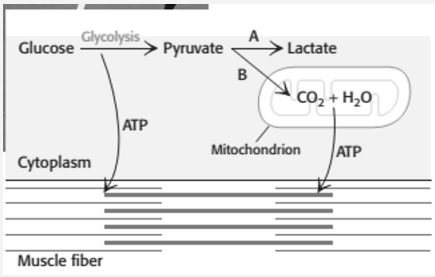
Glycolysis Cheat Sheet

by rhettbro via cheatography.com/133961/cs/27536/

A.Low O2 and B.Normal



Outline

Glycolysis Is an Energy-Conversion Pathway in Many organisms

The Glycolytic Pathway Is Tightly Controlled

Glucose Can Be Synthesized from Non-carbohydrate Precursors

Gluconeogenesis and Glycolysis Are Reciprocally Regulated

Glycolysis

the sequence of reactions that metabolizes **one molecule of glucose** to **two molecules of pyruvate** with the concomitant net production of two molecules of ATP.

Glycolysis is an ancient pathway employed by a host of organisms.

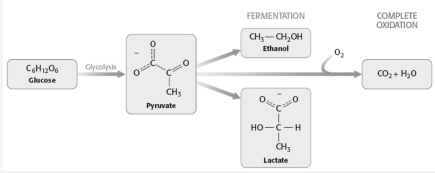
This process is anaerobic (i.e., it does not require O2), in as much as it evolved before the accumulation of substantial amounts of oxygen in the atmosphere.

Pyruvate can be further processed anaerobically to **lactate or ethanol**.

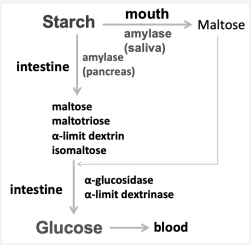
Under aerobic conditions(need O2), **pyruvate** can be completely oxidized to **CO2**, generating much more ATP.

Position of glycolysis: **cytoplasm**

Some fates of glucose



Glucose generated from dietary Carbohydrates

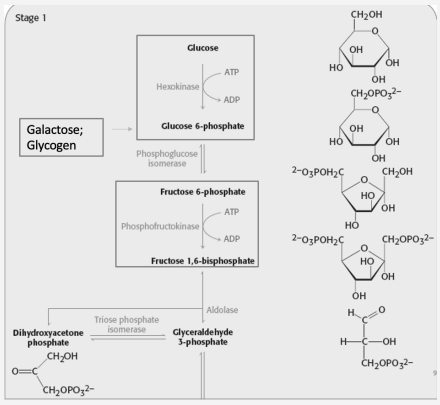


Glycolysis

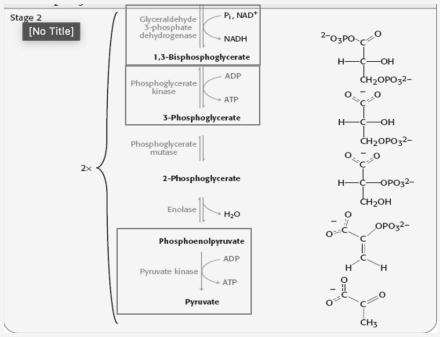
Stage 1: conversion of glucose into fructose 1,6-bisphosphate, and cleavage into two three-carbon fragments;

stage 2: ATP is generated when the three carbon fragments are oxidized to pyruvate.

Stage 1



Stage 2



Diverse fates of pyruvate

10 steps of Glycolysis

Step	Reaction
1	Glucose + ATP ⟶ glucose 6-phosphate + ADP + H^+
2	Glucose 6-phosphate ⟺ fructose 6-phosphate
3	Fructose 6-phosphate + ATP ⟶ fructose 1,6-bisphosphate + ADP + H^+
4	Fructose 1,6-bisphosphate ⟺ dihydroxyacetone phosphate + glyceraldehyde 3-phosphate
5	Dihydroxyacetone phosphate ⟺ glyceraldehyde 3-phosphate
6	Glyceraldehyde 3-phosphate + P_i + NAD^+ ⟺ 1,3-bisphosphoglycerate + NADH + H^+
7	1,3-Bisphosphoglycerate + ADP ⟺ 3-phosphoglycerate + ATP
8	3-Phosphoglycerate ⟺ 2-phosphoglycerate
9	2-Phosphoglycerate ⟺ phosphoenolpyruvate + H_2O
10	Phosphoenolpyruvate + ADP + H^+ ⟶ pyruvate + ATP

Significance of glycolysis

Fermentations provide usable energy in the absence of oxygen

- obligate anaerobes: Clostridium tetani (破傷風杆菌), Clostridium botulinum (肉毒杆菌)

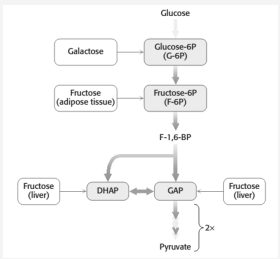
- intense exercise

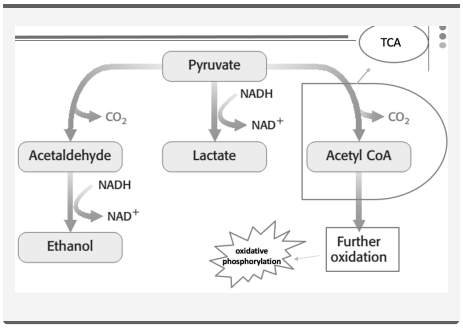
- food industry: sour cream, yogurt, various cheeses, beer, wine, and sauerkraut

Maintaining redox balance

The NADH produced by the glyceraldehyde 3-phosphate dehydrogenase reaction must be reoxidized to NAD+ for the glycolytic pathway to continue. In alcoholic fermentation, alcohol dehydrogenase oxidizes NADH and generates ethanol. In lactic acid fermentation (not shown), lactate dehydrogenase oxidizes NADH while generating lactic acid.

Glycolysis of other hexoses





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