
Instructor: Jeff Dahlseid, Ph.D.

E-mail: dahlseid@gustavus.edu

Office hours: M 9, F 1:30 or by appointment

Class URL: www.gustavus.edu/~dahlseid/CHE360/index.html

Texts: Proteins: Structures and Molecular Properties, Creighton, 2nd Ed., 1993, Freeman, NY, NY and Lehninger Principles of Biochemistry, Nelson & Cox, 4th Ed., 2005, Freeman, NY, NY

Office: Nobel 221C, Phone: x6129

Classroom: Nobel 222

Laboratory: Nobel 207

Class: MWRF 12:30-1:30

Course Description/Theme:

Biochemists study all aspects of the various molecules found in living systems, including their structures, synthesis, degradation, physical interactions, cellular localization, reactivities, and biological functions. Yet **biochemistry** is more than that. Nelson and Cox write that biochemistry's "ultimate concern is with the wonder of life itself." (pp. 3, Lehninger Principles of Biochemistry) This course will focus principally upon proteins and will attempt to give balanced and integrated consideration to both the various aspects of these molecules and the wonder underlying their study.

Course Objectives:

Biochemistry is an enormous subject, and much is lost in attempts to provide exposure to all aspects of the discipline in two semesters. Thus, we will use protein molecules as a focus and a vehicle to achieve the objectives of this course. The central objectives for this course are that you will **broaden and deepen** knowledge and understanding of biochemistry and biochemical principles, **develop** independent and critical thinking skills, **strengthen** communication skills, **cultivate and mature** collaborative skills, and **grow** in independence as a scientist and a "learner". I hope that you also experience the excitement of discovery and come to appreciate how biochemistry and the related biomolecular science fields influence and permeate one another. Specifically, my objectives are that you:

- add breadth and depth to your knowledge/understanding of protein biochemistry
- learn to *read and critically evaluate* the primary literature in the biochemical and related biomolecular science fields
- increase proficiency in communicating your scientific ideas clearly in oral and written form through discussing, presenting, planning, coordinating, executing, recording, reporting, and proposing experimental science
- develop skill at cooperating with a team to achieve progress toward a shared goal
- mature your ability to work independently in a field of experimental science
- develop proficiency at applying your knowledge, the primary literature, biochemical principles, and experimental approaches to testing hypotheses, both conceptually and experimentally

Teaching approach:

Your experience in this course will most likely be different from experiences you have had in other science courses. This course is structured particularly to reflect the *process of science*. The course objectives give you some idea of what this is going to look like, especially the emphasis placed upon increasing your independence as a scientist. In addition, what follows is intended to give you some idea of how we will spend our time this semester, with the aim of achieving the course objectives. Additional descriptions of the major vehicles for achieving these objectives follow in the syllabus.

We will use our time together *in the classroom* a number of different ways this semester. On Thursdays we will utilize this as part of laboratory, including having occasional progress updates as needed (see below). We will regularly use class time for a Journal Club, focused on presentation and discussion of the primary literature. If properly embraced, these meetings have great potential to add to the depth of your

training in science. Because the research proposal assignment will likely be new to you, we will periodically focus class toward the 'how to' of this endeavor. The remaining time will be used to review, initially, and then cover new and advanced topics concerning proteins, through interactive lecture and class discussion. For this, we will draw upon multiple sources, including the two texts for the course (both Creighton and Nelson & Cox - see above) as well as the primary literature and other sources. I welcome and encourage your participation in all classroom learning.

We will use scheduled laboratory time to engage in hands-on, investigative projects that are aimed toward publication. This will be a lot of fun, and will serve as one vehicle for cultivating independence through experimental biochemical research. The success of your group will depend heavily upon careful preparation and planning, and probably will require some time outside of scheduled laboratory. To help cultivate the skills necessary, we will have research team presentations during laboratory to engage in reporting research progress, trouble-shooting, and planning activity. This is an opportunity to gain help from your peers and I. Again, I welcome and encourage your participation.

Because biochemistry is a challenging discipline, you should prepare in advance for each meeting **and** participate in order to gain the most from this class. This includes reading or reviewing relevant material, preparing questions, identifying points for clarification, or noting ideas for discussion in class. Should your participation be lacking in class activities, I reserve the right to reduce your final grade to reflect this (note participation/attendance points).

You are **required** to attend all scheduled course meetings, both physically and mentally, to give yourself every opportunity to learn the discipline. If you anticipate a valid reason for being absent, please see me. I will try to work with you to make arrangements for acceptable reasons. However, should you miss a class, you are responsible for *understanding* the material from class, laboratory meetings, etc., including handouts. Note that absences for Journal Club are not permitted due to the discussion format. If you expect an unavoidable conflict, notify me immediately to permit rescheduling.

I welcome and encourage your participation in learning, whether in the classroom or laboratory. Biochemistry is a rigorous discipline and I expect hard work, but if you are having problems with the course please let me know. I am here to help you learn.

Course Activities and Requirements:

- **Content Summaries:** Typically, preparation for an exam involves cognitive rehearsal of course material, resulting in learning and retention. In this class, other means will be used to achieve this outcome. You will prepare summaries of the content from some of the six units of material covered by the recommended readings and class lecture and discussion. Typically, these will be due one week after completing a particular topic. An additional handout describing the summary is posted and due dates can be found on the course schedule (see course URL).
- **Research Proposal:** You will be asked this semester to prepare a comprehensive research proposal on a topic in the biomolecular sciences. We will be using resource material from the National Science Foundation and the National Institutes of Health to aid you in this endeavor, and the proposal will be prepared according to the National Science Foundation guidelines, modified as appropriate. Deadline for topic selection is **February 20th**. To help prepare you for writing the proposal, you will compile an annotated bibliography of the necessary references from the primary literature (due **March 6th**). The report itself will be turned in twice. First you will turn in the introductory background for the proposal, itself in final form, including references. Near the end of the semester you will turn in the entire proposal, including the experimental section and a revised version of the introductory background. See the course schedule for due dates. You will need to use the search tools Medline and/or SciFinder, the Gustavus library (and ILL), as well as a larger regional library (Mayo or U of MN) to identify and obtain the necessary research articles to complete this assignment. It is recommended that you consider using bibliographic software, such as Endnote or ReferenceManager. A software option called ProCite is available through the Gustavus library at no charge. An additional handout describing the details and information about topic selection is posted (see course web page).

- **Journal Club:** Reading, critically evaluating, discussing and applying the scientific literature are related and valuable skills. A common activity where you might employ all of these skills is known as a journal club. Although this activity takes many forms, in this class we will be meeting regularly (see schedule) to critically discuss pre-assigned papers of relevance to the course. Your full participation will require that you prepare in advance for these discussions by reading the papers carefully (and probably repeatedly). Also, for each meeting a group of you will prepare beyond that of others to be a resource for questions that might arise during the discussion, i.e. to serve as resident experts on that paper. The structure of this activity aims to promote participation by all. The class Journal Club is intended to give you experience with the journal club format as well as provide an opportunity for you to develop the skills of independent and critical thinking. Evaluation will be based on your participation and the quality of your contributions as an expert group member and as a participant. An additional handout describing the assignment information and detail is posted (see course web page).
- **Laboratory notebooks:** Keeping a careful record of your work is a critical component to laboratory investigation. A hallmark of scientific credibility is reproducibility, and reproducibility is favored by a detailed record of work completed. Your project this semester will be investigative, with the aim of obtaining a publishable (see poster) outcome, so it will be valuable (to you and to me) to have a clear record of your work. As you will be working with others, I want you to keep a single notebook for your group. It will take vigilance to make sure everyone is recording their work, but you can check each other on this. The notebooks are to be left in the laboratory, with the exception that they may be taken out for short periods (30 minutes) for photocopying. However, your group must set up a sign out procedure even for this, and the notebooks must not leave Nobel Hall. Notebooks will be evaluated during the semester. Records must be dated, pages numbered, and detailed enough to repeat.
- **Progress summaries:** In order to assist you in your project and help you evaluate the state of your notebooks, each member of your laboratory group will take a turn at preparing a progress summaries during the semester. As a group, you should compile a schedule for these and share it with me. I will expect your group to meet this schedule. Each summary should be done individually, though you must have your group acknowledge reading of the final drafts. An additional handout with details and information is posted (see course web page).
- **Laboratory poster:** For laboratory, your laboratory group, together, will prepare a poster and present the outcome of your group's project to the Gustavus community at semester's end. See course schedule for the due date for draft presentation and for the final poster presentation. We will be spending some class time on the subject of how to prepare posters, and additional resources will be noted. An assignment page describing the evaluation criteria for posters will be made available on the course web site, as the time draws near.
- **Participation:** Participation is an important part of learning in this class. It has been intentionally designed into the course activities through various forms of group work. Thus, it will also be assessed. Part of this assessment will come from me, but I will also be providing self- and peer-assessment tools for group work.

Grading breakdown:	Content summaries	140
	Annotated bibliography	40
	Research proposal part I & II - 100 pt @	200
	Journal Club Activities	100
	Laboratory notebooks	100
	Progress summaries	40
	Laboratory Poster	100
	<u>Attendance/participation</u>	<u>130</u>
	Total	850

- **Final grades** will be assigned according to a straight percentage scale. The following percentage scale will serve as a **guideline** for letter grade assignment:

90-100% = A
80 - 89% = B
70 - 79% = C
60 - 69% = D

Academic honesty: It is my expectation and policy that you will participate in this class in an honest and honorable way. This means that, while I encourage you to work together to learn protein biochemistry, the work you submit on behalf of an assignment must be your own. I will not tolerate academic dishonesty. Dishonesty includes plagiarism, which is presenting some else's ideas or words as your own. Thus, it is your responsibility in written work to credit sources from which you draw ideas and language (quotes are rare here) with proper referencing. Gustavus Adolphus College has an Honor Code, and you will be asked to print and sign the following statement at the end of major assignments: "On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work." Honorable work is assumed for ALL assignments. If you have questions about academic dishonesty, please see me. Documented dishonesty can result in failure of the course and will be reported to the Dean's office.

Class e-mail policy: I use e-mail to help manage and field questions about the course, so I require all that you use your **Gustavus** e-mail account. The advantages to this system include speed, avoided trips to Nobel Hall for simple questions, and a generally smoother running course. Here's the protocol. **When you have questions, e-mail them to me.** If your question is very specific, I will reply directly. If the question seems potentially interesting to the entire class, I will forward the question (anonymously) and my reply to the class. I will assume you do not object to sharing your question unless you specifically state so. **I also encourage you to use the class (s-che-360-all) and lab (s-che-360-003) aliases to ask each other questions.** As I may refer to e-mail questions in class and I use e-mail for general class announcements, **I encourage you to check your e-mail before class.** Campus rules for alias use apply and abuse will not be tolerated.

Feedback: I am very enthusiastic about being and becoming an outstanding educator, both for you and future students. I welcome constructive suggestions about how to improve class, my teaching, and the course. I expect to learn from you this semester how I might teach better. I invite you to discuss your suggestions with me in my office at any time.

Students with disabilities: Appropriate accommodations will be made for students with specific, documented disabilities of a physical, psychiatric or learning nature. Related information will be kept strictly confidential. Please contact either me or Laurie Bickett (x6286) in Academic Advising if this applies to you.

Note this syllabus and schedule are subject to change at the instructor's discretion.

2/9	Introduction, the Proteins course
2/11	How to read a scientific paper
2/12	Lab meeting - project prospectus
2/13	Research proposal assignment, topic selection
2/16	Review of principles of protein structure
2/18	Review of principles of protein function
2/19	Lab meeting - group project planning
2/20	Protein synthesis - Ribosomes and tRNAs
2/23	Protein synthesis - Aminoacylation and initiation
2/25	Protein synthesis -Initiation
2/26	Lab meeting
2/27	Protein synthesis - Methods of study
3/1	Journal Club 1 - Translation initiation
3/3	Protein synthesis - Elongation and termination
3/4	Lab meeting
3/5	Protein synthesis - Regulation
3/8	Grant Proposal Writing, Dr. Mike Joyner, Mayo Clinic
3/10	Localization - Secretory proteins
3/11	Lab meeting
3/12	Localization - Mitochondrial proteins
3/15	Journal Club 2- Translational regulation
3/17	Localization - Nuclear proteins
3/18	Lab meeting
3/19	Features - Protein Modifications
3/22	Features - Soluble and Membrane Proteins
3/24	Features - Protein stability and folding
3/25	Journal Club 3 - Mitochondrial protein import
3/26	Lab meeting
3/29	Interactions - Protein-ligand binding
3/31	Interactions - Protein-protein
4/1	Lab meeting
4/2	Class catch up day, Research Proposal-Part I Due
4/3-4/12	<i>Spring Break</i>
4/14	Research Proposals - Experimental Section
4/15	Lab meeting
4/16	Interactions - Protein-nucleic acids
4/19	Interactions - Allostery and regulation
4/21	Journal Club 4 - Yeast two-hybrid assay
4/22	Lab meeting - How to make and present a poster
4/23	Interactions - Multiprotein complexes
4/26	Interactions - Prions
4/28	Antibodies - Structure and ligand binding
4/29	Lab meeting
4/30	Antibodies - Antigen processing and presentation
5/3	Antibodies - Specificity, polyclonal versus monoclonal
5/5	Journal Club 5 - Prions in the brain, Research Proposal Final Draft Due
5/6	Lab meeting
5/7	Antibodies - Applications in methods
5/10	Degradation - Turnover and mechanisms
5/12	Degradation - Proteases

5/13 Lab meeting - **Poster Previews Day**
5/14 Degradation - Ubiquitin-mediated

5/17 Ubiquitin-like conjugates - *Final posters due to Pat for printing!*
5/19 To Be Determined, **Public Poster Presentations**

5/25 ————— **Final Exam time Tuesday at 3:30-5:30** —————

*See web page schedule for corresponding readings

CHE 360 Proteins Class Schedule Spring 2004

2/9 Introduction, the Proteins course
2/11 How to read a scientific paper
2/12 Lab meeting - project prospectus
2/13 Research proposal assignment, topic selection

2/16 Review of principles of protein structure
2/18 Review of principles of protein function
2/19 Lab meeting - group project planning
2/20 Protein synthesis - ribosomes and tRNAs

2/23 Protein synthesis - aminoacylation
2/25 Protein synthesis -initiation
2/26 Lab meeting
2/27 Protein synthesis - methods of study

3/1 Journal Club 1 - Translation initiation
3/3 Protein synthesis - elongation and termination
3/4 Lab meeting
3/5 Protein synthesis - regulation

3/8 Grant Proposal Writing, Dr. Mike Joyner, Mayo Clinic
3/10 Protein Modifications
3/11 Lab meeting
3/12 Targeted Protein Degradation

3/15 Journal Club 2- Translational regulation
3/17 Proteases
3/18 Lab meeting
3/19 Proteases

3/22 Mitochondrial protein import
3/24 Secretory protein localization
3/25 Journal Club 3 - Proteasome-mediated degradation/regulation
3/26 Lab meeting

3/29 Nuclear protein trafficking
3/31
4/1 Lab meeting
4/2 **Research Proposal-Part I Due**

4/3-4/12 ————— **Spring Break** —————

4/14 Research Proposals - Experimental Section
4/15 Lab meeting
4/16
4/19
4/21 Journal Club 4 - Mitochondrial protein import
4/22 Lab meeting - **How to make and present a poster**
4/23

4/26
4/28
4/29 Lab meeting
4/30

5/3
5/5 Journal Club 5 - Yeast two-hybrid assay, **Research Proposal Final Draft Due**
5/6 Lab meeting
5/7

5/10
5/12
5/13 Lab meeting - **Poster Previews Day**
5/14

5/17 - *Final posters due to Pat for printing!*
5/19 To Be Determined, **Public Poster Presentations**

5/25 _____**Final Exam time Tuesday at 3:30-5:30**_____

Targeted Protein Degradation
Proteases

- **Exams:** During the semester you will **NOT** be required to take any exams. Typically, exams assess your mastery of new concepts and principles, problem solving skills, and critical thinking skills that are integral to a particular class. Preparation for an exam involves cognitive rehearsal of course material, resulting in learning and retention. In this class, we will be using other means to assess learning outcomes and to achieve cognitive rehearsal/retention, in order that emphasis can be placed upon (learning) other aspects of the discipline of biochemistry.