

# THE CAPITAL CHEMIST



A Publication of the Chemical Society of Washington Section of the American Chemical Society

## 2016 Hillebrand Prize Awarded to Dr. Stuart Licht, GWU

CSW is pleased to announce that Dr. Stuart Licht, Dean's Research Professor at George Washington University, is the 2016 Hillebrand Prize recipient. Dr. Licht will accept the award, and be the featured speaker at the March CSW meeting on Thursday, March 23. Meeting logistics can be found on the next page.

### Biography

Stuart Licht is an electrochemist and environmental chemist with ~400 papers and patents focused on sustainability or fundamental chemistry, including a variety of studies published in *Science* and *Nature*. Today he is a Dean's Research Professor in the Department of Chemistry at George Washington University. Stuart Licht served as a Program Director in the Chemistry Division of the National Science Foundation. An early pioneer in the field of photoelectrochemistry, Licht helped establish basic principles of the field as well as highest efficiency photoelectrochemical solar cells. His principles of STEP (solar thermal electrochemical processes) have led to the demonstration of the highest solar conversion of hydrogen, methane, and syngas fuels from sunlight, air, and water, as well as STEP CO<sub>2</sub>-free syntheses of ammonia, iron & steel, cement, and organics. His research group has helped establish the principles of multiple electron per molecule charge storage, including the unusual 11 electron VB<sub>2</sub>, and the hexavalent "super-iron," and molten air batteries. Licht has broadened the foundation of understanding of a wide range of fundamental physical, analytical, and environmental electrochemical phenomena ranging from generation/collection microelectrochemistry, to fundamentals of speciation and water purification, and recently introduced a process to remove the greenhouse gas carbon dioxide to mitigate climate change by its transformation to carbon nanotubes. Recognitions include Licht's BASF 150th Anniversary Electrochemical Storage Award, the Electrochemical Society Energy Technology Research Award, the Alcoa Research Award, GWU's Trachtenberg Scholarship Award, the Gustella Award of the Technion, and Clark's Carlson Endowed Chair in Chemistry.

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### Inside this issue:

- Learn more about the March CSW Meeting
- Read about the two Project SEED Students who received scholarships
- Get your first look at CCED's 2017 theme: Chemistry Helps Feed the World
- MARM Call for Abstracts open until 3/31
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- Read about CSW's College Achievement Awards, hosted during the February CSW Meeting



### **Speaker Abstract: *Diamonds from the Sky to Mitigate Climate Change: Incentivized greenhouse gas removal by its transformation to valuable commodities***

As the levels of carbon dioxide increase in the Earth's atmosphere, this greenhouse gas's effects on climate change, including species extinction, flooding, draught, famine, and economic disruption become increasingly apparent. An incentive to remove CO<sub>2</sub> is provided by a low energy, low cost, high-yield conversion to valuable products such as carbon nanotubes. Displaying superior strength, conductivity, flexibility, and durability, carbon nanotube (CNT) applications had been limited due to the cost intensive complexities of their synthesis. An inexpensive source of CNTs made from carbon dioxide will facilitate the rate of its adoption as

an important societal resource for the building, aerospace, transportation, renewable energy, sporting, and consumer electronics industries, while concurrently consuming carbon dioxide. We present an inexpensive, high-yield and scalable synthesis of CNTs.

We show a new, unexpected chemistry for the effective capture of CO<sub>2</sub> and its transformation at high yield and low energy, by dissolution in a molten carbonate electrolyte, and electrolysis splitting it to carbon nanotubes and oxygen.<sup>1-7</sup> The CO<sub>2</sub> reactant is directly absorbed from air (without the need for pre-concentration), or can be used and removed from industrial, home, or transportation emissions.

We show that common metals act as CNT nucleation sites in molten media to efficiently drive the high-yield electrolytic conversion of CO<sub>2</sub> dissolved in molten carbonates to CNTs. We accomplish this by electrochemically reducing CO<sub>2</sub> on steel electrodes in a molten carbonate electrolyte. The CNT structure is tuned by controlling the electrolysis conditions, such as the addition of trace common metals to act as CNF nucleation sites, the composition of the carbonate electrolyte, and the control of temperature and current density. Upward scalability of the process is demonstrated over several orders of magnitude.

The Licht group at GW University is in the midst of the semifinals of the Carbon XPrize (we are the C2CNF team at [carbon.xprize.org](http://carbon.xprize.org)), a global competition to demonstrate the most valuable product from the CO<sub>2</sub> emissions of fossil fuel power plants. Our goal is to transform CO<sub>2</sub> from a pollutant to a desired resource. Molten carbonate electrolysis production is significantly less expensive than contemporary CVD and polymer pulling methods to produce carbon nanotubes or nanofibers, and uses CO<sub>2</sub>, rather than organometallics or polymers, as the reactant. An inexpensive source of CNTs has a large demand as a preferred, lighter weight, stronger replacements to metals and plastics, which (in addition to the battery, nanoelectronics, and catalysis applications) can provide a large market to mitigate anthropogenic carbon dioxide.

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<sup>1</sup>Ren, Li, Lau, Gonzalez-Urbina, Licht, One-pot synthesis of carbon nanofibers from CO<sub>2</sub>, Nano Letters, 15, 6142 (2015).

<sup>2</sup>Ren, Lau, Lefler, S. Licht, The minimum electrolytic energy needed to convert carbon dioxide by electrolysis in carbonate melts, J. Phys. Chem., C, 119, 23342 (2015).

<sup>3</sup>Licht, Douglas, Ren, Carter, Lefler, Pint, Carbon Nanotubes Produced from Ambient Carbon Dioxide for Environmentally Sustainable Lithium-Ion & Sodium-Ion Battery Anodes, ACS Central Science, 2, 162 (2015).

<sup>4</sup>Ren, Lau, Lefler, Licht, The minimum electrolytic energy needed to convert carbon dioxide by electrolysis in carbonate melts, J. Phys. Chem., C, 119, 23342 (2015).

<sup>5</sup>Lau, Dey, Licht, Thermodynamic assessment of CO<sub>2</sub> to carbon nanofiber transformation for carbon sequestration in a combined cycle gas or a coal power plant, Energy Conservation and Management, 122, 400 (2016).

<sup>6</sup>Wu, Li, Ji, Liu, Li, Yuan, Zhang, Ren, Lefler, Wang, Licht, One-Pot Synthesis of Nanostructured Carbon Material from Carbon Dioxide via Electrolysis in Molten Carbonate Salts, Carbon, 6, 27760 (2016).

<sup>7</sup>Ren, Licht, Tracking airborne CO<sub>2</sub> mitigation and low cost transformation into valuable carbon nanotubes, Scientific Reports, 106, 208 (2016).

## Meeting Logistics

**Date:** Thursday, March 23

**Time:** 6:00 p.m. Check-in and social hour

6:30 p.m. Dinner

7:15 p.m. Presentation

**Cost:** \$28 (Members and guests) / \$14 (Students)

**Location:** ACS Headquarters, Marvel Hall, 1155 16th St., N.W., Washington, DC

**Menu:** Prime Rib w/au jus, twice-baked potatoes, tossed salad, artisan bread. Vegetarian option: Cheese manicotti, grilled vegetables, tossed salad, garlic bread. Dessert: mini cookies and fresh fruit.

**Parking:** Parking is available in nearby commercial parking garages.

**Metro:** Blue/Orange/Silver Line: McPherson Square or Farragut West. Red Line: Farragut North.

RSVP by noon Tuesday, March 21 to [csw@acs.org](mailto:csw@acs.org) or by phone (messages only: 202-659-2650)

Please provide the names in your party when you RSVP, and indicate if you prefer the vegetarian option. The public is invited to attend. You may attend the talk only, but reservations are appreciated. Those who make a dinner reservation, but are unable to attend, should send a check for the cost of their meal to the CSW office.

## Two Local Project SEED Fellows Received Project SEED Scholarships for 2016-2017

Contributed by Allison Aldridge, CSW Project SEED Coordinator

The American Chemical Society Committee on Project SEED has announced the winners of its 2016–17 college scholarships. The recipients, who were selected from participants in ACS’s Project SEED research program, received one-year, non-renewable scholarships of up to \$5,000 to help cover tuition and fees during their freshman year of college. The 31 scholarships for the 2016–17 academic year, which have a total value of \$155,000, were funded by private corporations and individual donors. Additionally, three Project SEED college scholars received the Ciba Specialty Chemicals Scholarship.

Leul Tesfaye received a Fosbinder Scholarship. The estate of Elizabeth Ernst Fosbinder, wife of late ACS member Russell J. Fosbinder, has provided an endowment to fund scholarships for graduates of Project SEED. Miss Tesfaye is a graduate of Wheaton High School in Maryland. She conducted research under Andrei Vedernikov at the University of Maryland, College Park, titled “Aerobic C–H Oxidation of Benzene with a Pt II Complex.” Miss Tesfaye is majoring in chemical engineering at Cornell University.

Cindy Gnawa (pictured at right) received a Project SEED scholarship. These scholarships are provided through the generosity of ACS friends and members. Miss Gnawa is a graduate of Wheaton High School in Maryland. She conducted research on “Synthesis of Macrocycles” under Richard Weiss at Georgetown University. Miss Gnawa is majoring in biochemistry at the University of Maryland, College Park.

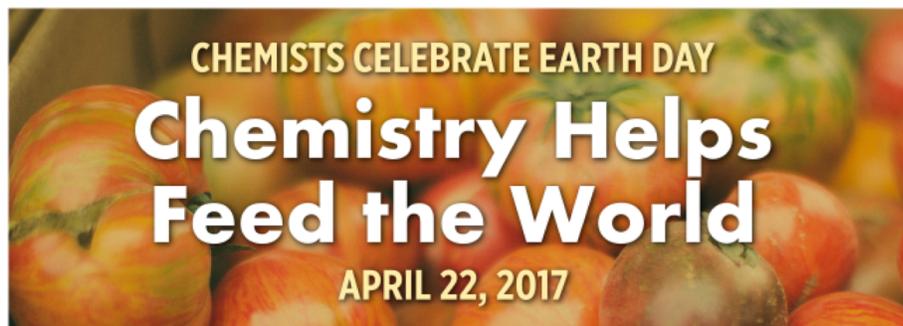


Congratulation to the students, their mentors, and their educators.

Photo provided by Cindy Gnawa.

## Chemists Celebrate Earth Day (CCED) 2017: “Chemistry Helps Feed the World”

Contributed by Kim Morehouse, CCED Coordinator



Earth Day was first officially recognized on April 22, 1970 as a way to demonstrate support for a healthy environment, raise awareness about environmental issues, and remind people that we all need to contribute to a sustainable planet. For years, chemists have been promoting a better world through recyclable plastics, cleaner-burning fuels, phosphate-free detergents, environmental monitoring, and green chemistry initiatives. The American Chemical Society joined the Earth Day celebration on April 22, 2003.

The Chemical Society of Washington (CSW) will once again participate in Chemists Celebrate Earth Day (CCED) activities. Chemistry is all around us and is vital to our planet’s sustainability. Whether it’s used in

recyclable and biodegradable materials or through the reduction of waste, chemistry is involved in ensuring that we can be eco-friendly and kind to our environment. CCED seeks to bring international focus to environmental causes, such as clean air, water, and energy. ACS offers events, contests, and educational resources for members, chemical educators, and chemistry enthusiasts to illustrate the positive role that chemistry plays in preserving the Earth. The CCED 2017 theme is "Chemistry Helps Feed the World." This year's theme looks at the impact of chemistry on soil and plants that are used to produce food, including the preservation of food, which is a critical element to provide an adequate amount of food. The world's population is growing and the need to produce more food to feed the population places additional strain on the environment. Chemistry can assist with the need to produce more food. The electronic version of the *Celebrating Chemistry* newsletter for CCED, as well as additional information about this year's CCED celebration is available from the ACS website ([www.acs.org/earthday](http://www.acs.org/earthday)).

CSW, in conjunction with the Chemistry Department at Montgomery College, Rockville Campus, will participate in Rockville Science Day on Sunday, April 23, 2017. Rockville Science Day is open to the general public and CSW encourages you to attend. Rockville Science Day is intended to provide a friendly environment for students and their parents to participate in some hands-on demonstrations and to learn more about how science and engineering are important to our society. There will be more than 70 exhibitors with hands on activities. Additional information about Rockville Science Day can be found on their website (<http://rockvillesciencecenter.org/rockville-science-day/>).

This event will be co-sponsored by the CSW Outreach Committee and the CSW Environmental/Sustainability Committee. Volunteers from CSW will be providing hands-on activities for children who attend the event as a part of CSW's participation in CCED. Volunteers will also hand out copies of the *Celebrating Chemistry* publication for CCED, and various CCED-themed products. If you would like to volunteer for this event, please contact the CSW CCED coordinator, Kim Morehouse ([Kim.Morehouse@fda.hhs.gov](mailto:Kim.Morehouse@fda.hhs.gov)).

## Illustrated Poem Contest

As part of the Chemists Celebrate Earth Day activities, the American Chemical Society is sponsoring an illustrated poem contest for students in Kindergarten through 12 grades. Students are asked to write and illustrate a poem using the Chemists Celebrate Earth Day 2017 theme, "Chemistry Helps Feed the World." This year's theme looks at the impact of chemistry on soil and plants that are used to produce food. The world's population is growing and the need to produce more food to feed the population places additional strain on the environment. Chemistry can assist with the need to produce more food. The illustrated poems should relate to how chemistry can impact soil and plants and their relationship to food. Detailed rules and guidelines are available on the Chemists Celebrate Earth Day website; [www.acs.org/earthday](http://www.acs.org/earthday). All entries must provide the information that the ACS requests via the entry form, which is available via the ACS or CSW websites. Teachers at schools in the Chemical Society of Washington area are encouraged to have a contest at their school and then submit the winning entries from the school to:

Chemist Celebrate Earth Day Coordinator  
Chemical Society of Washington  
1155 16th Street, NW, Stop O-218  
Washington, DC 20036

Electronic submissions should be sent to: [Kim.Morehouse@FDA.HHS.GOV](mailto:Kim.Morehouse@FDA.HHS.GOV)

All entries must be received by Monday, April 24, 2017 so winners at the local section level can be submitted to the ACS by Friday April 28, 2017.

## MARM 2017 Call for Papers

The call for papers for the 2017 Middle Atlantic Regional Meeting (MARM) has been issued. The meeting will take place June 4-6 at the Hershey Lodge, in Hershey, Pennsylvania. Details, including names and contact information for program and session chairs, can be found on the meeting website (<http://marm2017.sites.acs.org/>). The final program summary will be published in C&EN in the spring; the online program will be available on May 1, 2017.



Co-organized by the Lehigh Valley and Susquehanna Valley local sections, the symposium celebrates the theme of 'Elements of Transition', featuring the rapidly evolving knowledge and applications of the chemical sciences. In addition to over 50 technical symposia, the symposium will feature poster sessions, special programming on chocolate chemistry and Joseph Priestley, awards, an exposition, and more.

A sampling of the symposium sessions include "The Evolving Landscape of Drug Discovery and Development"; "Total Synthesis"; "Organometallic Chemistry"; "Active Learning: Strategies for Making it Work in Your Class"; "Chemistry of Renewable Carbon Sources"; "Nanoscience Fundamentals and Applications"; "Chemistry at Interfaces: Living on the Edge"; "Forensic Chemistry"; "Physical Chemistry of Materials"; "Advances in Nanotechnology, Polymers, Terahertz, and Analytical Research"; "Membrane Structure and Assembly"; "Protein Misfolding and Quality Control"; "Progress and Applications of Metabolomics"; and "Computational Chemistry in the Undergraduate Curriculum".

ACS's Meeting Abstracts Programming System (MAPS) opened on January 2, 2017 for abstracts. Please visit [maps.acs.org](http://maps.acs.org) to submit an abstract. Abstracts are due March 13, 2017.

## Green Chemistry & Engineering Conference Coming to Reston this June

The 21st Annual Green Chemistry and Engineering Conference (GC&E), hosted by the ACS Green Chemistry Institute® (ACS GCI), will be held on June 13-15, 2017 at the Hyatt Regency Reston in Reston, Va. In other words...GC&E 2017 is happening in your backyard! We encourage you to take this opportunity to engage, network, and learn more about green chemistry and engineering.

There will be a student workshop (<http://www.gcande.org/students/student-workshop>) held on Monday, June 12, 2017 at the Hyatt Regency Reston. This workshop, led by experts in the field, is designed to provide an integrated, fast-paced learning experience that advances the understanding of green chemistry and engineering principles. Students attending the conference can attend the workshop for free, but must apply by April 24th.

If interested in becoming a volunteer, you will be asked to work for four hours, and you will receive access to the general conference proceedings for the rest of the day you volunteer. Assistance is needed in the following areas: on-site conference registration, technical sessions, the roundtable reception, the hybrid meeting session, and more.

Don't miss out on the opportunity to attend this nearby conference! Early registration closes April 28<sup>th</sup>. For more information, please visit [www.gcande.org](http://www.gcande.org).

# College Chemistry Achievement Awards

The College Chemistry Achievement Awards are presented annually by the Chemical Society of Washington to the outstanding seniors majoring in chemistry and biochemistry from each of the area colleges and universities. The following students received awards:

Award Winner	School	Mentor
Pegah Bakhshi	Georgetown University	Dr. Christian Wolf
Sarah Burkhard	American University	Stefano Costanzi
Savanna Castello	George Mason University	Robert Honeychuck
Taylor Brooks Engdahl	St. Mary's College of Maryland	Amanda J. Schech
Nicolás Omar Francone	George Washington University	Lakeisha McClary
Stephanos Ganotakis	University of the District of Columbia	Dr. Isadora Posey
Cassidy Hart	American University	Matthew Hartings
Kelly McKenna	Georgetown University	Dr. Jennifer Swift
Rohith Rajasekaran	University of Maryland, College Park	Prof. Dorothy Beckett
Alexander Rhoades	St. Mary's College of Maryland	Dr. Kelly Y. Neiles
Meagan Tomasso	The Catholic University of America	Dr. Gregory Miller



**From left to right:** Alexander Rhoades, Rohith Rajasekaran, Kelly McKenna, Cassidy Hart, Sarah Burkhard

**Absent:** Pegah Bakhshi, Savanna Castello, Taylor Brooks Engdahl, Nicolas Omar Francone, Stefanos Ganotakis, Meagan Tomasso

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- [www.mboservices.net](http://www.mboservices.net)
- <http://membership.acs.org/W/WashDC/career.html>

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## CSW Calendar of Events

### March

Thursday, March 23: CSW Meeting

Monday, March 27: CSW Board Meeting

### April

April 2-6: ACS National Meeting, San Francisco

April 23: Rockville Science Day

April 24: Illustrated Poem deadline

### May

Monday, May 22: CSW Board Meeting

### June 2017 and Beyond

June 4-6: MARM

June 13-15: GC&E Conference

August 20-24: ACS National Meeting, DC

Monday, September 25: CSW Board Meeting

Monday, November 20: CSW Board Meeting