CONCEPT: FERMENTATION & ANAEROBIC RESPIRATION

What Happens to Aerobic Organisms If There's No Oxygen?

●Without oxygen, *aerobic cellular respiration* _____ occur.

□ The ETC gets "*backed-up*" (like a _____ *jam*) without O_2 as the final electron acceptor.

□ The amount of NADH _____ while the amount of NAD^+ _____.

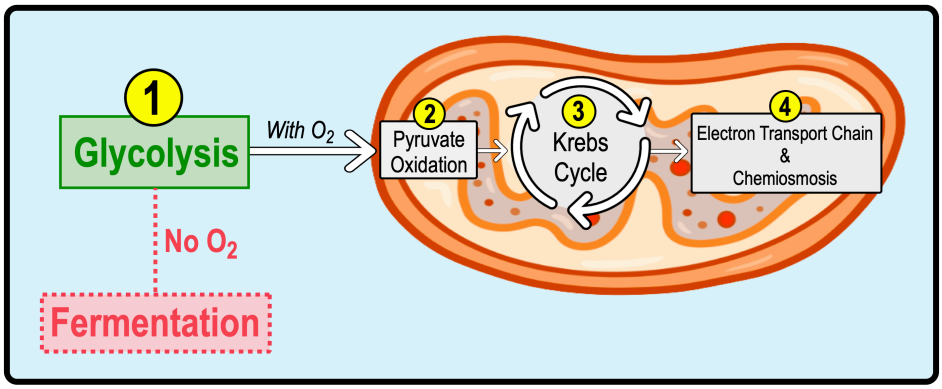
●**Fermentation:** process that uses the electrons from NADH to *reduce* _____ & *regenerate* NAD^+.

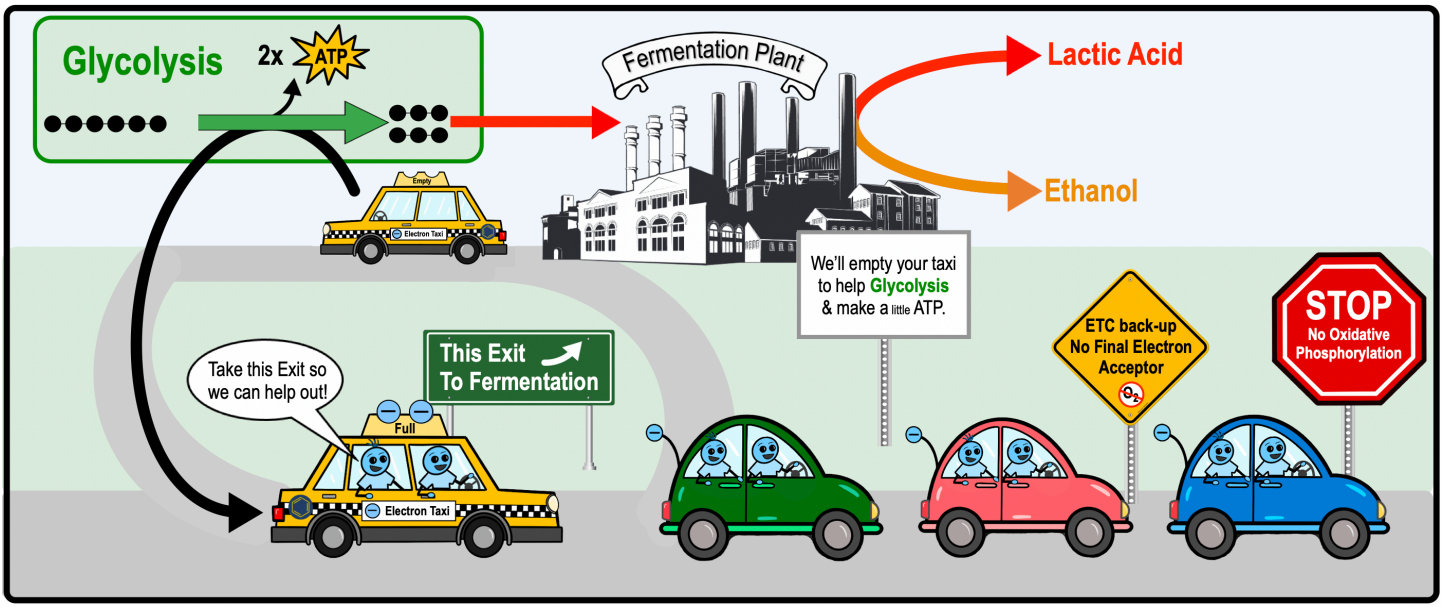
□ Depending on the organism, pyruvate can be *reduced* to _____ *acid* or _____.

□ Makes very _____ ATP, so only *some uni*cellular organisms can survive on just *fermentation*.

□ Regeneration of NAD^+ allows glycolysis to continue in the _____ of Oxygen.

EXAMPLE: Fermentation.





PRACTICE: Fermentation allows a cell to:

a) Recycle NADH to NAD^+ for glycolysis.

b) Use NADH as a terminal electron acceptor.

c) Reduce NAD^+ to NADH for glycolysis.

d) Synthesize ATP via ATP synthase.

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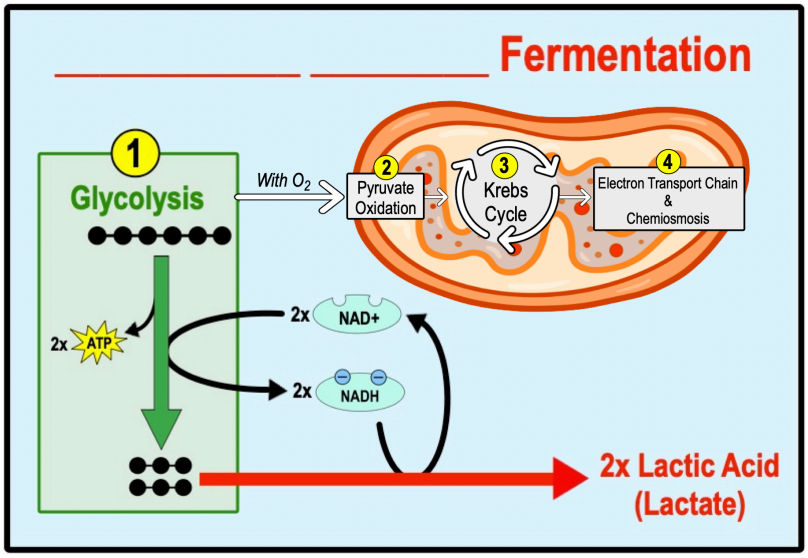
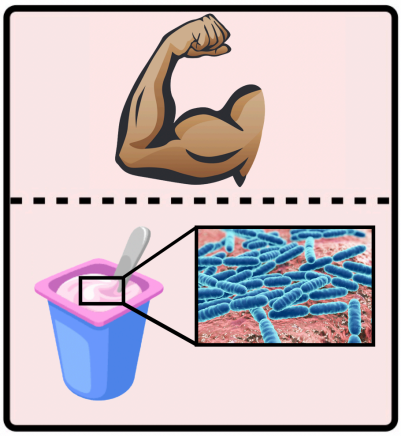
Lactic Acid Fermentation

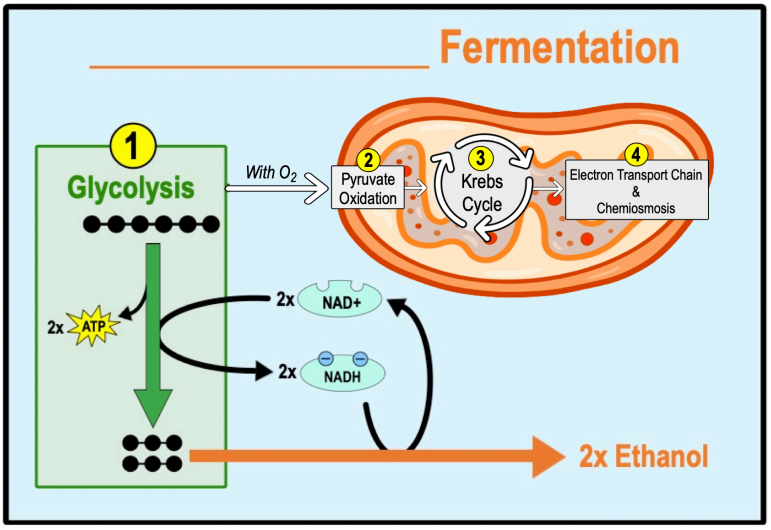
- _____ **Acid Fermentation**: pyruvate is reduced by NADH to form *lactic acid*/_____ & NAD^+.
  - □ Occurs in *human* _____ *cells* & in bacteria that gives yogurt its sour taste.





Alcohol Fermentation

- _____ **Fermentation**: pyruvate is reduced by NADH to form _____ & NAD^+.
  - □ Produces *beer* from barley & *wine* from grapes.



PRACTICE: Which of the following describes a primary function of both lactic acid fermentation and alcohol fermentation?

a) Reduction of NAD^+ to NADH.
b) Oxidation of NADH to NAD^+.
c) Reduction of FAD to $FADH_2$.
d) Hydrolysis of ATP to ADP.

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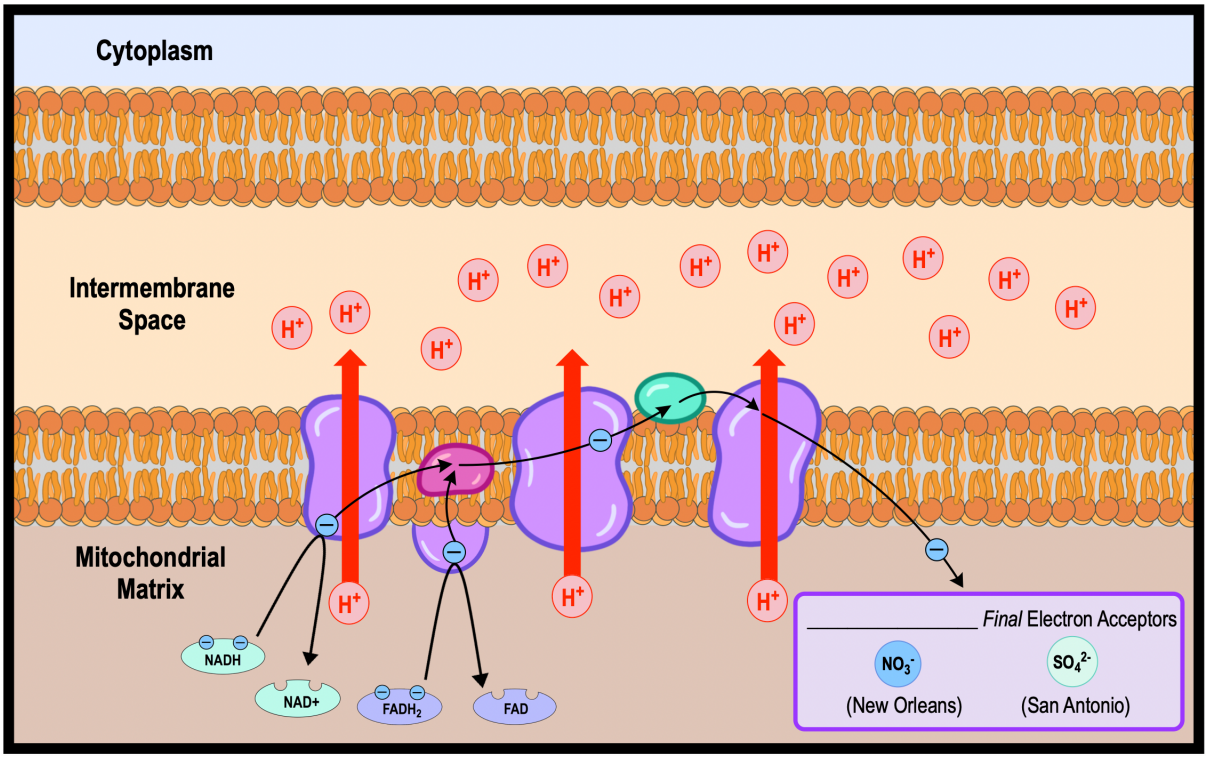
Anaerobic Respiration

- Some unicellular organisms can survive and make significant amounts of ATP _____ oxygen.
- _____ **Respiration**: uses other molecules (instead of O_2) as the *final electron acceptor* of ETC.
  - □ *Alternative* electron acceptors include: Nitrate (NO_3^-), Sulfate (SO_4^{2-}) & CO_2.
  - □ Makes _____ ATP than *fermentation*, but _____ ATP than *aerobic cellular respiration*.



PRACTICE: In which of the steps of aerobic and anaerobic cellular respiration does substrate-level phosphorylation occur?

a) In glycolysis only.
b) In the Krebs cycle only.
c) In the electron transport chain only.
d) In both glycolysis and the Krebs cycle.
e) In both the Krebs cycle and the electron transport chain.

PRACTICE: Which of the following statements about NAD^+ is true?

a) NAD^+ is reduced to NADH during glycolysis, pyruvate oxidation, and the Krebs cycle.
b) NAD^+ has more chemical energy than NADH.
c) NAD^+ donates high energy electrons to the electron transport chain.
d) In the absence of NAD^+, glycolysis can still function.