

BE3415: Fundamentals of Biomolecular Engineering
Fall 2017

Instructor(s): Prof. Justyn Jaworski

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Office Hours: Monday 12-1pm

Section Information: Lecture: BE3415-018 (89818)
Laboratory (Group A): BE3415-022 (90878)
Laboratory (Group B): BE3415-023 (90893)

Time and Place of Class Meetings:	Lecture:	COBA151	Tues/Thurs 5-6:29pm
	Laboratory (Group A):	ERB273	Monday 9-11:59am
	Laboratory (Group B):	ERB273	Friday 1-3:59pm

Description of Course Content: [Introducing the fundamentals of molecular structure of life, topics include the structure of the atom, the chemical bonding, the energetic rationale to create compounds and functional groups, and their roles in chemical reactions. Topics also include complex molecular systems such as carbohydrates, proteins, DNA, lipids and the synthesis of biopolymer. Methods and technology used for their characterization: spectroscopy, polarimetry, nuclear magnetic resonance, and other techniques will be introduced. Applied technology of recombinant DNA, PCR, etc. commonly used in molecular biology and genetic engineering will be introduced. The course also offers an introduction to enzyme chemistry and the metabolic pathways for carbohydrates and lipids. Pre-requisites: BE 1325, CHEM 1442, or consent of the instructor.

Student Learning Outcomes:

By the end of the course the student will have gained a firm knowledge of the following topics/concepts

1. Basic principles of chemistry, structure of atoms and chemical bonding/reactions
2. Acid and base chemistry, classification of molecules as alkanes/alkenes/alkynes, alcohols, aldehydes & ketones, ethers and epoxides, carboxylic acids, amines, carbohydrates, and aromatic compounds.
3. Principles of chemical reactions: stereo-isomerism, chemical reactivity, substitution reactions, addition reactions, aromatic substitution reactions, and pericyclic reactions.
4. Methods and their working principles for characterizing organic compounds: infrared, UV-Vis mass spectroscopy, and NMR
5. Basic principles in carbohydrates-sugars, nucleotides-nucleic acids, amino acids-proteins, as well as lipids and enzymes.
6. Transports and pathways, including glycolysis, TCA cycle, pentose phosphate pathway, electron transport chain and their roles in cellular respiration and metabolism
7. Working principles of contemporary technologies and tools used in molecular biology, genetic engineering (PCR, recombinant DNA, CRISPR)

Required Textbooks and Other Course Materials: Organic Chemistry by John McMurry (freely available online); Biochemistry by Mary Campbell and Shawn Farrell (freely available online)

Descriptions of major assignments and examinations: The course will have 6 homework assignments, 7 laboratory experiments, 2 midterm examinations, and 1 final examination each of which will be graded.

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I will take attendance sporadically. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Grading: The final grade will be calculated based on 100% cumulative total of the following components:

Homework:	30%
Laboratory:	28%
Exams:	42%

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wwwb.uta.edu/aao/fao/>).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act).

Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.*

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

Lab Safety Training: Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., Fall through Summer II) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory

examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located on the east side of the room and on the east side of the first floor. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

University Tutorial & Supplemental Instruction (Ransom Hall 205): UTSI offers a variety of academic support services for undergraduate students, including: 60 minute one-on-one tutoring sessions, Start Strong Freshman tutoring program, and Supplemental Instruction. Office hours are Monday-Friday 8:00am-5:00pm. For more information visit www.uta.edu/utsi or call 817-272-2617.

The IDEAS Center (2nd Floor of Central Library) offers **FREE** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in, or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

Course Schedule

Lecture Schedule

Week	Lectures	Lessons	HW
1	Aug 24 th	Basic principles of chemistry, structure of atoms and chemical bonding	
2	Aug 29 th Aug 31 st	Stereo-isomerism and chemical structures (alkanes, alkenes, alkynes, aromatic and cycloalkanes) How energetic forces and functional groups create compounds and their roles in chemical reactions	Homework 1 (due Sept 4 th)
3	Sept 5 th Sept 7 th	Overview of alcohols, aldehydes & ketones, ethers and epoxides, carboxylic acids, amines Chemical reactivity (acids and bases)	
4	Sept 12 th Sept 14 th	Substitution reactions and addition reactions Methods and working principles for characterizing organic compounds: infrared spectroscopy, UV-vis, mass spectroscopy, NMR	Homework 2 (due Sept 18 th)
5	Sept 19 th Sept 21 st	Review (Sept 19 th) Exam 1 (Sept 21st)	
6	Sept 26 th Sept 28 th	Carbohydrates (structure, glycosidic bonds, and roles) Nucleic Acids (DNA, mRNA, structure and coding)	
7	Oct 3 rd Oct 5 th	Proteins (structures, receptors, and catalysts) Peptide bond Cellular organelles and structures (some discussion of how cells form tissues through ECM)	Homework 3 (due Oct 9 th)
8	Oct 10 th Oct 12 th	Lipids (beta oxidation) <i>BMES</i>	
9	Oct 17 th Oct 19 th	Glycolysis and TCA cycle Pentose phosphate pathway, electron transport chain and their roles in cellular respiration and metabolism	Homework 4 (due Oct 23 rd)
10	Oct 24 th Oct 26 th	Review (Oct 24 th) Exam 2 (Oct 26th)	
11	Oct 31 st Nov 2 nd	Antibodies and Receptors Enzymes kinetics (inhibitors, ELISA, allosteric switches)	
12	Nov 7 th Nov 9 th	Restriction Enzymes, Ligation, and Molecular Cloning DNA Polymerase and PCR	Homework 5 (due Nov 13 th)
13	Nov 14 th Nov 16 th	DNA library/ Virus library/ Chemical genetics screening RNAi	
14	Nov 21 st	CRISPR/Cas9 <i>No lecture on 23rd due to holiday</i>	Homework 6 (due Nov 27 th)
15	Nov 28 th Nov 30 th	Epigenetic engineering/ Chromatic Modification Next Generation Sequencing	
16	Dec 5 th	Review (Dec 5 th)	
17	Dec 12 th	Final Exam (Tentatively Dec 12th)	

Laboratory Schedule

Lab	Group A	Group B	Laboratory Topic	Notes
1	Aug 28 th	Sept 1 st	Chromatography	
2	Sept 11 th	Sept 15 th	Identification of organic functional groups	
3	Sept 25 th	Sept 29 th	Synthesis of Aspirin	
4	Oct 9 th	Oct 6 th	Saponification of fatty acid	
5	Oct 23 rd	Oct 27 th	ELISA	
6	Nov 6 th	Nov 10 th	PCR	
7	Nov 27 th	Dec 1 st	Molecular cloning	

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –Justyn W. Jaworski.

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381
