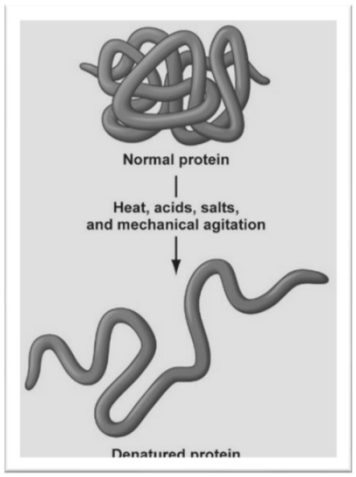
Today's Topic: Amino Acid

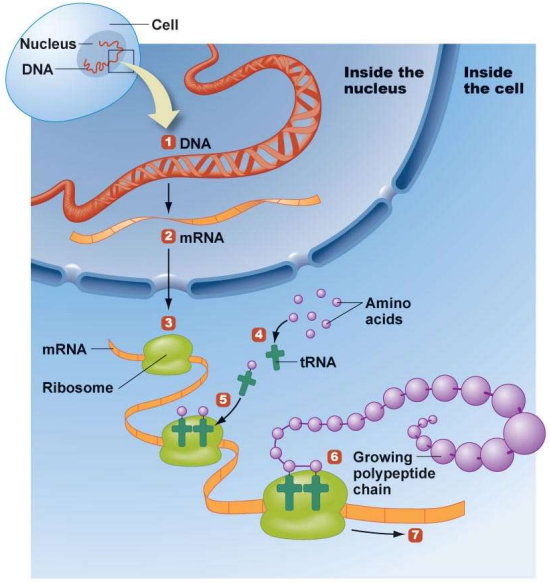
COURSE : DSE-IB

Semester : VI

B.Sc. Chemistry

BY
Soumya Sinha Roy
Department of Chemistry
Polba Mahavidyalaya
Polba, Hooghly, W.B. -712148.





1 Each strand of DNA holds the code to create specific proteins. Because the DNA can't leave the nucleus of the cell, a copy of the code, called messenger RNA (mRNA), is made. This is called transcription.

2 The mRNA takes this information outside the nucleus and brings it to the ribosome.

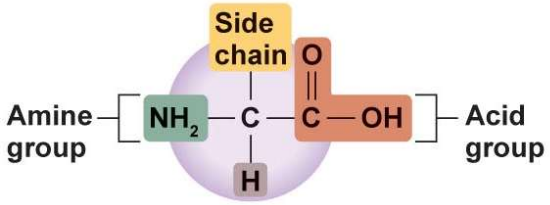
3 The ribosome moves along the mRNA, reading the code. This is the phase called translation.

4 Another type of RNA called transfer RNA (tRNA) collects the specific amino acids that are needed to make the protein. There are 20 different tRNAs, one for each amino acid.

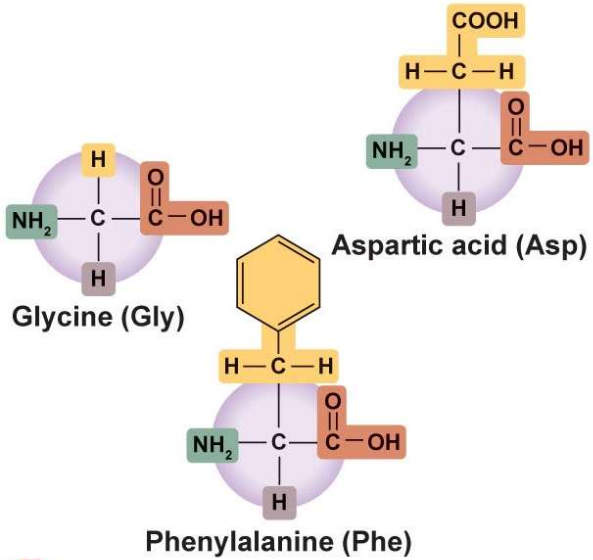
5 The tRNA brings the amino acid to the ribosome.

6 The ribosome then builds a chain of amino acids (the protein) in the proper sequence, based on the code in the mRNA, called elongation.

7 The ribosome continues to move down the mRNA strand until all the appropriate amino acids are added and the protein is complete.



a Amino acid structure



b Different amino acids, showing their unique side chains

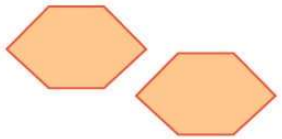
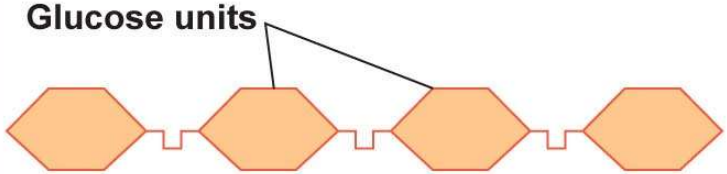
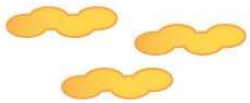
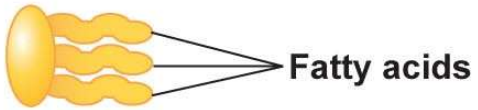
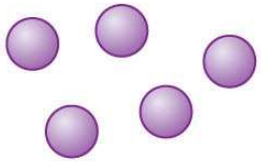
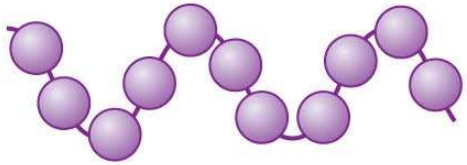
What Are Proteins?

- Large molecules
- Made up of chains of amino acids
- Are found in every cell in the body
- Are involved in most of the body's functions and life processes
- The sequence of amino acids is determined by DNA

Structure of Proteins

- Made up of chains of amino acids; classified by number of amino acids in a chain
  - Peptides: fewer than 50 amino acids
    - Dipeptides: 2 amino acids
    - Tripeptides: 3 amino acids
    - Polypeptides: more than 10 amino acids
  - Proteins: more than 50 amino acids
    - Typically 100 to 10,000 amino acids linked together
- Chains are synthesizes based on specific bodily DNA
- Amino acids are composed of carbon, hydrogen, oxygen, and nitrogen

Structural Differences Between Carbohydrates, Lipids, and Proteins

Macronutrients	Chains of	Example
Carbohydrates	Glucose 	Glucose units 
Lipids	Fatty acids 	Triglyceride 
Proteins	Amino acids 	Amino acids 

The Anatomy of an Amino Acid

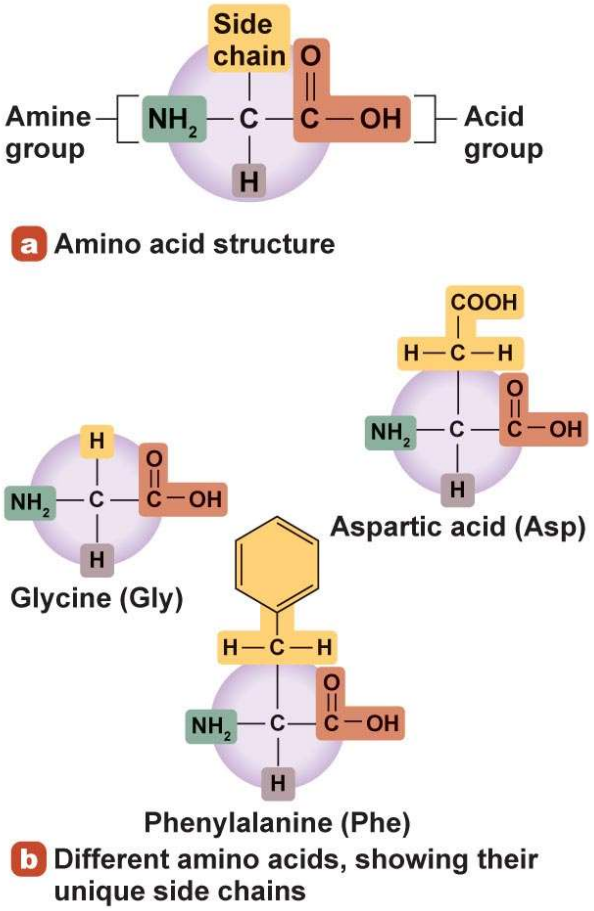
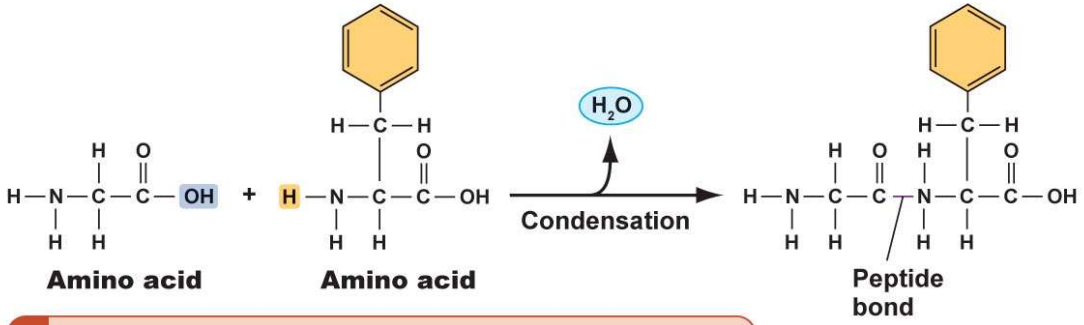


Figure 6.2b

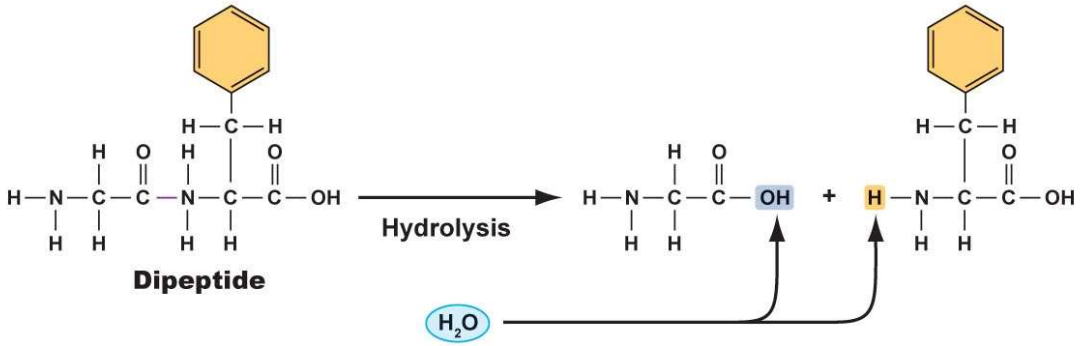
Peptide Bonds Link Amino Acids

- Form when the acid group (COOH) of one amino acid joins with the amine group (NH_2) of a second amino acid
- Formed through condensation
- Broken through hydrolysis

Condensation and Hydrolytic Reactions



a A peptide bond forms by condensation when the acid group (COOH) and amine group of two different amino acids join and release a molecule of water.



b When peptide bonds are broken by hydrolysis, the hydroxyl group (OH) and hydrogen (H) from water are added.

Essential, Nonessential, and Conditional

- Essential – must be consumed in the diet
- Nonessential – can be synthesized in the body
- Conditionally essential – cannot be synthesized due to illness or lack of necessary precursors
  - Premature infants lack sufficient enzymes needed to create arginine

Table 6.1

The Mighty Twenty

Essential Amino Acids	Nonessential Amino Acids
Histidine (His)[a]	Alanine (Ala)
Isoleucine (Ile)	Arginine (Arg)[b]
Leucine (Leu)	Asparagine (Asn)
Lysine (Lys)	Aspartic acid (Asp)
Methionine (Met)	Cysteine (Cys)[b]
Phenylalanine (Phe)	Glutamic acid (Glu)
Threonine (Thr)	Glutamine (Gln)[b]
Tryptophan (Trp)	Glycine (Gly)[b]
Valine (Val)	Proline (Pro)[b]
	Serine (Ser)
	Tyrosine (Tyr)[b]

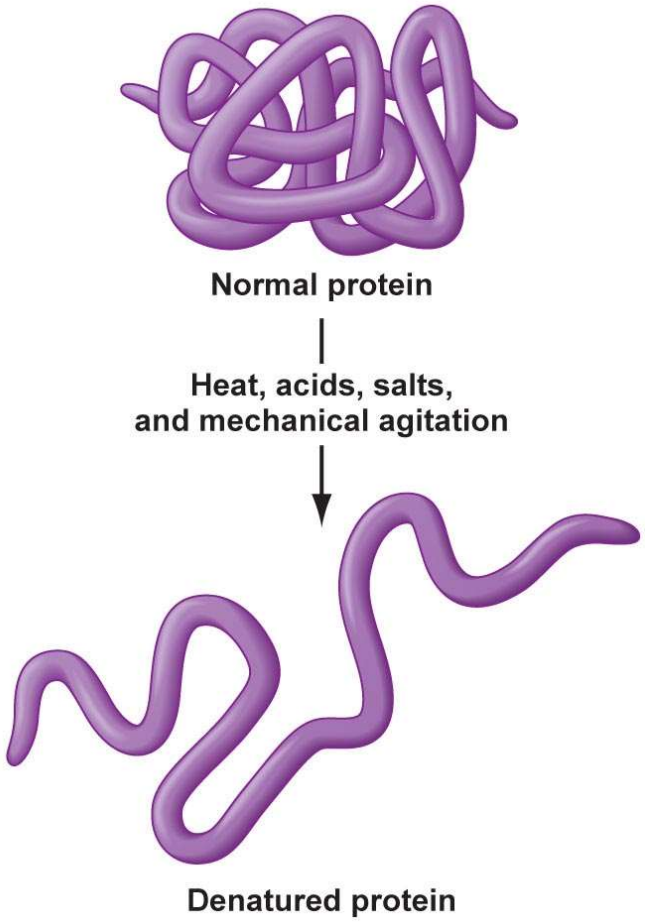
[a] Histidine was once thought to be essential only for infants. It is now known that small amounts are also needed for adults.

[b] These amino acids can be "conditionally essential" if there are either inadequate precursors or inadequate enzymes available to create these in the body.

Denaturing

- Alteration of the protein's shape and thus functions through the use of
  - Heat
  - Acids
  - Bases
  - Salts
  - Mechanical agitation
- Primary structure is unchanged by denaturing

Denaturing a Protein



Quick Review

- Attractions and interactions between the side chains cause the proteins to fold into precise three-dimensional shapes
- Protein shape determines its function
- Proteins are denatured and their shapes changed by
  - Heat
  - Acids
  - Bases
  - Salts
  - Mechanical agitation

Thank You ……