The Sustainability Curriculum and Green Chemistry at Wilkes University

Greg Peters
Department of Chemistry
Wilkes University
Wilkes-Barre, PA 18766
23 June 2009
Overview

- Brief introduction to Wilkes University
- Chemistry Department/Degree options
- Sustainability Concentration
  - Definitions
  - Variables
  - Degree Foundation
  - Program Requirements

- Coursework involves new ways of thinking (for a scientist)
Introduction to Wilkes

- Private, independent institution
- 1933 (Bucknell Teachers College)
- ~2500 undergraduates
  - Slightly above average incoming SAT scores
  - Mostly NEPA (~90%); first generation
- Pharm.; MBA; Ed.
- Law School initiative
Chemistry at Wilkes

- Offer both Chemistry and Biochem. Degrees
  - ACS certified (BS); BA options available

- Graduate between 5-15 students per year

- Variety of career paths
  - Industry, grad/professional school, education

- Well equipped (all the typical instrumentation)
  - Just received funding for a 400 MHz NMR
BA Degree Options

Designed with flexibility in mind

- BA in Chemistry—Secondary Ed./Computer Science, Law, Business, Engineering

- BA in Biochemistry—Med School, Dental, other allied Health Science students

- Flexible framework—took a look at ‘green’
Overview of Sustainability

- Sustainability—"meeting the needs of the present without compromising the ability of future generations to meet their own needs"

- General Definition
  - Nothing specific to science
  - Nor chemistry (nor science for that matter)
**Degree Considerations**

- Students need to ‘think’ in sustainability terms; …more than one variable
  - Scientific
  - Economic
  - Political
  - Social
  - Ethical
  - Legal

More than merging the three
Sustainability Degree Track

- Pretty typical “Gen Ed” start
  - Skills component, math/science, humanities, social, arts
- Chemistry Framework
  - Typical year-long courses
  - Lab work not neglected
    - Integrated lab (Inorganic, Biochem, etc)
    - Senior Research, capstone project
- Math and Physics requirements as well
- Program Requirements (~1/3rd of total credits)
  - Four categories
Foundation in Chemistry

- Year-long courses (with the labs) in the traditional areas.
  - Gen Chem, Organic, Analytical, PChem

- Upper level courses
  - Jr. Seminar—professional development, literature review
  - Environmental Chemistry

- Math through Calc III (some take diffy-q)
- Year of calc-based Physics
Lab Experience—Green Chem

- 12 credit hours of lab (including Gen Chem)
  - Introduced Green Chemistry into entire sequence
  - Inquiry-based “Preparation of Biodiesel” lab
  - Other labs with a “Green Theme”
    - Recycling of Copper, Aluminum
    - Colligative properties, kinetics
    - Modeling labs (computer or tinker-toy kits)

- Labs with Analytical, Organic, Physical

- Integrated Lab
  - Combination of disciplines into a more ‘real’ lab experience
  - Elements of biochem, structure, inorganic, env.,
    - Build on Analytical, Organic, Pchem labs
Advanced Lab

- Spring semester…junior year. (Jr. Seminar)
  - Select research advisor
  - Prepare literature review of project BEFORE beginning research in fall of Sr. year.

- Fall semester…conduct research
  - Give a typical 20-min ACS-style talk
  - King’s/Misericordia

- Spring semester…continue project
  - Poster presentation/dinner
Program Requirements

- 39 credits—from four “Areas/Perspectives”
- Builds upon variables discussed earlier
  - Writing Perspective
  - Political/Legal Perspective
  - Ethics and Economics
  - Environmental Perspective
Program Breakdown

Program Requirements:

Area 1—Writing Perspective (3)
___ENG 228 Professional/Workplace Writing (3)
___ENG 202 Technical/Workplace Writing (3)

Area 2—Political/Legal Perspective (6)
___BA 223 Legal Environment of Business (3)
___PS 260 Intro. to Political Thinking (3)
___PS 224 Public Policy Analysis (3)

Area 3—Ethical Perspective (3)
___PHL 250 Philosophy of Science (3)
___PHL 218 Environmental Ethics (*) (3)

Area 4—Environmental Perspective (21)
___EES 210 Global Climate Change (3)
___EES 240 Principles of Environ. Science (3)
___EES 330 Water Quality (4)
___EES 332 Air Quality (3)
___EES 340 Ecology (3)
___EES 271 Env. Mapping I: The GPS (3)
___EES 272 Env. Mapping II: The GPS (3)
___EES 304 Environmental Data Analysis (2)
___EES 398 Topics in EES (1-3)
___ENV 305 Solid Waste (3)
___ENV 315 Soils (3)
___ENV 321 Hydrology (4)
___ENV 351 Wastewater (4)
___ENV 353 Air Pollution (4)
___ENV 354 Hazardous Waste (3)
___ENV 398 Topics in Engineering (1-3)
___ME 322 Engineering Thermodynamics (3)
___ME 325 Energy Systems (3)

Students should check with their advisor to ensure appropriate course sequences/availability.
Writing / Political & Legal

- Writing—Integrated throughout the curriculum
  - Two semesters of Comp (meets Wilkes ‘core’)
  - Senior Research / Jr. Seminar

- One of two courses focused on “Workplace Writing”
  - “real world” writing…variety of formats/audiences etc

- Legal/Political Perspective—new ways to think
  - Training scientists to think about legalities/politics/business?
    - Instead of lawyers/politicians thinking like scientists?
  - Two courses (three options)
Ethical Perspective

- Again…another way to think…often not included in a science curriculum.
  - Philosophy of Science
  - Environmental Ethics

- Choose one of two (could choose both)
Environmental Perspective

- 21 credits…no set track for them either
  - Must work with advisor early to ensure sequential courses
  - Takes classes in EES (Earth/Environmental Science), ME (Mechanical Engineering) and ENV (Environmental Engineering)

- Allows student to choose courses of interest.
  - avoid the ‘jack of all trades’

- Capstone Research project ‘could’ come from these areas, as long as it meets with Dept. approval.
Chem. Dept. Projects

- CFC’s to Inductively Asymmetric Phosphanes
  - Uses CFC as reagent for IAP production
  - Completely consumed (LR)
  - Cl from CFC becomes LiCl

- Porphyrin Chemistry
  - OEP substitution chemistry (battery apps)

- Projects in the ENV/EES Department
Research/Capstone Projects

- Projects from other Departments
  - Arsenic Removal
  - AMD
  - Marcellus Shale Studies
  - Wellwater quality
  - Real-time monitoring of Susquehanna River
Wilkes University has developed a degree track with a sustainability ‘emphasis’.

Coursework stresses new (or sustainable) ways of thinking.

Currently two students in the program; though the degree track < a year old.
Acknowledgements

- Terri Wignot
- Dale Bruns
- Ned Fetcher
- Wilkes University
- The Institute for Environmental Science and Sustainability