Chemical Reactions and Enzymes

(Pages 49 – 59)
Chemical Reactions

• Chemistry of Life
  – Not just what life is made of.
  – What life does!
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  – What life does!

• What is a chemical reaction?
  – Process that changes one set of chemicals into another set of chemicals.
Chemical Reactions

- Contain two components:
  - Reactants: Elements that enter a reaction.
  - Products: Elements produced by a reaction.
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  – Products: Elements produced by a reaction.

• Always involves breaking old bonds and forming new bonds.

\[
\text{CO}_2 + \text{H}_2\text{O} \quad \rightarrow \quad \text{H}_2\text{CO}_3 \\
\quad \text{(Blood)}
\]

\[
\text{H}_2\text{CO}_3 \quad \rightarrow \quad \text{CO}_2 + \text{H}_2\text{O} \\
\quad \text{(Lungs)}
\]
Energy in Reactions

- Chemical reactions involve changes in energy.
  - Formation of bonds = Release of energy
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• Changes in energy determine whether a reaction will occur.
  – Spontaneous vs Energy source

\[ 2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} \]  
(Energy released as heat, light, & sound)
Energy in Reactions

• Significance for living things?
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  – Must have source of energy.
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• Not all reactions that release energy occur spontaneously!
  – **Activation energy**: Energy needed to get a rxn started.
  – Ex: Heat source
Energy in Reactions: Enzymes

• What if rxns in living things are TOO SLOW or have TOO HIGH activation energies?
Energy in Reactions: Enzymes

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    • Enzymes are biological catalysts.
      – Speed up chemical reactions in living cells.
      – Lowers the activation energies.
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- Carbonic anhydrase speeds up this rxn 10 million times faster
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  – Can be affected by many variables
    • ie~ pH or temperature
Enzyme Action

• How do enzymes work?

• Regulate chemical pathways, make materials cells need, release energy, & transfer information.