



Catalyzing sustainability:

Emerging fields in green chemistry

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Green
Chemistry
Institute



Overview



- Background
- Research
- Education
- Industrial Implementation
- Outreach & Communication



Green Chemistry and the Institute



- **Green chemistry** is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances.

- **Mission:** to advance the implementation of green chemistry and engineering principles into all aspects of the chemical enterprise
 - Research
 - Education
 - Industrial Implementation
 - Communication

- www.greenchemistryinstitute.org



Green Chemistry = Responsibility



- Why is there no ‘Green Geology’ or ‘Green Astronomy’? Because chemistry is the science that introduces new substances into the world and we have a responsibility for their impact in the world.”

- Ronald Breslow



Green Chemistry is also called...



- A new approach to designing chemicals and chemical transformations that are beneficial for human health and the environment
- An innovative way to design molecules and chemical transformations for sustainability
 - Meeting the needs of the current generation without compromising the ability of future generations to meet their own needs
- Benign by design
- Pollution prevention at the molecular level



New Way of Thinking



- The most fundamental approach to preventing pollution
- Recognizes the importance of incremental improvements
- Risk = $f(\text{Hazard} * \text{Exposure})$
- Focuses on the intrinsic versus the circumstantial



Circumstantial vs. Intrinsic

Recognize hazard as a design flaw



□ Circumstantial

- Use
- Exposure
- Handling
- Treatment
- Protection
- Recycling
- Costly

□ Intrinsic

- Molecular design for reduced toxicity
- Reduced ability to manifest hazard
- Inherent safety from accidents or terrorism
- Increased potential profitability



Twelve Principles of Green Chemistry



1. Prevention
2. Atom Economy
3. Less Hazardous Syntheses
4. Design Safer Chemicals
5. Safer Solvents
6. Design for Energy Efficiency
7. Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time Analysis
12. Inherently Safer Chemistry



Research Objective



- Increase research activity and funding in green chemistry and elucidate the benefits of green chemistry research
- Partnerships
 - Colleges and Universities
 - Independent Researchers
 - Government Agencies
 - Industry Roundtables



- Online database providing green chemistry technologies and information
 - Initial input of the 57 winning technologies from Presidential Green Chemistry Challenge Awards
 - **Expected Launch – September 2006**
 - **greenchemex@acs.org**
 - Designed for streamlined addition of new entries
- Users can:
 - Submit entries through the Contribute page
 - Receive notifications when new entries are added
 - Search by industry sectors, chemicals/materials, green chemistry keywords, and text



Greener Analytical Methods in NEMI



- National Environmental Methods Index will incorporate a “greener” criterion for each method
- Users compare and select methods based on environmental impact, in addition to performance criteria
- Entry of new methods will incorporate “greener” criterion
- www.nemi.gov



Centers at Research Institutions



- Center for Green Oxidation Chemistry
Carnegie Mellon University
- Center for Green Chemistry
University of Massachusetts, Lowell
- Alliance for Global Sustainability
Harvard
- Centre for Green Chemistry
Monash University (Australia)
- ETC...



Education Objectives



- Increase awareness and understanding of green chemistry principles, alternatives, practices, and benefits.
- Integrate the principles of Green Chemistry & Green Engineering into the curricula.
- Equip chemists to meet tomorrow's scientific challenges.

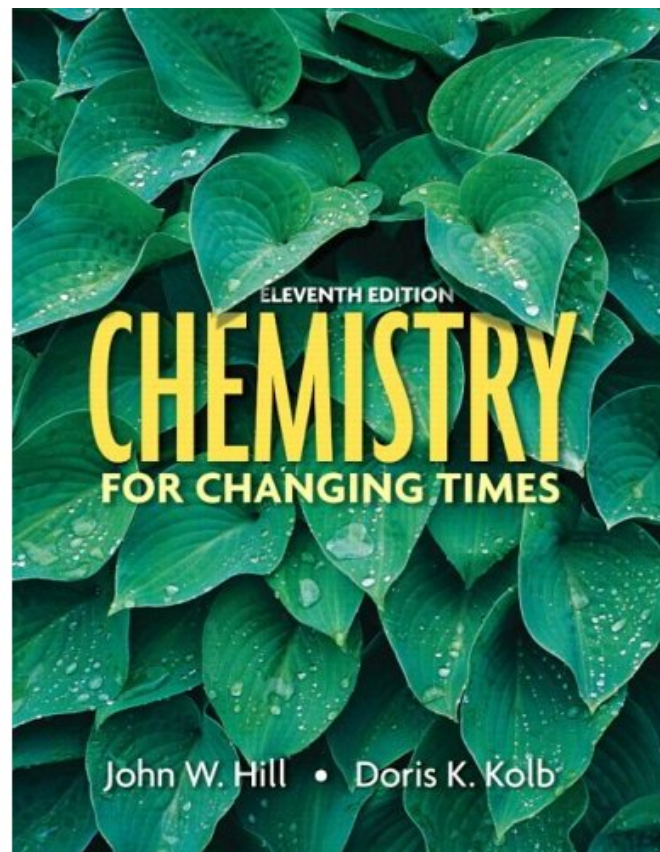


Textbook Project



Chemistry for Changing Times

- ❑ Create end-of-chapter, "MediaLab" web exercise on a Green Chemistry topics for the 11th edition of the Prentice Hall non-majors textbook
- ❑ Engage leading Green Chemistry educators from all over the U.S.A.
- ❑ Integrate Green Chemistry into mainline text
- ❑ Promote Green Chemistry to general audiences





Green Chemistry Education State-of-the-Art Symposium



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- 232nd ACS National Meeting
- San Francisco, California
- **Wednesday, September 13**
- The all-day session will feature:
 - Experienced green chemistry educators
 - Tools & techniques for different academic settings
 - Resources & materials for different educational levels



Industrial Objectives



- Catalyze the implementation of green chemistry practices in industry through strategic partnerships and promotion of best practices
- Partnerships
 - Six Fortune 100 companies
 - Traditional chemical companies
 - Consumer products companies
 - Large retailers
 - Government Operations



Industrial Implementation Activities



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- Training workshops
- Technical consultation
- Strategic planning
- Working with the supply chain
- Review of technical tools
- Review of technical analyses



Pharmaceutical Roundtable (GCIPR)



- A coalition between the ACS Green Chemistry Institute (GCI) and pharmaceutical corporations united by a shared commitment to integrate the principles of green chemistry and engineering into the business of drug discovery and production.
- **Mission:** To catalyze the implementation of green chemistry and engineering in the pharmaceutical industry globally.
- **Strategic Priorities**
 - Informing & Influencing the Research Agenda
 - Tools for Innovation
 - Education Resource
 - Global Collaboration





Outreach &

Communication Objective



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- Raise awareness of Green Chemistry principles and benefits throughout the chemical enterprise
- Partnerships
 - Internal ACS
 - Government
 - General Press
 - Trade/Technical Press
 - Industrial groups
 - Environmental groups
 - Philanthropic Foundations



Outreach & Communications Partnerships - Activities



- Conference & symposia planning and organizing
- Speaking events
- Radio and print interviews
- Workshops
- Publications



Publications



- NEW: Green Chemistry Letters & Reviews, **Coming Feb 2007**
- Green Chemistry
- Journal of Chemical Education
- Environmental Science & Technology
- Chemical & Engineering News
- Science, Nature, Wall Street Journal, USA Today
- Environmental Health News
- Books...



Upcoming Events



- **1st IUPAC Conference on Green-Sustainable Chemistry**
Dresden, Germany • **September 10-15, 2006**
- **International Conference on Green Chemistry**
Kuala Lumpur, Malaysia • **September 19-21, 2006**
- **International Symposium on Green Chemical Process for Pharmaceuticals** • Montreal, Canada • **October 20-22, 2006**
- **Biopharmaceuticals and Industrial Biotechnology: From Gene Expression to Bioprocessing** • Iowa City (IA) • **October 23-24, 2006**
- **11th Annual Green Chemistry & Engineering Conference**
Washington (DC) • **June 25-28, 2007**
- **3rd International Conference on Green & Sustainable Chemistry**
Delft, The Netherlands • **July 1-5, 2007**
- **1st Asian-Oceanian Conference on Green and Sustainable Chemistry**
Tokyo, Japan • **March 7-9, 2007**



Thank You!



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