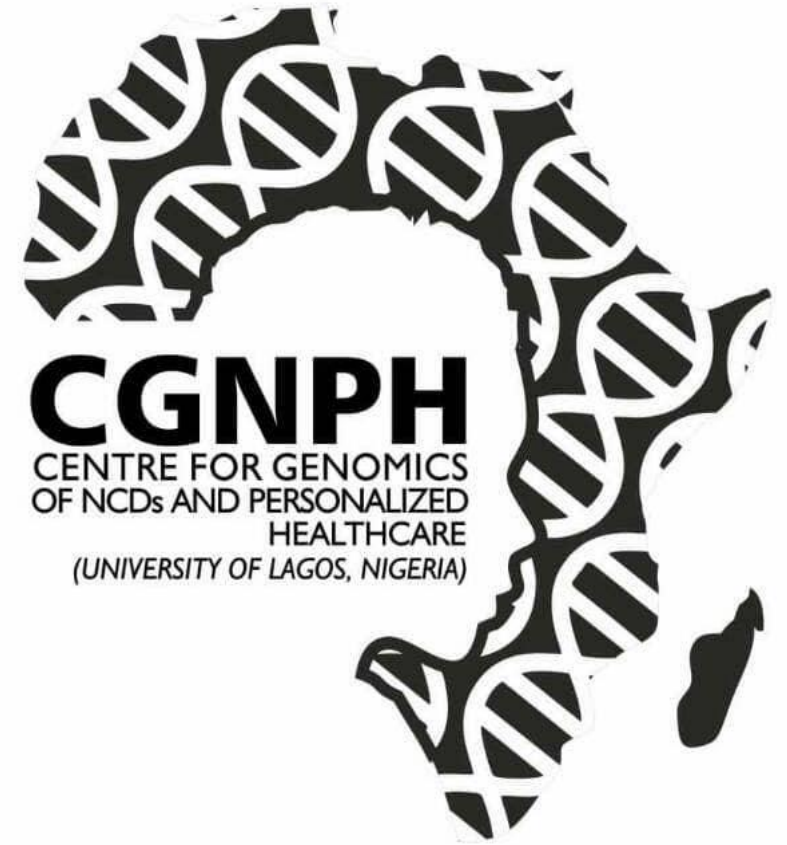
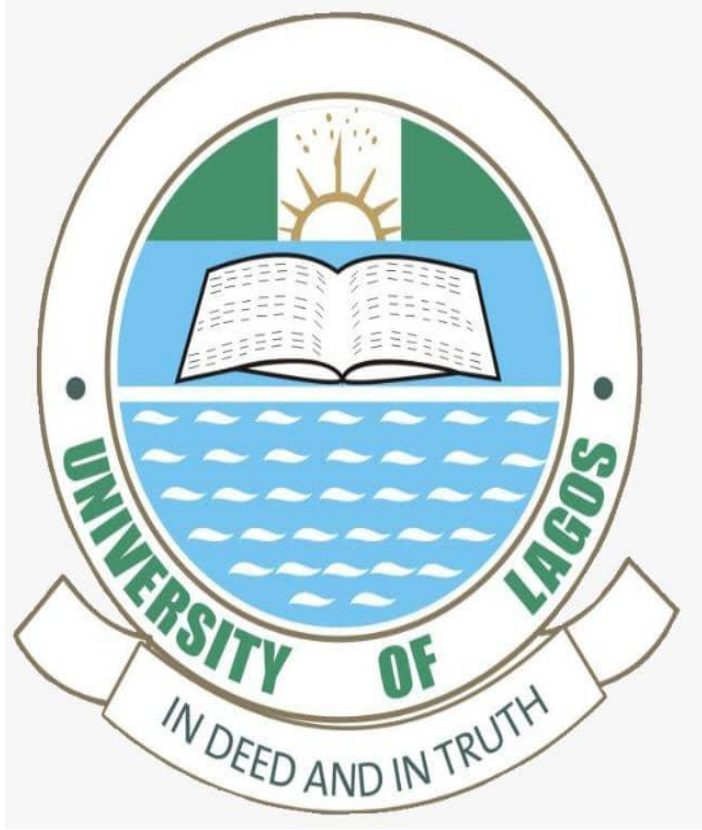




Prof Aderonke Samuel

Proteomic: Protein Structure and Function

2025 dry & wet lab summer school

What is Proteomics?

- Study of the entire set of proteins (proteome) expressed by a genome.
- Dynamic, varies by condition, tissue, and time.
- Complements genomics and transcriptomics.

Protein Basics

- Proteins are made of 20 amino acids.
- Functions: enzymes, transporters, receptors, structural support.

Amino Acids

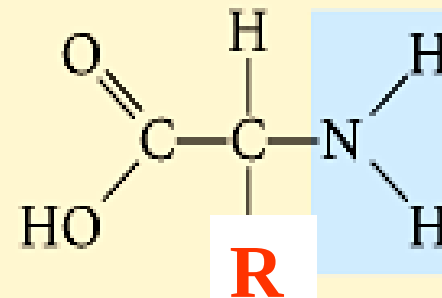
- ❑ Amino Acids are the building units of proteins. Proteins are polymers of amino acids linked together by what is called “Peptide bond”.
- ❑ There are about 300 amino acids occurring in nature. Only 20 of them occur in proteins.

Structure of amino acids:

Each amino acid has 4 different groups attached to α - carbon (which is C-atom next to COOH). These 4 groups are : amino group, COOH gp,

Hydrogen atom and side

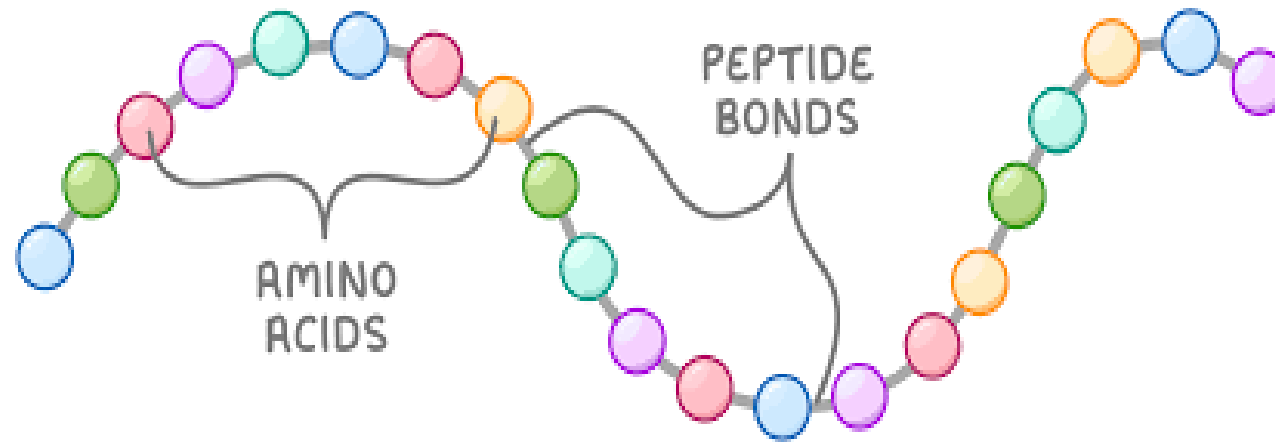
Chain (R)



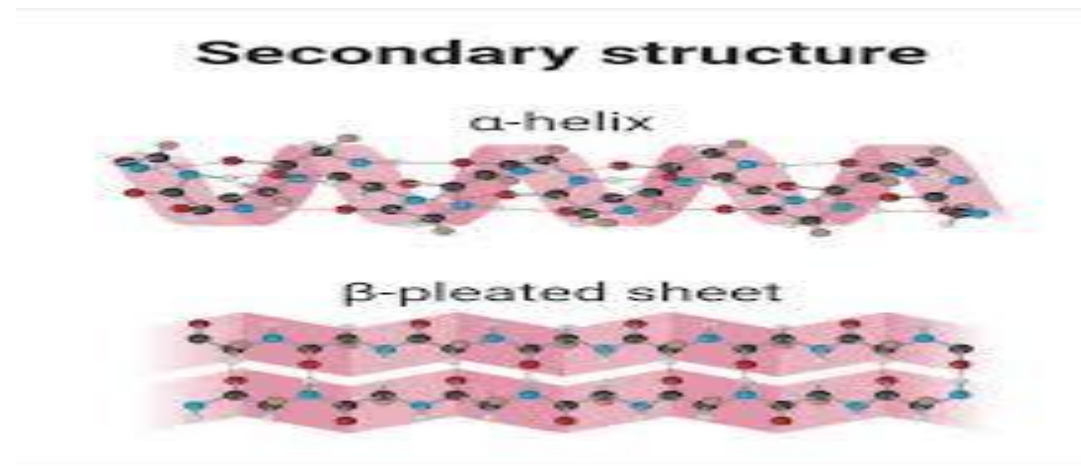
Levels of Protein Structure

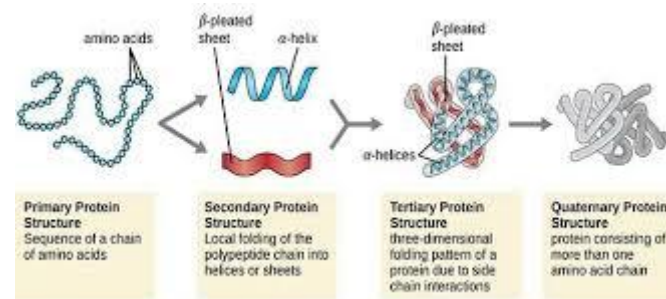
- 1. Primary – amino acid sequence
- 2. Secondary – α -helix, β -sheet
- 3. Tertiary – 3D folding
- 4. Quaternary – multi-subunit complexes

PRIMARY STRUCTURE



SECONDARY STRUCTURES





Structure–Function Relationship

- Protein shape determines function.
- Misfolding can lead to diseases (e.g., Alzheimer's).
- Examples: enzymes, antibodies.

Post-Translational Modifications

- Common PTMs: phosphorylation, glycosylation, methylation.
- Affect protein function, location, and interactions.

Proteomics Techniques

- - 2D Gel Electrophoresis
- - Mass Spectrometry
- - LC-MS/MS
- - Protein Microarrays
- - Western blotting, ELISA

Types of Proteomics

- Structural: 3D conformations
- Functional: interactions and activity
- Comparative: healthy vs disease states
- Clinical: diagnostics and therapeutics

Applications of Proteomics

- - Drug discovery
- - Biomarker identification
- - Personalized medicine
- - Functional gene annotation

Proteomics in Disease Research

- Cancer: tumor-specific proteins
- Neurodegeneration: misfolded proteins
- Infection: host-pathogen interactions

Limitations and Challenges

- High protein complexity
- Dynamic expression ranges
- Solubility and stability issues
- Need for robust bioinformatics

Future Directions

- - Single-cell proteomics
- - AI tools (e.g., AlphaFold)
- - Integrated omics (genomics + proteomics + metabolomics)

Summary

- - Protein structure governs function
- - Proteomics gives insight into biological complexity
- - Key to disease research and precision medicine

