Volume 110, No. 3 March 2023

THE CHEMICAL BULLETIN

Chicago Section of the American Chemical Society Newsletter

March Hybrid Monthly Meeting

Thursday, March 16, 2023 5:45–8:35 PM CT

Breaking Bad: My Experiences as a Science Advisor

Dr. Donna Nelson

Professor of Chemistry
University of Oklahoma

ABSTRACT

Professor Nelson will discuss her experiences serving as science advisor to the award-winning crime drama television series *Breaking Bad*. The talk will describe how Nelson volunteered her expertise to show creator Vince Gilligan midway through the series' first season as well as her activities as science advisor, particularly in the area of organic chemistry. The presentation will touch on bad science and also how the show's main character, Walter White, applied his knowledge of chemistry and experimental abilities to make sound science the "chemical star of the show," according to *ChemistryViews*. The series has inspired a new generation of scientists, generally in a good way. For more information on the show's sound science, members are referred to the book, *The Science of Breaking Bad* (2019), by Dave Trumbore and Donna Nelson.

IN-PERSON DINNER

$35 for ACS members
$40 for nonmembers
$20 for students
Lecture-only is free (on-site or online)

Matthew Bieszczat Volunteer Resource Center (VRC)
6100 N. Central Ave
Chicago IL 60646
https://www.forestpreserveevents.com/resource-center

REGISTRATION

By phone (847-391-9091), email (chicagoacs@ameritech.net) or online:

REGISTER HERE

DEADLINES TO REGISTER

Fri, March 10 at 8 PM (Buffet Dinner)
Tues, March 14 at 8 PM (In-person Lecture-only)
Wed, March 15 at 8 PM (Zoom Lecture-only)

IN THIS ISSUE

MEET THE SPEAKER

Donna Nelson obtained her Ph.D. in chemistry at the University of Texas, Austin, under the mentorship of Michael J. S. Dewar and conducted postdoctoral work at Purdue University with Herbert C. Brown. Her research interests include nanoscience, communicating science to the public, organic chemistry education, and scientific workforce development. Prof. Nelson's many honors and awards include American Chemical Society (ACS) Fellow, the ACS Stan Israel Award, ACS E. Ann Nalley Award, Oklahoma Chemist Award, Fulbright Scholar, National Science Foundation ADVANCE Leadership Award, Women's eNews 21 Leaders for the 21st Century, AAAS Fellow, Guggenheim Award, and Sigma Xi Faculty Research Award. Donna Nelson served as President of the American Chemical Society in 2016.

Prof. Nelson's nanoscience research involves functionalizing single-walled carbon nanotubes, which has applications in energy research and technology development. She has also conducted research into ethnic and gender diversity among science department faculty at highly ranked major research universities. Donna has advised television programs, such as *Breaking Bad,* in order to further the universal goal of presenting accurate science to TV audiences. In 2011, she organized two highly popular symposia at ACS National Meetings, the Hollywood Chemistry Symposium in March and Science on the Screen Symposium in August.

FROM THE EDITORS' DESK

Celebrate Chemistry!

In honor of Women's History Month, we'd like to share some ACS resources that highlight the contributions of female scientists. The ACS published a five-part virtual collection about "Women Scientists at the Forefront of Energy Research" based on publications from *Energy Letters.* Part 1 begins with a personal reflection from Sharon Hammes-Schiffer, the 2021 Willard Gibbs Award Medalist.

Other ACS virtual collections focusing on women in science include:

- Women in Toxicology
- Celebrating Women in the Pharmaceutical Sciences
- Resilient Women and the Resiliency of Science
- Celebrating Women in Organic Chemistry
- Women in Mass Spectrometry
- Women at the Forefront of Chemistry
- Women in Nanotechnology
- Highlighting Selected Women Analytical Chemists

Our sincere thanks to the following individuals for their contributions to this issue: Paul Brandt, Helen Dickinson, Ken Fivizzani, Josh Kurutz, Sherri Rukes, Margaret Schott, and James Seale.

—AMBER ARZADON AND IRENE CESA

AGENDA

5:45–6:20	Check-in Social Hour
6:20–7:15	Buffet Dinner
7:15–7:30	Announcements
7:30–8:30	Technical Presentation/Q&A
8:30–8:35	Closing Remarks

DINNER

Moretti's Buffet Menu:

- Salad
- Chicken Parmesan
- Italian beef sandwiches (sweet peppers, hot giardiniera)
- Penne pasta with marinara sauce
- Chocolate brownies
- Coffee, water, and soda

LETTER FROM THE CHAIR

Ladies Night—Early Days of Women in Chemistry

Our section's January program meeting fell exactly 100 years after the Chicago Section's "Ladies' Meeting" held on January 19, 1923. The main speaker for that evening was Dr. Elizabeth Miller Koch from the Department of Physiological Chemistry at the University of Chicago. In her talk on "Sunlight as a Factor in the Vitamine Problem," Koch shared with the audience a critical survey of the role of diet in deficiency diseases, including rickets. The topic was chosen for its broad appeal to further "the purpose of Ladies' Night, that is, to interest the wives of members of the Section as well as its members."

Following the main address by Dr. Koch, there was a choice of topical group meetings, a staple of the section's programs at the time. Topics that evening included Inorganic and Organic Laboratory Methods, Synthetic Chemistry, and Biologic Chemistry. Topical group speakers hailed from industry, local and U.S. government bureaus, and academic laboratories.

The following month *The Chemical Bulletin* ran a synopsis of the program written by Eloise Parsons: "An unusually large attendance at the dinner, at the address of the evening, and at the group meetings indicated once again that the Ladies' Meeting is one of the Chicago Section's most popular events of the year."

It had been the custom since December 1918 for the Women's Committee of the Chicago Section to plan one of the section's meetings each year. *Bulletin* articles and editorials praised the Women's Committee for their organizational acumen and thoughtful selection of speakers. An editorial published in early 1919, for example, expressed hearty congratulations and added that other ACS sections would do well to emulate the Ladies' Night concept.

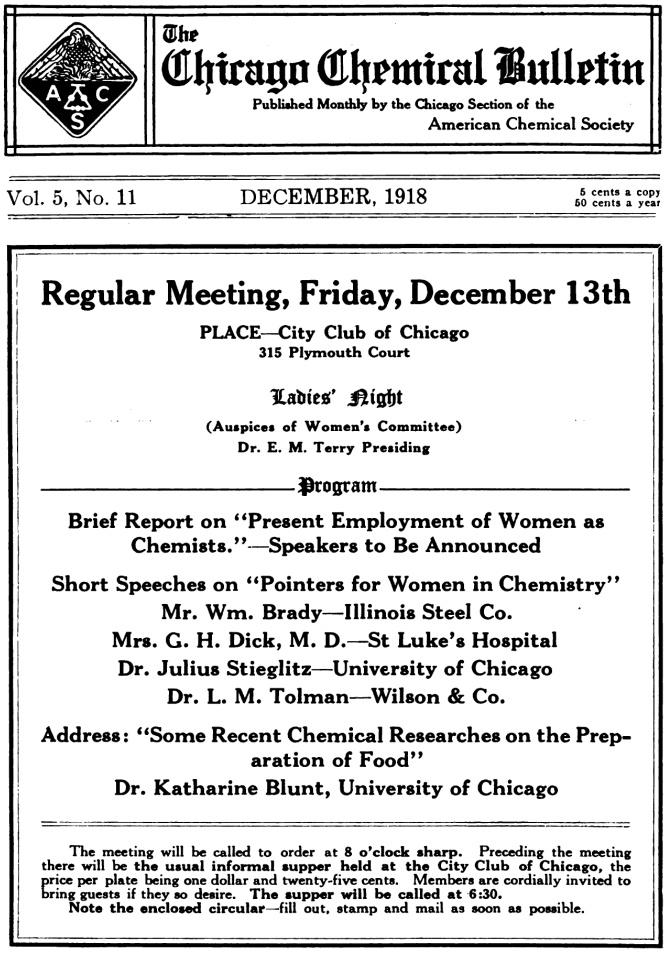
Explore the *Bulletin* Archives

Learn more about the fascinating history of the Chicago Section by exploring the digitized online archives of *The Chemical Bulletin,* which can be accessed from the Chicago ACS website at https://chicagoacs.org/Bulletin_Digitized.

There were several benefits to holding meetings run by women. Firstly, women other than Chicago Section members were attracted to the program topics. Secondly, women not only were given the freedom to plan the meetings as they saw fit, but also chaired them and presented talks including the evening's main address. Lastly, the topic of women in chemistry would soon become of growing and widespread interest.

As the nation celebrates Women's History Month in March 2023, it is valuable to recall some of this early history of women in chemistry. In alignment with the 2023 theme, "Celebrating Women Who Tell Our Stories," please visit the Chicago Section's archived website to read biographical sketches of pioneering women chemistry leaders in the Chicago area. See https://archive.chicagoacs.net/WCC/articles.php

—MARGARET SCHOTT



The Chicago Chemical Bulletin

Published Monthly by the Chicago Section of the American Chemical Society

Vol. 5, No. 11 DECEMBER, 1918 5 cents a copy 50 cents a year

Regular Meeting, Friday, December 13th

PLACE—City Club of Chicago
315 Plymouth Court

Ladies' Night

(Auspices of Women's Committee)
Dr. E. M. Terry Presiding

Program

Brief Report on "Present Employment of Women as Chemists."—Speakers to Be Announced

Short Speeches on "Pointers for Women in Chemistry"
Mr. Wm. Brady—Illinois Steel Co.
Mrs. G. H. Dick, M. D.—St Luke's Hospital
Dr. Julius Stieglitz—University of Chicago
Dr. L. M. Tolman—Wilson & Co.

Address: "Some Recent Chemical Researches on the Preparation of Food"
Dr. Katharine Blunt, University of Chicago

The meeting will be called to order at 8 o'clock sharp. Preceding the meeting there will be the usual informal supper held at the City Club of Chicago, the price per plate being one dollar and twenty-five cents. Members are cordially invited to bring guests if they so desire. The supper will be called at 6:30.
Note the enclosed circular—fill out, stamp and mail as soon as possible.

Cover page for the December 1918 issue of *The Chemical Bulletin* announcing the first Ladies' Night Meeting of the ACS Chicago Section.

SAFETY FIRST

Watch Out for Sodium Azide

Last year, the Nobel Prize in Chemistry was awarded for *click chemistry,* the quintessential example of which is the copper-catalyzed cycloaddition reaction of an azide and an alkyne. It's a simple, reliable chemical reaction that takes us pretty close to realizing an age-old metaphor of chemistry as the snapping together of molecular LEGO® bricks. The usefulness of this reaction has led to the frequently dangerous azide group becoming commonplace in organic chemistry.

Sodium azide is often the reagent of choice for attaching the azide group, $-N_3$, to organic molecules. My research group buys sodium azide in large, half-kilogram jars. A visiting colleague from Australia, seeing these containers, burst out laughing in incredulity because of their size and the potential danger they posed. Sodium azide is fatal if swallowed, highly reactive, and potentially explosive, and yet my lab buys it at a scale that a kitchen stocks table salt.

Part of the problem is that sodium azide shares a lot of features with plain old table salt; it's a fine, white, innocuous powder that dissolves readily in water. Sodium azide differs considerably from table salt in one key parameter, however—the number of ways it and its derivatives can be fatal:

- Ingestion (https://pubmed.ncbi.nlm.nih.gov/2313259/).
- Explosion (https://www.deseret.com/2002/4/16/19649677/iron-county-chemical-plant-safety-under-investigation).
- Overexposure following an explosion (https://academic.oup.com/jbcr/article-abstract/22/3/246/4733555).

It's worth noting that explosion fatalities often involve very large quantities of the chemical, such as industrial barrels and tanks. In the ingestion case, which took place in a college physiology lab, someone unwittingly drank 700-800 mL of a 1 g/L sodium azide solution, thinking it potable water. Such extreme scenarios are unlikely to occur at a typical lab scale. Nevertheless, you probably can't worry **too** much about a toxic salt that (1) can explode in its solid form from heat, shock, or even just friction (https://academic.oup.com/jbcr/article-abstract/22/3/246/4733555) and (2) can disappear into water and, apparently, taste acceptable enough that someone might drink almost a liter of it.

The dangers don't stop, however, with just sodium azide itself. There are many reagents and materials, ordinarily benign, that when combined with sodium azide can form compounds more hazardous still. Daniel S. Treitler and Simon Leung recently published a great perspective highlighting the pernicious risks of azide chemistry (https://pubs.acs.org/doi/10.1021/acs.joc.2c01402). The authors describe feeling compelled to spread awareness after seeing an earlier article in that same journal that reported many azide no-no's in synthetic protocols. Treitler and Leung highlighted three especially dangerous combinations:

1. **Acids.** Sodium azide reacts with acids to produce hydrazoic acid, a compound that shares with its progenitor the unfortunate property combo of explosiveness *and* toxicity. The authors point out that hydrazoic acid is "more explosive than TNT and orders of magnitude less stable." Even dilute solutions are extremely dangerous.
2. **Transition metals.** Sodium azide reacts with many metals, including copper and lead, and with transition metal salts to produce transition metal azides that are even more reactive than the sodium salt. "There is no general best practice for adding transition metals to reactions containing inorganic azide or hydrazoic acid, because such an act is extremely hazardous," the authors note.
3. **Dichloromethane.** The mixing of inorganic azides (like sodium azide) with the common solvent dichloromethane can lead to production of diazidomethane, a compound that is, again, more explosive than sodium azide.

The authors cite numerous sources reporting accidents and fatalities for violation of the above points. One problem is that many of these case-specific dangers aren't mentioned on sodium azide container labels and aren't elaborated upon on Safety Data Sheets. While general awareness and word-of-mouth can provide some safety guidance, it is imperative that anyone working with sodium azide develop or follow specific, written standard operating procedures for its use.

—JAMES SEALE

James Seale is a graduate student in Sir Fraser Stoddart's research group at Northwestern University. Thank you, Jim, for volunteering to contribute to the **Safety First!** initiative for the Chicago Section.

CALL FOR ACTION

Reach Out to Your Councilors

Do you have questions or concerns about how ACS is being run? Your nine Chicago Section Councilors are here to help get your message heard by the right people in ACS leadership. ACS governing bodies, including the ACS Council, will be meeting in Indianapolis during March 24–29, and your Councilors want to know what you think **before** we go to the meeting. Please write to councilors -at- chicagoacs.org to let us know your thoughts before March 9, when your local Councilors will meet to discuss the council agenda.

Councilors represent members of a local section or division at the ACS Council (see https://www.acs.org/about/governance/councilors.html). Council discusses and votes on ACS strategy statements, policy, setting of dues, changes to local sections, etc. At the Council meeting on Wednesday, March 29, we will have an opportunity to provide feedback to the ACS Board of Directors in front of the assembled Council, which includes more than 450 elected Councilors from all ACS local sections and divisions.

The Council Agenda for the ACS Meeting in Indianapolis is available on the ACS website, where you can obtain detailed information about the upcoming Council discussion and also read the minutes of previous meetings to learn more about how Council functions.

The Council Agenda includes two specific items that will merit discussion: one on the "Schedule of Membership" (types of and their dues settings), and another on the role of ACS Committees. See the action items highlighted in the Table of Contents, as well as pages colored blue: https://www.acs.org/content/dam/acsorg/about/governance/governance-cmt-mtgs-spring-2023/council-agenda-3-29-23.pdf . Your councilors would be especially interested in your thoughts on the action items.

Councilors and other Chicago Section board members can also provide a conduit to ACS Committees, which have their own activities and governance: https://www.acs.org/about/governance/committees.html. These 38 committees have wide-ranging functions and take action to meet specific needs. The Meetings and Expositions committee, for example, oversees ACS National Meetings and supports regional meetings like the Great Lakes Regional Meeting. The committees for Women Chemists, Younger Chemists, Senior Chemists, Minority Affairs, and Chemists With Disabilities, work for the interests of their communities. Starting Thursday, March 23, ACS committees will be meeting in Indianapolis to discuss business. To inquire about committee activities, please email the appropriate committee chairs and follow up with your Councilors at councilors -at- chicagoacs.org.

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2022–2024
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Jana Markley
Oluseye (Kenny) Onajole

2023–2025
Ilana Lemberger
Milton Levenberg
Avrom Litin
Margaret Schott

*Appointed by the board for one year (2023) to fill vacancies.

PAST MEETING

Nature Is a Chemist

The February 2023 Chicago ACS Program Meeting was held virtually on February 17 and featured Prof. Helen Zha of Rensselaer Polytechnic Institute. Her topic, "From Proteins to Polymers and Back Again," highlighted the fascinating interdisciplinary work her research group is doing that combines material science, organic synthesis, polymer chemistry, molecular biology, microbial engineering, and biotechnology. Prof. Zha's work is directed toward replicating the structural elements of silk that give it its unique, high-performance properties.

Primary silk proteins are alternating block copolymers consisting of crystalline, hydrophobic polypeptide segments interspersed with amorphous, hydrophilic segments in a regular manner.

How long does each segment or block need to be to achieve silk-like properties? What number of repeating units is necessary? Prof. Zha first described the synthesis of hybrid polypeptide–organic polymer structures in order to help answer those two questions. She then went on to discuss the preparation of artificial silk proteins using recombinant organisms and biotechnology.

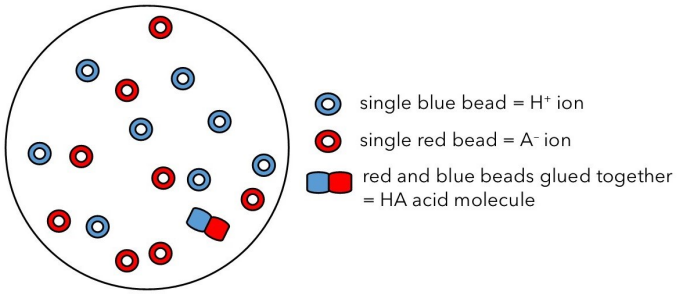
To learn more about this cutting-edge work, please see Dr. Zha's most recent paper, "Novel insights into construct toxicity, strain optimization, and primary sequence design for producing recombinant silk fibroin and elastin-like peptide in *E. coli.*" The paper appeared in *Metabolic Engineering Communications* and can be accessed at https://www.sciencedirect.com/science/article/pii/S2214030123000020.

TEACHER RESOURCES

Inquiry Activity for "Basic" Acid Concepts

Hands-on activities that students do in class to learn about acids and bases typically focus on the different properties of acids and bases and their neutralization reactions. When it comes to the difference between strong and weak acids and percent ionization, a lot of the time this chemistry is passively "covered" in lecture versus actively "uncovered" using inquiry. A lack of active engagement is often coupled with a lack of student retention as well, with students failing to develop a conceptual or particulate-level understanding of ionization in strong and weak acids.

A classroom activity titled "My Acid Can Beat Up Your Acid" that was published in a 2011 issue of the *Journal of Chemical Education* shows how to use models with beads for students to investigate the ionization of strong and weak acids. Students take on a more active role in the learning process as they analyze beads modeling the ionization of acids on the particulate level. Based on their observations and reasoning based on the evidence, students can then come up with the relationship between acid strength and the amount of ionization or dissociation of an acidic compound. Besides acid strength, students will also be able to model the difference in ionization behavior between monoprotic and diprotic acids.



Example of a strong monoprotic acid particulate model.

The author of the *Journal* article—and the activity's creator—is Alice Putti, who was the 2022 recipient of the James Bryant Conant Award in High School Chemistry Teaching. Ms. Putti used student-centered concepts, which correlate with the Illinois Next Generation Science Standards, to develop this modeling activity that can be done in 60 minutes or less depending on the level of the students. The number of unknowns and how many sets of bead models are used can also be varied to suit individual classroom needs. Enjoy reading the article and activity!

—SHERRI RUKES

CHEMSHORTS FOR KIDS

The Green Statue of Liberty

Photo credit: https://www.pexels.com/photo/figure-lady-liberty-landmark-monument-47086/

Everyone is familiar with the Statue of Liberty found in New York Harbor near Ellis Island, where more than 12 million immigrants came to the United States from 1892–1954. The statue was a gift to the U.S. from the people of France in 1886. However, the statue was not always the green color that we see today. Because the statue's coating is made of copper, it originally had the familiar reddish-brown color of a penny. So why is the statue green today? The transformation took place over the course of about 30 years as the copper metal reacted with the surrounding atmosphere. Let's see if we can do something similar with a penny by speeding up the reaction.

Materials

Dish soap	Small container (glass)
Measuring cup	Small plate
Paper towels	Tablespoon (plastic)
Penny	Vinegar
Salt	Water

***Be Safe*—**Vinegar will irritate eyes and skin. Avoid handling or contact with skin and eyes.

Experiment

Clean the penny using soap and water, then rinse it and place it in the glass container. Add a tablespoon of salt to the container, followed by ¼ cup of vinegar. Swirl the mixture to dissolve the salt. If all the salt has dissolved, add a bit more until no more dissolves. Let the reaction sit for about an hour.

Does anything happen to the penny? Fold a paper towel so that it is about 5 cm (2 inches) by 10 cm. Remove the penny using the plastic spoon and place the penny on the paper towel sitting on a plate. Pour some of the vinegar/salt solution onto the penny and fold the towel onto itself so that it is about 5 cm square and covers the penny. Pour the remaining vinegar solution onto the paper towel so it is saturated.

Let the experiment sit until the liquid has evaporated. (It's OK to check the penny periodically to see if anything is happening.) After 24 hours you should see some greening of the penny. If little color is seen, try wetting the towel again with more vinegar.

What's happening?

If you started with an old brown penny, you may have seen it turn shiny red when it was first exposed to the vinegar solution. Vinegar reacts with the surface coating on a penny, exposing the elemental copper metal underneath. Chloride ions from the sodium chloride (salt) help this process along by pitting the metal. (This is similar to what happens to cars that are exposed to roadway salt in the winter.)

As the vinegar evaporated you should have observed a green color begin to develop. Removing electrons from elemental copper converts it to positively charged copper ions, which can bond to negatively charged ions to form bluish-green solids. In the case of our penny exposed to air and vinegar, oxygen from the air removes two electrons from copper metal and the resulting copper ions bind to acetate ions found in vinegar to give copper acetate, a green solid. Because copper acetate is soluble in water, if you wash the coin in water the green coating should dissolve in the rinse.

Extension

Other web sites suggest using ammonia for this reaction to give a deeper blue color, or Miracle-Gro® to make the reaction go faster. Miracle-Gro® has copper ions in it so the final color is not derived from the penny. What effect would old pennies have (pre-1984 pennies are 95% copper) versus newer pennies that are only 5% copper? You can also experiment using red wine vinegar, which contains sulfite ions that are also found in urban atmospheres.

References

https://www.frugalfamilytimes.com/2019/11/how-to-turn-copper-green-patina/

https://www.acs.org/pressroom/reactions/library/the-statue-of-libertys-true-colors.html

https://www.snopes.com/fact-check/statue-liberty-different-color/

To view past "ChemShorts for Kids" activities, go to: https://chicagoacs.org/ChemShorts.

—PAUL BRANDT

2023 Chemists Celebrate Earth Week (CCEW) Illustrated Poem Contest

"The Curious Chemistry of Amazing Algae"

The Chicago Local Section of the American Chemical Society (ACS) is sponsoring an illustrated poem contest for students in kindergarten through 12th grade.

Contest Deadline: April 30, 2023 @ 11:59 PM
Prizes: Theme-related prize or gift card
Local Contact: Sherri Rukes (community@chicagoacs.org)
Entry Form: https://chicagoacs.org/CommunityActivities
Submission: Sherri Rukes (community@chicagoacs.org)

Winners of the Chicago Local Section's Illustrated Poem Contest will advance to the National Illustrated Poem Contest for a chance to be featured on the ACS website and to win prizes!

Write and illustrate a poem using the CCEW theme, "**The Curious Chemistry of Amazing Algae.**" Your poem must be **no more** than 40 words and in one of the following styles to be considered:

HAIKU - LIMERICK - ODE - ABC POEM - FREE VERSE - END RHYME - BLANK VERSE

Possible topics related to the theme include:

- Seaweed
- Micro- or macro- algae
- Photosynthesis
- Bioluminescent algae
- Algae as food & habitat for animals
- Consumer products from algae
- Oxygen from algae
- Biofuels from algae

Entries will be judged based upon:

- Artistic Merit - use of color, quality of drawing, design, and layout
- Poem Message - fun, motivational, inspiring about yearly theme
- Originality and Creativity - unique, clever and/or creative design
- Neatness - free of spelling and grammatical errors

Contest rules:

- All poems must be no more than 40 words and in one of the following styles to be considered: Haiku, Limerick, Ode, ABC poem, Free verse, End rhyme, and Blank verse.
- Entries are judged based upon relevance to and incorporation of the CCEW theme, word choice and imagery, colorful artwork, adherence to poem style, originality and creativity, and overall presentation.
- All entries must be original works without aid from others. Poems may be submitted by hand on an unlined sheet of paper not larger than 11" by 14" or scanned and sent via email. Illustrations may be created using crayons, watercolors, other types of paint, colored pencils, or markers. The illustration may also be electronically created by using a digital painting and drawing app on a computer, tablet, or mobile device.
- The text of the poem should be easy-to-read and may be typed before the hand-drawn or digital illustration is added, or the poem may be written on lined paper, which is cut out and pasted onto the unlined paper with the illustration.
- No clipart or unoriginal images can be used.
- Only one entry per student will be accepted; all entries must include an entry form.
- If the illustration is created using a digital painting or drawing app, the name of the program must be included on the entry form.
- Acceptance of prizes constitutes consent to use winners' first name and last initial, along with the name of the ACS Local Section, on the ACS web pages and in the magazine, Chemical & Engineering News.

UPCOMING EVENTS

March 9	Chicago Board of Directors Meeting
March 13	Articles due for the April 2023 *Bulletin* issue
March 16	Chicago ACS Monthly Program Meeting (Hybrid)
March 26–30	Spring 2023 ACS National Meeting in Indianapolis
April 10	Articles due for the May 2023 *Bulletin* issue
April 13	Chicago Board of Directors Meeting
April 21	Chicago ACS Monthly Program Meeting (Virtual)

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