

NOTES: Protein Structure & Function

Name: _____

1. **Proteins** do the nitty-gritty jobs in every living cell.
2. Proteins are made of long strings of individual building blocks known as **amino acids**.
 - a. Amino acids contain an amino group, a carboxyl group, a carbon and a unique R group.

Generalized Amino Acid

- i. Polar R group: _____
 - ii. Non polar R group: _____
 - iii. Ionically charged R group: _____
- b. There are _____ commonly occurring amino acids that are found in proteins

- c. _____
are those that must be ingested in the diet.

3. _____ join amino acids
 - a. It's a **condensation reaction** (meaning that _____)

- b. Two amino acids form a _____
- c. _____ are formed from more than two amino acids bonded together

4. Proteins have four levels of organization
 - a. _____ is the amino acid sequence (the polypeptide chain)
 - i. The amino acid sequence is _____

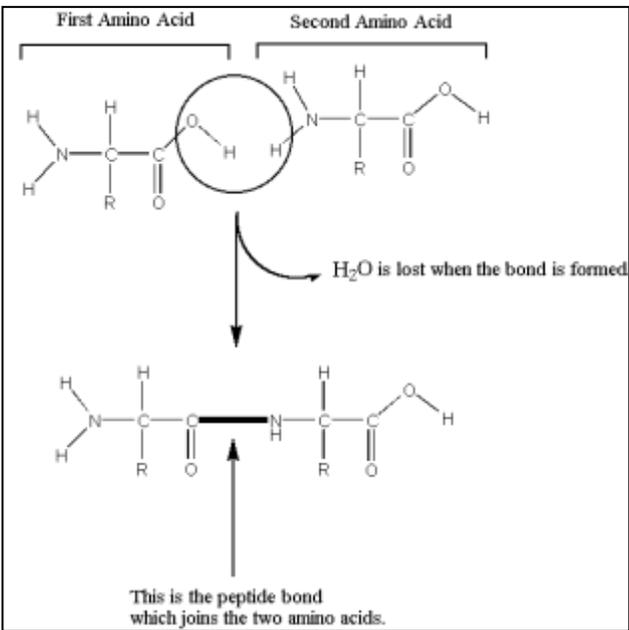
_____ and is unique for each kind of protein

- ii. The amino acid sequence determines how the polypeptide will fold into its 3D shape
- iii. Even a slight change in the amino acid sequence can cause the protein to malfunction
 - For example, mis-formed _____ causes _____

- b. _____ results from _____ between _____ of one amino acid and _____ of another

- i. The _____ is a coiled secondary structure
 - due to a _____
 - Examples: hemoglobin, ketatin, lysozyme

- ii. The _____ is formed by amino acids in parallel chains



- hydrogen bonds between parallel parts of the backbone
- Example: silk

iii. A single polypeptide may have portions with both types of the structure

c. _____ depends on the interactions among the _____

i. _____ interactions: amino acids with hydrophobic side chains cluster in the core of the protein, out of contact with _____

ii. Hydrogen bonds between _____

iii. _____ between positively and negatively charged side chains

iv. _____ (strong covalent bonds)

between sulfur atoms in the amino acid _____

d. _____ results from interactions among _____ (for example, hemoglobin is composed of 4 polypeptide chains)

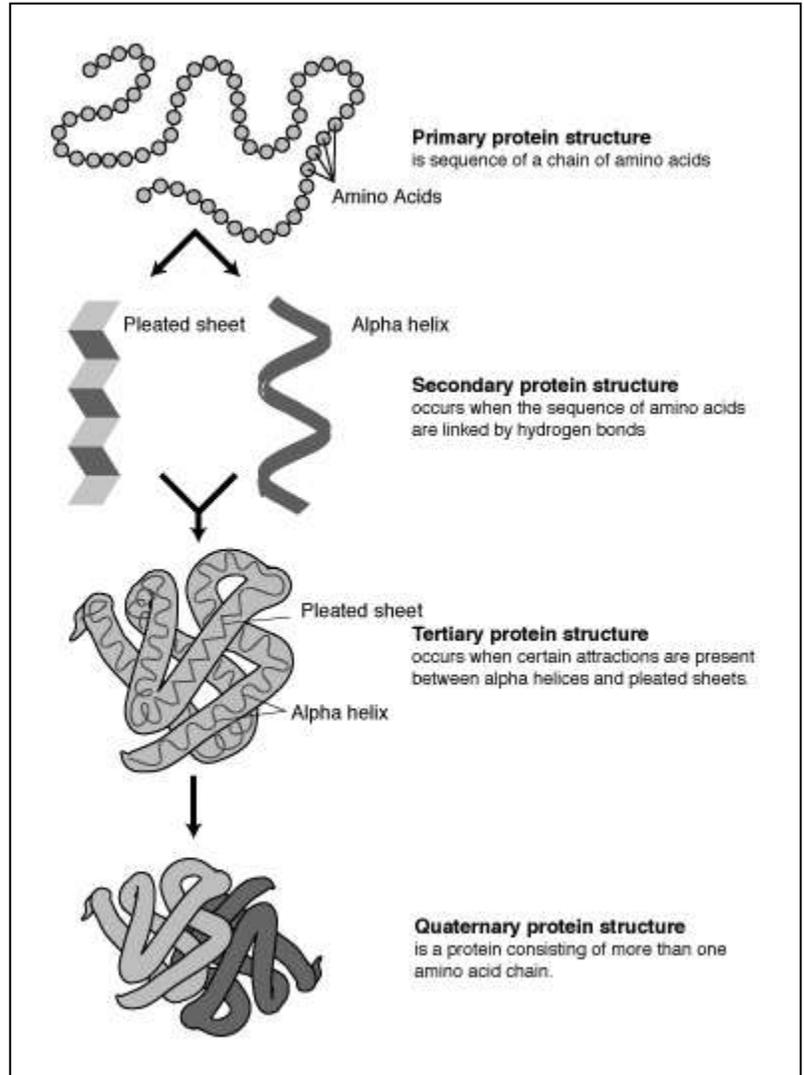
5. The folding of proteins is aided by other proteins called _____

- Act as _____ as proteins fold into their final conformation
- Research into chaperones is a hot area of research in biology

6. _____ results in disruption of the secondary, tertiary, or quaternary structure of the protein

a. Denaturation may be due to changes in _____, _____, or various _____.

b. Normal functioning is lost upon denaturation, which is often irreversible.



7. Folded proteins are placed into two general categories

a. _____ have polypeptide chains organized as strands or sheets

i. _____

ii. _____ – may be stretchy

iii. Functions of fibrous proteins

- _____ function in _____
 - Insects and spiders use _____ fibers to make cocoons and webs
 - _____ and _____ are used in animal tendons and ligaments
 - _____ is the protein in hairs, horns and feathers
- _____ function in movement
 - _____ and _____ contract to create the cleavage furrow and to move muscles
 - Contractile proteins move cilia and flagella

b. _____ have their chains folded into compact,

i. Easily _____

ii. Functions of globular proteins

- _____ function in the storage of amino acids
 - _____ is the protein in egg whites
 - _____ is the protein in milk, source of amino acids for baby mammals
- _____ proteins function in the movement of other substances
 - _____, the iron containing protein in blood, transport oxygen from lungs to other parts of the body ($C_{3032}H_{4816}O_{872}N_{780}S_9Fe_4$)
 - Membrane transport proteins such as _____ for potassium and water
- _____ proteins function as cellular messenger molecules that help maintain homeostasis
 - _____: sends message “allow sugar into cells” (when blood glucose levels are high, cells will transport glucose into the cells for use or storage)
 - _____: sends message “we need more sugar in the blood” (when blood glucose is too low, cells will release glucose)
- _____ proteins allow cells to respond to chemical stimuli

- _____ receptors initiate the signal transduction pathway when a growth hormone attaches
- _____ receptors on the cell membrane allow LDL to be endocytosed into the cell
- _____ proteins function as protection against disease
 - _____ combat bacteria and viruses
- _____ speed up chemical reactions
 - _____ and other digestive enzymes hydrolyze polymers in food
 - _____ converts hydrogen peroxide H₂O₂ into water and oxygen gas during cellular respiration

Review

	Primary	Secondary		Tertiary	Quaternary
What is it?	Sequence of amino acids				Two or more globular proteins
What bonds hold it in place?	Peptide bonds (from condensation)				
Simple drawing		Alpha helix	Beta-pleated sheet		
Further notes	Primary structure is determined by DNA base sequence in genes				

	Fibrous	Globular
What does it look like		
Solubility		
Functions		
Examples		

Protein Self Quiz Questions

Name: _____

ARE STATEMENTS 1- 5 TRUE OR FALSE? IF FALSE, EXPLAIN WHY:

1. Amino acids are linked by hydrolysis, a process that splits molecules of water as the amino acid subunits are linked together.
2. R groups are identical on the different amino acids.
3. The primary structure of a protein is formed principally by hydrogen bonds linking various amino acids.
4. An amino group contains a nitrogen atom and two hydrogen atoms; a carboxyl group contains two oxygen atoms, a carbon atom, and a hydrogen atom.
5. Enzymes are an important class of proteins whose subunits are simple sugars.
6. What elements do proteins contain?
7. How many peptide bonds does a dipeptide contain?
8. If 12 amino acids were combined to form a long chain, how many peptide bonds would be formed?
9. What chemical groups are found at either end of a polypeptide?
10. Describe the structural difference between globular and fibrous proteins.
11. Explain how denaturation destroys proteins function.
12. Give examples of proteins involved in the following functional roles:
 - a. Structural tissues
 - b. Regulation of body processes
 - c. Contractile elements
 - d. Immune system response
 - e. Transporting molecules in the bloodstream
 - f. Catalyzing metabolic reactions in cells