Syllabus
CHEM 4601, "Green Chemistry," Spring 2011 (3 credits)

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."[1] After discussing this and other definitions, this course will survey key aspects of green chemistry in modern research and development both in academia and industry, as well as relevant implications for the environment, technology, and public policy. Case studies will be emphasized that 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, government regulation, and the impacts on biogeochemical processes. In addition to the assigned textbooks, source material will include primary literature.

Instructors: Prof. William Tolman and Prof. Marc Hillmyer

Meeting Times: T/Th, 1hr 15min slot TBD

Pre-requisites: Senior status (as defined by credits), chemistry major

Grading: One midterm exam (in class, week 8, 100 points), Writing Assignment (due week 11, 100 points), Poster Presentation (due week 15, 100 points), Final Exam (100 points). Note: the poster presentation will be a group project, involving the preparation and oral presentation of a professional-quality poster on a topic in green chemistry.

Office hours: Yes. TBD

Scholastic Dishonesty Policy: "Scholastic dishonesty is any act that violates the rights of another student with respect to academic work or that involves misrepresentation of a student's own work. Scholastic dishonesty includes (but is not limited to) cheating on assignments or examinations, plagiarizing (misrepresenting as one's own anything done by another), submitting the same or substantially similar papers (or creative work) for more than one course without consent of all instructors concerned, depriving another of necessary course materials, and sabotaging another's work." — *Classroom Grading and Examination Procedures, College of Liberal Arts.*

> 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. Furthermore, the incident will be reported to the Scholastic Conduct Committee of the college in which the student is enrolled.

Texts: Lancaster, M. *Green Chemistry: An Introductory Text*; The Royal Society of Chemistry: Cambridge, UK, 2002, and Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*; Oxford University Press: New York, 1998.

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[1] "Green Chemistry: Theory and Practice" (P.T. Anastas and J.C. Warner, Oxford University Press, 1998, p. 11.

Class Schedule:

Week	Topic	Primary Reading*
1	Introduction, Principles & Concepts of Green Chemistry	Lancaster, Chapter 1
2	Historical context: The Greening of Chemistry	
3	Waste: Production, Problems, Prevention	Lancaster, Chapter 2
4	Measuring and Controlling Environmental Performance	Lancaster, Chapter 3
5	Catalysis and Green Chemistry: Introduction, Basics of Organometallic Chemistry & Catalysis	Lancaster, Chapter 4
6	Catalysis and Green Chemistry: Oxidations and Reductions	Lancaster, Chapter 4
7	Catalysis and Green Chemistry: C-C Bond Formation	Lancaster, Chapter 4
8	Organic Solvents: Environmentally Benign Solutions (Focus on Water and Ionic Liquids)	Lancaster, Chapter 5
9	Organic Solvents: Environmentally Benign Solutions (Focus on fluorous solvents and supercritical CO_2)	Lancaster, Chapter 5
10	Renewable Resources: What's Available?	Lancaster, Chapter 6
11	Renewable Resources: Chemicals from Biomass	Lancaster, Chapter 6
12	Sustainable Polymers: The Case of Polylactide	
13	Sustainable Polymers: Using CO_2 and other feedstocks	
14	Green Chemistry and Public Policy	
15	Poster Presentations	

* Additional readings TBA.

Additional Resources

- *Chem. Rev.* **2007**, *107*, 2167-2820 (special issue on Green Chemistry)
- Ahluwalia, V. K. *Green Chemistry: Environmentally Benign Reactions*; CRC Press: Boca Raton, FL, 2008.
- Ahluwalia, V. K.; Kidwai, M. *New Trends in Green Chemistry*; Kluwer Academic: Dordrecht, The Netherlands, 2004.
- Anastas, P.; Horvath, I. T. *Chem. Rev.* **2007**, *107*, 2169-2173.
- Anastas, P. T.; Kirchhoff, M. M. *Acc. Chem. Res.* **2002**, *35*, 686-694.
- Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*; Oxford University Press: New York, 1998.
- *Renewables-Based Technology: Sustainability Assessment*; Dewulf, J.; Langenhove, H. V., Eds.; John Wiley & Sons, Ltd.: Chichester, UK, 2006.
- Doble, M.; Kruthiventi, A. K. *Green Chemistry and Engineering*; Elsevier: Burlington, MA, 2007.

- Lancaster, M. *Green Chemistry: An Introductory Text*; The Royal Society of Chemistry: Cambridge, UK, 2002.
- Manahan, S. E. *Green Chemistry and the Ten Commandments of Sustainability*; ChemChar Research, Inc.: Columbia, Missouri, 2005.
- Sheldon, R. A.; Arends, I.; Hanefeld, U. *Green Chemistry and Catalysis*; Wiley-VCH: Weinheim, 2007.
- *Renewable Resources: Scope and Modificaiton for Non-Food Applications*; Stevens, C. V.; Verhé, R. G., Eds.; John Wiley & Sons Ltd.: West Sussex, 2004.
- *Methods and Reagents for Green Chemistry: An Introduction*; Tundo, P.; Perosa, A.; Zecchini, F., Eds.; John Wiley & Sons, Inc.: Hoboken, NJ, 2007.