

GENERAL BIOLOGY Lecture 8 - Enzymes & energetics

- I. **Definition of metabolism**
 - A. The sum of biochemical processes in living cells involved in the synthesis, breakdown, and inter-conversion of constituents in the cell
 - II. **Laws of thermodynamics**
 - A. **First law of thermodynamics**
 - 1. Energy is conserved; energy cannot be created nor destroyed
"HEAT IS WORK AND WORK IS HEAT"
 - B. **Second law of thermodynamics**
 - 1. Energy tends to follow a path of disorder; spontaneity; entropy
"HEAT, CANNOT ON ITSELF PASS FROM A COOLER BODY TO A HOTTER BODY"
 - C. **How does the world of life continue to flow?**
 - 1. Energy is constantly supplied by energy lost from some place else
 - III. **Reactions & metabolic pathways**
 - A. **Metabolic pathways**
 - 1. **Orderly sequence of reactions**
 - A) Reactants (precursors, substrates)
 - B) Metabolites (intermediate compounds in pathway)
 - C) Enzymes (catalysts)
 - D) Cofactors (coenzymes - NADH, Mg, etc)
 - E) Energy carriers (ATP)
 - F) End products (final outcome)
 - IV. **Enzymes**
 - A. **Function - catalysts**
 - 1. Lower activation energy
 - a) Climb over desk & then move desk to walk, etc.
 - B. **What they act on - substrates**
 - C. **Structure - complex**
 - 1. Active site
 - 2. Enzyme-substrate complex
 - 3. Induced fit model
 - D. **Interactions - regulations**
 - 1. pH and temperature
 - 2. Allosteric enzymes (with a regulatory site)
 - 3. Feedback inhibition
 - 4. Cofactors FAD, NAD, NADP
 - a) Simultaneous reaction(s) coupled to key reaction
 - 1) Acetaldehyde = ethanol; NADH = NAD (Reaction driven)
- Acetaldehyde + NADH + 2H⁺ + 2 electrons =====> ethanol + NAD
 HCOCH₃ =====> H₂C(OH)CH₃
 (This is a reduction of acetaldehyde)
- V. **The universal "currency" of free energy in biological systems**
 - A. **Adenosine triphosphate**
 - 1) Contains two energy rich phosphate bonds