



## Bradley University

***Green Chemistry education and outreach are a labor of love*** — A long legacy of outreach in the Mund-Lagowski Department of Chemistry and Biochemistry at Bradley University is still alive today. By putting on emphasis on the importance of experiential learning, students learn important skills outside the classroom by being involved in scientific demonstrations in their communities.

When John Warner recently visited Bradley University to give the Kolb lecture, it was easy for the Department to recognize the importance of the Green Chemistry Commitment. This sparked an interest within the Department, and led to participation in the conference at the Beyond Benign headquarters in November. The Chemistry and Biochemistry faculty are particularly motivated by the positive philosophy of the Green Chemistry Commitment and dedicated to training a new generation of chemists with a greater awareness of personal and environmental safety in mind. “Every faculty member agreed verbally to include green chemistry initiatives. Our curricula are being re-worked to include more green chemistry” say Professors Dean Campbell and Michelle Fry.

Bradley University has a long history of reaching out to the community through a variety of events. Since the 1970s, the Department of Chemistry and Biochemistry has hosted a High School Chemistry Contest that involves visiting high school students competing on a written chemistry exam and attending a chemistry demonstration show. The faculty have also worked with Bradley University Undergraduate Chapter of the American Chemical Society on the Demo Crew project. Students and faculty in this project have been involved in over 300 outreach events, bringing science to over 32,000 participants since 2007. The Department works to bring aspects of Green and Environmental Chemistry into these events in multiple ways. Top priorities are to maximize safety and minimize environmental hazards associated with the experiments. This includes using lower acid and base concentration and minimizing the use of heavy metals. Discussions of past and present environmental issues such as increasing atmospheric carbon dioxide concentration, ocean acidification, microplastics pollution, and radium contamination of watch-dial painters working with phosphorescent paint have been incorporated into the demonstrations.

To departments looking to join the Green Chemistry Commitment, and improve or start their Green Chemistry outreach efforts, Dean Campbell says: “Use outreach to connect the promise green chemistry offers for solving major issues we as a society face to engage students. Show funding agencies the importance of doing outreach. Local schools love to have university students give demonstrations and its a great place to start your outreach efforts!”

### Why does Bradley University participate in the Green Chemistry Commitment?

#### A way to minimize hazards and recycle reagents

Armed with the Green Chemistry Commitment, hazards have been significantly minimized in the Department of Chemistry and Biochemistry. Highly toxic substances like arsenic, tin, ammonium sulfide, and thioacetamide have been removed from teaching labs and commonplace lab materials such as copper sulfate, dry ice, metal beads, buffer and EDTA solutions are recovered and reused in other experiments.

#### A legacy of outreach

The Department of Chemistry at Bradley University has maintained an open mind when it comes to new ways of teaching their undergraduate students, and outreach has always been held in high regard. This culture is key for sustainable community engagement efforts. “Departmental and institutional support should recognize the value and the importance of outreach – it is a labor of love. Outreach events [serve](#) as a chemical education research tool.”



### What is Green Chemistry?

Green chemistry is the design of chemical products and processes that reduce and/or eliminate the use or generation of hazardous substances. This approach requires an open and interdisciplinary view of material and product design, applying the principle that it is better to consider waste and hazard prevention options during the design and development phase, rather than disposing, treating and handling waste and hazardous chemicals after a process or material has been developed.

## The Green Chemistry Commitment (GCC) is

helping to *transform chemistry education* in college and university chemistry departments that strive to:

- prepare world class chemists whose skills are well aligned with the needs of the planet and its inhabitants in the 21<sup>st</sup> century, and
- design and develop innovative, efficient, and environmentally sound solutions to the safety and effectiveness of chemical products and processes.

The Green Chemistry Commitment offers access to a broad and supportive community of chemistry experts and a flexible framework for green chemistry curriculum and training. With multiple pathways to the implementation of green chemistry education, the Green Chemistry Commitment sets a benchmark to track progress on specific learning and research objectives.

With the GCC, college and university faculty can band together to share resources and experience to shift how and what the next generation of chemists learn. Students will enter the workforce armed with the necessary skills, knowledge, and confidence to be leaders in making the principles of green chemistry standard practice in all fields and sub-disciplines of chemistry.

## Why introduce the Green Chemistry Commitment?

During the last 15 years, individual teachers, professors, and chemistry departments have introduced green chemistry concepts into lectures and lab activities, outreach initiatives, and some have even used green chemistry as the basis for academic research projects. The Green Chemistry Commitment seeks to build on the efforts of leaders in the field and systematically change chemistry education. The Green Chemistry Commitment aims to facilitate and support the development of a consortium program that unites the green chemistry community around shared goals and a common vision to:

- expand the community of green chemists
- grow departmental resources
- improve connections to industry and job opportunities in green chemistry
- affect systematic and lasting change in chemistry education

**“The time is ripe to make Green Chemistry principles part of the norm in our curricula. Our students appear to be very receptive to our moves in this direction.”**

*Quote from Michelle Fry, Department Chair*

**“The goal of Green Chemistry is for the term to disappear and it simply becomes how we practice chemistry.”**

*John C. Warner Co-author of “Green Chemistry: Theory and Practice” and Founder of the Warner Babcock Institute for Green Chemistry*

## Who is part of the Green Chemistry Commitment?

Colleges, universities, and industry leaders from around the world have signed the Green Chemistry Commitment for access to shared up-to-date resources, collaborative discussions and projects, improved curriculum, and accountability to track progress on specific learning and research goals.

The Green Chemistry Commitment is shaped and led by a Faculty Advisory Board comprised of faculty members of chemistry departments from across the United States, representing large and small academic institutions.

The supporting organization for the Green Chemistry Commitment is Beyond Benign ([www.beyondbenign.org](http://www.beyondbenign.org)), a non-profit organization dedicated to providing future and current scientists, educators and citizens with the tools to teach and learn about green chemistry in order to create a sustainable future.

Beyond Benign’s vision is to revolutionize the way chemistry is taught to better prepare students to engage with their world while connecting chemistry, human health, and the environment. Beyond Benign is led by Dr. John Warner, a founder of the field of green chemistry and co-author of *Green Chemistry: Theory and Practice*, and Dr. Amy Cannon, the world’s first PhD in green chemistry.