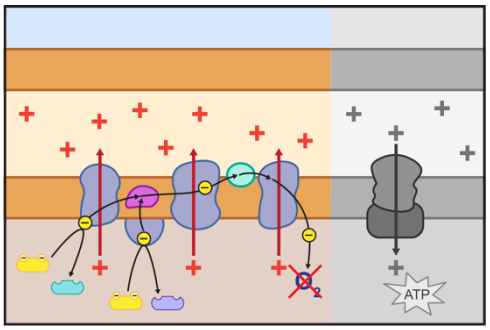
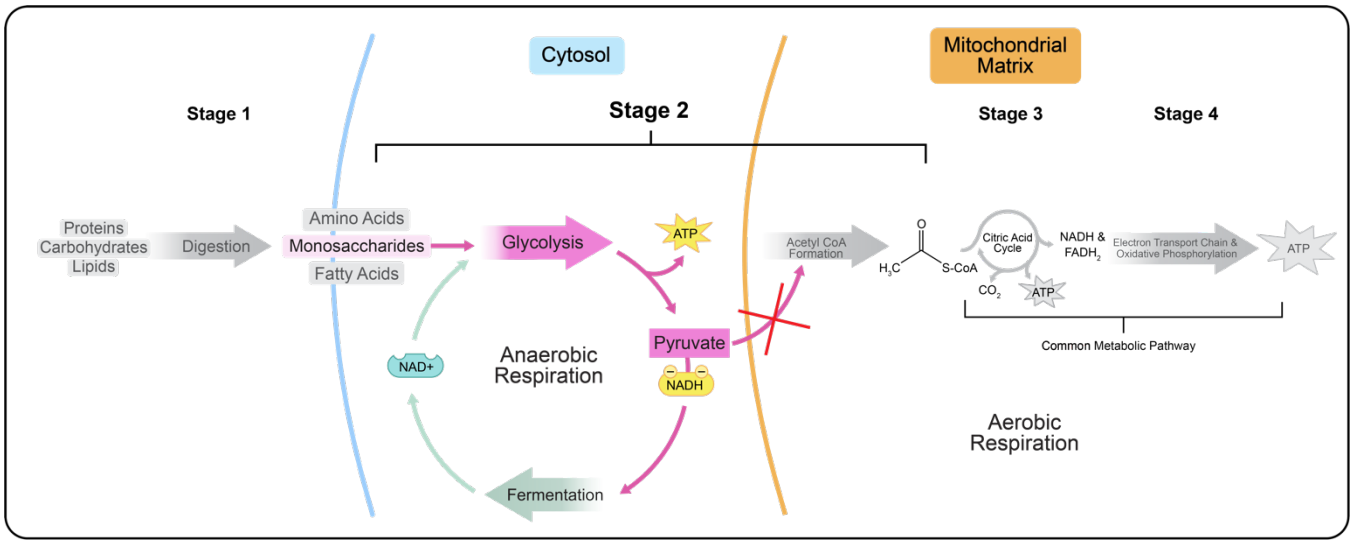
CONCEPT: ANAEROBIC RESPIRATION



Limitations of Anaerobic Respiration

- Without O_2 as _____ electron acceptor, ETC is not able to produce _____.
  - □ Instead, pyruvate is redirected through _____ in the cytosol.



- **Fermentation:** generation of energy in the absence of oxygen (_____ efficient than aerobic respiration).
  - □ Utilized by animals and certain microorganisms.
  - □ In the absence of ____ (oxidizing agent), fermentation regenerates _____ allowing glycolysis to continue.
    - **Recall:** Glycolysis only makes ___ ATP vs 20+ from aerobic respiration.

EXAMPLE: Why is anaerobic respiration (fermentation) in eukaryotic cells inefficient?

a) No metabolic processes are able to continue without oxygen.

b) Electron Transport Chain is not able to produce ATP without oxygen as final electron acceptor.

c) Glycolysis only produces 2 ATP molecules per 1 glucose molecule.

d) Overproduction of NAD^+ causes glycolysis to shut down.

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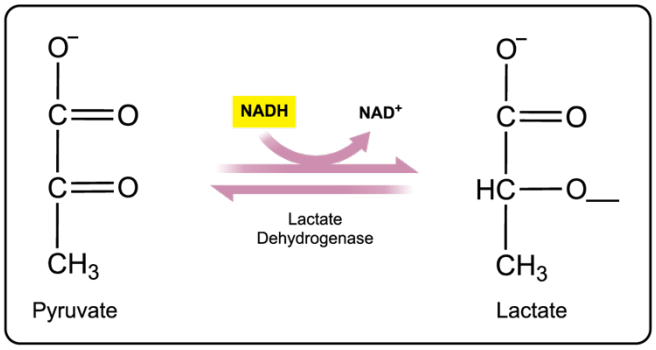
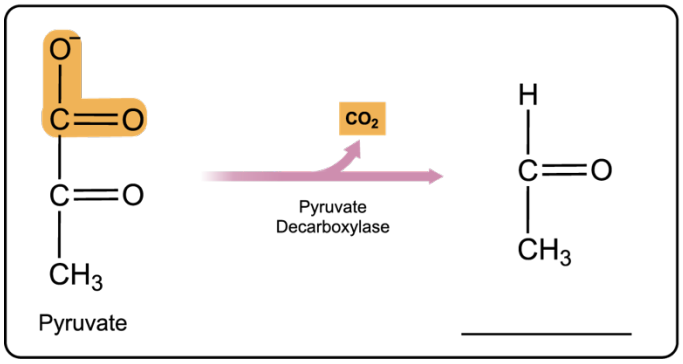
Lactate Fermentation

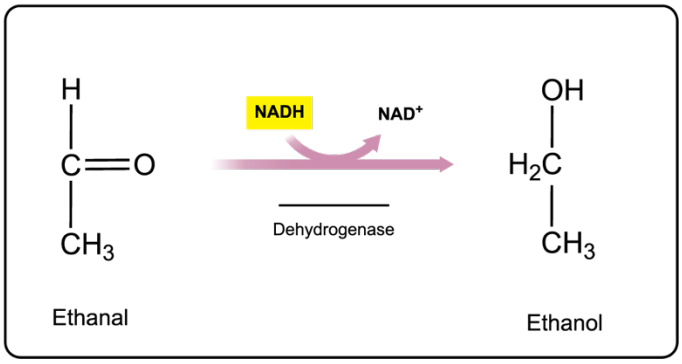
- Process occurs in animal _____ cells during strenuous activity.
- Pyruvate is _____ by lactate dehydrogenase to _____.
  - □ 1 NADH is oxidized to 1 _____.



Alcohol Fermentation

- Process by which certain _____ and yeast convert pyruvate to _____ and CO_2.
- Pyruvate is reduced to ethanol by a ____ step process.
  - □ 1 C atom is lost as _____.
  - □ 1 NADH is oxidized to 1 _____.





EXAMPLE: Pyruvate is converted into ethanol and CO_2 by which of the following enzymatic reactions?

a) Pyruvate is directly converted to ethanol by alcohol dehydrogenase.

b) Pyruvate is converted to acetaldehyde by pyruvate decarboxylase, then reduced to ethanol by alcohol dehydrogenase.

c) Pyruvate is converted to lactate by lactate dehydrogenase, followed by conversion to ethanol by lactate reductase.

d) Pyruvate is converted to ethanol by oxidative decarboxylation.

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PRACTICE: How is aerobic respiration different from anaerobic respiration?

a) Anaerobic respiration produces ethanol or lactate, while aerobic respiration produces water and more CO_2.

b) Fermentation takes place in the mitochondrial matrix, whilst pyruvate oxidation takes place in the cytoplasm of the cell.

c) Aerobic respiration produces less ATP than anaerobic.

d) Aerobic respiration can be described as reduction reactions, while anaerobic is oxidation reactions.

e) Both fermentation and pyruvate oxidation produce NAD^+.

PRACTICE: Select statement that explains importance of conversion of NADH to NAD^+ during anaerobic respiration.

a) Cells rely on glycolysis to produce ATP and NAD^+ in the absence of oxygen.

b) Conversion of glucose to pyruvate in glycolysis requires NAD^+ as an electron acceptor.

c) Allows for conversion of glucose to Acetyl CoA in the absence of oxygen.

d) Regeneration of NAD^+ through fermentation ensures that glycolysis will come to a halt.

PRACTICE: Circle the correct type of respiration under which:

a) Pyruvate converted to lactate (aerobic or anaerobic)

b) Glucose converted to pyruvate (aerobic or anaerobic)

c) Pyruvate converted to Acetyl CoA (aerobic or anaerobic)

d) Pyruvate converted to ethanol (aerobic or anaerobic)