



UNIVERSITY OF
TORONTO

The University of Toronto

A student-led effort — The Green Chemistry Initiative at the University of Toronto is a student-led group devoted to the promotion of sustainable practices in the chemical sciences. The GCI was founded in 2012 by a group of graduate students looking to learn more about Green Chemistry and how it could be applied to their research and in the chemistry community in creative and engaging ways. The GCI hosts an annual symposium which includes speakers from academia, industry and government, networking sessions, case studies and a poster session. In 2017, the GCI hosted their annual symposium as part of the CCCE, Canada's largest chemistry meeting. Currently, the executive student members of the GCI are working with newly-formed GCI groups at the University of British Columbia and Dalhousie University to establish a Canada-wide partnership of student groups in the planning of meetings at national conferences.

Closer to home, the GCI spearheaded the acquisition of a solvent recycling system for the chemistry research laboratories – today, the department recycles most of the acetone waste generated in the department and returns it to the research groups for free. To strengthen ties to their community, executive members of the GCI have participated as judges in local elementary school science fairs and organized community trash pick up events in partnership with Shoreline Cleanup. This latter event brought together GCI members with the community to pick up over 30 pounds of garbage from a local park. These efforts were recently shared in a blog post authored by the Chemical Institute of Canada.

Members of the GCI have successfully implemented Green Chemistry concepts into various classes, assignments, and organic and inorganic teaching laboratories. This has often been achieved via the well-established Chemistry Teaching Fellowship Program (CTFP) offered by the Department of Chemistry, which bring together a graduate student with a faculty member and provides associated funding to engage in pedagogical improvements to the undergraduate student experience. In addition, members of the GCI annually attend Introductory Chemistry co-curricular mentorship sessions to speak about their work and emphasize the culture of departmental “green thinking”. Although the GCI has been a traditionally graduate student organization, active recruitment of undergraduate students has led to increased membership and visibility in the Department. Next year, the GCI will have the first undergraduate students holding executive positions.

The GCI has been prolific in their online outreach. The group has published an open-access YouTube video series explaining the 12 Principles of Green Chemistry through everyday analogies and has accumulated over 40,000 views spanning over 70 countries. Monthly blog posts have ensured that the GCI have significant visibility and encouraged other similar student groups to develop. Promoting guest blog contributors from other universities serves to increase the GCI's network of Green Chemists.

Why does the University of Toronto participate in the Green Chemistry Commitment?

Teaching the new generation of chemists

Of the 29 past GCI members who have now graduated from the University of Toronto, 10 have continued to directly apply green chemistry and/or sustainability concepts in their current jobs.

To be at the cutting edge of creating new green chemistry educational materials

A top priority for the University of Toronto has been to expose the undergraduate chemistry student body to Green Chemistry in the reaching laboratories. Students explore green halogen sources, recyclable content in consumer goods, solvent and catalyst recyclability, microwave synthesis and the many of the Principles of Green Chemistry including waste prevention, atom economy, and design for energy efficiency.



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 21st 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

“Green Chemistry represents an essential way of thinking, being underpinned by a set of principles and practices that positively impact all aspects of chemistry education and research”

Quote from Professor Andy Dicks

“Green Chemistry is the common thread that joins all of our sub-disciplines together and it is something that all chemists across all fields should be conscious of.”

Quote from Matthew Gradiski, GCI 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), 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.