

## Chapter 8 Metabolism

- Contrast the two broad categories of metabolic pathways.
  - Anabolic pathways: synthesis of complex molecules from simpler ones.  
Require energy
  - Catabolic pathways: breakdown of complex molecules into simpler ones.  
Release energy
- Which generally require energy and which release it?
  - Anabolic require energy
  - Catabolic release energy
- Which tend to involve hydrolysis reactions and which tend to involve condensation (dehydration) reactions?
  - Anabolic involves condensation reaction
  - Catabolic involves hydrolysis reaction
- What is kinetic energy is and how is it measured?
  - The energy of motion
  - Average speed measured as temperature
- Can this kind of energy be used to satisfy a living organism's energy requirements? Explain.
  - No because you cant use heat to make energy
- Explain the concept of potential energy.
  - Stored energy
- How is energy stored?
  - By doing work against a force
- Give some examples.
  - Rolling a rock up a hill/ mountain and chemical bonds (battery)
- Which types of covalent bonds contain potential energy that can be transferred or released in chemical reactions?
  - Non polar bonds
- Why is it that organic molecules provide a rich source of chemical energy?
  - Because they are nonpolar
- Explain the concept of entropy.
  - Disorder, disorganization; tendency of energy to spread out
- To what levels of potential energy and entropy do systems naturally tend toward, according to the laws of thermodynamics?
  - A chemical reaction will tend to occur spontaneously if products have LOWER potential energy and HIGHER entropy compared to the reactants.
- What's the difference between exergonic and endergonic chemical reactions?
  - Exergonic: releases free energy;  $G$  negative, spontaneous (Ex:burning)
  - Endergonic: stores free energy;  $G$  positive; nonspontaneous
- Which occur spontaneously?
  - Exergonic chemical reactions
- What factors will determine whether a reaction occurs spontaneously?
  - Potential energy and entropy
- What is meant by (Gibbs) free energy?
  - The total energy available for transfer

- Explain in a general way how the change in free energy ( $\Delta G$ ) predicts whether a particular reaction is endergonic or exergonic.
  - A chemical reaction will tend to occur spontaneously if there is an overall loss in free energy ( $G$ ). Exergonic
- What are enzymes?
  - proteins that catalyze (facilitate) chemical reactions
- How do they function?
  - They bring together and orient the reactants favorably, so that less energy is needed to pass through the transition state
- Describe how they interact with their specific substrate molecules.
  - The substrate/reactants fit in enzyme's active site, react with each other to form product.
- What physical factors affect enzyme activity?
  - Temperature and pH
- Explain why changes in these physical conditions can affect how an enzyme functions.
  - Because organisms tend to have enzymes that function best under conditions in which they live in.
- How do enzymes affect the energetics (energy relationships) in chemical reactions?
  - They lower the activation energy of a reaction.
- What does the term *transition state* refer to?
  - When the molecules have absorbed energy for the bonds to break and the reactants are in an unstable condition
- Explain what activation energy is, and contrast it with the free energy change of a chemical reaction.
  - The amount of energy needed to make a chemical reaction occur; The initial investment of energy for starting a reaction the energy required to contort the reactant molecules so the bonds can break
- Make a simple graph with labeled axes to illustrate your answer.
  - Diagram
- In what two basic ways can enzyme activity be regulated/inhibited?
  - Competitive inhibitors and noncompetitive inhibitors
- Describe how each works.
  - Competitive Inhibitors: bind to active site, blocking substrate's access
  - Non- Competitive Inhibitors: bind to an allosteric site on enzyme, changing conformation of active site. (= allosteric inhibition)
- Explain what feedback inhibition is and how it works, giving an example.
  - A process that creates the conditions that shuts itself off
  - end product acts as allosteric inhibitor of an enzyme involved in its production
  - A/C analogy
- Explain how ATP supplies energy to make endergonic reactions occur.
  - ATP transfers energy to reactants, powering an endergonic reaction.
- How does this affect the energy relationship of reactants and products?
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