

# Introductory Biochemistry Laboratory, CHEM 5720, Spring 2008, 2 Credits

Utah State University

Department of Chemistry and Biochemistry

Maeser Lab 148

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**Course Goals:** This course is designed to provide hands-on experience with techniques and concepts common to biochemistry research. This will be accomplished through a laboratory experience that will involve directed reading, observations of demonstrations, performance of experiments, data analysis, and completion of laboratory reports. This course is intended to be taken concurrently with chemistry 5710. Learning objectives include: appreciation of laboratory safety, use of molecular biology, understanding of chromatography, use of gel electrophoresis, understanding of enzyme kinetics and protein structure, understanding of the PCR and restriction enzyme actions on DNA. Exposure to these topics is appropriate for all pre-health and pre-vet professionals, along with majors in many other life science areas.

**Prerequisites:** Concurrent enrollment in Chemistry 5710. Prior general chemistry and organic chemistry laboratory experience is expected.

**Texts:** There is no required textbook. All lecture notes will be posted on the course Blackboard Vista site.

**Blackboard Vista:** Information essential to the course will be available through the course Blackboard Vista page. This site is found at [bb.usu.edu](http://bb.usu.edu). Username = banner ID; Password = banner pin. Only students who are registered for the class will have access to the course Blackboard Vista pages.

**Grading:** This course will be graded based on the total points received for quizzes, laboratory notebook, and laboratory reports. The lowest quiz grade and the lowest notebook grade will be dropped. Final letter grades will be assigned based on the percentage of the total points possible with the following scale: A's 100%-90%, B's 90%-80%, C's 80%-70%, D's 70%-60%, F below 60%. Attendance at all of the assigned meetings is essential. Make-up of any missed meeting will only be allowed for excused absences or at the discretion of the Professor. The preferred make-up for a missed meeting is attendance at another section of the same laboratory, if space is available. If this is not possible, then a suitable make-up assignment will be decided on by the Professor in consultation with the student. Missing more than three of the meetings will result in zero points for all missed meetings with no option for make-up. All laboratory reports turned in after the deadline will have 10% of the possible points deducted for the first day that it is late, with 10% of the possible points deducted for each additional day that it is late. All assignments are due by 5 PM of the deadline date.

**Graded Elements:** Following are the graded elements (with maximum possible points).

Chemistry 5720 Spring 2008 Possible Points		
Element	Description	Max. Points
Pre-laboratory quizzes	Top 24 of 25 reports, worth 5 points each. Due at the beginning of each lab.	120
Daily laboratory notebook	Top 24 of 25, worth 5 points each. Due before leaving lab each day.	120
Laboratory reports	15 experimental reports (see schedule below). Due by 5 PM one week after completion of the laboratory.	420
Quizzes from lectures	3 quizzes held during lecture time. Worth 20 points each.	60
Total		720

**Assessment:** Assessment of the course will include a Course Evaluation (the blue forms administered by USU) at the end of the course and a mid-term survey (administered by the Professor) seeking input on course direction and suggestions for improvement. Information from the Course Evaluation and Survey will be used to improve the course this year and in subsequent years.

**Provisions:** This course will adhere to the USU Academic Policies and Procedures Manual found at the web site <http://www.usu.edu/policies/>. Any student with a disability who requires accommodation must contact the instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.

**Supplies:** Goggles, full-length pants, and closed-toe shoes are required in the laboratory. A laboratory notebook with carbon-copy pages is also required, and may be purchased at the USU Bookstore. The lab fee of \$55 is used to purchase equipment and supplies for the laboratory.

## Pre-lab quiz

A short pre-lab quiz will be posted on the Blackboard Vista website, and will be due by the start of lab each day. Late quizzes will not be graded.

## Laboratory notebook

You are required to individually keep a laboratory notebook containing the title, date, objectives, materials and methods, and results for each experiment. Include tables for all dilutions and show all calculations in this section. Prepare the **title, objectives and procedures sections BEFORE coming to the laboratory!** It is also best to prepare tables for results ahead of time as well. Be sure to note any problems or observations in the results section. Such observations will aid in your discussion in the laboratory report.

Try to keep your notebook as neat as possible. Mistakes are made and are common, but be neat about crossing-out “wrong” sections. DO NOT ERASE!!! Always write in INK!! A research notebook must be organized and neat such that ANYONE could pick it up and repeat your work without any questions (and hopefully get the same results and observations). Laboratory notebooks are scientific records and can be submitted as evidence in court trials, so learn now how to keep a neat, detailed (but succinct) notebook!

The carbon-copy pages of your notebook must be turned in at the end of lab each day – BEFORE you leave the lab.

## Laboratory Reports

Laboratory reports are required for each experiment. The report is due one week after the last day of the experiment by 5 pm. Some experiments will be completed in a single day, while others will take multiple days to complete. Accordingly, some laboratory reports will require more effort and will be worth more points than others (see table below). Specific instructions will be given with each lab. However, each report must contain the following elements:

**Title:** The title should include experiment number, experiment name, the date(s) performed, the due date, your name, and the name of your lab partners.

**Objective/Introduction:** This is a brief summary of the objective or purpose of the experiment.

**Methods:** DO NOT reproduce the experimental protocol that was handed out to you. Describe what you did. Use numbered steps or a flow chart. If the procedure required the preparation of reaction mixtures (for example, creation of standard curves) from stock solutions, tables showing volumes of components used should be included in this section. If part of the procedure is a repeat of a method used in a previous lab (e.g. running an SDS or agarose gel), it is sufficient to state that the procedure “was performed as described previously in experiment X.” However, if you modified the procedure in any way, you must explain what the modification was.

**Results:** Whenever possible, results should be presented in a table or as a graph.

**Tables:** Each column should have the name of the quantity and units at the top. If one column of data was generated from another, show a sample calculation.

**Graphs:** Each graph must have a title and the axes must be labeled with the name and units of the quantity plotted. Graphs should be plotted with the quantities, units, and axes assignments (x-axis: independent variable; y-axis: dependent variable) given in the protocol. Include the data points on all graphs. If several sets of data are plotted in the same graph, use a different point marker for each set. Include a legend to identify the various markers. In most cases the spreadsheet graphics-routine will draw lines connecting the points. A line of best fit, however, will occasionally be required, in which case you must repress the computer “dot-to-dot” line and generate a line of best fit.

**Discussion:** Succinctly summarize your results. Answer all the questions or problems from the protocol.

Chemistry 5720 Laboratory Report Schedule				
Lab #	Experiment	Due date	Lab days	points
1	Buffer preparation	1/17	1	20
2	Bioinformatics	1/22	1	20
3	PCR of human DNA	1/29	2	40
4	GFP cloning	2/12	4	40
5	Restriction digest	2/14	1	20
6	TEV protein expression	2/28	3	40
7	TEV protein purification	3/18	3	60
8	Size exclusion chromatography	3/26	1	20
9	EMSA	3/28	1	20
10	TEV activity assay	4/1	2	20
11	Lactase enzyme kinetics	4/10	2	40
12	Sunscreen photometry	4/15	1	20
13	Inhibiting the Flu	4/17	1	20
14	Protein crystallization	4/22	1	20
15	Protein structure - PyMol	4/24	1	20

## Chemistry 5720 Laboratory Schedule – overview Spring 2008

Month	Week	Monday – lecture RWST 114	Tuesday – lab	Thursday – lab
Jan	7	Lecture – Overview	Safety, Check-in	<b>Lab 1.</b> Buffer/media preparation
	14	Lecture – molecular biology	<b>Lab 2.</b> Bioinformatics	<b>Lab 3.</b> PCR of human DNA
	21	No classes (Martin Luther King, Jr. Day)	PCR of human DNA (cont.)	<b>Lab 4.</b> GFP cloning
	28	Lecture – molecular biology	GFP cloning (cont.)	GFP cloning (cont.)
Feb	4	Lecture – restriction analysis <b>Quiz – molecular biology</b>	GFP cloning (cont.)	<b>Lab 5.</b> Restriction Digest (“CSI”)
	11	Lecture – protein expression	<b>Lab 6.</b> TEV protein expression	Protein expression (cont.)
	18	No classes (President’s Day)	(Monday Schedule) Lecture – protein expression analysis (gels)	Protein expression (cont.)
	25	Lecture – protein purification	<b>Lab 7.</b> TEV prep (cont.)	TEV prep (cont.)
Mar	3	Lecture – protein purification	TEV prep (cont.)	Make-up lab
	10	Spring break	Spring break	Spring break
	17	Lecture – protein size, interactions <b>Quiz – protein expression &amp; purification</b>	<b>Lab 8.</b> Size exclusion chromatography	<b>Lab 9.</b> Protein interactions
	25	Lecture – protein assays	<b>Lab 10.</b> TEV activity assay	TEV activity assay (cont.)
	31	Lecture – protein assays	<b>Lab 11.</b> Lactase enzyme kinetics	Lactase enzyme kinetics (cont.)
Apr	7	Lecture – protein assays	<b>Lab 12.</b> Sunscreen photometry	<b>Lab 13.</b> Inhibiting the Flu
	14	Lecture – protein structure <b>Quiz – protein assays</b>	<b>Lab 14.</b> Protein structure – crystallization	<b>Lab 15.</b> Protein structure – pymol
	21		Make-up lab	Check out