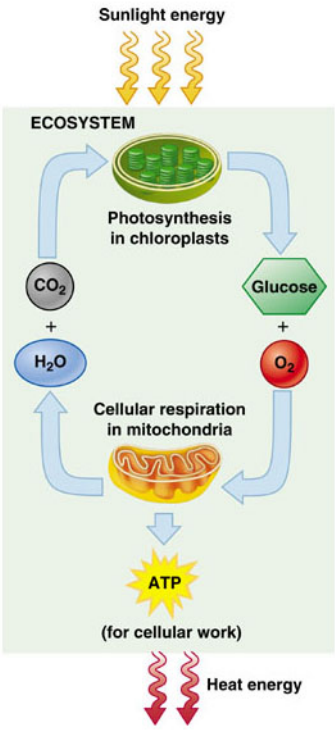
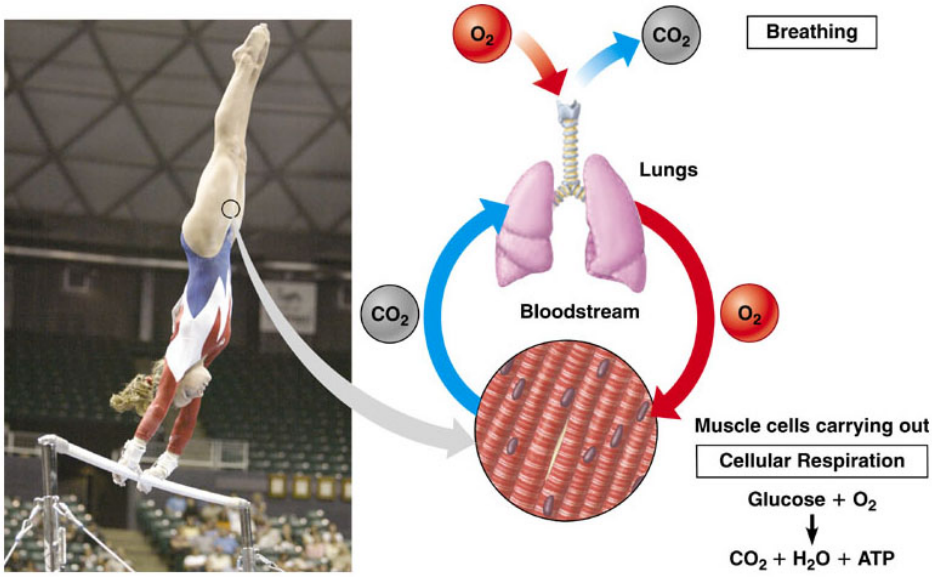
Chapter 6 How Cells Harvest Chemical Energy

- all cells need energy for building, growing, repairing and reproducing.

*6.1 - PHS and cellular resp'n provide energy for life

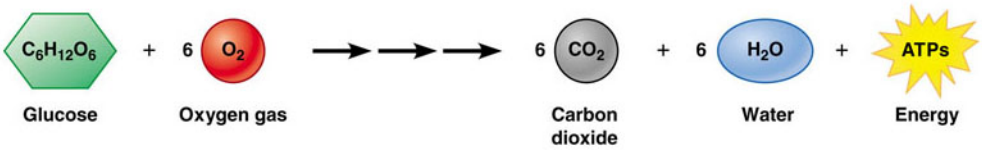


*6.2 - breathing supplies oxygen to our cells and removes CO2



*6.3 - cellular resp'n stores energy in ATP molecules

- works like a bank
- make- deposits and withdrawls



- the ATP stores energy in the bonds b/n the phosphate groups. When the bond is broken, energy is released

- respiration is the process that both plants and organism use to release energy into the cell

- requires oxygen & involves breaking down food molecules to release energy

- Respiration & PHS can be seen as opposite processes

*6.4 - Human body uses energy from ATP for all its activities

TABLE 6.4 ENERGY CONSUMED BY VARIOUS ACTIVITIES (IN KCAL)

Activity	Kcal Consumed per Hour by a 67.5-kg (150-lb) Person*
Bicycling (racing)	514
Bicycling (slowly)	170
Dancing (slow)	202
Dancing (fast)	599
Eating	28
Gymnastics	186
Laboratory work	73
Running (7 min/mi)	865
Sitting (writing)	28
Sleeping or lying still	0
Standing (relaxed)	32
Swimming (2 mph)	535
Walking (3 mph)	158
Walking (4 mph)	231

* Not including kcal needed for body maintenance

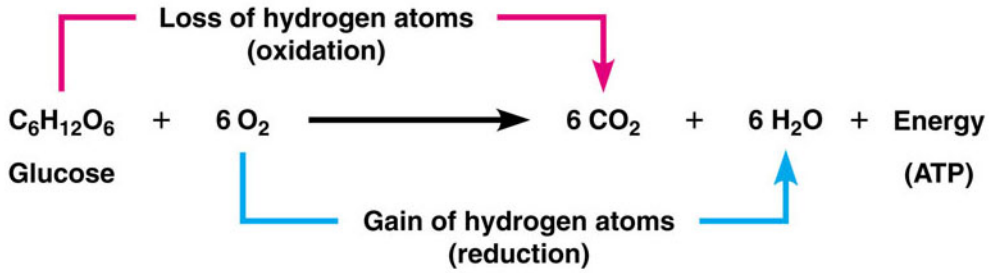
*6.5 - Cells tap energy from electrons “falling” from org. fuels to water

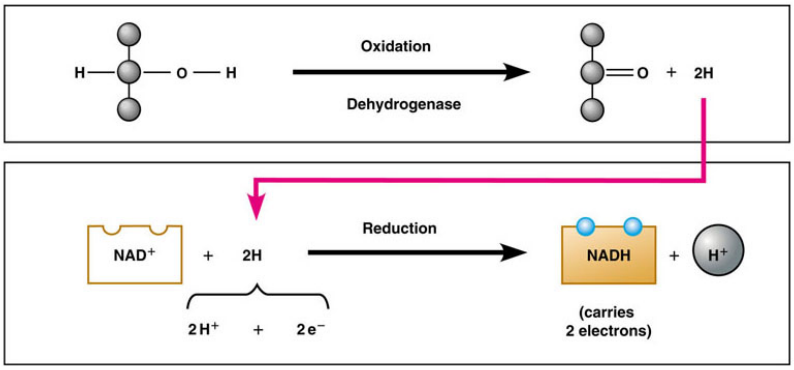
- The energy available to cells is contained in the arrangement of electrons in the chem. bonds that organic molecules (like glucose) together.

- during resp/ electrons are transferred to O as the C-H bonds of glucose are broken and the H-O bonds of water form.

- O attracts electrons very strongly when it “falls” to O

- known as **oxidation & reduction** reactions





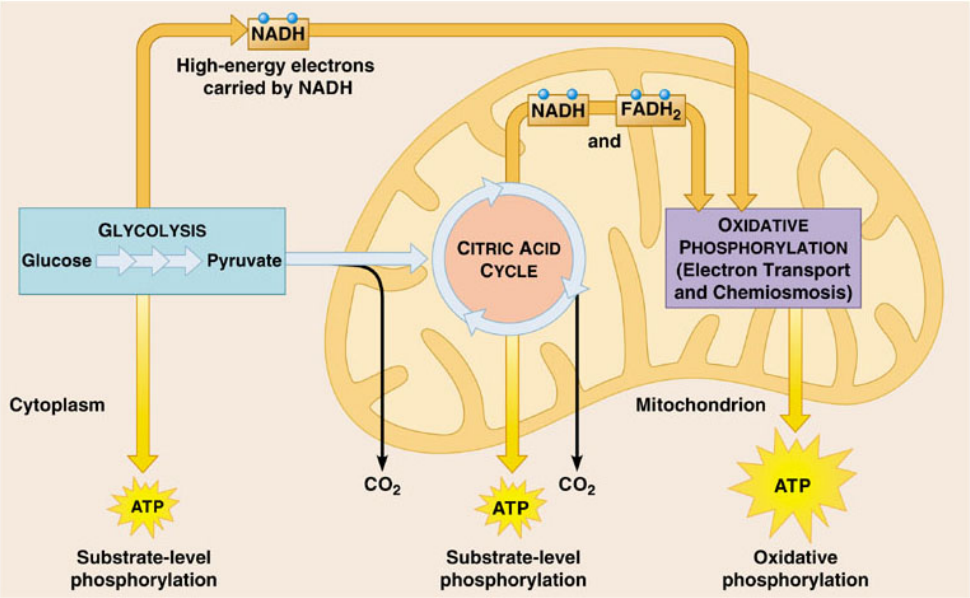
*6.6 - Overview – respiration occurs in three main stages

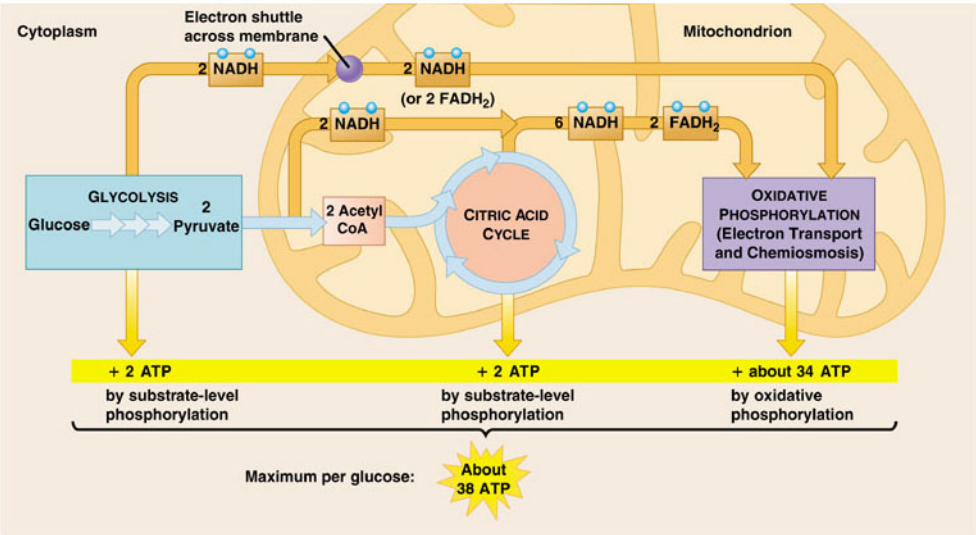
STAGE 1: Glycolysis

- occurs in cytoplasm
- requires no oxygen
- involves breakdown of glucose
- this reaction gives 3811 calories per g of glucose (1 cal. = energy required to raise 1 g of water 1 degree celcius)

STAGE 2: Citric Acid Cycle

STAGE 3: Oxidative Phosphorylation





- occurs when oxygen is present

$C_6H_{12}O_6 + 6\ O_2$ $\qquad$ $6\ CO_2 + 6\ H_2O + 38$ ATP

- most organisms use this form of resp'n b/c it releases the most energy - 38 molecules of ATP

glycolysis = 2 ATP mol.
Kreb's cycle = 2 ATP mol.
Electron Transport chain = 34 ATP mol.

- occurs in the mitochondria

- The Kreb's cycle (named after Sir Hans Krebs) is the central biochemical pathway. Also called citric acid cycle b/c the citric acid is produced.

*6.13 – Fermentation is an anaerobic alternative to cellular respiration

- occurs when no oxygen is available

- sometimes called ***anaerobic*** b/c of lack of oxygen

- enables cells to carry out energy production in the absence of oxygen

- two types of fermentation exist:

1. lactic acid fermentation
2. alcoholic fermentation

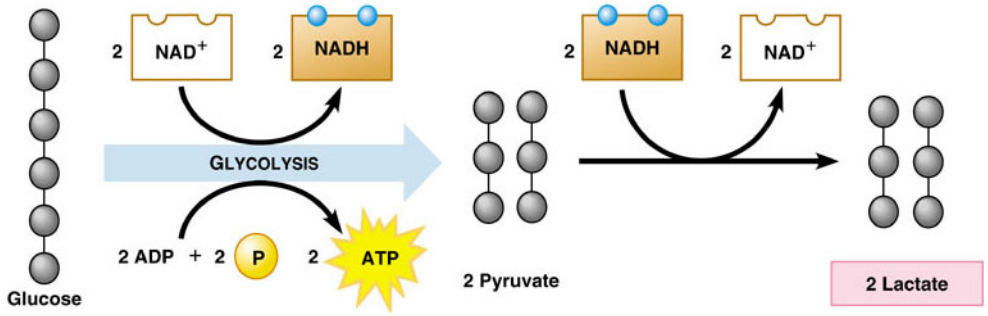
1. Lactic Acid Fermentation

- occurs in animal cells when oxygen is in short supply

- often used where short term burst of energy is needed
    - ex. sprinting

- forms lactic acid (this is part of the reason muscles are tired and sore the day after exercise)

- pyruvic acid + NADH + H+ lactic acid + NAD+

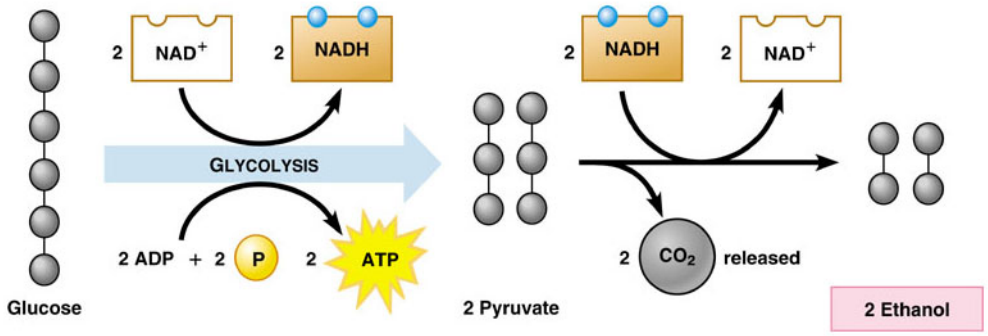


2. Alcoholic Fermentation

- occurs in yeast and some unicellular & plant cells

- alcohol in beer & wine is produced by fermentation by some organisms

pyruvic acid + NADH + H+ ethyl alcohol + CO2 + NAD+



*6.15 – Food molecules provide raw materials for biosynthesis

*6.16 – Fuel for respiration ultimately comes form PHS