



CHEM 4581

Biochemistry Laboratory I

Course Syllabus

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COURSE OBJECTIVE

The primary objective of this course is for students to (1) learn fundamental approaches for experimentally investigating biochemical problems, (2) learn the theoretical foundations for the methods used, and (3) understand the applicability of the biochemical methods to realistic situations. Topics covered in this course include methods for the isolation, purification, and characterization of proteins, nucleic acids, carbohydrates and lipids, and manipulation of macromolecular structures from databases using contemporary visualization software.

CLASS MEETINGS

Lectures:	Mondays	2:05 – 2:55 pm	Boggs 228
Labs:	Wed and Thu	1:05 – 6:55 pm	Boggs 246

PREREQUISITES

CHEM 3511 (Survey of Biochemistry) or 4511 (Biochemistry I)
CHEM 3371 (Organic Chemistry Laboratory) or 3380 (Synthesis Laboratory II)

TEXT

No official text is required, but *Biochemistry* by Voet and Voet is recommended as a supplement. Additional background reading material will be provided.

HONOR CODE

All students are expected to follow the Georgia Tech Honor Code.

PLAGIARISM

Using the words or work of another as if it were one's own is plagiarism. Plagiarism is inappropriate in this laboratory and in all other situations, and is a violation of the Georgia Tech Honor Code. Students should minimize if not avoid the use of quotations in the text of their laboratory reports in an effort to develop mature technical writing skills. Material copied from laboratory handouts, textbooks, other students, or other sources must be contained within quotes, with the source cited. Occasionally experimental work in this laboratory will be done in teams or groups. However all data analysis and writing should be performed independently.

EQUIPMENT AND SUPPLIES REPLACEMENT

In the event that glassware, equipment and supplies are damaged or broken by students, the student must pay for the replacement of those items with his/her Buzz card. Please exercise caution when working with electronic pipetting devices and electrophoresis equipment, among other delicate items in the Biochemistry Laboratory. Students are expected to report any damage, destruction or other incidents involving equipment, materials and supplied to the teaching assistant and/or instructor.

ABSENTEEISM

Lack of attendance and tardiness to class are unacceptable practices for laboratory courses. Obviously unforeseen events can lead to absenteeism and/or tardiness, but those instances are expected to be rare. So, please report to class on time! Due to limitations in support personnel and materials/supplies, opportunities to make up missed laboratory experiments will not be feasible. If a student is absent for any reason, he/she should email Dr. Peek and the teaching assistant as soon as possible. Late assignments will only be accepted at the discretion of the instructor. Typically prompt written documentation will be required to justify the acceptance of late assignments as a result of absenteeism.

GRADING

The overall grading scheme for this course is as follows:

- 30% Laboratory Reports
 - No lab report is required for Lab #1.*
 - Lab #9 (GMO Project) will count twice in the final averaging.*
 - Among Labs #2-8, only the top 7 scores will be averaged; the lowest score will be dropped.*
- 30% Laboratory Performance
- 10% Homework
- 10% GMO Project Presentation
- 10% Laboratory Notebook Maintenance
- 10% Mid-term and Final Examinations

LABORATORY REPORTS

The purpose of the laboratory report is to communicate experimental work in writing. The educational goal is to help students learn and practice expressing their ideas and describing their work in a professional manner. With this in mind, the requirements for the structure of the laboratory report are similar to those for peer-reviewed scientific literature:

- Laboratory reports must be submitted in hard-copy format to the instructor or TA directly. Do **NOT** leave reports in insecure places for them to be found by the TA at some unspecified time.
- Students will be asked to compose both long reports and short reports (no more than 2 single-spaced pages excluding the cover page). Specific guidelines will be given for short reports within the respective protocols.
- LONG REPORTS:** Acceptable long laboratory reports will be no longer than **10 double-spaced pages** with writing on one side of the paper (title page not included). NOTE: Double-spacing allows graders to make comments near the relevant text. The laboratory report for the problem-based learning session should not exceed 15 double-spaced pages.
- Both long and short laboratory reports should be written in grammatically correct English, and prepared using a clear font of size 12-point, with 1-inch margins on all sides.
- Each page should be numbered, excluding the title page.
- Laboratory reports should **NOT** be formatted with dual column text as seen in published journal articles.

- ❑ Figures should have figure legends describing the figure in sufficient detail underneath the figure. Tables should have headings at the top of the table. Font sizes of text for figure legends or tables may be 8-10 point in size.

DEADLINES

Laboratory reports are due one week after scheduled completion of lab work as indicated by the schedule online. The report must be given to a TA or instructor, and dated. Do not put reports in the instructor's mailbox or under his/her door to avoid misplacement of your report. **Delinquent laboratory reports will not be accepted this term.**

General Laboratory Report Components

- ❑ **Title Page** – (Required) Provide the experiment title, author, partner's name (if applicable), date(s) experiment performed, date handed in, and the author's signature indicating that the laboratory report was the authentic work of the person whose signature is listed and that the Georgia Tech Honor Code was followed.
- ❑ **Introduction** (15 points) – Present background for the experimental work described. State relevant concepts and hypotheses and the objectives of the experiment. Refer to journal articles (**not web sites**) where you have read supportive background information.
- ❑ **Experimental Procedures** (15 points) – Summarize the specialized reagents and their sources and equipment used in the experiment. Generally describe methods used especially where deviations to the protocol were made. Include the level of detail commonly found in published research articles and, only when necessary, add additional details.
- ❑ **Results** (30 points) – Describe the data generated from the experiment in words. Then, present figures (including graphs) or tables of your data for emphasis and clarity. Each figure should have a figure legend underneath the figure - a statement describing the figure itself. Each table should have a table heading above the table. All figures should be clearly labeled. Results sections with insufficient text describing the results and/or key illustrations of data will merit very few possible points.
- ❑ **Discussion** (30 points) – State the overall conclusions from your experiment here. In cases where the work was hypothesis-based, the discussion should address the hypothesis directly. Discuss the significance, implications, comparisons of results to other work, etc. State and critically evaluate any assumptions that were made. Estimate the accuracy of your results. Discuss any observations that you found unusual or unexpected, and why they may have occurred. Note and discuss inconsistencies in your data that make drawing firm conclusions difficult. Discuss improvements that could be made in the laboratory hardware and apparatus that could improve your results.
- ❑ **References** (10 points) – List the references made throughout the text of the research article in the order in which you refer to them in the text. References are required, not optional! Reputable resources should be used as references. **Web sites are generally not reputable resources for a professional laboratory report.** Avoid referencing your Biochemistry textbook since it contains general information.

LABORATORY PERFORMANCE/CONDUCT

- Students are expected to have read the laboratory protocol for the day prior to reporting to class. Note: Be sure to review all links associated with a laboratory protocol.
- Students are expected to follow written procedures for conducting assigned experiments. Due to limitations in equipment, students will be asked to work with the TA/instructor in cycling through the laboratory work.
- Students are expected to work independently (or when necessary, with laboratory partners).
- Students are responsible for the upkeep of their assigned workstations. Be sure to restock all pipette tip boxes at the end of each class period.
- Be sure to clean all glassware before the end of the class period.
- Keep the balance and instrumentation areas clean and free from clutter.
- Be sure to report any malfunctions in equipment to the TA or instructor.
- All materials stored in the refrigerator, freezers, or at room temperature must be capped and clearly labeled with your name and its contents.
- Follow all safety regulations and encourage others around you to work safely as well.
- Do not eat, drink, or chew gum in the laboratory. Do not bring food, including bottled water into the laboratory.
- Do not discard food trash in the laboratory. Do not bring food into the laboratory.

Laboratory Hazards

Some of the chemicals used in this laboratory are harmful if inhaled or ingested.

- New Policy in Fall 2011:** Students must wear a laboratory coat at all time while working in the Biochemistry Teaching laboratory. The coat may be made of a 65%/35% polyester/cotton blend, 100% cotton, or any higher-grade safety fabric. Typical lab coats being sold on campus are full-length. Aprons will not suffice. Other requirements are described in detail in the Personal Protective Equipment and Laboratory Attire Policy (See T-Square→ Resources for PDF).
- Always wear safety glasses in the Biochemistry Laboratory! Reading eyeglasses no longer suffice as suitable safety protection for the eyes.
- Wear suitable clothing in the Biochemistry Laboratory. Sandals, shorts are not permitted in the lab.
- Wear nitrile gloves when working with dangerous biochemicals.
- Do not allow laboratory chemicals to enter your mouth or small cuts or scratches on your hands. Nitrile/latex gloves are available for daily use to avoid this problem and to prohibit contamination of laboratory experiments.

- ❑ Do not inhale powders or vapors. This is especially important when working with sodium dodecyl sulfate (SDS) powder, concentrated acids/bases, and mixtures of acrylamide and bisacrylamide solutions.
- ❑ It is good practice to wash your hands carefully before leaving the laboratory.
- ❑ Read and follow instructions.

Student performance in the laboratory will be monitored each week in the following categories.

1. Promptness
2. Preparedness
3. Industriousness
4. Intellect
5. Reliability
6. Cooperation

More details about work ethic expectations will be given during the course introduction.

HOMEWORK

Homework assignments will be given to students via T-Square under the HOMEWORK ASSIGNMENTS tool. Deadlines for each assignment are posted on the Fall 2011 Schedule; in general, homework is due in hardcopy at the beginning of the lecture period. **Late homework will not be accepted!** There will be 6 homework assignments given. The homework average will be computed based on the top 5 scores.

PROJECT PRESENTATION

Problem-based learning (PBL) is a contemporary approach for educating students with “real world problems” as a means of stimulating thinking and consolidating knowledge from a variety of disciplines in an effort to solve a problem or propose a strategy to solve a problem.

CHEM 4581 students will participate in a very short-term PBL experience involving determination of genetic modifications in a food of the student’s choice. Genetically modified organisms (GMO) in foods have some characteristic features in DNA that are not present in natural foods. Students will have two days to complete their experimentation and will present their findings in a short presentation at the end of the term.

Day 1	Extraction of DNA from Food PCR Amplification of DNA
Day 2	Electrophoretic Analysis of PCR Products
Day 3	Oral Presentation of Student Findings

Students should prepare a Power Point presentation and submit an electronic version of their talk to the instructor prior to the class period on the presentation day. The instructor and TA’s will evaluate the project presentations. Presentations will be evaluated based on the following criteria.

1. Description of test sample
2. Support for hypothesis

3. Description of relevant experimental details
4. Clarity and accuracy of results and data analysis
5. Clarity and accuracy of conclusions
6. Appeal and effectiveness of visual aids
7. Communications skills (voice, stage presence, demeanor, etc)
8. Handling questions

More guidance for preparing for the evaluation criteria will be provided later in the term.

LABORATORY NOTEBOOK MAINTENANCE

- All experimental data, except instrument output, should be recorded in indelible ink in a bound laboratory notebook with pre-printed sequential page numbers.
- Students should sign the notebook on the last page of that day's experiment.
- Do not leave blank pages in a laboratory notebook.
- A lab notebook should include protocols, identification of samples, observations, and data.
- Record data and observations as you obtain or make them. Do not write on scraps of paper with the intention of transferring information to the lab notebook later.
- Do not worry if your notebook is a little messy.
- The recording and organization of a permanent record of laboratory observations is as important a technique to master as any of the experimental methods you learn. The research notebook is a day-by-day record of the progress of experimental work. It should reflect the integrity and honesty of the experimenter as well as the clarity of his or her thought.

EXAMINATIONS

Students in CHEM 4581 will complete closed book mid-term and final examinations. The mid-term exam will be administered during the 50-min lecture period and will cover content from the lectures and laboratory sessions up to the date of the exam. The final exam is currently scheduled for Monday, December 12, 2011 from 11:30 am – 2:20 pm. Students are allowed to use a standard calculator for both examinations, but sharing amongst peers is not allowed. Please write legibly, show/explain all details of your work and be sure to include units for all measurements in responses.