

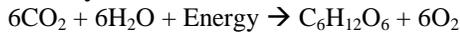
2.3 Use cellular evidence (such as cell structure, cell number, and cell reproduction) and modes of nutrition to describe six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).

- **Six Kingdom System of Taxonomy**- Animal, Plant, Fungi, Protist, Eubacteria, & Archaeobacteria

2.4 Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.

Photosynthesis is the process by which autotrophs convert light energy to chemical energy by producing organic compounds. Photosynthesis occurs because of the presence of pigments, which absorb certain wavelengths of light while reflecting others.

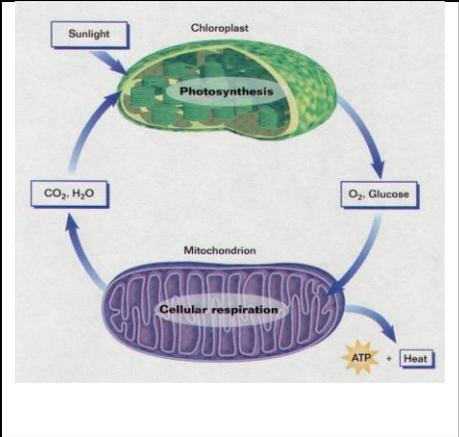
Photosynthesis



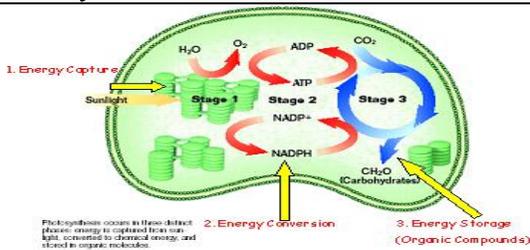
Cellular Respiration



Cellular Respiration- the process by which living organisms harvest the energy in food molecules. This occurs when glucose molecules are broken down through a series of chemical reactions which produces ATP. The foods we eat provide our bodies with the raw materials for cellular respiration, which converts proteins, carbohydrates, and lipids into ATP. The O₂ in the air that we breathe makes this process more efficient



Photosynthesis



Three Stages of Photosynthesis:

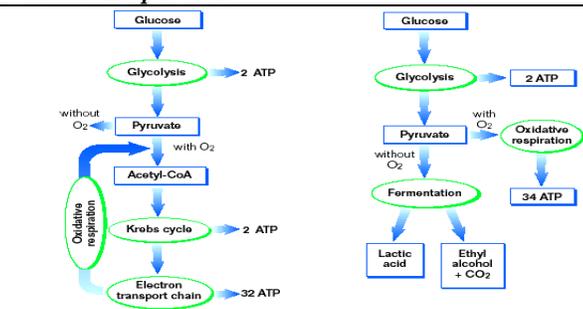
Light Dependent Reactions:

1. **Energy Capture**-water is split into hydrogen ions, electrons, and oxygen. (occurs in the Grana/Thylakoids)
2. **Energy Conversion**-NADPH and ATP are produced. (occurs across the Thylakoid Membrane)

Light Independent Reaction:

3. **Energy Storage-The Calvin Cycle**: The products of the LDR(stored chemical energy in ATP and NADPH) powers formation of organic compounds, using CO₂ (occurs in Stroma).

Cellular Respiration



1. Glycolysis- “to break apart a sweet” Glucose is converted to pyruvate, producing a small amount of ATP and NADH (4 ATP are produced, but two are consumed for a net of 2 ATP). (Glycolysis occurs in the Cytoplasm).

- 2a. **Aerobic**, which requires oxygen produces 36 molecules of ATP for each molecule of glucose. (occurs in mitochondria)
- 2b. **Anaerobic**, which does not require oxygen- produces only 2 molecules of ATP for each molecule of glucose.

Alcoholic Fermentation-Produces CO₂ and Ethanol (alcohol).

Lactic Acid Fermentation-Produces lactic acid (think yogurt).

2.5 Explain the important role that ATP serves in metabolism.

- **Energy and ATP**-When our bodies digest food some energy is released as heat, but the majority of the energy is stored temporarily in molecules like ATP, the energy “currency” utilized by cells. This energy is used to power chemical reactions.
- **ATP (Adenosine Triphosphate)**-an organic energy-storing molecule that consists of three distinct parts: ribose (a 5 carbon sugar), adenine (a nitrogen base), and three phosphates. The energy in a molecule of ATP is stored in the bonds between the phosphate groups. When the bonds are broken during ATP Hydrolysis energy is released and **ADP (Adenosine Diphosphate)** is created. Cells will continuously replace the supply of ATP by attaching a phosphate to an ADP molecule during cellular respiration. ATP synthesis occurs at a rate of approximately 10 million molecules per second/per cell. This interplay is called the **ATP/ADP Cycle**. Energy from ATP is used to provide energy for mechanical functions like muscle cell contraction, to provide energy for Active transport, and to synthesize and break down molecules in cells.

2.6 Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.

- **Mitosis**-a process during cellular division in which the nucleus of a cell divides into two nuclei each with the same number and kind of chromosomes.

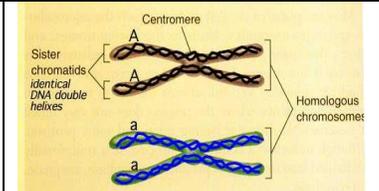
Chromosome-a structure made of DNA and associated proteins on which genes are located. DNA condenses from **chromatin** into chromosomes before the process of cellular reproduction

Chromatin-a thin, tangled bundle of DNA threads found in the nucleus during interphase.

Centromere-the point where sister chromatids are joined

Sister Chromatids-identical copies of genetic material attached at **centromere**

Homologous Chromosomes-pairs of Chromosomes that are similar in size, shape, and genes

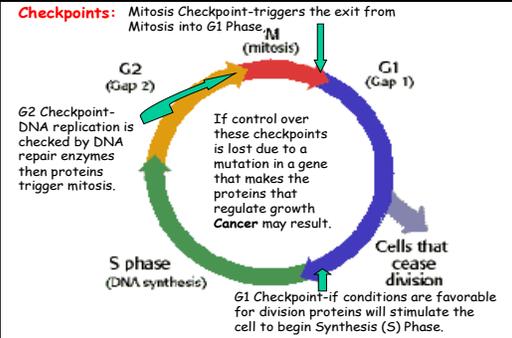


Cell Cycle-a repeating 5-phase sequence of eukaryotic cellular growth and division.

Interphase-a period of cell growth and preparation that occurs between periods of division. It is the longest part of the cell cycle (90%) and consists of three parts G1, S, & G2 phases.

The Cell Cycle

1. **G1**-cell grows rapidly, normal cellular functions, DNA=Chromatin
2. **S**-DNA Replication
3. **G2** -Cell prepares for division, synthesis of organelles, microtubules are assembled, centrioles in animals replicate
4. **Mitosis**-nucleus of the cell is divided (1-hour)
5. **Cytokinesis**-division of cytoplasm



Mitosis-a process during cellular division in which the nucleus of a cell divides into two nuclei each with the same number and kind of chromosomes. **IPMAT**

Prophase: 1. Chromatin condenses, 2. Nuclear envelope and nucleolus dissolve, 3. Centrioles migrate to poles, 4. Spindle forms

Metaphase:

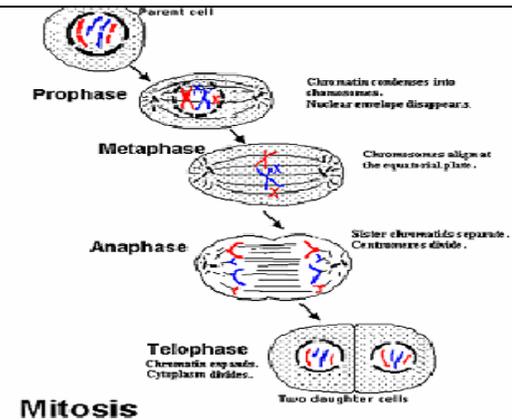
1. Chromosomes align along equator (metaphase plate) 2. Spindle fibers link chromatids to opposite poles of cell

Anaphase:

1. Centromeres divide, 2. Chromatids pulled to poles as spindle fibers shorten. Once separated chromatids become two identical sets of daughter chromosomes.

Telophase: 1. Nuclear envelope forms, 2. Chromosomes uncoil, 3. Mitotic Spindle dissolves, 4. Cytokinesis begins along a cleavage furrow

Cytokinesis: Cytoplasm of cell divides in half Cell membrane grows to enclose each cell



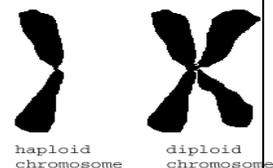
2.7 Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the process of fertilization.

Haploid (n)-“single vessel” referring to a cell having one set of chromosomes. Haploid cells are gametes (sex cells)

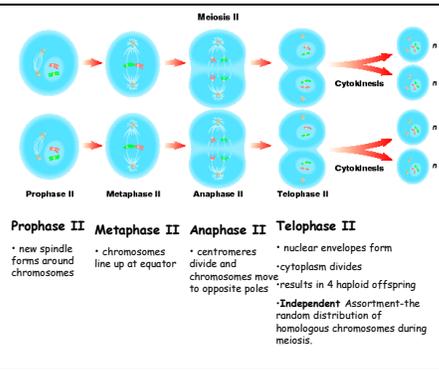
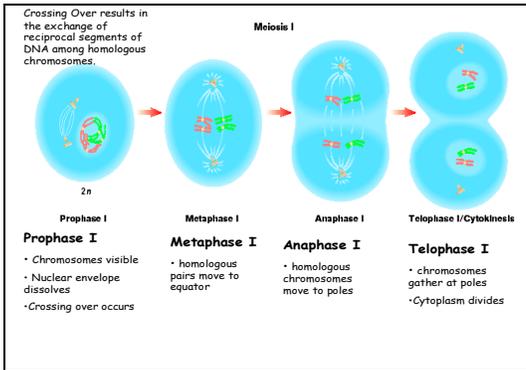
Gamete-reproductive cells such as sperm or egg they are haploid cells that participate in fertilization by fusing with another haploid cell.

Diploid (2n)-“double vessel” referring to a cell having two sets of chromosomes. Diploid cells are somatic (body/non-sex cells)

Zygote-fertilized egg. The fusion of two haploid cells forms a zygote.



Fertilization-The fusion of two haploid gametes to form a diploid zygote (a fertilized egg), the first cell of a new individual

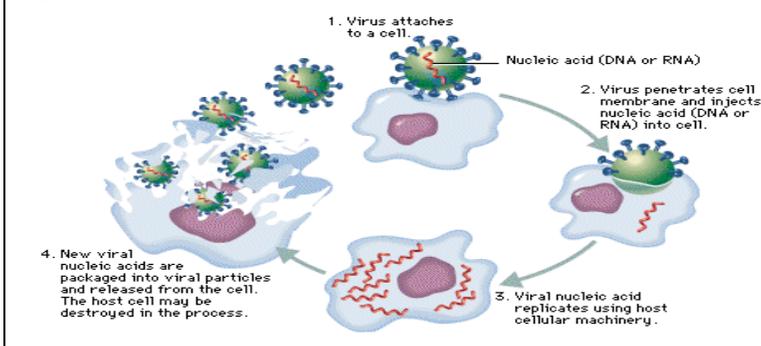


Meiosis-a type of cellular reproduction in which the number of chromosomes is reduced by half so that daughter cells are haploid (n).

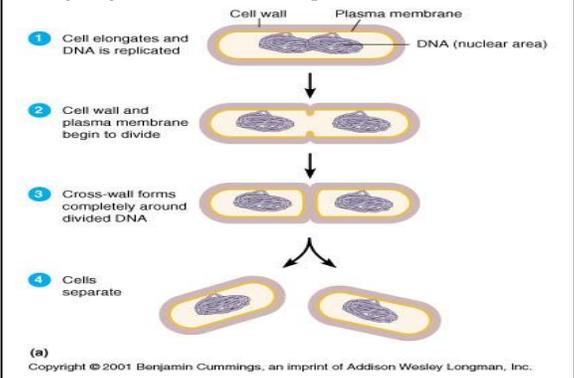
- allows chromosome number to remain stable over multiple generations
- in humans meiosis yields 4 haploid cells with 23 chromosomes

2.8 Compare and contrast a virus and a cell in terms of genetic material and reproduction.

Virus Replication-Once a virus has "infected" a cell, it will use the cell's ribosomes, enzymes and much of the cellular machinery to reproduce



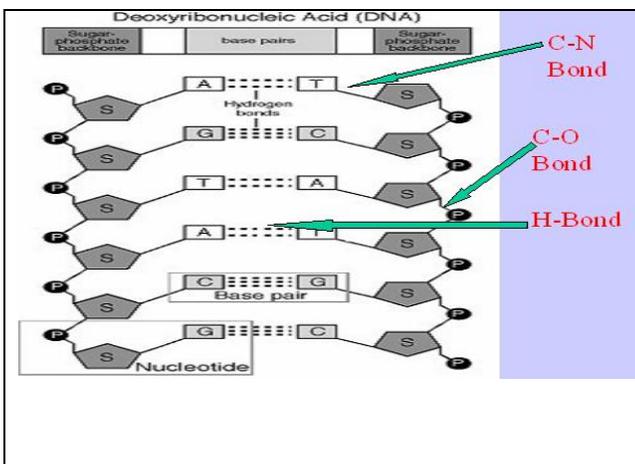
Binary Fission-bacterial replication-bacteria are living organisms and can reproduce on their own.



3. Genetics

Broad Concept: Genes allow for the storage and transmission of genetic information. They are a set of instructions encoded in the nucleotide sequence of each organism. Genes code for the specific sequences of amino acids that comprise the proteins that are characteristic of that organism.

3.1 Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.



DNA structure is double helix consisting of the following: Nucleotide:

- Deoxyribose (a five carbon sugar)
- Phosphate Group
- Nitrogen Base
 - Purines (Adenine & Guanine) Double Ring of C and N
 - Pyrimidines (Thymine & Cytosine) Single Ring of C and N

Deoxyribose and Phosphate groups form backbone/uprights of ladder.

Nitrogen bases are rungs of ladder

Chargaff's Rule A=T(triple H-bond) G=C (double H-bond)

Strands of DNA are antiparallel.

3.2 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.

DNA Replication: The complementary structure of the DNA double helix serves as a template during DNA Replication.

Step 1: Unwinding

- a. **DNA Helicase** (an enzyme) breaks H bonds
- b. Double helix unwinds into two Replication Forks
- c. Proteins attach to each strand to prevent reattachment.

Step 2:

- a. **DNA Polymerases** (enzymes) add new nucleotides according to the base pairing rules-creating two new double helixes.

Step 3:

- a. DNA polymerases prevent reattachment until a new strand has been synthesized.
- b. DNA polymerases “proofread” to minimize errors (mutations) Resulting in < one error per 1 billion nucleotides.

Multiple **Replication Forks** enable a strand of DNA to replicate much faster.

100 sections allow for replication in 8 hours, if not it would take 33 days.

