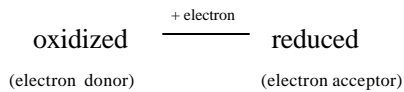


How Cells Harvest Energy: ***Chapt. 7***

- food substances are energy-rich molecules
- cells oxidize food to release energy

Oxidation

- removal of electrons (often as hydrogen atoms)
- as one molecule is oxidized another is reduced (Red-Ox reactions)
- Text pg 116



Cellular Redox Reactions

- Typically Exergonic reactions
- ΔG is negative
- Reactants \longrightarrow Products + E.
- E. (in the form of e^-) is used for initiating other reactions

***Cell Oxidation-Reduction
Reactions Performed by:***

- Cell molecules such as NAD, NADP, FAD, FMN ...termed coenzymes
- each of these work with specific enzymes to catalyze redox reactions
- Text pg 116
- when reduced (ie. NADH, NADPH) each gains energy for use elsewhere in the cell

***Storage Sources of
Cell Energy:***

- Triglycerides (fats)
- Carbohydrates (glycogen, starch)

Both end up following the breakdown pathway for glucose.....

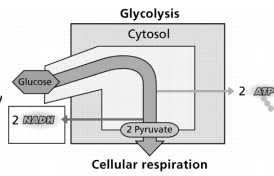
***Glucose Breakdown-
an oxidation process***

Occurs as two separate processes:

1. Glycolysis
2. Cellular respiration

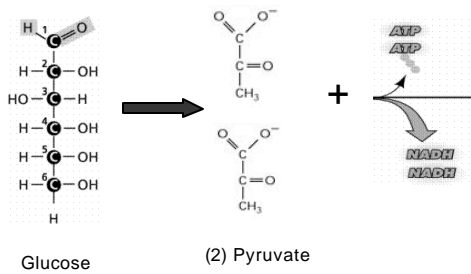
1. Glycolysis

- occurs in cytoplasm
- evolutionary primitive energy creating system
- may occur in anaerobic environments



Summary: One (6-carbon glucose) goes to form Two (3- carbon pyruvate) molecules
 produces 2 ATP & 2 NADH
 Low energy yield (~3% Potential)

Glycolysis



Glycolysis Energy Yield

~700 Kcal of energy stored in 1 glucose sugar...

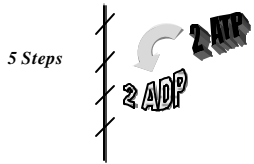
Glycolysis produces 2 ATPs from glucose
 Each ATP is worth ~7-10 Kcal
 Therefore, ~20 Kcal produced

$20/700 = \sim 3\%$ efficiency

Glycolysis:

Part 1- Uses ATP Energy

Glucose (6C)

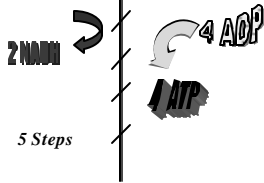


Glyceraldehyde 3-phosphate (3C)

Glycolysis:

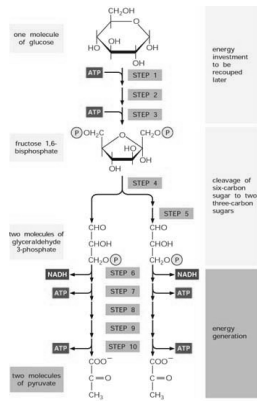
Part 2- Generates ATP + NADH

G3P (3C)



Pyruvate (3C)

Glycolysis



Glycolysis: Summary

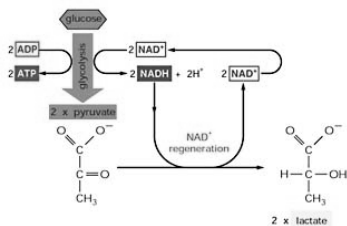
- 10 enzymes act in sequence to:
- Convert 1 Glucose (6C) --> 2 Pyruvate (3C)
- 2 ATP's produced
- 2 NADH produced
- Reactions occur in cytoplasm

- When Oxygen is available to the cell, glycolysis is followed by cellular respiration...
 - Text pg 117
- When O₂ is unavailable, glycolysis will lead to Fermentation steps...
 - Text 117

Fermentation

When inadequate oxygen is present, for example, in a muscle cell undergoing vigorous contraction, the pyruvate produced by glycolysis is converted to lactate. This reaction uses NADH produced in glycolysis, and the whole pathway yields much less energy overall than complete oxidation.

(A) FERMENTATION LEADING TO EXCRETION OF LACTATE



Fermentation

In some organisms that can grow anaerobically, such as yeasts, pyruvate is converted via acetaldehyde into carbon dioxide and ethanol. Again, this pathway regenerates NAD^+ from NADH , as required to enable glycolysis to continue.

(B) FERMENTATION LEADING TO EXCRETION OF ALCOHOL AND CO_2

