

What is nutrition?

It is the science of the nutrients and "other substances" in food:

- Their action, interaction, and balance in relation to health and disease
- The processes by which the organism ingests, digests, absorbs, transports, utilizes and excretes food substances

What is Nutrients?

- Substances that we must have in our diets in order for our cells to function properly

- Include:

1-Proteins 2-Carbohydrates

3-Lipids 4-Vitamins

5-Minerals 6- Water

Digestion: How do we get nutrients from food.

Animals ingest their food in a variety of ways

- **Animals obtain and ingest their food in different ways**
 - 1) **Suspension feeding**
 - 2) **Substrate feeding**
 - 3) **Fluid feeding**
 - 4) **Bulk feeding**

Stages of food processing:

- **Food is processed in four stages**
 - 1) **Ingestion**
 - 2) **Digestion**
 - 3) **Absorption**
 - 4) **Elimination**

Digestion:

There are two types of digestion

1. **Mechanical digestion:** breaks food down into smaller pieces
2. **Chemical digestion:** enzymatic break down of large organic molecules into their components

A healthy diet satisfies three needs:

- 1) Fuel to power the body**
- 2) Organic molecules to build molecules**
- 3) Essential nutrients — raw materials that animals cannot make for themselves like vitamins, minerals and the essential amino acids**

Chemical energy powers the body:

- Nutrients are oxidized inside cells to make ATP**
- Proteins, carbohydrates, and fats are the main sources of calories**
- Basal metabolic rate (BMR): energy a resting animal requires each day**
- Metabolic rate: BMR plus the energy needed for physical activity**
- Excess energy is stored as glycogen or fat**
- Our metabolic rates typically decrease throughout adulthood**

Essential vitamins:

- **Main function is to allow chemical reactions to occur in body**
 - **Required in minute amounts**
 - **Help release energy trapped in carbohydrates, lipids and proteins**
- **13 vitamins divided into 2 groups:**
 - **Fat soluble- A, D, E, K**
 - **Water soluble- C and B vitamins**

Minerals:

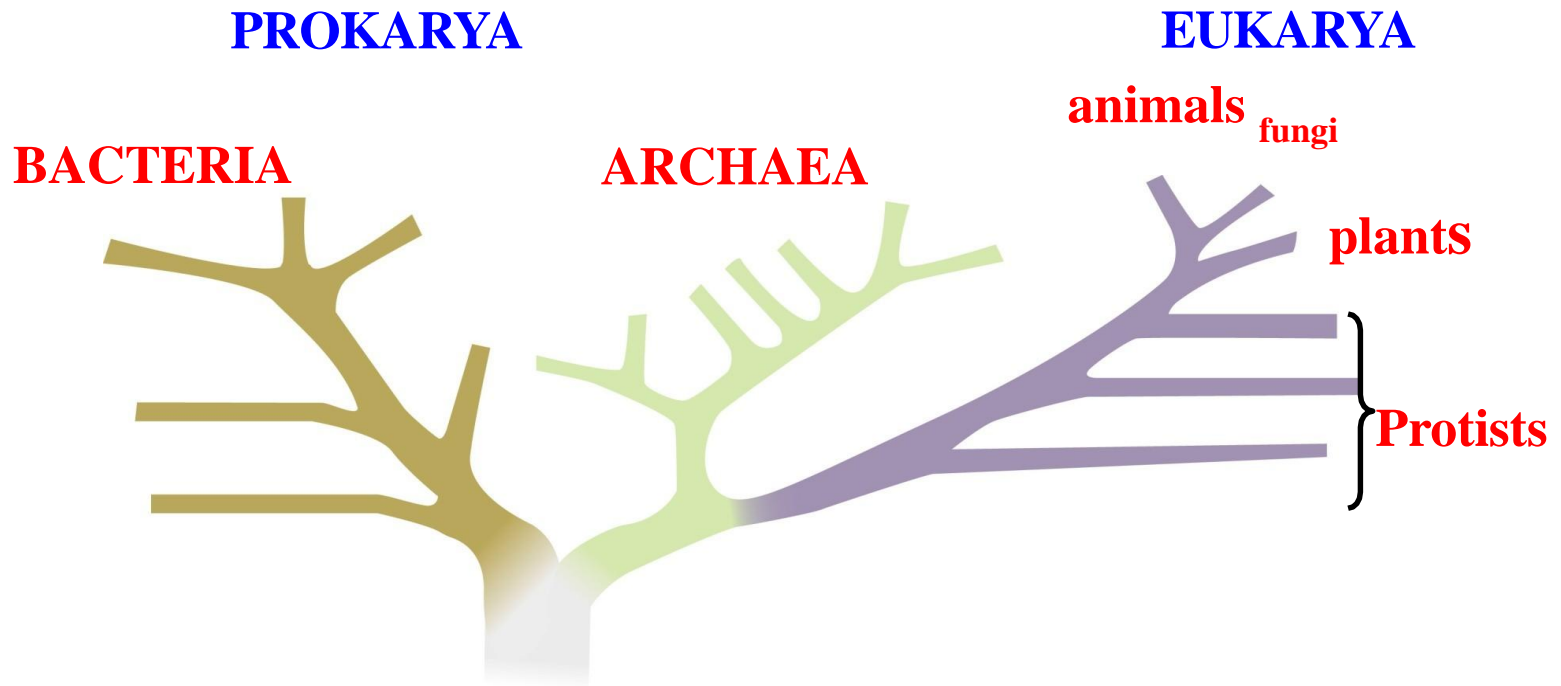
- **Minerals are simple inorganic nutrients include:**
- **Na⁺, K⁺ and Mg⁺⁺ which usually required in small amounts**
- **Ca⁺⁺ and PO₄³⁻ which are required in larger amounts**
- **They are critical for nervous system function, maintaining electrolyte levels, water balance, and skeletal system**

BIOLOGICAL DIVERSITY \ Means \ BIODIVERSITY

- Organisms are placed into categories on the basis of their evolutionary relationships.
- These categories form a nested hierarchy in which each level includes all the ones before it.
- There are eight major categories:
 - Domain, kingdom, phylum, class, order, family, genus, species.

What Are The Domains of Life?

- There are three domains in life: **Bacteria**, **Archaea**, and **Eukarya**.



- The scientific name of an organism is a two-part name formed from the genus and species categories.
- Each genus includes a group of closely related species, and within each species are individuals that can interbreed.
 - The species name is never used alone but is always paired with its genus name.

- Kingdom-level classification remains unsettled.
- Biologists recognized:
 - 15 kingdoms among the Bacteria.
 - 3 kingdoms in the Archaea
 - 4 kingdoms among the Eukarya, these are
 - Animals
 - Plants
 - Fungi
 - Protists (Protista)

Bacteria and Archaea

- **Earth's first organisms were prokaryotes**
 - **In terms of abundance, prokaryotes are Earth's predominant form of life.**
 - **Prokaryotes include Bacteria and Archaea**
 - **They are single-celled microbes that lacked organelles such as a nucleus, chloroplasts and mitochondria.**
- **Bacteria and Archaea are fundamentally different.**
 - **Bacterial cells contain molecules of the polymer peptidoglycan, which strengthens the cell wall.**
 - **They also differ in the structure and composition of the plasma membrane, ribosomes, and RNA polymerases, as well as in the processes of transcription and translation.**

Domain Eukarya

Domain Eukarya is divided into four kingdoms:

- **Protists** (everything that doesn't fit into the other three kingdoms)
- **Plants**
- **Fungi**
- **Animals**

Protists

- **The protists are eukaryotes that are not a plant, an animal, or a fungus.**
 - **Most protists are small and single-celled.**
 - **Protista have both positive and negative effects upon humans and other organisms.**
 - **Some of the larger protists are colonies of single-celled individuals, while others are multicellular organisms.**

Plants

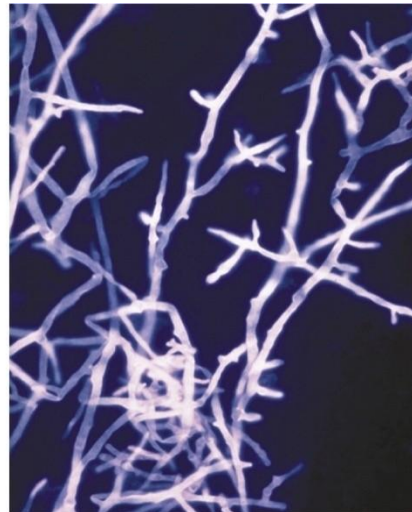
Properties that distinguish plants from other organisms:

- **Plants have chlorophyll for photosynthesis.**
- **Plant reproduction features alternation of generations.**
- **Plants have dependent embryos.**
- **Plants have roots or root-like structures that anchor it and absorb water and nutrient from the soil.**
- **Plants have a waxy cuticle that covers the surface of leaves and stems, limiting water loss.**

Fungi

- **Fungi have distinctive adaptations.**
 - A typical fungus is a **mushroom**, which is actually the reproductive part of a more extensive organism.
 - Fungi feed off **dead material** by secreting that digestive fluids break down their food **outside** of their bodies.
 - The body of a fungus is called a **mycelium** and is one-cell thick.
 - The mycelium is made up of extensive numbers of filaments called **hyphae**, which grow across a food source.

Mycelium



Hyphae

Animals

Characteristics of animals:

1. **Animals are multicellular.**
2. **Animals get their energy by consuming other organisms.**
3. **Animals reproduce sexually.**
4. **Animal cells lack a cell wall.**
5. **Animals are mobile.**
6. **Animals react rapidly to external stimuli.**

■ For convenience, animals are categorized as:

- 1- **Vertebrates**)with **backbones**)
- 2- **Invertebrates**)without **backbones**)

■ **Arthropods are the dominant animals on Earth. They includes :**

- 1- **Insects**
- 2- **Arachnids**
- 3- **Crustaceans.**

- **They all have an exoskeleton.**

REPRODUCTION and CELL DIVISION

Methods of Reproduction

Living organisms reproduce by **two** methods

1. Asexual reproduction

- Offspring are identical to the original cell or organism
- Involves inheritance of all genes from **one** parent
- Prokaryotes reproduce asexually by binary fission.

2. sexual reproduction

- Involves inheritance of unique sets of genes from two parents
- Offspring are similar to parents, but show **variations** in traits

Prokaryotes reproduce by binary fission

- **Binary fission means “dividing in half”**
 - **Occurs in prokaryotic cells**
 - **Two identical cells arise from one cell**
 - **Steps in the process:**
 - **A single circular chromosome duplicates, and the copies begin to separate from each other**
 - **The cell elongates, and the chromosomal copies separate further**
 - **The plasma membrane grows inward at the midpoint to divide the cells**

Eukaryotic Cell Division and Cell Cycle

The cell cycle is an ordered sequence of events for cell division.

- Cells divide when they reach a certain size.
- The cell cycle consists of **two** stages

1. **Interphase:** Includes G₁, S, and G₂ phases during which cell contents are duplication .

G₁: first gap phase, growth and prepares for S-phase

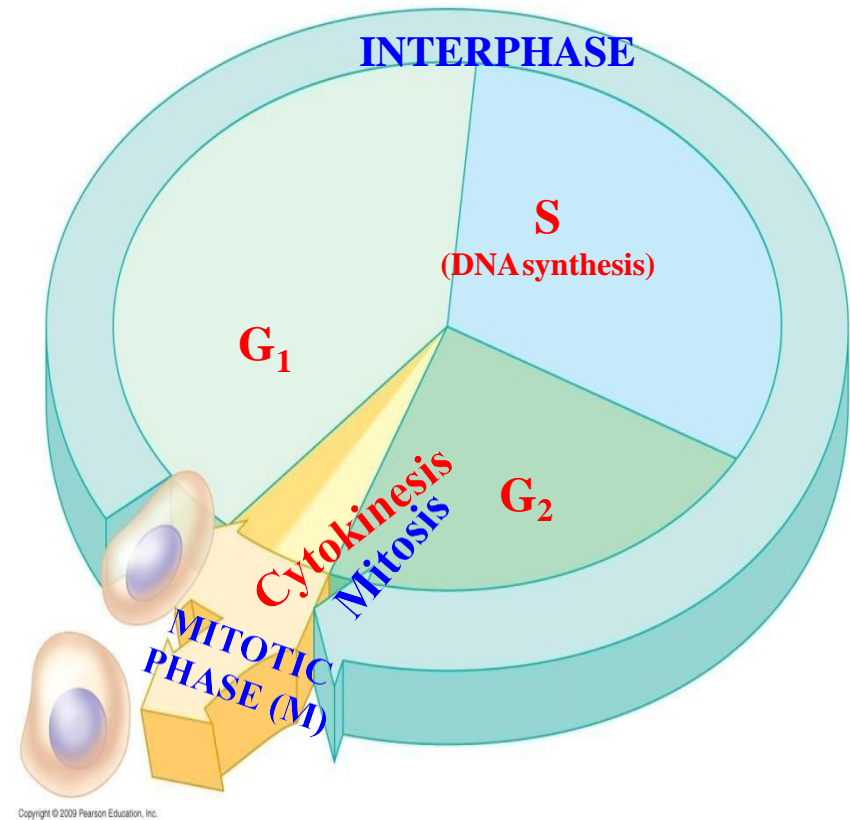
S: DNA synthesis phase, duplication of chromosomes, each becomes two sister chromatids

G₂: second gap phase, growth and preparation for division

2. **Mitotic phase:** (the M phase) involves mitosis and cytokinesis.

Mitosis: division of the chromosomes

Cytokinesis: division of cytoplasm



The eukaryotic cell cycle

Mitosis is a process where a single cell divides into two identical daughter cells (cell division) containing the same amount of genetic information in the parental cell and it occurs in somatic cells

Meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information in the parental cell and it occurs in sex cells of the human body (sperm cell and egg cell)

What are 4 major differences between mitosis and meiosis?

Mitosis gives two nuclei, and hence two cells, while **meiosis** gives four cells.

Mitosis gives identical cells to each other and to the mother cell, while

Meiosis leads to genetic variation due to crossing over and independent assortment.

Mitosis gives nuclei with the same number of chromosomes as the mother cell while **Meiosis** gives cells with half the number.

Mitosis includes one division, while

Meiosis includes two divisions.