Course 2851 Principles of Metabolism
Metabolism and endocrinology programme, Karolinska Institutet

Lecture 4

Carbohydrates

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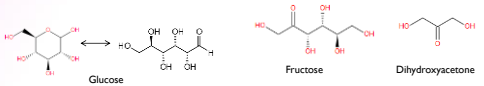
Carbohydrates

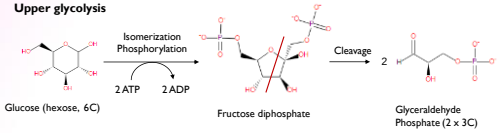
- Literally "carbon with water"; compounds of the form $C_m(H2O)_n$
- The primary product of photosynthesis



- Polymerized to complex carbohydrates

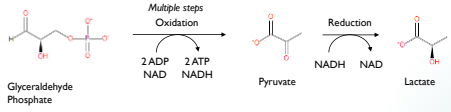
Glycolysis: getting ATP without oxygen

Upper glycolysis



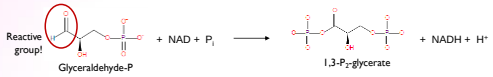
Lower glycolysis

Generates ATP *without* net oxidization



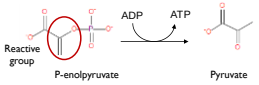
A closer look at lower glycolysis

- The GAPDH reaction phosphorylates *without* using ATP , and gains 1 NADH

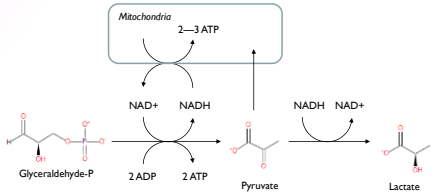


- The doubly phosphorylated glycerate is high energy, can phosphorylate ADP

- An isomerization and dehydration gives P-enolpyruvate, which can also phosphorylate ADP



NAD balance in (lower) glycolysis



Acidification

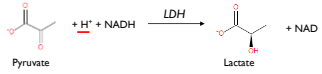
- Glycolytic metabolism is acidifying. Why?

Glucose + 2 ADP + 2 P_i —*Glycolysis*→ 2 Lactate + 2 H2O + 2 ATP

2 ATP + 2 H_2O —*ATP hydrolysis*→ 2 ADP + 2 P_i + 2 H^+

Glucose —*Net result*→ 2 Lactate + 2 H^+

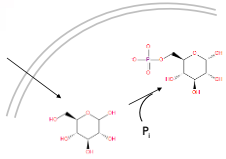
- Lactate dehydrogenase helps by capturing one proton.

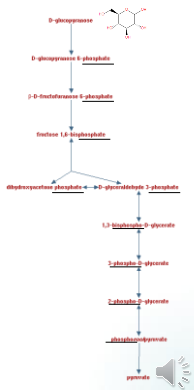


Hochachka & Mommsen, Scienc e 219:1391-1397, 1983

The importance of phosphate groups

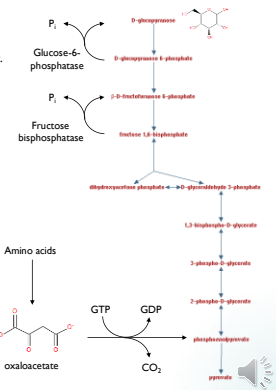
- Glucose is immediately phosphorylated to after uptake
- Phosphate groups traps metabolites in the cell

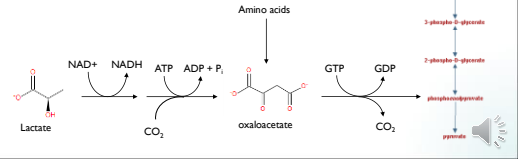




Gluconeogenesis

- Glycolysis is a favorable process, cannot simply be reversed to synthesize sugar.





Generating NADPH from glucose

- The "pentose phosphate pathway"