

Sul Ross State University
Syllabus for Biochemistry II: CHEM 4302 (Fall 2019)
(Alpine and Midland)

Class: Biochemistry II
Room: WSB 321 (Alpine)
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):

A student graduating with the 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 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 theory of analytical chemistry and conduct analytical analysis, including data analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, 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.

Biochemistry II Learning Objectives:

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

1. Signal transduction in GPCRs, receptor tyrosine kinases, gated ion channels and how sensory transduction is used in vision, olfaction and gustation
2. Bioenergetics and biochemical reaction types
3. Glycolysis, gluconeogenesis, and the pentose phosphate pathway
4. Principles of metabolic regulation, hormonal regulation, integration of mammalian metabolism and protein metabolism
5. Citric Acid Cycle
6. Fatty Acid Catabolism
7. Biosynthesis of lipids, amino acids, nucleotides and related molecules

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:

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

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.

The following chapters will be covered:

Chapter 12: Biosignaling

Chapter 13: Bioenergetics and Biochemical Reaction Types

Chapter 14: Glycolysis, Gluconeogenesis, and the Pentose Phosphate Pathway

Chapter 15: Principles of Metabolic Regulation

Chapter 16: The Citric Acid Cycle

Chapter 17: Fatty Acid Catabolism

Chapter 18: Amino Acid Oxidation and the Production of Urea

Chapter 19.1-19.5: Oxidative Phosphorylation

Chapter 21: Lipid Biosynthesis

Chapter 22: Biosynthesis of Amino Acids, Nucleotides and Related Molecules

Chapter 23: Hormonal Regulation and Integration of Mammalian Metabolism

Chapter 20: Carbohydrate Biosynthesis and Plants and Bacteria (*if time permits*)

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

HOMEWORK:

Twelve (12) homework assignments will be assigned throughout the semester and will be equal weight per assignment. All of the combined homework assignments will contribute 23% of your final mark. Homework must be completed in PEN!

EXAMINATIONS:

There will be three in-course examinations and a final examination. The final is mandatory and will be comprehensive.

ORAL RESEARCH PRESENTATION (worth 15%):

Presentations to the whole class will be on Wednesday 6th November (Alpine) and Friday 8th November (Midland).

PRESENTATION SLIDES MUST BE EMAILED TO DR. LEAVER BY 5:00 PM ON TUESDAY NOVEMBER 5TH.

A research based project that will involve searching relevant biochemical literature (SciFinder, EBSCO, etc.) on a relevant topic. The presentation will be orally presented to the whole class with the use of PowerPoint. You should have > 5 peer reviewed publications cited in your presentation. Duration of

presentation should be ~ 10 minutes and more information will be provided later in class and on Blackboard.

Scoring rubric for oral presentation:

60%: Relevant biochemical literature/examples discussed in presentation, 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 untreatable?), current drugs (include some structures) or current development of drugs, issues concerning this disease &/or how to treat it.

40%: Delivery, flow of talk, quality pictures/figure/tables etc., and properly cited references (cited references MUST BE emailed to Dr. Leaver as .pdfs.)

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 23%

Oral Research Presentation: 15%

Each Midterm Exam (14%): 42%

Final Exam: 20%

EXAM SCHEDULE:

Midterm Exam I: Monday 23rd September

Midterm Exam II: Wednesday 16th October

Midterm Exam III: Wednesday 20th November

Final Exam: Tuesday December 10th from 10:15 am -12:15 pm

Course Calendar

Lecture 1 (August 26): Discussion on syllabus, general features of signal transduction, G protein—coupled receptors (GPCRs) and secondary messengers

Lecture 2 (August 28): Receptor kinases, receptor guanylyl cyclases, cGMP, protein kinase G, multivalent adapter proteins and membrane rafts

Lecture 3 (August 30): Gated ion channels, integrins, regulation of transcription by nuclear hormone receptors

September 2: NO CLASS: LABOR DAY HOLIDAY

Lecture 4 (September 4): Sensory transduction in vision, olfaction and gustation, regulation of cell cycle by protein kinases

Lecture 5 (September 6): Oncogenes, tumor suppressor genes and apoptosis, revision on Chapter 12 (*Homework Chapter 12 due*)

Lecture 6 (September 9): Bioenergetics and thermodynamics, chemical logic and common biochemical reactions, phosphoryl group transfers and ATP

Lecture 7 (September 11): Biological oxidation-reduction reactions, revision on Chapter 13, Glycolysis

Lecture 8 (September 13): Glycolysis and gluconeogenesis (*Homework Chapter 13 due*)

Lecture 9 (September 16): Pentose phosphate pathway of glucose oxidation and revision of Chapter 14

Lecture 10 (September 18): Principles on metabolic pathways and analysis of metabolic control (*Homework Chapter 14 due*)

Lecture 11 (September 20): Exam revision

Lecture 12 (September 23): Exam Chapters 12-14

Lecture 13 (September 25): Coordinated regulation of glycolysis and gluconeogenesis and metabolism of glycogen in animals

Lecture 14 (September 27): Coordinated regulation of glycogen synthesis and breakdown, revision of Chapter 15

Lecture 15 (September 30): Citric acid cycle, biosynthesis of acetyl-coenzyme A (*Homework Chapter 15 due*)

Lecture 16 (October 2): Regulation of the citric acid cycle and the glyoxylate cycle

Lecture 17 (October 4): Revision on Chapter 16 and fatty acid catabolism

Lecture 18 (October 7): Oxidation of fatty acids, ketone bodies (*Homework Chapter 16 due*)

Lecture 19 (October 9): Revision on Chapter 17 and metabolic fates of amino groups

Lecture 20 (October 11): Nitrogen excretion and the urea cycle (*Homework Chapter 17 due*)

Lecture 21 (October 14): Exam Revision

Lecture 22 (October 16): Exam II (Chapters 15-17)

Lecture 23 (October 18): Pathways of amino acid degradation

Lecture 24 (October 21): Revision on Chapter 18, electron-transfer reactions in mitochondria and ATP biosynthesis

Lecture 25 (October 23): Regulation of oxidative phosphorylation, mitochondria in thermogenesis (*Homework Chapter 18 due*)

Lecture 26 (October 25): Steroid synthesis and apoptosis, revision on Chapter 19.

Lecture 27 (October 28): Biosynthesis of fatty acids and eicosanoids and biosynthesis of triacylglycerols (*Homework Chapter 19 due*)

Lecture 28 (October 30): Biosynthesis of membrane phospholipids, cholesterol, steroids, and isoprenoids

Lecture 29 (November 1): Revision on chapter 21, overview of nitrogen metabolism, biosynthesis of amino acids

Lecture 30 (November 4): Molecules derived from amino acids (*Homework Chapter 21 due*)

Lecture 31 (November 6): Oral Presentations (Alpine)

Lecture 32 (November 8): Oral Presentations (Midland), Biosynthesis and degradation of nucleotides

November 11: NO CLASS: VETERANS DAY HOLIDAY

Lecture 33 (November 13): Revision on Chapter 22, hormones and tissue-specific metabolism, hormonal regulation of fuel metabolism, obesity and the regulation of body mass (*Homework Chapter 22 due*)

Lecture 34 (November 15): Obesity and type 2 diabetes, revision on Chapter 23

Lecture 35 (November 18): Exam revision

Lecture 36 (November 20): Exam III; Chapters 18, 19, 21

Lecture 37 (November 22): Photosynthetic carbohydrate synthesis (*Homework Chapter 23 due*)

Lecture 38 (November 25): Photorespiration, biosynthesis of starch and sucrose

November 27-29: NO CLASS: THANKSGIVING HOLIDAY

Lecture 39 (December 2): Synthesis of cell wall polysaccharides, revision on Chapter 20 (*Homework Chapter 20 due*)

Lecture 40 (December 4): Final Exam Revision

Final Exam (December 10): At 10:15 am-12:15 pm (Comprehensive)

Important Links:

SRSU Interlibrary loan:

<https://library.sulross.edu/home/services/online-services/interlibrary-loan-document-delivery/>

Download ChemDraw:

<http://sitelicense.cambridgesoft.com/sitelicense.cfm?sid=3000>

Register for SciFinder:

<http://sulross.libguides.com/az.php?a=s>

Access SciFinder:

<https://scifinder.cas.org/scifinder/login>

Distance Education Statement: *Students enrolled in distance education courses have equal access to the university's academic support services, library resources, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should submit online assignments through Blackboard or SRSU email, which require secure login information to verify students' identities and to protect students' information. The procedures for filing a student complaint are included in the student handbook. 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 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 Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8203. E-mail: mschwartz@sulross.edu.*

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 smart phone) 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.*