

*Syllabus*  
**CHEM 4601- GREEN CHEMISTRY**  
*Spring 2017 (3 credits)*

**Instructor:** Prof. Jane Wissinger ([jwiss@umn.edu](mailto:jwiss@umn.edu))

**Teaching Assistant:** Craig Van Bruggen ([vanbr031@umn.edu](mailto:vanbr031@umn.edu))

**Meeting Times:** M/W, 2:30 - 3:45 pm, Bruininks 512B

**Office Hours:** Thursdays 1:30-2:30 pm, plus one TBD, and by appointment.

**Pre-requisites:** CHEM 2302

**Text:** Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*; Oxford University Press: New York, **1998** (“A&W” in the lecture plan).

**Overview:** Green chemistry has been defined as “the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products.”<sup>1</sup> After reflecting on the historical perspective that transitioned the environmental movement from cleanup to prevention, we will learn about the principles of green chemistry and chemical engineering and their modern application in both academia and industry. Green chemistry metrics will be defined to help quantify improved processes. Throughout, we will emphasize relevant implications for the environment, technology, and public policy. Case studies will be used to illustrate the use of alternative feedstocks, reagents, and reaction media, recent developments in environmentally benign catalysis and synthetic methods, and broader considerations of energy utilization. Important contemporary issues include biodiesel/ethanol production and use, CO<sub>2</sub> generation and carbon footprint, and predicting and understanding the toxicity of materials and contaminants of emerging concern (CECs) in the environment (e.g. pharmaceuticals, personal care products, and endocrine disruptors). Guest speakers from both industry and academia will join the classroom for a broad perspective of research. In addition to the assigned textbooks, primary scientific literature will provide the background for class discussions and learning.

**Goal:** My goal is for each student to gain skills and knowledge in the areas of green chemistry and sustainability relevant to their future career aspirations – minimally as an educated citizen of society. Therefore, ample opportunity will be provided to select topics of personal interest and delve deeper on those topic(s) on an individual basis. No one person can be an expert in all areas of green chemistry but this course should provide a base of knowledge and understanding of resources and directions of innovations in green chemistry and green engineering for future awareness. Ultimately, the current green chemistry community of scholars hopes that the term “green chemistry” becomes obsolete because ALL chemistry will be approached with the 12 principles in mind.

**Grading:** Each student’s grade will be determined as follows:

Green Chemistry Minute Presentation	12.5%
Quizzes (pre-class readings and lectures, ~7, one drop allowed)	15.0%
Homework assignments and in-class group work*	12.5%
Seminar attendance/report (> 40 minute seminar/webinar on an approved topic)	5.0%
Term Paper 2500–3000 words (including drafts and peer reviews)	35.0%
<b>Final Examination</b> (Tuesday, May 9, 2017, 8:00-10:00 a.m.)	<u>20.0%</u>
	100.0 %

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<sup>1</sup> “Green Chemistry: Theory and Practice” (P.T. Anastas and J.C. Warner, Oxford University Press, 1998, p. 11.

## Assignments:

*Quizzes:* There will be two types of quizzes: In-class, unannounced pop quizzes on reading assignment for the day and online quizzes based on flipped lecture content. Make-ups for missed in-class quizzes will be available to students with documented excused absences only.

*Homework assignments:* Homework assignments will be scattered throughout the semester and details, with due dates, posted on the Moodle course site. Another example is searching EPA databases for information on chemicals of concern. Late assignments will not be accepted unless the assignment is late due to a reason consistent with an excused absence.

*Green Chemistry Minutes:* Each student will give a 4-minute presentation to the class on a news segment from the popular media (newspapers, web) that discusses an issue germane to green chemistry. After the presentation, time for questions/comments by the instructors and/or classmates will be allotted. Two or three such presentations will be given on most class days; each student will sign up on the Moodle site for a time slot by the end of the first full week of class. If a student has to be absent for the presentation for a documented reason (e.g., note from a doctor), the presentation will be rescheduled for the soonest possible class time. No more than 5 slides (e.g. PDF or PowerPoint) should be used in each presentation, which will be presented from the student's device (or the instructor's) to the entire class. A PowerPoint version of the slides should be uploaded to the assignment file drop link by 12:00 of the day of presentation. The file will be posted for registered enrollees to view on the Moodle site. **The presentation should concisely describe the news item, its significance, how it relates to green chemistry, and what future implications it portends.** The grade on the presentation will be based on how well these parameters are addressed, as well as its clarity and organization. Each student will receive detailed feedback regarding how effective the presentation was, the quality of the content, and the professionalism with which the presentation was delivered and questions were fielded.

**Paper (2500-3000 Word).** Each student will be required to prepare a paper on a green chemistry topic and to participate fully in the peer review and drafting process described below.

### General guidelines

The paper should be well-organized, well-researched, and well-written. Use your own words (no plagiarism!) and reference articles correctly. The topic will be chosen from the list provided by the instructor, and the paper should initially explore the area and then a suitable, specific sub-topic should be chosen and investigated. The material should go beyond what was discussed in class.

### Format

The length should be no less than 2,500 and no more than 3,000 words (not including references); figures should be used as needed but will not count toward the word count. The text should be 12-point Times or Times New Roman, 24 point exact spacing, 1" margins, and all pages numbered. At least 10 journal articles (excluding web citations) must be obtained and referenced, and of these at least half must be from 2006-present. Both general and specific references should be cited. The paper should be submitted electronically as a single PDF via download on the Moodle site. It is suggested that the paper begin with a brief summary/abstract, an introduction, a discussion of the material learned, conclusions (comments, important results, critical evaluation, future implications, etc.), and the references (include article titles and format according to the ACS Style Guide, which is available electronically through the U of MN library web pages).

Grading and Due Dates: Check the course website for updates on dates and details.

Late submissions will not be accepted unless the assignment is late due to a reason consistent with an excused absence. Please contact Prof. Wissinger in advance of a due date should you have concerns about submitting on or before the due date associated with each step of the paper.

- 1/30 (Monday): List of top 4 specific topic choices in order of preference. Beginning of class.  
2/13 (Monday): Tentative title and 1 paragraph summary with sample references. Upload by 2:30 p.m.(10 points).  
3/10 (Friday): Draft 1 Upload by 5:00 p.m. (20 points).  
4/10 (Monday): Peer reviews. Each student will read two drafts by their peers and will provide a review of each using a specified rubric (10 points each (20 pts)).  
5/1 (Monday): Final version, Upload by 2:30 p.m. (50 points).

General topic list as starting point for a subtopic:

- Biorenewable polymers
- Bioremediation
- Phthalates
- Bisphenol-A
- Endocrine disrupters
- Obesogens
- Use of benign solvents
- Waste reduction strategies
- Biomass as a feedstock
- Chemical regulations
- Biofuels
- Use of earth-abundant, non-toxic metals
- Green nanotechnology
- Green materials synthesis
- Chemistry of Sustainable Energy
- Green chemistry education
- Alternative energy sources
- Green chemistry in the Pharmaceutical Industry
- Presidential Green Chemistry Challenge Awards
- Recycling of materials and chemicals
- Degradable Materials
- Biomimicry
- Solvent-less Reactions
- High-efficiency catalytic transformations
- Toxic chemicals in the environment
- Green Chemistry Metrics
- Computational Prediction of Toxicity

**Writing resources:** An appointment with a writing lab tutor may help you write your best possible paper for this course. Take a copy of the above information as well as a copy of your current draft with you for the tutor to read. Tutors will offer suggestions for revisions to improve clarity and better meet your needs and the requirements of the assignment. Make the appointment earlier rather than later! Center for Teaching and Learning Services: <http://writing.umn.edu>

### Course Policies

**Policy for “I” (Incomplete) Grades:** An incomplete may be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., hospitalization) a student is prevented from completing the work of the course on time. Students who have an EXCUSED ABSENCE from the Final Examination, and have a passing grade on all other assignments in the course (paper, quizzes, etc.), *may* be eligible to receive a grade of "I". This grade is not routinely assigned. An “I” grade may only be made up by obtaining a signed agreement involving the instructor and student outlining a specific plan for completing the course requirements.

**Scholastic Dishonesty Policy:** You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty includes 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, professional endorsement, or an excused absence; altering, forging, or misusing an excuse or 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](http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.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>.

All incidents will be reported to the Scholastic Conduct Committee – no exceptions.  
A student guilty of scholastic dishonesty will be awarded a grade of zero (0) for the work involved and that score will not be dropped in calculating the final course grade. If the misconduct occurred on any portion of the final exam, for example, a grade of zero (0) will be recorded for the entire exam (100 points total). If the misconduct occurred on any portion of the *2500-3000 Word Paper*, a grade of zero will be recorded for at least the step involved but may be recorded for the entire assignment (total of six steps), depending on the severity of the misconduct.  
Plagiarism guidelines: <http://writing.umn.edu/tww/preventing/definitions.html>.

If in doubt, please ask! No one will be penalized for asking questions about plagiarism or other forms of academic misconduct.

**Turnitin.com:** All drafts and papers will be submitted through the Turnitin.com plagiarism feature on the Moodle course website.

**Late submissions:** Late assignments will be accepted only with prior communication with Professor Wissinger. Late submissions due to reasons consistent with excused absences will be awarded the full grade earned. Late submissions due to reasons outside of an excused absence will be awarded the grade earned minus 20% for each day late. If you encounter a problem with submitting an assignment on time, contact me immediately.

### **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](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."

### **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. Please turn off phones, pagers, and other text devices during class.

**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/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>.

**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.

Additional resources: [http://regents.umn.edu/sites/default/files/policies/Equity\\_Diversity\\_EO\\_AA.pdf](http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf)  
<http://www.chem.umn.edu/diversity/>

**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:**

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".