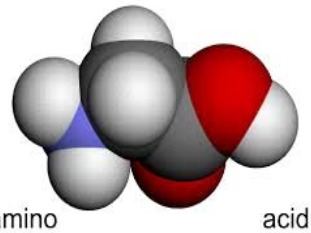
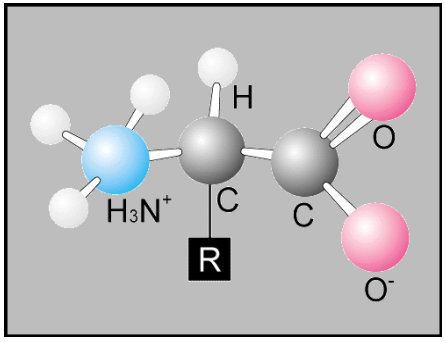
# PROTEINS

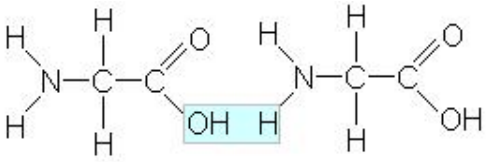
revised 30 Sept 2106
Campbell 6th: 71-80, 7th: 77-85, Sadava 8th: p42-49, Campbell 9th: 77-86, 10th: 75-83



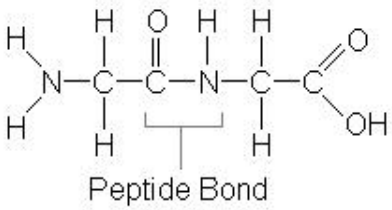




**Proteins:** Once thought to be the foremost molecules of biology (therefore: ***prot***ein)
functions:(p. 76)

| | |
|---|---|
| enzymes | ***protein catalysts:*** amylase, pepsin, etc |
| defensive | antibodies, compliment |
| storage | ovalbumin, casein (both serve as AA source for development) |
| transport | hemoglobin, LDL, HDL |
| hormones | peptide hormones like insulin, etc |
| receptors | in nerves |
| contractile | actin and myosin in muscle |
| structure | silk, keratin, collagen |



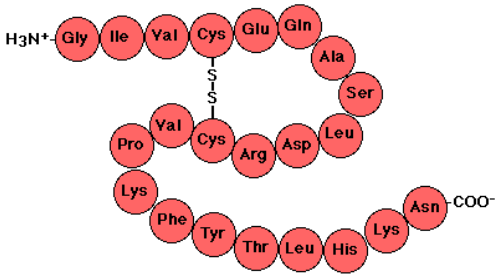
Chemical definition
**LEARN**!: **a linear polymer of amino acids connected by peptide bonds**.
Review amino and carboxyl groups (p 78), both ionize at pH 7:
zwitterion [double charged particle]




Has one asymmetric carbon (L in most proteins) (some weird microbial peptides: D.]
Properties of 20 AA depend on **side chain** (R group) (P.77)

| | | **LEARN these 4 amino acids:** |
|---|---|---|
| 9 are hydrocarbon | (hydrophobic) | glycine |
| 6 are polar | (hydrophilic) | cysteine |
| 5 are ionic | (pH dependent "-" and "+" attract) | aspartic acid |
| | | lysine |

A molecule of water is removed from two glycine amino acids to form a peptide bond.

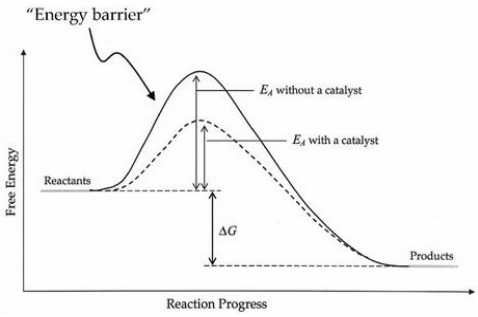



Proteins unidirectional, written N terminal to C terminus connected by peptide bonds (p 80)
**PROTEIN STRUCTURE (LEARN)**: (p 80-81)
Folding of protein is spontaneous: ***Self Assembly*** (IMPORTANT!)
p 80 **primary**: Linear sequence (determines everything else) (mutation alters)

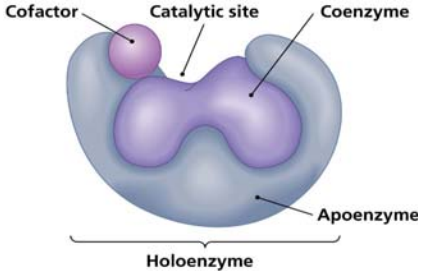
**secondary**: local interactions due to bonding between peptide H bonds,
***not*** side chains: highly predictable.
**alpha helix** a la Pauling and Corey, 1951, keratin, collagen
**β pleated sheet**: fibroin in silk, troughs and peaks
**fibrous proteins** have repeating structure, favor helix and pleated
[see excellent 3D demo at: http://www.pdb.org/pdb/explore/jmol.do?structureId=5RSA&bionumber=1 ]


p 81 **tertiary**: Depends on (non-repetitive) side chains, not easily predictable
Side chain H bonds, ionic bonds, hydrophobic bonds, disulfide
Disulfide bridges: rearrange for **permanent wave: 1: reduce, 2: set, 3: oxidize**
**globular proteins** rely more on tertiary

**quaternary:** multimeric proteins, above 50,000 MW same forces as as 3rd.
**hemoglobin** (a tetramer**)** is a classic example.




**ENZYMES** ("inside yeast")**:** **LEARN**: 2 word definition: Protein catalysts (p 153)
p 152 Illustrate profile of exergonic chemical reaction, role of **catalys**t ("down break")
p. 132 Diagram an enzyme (**LEARN**):
**apoenzyme** (protein portion)
**prosthetic group** (required to assist apoenzyme
**cofactor:** inorganic prosthetic group
**coenzyme:** organic prosthetic group (vitamins)
**holoenzyme:** active complex of apo- + prosthetic group
**active site** binds substrate, performs action
Lucy Chocolate factory: https://www.youtube.com/watch?v=Jm1VEO9C4VQ




**Configuration is *critical* for enzyme activity**.
Factors which affect configuration (p 156):
Inhibition of enzymes explain antiseptics, cooking, etc

**pH** (Affects charge on ionic side chains)
**temperature** affects tightness of folding
**osmolarity:** salt and sugar disrupt
**disrupt S-S bonds** (Heavy metals.)