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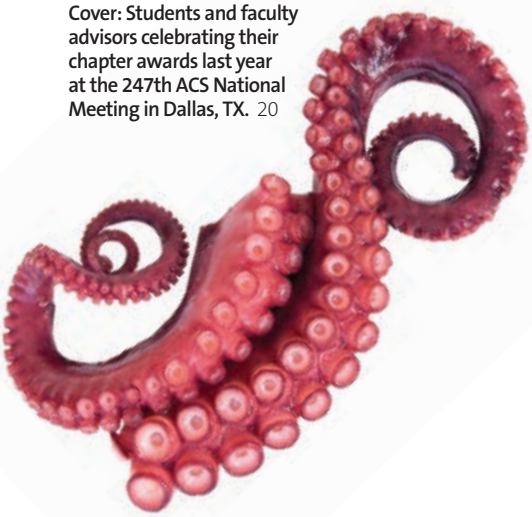
inChemistry

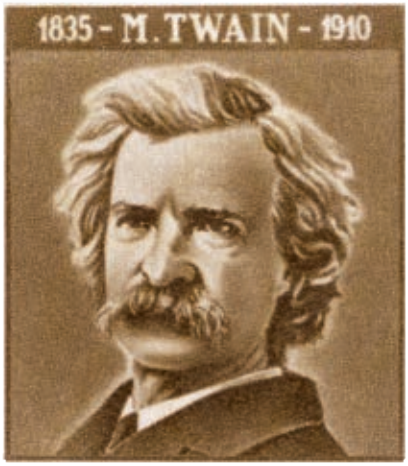
THE MAGAZINE FOR ACS STUDENT MEMBERS

Volume 23 • Number 2
November/December 2014

PHOTO: CHRISTINE BRENNAN SCHMIDT, ACS

Cover: Students and faculty advisors celebrating their chapter awards last year at the 247th ACS National Meeting in Dallas, TX. 20





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Call for Applications

SCI SCHOLARS

Summer Industrial Internship Program for Undergraduates

Summer 2015

The Society of Chemical Industry (SCI) is pleased to offer the **SCI Scholars Program,** which is designed to introduce exceptional chemistry and chemical engineering students to careers in chemical industry. Selected students will become SCI Scholars and participate in one of many prestigious 10-week industrial internships during the summer of 2015.

BENEFITS:

- Industrial experience
- Generous award—the stipend is in the $6,000–10,000 range for the 10-week internship
- Certificate and $1000 travel award to participate in a scientific meeting
- SCI Scholars will nominate a high school chemistry teacher for recognition and a $1000 award

REQUIREMENTS:

- Current sophomore or junior
- Chemistry or chemical engineering major
- Minimum GPA of 3.5
- U.S. citizen or permanent resident

SCI Scholars will be selected based upon the strength of their application, statement of interest, and letters of recommendation.

To see information and apply, visit www.acs.org/sci

Deadline to apply is December 19, 2014

EDITORIAL: **A Job Well Done!**

BY THOMAS J. BARTON

PHOTOS: CHRISTINE BRENNAN SCHMIDT, ACS

Chapter president Dannajoe Galarza-Ramos accepts two awards on behalf of the Inter American University of Puerto Rico-San Germán student chapter at the Chapter Awards Ceremony at the 247th ACS National Meeting in Dallas, TX.

It is a tremendous pleasure for me to help recognize and celebrate the many accomplishments ACS student chapters and their faculty advisors have made throughout the country. Over the past year as the president of ACS, I have had the wonderful opportunity to meet and work with many undergraduate students and their advisors. What you are doing is incredibly important: introducing young students to the exciting world of science, and educating non-scientists about the fundamental importance of chemistry in our daily lives.

I have personally witnessed your tremendous efforts, and I know you understand just how important they have been. Unless we work together to increase public interest and support of chemistry, there will not be adequate funding to solve fundamental health and societal issues through chemical research. We must enable chemists to contribute solutions to global problems by doing such things as continuing to discover new powerful drugs to fight cancer, developing better catalysts for converting biomass to fuels, and creating solar-activated catalysts to convert water to hydrogen and oxygen to solve our global energy crisis — to name just a few critical needs.

Over the past year, I have also noticed how your efforts have helped you gain valuable professional skills that will serve you well throughout your career. Through your student chapter activities, you have started to develop and exercise your leadership skills, build a strong network of mentors, colleagues, and friends, and broadly take advantage of all the development opportunities ACS has to offer.

Thank you for all you have done, and for what you will continue to do to advance the mission of ACS. No matter where the future takes you, you will always have the experience of having learned how chemistry can improve the world we live in. I wish you continued success!

Congratulations, students and faculty advisors! Well done! iC

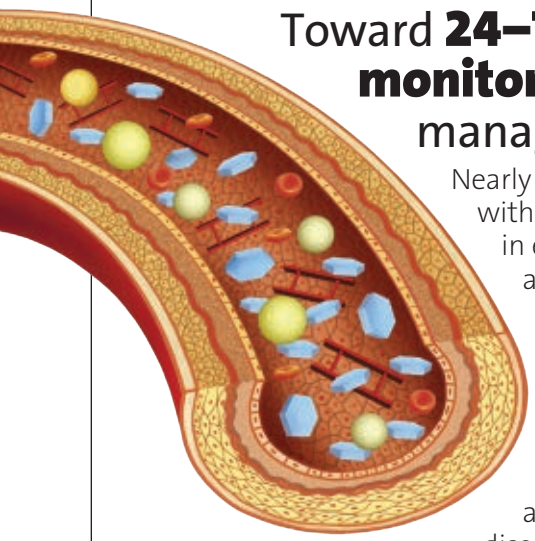
Thomas J. Barton, *distinguished professor emeritus of chemistry at Iowa State University and former director of the U.S. Department of Energy's Ames Laboratory, is president of ACS.*

The University of Texas at Dallas student chapter members pose with Nick L. Mole (mascot of the Fresno State, CA, student chapter) after the Student Chapter Awards Ceremony at the 247th ACS National Meeting in Dallas, TX.

ATOMIC NEWS

COMPILED BY JESSICA ROBERTS

Source: ACS Office of Public Affairs Weekly PressPac, www.acs.org/content/acs/en/pressroom.html



Toward **24–7 glucose monitoring** to help manage diabetes

Nearly half a million people with diabetes end up in emergency rooms around the United States every year due to seizures and other consequences of dropping or spiking blood-sugar levels associated with the disease. To help prevent serious complications, researchers have now developed a new glucose-sensing protein that could one day be part of an implantable, 24–7 monitoring device. They describe the protein in the journal *ACS Chemical Biology*.

Sylvia Daunert and colleagues note that researchers have been working on new ways to track glucose levels. Most patients with diabetes do this by using a glucose meter. They prick a finger with a tiny needle to draw blood, which they apply to a test strip inserted into the meter. The meter provides a reading of the level at that moment. But glucose levels change throughout the day, so many readings are needed. That's not always convenient, and some people find that pricking their finger is painful. As a result, many patients don't test their blood as often as they should, risking complications such as seizures.

For more continuous monitoring, some patients use implantable devices that measure blood sugar as often as once a minute, but they have drawbacks. They are expensive, can only be used for up to a week, and are not as reliable as conventional meters. Daunert's team set out to improve upon these limited options.

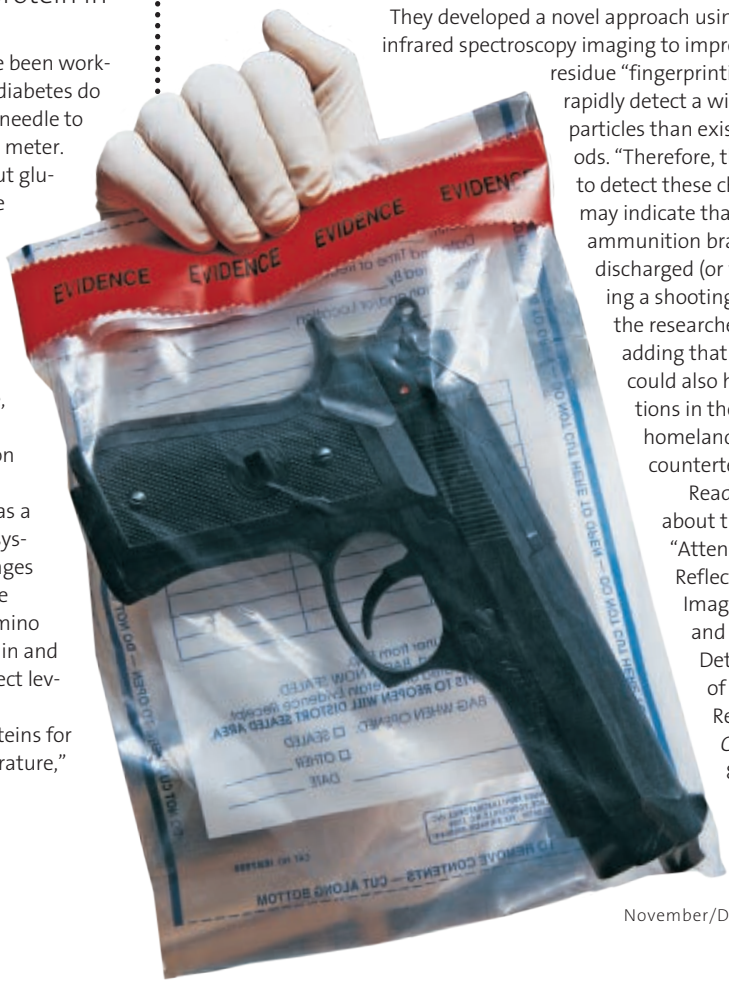
They turned to a protein that has already been explored as a good candidate for use in a continuous glucose monitoring system. It's a glucose/galactose binding protein (GBP) that changes shape when it attaches to glucose. Through truncation of the native *E. coli* protein and incorporation of a few unnatural amino acids, they engineered the protein so that it would be stable in and out of the body for long periods and so that it could also detect levels of glucose under physiological conditions.

Read more about the research: "Glucose Recognition Proteins for Glucose Sensing at Physiological Concentrations and Temperature," *ACS Chem. Biol.*, May 19, 2014 (Web).

Real-life CSI: What can investigators really tell from gunshot residue?

The popular TV series *CSI* is fiction, but every day, real-life investigators and forensic scientists collect and analyze evidence to determine what happened at crime scenes. In a study published in the ACS journal *Analytical Chemistry*, researchers say they have developed a more rapid and accurate method that could allow crime scene investigators to tell what kind of ammunition was shot from a gun based on the residue it left behind.

Igor K. Lednev and Justin Bueno point out that when someone fires a gun, burnt particles from the bullet spray out of the weapon onto a shooter's hand, clothes, furniture, and other surfaces nearby. The presence or absence of that residue says whether a gun was discharged and — based on its location on clothing and other surfaces — who and what was near the weapon when it was fired. But current analysis methods can only re-create a crime scene story in hazy detail. The most widely used technique today, scanning electron microscopy combined with energy-dispersive X-ray spectroscopy (SEM/EDS) specializes in detecting the heavy metals that some ammunition contains. Newer bullets, however, aren't necessarily made with heavy metals, making analyses much more difficult. Also, these methods require expensive equipment and a lot of time, luxuries law enforcement cannot afford. To bring real-life CSI closer to what's hyped on TV, Lednev's team set out to find a new way to trace the ammunition used in a crime.



They developed a novel approach using a type of infrared spectroscopy imaging to improve gunshot residue "fingerprinting" that can rapidly detect a wider range of particles than existing methods. "Therefore, the ability to detect these chemicals may indicate that a specific ammunition brand was discharged (or was not) during a shooting incident," the researchers state, adding that their work could also have applications in the fields of homeland security and counterterrorism.

Read more about the research: "Attenuated Total Reflectance-FT-IR Imaging for Rapid and Automated Detection of Gunshot Residue," *Anal. Chem.*, 2014, 86 (7), pp 3389–3396.

ALL PHOTOS IN ATOMIC NEWS: THINKSTOCK

Squid sucker ring teeth material could aid reconstructive surgery, serve as eco-packaging

Squid tentacles are loaded with hundreds of suction cups, or suckers, and each sucker has a ring of razor-sharp "teeth" that help these mighty predators latch onto and take down prey. In a study published in the journal *ACS Nano*, researchers report that the proteins in these teeth could form the basis for a new generation of strong, but malleable, materials that could someday be used for reconstructive surgery, eco-friendly packaging, and many other applications.

Ali Miserez and colleagues explain that in previous research, they discovered that sharp, tough squid sucker ring teeth (SRT) are made entirely of proteins. That makes SRT distinct from many other natural polymers and hard tissues (such as bones) that require the addition of minerals or other substances to perform the right activities. The team already had identified one "suckerin" protein and its encoding gene.

In the new study, they identified 37 additional SRT proteins from two squid species and a cuttlefish. The team also determined their architectures, including how the secondary structures, called β-sheets, were formed. These nanoconfined β-sheets form a reinforced polymer network. Spider silks also form these structures, which help contribute to their strength and stability. And just as silk is finding application in many areas, so too could SRT proteins, which could be easier to make in the lab and more eco-friendly to process into usable materials than silk. "We envision SRT-based materials as artificial ligaments, scaffolds to grow bone, and as sustainable materials for packaging, substituting for today's products made with fossil fuels," says Miserez. "There is no shortage of ideas, though we are just beginning to work on these proteins."

Read more about the research: "Nanoconfined β-Sheets Mechanically Reinforce the Supra-Biomolecular Network of Robust Squid Sucker Ring Teeth," *ACS Nano*, 2014, 8 (7), pp 7170–7179.

New method to identify inks could help **preserve historical documents**

The inks on historical documents can hold many secrets. Their ingredients can help trace trade routes and help reveal a work's historical significance. And knowing how the ink breaks down can help cultural heritage scientists preserve valuable treasures. In a study published in the *Journal of the American Chemical Society*, researchers report the development of a new, non-destructive method that can identify many types of inks on various papers and other surfaces.

Richard Van Duyne, Nilam Shah, and colleagues explain that the challenge for analyzing inks on historical documents is that there's often very little of it to study. Another complication is that plant- or insect-based inks, as well as some synthetic ones, are composed of organic molecules, which break down easily when exposed to light. Current methods are not very specific or sensitive, and can leave a residue on a document. To address these issues, the research team set out to develop a different way to analyze and identify historical inks.

They used tip-enhanced Raman spectroscopy (TERS) to analyze indigo and iron gall inks on freshly dyed rice papers. They also studied ink on a letter written in the 19th century. "This proof-of-concept work confirms the analytical potential of TERS as a new spectroscopic tool for cultural heritage applications that can identify organic colorants in artworks with high sensitivity, high spatial resolution, and minimal invasiveness," say the researchers.

Read more about the research: "Tip-Enhanced Raman Spectroscopy (TERS) for *in Situ* Identification of Indigo and Iron Gall Ink on Paper," *J. Am. Chem. Soc.*, 2014, 136 (24), pp 8677–8684.

1.9×10^{19} The half-life (in years) of alpha decay for bismuth-209. This is longer than the current estimated age of our universe.

55 The atomic number of cesium, the softest metal. It is so malleable that it can be cut with a butter knife.

22.59 The density in g/cm³ of osmium, the densest naturally occurring element. It is often used in the tips of fountain pens, as it can stand up easily to repeated use.

30,000 The Celsius temperature of a lightning strike. This is about five times hotter than the Earth's core.

20 The percentage of oxygen in the atmosphere produced by the Amazonian rainforests.

CHEMISTRY OF NATURAL RESOURCES

249th ACS National Meeting
DENVER, COLORADO • MARCH 22–26, 2015

UNDERGRADUATE PROGRAM

SUNDAY, MARCH 22

Undergraduate Hospitality Center
8:30 AM–5:00 PM

Undergraduate Research Oral Session
8:30 AM–5:00 PM

Making the Most of Your First National Meeting
9:00–9:45 AM

Graduate School Reality Check: Getting In
10:00–11:15 AM

Workshop: Jump Start Your Career with an Undergraduate Internship!
10:00 AM–12:00 NOON

Chem Demo Exchange
11:00 AM–12:30 PM

Graduate School Reality Check: You're In– Now What?
11:15 AM–12:30 PM

Networking Social with Graduate School Recruiters
1:00–5:00 PM

Can You Have a Life and Career? Symposium
2:45–4:00 PM

ACS Strategy Café
2:45–4:00 PM

Improving Scientific Communication Skills Workshop
4:00–5:15 PM

Teaching High School Chemistry Workshop
4:00–5:30 PM

Student Chapter Awards Ceremony
7:00–8:30 PM

Undergraduate Social
8:30–11:00 PM

ACS Chemistry for Life®

Attention: Graduate School Recruiters!

Network with highly qualified undergraduate students who are interested in learning more about your graduate school programs. Register to participate in the graduate school recruiting events. To register, go to www.acs.org/GradSchoolRecruiters. For more information contact Lori Betsock at l_betsock@acs.org.

All events are sponsored or co-sponsored by the Society Committee on Education Undergraduate Programs Advisory Board.

CHAIR: Matthew J. Mio • *University of Detroit Mercy, MI*

PROGRAM CHAIR: Daniel J. Swartling • *Tennessee Tech University, Cookeville*

MONDAY, MARCH 23

Undergraduate Hospitality Center
8:30 AM–5:00 PM

Undergraduate Research Oral Session
8:30 AM–5:00 PM

Biomass to Fuel & Products Symposium
9:00–10:30 AM

Workshop: Chemists Celebrate Earth Day
9:00–1 1:00 AM

Networking 101 Workshop
9:45–10:45 AM

Forensic Toxicology of Marijuana Symposium
10:45–11:45 AM

Undergraduate Research Poster Session
12:00 NOON–2:00 PM

Eminent Scientist Lecture
Featuring Dr. Henry Kohlbrand, Dow Chemical, on "Sustainability from a Research and Industrial Point of View"
2:30–3:30 PM

Speed Networking with Chemistry Professionals
3:45–5:15 PM

Kavli Lecture
5:30–6:30 PM

Sci-Mix/Successful Student Chapter Posters
8:00–10:00 PM

TUESDAY, MARCH 24

Chemistry and the Environment Film Series
12:00 NOON–2:00 PM

Program format and times are subject to change. Please consult the final program.

DISCOVER *the* Unexpected

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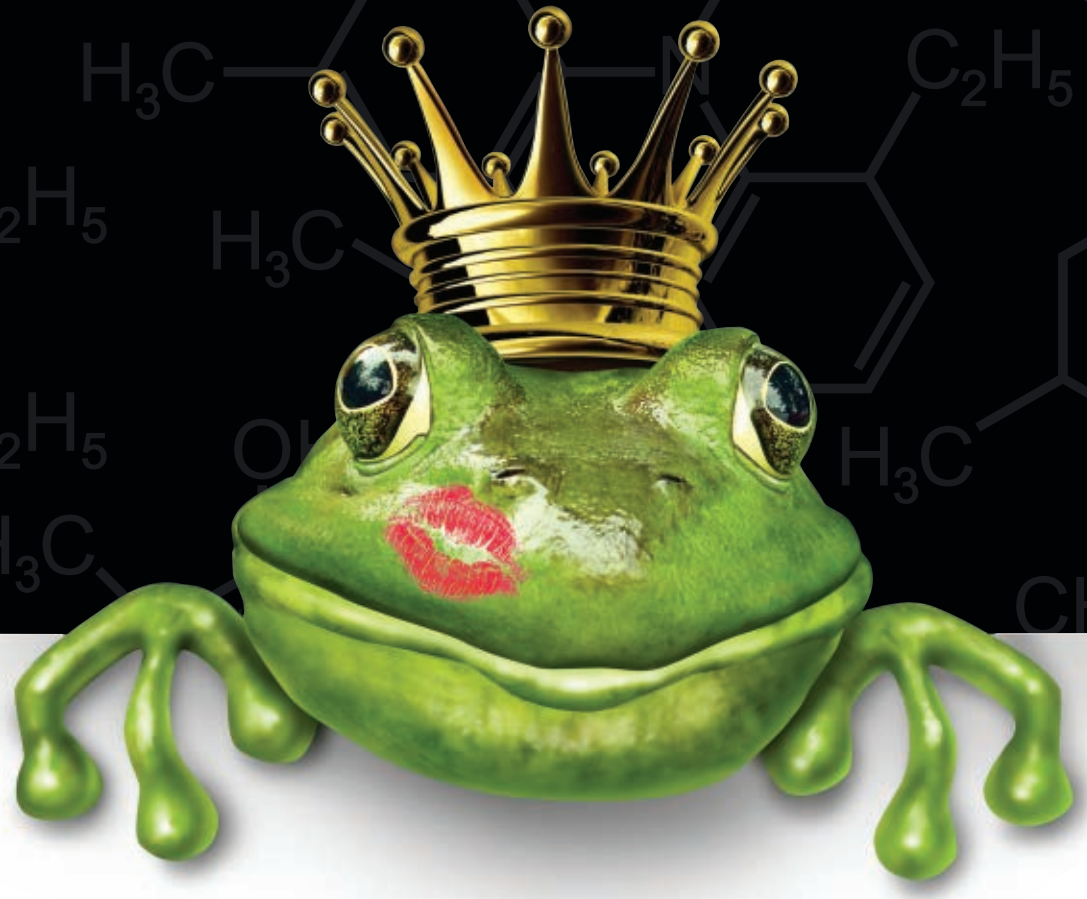

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American Association of Chemistry Teachers

3 Reasons to Get Involved – Now!

BY ADAM BOYD

You should consider being a chemistry teacher. Seriously, you should.

You may not realize it, but as a student member of ACS, you have a skill set that is coveted across the country and around the world — a love of chemistry and the ability to demonstrate it in new and creative ways. Remember when you made that periodic table of cupcakes? Remember when you stayed up until 2:00 a.m. studying protecting groups so you could ace that organic exam?

You are among the most elite candidates to inspire the next generation of scientists and scientifically literate citizens. So if you want a challenging career that makes great use of your skills and makes a difference in the world every day, teaching might be for you.

The good news is that if you're open to considering the idea, there's never been a better time to consider being a chemistry teacher, thanks in part to AACT, a new association for chemistry teachers launched by ACS this fall.

Membership is open to everyone who has an interest in chemistry education, including undergraduate students. Here are three big reasons why joining AACT could benefit you, either now as an undergraduate student or in the future.

1. Learn from a supportive community of other chemistry teachers.

Until this year, there had never been a national network specifically by and for K–12 teachers of chemistry. With the launch of AACT, new teachers entering the field have access to other teachers with decades of experience with whom they can trade ideas, exchange strategies, and find support.

When you become a new teacher entering the field, it may especially benefit you to find more experienced teachers who can mentor you and support you. It will also benefit you to be able to learn from tips of others who have been new teachers before and have developed successful strategies to teach the finer points of covalent bonding to a room full of Jesse Pinkmans before lunch. Whatever you encounter, you'll have support from a community of thousands who can help you succeed.

2. Access high-quality and reliable chemistry teaching resources.

Searching the Internet can be time-consuming and frustrating despite its great power. To aid new and experienced teachers alike, the AACT website contains a vetted collection of teaching resources developed by teachers across the country that provides a unified repository for lesson plans, demos, and labs that are trustworthy and safe. It also houses a collection of multimedia, including videos, animations, and simulations.

So if you need a video to help a chemophobe appreciate the applicability of chemistry, or to convince your flatmates that spending extra time in the lab is actually evidence of your greatness, the multimedia provided through AACT may be one way to do it.

3. Pave the way for other younger teachers of chemistry.

As an inclusive community of educators, AACT needs the perspective of younger chemists and new teachers to grow and thrive. If you're interested in being a teacher, joining AACT is an opportunity to support the community at large and specifically your peers, to explain your unique needs and perspectives.

So, think about it, won't you? Even if you're certain that your career path won't again intersect with a K–12 classroom, you can still support AACT by supporting your peers for whom it will.

Please visit **teachchemistry.org** to learn more, become a charter member, and get involved. iC

Adam Boyd *is the program director of AACT.*

What is AACT?

To support future teachers of chemistry (like yourself?) and teachers already in the field, ACS recently launched the American Association of Chemistry Teachers (AACT) — the first and only national association by and for K–12 teachers of chemistry. It offers:

- Specialized chemistry teaching resources.
- Annual subscriptions to *Chemistry Solutions* and *ChemMatters*.
- Professional development opportunities.
- Platforms to connect with other educators.
- Special student member dues discount.
- *And more!*

To learn more about AACT and how you can become a charter member, go to: teachchemistry.org. iC

A Matter of Degree

Which Graduate Degree Program Is Right for You?

BY NANCY McGUIRE

In this economy, is earning a B.S. degree in chemistry enough to land a job? Will you need to earn a Ph.D.? What other options do you have? The answers depend on what you're looking for and the direction you intend for your career to take.

Ph.D.s have a wide range of career options open to them. They weathered the Great Recession better than their counterparts with B.S. and M.S. degrees, and on average, they earn higher salaries. On the other hand, getting a Ph.D. means more time out of the main workforce, at least several more years living on a tight budget, and very likely, a postdoctoral fellowship or two.

Not everyone who goes to graduate school wants to go into basic research or academia, and not everyone can. Graduate schools in the United States have been churning out many more science graduates than there are laboratory or academic jobs available in these sectors (1,2). Fortunately, many scientists with graduate degrees find fulfilling jobs in a wide variety of career areas, with or without graduate degrees (3,4). The National Science Foundation's *Science and Engineering Indicators* report for 2014 states, "Many more individuals have science and engineering degrees than work in science and engineering occupations" (5).

Choosing a field of study

If you do decide to go to graduate school, how can you make sure you get the education you need for the career you want? To some extent, your choice may be a numbers game. If you pursue a career in a popular field, you must find a way to distinguish yourself and your work from your many colleagues. If you go into something more obscure, you may struggle to find job openings in your specialty or you may have to explain to a potential employer how your experience makes you the ideal candidate for a job opening that may be tangentially related to your graduate work.

According to the 2014 ACS Salaries and Employment survey results report in the September 1, 2014 issue of *Chemical & Engineering News*, employment of ACS members has risen in agricultural and food chemistry, specialty and fine chemicals and coatings, paint, and ink, while employment continued to decline in the pharmaceutical and medical device industries. Steven Meyers, assistant director of ACS's Career and Professional Advancement Office, also noted that the service sector has seen increased employment in analytical testing and other professional services relating to science, engineering, and the law. Basing a career choice strictly on employment projections is risky, as employment trends can change over time. However, if your interests coincide with an area of high demand, the job market is one factor to consider.

A graduate degree can, and should, offer benefits beyond technical training and job credentialing. The contacts you make in graduate school can provide access to professional networks and opportunities that you might not have otherwise. Attending conferences, making presentations, and publishing your research can develop your communication skills and raise your visibility within the professional community. Working on collaborative projects, especially with colleagues in various disciplines or geographic locations, is valuable practice for team projects after you graduate. Mentoring undergraduate students and managing lab projects provides valuable experience in personnel and project management.

Science graduates can find that their training is an asset in a completely different field. Fields in technical communication

THINKSTOCK

benefit from professionals who have honed their critical thinking and research skills in science. Scientists with law degrees can tackle highly technical court cases. Depending on how far afield you go, you may need to do extra coursework to fulfill the prerequisites for your graduate program.

The best degree program for you depends on your field of study and your career goals. If you stay with chemistry, the most common options are the doctorate, the master's degree, and a graduate certificate.

Ph.D. programs

Typically, Ph.D. students spend their first couple of years taking courses, taking cumulative exams, and teaching undergraduate laboratories and recitation sections. Depending on the university and your area of specialization, you will have anywhere from a few months to a year or so to identify a research area and a faculty mentor. The remaining years are spent doing laboratory research and writing a dissertation.

The Ph.D. student is expected to generate new knowledge by solving novel problems or finding novel ways of solving problems. This model is designed to produce academic scientists who do basic research.

Science Ph.D. graduates who work in industry often note that the biggest adjustment they have to make is learning to produce quick, practical results that meet the company's needs. They must learn to fulfill client expectations and communicate the results and relevancy of their projects to busy managers, who might have little to no technical background. Getting this experience during graduate school may be difficult because many Ph.D. programs discourage or even prohibit outside employment. Ph.D. students will often work around these rules by taking extra courses or becoming active in a professional organization to gain these skills.

On the plus side, Ph.D. graduates learn to be self-motivated and think independently, skills that can be applied in many different fields. Earning a Ph.D. is solid evidence that you can take on a difficult project and see it through to completion, an accomplishment that many employers value highly.

Traditional M.S. degrees

Traditional M.S. degree programs are robust and take approximately two years to complete. As Sam Pazicni, assistant professor of chemistry and chemistry education at the University of New Hampshire, explains, "Students who are interested in developing a high degree of proficiency in a specialized research area while gaining modest exposure to independent research should consider enrolling in a traditional M.S. program." Coursework and research are required; a thesis may be optional. Students who earn M.S. degrees frequently go on to doctorate programs, and when they do, typically they find that they are well prepared to handle the rigors of those programs. M.S. degrees are also awarded to graduate students who have successfully completed their coursework in the Ph.D. programs but are unable to complete their Ph.D. research and dissertation.

Often, however, master's graduates find that their degree satisfies their objectives as well as or better than a Ph.D. Master's degree holders can pursue careers in management, in policy, or as research assistants or legal aides. Colleges and high schools hire master's graduates as instructors or laboratory coordinators.

Master's students complete the same coursework, including advanced theoretical courses, as their Ph.D. colleagues, and they may finish a scaled-down version of their dissertation research. Pazicni recommends that master's degree students complete a thesis project, even if it's not strictly required, because many employers seek applicants with research experience.

Returning to finish a Ph.D. program can be easier with an M.S. degree than with other graduate degrees, since the coursework is the same. However, M.S. graduates who return after more than a few years might have to repeat some courses or re-take qualifying exams.

Professional Science Master's degrees

The Professional Science Master's (PSM) degree is a relatively new development, but about 300 such programs exist in the United States as of 2014. Touted as "the MBA degree for science," these programs train students who intend to go into law, government policy, management, journalism, or other non-laboratory careers that nevertheless require an advanced knowledge of scientific principles.

The coursework and internships in PSM programs give students job-focused experience in their areas of interest. Generally, PSM students do not do basic research, and not all programs require a thesis project. PSM students have their eyes on a specific career path, and their internships give them and their potential employers a chance to check each other out.

It's critical to investigate what a particular PSM program has to offer before signing up. The best PSM programs provide students with a course of study and practical experience specifically geared toward their target careers, as well as access to potential employers and career entry points. Smaller and less well-developed programs may have PSM students taking the same science classes as students pursuing M.S. and Ph.D. degrees, with some internship experience added in.

In the final analysis, getting the most from a graduate program is a balancing act.

PSM graduates are of most interest to employers in the industries and geographic regions where they get their degrees. Universities attract corporate cosponsorships by promising local companies a supply of highly focused graduates trained in relevant skills.

Employers not directly involved in PSM sponsorships commonly make no distinction between the PSM degree and the M.S. degree, so cross-disciplinary training and productive internships are of key importance to getting the greatest value from the PSM.

Graduate certificate programs

Certificate programs attract students who need to meet state or national licensing requirements or those who already hold a bachelor's degree but seek to launch a new career not related to that degree. Certificate programs typically consist of 3 to 12 courses that help you develop career competency in a single subject within 12 or 18 months, but the programs can vary greatly. For example, Arizona State University offers certificates in conjunction with conventional Ph.D. programs as a formal recognition that a student has completed additional coursework in areas such as business administration or communications.

Stevens Institute of Technology (Hoboken, NJ) takes a different approach, offering science and engineering graduate certificates upon completion of one of several four-course programs, geared toward working professionals who want to broaden their skill sets and advance their careers.

Montgomery College (Germantown, MD) offers a third type of graduate certificate, for students seeking careers in the biotech industry. This effort started as a two-year associate's degree program, but now it also provides supplemental training to students who already have their bachelor's degrees. Collins Jones, biotechnology industry coordinator for the program, works closely with local biotech businesses to design coursework and lab facilities and industry internships. Students gain hands-on experience with the equipment and methods that they will encounter in the workplace, and the companies often hire their most promising student interns.

Making the choice

In the final analysis, getting the most from a graduate program is a balancing act. Going after a targeted, specific goal can help you land a job in a specific employment sector, but pursuing a broader education can give you basic reasoning, investigative, and problem-solving skills that you can apply just about anywhere. The conventional Ph.D. program offers definite advantages in respect and recognition, and the independent research provides experience that can be applied to a wide range of fields. Graduates who make the commitment of time and effort and see their programs through to completion are valued assets for many employers.

Master's degree, PSM degree, and graduate certificate programs offer advantages to students who are pursuing specific career paths. Students can enter (or re-enter) the workforce more quickly, and they may eventually return for a higher degree.

Choosing the best program for you requires a general idea of the direction you want to go, along with the flexibility to pursue unexpected opportunities along the way. iC

Nancy McGuire *is a freelance writer based in Silver Spring, MD. She has a Ph.D. in solid state chemistry and began her career doing applied research.*

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This article is presented in recognition of the International Year of Crystallography in an effort to increase public awareness worldwide of the science of crystallography.

THINKSTOCK

Crystal Chemistry

Explore the Solid State of Matter by Growing Your Own Crystals

BY CAMILLE Y. JONES

Crystals are a ubiquitous part of our world and essential to our everyday existence. We use them to pave roads and erect buildings and in the manufacture of cars, buses, and electronic devices. We ingest crystals in our foods and medicines, apply them to our skin, and wear them as jewelry. Simply take a brief excursion into any of the spaces on our planet, either natural or artificial, and at least a few crystals are bound to turn up.

The great news is, if you're interested in gaining a better understanding of crystals and crystallography, you don't necessarily need access to exotic chemicals or expensive laboratory equipment. In fact, you needn't go any farther than your kitchen cupboard or garage to begin your exploration of the crystalline world. With just a few basic household chemical ingredients and some basic tools, you can grow and study beautiful crystals. And since 2014 is the International Year of Crystallography (IYCr), you can also access a wide range of special crystallography resources on the IYCr website at **www.iycr2014.org**.

Let the exploration begin

First, look around and consider the big picture. The solid materials in our world are either crystalline or amorphous. Plastics, for example, can be in a completely amorphous, glassy, or partially crystalline form. Many properties of plastics depend on the extent of crystallinity in their structure. Also, most metals you see are probably crystalline; however, some metals can be processed into a glassy form. The same is true of ceramics, which can be either crystalline or glassy. Composites of all varieties, ceramic/ceramic, polymer/ceramic, and so on, may also contain a combination of crystalline and glassy materials. Some *forms* of materials, such as fibers, can be crystalline, amorphous, or both.

Many crystalline materials would be too difficult for us to try to grow without special apparatus, because of the extreme conditions of temperature and pressure that would be required, or because of their toxicity or other hazards. With these difficulties in mind, the best candidates to use for exploring crystals are the products that we use for cooking and personal care.

Crystals from the kitchen

As a first example, consider table salt. Sodium chloride forms beautiful cube-shaped crystals that are large enough to see with the naked eye. Inspected closely, the tiny crystals are all seen to take on the same cubic shape. You can also use sea salt, kosher salt, and the "salt substitute" potassium chloride to grow salt crystals. Note that these products are not always pure salts; they may each contain one or more additives or impurities. Supersaturated solutions of these salts will eventually deposit crystals of the salt on a rough surface such as a string, wire tip, or wooden stick. The crystals are small, so you might want to have a magnifying glass or small microscope handy.

Sucrose, or table sugar, is also available as small but visible crystals with the telltale signs of flat sides, straight edges, and similar shapes; however, their shapes are more irregular than the shapes of sodium chloride crystals. Dissolve these crystals in hot water and you've performed the first step in the process of growing beautiful clusters of rock candy.

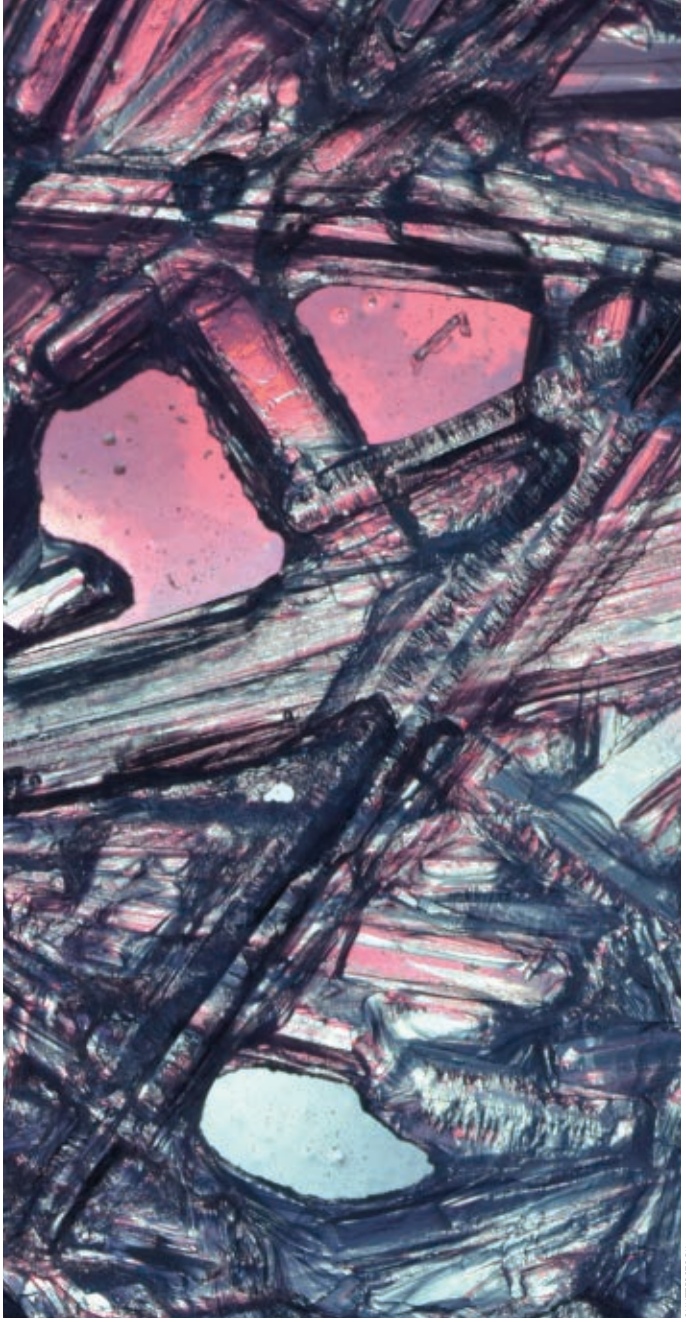
One of the advantages of exploring the growth of sugar crystals is that pure sugar is available in more than one particle size, which provides you the opportunity to study how particle size affects the crystal growth process. For example, choices range from regular table sugar (with millimeter-sized particles) and "superfine" sugar (with sub-millimeter-sized particles) to powdered sugar (with micron-sized particles). Some brands of powdered sugar may also have cornstarch added as a flowing agent, because the strength of the forces between fine particles relative to their size causes them to stick together. Particle size can give various forms of sugar different properties. For example, superfine sugar is marketed as "quick-dissolving" (but this is no special trick, since dissolution rate is inversely proportional to particle size!). But how do particle size and additives such as cornstarch affect crystal growth?

You may still find alum, a baking ingredient, in some kitchen cupboards. In the past, this substance was used as a stiffening agent in baking, for example, to make meringues "stand up." Since its use as a stiffening agent has declined, it has all but disappeared from the supermarket's baking aisle. More accurately referred to as potassium aluminum sulfate dodecahydrate, alum in the broader usage defines a class of compounds of the general formula $AM(SO_4)_2{\cdot}12H_2O$, where A is potassium, ammonium, or other +1 cation and M is aluminum, chromium, or other +3 cation. It's well worth taking the time to grow these crystals. Alum crystals grow remarkably fast: within hours or overnight, small crystals will form that can be used as seed crystals for the growth of large specimens in a matter of days.

Crystals from the medicine cabinet

Epsom salts, or magnesium sulfate heptahydrate, $MgSO_4{\cdot}7H_2O$, has been used for centuries as a natural remedy for a number of ailments and is still available in most supermarkets and drugstores. Supersaturated solutions of Epsom salts produce clusters of beautiful, transparent, columnar crystals within hours.

Alum is more likely to be found in the pharmacy, where it is used as an astringent or tissue-constricting agent. It is now sold as a product known as a styptic pencil, a pressed rod of salt that is wetted and applied to cuts to constrict tissue and stop bleeding. You may recognize its use in first aid for nicks caused by shaving and in certain sports. However, styptic pencils may contain other unknown ingredients, such as binders. Performing physical and chemical separation methods to isolate the alum salts before growing the crystals adds another level of challenge to growing the crystals.



SHUTTERSTOCK

Crystals from the laundry room

Borax, or sodium tetraborate decahydrate, is a favorite of recreational crystal growers because it produces clusters of crystals that can be colored with food dyes and grown quickly and easily on supports such as pipe cleaners for artistic effect. Borax is available in pure form as a detergent booster. It is also found in other products such as heavy-duty hand soaps. However, be aware that the presence of soap and other additives inhibits crystal growth, so it's best to use pure borax.

Crystals from the garage

We use various types of crystalline rock salts to help prevent water from freezing on roads and sidewalks in the winter. But even more interesting, you can grow blue crystals from the salts used as plant fertilizers; the bright blue color gives away the presence of copper(II) ion in these products. Plant food containing copper sulfate is a mixture of compounds, including other inorganic salts and organic chelating agents, such as ethylenediaminetetraacetic acid (EDTA). Products in solid form that are marketed to destroy roots near septic and sewer systems are pure copper sulfate pentahydrate. Isn't it interesting that the plant food and the root killer are the same compound?

Crystals from kits

If you'd rather not raid your home for materials to use to grow crystals, you also have the option of purchasing a crystal-growing kit. Inexpensive crystal kits are available for growing crystals such as potassium phosphates. Some kits have dyes added to the crystal-growing ingredients to make the crystal formations more aesthetically appealing.

Growing crystals from an aqueous solution

Numerous recipes and demonstrations are available online to help you get started. The key to growing crystals from an aqueous solution is to start with a supersaturated solution. You may find that the degree of supersaturation has an impact on whether you observe fast precipitation of microcrystalline powder or slow precipitation of large crystals. Temperature is also a factor; the lower the temperature of the solution, the larger the driving force for crystallization. Furthermore, dust or other solid particles in the solution will initiate the growth of crystals.

From a thermodynamic standpoint, the larger the driving force, the faster the crystals will nucleate and grow; this condition promotes the growth of many crystals simultaneously. Thus, the growth of large crystals is a balancing act of achieving growth — but not too vigorously. Also, many crystals growing at the same time will exhaust the resources in solution, so it may be beneficial to remove all crystals from the solution except the desired ones. In the case of organic crystals such as sucrose, care must be taken not to overheat the solution in order to avoid any unwanted chemical reactions taking place. Moreover, because of the high solubility of sucrose in water, supersaturated solutions are highly viscous, and thus slow cooling helps the sucrose molecules to maintain sufficient mobility for crystal formation.

Crystal-growing contests

Once you've achieved success growing your crystals, you might want to consider entering them in a crystal-growing contest, or maybe your student chapter could host a contest. Take photos at regular intervals, so that when you grow that one truly amazing crystal, you'll be ready to share it with the world. You can even film fast-growing crystals with your smartphone. Later, you can share your photos and videos in a time-lapse presentation. Be sure to document the conditions used to grow your crystals. Once you show your crystals to others, they may want to grow similar crystals, and your documentation can be a helpful resource for them.

Studying and understanding the amazing crystalline state of matter has resulted in many technological advances and Nobel Prizes. It is no wonder that 2014 has been designated worldwide as the International Year of Crystallography. The science and beauty of crystals is within everyone's reach to explore and enjoy. But the most wonderful thing about crystals is that there are still many waiting to be discovered! For more information on how to get started with your own crystal growth projects, go to **www.iycr2014.org**. iC

Understanding the art and science of growing crystals

Good crystal growth depends on the control of many environmental variables. However, growing good crystals is also a bit of an art. Be creative in your exploration of growth conditions, additives, and crystallization sites such as pipe cleaners and wooden sticks.

THE SCIENCE BEHIND CRYSTAL GROWTH

In the aqueous solutions that are used to crystallize the common compounds discussed in this article, it is the accumulation of ions or molecules into the *nuclei* that eventually forms crystals. This is an essential step in the crystallization process. The study of *nucleation and growth* elaborates the thermodynamic driving force and kinetics of the formation of crystals. In crystal growth, Gibbs energy of surfaces opposes the process and Gibbs energy of the volume of embryonic crystal advances growth. The balance of these and other competing energies determines everything from the rate of growth to the final shape of the crystal. Also, you can vary the temperature or the composition of the growth solution to enhance the growth of crystals or change their shapes.

CRYSTAL MORPHOLOGY

Describing what your crystals look like is also part of the science. Crystal morphology involves the systematic description of the shape and size of a crystal and the relationship between these qualities and the underlying structure and growth behavior at the atomic level. For describing small crystals' morphology, a magnifying glass, macro lens, or microscope is an essential tool. Be sure to examine your crystals closely to describe their shape, size, color, and transparency as accurately as possible. iC

Camille Y. Jones *is an experimental physical chemist currently developing and teaching a new materials science laboratory at the Columbia University School of Engineering in the Applied Physics and Applied Mathematics Department. For more details on her crystallography and crystal growth projects, and additional resources on crystals and crystal growth, visit www.crystallog.wordpress.com.*

Career Advice from Mark Twain

An abbreviated version of this article was first published in the ACS Careers Blog: http://acscareers.wordpress.com/2014/02/24/career-advice-from-mark-twain/.

BY LISA M. BALBES

I recently came across the following quote from American author and humorist Mark Twain (1835–1910), explaining how he thought chemists could solve the world's ills and bring about world peace: "I am going to get a chemist — a real genius — and get him to extract all the oxygen out of the atmosphere for eight minutes. Then we will have universal peace, and it will be permanent." While I appreciate his faith in our abilities as chemists, there might be a fatal flaw in his plan.

But what about other matters? Twain had a lot to say on a wide variety of topics, and much of it still applies today. In fact, many of his quotes provide excellent career advice. Below are some of them, along with modern career-based applications.

CAREER DEVELOPMENT

"Don't go around saying the world owes you a living. The world owes you nothing. It was here first."

"The secret of getting ahead is getting started."

No one is going to just hand you a job. In fact, no one else is even going to care about your career path as much as you do. It's up to you to find out what opportunities are available, what education and experience are required, and then to go out and get it. You need to actively seek out new experiences and responsibilities — or sometimes create them. It's easy to sit around and wait for the perfect opening to fall in your lap, but much harder to overcome the activation energy to go out and make it happen.

WRITTEN COMMUNICATION SKILLS

"The difference between the almost right word and the right word is really a large matter — it's the difference between the lightning bug and the lightning."

Twain said this in 1888, but it's just as true today. We write a lot more than we used to — journal articles, memos, proposals, reports, emails, tweets, LinkedIn and Facebook status updates… and don't always take the time to make sure we're using exactly the right words. In this world of remote work, some people may only know you by what you write, so it's important to take the time to find the right words, with exactly the meaning and connotation you intend to convey. This is especially complicated when communicating with others from different cultures or those whose first language is different from yours. Some words may have other meanings, or others may not understand your use of idioms and cultural references.

ORAL COMMUNICATION SKILLS

"Get your facts first, then you can distort them as you please."

"It is better to remain silent and be thought a fool than to open one's mouth and remove all doubt."

We all know that in meetings you often learn more by listening than by talking. However, scientists are often asked to give oral presentations on their work, both to share scientific advances with colleagues and to sell their ideas to managers and business colleagues. In either case, giving an answer when you don't really know is tempting, but bluffing is seldom the best choice. Admitting that you don't know the answer and offering to find out and get back to the interested parties (and then doing it) is a much better solution.

NETWORKING

"Let us make a special effort to stop communicating with each other, so we can have some conversation."

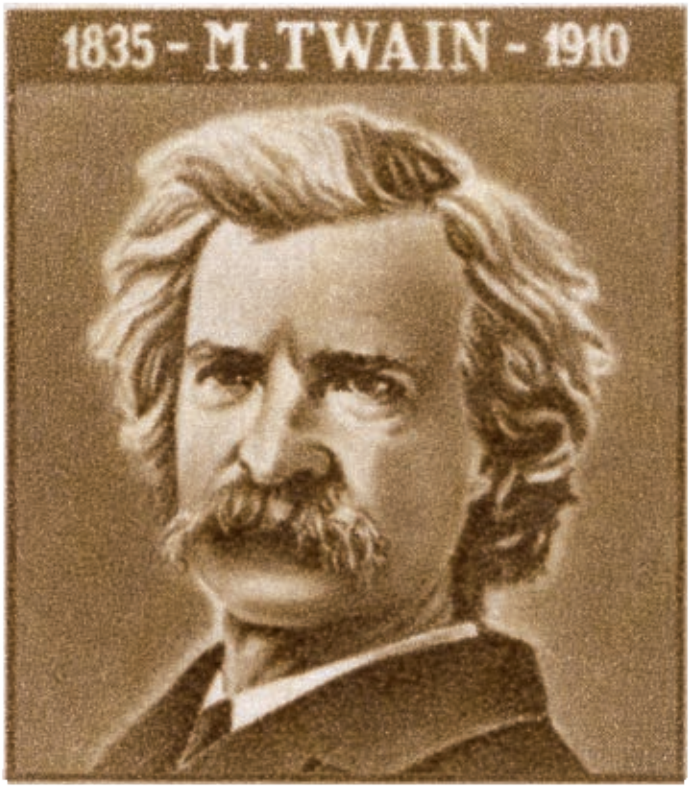
How Twain managed to address social media before it existed is pretty amazing. Do you spend too much time updating your online status and profiles and have too little time to have actual conversations with people? Disconnect from your electronic devices, and make time for some in-person conversations, over coffee or lunch. Look for common interests and other ways to help and truly connect with people, both personally and professionally. Invite others out to attend professional or social events of mutual interest. Send articles you think they'll be interested in, or pass along the solution to a problem they mentioned. This will build real relationships, not surface connections.

EDUCATION

"A person who won't read has no advantage over one who can't read."

"Be careful about reading health books. You may die of a misprint."

Continue to listen, read, and learn as much as possible, but always consider the source and critically evaluate what you hear and read, and draw your own conclusions. Not all information trending on social media or appearing in print or on the Internet is necessarily true or unbiased.



CONTINUOUS LEARNING

"Don't let schooling interfere with your education."

"Education consists mainly of what we have unlearned."

Don't think you are finished learning just because you earned a degree. You need to continue to learn new things throughout your career, in both formal and informal settings. Formal education in a classroom setting is not the only way to learn new skills. Volunteer to be treasurer to learn how to set a budget and manage expenditures. Start a blog with a regular posting schedule to improve your writing and meet deadlines. Don't be afraid to try new things and new ways of doing things, to learn what works for you — and what does not.

ADAPTING

"A round man cannot be expected to fit in a square hole right away. He must have time to modify his shape."

If you find yourself in a job that does not quite fit, give yourself some time to adjust your expectations, attitude, and actions. There might be some small changes you can make, to yourself or to the job responsibilities, which will make the job a better fit.

"I was seldom able to see an opportunity until it had ceased to be one."

Don't let your career path be determined by random chance or by regrets. Be alert for opportunities that come your way, but also be proactive — find ways to create them.

ETHICS

"Do the right thing. It will gratify some people and astonish the rest."

"If you tell the truth, you don't have to remember anything."

"A man cannot be comfortable without his own approval."

"A man is never more truthful than when he acknowledges himself a liar."

You will see ways to take a shortcut, or cut corners. Before you do, consider all the likely outcomes and whether you can live with the worst-case scenario. If you always make the ethical choice, your reputation will reflect that.

HANDLING DIFFICULT TASKS

"If it's your job to eat a frog, it's best to do it first thing in the morning. And if it's your job to eat two frogs, it's best to eat the biggest one first."

Sometimes the dread of doing something is worse than the thing itself. If you have a difficult task to do, just get it over with.

INNOVATION

"To succeed in life, you need two things: ignorance and confidence."

"A person with a new idea is a crank until the idea succeeds."

"Whenever you find yourself on the side of the majority, it is time to pause and reflect."

Many new inventions have come about because no one bothered to tell the inventor that they were impossible to create. If you truly believe in something, give it a try. Don't be afraid to fail or try something new and different — you may find a way to succeed when the others before you couldn't.

CAREER SATISFACTION

"The lack of money is the root of all evil."

"Work is a necessary evil to be avoided."

Most of us need to earn a living. Strive to find a career that suits your passions and it will become a labor of love. Find a career path that excites you and you'll never work a day in your life.

Lisa M. Balbes, *Ph.D. of Balbes Consultants LLC, is a freelance technical writer/editor and author of* Nontraditional Careers for Chemists: New Formulas for Chemistry Careers *(Oxford University Press).*

SPOTLIGHT
Bradley University
Peoria, IL

COMPILED BY ROBIN LINDSEY

Chapter president: Donny Schorr **Chapter members:** 96 **ACS student members:** 19
Website: http://lydia.bradley.edu/campusorg/chemclub/ **Institution description:** Small, private, urban, 4-year

Q: How do you ensure a smooth officer transition from year to year?

A: Beginning this past year, we moved elections from the end of the academic year to the middle of the second semester. This gives our new executive committee time to learn from their predecessors, especially when working on the annual report. Also, although not a requirement, the incoming president is typically an officer who served the year before in another position. This allows for the incoming president to begin with a clear sense of what is expected and demanded from the position.

Q: What types of activities do you sponsor?

A: Our chapter has a Demo Crew subgroup that is very involved in outreach activities. We recently hosted a Younger Chemists Committee Program-in-a-Box event and this past spring we hosted the first Illinois Heartland Battle of the Chemistry Clubs. For this event, we invited other area ACS student chapters to compete in a series of chemistry-related events. The competition was a great success and we hope to repeat the it again next year. Our chapter also sponsors tours of area businesses that employ chemists. Some of our most recent tours included have Sigma-Aldrich and Budweiser in St. Louis, MO, and Carus Chemical Company in La Salle, IL.

Q: In what ways does your chapter give back to the community?

A: The Demo Crew performs chemistry demonstration events in the central Illinois area. While we target the "pre-K to gray" audience at area schools, churches, and museums, most of our events are at held at elementary and middle schools. Over the past 6 years, we have hosted more than 140 events that have attracted more than 12,000 attendees.

Q: What methods are used to attract students to your activities?

A: Each spring, the chapter hosts a picnic for the chemistry faculty and students. Free food at chapter events is an excellent way to entice more students to attend. The Demo Crew occasionally holds on-campus events that are open to the public. Students, especially non-science majors, are curious to see our demos because they have not had the opportunity to see them in a chemistry lab course. iC

Faculty advisor:
Dean Campbell, 12 years

Q: How did you become a faculty advisor?

Campbell: I was asked to do so by the former advisor. I gladly accepted since I enjoyed being part of a student chapter when I was an undergraduate.

Q: What challenges have you faced in your position?

Campbell: The biggest challenge is information transfer from year to year. We have tried various approaches to keep students from having to reinvent the wheel, including recently moving executive committee elections from the end of the academic year to the middle of the second semester.

Q: What advice can you offer those new to the advisor position?

Campbell: The chapter president can make or break the chapter's overall performance in any given year, but it helps immensely if the president is surrounded by responsible people who can shoulder some of the burden. Try to build as much momentum as possible in the first semester, because in the second semester many of the seniors (who tend to have the most experience) often become focused on their post-graduation plans. iC

PHOTO COURTESY OF BRADLEY UNIVERSITY

Bradley University student chapter members display the trophy they won in the Illinois Heartland Local Section's first Battle of the Chemistry Clubs.

SPOTLIGHT

California State University Stanislaus

Turlock, CA

COMPILED BY ROBIN LINDSEY

Chapter president: Monica Trejo **Chapter members:** 58 **ACS student members:** 16
Website: www.facebook.com/acs.affiliates.csustan
Institution description: Small, public, suburban, minority-serving, 4-year

Q: **How did you celebrate National Chemistry Week?**

A: We celebrated NCW with our Science Saturday event for students between the ages of 13 and 18 from local schools and nearby cities. Each student becomes a member of a research team with chapter students to work on a chemistry project related to the NCW theme.

Q: **Do you collaborate with other clubs on campus on activities?**

A: Our chapter co-hosts Science Day, an annual event where children from the community do hands-on activities from a variety of scientific areas. We prepare several stations with chemistry demonstrations, hands-on-method activities, and forensic chemistry games.

Q: **What is your most successful fundraiser to date?**

A: To help preserve the ecology of our area, we organize several activities to raise funds to donate to the Trans-California Pathway Project. The organization uses these funds to purchase and grow trees, shrubs, and bushes.

Q: **Describe any fun social events your chapter recently had.**

A: The most successful social event for our chapter is the Mad Scientist Ball fundraiser, where students and faculty are able to enjoy free food, music, and entertainment, and win prizes by playing a variety of free games and by participating in a costume competition. All raised funds are donated to a local charity.

Q: **What careers-related events does your chapter do?**

A: We have tours to visit graduate schools and national labs, as well as companies such as Ernest & Julio Gallo Winery, where we learned more about how chemistry affects the color and smell of wine. We also host speakers from chemistry graduate schools, food chemistry industry, meat research labs, and biofuel labs. In these presentations, the students also learn more about Research Experience for Undergraduates (REU) and internship opportunities.

Q: **If your chapter has recently attended an ACS regional, national, or local section meeting, how did members benefit?**

A: Members from our chapter attended the 247th ACS National Meeting in Dallas, TX, and the 26th Annual Northern California Undergraduate Research Symposium in San Francisco, CA. We presented posters, did oral presentations, and learned about advancements in biochemistry, physical chemistry, nanotechnology, and agricultural and food chemistry. iC

PHOTO COURTESY OF CALIFORNIA STATE UNIVERSITY STANISLAUS

2013–2014 student chapter members at California State University Stanislaus.

Faculty advisor:
Elvin A. Alemán, 2 years

Q: **Why did you become a faculty advisor?**

Alemán: As an undergraduate student, I was fortunate to have been mentored by wonderful faculty advisors at the University of Puerto Rico Humacao. It is my goal to follow in their footsteps and become a good mentor to my students. I believe that by serving as a chapter faculty advisor and participating in their activities, I can get to know the students better.

Q: **What challenges have you faced in your position?**

Alemán: I am in my third year at CSU Stanislaus, and one challenge has been finding time between teaching and research to help students organize their activities.

Q: **What has been the most rewarding aspect of your service as a faculty advisor?**

Alemán: Getting to know our chemistry majors better and being able to advise them to get ready for their upper division chemistry classes. I also enjoy watching them graduate and continue their studies in chemistry or find successful positions in industry or as science teachers.

Q: **What advice can you offer those new to the advisor position?**

Alemán: Get the new officers elected in March/April and encourage them to get involved in some of the activities for the Earth Day celebration to get familiar with how to run the chapter. iC

SPECIAL RECOGNITION FOR 2013–2014 PROGRAMS

The ACS Society Committee on Education has selected the following student chapters to receive special recognition for the programs and activities described in their 2013–2014 annual reports. They will be honored at the 249th ACS National Meeting in Denver, CO, on Sunday, March 22, 2015.

In addition, because student involvement in applying green chemistry principles and practice is so essential to integrating environmentally benign technologies in academia and industry, the ACS Green Chemistry Institute has recognized 97 student chapters that have engaged in at least three green chemistry activities during the 2013–2014 academic year.

We congratulate the 44 Outstanding, 104 Commendable, and 151 Honorable Mention award-winning student chapters.

KEY: ***Winning Institutions*** Faculty Advisors *Chapter Presidents*
= Green Chemistry Student Chapter

OUTSTANDING

Barry University, Miami Shores, FL
George Fisher & Tamara Hamilton
Elliott Rodriguez & Jason Llaneras

California State University-Fresno
Melissa Golden & Joy Goto
Mee Vang & Bryton Cole

City Colleges of Chicago Wilbur Wright College, IL
Doris Joy Espiritu
Michael Foley & Manal Dahcha

Duquesne University, Pittsburgh, PA
Jeffrey Evanseck & Paul Johnson
Sarah Kochanek & Sarah Richards

East Los Angeles College, Monterey Park, CA
Kirk Olsen & Armando M. Rivera-Figueroa
Julianna Jimenez & Millie Szeto

Erskine College, Due West, SC
Tiffany Hayden
Rachel Whitmire & Dallas Roe

Florida International University-Biscayne Bay Campus, Miami
Mayra Exposito & Milagros Delgado
Christopher Harrilal & Anabel Riego

Georgia College & State University, Milledgeville
Catrena Lisse
Morgan Ownbey & Jordan Dickens

Inter American University of Puerto Rico-Ponce Campus, Mercedita
Edmy Ferrer Torres
Anthony Lopez & Angel Colon

Inter American University of Puerto Rico-San Germán Campus
Angela Gonzalez
Dannajoe Galarza-Ramos & Keyla Lopez-Perez

Mississippi State University, Mississippi State
Emily Rowland
Ashley Horn & Anna Robinson

Old Dominion University, Norfolk, VA
Marie Melzer
James Britton & Emily Kowalczyk

Pasadena City College, CA
Veronica Jaramillo & Peter Castro
Paul Priego & Keith Frogue

Saginaw Valley State University, University Center, MI
Stephanie Brouet & Jennifer Chaytor
Alaina Nunn

Saint Francis University, Loretto, PA
Edward P. Zovinka
Stephanie Ciraula

Salt Lake Community College, UT
Ron Valcarce
Michael Tranter & Michael Smith

South Texas College, McAllen
Ludivina Avila & Joe Studer
Cynthia Prado & Reymundo Gonzalez

Southern Illinois University Edwardsville
Sarah Luesse
Michael Meyers

Southwest Minnesota State University, Marshall
Noelle Beyer & Frank Schindler
Ross Kuchta & Angela Wieland

Spring Hill College, Mobile, AL
Raluca Craciun
Rachel Wills & James Kizziah

Temple University, Philadelphia, PA
Steven Fleming
Joseph Madanat & Jed Kao

Tennessee Technological University, Cookeville
Daniel Swartling & Amanda Crook
Christine Beck & Michael Probasco

Texarkana College, TX
Mike Buttram & Patricia Harman
Twinkle Burney & Javier Ordonez

Texas Christian University, Fort Worth
Kayla Green & Julie Fry
Danielle Bishop & Caleb Ashbrook

The College of New Jersey, Ewing
Benny Chan & Abby O'Connor
Taylor Maney & Susan Knox

The Pontifical Catholic University of Puerto Rico, Ponce
Lizette Santos & Carmen Collazo
Lizette Maldonado Laboy & Kathyria Toro Arevalo

The University of Texas at Dallas, Richardson
Kenneth Balkus
Stephanie Almaraz & Dorothy Nguyen

University of California-San Diego, La Jolla
Stacey Brydges & Haim Weizman
Min Wu & Karan Patel

University of Central Arkansas, Conway
Kristin Dooley & Karen Steelman
Sergio Ivan Perez Bakovic & Johnathon Schmidt

University of Central Florida, Orlando
Stephen Kuebler
Krystal LaBelle & Morgan Beebe

University of Detroit Mercy, MI
Matthew Mio & Kendra Evans
Dominick Alton & Alexis Konja

University of Mary Hardin-Baylor, Belton, TX
Lin Gao & Joy Beckendorf
Kendall McGahey & Christopher Clarke

University of Michigan-Flint
Jessica Tischler & Monique Wilhelm
Alexa Barres & Robert Heaton

University of Pittsburgh, PA
George Bandik
Joshua Casto & James McKay

University of Puerto Rico-Aguadilla
Brenda Ramos-Santana & Carlos Ruiz-Martinez
Stephanie Chaparro-Ruiz

University of Puerto Rico-Río Piedras Campus
Ingrid Montes
Adolfo Barragan-Cabrera & Raul Martinez-Quiñones

University of Saint Thomas, Saint Paul, MN
Lisa Prevette & Eric Fort
Kristin Braden & Ryan Smith

University of St. Thomas, Houston, TX
Elmer Ledesma
Sally Acebo & Valeria Hernandez

University of Texas at Tyler
Laura Boyd & Jason Smee
Matt Brantley & Justin Hazlerig

University of the Sciences, Philadelphia, PA
Catherine Bentzley & Vanessa Jones
Megan Mohadjer Beromi & Julie Mercadante

Waynesburg University, PA
Evonne Baldauff & Robert La Count
Elizabeth Kohr & Tiffany Onifer

West Virginia State University, Institute
Michael Fultz & Thomas Guetzloff
John Kessinger & Ronn Smith

Western Washington University, Bellingham
Elizabeth Raymond & Steven Emory
Noah Burlow & Chris Grote

Xavier University of Louisiana, New Orleans
Michael Adams & Janet Privett
LeaAnn Love & Shannon Douglas

KEY: ***Winning Institutions*** Faculty Advisors *Chapter Presidents*
= Green Chemistry Student Chapter

COMMENDABLE

Adrian College, MI
David Bartley
Caitlyn Cookenmaster & Elizabeth Milligan

Alvernia University, Reading, PA
Rosemarie Chinni & Kevin Burns
Brandi Loga

Angelo State University, San Angelo, TX
Edith Osborne & Kevin Boudreaux
Christian Herrera & Brandon Allen

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2014–2015 Community Interactions Grants (CIG)

KEY: **Chapters** Faculty Advisors *Student Project Directors* ***Project Title*** Amount

For the 2014–2015 academic year, the ACS Society Committee on Education has selected the following nine CIG proposals to receive funding. The ACS Undergraduate Programs Office is pleased to announce the grant recipients.

Barry University, Miami Shores, FL
George Fisher • *Elliott Rodriguez*
Science Outreach to Minority-Serving Elementary & Middle Schools
$500

Pima Community College, Tucson, AZ
Pedro Flores Gallardo • *Stefan Hinote*
Engaging and Promoting Chemical Sciences among Economically Disadvantaged Students and Underrepresented Minorities at Dietz K-8 School
$500

Saint Francis University, Loretto, PA
Edward P. Zovinka • *Stephanie Ciraula*
Gloria Gates Partnership
$278

Saint Louis University, MO
Brent M. Znosko • *Lisa Green & Nicholas Schlarman*
$275

Texas Christian University, Fort Worth
Kayla Green • *Caleb Ashbrook*
Bringing the Sick Science Show to the Patients of Cook Children's Hospital
$500

Valdosta State University, GA
Linda De La Garza • *Malcolm McCray*
Fizz, Boom, Read!
$500

West Virginia State University, Institute
Michael Fultz • *Jade Weinkauf & Brandi Bricker*
Water Sustainability and Societal Needs
$500

Xavier University of Louisiana, New Orleans
Michael Adams • *Lydia Mensah*
Chemistry in a Box
$400

Yakima Valley Community College, WA
Tanya Knickerbocker • *Matthew Ellenberger*
GEAR UP! Science and Engineering Festival
$500

2014–2015 Innovative Activities Grants (IAG)

KEY: **Chapters** Faculty Advisors *Student Project Directors* ***Project Title*** Amount

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East Los Angeles College, Monterey Park, CA
Armando M. Rivera-Figueroa • *Julianna Jimenez*
Organic Chemistry Through Smells
$400

Eastern Oregon University, La Grande
Anna Cavinato • *Logan Loennig*
Measurement of Mercury in Native American Food Items: A Day of Outreach to the Umatilla Tribe
$478

Heidelberg University, Tiffin, OH
Nathaniel Beres • *Lily White*
How Much P Is in the Water? An Interactive Presentation on the Chemistry of Water and the Substances It Contains
$250

Ouachita Baptist University, Arkadelphia, AR
Sara Hubbard • *Dustin Walter & Jessie Meyer*
Science Skits at Children's Hospital
$300

Penn State Berks, Reading, PA
Greglynn Gibbs • *Kyle Bramble & Katelyn Leets*
Career Preparation and Training for Undergrads
$250

Pima Community College, Tucson, AZ
Pedro Flores Gallardo • *Stefan Hinote*
Learning Beyond the Community College
$500

Saint Louis University, MO
Brent M. Znosko • *Xumei Chaney*
The Power of Liquid Nitrogen and Light
$275

University of the Sciences, Philadelphia, PA
Catherine Bentzley • *Cathrine Jarinko & Susan Jones*
University of the Sciences ACS Student Affiliate Elementary School Science Outreach Collaboration
$270

Valdosta State University, GA
Linda De La Garza • *Krina Patel & Ashley Hopkins*
Peer Mentoring for Chemistry Freshmen: Making It ALL Bond
$250

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