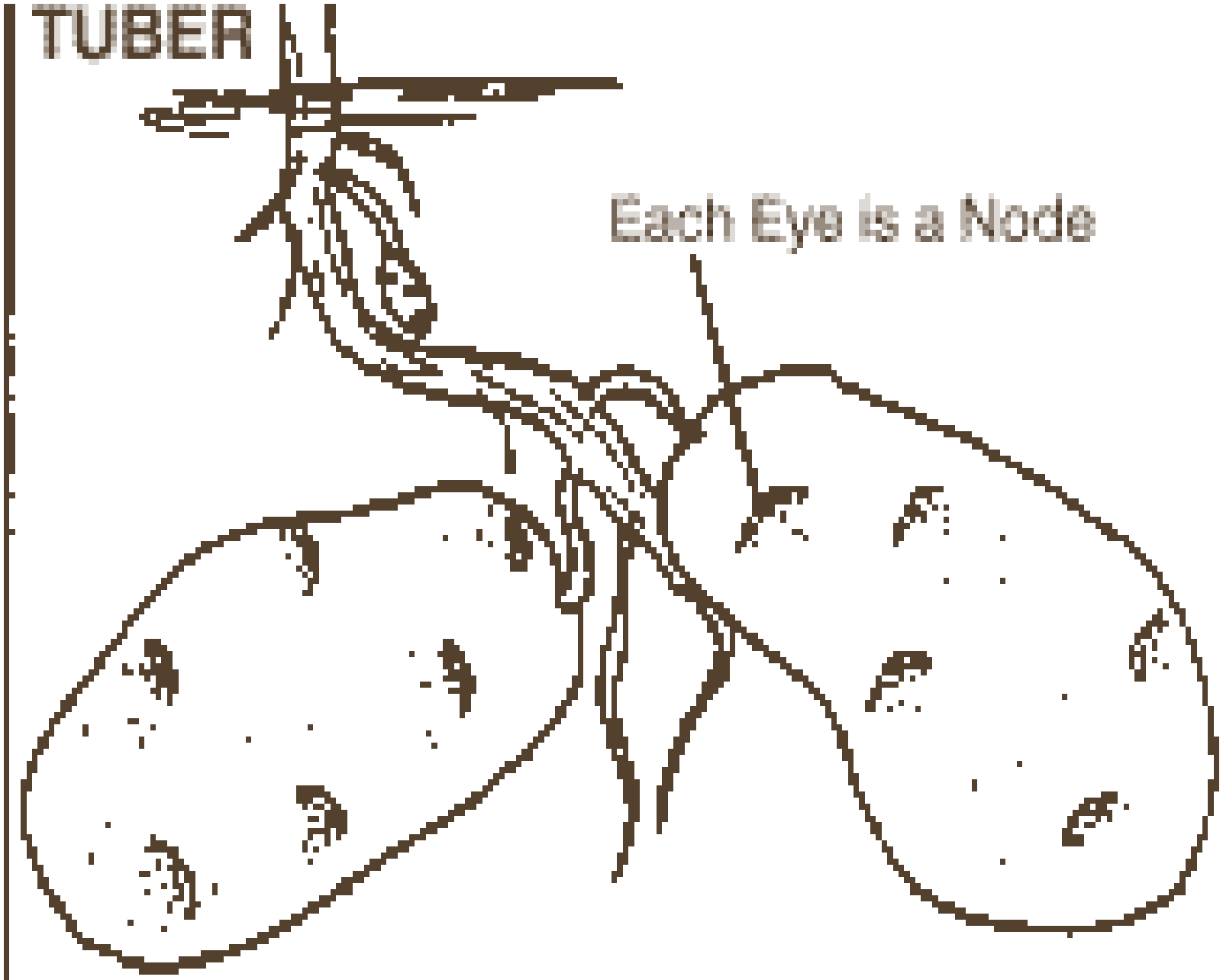
Specialized Kinds of Stems

- Rhizome—A rhizome is an underground stem that grows horizontally.
- It may grow adventitious roots and stems to develop as a separate plant.
- Examples include iris and wild ginger.


RHIZOME
Typical Leaf
Scalelike Leaf at Each Node
Adventitious Roots

Specialized Kinds of Stems

- Tuber—A tuber is an enlarged part of a stem that grows underground.
- A tuber can develop into a separate plant.
- Examples include potatoes and yams

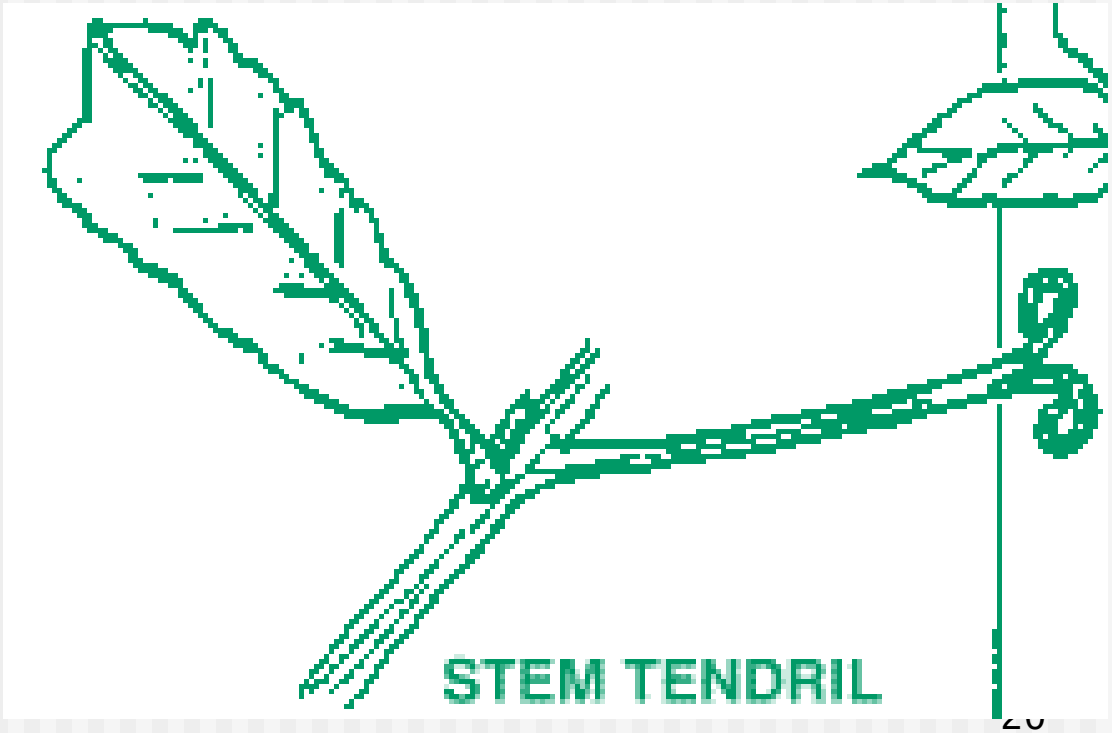

TUBER
Each Eye is a Node

Specialized Kinds of Stems

- Tendril—A tendril is a threadlike leafless growth on a stem that attaches itself around other stems and objects.
- Tendrils typically grow in a spiral shape. attaching itself, it holds the stem in position.
- Vines and climbing plants often have tendrils.

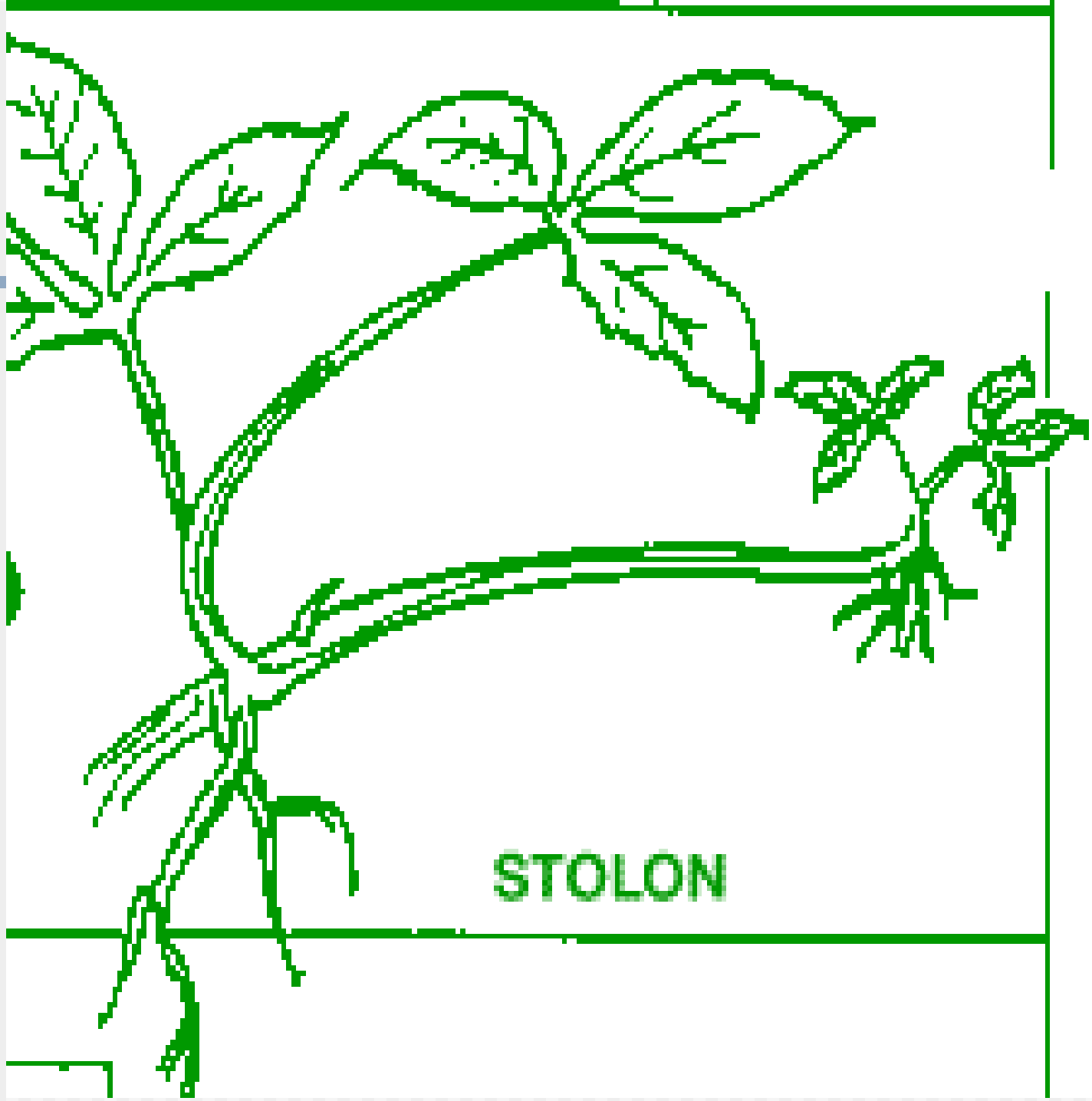
Tendril

- Examples are sweet peas and cucumbers.



Specialized Kinds of Stems

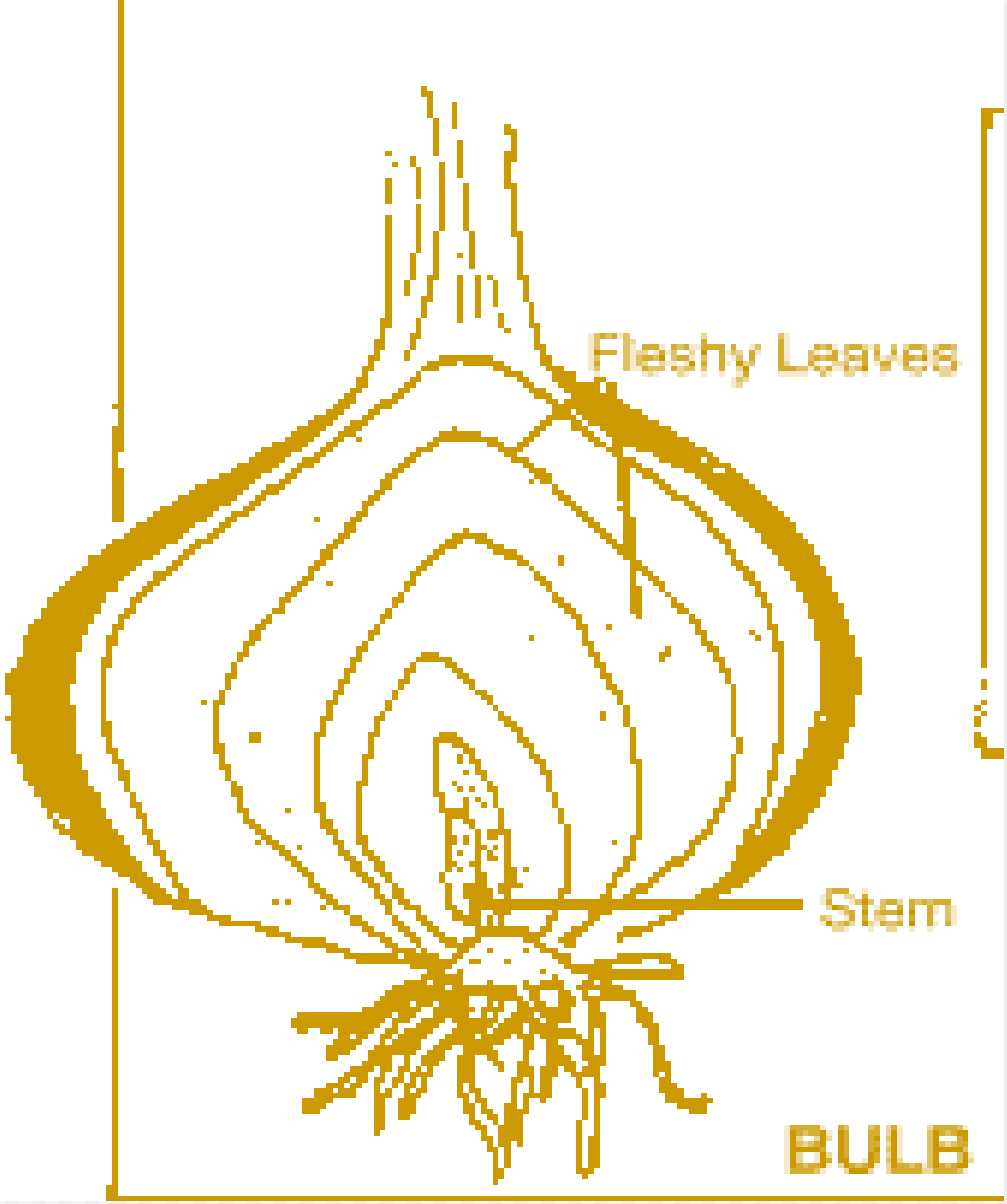
- Stolon—A stolon is an above ground stem that grows horizontally and propagates new plants.
- Strawberries are well known as examples of plants that multiply using stolons.


STOLON

Specialized Kinds of Stems

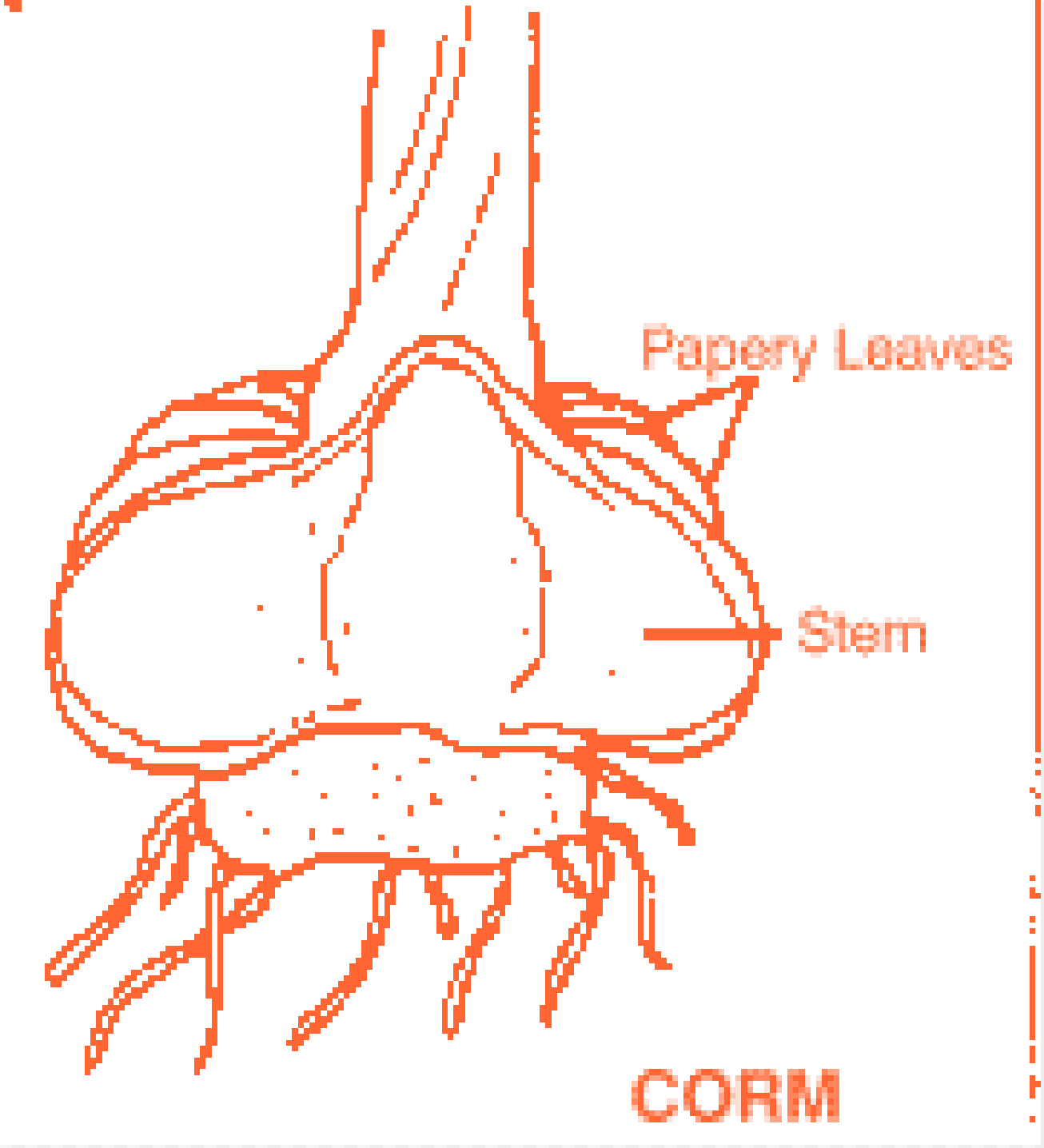
- Bulb—A bulb is an underground food storage organ consisting of flattened, fleshy stem-like leaves with roots on the lower side.

- Examples of bulbs are onions and daffodils.


Fleshy Leaves
Stem
BULB

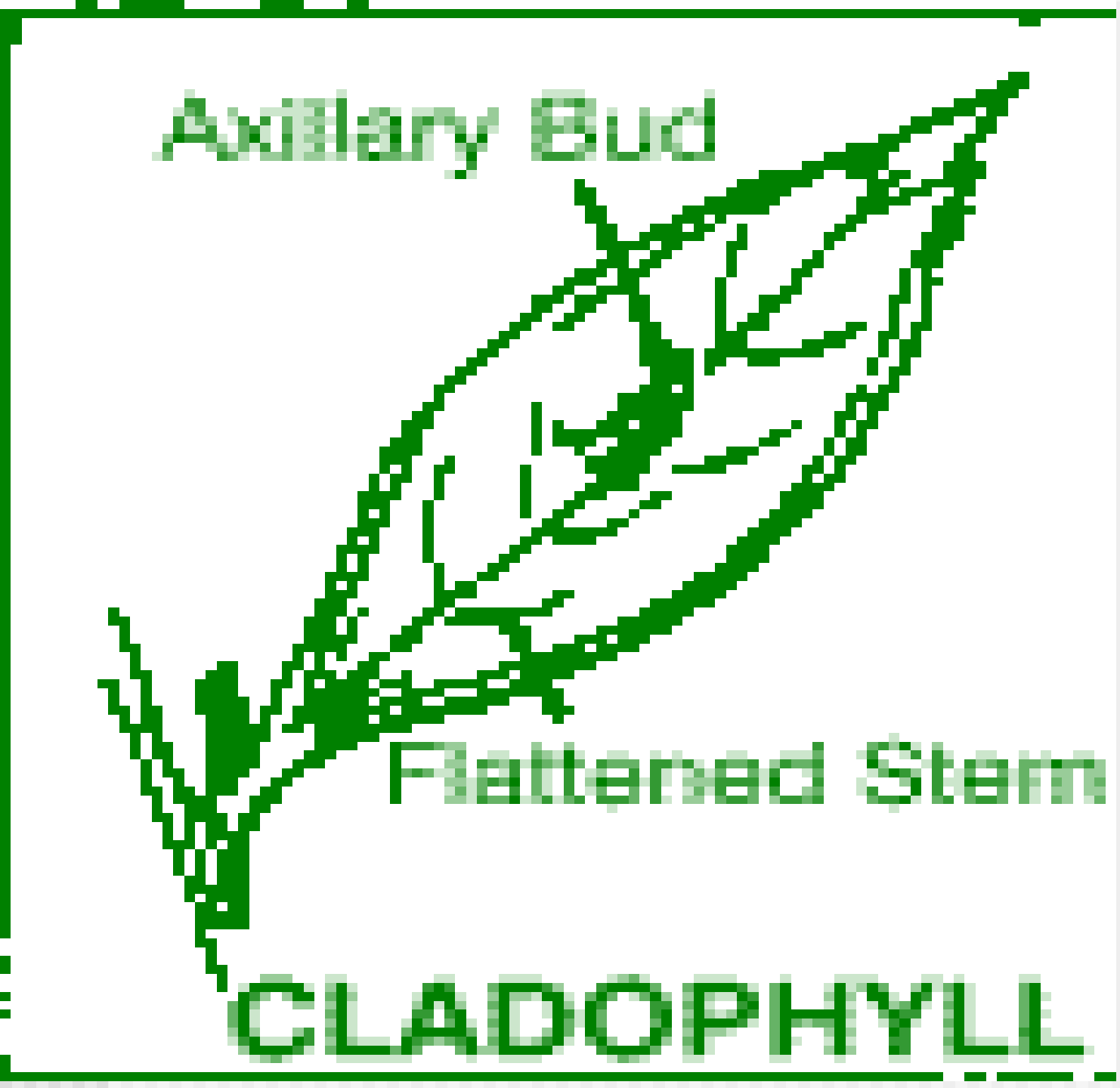
Specialized Kinds of Stems

- Corm—A corm is a food storage structure at the end of a stem that grows underground.
- It is an enlarged or swollen stem base.
- Examples include gladiolus and crocus.


Papery Leaves
Stem
CORM

Specialized Kinds of Stems

- Cladophyll—A cladophyll is a leaflike branch that resembles a leaf.
- It is also called a cladode.
- A cladophyll functions much like a leaf.

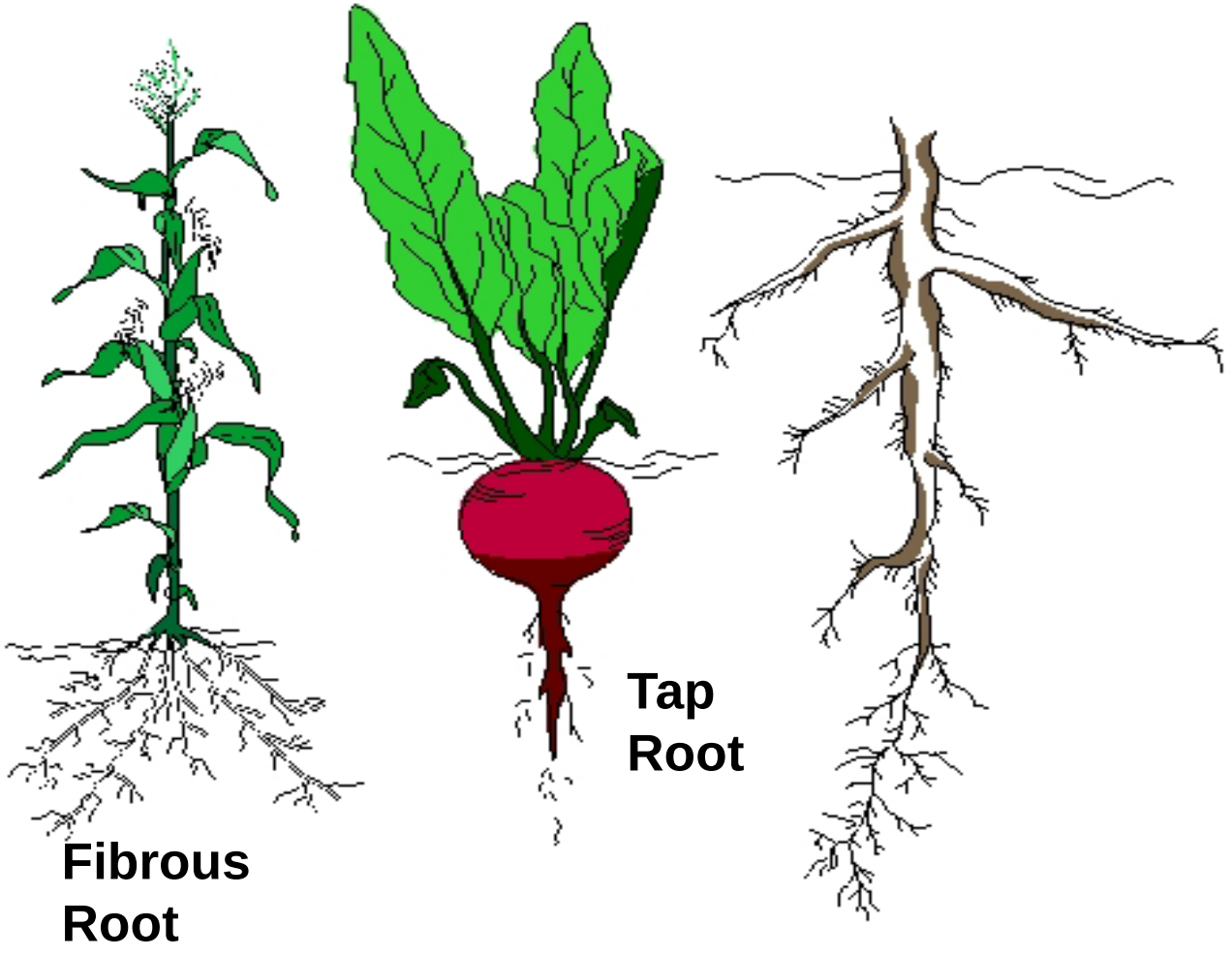

Axillary Bud
Flattened Stem
CLADOPHYLL

Roots

- A ***root*** is the part of a plant that grows in the soil or other media. Roots anchor plants, absorb water and minerals, and store food. The root system structure varies widely depending on the species of plant.

Classification of roots

- Fibrous—A ***fibrous root system*** is made of many small roots and spread throughout the soil.
- Taproot—A ***taproot system*** is made of one primary root with a number of small secondary roots.

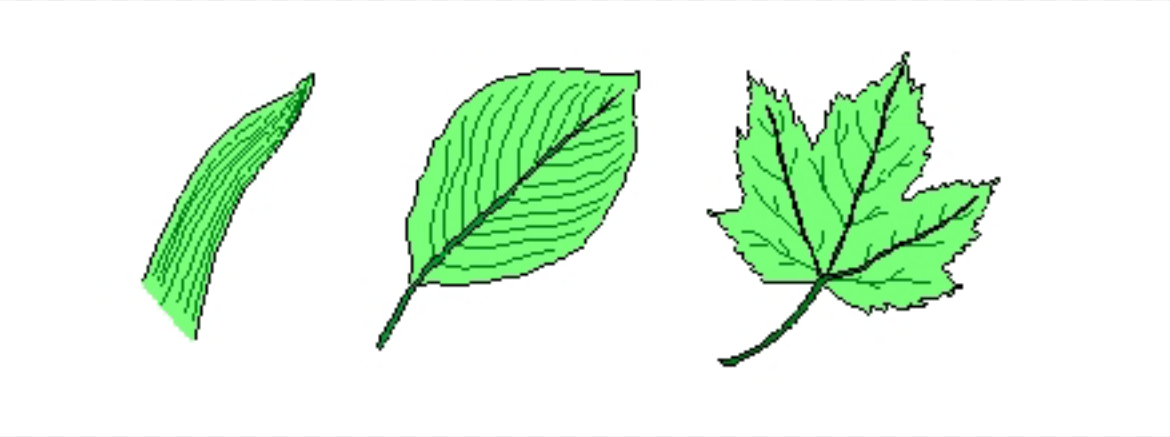

Fibrous
Root
Tap
Root

Leaf

- 3. A ***leaf*** is typically a large, flat, green organ attached to the stem. Leaves carry out photosynthesis, transpiration, and may store food. Shape, arrangement, and other features vary widely with the species of plant.

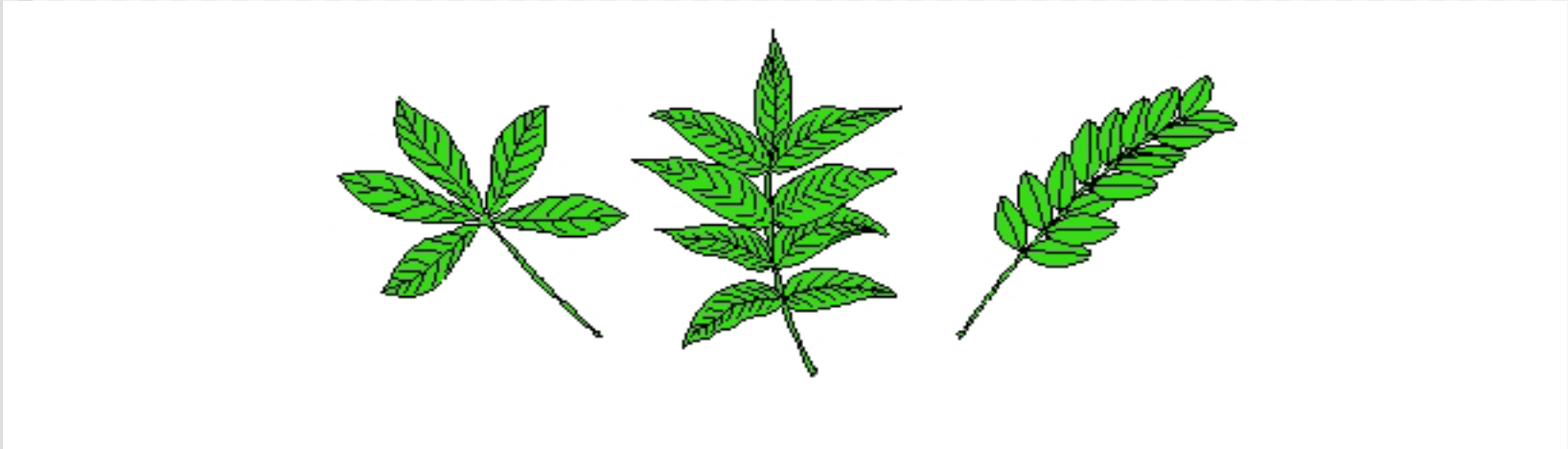
Types of Leaves

- Simple—A ***simple leaf*** has only one blade.



Types of Leaves

- Compound—A ***compound leaf*** is divided into two or more leaflets

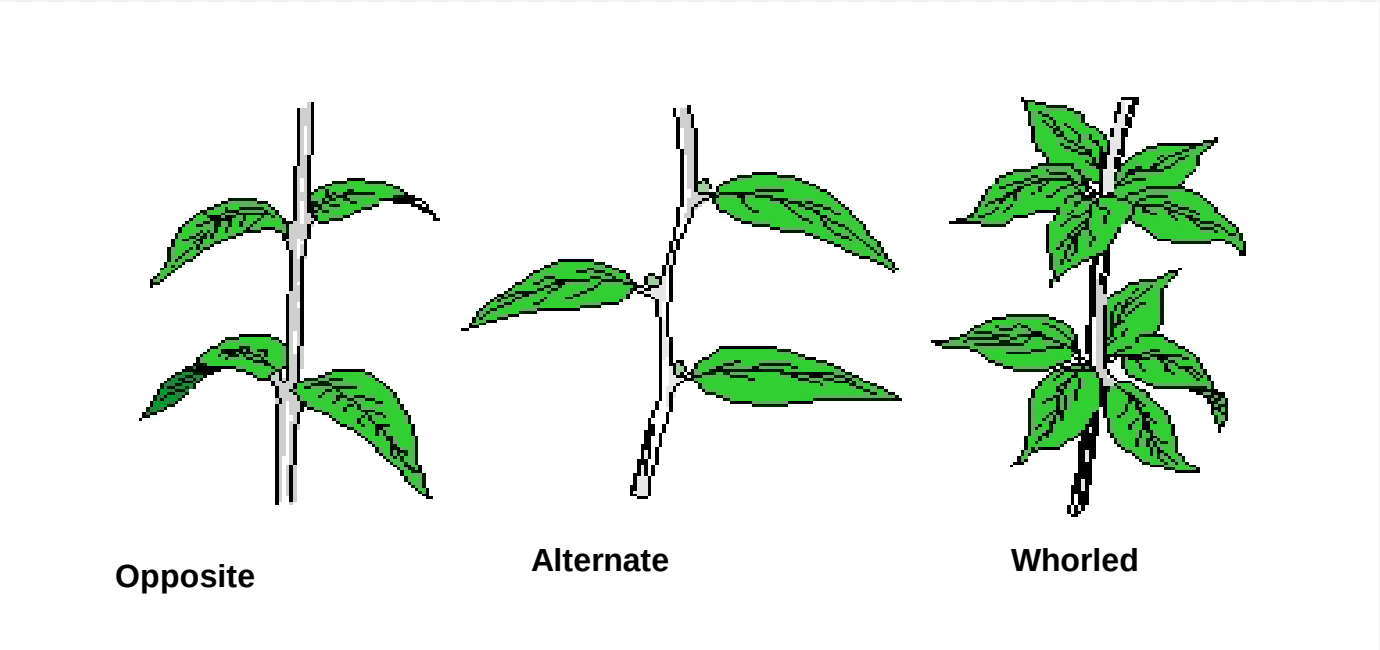


Leaf Attachment

- Leaf attachment also varies. This refers to the spacing and arrangement of leaves on the stem of a plant.

The major kinds of attachment are:

- (1) Alternate—***Alternate leaf arrangement*** is one leaf at each node on a stem.
- (2) Opposite—***Opposite leaf arrangement*** is two leaves are attached at nodes opposite each other.
- (3) Whorled—***Whorled leaf arrangement*** is three or more leaves are at each node.

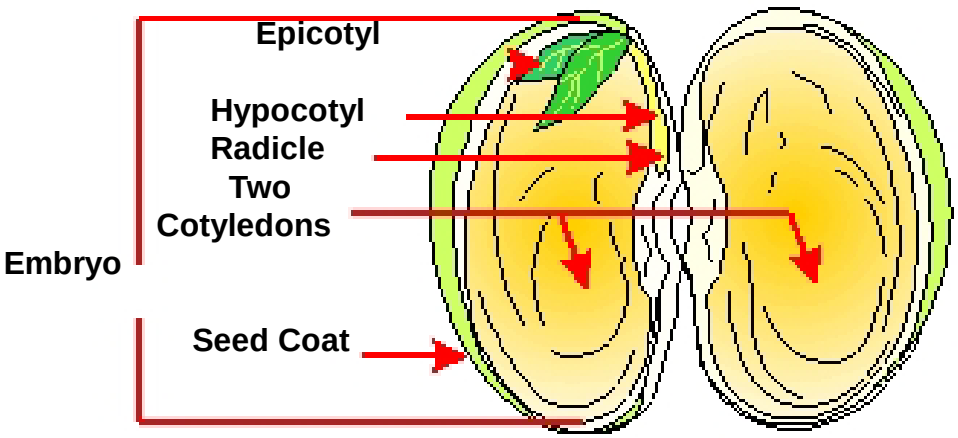

Opposite
Alternate
Whorled

Reproductive Parts

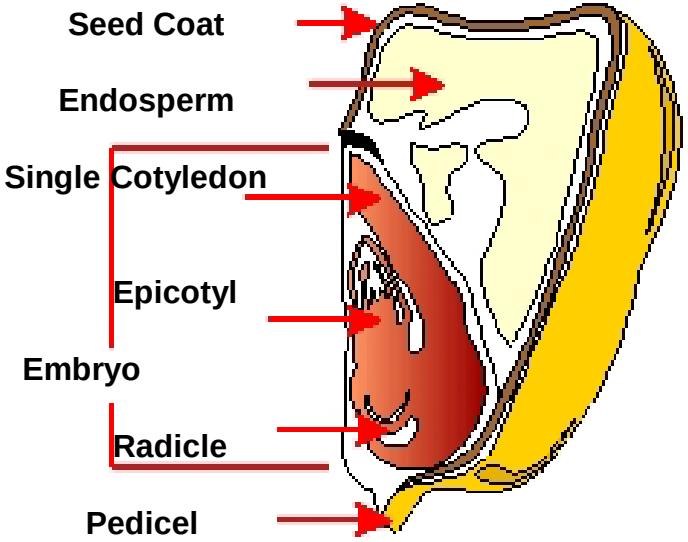
- The major ***reproductive parts*** of plants are flowers, seed, and fruit.
  - A ***flower*** is a part containing the reproductive organs. The types of flowers vary considerably.
  - In general, flowers produce pollen and ovules. Fertilization occurs when a pollen cell unites with an ovule.
  - ***Seed*** are formed by fertilized ovules and contain new plant life.
  - ***Fruit*** are the ovaries which develop to protect and nourish the developing seed. The kinds and nature of fruit vary widely.

Distinguish between plants based on seed cotyledons.

- A ***cotyledon*** is the fleshy structure within a seed that contains food for a developing embryo.
- Depending on the plant species, a seed may have one or two cotyledons.



Bean Seed

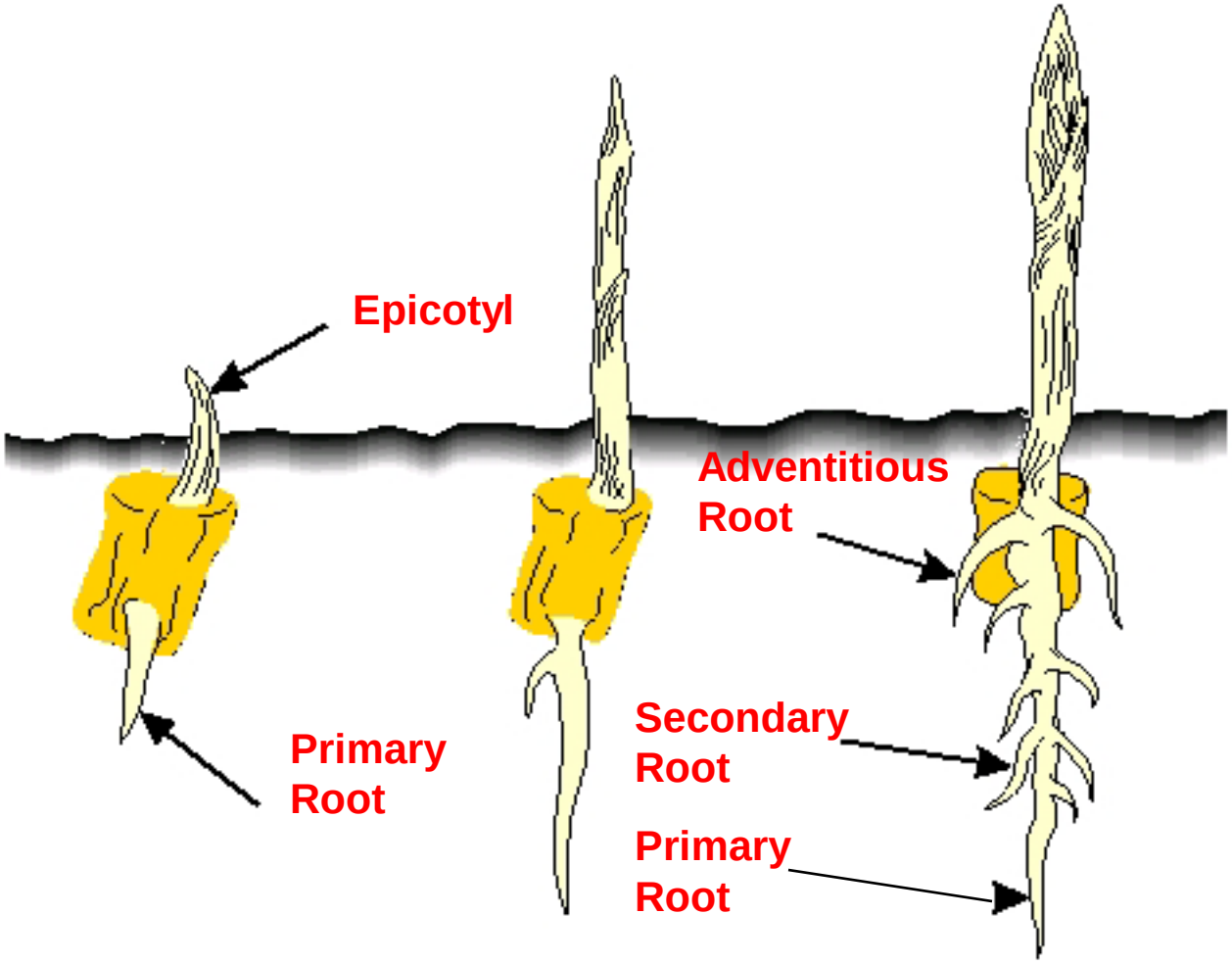


Corn Seed

Monocots

- A plant species producing seed with one cotyledon is a ***monocotyledon***, or monocot.
  - All grasses are monocots. Corn, wheat, oats, Bermuda grass, and sugarcane are examples of monocots.
  - Monocot plants have long, narrow leaves with parallel veins. All leaves branch from the main stem.
  - Stems are non-woody and tend to have a large area of pith in the center.

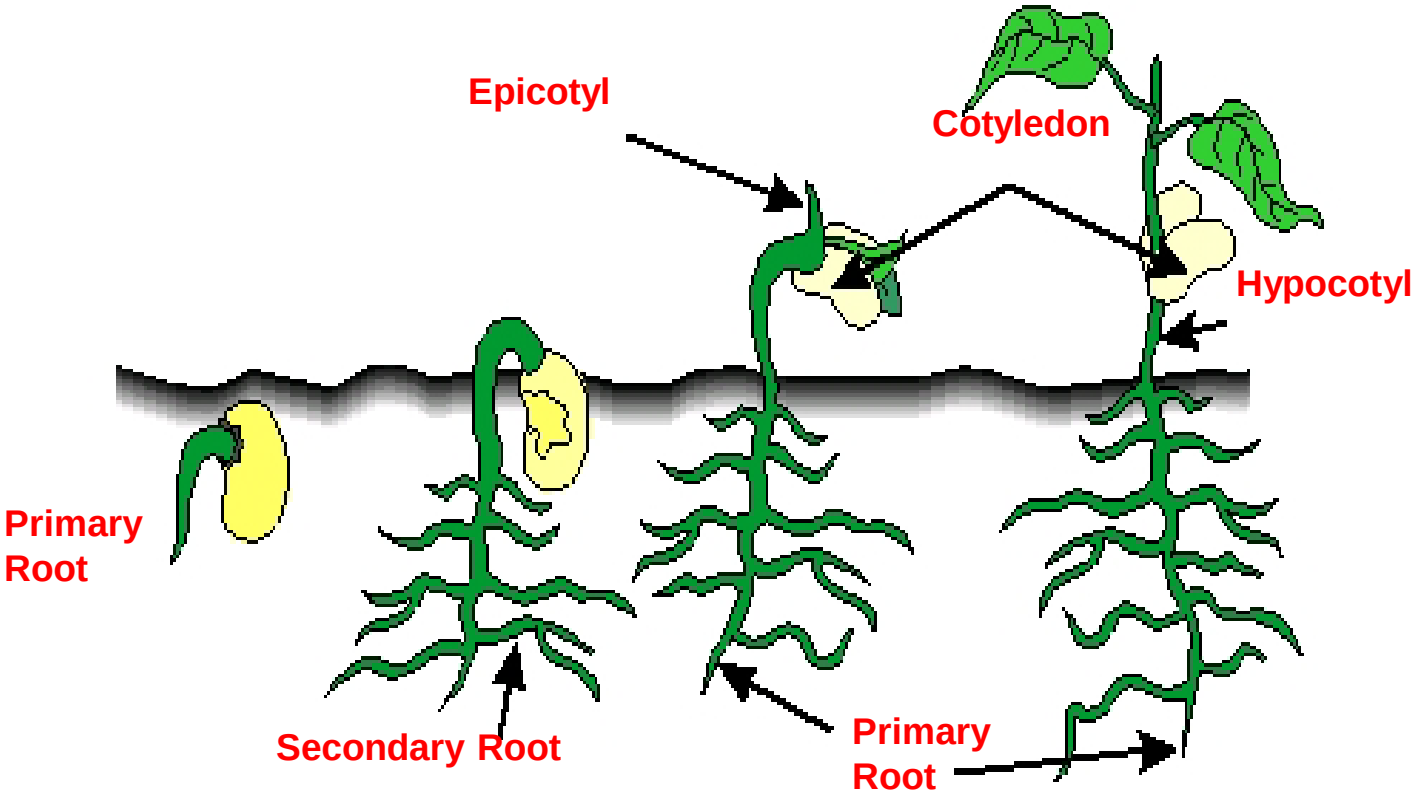
Corn


Epicotyl
Adventitious Root
Secondary Root
Primary Root
Primary Root

Dicots

- A plant species producing seed with two cotyledons is a ***dicotyledon***, or dicot.
  - All plants other than grasses are dicots. Soybeans, trees, lettuce, sunflowers, and petunias are examples of dicots.
  - Dicot plants have broad leaves with a net-type of veins.
  - Stems are often long and branching. They may be woody or non-woody, depending on the plant species.

Bean


Epicotyl
Cotyledon
Hypocotyl
Primary Root
Secondary Root
Primary Root

Absorption and transport systems of plants

- Water and nutrients are primarily absorbed by the roots and transported throughout the plant by various tissues in the roots, stems, and leaves.

- Roots have tiny root hairs covered with thin membranes that allow water and nutrients to enter.
  - ***Osmosis*** is the movement of water from greater concentration in the soil or media to lower concentration in the root.
  - Water enters until the concentration in the root is equal to the concentration outside the root.
  - The water entering roots also carries inorganic substances known as nutrients.

- . After absorption by roots, water is passed from cell to cell until it reaches the xylem.
- 1. ***Xylem*** is tissue, formed as tubes, that conducts water up the stem and to the leaves.
- 2. The petiole of the leaf takes the water from the xylem in the stem to the leaf veins, which distribute it throughout the leaf.

- Leaves lose water by ***transpiration***.
- 1. Transpiration occurs through tiny stomata on leaves.
- 2. Transpiration creates somewhat of an upward pull that assists the xylem in moving water and nutrients.

- Manufactured food is conducted from the leaves through the stems to the roots in phloem tissue.
- 1. ***Phloem*** is the tissue that conducts sugars, proteins, hormones, dissolved materials, and salts from leaves to other parts of a plant.
- 2. The structure is observed as elongated sieve-type cells that form tube structures in stems

Arrangement of Tissues in Stems