

Glycolysis

- Glucose is the major energy substrate in certain tissues like brain
- Glycolysis occurs in the cell's cytosol
 - it takes place in all organisms both aerobic and anaerobic
 - it's a linear process
- The intermediates either:
 - ① Provide entry points to the cycle
 - ② They are useful directly (e.g. Lactate)

① Priming / Activation
 ② Tricking the cell by changing the glucose's form. Keep continuous influx!
 ③ Trapping the sugar inside the cell.



④ Step 1 is mediated by → Hexokinase

- transfer phosphate from ATP to (OH) at carbon #6.
- target site for cell regulation ⇒ allosteric enzymes regulation.
- trap the glucose inside the cell.
- The receptor that maintains the glucose influx inside the cell is ⇒ GLUT
- irreversible ⇒ but there is specific enzyme found in specific tissues called Glucose-6-phosphatases ⇒ dephosphorylation.



- mediated by → phosphoglucomutase
- mannose + Fructose ⇒ enters glycolytic pathway at this point!
- Reversible.

Regarding the Enzyme used in Step 1 (Hexokinase)

Hexokinase ⇒ different versions isoforms exist in the heart, brain and liver same gene but different expression

Hexokinase I, II, III ⇒ non specific can phosphorylate variety of hexoses like: ① glucose ② mannose ... etc

- type I ⇒ involved in the catabolic pathways
- type II + III ⇒ involved in anabolic pathways
- all the time phosphorylation - allosterically inhibited

Hexokinase IV ⇒ expressed in the liver and β-cells of pancreas

- specific for D-glucose
- Specific phosphorylation only when the blood glucose is high.

Bi → 2 but not close
 Di → 2 close (beside each other)



- Goal? Destabilize the ring!
- mediated by → Phosphofructo Kinase (PFK-1)
- rate limiting step (key regulatory step) ⇒ slowest step that determines the speed of the reaction
- Phosphorylation of (OH) at carbon #1



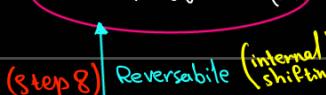
- mediated by → Aldolase
- cleavage into 2 triose phosphates at the bond between C3-C4.
- then C2 can go further! → isomerization to GAP! (Step 5) By Triose phosphate isomerase.
- precursor for glyceral → used for the formation of triglycerols!!



- Super High energy molecule (Storing)
- oxidative phosphorylation.
- by → Glyceraldehyde 3-phosphate dehydrogenase.
- Goal → making high energy molecule.
- electron donors / reductants (NADH)



- First ATP forming reaction (Direct Energy) (Substrate level formation)
- by → phosphoglycerate kinase



- Only terminal shifting → C3 to C2
- isomerization by: phosphoglycerate mutase
- Activation of phosphate group



- 2nd super high energy molecule
- by → Enolase
- increase in the energy stored in phosphate
- OH from Carbon #3 is gone
- H from Carbon #2 is gone
- Double bond between C3 + C2



- 2nd ATP is generated
- Substrate level formation
- By pyruvate kinase



⑤ Net result of Glycolysis

$$\begin{array}{rcl} \text{Step 7, 8, 9} & - 2 \text{ATP} & \xrightarrow{\substack{\text{End result}}} \\ 4 - 2 = 2 & & \\ \text{Step 10} & - 2 \text{Pyruvate} & \\ & & \\ & - 2 \text{NADH} & \xrightarrow{\substack{\text{step 6}}} \end{array}$$