Chem 450
Biochemistry: Information Storage and Transfer - Molecules and Pathways (CRN 73164)
Fall 2022

Instructor: Maegan Weltzin, Murie 113E, 474-6527, mmweltzin@alaska.edu

Office Hours: Monday following lectures (1-3). However, students are encouraged to contact the instructor by email at any time.

Lecture: Monday, Wednesday, Friday 11:45-12:45 AM, 8.29-12.9 (not including final), REIC 164

Textbook: *Principals of Biochemistry* 8th Edition
David L. Nelson and Michael M. Cox
W. H. Freeman and Company, NY
ISBN: 9781319228002

Most general biochemistry books provide adequate reading material with minimal difference in detail and depth on most topics.

Course Platform: In-person and Canvas (https://canvas.alaska.edu/)

Course
This 3-credit course will focus on the biochemistry (structure and dynamics) of cellular information storage and transfer linking the three principal macromolecules DNA, RNA, and Proteins including nucleotide metabolism, DNA structure and topology, DNA Replication/Repair/ Recombination, Cell Cycle Regulation, RNA transcription and processing, Gene Expression, Translation, and Protein Metabolism. Biomedical relevance and contemporary techniques will be addressed when appropriate.

Paper Discussions
Research paper(s) pertinent to topics addressed in lectures will be discussed with respect to rationale, hypothesis, research data, and analysis. Papers will be distributed ***one week prior*** to discussion. Student pairs will be assigned a section and figure(s), and will be asked to explain the material to their classmates. These discussions are important to translate science knowledge into understanding (i.e. the application of science).

Course Goals:
- Develop an understanding of the biochemical processes underlying structure, function, regulation, and dynamics of DNA, RNA, and Proteins.
- Fundamentals include but are not limited to structure-function relations of protein/DNA interactions, regulation and synchronization of complex macromolecular processes, and protein quality control. All topics are discussed in the context of developmental processes and/or pathologies.
- Use of concepts to formulate hypotheses and interpret experimental data to benefit the understanding of current research through paper discussion.

Learning Outcomes
1. Understand structure-function relationship determining macromolecular interactions
2. Aspects of synergism, cooperativity, and reciprocity relevant to macromolecular dynamics

3. Gene regulation – interplay among macromolecules and expression of phenotypes
4. Biomedical/disease-related aspects of topics
5. Critical reading of primary research literature
6. Understanding of principal methods and techniques

Instructional Methods:
The teaching methods employed in this course will consist of PowerPoint lectures (70%), groupwork (10%), and class discussions (20%). Primary research papers allow us to explore distinct topics more in depth through discussions and to translate science knowledge. Canvas (https://canvas.alaska.edu/) will be utilized as a platform to distribute papers, other assignments, lecture material, exams, and other announcements regarding the course. It is imperative that reading (see schedule) of sections should be done ***in advance*** and ***notes are taken*** during lecture. It is assumed that every student is frequently visiting Canvas to check for announcements as well as email notifications

Students will assemble a course portfolio composed of summary write-ups on sets of lectures pertinent to each topic. Summaries are guided by a set of questions provided by the instructor. Outcomes of paper discussions will also be infused into the portfolio. Twice times during the semester (listed in course schedule) the portfolio will be subject to grading by the instructor.

Grading
Exams: There will be four (4) exams (100 points each) over the course period (listed in course schedule). These exams will be a combination of multiple choice/short answer (in class) and essay questions (take home).
Papers: ***Six paper*** discussions over the term of the semester account for 100 points (20 points each paper, 5 out of 6 papers will be accounted for). Students are expected to contribute to these discussions with explanations and arguments. One constructive contribution is sufficient to receive full points.
Participation: ***Class participation*** will be included in the final grade (35 points). This entails an active involvement into the regular lecture materials discussed and group activities.
Portfolio: Written assignments will be used to generate summaries of key topics discussed. Summaries will be guided by questions given by the instructor (85 points). There will be one midterm evaluation and one final evaluation (see course schedule).
Group project: There will be a group project (85 points).

Class Participation	35 Points
Portfolio	80 Points
Group Project	85 points
Paper Discussion	100 Points
Term Exam I	100 Points
Term Exam II	100 Points
Term Exam III	100 Points
Final Exam	100 Points
Total	700 Points

Grade:	***Percentage:***
A+	97-100
A	90-96
A-	88-89
B+	86-87
B	80-85
B-	78-79

C+	76-77
C	70-75
C-	68-69
D+	66-67
D	60-65
D-	58-59
F	0-57

Course Policies

Attendance: Regular attendance is expected to ensure consistency in discussions and presentations. Active student participation is essential and will be accounted for in the final grade. If you are unable to attend class, you should contact the instructor in advance.

*Exams***:** Four exams will be given. Although exams are NOT cumulative, with the progression of the course a cumulative character is unavoidable. *Makeup exams* will only be allowed with pre-approval of the instructor or with an acceptable, documented reason such as unexpected illness, family emergencies, or other unavoidable events. The format of a make-up exam could vary from the original.

Papers: Students will receive adequate preparation time (1 week). ***Emphasis*** is put on an understanding of sections such as rationale, hypothesis, data/experimental design, results, and critical analysis. Student pairs will be assigned a section and associated figure(s). Students should be able to explain the data and answer questions.

Participation: Class participation is expected and entails an active interest aside form paper discussion/presentations. This includes but is not limited to answering questions during lectures, asking for clarifications, contributing to *ad hoc* discussions, participating in groupwork and responding to Canvas posts.

Portfolio (HW): Writing summaries of key topics is the most effective check whether concepts are fully understood and also help to integrate the material into the greater context. Content of the portfolios should include: class notes, research articles, group work, exams, topic summaries.

Group activity: There will be a group activity. Students will receive adequate preparation time (>1 week). Students will be required to co-present and put together material that peers can use to better learn/ study the topic. Scoring rubric will be posted on Canvas/Blackboard.

Ethical Considerations:

The Chemistry Department's policy of cheating is as follows: *"Any student caught cheating will be assigned a course grade of F. The student's academic advisor will be notified of this failing grade and the student will not be allowed to drop the course"*.

Students must also adhere to UAF policies, the student code of conduct as well as the University of Alaska *Honor Code,* which states:

Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations. Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses, and other reports. No work submitted for one course may be submitted for credit in another course with- out the explicit approval of both instructors. Violations of the Honor Code will result in a failing grade for the assignment

and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion.

Plagiarism Policy:

Plagiarism is defined as the use of "other" intellectual property without proper reference to the original author. Intellectual property includes all electronic, spoken or print media ***thus any information taken of the web is included under this statement***. Students are expected to cite all sources used in oral and written presentations. Cases of plagiarism will be taken seriously with a grade 0 for the particular assignment. Severe cases may be referred to the Department Chair or Dean or class failing considered.

Computer Access: Currently Department of Computing and Communications (DCC) maintains two open labs on campus: the Bunnell Lab, and the Node (Rasmussen library). The Node has 24-hour access.

Classroom Etiquette: The purpose of this information is to assist students in understanding proper classroom behavior. The classroom should be a learning centered environment in which faculty and students are unhindered by disruptive behavior. Students are expected to maintain proper decorum in the classroom and to stay for the entire length of class. If the student must leave during class, they should inform the instructor prior to the start of class. The University of Alaska Fairbanks is an institution of higher education that promotes the free exchange of ideas. However, students must adhere to the rules set forth by the University and the instructor. Failure to comply with classroom rules may result in dismissal from the class and/or the University. Faculty have the authority to manage their classrooms to ensure an environment conducive to learning. The University of Alaska Student Code of Conduct (the Code), part of the Board of Regents Policy 09.02, is available at https://www.alaska.edu/bor/policy/09-02.pdf. You should be familiar with the Code as you will be held accountable to maintain the standards stated within. The Code includes the following statements:

P09.02.020.A As with all members of the university community, the university requires students to conduct themselves honestly and responsibly and to respect the rights of others. Students may not engage in behavior that disrupts the learning environment, violates the rights of others or otherwise violates the Student Code of Conduct (Code), university rules, regulations, or procedures. Students and student organizations will be responsible for ensuring that they and their guests comply with the Code while on property owned or controlled by the university or at activities authorized or sponsored by the university.

P09.02.030.B Behavior that occurs on property owned or controlled by the university, in university online environments and classes, or at activities sponsored by or authorized by the university, is subject to university student conduct review and disciplinary action by the university. The Student Code of Conduct may also apply to behavior that occurs off campus when it may present a potential danger or threat to the health and safety of others or may reasonably lead to a hostile environment on campus. The Student Code of Conduct may also apply to behavior exhibited online or electronically via email, social media, text messaging, or other electronic means.

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website: https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0
Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination

(Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

ASUAF advocacy statement: The Associated Students of the University of Alaska Fairbanks, the student government of UAF, offers advocacy services to students who feel they are facing issues with staff, faculty, and/or other students specifically if these issues are hindering the ability of the student to succeed in their academics or go about their lives at the university. Students who wish to utilize these services can contact the Student Advocacy Director by visiting the ASUAF office or emailing asuaf.office@alaska.edu.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uaf-traccloud@alaska.edu, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, https://www.ctc.uaf.edu/student-services/student-success-center/)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling **[6 free counseling sessions]** (907-474-7043, https://www.uaf.edu/chc/appointments.php, Gruening 215)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:
UAF Department of Equity and Compliance
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Amending Syllabus
The instructor may initiate changes to this syllabus subject to majority approval by students. Any and all changes will be clearly communicated (oral, email, blackboard). The instructor reserves the right to make minor change to the lecture schedule or calendar and any grading policies that are favor of the student.

Special Dates pertinent to the course
See academic calendar for details at: https://catalog.uaf.edu/calendar/

Course Schedule

Date	Lecture	Topic	Text
8-29	1	Introduction to Course	
8-31	2	Nucleotide Basics (Chemistry & Biosynthesis)	262-69, 294-96 888-903
9-2	3	Nucleotide Biosynthesis	
9-5		**Labor Day**-no class	
9-7	4	Nucleotide Degradation & Associated Diseases	823-838
9-9	5	Deoxynucleotides & DNA Structure	829-838, 269-77
9-12	6	DNA lab techniques and DNA Topology	885-98
9-14	7	Chromosome Structure / **Group 1 activity**	898-910
9-16	**I**	**Paper Discussion I (Topoisomerases)**	
9-19	8	DNA Replication	915 - 30
9-21	**(1-7)**	**Exam I**	
9-23	9	DNA Replication (Telomeres)	915 – 30 & 993 – 994
9-26	10	DNA Repair	930 - 55
9-28	11	DNA Repair/Recombination	
9-30	12	DNA Recombination/Transposition / **Group 2 activity**	
10-3	**II**	**Paper Discussion II (Repair)**	
10-5	13	Cell Cycle Regulation	446 - 456
10-7	14	Oncogene/Tumor Suppressor/Cancer	
10-10	15	RNA polymerases	961-72
10-12	**(8-14)**	**Exam II** (1^{st} portfolio check)	
10-14	16	RNA polymerases	961-72
10-17	**III**	**Paper Discussion III (RNAP mechanism)**	
10-19	17	RNA processing (capping, poly A) splicing, editing, siRNA	972-87

10-21	18	RNA processing (capping, poly A) splicing, editing, siRNA	
10-24	19	Gene Expression (prokaryotes) / **Group 3 activity**	1055-75
10-26	20	Gene Expression (eukaryotes)	1075-94
10-28	**IV**	**Paper Discussion IV (siRNA or editing)**	
10-31	21	Chromatin Dynamics	1075-94
11-2	**(15-20)**	**Exam III**	
11-4	22	Translation (Genetic Code, tRNA)	982-85, 1006-15
11-7	**V**	**Paper Discussion V (chromatin)**	
11-9	23	Translation (Ribosomes) / **Group 4 activity**	1015-40
11-11	24	Translation (Initiation, Elongation) (guest)	1015-40
11-14	25	Translation (Termination, Degradation) (guest)	Literature
11-16	26	Protein Folding and Structure (guest)	115-151
11-18	27	Protein Folding and Sorting	107-142 & 1041-47
11-21	28	Protein Sorting and Targeting	1041-49
11-23		**Thanksgiving**	
11-25		**Thanksgiving**	
11-28	29	Protein Degradation / **Group 5 activity**	1041-49
11-30	**VI**	**Paper Discussion VI (Folding/Degradation)**	
12-2	30	Unfolding Protein Response	Literature
12-5	31	Unfolding Protein Response	Literature
12-7	32	Enzymes - Kinetics	178-223
12-9	33	Enzymes - Kinetics	178-223
12-16	**(21-34)**	**Final Exam 10:15-12:15pm** (2^{nd} portfolio check)	