



DEPARTMENT OF BIOCHEMISTRY

## **BCHM 22100 – Small Molecule Biochemistry**

Spring 2017

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Office hours: We are pretty flexible but may be unavailable due to meetings, etc.

### **COURSE OBJECTIVES**

The primary objectives of this course are to introduce students to small biological molecules that may have biological functions on their own or be precursors to large macromolecules. The structure and function of the small molecules will be demonstrated through the observation of their separatory properties and chemical reactivities. Principles and theory of techniques will be presented during lecture periods followed by application of the techniques during lab periods. Methods include chemical fractionation, thin layer chromatography, HPLC, scanning spectrophotometry, ELISA assays, and mass spectrometry. Basic lab skills and concepts will be reinforced and use of the scientific method will be incorporated into the lab experiments. Students will be introduced to the concepts of positive and negative controls in experimentation. Students will learn proper scientific communication skills by writing lab reports.

### **LEARNING OUTCOMES**

BCHM 22100 students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics.

BCHM 22100 students will be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques.

BCHM 22100 students will understand the scientific method. They will understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge.

BCHM 22100 students will acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication.

BCHM 22100 students will communicate scientific knowledge, experiments and conclusions effectively as writers.

BCHM 22100 students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy and the environment.

## **TEXTBOOK AND COURSE MATERIAL**

Biochemistry Laboratory: Modern Theory and Techniques by Rodney Boyer.

This textbook is suggested but not required.

Each week an electronic version of the experiment handout will be available on the course Blackboard page.

In some cases you will be directed to websites or provided with additional reading material for information relevant to the labs. Some of the extra reading material may also be posted on the course Blackboard page.

A very useful website for some of the material is available from Michigan State University Chemistry Dept.: <http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/biomol.htm>

## **TIME AND PLACE**

Lecture: Monday 1:30-2:20 PM, BCHM 105

Lab: Section 1: Tuesday 10:30 AM-1:20 PM, BCHM 112  
Section 2: Tuesday 2:30-5:20 PM, BCHM 112

Lab Review: Friday 1:30-2:20 PM BCHM 105

Attendance Policy:

Attendance in the laboratory is mandatory. The laboratory facilities used by this class are only available during the scheduled laboratory session. Thus it is not possible to make up labs at other times. In the event that an absence from lab is unavoidable, you should contact the teaching assistant. At the discretion of the TA you may be able to make up the laboratory by submitting a short (5 typewritten pages) paper discussing the subject of that lab exercise. Unexcused lab absences will result in a score of 0 on that week's lab report. Please be aware that we may on occasion use part of the Monday lecture time to set up experiments in the lab.

## **BLACKBOARD**

The course syllabus, lecture notes, lab instructions, extra reading material, and grading keys for quizzes and exams will be available via the Purdue University Blackboard site at: <https://blackboard.purdue.edu/webct/logonDisplay.dowebct>

## **ASSESSMENT**

Exams are non-cumulative.

The grading for this course will be as follows:

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|--------------|-----|
| Midterm Exam | 25% |
| Final Exam   | 25% |
| Lab Reports  | 50% |

The cutoff values for letter grades are as follows:

90% A  
80% B  
70% C  
60% D  
59% or lower F

Depending on the distribution of grades in the class, the instructor may choose to curve the grade scale upward at his discretion. Grades will never be curved downward.

Missing an exam or failure to turn in a lab report will result in a grade of 0 being recorded unless documented justification is presented. Any request to be excused from an exam must include official documentation (doctor's note, request from academic advisor, etc) explaining why the exam was or will be missed. Makeup tests will be scheduled in consultation with the instructor.

If you have any disagreements with the way any of your lab reports have been graded, please consult the grading key and then discuss them with the TA. In the event this does not resolve your concerns, please take them up with the instructor. If you have questions with the way the exams are graded, consult the instructor directly. He is responsible for exam grading.

Requests for re-grades must be submitted no later than the end of the second class period after the graded exam or lab report has been returned.

#### **Lab Reports:**

Although you will work in lab with a partner each student is expected to prepare an independent lab report. The only material you should share is the data. Each lab report will be graded by the teaching assistant using a 20 point scale. Your final lab report grade will be the average of all reports you have submitted. All lab reports are expected to include the following:

1. Title page - title of lab exercise, your name and your lab partner's name.
2. Introduction - Briefly describe the experiment performed and the purpose for the experiment. Include a statement of hypothesis describing what you expect to observe. This section should be no more than 1 page, double-spaced.
3. Methods - Describe the procedures used to conduct the experiment in sufficient detail so someone with the appropriate knowledge and skill could use your report to repeat the experiment. There is no length restriction for this section – use as much space as needed.
4. Results – Present, in an organized manner, the data requested in the lab handout. Be sure you show all your data and any calculations you have made to interpret the data. This is essential for obtaining partial credit. Include in this section any graphs, photos, and tables as appropriate. Be sure to include legends with the figures, explaining the content of the figure. There is no length restriction for this section – use as much space as needed.
5. Discussion – provide a concise discussion of the results you obtained in the lab experiment. Specifically, address whether or not your data support your hypothesis. Speculate why any unexpected results might have been observed and suggest explanations for why any experiments didn't work as expected. Give your interpretations as to the quality of the data obtained and what you learned/discovered from the experiment. This section should be no more than 1 page, double-spaced.

For each lab report you will be given a more specific list of items that should be included and on which you will be graded.

Lab reports will be submitted through Blackboard under the "Assignments" tab. All lab reports are due at the midnight of the following week's lab. Reports handed in late will not be accepted without documentation of a medical reason or prearranged permission from the instructor.

There is no required lab notebook for this course. You are free to keep notes and data from the lab experiments in any form you like.

### **EXTRA CREDIT**

There will be no opportunity for extra credit.

### **OBTAINING EXTRA HELP**

Dr. Broyles will be available to answer your questions immediately after class, during the lab period, during office hours, or by appointment (arranged in class or by e-mail). Alternatively, you can submit questions by e-mail.

### **ACADEMIC MISCONDUCT**

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. Information on Purdue's policies with regard to academic misconduct can be found at <http://www.purdue.edu/ODOS/osrr/integrity.htm>.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

"Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, [University Regulations](#)] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

More specifically, the following are a few examples of academic dishonesty which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports

- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam
- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students
- any use of a telephone or other device capable of internet access during an exam

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment
- submitting a document written by someone else but representing it as one's own

## **EMERGENCY PREPAREDNESS**

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. To get information about changes in this course consult the class Blackboard site or e-mail or phone the instructor.

## **ON-LINE COURSE EVALUATIONS**

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

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| BCHM 221 | Course Syllabus   |
| Date     | Experiment  |
| Jan. 9   | Lab Safety  |
|          | How biochemists measure volumes and weights   |
| Jan. 16  | MLK day (no class, but we will have lab ) Use of spectrophotometers, effects of freezing on biochemical solutions |
| Jan 23   | Plant pigments-Organic extraction and purification by TLC   |
|          | Scanning spectrometry to identify the pigment.  |

|         |   |
|---------|---|
| Jan. 30 | Acid-Base Chemistry in Water<br>pH titration to determine pK <sub>a</sub> s, observation of a carbanion in solution   |
| Feb. 6  | Qualitative Analysis of Sugars<br>Chemical tests for reducing sugars, pentoses, and ketoses<br>Determination of sugars in hydrolyzates of several plant materials<br>Introduction to positive and negative controls                   |
| Feb. 13 | Lipids-purification by organic extraction and partition column chromatography, and quantitation of phospholipids, triglycerides, and cholesterol<br>Determination of relative purity by TLC   |
| Feb. 20 | Lipids-chemical analysis of their purified lipids to determine esters (fatty acids), phosphate (phospholipids), and cholesterol   |
| Feb. 27 | Lipid experiment 3 Natural sources of lipids  |
| Mar. 6  | Help session  |
| Mar. 7  | Midterm Exam  |
| Mar. 13 | Spring break  |
| Mar. 20 | Amino acids-identification of primary amines, amides, and substituted benzene ring by chemical reaction and paper chromatography<br>Identification of unknown amino acid samples<br>More discussion of positive and negative controls |
| Mar. 27 | Mass spectrometry. Determination of amino acid sequence of a tripeptide by tandem mass spectrometry   |
| Apr. 3  | HPLC  |
| Apr. 10 | Steroid hormone-quantitation of hormone by ELISA  |
| Apr. 17 | Nucleotides-Quantitation of intracellular ATP by bioluminescence  |
| Apr. 24 | Help session  |
| Apr. 25 | Final Exam  |

