DEPARTMENT OF BIOCHEMISTRY

BCHM 22100 – Small Molecule Biochemistry
3.00 Credit Hours
Fall 2020

COURSE INFORMATION

• Course number and title: BCHM 22100-Small Molecule Biochemistry
• CRN: 11889
• Meeting times:
  Lecture: Monday 11:30-12:20 PM, LILY G420
  Lab Review: Friday 11:30-12:20 PM LILY G420
  Lab: Section 1: Tuesday 10:30 AM-1:20 PM, BCHM 112
       Section 2: Tuesday 2:30 PM-5:20 PM, BCHM 112
• Course Credit hours: 3.00
• Course Brightspace page: https://purdue.brightspace.com/d2l/home/49646

INSTRUCTOR:
Dr. Frederick Gimble
Office: BCHM 10
TEL: 494-1653
e-mail: fgimble@purdue.edu

TEACHING ASST:
Gary Gan
Office: BCHM 22
e-mail: rgan@purdue.edu

Office hours: Please contact us for availability for WebEx or Zoom meetings

COURSE DESCRIPTION

The primary objectives of this course are to introduce students to small biological molecules that have biological functions on their own or are 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 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.

LEARNING RESOURCES, TECHNOLOGY AND TEXTS

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

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

TIME AND PLACE

Lecture/Lab review: Monday 11:30-12:20 PM, LILY G420

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

Lecture/Lab Review: Friday 11:30-12:20 PM LILY G420

Laboratory sessions:
   To ensure social distancing in the laboratory among students, TAs and faculty, it is necessary to restrict the number of students who attend laboratory sessions each week. Each section will be comprised of six teams of 3-4 students. Each week, one student from every team will be designated by the instructor to attend the laboratory and to perform the lab exercise. This student will provide the other team members with the collected data. In the event that a designated student needs to be absent from the laboratory, you should contact the teaching assistant or instructor. Unexcused lab absences will result in a score of 0 on that week’s lab report.
   The lecture periods on Monday and Friday will be used to review important concepts that are covered by the lab exercises and to do problem solving. Section 2 will attend the Monday session and Section 3 will attend the Friday session. The instructor will inform the class if a Lecture session will not be held during any particular week.

BRIGHTSPACE

The course syllabus, lecture notes, lab instructions and other materials will be available via the Purdue University Brightspace site at: https://purdue.brightspace.com/d2l/home/49565

ASSESSMENT

Your learning will be assessed through a combination of exams, problem sets and laboratory reports. Details on these assignments and exams will be posted on the course website. More detail about the Final exam will be posted by Nov. 1. Exams are non-cumulative.

The grading for this course will be as follows:
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In class problem sets</td>
<td>25</td>
<td>5%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Lab Reports</td>
<td>275</td>
<td>55%</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100</td>
</tr>
</tbody>
</table>

**GRADING SCALE**

The cutoff values for letter grades are as follows:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>A</td>
</tr>
<tr>
<td>80%</td>
<td>B</td>
</tr>
<tr>
<td>70%</td>
<td>C</td>
</tr>
<tr>
<td>60%</td>
<td>D</td>
</tr>
<tr>
<td>59% or below</td>
<td>F</td>
</tr>
</tbody>
</table>

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

Lab reports will be due by the beginning of the subsequent lab session. They will be submitted via Brightspace. Lab reports can be submitted within a 24 hour “late” window after the deadline, and will then be penalized 30% of the total score. Failure to turn in a lab report after this time will result in a grade of 0 being recorded. Makeup exams will be scheduled entirely at the discretion of the instructor.

If you have any disagreements with the way any of your lab reports have been graded, please consult with the TA. If you have questions with the way the exams are graded, consult the instructor directly.

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.

Because BCHM 22100 is a 200 level class, the University requires an official submission of grades to the registrar’s office between the beginning of the 5th and the end of the 7th week. This grade does not appear on your final record.

**Lab Reports:**

Students will be assigned to teams of 3 or 4 students for completing the laboratory exercises. To ensure physical distancing, only a single member of each team will perform the laboratory experiments each week. Members of the team that will attend the lab will rotate each week to provide all members an opportunity to perform experiments. Data collected each week by a team member will be distributed to the other members of the team for analysis. All members of the team are allowed to work together to analyze the data. However, each student is expected to prepare an independent lab report for submission. The only material you should share are the data. All lab reports will be examined using the turnitin function in Brightspace to ensure the reports were written independently. If plagiarism is detected by turnitin, a score of zero will be assigned. Each lab report will be graded by the teaching assistant using a 22 point scale. For the first report, all point values are halved. 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/Overall organization (3 pts)** - title of lab exercise, your name and your lab partner’s name.
2. **Introduction (3 pts)** - 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. **Materials and Methods (3 pts)** - 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 (8 pts)** – 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 (5 pts)** – 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 graded based on an established rubric that will be posted on Brightspace.

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**

Professor Gimble will be available to answer your questions using WebEx (arrange by e-mail) or you can submit questions by email.

**CLASS ATTENDANCE**

*Attendance Policy during COVID-19*: Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor’s department because of circumstances beyond the student’s control, and in cases of bereavement, quarantine, or isolation, the student or the student’s representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.
ACADEMIC GUIDANCE IN THE EVENT A STUDENT IS QUARANTINED/ISOLATED

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

PROTECT PURDUE PLAN

The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask in classrooms and campus buildings, at all times (e.g., no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining proper social distancing with peers and instructors (including when entering/exitng classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

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/studentregulations/student_conduct/regulations.html

Any incidence of academic misconduct will be reported to the Office of the Dean of Students. Academic misconduct may result in disciplinary sanctions including expulsion, suspension, probated suspension, disciplinary probation, and/or educational sanctions. In addition, such misconduct will result in punitive grading such as:

• receiving a lower or failing grade on the assignment, or
• assessing a lower or failing grade for the course

Punitive grading decisions will be made after consultation with the Office of the Dean of Students. Please note reported incidences of academic misconduct go on record for reference by other instructors. Further, a record of academic misconduct is likely to influence how current/future situations are handled.

To provide you with an unambiguous definition of academic misconduct, the following text
"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, Student 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

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"

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Purdue's Honor Pledge was developed by students to advance a supportive environment that promotes academic integrity and excellence. It is intended that this pledge inspires
Boilermakers of all generations to stay "on track" to themselves and their University. "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

LAB REPORTS SHOULD NOT BE PLAGIARIZED. IT IS STRESSED THAT EACH STUDENT IS EXPECTED TO PRODUCE AN INDEPENDENT, ORIGINAL LAB REPORT! TURNITIN WILL BE USED TO EXAMINE ALL LAB REPORTS FOR PLAGIARISM

Determination of academic misconduct by the instructor will result of forwarding of that information to the Dean of Students office. Should that office agree with the assessment of misconduct, a grade of 0 will be give for the assignment or exam.

NOTICE OF COPYRIGHT PROTECTION OF COURSE MATERIALS

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

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 beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

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.

NON-DISCRIMINATION POLICY

Purdue University's non-discrimination policy will be upheld in this classroom. Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to
develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs and values expressed by students and staff involved in this course. We support Purdue’s commitment to diversity, and welcome individuals of all ages, backgrounds, citizenships, disability, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences.

For more information, see http://www.purdue.edu/purdue/ea_eou_statement.html.

MENTAL HEALTH

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765) 494-6995 or http://www.purdue.edu/caps/ after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

ACCESSIBILITY AND ACCOMMODATIONS

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

DISCLAIMER

This syllabus is subject to change.
<table>
<thead>
<tr>
<th>Date</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 25</td>
<td>Lab Safety</td>
</tr>
<tr>
<td></td>
<td>How biochemists measure volumes and weights, proper use of pipettors</td>
</tr>
<tr>
<td>Sep. 1</td>
<td>Use of spectrophotometers, effects of freezing on biochemical solution</td>
</tr>
<tr>
<td></td>
<td>concentrations</td>
</tr>
<tr>
<td>Sep. 8</td>
<td>Acid-Base Chemistry in Water</td>
</tr>
<tr>
<td></td>
<td>pH titration to determine pKas, observation of a carbanion in solution</td>
</tr>
<tr>
<td>Sep. 15</td>
<td>Qualitative Analysis of Sugars</td>
</tr>
<tr>
<td></td>
<td>Chemical tests for reducing sugars, pentoses, and ketoses</td>
</tr>
<tr>
<td></td>
<td>Determination of sugars in hydrolyzates of several plant materials</td>
</tr>
<tr>
<td></td>
<td>Introduction to positive and negative controls</td>
</tr>
<tr>
<td>Sep. 22</td>
<td>Lipids-purification by organic extraction and partition column chromatography, and quantitation of phospholipids, triglycerides, and cholesterol</td>
</tr>
<tr>
<td>Sep. 29</td>
<td>Lipids-chemical analysis of their purified lipids to determine esters (fatty acids), phosphate (phospholipids), and cholesterol</td>
</tr>
<tr>
<td>Oct. 6</td>
<td>Lipid chemistry in natural fats</td>
</tr>
<tr>
<td>Oct. 13</td>
<td>Midterm Exam (exam is at lab time)</td>
</tr>
<tr>
<td>Oct. 20</td>
<td>Amino acids-identification of primary amines, amides, and substituted benzene ring by chemical reaction and paper chromatography</td>
</tr>
<tr>
<td>Oct. 27</td>
<td>Identification of unknown amino acid samples</td>
</tr>
<tr>
<td></td>
<td>More discussion of positive and negative controls</td>
</tr>
<tr>
<td>Nov. 3</td>
<td>Plant pigments-Organic extraction and purification by TLC</td>
</tr>
<tr>
<td></td>
<td>Scanning spectrometry to identify the pigment.</td>
</tr>
<tr>
<td>Nov. 10</td>
<td>Steroid hormone-quantitation of hormone by ELISA</td>
</tr>
<tr>
<td>Nov. 17</td>
<td>HPLC of small molecules. Identification of purified plant pigment</td>
</tr>
<tr>
<td>Nov. 24</td>
<td>Nucleotides-Quantitation of intracellular ATP by luminescence</td>
</tr>
<tr>
<td>Dec. 1</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>