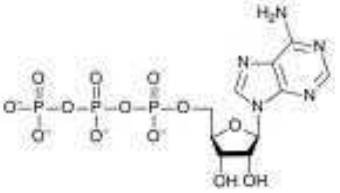
CATABOLIC PATHWAYS, FERMENTATION

22 Jan 02, 15 July 02, 13 July 07, 17July08, 14July09, 19July10, 15July11, 29Jan13, 23Sept15
pp. 122-149, TFC 7th: , Black: 120-136, Bauman 2nd: 134-150, 4th: 133-148

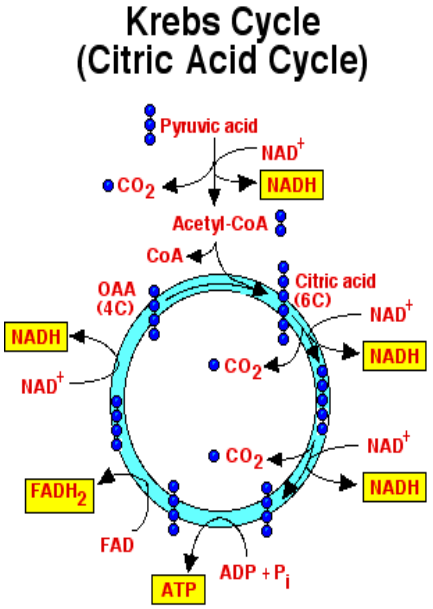


Primary goal of catabolism is to **generate ATP (p 127)** to be used for anabolism, run the cell.

In catabolism of glucose, transfer of H (or electrons) from glucose (**oxidation**) is major source of energy:
(overview on p 134)

Definition: **Fermentation** the catabolism of glucose in which the terminal H acceptor is **organic**
Respiration the catabolism of glucose in which the terminal H acceptor is **inorganic**

GLYCOLYSIS ["sugar-break-process"] (p 135) per glucose , nets **2 ATPs** and **2 NADHs**
requires **2 NAD$^+$** (**NOTE:** this requirement explains fermentation).
end products 2 **pyruvates**



RESPIRATION uses an inorganic H acceptor (oxygen, nitrogen, sulfur, etc)
nets approximately **38 ATPs**
Acetyl CoA is generated from pyruvate, feeds into Krebs cycle (p. 137)

Krebs cycle major features (p. 137) GOAL: dissect off hydrogens for later combination with O_2, etc

decarboxylation	(always requires thiamine pyrophosphate, yields CO_2)
reduction of NAD$^+$ to NADH	feeds into the electron transport chain: oxidative phosphorylation.
reduction of FAD to $FADH_2$	feeds into the electron transport chain: oxidative phosphorylation.
generation of ATP	(GTP intermediate)

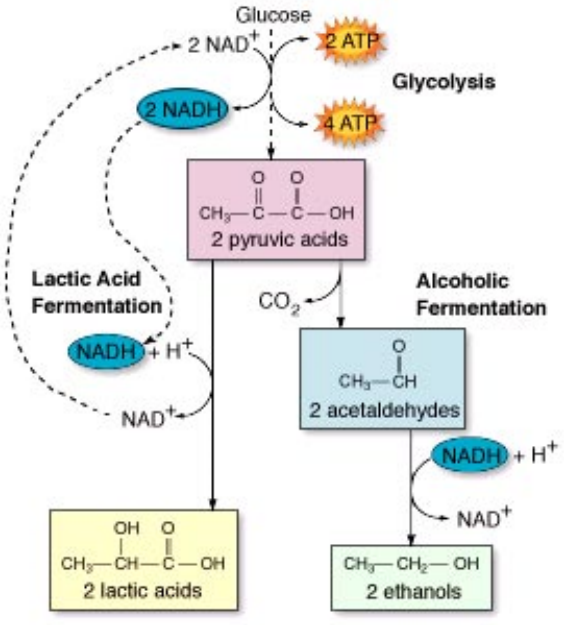
OXIDATIVE PHOSPHORYLLATION:
NADH and FADH feed their hydrogens into the **electron transport system**
energy released upon donation of these hydrogens (oxidation) to the inorganic terminal H acceptor is used to **generate ATP**. (138, 139)
aerobic respiration: terminal H acceptor is oxygen

Alternative H acceptor molecules for anaerobic respiration (they produce fewer ATPs than O_2

N in NO_3^- yielding N_2 (denitrification)	*Pseudomonas, Bacillus*	in water-soaked fields
S in SO_4 yielding H_2S	*Desulfovibrio*	in stagnant pools, swamps etc.

FERMENTATION regenerates NAD$^+$, absent an inorganic H acceptor
Lactic Acid fermentation (Homolactic = *only* lactic acid produced):
Ex: Ferment milk (yogurt, buttermilk, etc). pickles, sauerkraut

Alcoholic fermentation (p 144)



See chart and picture on p 145:
Other fermentation products:

propionic acid	*Propionibacterium*	Swiss cheese
acetic acid	*Acetobacter*	vinegar
acetone	*Clostridium*	industrial production of acetone, gas gangrene...
methane	*Methanosarcina*	generate methane from digestion of sewage, etc
citric acid	*Aspergillus*	flavoring (soft drinks)

Other catabolic reactions: (p 149)

fats to glycerol and fatty acids:	hydrolysis can give off taste to butter and milk (butyric acid)
Protein to amino acids:	deamination producing NH_3 (p 147)