

# Cellular Respiration Introduction

## I. Comparison with photosynthesis

	PHOTOSYNTHESIS	RESPIRATION
Where?	In chlorophyll-bearing cells	In all cells
When?	In the presence of light	All the time
Input	Carbon dioxide and water	Reduced carbon compounds and oxygen
Output	Reduced carbon compounds, oxygen, and water	Carbon dioxide and water
Energy sources	Light	Chemical bonds
Energy result	Energy stored	Energy released
Chemical reaction	Reduction of carbon compounds	Oxidation of carbon compounds
Energy carrier(s)	NADP	NAD and FAD

## II. Some main points on respiration

- A. respiration releases energy for use by the organism
- B. respiration involves four biochemical systems
  - 1. Anaerobic
    - glycolysis
    - fermentation
  - 2. Aerobic
    - Kreb's cycle
    - electron transport system
- C. respiration pathways are different between prokaryotes

## III. General Formula for Respiration

1 glucose + 6 oxygen = 6 carbon dioxide + 6 water + energy

## IV. ATP- The currency of life

- A. Formulas= ATP Adenosine-phosphate~phosphate~phosphate  
ADP Adenosine-phosphate~phosphate~ = high energy bond
- B. Phosphorylation= addition of phosphates

## V. Glycolysis

- A. (lysis= breakdown) sugar is broken down
- B. First stage in all respiration pathways
- C. Takes place in cytoplasm
- D. Input= glucose
- E. Products= 2 pyruvic acids + 2 ATP's + 2 H atoms (NADH<sub>2</sub>)
- F. No oxygen required (anaerobic)
- G. Pyruvic acid is a three carbon molecule
- H. Glucose is a six carbon molecule

## VI. Fermentation

- A. Fermentation= production of ethyl alcohol and lactic acid
- B. Input= glucose (Pyruvic acid)
- C. Products= 2 ETOH or lactic acid + 2 carbon dioxide + 2 ATP's
- D. Anaerobic process
- E. Anaerobic respiration does not use all of the available energy in glucose, it is not very efficient
- F. Economic value of fermentation
  - yeast in baking
  - production of beer, wine and liquor

## VII. The Krebs Cycle (Citric acid cycle)

- A. Named for biochemist Hans Krebs
- B. Takes place in matrix of mitochondria
- C. Input= 2 pyruvic acid
- D. Products= 2 carbon dioxide + 4 H atoms + 1 ATP

## VIII. The Electron Transport System (ETS)

- A. Produces the most ATP (32 or 34)

- B. Occurs on cristae of mitochondria
- C. Cytochromes= hydrogen acceptors (protein + iron)
- D. Cytochromes + enzymes make up ETS
- E. As electrons pass from one cytochrome to the next energy is given off
  - 1. some is lost as heat
  - 2. some used to make ATP
- F. Final electron acceptor is oxygen
  - Water is the result
- G. Input= 12 H atoms + 6 oxygen + 17 ADP's + 17 phosphate ions
- H. Products= 17 ATP's + 6 water

## IX. Efficiency

- A. Respiration is about 40% efficient
- B. Comparable to man-made machines

## X. Summary of ATP Yield

Source	Energy Yield
Glycolysis	2 ATP
Krebs Cycle	2 ATP
Electron Transport System	32 ATP
Total	36 ATP

