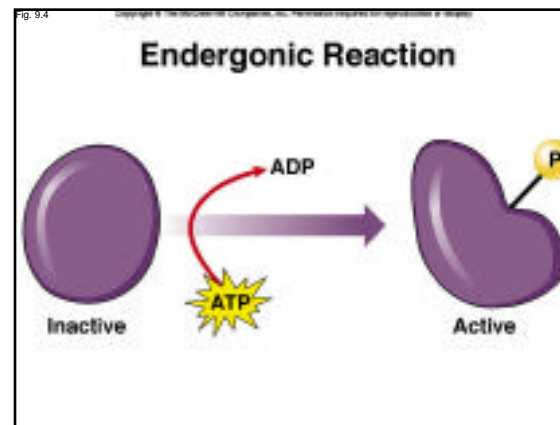
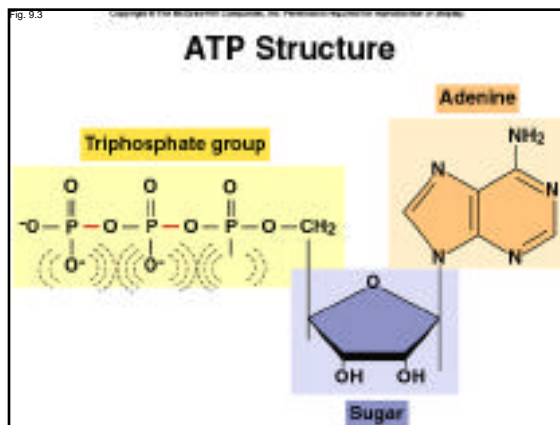


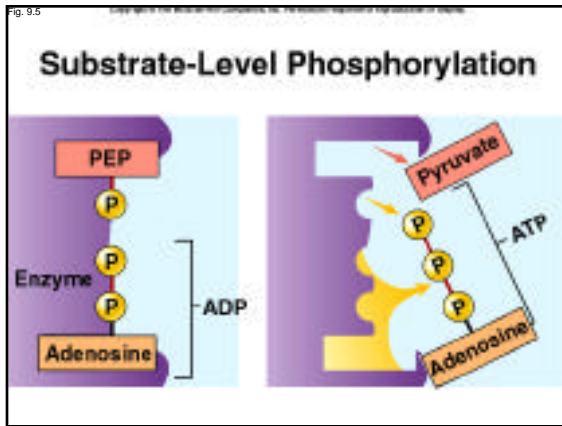
Enzyme Lab

✓ On data sheets for each lab list

- x , x^2 , y , xy , m , V_{max} , b (y intercept), k_m (-x intercept)
- Draw Hanes plots using two graph papers - use 2:30 lab data for the graphs
- Label experiments
- Graph Paper A -- Exp 1, lead, 2, 3a,
- Graph paper B -- Exp 1, 3b, and predict exp 4 (temp)
- Draw a Michaelis-Menton plot on the 3rd graph paper. Label experiments, V_{max} , k_m for each experiment.
- On Lab -- k_i is optional
- Do pH enzyme activity graph

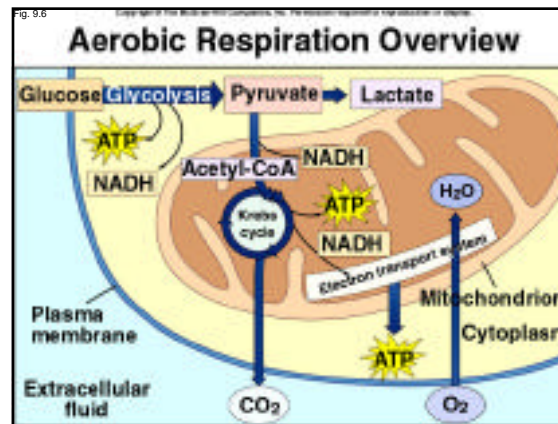
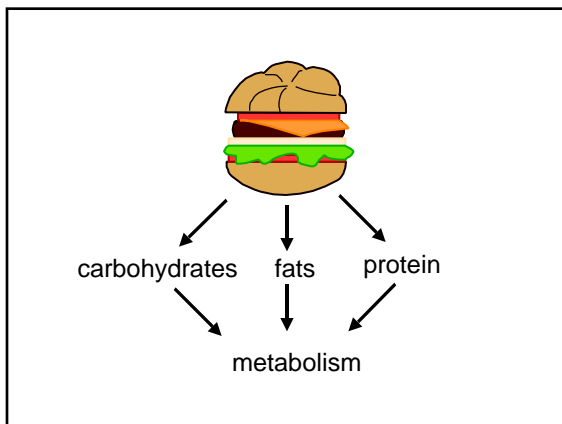
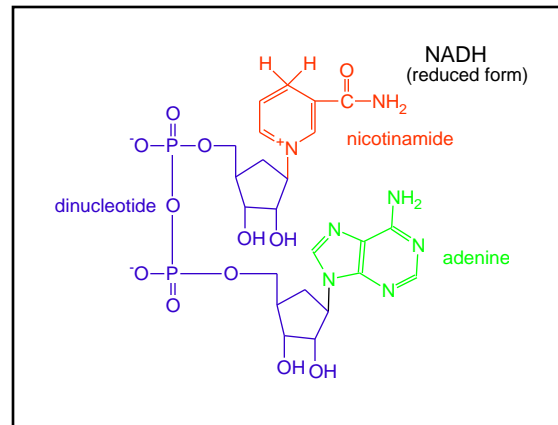
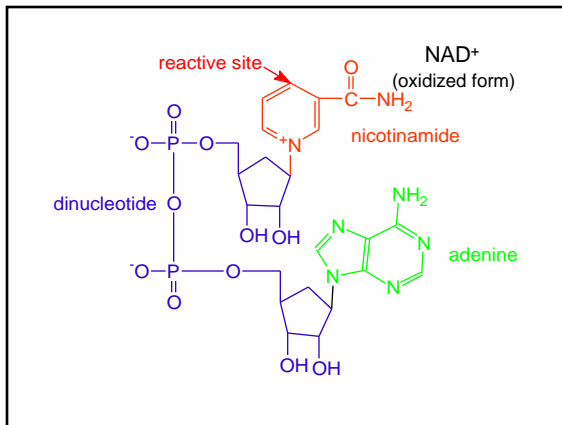
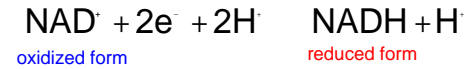
Essential Concepts of Metabolism

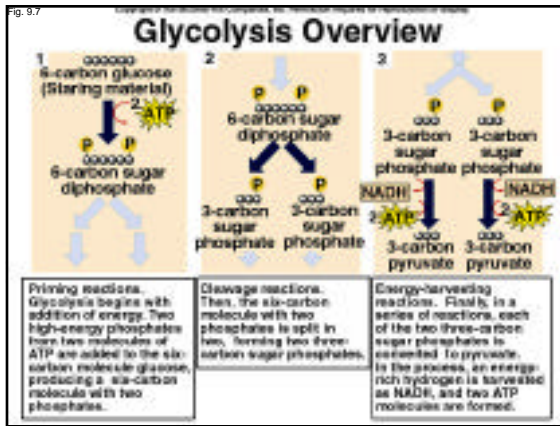




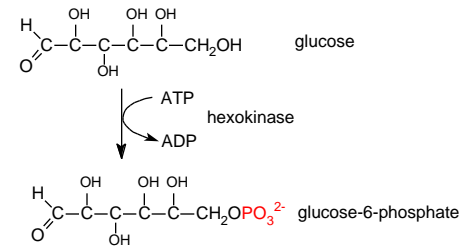
Common electron acceptors

- ✓ Nicotinamide adenine dinucleotide (NAD⁺).
- ✓ Flavin adenine dinucleotide (FAD⁺)

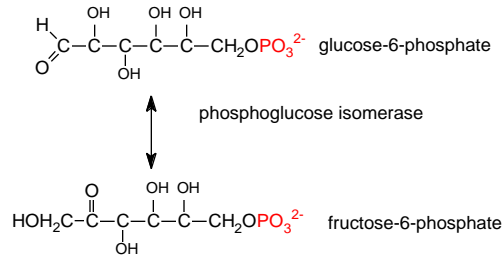




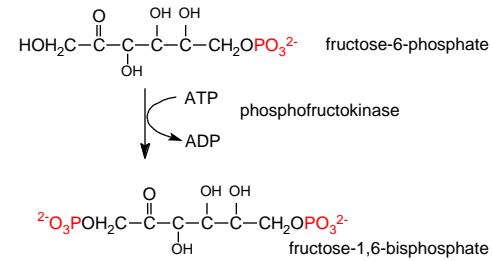
Phosphorylation prevents glucose from leaving the cell



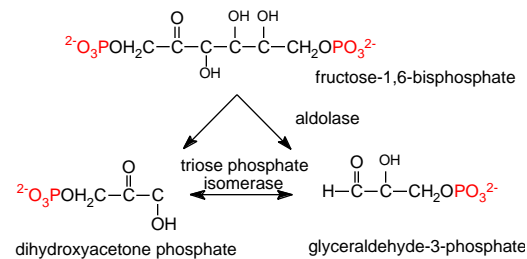
Aldose to ketose



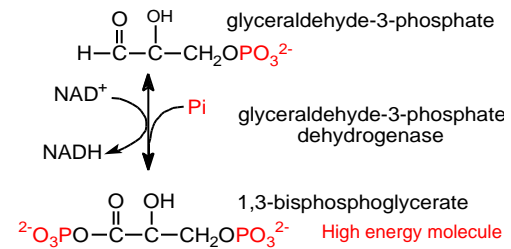
Phosphofructokinase is the key enzyme in glycolysis



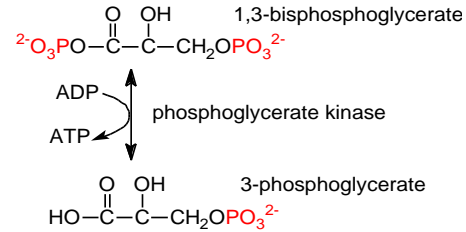
Sugar-splitting



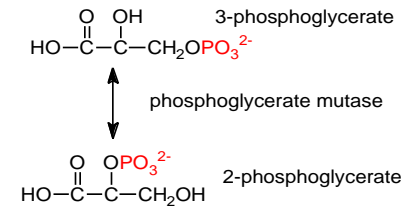
Energy transfer



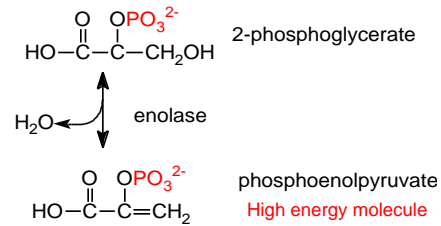
Forming ATP



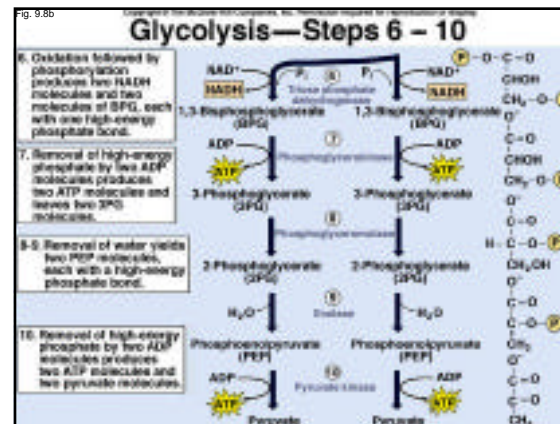
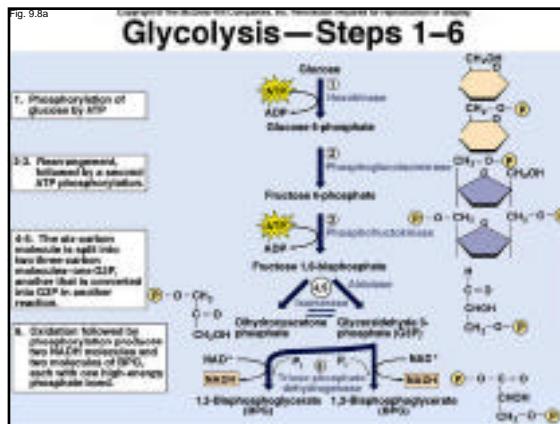
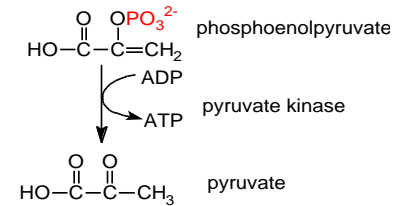
Rearrangement

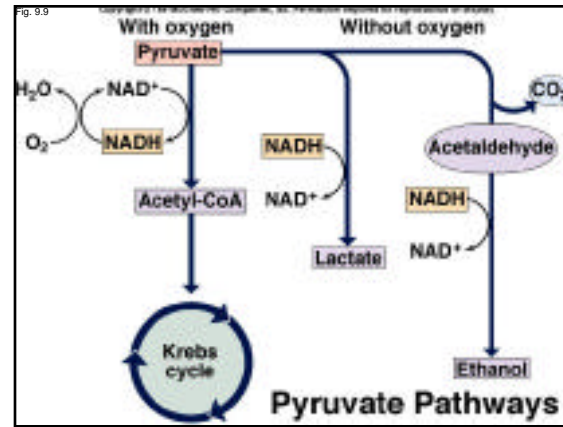
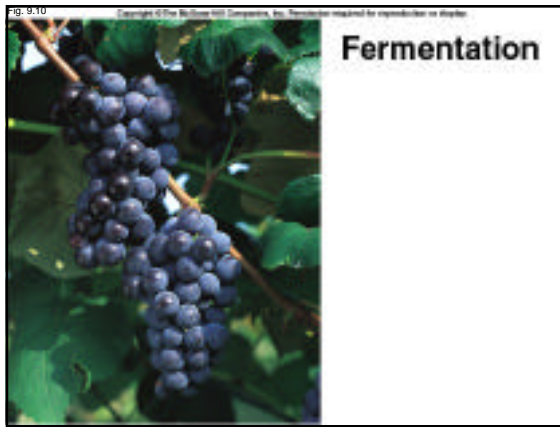


Dehydration increases the potential for transfer of phosphate to ADP



Transfer of P to ADP is irreversible

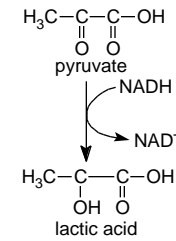




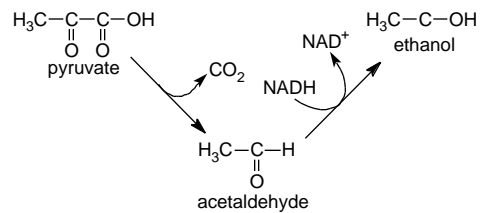
Fermentation

- ✓ Anaerobic process
- Formation of 2 ATP (net) in glycolysis.
- Regeneration of NAD⁺

Lactic acid fermentation



Alcoholic fermentation



Other fermentations

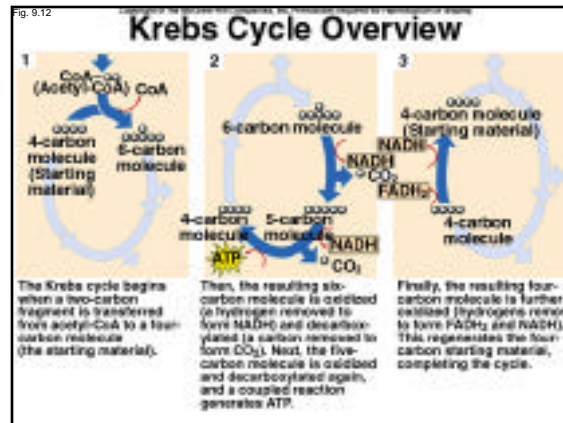
- ✓ Mixed acid fermentation
 - Acetic acid, succinic acid, ethanol, CO₂, H₂.
- ✓ Propionic fermentation
 - Propionic acid, acetic acid, CO₂
- ✓ Butanediol fermentation
 - Butanediol,
- ✓ Butyric-butylic fermentation
 - Butanol, isopropanol, acetone, CO₂

Fermentation

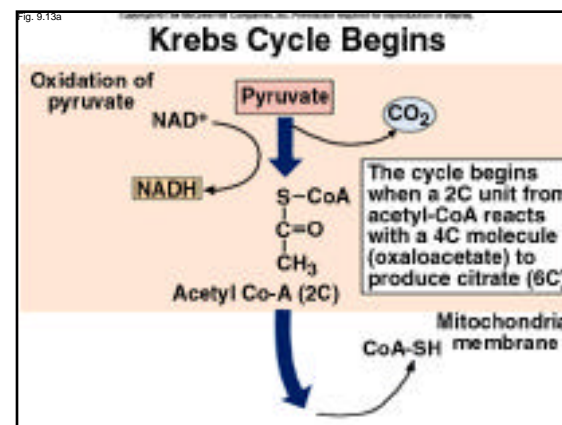
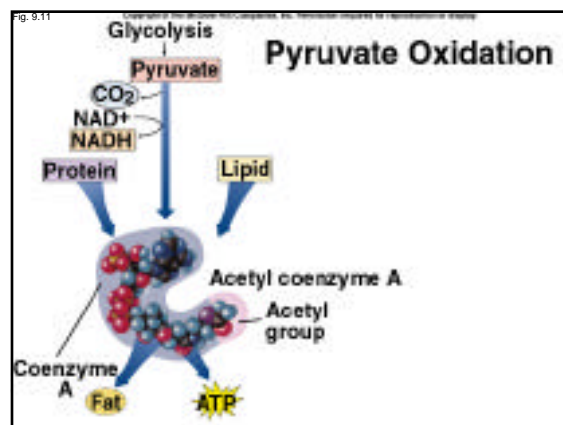
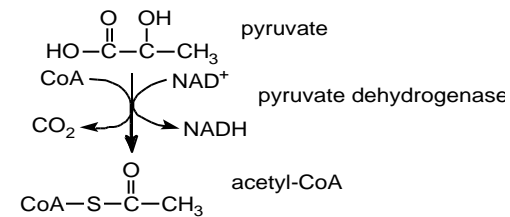
- ✓ Reduction of pyruvate.
- ✓ Anaerobic process.
- ✓ Regenerates NAD^+
- ✓ Produces very little energy (2ATPs)
- ✓ Produces lactic acid, ethyl alcohol, CO_2 , H_2 , acetic acid, succinic acid, propionic acid, butyric acid etc.

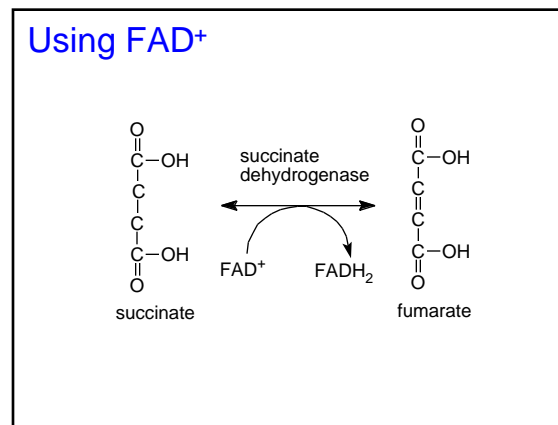
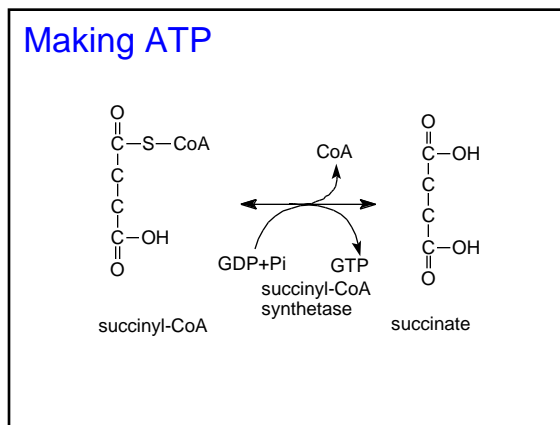
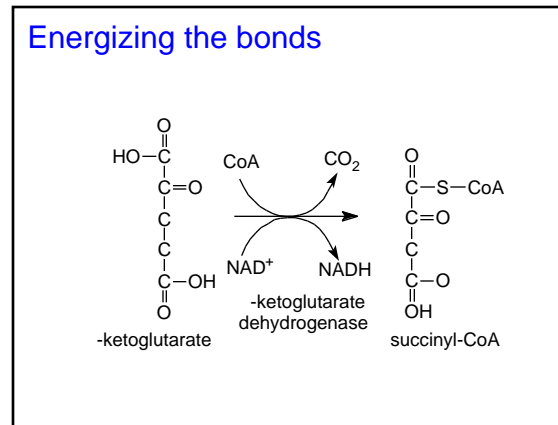
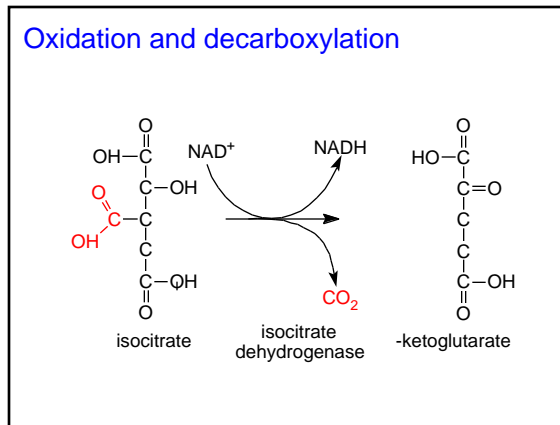
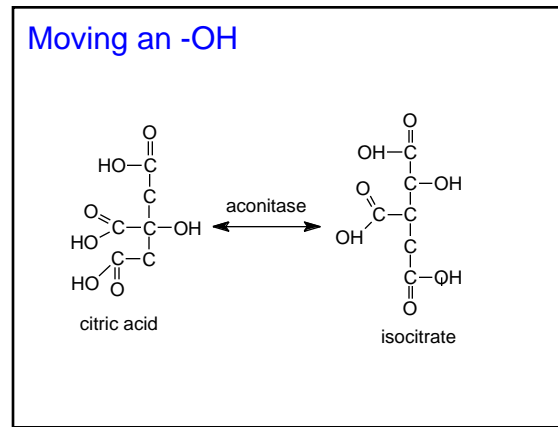
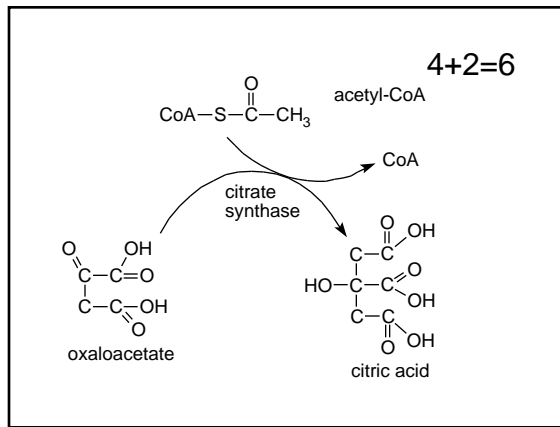
Krebs cycle

- ✓ A sequence of reactions by which acetyl (2C) groups are oxidized to CO_2 .
- ✓ Hydrogen groups are removed and electrons are transferred to NAD^+ and FAD^+ .

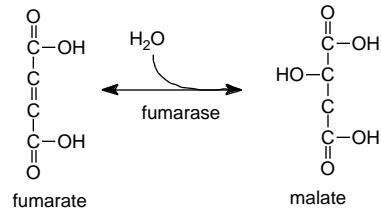


CoA activates the carbons from pyruvate

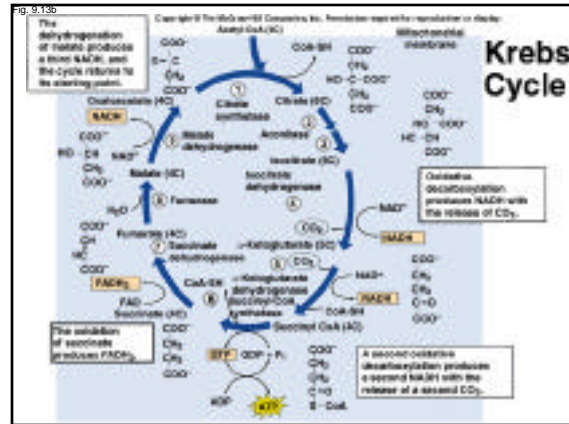
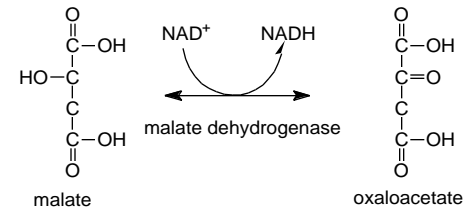




Hydrating fumarate

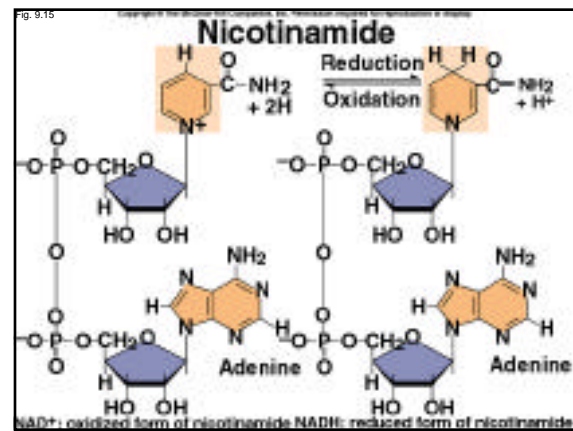
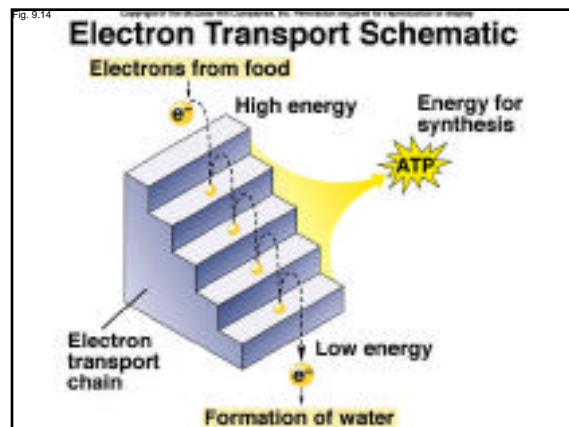


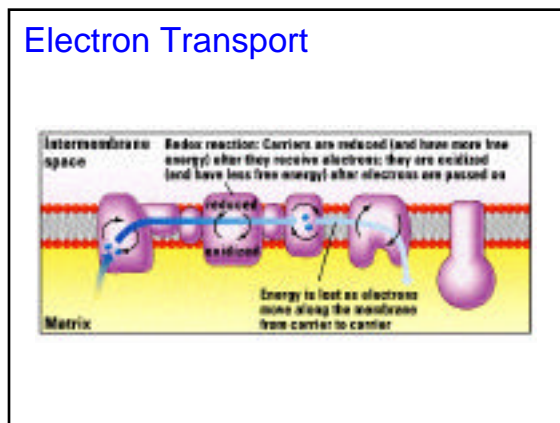
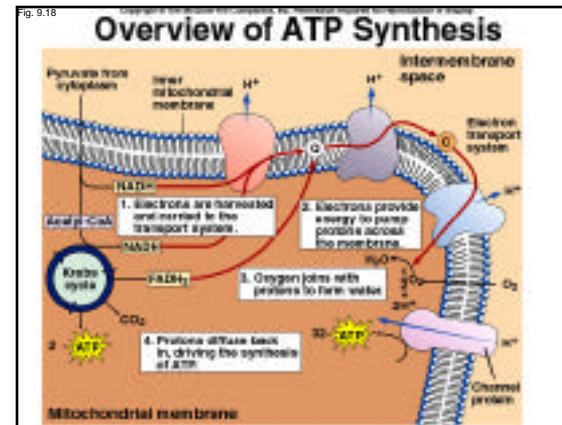
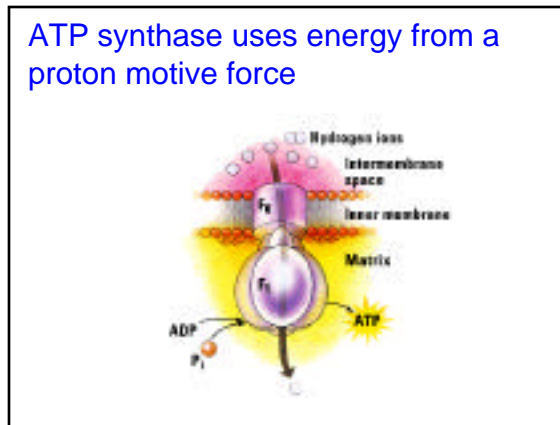
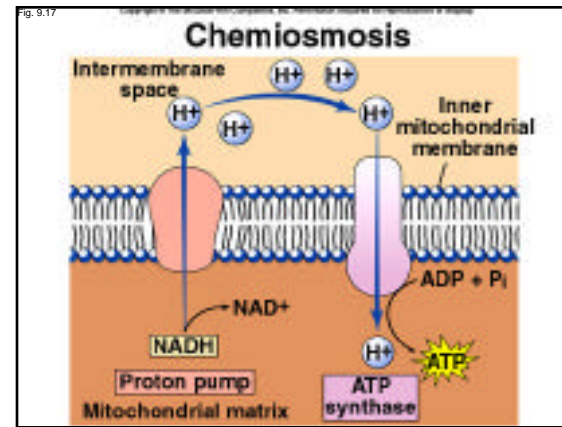
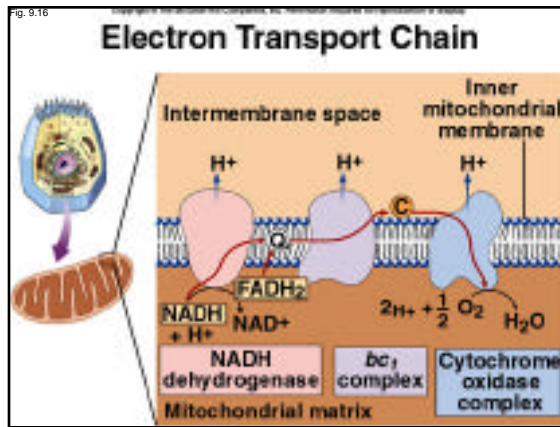
Oxidation of malate



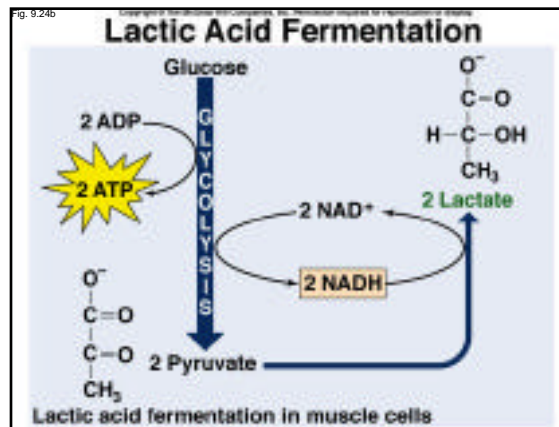
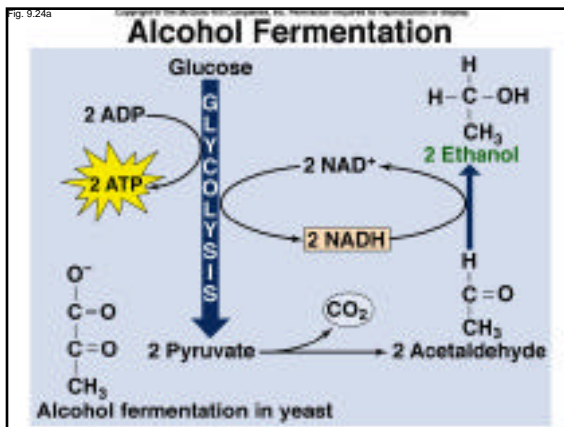
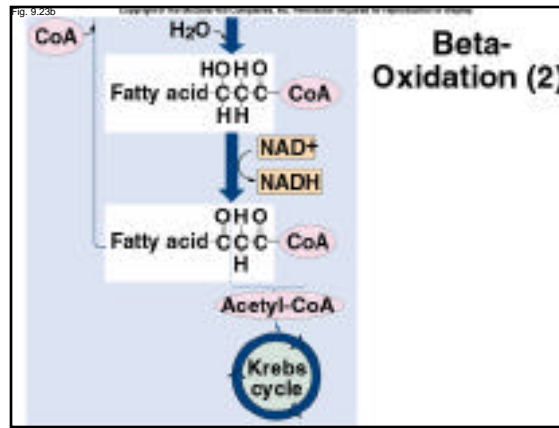
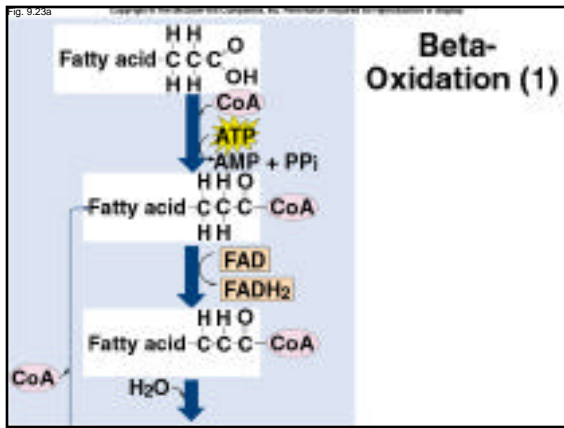
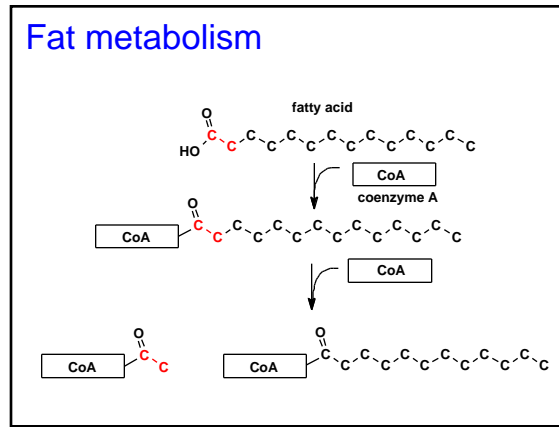
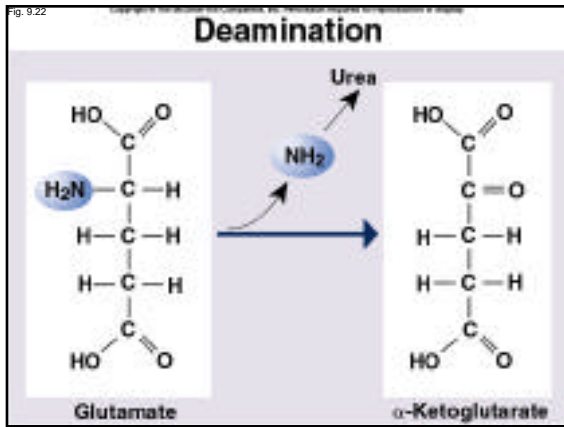
Krebs cycle summary

- | IN | OUT |
|----------------------|----------------------|
| • 2 acetyl-CoA | • 2CO ₂ |
| • 6 NAD ⁺ | • 6NADH |
| • 2 FAD ⁺ | • 2FADH ₂ |
| • 2GDP | • 2GTP |
| • 2P _i | • 2H ⁺ |
| • 2H ₂ O | • 2 CoA |





- ### Krebs cycle leads to 20 ATP
- | IN | OUT |
|----------------------|-----------------------------|
| • 2 acetyl-CoA | • 2CO ₂ |
| • 6 NAD ⁺ | • 6NADH = 15ATP |
| • 2 FAD ⁺ | • 2FADH ₂ = 3ATP |
| • 2GDP | • 2GTP = 2ATP |
| • 2P _i | • 2H ⁺ |
| • 2H ₂ O | • 2 CoA |



Respiration (review)

Producing energy for the cell

Respiration (background)

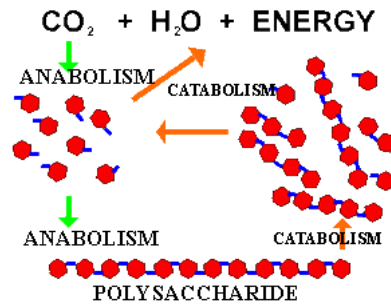
✓ Metabolism

- Sum of all chemical reactions in the cell

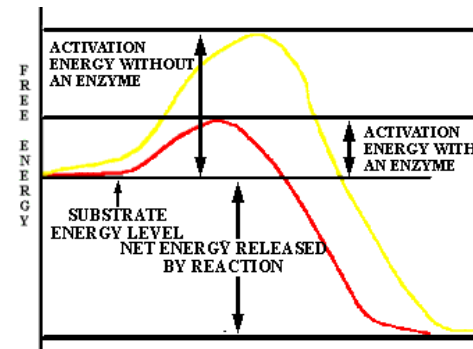
↳ **Catabolism** is the conversion of complex molecules to simpler and smaller molecules. This usually involves the release of useful energy for the cell. Example: Glucose + oxygen → carbon dioxide, water, and energy.

↳ **Anabolism** is the conversion of simple molecules to larger and more complex molecules. This usually involves the input of energy into the system to create the new covalent bonds needed to form the more complex molecules created. Example: glucose + glucose + glucose + glucose + ENERGY → glycogen (starch)

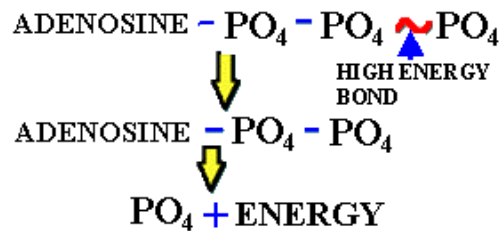
Catabolism and Anabolism



Enzymes lower the energy of activation

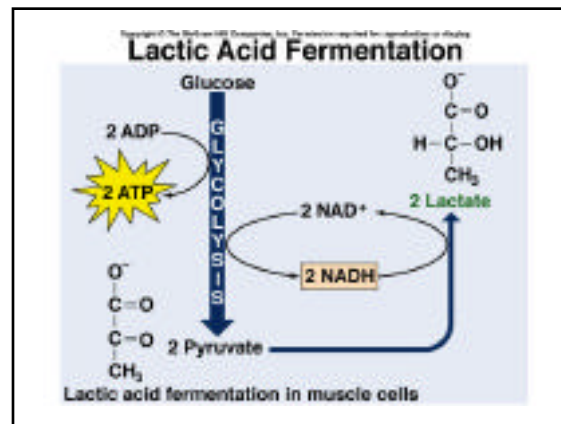
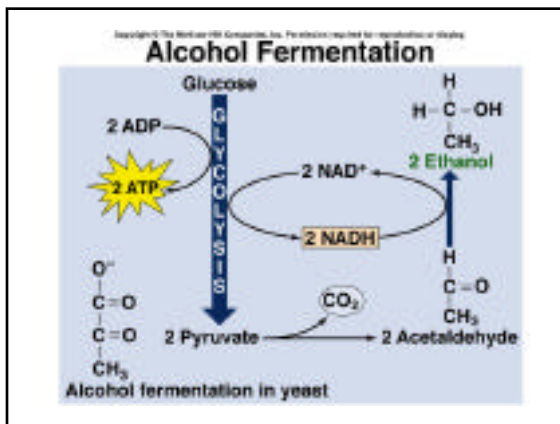
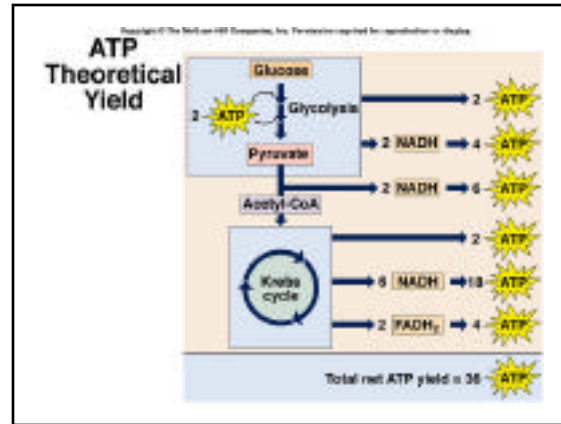
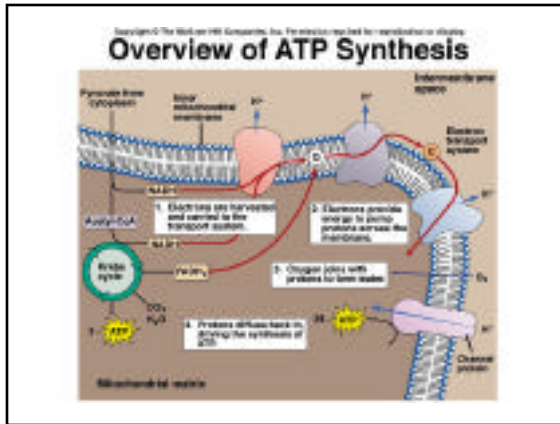
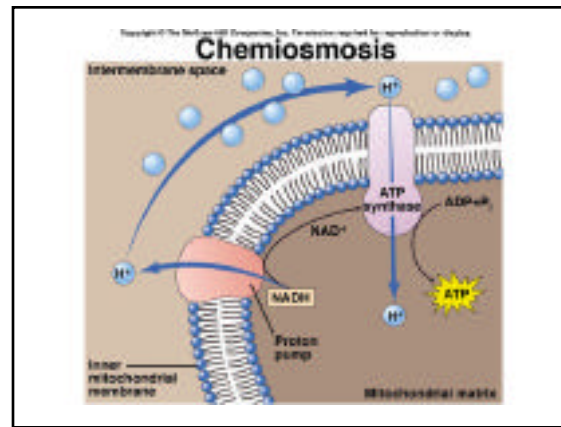
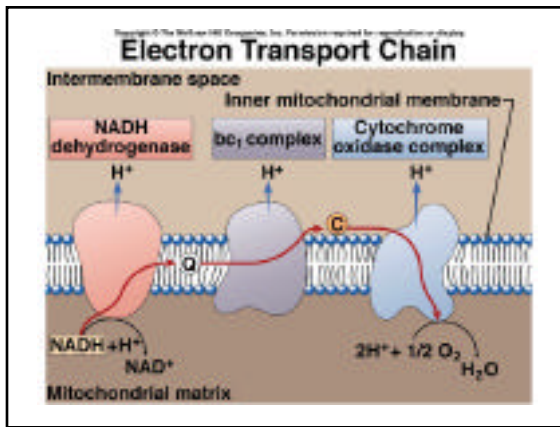


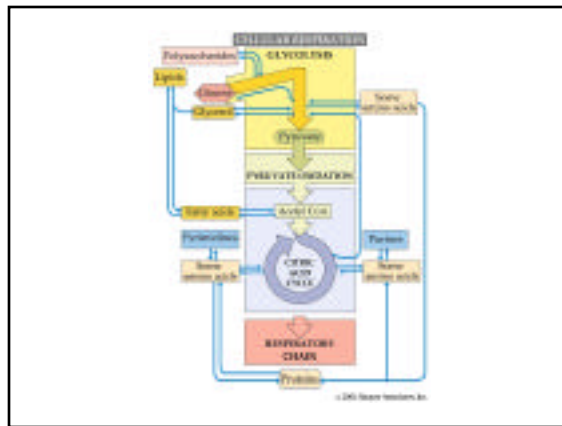
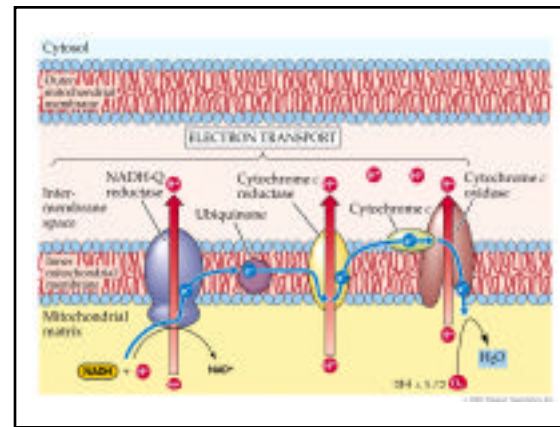
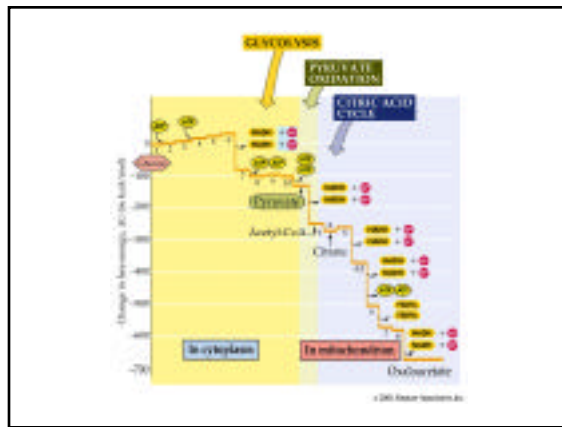
ATP (energy source of the cell) (GTP?)



Overview of respiration

- ✓ nicotinamide adenine dinucleotide (NAD^+)
- ✓ flavin adenine dinucleotide (FAD)
- ✓ NADH and FADH_2 are coenzymes that are used to shuttle electrons to their final receptor in many cells.
- ✓ NADH and FADH_2 are coupled to the production of ATP by the process of oxidative phosphorylation.
- ✓ The pathway through a series of electron carriers is the **electron transport chain** (**respiratory chain**)
- ✓ The electron transport chain creates a proton gradient that produces ATP using an ATP synthase (**chemiosmosis**)





7.1 Cellular Locations for Energy Pathways in Eukaryotes and Prokaryotes

EUKARYOTES	PROKARYOTES
External to mitochondrion	In cytoplasm
Glycolysis	Glycolysis
Fermentation	Fermentation
	Citric acid cycle
Inside mitochondrion	On inner face of plasma membrane
Inner membrane	Pyruvate oxidation
Pyruvate oxidation	Respiratory chain
Respiratory chain	
Matrix	
Citric acid cycle	

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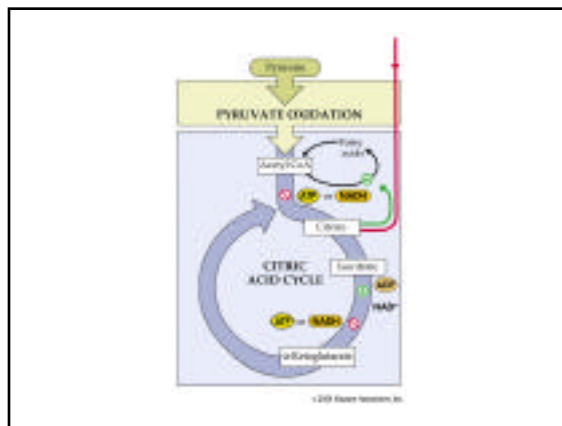


Fig. 9.5A

A Food Chain in East Africa

Stage 1: Photosynthesizers

Stage 2: Herbivores

A Food Chain in East Africa (Continued)



Stage 3:
Carnivore



Stage 4:
Scavengers



Stage 5:
Refuse utilizers

The End.