

Energy Transfer and Glycolysis

Cellular Respiration

- Remember that there are four stages that occur in three different places within the cell
 1. Glycolysis: occurs in the cytoplasm
 2. Pyruvate Oxidation: occurs in the matrix of the mitochondrion
 3. Kreb Cycle: occurs in the matrix of the mitochondrion
 4. Electron Transport and Chemiosmosis: occur on the cristae (the inner mitochondrial membrane)

Energy Transfer

- There are two main types
- Substrate-Level Phosphorylation: an enzyme catalyzes the transfer of a phosphate group from a high-energy level molecule to ADP, creating ATP
- For each glucose molecule processed, 4 ATP molecules are generated this way in Glycolysis and 2 in the Kreb's Cycle (See Fig.2, p.95)
- Oxidative Phosphorylation: the transfer of energetic electrons from various molecules to NAD⁺ and FAD.
- The coenzymes will then deliver the electrons to the ETC, which uses this energy to generate a H⁺ gradient within the mitochondrion, which in turn is used to generate ATP

Glycolysis

- Anaerobic process (does not require oxygen)
- Name is Greek for "sugar splitting"
- Glucose (6-Carbon compound) is broken down into 2 molecules of pyruvic acid (3-C compound) and yielding 2 molecules of ATP and 2 NADH molecules
- Occurs in the cytoplasm (see Fig.11 on p.98)

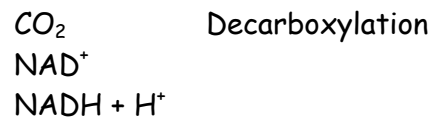
Steps of Glycolysis

REQUIRES ENERGY	Glucose (6-C)	ATP ADP	Dephosphorylation
	Glucose 6-phosphate		Structural Change
	Fructose 6-phosphate	ATP ADP	Dephosphorylation
	Fructose 1,6-biphosphate		
	Molecule splits into		
RELEASES ENERGY	(x2) Phosphoglyceraldehyde (P-PGAL) (3-C)	2NAD ⁺ 2NADH	
	P _i		
	(x2) 1,3-biphosphoglycerate (P-PGAL-P)	ADP ATP	Phosphorylation
	(x2) 3-phosphoglycerate		Structural Change
	(x2) 2-phosphoglycerate		Dehydration
		H ₂ O	
	(x2) phosphoenolpyruvate (PEP)	ADP ATP	Phosphorylation
	(x2) pyruvate (3-C)		

Pyruvate Oxidation

- The pyruvate molecules enter the matrix of the mitochondrion via a transport protein

(x2) pyruvate



(x2) Acetyl Co-A (2-C)

- Overall formula (occurs twice for each molecule of glucose):



- Acetyl CoA proceeds to the Krebs Cycle, NADH proceeds to the Electron Transport Chain, CO_2 diffuses out and the H^+ stay in the matrix