Dr. Minakshi Kumari
P.G. Dept. Of Zoology.
Maharaja College, ARA.

P. G. SEM - II
(CC- 7), Unit - IV
Enzyme Biochemistry

ENZYMES

INTRODUCTION :.

Enzymes are proteins that have essential functions in all vital processes such as metabolism, gene expression, cell division, reactions of the immune system, and others. They play important roles in the biotechnology industry or medical diagnostics due to their very efficient way of catalyzing chemical reactions. Any living organism needs enzymes to function properly. Chemically, enzymes are naturally occurred proteins, basic function of which is to speed up the process and efficiency of a chemical reaction without being consumed in the process. Enzymes catalyze all kinds of chemical reactions that are involved in growth, blood coagulation, healing, diseases, breathing, digestion, reproduction, and many other biological activities.

DEFINITION OF ENZYMES:

"**Enzymes** can be **defined** as biological polymers that catalyze biochemical reactions." Majority of **enzymes** are proteins with catalytic capabilities crucial to perform different processes. Metabolic processes and other chemical reactions in the cell are carried out

by a set of **enzymes** that are necessary to sustain life. Due to the action of enzymes, chemical reactions in organisms can also be carried out efficiently and specifically under mild conditions. In this type of chemical reaction, the starting molecules are called substrates. The enzyme interacts with a substrate, converting it into a new product. Most enzymes are named by combining the name of the substrate with the **-ase suffix (e.g., protease, urease).** The word 'enzyme' was first used by the German physiologist **Wilhelm Kuhne in 1878,** he was describing the ability of yeast to produce alcohol from sugars, and it is derived from the Greek words ***en*** **(meaning 'in') and** ***zyme*** **(meaning 'yeast').**

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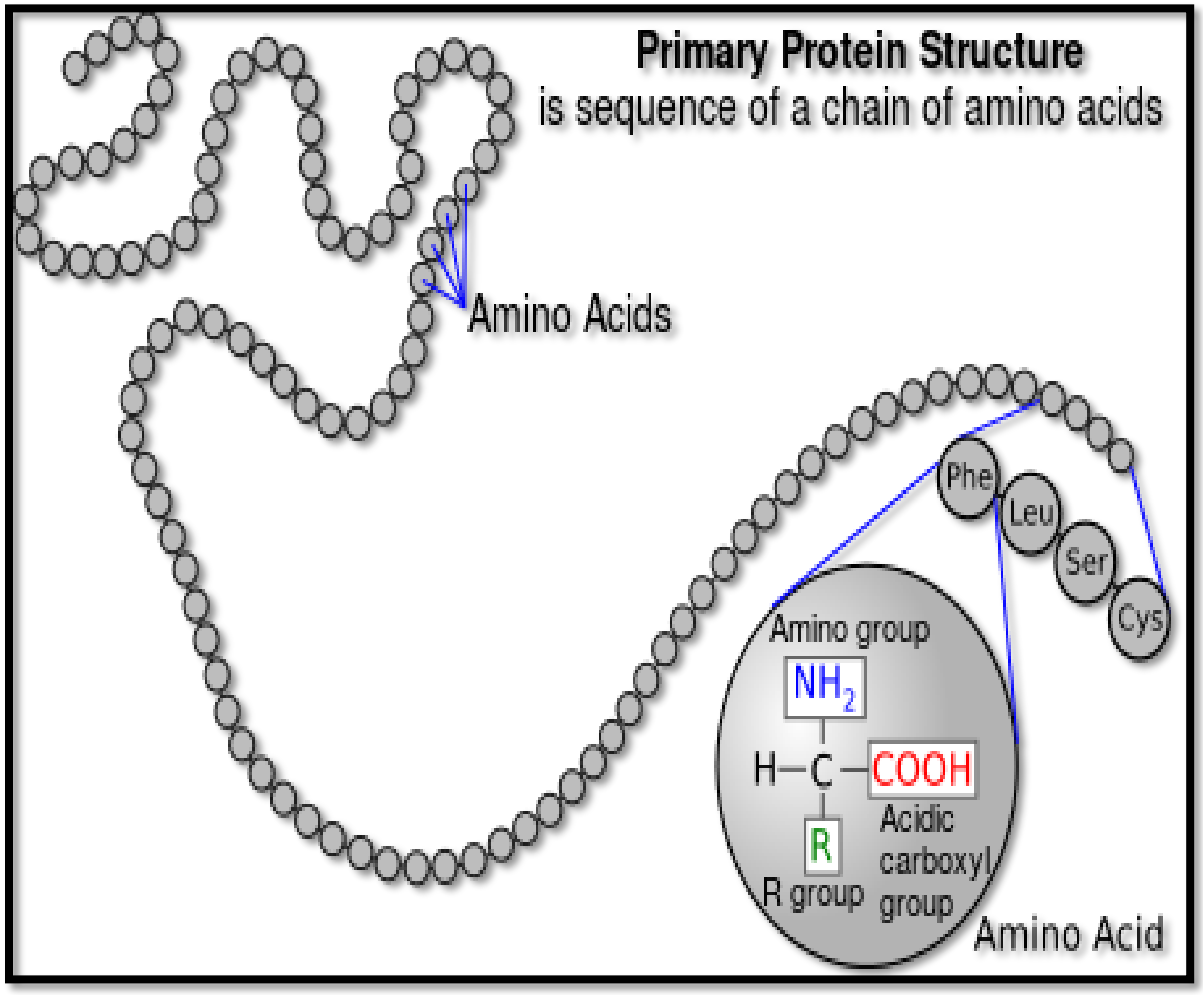
STRUCTURE OF ENZYMES

Primary structure

Enzymes are made up of **amino acids** which are linked together via amide (peptide) bonds in a linear chain. This is the **primary structure**. The resulting amino acid chain is called a *polypeptide* or *protein*. The specific

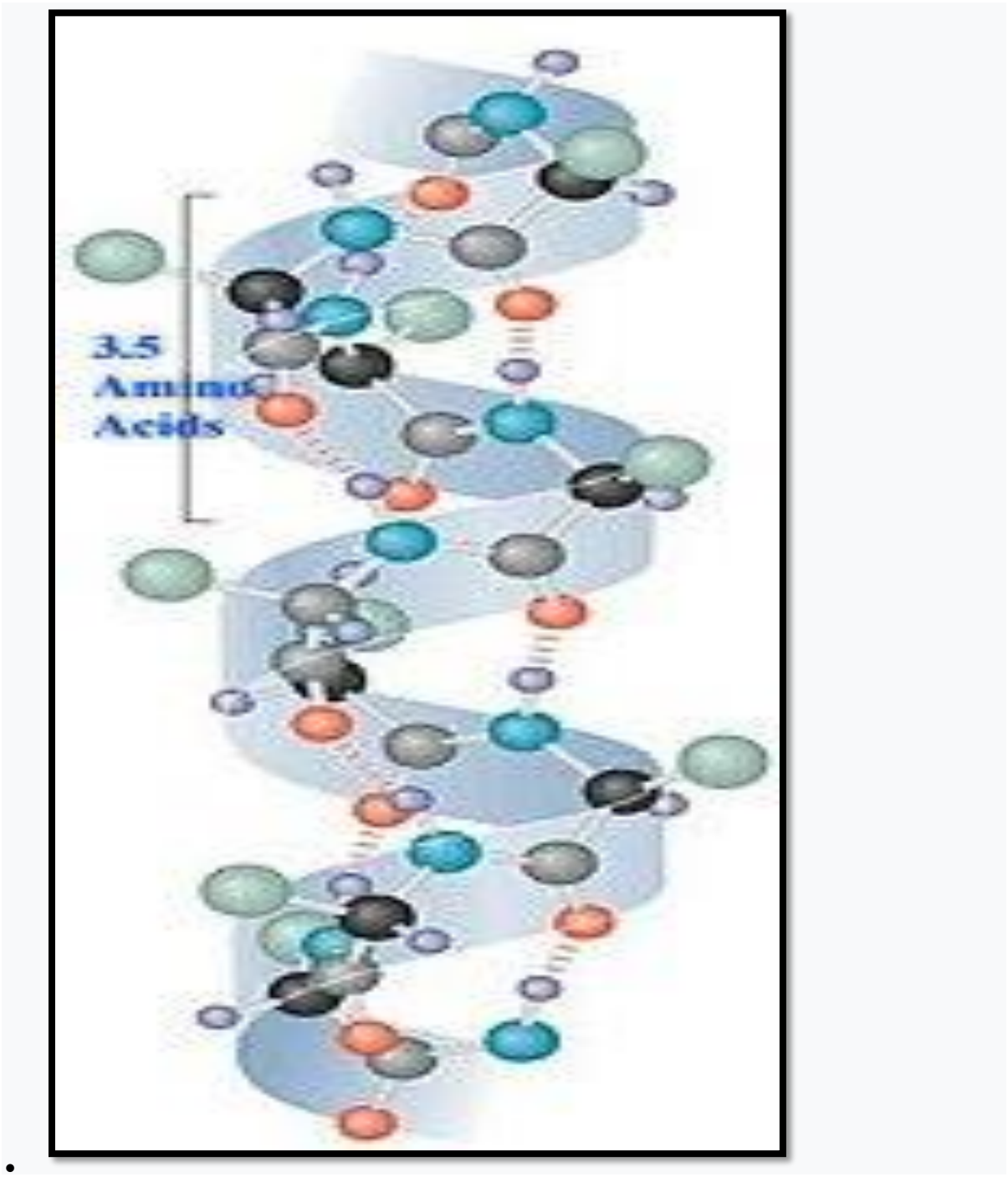
order of amino acid in the protein is encoded by the DNA sequence of the corresponding gene.



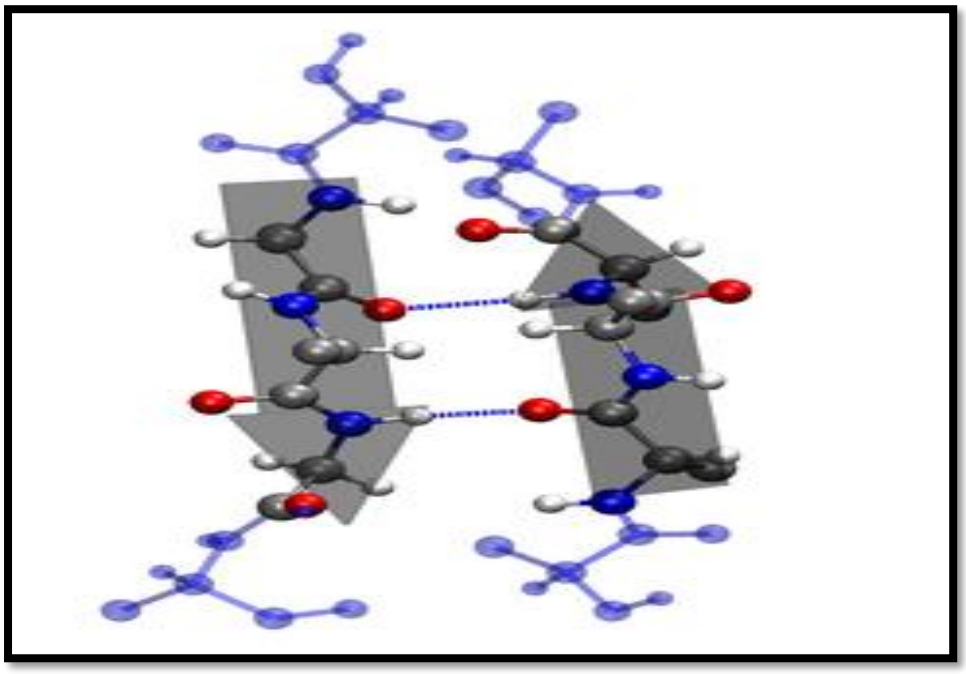
Secondary structure

The hydrogen in the amino group (NH_2) and the oxygen in the carboxyl group (COOH) of each amino acid can bond with each other by means of hydrogen bond, this means that the amino acids in the same chain can interact with each other. As a result, the protein chain can fold up on itself, and it can fold up in two ways, resulting in two **secondary structures**: it

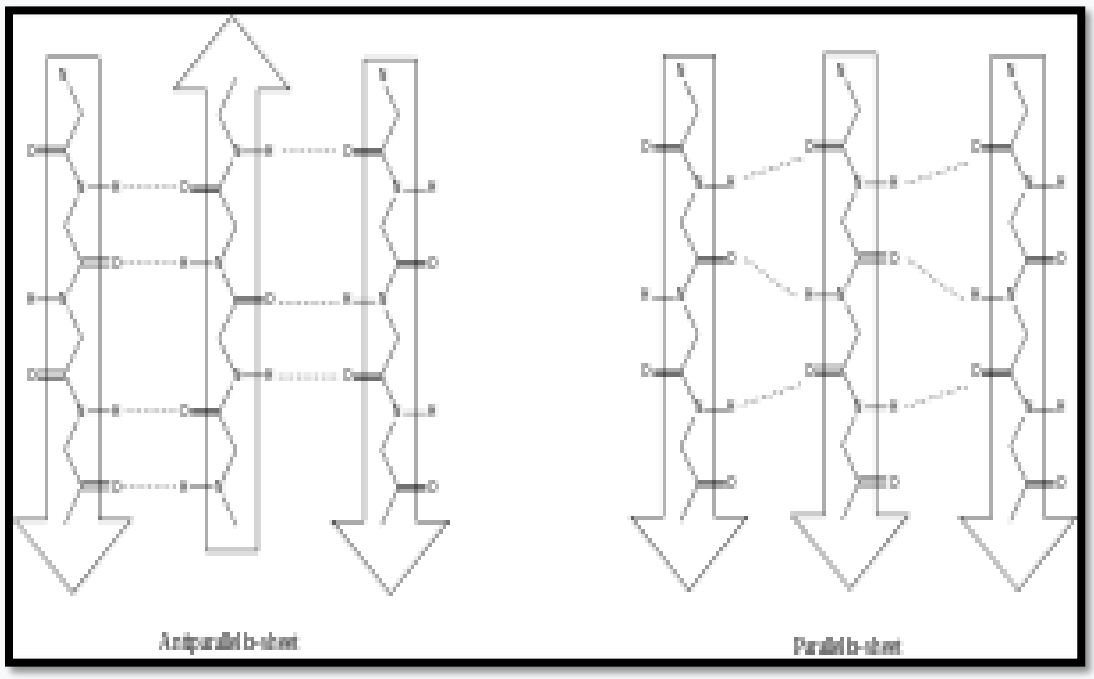
can either wrap round forming the **α-helix**, or it can fold on top of itself forming the **β-sheet**.



α-helix



β-sheet

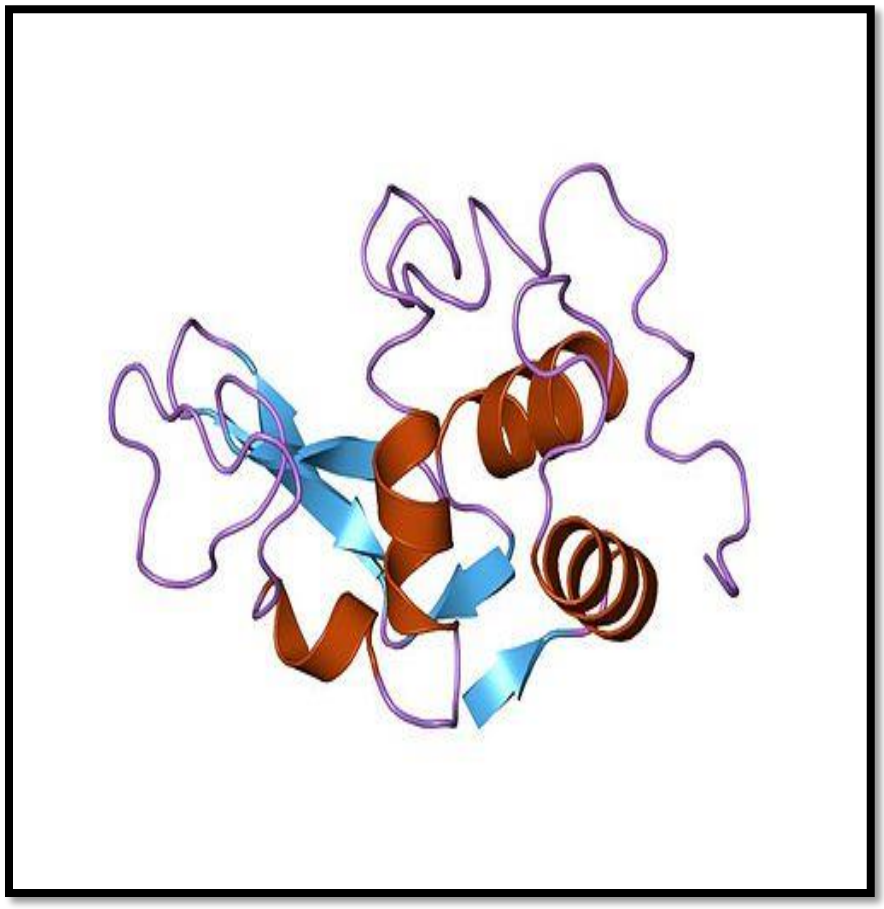


- **Molecular diagram of β-sheets**

In the images above, the dotted lines represent the hydrogen bonds. There are two forms of β-sheet, depending on the direction of the protein chain. If the direction alternates between every fold, it forms an **anti-parallel sheet**; if it remains the same direction, it forms a **parallel sheet**.

Tertiary structure

As a consequence of the folding-up of the 2D linear chain in the secondary structure, the protein can fold up further and in doing so gains a three-dimensional structure. This is its **tertiary structure**.



Lysozyme. The red helices are α-helices, and the blue arrows the β-sheet.

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