Sul Ross State University
Syllabus for Biochemistry I: BIOL 5307 (Spring 2019)

Class: Biochemistry I
Room: WSB 321
Time: MWF 11:00-11:50am

Instructor: Dr. David Leaver
Office: WSB 318
Office Hours: M-R 2:00-5:00pm
Email: david.leaver@sulross.edu
Office Phone: (432) 837-8115

OBJECTIVES

Student Learning Objectives (SLO):

The biology student graduating with a MS in Biology should be able to:

1. Understanding and implementation of scientific methodology.

2. Utilization of field techniques toward addressing scientific questions.

3. Be able to utilize statistics toward the analysis of data within the discipline.

4. Be able to effectively disseminate scientific findings using both written and oral communication.

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)
**Calculator:** A scientific calculator is required for this course.

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

**REQUIRED TEXT:**


The following chapters will be covered from “Lehninger Principles of Biochemistry” 6th Edition:

- **Chapter 1:** The Foundations of Biochemistry
- **Chapter 2:** Water
- **Chapter 3:** Amino Acids, Peptides, and Proteins
- **Chapter 4:** The Three-Dimensional Structure of Proteins
- **Chapter 5:** Protein Function
- **Chapter 6:** Enzymes
- **Chapter 7:** Carbohydrates and Glycobiology
- **Chapter 10:** Lipids
- **Chapter 11** Biological Membranes and Transport
- **Chapter 8:** Nucleotides and Nucleic Acids
- **Chapter 24:** Genes and Chromosomes
- **Chapter 25:** DNA Metabolism
- **Chapter 26:** RNA Metabolism (*If time permits*)

**ATTENDANCE PREREQUISITE:** BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.
HOMEWORK:
Thirteen (13) homework assignments will be assigned throughout the semester and will be equal weight per assignment. All of the combined homework assignments will contribute 20% of your final mark. Homework must be completed in PEN!

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

TWO RESEARCH ESSAYS WORTH 15.5% EACH (TOTAL = 31%)

Paper 2 (Due Friday 15th March @ 5:00 PM)—methodology focused: You are required to prepare a 12+ page paper (excluding bibliography) that summarizes your findings in the literature of a particular laboratory method in the field of biochemistry (PCR, Sanger DNA sequencing method, CRISPR/Cas9, other DNA sequencing methods, etc.). Your project needs to be pre-approved by Dr. Leaver. Your bibliography should have > 14 peer-reviewed articles or citations that pertain to your topic of interest. Website citations WILL NOT be accepted. You will need to turn (email or hardcopy) in a copy (pdf) of the journal articles that you cite.

Paper 2 (Due Monday 29th April @ 5:00 PM)—disease focused: You are required to prepare a 10+ page paper (excluding bibliography) that summarizes your findings in the literature of a particular topic in the field of biochemistry (more details will be provided in class). Your bibliography should have > 14 peer-reviewed articles or citations that pertain to your topic of interest. Website citations WILL NOT be accepted. You will need to turn (email or hardcopy) in a copy (pdf) of the journal articles that you cite.

SCORING RUBRIC FOR BOTH RESEARCH ESSAYS:

60%: Relevant biochemical literature/examples discussed in paper, concise up-to-date analysis of literature / field of the disease being investigated/molecular understanding of the disease and how to treat it (or is it currently untreated?), current drugs (include some structures) or current development of drugs, issues concerning this disease &/or how to treat it.

20%: Grammar and organization of the essay, relevant tables, figures, etc.
20%: Bibliography per ACS standards and all references as .pdf are emailed to Dr. Leaver on time.

PERCENTAGE BREAKDOWN OF MARKS FOR BIOCHEMISTRY II:

Homework: 15%
Research Essays (15.5%): 31%
Each Midterm Exam (13%): 39%
Final Exam: 15%

Midterm Exam I: Wednesday, February 20th
Midterm Exam II: Wednesday, March 27th
Midterm Exam III: Wednesday, April 17th
Research Essays: Friday 15th March (5:00 pm) and Monday, April 29th (5:00 pm)
Final Exam: Tuesday, May 14th 10:15am -12:15 pm

Course Calendar

Lecture 1 (January 23): Discussion on Syllabus, importance and historic background of Biochemistry, cellular foundations, overview of organelles, cells, and organisms
Lecture 2 (January 25): Chemical elements in biomolecules, major classes of biological macromolecules, chemical and physical foundations.
Lecture 3 (January 28): Preview of storage and transfer of biological information, genetic foundations + revision on chapter 1
Lecture 4 (January 30): Biological roles of water and cellular reactions of water
   (Homework 1 due)
Lecture 5 (February 1): Overview of pH and pK, buffer and titration curves, General structure of amino acids, properties of $\alpha$-amino acids, classification of amino acids, reactivity and analysis of amino acids
Lecture 6 (February 4): Revision on Chapter 2 + peptide bonds in polypeptides and proteins. (Homework 2 due)
Lecture 7 (February 6): Preview of protein function and structural properties of proteins
Lecture 8 (February 8): Structural elements of proteins—primary, secondary, tertiary and quaternary structures, protein folding process
Lecture 9 (February 11): Revision on Chapter 3 General principles of protein design (Homework 3 due)
Lecture 10 (February 13): Elements of secondary structure and protein tertiary structure
Lecture 11 (February 15): Protein quaternary structure and more examples of protein structure and related biological function, revision on Chapter 4 (Homework 4 due)
Lecture 12 (February 18): Exam revision on Chapters 1-3
Lecture 13 (February 20): Exam I (Chapters 1-3, subject to change)
Lecture 14 (February 22): Understanding the relation between protein structure and biological function with few examples
Lecture 15 (February 25): More examples of protein function, revision on Chapter 5, roles and properties of enzymes
Lecture 16 (February 27): Fundamental principles of enzyme action and kinetic properties of enzymes
Lecture 17 (March 1): Substrate binding and enzyme action, enzyme inhibition, enzymatic reaction examples (Homework 5 due)
Lecture 18 (March 4): Role of coenzymes in the activity of enzymes, allosteric enzymes
Lecture 19 (March 6): Cellular regulation of enzymes, more enzyme reactions and practical uses of enzymes
Lecture 20 (March 8): Revision on Chapter 6 (Homework 6 due)

March 11-15th is Spring Break at MC. SRSU classes are still on!

Lecture 21 (March 11): Introduction to carbohydrate chemistry, classification of carbohydrates, reactions of monosaccharides
Lecture 22 (March 13): Structures and functions of polysaccharides and glycoproteins
Lecture 23 (March 15): Revision on Chapter 7, Chemical structures, physical and chemical properties of fatty acids (Homework chapter 7 due), Research Essay 1 is Due @ 5:00 PM.

March 18-22nd is Spring Break (No classes)

Lecture 24 (March 25): Exam revision on Chapters 4-7
Lecture 25 (March 27): Exam II (Chapters 4-7, subject to change)
Lecture 26 (March 29): Polar and non-polar lipids, structural lipids in membranes, and importance of lipids
Lecture 27 (April 1): Working with lipids and revision on Chapter 10
Lecture 28 (April 3): Molecular composition, architecture, and biological functions of cell (Homework chapter 10 due)
Lecture 29 (April 5): Membrane dynamics
Lecture 30 (April 8): Modes of action used by membrane transport proteins
Lecture 31 (April 10): Revision on Chapter 11 (Homework Chapter 11 due), chemical structures of DNA and RNA, Structural elements of DNA and RNA
Lecture 32 (April 12): Functions of nucleotides, revision on Chapter 8, (Homework Chapter 8 due)
Lecture 33 (April 15): Exam revision on Chapters 8, 10, 11
Lecture 34 (April 17): Exam III; Chapters 8, 10, 11 (subject to change)
Friday 19th April is Good Friday (No Class)
Lecture 35 (April 22): Chromosomal elements, DNA supercoiling
Lecture 36 (April 24): Structure of chromosomes
Lecture 37 (April 26): Revision on Chapter 24, (Homework Chapter 24 due)
Lecture 38 (April 29): DNA replications, DNA repair, DNA replication. 2nd Research Essay Is Due @ 5:00 pm
Lecture 39 (May 1): Revision on Chapter 25, DNA-dependent synthesis of RNA (Homework Chapter 25 due)
Lecture 40 (May 3): RNA processing and RNA-dependent synthesis of RNA and DNA
Lecture 41 (May 6): Revision on Chapter 26, Final Exam Revision (Homework Chapter 26 due)
Lecture 42 (May 8): Final Exam Revision
Final Exam (May 14): At 10:15 am-12:15 pm (Comprehensive)

Students with Special Needs: Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student’s responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact
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. All assignments (including homework) need to be individually completed and not copied from another student’s work. Electronic submission of homework is accepted after hours (not recommended), but must be hand written and scanned (either with a scanner or a smartphone) and emailed to Dr. Leaver at: david.leaver@sulross.edu. [.pdf files are the recommended format for electronic submission of assignments]. Homework electronically completed in Microsoft Word or other similar programs will NOT be accepted.