2017 ACS GCI Pharmaceutical Roundtable Research Grant for Increasing the Utility of Photoredox Catalysis in Medicinal Chemistry

The ACS GCI Pharmaceutical Roundtable (Roundtable) is a partnership between the ACS Green Chemistry Institute® and pharmaceutical related corporations united by a shared commitment to integrate the principles of green chemistry and engineering into the business of drug discovery and production. Current members include Amgen, AstraZeneca, Asymchem, Biogen, Boehringer-Ingelheim Pharmaceuticals, Inc., Bristol-Myers Squibb, Codexis, Eli Lilly and Company, F. Hoffman-La Roche Ltd., GlaxoSmithKline, Johnson & Johnson, Merck & Co., Inc., Novartis, Pfizer, Inc., Pharmaron, Sanofi, WuXi AppTec, and ACS GCI.

The ACS GCI Pharmaceutical Roundtable is seeking a one year R&D commitment to assist the Roundtable's medicinal chemistry initiative. The focus of the R&D will be toward optimizing existing methodology and reactor technology toward gram-scale photochemical reactions in greener solvents using substrates that are employed widely in the pharmaceutical industry, such as heterocycles and heavily functionalized intermediates. Proposals are invited from public and private institutions of higher education worldwide. This collaborative project is intended for a student within the selected Principal Investigator's research group. One grant is planned to be awarded and the total award is limited to $50,000 for a grant period of 12 months. Interested PI's are required to provide a written proposal describing the investigator's capability to carry out the Roundtable's proposed research. **Deadline for receipt of proposals is June 2, 2017 at 5 p.m. EDT**. All submissions must be emailed to gcipr@acs.org. The Principal Investigator with the selected proposal will be notified by July 31, 2017. It is expected that research will commence in the principal investigator's lab by October 2017 and last approximately 12 months.

Requirements for Submission

Proposals will only be accepted from public and private institutions of higher education. The grant is not limited to institutions in the United States. Proposals must be submitted by email to gcipr@acs.org through the appropriate institutional office for external funding. For international submissions, if there is no comparable office, submit a pdf of a letter signed by an appropriate university official recognizing the terms of the grant.

Detailed Project Description

Recent advances in modern photoredox catalysis have enabled the development of a wide array of novel synthetic methodologies. As a result, a variety of nontraditional bond constructions have greatly increased medicinal chemists' access to scaffolds and building blocks that previously required a significant number of operations. However, these new methodologies have not been fully utilized due to gaps in reactor capabilities and reaction conditions that are amenable to producing multigram quantities of pharmaceutically relevant compounds. In order to use these

methods to their full potential, reaction parameters enabling efficient scaling as well as greener solvents, greener reagents, and higher yields are needed.

One key challenge faced in achieving widespread implementation of photoredox catalysis within medicinal chemistry is the scalability and robustness of processes in existing equipment. Adaptation of current methodologies to a user-friendly benchtop unit utilizing batch or continuous flow parameters with safety features to protect from the light source is sought. This capability would allow for more effective production of multigram quantities of intermediates, which would both increase synthetic efficiency and facilitate the transition of programs from discovery to process development.

Key Considerations:

- Current equipment allows access to milligram quantities of targets via photoredox catalysis in batch mode. Targeted development in a production environment has allowed for the preparation of multikilogram batches of a limited number of substrates. Engineering expertise has yet to be fully leveraged in a research environment to allow for the rapid preparation of multigram quantities of diverse targets.
- Calibration of instrumentation is not routine. Translation of literature methods between laboratories and industry is nontrivial due to a lack of understanding of applied reaction parameters.
- Precise control of light flux and wavelength as well as reaction temperature is a desirable trait of developed technology.
- Ability to utilize developed reactor for a wide arrange of chemistries: reaction screening, application to larger biomolecules, etc.
- As multigram quantities is goal, ability to transfer technology to a continuous flow environment would be preferred.
- Application of Green Chemistry principles is desired, including solvent selection.*

* For further solvent guidance, refer to the ACS GCI Pharmaceutical Roundtable Solvent Selection Guide.

Project Goal

Promote innovation at the interface of photoreactor design and photoredox catalysis method development to allow for tunable photochemical processes on multigram scale, while also encouraging green chemistry principles.

Project Timeline

It is expected that one year of research support will be sufficient to provide progress toward intended goals.

Proposal Format (Maximum 3 pages as described below + CVs)

All of the information below must be submitted as a single PDF file. All components described in sections A, B, and C must be included in the same PDF file to assure the proposal is reviewed in its entirety.

A) Title Page (1 page, 12 pt font, 1-inch margins)

1. Project Title:
2. Principal Investigator:
3. Title / Position(s):
4. Telephone Number(s):
5. Fax Number(s):
6. Postal Mailing Address:
7. E-Mail Address:
8. Research Group website:

B) Proposed Plan of Work *(2 pages, 12 pt font, 1-inch margins)*

1. Summarize the student's (undergraduate, graduate student and /or postdoc) capabilities to perform the Roundtable's proposed work.
2. Brief description of the PI's research facilities.
3. Proposed milestone deliveries (primary project and side project) with brief description of the manner in which the researcher intends to achieve them.
4. The PI should list any existing background intellectual property and/or collaborations they are aware of that might limit the freedom to operate any of the results arising from any research funded by ACS GCI. The priority of the Roundtable is to encourage research utilizing reaction conditions that are commercially available with the freedom to use.
5. References (Does not count toward your page limit.)

C) Curriculum Vitae of Project Team Members: Please submit a two page curriculum vitae of all project team members. (Does not count toward your page limit.)

Report Requirements

- As a collaborative research project, the Roundtable will work closely with the principal investigator and student(s) to provide industrial direction, when appropriate, in a manner that respects the independence of the researcher/student.
    - Progress updates are due at 1 month intervals from initiation of research and discussed in arranged teleconferences.
    - Updates are to include research milestones/significant outcomes, summary of progress to date noting any deviations from the proposal, and research plans for upcoming months.
- A final comprehensive report including research outcomes and final budget is due one month after the end of the grant period.
    - The report must be submitted as an Adobe PDF document electronically to gcipr@acs.org. The report will be shared with the member companies of the Roundtable.
    - The content of the report will be targeted for publication in a peer review technical journal within six months of the conclusion of the research. As a collaborative research project, the paper will be written by the principal investigator and student(s) performing the work, with the Roundtable as co-authors.

Intellectual Property, Publication Acknowledgement, and Terms of the Grant

- The primary purpose of this grant is to publish research to make information publicly available.
- Every patent, United States or foreign, that results from research funded (in part or in its entirety) by the ACS GCI Pharmaceutical Roundtable Grant shall be immediately dedicated to the public, royalty free.
- Publication of results is expected within 6 months of work completion.
- Each publication prepared in connection with the ACS GCI Pharmaceutical Roundtable Grant shall make acknowledgement to the ACS GCI Pharmaceutical Roundtable Research Grant, in the following manner. "Acknowledgement is made to the ACS GCI Pharmaceutical Roundtable Grant for support (or partial support) of this research."
- Acceptance of a Roundtable Grant will be conditioned upon agreement by the grantee institution that in the event the principal investigator is unable for any reason to conduct the research proposed, the funds, if previously paid by the Roundtable, shall, upon demand, be returned in full to the Roundtable, and further, that in the event the PI is unable for any reason to continue with the research after it has commenced, this grant shall be terminated forthwith and the unexpended and unencumbered balance of any funds theretofore advanced shall be returned to the Roundtable.
- The grantee institution, by acceptance of this grant, provides assurance that support normally provided by the institution for research of the faculty member will not be diminished.
- Applicants may have only one research grant with the ACS GCI Pharmaceutical Roundtable at a time. In order to close a grant, the required reports must be received and approved by the ACS GCI Pharmaceutical Roundtable.

For additional information:
Website: www.acs.org/gcipharmaroundtable
Email: gcipr@acs.org