

## Feb 17, 2023 | 📅 Unit 3 Plants: Green Factories

Foundational Scripture: Gen. 1:29 **God said, "See, I give you every seed-bearing plant that is upon all the earth, and every tree that has seed-bearing fruit; they shall be yours for food."**

### Lessons:

#### 1. How are plants made?

##### a. Objectives

##### i. List the various jobs that cells are capable of.

1. A CELL IS THE BASIC BUILDING BLOCK OF AN ORGANISM
2. ENGLISH PHYSICIST ROBERT HOOKE: FIRST TO DESCRIBE PLANT CELL
3. NEARLY 30 TRILLION CELLS IN THE HUMAN BODY
4. PLANTS CONVERT SOLAR ENERGY INTO CHEMICAL ENERGY
5. THE CELL WAS FIRST IDENTIFIED AND NAMED 350 YEARS AGO

##### ii. Distinguish how plant cells are similar and different from other cells.

##### 1. Similar

##### a. Structure

- i. Outer membrane or plasma membrane
- ii. Cytoplasm located between the membrane and the nucleus
- iii. Genetic material found in the nucleus

##### b. Function

- i. Energy conversion
- ii. Synthesize complex chemicals
- iii. Decompose chemicals
- iv. Perform maintenance
- v. Selective exchange/TRANSFER
- vi. Route and transfer chemicals
- vii. Interpret coded information
- viii. Duplicate itself

##### 2. Different

##### a. Plant cells differ from other cells

- i. Rigid cell wall **made of cellulose**
- ii. A large vacuole containing cell sap
- iii. Chloroplasts scattered in the cytoplasm

##### b. Cell Design

- i. VACUOLES ARE RESERVOIRS THAT MAINTAIN WATER BALANCE

ii. VACUOLES CONTAIN

1. ANTHOCYANINS
2. MINERALS
3. DISSOLVED PROTEINS
4. SUGARS
5. CALCIUM OXALATE

iii. PLASTIDS

1. Found in the cytoplasm of plants; named for their pigments (colors)
2. Chloroplasts (green); carry out photosynthesis
3. Chromoplasts (orange); give carrots their color
4. Leucoplasts (colorless); assist in starch storage in potatoes

c. PLANT AND ANIMAL CELLS HAVE ALL **BUT** THE FOLLOWING IN COMMON

- i. A CELL WALL
- ii. CHLOROPLASTS

3. CELLS DIFFER IN TYPE AND FUNCTION, BUT ARE SIMILAR IN COMPOSITION AND STRUCTURE.

b. Vocabulary

- i. PROTOPLASM VS. CYTOPLASM (NOT THE SAME)
- ii. PROTOPLAST
- iii. CHLOROPLAST

2. How do plants grow?

a. Objectives

i. Follow the seedling development of a bean

1. "The energy must be harnessed and directed by the information content which is initially present within the DNA of all seeds or reproductive cells" (Ignitia).
2. When energy is not directed, there is chaos and death (entropy-RUNNING DOWN)
3. A SEED MUST OVERCOME THE LAW OF ENTROPY IN ORDER TO GROW
  - a. MATTER
  - b. GENETIC INFORMATION
  - c. ENERGY
4. Parts of a seed
  - a. Seed coat
  - b. Embryo
  - c. Cotyledon
  - d. Endosperm
5. Four stages of growth

- a. Germination
      - b. Growth
      - c. Maturation
      - d. death
    - 6. See picture in the lesson
  - ii. Compare and contrast the structures of a monocot and a dicot
    - 1. Monocot have one *cotyledon* (seed leaf) such as grass; food is stored in the endosperm
    - 2. Dicots have two *cotyledons* (seed leaves) such as beans; food is stored in the seed leaves which are a part of the embryo; vascular rings and netted veins
  - iii. Differentiate between an annual and a perennial
    - 1. **Annual** plant completes its life cycle from germination to fruit and seed production within one year's time; rapid growth; DO NOT BEAR FRUIT OR FLOWERS EVERY YEAR
    - 2. **Perennial** plant shows slow uniform growth and seed production at different times throughout the year
    - 3. FLOWERING PLANTS ARE CALLED ANGIOSPERMS
  - b. Vocabulary
3. How do plants work?
- a. Objectives
    - i. Define agronomy
      - 1. Agro - agriculture; science that deals with crop production and improvement
      - 2. 100 BILLION PEOPLE IS THE GREATEST NUMBER THAT PLANTS HAVE THE POTENTIAL TO FEED
    - ii. Discuss the history and men involved in the search for "how plants grow?"
      - 1. Jan Baptista van Helmont: 300 years ago Belgian physician who determined soil alone does not provide food for plants; CONCLUSIONS PARTLY CORRECT, PLANT MASS RELATED TO H<sub>2</sub>O; LOSS OF SOIL MASS < GAIN OF PLANT MASS
      - 2. Joseph Priestly: 1771, English minister and chemist discovered oxygen AND THAT PLANTS ARE ASSOCIATED WITH O<sub>2</sub> AND ANIMALS REQUIRE O<sub>2</sub>
      - 3. Jan Ingenhousz: 1779, Dutch physician working off Priestly, discovered that plants only replenished oxygen in sunlight
      - 4. Nicholas Theodore de Saussure: 1804, Swiss chemist demonstrated the importance of water and carbon dioxide, and that equal amounts of carbon dioxide and oxygen are exchanged during photosynthesis; QUANTIFIED THE PROCESS OF PHOTOSYNTHESIS
      - 5. THE ENERGY REQUIREMENTS OF ALL ORGANISMS ARE LINKED TO THE SUN BY PHOTOSYNTHESIS
    - iii. Understand and write the equation for photosynthesis

1.  $\text{CO}_2 + \text{H}_2\text{O} + \text{light} + \text{chlorophyll} \rightarrow (\text{CH}_2\text{O})_n + \text{O}_2$
  2.  $(\text{CH}_2\text{O})_n$  corresponds to a variety of carbohydrates whether simple glucose, fructose, sucrose, starches, or cellulose
    - a.  $N=6$  for glucose
    - b.  $N=11$  for sucrose (table sugar)
  3. Balanced equation:  $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$
- b. Vocabulary
4. How do plants help people?
- a. Objectives
    - i. Discuss briefly the history of crop production to meet demand
    - ii. Explain the green revolution that is taking place in the world
  - b. Vocabulary

Other lessons:

☐ Parts of the plant cell

- ☐ Ribosomes
- ☐ Endoplasmic reticulum
- ☐ Golgi body
- ☐ Chromosomal material
- ☐ Nucleolus
- ☐ Nucleus
- ☐ Nuclear membrane
- ☐ Mitochondrion
- ☐ Chloroplast
- ☐ Cytoplasm
- ☐ Vacuole
- ☐ Vacuolar membrane
- ☐ Cell wall
- ☐ Plasma membrane

☐ Developmental Anatomy

☐ Root tip zones

- ☐ Root cap
- ☐ Meristem
- ☐ Differentiation
- ☐ elongation

- ☐ The regular growth of plants is due to the cells produced by meristematic tissue, which differentiate into cells of different nature and function according to what portions of the DNA that become active.
- ☐ Root cells elongate
  - ☐ The vascular cambium cells in the stem differentiate into phloem and xylem

- ☐ Xylem cells form the inner margin of a tree trunk and become part of the wood system; phloem cells are on the outer margin and become bark. The differentiation of vascular cambium causes lateral growth
- ☐ A closer look at Photosynthesis
- ☐ Respiration
  - ☐  $(CH_2O)_n + O_2 \rightarrow CO_2 + H_2O + \text{energy to produce ATP (adenosine triphosphate)}$
  - ☐ Glycolysis anaerobic occurs in cytoplasm
  - ☐ Krebs's cycle aerobic process and electron transport occur in mitochondria
  - ☐ Uses of energy produced via respiration
    - ☐ Maintenance
    - ☐ Repair
    - ☐ Making new molecules
    - ☐ Conducting nerve impulses
    - ☐ Production of light in bioluminescent organisms
    - ☐ Production of heat
    - ☐ Muscle movement