Basic Principles of Plant Science

EXAMINING PLANT STRUCTURES AND FUNCTIONS

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

Cellular Structure of Plants

- Plants are **multi-cellular organisms**, meaning that they have many cells.
  - Some cells have specific functions.
- **Cell specialization** is the presence of cells that perform unique activities for a plant.
  - Flowers, leaves, roots, and stems are made of specialized cells.

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.

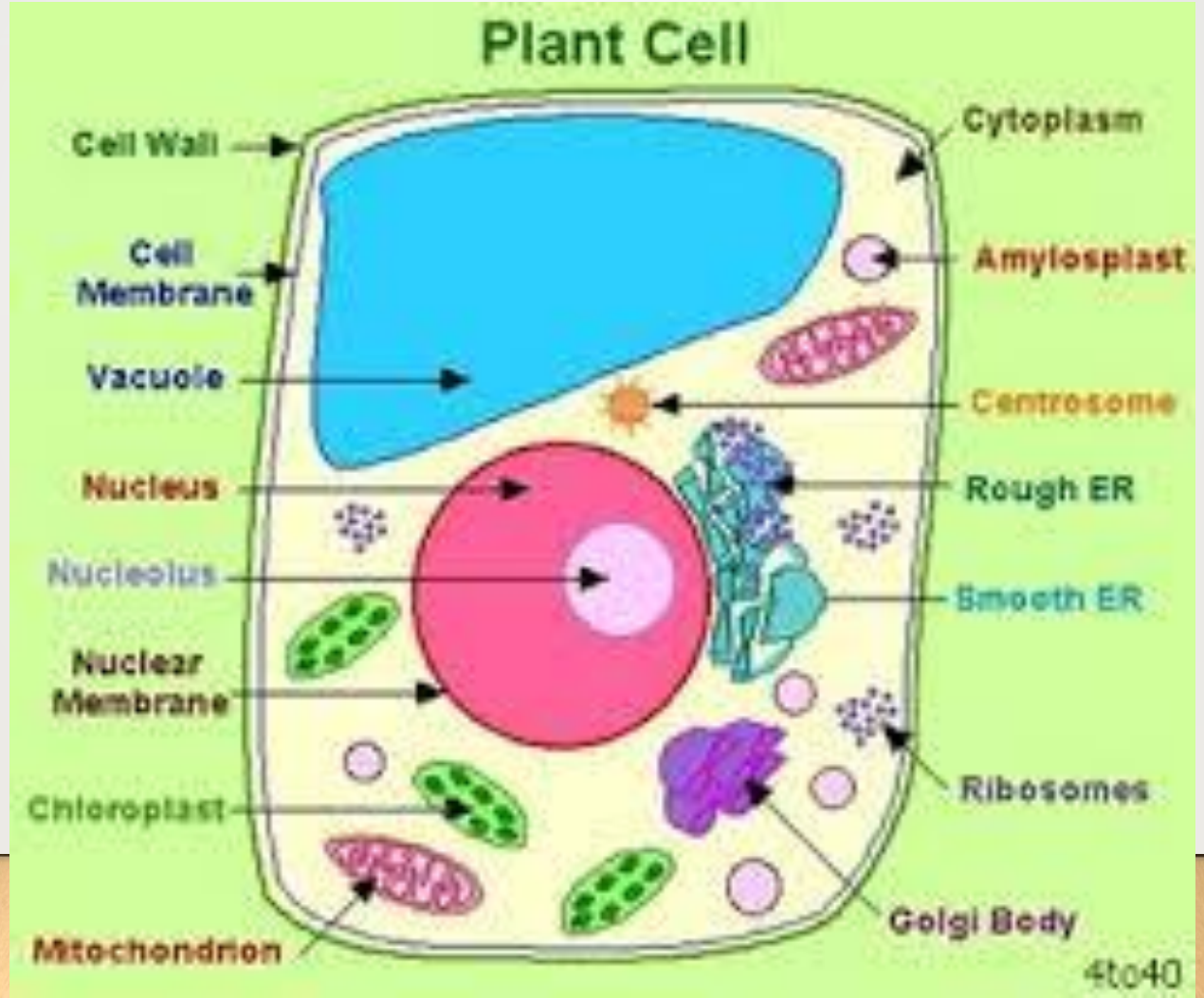
Cellular Structure of Plants

- 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. (mammal cells do not have cell walls – only cell membrane)
- The **nucleus** is near the center of a cell and contains protoplasm, chromosomes, and other structures that control cell activity.

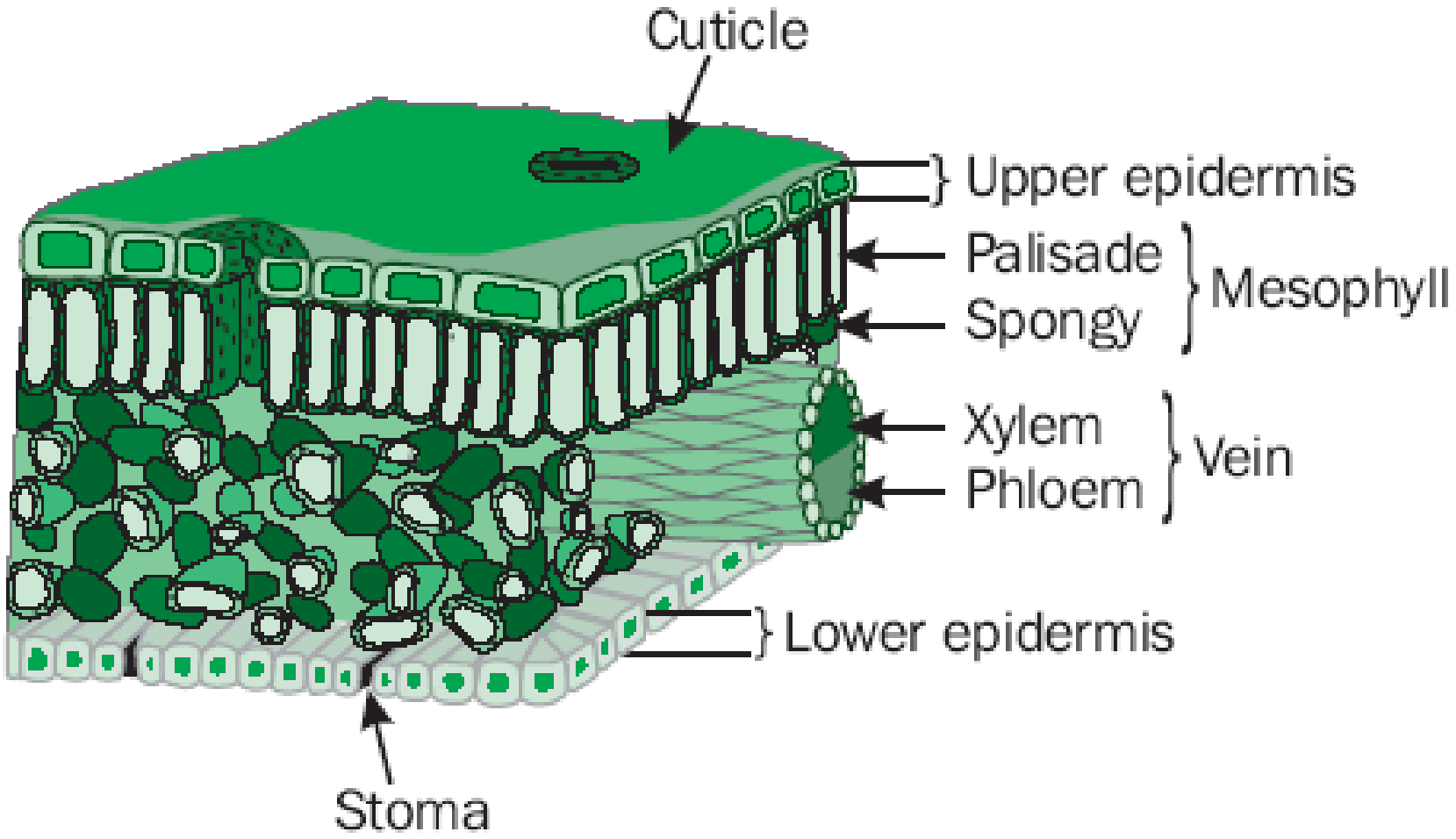
Cellular Structure of Plants

- The **cytoplasm** is a thick solution inside the cell wall surrounding the nucleus.
- Plant cells have many additional parts, including: chloroplasts, nucleolus, vacuole, mitochondria, and golgi body. (mammal cells do not contain chloroplast or plastids)

Cellular Structure of Plants



Cross Section of a Leaf



Plant Anatomy

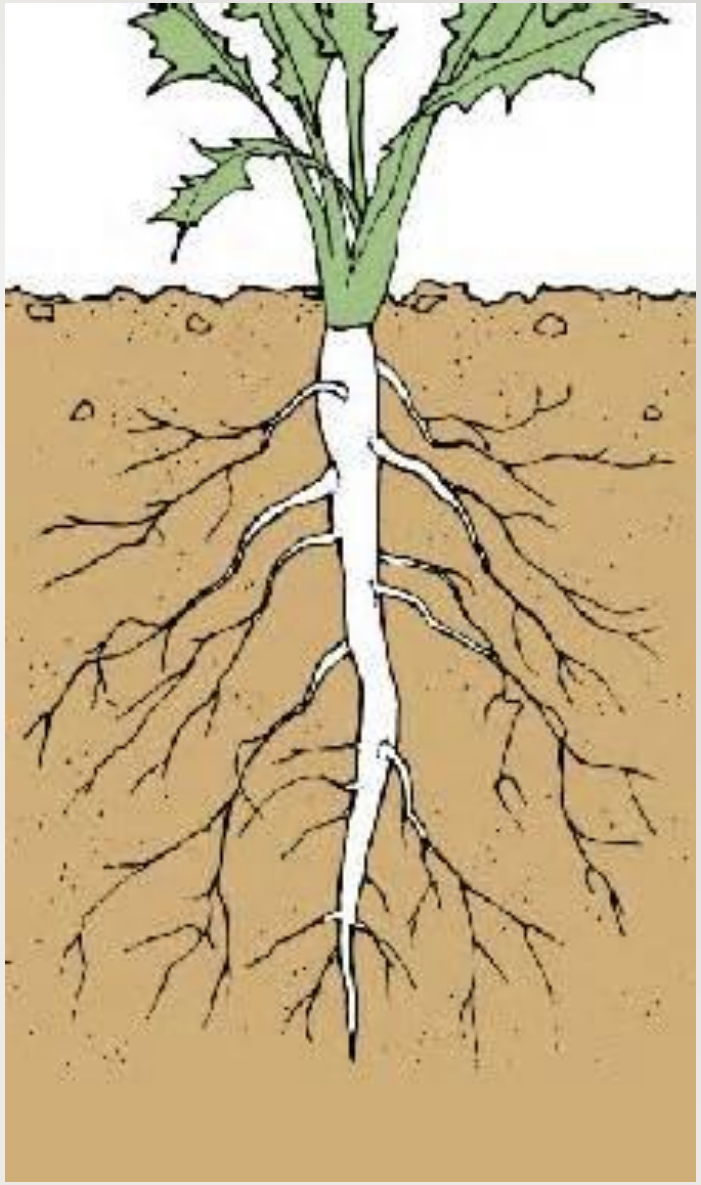
- Plants are comprised of vegetative and reproductive parts.
- The major **vegetative** parts of plants are stems, leaves, and roots.
- The major **reproductive** parts of plants are flowers, seed, and fruit.

The Roots

- Roots absorb water and minerals from the soil.
- Roots anchor the plant so that it can grow straight.
- Roots store food that is manufactured in the leaves.

The Roots

- **Primary Root** – single, main root.
  - First part to emerge when germination occurs
- **Secondary Roots** – smaller root branches off of the primary root



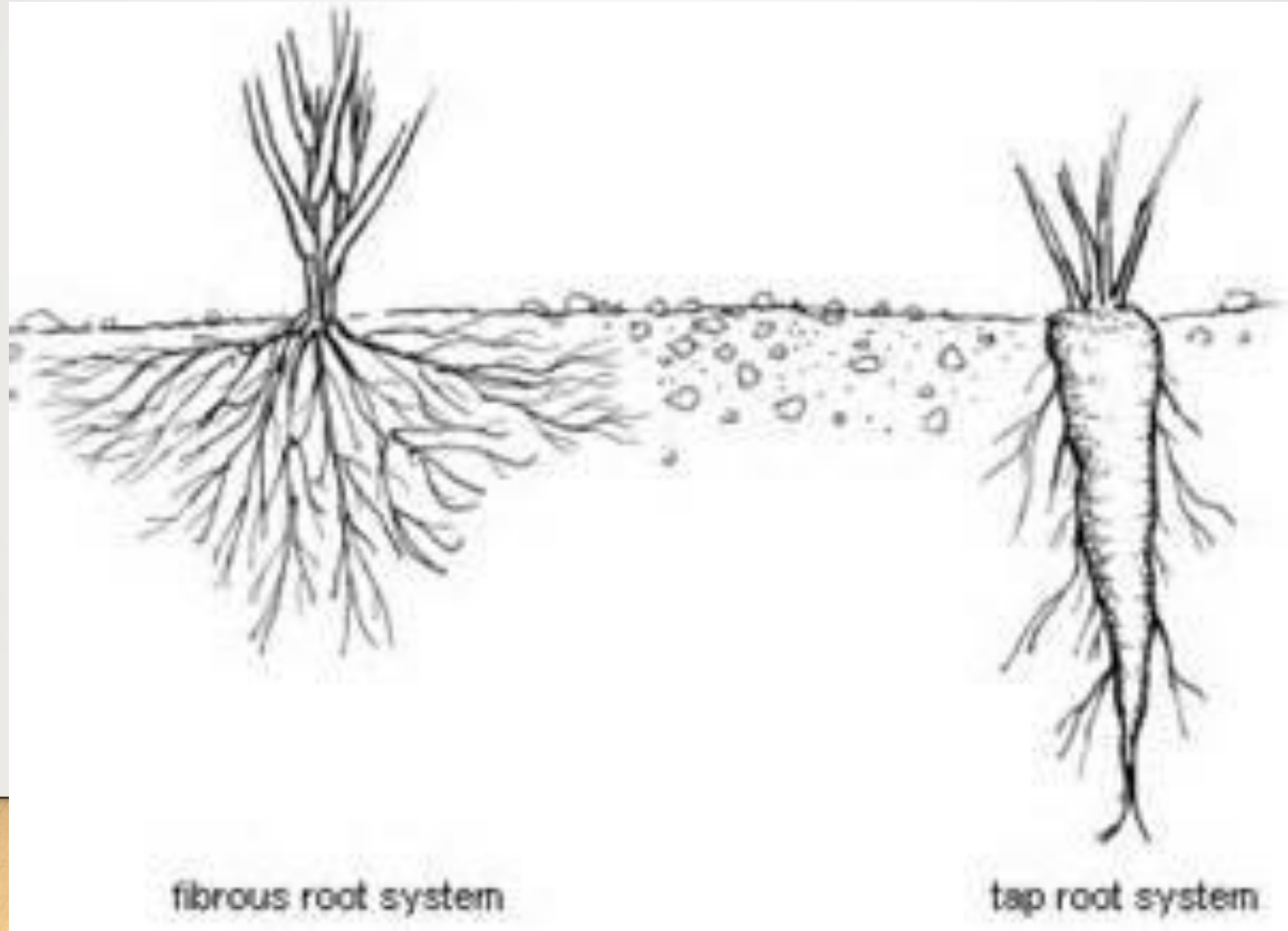
The Roots

- **Root Hairs** – tiny hairs found near the growing top of the root.
  - Greatly increase the surface area so more water and minerals can be absorbed.
- **Root Cap** – Mass of cells that protects the tip of the root from coarse soil

Root Systems

- Taproot System – thick, main root that grows straight down with smaller roots branching off
- Fibrous Root System – consists of numerous slender roots

Root Systems



Plant Anatomy

- 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.

The Stem

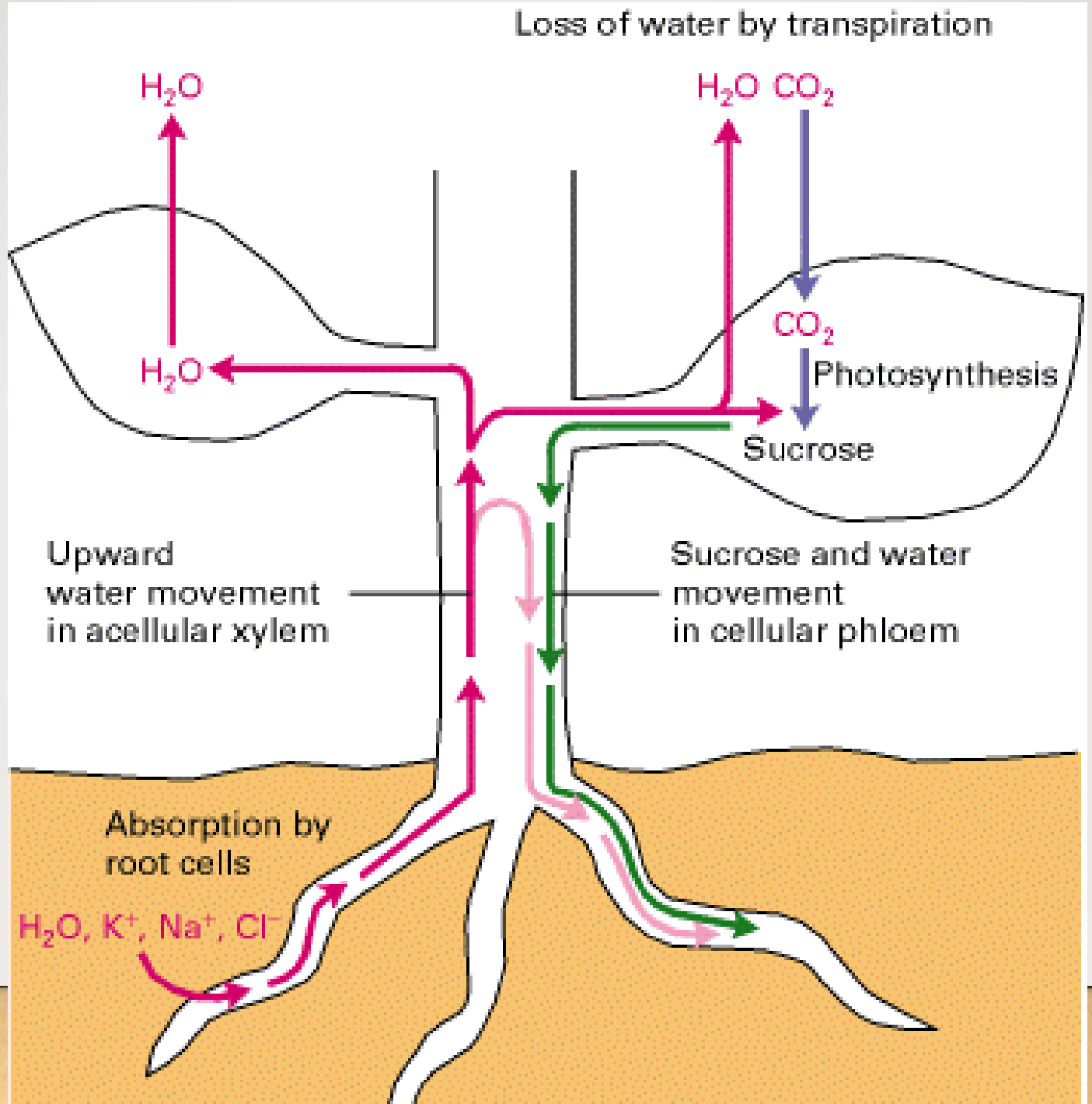
- The life flow of a plant is found in its stem.
  - Water and minerals are transported from the roots to the leaves by the **xylem**.
  - Food made in the leaves are transported through the rest of the plant by the **pholem**.

The Stem

- Xylem and Phloem Tissues
  - Xylems transport water and mineral salts (nitrates) from the roots to the leaves
  - Phloem transport organic products (sucrose) from the leaves to all parts of the plant

The Stem

- Vascular Bundles
  - Xylem and Phloem tissues are arranged in vascular bundles
  - A cambium separates the xylems and phloem
  - The cambium undergoes division to produce new xylems and phloem

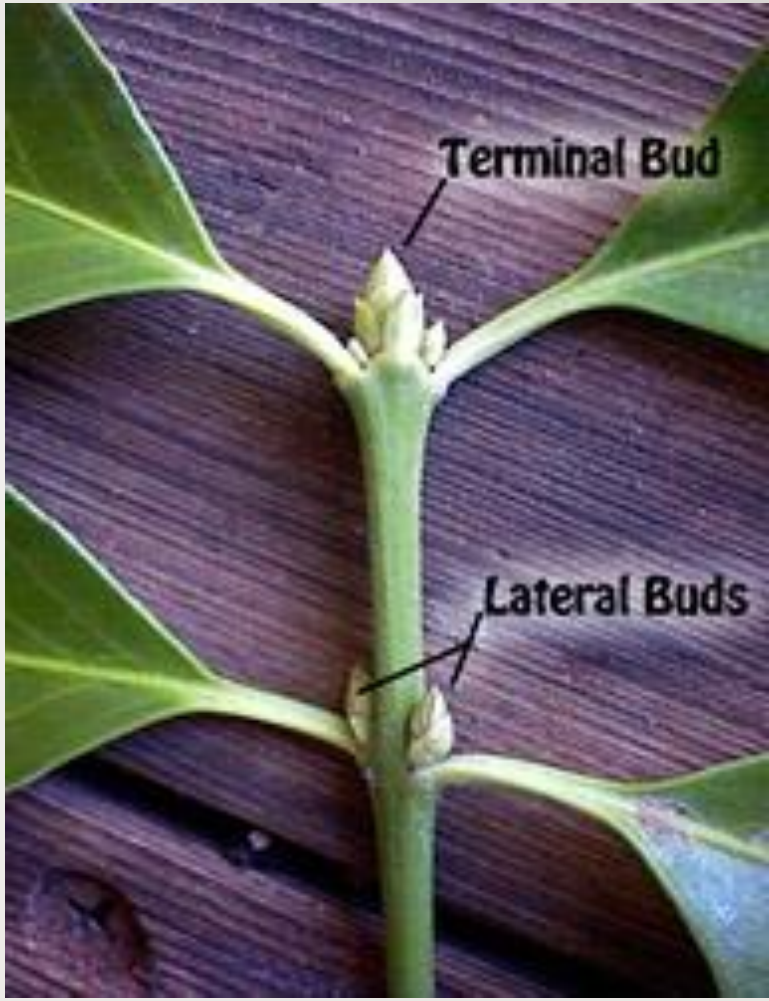

Loss of water by transpiration
H_2O
H_2O CO_2
H_2O
CO_2
Photosynthesis
Sucrose
Upward
water movement
in acellular xylem
Sucrose and water
movement
in cellular phloem
Absorption by
root cells
H_2O, K^+, Na^+, Cl^-

The Stem

- Xylem tissues transport water and soluble minerals
- Phloem tissues transports sugars and amino acids

The Stem

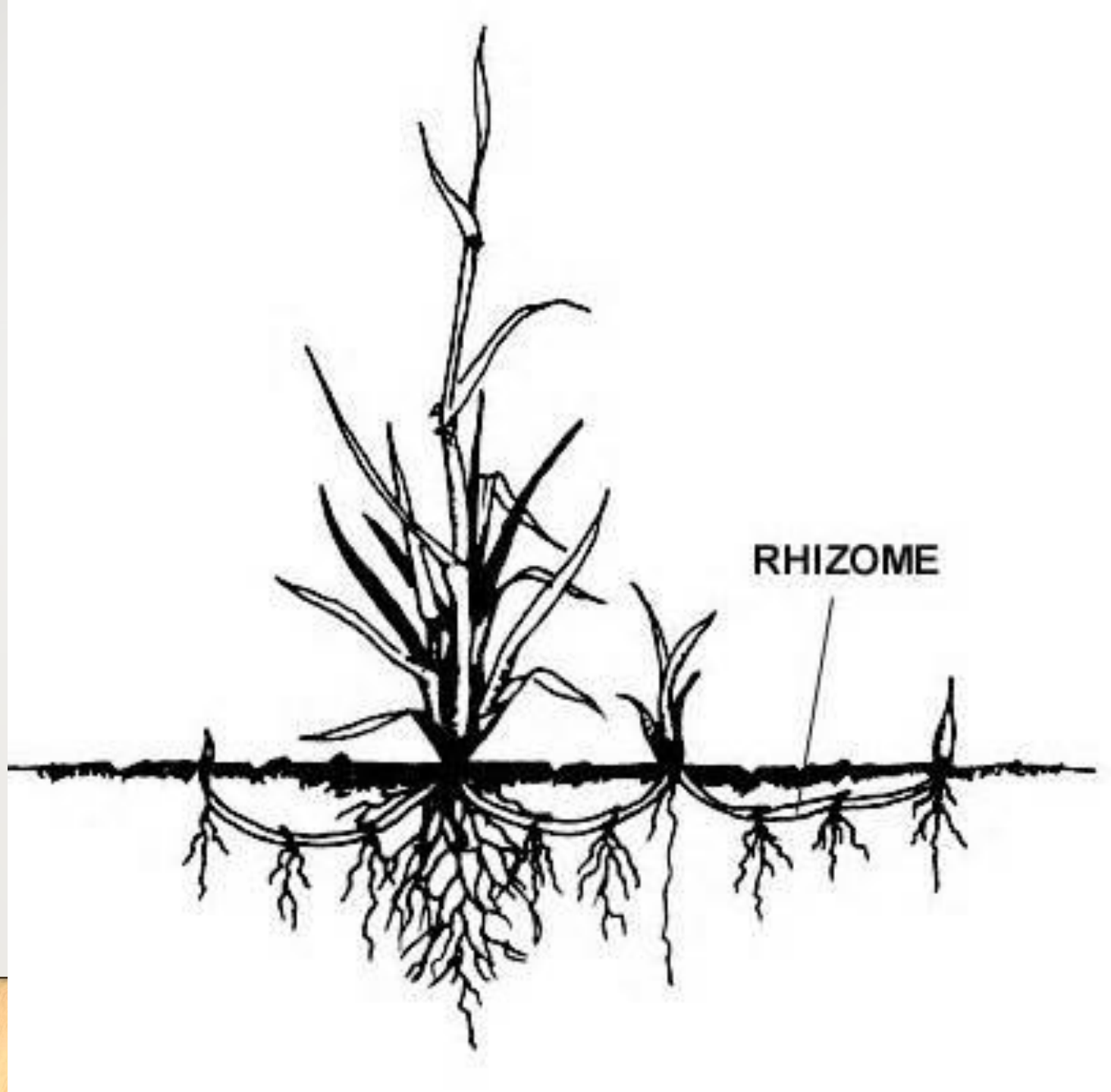
- Stems of woody plants have structures called **buds**.
  - **Terminal Buds**
    - At the end of the stem
    - Contains the **apical meristem** which is the primary growing point
  - **Lateral Buds**
    - Located on the side of the stem



The Stem

- **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.

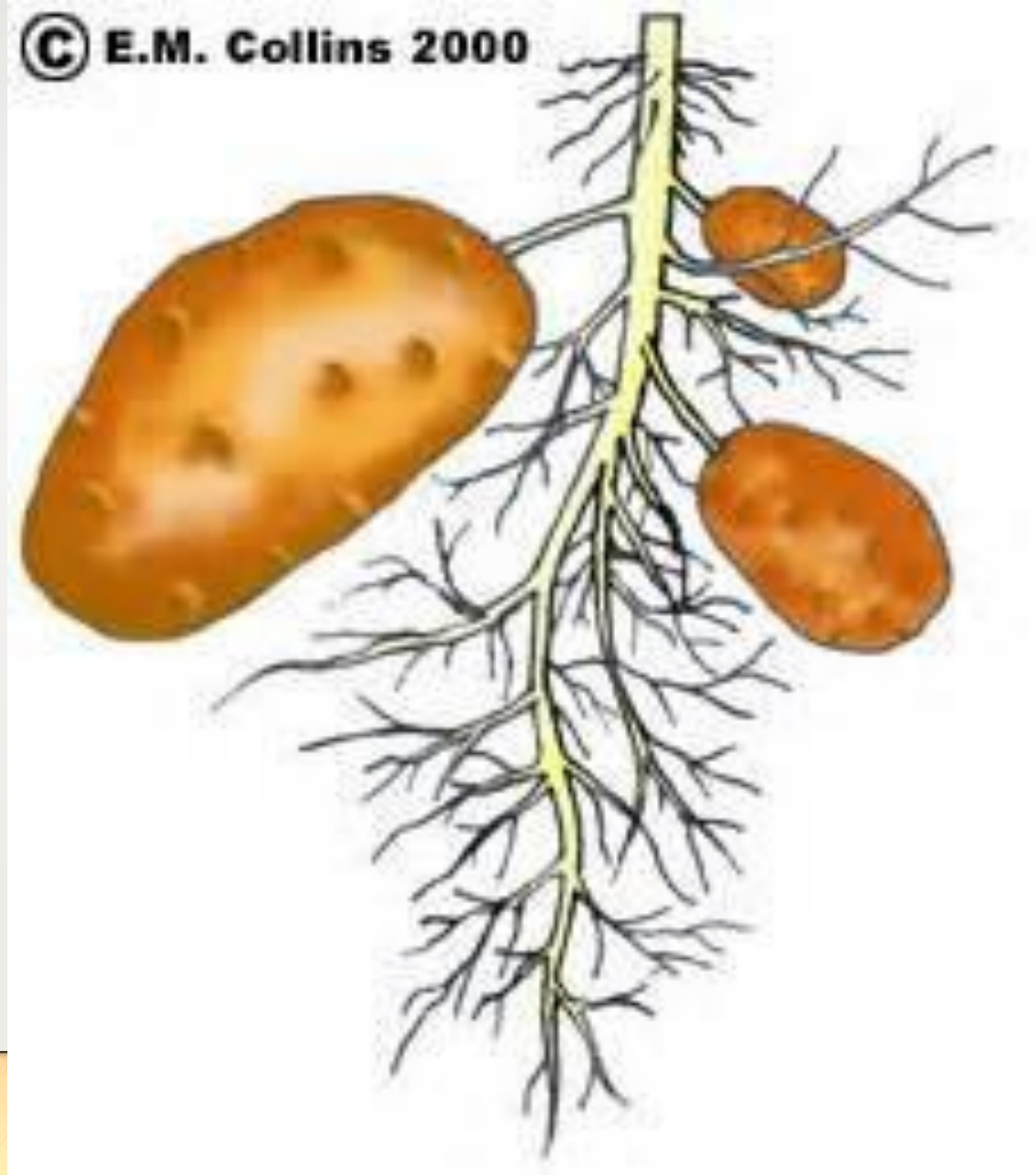
Rhizome



The Stem

- **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

Tubar



The Stem

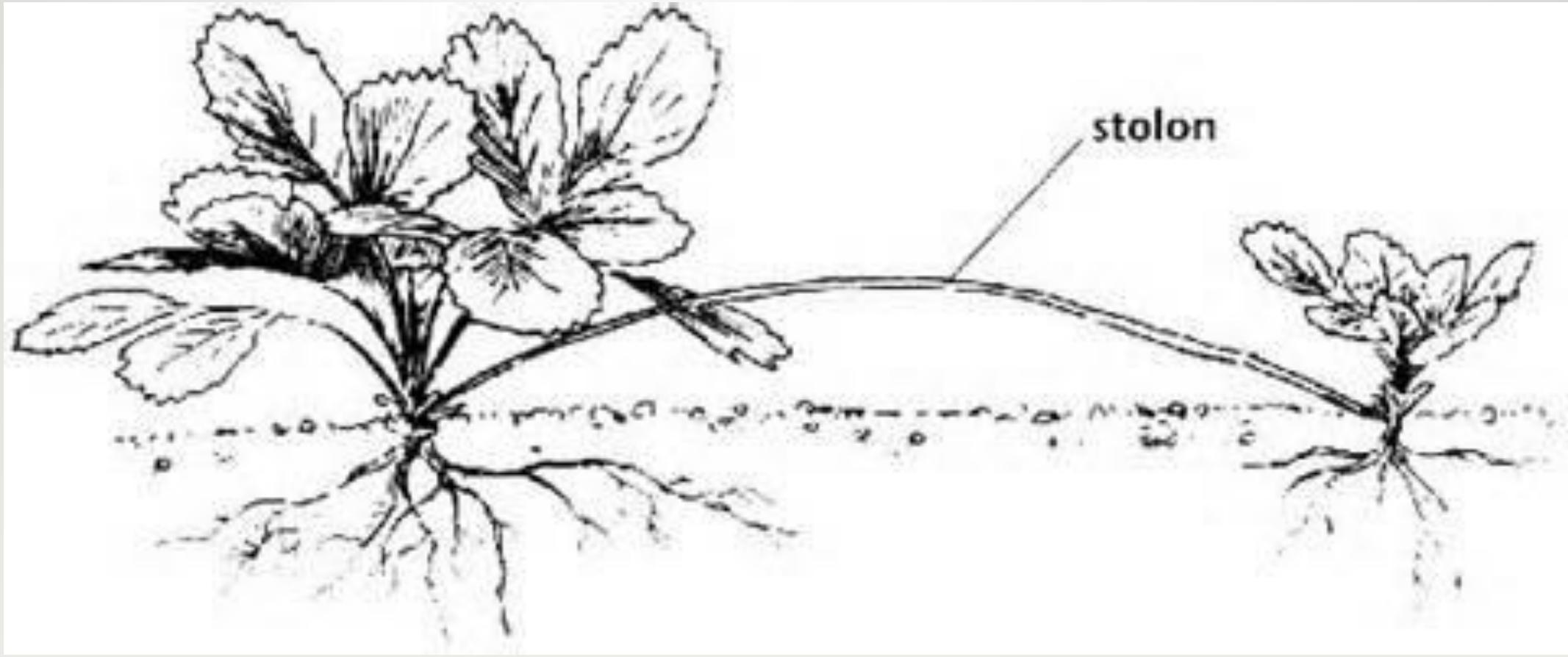
- **Tendril**—A tendril is a threadlike leafless growth on a stem that attaches itself around other stems and objects.
- Tendrils typically grow in a spiral shape, attaching itself, it holds the stem in position.
- Vines and climbing plants often have tendrils.
- Examples are sweet peas and cucumbers.

Tendril

The Stem

- **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.

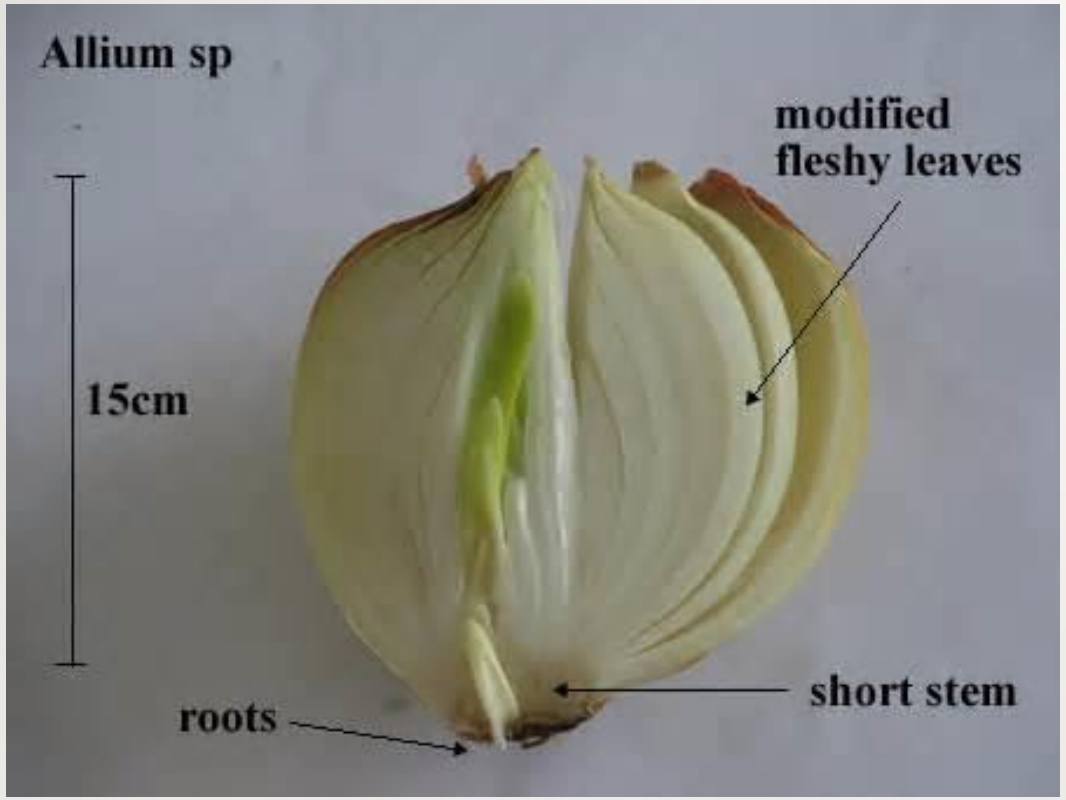
Stolon

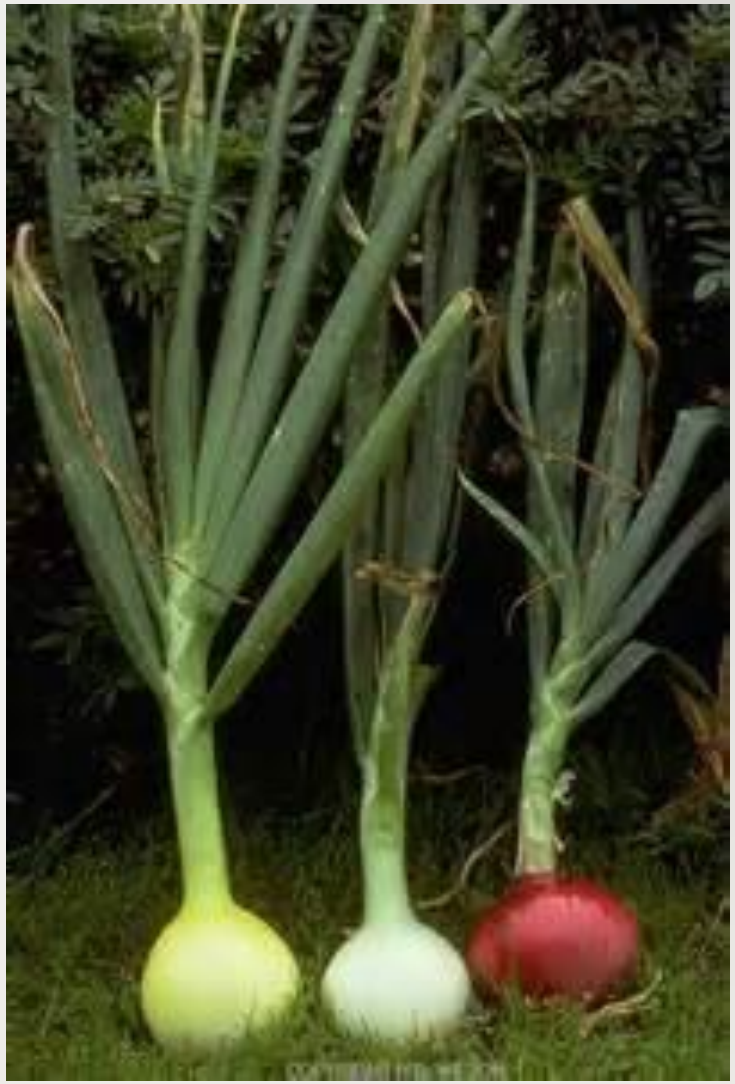


The Stem

- **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.

Bulbs





The Stem

- **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.

Corm

The Stem

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

Cladophyll

The Flower

- The **flower** is the reproductive part of flowering plants.
- Once fertilized, they produce fruit, vegetables, and seeds.

The Flower

- **Stamen** –the *male* parts of the flower.
- **Anther** is the part of a stamen that produces pollen.
- **Filament** is the slender part of a stamen that supports the anther.
- **Pollen** – male sperm cells.

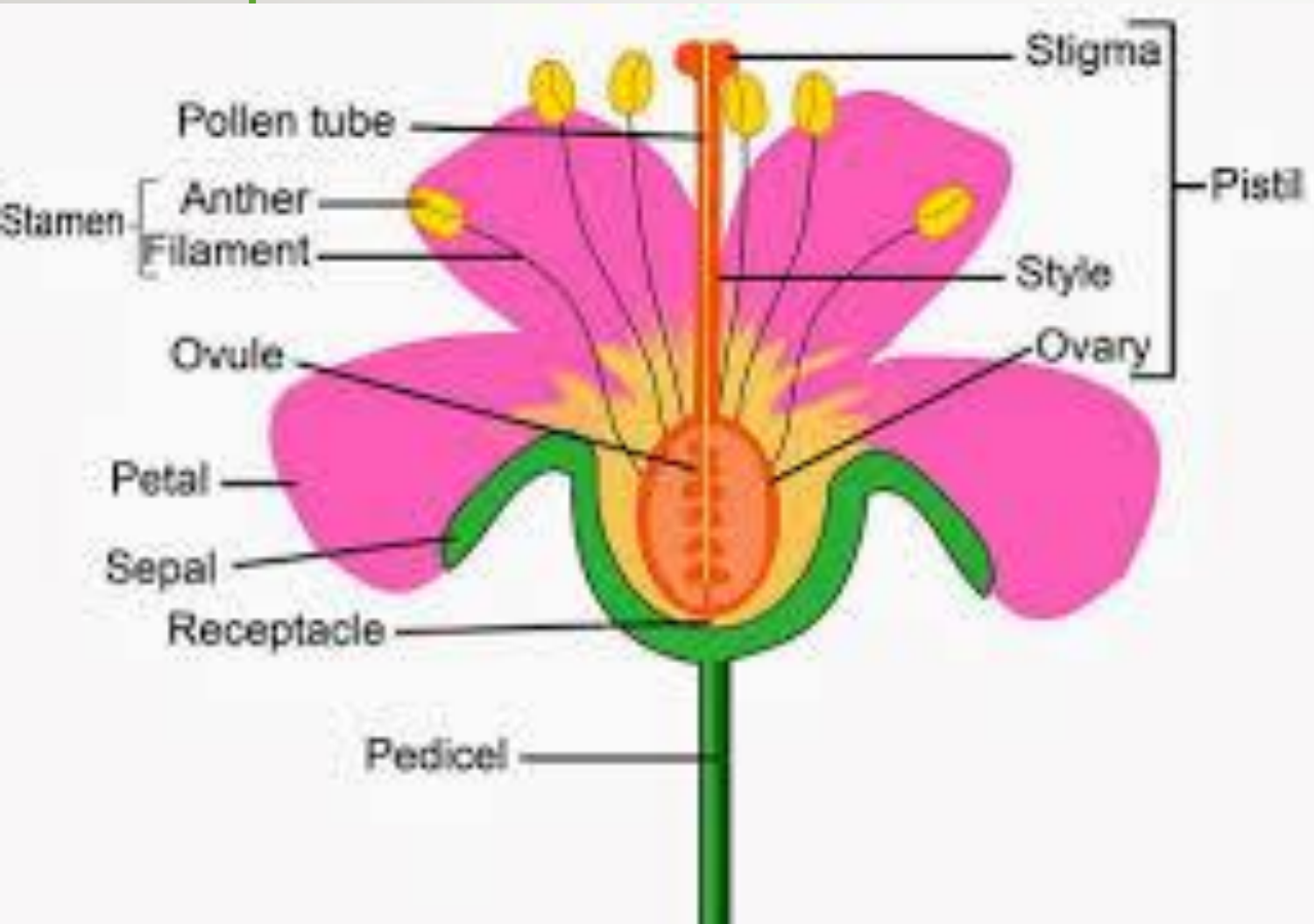
The Flower

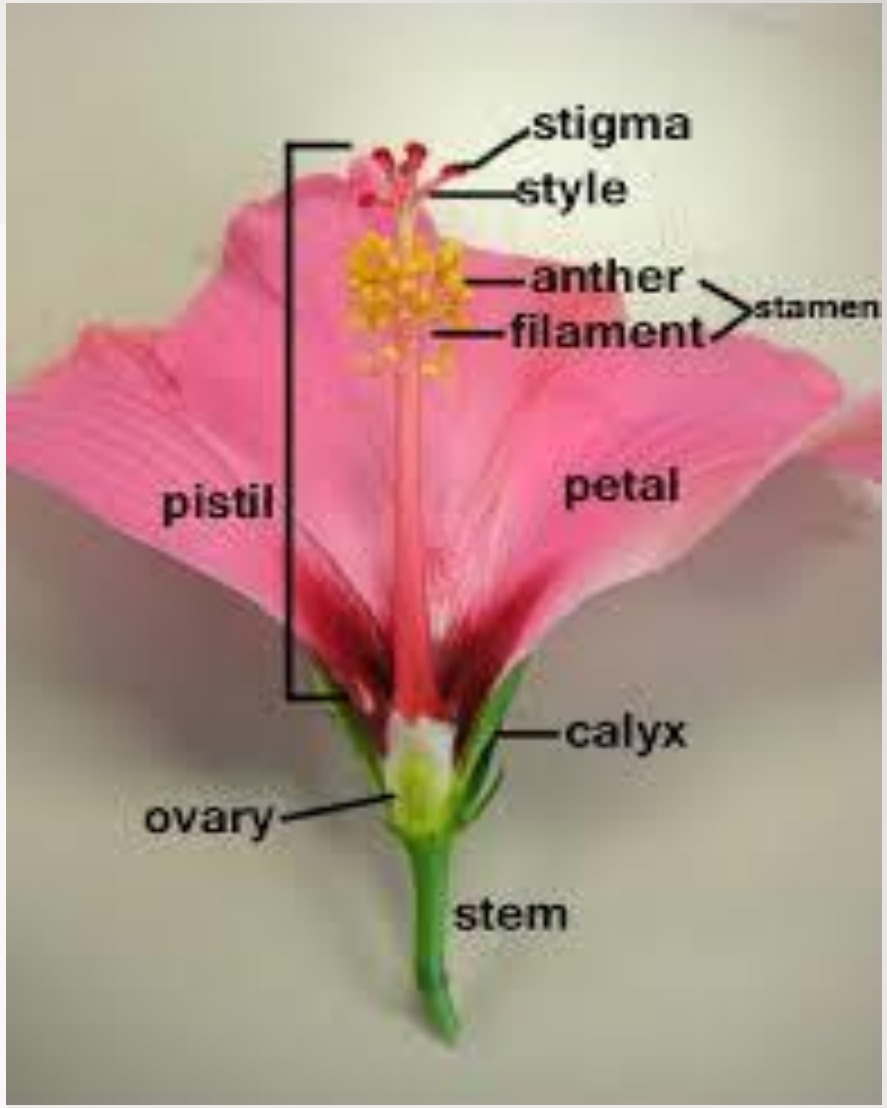
- **Pistil** – the *female* reproductive part of a flower and where the seed(s) and fruit/vegetable is produced
- The mature **ovary** is a fruit, and the mature **ovule** is a seed.
- **Stigma** – a sticky platform where pollen germinates.
- **Style** is a long, slender stalk that connects the stigma and the ovary.

The Flower

- **Petals** - are located just inside the sepals and are usually brightly colored to attract insects and promote pollination.
- **Sepals** are modified leaves that form the outer whorl of a flower and are the first part of a flower to form. Sepals function to protect the developing flower and keep it from drying

The Flower


Stigma
Pollen tube
Stamen
Anther
Filament
Pistil
Style
Ovule
Ovary
Petal
Sepal
Receptacle
Pedicel


stigma
style
anther
filament
stamen
pistil
petal
calyx
ovary
stem