**Chem8411/4411 Syllabus**
**Foundations of Chemical Biology**

**Instructor**: Professor Erin Carlson

**Teaching Assistants**: Peter Ycas

**Contact Information:** Please contact us through the Moodle website interface. I will not explain chemical concepts via email as they are difficult to interpret and answer without communicating in person. Feel free to ask these kinds of questions before or after class. I will also not respond to questions that could be answered by looking at the syllabus, Moodle, lab materials or class notes.

**Lecture Location**: 231 Smith Hall
**Course Credits:** 4411 Three credits, 8411 Four credits
**Office Hours:** Thursday 12-1 pm, Smith 341
**TA Office Hours:** Tuesday 3-4 pm, Kolthoff 151
**Microcomputer Lab**: 101D Smith Hall, www.chem.umn.edu/services/microlab/

**Required Textbook**: Introduction to Bioorganic Chemistry and Chemical Biology, David Van Vranken and Gregory Weiss, Garland Science, Taylor & Francis Group, LLC, 2013

**Moodle Site**: moodle.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 Moodle site frequently for access to assignments, course information and your current grades.

**Course Overview:** Chemical biology is a rapidly developing field at the interface of chemical and biological sciences. Generally speaking, Chemical Biology deals with 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. 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.

**Tentative Course Schedule**

| **Day** | **Topic** | **Readings**<br>*Primary literature – underlined materials are required reading* |
|---|---|---|
| ***Part I Biopolymer Structure, Function and Synthesis*** | | |
| Tues. Sept 6 | *Introduction to Chemical Biology* | VV Chap 1 |
| Thur. Sept 8 | *Organic Chemistry Review – fundamentals required to understand bonding, catalysis and inhibition* | VV Chap 2.1-2.2 |
| Tues. Sept 13 | *Chemical Catalysis* | |
| Thurs. Sept 15 | *Amino acids, peptides, and proteins* | VV Chap 5.1, 5.3-5.6<br>Miller 1.1-1.2, 4.1-4.3<br>Stryer Chap 2 |
| Tues. Sept 20 | *Structural Forces in Biomolecules*<br>***Quiz 1 – Amino Acids and Peptides*** | VV Chap 2.4, 2.5, 5.3-5.6, 6.1<br>Miller 1.6<br>Stryer Chap 2 |

| | | |
|---|---|---|
| Thurs. Sept 22 | *Peptide Synthesis in Chemical Biology, Combinatorial Chemistry* | VV Chap 5.2<br>Miller 2.1-2.2 |
| Tues. Sept 27 | *Protein Expression, Protein Purification* | VV Chap 3.7, 3.8, 4.6<br>Miller, 2.6, 3.5<br>Stryer Chap 4 and 5 |
| Thurs. Sept 29 | *Unnatural amino acid incorporation* | VV Chap 4.6 |
| ***Part II Enzymes, Inhibitors and -Omics*** | | |
| Tues. Oct 4 | *Enzymatic Catalysis*<br>***Quiz 2 – Protein Production and Purification*** | VV Chap 6<br>Stryer Chap 8 and 9 |
| Thurs. Oct 6 | *Enzymatic Catalysis, Enzyme Kinetics* | VV Chap 6<br>Stryer Chap 8 and 9 |
| Tues. Oct 11 | *Enzyme Kinetics* | Stryer Chap 8 and 9 |
| Thurs. Oct 13 | *Enzyme Inhibition and Mechanistic Probes*<br>*Guest Lecture: Dr. Mani Goswami* | |
| Tues. Oct 18 | *Enzyme inhibition and Mechanistic Probes*<br>*Guest Lecture: Dr. Mani Goswami* | |
| ***EXAM 1 Thursday Oct. 20th*** | | |
| Tues. Oct 25 | No Class – International Chemical Biology Conference | |
| Thurs. Oct 27 | *Chemical Protein Modification, Bioorthogonal Reactions* | |
| Tues. Nov. 1 | *Chemical Protein Modification, Bioorthogonal Reactions* | |
| Thurs. Nov. 3 | *Proteomics and Bioanalytical Methods*<br>***Quiz 3 – Protein Modification*** | Miller 9.1 - 9.4 |
| Tues. Nov. 8 | *Proteomics and Bioanalytical Methods* | |
| Thurs. Nov. 10 | *Metabolomics* | |
| ***EXAM 2 Tuesday Nov. 15th*** | | |
| ***Part III Visualizing and Perturbing Biomolecules*** | | |
| Thurs. Nov. 17 | *Chemical Genetics* | VV page 405-407 |
| Tues. Nov. 22 | *Chemical Genetics* | |
| Thurs Nov. 24 | **THANKSGIVING** | |
| Tues. Nov. 29 | *Tools for Molecular Imaging* | Miller 4.5, 7 |
| Thurs. Dec. 1 | *Tools for Molecular Imaging*<br>***Quiz 4 – Topic TBA*** | |
| Tues. Dec. 6 | *NMR 1D and 2D NMR*<br>*Guest Lecture: Professor Pomerantz* | Miller 5.1 - 5.5 |
| Thurs. Dec. 8 | *Protein-protein interactions, Hot Spots* | |
| Tues. Dec. 13 | Review<br>***Scientific Paper Abstract Due*** | |
| ***FINAL EXAM Monday Dec. 19 8:00 - 10:00 am*** | | |

**Attendance**: Attendance is required at all quizzes and exams. In the case of a true emergency, serious illness, or university-related trip that prevents a student from attending, an **excused absence may be granted.** To obtain an excused absence, students must contact Professor Carlson as soon as circumstances allow, to discuss the nature of the emergency, and eventually to provide documentation.

## Primary Literature

*Below are some seminal and current references for Chemical Biology 4411/8411. We will not go over every article explicitly, but they will provide you with a deeper understanding of the material for the course and in your future studies. Underlined materials are required reading and are provided on Moodle.*

**What is Chemical Biology?**

1. R. B. Merrifield, *J. Am. Chem. Soc*. **1963**, *85*, 2149
2. D. J. Cram, *Angew. Chem. Int. Ed.* **1988**, *27*, 1009
2. P. B. Dervan. *Biorg. Med. Chem.* **2001**, *9*, 2215-35
3. P. G. Schultz; P. B. Dervan, *J. Am. Chem. Soc.* **1983,** *105*, 7748
4. A. K. Mapp et al. *Proc. Nat. Acad. Sci.,* **2000**, *97*, 3930
5. Kritzer, J. A. *Nat. Chem. Biol.* **2010**, *6*, 868
6. Arrowsmith et al. *Nat. Chem. Biol*. **2015**, *11,* 536
7. Schreiber, *Cell*, **2015**, *161*, 1252.

**Catalysis**

Richard Wolfenden, and Mark J. Snider. *Acc. Chem. Res*., **2001**, 34 (12), 938-945.
Page and Jencks. *Proc. Nat. Acad. Sci. USA* **1971**, Vol. 68, No. 8, pp. 1678-1683
Menger. *Acc. Chem. Res*. **1985**, 18, 128-134.
Bruice. *Acc. Chem. Res*., **2002**, 35 (3), 139-148.

**Amino acids, peptides, and proteins**

1. Uemura et al. *Org. Lett.*, **2012**, *14*, 882-5 (Enantioselective Hydrocyanation of *N*-Protected Aldimines)
2. *J. Mol. Bio*. **1993**, *229*, 105-124 - non-canonical amino acid incorporation (selenium)
3. *J. Am. Chem. Soc.* **1996**, *118*, 6105 – Determining amide bond stability
4. *Pace et al. Biophys. J. **1998**, 75, 422-7* – Determining dihedral angle for secondary protein structures

*Protein Translation*

http://cen.acs.org/media/video/2007/01/cen-translation_bacterial-vid1.html How translation occurs…Movie

*Protein Expression*

http://www.jove.com/video/4204/purification-aggregation-amyloid-precursor-protein-intracellular - Protein expression movie

*Protein Purification*

http://media.oit.edu/ken.usher/
http://www.jove.com/video/4204/purification-aggregation-amyloid-precursor-protein-intracellular

**Noncovalent interactions in biopolymers**

1. S. Marquese, R.L. Baldwin. *PNAS,* **1987**, *84*, 8898 - Helix stabilization by Glu-Lys+ salt bridges in short peptides
2. *Biochemistry*, **1991**, *30*, 7188 - Van der Waals effects on Lipid Melting
3. *Science,* **1993**, *262*, 1401-6 - Non-Covalent Interactions in Protein Folds

**Chemical synthesis of peptides**

1. R. B. Merrifield, *J. Am. Chem. Soc*. **1963**, *85*, 2149 - Seminal Peptide syn. paper
2. *Org. Let.* **2005**, 7, 8, 1517 – Application of microwave irradiation during peptide synthesis

**Chemical synthesis of proteins, native chemical ligation, combinatorial chemistry**

1. Dawson, Muir, Kent, *Science*, **1994**, *266*, 776 – Native chemical ligation
2. Tom Muir, *Proc. Nat. Acad. Sci.* **1998**, 95, 6705 – Expressed protein ligation

3. Wang et al., *J. Am. Chem. Soc.* **2012**, *134*, 13244
4. Ellman *Proc. Natl. Acad. Sci. USA* **1997**, Vol. 94, pp. 2779

**Non-canonical Amino Acid Incorporation**

1. Wang, Schultz, *Chemistry and Biology*, **2001**, *8*, 883 – Site-specific non-natural amino acid incorporation
2. *J. Am. Chem. Soc.* **2009**, 131, 14240 – Photo-crosslinking amino acid (pBpa) mutations to study Gal4 interaction partners
3. Chin. *Science*, **2003**, *301*, 964 – Engineering unnatural amino acid specific TyrAS
4. *Angew. Chem. Int. Ed.* **2001**, *40*, 81494 - sequence selective non-canonical amino acid incorporation
5. Tang et al. *J. Am. Chem. Soc.* **2001**, *123*, 11089 - sequence selective non-canonical amino acid

**Kinetics**

1. Attie, *J. Chem. Ed*. **1995**, *72*, 119.
2. Burlingham, *J. Chem. Ed*. **2003**, *80*, 214.
3. Raines, *J. Chem. Ed*. **1988**, *65*, 757.

**Enzyme Inhibition and Mechanistic Probes**

1. Carlson, *ACS Chem Bio*, **2011**, *5*, 639.
2. Wilke, *ACS Chem Bio.* **2015**, *10*, 328.
3. Drahl, *Angew. Chem. Int. Ed*. **2005**, *44*, 5788 – 5809.
4. Higgin-Soltero. *Nat. Struct. Mol. Biol*. **2004**, *11*, 539.
5. Liang, P. *Biochemistry*, **1998**, *37*, 16390.

**Chemical Protein Modification**

1. Carrico, *Chem. Soc. Rev*., **2008**, *37*, 1423–1431.

**Bioorthogonal Reactions**

1. Garber, *ACS Chem Bio* **2013**, 8, 1671.
2. Hannoush, *ACS Chem Bio* **2009**, 4, 581.
3. Kamber, *J. Am. Chem. Soc*. **2015**, *137*, 8388.
4. Patterson, *Current Opinion in Chemical Biology* **2015**, 28:141–149.
5. Prescher, *Nat Chem Bio*, **2005**, 1, 13.
6. Tanaka, *J. Am. Chem. Soc*. **2008**, 130, 3278-3279.
7. Wu. *Proc Natl Acad Sci U S A*. **2009**, 106, 3000.

**Omics and Activity-Based Protein Profiling**

1. Waters et al. *Nature Biotech*, **2001**, *19*, 242-7 - protein sequencing for proteomics "MudPIT"
2. Link et al. *Nature Biotech*, **1999**, *17*, 676 - MudPIT
3. Henzel et al. *Proc. Acad. Sci.* **1993**, *90*, 5011 - early proteomics
4. *Nature Biotech*. **1999**, 17, 676 – two-dimensional gel electrophoresis
5. *Nature Methods*, **2012**, *9*, 84 – Activity-Based Protein Profiling
6. Wilke. *ACS Chem. Biol*., **2012**, *7,* 1653 – Activity-Based Protein Profiling
7. *PNAS*, **2004**, *101,* 13756 - Example of an ABPP gel
8. Sidebottom, *Current Opinion Chem Bio*, **2015**, 24, 104.
9. Niphakis, *Annu. Rev. Biochem*. **2014**, 83:341–77. ABPP
10. Sidebottom, *ACS Chem Bio*, **2013**, 8, 2009.
11. Abo. *J. Am. Chem. Soc*. **2015**, 137, 7087−7090. Proteomics probes.
12. Backus. *Nature*, *2016*, 534, 570.
13. Speers. *J. Am. Chem. Soc*. **2005**, 127, 10018-10019.
14. *Chem. Rev*. **2013**, 113, 2343.

**Chemical Genetics**
1. Spring, *Chem. Soc. Rev*., **2005**, 34, 472–482.
2. Stockwell, *Nature Reviews Genetics*, **2000**, 1, 116.
3. Kocaoglu, *Antimicrob Agents Chemother* **2015**, 59:3548 –3555.

**Protein Imaging**
1. Kocaoglu. *Nature Chemical Biology*, **2016**, 12, 472.
2. Kocaoglu, *ACS Chem Bio*, **2012**, 7, 1746.
3. Adams. *J. Am. Chem. Soc*. **2002**, 124, 6063-6076
4. Beatty. *J. Am. Chem. Soc*. **2005**, 127, 14150-14151
5. Ray, *ChemBioChem* **2010**, 11, 2089 – 2091.
6. Kuru, *Angew. Chem. Int. Ed*. **2012**, 51, 12519 –12523
7. Rush. *ChemBioChem* **2010**, 11, 2096 – 2099.

**Fluorescence**
1. Lavis L., R. Raines, *ACS. Chem. Biol.* **2008**, 3, 142 - Brightness and fluorophore table
2. Minta et al. *J. Biol. Chem.* **1989**, *264,* 8171
http://www.youtube.com/watch?v=u63eZz8R0GI – Imaging the glycome movie (selected parts)

**Fluorescence Polarization**
1. *Chembiochem*. **2009**, 10, 990-3 – Cell permeable β-peptide inhibitors of P53
2. *Anal. Biochem*. **2004,** 331, 138-46 - Fluoresce polarization to monitor protein antagonist interactions
3. Wilke. *ACS Chemical Biology*, **2015**, 10, 328.

**FRET**
1. *J. Biol. Phys.* **2008**, *34*, 487-93 – Principles of FRET Pairing
2. Pauker et al. **2012**, *5*, *Science Signaling*, *5*, 1 - In-cell 3 way FRET

**Multidimensional NMR**
1. Shuker. *Science* **1996**, 274, 1531- Advances in HSQC NMR
2. Freire. *J. Am. Chem. Soc.* **2008**, 130, 7840 - NMR solution structure and 2D NMR analysis
3. *J. Biol. Chem*. **2002**, 277, 4316 – Exploring the binding sight of MLL with HSQC
http://www.nmr.chem.uu.nl/~abonvin/tutorials/Assignment-Data/assignment.html - tutorial on HSQC $^{1}H$-$^{15}N$

**Protein Hot Spots and Disulfide Tethering**
1. Clackson, Wells, *Science*, **1995**, *267*, 383 - Identification of "Hot Spot" residues by Alanine Mutagenesis
2. Erlanson, *PNAS*, **2000**, *97*, 9367 - Applications of "disulfide tethering"
3. *J. Am. Chem. Soc*., **2003**, *125*, 3714 – Discovery of potent small molecule IL-2 inhibitor though fragment assembly
4. *PNAS*, **2006**, *103*, 15243 - Hot spot determination by site-specific amino acid mutations
5. Tsukiji. Nat Chem. Bio. 2009, 5, 341.

**Additional Topics of Interest**

**DNA and RNA: Why Nature Chose Phosphates**
1. *Science*, **2011**, *332*, 1163 – Arsenic instead of phosphorus as DNA building block
and 2012 released review: http://www.usatoday.com/story/tech/columnist/vergano/2013/02/01/arseniclife-peer-reviews-nasa/1883327/

2. E. Landers. *Nature ,* **2001**, 860, 91 - Mapping the human genome
   C. Venter. *Science,* **2001**, 1304 – Mapping the human genome
3. *Science,* **1987**, *235*, 1173-8 - Hydration rates of amides, esters, and phosphates; why Nature chose phosphates
4. *Nature*, **2012** *489*, 57 - Analysis of all functional DNA beyond 23,000 genes: Encode Project

**Circular Dichroism and Protein Stability**
1. Pace et al. *Prot. Science,* **1995**, *4*, 2411 - Protein Concentration determination
2. Farood. *PNAS***, 1993**, *90*, 838 – Single amino acid mutation distorts protein structure; the power of CD
3. *JACS,* **2007,** *129* 2456 - Understanding CD and determining % helicity
4. Ahmad. *Biochem. J.* **1992,** 287, 481–485 - Guanidinium chloride denaturation to determine $\Delta G_u$
   Pace et al. *Biochemistry* **1979**, *18*, 288

**Reference Texts**: **Available in Walter Library**

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.

Experiments in the Purification and Characterization of Enzymes: A Laboratory Manual, Thomas A. Crowley and Jack Kyte, Elsevier, 2014, and related literature.

Biochemistry, Berg, Tymoczko, and Stryer, W. H. Freeman; 7th edition and related literature.

**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

**Assignment Submission:** Points will be taken off when assignments are late. The respective grade will be reduced by 20% (e.g., 20 points if it is out of 100) the first 24 hours of being late and then reduced 10% per additional workday of being late. 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 work on time. There is no excuse for a "failure to communicate" in advance of a deadline.

8411 students are responsible for writing two 2 paragraph summaries, each on one research seminar of their choosing related to chemical biology. Summaries are due up to two weeks following the seminar. Find seminar schedules on campus here: https://sites.google.com/a/umn.edu/chemicalbiology/chembiosem

All students are responsible for writing a scientific abstract of one ACS Chemical Biology article. Sign up ACS Chemical Biology ASAP alerts for the first part of the assignment! http://pubs.acs.org/page/follow.html

| **Grading** | **4411 (3 credits)** | **8411 (4 credits)** |
|---|---|---|
| **Quizzes** | 10% | 10% |
| **Problem Sets/Assignments** | 20% | 30% |
| **Midterms** | 40% (20% each) | 40% |
| **Final** | 30% | 20% |

**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 below.

Final Grade: Total Percentage
A 90 – 100
A- 85 - 89.9
B+ 80 – 84.9
B 75 – 79.9
B- 70 – 74.9
C 65 – 69.9
D 60 – 64.9
F < 60.0

**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.

**Reference Texts**: Although the instructor will provide a large number of resources, you will need to find additional 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.)

**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/default/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."

**Disability Accommodations:** The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact Professor Carlson 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/.

**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.

**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:
http://regents.umn.edu/sites/default/files/policies/SexHarassment.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/default/files/policies/Equity_Diversity_EO_AA.pdf.

**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/default/files/policies/Student_Conduct_Code.pdf) In this course, direct copying of assignments or fabricating lab data will be considered dishonest and the proper sanctioning guidelines will be followed (http://www.oscai.umn.edu/integrity/faculty/Sanctioning%20Guidelines.pdf). If it is determined that a student has cheated, he or she 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/Policies/Education/Education/INSTRUCTORRESP.html.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional questions, please clarify with Professor Carlson or the TAs.

**Makeup Work for Legitimate Absences:** Students will not be penalized for absence 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. For complete information, see: http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html.

**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/Policies/Education/Education/STUDENTRESP.html.

**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. Carlson for further information.

If you feel you are having troubles or concerns about the class, please feel free to contact Prof. Carlson or the TA; 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.