MCB 150

The Molecular and Cellular Basis of Life

Lecture 10: Introduction to Cellular Respiration

Today's Learning Catalytics Session ID is:
35848464

Announcements:

- Exam answer key will be available on Canvas at 3:00
  - Under Exam Information → Exam Schedule Table
- If you have questions about the actual grading of your exam, please direct them to Melissa Reedy
- If you have questions about the problems on the exam, please visit my student hours or talk to me after class
- If you took the Conflict Exam, you may pick up your exam packet in 127 Burrill Hall at your convenience
- Today's handouts will cover today, Monday, and Wednesday

We eat food to give us energy, but how does the energy from food get to ATP?

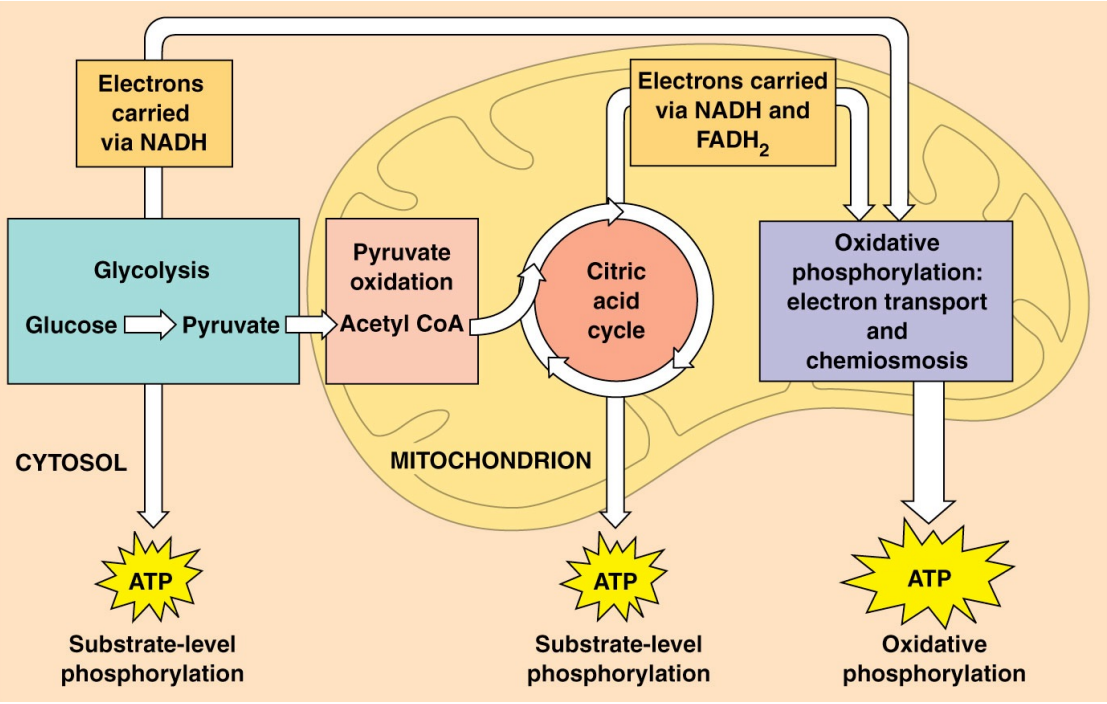
Cellular Respiration

The breakdown of glucose to CO_2 and H_2O

Multiple reactions in 3 distinct pathways or "phases"

- Glycolysis
- Pyruvate oxidation and Krebs cycle
- Oxidative phosphorylation (electron transport and chemiosmosis)

Cellular Respiration:



Phase 1 in the path of making ATP from glucose:

Glycolysis

- "Glyco" (sugar) + "lysis" (splitting)
- Starts with a 6-carbon sugar (**glucose**), ends with two 3-carbon molecules (**pyruvate**)
- Pathway is actually endergonic up to production of first 3-carbon molecules (uses cell's store of ATP)
- Occurs in the cytoplasm of all living cells

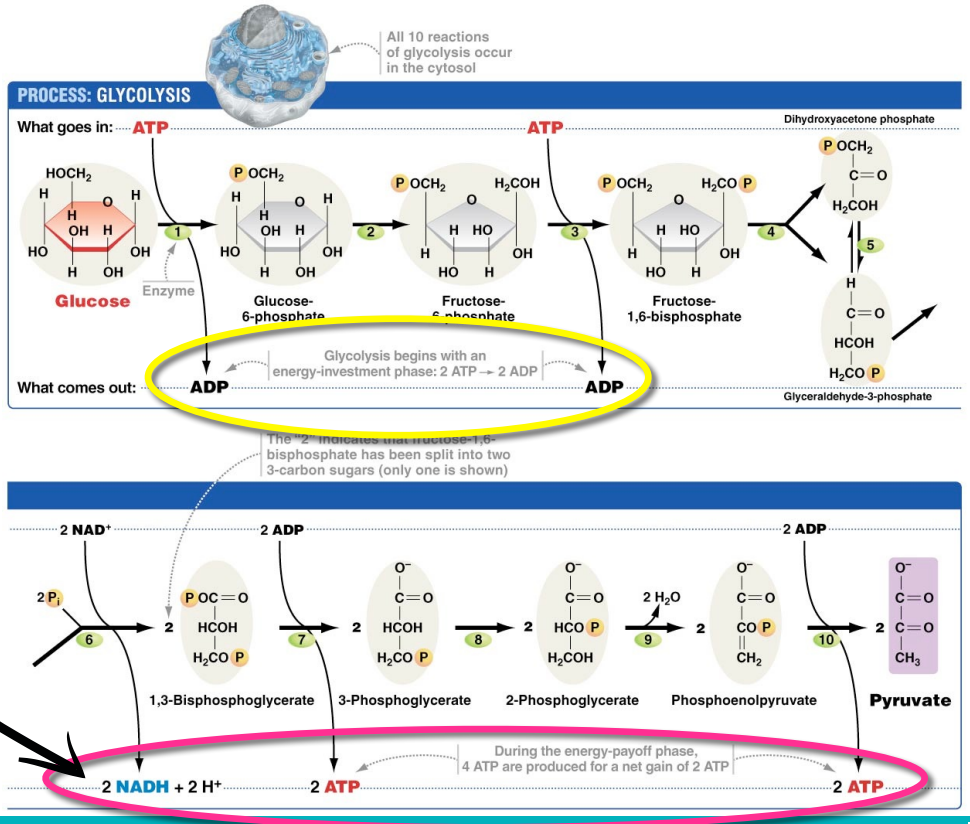
Glycolysis:

2 steps are endergonic

3 steps are exergonic

This energy is harnessed and saved for later

2 SLP reactions



Problems at the end of glycolysis:

1. Molecules still are not at their lowest energy state
2. Some of our energy is being held in NADH
3. NAD^+ is being used up and not replaced

Leads to new questions:

1. How do we get more energy out of pyruvate?
2. How do we transfer the energy in NADH to ATP?
3. How do we regenerate NAD^+?

Answer to previous questions: It depends on the presence or absence of oxygen (O_2) or other terminal electron acceptor

- If oxygen (O_2) is present, cells will undergo **aerobic respiration**
- If oxygen (O_2) is absent but an alternative terminal electron acceptor exists, cells will undergo **anaerobic respiration**
- If oxygen (O_2) is absent and no terminal electron acceptor exists, cells might be able to undergo **fermentation**

Aerobic Respiration:

- Carbon source (2 molecules of pyruvate) completely converted to carbon dioxide
  - Pyruvate molecules first converted to acetyl-CoA, which then enters the Krebs (or Citric Acid) Cycle
  - All C-H bonds converted to C-O bonds (6 CO_2 released)
- More energy transferred to NAD^+ and FAD (makes more NADH & $FADH_2$)
- Another SLP reaction in Krebs cycle (GTP is ATP analog)
- Occurs in mitochondria of eukaryotes; cytoplasm and plasma membrane of prokaryotes