Southern Luzon State University
Accounting, Business and Management
Earth and Life Science
EXAMINATION REVIEWER

11-INTEGRITY | A.Y. 23 - 24, 1ST SEMESTER | Mr. Edarlen Portea Jr.

Earth and Life Science

COURSE OUTLINE

I. Flow of Energy in Living System
   A. Nature of Bioenergetics
   B. The Photosynthesis
   C. Cellular Respiration
   D. The Consumers
   E. Flow of Energy in an Ecosystem
   F. Ecological Pyramid
II. Reproduction of Life
   A. Plant Reproduction
   B. Animal Reproduction

Flow of Energy in Living System

Flow of Energy in Living System

Introduction

- The organisms that function in ecosystems like growing, running, breathing, and jumping need energy for them to function well. It is better for organisms to obtain energy or else it might be the end of their lives.

Nature of Bioenergetics

BIOENERGETICS

- is the study of energy in living systems and organisms.

ENERGY

- is very important to all organisms

Kinetic Energy

- is the energy in motion
- example: running

Potential Energy

- is the energy not in motion at all; stationary
- example: a car that is parked at the top of a hill.

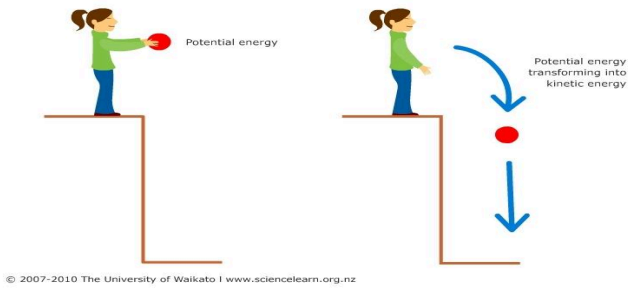

Figure 1. Potential and kinetic energy - Science Learning Hub

ENERGY REACTIONS

Endergonic Reaction

- is a chemical reaction that requires a net input of energy
- example: Photosynthesis
  - **Light (Solar Energy) + CO2 + H2O → C6H12O6 + O2**

Exergonic Reaction

- is a chemical reaction that releases energy
- example: Cellular Respiration
  - **C6H12O6 + O2 → CO2 + H2O + ATP**

METABOLISM

- is referred to as the sum total of the chemical activities of all cells

Anabolic Pathway

- consumes energy to build complicated molecules from simpler compounds
- example: Photosynthesis
  - **Light (Solar Energy) + CO2 + H2O → C6H12O6 + O2**

Catabolic Pathway

- releases energy by breaking down complex molecules into simpler compounds
- example: Cellular Respiration
  - **C6H12O6 + O2 → CO2 + H2O + ATP**

ADENOSINE TRIPHOSPHATE (ATP)

- is the energy currency of the cell.
- it is composed of nitrogenous base, a five carbon sugar, and phosphate group

PHOSPHORYLATION

- is the process of breaking the bonds of ATP

The Photosynthesis

PLANTS

- are autotrophs because they can produce their own food
- can convert carbon dioxide into oxygen and glucose (a common sugar consumed by most organisms through photosynthesis)

CHLOROPHYLL

- is the green pigment in plants stored in the chloroplast
- this pigment aids in capturing light energy from the sun that enables plants to change into chemical energy stored in the food
- absorbs white light, but it looks green because white light consists of primary colors; red, blue, green. only red and blue are being absorbed while the green is reflected which can be seen by the naked eyes

PHOTOSYNTHESIS

- allows the plants to use sunlight as a source of energy
- is the process of food making done by plants and other autotrophic organisms
- in plants, this takes place mainly in the leaves of the plants
  - **Upper and Lower Epidermis**
    - *protects the leaves*
  - **Mesophyll layer**
    - *most of the chloroplasts are found here*
  - **Vascular Bundles: Xylem & Phloem**
    - *serve as the transporting vessels of manufactured food and water*
  - **Stomata**
    - *carbon dioxide and oxygen are collected in the spongy layer and enter and exit the leaf through the stomata*

    - *Guard cells: main function is to allow gases such as carbon dioxide and oxygen, water vapor to move rapidly in and out of the leaf*
- factors that affect the rate of Photosynthesis
    - **Temperature**
    - **Amount of carbon dioxide and water**
    - **Availability of light energy**

Providing the right amount of these materials will ensure the quality and quantity of the harvest

- Light (Solar Energy) + 6CO2 + 6H2O → C6H12O6 + 6O2

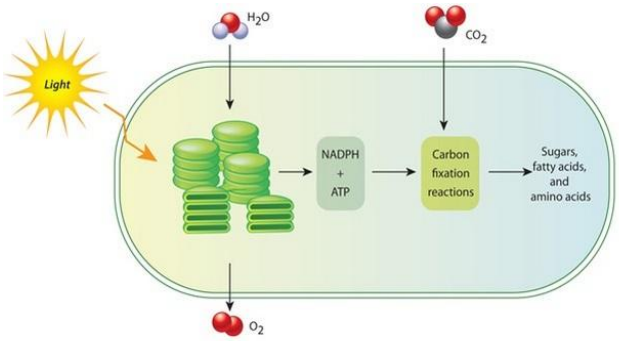

Figure 2. Photosynthesis, Chloroplast | Learn Science at Scitable

Light Dependent Reaction

- occurs in the presence of light
- occurs in the thylakoid membrane
- the energy being harvested is stored in the form of ATP and NADPH

Calvin Cycle (Dark Reaction)

- a light independent reaction that takes place in the stroma
- occurs immediately after the light reaction

Cellular Respiration

RESPIRATION

- food is broken down to release energy in a form of ATP in the presence of oxygen
- it takes place in the mitochondria of the cell
- the food must be digested to simple forms such as glucose, amino acids and triglycerides
- in order for the cell to convert the chemical energy in a form of ATP, the glucose must be broken down into high energy molecule
- C6H12O6 + 6O2 → 6CO2 + 6H2O + ATP

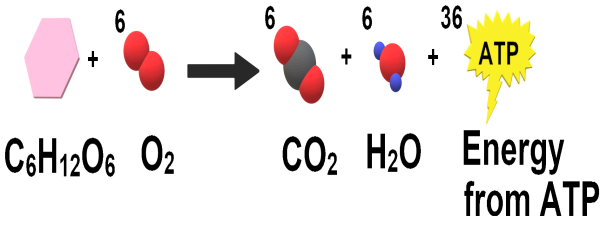

Figure 3. 15 Intriguing Facts About Cellular Respiration - Facts.net

The Consumers

CONSUMERS

- organisms that eat plants or other organisms to get energy; heterotrophs
- solar energy → chemical energy → kinetic energy → heat energy
- different types of consumers:
    - **Herbivores**
        - *feed on plants, primary consumers*
        - *examples: cow, elk, carabao, buffalo*
    - **Carnivores**
        - *feed upon other animals*
        - *examples: wolf, lion, crocodile*
    - **Omnivores**
        - *eat both plants and animals*
        - *examples: pig, gorilla, bear, human*
    - **Detritivores**
        - *utilize the wastes from all levels*
        - *examples: millipedes, flies, worms*

Energy cannot be created nor destroyed

Flow of Energy in an Ecosystem

ENERGY

- passes through trophic levels in the ecosystem
- one of the most important species interactions is who eats who

TROPHIC LEVELS

- show the rank in the feeding hierarchy among biotic among living organisms: producers, consumers and detritivores and decomposers
    - **Producers**
        - *are in the first trophic level*
        - *autotrophs or "self-feeders" are organisms that capture solar energy for photosynthesis to produce glucose (e.g. plants, cyanobacteria and green algae)*
        - *CHEMOSYNTHETIC BACTERIA:*
            - *use geothermal energy in hot springs or deep-sea vents to produce their own food*
            - *are not plants, but are still producers*
    - **Consumers**
        - *consume producers*
        - *are classified as primary consumers*
        - *second trophic level*
        - *herbivores consume plants like goat, cow, and grasshoppers*
    - **Secondary Consumers**
        - *belong in the thor trophic level*
        - *prey on primary consumers*

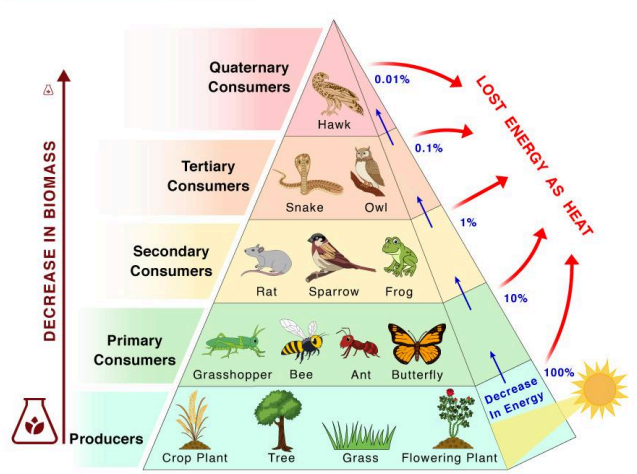

Figure 4. Trophic Level - Definition, Examples, and Diagram

FOOD CHAIN

- shows the relationship of how energy is transferred up the trophic levels

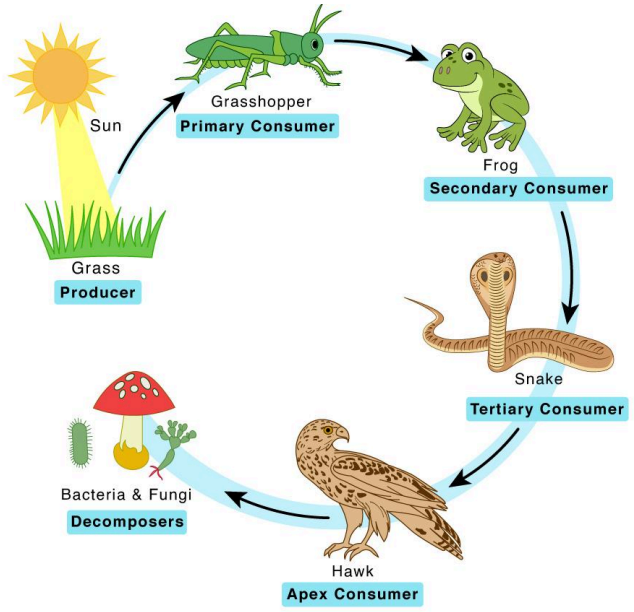

Figure 5. Grassland Food Chain - Examples and Diagram

- as it flows, energy is alternately stored and used to the life processes of animals through which it moves
- What will happen if one member of the ecosystem is removed from the food web?
    - The loss of such a species has the ability to alter the distribution and abundance of other species within the network as well as to disrupt a number of relationships.

FOOD WEB

- is a pattern of food chain that interlocks and forms a network
- is a diagram of the links among species in an ecosystem
- a horizontal illustration among consumers
- represents an attempt to describe the numerous alternative food energy pathways in a community
- *proves that we all need each other and no one will live in this world without the help of one another*

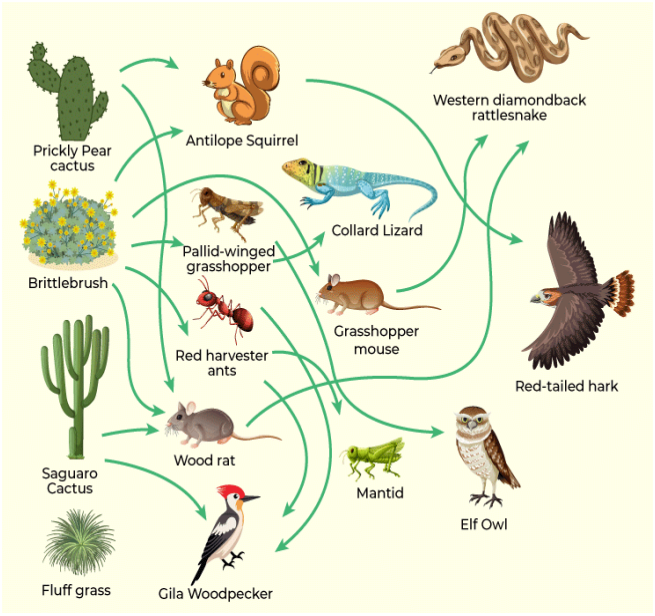

Figure 6. Food Chains and Food Webs - GeeksforGeeks

DECOMPOSERS

- are responsible for breaking down the complex organic compounds into simpler nutrients
- the nutrients from the decomposed organism will remain in the soil and will help in the growth of plants

FOOD CHAINS/WEBS

- show how matter and energy move from one organism to another through an ecosystem
- each trophic level contains a certain amount of biomass
    - *chemical energy stored in biomass is transferred from one trophic level to the next*
    - *with each trophic transfer, some usable energy is degraded and lost to the environment as low quality heat*
        - 1000 kg → 100 kg → 10 kg
        - 900 kg low quality heat, 100 kg stored energy

ECOLOGICAL EFFICIENCY

- is the percentage of usable energy transferred as biomass from one trophic level to the next
- use 10% as a rule of thumb

Law of Thermodynamics

- *the amount of energy flowing through the biosphere obeys basic principles*

Ecological Pyramid

INTRODUCTION

- food is broken down to release energy in a form of ATP in the presence of oxygen

Productivity

- refers to the amount of energy stored in chemical compounds of plants

Gross Primary Productivity

- refers to the rate at which organic matter is produced during photosynthesis

Net Productivity

- is the rate at which this organic matter stored in plants produces growth

PYRAMID OF ENERGY

- 100% → 10% → 1%
- 90% low quality heat, 10% stored energy

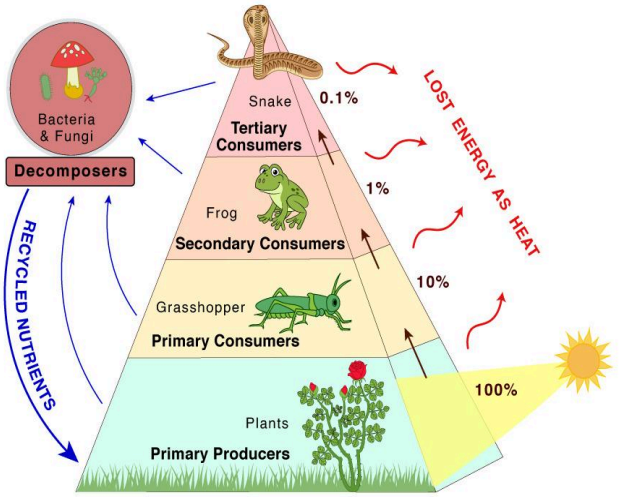

Figure 6. Energy Pyramid – Definition, Trophic Levels, and Example

PYRAMID OF BIOMASS

- 1000 kg → 100 kg → 10 kg
- 900 kg low quality heat, 100 kg stored energy

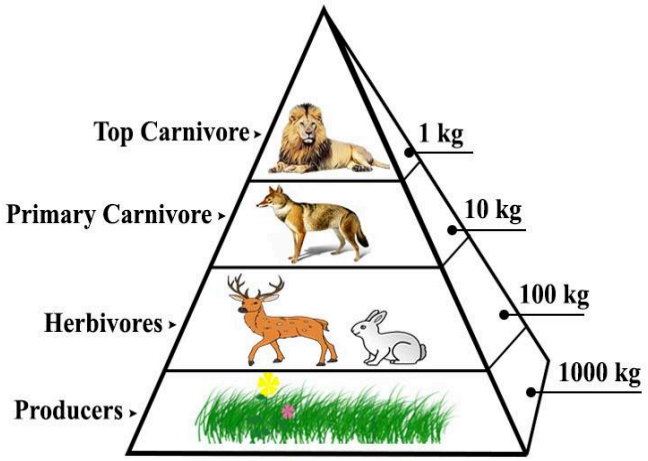

Figure 7. Pyramid of biomass indicates?A) Biotic potentialB) Standing cropC) Standing stateD) Productivity

PYRAMID OF NUMBERS

- the number of producers is greater than the number of consumers
    - *Example: there is a need for a large amount of grass to feed two goats because of the mass and size of the producer which is the grass*

INVERTED PYRAMID

- we can use a small amount of producer to feed a large quantity of consumers, depending on the size of the producers
    - *Example: there is only one mango tree to feed one hundred children*
- **Carbon Cycle**
    - *is linked to the flow of energy in the ecosystem*
    - *carbon enters the living portion of the carbon cycle through photosynthesis, then organisms release it through cellular respiration*
    - ***Example: burning of coal***

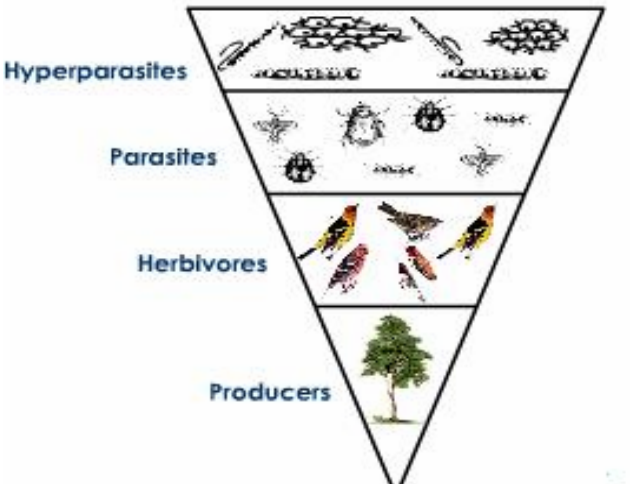

Figure 8. In parasitic food chain, the pyramid of numbers is

Reproduction of Life

Reproduction of Life
Introduction

- Reproduction is one of the important aspects and functions of an organism for the existence of its species
- Organisms, plants and animals, reproduce by means of gametes or without the gametes

Plant Reproduction

PLANTS

- are eukaryotes are many celled and most contain the green pigment chlorophyll
- can be vascular or non-vascular
    - **Non-vascular Plants**
        - *plants that have no vessels or no internal system*
        - *live either in water or within moist habitats*
        - *Example: mosses (bryophytes)*
    - **Vascular Plants**
        - *plants that have vessels or an internal system*
        - *have roots, leaves, stems, and even flowers*
        - *Example: trees, bushes, stems, and even flowers (tracheophytes)*

Vascular Plants

- Gymnosperms
    - *means naked seed;*
    - *produce seeds on the scales of female cones;*
    - *seeds are not protected by a fruit;*
    - *with needle-like or scale-like leaves;*
    - *have no flowers and large plants;*
    - *adapted for reproduction on dry land*
    - *reproduce by means of sperm develop within pollen grains that are dispersed by the wind;*
    - ***Examples: pine trees, tobacco, rice, corn***
- Angiosperms
    - *means seed in a container; →* ***ripe mango***
    - *seed is enclosed inside a fruit;*
    - *produce flowers and true seed-bearing plants;*
    - *can be monocots and dicots*

Basic of Comparison	Monocots (Monocotyledon)	Dicots (Dicotyledonae)
SEED	One cotyledon	Two cotyledons

STEM	Scattered vascular bundles	Vascular bundles in rings
LEAVES	Parallel veins in leaves	Netlike veins in leaves
FLOWERS	Flower parts in threes	Flower parts in fours or fives
SECONDARY OR WOODY GROWTH	Absent	Present
EXAMPLES	*corn, rice*	*watermelons, lettuce, rose, and other garden flowers*

Sexual Reproduction
- *requires gametes for the fertilization to occur*

Asexual Reproduction
- does not need fertilization or union of two gametes

Asexual Reproduction

- Vegetative Propagation
  - **Budding**
    - *a bud outgrows from the parent organism and detaches itself later to become a new but the same organism as the parent*
  - **Marcotting**
    - *develop roots in the stem of a parent plant for several days after putting soil in it*
  - **Grafting**
    - *when a scion (shoot of one plant) is inserted into the stem of another plant (same species or closely related)*
  - **Kalanchoe stem and leaf cuttings**
    - *the cut stem and leaf are placed in loose, moist soil, the cuttings readily grow adventitious roots and develop new shoots*
  - **Plantlets (e.g. kalanchoe)**
    - *tiny new plants which develop in the notches along the leaf margins*
    - *beings to grow but removing and potting is the fastest way to propagate new maternity kalanchoe plant*
- Tissue Culture
  - **a technique for growing species of living tissue in artificial media**
  - **first demonstrated by the botanist *F.C. Steward in 1958***
- Modified Stems

Types of Stem	Characteristics	Function	Examples
STOLONS/ RUNNERS	- horizontal & above ground stem - creeping stems	- spreading growth - asexual reproduction	strawberry
TUBERS	- enlarged underground stem	- food storage	potato, sweet potato
RHIZOMES	- long and underground stem - fleshy and parallel to the ground (magkakakapit)	- food storage	ginger
BULBS	- thickened bases of leaves	- food storage in leafy scale	onion, garlic
CORMS	- vertical, thick, and short underground stem	- food storage	gabi or taro stem
SUCCULENTS	- fleshy, often leafless stem	- water storage	cactus

Flowers

- are the reproductive organs of the plants which contains the male part (stamen) and the female part (pistil)
- ***Example: Gumamela***
  - Perfect Flower
    - *has complete accessories (petals & sepals)*
  - Complete Flower
    - *has complete gametes (sperm & egg)*

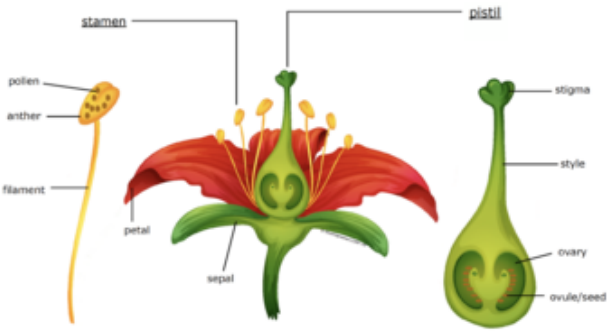

Figure 9. Label the flower parts — Science Learning Hub

Parts of a Flower (Reproduction)

- Stamen
  - ***male part of the flower***
- Anther
  - ***small sac that produces pollen grains*** *which are immature (male gametophyte)*
- Filament
  - *tube-like structure that **supports the anther** and where pollen grains pass through the anther*
- Pistil
  - ***female part of the flower***
- Stigma
  - *sticky and feathery surface on which **pollen grains land and grow***

- Style or Stalk
  - *slender tube which **connects the stigma to the ovary** and where the pollen reach down the ovary*
- Ovary
  - *holds the ovules and later becomes the fruit*
- Ovules
  - *if fertilized will eventually become the seed*

Accessory Parts of a Flower

- Sepals
  - *make up the **outermost portion of the flower** and sometimes colored and resembled petals*
- Calyx
  - ***all of the sepals together** form this part, serves as a protective covering for the flower bud*
- Petals
  - *brightly colored and **often have perfume or nectar at their bases***
- Corolla
  - ***made up of the flower's petals** and provides a surface for insect pollinators to rest on while feeding*

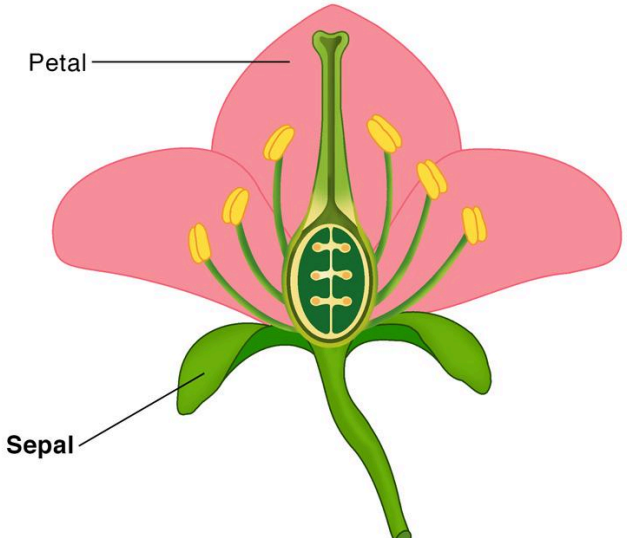

Figure 10. Sepals - Definition, Meaning, Function & Diagram

Pollination

- is the process by which pollen grains are being transferred by pollinators from the anther of the stamen to the stigma of the pistil
  - **Self-pollination**
    - *pollen grains from the anther of the stamen transfers to the stigma of the pistil of the same flower or another flower of the same plant*
  - **Cross Pollination**
    - *pollen grains from the anther of the stamen transfers to the stigma of the pistil of the flower from one plant to another*

Double Fertilization

- involves two sperm cells; **one fertilizes the egg cell to form the zygote**, while **the other fuses with the two polar nuclei that form the endosperm**
- after fertilization, **the fertilized ovule forms the seed** while **the tissues of the ovary become the fruit**
- in the first stage of embryonic development, the **zygote divides to form two cells**; one will develop into a suspensor, while the other gives rise to a proembryo
- in the second stage of embryonic development (in eudicots), the developing embryo has a heart shape due to the presence of cotyledons
- as the embryo grows, it begins to bend as it fills the seed; at this point, the seed is ready for dispersal

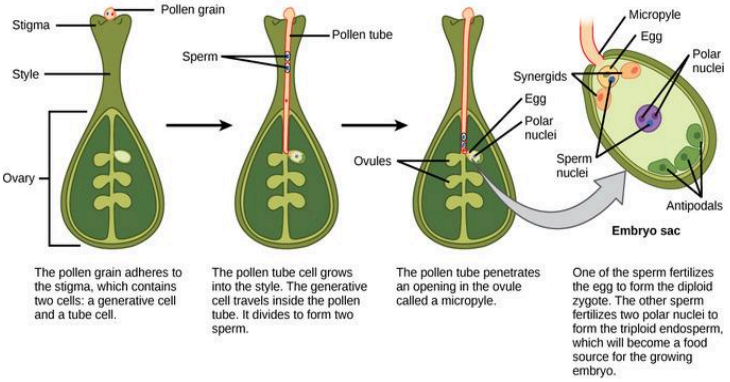

Figure 11. Double Fertilization | Biology for Majors II

What is the difference between pollination and fertilization?

- *Pollination is the transfer of pollen from the anther of one plant to the stigma of the same or another plant. Fertilization is the joining of a sperm (from the pollen grain) with the egg in the ovule.*

Animal Reproduction

Animals

- can produce in two ways: sexual or asexual
- *Reproduction* is a cellular process by which an organism produces others of the same kind

Asexual Reproduction

- does not require the union of two gametes and produces an offspring of the same characteristic (have identical DNA) as the parent
- an offspring produced asexually is a clone
- *Example: mitosis*

Several types of Asexual Reproduction

- **Fission**
  - *is the division of an organism into two equal parts (binary fission) or more individuals (multiple fission)*
  - ***Example: bacterial cells and planaria***

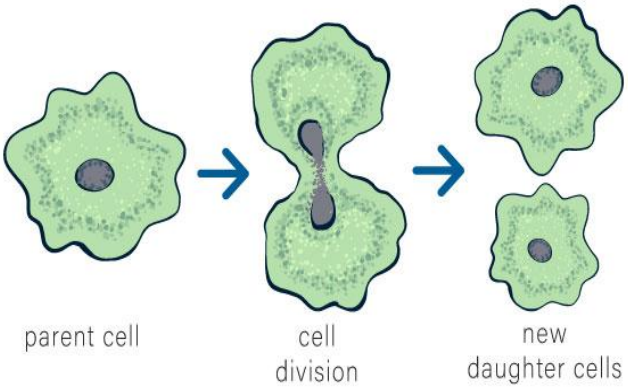

Figure 12. What are binary fission and multiple fission in asexual reproduction?

- **Fragmentation & Regeneration**
  - *when an organism breaks into two parts or fragments, both parts regenerate to form a whole*
  - ***Example: starfish, sponges, lizards***

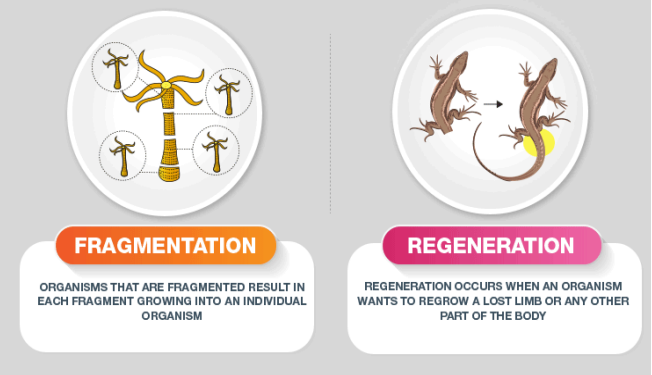

Figure 13. What is the Difference Between Fragmentation and Regeneration

- **Budding**
  - *a new organism grows from the body of the parent organism*
  - ***Example: hydra, jellyfish, and corals***

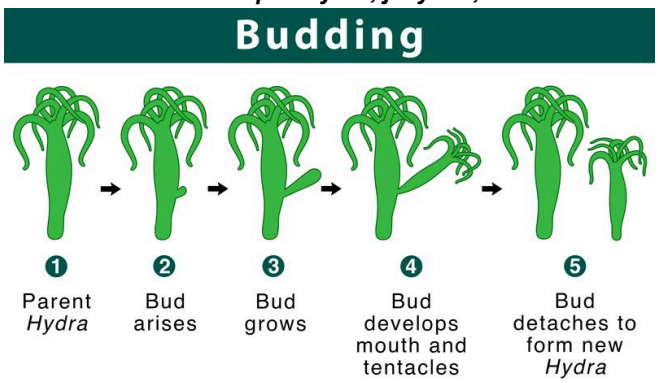

Figure 14. Budding: Definition & Types with Examples & Diagram

- **Parthenogenesis**
  - *requires an egg to develop into new organism without undergoing fertilization*
  - ***Example: bees and parasitic insects***

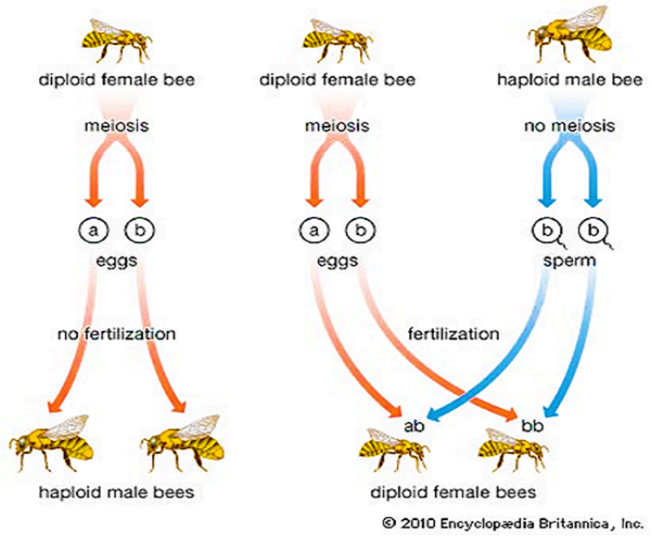

Figure 15. BIL 360 - Lecture 13a

What is the difference between Binary Fission and Budding?

- *In Binary Fission, the parent cell disappears and there is equal separation. In Budding, the parent cell is bigger than the daughter cell.*