• The Introduction of Biology
• Defining of life
• Basic chemistry, the chemistry of organic molecules
• Classification of living things
• History of cells and Cells structures and functions

- **Photosynthesis and cellular respirations**
- Darwin evolutions
- Ecosystem and human interferences
Cellular Respiration

LO’s

- Able to understand the processes of glycolisis, the citric acid cycle, krebs cycle and electron transport system.

- Able to compare between photosynthesis and cellular respiration
Cellular Respiration

• Process that unlocks stored energy
  – Nutrient molecules store energy in bonds
  – Chemical reactions produce ATP
  – ATP provides cellular energy

Skunk cabbage using metabolic heat to melt snow
So what?

- Energy is stored in these bonds.
- So?
- The breaking of the chemical bond releases the energy

\[
\text{ATP} + \text{H}_2\text{O} \rightarrow \text{ADP} + \text{P} + \text{ENERGY}
\]
Photosynthesis and cellular respiration – provide energy for life

**Photosynthesis** is the process where green plants use sunlight, carbon dioxide, and water to make food and oxygen *(chloroplasts - chlorophyll)*

\[
6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy} \rightarrow 6\text{O}_2 + C_6\text{H}_{12}\text{O}_6
\]

**Cellular Respiration** is the process where cells use this food to release stored energy *(mitochondria)*

- takes glucose, breaks it down into atoms, and by mixing it with the atoms from more oxygen, produces carbon dioxide, water and energy ... A new energy is form and it can be used by all cells

\[
6\text{O}_2 + C_6\text{H}_{12}\text{O}_6 \rightarrow 6\text{H}_2\text{O} + 6\text{CO}_2 + \text{energy (ATP)}
\]

The theoretical maximum yield of cellular respiration is 36 ATP per molecule of glucose metabolized.
Chemical Reactions for Photosynthesis

• Light dependent reactions
• Light independent reactions
Cellular respiration

The process by which mitochondria break down glucose to make ATP
Cellular Respiration - *Aerobic respiration* requires **oxygen** in order to generate energy (ATP)

- Chemical reactions to yield energy
  - Break down carbohydrates
  - Series of reactions
In the absence of oxygen, respiration consists of two metabolic pathways: glycolysis and fermentation. Both of these occur in the cytosol.
Intermediate step

• Pyruvate is converted to acetyl CoA

• Occurs in the cytoplasm

• See diagram on simple explanation handout
Krebs Cycle (Citric Acid Cycle)

- Occurs in the matrix of mitochondria
- A series of reactions occur (this is not just one step)
- Main purpose is to generate electrons for use in ETC
- 2 ATP is given off
- See diagram on simple explanation handout
Electron Transport Chain

• Occurs in inner membrane of mitochondria
• Series (chain) of coupled redox reactions (electrons are transported through the chain)
• Electrons carried to this step by NADH and $\text{FADH}_2$ (produced in previous steps)
• Oxygen is used in this step
• Water is given off
Where do we get 38 ATP?

- 2 ATP made in glycolysis
- 2 ATP made in Krebs Cycle
- 34 ATP made in ETC
  - 1 NADH = 3 ATP
    - $10 \times 3 = 30$
  - $1 \text{ FADH}_2 = 2 \text{ ATP}$
    - $2 \times 2 = 4$
Aerobic Cellular Respiration

• Oxygen dependent

• Byproducts
  – Raw materials for photosynthesis
  – Carbon dioxide
  – Water
Three Phases Of Aerobic Cellular Respiration

Aerobic Cellular Respiration happens in **Mitochondria**. Three main reactions are involved:

1. **Glycolisis** occurs in cytoplasm of mitochondria (requires 2 ATP to start/ makes 2 ATP)

2. **Krebs Cycle** occurs in matrix of mitochondria (makes 2 ATP)

3. **Electron Transport Chain** occurs in mitochondria; makes majority of ATP (32 ATP)

Out of 38 ATP Produced - energy of 2 ATP required to start the process.
Anaerobic Respiration (Fermentation)

• Glycolysis
• Yields 2 pyruvate and 2 ATP
• With no oxygen present, cellular respiration does not occur
• ONLY 2 ATP ARE PRODUCED (compare to aerobic respiration)
Two Types of Fermentation

Alcoholic Fermentation
• Pyruvate converted to ethyl alcohol and CO₂
• Carried out by yeast and some bacteria
• Used in producing alcohol (both consumable and for ethanol), and for baking

Lactic Acid Fermentation
• Pyruvate converted to lactic acid
• Carried out by muscles when working hard (muscles need ATP but can’t get O₂)
• Causes muscle soreness and cramps