Chapter 5 - Energy

Energy and the World of Life

- Energy is the capacity to do work
- Energy's source is the sun
- 2 basic forms of energy
  - Potential energy – stored energy
  - Kinetic energy – energy of motion

The 2 forms of energy are converted back and forth!

Measuring Energy

- Calorie – amount of heat energy needed to raise the temperature of 1 gram of water by 1^0C

Laws of thermodynamics (energy)

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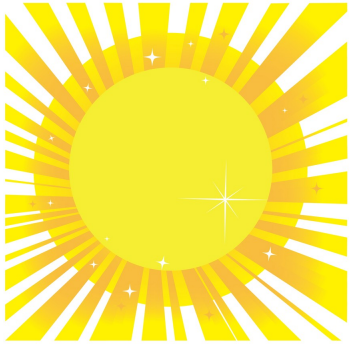
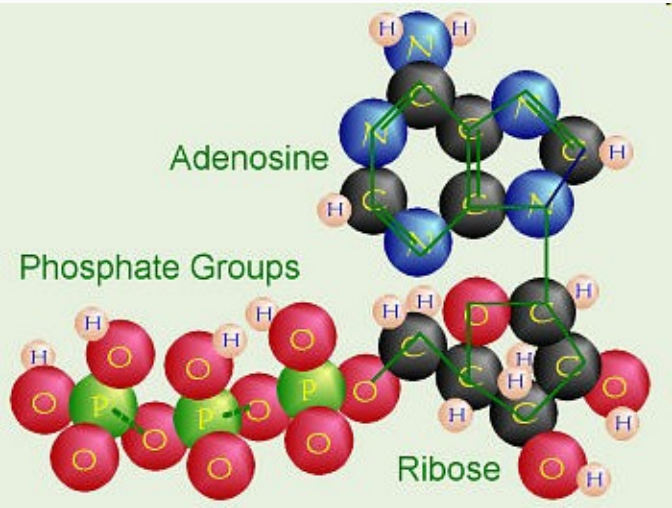
Increased entropy (disorder)…how can we fix this???



ATP – The Cell's Energy Currency

- **ATP** (adenosine triphosphate) WHY ATP???
  - A nucleotide with three phosphate groups (unstable)
  - Easily loses a phosphate – becomes ADP (adenosine diphosphate)
- **ATP/ADP cycle – this happens constantly and drives most reactions!!!**



You should know this!!!

cellular work (e.g., synthesis, breakdown, or rearrangement of substances; contraction of muscle cells; active transport across a cell membrane)

reactions that release energy (like cellular respiration)

ATP

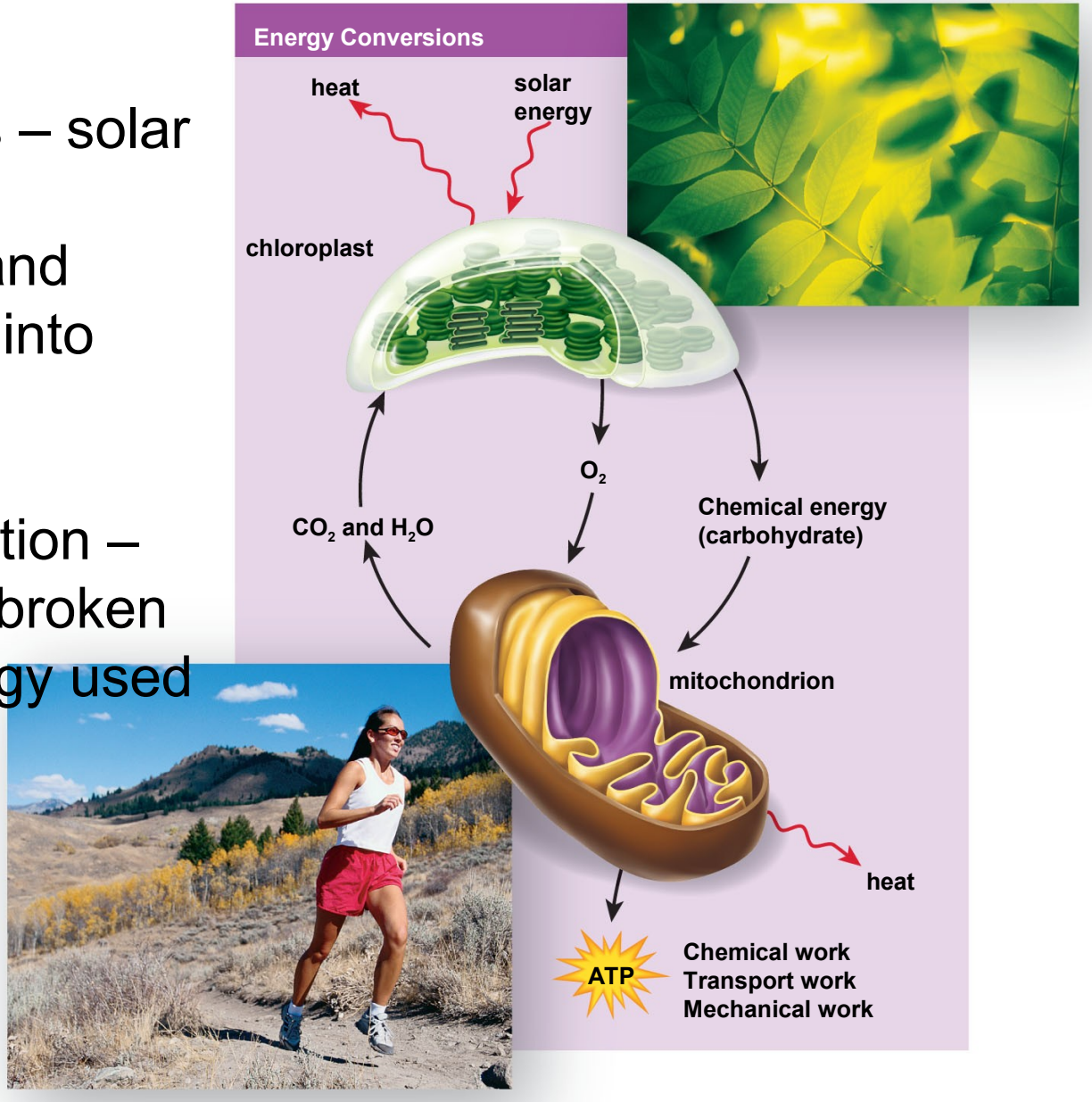
ADP + P_i

reactions that require energy (like photosynthesis)

Two important energy-requiring/producing processes!

Photosynthesis – solar energy used to convert water and carbon dioxide into carbohydrates

Cellular respiration – carbohydrates broken down and energy used to build ATP



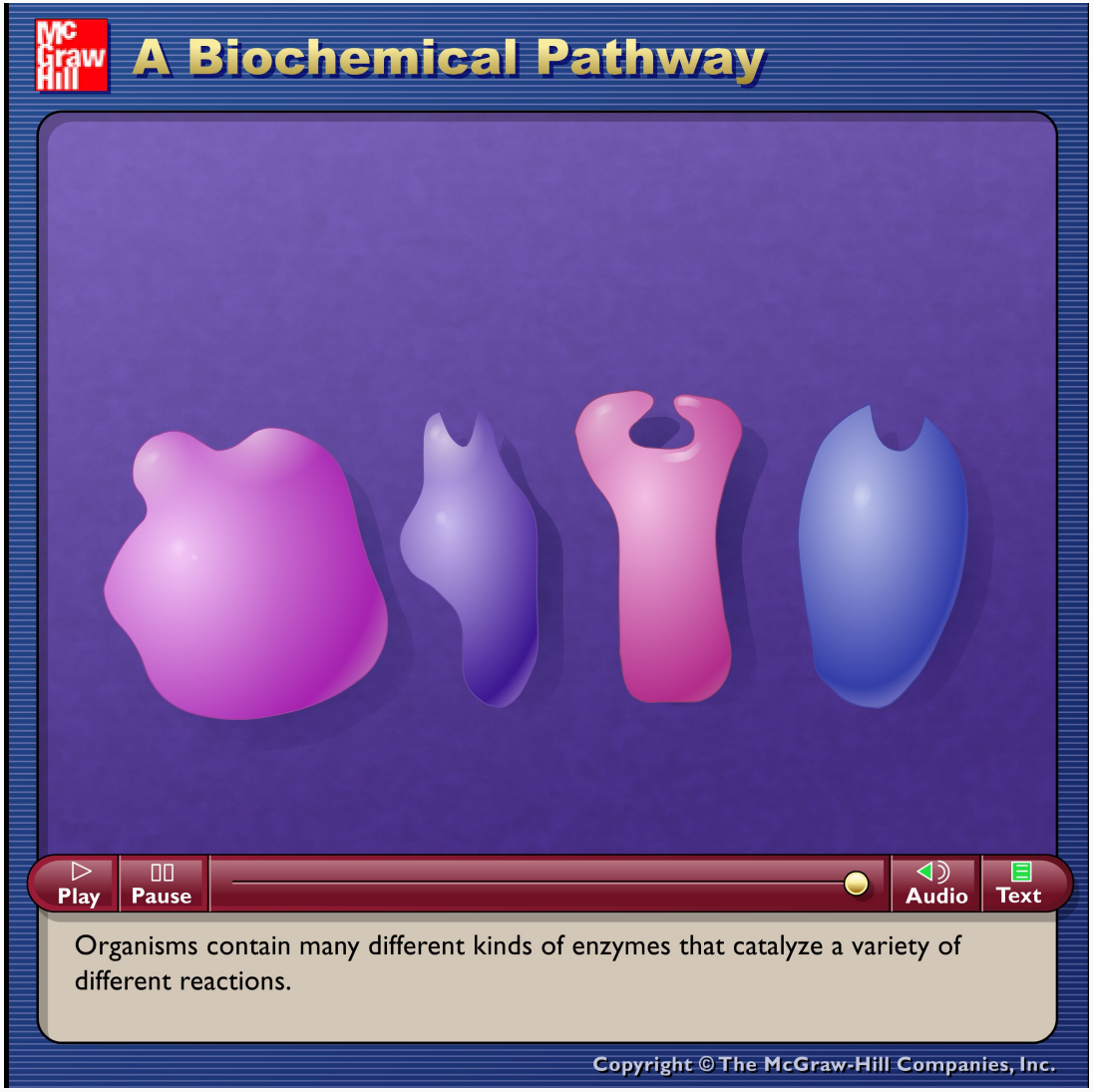
Metabolic Pathways and Enzymes

- **Metabolic pathway – series of linked reactions**
  - **Found in photosynthesis & cellular respiration!**
  - **Product of a previous reaction becomes the reactant in the next!**

- **Enzyme**
  - makes a specific reaction occur much faster than it would on its own
  - Most are proteins

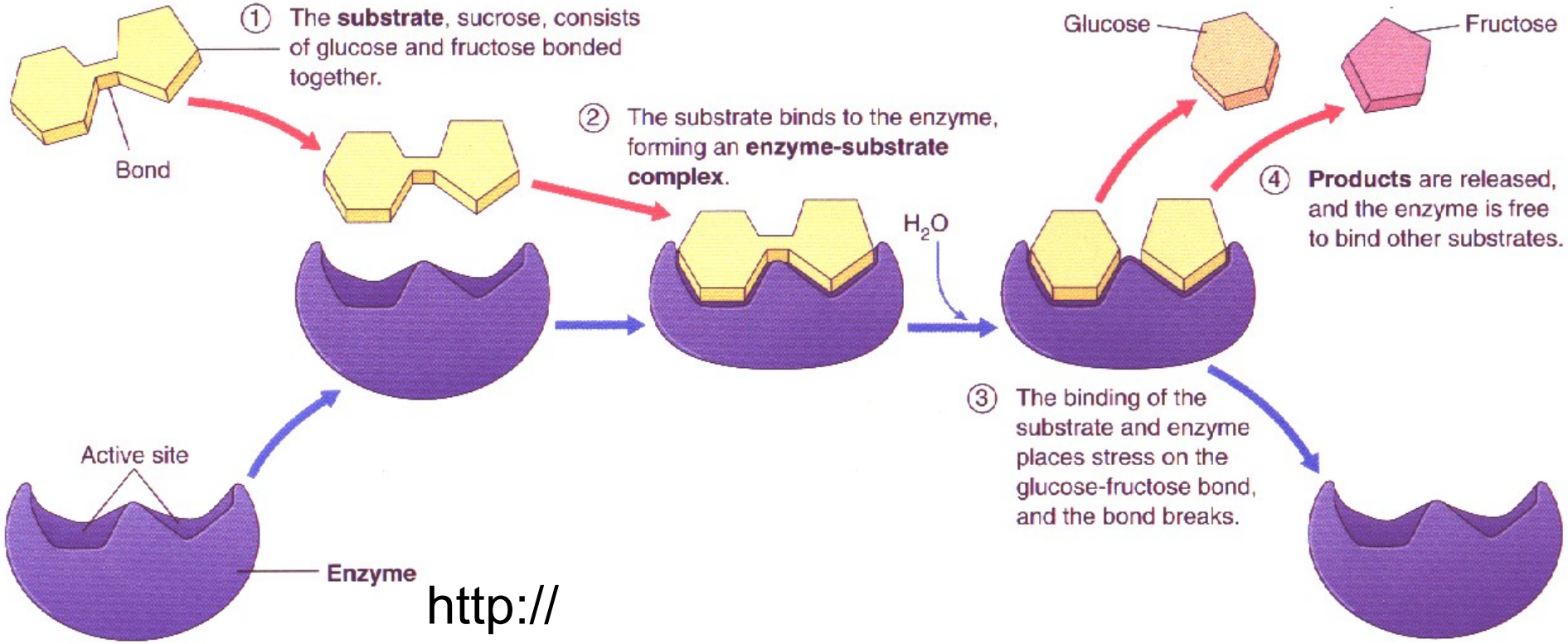
- **Substrate**
  - The specific reactant acted upon by an enzyme

Animation – Metabolic pathway



Types of Reactions (hydrolysis, condensation, etc…) – all require enzymes!

- Active site
- Enzyme not used up by rxn
- Each enzyme is specific to a rxn

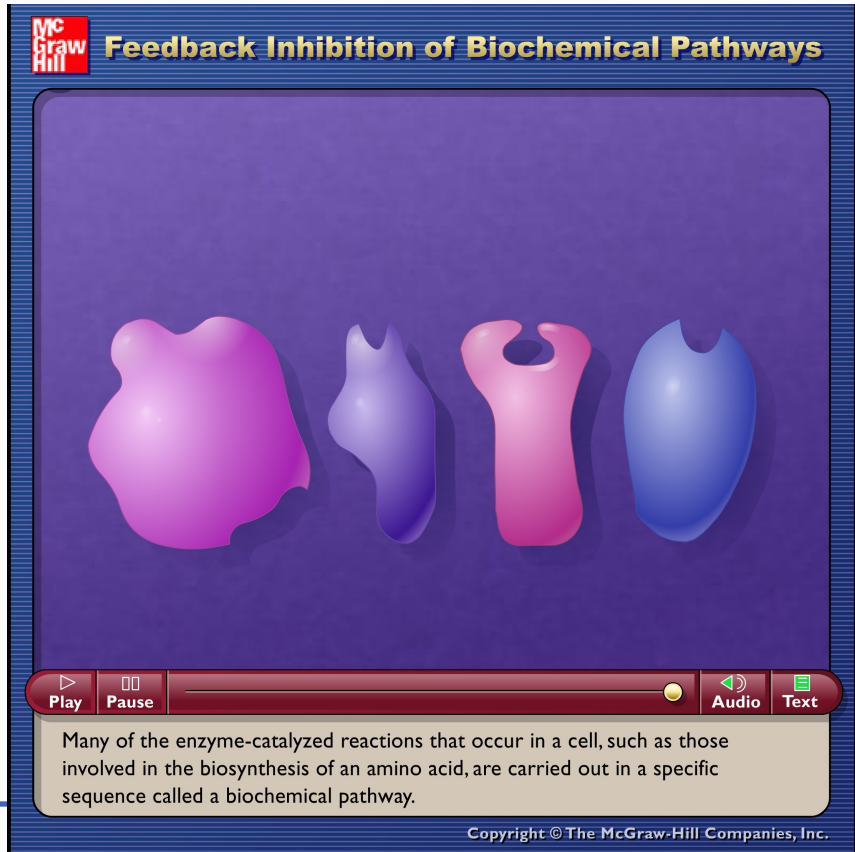


http://www.youtube.com/v/V4OPO6JQLOE

Why enzymes are important!

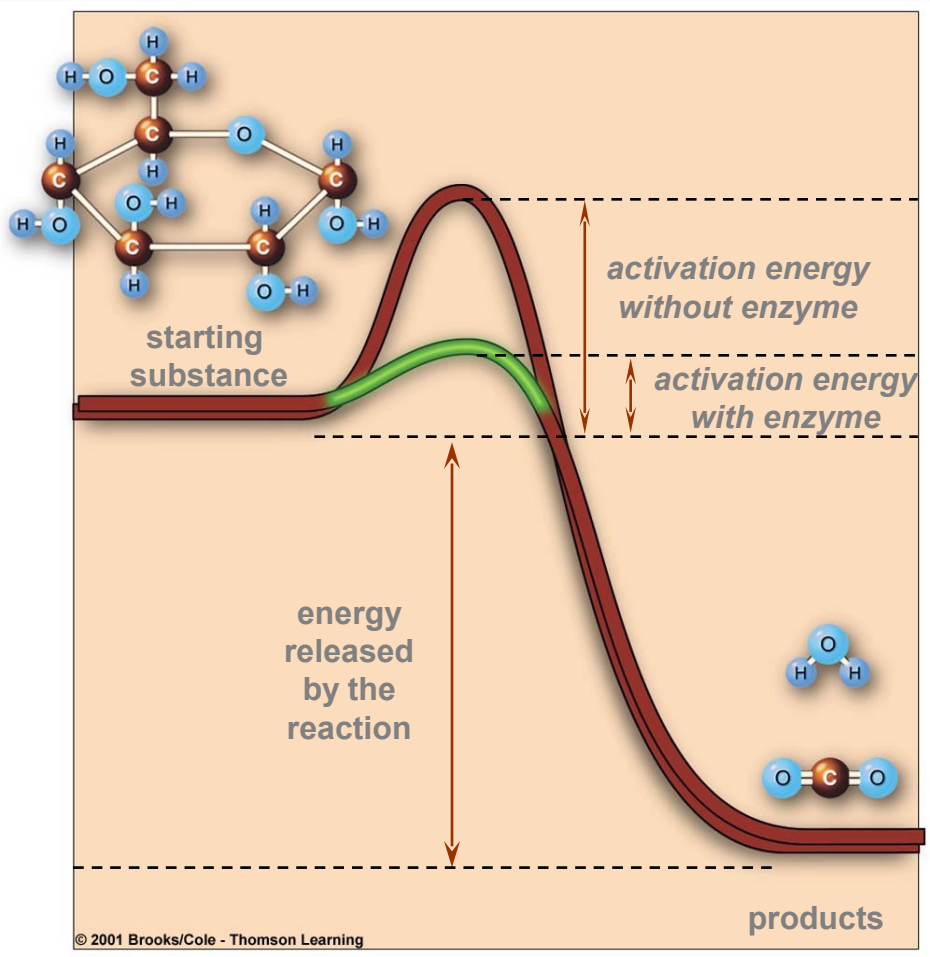
- Enzyme inhibition – enzyme is prevented from combining with its substrate
  - Cyanide inhibits enzymes
  - Penicillin interferes with a bacterial enzyme

Feedback inhibition



Activation Energy – what enzymes specifically do!

- For a reaction to occur, an energy barrier must be surmounted
- Enzymes make the energy barrier smaller (i.e. lower the activation energy)



Metabolism – Organized, Enzyme-Mediated Reactions

- ATP, enzymes, and other molecules interact in organized pathways of metabolism (activities by which cells acquire and use energy)