- Proteins never go backwards in folding process

Denaturation: unfolding of the protein to create a non-functional protein; not always completely unfolded; heat denaturation breaks H bonds and is abrupt; can also occur due to extreme pH, miscible organic solvents, solutes (urea) and detergents; never breaks covalent bonds, just hydrophobic aggregation and H-bonds

- Irreversible if the activation energy for folding is very high and if part of primary sequence is missing/damaged

Disulfide linkages: not common in cytosol since it has reducing agents which break disulfide bonds; break upon amidation

Standard Conditions: atmospheric pressure, water-based solvents, room temp (25 degrees C) to body temp (35 degrees C), pH of 2-9

Unit 3: Enzymes:

Thermodynamics: whether a reaction will occur spontaneously; determines ratio of products to reactants in given conditions; depends on Gibbs free energy

Kinetics: determines rate of rxn; depends on activation energy

Enzymes: have specificity for substrates, accelerate reactions, function in physiological conditions (few non-biological catalysts have all these properties)

- All are proteins
- Catalytic activity depends on native conformation
- May require a cofactor/prosthetic group of inorganic ions and/or organic/metalloorganic molecules
- Some modified covalently by glycosylation, phosphorylation, etc.

Holoenzyme: complete, catalytically active enzyme with bound coenzyme and/or metal ion

Apoenzyme: protein part of holoenzyme

How enzymes catalyze reactions:

1. Functional groups in active site may activate substrate to lower activation energy
2. Binding energy between enzyme and substrate contributes to specificity but also can be used to decrease activation energy
3. Enzyme binds transition state to stabilize it; doesn't bind tightly to substrate since this would cause the reaction to stop if the reactant/substrate was too stable
4. Ultimately, it speeds up reaction by lowering activation energy

How enzymes overcome thermodynamic barriers:

1. Entropy of molecules in solution reduces possibility of reaction: overcome by binding substrate to enzyme to reduce entropy and provide proper reaction orientation
2. Solvation shell of H-bonded water stabilizing molecules in solution: overcome by forming noncovalent interactions between substrate and enzyme, causing desolvation
3. Distortion of substrates: overcome by binding energy compensating for unfavourable distortion needed for reaction
4. Required proper alignment of catalytic functional groups: binding energy changes conformation of enzyme when substrate binds, activating the active site

Acid/base catalysis: requires ionizable functional groups; transfer of protons

a) Specific Acid/Base Catalysis: uses only ions in water; usually not strong enough to stabilize intermediate