

Chem4423W Syllabus

Foundations of Chemical Biology Laboratory

Instructor: Professor William Pomerantz

Contact Information: email: wcp@umn.edu When contacting Professor Pomerantz via email please use CHEM4423W in the subject line. I can also be reached at my office 215 Smith or via **Zoom:** <https://umn.zoom.us/my/wpomer>

Teaching Assistants:

Tyler Karow (Prep TA and Thurs 8-1140 AM, Sec 3), karow020@umn.edu

Richard Ede (Prep TA Thurs 8-1140 AM Sec 3), ede00002@umn.edu

Ruoqi Jiang (Tues and Thurs 1240-430 PM, Sec 5 grader) jian0840@umn.edu

Hari Kottala (Tues and Thurs 1240-430 PM, Sec 2 grader) kotta016@umn.edu

Laboratory: 494 Kolthoff Hall

Stockroom: 249 Smith Hall

Lecture: 231 Smith Hall

Course Credits: Two credit hours; 4 hours of lab per week, Prelab Wed. 230-345 PM

Pomerantz Office Hours: Monday 4-5 pm, Smith 215 or via zoom: <https://umn.zoom.us/my/wpomer>

Contact your TA for their office hours and location

Microcomputer Lab: 101D Smith Hall, Phone: (612) 624-3372

www.chem.umn.edu/services/microlab/

Prerequisites: Organic Chemistry II 2302 or Organic Chemistry II for the Life Sciences 2304 and Organic Laboratory 2311 Chem4411 or BioC 3021 (or concurrent enrollment)

Required Materials:

Bound laboratory notebook (available at Univ. bookstore)

Jump drive for data transfer (available at Univ. bookstore), **bring to every lab**

Calculator (available at Univ. bookstore)

Labcoat (available at Univ. bookstore)

Safety goggles (bring your own, or buy at Smith 249 General Chemistry stockroom)

Fundamental Laboratory Approaches for Biochemistry and Biotechnology: 2nd (second) Edition, Alexander J. Ninfa, Wiley, John & Sons, 2010. (available at Univ. bookstore)

Recommended Textbook: Essentials of Chemical Biology: Structure and Dynamics of Biological Macromolecules, Andrew Miller and Julian Tanner, John Wiley & Sons, 2008, ISBN 978-0-470-84531-8 and related literature.

General Biochemistry textbooks are also useful refreshers for understanding biomolecules particularly in regard to protein structure and function. See for example Biochemistry by Voet and Voet Parts II and III)

Canvas Site: www.canvas.umn.edu

Use this resource to download course material, upload reports and answer sheets, and keep track of grades. *Students are responsible for printing their own materials.* Every effort will be made to post them in a timely fashion. Please check the Canvas site frequently for access to assignments, course information and your current grades.

Course Library Page: <https://www.lib.umn.edu/course/CHEM/4423W>

Course Overview: Chemical biology is a rapidly developing field at the interface of chemical and biological sciences that encompasses chemical research that expands our understanding of biology, and biological research that expands our understanding of chemistry.

The scientific journal *Nature Chemical Biology* defines chemical biology as:

“Both the use of chemistry to advance a molecular understanding of biology and the harnessing of biology to advance chemistry.”

In this lab, chemical biology approaches will be used to illustrate how chemistry can be applied to manipulate and study biological problems using a combination of experimental techniques ranging from organic chemistry, analytical chemistry, biochemistry, molecular biology, biophysical chemistry and cell biology. Students will perform experiments to highlight many of the major techniques and concepts used in modern chemical biology research, including experiments that emphasize the clear connections between the material that they are taught in the classroom/laboratory and experimental science, health, disease and medical research.

The purpose of this course is to teach students the core skills that are used by practicing, professional scientists at the interface of chemistry and biology. These include experimental techniques, safe handling of equipment and chemicals, familiarity with modern instrumentation, interpretation of experimental and spectroscopic results, and the preparation of written reports that accurately, yet concisely, convey the essence of all of the above. These reports constitute the primary vehicle by which students convey their learning and understanding of the above skill set and are the primary data used for evaluating student's performance. Experimental science is of no value unless the results are clearly and accurately presented, and thus, available for scrutiny by others.

Objectives:

1. Apply the knowledge you learned in organic chemistry in a biological context.

2. Learn experimental skills used in chemical biology such as protein purification, biopolymer synthesis and purification, transcription, microscopy, protein-ligand characterization, protein/peptide mass spectrometry, working in microwell plates.
3. Learn about several available online and university resources important to interdisciplinary science including Pymol, PDB, Pubmed, Department of Chemistry Mass Spectrometry Lab.
4. Evaluate experimental data through basic statistical analysis.
5. Participate in the evaluation of large data set collections using lab generated data.
6. Prepare high-quality figures and technical reports based on the formatting of a premier chemical biology journal, *ACS Chemical Biology* (official manuscript guidelines for this journal: <http://pubs.acs.org/journal/acbcct>). Students will become better science writers over the course of the semester and learn to effectively communicate to the greater scientific community.

Please also refer to “Write Like a Chemist” as an excellent resource on writing a scientific paper. We have made this available on the library website and you can get the Ebook through ProQuest. https://primo.lib.umn.edu/permalink/f/11uk8fo/UMN_ALMA51845874480001701
I will use several examples in class to help supplement your writing instruction.

Lab Experiments: Working groups of two persons will be formed at the first lab meeting if there is an odd number of students one group of three will be formed. Prelab will be on the Wednesday preceding the lab. Please refer to the **bolded dates** below.

<i>Lab Week</i>	<i>Lab</i>	<i>Lecture Concepts (Pre lab date the week before lab)</i>	<i>Assignments</i>	<i>Duration</i>	<i>Reference Materials and Readings Or Notes</i>
Sep 4	No Lab	See Prelab description below for Sept 6			
Sep 11	Lab Check-In and Basic Lab Techniques	Syllabus Micropipette tutorial, spectrophotometry, dilutions, protein concentration determination, Amino Acids, peptides (Prelab Sept 6)		1 week	Fundamentals textbook: Chap 1-4 Reference ¹
	Lab Module A - Transcription				
Sep 18	Broccoli transcription	Green fluorescent protein, transcription, aptamers, (Sept 13)	Assignment #1 Due (Intro lab)	1 week	Heilie et al. J. Chem. Ed. 2018, 95, 1867

	Lab Module B - Peptide Synthesis			3 weeks	
Sep 25	Part 1 – Peptide Synthesis	Solid Phase peptide synthesis: Amide bond formation, protecting group removal, resin cleavage steps <i>Writing: intro to lab reports (Sept 20)</i>			References ^{9,10}
Oct 2	Part 2 (2 weeks) – Purification of peptide by HPLC and characterization by MS	Polar molecule purification, peptide accurate mass for sequence determination MALDI-TOF MS, <i>Writing abstracts: (Sept 27)</i>	Lab Report #1 (Broccoli) Due (short length)		Reference ¹¹
Oct. 9	Purification and characterization continued	Fmoc quantification <i>(Oct 4)</i>			
	Lab Module C – Lysozyme Bioconjugation/ Crystallization			3 weeks	
Oct 16	Part 1 – Protein Crystallization (set up protein trays), Learn to utilize the Protein Data Bank (PDB) and PyMol	Protein crystallography, Protein structure, Lysozyme intro (Oct 11) <i>Writing: Figure generation Online Databases</i> TBD Maybe on Zoom	Lab Report #2 (peptide) Due to peer		Fundamentals textbook: Chap 11.7 and 15 References ^{2,3}
Oct 23	Part 2 – Examine crystals under microscope, Prepare reagents for next lab period	Protein Bioconjugation, EAS reaction with diazonium salts, gel electrophoresis (Oct 18)	(Assignment 2, peer edits on Lab report #2)		Schlick et al. J. Am. Chem. Soc. (2005) 127, 3718-3723
Oct 30	Part 3 – Protein modification and assessment by SDS-PAGE	Protein Bioconjugation, EAS reaction with diazonium salts, gel electrophoresis continued (Oct 25)	Due. Lab Report #2 (peptide)		Fundamentals textbook: Chap 6 References ⁴⁻⁸

	Lab Module D – β-Lactamase	<i>These proteins are a major source of antibiotic resistance.</i> http://www.pbs.org/wgbh/frontline/film/hunting-the-nightmare-bacteria/		3 weeks	References ¹²⁻¹⁴
Nov 6	Part 1 – Protein Production Day 1 – MAC Chromatography	Introduction to β -lactamase, Protein purification, anion exchange, enzyme activity assay (Nov 1)	Assignment #3 Due (Pymol)		Fundamentals textbook: Chap 5, 7 and 8
Nov 13	Part 2 – Protein Production Day 2 – Quantify Enzyme Activity and Protein Concentration	Protein concentration determination, revisit SDS-PAGE, (Nov 8)			Fundamentals textbook: Chap 12
Nov 20	Thanksgiving break. <i>In class Pre-lab but no lab this week.</i>	Colorimetric assay for enzyme kinetics (Michaelis-Menton and Lineweaver Burk plots), Protein stability assays, (Nov 15) TBD Maybe on zoom	Worksheet #4 due: lysozyme (graded as a lab report) Due Monday Nov. 27th all sections		Make-up labs will be held on Tues. Work on writing and worksheet feedback on Nov. 23
Nov 27	Part 3 – Protein Production Day 3 - Assess protein kinetics and stability				Fundamentals textbook: Chap 10 and 11 References ^{15,16}
	Lab Module A – GFP-Ras Reporter Assay for Anti-Cancer Compound			1 week	
Dec 4	Visualization of Ras protein localization after inhibitor treatment	KRAS, Farnesylation inhibitors, Cell-based assay, inhibitor action, microscopy, fluorescent read-out (Nov. 29)			

Dec 11	Lab Check-Out	Course Wrap-up (Dec 13) No Thurs lab Check- Out Wednesday	Lactamase Lab Report Due (long length) and Assignment #4 for imaging lab Dec. 11 Tues lab, Dec. 13 Thurs. lab.		
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Attendance: Attendance in lab, for the entire lab period, is required. Missing more than 15 minutes of a lab period will be considered an absence. In the case of a true emergency, serious illness, or university-related trip that prevents a student from attending a lab meeting, an **excused absence may be granted.** To obtain an excused absence, students must contact Professor Pomerantz as soon as circumstances allow, to discuss the nature of the emergency, and eventually to provide documentation. For an absence, the average score of the student's other work will replace the zero for the day. If extenuating circumstances prevent a student from attending more than one lab period, a meeting must be scheduled immediately to discuss any options available. If any absence is unexcused, it will reduce your final laboratory grade by 5%, in addition to the missing points for the day. Three absences, whether partial or full, may result in an automatic F is earned in lab. **MAKE UP DAY: Tues Nov. 21, a makeup lab will be held during the regularly scheduled Tues lab afternoon time to earn back attendance points.**

University Athletes and Military Personnel: If you are a member of a varsity team at the University and will be traveling during the semester, or will have military duty that conflicts with more than one lab period, you are responsible for contacting the instructor or staff in Smith 115 in order to be moved to a lab section that minimizes scheduling conflicts.

Reference Texts: Available through Walter Library Reserve

Introduction to Bioorganic Chemistry and Chemical Biology, David Van Vranken and Gregory Weiss, Garland Science, Taylor & Francis Group, LLC, 2013, and related literature.

Experiments in the Purification and Characterization of Enzymes: A Laboratory Manual, Thomas A. Crowley and Jack Kyte, Elsevier, 2014, and related literature is available in digital formal from the library or can be found [here](#):

Additional Resources Online:

Student Writing Support provides free writing instruction for all University of Minnesota students at all stages of the writing process. In face-to-face and online collaborative consultations, they help students develop productive writing habits and revision strategies. UMN Student Writing Support Center: <http://writing.umn.edu/sws/>

How to write a scientific paper:

1) How to Write a Paper in the Scientific Journal Style and Format (Greg Anderson, Bates College). Gives information on the structure of a paper and its parts. Important, though: different journals require different parts in papers. Fit Greg's advice to your needs.

<http://abacus.bates.edu/%7Eganderso/biology/resources/writing/HTWtoc.html>

2) UW-Madison Writing Center Science Writer's Handbook. More advice on structure of scientific papers. <http://writing.wisc.edu/Handbook/ScienceReport.html>

3. Helpful examples on writing expectations in the chemistry department can also be found [here](#):

Pre-Lab Lectures: These lectures will be used to discuss the syllabus, review and introduce new concepts, discuss scientific writing, provide laboratory logistics, discuss data analysis from previous experiments, and interpret results obtained by the entire class. Attendance is required.

Laboratory notebooks: A laboratory notebook per student is required to write annotations related to experiments conducted in the laboratory throughout the semester. Prior to starting a laboratory experience, the notebook must include calculations needed and notes on the procedure that will be followed that day. During the laboratory experience, the student must fill up tables prepared for data collection and tabulation and write observations that will help prepare the lab report. After the lab experience, the student will complete the data analysis, add graphs and images, and write conclusions.

Lab Reports: Instructions to prepare lab reports will be provided on the Canvas site and in pre-lab lecture. Three lab reports will be required. Each will describe one lab module and should include how each experiment relates to the overall goal of the module and the biological and chemical significance of the performed work. **Word limits for each report – short report (1 x) is 1500 words, medium length (1 x) is 2500 words and long report (1 x) is 3500 words – this does not include the methods sections. This semester we have replaced the 4th lab report with a writing intensive assignment worth the same points as a medium lab report.** The course grades will be based on the progress that is assessed largely through the series of written lab reports. These must meet "journal style" standards for presentation, style, and clarity. The journal that we will use as the key example is *ACS Chemical Biology* (official manuscript guidelines for this journal: <http://pubs.acs.org/journal/acbcct>). Feedback will be given on each report by the teaching assistants, who will be equipped with explicit grading rubrics and expectations. Feedback on each report will be returned to the students via Canvas that provides the breakdown of their grade and the areas that need improvement. Make sure to look in the legends of the your graded report for comments. Students will be required to apply comments they receive in regards to formatting, writing style and scientific clarity to each successive report.

Assignments and lab reports for a given experiment are due at the start of the lab period based on the course syllabus deadlines unless you are otherwise instructed. **Each report and assignment must be submitted electronically as a PDF file uploaded on Canvas.** In addition, some numeric values from the report will be submitted to databases accessible through the Canvas site. These databases will be used for discussions during pre-lab sessions.

Points will be taken off when reports or assignments are late (based on time stamp in the Canvas Site). The respective grade will be reduced by 5 points for the first day the assignment is turned in late. 10 additional pts will be taken off for each additional week of being late (rounded up to the nearest week, with the exception of week 1). The instructor may waive a late penalty to those presenting a strong and legitimate reason (illness, serious accident, etc.; not my computer crashed) for not submitting the lab report on time. Communication far in advance of a deadline is a best practice to avoid potential deductions.

Award: One to two exceptional lab reports may be selected for the Chemistry Department's Writing award in the Spring 2024 award ceremony.

Quizzes: Short canvas quizzes will be administered throughout the semester to examine your knowledge of key concepts to help prepare you for each lab day. Quizzes will be due before the start of Tuesday lab section at 1240 PM.

Grading

12 Lab Technique Point Days: 10% of grade (4 pt. per day)

4 Assignments 15% of grade

4 Lab reports 1x short lab report, 1x medium, 1 medium written worksheet, 1x long report 65% of grade,

Up to 10 Quizzes 10% (2 lowest quiz scores will be dropped)

Final Grade: The final grade for the course is determined from the total number of points that are accumulated throughout the semester. The course will be curved as necessary, however, the approximate grading structure is shown below.

Final Grade: Total Percentage

A 92 – 100

A- 87 - 91.9

B+ 82 – 86.9

B 77 – 81.9

B- 72 – 76.9

C 67 – 71.9

D 62 – 66.9

F < 62.0

Safety: The Department of Chemistry promotes a culture of safety in the laboratory. Although general safety instructions will be provided during the first lab session (Check-in Day), each student working in a chemistry lab is strongly encouraged to visit <http://www.chem.umn.edu/services/safety/> to get acquainted with the Chemical Hygiene Plan in the department.

All personnel must wear personal protective equipment (safety goggles, lab coat and no open shoes) at all times while working in the lab. Do not sit on lab surfaces, run in the lab or do *anything*

that could jeopardize the safety of you or anyone else in the lab. If you see unsafe behavior, point this out to your TAs immediately.

Prior to each experiment, you are responsible for reviewing the material safety data sheets (MSDS) for chemicals that you will be utilizing on that day. See <http://www.ilpi.com/msds/>.

COVID-19, Face-Coverings, Symptoms, and Vaccination

Please stay at home if you experience symptoms of COVID-19 and consult with your healthcare provider about an appropriate course of action. An absence due to symptoms of COVID-19 is an excused absence, and I will work with you to find the best course of action for missed work and/or class experiences.

Please refer to this [site](#) for further information:

E-mail: All students should be reachable at their University-wide e-mail accounts. If you normally use a departmental or private e-mail account, you should set up your University-wide account to automatically forward messages to this other address. You can do this most easily through the account settings page. I will also use CHEM4423W in the subject line.

Reference Texts: Although the instructor will lecture on various topics related to the experiments you do in this lab, it will often be your responsibility to find appropriate reference materials. This means chemical biology, biochemistry and organic chemistry textbooks, handbooks, encyclopedias, and original literature (i.e. journal articles). SciFinder Online (<http://scifinder.cas.org/>), the search tool for the American Chemical Society's Chemical Abstracts Service, is an excellent tool for searching for journal articles on a particular topic. To use SciFinder Online, you will need to register (<http://tinyurl.com/scifinderumn>) with your umn.edu email address. You can also usually access journal articles directly from a SciFinder search by clicking "Get Full Text". To read the articles online, you will either need to be using a computer with a UMN IP address, access them via the U of M Libraries website (<http://www.lib.umn.edu/#journals> to search), or use a virtual private network (VPN) tunnel. (Go to <http://www.oit.umn.edu/vpn/> to download the software needed to do this, and to learn more.) Web of Science is a second database for searching for literature. <http://login.webofknowledge.com/>.

Important Policy Statements

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Any student found performing unauthorized experiments or behaving in an unsafe manner in the laboratory may be removed from the laboratory at any time. Whether or not behavior is unsafe is at the discretion of the instructors, and this includes failure to properly respond to instructions in a timely manner. Removal from the laboratory may be for a period of time as short as the remainder of the current lab period or as long as the remainder of the course itself, depending on circumstances.

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: <http://policy.umn.edu/education/studentresp>.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct

Code: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, the student may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/education/instructorresp>.

The Office for Community Standards has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <https://communitystandards.umn.edu/avoid-violations/avoiding-scholastic-...>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam. If you have additional questions, please clarify with Professor Pomerantz or the TAs.

Makeup Work for Legitimate Absences

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: <http://policy.umn.edu/education/makeupwork>.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: <http://policy.umn.edu/education/studentresp>.

Grading and Transcripts

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

A	4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
A-	3.667
B+	3.333
B	3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
B-	2.667
C+	2.333
C	2.000 - Represents achievement that meets the course requirements in every respect
C-	1.667
D+	1.333
D	1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S	Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to: <http://policy.umn.edu/education/gradingtranscripts>.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents

Policy: https://regents.umn.edu/sites/regents.umn.edu/files/policies/Sexual_Harassment_Sexual_Assault_Stalking_Relationship_Violence.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For

more information, please consult Board of Regents

Policy: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (UM Twin Cities - [612.626.1333](tel:612.626.1333)) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, **can** often work with instructors to **minimize** classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact your instructor early in the semester to review how the accommodations will be applied in the course.
- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact Professor Pomerantz as early in the semester as possible to discuss how the accommodations will be applied in the course. For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

Additional information is available on the DRC website: (UM Twin Cities - <https://diversity.umn.edu/disability/>) or e-mail (UM Twin Cities - drc@umn.edu) with questions.

Mental Health and Stress Management

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

Academic Freedom and Responsibility: *for courses that do not involve students in research*

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [Customize with names and contact information as appropriate for the course/college/campus.]

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Conflict Resolution: The instructor and TA are willing to settle disagreements as quickly and amicably as possible. If you need assistance please contact the Office of Conflict Resolution (<http://www.sos.umn.edu/>).

FERPA Compliance: In this class, our use of technology will make students' names visible within the course Moodle website, but only to other students in this class. Since we are using a secure, password-protected course website, this will not increase the risk of identity theft or spamming for anyone in the class. If you have concerns about the visibility of your name, please contact Prof. Pomerantz for further information.

If you feel you are having troubles or concerns about the class, please feel free to contact Prof. Pomerantz or the TAs; we want you to have a positive learning experience in this course. If you feel for any reason that we are not taking your concerns seriously, and that this is negatively impacting your learning, the Student Dispute Resolution Center (<http://www.sos.umn.edu/>) makes both informal (ombudsman) and formal (advocate) representatives within the University available for students to share their concerns with.

References

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2. PyMol. <http://www.pymol.org/>.
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4. *Protocols adapted from course offered at UC Irvine (Prescher)*.
5. Arnquist, I.J. & Beussman, D.J. Incorporating Biological Mass Spectrometry into Undergraduate Teaching Labs, Part 1: Identifying Proteins Based on Molecular Mass. *J. Chem. Ed.* **85**, 1971-1973 (2007).
6. Hooker, J.M., Kovacs, E.W. & Francis, M.B. Interior Surface Modification of Bacteriophage MS2. *J. Am. Chem. Soc.* **126**, 3718-3719 (2004).
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9. Merrifield, R.B. Solid Phase Peptide Synthesis. I. The Synthesis of a Tetrapeptide. *J. Am. Chem. Soc.* **85**, 2149-2154 (1963).
10. Nilsson, B.L., Soellner, M.B. & Raines, R.T. Chemical Synthesis of Proteins. *Annu. Rev. Biophys. Biomol. Struct.* **34**, 91-118 (2005).

11. Arnquist, I.J. & Beussman, D.J. Incorporating Biological Mass Spectrometry into Undergraduate Teaching Labs, Part 2: Peptide Identification via Molecular Mass Determination. *J. Chem. Ed.* **86**, 382-384 (2009).
12. Jacoby, G.A. AmpC b-lactamases. *Clin. Microbiol. Rev.* **22**, 161-182 (2009).
13. *Protocols adapted from course offered at IU (Marketon).*
14. Ninfa, A.J., Ballou, D.P. & Parsons, M.B. *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*, (Wiley, John & Sons, Incorporated, 2010).
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16. Nitrocefin Reagent.
<https://http://www.caymanchem.com/app/template/Product.vm/catalog/15424;jsessionid=840C15B07CF0D1C60AD33B313C4EEDC0>.

