Making Pharma Greener: 5 Years of the ACS GCI Pharmaceutical Roundtable

Buzz Cue
ACS Green Chemistry Institute® Governing Board
1155 Sixteenth Street, NW, Washington, DC 20036
www.acs.org/greenchemistry
www.acs.org/gcipharmaroundtable
Purpose

- Membership
- Highlights & Impacts
ACS GCI Pharmaceutical Roundtable

To catalyze the implementation of green chemistry and engineering in the pharmaceutical industry globally
2005 Membership

Pfizer

MERCK

Lilly

ACS Green Chemistry Institute®
Current Membership as of April 2010

AstraZeneca
Abbott
GlaxoSmithKline
MERCK
DSM
Boehringer Ingelheim
Codexis
Lilly
Pfizer
Roche
Dr. Reddy's
Johnson & Johnson
Strategic Priorities

- Informing & Influencing the Research Agenda
- Collaborating Globally
- Educating Leaders
- Developing Tools for Innovation
Informing and influencing the research agenda

• **Key Green Chemistry Research Areas**
  
  – Our paper published in 2007 has been cited 44 times (ISI Web of Science 03/24/10). Ten unique countries are associated with the authors of the 44 papers. Looking forward 2 generations, the paper has impacted 310 papers in the 3 years since its publication.
  
  – Identified as Top Ten Most Accessed Papers in the journal on more than 1 occasion in various years.

• **Research Grant**
  
  – $800,000 awarded since 2007
  
  – "GCI Pharmaceutical Roundtable" has been cited as a funding source in 10 papers. Those papers have been cited a total of 125 times. (ISI Web of Science 03/24/2010) However, in a manual exercise, the Roundtable has identified 23 papers associated with the award funding from the grant.

• **Collaboration with NIGMS**

• **Key Green Engineering Research Areas (being publicized in 2010)**
Key Green Chemistry Research Areas

• Current Reactions
  – Amide Formation
  – OH activation
  – Amide Reduction
  – Greener Mitsunobu reactions
  – Oxidation/Epoxidations

• More Aspirational Reactions
  – C-H activation or aromatics
  – Chiral amine synthesis
  – Asymmetric Hydrogenation
  – Greener Fluorination Methods
  – N-Centered Chemistry

• Key Ideas outside the Reaction theme
  – Solvent-less Reactor Cleaning
  – Greener alternatives to polar aprotic solvents
Research Grant Proposals 2007-2009

Statistics
105 Proposals
71 Universities
Educating Leaders

- Undergraduate workshops
- Articles of Interest (published in *OPRD*)
- Sponsored research lectures at company sites
- Participation in technical conferences
Developing Tools for Innovation

- Defined Process Mass Intensity (PMI)
- Completed 2 benchmarking studies against PMI
- Reagent selection guide
- Solvent selection guide
- CAS collaboration to integrate green search criteria into Sci-Finder
Metrics: Process Mass Intensity (PMI)

\[
\text{Process mass intensity} = \frac{\text{quantity of raw materials input (kg)}}{\text{quantity of bulk API out (kg)}}
\]

Collected for compounds in the *development pipelines* at each company.

The result is a representative snapshot.

*Complete metrics presentation & definitions available at [www.acs.org/gcipharmaaroundtable](http://www.acs.org/gcipharmaaroundtable)*
Process Mass Intensity

Median = 120 kg Material Use/kg API

- Total Solvents (excludes water)
- Total Reactants
- Total Other Process Materials
- Total Water
- Total Material Use
Collaborating Globally

• This was defined as a strategic priority to ensure the Roundtable meets the needs of its members and stays true to the global nature of its mission.

• All activities of the Roundtable are global regarding participation and influence.

• All meetings are online to facilitate global collaboration.

• Commitment to host 1 meeting per year outside of US
  – Switzerland 2010
  – Belgium 2009
  – London 2008
  – London 2007
Opportunity to Influence & Collaborate

- NIH Challenge grant in Green Chemistry
- Collaborative effort with NIH to communicate green chemistry
- Influence editorial policy
Miscellaneous Activities

- Sponsored an academic tour of US and EU member companies
- Met with editors of journals where green chemistry is published to persuade them to incorporate green metrics and solvents into the publication submissions via editorial policy
  - Note: Green Chemistry: Letters and Reviews does this now.
- Met with solvent producers to persuade them to search for greener solvents
- Met with Chem Abstract Services to discuss incorporation of green tools into the CAS search engines
- Expanding remit into biological drugs, drug discovery, chemical engineering and (hopefully) formulation/drug delivery
- Increasingly frequent discussions with US FDA about green chemistry
So, What’s Next?

• Expand the scope of the Roundtable to the entire lifecycle of a drug
  – basic building blocks from renewable sources to fate and effects of the drugs and their metabolites that are excreted into the environment—anything and everything in between

• Support training and education
  – Education of the next generation of pharmaceutical employees
  – Education of the scientists and engineers who work in pharma now
  – Education of the decision makers: CEO’s, CFO’s and senior R&D and manufacturing leaders

• Expand membership to the generic pharma industry, to small and medium pharma companies and to biopharma companies
Contact Information

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