AP Biology
Notes: Fermentation

Fermentation (enables some cells to produce ATP without the help of oxygen)

Aerobic = (Aer = air; bios = life); existing in the presence of oxygen
Anaerobic = (An = without; aer = air); existing in the absence of free oxygen.
Fermentation = Anaerobic catabolism of organic nutrients

Remember:

*Glycolysis oxidizes glucose to two pyruvate molecules, and the oxidizing agent for this process is NAD^+, **not oxygen**

*Glycolysis produces a net of two ATPs whether conditions are aerobic or anaerobic

Two pathways:

Aerobic conditions: Pyruvate is oxidized further by substrate-level phophorylation and by oxidative phosphorylation and more ATP is made and NADH passes electrons to the electron transport chain. NAD^+ is regenerated in the process.

Anaerobic conditions: Pyruvate is reduced and NAD^+ is regenerated. This prevents the cell from depleting the pool of NAD^+ which, is the oxidizing agent necessary for glycolysis to continue. no additional ATP is produced.

Fermentation recycles NAD^+ from NADH. This process consits of anaerobic glycolysis plus subsequent reactions that regenerate NAD^+ by reducing pyruvate.

Two of the most common types of fermentation
(1) alcohol fermentation
(2) lactic acid fermentation
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Alcohol Fermentation:

Pyruvate is converted to ethanol in two steps:

a. Pyruvate loses carbon dioxide and is converted to the two-carbon compound acetaldehyde.
b. NADH is oxidized to NAD^+ and acetaldehyde is reduced to ethanol. Many bacteria and yeast carry out alcohol fermentation under anaerobic conditions.

Lactic Acid Fermentation:

NADH is oxidized to NAD^+ and pyruvate is reduced to lactate.

*Commercially important products of lactic cid fermentation include cheese and yogurt.

*When oxygen is scarce, human muscle cells switch from aerobic respiration to lactic acid fermentation. Lactate accumulates, but it is gradually carried to the liver where it is converted back to pyruvate when oxygen becomes available.