

GREEN CHEMISTRY COMMITMENT

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**GREEN
CHEMISTRY
COMMITMENT**
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THE GREEN CHEMISTRY COMMITMENT

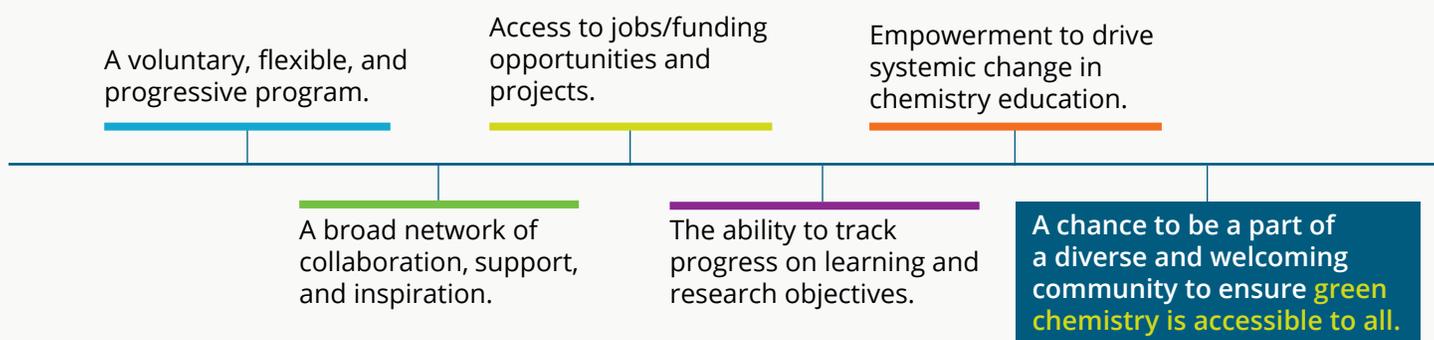
The Green Chemistry Commitment (GCC) program was created in 2013 by [Beyond Benign](#) with higher education faculty members as a framework to **unite, celebrate,** and **empower** the global green chemistry community.

The goal of the GCC is to infuse green chemistry into higher education with the aim to give scientists the required skills to design processes and products less hazardous to human health and the environment.

With the GCC, colleges and universities can inspire

the adoption of green chemistry education on their campuses and worldwide. By combining their strengths, sharing resources, and discussing experiences, institutions can shift how and what the next generation of chemists learn. Students will enter the workforce armed with the necessary skills and knowledge to be leaders in making the principles of green chemistry standard practice in all branches of the chemical sciences, thus helping our society to solve our current sustainability challenges.

THE GCC PROVIDES:



THE FOUR PILLARS OF THE GCC

With the recognition that there are multiple and unique pathways to the implementation of green chemistry at each institution, the GCC provides flexibility within a realistic framework for guiding change in academia. Our Committed Institutions (GCC Signers) are united in the program towards achieving the following four student learning and research objectives:



THEORY: Knowledge of the 12 Principles of Green Chemistry.



LABORATORY SKILLS: Ability to assess processes and products, and design greener alternatives when appropriate.



TOXICOLOGY: Basic principles of toxicology, the molecular mechanisms of how chemicals affect human health and the environment, and the resources to identify and assess molecular hazards.



APPLICATION: Serve society in their professional capacity as scientists, professionals, and citizens through the employment of methods and chemicals benign to human health and the environment.

OPPORTUNITIES AND BENEFITS OF THE GCC



A COLLECTIVE VOICE: The GCC Signers can help to inspire other institutions to get involved with green chemistry and transform their own departments. Through a collective voice, signing institutions can also help to influence other initiatives that affect academia, such as funding agencies, degree program certifying institutions, and other governmental and non-governmental organizations.

TRACKING PROGRESS: The GCC will help to track progress at your own institution as well as progress of the green chemistry education adoption around the globe. Through a list of simple questions realized at the end of each year (our GCC audit), departments can track their past accomplishments and map out future goals.

SHAPING THE GCC: Faculty of participating institutions will have an opportunity to serve on the [advisory board](#) of the GCC, composed of faculty members from chemistry departments worldwide, along with green chemistry professionals from government and industry. The board is responsible for periodically reviewing the student learning objectives, reviewing annual reports, guiding resources for member benefits, and providing direction for outreach and advocacy.

WORKING GROUPS PARTICIPATION: The GCC will host collaborative discussions and working groups comprised of GCC signing institutions and outside experts to advance green chemistry in higher education.

RESOURCES AND GRANTS: The GCC will gather and create resources for faculty, departments, students, and administrators that will be useful for advocating and implementing green chemistry. Some benefits may arise that are open to only signing institutions, including grants for faculty professional development, grants for faculty and students for research and conference presentations.

The encouragement I've received from the GCC community has built my confidence to move forward with the project. I have found my feet and my voice."

- Dr. Andrea Oseolorun, Assistant Professor, Prairie View A&M University



The Green Chemistry Commitment is helping our Department to formalize an existing commitment and is a way for sharing the work that we are doing."

- Anne Marteel-Parrish, Associate Professor and Creegan Chair in Green Chemistry, Department of Chemistry, Washington College



THE URGENT NEED FOR CHANGE

Green chemistry is being adopted widely throughout the chemical industry as a means for addressing pollution at the beginning of the design stages of a product life cycle, thus saving costs and enhancing efficiency. As the global chemicals market doubles by 2030, students and scientists with green chemistry skills:

- Have a tremendous impact on addressing hazards at the design stage of a product.
- Are able to develop innovative, efficient, and environmentally friendly sound solutions for making chemical products and processes safe and effective.
- Present world-class, well-aligned expertise with the needs of the planet and its inhabitants in the 21st century.
- Can design solutions for a sustainable future at the molecular level.

Our industry partners believe in and support the GCC program as the foundation for a chemistry workforce prepared to address our societal and environmental challenges.

Millipore
Sigma

3M

Biogen

DOW

5%

increase in jobs for chemists specialized in green chemistry through 2029.*

**Where the Green Jobs Grow, U.S. Department of Labor, April 2021.*



During the last two decades, individual teachers, professors, and chemistry departments have introduced green chemistry concepts into lectures and lab activities to **support this shift in the chemical industry**. For many, green chemistry is the basis for academic research and outreach. The GCC seeks to build on the efforts of leaders in the field to systemically change chemistry education.

Now more than ever, the role Green Chemistry will play in solving the challenges of today and tomorrow is clear. We need students that are prepared to enter the workforce with the tools necessary to not only solve technical challenges but also address environmental impact simultaneously."

- Jeffrey Whitford, Head of Sustainability & Social Business Innovation and Branding Life Science at MilliporeSigma



In chemistry, it is essential to consider the consequences of our actions. The Green Chemistry Commitment is helping to bring focus to the importance of understanding these consequences and designing chemistry right from the beginning."

- Dalila Kovacs, Professor, Department of Chemistry, Grand Valley State University



THE PARTICIPATING INSTITUTIONS (GCC SIGNERS)

Over 120 institutions around the world participate in the GCC program and have access to shared up-to-date resources, collaborative discussions, funding, and leadership opportunities as well as accountability to track progress on specific learning and research goals.

The adoption of green chemistry education can be carried out through different formats including, but not limited to:

[See Who's Committed!](#)



REVISING EXISTING DEPARTMENTAL CURRICULUM



- Inclusion of green chemistry throughout existing chemistry courses.
- Inclusion of green chemistry exercises throughout laboratory courses.
- Incorporation of green chemistry principles into research projects and programs.
- Building toxicology and environmental health science modules into existing chemistry courses.

CREATING NEW DEPARTMENTAL CURRICULUM

- Development of new courses dedicated to green chemistry.
- Design of toxicology and environmental health science courses.
- Development of a seminar series on green chemistry and/or toxicology.

USING OTHER INSTITUTIONAL OR EXTERNAL RESOURCES

- Encouragement of students to take elective courses in toxicology and/or environmental health sciences from other departments or institutions.



Did you know? 98% of our GCC Signers implement green chemistry into lab courses. General and organic chemistry lectures and labs are the most common courses to implement green chemistry.



The Green Chemistry Commitment is becoming one of several factors driving continued developments in our undergraduate curriculum."

*- Doug Raynie, Research Emeritus Professor,
Department of Chemistry & Biochemistry, South
Dakota State University*



CHECK OUT UNIQUE APPROACHES TAKEN BY SIGNERS IN THE CASE STUDIES BELOW:



UNIVERSITY OF
TORONTO



UNIVERSITY OF MINNESOTA



GCC INITIATIVES

Started in the U.S., Beyond Benign is on a mission to ensure that 25% of U.S. graduating chemists have a background in green chemistry by 2025. The GCC 25x25 Initiative comes at a time when today's societal challenges are immense, as articulated through the United Nation's Sustainable Development Goals (UN SDGs).

A critical component of the 25x25 goal is comprised by the Minority Serving Institutions (MSI) Initiative, which is intended to ensure that the next generation of scientific leaders, prepared to address sustainability through chemistry, are reflective of the diversity of the global community. In this regard, Beyond Benign is also expanding its GCC to universities across the globe.

TRAINING



25%

GRADUATING CHEMISTS IN GREEN CHEMISTRY

BY 2025



Community is important. The GCC helps bring people together through a support network for faculty who are trying to do the right thing."

– Rich Gurney, Professor and Chair, Department of Chemistry and Physics, Simmons College



Did you know? 77% of our GCC Signers have active research groups performing green chemistry in the lab.



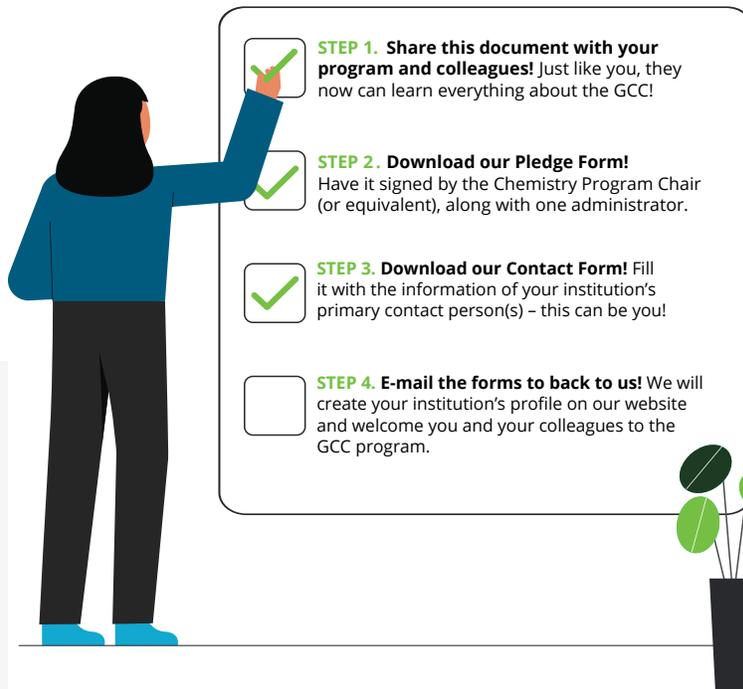
COMMIT TO A SUSTAINABLE FUTURE: BECOME A GCC SIGNER

The GCC is a voluntary, flexible framework for higher education institutions to progressively adopt green chemistry theory and practice. Recognizing that each institution has different capabilities and resources, the GCC strives to unite and support the community towards the achievement of a sustainable future through green chemistry education.

We invite your institution to join the GCC!

Chemistry programs do not have to be perfect in their implementation of green chemistry to sign up, **they just need to commit to continual improvement.**

 **Did you know? After signing the GCC, all we ask is a small, online annual survey to learn about your institution's work in green chemistry, understand future goals, and see how we can support you to achieve them. See the latest results from the 2022 Audit [here](#).**



- STEP 1. Share this document with your program and colleagues!** Just like you, they now can learn everything about the GCC!
- STEP 2. Download our Pledge Form!** Have it signed by the Chemistry Program Chair (or equivalent), along with one administrator.
- STEP 3. Download our Contact Form!** Fill it with the information of your institution's primary contact person(s) – this can be you!
- STEP 4. E-mail the forms to back to us!** We will create your institution's profile on our website and welcome you and your colleagues to the GCC program.



HOW CAN I LEARN MORE?

Visit the GCC website, which contains more information and resources.



Sign up for the GCC informational email series.



JOIN US TO TRANSFORM CHEMISTRY EDUCATION TOGETHER!

Contact Dr. Juliana Vidal, Higher Education Program Manager (juliana_vidal@beyondbenign.org) for questions and/or to submit the [Pledge Form](#) and [Contact Form](#) to join the GCC program.



FAQs

? **Question: What types of institutions or departments can sign the Commitment?**

Answer: The GCC can be signed by any institution that teaches chemistry courses at the higher education level. Whenever possible, we advise the departments of chemistry to sign the GCC. If an institution has a chemistry department, another department at this institution cannot sign without the chemistry department, as this is an institutional Commitment to integrating green chemistry education throughout chemistry courses. If an institution does not have a chemistry department, then the department, school, center, etc., that teaches chemistry courses can be the leader for the Commitment on campus.

? **Question: By signing the GCC, what am I committing to? What is required from me and from my department?**

Answer: The GCC program is built around four student learning objectives that Signers work towards implementing into their programs. Advancing green chemistry at your institution is a journey, and the learning objectives are the overall goals that Signers are committing to incorporating at their institution. Importantly, the GCC Program is not prescriptive. We will not tell you how to implement these learning objectives, nor will we set deadlines for you. We want our Signers to implement the objectives at their own pace and in ways that work best for their department and institution to achieve sustainability. We also call this a Commitment because while you are committing to continual improvement towards a sustainable future, we are also committing to providing you the support you need to integrate green chemistry into your courses.

At the end of the academic year, we send a yearly survey to our Signers to audit the curriculum for green chemistry content. This Audit is not to “assess your progress,” but it is instead meant for us to understand the needs of our Signers and what is working best for them on their green chemistry journeys. Questions in the survey range from the number of students that are taught chemistry in your department to those asking specifically if there are needs you have that are not being met through our support.

? **Question: How can we work to implement the green chemistry student learning objectives?**

Answer: The green chemistry student learning objectives can be implemented through many different pathways. Each institution approaches their integration differently and must find ways that work best for their department, faculty, and resources. We help to share best practices from other GCC Signing institutions to guide others towards tried-and-true approaches. However, we believe that each institution must find its own unique path that works best for them.

? **Question: To what extent will we be committing to sharing teaching resources? Does this include actual materials like slides, or summaries and descriptions?**

Answer: Each institution (and individual) determines how, how much, and how often they share resources with the GCC program, Beyond Benign, and the community at large.

? **Question: Is there a cost associated with the GCC program?**

Answer: There is no cost associated with the GCC program. Participating Institutions (GCC Signers) can apply for grants through the GCC program as they are available.

? Question: Why should a chemistry department that's already incorporating green chemistry sign?

Answer: The GCC is a rallying point that helps individual faculty bring their whole department on board. We have observed that many faculty who have been doing green chemistry for years are often the only ones in their institutions. The GCC is a framework for making a case for adding more faculty members, helping new hires gain green chemistry expertise, and bringing additional resources to the department. It has also helped faculty advocate for additional curriculum changes that have been harder cases to make – such as additional toxicology topics within chemistry courses. The GCC has opened doors to cross-departmental collaborations and engaging with campus sustainability initiatives.

? Question: I am a leader in the field. What are the benefits for me to participate and advocate for the GCC?

Answer: The GCC provides access to networks of like-minded faculty who can collectively advance their goals. As a leader in the field, your institution's involvement will likely inspire others to act. We feature and highlight GCC faculty and institutions and share these with prospective Signers. Our goal is to build a community that empowers people to create change in how they teach and practice chemistry. No single person or institution can do this. Celebrating the differing approaches is something that we also aim to do. Each path is different, and we want folks to be able to see their unique path.

We also do have some very specific “members only” benefits, such as access to grants for faculty to make curricular changes and students to get engaged with green chemistry outreach activities. These offerings continue to grow each year.

? Question: I'm a student. What can I do to bring this to the faculty in my department?

Answer: Students have tremendous influence within higher education institutions and often are catalysts for change towards greener chemistry. Visit our [For Students](#) page to learn more about how you can get involved and advocate for green chemistry on your campus and in your community.



The supporting organization for the GCC is [Beyond Benign](#), a non-profit dedicated to fostering a green chemistry community that empowers educators to transform chemistry education for a sustainable future.

Beyond Benign envisions a world where the chemical building blocks of products used every day are healthy and safe for humans and the environment. Beyond Benign was co-founded 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 Ph.D. in green chemistry.

