BIOC 3620: Elementary Biochemistry

2022 Fall Session	
Total Class Sessions: 25	**Instructor: Staff**
Class Sessions Per Week: 5	**Classroom: TBA**
Total Weeks: 5	**Office Hours: TBA**
Class Session Length (Minutes): 145	**Language: English**
Credit Hours: 4	

Course Description:

This course explores the basic of Biochemistry, which includes amino acids, lipids, carbohydrates, metabolites, nucleic acids and biochemical properties. We will discuss the generation of biochemical energy and the regulatory mechanisms of cellular metabolism, which includes glucose metabolism, lipid metabolism, nitrogen metabolism, and regulation of mammalian fuel metabolism. Students will also learn about that have profoundly changed how we study and use cell functions.

Learning objectives:

After having followed the course activities the student will be able to:

- understand the basic knowledge about the structure, roles, and functions of the different classes and feature of biomolecules
- predict potential outcomes of biochemical defects from the knowledge in this course
- describe the central pathways that provide living organisms with energy, and the regulation of them
- explain the flow in living systems and mechanisms that regulate the expression of genetic material
- Combine the knowledge with other subjects to build a comprehensive knowledge network

Course Materials:

Required Textbook:

Charlotte W. Pratt & Kathleen Cornely. Essential biochemistry (4th edition). 2018

Additional Readings:

Essential Cell Biology, Fourth Edition – Bruce Alberts, Dennis Bray, Karen Hopkins, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter by W.W. Norton & Company Inc.

Course Assignments:

Quizzes:

There will be 6 quizzes administered through the whole semester and the lowest score will be neglected. Quizzes will always be completed in the first ten minutes of class. The quiz problems will be related to labs and examples on slides. There will be no make-up quizzes.

Exams:

Midterm Exam

There will be one midterm exam in this course. The midterm exam will be based on concepts covered in class. They will be in-class, close-book and non-cumulative.

Final Exam

The final will be cumulative and close-book. Note that the final will not be taken during the normal class times. Exact time and location for final will be announced later.

Presentation:

Present an up-to-date paper about one topic in the syllabus. This aims to provide the latest information about the course and improve students with skills to select information from experimental paper, synthesize information, and make their own comments.

Attendance:

Students are expected to attend and participate in class. Strong attendance and participation are good indicators of success. Each student is responsible for all course material, announcements, quizzes and exams made in class, whether or not the student attended that day's class.

Course Assessment:

5 Quizzes	15%
Midterm Exam	25%
Final Exam	35%
Presentation	20%
Attendance	5%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	**93-97**	**90-92**	**88-89**	**83-87**	**80-82**	**78-79**	**73-77**	**70-72**	**68-69**	**63-67**	**60-62**	**<60**

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are

described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

Week	Topics	Assignments
Week One (Class 1~5)	• Course & Syllabus Overview • Introduction of biochemistry • Nucleotides and Nucleic Acid Structure • **Amino Acids: the building blocks of proteins** ➢ General formula of amino acid ➢ The different chemicals of the 20 amino acids ➢ Monosodium glutamate ➢ Titration curve of amino acid and its significance • Myoglobin and Hemoglobin: Oxygen-Binding • Clinical Connection: Hemoglobin variants • Structural Proteins • Motor Proteins	• Quiz 1&2 • Textbook review • Finish the hard copy of problem set about amino acids assigned by teacher
Week Two (Class 6~10)	• **Enzyme's concept (structure and classification)** • Chemical Catalytic Mechanisms • Unique Properties of Enzyme Catalysts • Chymotrypsin in Context • Clinical Connection: Blood Coagulation • Enzyme Kinetics and Inhibition • Derivation and Meaning of the Michaelis-Menten Equation • Enzyme Inhibition • Clinical Connection: Drug Development	• Quiz 3&4 • Textbook review • Finish the hard copy of problem set about enzyme and lipids assigned by teacher

	• Mechanism of Action of Enzymes ➢ Active site ➢ Transition state complex and activation energy ➢ Significance of hyperbolic, double reciprocal plots of enzyme activity • **Lipids** (Definition and major classes of storage and structural lipids) ➢ Storage lipids ➢ Fatty acids structure and functions ➢ Essential fatty acids ➢ Triacyl glycerol structure, functions and properties ➢ Saponification • The Lipid Bilayer • Membrane Proteins • The Fluid Mosaic Model • Lipid functions: cell signals, cofactors, prostaglandins	
Week Three (Class 11~15)	• **Membrane Transport** • The Thermodynamics of Membrane Transport • Passive Transport • Active Transport • Membrane Fusion • Carbohydrates • Monosaccharides • Polysaccharides • Glycoproteins • **Metabolism and Bioenergetics** • Food and Fuel • Metabolic Pathways ➢ Common intermediates ➢ Oxidation-reduction reactions • Free Energy Changes in Metabolic Reactions	• Midterm • Textbook review • Finish the hard copy of problem set about membrane transport and metabolism assigned by teacher

	➢ Reactant concentrations ➢ Free energy can take different form	
Week Four (Class 16~20)	• Glucose Metabolism • Glycolysis ➢ Catabolism of other sugars ➢ Alcohol metabolism • Gluconeogenesis • Glycogen Synthesis and Degradation • Lipid Metabolism • Lipid Transport • Fatty Acid Oxidation • Fatty Acid Synthesis • Nitrogen Metabolism • Nitrogen Fixation and Assimilation • Amino Acid Biosynthesis • Amino Acid Catabolism • Nitrogen Disposal: The urea cycle • Regulation of Mammalian Fuel Metabolism • Integration of Fuel Metabolism • Hormonal Control of Fuel Metabolism	• Quiz 5&6 • Textbook review • Finish the hard copy of problem set about glucose metabolism and lipid metabolism assigned by teacher
Week Five (class 21~25)	• **Heritable Information** • DNA Replication and Repair • The DNA Replication Machinery • Telomeres • DNA Damage and Repair • Clinical Connection • DNA Packaging • Transcription and RNA • Initiating Transcription • RNA Polymerase • RNA Processing • Protein Synthesis • tRNA and the Genetic Code • Ribosome Structure	• Finish the hard copy of problem set about heritable information assigned by teacher • Final exam (cumulative) TBA

	• Translation • Post-Translational Events • Wrap-up	