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: protein)
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

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 catalyst (“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.)