

Protein Biochemistry (BIOL4800/6800)

PREREQUISITES: BIOL1108, BIOL3200, CHEM1212 or permission of the instructor

INSTRUCTOR: Dr. Theresa Grove
Office: BC 1099
Office hours: Tuesday 2:00-4:00 p.m. or by appointment
Email: tjgrove@valdosta.edu

COURSE GOALS AND OBJECTIVES: This class is designed to teach you an overview into the structure and function of proteins with emphasis on properties of amino acids, protein folding, protein-protein and protein-ligand interactions, enzyme kinetics, binding properties, and protein expression. The laboratory component will introduce you to many techniques that are not only used by researchers who study the structure and function of proteins, but by many other scientists in diverse fields of biology such as physiology, molecular and cell biology, population genetics and microbiology. By the end of the semester you will have:

- Gained knowledge of protein structure and function
- Maintained a comprehensive scientific notebook of techniques and results
- Learned experimental techniques used to study protein structure and function
- Strengthened your ability to critically read and understand scientific literature

These goals support the Department of Biology Education and VSU General Outcomes to:

- 1) Develop and test hypotheses, collect and analyze data, and present the results and conclusions in both written and oral formats used in peer-reviewed journals and at scientific meetings
- 2) Demonstrate an understanding of the cellular basis of life.
- 3) Relate the structure and the function of DNA/RNA to the development of form and function of the organisms.
- 4) Demonstrate knowledge of scientific and mathematical principles and proficiency in laboratory practices.

TEXT BOOK: There are no required textbooks. Suggested texts include: Introduction to Peptides and Proteins (2010) by Ulo Langel et al. (ISBN 978-1-42000-6412-4 and Molecular Biology of the Cell (2008) by Bruce Alberts et al. 5th edition (ISBN978-0-8153-4105-5)

OTHER READING: Handouts will be given throughout the semester as necessary.

LECTURE: Tuesday and Thursday 8:00-9:15 a.m. (BC 1202)

LAB: Thursday 11:00-1:50 p.m. (BC 2070) Bring a calculator and flash drive. I will supply you with a notebook.

ATTENDANCE: Attendance in lecture is expected by all students. Attendance in laboratory is mandatory; see lab policy below.

ACCESS TO SLIDES/INFORMATION: Lecture slides will be made available on BlazeView by 5:00 p.m. the day before lecture. These slides will not have all the information on them; it is the student's responsibility to come to class and take notes. Students are responsible for getting the notes from other students if they miss a lecture. The professor will not email slides when students miss a lecture.

LECTURE CONDUCT:

- Arrive on time. If lateness becomes an issue, I will start locking the door at 8:05 a.m..
- Turn off cell phones during class and lab; there is no reason you should be texting or calling anyone.
- Don't talk during lecture; if you don't understand something or didn't hear something ask.
- Unless it's an emergency (and using your cell phone does not constitute an emergency) do not get up in the middle of lecture, leave and come back.
- Do not leave class early unless you have informed me prior to the start of the class or if it's an emergency.
- During exams NOBODY can leave the exam and re-enter the exam room. If a student leaves, their exam will be graded as is; the student will not be allowed to finish the exam.

WITHDRAWING FROM THE COURSE: The last day to withdraw without penalty is March 6, 2014. If you don't officially withdraw, and instead just stop coming to class, you will receive an F for the course.

ACADEMIC CONDUCT: Cheating and plagiarism will not be tolerated and may result in a failing grade for the assignment, exam or the class. The Department of Biology has a plagiarism policy on their website; it is your responsibility to make sure you read it and understand it.

PRIVACY ACT (FERPA): The Family Educational Rights and Privacy Act (FERPA) prohibits the public posting of grades by social security number or in any manner personally identifiable to the individual student. No grades can be given over the telephone or over email because positive identification can't be made.

STUDENTS WITH DISABILITIES: Students requiring special accommodations because of disability must discuss their needs with me as soon as possible. Those needing accommodations who are not registered with the Special Services Program must contact the Access Office for Students with Disabilities located in Farber Hall. The phone numbers are 245-2498 (voice) and 219-1348 (tty).

LAB NOTEBOOK: Students will keep a research notebook, which I will provide to you. The notebooks must have a table of contents on the first page. During each lab period you will include the date, purpose of the experiment, protocol you follow (fill in as you go along during lab; you cannot paste lab handouts in your notebook), results, and analysis of results. Notebooks are normally not perfectly neat (no recopying after lab). There is no printer in lab, so everyone should either be prepared to email themselves any spreadsheets or graphs or bring a flash drive with them to lab. Data analysis will occur (usually) in lab; bring a calculator to lab. You will be able to use your notebooks for the lab exams. In the lab you will be collecting real scientific data. Like in the real world, your lab notebooks will not be able to leave the building, unless I have ok'd it first. The data that you will collect have the potential to be preliminary data that will be included in a future grant proposals or as part of a manuscript. I will keep all notebooks (and all data) at the end of the semester. If you would like a copy of your notebook, that can be arranged.

LECTURE EXAMS: The dates for the exams are included in the Tentative Class Schedule. Note, that these are TENTATIVE. I reserve the right to adjust the dates of the exams. Three exams (excluding the final) will be given throughout the semester. Each exam will be worth 100 points and will consist of a variety of types of questions that will include (but aren't limited to) matching, multiple choice, labeling, fill in the blank, short answer and essay. During the exam all cell phones must be turned off. Exams will not be handed back.

It is the instructor's prerogative to accept (or not accept) an excuse for a missed exam; therefore, DO NOT MISS EXAMS! Make-up exams are available for students with approved reasons, but these exams may be more challenging than the original exam, and the format may also be different (i.e. an oral exam or all essay). Students must contact me via email on the day of the exam for approval (NO PHONE CALLS) and

are required to make-up the exam within 2 days of the missed exam, except under extreme circumstances. The professor reserves the right to not approve a missed exam as well as to require documentation of the reason why the exam is missed. Only students with a University related excuse may take an exam early.

LAB EXAMS: Two lab exams (50 points each) will be given throughout the semester. These exams will test you over the practical side of protein biochemistry and what you did in lab. These will be open notebook (handouts cannot be used).

FINAL: The final will be worth 200 points. 100 points will be over the last quarter of the semester and will be of similar format to the previous exams, and 100 points will be over everything that you learned for previous exams and will be multiple choice. It is not optional. The date of the final is Wednesday, May 7, 2014 (10:15 a.m. -12:15 p.m.). **NO EARLY EXAMS WILL BE GIVEN!**

GRADUATE STUDENTS: Graduate students will write a 7 page paper on a protein of their choice. The due date is March 28, 2014. A separate handout will be given.

LAB CONDUCT

- Arrive on time.
- Assignments are collected at the start of lab. Late assignments will lose 10% of total points (e.g. if it's a 10 point assignment, the highest grade that can be earned would be 9/10). Emailed assignments will not be accepted.
- You must keep a lab notebook. Lab practicals will be open notebook. Handouts given to students cannot be used for the lab practicals. Notebooks will remain in the lab unless I have given you permission.
- No eating or drinking during the lab. We will be working with mutagens and neurotoxins.
- Attendance to lab is mandatory. Excused absences are usually given for medical emergencies and documentation must be provided; the professor determines whether or not an absence is "excused" or not. If a student misses three labs *for any reason* the student cannot earn higher than a D for his/her final grade. Labs cannot be made up outside of scheduled laboratory sessions. Students are responsible for learning all lab content from missed labs.
- Students must take care of lab equipment. Notify the professor if something is not working properly or if something breaks during the course of the lab.
- Cell phones are not allowed to be used in lab with the exception of using them as timers.

LAB INTRODUCTION

The lab component of this course will give students an independent research experience. What this means is that you will not be conducting "canned" labs, instead I will lead you through how to design and conduct experiments using techniques that are common in the fields of protein biochemistry, physiology and molecular biology, and then analyze the subsequent data. Generally, the labs will be completed during lab period. However, this does not mean that everything will work perfectly. If an experiment isn't successful students will have the opportunity to schedule times outside of the normal lab or repeat an experiment if there is time in a future lab. Depending on the quality of data at the end of the semester students may have the opportunity to continue to be involved with the research to gather enough data for a manuscript or to submit as part of a grant proposal to the National Science Foundation. Students will work in pairs (usually).

ASSESSMENT:	Exams (3 exams + final)	500 points
	Lab exams (2 exams; 50 points each)	100 points
	Homework and other Assignments (Graduate Student Paper)	~50 points (50 points)
	Total Points 650 (Graduate Students = 700)	

GRADE SCALE: For all students, grades will be based on the above assessments. The grading scale I will use is:

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

EXTREMELY TENTATIVE LAB SCHEDULE

January

- 16 Introduction to research topics
Importance and ethical considerations of using animals in research
- 23 Discussion of projects
Pipetting and solution making techniques
- 30 Further discussion about projects
RT-PCR and PCR background
Primer design and ordering (due February 3)

February

- 6 Principles of sample homogenization
RNA isolation and cDNA reaction
- 13 Positive and negative controls for PCR reaction
Lecture on Protein Assays
Sample preparation for 2D gels
- 20 Principles of agarose electrophoresis
Run PCR reaction from February 13 out on agarose gel
Lecture on cloning and sequencing
Lecture on gradient thermal cyclers
If PCR worked (with no contamination) run gradient PCR reactions
- 27 Run reactions from March 20 on agarose gel and set up cloning reaction (if PCR worked)
2D gel electrophoresis

March

- 6 Catch-up or repeat experiments (e.g. PCR reaction)
Introduction to 2D gel analysis
- 13 **Lab Exam 1**
- 20 **No lab--Spring Break**
- 27 2D gel analysis
Continue PCR analysis

April

- 3 Quantitative PCR or 2D gel analysis
- 10 Quantitative PCR
- 17 Data presentations
- 24 Data presentations

May

- 1 **Lab Exam 2**

TENTATIVE LECTURE SCHEDULE

January

- 14 Introduction and Overview of course
- 16 Amino Acids
- 21 Amino Acid Structure
- 23 Noncovalent Interactions
- 28 Noncovalent Interactions (cont'd)
- 30 Structural Organization of Proteins

February

- 4 Structural Organization of Proteins (cont'd)
- 6 Catch-Up and Review
- 11 **Exam 1**
- 13 Biosynthesis of Proteins Biosynthesis of Proteins
- 18 Biosynthesis of Proteins Biosynthesis of Proteins (cont'd)
- 20 Posttranslational Modifications Review
- 25 Protein Folding
- 27 Membranes

March

- 4 Intracellular Sorting of Proteins
- 6 Intracellular Sorting of Proteins (cont'd)
- 11 **Exam 2**
- 13 Chapter 8: Protein Turnover
- 18 No Class spring break
- 20 No Class spring break
- 25 Enzymes
- 27 Enzymes (cont'd)

April

- 1 **Exam 3**
- 3 Other classes of proteins
- 8 Other classes of proteins (cont'd)
- 10 Control of Protein function
- 15 Control of Protein Function (cont'd)
- 17 Methods to Study Proteins
- 22 Methods to Study Proteins (cont'd)
- 24 Protein Diseases due to misfolding, miscleavage and missequence
- 29 Peptides and Proteins as Drugs

May

- 1 Catch-Up and Review