

CHE-360: Proteins
Spring 2008
Gustavus Adolphus College

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Textbook & Supplies: Proteins: Structure and Function, Whitford, 2005, Wiley, England.
Safety glasses & group laboratory notebook

Optional textbook: Lehninger Principles of Biochemistry, Nelson & Cox, 4th Ed., 2005, Freeman, NY, NY

Class Meetings: Nobel 222 MWRF 12:30 pm-1:20 pm
Nobel 207 R 1:30 pm – 5:20 pm

Office Hours: My scheduled office hours are the following, or by appointment:

Monday: 1:30 to 2:30 pm

Tuesday: 2:30 to 3:30 pm

Wednesday: 10:30 to 11:30 am

If these times are not convenient, see me and we will arrange a time to meet. I am frequently in my office or research lab and am certainly willing to talk with you about class if I am available. I will usually not, however, be available 30 minutes immediately preceding class.

Course Overview

Biochemists study the structure, function, interactions, synthesis, degradation, cellular localization, and reactivity of a variety of biomolecules that are found in living systems, including proteins, carbohydrates, nucleic acids, and lipids. As it is not possible to study all aspects of all biomolecules in a single course, here, we will focus principally on the subject of proteins. In this course, I hope to build upon and extend the basic knowledge of proteins that you acquired in CHE-255, provide you with an integrated, current, and detailed view of the field of protein biochemistry and give you the opportunity to gain a deeper understanding of the importance and role of proteins in living systems.

Course Objectives and Expectations

- To gain an enhanced understanding of and appreciation for protein biomolecules in living systems
- To enhance your ability to read, comprehend, and critically evaluate scientific information and data
- To develop skill in working independently and collaboratively to achieve progress toward a defined experimental goal
- To increase your proficiency in communicating scientific ideas both orally and in written formats
- To apply your scientific knowledge (and the literature) to independently develop an experimental idea, hypothesis, and plan in its entirety

The course lectures, activities, assignments, and laboratory are aimed to provide you with the opportunity to achieve each of these objectives. Over the course of the semester, we will cover (through class lecture and discussion) five advanced topics related to the subject of proteins. The primary resources for these classroom activities will be Whitford's 'Proteins: Structure and Function' and 'Lehninger Principles of Biochemistry' by Nelson and Fox, but I will also be using some supplementary material from other texts and articles that may also assist to enhance your understanding of a subject. I will include appropriate chapters from each text/article on the Moodle page. Four times during the semester, we will use class time for a Journal Club in which you will have the opportunity to present and discuss a manuscript from the primary literature that is related to the current course topic. Periodically, our class time will focus on the major written assignment for this course, the research proposal. On Thursdays, we will utilize our scheduled 'classroom' time as part of the laboratory. This 'extra' laboratory time may be used for planning, preparation, execution, and analysis of experiments, but will also provide time for demonstrations of techniques and lab progress group meetings.

We will use our scheduled laboratory time to engage in hands-on, investigative projects that are aimed toward presentation (*i.e.* an end-of-semester poster presentation and/or presentation at the Sigma Xi symposium). If you recall the laboratory projects from Biochemistry, you can think about Proteins laboratory as a semester-long, student group-driven, investigative laboratory project. As you can imagine, this will be a lot of fun and challenging and will help to cultivate both independence and teamwork through experimental biochemical research. The success of your group and project will depend heavily upon careful preparation and planning, thus, will likely require some time outside of scheduled laboratory. To foster communication among the group members and to cultivate the skills necessary to achieve your experimental goal, we will have (somewhat informal) research group meetings each week during laboratory to report, trouble shoot and plan experiments. This will be a great opportunity to gain help from your peers and me.

I expect that you will find CHE-360 to be a challenging and rigorous course. We will cover complex material in a good degree of depth, laboratory will be investigative (thus we will not know what the outcome for a particular experiment/set of experiments will be), and you will be challenged to communicate and comprehend complex and technically advanced material from the literature. I am, however, confident that all of you have the ability to do well and excel in this course. If you are experiencing difficulty at achieving these objectives, please come and see me.

Attendance

I encourage and expect that you will attend, prepare for, and participate in all scheduled course activities and meetings to provide every opportunity to achieve the course objectives. This includes reading or reviewing relevant material, preparing questions, completing the assignments, identifying points for clarification, or noting ideas for discussion. These components of your work will be included as part of the participation component of your grade. If you anticipate a valid reason for being absent, please see me as soon as possible. However, should you miss a class, you are responsible for understanding and obtaining any materials from class, discussions, laboratory meetings, etc., including handouts.

Attendance and active participation in laboratory is **required** for passing the course. Depending on your laboratory project, in some cases, some of your time in laboratory may not occur during the hours 'scheduled' for laboratory. This is perfectly acceptable and often necessary. I do, however, expect that you will still attend the beginning component of the Thursday laboratory time every week for the group meeting and to plan for future experiments. In addition, I expect you to keep track of your laboratory work in your notebook (no matter the time that the work is performed). If it appears that you are not working on your laboratory project for an acceptable or necessary period of time, you will likely not pass this course. If an emergency situation arises, please inform me as soon as possible.

Cell phones/pagers

As a courtesy to your fellow classmates and instructors, please turn your cell phones, pagers, and any other noisy device OFF during lecture and laboratory.

Academic Honesty and Honor Code

Every Gustavus Adolphus College student is required to sign the following statement before course registration:

‘As a community of scholars, the faculty and students of Gustavus Adolphus College have formulated an academic honesty policy and honor code system, which is printed in the Academic Bulletin and in the Gustavus Guide. As a student at Gustavus Adolphus College, I agree to uphold the honor code. This means that I will abide by the academic honesty policy, and abide by decisions of the joint student/faculty Honor Board.’

The following code will be written in full and signed on every examination and graded paper:

‘On my honor, I pledge that I have not given, received, nor tolerated others’ use of unauthorized aid in completing this work.’

This code places the responsibility for academic honesty exactly where it should be – with the student. As a student of this college, you have promised to uphold the pledge and to abide by it. For my part, I will expect the honor pledge code to be signed on each formal written document (content summaries, research proposal, and progress summaries) that you complete in this course. In order to complete your laboratory progress summaries, you will need (and I encourage you) to discuss, analyze results and review the laboratory notebook with those members of your lab group. I also encourage you to discuss material with your peers before writing of the content summaries (just like you would review material with others before an exam). These activities will not be in violation of honor code policy. However, the actual writing of the progress and content summaries should be an individual endeavor. Because of the intensity of formal and informal writing in this course, we will take time to discuss the subject of plagiarism as it pertains to each assignment-type during class time.

An integral part of the honor code is non-tolerance of violations. Under this code, students are not expected to police others’ actions. Rather, you agree to report violations of which you become aware. Failure to do so will constitute an honor code violation in this class. Any student found in violation of the academic honesty policy and honor code will receive a grade of 0 for that assignment. In addition, the office of the Dean of the Faculty will be notified of the nature of the offense. Repetition will result in an F for the course. If you have any questions about these policies, please come see me.

Course Grading

The breakdown of your grade in this course will be as follows:

Four content summaries/oral presentation.....	200
Research proposal-identification of an appropriate topic..	10
Research proposal annotated bibliography.....	40
Research proposal—background draft.....	100
Research proposal—complete and final draft.....	100
Journal club activities.....	100
Laboratory notebooks.....	100
Research progress summary--written.....	25
Research progress summary--oral.....	25
Laboratory poster.....	100
Attendance/participation.....	100

Total

900 points

Course Grading Components

- **Content Summaries/Oral Presentation:** You will prepare summaries of the content from four of the units of material covered by the recommend readings, classroom lectures, and discussion. Typically, these will be due one week after completing a particular topic (see schedule). A handout describing the components and format of the content summary will be posted on Moodle. You must turn in the first two content summaries. In place of one of the graded content summaries in the latter half of the semester, you may do an oral presentation on a topic related to Proteins in Therapy and Disease (the last unit topic). The requirements for the presentation will be posted on Moodle. These presentations will take place during the last two class periods of the semester.
Due dates: 3/12, 4/11, 4/30, 5/12, 5/23
- **Research Proposal:** Your major written assignment for the semester will be a comprehensive research proposal on a topic in the biomolecular sciences. We take a (somewhat) systematic approach to the assignment by having 'introductory' lectures and periodic due dates of the different components of the proposal throughout the semester. At the beginning of the semester, you will be introduced to the area of topic selection. Your topic choice will be due shortly after this introduction. An annotated bibliography of necessary and appropriate references from the primary literature will be due mid-way through the semester. Next, you will turn in the background section, in final form, including references. I will review and make recommendations to you for improvement on all of these components. At the end of the semester you will turn in the entire proposal, including the experimental section and a revised version of the background and bibliography. This assignment will require your use of search tools that may include Medline, SciFinder, Web of Science, 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. You may also find it useful to use bibliographic software, such as Endnote Web or Ref Works (information available on the Gustavus library website). Supplemental material describing the details and information about this topic will be posted on Moodle.
Due dates: Proposal topics—2/27, Annotated bibliography—3/17, Background—4/18, Final version—5/7
- **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. We will be meeting regularly to critically discuss papers of relevance to the current topic being discussed in the course. Your full participation will require that you prepare in advance for these discussions by reading the papers carefully (and probably repeatedly). In addition, for each meeting, one or two of you will prepare to be a resource for questions that might arise during the discussion, i.e. to serve as resident experts on that paper/subject. The Journal Club is intended to provide you with an opportunity 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. Supplemental material describing the assignment information will be posted on Moodle.
Journal club dates: 2/29, 4/4, 4/25, 5/9
- **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 (poster and/or oral presentation) outcome, so it will be valuable (to you, to your lab mates, and to me) to have a clear record of your work. Because your lab group members will be dependent upon having access to the information present in your laboratory notebook, all notebooks are to be left in the laboratory. Notebooks will be evaluated at various, unannounced

points throughout the semester. Notebook records must be dated, pages numbered, and detailed enough for another junior or senior level bio/chem/biochem major to repeat. Please see me if you have questions about the formatting or components of the notebook.

Notebook due dates: Unannounced four times during the semester

- **Progress summaries (written):** In order to assist you in your project and help you evaluate the state of the laboratory notebooks for your group, each member of your laboratory group will (at least once) prepare a project progress summary during the semester. As a group, you will compile a schedule for these and share (in a written, electronic document posted on Moodle) this with me. I will expect your group to meet this schedule. Each summary should be done individually, though you must have each member of your group read and acknowledge (by initialing or signing) the draft that will be turned in to me. Supplementary material with details and information will be posted.

Due dates: Schedule determined by your group by Feb 22.

- **Progress summaries/group meeting (oral):** In order to assist you in your project and to keep your peers and me abreast of the accomplishments and challenges within your lab group, on most Thursdays, one person will be assigned to give a short 'group meeting' to the class. This will be a very informal, 10-15 minute talk, about your work, the subject of which will change throughout the semester. The first talks will likely have a larger background component, while later talks will cover current experiments, results, data analysis, challenges experienced, etc. The talk may be prepared using overheads, powerpoint, the chalkboard, or handouts. Every person in class will present at least one group meeting during the semester.

Due dates: Thursday, 2/28, 3/6, 3/13, 3/20, 4/3, 4/10, 4/24.

Laboratory poster/Oral Presentation: As a laboratory group, you will prepare a poster and/or an oral presentation and present the outcome of your group's laboratory project to the Gustavus community at a poster symposium on the last day of class (May 21) and/or the Sigma Xi research symposium (May 2nd). We will be spending some class and lab time on the subject of how to prepare posters and oral presentations, and additional resources will be noted. A supplementary handout describing the evaluation criteria for the presentations will be available on Moodle as the time draws near.

Due dates: 5/2 (Sigma Xi symposium) and 5/21 (poster session)

- **Participation:** Participation is one of the most important parts of learning in this course. Your participation in all aspects of the course (lecture, discussions, journal clubs, laboratory projects and assignments) will be assessed by me. However, because much of the class components involve group work, I will also be requesting self- and peer feedback in order to allocate these points. Achieving high marks in lecture and discussion participation means active engagement in the subject matter, both verbal and non-verbal. Some examples of active participation may include asking clarifying questions, responding when I pose a question to the class, actively listening/taking notes, completing the 'mini' assignments that will be given ~1/week in class in preparation for the next lecture period. Active participation in journal club means reading and critically evaluating all of the articles (this means reading them more than once), writing questions that go beyond the basic, topical information that can be found easily in the text of the article, responding to the presenters questions, asking questions that get at the heart of the results, conclusions, and analysis of the paper. Active participation in laboratory means putting in appropriate and well-utilized time in the laboratory to lead to an outcome, collaborating with your lab group members in a productive way, equivalent sharing of laboratory tasks among all group members.

Due dates: Throughout semester

Late assignment policy

I expect you to turn in a given lecture/laboratory assignment on or prior to the due date and time. All assignments (unless otherwise noted) are due on the given date by 5:20 pm. You may hand the assignment directly to me, place the assignment in the blue box directly outside of my office, or post the assignment on the course Moodle site. If your assignment is turned in late, your final score on the assignment will be deducted by **5% each 24 hour period** after the due date/time. Please speak with me prior to a due date if extenuating circumstances prevent you from turning in an assignment on time.

Grading Scale

The approximate grading scale in CHE-360 will be 93-100 A; 90-92 A-; 88-89 B+; 83-87 B; 80-82 B-; 78-79 C+; 73-77 C; 70-72 C-; 68-69 D+; 63-67 D. This scale will be used as a **guideline** for final grade assignment.

If you have specific physical, psychiatric or learning disabilities and require accommodations to help you fulfill these expectations, please let me know during the first week of class so that your learning needs may be appropriately met. You will need to provide documentation of your disability to Laurie Bickett (x7027) in the Advising Center (202 Johnson Student Union.) All discussions will remain confidential.

Lecture Coverage and Tentative Schedule

The schedule below gives an outline of the course topics and activities, including relevant due dates. Note that the schedule is VERY tentative. Schedule updates will be made on Moodle as necessary.

Dates	Topic	Reading
2/11	Introduction to the course Journal article assignment	Chap. 1,2—Whitford Moodle link
2/13	How to read a scientific paper Research proposal—topic selection	Moodle link
2/14	Lab project overview, lit searches, and ranking	
2/15, 2/18, 2/20	Review—protein structure & function	Chap. 3,4,5--Whitford
2/21	Lab—groundwork on projects Culturing yeast demonstration	Moodle link for recipes
2/22,2/25,2/27	Enzymes—mechanisms and structure 3-D structure assignment	Chap 7—Whitford Chap 6—Lehninger, Fersht, Creighton, Walsh readings
2/27	Research proposal topics due	
2/28	Lab –group meeting 1	
2/29	Journal club—Enzymes	
3/3	Enzymes—non-steady state kinetics Introduction to annotated bibliography	Fersht, Whitford, Moodle links
3/5	Enzymes—inhibition and inhibitor design Inhibitor design assignment	Whitford, Moodle links
3/6	Lab—group meeting 2	
3/7, 3/10, 3/12	Protein Synthesis—transcription Content Summary overview	Chap 8—Whitford Chap 26 & 28— Lehninger Chap 25-Voet and Voet
3/12	Enzymes—content summary due	
3/13	Lab—group meeting 3	
3/14, 3/17, 3/19	Protein Synthesis—translation Research Proposal workshop	Chap 8—Whitford Chap 27—Lehninger Chap 26—Voet and Voet
3/17	Research proposal annotated bibliography due	
3/20	Lab—group meeting 4	
3/21-3/30	Spring break	

Dates	Topic	Reading
3/31,4/2	Protein Synthesis--translation	Chap 8—Whitford Chap 27—Lehninger Chap 26—Voet and Voet
4/3	Lab—group meeting 5	
4/4	Journal club—Protein Synthesis	
4/7,4/9	Post-translational modification PT modification assignment	Chap 8—Whitford Chap 27—Lehninger Walsh, Stryer, Creighton
4/10	Lab—group meeting 6	
4/11, 4/14, 4/16	Post-translational modification	Chap 8—Whitford Chap 27—Lehninger Walsh, Stryer, Creighton
4/11	Content Summary due—Protein Synthesis (transcription and translation)	
4/17	Lab	
4/18, 4/21	PT modification—localization and targeting	Chap 8—Whitford Chap 27—Lehninger Walsh, Stryer, Creighton
4/18	Research Proposal Background due	
4/23	Dr. Mike Joyner class visit	
4/24	Lab—group meeting 7	
4/25	Journal club—post translational modification	
4/28, 4/30	Post-translational modification—degradation	Chap 8—Whitford Creighton, Voet and Voet
4/30	Content Summary for PT modification—localization and targeting emphasis	
5/1	Lab How to make and present a poster/give an oral presentation	Moodle links
5/2,5/5,5/7	3-D structure determination	Chap 10—Whitford Creighton, Voet and Voet
5/2	Sigma Xi Symposium	
5/7	Final research proposal due	
5/8	Lab	
5/9	Journal Club—3D structure determination	
5/12	3-D structure determination	Chap 10—Whitford Creighton, Voet and Voet
5/12	Content Summary—PT modification-degradation emphasis due	
5/14,5/16	Proteins in Therapy and Disease	TBA
5/15	Lab—poster preview	
5/19,5/21	Proteins in Therapy and Disease—student presentations	TBA
5/21	Poster Session--afternoon	
5/23	Content summary due for 3-D structure determination and Proteins in Therapy and Disease	