by Erwin Pro Vost office

GENESEO FOUNDATION

2012-13 APPLICATION DEADLINES

- ☐ Friday, Sept 14, 2012 - Fall 2012 Research & Travel
- ☑ Friday, Nov 9, 2012 - Spring 2013 Research & Travel
- ☐ Friday, Feb 1, 2013 - Spring 2013 Research & Travel

STUDENT ASSOCIATION SA Funded by Mandatory Student Activity Fees

Individual Research-Chemistry

Student Association & Geneseo Foundation

Undergraduate Research and Travel Grant Program (Rev. 07/06/12)

As a part of its long-range allocation of student activity fees, the Geneseo Student Association has awarded $40,000 to the Undergraduate Research Grant Program. As in previous years the Student Association's allocation has been matched by the Geneseo Foundation, bringing total support for this year's program to $80,000.

The Geneseo Foundation, a nonprofit organization which accepts, administers and allocates private gifts to benefit SUNY Geneseo, will oversee the distribution of these funds by a subcommittee of the College Research Council.

The Research Grant funds are designed to aid undergraduates in the purchasing of supplies, equipment, and other expenses they might incur in their research project. The research travel grant funds cover travel to present research at professional or scholarly meetings.

The opportunity for undergraduate students to conduct research is a unique and rewarding experience for everyone involved. Geneseo currently has a strong tradition of providing such opportunities for undergraduates. The Undergraduate Research Grant Program will continue to further this tradition by providing worthy projects with funding.

ATTENDANCE AT A GRANT WRITING WORKSHOP PRESENTED BY THE OFFICE OF SPONSORED RESEARCH IS MANDATORY IN ORDER TO BE ELIGIBLE FOR FUNDING. FOR GROUP APPLICATIONS ONLY ONE REPRESENTATIVE FROM THE GROUP NEEDS TO ATTEND.

FOR GROUP APPLICATIONS, EACH APPLICANT IN THE GROUP MUST SUBMIT THEIR OWN APPLICATION FORM BUT ONLY ONE COPY OF THE PROPOSAL AND ANY OTHER ATTACHMENTS IS REQUIRED. PLEASE STAPLE ALL FORMS AND ATTACHMENTS TOGETHER.

Name [redacted] G ID # [redacted]

College Address [redacted]

Home Address [redacted]

College Phone [redacted] Graduation Date [redacted] GPA [redacted] (minimum 2.5 required in major)

Amount of Support Requested $ 366.40 E-mail [redacted]

Title of Project Solar Derived Fuels by using a Supramolecular Approach

Are you applying to other sources? If yes, please list

Department Chemistry Faculty Sponsor Dr. McGarrah

Department Chairperson's Signature [signature]

Student Signature [redacted]

NOTICE: IF THIS APPLICATION IS FOR FUNDS TO SUPPORT RESEARCH FOR ACADEMIC CREDIT AT AN INSTITUTION OTHER THAN SUNY GENESEO, YOU MUST FILL OUT A "PRE-APPROVAL FOR TRANSFER CREDIT" FORM (AVAILABLE FROM THE DEAN'S OFFICE) BEFORE ENROLLING WITH THE OUTSIDE INSTITUTION.

BEFORE SUBMITTING YOUR PROPOSAL, PLEASE MAKE SURE YOU HAVE COMPLETED THE "CHECKLIST FOR ALL PROPOSALS" AS WELL AS THE CHECKLIST THAT APPLIES TO THE TYPE OF FUNDING (RESEARCH OR TRAVEL) YOU REQUEST.

CHECKLIST FOR ALL PROPOSALS

- ☑ Are you a student enrolled full-time this semester?
- ☑ Please circle date of proposal writing workshop you last attended:

  Sept. 8, 2009 Jan 26, 2010 Sept. 7, 2010 Jan. 25, 2011 Sept. 6, 2011 January 24, 2012 September 4, 2012 or met with the Director of Sponsored Research 11/8/12
- ☑ Minimum 2.5 GPA in major
- ☐ Do you have your Department Chair Signature?
- ☐ The original, signed, collated copy of both proposal and faculty support letter? Faculty support letters should discuss the specific role of the student(s) in research projects or presentations.

CHECKLIST FOR RESEARCH EXPENSE PROPOSALS

- ☐ Applied for or obtained IRB approval (human subjects) or IACUC (animal subjects), if necessary? (please refer to #5 under general guidelines)
- ☐ Obtained current price quotes for equipment and added appropriate shipping & handling costs?

IF ANY PORTION OF THIS PROJECT WILL BE CONDUCTED OFF-CAMPUS, PLEASE LIST THE LOCATION(S) AND APPROXIMATE DATES THAT YOU EXPECT TO BE AT THE OFF-CAMPUS SITE(S).

_____

_____

CHECKLIST FOR PRESENTATION/PERFORMANCE TRAVEL PROPOSALS

- ☐ Included confirmation of presentation acceptance for conference? If not, include in your proposal the date you expect to be notified.
- ☐ Does your travel budget adhere to stated allowances for auto, lodging and meals?

DATE OF MEETING _____ LOCATION _____

NAME OF MEETING/CONFERENCE _____

GENERAL GUIDELINES

1. A **maximum of $600** will be awarded to each undergraduate recipient per semester.
2. Groups of 3 or more students applying together for the same project or presentation will be limited to a **total of $1500.**
3. Students must be enrolled on a **full-time** basis.
4. Research projects must be **supervised by a faculty mentor** or sponsor.
5. URG funds may not be granted to fund stipends.
6. Research must conform to standards set by the Institutional Review Board for the Protection of Human Participants and Institutional Animal Care and Use Committee. Students using human or animal subjects for data collection need to include evidence that IRB or IACUC approval has been obtained or is being sought. Evidence of IRB or IACUC approval is required for those seeking support for travel.
7. A final report must be submitted to the Geneseo Foundation promptly after completion of the project.
8. **Submit original signed application with faculty support letter to Erwin 205.**

PRESENTATION or PERFORMANCE TRAVEL GRANTS

GUIDELINES FOR TRAVEL TO PRESENT RESEARCH RESULTS OR A PERFORMANCE AT A PROFESSIONAL MEETING OR SCHOLARLY CONFERENCE:

1. **Awards are competitive and decisions for funding will be based on the quality of your grant application.** Having a paper accepted, personal or career goals, and graduate school admission alone are not sufficient justification for funding. Please include a **one page rationale** to support your application which includes the following information:
   a. What was the purpose and significance of the research project?
   b. What was accomplished towards these goals?
   c. How will you be participating at the conference? Ex: presenter, poster session, panelist
   d. For GROUP travel applications, please provide additional justification by answering the following questions:
   - How will each student participate in the presentation or performance? Will they be making all or part of the presentation or performance or will they attend the meeting as a non-presenting co-author?
   - For travel for research presentations, what was each student's intellectual contribution to the project?
   - For travel involving performances, what was each student's creative contribution to the development of the performance and/or how will each student contribute to the final performance?

The Research Council reserves the right to limit the travel support for a single presentation or performance.
Your rationale must be written so that a student or faculty member outside of your major may understand.

2. For group applications, each student should submit their own application form including budget, but only one copy of the one-page rationale and other attachments (see below) is needed. Please staple everything together.
3. Include a copy of the letter or the e-mail confirming acceptance of your presentation or poster. If you have not yet received confirmation by the application deadline, please deliver it to Erwin 205 or email it to Anne Baldwin, baldwinA@geneseo.edu, as soon as possible, otherwise your award will be delayed.
4. All applications must be accompanied by a letter from an appropriate faculty sponsor describing the merit of the research and the significance of the conference.
5. Please include a detailed travel budget (below) with explanations to justify your budget requests. Please list all anticipated expenses (even if the total exceeds the current $600 maximum award).
6. Do not attach a copy of your presentation.
7. Please Note: For group applications where students DRIVE to the conference or meeting, generally only ONE student will be reimbursed for auto expenses (e.g. mileage, tolls, parking).
8.

Item	Explanation	Description	Total
Air, train, bus			$
Auto		@ $0.22 a mile	$
Tolls			$
Parking			$
For lodging costs, on the Lodging 1 line please indicate A) the # of students sharing the room, B) the total cost of the room per night (including applicable taxes), and C) the actual cost per student per night. Use the LESSER of the actual cost per student per night (C) or $70 per night for your calculations in the Lodging 2 line.			
Lodging 1	A) Total room cost (with taxes) per night: $	B) # of students sharing room:	C) Actual cost per student per night (A ÷ B): $
Lodging 2		@ $_____ a night	$
Meals		@ $31 a day*	$
Conference Registration			
Other			$
	*the per diem for meals should be broken out at $7 for breakfast, $9 for lunch, and $15 for dinner, as appropriate.	**TOTAL**	$

RESEARCH EXPENSE GRANTS

GUIDELINES FOR GRANTS FOR SUPPLIES, EQUIPMENT, RESEARCH-RELATED TRAVEL, AND OTHER EXPENSES TO BEGIN OR CONTINUE A RESEARCH OR CREATIVE PROJECT:

1. **Awards are competitive and decisions for funding will be based on the quality of your grant application.** Having a paper accepted, personal or career goals, and graduate school admission alone are not sufficient justification for funding. You must respond to all questions in #2 and #3 below and it should be 3-5 pages in length to provide the review committee with adequate information.
2. Please include a **detailed rationale** to support your proposal which includes the following information:
   a. What is the purpose of your project? *(hypothesis, thesis, objective)*
   b. How are you doing the project research? *(methodology, procedures, research strategies, etc.)*
   c. Indicate the specific role of each student in the project (e.g. what specific experiments or activities will the student(s) be responsible for?)
   d. What is your timetable?
   e. What are the expected conclusions or results of your project? (What do you hope to find out and/or accomplish?)
   f. Why should you receive Student Association/Geneseo Foundation funds for this project?

   Your rationale must be written so that a student or faculty member outside of your major may understand.
3. Include supporting documentation as it applies to your proposal:
   a. Examples of research "tools," if applicable *(Include, when appropriate, questionnaires, surveys, interview questions, lists of collections or archives you intend to utilize, etc. and explain how these address the purpose of your research)*
   b. Verification of your ability to do the research *(appointments for interviews, availability of needed equipment, contact with archivists to discuss accessibility of collections, etc.)*
   c. Equipment - ***(current price quote including S & H,*** *explanation of equipment, what it is used for, and appropriate shipping and handling costs. Demonstrate that equipment is not otherwise available, integral to the research, too inaccessible to borrow and would enhance student academic pursuits beyond your project)*
   d. References – (*cite works used in developing your proposal*)
4. All applications must be accompanied by a letter from an appropriate faculty sponsor specifically endorsing the merit and plausibility of the proposal and outlining both student and faculty sponsor roles.
5. Please include a detailed project budget with explanations to justify your budget requests. ***Budget allowance for duplicating is $0.05 per copy with $100 maximum.***
6. Travel expenses for trips to conduct research (e.g. to travel to an archive or library or to conduct field research) are allowed under the Research Grant category. Please follow the limitations for travel expenses noted on Page 3 (Presentation or Performance Travel Grants) as follows: auto $0.22/mile; for lodging use the lesser of the actual per-night student cost or $70/night; meals $31/day (broken out at $7 breakfast, $9 lunch, and $15 dinner, as appropriate).

Item	Explanation	Description	Total
Copper(I)-Iodide	materials needed for the synthesis		$ 49.90
Dichlorobenzene	of compounds 2 & 3 as described		$ 29.80
Acetylene	in the proposal		$ 54.00
Iodobenzene			$ 24.20
4-pyridinylboronic acid			$ 80.00
Dichloromethane	~~TOTAL~~		$ 128.50

Please direct any questions to: Anne Baldwin, Director of Sponsored Research, 245-5547, Erwin 205, baldwinA@geneseo.edu

Total: $366.40

Solar Derived Fuels using a Supramolecular Approach

The Global energy demand is expected to double by the year 2050. (1) Currently, the largest source of the worlds energy comes from fossil fuels. While there are enough fossil fuels to last beyond 2050, the burning of fossil fuels causes the release of CO_2 (carbon dioxide), which is having a large impact on the world's climate. On top of this, as fossil fuels become less and less accessible, their price is sure to continue increasing, which could cause more economic turmoil. (2) Because of this, it is important to develop new technologies that are cheap, renewable, and do not produce carbon dioxide.

Solar energy is a very appealing option to this energy problem. The sun provides visible energy in the form of sunlight at a rate of 122 TW (1 terawatt, TW, is 10^{12} joules per second) on the Earth's surface. In fact the amount of energy that hits the earth from the sun in 1 hour is more than humans use in an entire year. (1) Solar energy is in unlimited supply (until the sun burns out), it is also carbon-neutral, and free. The major obstacle with solar energy is converting it into chemical energy, so that it can be used. One way that it can be used to convert solar energy into chemical, is through the use of hydrogen (H_2).

Using solar energy to split H_2O (water) into its constituent elements, hydrogen (H_2) and oxygen (O_2) (Scheme 1), is a good way to get hydrogen into a useable form of energy. Because the splitting of water into its constituent elements takes two reactions (Scheme 1, equations b and c), research into this industry is divided into two parts, water oxidation (Scheme 1, equation b) and H^+ reduction (Scheme 1, equation C). Work on water reduction currently uses a

(a) $H_2O \rightarrow H_2\,(g) + \frac{1}{2}O_2\,(g)$

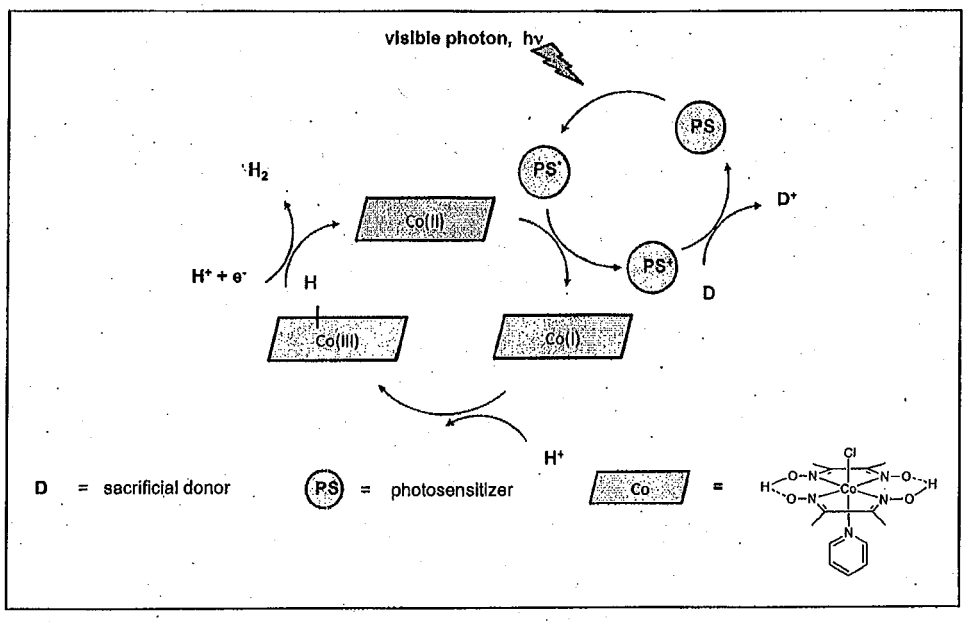
(b) $2H_2O \rightarrow O_2\,(g) + 4H^+ + 4e^-$

(c) $2H^+ + 2e^- \rightarrow H_2\,(g)$

Scheme 1: Water splitting equations. (a) Overall reaction; (b) Oxidation of H_2O to O_2 and hydrogen ions (H^+); (c) Reduction of H^+ to H_2.

sacrificial donor such as ascorbic acid, or triethanolamine to replace the electrons gained from oxidation. (3) Hopefully, research will eventually discover a way to remove the need for a sacrificial donor. This work focuses on reducing H^+ to H_2.

Currently one approach for photocatalytic H^+ reduction uses H_2-evolving catalyst with a photosensitizer and a sacrificial donor to give off electrons.



Scheme 2: H_2 reduction using a cobaloxime catalyst and a sacrificial electron donor

Photons are absorbed by the photosensitizer, to make an excited stated. The catalyst then uses the electrons in the excited state to reduce H^+ to H_2. The sacrificial donor gives electrons to the photosensitizer so that the reaction can be done again. Until recently, the only effective H_2 evolving catalysts have employed the use of rare and expensive metals, such as platinum. (4) Recently, work has gone into using more common and thus cheaper catalysts, such as cobalt. (3,5) Cobalt catalysts are a much better solution for converting solar energy into fuel, as they are cheap and easy to come by. Unfortunately, cobalt catalysts decompose and/or lose their catalytic activity after several hours of exposure to irradiation. This project uses a supramolecular

approach in an attempt to stabilize and improve the cobalt catalyst in H_2-evolving system by putting it inside a molecular cage.

Over the past two decades scientists such as Fujita and other have studied supramolecular self-assembling molecules. Fujita first reported assembling a square palladium complex in 1990. (6) Since 1990, many more complexes have been assembled, the most notable are three dimensional assemblies that are referred to as "cages". (7,8) These cages are water soluble and self-assemble, mostly through hydrophobic interactions. Figure 1 provides and example of a three-dimensional cage.

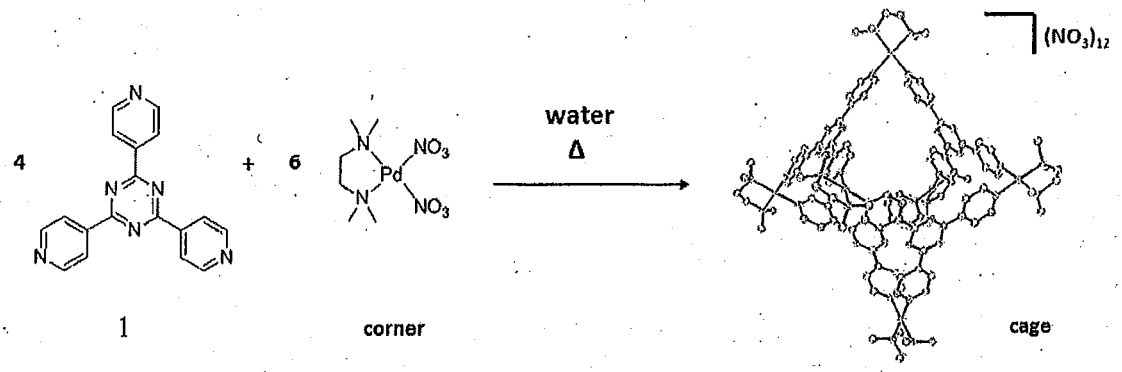


Figure 1: Assembly of a three-dimensional coordination cage.

These cages have been shown to be able to encapsulate small molecules, also due to their symmetry they are easy to classify using NMR (Nuclear-Magnetic Resonance). (8)

Research will go towards switching out compound 1 in figure 1 with other panels such as 2 and 3, which are pictured below in figure 2.

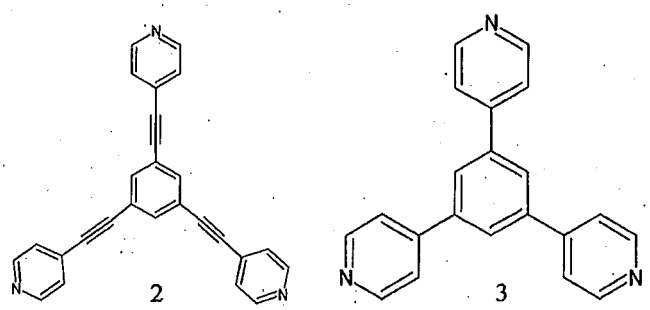


Figure 2: Alternate panels for the cage

Molecules 2 and 3 in figure 2 are not commercially available. So I will be synthesizing them using palladium catalyzed carbon-carbon bond forming reactions. This is exciting because the last chapter in the organic chemistry text shows these reaction but we did not cover it when I took organic chemistry and neither do we do it as a laboratory experiment in any chemistry laboratory class that I have taken thus far. Money awarded in the grant will go towards purchasing the materials and supplies necessary for the synthesis compounds 2 and 3. I hope to someday design pharmaceutical drugs, and to do this I will need a good understanding of organic synthesis techniques, which I will gain from doing this experience.

References:

1. Lewis, N.; Nocera, D. *Proc. Nat. Sci. Acad. USA* **2006**, 103, 15729-15735.
2. Basic Energy Sciences Advisory Committee. *New Science for a Secure and Sustainable Energy Future*. December **2008**.
3. Lazarides, T.; McCormick, T.; Du, P.; Luo, G.; Lindley, B.; Eisenberg, R. *J. Am. Chem. Soc.* **2009**, 131, 9192-9194.
4. Grätzel, M. *Acc. Chem. Res.* **1981**, 14, 376-384.
5. Artero, V.; Chavarot-Kerlidou, M.; Fontecave, M. *Agnew. Chem. Int. Ed.* **2011**, 50, 7238-7266.
6. Fujita, M.; Yazaki, J,; Ogura, K. *J. Am. Chem. Soc.* **1990**, 112, 5645-5648.
7. Fujita, M.; Tominaga, M.; Hori, A.; Therrien, B. *Acc. Chem. Res.* **2005**, 38, 371-380.
8. Zheng, Y.R.; Zhao, Z.; Wang, M.; Ghosh, K.; Pollock, J.; Cook, T.; Stang, P. *J. Am. Chem. Soc.* **2010**, 132, 16873-16882.

Order Preview(This order has not been submitted)

Web Copy

Order Date:2012-11-09 **Purchase Order:** **Additional Reference:** **Payment Term:Prepaid - 1 day net**	**Email order confirmations to:**

Subtotal:366.40 USD
Order Total:366.40 USD

Line	Product Number	Description	Qty	Your Reference	Sell Price	Net Price
000010	03140-100G	COPPER(I)-IODIDE PURE	1		49.90	49.90
		1 In Stock from MILWAUKEE 11/09/12				
000020	208671-1G	DICHLOROBIS(TRIPHENYLPHOSPHINE)- &	1		29.80	29.80
		1 In Stock from MILWAUKEE 11/09/12				
000030	218170-5G	(TRIMETHYLSILYL)ACETYLENE, 98%	1		54.00	54.00
		1 In Stock from MILWAUKEE 11/09/12				
000040	I7632-5G-A	IODOBENZENE, 98%	1		24.20	24.20
		1 In Stock from MILWAUKEE 11/09/12				
000050	634492-5G	4-PYRIDINYLBORONIC ACID, 90%	1		80.00	80.00
		1 In Stock from MILWAUKEE 11/09/12				
000060	320269-4L	DICHLOROMETHANE, >=99.5%, A.C.S. REAGEN&	1		128.50	128.50
		1 In Stock from MILWAUKEE 11/09/12				

366.40

Geneseo

Department of Chemistry
Assistant Professor James McGarrah
mcgarrah@geneseo.edu

November 9, 2012

Re: [redacted] application for an Undergraduate Research Grant

Dear Members of the Research Council,

I'm very pleased to start working with [redacted], a junior chemistry major. For the spring of 2013 he will work on a project titled *Solar Derived Fuels using a Supramolecular Approach.* Westley is interested in becoming a pharmaceutical chemist someday and is very excited about doing organic synthesis. Our research is focused on making supramolecular assemblies and we have currently reached a dead end in using only commercially available starting materials. Westley's research will propel us toward new avenues by giving us new building blocks for making supramolecular cages.

I enthusiastically endorse [redacted] application for an Undergraduate Research Grant from the Geneseo Foundation. You will note that in [redacted] budget is for chemicals needed in order to synthesize these new compounds.

Sincerely,

James McGarrah

1 College Circle, Integrated Science Center, Geneseo, NY 14454 (585)245-5699 · FAX: 245-5288