3 noncovalent bonds that help w/ protein structure

* covalent (sharing)
* noncovalent (not-sharing) Ionic

Supplemental Instruction Biology 2300

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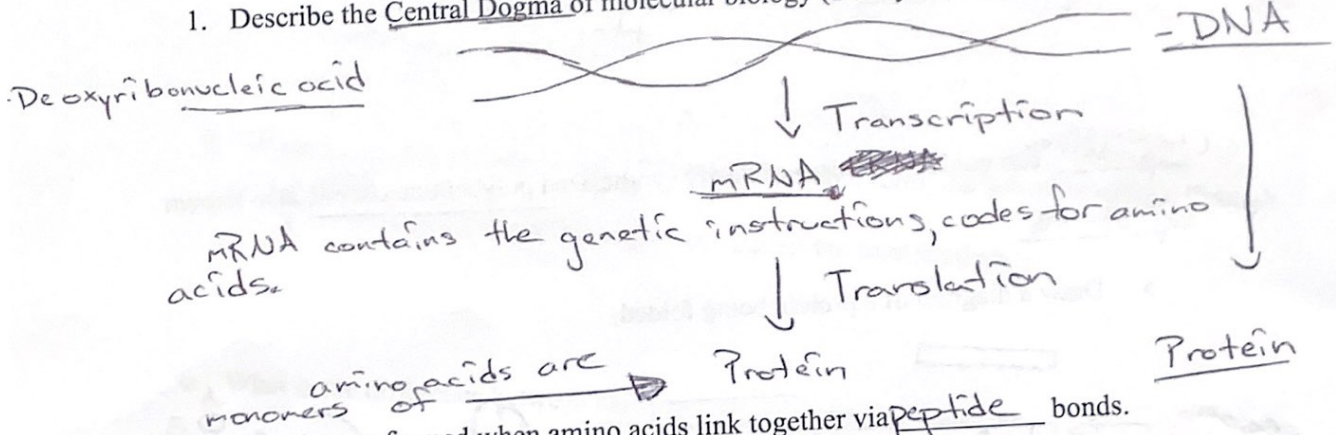
Session 1: Protein Structure and Function

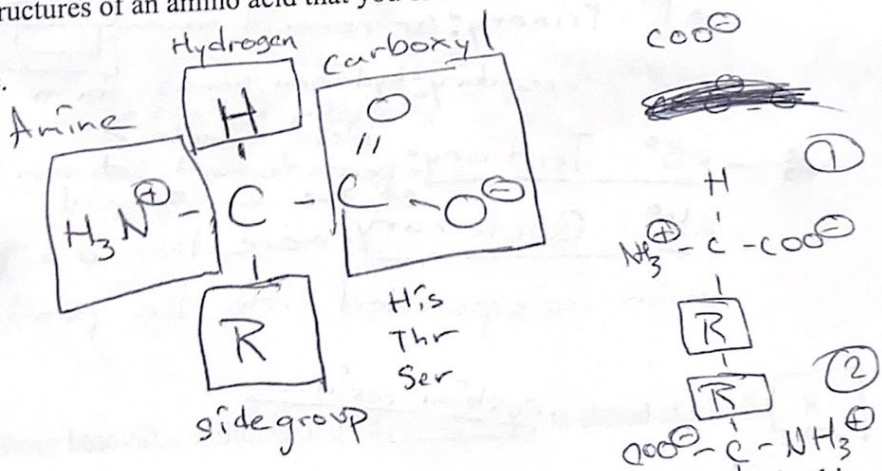
- Ionic - donation/receiving electrons
- Van Der Waals - everpresent, occurs because of random movement of electrons
- Hydrogen - bond between H - N, O, S, F
- Electrostatic - constant ⊕⊖ charges between ions

1. Describe the Central Dogma of molecular biology (draw your own diagram if that helps):



2. Proteins are formed when amino acids link together via peptide bonds.

3. List the different structures of an amino acid that you can remember, then draw out the molecular structure.



4. A protein is made up of more than one amino acid linked together by peptide bonds, this structure is known as a polypeptide chain.

- amino acid chain

5. List 3 examples of ~~noncovalent~~ bonds covered in class.

other than Ionic's, covalent

a. Van Der Waals

b. Hydrogen bond

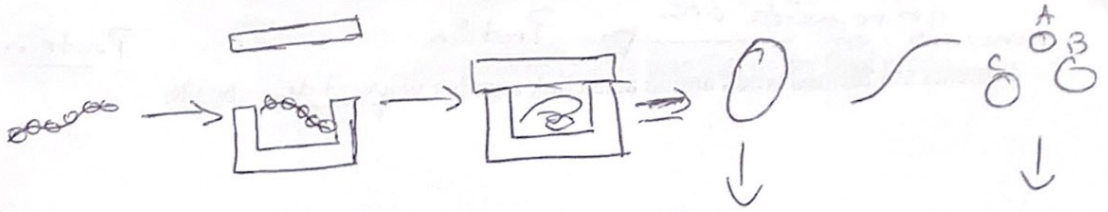
c. Peptide bonds

SH

H-

6. Chaperone proteins can guide the folding of newly synthesized polypeptide chains, also known as proteins.

a. Draw a diagram of a protein being folded.



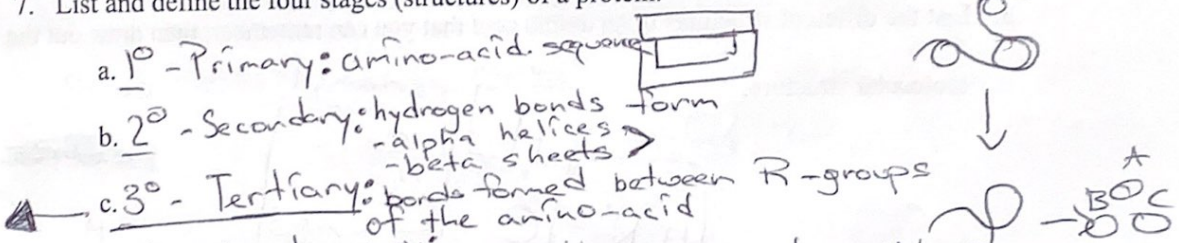
7. List and define the four stages (structures) of a protein.

a. 1° - Primary: amino-acid sequence

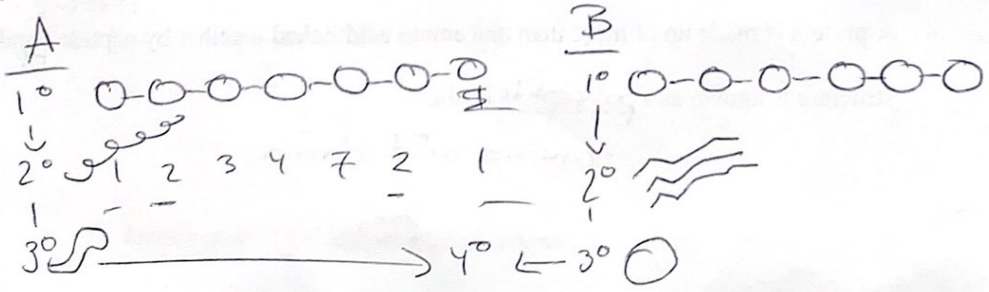
b. 2° - Secondary: hydrogen bonds form
- alpha helices
- beta sheets

c. 3° - Tertiary: bonds formed between R-groups of the amino-acid

d. 4° - Quaternary: more than one polypeptide chain incorporated into the protein



8. Disulfide bonds at cysteine residues help to stabilize a favored protein confirmation.



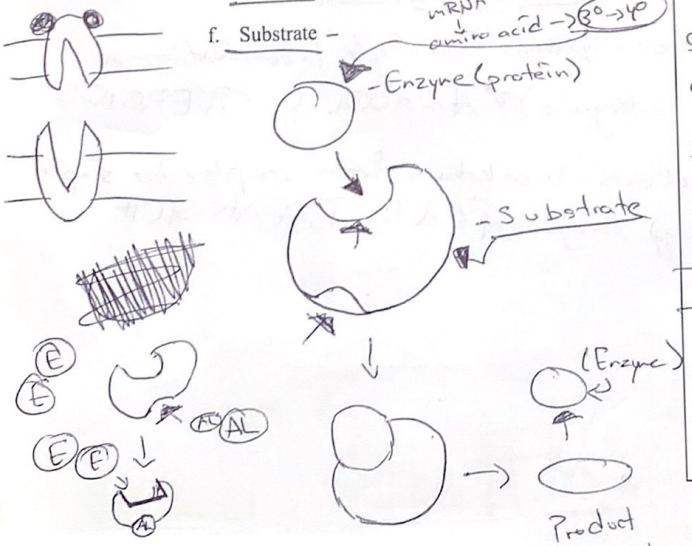
Prion - improperly folded protein

9. What is a prion? This is present in animals as Bovine spongiform encephalopathy or Cows
Scrapie, what is a human disease caused by prions?
Sheep Creutzfeldts - Jakob - common in Jewish community
Kuru (funerary cannabalism)
Moving onto protein regulation.

1. Binding of proteins to other molecules is highly selective. Match the following terms regarding binding of proteins.

a. Enzyme - catalytic protein
b. Ligand - bind to proteins
c. Active site
d. ~~Binding site~~ allosteric binding site
e. Specificity -
f. Substrate -

DNA → mRNA → amino acid → 3° → 4°



e the selective affinity of one molecule for another that permits the two to bind or react, even in the presence of a vast excess of unrelated molecular species.

f a molecule on which enzymes act.

b a general term for a molecule that binds to a specific site on a protein.

a. a protein that catalyzes a specific chemical reaction.

c a region on the surface of an enzyme that binds to a substrate molecule and catalyzes its chemical transformation.

d a region on the surface of a protein, typically a pocket, that interacts with another molecule, a ~~ligand~~ through the formation of multiple noncovalent bonds.

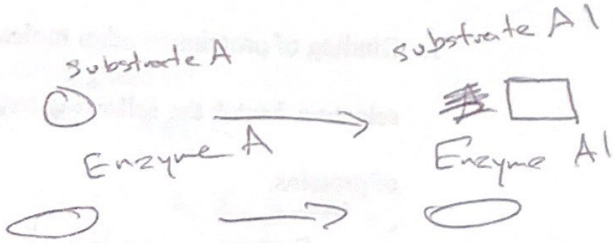
Do enzymes cause reactions to occur? Or do they ~~simply~~ speed them up?

fusion - bring together
fission - break apart

2. In comparison to covalent or ionic bonding, noncovalent bonds are relatively weak.
   electrostatic -
   hydrogen -
   van der waals -

3. Enzymes are proteins that speed up chemical reactions by lower the activation energy.
   a. ~~Increasing~~
   b. Providing
   c. Lowering
   d. ~~Raising~~

4. What are the functions of an enzyme? 3
   - catalyze reactions
   - specific
   - remains unchanged



5. When an enzyme changes a substrate into its product form, the substrate will go through a transition state.
   a. This stage is more/less stable than that of the final product.

6. What is the difference between catabolic and anabolic reactions?

anabolic reaction - synthesis from simple to complex (increase of internal energy - endergonic) ANABOLIC STEROIDS

catabolic reactions - breakdown from complex to simple (release of energy) - exergonic CATS BREAK STUFF

7. Define each of the enzymes listed below:

-ase = enzyme

a. Protease = Prote-ase = breaks down proteins

b. Polymerase = synthesis of DNA or RNA

c. Ligase = ligate (join) = joins together the okazaki fragments

d. Nuclease = Nucle-ase = breaks down nucleic acids

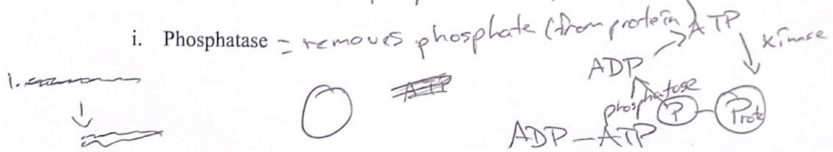
e. Synthase = synthesis of ATP - Adenosine Triphosphate

f. Isomerase = catalyzes the formation of isomers

g. Lipase = Lip-ase = breaks down lipids

h. Kinase = adds a phosphate (to protein)

i. Phosphatase = removes phosphate (from protein)



8. What is protein post-translational modification (PTM)? What are some examples of common modifications?

- increase diversity of protein function
  - phosphorylation
  - methylation
  - acetylation
  - ubiquitination

9. What is feedback inhibition?

A control mechanism that inhibits enzyme function in response to levels of a substance

a. What is the difference between positive and negative regulation?

negative prevents enzyme function

positive encourages enzyme function

10. allosteric: Describes a protein that can exist in multiple conformations depending on the binding of a molecule at a site other than the catalytic site; changes from one conformation to another can alter the activity or ligan affinity for the protein.

a. What are some examples of interactions regarding this protein?
allosteric inhibition

allosteric activation

11. What is the difference between ATP and GTP protein regulation?

ATP - loses a phosphate which binds to protein

GTP - the entire GTP molecule binds to the protein.