

### Enzymes

Enzymes: biological catalysts that facilitate chemical rxns in cells by lowering the activation energy

Structure:

-Active site that specifically interacts with substrate molecules

-Shape and charge of the substrate must be compatible with the active site of the enzyme

Environmental Impacts:

Denaturation: protein structure is disrupted, eliminating the ability to catalyze rxns

-Environmental temperatures and pH outside the optimal range will cause structural changes

a. pH change can alter H-bonds that provide enzyme structure

b. H temp increases speed of molecules in a solution, increasing frequency of collisions between enzymes and substrates (increase rate of rxn)

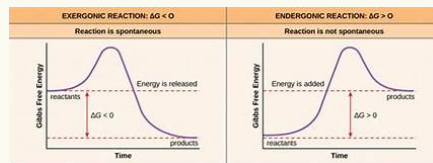
-Relative concentrations of substrates and products determine how efficient rxn is

Inhibitors:

-Competitive inhibitor molecules can bind reversibly or irreversibly to the active site of enzyme

-Noncompetitive inhibitors can bind allosteric sites, changing the activity of the enzyme

### Endergonic vs. Exergonic



### Thermodynamics

1st Law Nrg cannot be created nor destroyed  
only transferred

2nd Law every nrg transfer increases entropy (S) of universe; process must increase entropy to be spontaneous

-Energy input must exceed energy loss to maintain order and to power cellular processes

-Cellular processes that release energy may be coupled with cellular processes that require energy

a. Often sequential; product of rxn is reactant for next step

-Loss of order or energy flow results in death

-Living systems require constant nrg input

### Cofactor vs. Coenzyme

Cofactor Inorganic; Cu, Zn, Mg, Fe, Ca ions; Remove electrons, protons or chemical groups from substrate

Coenzyme Organic (non-protein); NAD<sup>+</sup>, FAD<sup>+</sup>, vitamin complexes; Remove electrons from substrate and transfer to other molecules

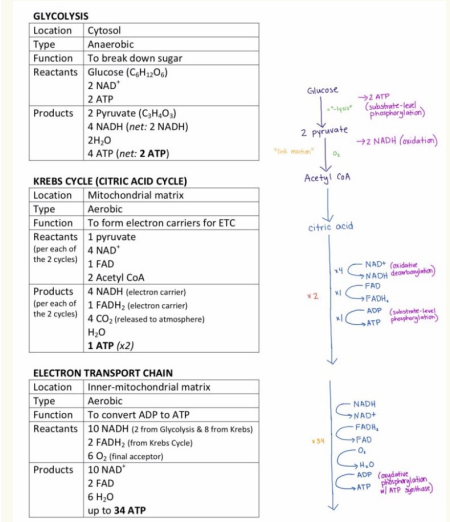
Both aid in proper functioning of enzyme

### Fitness

-Variation at the molecular level provides organisms with ability to respond to various environmental stimuli

-Variation in the number and types of molecules within cells provide organisms with greater ability to survive and/or reproduce in different environments

### Cellular Respiration



### Photosynthesis

