

# Chem 110L

*Department of Chemistry and Biochemistry*  
*University of California, Santa Barbara*  
*Fall 2006*

## DRAFT-2

### Syllabus and general course information for Chem110L, **INTRODUCTORY BIOCHEMISTRY LABORATORY**

**Lecturer:** Kalju Kahn [kalju@chem.ucsb.edu](mailto:kalju@chem.ucsb.edu) Phone: x6157  
Office: PSB-N 2623  
Office hours: Tuesday 10–11 AM and by appointment.

**Teaching assistants:**

Section 1 (TR 2-5:50): Joanna Deek [jdeek@chem.ucsb.edu](mailto:jdeek@chem.ucsb.edu)  
Office hours: Mon 6-7 PM Phone: N/A

Section 2 (TR 6-9:50): Tyronne Martin [tmartin@chem.ucsb.edu](mailto:tmartin@chem.ucsb.edu)  
Office hours: TBA, PSB-N 1005C Phone: N/A

Section 3 (WF 2-5:50): Doug Matje [dmatje@chem.ucsb.edu](mailto:dmatje@chem.ucsb.edu)  
Office hours: TBA, PSB-N 1005C Phone: N/A

Section 4 (MW 6-9:50): Robert Levenson [rlevenson@chem.ucsb.edu](mailto:rlevenson@chem.ucsb.edu)  
Office hours: TBA, PSB-N 1005C Phone: N/A

**Lecture time** Monday 2:00–2:50 **Phelps Hall 3505**

**Lab session times**

Lab section 1: Tue 2:00–5:50; Thu 2:00–5:50;  
Lab section 2: Tue 6:00–9:50; Thu 6:00–9:50;  
Lab section 3: Wed 2:00–5:50; Fri 2:00–5:50;  
Lab section 4: Mon 6:00–9:50; Wed 6:00–9:50;

Lab sections are in PSB-N 2619 unless otherwise noted

**Course website:** <http://www.chem.ucsb.edu/~kalju/chem110L>

## **Course Goals**

The purpose of Chem 110L is to get hands-on experience with modern methods of separation, identification, and study of biomolecules and macromolecular structures. It will strengthen your understanding of material taught in Chem 142A (Biochemistry lecture). In Chem 110L, you will do experiments with biomolecules such as nucleic acids, proteins, sugars, and lipids. The 1-hour lecture series focuses on instrumental techniques and explains the methods used in the following lab. Some lectures or demonstrations may be given by special guest lecturers who are experts in their field.

## ***General Information and Expectations from Students***

Chem 110L is a laboratory course where the main portion of your grade is earned by performing experiments, documenting your work in your lab notebook, and answering questions presented with the experimental handout. There is a quiz at the beginning of each experiment and there is one final exam at the end of the course.

Attendance in lectures and taking good lecture notes is expected. Supplementing the lecture notes with study notes based on the information available in the experiment manual, your Chem142 textbook, or resources on the internet is a good way to improve your chances to be successful in this course.

Attendance in all laboratory sessions is mandatory. Please contact your instructor, your TA, and your lab partner at least one week ahead of time if you have to miss a class. For unexpected misses, you must provide a verifiable documentation stating that you “could not take the class”. There are two make-up days to repeat missed or unsuccessful experiments toward the end of the quarter.

Honesty and academic integrity must be always preserved. While working with your partner(s) is encouraged in the laboratory, you must write your notebook up independently. You may discuss the discussion questions with other students in the class but make sure that your answers are original. Plagiarism will not be tolerated and will result in a warning with deduction of 50% of points on the first instance, and with score zero on the experiment on any following instance. No supplemental material should be used during quizzes and the final exam.

No student shall give, sell, or otherwise distribute to others or publish any electronically available course materials or recordings made during any course presentation without the written consent of the instructor.

Chem 110L is a relatively new course. Because most of the experiments were recently developed by your instructor here at UCSB, you do not have to purchase a lab manual for this course. Individual experiments can be downloaded from the course website: <http://www.chem.ucsb.edu/~kalju/chem110L>. Two books may be helpful in understanding the course materials. I have placed a book “Experiments in Biochemistry: A Hands-on Approach” by Farrell and Ranallo in the library reserve. Students who plan to take the whole biochemistry series may want to purchase “Biochemistry Laboratory : Modern Theory and Techniques” by Rodney Boyer.

As with any laboratory course, standard lab fee is collected from students who stay beyond the standard drop deadline.

If you are a student with a disability and would like to discuss special academic accommodations, please contact me during my office hours.

## Safety

Even though we have had an excellent safety record in our biochemistry laboratory, the teaching laboratory can be a dangerous place. A few hazards that are present include hot water or hot surfaces, toxic or corrosive chemicals (ethidium bromide, acrylamide, trichloroacetic acid etc), electricity, ultraviolet light, operating centrifuges, and broken glass. The general advice to safety is: **know what you are doing by preparing for lab**. Each experiment in the manual outlines most serious hazards that are present while performing the experiment and discusses ways to prevent accidents. Be sure to read these carefully and ask your TA or the instructor if you have any questions. Students have a right to view Material Safety Data Sheets (MSDS) for chemicals used in the class. These can be accessed from <http://ehs.ucsb.edu>. Your TA will remind you of the potential hazards before each class.

You must follow basic safety rules<sup>1</sup> to ensure safety for yourself and fellow students during the class.

- 1) Always wear some sort of protective eyewear. You must wear either lab goggles that protect from the sides as well as from the front or a face shield. You can purchase lab goggles during the first weeks of the class from the department. There are two face shields in the laboratory. If you are wearing normal glasses, wear goggles over them as normal glasses do not provide side-protection. You may wear contact lenses along with lab goggles. Protective eyewear is not required in the computer lab.
- 2) Wear gloves when required, or when you are working with dangerous chemicals. Replace gloves when they become contaminated with toxic materials, such as ethidium bromide. Throw used gloves into the trash.
- 3) Wear appropriate clothing. You must wear closed shoes, and a shirt that covers the midsection. No shorts are allowed, and long pants and long sleeves are recommended.
- 4) Label all solutions that you prepare clearly. If the solution is in a container larger than 5 mL, make sure that the label conveys information about the content of the container and also identify your group or you personally as the person responsible for this solution. Unlabeled solutions will be discarded.
- 5) Familiarize yourself with the safety equipment in the lab. Our lab has one fire extinguisher near the back door, and eyewash/shower station near the front door. First aid kits are available in the storerooms on the first and second floor. Emergency phone numbers are posted in the lab. In case of fire, earthquakes, or other major disasters leave the lab if this is safe, and meet your instructor at the lawn south of PSB-N building.
- 6) Do not eat or drink in the laboratory. Closed containers with food may be brought into the laboratory but must be stored in your bag or backpack placed in the cabinet box. You may eat or drink outside the laboratory if time permits.
- 7) Never work alone. Never use mouth suction. Never open the lid of a spinning centrifuge. Do not perform any unauthorized experiments. Come and see your instructor if you would like to perform an additional interesting or fun experiment. He is probably willing to let you do it.
- 8) In case of accident, alert fellow students and immediately take an appropriate action. Explain to your TA what happened and seek further help if necessary.

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<sup>1</sup> The course manual is the equivalent to the OSHA Chemical Hygiene Plan. This applies to course TA-s.

Ignoring safety rules while in the laboratory will lead to oral warning on the first instance, and deduction of lab quality points for each following instance. Serious intentional violations of safety rules will lead to the dismissal from the course.

### **Preparation for the lab**

Please respect the time of your course TA. His or her main obligation is to help you through difficult steps and evaluate your performance. However, you should not expect that your teaching assistant has time during the lab to explain procedures that are clearly described in the lab manual. This means that you should take care in preparing for each lab several days before the class meets, so that if you have a question, you can meet with your teaching assistant before the lab, or ask your question during the lecture hour.

You should show an adequate preparation for the lab. Your preparation is judged to be inadequate if you receive 25% or fewer points **both** on your quiz and on your prelab for that day. Your preparation is also judged to be inadequate if you receive 0 points on **either** the prelab or the quiz for that day. If you are not adequately prepared, you are asked to leave the lab. If it was your first instance of inadequate preparation, you are allowed to make up the lab on a later date; subsequent inadequate preparations will result in a zero score for the lab. The final quiz and prelab scores of the lab that you make up will be calculated as a mean of your original and new scores.

### **Cleanliness**

It is important to maintain cleanliness in this laboratory. Even minor impurities on the glassware or on the pipette tip may ruin an otherwise well-done biochemical experiment. For example, using the same pipette tip to transfer two enzymes from their containers into your microcentrifuge tube will most surely contaminate the contained of the second enzyme with the first one and will likely ruin the results for the whole class. You will be working a lot with pipettors that use disposable tips. Discard the tip as soon as you do not need it. They are a lot cheaper than the chemicals that you are working with. Most used plasticware, such as microcentrifuge tubes or Falcon tubes (15 mL, 50 mL size) are for one-time use. Empty all the tubes before discarding them (it's OK to leave less than 50  $\mu$ L in microcentrifuge tubes). Discard broken glassware and used glass pipets into the red container. Do not discard functional glassware or any parts of the equipment used. If your glassware is visibly dirty, wash it with soap and hot water, otherwise rinse several times with distilled water from the tap, and place on the drying racks. **Do not leave any dishes in the sink.** Each student is responsible for completely cleaning the workplace and all the glassware used. Your TA will adjust your grade based on your work ethics. Leaving a mess will result in a bad grade.

### **Experiments and group work**

You will perform ten experiments in this laboratory and complete several computer assignments. Because of the large number of students and limited resources, students will work in pairs or small groups to perform the experiment. One experiment, 'Identification of milk sugar and grape sugar using thin layer chromatography (TLC)' will be performed independently.

Biochemistry laboratory experiments in this course require expensive equipment. For example, the cost of instrumentation and consumable materials in the 'Identification of cold-induced proteins in *Arabidopsis thaliana*'

experiment' is well over \$10,000. To use most efficiently the available resources, different students in the class may perform different experiments in any given day. To facilitate this system, students will be assigned into groups during the first week of classes. The schedule for experiments is available in the course website.

#### **List of experiments:**

- 1 Introduction to Computer Visualization: Tutorial
- 2 Experiment Design: Determination of the Molar Absorptivity of Urate
- 3 Microscopy Techniques Demonstration
- 4 Agarose Gel Electrophoresis of DNA
- 5 Thermal Denaturation of DNA
- 6 Proteomics Project. Identification of Cold Induced Proteins
- 7 Quantitative Determination of Glucose Using Glucose Oxidase
- 8 Identification of Saccharides by Qualitative TLC assay
- 9 Determination of the Iodine Value by  $^{13}\text{C}$  NMR
- 10 Light-induced Proton Gradient in Chloroplast Membranes

#### **Lab notebooks**

There will be total of ten experiments in this course. Most experiments take one lab session but one, 'Identification of cold-induced proteins in *Arabidopsis thaliana*' takes four lab sessions. All experiments are to be written up as single write-ups composed of several parts. The parts and approximate percentages of points from total are:

- the lab unit objective in your own words (3 %)
- the rationale of the experimental set-up (10 %)
- answers to the prelab questions (17 %)
- all calculations and raw data that were collected (10 %)
- a results section with appropriate equations to fit your data in graphic form (15 %)
- discussion of the experiment and your results (15 %)
- answers to the additional questions given at the end of the handout (20 %)
- and a conclusions section on the physical meaning of your results (10 %)

Use notebooks with carbon copy pages for documenting your work. The copy of the notebook that you present to your TA is very important. Your notebook is the primary way you have to convey that you understand the lab unit. All raw data should be written directly into the notebook and not onto scrap paper for later recopying into the notebook. Of course, legible handwriting is a key to effective communication. Your TA will grade the lab notebook and may have more specific requirements. Turn your experiments in for grading by no later than the week indicated in the schedule (below). Your TA will arrange a specific time to turn in lab reports. Please discuss any grading-related issues first with your TA, and then with your instructor.

## Prelab questions

The prelab questions are designed to help you to understand the experiment that you are doing. Answer your prelab questions directly into your notebook but make an additional carbon copy (or photocopy) of the answers and turn in the copy at the beginning of the lab. Your TA will tell you if any of your answers were wrong, but will not provide correct answers at this time. You may correct your wrong answers and get up to 25% of credit on the wrong answer when you turn your notebook in for final grading. Please mark the corrected answer clearly, so that your TA can easily find them. Answers to the prelab questions typically contribute about 17% of your total lab report points.

## Quizzes and exams

Twelve quizzes will be given throughout the quarter. You'll typically take a quiz on the day that you do an experiment; the quiz will test your knowledge and preparation for this lab and your understanding of previous labs. The quiz questions are based on the experiment manual and additional handouts. There is no quiz in the first week of class; the visualization quiz will be combined with the experiment design quiz. The microscopy quiz will be given after the demonstration. On days that you will be doing experiments that we have not covered in the lecture, your quiz will be postponed as indicated in the schedule. The maximum number of points for each quiz is 10 and your TA will grade the quizzes. The lowest-scoring quiz will be dropped, so the maximum number of quiz points is 110.

## Exams

There will be a final exam. The purpose of the exams is to evaluate (1) your understanding of the theory behind the technique and (2) your ability to interpret the meaning of the data obtained. The final exam is worth 80 points.

## Grading

Your grade will be based on the number of points you earn out of 570 points possible. There are 10 lab write-ups. Each lab write-up is worth 30 points except the four-day *Arabidopsis* lab, which is worth 90 points. The total number of points from your lab write-ups is 360 points. You may make up failed experiments during the last week of the classes.

|                                         |            |
|-----------------------------------------|------------|
| Lab reports (10)                        | 360        |
| Quizzes (12–1)                          | 110        |
| Exam                                    | 80         |
| Work quality points by your instructors | 20         |
| <b>Grand Total</b>                      | <b>570</b> |

The course grade will be based on the curve. Last years, students who received more than 84–88% of possible points received A in this course. I anticipate that earning less than 65 % of possible points in this course will likely result in an unsatisfactory grade.

— *Wishing you fun and success with experiments!* — Kalju