

SUL ROSS STATE UNIVERSITY
Syllabus for Biochemistry I-11516
CHEM 4301_001 (Fall 2024)
(Alpine Campus)

Biochemistry I: Lecture
Room: WSB 307
Time: T/TR 9:30 am -10:45 am
Date: Aug. 26 to Dec. 11

Instructor: Dr. Hong Young Chang
Office: WSB 219
Email: hong.young.chang@sulross.edu
Office Hours: M-TR 2:00-6:30 pm

OBJECTIVES:

Student Learning Outcomes (SLO):

A student graduating with a *chemistry major* is expected to demonstrate that (s)he is able to do the following:

1. Organic Chemistry—Students will be able to draw organic molecular structures and explain organic reactions, stereochemistry, structural analysis, and reactions in biological systems.
2. Inorganic Chemistry—The student will be able to demonstrate an understanding of coordination chemistry, valence theory, elementary actions, and advanced molecular theory.
3. Analytical Chemistry—The student will be able to demonstrate an understanding of the theory of analytical chemistry and conduct analytical analysis, including data analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, and spectroscopic analysis, and electrochemical analysis.

4. Physical Chemistry—The student will be able to demonstrate an understanding of the application and theory of physical chemistry, including topics such as atomic structure, electrochemistry, surface chemistry, solid-state chemistry, and thermodynamics.

5. Research—The student will collect and analyze published chemical literature and undertake a chemistry research project.

BSc in Chemistry Marketable Skills:

1. Students will become good at punctuality and time management.
2. Students will analyze &/or synthesize molecules and perform spectroscopic characterization and interpret their results scientifically.
3. Students will become proficient at writing scientific papers and identifying appropriate references for the papers.
4. Students will become proficient at orally presenting scientific topics including the use of visual aids.

Biochemistry I Learning Objectives:

At the end of this course, a student should have a good understanding of:

1. Chemistry and biological functions of water, amino acids, and proteins
2. Enzyme reactions, kinetics, and inhibition
3. The structure and biological function of carbohydrates and lipids
4. Biological membranes and cellular transport
5. Storage and transfer of biological information (DNA replication/transcription and RNA translation)
6. SciFinder (Chemical Database), RCSB PDB bank, and the Protein Data Bank (NCBI)

Required Text Book:

“Concepts in Biochemistry” by Rodney Boyer, 2006, (3rd Edition), John Wiley & Sons, INC.

The SRSU library has one copy of this textbook in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook.

Optional Reading:

“Lehninger Principles of Biochemistry” 6th Edition, David L. Nelson & Michael M. Cox, 2013, W.H. Freeman and Company, New York.

SRSU Library Services: The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library’s website, library.sulross.edu. Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or by phone (432-837-8123).

PyMOL is a free and open-source molecular graphics system for visualization, animation, editing, and publication-quality imagery on biomolecules. PyMOL is scriptable and can be extended using the Python language. Supports Windows, Mac OSX, Unix, and Linux. You can download PyMOL from the following website: [PyMOL | pymol.org](http://pymol.org)

The following chapters will be covered from “Concepts in Biochemistry”, 2006, (3rd Edition):

Chapter 1: Biochemistry: from atoms to molecules to cells

Chapter 2: Biomolecules in water

Chapter 3: Amino acids, Peptides, and Proteins

Chapter 4: Protein Architecture and Biological Function

Chapter 5: Enzymes I: Reactions, Kinetics, and Inhibition

Chapter 6: Enzymes II: Coenzymes, Regulation, Abzymes, and Ribozymes

Chapter 7: Carbohydrates: Structure and Biological Function

Chapter 8: Lipids: Structure and Biological Function

Chapters 10 & 11: DNA and RNA: Structure and Function, DNA Replication and Transcription

ATTENDANCE PREREQUISITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.

Cell phones **ARE NOT** permitted for use in exams and should be turned off during class time.

Homework: Ten (10) homework will be assigned throughout the semester. All of the homework will contribute 20% of your final mark. Homework must be completed in PEN! You need to keep the due day.

EXAMINATIONS: There will be three in-course examinations and a final examination. **NO MAKEUP EXAMS WILL BE GIVEN.** The final is mandatory and will be comprehensive.

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 20%

Each Midterm Exam (20%): 60%

Final Exam: 20%

Midterm Exam I: Thursday, September 26th

Midterm Exam II: Thursday, October 24th

Midterm Exam III: Thursday, November 14th

Final Exam: Monday, December 9th, 8:00 am -10:00 am at WSB 307

SRSU Disability Services: ADA (Americans with Disabilities Act):

Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility/accommodations services must contact Rebecca Greathouse Wren, LPC-S, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and we'll get back to you as soon as we can during working hours), or email rebecca.wren@sulross.edu. Their office is located on the first floor of Ferguson Hall (Room 112), and our mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

Scholastic Dishonesty:

*Students who violate the University rules on scholastic dishonesty are subject to penalties, including the possibility of an **F** in the course and/or dismissal from the University.*

Course Calendar

* This course calendar could be changed. Before one week, your professor will let you know the changes.

Date	Lecture #	Chapter #	Topics	Due work
Aug. 27	Lecture 1	Ch 1	Discussion on Syllabus, importance, and historical background of biochemistry, All living matter contains C, H, O, N, P, and S, Chemical elements in biomolecules, Combining elements into compounds, Biological Macromolecules, Cellular reactions, Organelles, Cells, Viruses, living cells (eukaryotes, prokaryotes, archaeobacteria archaea) Biochemistry comes in all sizes (S, M, L, and XL)	
Aug. 29	Lecture 2		Storage and transfer of biological information- a preview Biological information, Genome, The DNA molecule, DNA -->DNA DNA-->RNA, mRNA-->Proteins, The Genetic Code, DNA mutations	

Sep. 3	Lecture 3	Ch 2	<p>Revision of Chapter 1</p> <p>The biological roles of water, Noncovalent interactions in biomolecules</p> <p>Examples of non-covalent interactions; Hydrogen bonds, VDW, and Ionic bonds</p> <p>Characteristics of noncovalent interactions, Structure of water, Physical properties of water, Hydrophobic/amphiphilic, micelles polar compounds</p>	
Sep. 5	Lecture 4		<p>Ionization of water, Equilibrium constant (K_{eq}), $pH = -\log[H^+]$, pK, conjugate acid-base pairs, acid dissociation constant, titration, titration curves for monoprotic acids and polyprotic acids,</p> <p>Henderson-Hasselbalch equation, Water solubility of molecules,</p> <p>Buffer systems to maintain a constant pH</p>	Ch1 HW due
Sep. 10	Lecture 5	Ch 3	<p>Revision of Chapter 2</p> <p>Proteomics, The amino acids in proteins, Properties of alpha-amino acids</p>	
Sep. 12	Lecture 6		<p>Ionic forms of amino acids, Zwitteric ions, pK values of the 20 amino acids from the alpha-carboxyl group and the alpha-amino group</p> <p>Stereochemistry (chiral center), enantiomers, optical activity</p>	Ch2 HW due
Sep. 17	Lecture 7		<p>pK_1 values for the alpha-carboxyl groups</p> <p>pK_2 values for the alpha-amino groups</p> <p>pK_R values to ionizable groups</p> <p>Calculation of isoelectric pH (pH_i)</p>	
Sep. 19	Lecture 8		<p>Classification of amino acids (Group I, II, & III)</p> <p>Reactivity and analysis of amino acids by chromatographic methods</p> <p>Polypeptide and proteins; condensation, residues, amino terminus, Peptidases,</p> <p>Classes of proteins based on their biological functions: Enzymes, Structural proteins, Immune proteins, Transport and Storage proteins, Regulatory and Receptor</p> <p>Peptide bond formation and protein synthesis</p>	
Sep. 24	Lecture 9		Exam 1 Revision	

Sep. 26	Lecture 10	Review & Test	Exam 1 (it covers ch 1 & 2)	
Oct. 1	Lecture 11	Ch 3	Determination of primary structure: Edman method of protein sequencing Importance of protein sequence data General principles of protein design Elements of secondary structure; alpha-helix, beta-sheets, bends, and loops, super secondary structure, fibrous structure	
Oct. 3	Lecture 12	Ch 4	Tertiary structure, Protein folding process, Protein unfolding Quaternary structure: Monomeric and Oligomeric proteins Protein structure and biological function	Ch 3 HW due
Oct. 8	Lecture 13		Hemoglobin, alpha-keratin, Bacterial and Bovine Rhodopsin Revision on Chapter 4	
Oct. 10	Lecture 14	Ch 5	Catalytic properties of the enzyme Enzymes, cofactors, and naming of enzymes Kinetic properties of enzymes (Michaelis-Meten equation), Kinetic constant K_M , V_{max} , and k_3 Characteristics of enzyme reactions	
Oct. 15	Lecture 15		Enzyme active sites, substrate binding, and enzyme action Enzyme inhibition (Reversible & and irreversible, Competitive, Noncompetitive, Uncompetitive)	Ch 4 HW due
Oct. 17	Lecture 16	Ch 6	Revision on Chapter 5 Coenzymes, Vitamins, Metals as Nutrients, Allosteric enzymes Cellular regulation of enzymes	
Oct. 22	Lecture 17	Review & Test	Exam 2 Revision	Ch 5 HW due
Oct. 24	Lecture 18		Exam 2 (it covers Ch 3, 4, & 5)	
Oct. 29	Lecture 19	Ch 6	Design of new enzymes: Site-directed mutagenesis, Abymes, ribozymes Revision of Chapter 6	
Oct. 31	Lecture 20	Ch 7	Monosaccharide (Aldose & Ketose) Carbohydrates in cyclic structures Reactions of monosaccharides	Ch 6 HW due

Nov. 5	Lecture 21		Structural /Storage Polysaccharides, Peptidoglycans Glycoprotein structure and function Revision of Chapter 7	
Nov. 7	Lecture 22	Ch 8	Fatty acid structure, Triacylglycerols, Glycerophospholipids, Sphingolipids, Steroids etc.	Ch 7 HW due
Nov. 12	Lecture 23		Terpenes, Eicosanoids, Lipid-soluble vitamins, Pheromones, Electron carriers Revision of Chapter 8 & Revision of Exam3	
Nov. 14	Lecture 24	Test	Exam 3 (it covers Ch 5, 6, 7, & 8)	Ch 8 HW due
Nov. 19	Lecture 25	Ch 10-11	RNA and DNA chemical structures, Nucleic acids, components of nucleotides, DNA double helix, tRNA/rRNA, Nucleases, Ribonucleoprotein enzymes	
Nov. 21	Lecture 26		Replication of DNA, Action of DNA polymerases, Okazaki fragments, Eukaryotic chromosomes, Telomeres	
Nov. 26	Lecture 27	Review	Final Exam Revision I	
Dec. 3	Lecture 28	Review	Final Exam Revision II	
Dec. 9	Lecture 30	Test	Final Exam, Monday, 8:00 AM to 10:00 AM, WSB307	

Libraries:

The Bryan Wildenthal Memorial Library in Alpine offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu/. Off-campus access requires logging in with your Lobold and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or by phone (432-837-8123).

No matter where you are based, public libraries and many academic and special libraries welcome the general public into their spaces for study. SRSU TexShare Cardholders can access additional services and resources at various libraries across Texas. Learn more about the TexShare program

by visiting library.sulross.edu/find-and-borrow/texshare/ or ask a librarian by emailing srsulibrary@sulross.edu.

New for Fall 2024: Mike Fernandez, SRSU Librarian, is based in Eagle Pass (Building D-129) to offer specialized library services to students, faculty, and staff. Utilize free services such as Interlibrary Loan (ILL) and Scant to get materials delivered to you at home or via email.

Academic Integrity:

Students in this class are expected to demonstrate scholarly behavior and academic honesty in the use of intellectual property. Students should submit work that is their own and avoid the temptation to engage in behaviors that violate academic integrity, such as turning in work as original that was used in whole or part for another course and/or professor; turning in another person's work as one's own; copying from professional works or internet sites without citation; collaborating on a course assignment, examination, or quiz when collaboration is forbidden. Students should also avoid using open AI sources *unless permission is expressly given* for an assignment or course. Violations of academic integrity can result in failing assignments, failing a class, and/or more serious university consequences. These behaviors also erode the value of college degrees and higher education overall.

Counselling:

Sul Ross has partnered with TimelyCare where all SR students will have access to nine free counseling sessions. You can learn more about this 24/7/356 support by visiting [Timelycare/SRSU](https://timelycare.com/SRSU). The SR Counseling and Accessibility Services office will continue to offer in-person counseling in Ferguson Hall room 112 (Alpine campus), and telehealth Zoom sessions for remote students and RGC students.

Classroom Climate of Respect:

Importantly, this class will foster free expression, critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility,

and respect for the viewpoints of others. Similarly, we must all learn how to probe, oppose, and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another on the basis of race, religion, ethnicity, age, gender, national origin, or sexual preference. Still, we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.

Distance Education:

Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires a secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.