



20 Years of Driving Sustainability Globally through  
Green Chemistry

# ACS Green Chemistry Institute Pharmaceutical Roundtable



2025 YEAR IN REVIEW



ACS Green Chemistry Institute  
Pharmaceutical Roundtable

## VISION

Recognizing the connection between human health and environmental health, we are working toward a future where life-changing medicines are produced in harmony with the planet.

## MISSION

The ACS GCI Pharmaceutical Roundtable's mission is to catalyze green chemistry & engineering in the global pharmaceutical industry.

## 2025 MEMBERS

abbvie



AMGEN

AstraZeneca



Biogen

biohaven  
pharmaceuticals

Boehringer  
Ingelheim

Bristol Myers Squibb

FERRING  
PHARMACEUTICALS

EMD  
SERONO

GILEAD

GSK

IPSEN  
Innovation for patient care

Johnson  
& Johnson

Lilly

MERCK  
INVENTING FOR LIFE

NEUROCRINE  
BIOSCIENCES

NOVARTIS

novo nordisk

Pfizer

Roche

sanofi

Takeda

ucb

VERTEX

## ASSOCIATE MEMBERS

CASYMCHEM

axplora  
Reliable partner. Agile explorer.

BACHEM

CatSci  
BEYOND PROCESS CHEMISTRY

ChemExpress

CODEXIS

euroAPI

HIKAL

Hongene  
Biotech

Hovione

I-N-N-O  
S-Y-N  
Tomorrow's chemistry. Today.

Nitto

Avécia  
Pharma Services

康龙化成  
PHARMARON

PharmaBlock

PolyPeptide

PORTON 博腾

Sai

ST PHARM

SK pharmteco

Syngene

WuXi AppTec

## AFFILIATE MEMBERS

ARALEZ BIO

CORTEVA  
agriculture

FMC An Agricultural  
Sciences Company

PHT  
International Inc.

zoetis

usp

## LEADERSHIP



Isamir Martinez, Ph.D.,  
Assistant Director,  
ACS Green Chemistry  
Institute®/ Office of  
Sustainability



Paul Richardson, Ph.D.,  
2025 Co-chair  
Director, Analytical and  
Synthesis Technologies,  
Pfizer



Michael Kopach, Ph.D.,  
2025 Co-chair  
Associate Vice President,  
Lilly

## CELEBRATING 20 YEARS, FORGING THE FUTURE

2025 marked the 20th anniversary of the ACS GCI Pharmaceutical Roundtable (GCI-PR), a truly meaningful milestone for this partnership between global companies and the ACS Green Chemistry Institute® (ACS GCI). Over these 20 years, the collaboration has shown that a competitive industry can come together in a shared commitment to drive sustainability in pharma and beyond.

In honor of the 20th anniversary, we had a series of special events to fulfill our mission of educating future leaders, investing in tools for innovation, and advancing research through our grants program. We collaborated with over 4,000 stakeholders by holding workshops in multiple countries, organizing a summit on the U.N. Sustainable Development Goal Good Health and Well-Being, and reaching audiences in China, India, and beyond through webinars and conferences, and by the many symposia organized.

While 2025 was a chance to celebrate and reflect, we also have been busy preparing a "Roadmap for Sustainable Medicines," which will guide our priorities over the next 20 years and signal to the research community strategic focus areas and collaboration opportunities.

## 2025 HIGHLIGHTS

15

symposia, workshops, and  
webinars presented globally

4,912

total stakeholders engaged in 2025

45

countries reached

\$480,000

distributed in research grants

5

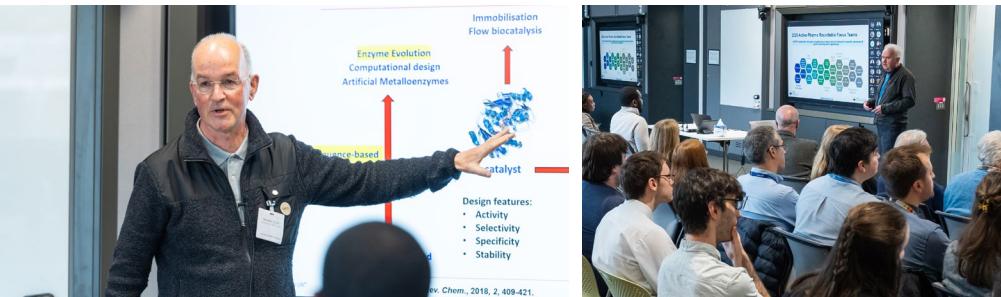
journal publications

5

conferences sponsored

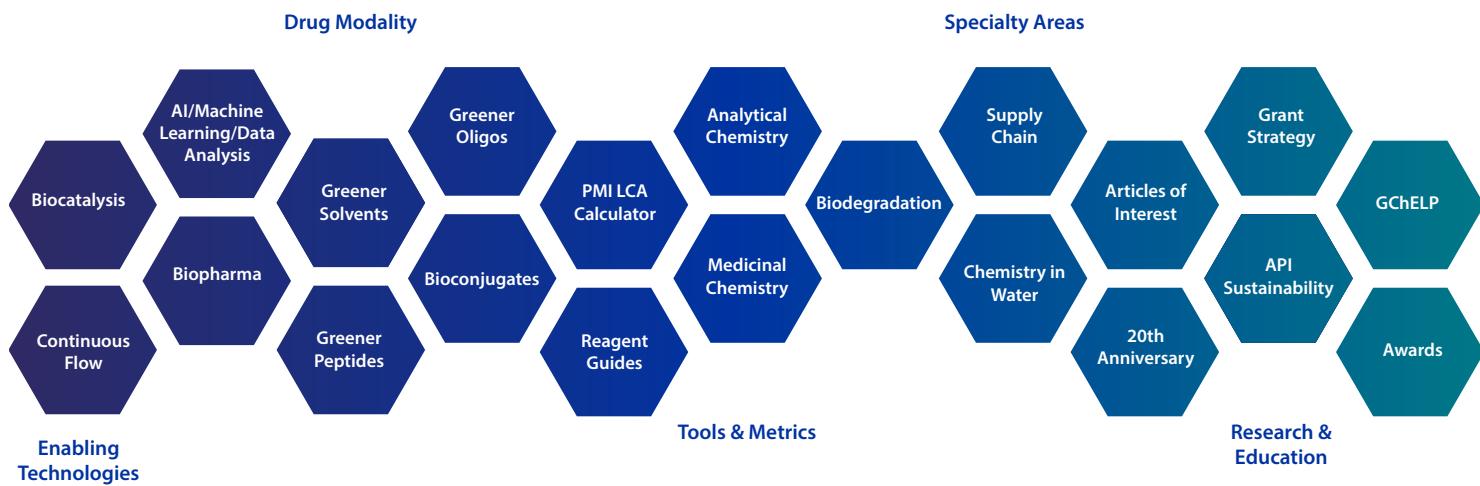
*"Being part of the roundtable provides access to cutting-edge green chemistry tools and reinforces the importance of collaboration on sustainable practices to meet our goals."*

– Frank Roschangar, Boehringer Ingelheim



## 2025 FOCUS TEAMS

In 2025, there were 21 active focus teams co-led by Roundtable members with area expertise. All Roundtable members are encouraged to join focus teams to engage in the activities and outputs of the Roundtable.



## GCIPR MEETINGS: NURTURING COLLABORATIONS, ADVANCING OUR MISSION

The ACS GCI, in collaboration with host companies, organizes three in-person meetings with the Roundtable each year. In 2025, the spring meeting was hosted by AstraZeneca in Macclesfield. The summer meeting was in Pittsburgh, PA during the GC&E conference. The fall meeting was hosted by Sanofi and Takeda in Cambridge, MA. Meetings

averaged 33 in-person attendees and 42 virtual attendees from around the globe (US, Europe, India and China). These interactions nurtured collaborations facilitating the advancement of the Roundtable's mission globally.

Spring Meeting, Hosted by AstraZeneca in Macclesfield, UK



Summer Meeting, Hosted by ACS GCI at the GC&E Conference in Pittsburgh, PA



Fall Meeting, Hosted by Sanofi and Takeda in Cambridge, MA





## ADVANCING THE RESEARCH AGENDA

Each year the ACS GCIPR selects grant topics to further key research priorities. In 2025, proposals were sought to advance greener catalysis, biocatalysis, technologies for manufacturing processes, and greener peptides, as well as for the Ignition Grant Program. From 266 proposals received, eight were funded for a total of \$480,000.

### KEY RESEARCH AREAS, \$80K



#### BIOCATALYSIS

**Alison Narayan**

University of Michigan  
Stereoselective biocatalytic C-C bond formation for 1,2-amino alcohol synthesis



#### PEPTIDES

**Qilei Zhu**

The University of Utah  
*Phosphine Catalyzed Electrochemical Amide Coupling Enabled by Structure Activity Relationships (SARs) Guided Optimization*



#### PROCESS CHEMISTRY

**Leah Spangler**

Virginia Commonwealth University  
*Development of a Low-Cost, Continuous Bioreactor and Process for the Production of Peptide Therapeutics*



#### CATALYSIS

**Rachel Baker**

Queen's University  
*Thinking inside the box: designing sustainable electrochemical cells for alcohol oxidation*

### IGNITION, \$40K



**Soumitra Athavale**

UCLA

*Asymmetric, Biocatalytic Reduction of Unactivated Olefins*



**Philipp Gemmel**

Trinity College (Connecticut)  
*Enzyme-mediated protecting group chemistry: Site-selective deprotection of benzylic ethers*



**Melissa Ramirez**

University of Minnesota Twin Cities  
*Enantioselective Quaternary Carbon Center Synthesis via Cu-Catalyzed Dicarbofunctionalization of N-Tosylhydrazones*



**Kyle Lambert**

Old Dominion University  
*Advancing Operationally Simple and Green Methods for Cobalt-Mediated Carbonyl Additions and Cross-Couplings*

*"The combination of funding along with mentorship from the GCI representatives is unlike other "starter" grants because dialogue taught us about new problems and connected us to potential future collaborators."* — Dan Weix, former grant recipient

### AWARDS



#### 2025 PETER J. DUNN AWARD – Large Molecules Category

**Merck**

From Bottleneck to Breakthrough: Developing a Sustainable and Scalable Manufacturing Process for a Complex ADC Drug-Linker



#### 2025 PETER J. DUNN AWARD – Small Molecules Category

**Corteva**

A Sustainably-Designed Manufacturing Process to Adavelt™ Active from Renewable Feedstocks."



#### 2025 CMO AWARD

**Olon S.p.A.**

Recombinant DNA technology and chimeric protein expression for sustainable production of therapeutic peptides by microbial fermentation.



#### 2025 (Inaugural) DISCOVERY CHEMISTRY AWARD

**Pfizer**

Walk-Up Automated Reaction Profiling (WARP) System: A Tool for Reaction Monitoring Designed for Discovery Chemists



#### 2025 DATA SCIENCE AND MODELING FOR GREEN CHEMISTRY AWARD

**Merck and Sunthetics**  
Igorithmic Process Optimization (APO) for Pharmaceutical Development



## TOOLS AND METRICS FOR INNOVATION

Invested in further development of two key tools:



### Analytical Method Greenness Score (AMGS)

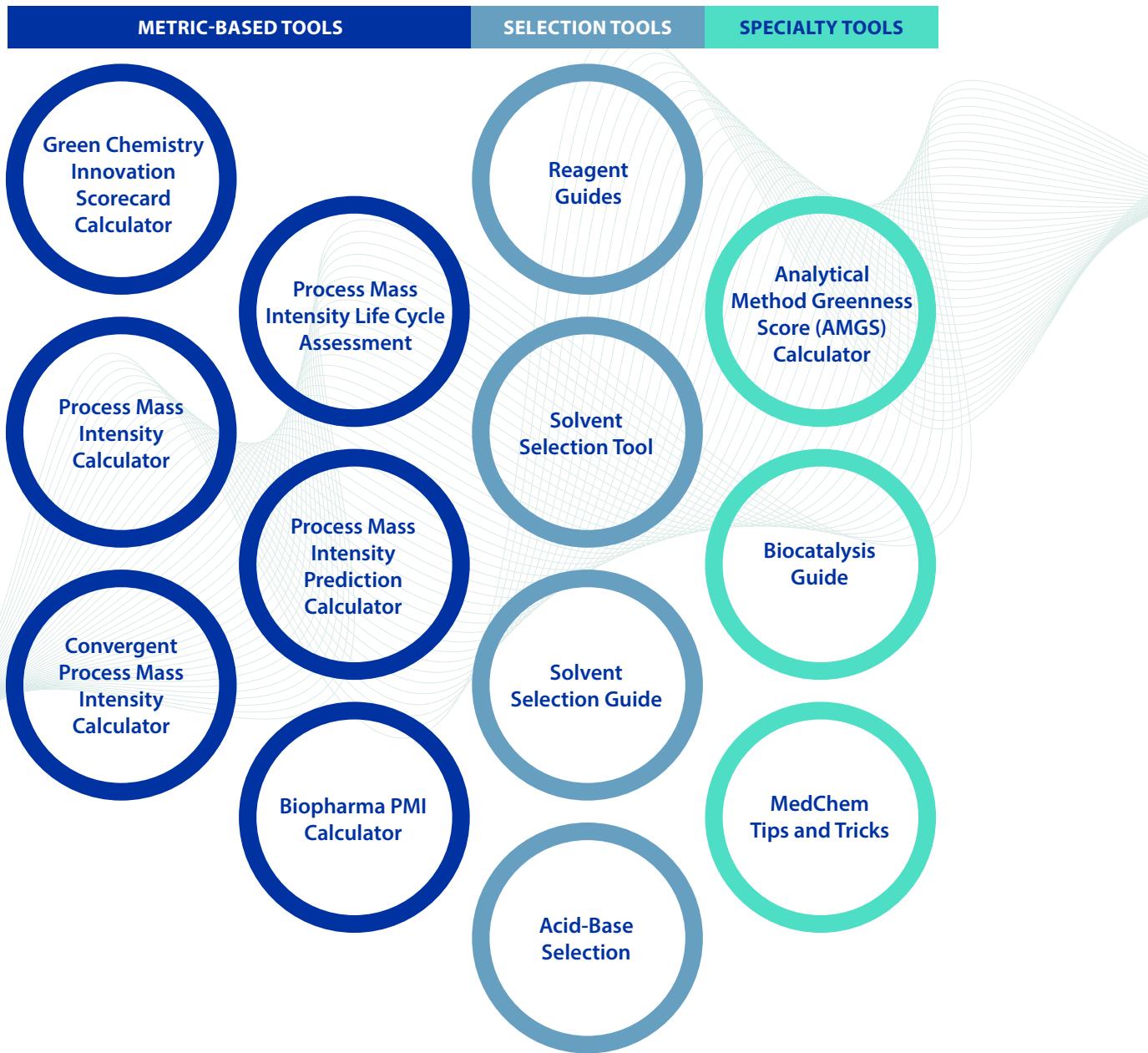
Tool expansion to include Gas Chromatography.



### Process Mass Intensity - Life Cycle Assessment (PMI-LCA) Tool

Development of online and downloadable application-based tool.

## GCIPR TOOLBOX



*"The AMGS [Analytical Method Greenness Score] has driven a move towards sustainable methods, a change recognized not only by separation scientists but also by instrument vendors, smaller contractors, and academics. This is reflected in the diverse range of published papers citing the original AMGS paper, which has reached over 207 citations as of December 2025." – Michael B. Hicks, Merck & Co., Inc.*



20th Anniversary Poster Reception at GC&E



## EDUCATING STUDENTS & INFLUENCING LEADERS



**Green Chemistry & Engineering Conference**  
Pittsburgh, PA

The ACS GCIPR was a key part of the 29th Annual Green Chemistry & Engineering Conference (GC&E) held in June 2025 in Pittsburgh PA. The Roundtable was a Gold Sponsor, provided travel awards to students and academics, held an industry poster session and networking event, and organized 8 symposia and interactive panels.



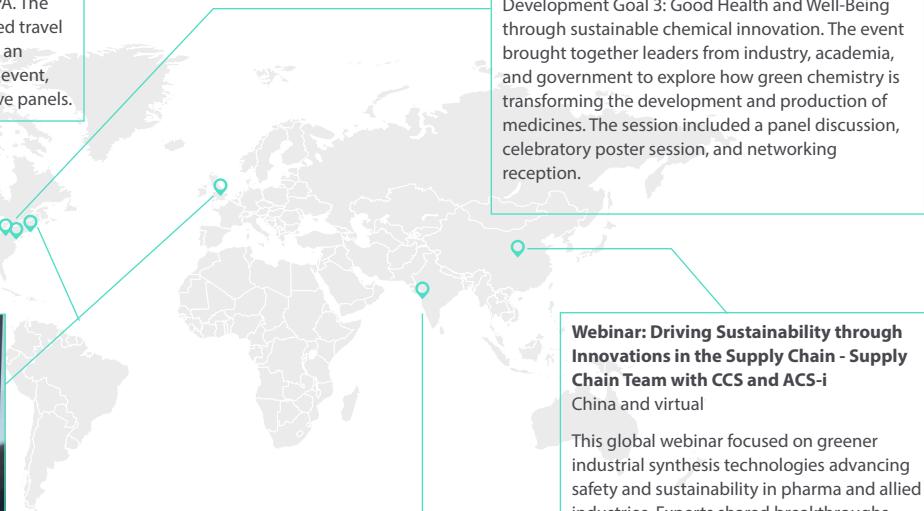
**Good Health and Well-Being: Advancing Good Health through Innovative Chemistry**  
Washington, D.C.

A summit dedicated to advancing U.N. Sustainable Development Goal 3: Good Health and Well-Being through sustainable chemical innovation. The event brought together leaders from industry, academia, and government to explore how green chemistry is transforming the development and production of medicines. The session included a panel discussion, celebratory poster session, and networking reception.



**Driving Sustainability in Pharma and Allied Industries Workshop,**  
Macclesfield, UK and Cambridge, MA

The Roundtable presented two full day workshops in 2025; one hosted at AstraZeneca in Macclesfield, UK and a second at Takeda's campus in Cambridge, MA. These events brought together chemists, university students, and industry leaders to explore cutting-edge industrial green chemistry innovations. Participants gained a better understanding of how to apply green chemistry in practice through learning about Roundtable case studies, tools, and resources, and had an opportunity to engage members during the workshops' poster sessions.



**Industrial Green Chemistry World Conference**  
Mumbia, India and virtual

IGCW highlights success stories to help drive greener manufacturing in chemical industry in India and beyond. Roundtable members presented case studies, greener peptide synthesis approaches, and best practices in medicinal chemistry, demonstrating the practical impact and global relevance of GCIPR resources. By aligning with IGCW, we aim to accelerate sustainable transformation across the chemical and pharmaceutical sectors, strengthening industry-wide adoption of green chemistry solutions globally.

**Webinar: Driving Sustainability through Innovations in the Supply Chain - Supply Chain Team with CCS and ACS-i**  
China and virtual

This global webinar focused on greener industrial synthesis technologies advancing safety and sustainability in pharma and allied industries. Experts shared breakthroughs in continuous flow processes, green hydrogenation, and tools to reduce carbon footprints. Together with ACS-i and the Chinese Chemical Society (CCS), we celebrated the final event of the Roundtable's 20th anniversary year and shared how we plan to drive the next 20 years of sustainable chemistry.

## PUBLICATIONS

**The Evolving Landscape of Industrial Biocatalysis in Perspective from the ACS Green Chemistry Institute Pharmaceutical Roundtable.** ACS Catal. 2025, 15, 12, 10780–10794

**Environmental Sustainability Strategy of Active Pharmaceutical Ingredient Manufacturing: A Perspective from the American Chemical Society Green Chemistry Institute Pharmaceutical Roundtable.** ACS Sustainable Chem. Eng. 2025, 13, 27, 10268–10284

**GChELP: A Vital Resource for Teaching Practical Green Chemistry in Industry and Academia.** ACS Sustainable Chem. Eng. 2025, 13, 27, 10259–10267

**Solvent Sustainability in Drug Discovery: Where Are We Now, and How Can We Improve?** J. Med. Chem. 2025, 68, 24, 25625–25664

**Green Chemistry Articles of Interest to the Pharmaceutical Industry.** Org. Process Res. Dev. 2025, 29, 6, 1361–1372.

**ACS GCI Pharmaceutical Roundtable: 20 years of green chemistry leadership,** Chemistry Today, January/February 2025, 43, 1.

**c&en**  
CHEMICAL & ENGINEERING NEWS

**ACS GCI Pharmaceutical Roundtable reflects on 20 years of growth, collaboration, and sustainable breakthroughs**



## EVENTS APPENDIX

### SESSIONS ORGANIZED AT GC&E

- Advancing Sustainable Processes in Pharma and Allied Industries Utilizing Green Chemistry Innovation
- 20 Years of Sustainable Continuous Flow Chemistry: Lessons Learned
- ACS GCIPR Strategic Planning and Roadmap Development for Sustainable Technology and Operations
- Greener Reaction Systems for Pharmaceutical Manufacturing
- Sustainability in Organic Chemistry: Special Student/Postdoc Session
- Greening the Pharma Supply Chain: Innovations for Early Intermediate/Raw Material Processes
- Peptides, Pepteins, and Proteins: Greener Biomolecule Production and Analysis
- Data Science Applications in Base Metal Catalysis

### ACS CONFERENCES

- ACS Spring 2025, San Diego: Sustainability in Organic Chemistry: 20 Years of the ACS GCIPR Grants Program; Unlocking a New Era: How AI is Transforming Drug Discovery and Development; Practical Green Chemistry Tools and Techniques for Research and Development Scientists
- ACS Fall 2025, Washington, D.C.: Workshop: Practical Green Chemistry Tools for Pharmaceutical Scientists; Good Health and Well-Being: Advancing Good Health through Innovative Chemistry
- 2025 Green & Sustainable Chemistry Summer School, Burlington, VT: Roundtable member and Takeda POC Dan Bailey presented the GCIPR toolkit and process metrics to a cohort of 74 graduate students from North, South, and Central America and the Caribbean

### ACS WEBINARS

- Green Chemistry Using Smarter Metrics: A Life Cycle Approach
- Fewer Steps, Greater Strides: Celebrating Breakthroughs in Sustainable Manufacturing (Peter Dunn Award Webinar)
- Metrics & Mandates: Driving Chemistry Toward a Greener Future (GCIPR and ACS Government Affairs)

### OTHER INTERNATIONAL ENGAGEMENTS

- Industrial Green Chemistry World 2025, Mumbai, India
- Emerald Isle Conference on Sustainable Chemistry and Engineering, Belfast, Northern Ireland
- Driving Sustainability through Innovations in the Supply Chain - Supply Chain Team with CCS and ACS-i
- CPhI Milan - Sustainable Future Track Symposia
- Global Conversation on Sustainability (GCS) (IUPAC event)

### OTHER US-BASED ENGAGEMENTS

- International Symposium on Preparative and Process Chromatography (PREP), Philadelphia, Pennsylvania
- International Meeting of World Pharmacopoeias (IMWP)
- SACNAS, Columbus, OH: Charting Your Path: Career Pathways and Opportunities in Green Chemistry and Sustainability
- UConn GCI - ACS Green Chemistry Institute: Chemistry Implementations to Enable Sustainability, Mansfield, CT
- 29th American Peptide Symposium, San Diego, CA
- Pacific Chem 2025, Honolulu, Hawaii

### Full-Day Public Workshops: Driving Sustainability in the Pharma and Allied Industries

- Workshop and poster reception at AstraZeneca, Macclesfield, UK
- Workshop and poster reception at Takeda, Cambridge, MA

**CONTACT US TO COLLABORATE WITH  
THE ACS GCI PHARMACEUTICAL ROUNDTABLE**

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WEBSITE: [ACSGCIPR.ORG](http://ACSGCIPR.ORG)