CHEM F654: Protein Structure and Function

Instructor: Dr. Maegan Weltzin, 907-474-6527, mmweltzin@alaska.edu
Department of Chemistry and Biochemistry
Murie 113E

Lecture: TR 9:45 am – 11:15 pm
Murie Rm 130

Office Hours: 11:15-1:15 T Murie 113E or arrange via phone/email

CRN: 34020
Prerequisite: CHEM F351 (Macromolecules)
Textbooks: The suggested textbook serves merely as a basic reference. Course material also composed of review articles and primary research literature pertinent to the topics.

- Scientific research articles and review articles (PDF via Blackboard)
  Handouts provided in class

- David Whiteford. 2005. **Proteins: Structure and Function**. John Wiley & Sons.
  ISBN: 978-0471-49894-0

Course Description

This 3-credit course introduces the concept of the intricate relationships between protein structure and protein function, one of the most fundamental concepts of biochemistry. The four major topics include: *1)* basic aspects of protein structure, *2)* protein function, *3)* protein life history, and *4)* protein structure in disease. With the chemistry of amino acids as a foundation, the course will examine the constraints on protein structure/motifs that determine ultimately their biological function as well as the detrimental consequences of protein misfolding disease, particularly in the nervous system. Modern technologies to elucidate structure and function aspects of proteins are integrated.

Course Goals:

- Develop an understanding of protein structure-function relationships
- Integration of physicochemical concepts into protein folding and stability
- Become familiar with methods relevant to protein structure and function
- Navigate online information related to protein structure
- Misfolding of proteins and its consequences

Learning Outcomes

- Identify key elements in proteins to predict function and stability
- Utilize knowledge to develop strategies for protein purification/analysis
- Design approaches to elucidate protein-protein interactions
- Design proteomics approaches to the study of proteins
- Apply key concepts to contemporary research

Course Structure:

This course will be composed of lectures intended to introduce the topic (approximately 40%), discussions of relevant research articles and group work (approximately 40%), and presentations

(approximately 20%). The suggested textbook serves as a basic reference. Being prepared for discussion is essential, hence preparation and reading of material is critical.

Blackboard:
Blackboard (https://classes.uaf.edu) will be utilized as a central communication platform for announcements, posting of lectures, and reading material. It is assumed that every student is frequently visiting blackboard to check for announcements as well as email notifications.

Course Policies:

Attendance: Regular student attendance is expected to ensure consistency in discussions and presentations. Active student participation is essential and will be accounted for in the final grade.

Exams: Two exams will be given including one midterm and one final exam (see grading for details). These exams will be take-home and consist primarily of essay questions. Importantly, ***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. Alternatively, an oral exam may also substitute if acceptable with student.

Paper discussions: Students will receive adequate preparation time for all assignments. Students will either lead a paper discussion or be responsible for explaining material associated with a figure or figures from the paper (non-lead person).

Presentations: Students will receive adequate preparation time for all assignments. Content and organization of topics are the primary concern however, presentation style and discussions are also subject to score (scoring sheet). In some cases, a written assignment maybe part of the oral presentation in form short answers or an essay.

Homework: Homework will consist of short answers and essays. Sufficient time will be provided for writing.

Cell phones: Cell phones should be off during class. NO texting/calling during class.

Late assignments: Are not accepted. Students are given at least one week to complete assignments.

Grading:
Students will be evaluated in four basic areas: ***participation in class***, written assignments, oral assignments, and knowledge (exams).

Evaluation Type	**Points**	**Percent**
Midterm Exam	250	25%
Final Exam	250	25%
Daily Participation	60	6%
Student led-presentations (non-lead) (10pts each)	100	10%
Student led-presentations (lead) (25pts each)	75	7.5%
Presentations (50 pts each)	100	10%
Written Homework (10.7pts each)	75	7.5%
Final Projects	90	9%
Total	**1000**	**100 %**

- Participation will be based on an average score, which includes material read, ability to answer questions directly related to text, ability to answer questions by applying learned material, and similar.

- Written and oral assignment(s) will be scored as follows (detailed scoring sheet will be provided):

Content:	40%
Organization:	30%
Presentation/Format:	15%
Quality of Discussion:	15%

- Student-led discussions will be evaluated on a scoring matrix including material read (10%), understanding of methodology (20%), ability to answer questions directly related to text (50%), ability to answer questions applying learned knowledge (20%).
    - As lead student, each paper is worth 25 pts (25pts * 3 papers = 75 pts)
    - As a non-lead student, each paper is worth 10 pts (10pts * 10 papers= 100 pts)

- Student presentations will be evaluated on a scoring matrix including organization, introduction of topic (20%), delineation of problem (10%), understanding of methodology (20%) and results (25%), discussion (10%), quality of sources (5%), and addressing audience questions (10%).

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

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 and your advisor will be notified. Severe cases may be referred to the Department Chair or Dean or class failing considered.

Disabilities
Students with a physical or learning disability are required to identify themselves to the Disability Services office, 474-7043, located in the Center for Health and Counseling. The student must provide documentation of the disability. Disability Services will then notify the instructor of special arrangements for taking tests and working homework assignments.

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.

Support Services: Support can be obtained through the University of Alaska Library system, online resources, and the instructor. Additional services are available through Student Support Services (http://www.uaf.edu/sssp/) at UAF.

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 plans to 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.

Student protections and services statement: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/.

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.

Course Schedule

Date	Topic	Reading Homework (Whitford/Papers)	Written Homework
Jan 14	Syllabus, Amino Acids	Chapter 2	**Quantitative Protein Detection**
Jan 16	Amino Acids, Peptide Bond	Chapter 2	
Jan 21	Working with proteins Paper Discussion	Chapter 2; Lau and Dunn 2018 *(Weltzin)*	
Jan 23	Primary Structure, Secondary structure, group work	Chapter 3	**Protein Structure (1)**
Jan 28	**Proteomics Student Led Discussions:** Paper Discussion (45 min)	Makwana and Mahalakshmi 2015 ***(Kowalski)*** Yang et al., 2020 ***(Lamecker)***	
Jan 30	Tertiary and Quaternary Structures	Chapter 3	**Protein Structure (2)**
Feb 4	**Proteomics Student Led Discussions:** Paper Discussion (45 min)	Desikan et al., 2020 (**Striker)** Bornholdt et al., 2013 (**Suarez)**	
Feb 6	Enzyme Kinetics	Chapter 7	**Enzyme Kinetics**
Feb 11	Enzyme Kinetics	Chapter 7	
Feb 13	**Protein Structure/Function Student Led Discussions:** Paper Discussion (45 min)	Zhang and Chen 2016 ***(Kowalski)*** Infield et al., 2018 ***(Lamecker)***	
Feb 18	**Protein Structure/Function Student Led Discussions:** Paper Discussion (45 min) Protein function: Allosteric Regulation	Hayouka et al., 2007 ***(Striker)*** Chapter 7 and 5 (first part) and papers	
Feb 20	**Protein Structure/Function Student Led Discussions:** Paper Discussion (45 min)	Motlagh et al., 2014 ***(Suarez)***	**Lipid-protein interactions and methods (Hsia 2015 et al., 2015)**

	Membrane proteins		
Feb 25	**Protein Structure/Function Student Led Discussions:** Paper Discussion (45 min)	Fantini et al., 2016 (***Kowalski)*** Gunasekaran_et_al. 2004 ***(Lamecker)***	
Feb 27	**Protein Structure/Function Student Led Discussions:** Paper Discussion (45 min) **MIDTERM** (handout)	Earl et al., 2018 ***(Striker)*** Walsh et al., 2018 ***(Suarez)***	
March 3	**MIDTERM**		
March 5	**MIDTERM - Due by 4.30pm**		
March 9-13	**Spring Break- no classes** **Download DeepView before March 17's class**		
March 17	**DeepView/Protein Sequence BLAST**	Protein viewing and sequence searching	
March 19	Protein Synthesis	Chapter 8	**Protein synthesis, trafficking and targeting** **Student Presentations:** (~45 min)
March 24	Trafficking and Targeting	Chapter 8	
March 26	Trafficking and Protein Folding	Chapter 8 & 11	**Protein folding**
March 31	Protein Folding	Chapter 11	
April 2	**Student Presentations:** Protein Folding (45 min)	Daggett and Fersht (2003) (**Kowalski*)*** Mayor et al, 2003 (***Lamecker)***	**Final Project handout**
April 7	**Student Presentations:** Protein Folding & Disease (45 min)	Smith et al., 2015 (**Striker)** Pensalfini et al., 2014 ***(Suarez)***	

April 9	Unfolded Protein Response		
April 14	Protein Degradation (proteasome)		
April 16	**Student Presentations:** Protein Folding & Disease	Halliday and Mallucci, 2014 (**Kowalski**) Kanatsu et al., 2014 (**Lamecker**)	**Student Presentations:** Protein Folding & Disease
April 21	**Student Presentations:** Protein Folding & Disease	Calafate et al., 2016 (**Striker**) Poirier et al., 2019 (**Suarez**)	**Student Presentations:** Protein Folding & Disease
April 23	Final Project due Final (handout)	Final project presentations	
April 28	**Final**		
April 30	**Final due by 4.30 pm**		