

DEPARTMENT OF BIOTECHNOLOGY
Central University of Kashmir
CURRICULUM TRANSACTIONAL STRATEGY (CTS)

BTCH-CC-101: Fundamentals of Biochemistry

Unit	Topic	Method	No. of classes needed
I	Amino acids structure and properties	Lecture, Discussion	03
	Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins,	do	04
	Protein Purification. Denaturation and renaturation of proteins. Fibrous and globular proteins.	do	04
	Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides	do	03
	Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides	do	03
	Glycoprotein's and their biological functions	do	02

Learning Outcomes

After going through this unit student shall be able to:

- Know the structure, classification and properties of amino acids.
- Learn about protein structure, levels of protein structure and forces stabilizing protein structure.
- Learn about the different processes involved in protein purification. Know about protein folding, denaturation and diseases due to protein misfolding.
- Know about the structure, properties and classification of carbohydrates.
- Learn about homo, hetero, storage and structural polysaccharides.
- Know the organization of the bacterial cell wall.
- Learn about glycoproteins and their biological functions.

Activities

- Preparation of assignments by each student on different topics.
- Preparation of PPT for presentation in the class;

Points for discussion

- About acidic, basic, aromatic and sulfur containing amino acids.
- Diseases due to protein misfolding, Anfinsen's principle and Levinthal's paradox.
- Organization of the bacterial cell wall
- Glycoproteins and their biological functions.

Unit	Topic	Method	No. of classes needed
II	Nomenclature and properties of fatty acids.	Lecture, Discussion	02
	Classification of fatty acids: Saturated, unsaturated fatty acids, hydroxyl. Cyclic fatty acids. Essential fatty acids	do	03
	Phospholipids, Sphingolipids,	do	02
	Glycolipids: cerebrosides and gangliosides, Cholesterol, Prostaglandins	do	03
	Physical and chemical properties of nucleic acids. Nucleosides and nucleotides, purines and pyrimidines	do	03
	Double helical model of DNA structure. A, B and Z DNA.		03
	Denaturation and renaturation of DNA		01

Learning Outcomes

After going through this unit student shall be able to:

- Give the classification of lipids.
- Describe the basic structure of glycerol and fatty acids; outline the formation of triglycerides by the condensation reactions between glycerol and fatty acids.
- Know the differences that distinguish lipids from other biomolecules?
- Describe the structures of saturated and unsaturated fatty acids and outline their roles and importance in the human body.
- Know the general structures of steroids and their significance.
- Describe the components of a nucleotide. Describe how nucleotides are linked together to form nucleic acids.
- Know the Watson and Crick model of DNA structure.

Activities

- Preparation of assignments by each student on different topics.
- Preparation of PPT for presentation in the class;

Points for discussion

- What is the composition and function of lipid bilayer in plasma membrane?
- What are the major structural features of lipids some of the following points.
- How Blood cholesterol levels are related to risk of CVD.
- Why uracil is absent from DNA.
- Why RNA is single stranded and DNA is double stranded.

Unit	Topic	Method	No. of classes needed
III	Enzymes	Lecture, PPT, Discussion	15
	Introduction and definition, of enzymes. Role of enzymes, How enzymes work. MM equation derivation. Significance of K_M , k_{cat} , Enzyme Activity units, and Inhibition. Classification and nomenclature.	Lecture, Discussion.	4
	Cofactors, types of cofactors, Structural and functional importance of cofactors.	Lecture, discussion	1
	Theories of enzyme action, features of enzymes, monomeric, dimeric, multimeric enzymes.	Lecture, Discussion	2
	Biocatalysts from hyperthermophiles, properties of thermophiles, uses of the hyperthermozymes for molecular biotechnology, industrial application, food, rubber, paper and biomass industry. Molecular properties of thermophiles.	Lecture	5
	Role of various vitamins as coenzymes	Lecture, discussion	3

Learning Outcomes

After going through this unit student shall be able to:

- Enzymes, composition, structure function and general properties enzymes.

- To understand how Classification of enzymes is done and the role of IUB.
- Concept of cofactor and their role in enzyme functioning.
- Enzymes found in Hyperthermophiles and how these are and could be cloned and produced to be utilized for molecular biology, food industry and conversion of biomass to solve the fuel problems.
- How organic molecules help in structural and functional role of enzymes. The deficiency diseases caused by lack of vitamins.

Activities

- Assignments were prepared on the sub topic related by individual students;
- Talks and PPT were delivered by students.

Points for discussion

- How enzymes from hyperthermophiles revolutionized the molecular biology technique. How could we utilize enzymes from hyperthermophiles for waste management, paper production, biomass conversion and fuel production?

Unit	Topic	Method	No. of classes needed
IV	Metabolism	Lecture, PPT, Discussion	15
	Carbohydrate metabolism, glycolysis, its regulation significance, reactions and energetics	Lecture, Discussion.	3
	Anaerobic and aerobic fates of pyruvate. Significances and energetic and reactions	Lecture, discussion	1
	Comparative studies of glucose synthesis, storage, breakdown, reactions regulation, role of hormones insulin, glucagon.	Lecture, PPT	5
	Pentose phosphate pathway reaction, significance and regulation. Citric acid cycle, reactions energetic and regulations.	Lecture, Discussion	3
	β oxidation, reactions and significance, oxidative phosphorylation and its role.	Lecture, discussion	3

Learning Outcomes

After going through this unit student shall be able to:

- Explain various metabolic pathways their role and significance.
- Discuss the regulations and various switches, hormones and metabolites involved in maintaining the homeostasis of the human body.
- To understand the energetic of various metabolic pathways.
- Draw the reaction flow chart of various metabolic cycles.
- Learn about feedback mechanism and allosteric enzymes involved in metabolic pathways.

Activities

- Assignments were prepared on the different sub topic by individual students;
- Talks and PPT were delivered by each student during the semester.

Points for discussion

- How various metabolic pathways are interrelated to maintain the homeostasis in living beings?

References:

1. Berg, J.M., Tymoczko, J.L. and Stryer L., Biochemistry (2012) 7th ed., W.H. Freeman and Company.
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3. Nelson, D.L. and Cox, M.M Lehninger: Principles of Biochemistry (2013) 6th ed, W.H. Freeman and Company .
4. Donald, Voet. and Judith G.Voet, Biochemistry (2011) 4th ed. John Wiley & Sons Asia Pvt.Ltd.
5. Devlin, T.M , Textbook of Biochemistry with Clinical Correlations (2011) 7th ed. John Wiley & Sons, Inc.