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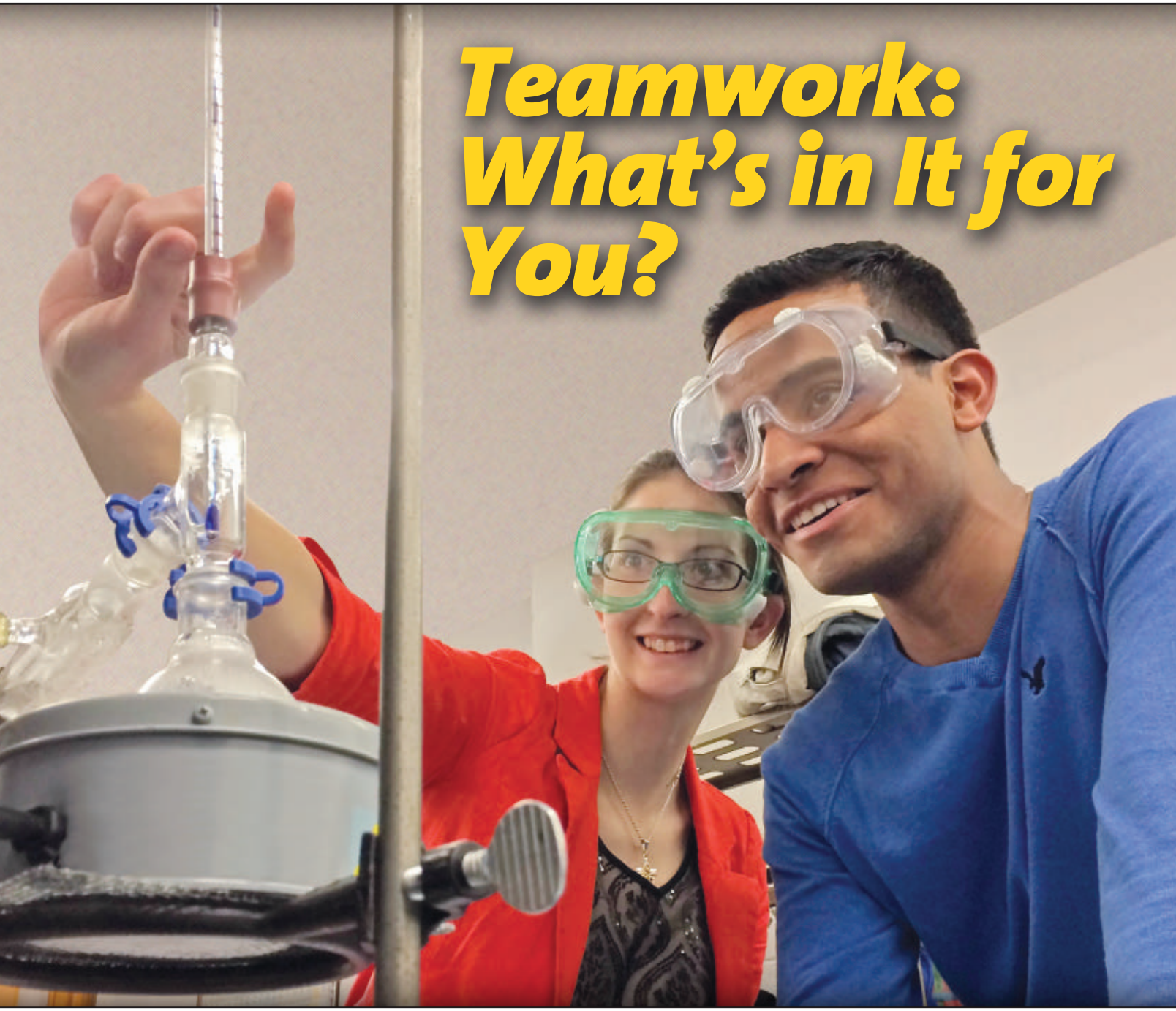
THE MAGAZINE FOR ACS STUDENT MEMBERS
April/May 2015

Teamwork: What's in It for You?



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- **Tweaking Your Scientific Skills at Community College** PAGE 10
- **Increasing Your Career Savvy with Informational Interviews** PAGE 15
- **Debunking Common Myths about Careers in Chemistry** PAGE 18

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Published for student members by the American Chemical Society Education Division at 1155 Sixteenth Street, NW, Washington, DC 20036

ACS Chemistry for Life®

Canadian GST Reg. No. 127571347

inChemistry

THE MAGAZINE FOR ACS STUDENT MEMBERS

Volume 23 • Number 4
April/May 2015

PHOTO COURTESY OF INDIANA UNIVERSITY OF PENNSYLVANIA

Cover: Indiana University of Pennsylvania students building teamwork skills. 12

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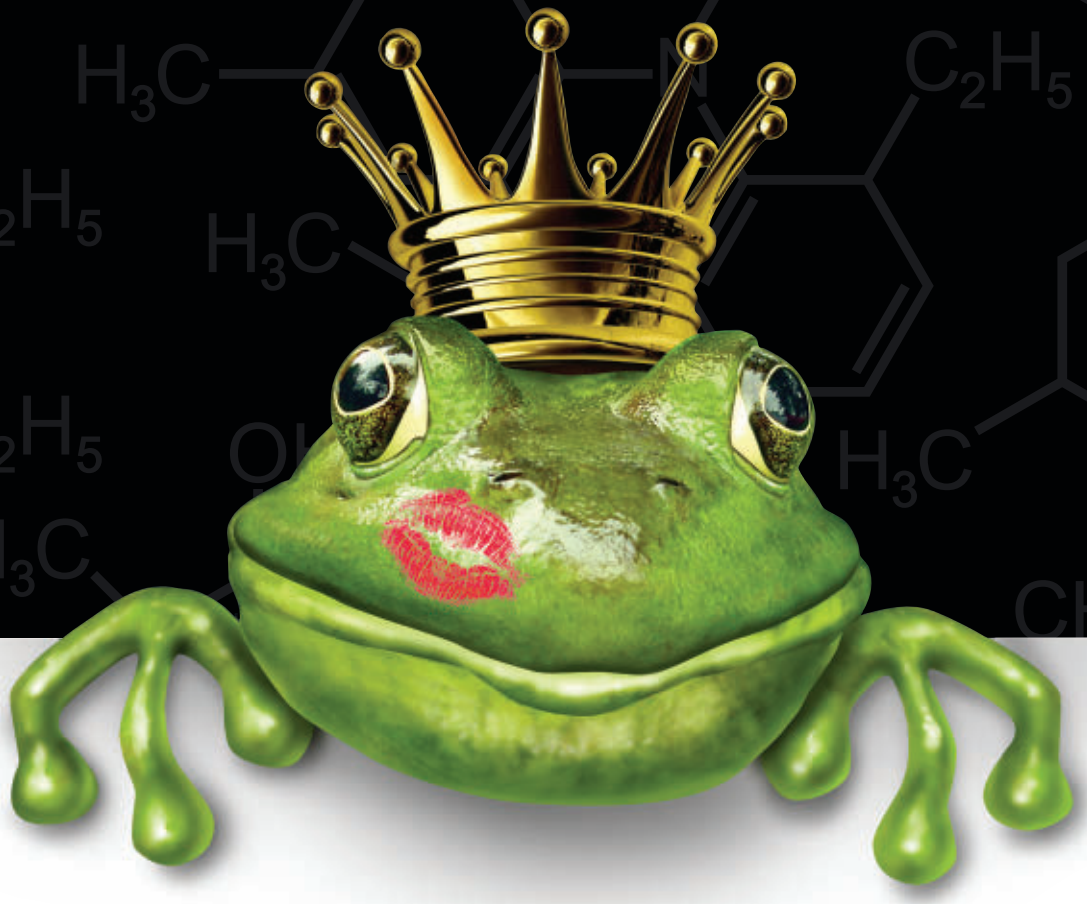
DISCOVER *the* Unexpected

Leap to the right choice
for your career and future.



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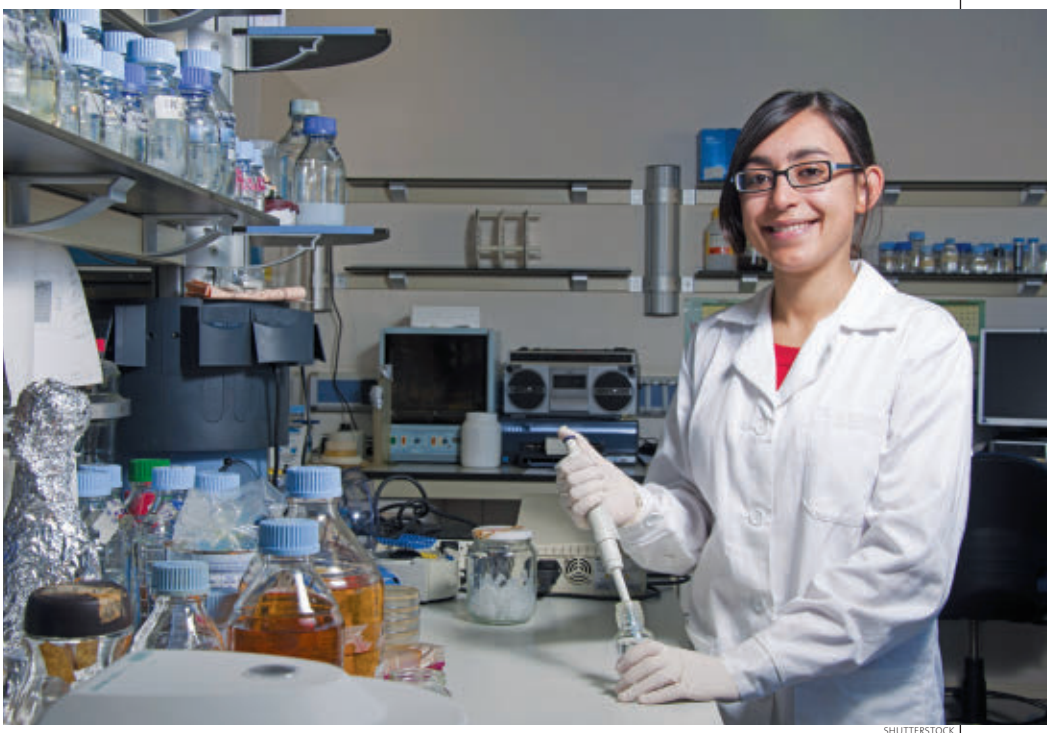
EDITORIAL: Making the Most of Your Summer Break

BY NICOLE DI FABIO AND LORI BETSOCK



SHUTTERSTOCK

Can't you feel it in the air? In just a few short weeks, summer break will be here — bringing a much-needed respite from exams, roommates, labs, dining hall food, and all-nighters. How sweet it will be to rest, recharge, and have fun with friends.

Vegging out will be fun — but realize, too, that summer break also brings a three-month window of opportunity that you won't likely experience again once you enter graduate school or the working world. So try to appreciate this gift of time and use it wisely; in particular, seek out opportunities to build your résumé.

What kinds of opportunities should you be looking for? Try to find hands-on, real-world experience. Congratulations if you've already landed a coveted slot in a summer research position or an internship! This experience will look great on your résumé. But don't stop there! Make an effort to get to know fellow students at your workplace — and other employees as well. Set up informational interviews. Ask to shadow people who have positions that interest you.

If you don't have a summer research position lined up, don't fret. Opportunities for gaining real-world experience still abound! Realize that, at this point in your life, just about ANY employment experience will teach you valuable life lessons and skills and give you real-world experience. You may find that you excel at customer service, are inspired by teaching others, or find fulfillment advocating for a social cause; these are all great ways to get the experience you need to be an asset to future employers or graduate programs. But be sure to tend to your scientific interests along the way too, such as sharing your professional aspirations with friends, neighbors, and others, including your ACS local section leaders. They might be able to provide leads on science-related opportunities for next summer, or introduce you to fellow science professionals.

Your summer experiences may inspire you to pursue a particular career path — or give you a clear sense of a particular pathway to avoid in the future. At any rate, real-world employment experiences demonstrate to future employers that you are dedicated, goal-oriented, and likely to succeed.

It's also very important to take time to nourish your brain and expand your mind. Consider exploring an interest that you didn't have time for during the school year, deepening your knowledge of a favorite subject, or developing a hobby. Or maybe your mind would thrive through exposure to course at a community college, a massive open online course (MOOC), TED Talks, news about current events, or reading books. Is there a course in your fall schedule that will be particularly challenging for you next year? Get the course text now and begin reading and reviewing the material or explore course topics online.

Last but not least, take advantage of your ACS member learning resources. Attend the 250th ACS National Meeting in Boston August 16–20, 2015 (**www.acsorg/meetings**); watch ACS Webinars (**www.acs.org/acswebinars**); explore the College to Career website (**www.acs.org/collegetocareer**); catch up on reading by downloading the *inChemistry* app to read current and back issues of the magazine (**www.acs.org/inchemistry**), or check out the latest in *Chemical & Engineering News* (**http://cen.acs.org/index.html**).

However you choose to spend the next few months, have a great summer! We'll connect with you again in September.

Nicole Di Fabio *is the editor of* inChemistry *and the manager of the ACS Undergraduate Programs Office (UPO).*

Lori Betsock *is the managing editor of* inChemistry *and the senior program manager of UPO.*

ATOMIC NEWS

COMPILED BY JESSICA ROBERTS

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

Oranges versus orange juice: Which one might be better for your health?

Many health advocates advise people to eat an orange and drink water rather than opt for a serving of sugary juice. But in ACS's *Journal of Agricultural and Food Chemistry*, researchers report that the picture is not clear-cut. Although juice is indeed high in sugar, the researchers found that certain nutrients in orange juice might be easier for the body to absorb than when a person consumes them from unprocessed fruit.

PHOTO: SHUTTERSTOCK

Ralf Schweiggert, Julian Aschoff, and colleagues note that oranges are packed with nutrients such as carotenoids and flavonoids, which, among other benefits, can potentially help lower a person's risk for certain cancers and cardiovascular disease. But many people prefer to drink a glass of orange juice rather than eat the fruit. Sugar content aside, are they getting the same nutritional benefits? Schweiggert's team set out to answer that question.

The researchers found that the production of pasteurized orange juice slightly lowered the levels of the carotenoids, lutein and β-cryptoxanthin, and did not affect levels of β-carotene and vitamin C. But at the same time, it significantly improved carotenoid and vitamin C bioaccessibility — or how much the body can absorb and use. And contrary to conventional wisdom, although juicing oranges dramatically cut flavonoid levels, the remaining ones were much more bioaccessible than those in orange segments.

Read more about the research: "In Vitro Bioaccessibility of Carotenoids, Flavonoids, and Vitamin C from Differently Processed Oranges and Orange Juices [*Citrus sinensis* (L.) Osbeck]," *Journal of Agricultural and Food Chemistry*, 2015, 63 (2), pp 578–587.

Nanowire clothing could keep people warm — without heating everything else

To stay warm when temperatures drop outside, we heat our indoor spaces — even when no one is in them. But researchers have now developed a novel nanowire coating for clothes that can both generate heat and trap the heat from our bodies better than regular clothes. They report on their technology, which could help us reduce our reliance on conventional energy sources, in the ACS journal *Nano Letters*.

Yi Cui and colleagues note that nearly half of global energy consumption goes toward heating buildings and homes. But this comfort comes at a considerable environmental cost: it's responsible for up to a third of the world's total greenhouse gas emissions. Scientists and policy makers have tried to reduce the impact of indoor heating by improving insulation and construction materials to keep fuel-generated warmth inside. Cui's team wanted to take a different approach and focus on people rather than structures.

The researchers developed lightweight, breathable mesh materials that are flexible enough to coat normal clothes. When compared with regular clothing material, the nanowire cloth trapped body heat far more effectively, while still maintaining breathability because of its porous structure. Because the coatings are made out of conductive materials, they can also be actively warmed with an electricity source to further crank up the heat. The researchers calculated that their thermal textiles could save about 1000 kilowatt-hours per person every year — that's about how much electricity an average U.S. home consumes in one month.

Read more about the research: "Personal Thermal Management by Metallic Nanowire-Coated Textile," *Nano Letters*, 2015, 15 (1), pp 365–371.

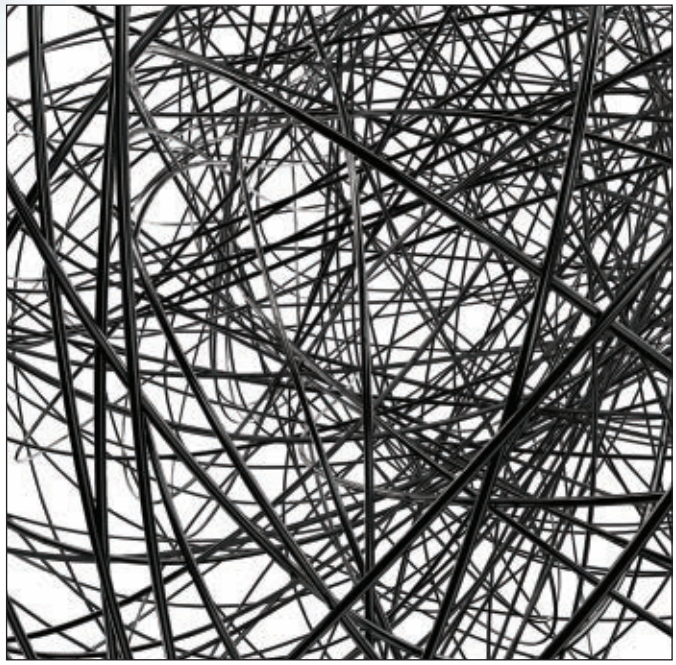


PHOTO: SHUTTERSTOCK

Tiny robotic hands could **improve cancer diagnostics**, drug delivery

Many people imagine robots today as clunky metal versions of humans, but investigators are forging new territory in the field of "soft robotics." One of the latest advances is a flexible, microscopic hand-like gripper. The development could help doctors perform remotely guided surgical procedures or perform biopsies. The materials also could someday deliver therapeutic drugs to hard-to-reach places. The report appears in the journal *ACS Applied Materials & Interfaces*.

David H. Gracias and colleagues note that many robotic tools require cords to power their movements. But cords add to the bulk of robots, which limits the spaces they can access. To address this constraint, many researchers have turned to hydrogels. These soft materials can swell in response to changes in temperature, acidity, or light, providing energy to carry out tasks without being tethered to a power source. However, hydrogels are too lacking in stiffness for some applications, so the group combined the hydrogels with a stiff biodegradable polymer, making the microhands strong enough to wrap around and remove cells. The team then sought a way to control where the grippers go once deployed in the body.

The researchers incorporated magnetic nanoparticles in the materials so they could guide the microhands with a magnetic probe. The team concluded that this added trait could help in the microassembly or microengineering of soft or biological parts, and give surgeons the ability to remotely direct where biopsies are taken. Also, Gracias says that the use of soft materials suggests the possibility of creating biodegradable, miniaturized surgical tools that can safely dissolve in the body.

Read more about the research: "Self-Folding Thermo-Magnetically Responsive Soft Microgrippers," *ACS Applied Materials & Interfaces*, January 16, 2015 (Web).
www.youtube.com/watch?v=zpJAnFE33w0&feature=youtu.be

98
Number of naturally occurring elements. Elements 93–98, although originally artificially synthesized, have actually been found in the byproducts of nuclear testing experiments.

Approximate number of genes present in humans, as determined by the Human Genome Project. **20,500**

10 *Amount of water, in gallons, needed to produce one slice of bread.*

30,000
Amount of water, in gallons, that the average U.S. citizen uses on a daily basis. This water is found not only in the water we we drink and use to shower but also in the products and food we buy.

30
Amount of francium, in grams, theorized to exist in the Earth's crust.

Beer compound could help **fend off Alzheimer's and Parkinson's diseases**

The health-promoting perks of wine have attracted the spotlight recently, leaving beer in the shadows. But researchers are discovering new ways in which the latter could be a more beneficial beverage than once thought. They're now reporting in ACS's *Journal of Agricultural and Food Chemistry* that a compound from hops could protect brain cells from damage — and potentially slow the development of disorders such as Alzheimer's and Parkinson's diseases.

Jianguo Fang and colleagues note that mounting evidence suggests that oxidative damage to neuronal cells contributes to the development of diseases that originate in the brain. If investigators could find a way to guard these cells from this type of damage, they might be able to help prevent or slow down Alzheimer's disease, Parkinson's disease, and other neurodegenerative conditions. One compound found in hops, called xanthohumol, has attracted the attention of researchers because of its potential benefits, including antioxidation, cardiovascular protection, and anticancer properties. Fang's team decided to test xanthohumol's effects on brain cells.

In lab tests, the researchers found that the compound could protect neuronal cells and potentially help slow the development of brain disorders by serving as an antioxidant that rids neurons of free radicals and also by activating cytoprotective genes that induce intrinsic antioxidant defense.

Read more about the research: "Xanthohumol, a Polyphenol Chalcone Present in Hops, Activating Nrf2 Enzymes To Confer Protection against Oxidative Damage in PC12 Cells," *Journal of Agricultural and Food Chemistry*, January 14, 2015 (Web).


PHOTO: SHUTTERSTOCK

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SUNDAY, AUGUST 16

Hospitality Center
8:30 AM–5:00 PM

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

Careers in Chemical Information and Cheminformatics Panel Discussion & Brunch
Cosponsored by the ACS Division of Chemical Information
9:00–11:00 AM

Graduate School Reality Check, Part I: Getting In
Cosponsored by the ACS Younger Chemists Committee
11:00 AM–12:15 PM

Graduate School Reality Check, Part II: You're In– Now What?
Cosponsored by the ACS Younger Chemists Committee
12:15–1:30 PM

Networking Social with Graduate School Recruiters
2:00–5:00 PM

MONDAY, AUGUST 17

Hospitality Center
8:30 AM–5:00 PM

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

Networking Basics for Students
Cosponsored by the ACS Committee on Economic and Professional Affairs
9:45–11:15 AM

Eminent Scientist Luncheon and Lecture
with John C. Warner, President and Chief Technology Officer, Warner Babcock Institute for Green Chemistry
12:00 NOON–1:30 PM

Undergraduate Research Poster Session
Cosponsored by the ACS Divisions of Agricultural and Food Chemistry, Analytical, Environmental, Inorganic, Medicinal, Physical, and Polymer Chemistry, Biological Chemistry, and Geochemistry
2:00–4:00 PM

Undergraduate Speed Networking with Chemistry Professionals
Cosponsored by ACS Corporation Associates and the ACS Senior Chemists Committee
4:00–5:30 PM

Kavli Lecture
5:30–6:30 PM

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

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

Chair: Matthew J. Mio, *University of Detroit Mercy, MI*
Program Chair: Gilles Muller, *San José State University, CA*

To view late-breaking developments in the Undergraduate Program go to
www.acs.org/content/acs/en/education/students/college/acsmeetings.html

ACS Landmarks

Notable Chemistry Might Be Closer Than You Think

BY KEITH LINDBLOM

Here's something you probably do a dozen times each week: walk into the chemistry building on your campus. Let's call it the John Smith Hall of Chemistry. You go there for classes, labs, meetings with your advisor, and study sessions with your student chapter colleagues. In all the times you've walked through those doors, have you ever stopped to wonder, "Who was John Smith, and what did he do for chemistry?"

Through its National Historic Chemical Landmarks (NHCL) program, ACS recognizes chemistry buildings and achievements in the chemical sciences in an effort to provide greater awareness of the chemist whose name adorns the building, or the notable chemical research that took place inside those walls. More than 30 educational institutions in the United States are designated ACS Chemical Landmarks. Each of these Landmarks must relate to a seminal achievement in the chemical sciences, be at least 25 years old, and have provided a significant benefit to the public.

ACS Landmarks are recognized at public ceremonies that highlight the accomplishments of each chemist being recognized. Undergraduates are always invited to attend these events, and students have even taken on special roles at Landmark dedications.

Percy L. Julian Science and Mathematics Center

Take, for example, the Percy L. Julian Science and Mathematics Center at DePauw University in Greencastle, IN. The Julian Center memorializes a legend in natural products research, whose research led to the synthesis of drugs like physostigmine (a glaucoma treatment) and hydrocortisone (a treatment for arthritis). Percy Julian (1899–1975) succeeded in his field despite the overt discrimination that he faced as an African American during his lifetime. In 1999, an ACS Landmark was named in honor of his work.

Landmarks Ahead in 2015

KELLY PNEUMATIC IRON PROCESS

Lyon County Public Library, Eddyville, KY; Murray State University, Murray, KY

In 1847, William Kelly of Lyon County, KY, began experimenting with a new method for refining iron. His discovery involved blowing air through molten pig iron, a crude form of iron, in a specially designed cupola furnace. Oxygen in the air combined with carbon in the iron to produce heat without the use of fuel and removed impurities as oxides. When combined with later chemical and mechanical improvements, Kelly's pneumatic process revolutionized the manufacture of iron and steel, two key materials of the 20th century.

KEELING CURVE: ATMOSPHERIC CO_2

Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA; Mauna Loa Observatory, National Oceanic and Atmospheric Administration, Hilo, HI

In 1958, Charles David Keeling of the Scripps Institution of Oceanography initiated a research program for the study of atmospheric carbon dioxide. By 1960, Keeling published the results of his research, reporting evidence of Earth's natural, seasonal oscillations in CO_2 and the annual increase in CO_2 as a result of fossil fuel combustion. Keeling's dedication to the precise and continuous monitoring of atmospheric CO_2 allowed these data to become an unequivocal record of the global rise in CO_2, an important greenhouse gas and a major contributor to climate change.

EDWIN LAND AND INSTANT PHOTOGRAPHY

Massachusetts Institute of Technology, Cambridge, MA

Edwin H. Land established the Land–Wheelwright Laboratories in 1932 to develop polarized sheet technology. In 1947, Land devised the one-step system of photography that would become known simply as Polaroid. The system centered on a novel viscous reagent, sealed within a rupturable pod, that was spread by precision rollers between the exposed negative and a positive image-receiving sheet. A celebrated inventor, businessman, and scientific advisor, Land received numerous prestigious awards, including the Presidential Medal of Freedom and the National Medal of Technology.

ISOLATION OF PHYTOCHROME

U.S. Department of Agriculture Agricultural Research Service Beltsville Area Research Center, Greenbelt, MD

Phytochrome is the photoreceptive pigment in plants that controls their germination, growth, and flowering. This protein was isolated in 1959 after a 40-year research program by a multidisciplinary scientific team at the USDA's Beltsville Area Research Center. The discovery of phytochrome elucidated the method by which plants detect daylight. This understanding allowed horticulturists to grow commercial crops in seasons and latitudes not previously possible, both by manipulating the plant's environment through greenhouse controls and by breeding plants that take advantage of traits in plant periodism.

For information about the dedication ceremonies for each of these subjects or to learn more about the NHCL program, visit **www.acs.org/landmarks**.

PHOTO COURTESY OF PURDUE UNIVERSITY

PHOTO BY KEITH LINDBLOM/ACS

TOP: **Leslie Rank (at podium) served as emcee during the 2013 dedication of Purdue University's R. B. Wetherill Laboratory of Chemistry as a National Historic Chemical Landmark. The event recognized Purdue as a center of chemical education in the United States and the site of important advances in organic chemical synthesis.**

BOTTOM: **Speakers at the Rachel Lloyd Memorial Conference on Women in Science included Marinda Li Wu (former ACS president), Jeannette Brown (historian of African American chemists), Melanie Simpson (University of Nebraska-Lincoln), Juliane Strauss-Soukup (Creighton University), Mary Cloninger (Montana State University), and MariJean Eggen (Eli Lilly & Company).**

Kolthoff Hall

Another example is Kolthoff Hall at the University of Minnesota, Twin Cities. This facility honors Izaak Maurits Kolthoff (1894–1993), who has been described as the father of modern analytical chemistry. Kolthoff's research, publications, and teaching transformed the ways in which scientists separate, identify, and quantify chemical substances, and helped to bring chemical analysis into the modern era of science. Kolthoff's work was recognized as an ACS Landmark with a dedication ceremony and symposium in 2014. Minnesota governor Mark Dayton proclaimed the day Izaak M. Kolthoff Day in honor of Kolthoff's contributions.

Pioneering woman in chemistry

Other Landmark subjects may not have a building named after them, but their legacy stands out in the history of chemistry. At the University of Nebraska-Lincoln (UNL), Rachel Lloyd (1839–1900) is one such figure. UNL hired Lloyd, the first American woman to receive a Ph.D. in chemistry, as a teacher and researcher in 1887. She became the first female professor of chemistry at a coeducational institution, and her research led to the development of a multimillion-dollar sugar industry in Nebraska. Lloyd's legacy was celebrated at the Rachel Lloyd Memorial Conference on Women in Science last fall.

A center of chemical education and research in the United States

Leslie Rank (Purdue University, B.S. Chemistry, 2013) served as emcee during the 2013 dedication of the R. B. Wetherill Laboratory of Chemistry at Purdue. The dedication recognized Wetherill as a center of chemical education and research in the United States and the site of important advances in organic chemical synthesis. In a guest blog post for ***Reactions***, the ACS undergraduate blog, titled "Purdue's Wetherill Chemical Laboratory– 80 Years of Advancing Chemistry" (July 24, 2013), Rank wrote, "With the unveiling of the plaque, I was reminded of the history surrounding Wetherill Laboratory and the influential chemists who made their living there... Here in this building, two Nobel laureates have conducted their research: Herbert C. Brown (1979) and Ei-ichi Negishi (2010). Advances in the development of tandem mass spectrometry, palladium-catalyzed cross-coupling, hydroboration for organic synthesis, and innumerable other developments also had their beginnings at Purdue University in the Wetherill Building."

Your chemistry building has a story. More likely than not, generations of chemists have been taught within its walls, and thousands of hours have been logged inside its labs. Learn more about the more than 75 ACS Landmarks around the world at **www.acs.org/landmarks**, and share the chemists and chemistry that make your school unique by sending a Tweet to **@ACSLandmarks**.

Keith Lindblom *manages the National Historic Chemical Landmarks program for the ACS Office of Public Affairs.*

PHOTO: CHRISTINE SCHMIDT/ACS

The Road Less Traveled

How Bachelor's Graduates Are Finding Successful Careers through Associate's Programs

BY JOAN SABOURIN

It's an increasingly familiar story for recent graduates in today's economy: you work for four to six years to earn a bachelor's degree in your dream field, send out your résumé to 100 companies, network like crazy, and a year later, you are still jobless. What do you do when your bachelor's degree doesn't get you the job you want?

For some people the answer is to go back to school ... for an associate's degree. In 2009–2010, 6.1% of all bachelor's degree recipients enrolled in two-year institutions within two years of receiving a bachelor's degree. Among biological and biomedical sciences degree recipients, the proportion was higher: 14.3% went back for their associate's.

While going back to school for an associate's degree may seem counterintuitive, it can provide you with the technical skills you need to learn to get hired, and also shed light on alternative career paths that could be right for you.

The two-year advantage

What makes a two-year college chemical technology degree or certificate attractive to employers? Frequently, these programs partner with local employers and tailor the curriculum to meet employers' needs.

Collins Jones is the Biotechnology Program Coordinator at Montgomery College (MD). Jones has seen a slow but steady increase in the number of students with a bachelor's degree or higher entering Montgomery College for its biotechnology and biomanufacturing certificate programs. Approximately 40% of the programs' students already have a bachelor's or master's degree.

As with most chemistry-based technology programs, the biotechnology program attracts students with higher degrees whose undergraduate experience did not include specialized skills that employers are looking for in new hires. In the Montgomery College biotechnology program, lab experiments are presented as industry-style standard operating procedures (SOPs); these SOPs incorporate the good laboratory practices (GLPs) or good manufacturing practices (GMPs) common in biotechnology and pharmaceutical industries. In the process, students learn documentation, teamwork, communication, and time management.

Even the mistakes students make in the lab are viewed as a plus. Jones notes that "some students get it wrong, which is then a teaching moment for not covering up mistakes that otherwise could lead to sometimes-serious effects, both in the workplace and with customers and consumers."

Jessica Wyatt credits her chemistry-based technology program with giving her the skills she needed to move from a job to a career. Wyatt had a job lined up before starting her four-year degree. In 2009, Wyatt received her B.A. degree in environmental science and biology, with an eye toward environmental testing or teaching. However, between the economy and the nature of her field, she could not find financially stable work. After pursuing jobs in different states, Wyatt enrolled in the chemical technology program at St. Louis Community College at Florissant Valley (MO).

Wyatt commends the college for providing theoretical and practical hands-on course content as well as helpful and available instructors. She became proficient in instrumentation software, preparing presentations and reports, and also acquired laboratory management skills. Because Wyatt learned how to write and maintain professional laboratory notebooks, she went to job interviews with her lab notebook in hand and was able to show her lab results and demonstrate her understanding of the instrumentation used, including its maintenance and troubleshooting.

Wyatt now works as a research and development technician at a small food company near St. Louis, MO. She assists the quality assurance department in testing for pH, total acidity, viscosity, and stability through instrumental and wet analysis. Wyatt also helps the food chemists develop new products for present and future customers.

Chemical technology careers

Chemical technology is a good career choice for those who like to work in a lab and focus on short-term projects or support long-term work. The U.S. Bureau of Labor Statistics predicts that chemical technician employment will grow 9% from 2012 to 2022. Demand will come from scientific research and development, and from the need to monitor the quality of chemical products and processes, particularly in jobs related to environmental issues. In addition, as the instrumentation used in research, development, and production becomes more complex, the demand will be greater for job candidates with more highly developed technical skills.

SHUTTERSTOCK

The U.S. Bureau of Labor Statistics predicts that chemical technician employment will grow 9% from 2012 to 2022.

Is chemical technology a satisfying career? Leah Dunlap thinks so. Dunlap received a B.S. degree in construction management with a minor in business. However, she lost her job when the company where she worked collapsed with the economy in 2008. Upon learning of the need for chemical process operators in her area, she enrolled in the Delta College Corporate Services Industrial Fast Start program. The Fast Start training programs— a partnership between Delta College (MI), Great Lakes Bay Michigan Works!, and regional businesses — provide an accelerated learning environment that leads successful participants to a certificate of completion. The program teaches practical technical skills, with courses led by a team of technical subject matter experts, educators, facilitators, executive coaches, instructional designers, and consultants.

After completing the program, Dunlap was hired at Hemlock Semiconductor Corporation (HSC) in Michigan, working in the operations area as a reactor care operator. One year later, she was promoted to reactor care leader. After two years working in different roles in operations, Dunlap is now an instrumentation and electrical apprentice at HSC, working with reactant and product flow, maintenance, repair, and troubleshooting of process equipment. She verifies that safety systems work properly in order to validate HSC's license to operate as a business.

Dunlap appreciated her construction management job, but in hindsight, she feels that she is more satisfied with her present job because of the opportunities for personal growth within a larger company, career opportunities, and tuition reimbursement.

A Wide Range of Two-year Programs

The skills needed by chemical technicians vary greatly by region and industry. As a result, two-year college programs work with local employers to address the skills needed to get a job at those companies. Thus, specific titles for chemistry-based technology programs vary by school, and can include:

- Applied chemistry
- Biomedical technology
- Biotechnology
- Chemical technology
- Cleanroom technology
- Environmental technology
- Field service
- Forensic technology
- Hydrologic technology
- Laboratory science technology
- Microbiology technician
- Pharmaceutical manufacturing technology
- Process technology
- Quality assurance
- Quality control
- Research and development (R&D) technician

Lessons learned

Wyatt encourages undergraduates, while in college, to take advantage of opportunities that increase their employability, including internships, employment, volunteering, joining clubs relating to their degrees, and finding mentors with whom to explore career options. She found a valuable mentor at the community college she attended. She also notes, "I regret and wish I had researched more about career opportunities — not only in the specific area of environmental science and biology, but also in considering a B.A. versus B.S. degree."

Likewise, Dunlap advises graduates to "network with instructors and fellow students, take advantage of cooperative education, and job-shadow to figure out if you will enjoy and grow in [your] career." She also suggests that undergraduates do informational interviewing with potential employers to determine their needs and to find out what education and training will be valuable to the companies.

It is also good practice to be open to unexpected opportunities. Shortly after graduation, Wyatt was called to fill a contract position, and accepted a week-long job that several others had refused. She said yes, despite the fact that the job lasted only one week, entailed 12-hour workdays, and was a night job. Wyatt realized the temp job was an excellent opportunity to gain additional experience. Because she willingly accepted the offer and worked diligently, her supervisor recommended her for any type of laboratory contract work. Soon after this experience, she obtained her current position.

The path to the right career is not always straightforward, but by learning the skills employers need and being open to new possibilities, you can get to the career that's best for you. iC

Joan Sabourin *is professor emeritus at Delta College (University Center, MI), where she worked with industry partners in developing the Chemical and Chemical Process Technology Associate in Applied Science programs. Recently she retired from ACS as the Program Manager of the Office of Two-Year Colleges.*

Build Your Marketability!

and Other Key Ways You Benefit from Group Work

BY JUSTIN FAIR AND ANNE KONDO

As a chemistry or biochemistry major in college, you will spend years learning how to think on a molecular scale, developing problem-solving skills, building your chemical intuition, and meticulously honing laboratory techniques. It's easy to understand the value of doing so: employers want to hire people with these technical skills. But it might surprise you to learn that many employers look more critically at your ability to work with others than your grade point average![1]

In some fields, learning and practicing teamwork, interpersonal, and collaborative skills are essential parts of the experience. Engineering and information technology, for example, are fields that explicitly teach these skills in their coursework.

But in other fields, including chemistry and biology, it's different. Teamwork experiences may be part of laboratory courses, but the interpersonal and collaborative skills needed for success are often assumed to be innate or learned prior to coming to college.

Think back to a class you had where the professor first mentioned a group project — maybe a group paper or a short class presentation. Which of the following best describes your initial reaction? You:

- **Leaped excitedly from your seat and high-fived the best friends you always work with, because group project = late-night pizza parties with lots of laughter.**
- **Nodded in satisfaction, because your workload just got cut to x%, where x = 100 ÷ #group members.**
- **Slumped in your chair with a groan, because group project = you doing all the work for the freeloaders who never carry their own weight.**
- **Groaned, because the last thing you need is extra out-of-class work on top of your job, homework, and everything else in your life.**
- **Whipped out your phone to check if it's too late to withdraw from the class.**

Often students see teamwork as simply a division of labor that assigns more critically valued tasks and responsibilities to individual group members based on their respective roles, such as team leader or reporter. But teamwork is most effective when the roles are closer to being equal and tasks are collaborative in nature. Strong evidence shows that effective group work enhances the development of knowledge, critical thinking skills, and social skills[2] — all of which are important attributes that employers look for in potential employees.

Think about it. You've probably had a range of lab partners: everything from the questioning, helpful, and considerate to the idle, texting-the-whole-time, and won't-help-with-calculations. And don't forget about the classic type-A partner: the bossy, know-it-all-who-won't-let-you-contribute-because-you-won't-do-it-perfectly one. Whom did *you* prefer working with?

PHOTO COURTESY OF INDIANA UNIVERSITY OF PENNSYLVANIA

LEFT: **Kelsey Claypool and Edgar Ceballos practice their teamwork and interpersonal skills during organic chemistry lab at Indiana University of Pennsylvania.**

How could this help you?

It's important to understand that your future employer is looking for much more than someone who can work with a lab partner to complete a task. While they expect you to be able to lead and to follow appropriately, they are more interested in whether you have the skills and ability to work collaboratively and cooperatively with other group members and other groups. Can you get the slacker to pitch in? Can you get the dictator to chill? Or are you one of those types yourself?

Think of it from the boss's point of view. Why would you hire someone who could disrupt an efficient, collaborative group? The inability to work collaboratively could hurt the company's productivity and ultimately its bottom line. Whether fair or not, it is important to recognize that how you are perceived by fellow team members is really important to the company.

So, what are the interpersonal traits and collaborative skills associated with good teamwork that companies look for? Here's what you can do to practice and develop these while you are still in college.

Be on time, be prepared, and work efficiently.

Never be late to a meeting. Being on time says that you are dependable. Make sure meetings have a specific agenda — either write one or ask for one. "Work on project" is too vague for an agenda item, the equivalent of "pizza with everything on it." "Complete the background section" is more definitive. Help the meeting stay focused by keeping social chatting to a minimum. Be dependable and responsible regarding the tasks you are asked, or volunteer, to do.

Do your share of the work, but don't go overboard.

Do productive work *ahead* of group-set deadlines. Also, try to propose high-quality ideas — which will require you to have a solid understanding of core concepts involved in the project. Devote time and effort to the project. Feel free to help other group members with encouragement, structure, and ideas (but not so many that you squelch their creativity). With multiple members providing input, you will be surprised by how well the overall structure of the project comes together.

Communicate effectively and often. In our discipline, you must be able to communicate — both verbally and in writing — your procedures and your scientific data and outcomes. If you cannot tell anyone what you did, why should anyone hire you, let alone retain you on their team? Communication starts prior to the first meeting. All correspondence should be polished and complete, with limited acronyms or slang. Very few projects can be planned and executed in a single meeting, so all members should keep up-to-date with each other's accomplishments. Even small projects can take four or five meetings, in order to allow for the necessary collaboration and input from group members. You will also need time to edit the components of a project into one cohesive package.

Show motivation and be positive. Active listening, being engaged, and accepting constructive criticism make for a good group participant. If your heart is not in the project, that indifference can be contagious. Nonverbal signals like crossed arms and poor posture could give the perception that you are unapproachable, don't care, or are clueless. If you are a person who takes a while to make new friends, know that your lack of effort may be perceived as "snobbish." Other people prefer to be around positive individuals. Negativity can be toxic and can squash a collaborative effort or even kill a project before it starts.

Look at things from a positive perspective. Is a deadline looming? The project will be done soon! Are there insufficient funds? We have to be extra-creative! The more supportive members are, the more collaboration occurs. A project can become very successful if everyone in the group is willing to assist each other. Before you know it, your team will be crossing the finish line.

Have empathy when the situation warrants it. If you can't make a meeting, notify other group members as soon as you know, and send any project comments you prepared for the meeting in writing, in advance. Just don't make it a habit! Lack of attendance or showing up unprepared signals, "I don't care." If someone else can't make a meeting, cut them some slack (once or twice). Group members might be working on other projects, have personal commitments, have jobs or children, or have time conflicts with other classes or due dates. Empathy and understanding go a long way toward building a can-do team spirit. If someone is slacking and gives lame excuses, it is perfectly appropriate to call them on it; part of a strong interpersonal skill set is getting everyone to do their share.

Be respectful and humble. Remember that learning is a lifelong process. You will find gaps in your team members' knowledge base — and that is OK. "Bad ideas" can help good ones bubble up, and can help you recognize when you have landed a great one. Realize that everyone in the group has something to offer. Two keys for any group are identifying who is best at each task and expecting that no one person will be the best at all tasks. The person with limited ideas during the brainstorming meeting might be an awesome editor or a presentation wizard. Know your limits, when to express them, and when to ask for help.

Handle conflicts in a constructive manner. All sorts of conflicts can arise — from opposing opinions about the project to grating personality differences between group members. Conflicts can be displayed verbally, nonverbally, or both — and typically stem from poor communication or past issues between group members. That being said, conflict on scientific projects is sometimes how fields advance. If conflict is handled correctly and respectfully, group members can feel confident about expressing their ideas and providing constructive criticism. So encourage team members to focus on the task at hand and be dedicated to the success of the project. As each person buys into the project, trust will grow.

The next step is yours

Companies have revealed that teamwork, interpersonal, and collaborative skills are more highly valued than traditional technical skills acquired in college. Use the time you have left in school to identify opportunities to practice these important skills and integrate them into your everyday life.

Put simply: be the group member *you* would want to work with. Others will want to work with you, enhancing your marketability and that of the degree you have worked so hard for. iC

What You Can Do Now

Group work offers a great way for you to begin developing your teamwork, interpersonal, and collaborative skills — but it is up to you to find ways to practice and fine-tune your skills. Here are four ways you can begin building professional skills now:

1. BECOME ACTIVE IN YOUR STUDENT CHAPTER. Groups like your ACS student chapter often feature great diversity, and you may encounter a variety of personalities as you meet, plan, and conduct outreach and social events. Both leadership and nonleadership roles offer opportunities to practice and reflect on your teamwork and interpersonal skills.

2. TUTOR A FELLOW STUDENT. If your chapter offers tutoring, for example, this can be a great way to practice and enhance teamwork and collaboration skills. In addition, explaining scientific principles and problem-solving skills to underclassmen gives you a chance to review previous class material and make connections between lower and higher level course work.

3. JOIN A STUDY GROUP OUTSIDE OF CLASS. Laboratory group partners and study groups provide for both in-class, structured group interactions and out-of-class, unstructured interactions. These two settings will provide multiple opportunities for you to practice teamwork, interpersonal, and collaborative skills — and just as importantly, a chance to reflect on how others perceive you.

4. ATTEND OR PRESENT YOUR RESEARCH AT A REGIONAL OR NATIONAL ACS MEETING. ACS regional and national meetings are chock-full of new people and events. Meetings have posters and oral presentations, workshops, and opportunities for networking and refining your interpersonal and collaborative skills. iC

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Informational Interviewing

Finding Out about Career Options (and Hidden Career Opportunities!)

BY DAVID MASTERS

SHUTTERSTOCK

Your graduation date is inching closer and closer, and increasingly, you're wondering, "What will I do with my degree?"

Your chemistry degree will open up a wealth of potential career opportunities. You could help discover new medicines as a pharmaceutical researcher, dive into business by developing new products, or inspire the next generation of scientists through teaching. And those are just three options. Having so many options is wonderful, but it also leaves you with an important question: Where do you want your career to take you?

Conducting informational interviews is a very effective way for you to learn about specific career areas, work cultures, and career options. In an informational interview, you simply schedule a meetng to talk to people who already work in a career you're considering. They can give you the inside scoop on what it's really like to do a particular job and the specific skills that they look for in potential job candidates and show you the shortest career path to your ideal job.

In addition, informational interviewing is a great strategy for finding hidden job opportunities – openings that don't appear on career websites or job boards. Did you know that only about

Did you know that only about 50% of jobs are advertised? The other 50% comprise the hidden jobs market.

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50% of jobs are advertised? The other 50% comprise the hidden jobs market. Often, these jobs are better opportunities, and people are eager to find them. As a result, the positions are easy to fill internally or through referrals from company employees or others, so they don't need to be advertised.

According to careers expert Randall Hansen, founder of Quintessential Careers and CEO of EmpoweringSites.com, nearly one in 12 informational interviews leads to a job offer. By comparison, only one in 200 résumés submitted leads to a job offer.

That said, informational interviewing is first and foremost a research strategy. You are interviewing chemistry professionals to find information about career options, the chemical industry, and the culture of a potential future workplace. In the process you are expanding your professional network and perhaps gaining a few job leads. Getting a job — if that happens — is simply a nice byproduct. An informational interview differs from a job interview because the conversation is not about hiring or about a specific job. The people you interview, in turn, expand their own professional networks and learn about you as a potential colleague or as a candidate for a future hire.

How to find people to interview

The best people to interview are people you've already met face-to-face or with whom you have some connection. They know and trust you, so they're more likely to want to help you. A good place to start is with your friends and family. Make them aware of the careers you'd like to learn more about, and ask whether they know anyone who works in one of those careers or a related industry.

The next step is to think about the chemists you interact with as part of your college experience — and that doesn't only mean your professors. Graduate students, guest lecturers, chemists in your ACS local section, and others in your network can all provide helpful information about your career options.

A really simple way to meet people who can help answer your career questions is to join and become active in the ACS student chapter at your college or university. At chapter events, you will get to know other chemistry students and meet graduate students and professional chemists who are invited to speak. Get to know your chapter faculty advisors and other faculty members who participate in chapter events. Joining your university's ACS student chapter also gives you the opportunity to go to meetings and activities of your ACS local section, which is made up of working chemists.

Additionally, summer internships and Research Experiences for Undergraduates both provide excellent opportunities to talk to and connect with working chemists. You'll have plenty of opportunity to get to know the chemists you're working alongside, so it's a good idea to develop and memorize the questions you have about chemistry careers. You could also arrange a more formal informational interview with your colleagues.

As you think about people you could approach for an informational interview, bear in mind the broad range of career options for people with a chemistry degree. You may be surprised at the opportunities you discover by connecting with people outside of a traditional lab setting, including writers, lawyers, public policy makers, and art conservationists.

Once you've found someone to interview, all you need to do is ask if they'd be willing to give you a tour of their workplace and answer a few questions about their job. When you're asking, make it clear that you're researching your career options (not looking for a job) and that you'll only need a short amount of their time. Twenty minutes should be the most you need to ask all your questions.

Finally, when you're reaching out to ask for interviews, be prepared! Some people will request to be interviewed on the spot, so always have your questions on hand.

Come Up for Some AIR

One easy way to remember the goal of informational interviewing is the acronym AIR: advice, information, and referrals. If the person you're interviewing senses that you may be using them to try to find a job, they could feel uncomfortable. But if you make it clear you only want advice, information, and referrals, they'll probably be more approachable and helpful.

Why informational interviewing is so useful

Informational interviewing has a range of benefits. By conducting informational interviews, you will:

- Find out about the different types of jobs that are available to chemistry graduates.
- Learn about the skills you should develop and the career paths you can follow to achieve your goals.
- Discover what different jobs actually involve. That way, you'll have a better idea of whether a job is a good fit for you.
- Learn the jargon that people who work in your ideal career use. This can help you stand out when you prepare your résumé or go for an interview.
- Gain confidence about the skills you can offer potential employers.
- Expand your network of contacts. Every person you meet will provide new insights, and many of them will become people you can turn to for help throughout your career.

Sample informational questions

Prior to your informational interview, prepare a list of open-ended questions to help guide your conversation. Think about your overall career interests and goals and what you want to learn about a person's career path, their employer, or career field.

- What first got you interested in this job?
- What training or skills are vital in your work?
- What do you enjoy most about your work?
- What are the most satisfying moments?
- What are some of the challenges you face in your work?
- How have things changed at your workplace over the past few years?
- How do you see your work changing in the future?
- What does your typical day look like?
- What are your key responsibilities?
- What's the typical path into this line of work?
- How can I find out more about this type of work?

Conducting the interview

Your next step is to plan your interview questions. See the sidebar for a sample list of useful questions. Use these as a starting point to come up with your own questions.

On the day of the interview, dress professionally and give yourself plenty of time to get to the interview. Someone is giving you their time, so you should respect that by being punctual. At the start of the interview, introduce yourself and let the interviewee know what you're hoping to get out of the interview. Then, plunge into your questions. You don't have to stick rigidly to the questions you've prepared. If your interviewee mentions something interesting and you'd like to ask a follow-up question, ask away! The only caveat to this is that you must stick to the time frame you agreed upon when you arranged the interview. It's worth recording the answers you're given, as you're unlikely to remember everything afterwards. The easiest way of doing this is by recording the conversation on your smartphone, but you'll need permission from your interviewee to do this. Alternatively, take notes in a notepad or on your tablet.

At the end of the interview, thank your interviewee for their time, and let them know how they've helped you. A great question to conclude with is: Could you put me in touch with someone else who could give me insights into this type of work from another point of view?

It's possible that the tables will be turned and you'll be offered a job interview on the spot. If this happens, you can always let your interviewee know you'd like some time to prepare, and give them dates when you'll be available.

After the interview

When the interview ends, your work isn't quite done yet. When you get back home, review your notes or listen to the recording of the interview and note down the key insights you picked up from the interview. Second, take the time to write your interviewee a thank-you note or e-mail. This is a good opportunity to remind them that you'd like to be connected with the people they recommended in response to your final question. Finally, add the interviewee to your contact list and connect with them through LinkedIn. You never know when you might need their help again.

No time like the present

Studying and getting the right qualifications are only two aspects of preparing for a satisfying chemistry career. The other is developing your people skills and connecting with the people who can help you find the career that's right for you. And that's something you can start doing now.

The first time you reach out for an informational interview may take a bit of courage on your part. Be brave, and go for it anyway! Afterwards, you'll never look back.

David Masters *is a freelance writer based in Swansea, UK.*

14 Myths about Careers in Chemistry ... *and the Realities Behind Them*

BY LISA M. BALBES

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As you prepare to move into the next phase of your professional life, you are probably weighing your options — perhaps it's graduate school, or a job in industry, government, or academic research. You may even be considering working for a non-profit, or starting your own company.

At this point, you probably know a significant amount about careers in academia. You've spent years watching your professors, so you know how they spend their time. If you've held a job or have research experience, you know something about a particular industry or area of inquiry. But you might not be as aware of other, wide-ranging employment options. More importantly, many of the things you've heard people say about the job market might be outdated or otherwise inaccurate.

Below are some of the most common myths about non-traditional (and traditional) careers in chemistry, along with the current realities.

Myth 1: Few chemists pursue non-traditional careers.

Reality: To answer this, we need to define what a "traditional" career is. If tenured university professor positions or any position where you work at a lab bench first come to mind, the truth is, only a minority of all chemists are engaged in these positions! Expand your thinking to include the many chemistry-related careers relating to medicine, regulatory affairs, or patent law, where you're speaking, writing, and thinking about science, but not working at a bench. You don't stop being a chemist when you aren't working at a bench or in a classroom. Your chemistry education teaches you how to think and approach problems analytically. It also provides a background in scientific principles and techniques that you will continue to use, no matter what your job title is. It may sound a little paradoxical, but actually, most chemists have non-traditional careers!

Myth 2: Non-traditional careers in chemistry are a new thing.

Reality: Nope, sorry. ACS has been promoting non-traditional careers at least as far back as 1963, describing the wide variety of careers that chemists are prepared for. As long as there have been chemists (or even alchemists), there have been those who blaze their own trail!

Myth 3: There are no jobs for chemists.

Reality: The vast majority of chemists are employed. In fact, as of March 2014, only 3.1% of all chemists surveyed by ACS were unemployed and seeking employment — meaning 96.9% had jobs (2014 ACS Salary Survey, *C&EN*, Sept 1, 2014, pp 68–71). Of chemists with a bachelor's degree, only 4.2% were unemployed, and of those with a master's degree in chemistry, the figure was 4.6%. There are jobs out there, though they may not be as plentiful as they were in the past. There still are opportunities in many new and emerging fields, including analytical testing and professional services related to science, engineering, and the law.

We are also seeing hiring increases in agricultural and food chemistry, specialty and fine chemicals, and chemical coatings, paints, and inks. However, as the types of companies that employ chemists have become more diverse, both geographically and functionally, it has become harder to summarize employment statistics than when the vast majority of chemists worked in a few large industries. In addition, anecdotal evidence suggests that governmental positions may open up as waves of retirement begin in early 2015.

Myth 4: Most chemists have a Ph.D.

Reality: While ACS membership is highly skewed toward advanced degrees (about 70% of ACS members have a Ph.D.), according to O*NET OnLine, 86% of chemists overall have bachelor's degrees (**www.onetonline.org/link/details/19-2031.00**).

Myth 5: There is a glut of Ph.D. chemists in the job market, so I should not consider earning a Ph.D.

Reality: Whether or not that's the case today, the job market may change during the six years or so that you would be in graduate school. If you decide to go on to earn a master's or Ph.D., make sure you're doing it for the right reasons, rather than trying to second-guess the job market. Earning an advanced degree will change the kind of work for which you are qualified— it will become more intellectual and less hands-on.

Myth 6: Most chemists work in academia as tenured university professors.

Reality: The majority of chemists (52.3%) worked in industry in 2014, and an additional 7% worked for the federal government. While the percentage of chemists who are working in academia has been increasing slowly (38.9% in 2014), that figure includes postdocs and other non-tenure-track positions. In fact, *The Washington Post* estimates that at least 50% of all professors are now adjuncts, and many of those positions are part-time (**www.washingtonpost.com/opinions/adjunct-professors-fight-for-crumbs-on-campus/2014/08/22/ca92eb38-28b1-11e4-8593-da634b334390_story.html**).

Myth 7: I am a failure if I don't go to graduate school, because a tenure-track professorship is the ultimate career goal of every chemist.

Reality: Although you may have talked to many professors who are very happy with their chosen career path, there is no single path that is right for everyone. Professors must enjoy and excel at both teaching and directing a research group, which are two very different skill sets. You are a success if you find a career that you enjoy and are good at — no matter what others say.

Myth 8: I can do anything.

Reality: Although perhaps you can do lots of things, do you really want to? You will be much more successful if you identify the skills you have that others do not, as well as the skills you really enjoy using — and then find a career path that will let you take advantage of them.

Myth 9: I have no transferrable skills.

Reality: Everyone has skills; you just need to identify the ones that you want to use. You are used to thinking about your laboratory skills in organic synthesis, NMR, and materials characterization. However, you also have experience with soft skills, such as communication and teamwork, as well as domain expertise in proper safety equipment, data interpretation, and more. Review your most significant accomplishments, and the skills you used to achieve them, to gain valuable insight into your professional assets.

Myth 10: I can become a consultant, start my own company, and make millions!

Reality: A successful career as a consultant requires extensive expertise in a particular subject, and a well-developed network of peers who will confirm and advertise your services. It is highly unlikely that an undergraduate degree alone would provide either of these, or the business skills required to run a company.

Myth 11: I have to get more education to move into another career.

Reality: In many cases, this is not true. Hands-on experience in an area will generally carry much more weight than a certificate. Sometimes it's as simple as describing what you have done in different words; in other cases, you may want to seek out extra responsibilities (either for pay or as a volunteer) to get specific experience.

Myth 12: I can't change careers.

Reality: Technology and the world of work are changing so fast that whatever job you start out at is going to change during the time you are working at it. You will be changing positions and companies much more often than chemists in previous generations did, and someday you might even find that you have changed careers without realizing it!

Myth 13: I will join a start-up and make a ton of money!

Reality: Most start-up companies fail. Although working in a new company can be a great education in how to run (or how not to run!) a business, you should enter with realistic expectations and a backup plan. (**www.wsj.com/articles/SB10000872396390443720204578004980476429190**)

Myth 14: There is a single perfect job out there for me, and I will be unhappy unless I find it.

Reality: You are a multifaceted individual, interested in a number of different things. There are many different career paths that you could take, and only by carefully examining your own skills, interests, and values can you find the direction that is best for you. In addition, your values and priorities will change throughout your life. What is ideal for you now may not be so in the future, so you need to constantly re-evaluate the match between your professional and personal needs.

The take-away message

The reality is that some of your friends will receive job offers before graduation, while others may be unable to find a job even after months of intense searching. To find your own ideal career path, do your homework. Start with the ACS College to Career website at **www.acs.org/CollegetoCareer**. Talk to as many people as possible about their careers. Try informational interviewing. Hone your professional skills. Remember that each person's set of circumstances is unique and their advice and experiences may not necessarily apply to your own future career path or success. Best of luck to you on your journey! iC

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This article was adapted from "14 Myths about Non-Traditional Careers in Chemistry… and the Realities Behind Them", which will be published later this year in the Graduate & Postdoctoral Chemist*, Issue 4, Vol. 2.*

Chemical Information Management Specialist

Be a Fount of Knowledge

BY ACS STAFF

Chemical information management specialists are responsible for finding, organizing, and disseminating information. They work with electronic information, especially chemical information found in journals, databases, patent literature, content management systems, and internet resources, to make it easily accessible to researchers, students, industry professionals, and others.

These specialists are hired by libraries, chemical companies, market research firms, publishing units of professional societies, and management consulting firms. They are also employed by the technical and trade divisions of publishing houses and by software and chemical information database companies. Some work as independent consultants hired on a project-by-project basis. Most roles require both technical understanding and computer expertise.

Job responsibilities include balancing patrons' needs with budget availability, managing online and print resources, planning for disaster recovery, evaluating usage and impact of various resources, and negotiating contracts.

Possible job titles and areas of opportunity for chemical information management specialists include:

- Computer software developer
- Technical information specialist (organizing and archiving company reports, standard operating procedures, and historical data)
- Data curation (enabling access to, and ensuring quality of, chemical data sets over their entire life cycle)
- Abstracter (summarizing technical content for a specific audience)
- Indexer (creating indexes so users can find information easily)
- Science librarian
- Market researcher
- Patent researcher
- Management consultant
- Technical publisher
- Patents and intellectual property.

Is this career a good fit for you?

A greater interest in scientific literature than in scientific method is a good sign that this is a career path worth exploring for you. An eye for detail and a propensity for public service are also important. Most chemical information specialists stress the importance of being able to work with people and communicate well, both verbally and in writing. It helps to be highly organized. Information specialists combine their technical skills with good interpersonal communication skills and the ability to work in a service-oriented position.

Technical skills required

- **The ability to read, search, and understand technical information for a technical audience is crucial for many career paths in chemical information management.**
- **A solid foundation in science and chemical reference works, including the ability to search chemical databases and conduct chemical structure and patent searches, is required.**
- **The ability to write about or summarize (abstract or index) chemical information is also required for some positions.**
- **Web programming and Web development skills may also be useful.**

LEARN MORE ABOUT CAREER OPTIONS IN THIS FASCINATING AREA! ATTEND:

Careers in Chemical Information and Cheminformatics Panel Discussion & Brunch

250th ACS National Meeting · Boston, MA
Sunday, August 16, 2015, 9:00–11:00 AM

- Learn about career opportunities in academia, industry, and government.
- Participate in Q&A discussions.
- Meet professionals working in chemical information and informatics careers from Pfizer, National Institutes of Health, Massachusetts Institute of Technology, Schrödinger, and more!

Career path

Most chemical information professionals start out as researchers, with varying areas of expertise. Over time, they may start managing other researchers, sometimes taking charge of a division or an entire library or information center. They may also move into project management.

Future employment trends

The job outlook for chemical information specialists is steady for the foreseeable future. Since this is a fairly specialized market, obtaining a position often requires a willingness to relocate. Computer expertise is becoming a prerequisite, and patent or intellectual property work is a growing area. iC

Quick Facts

OPPORTUNITIES

- Job outlook is very strong, with a high demand for people with technical understanding and computer expertise.

SALARIES

- Average annual salary: $84,448 (2007).

EDUCATION

- Educational requirements vary considerably, depending on the specific area in which you want to work. Indexers and document analysts generally have a bachelor's degree in chemistry, although a master's or doctoral degree may be required for more specialized work. Additional training and a master's degree in library science (M.L.S.) are necessary to be a chemical librarian in an academic or industrial work environment, and information specialists in industry often have an advanced degree in their scientific discipline.
- The ability to efficiently and effectively search for chemical structures and for biosequences is also a highly desirable skill. Market researchers, consultants, and individuals in sales and management positions generally combine their technical training with a business degree.

WORK SPACE

- Most jobs require a good deal of reading and analyzing technical data. Chemistry training is vital to understanding the material and distilling what is most important from it. The presentation and organization of information is also a component of the job.
- Most spend a good deal of the day at their desks, in front of a computer. Some may travel or work in the laboratory, depending on the nature of their positions. Because it is a service industry, there is a high level of contact with other people. iC

Chemists in the Real World: Susan Cardinal

B.S. CHEMISTRY; MASTER'S IN LIBRARY SCIENCE
CHEMISTRY LIBRARIAN, UNIVERSITY OF ROCHESTER

After Susan Cardinal earned her B.S. in chemistry in 1989, she worked for several years for a small start-up company involved in dechlorinating water and soil, followed by employment at an environmental laboratory, where she worked as supervisor of the firm's organic extractions lab. She found the work interesting but also recognized that the work didn't align with her skill set.

Cardinal began thinking about making a change in her career, and worked with career counselors and took various assessments such as the Myers–Briggs Type Indicator and others. She also found helpful advice in the book *What Color Is Your Parachute?* The pivotal moment came when she started thinking about how much she had always enjoyed libraries and began considering a career in library science.

To get a better sense of what the career change might mean, Cardinal began volunteering at a local public library; soon afterward, she started taking classes in library science. She also took some part-time jobs in libraries, which prepared her for a full-time position as a circulation supervisor. After earning her M.L.S., Cardinal found the position at the University of Rochester, applied for it, and was hired. As she was learning on the job, she became involved in ACS, and found a mentor who was willing to give her career suggestions and advice.

Q: *How did you find your first chemistry-related job after you graduated from college?*

Cardinal: As I was wrapping up my B.S. in chemistry, the University of Iowa brought in potential employers and I interviewed with a few.

Q: *What is your major responsibility in your current position?*

Cardinal: I meet the information needs of students, staff, and faculty of the University of Rochester, especially those in the chemistry department.

Q: *Describe your typical day on the job.*

Cardinal: I communicate via e-mail (30%), meet with colleagues (20%), do research about libraries and chemistry (20%), read articles (10%), supervise two staff on library-related projects (10%), and make decisions about what books to buy or which journals to buy or where to locate print items (10%).

Q: *How many hours do you work in a typical week?*

Cardinal: About 35–40 hours is typical. I may work more if I'm preparing a presentation or training session. The intensity of our pace varies with the flow of undergraduate classes and with library projects; it is more relaxed in December and more hectic in September.

Q: *What do you like most about your job and why?*

Cardinal: No two days are the same. I meet with different people with interesting questions. One of the most enjoyable moments for me is to help someone connect with the hard-to-find information they've been looking for. I get a lot of satisfaction when I see their excitement and sense of relief.

Q: *What's the best career advice you've received?*

Cardinal: Know yourself and your preferences, and find a job that matches.

Q: *What personal talent or trait makes you a great fit for your job?*

Cardinal: I love to talk with people and go on "treasure hunts" for information. Often I'm far less interested in what the particular answer is than I am in simply finding it. Choosing which tools to use, which route or process to follow, and helping to find it as fast as we can — those are some of the challenges of being a librarian.

Q: *Is there anything else you would like to mention about your career?*

Cardinal: Libraries and information science may appear boring from the outside, but they are really exciting and interesting fields because technology and software are evolving to enable convenient, broad access to information. And people have so many varied passions that it is a joy to further their research.

When I first started taking classes in library science, the World Wide Web was just beginning to become popular. As I earned my master's and have worked at the University of Rochester, the Web has transformed itself — and it's also transformed the world of libraries. Because people can find the answers to many questions on the Web, they tend not to come to the library for answers to fairly straightforward questions or to look up basic concepts. Instead, they need to find very specific and hard-to-locate information — and I love the challenge of helping them do so.

Q: *What is your favorite ACS resource?*

Cardinal: SciFinder is my go-to resource for finding all sorts of chemical information. No other database has the same depth and currency. The support people are excellent.

Q: *How have you benefited from being an ACS member?*

Cardinal: At first, I read *C&EN* to get to know what was happening in the field. Over time, I've gotten more involved in the Division of Chemical Information committees and conference activities, and I've met so many wonderful colleagues from all over the world. They understand my work better than anyone else and are so supportive. iC

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SPOTLIGHT

Benedictine University

Lisle, IL

COMPILED BY ROBIN LINDSEY

Chapter president: Sree Bodepudi **Chapter members:** 27 **ACS student members:** 16
Website: www.benuscience.org/physics/acs-sps-club.php **Institution description:** Small, private, suburban, 4-year

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

A: After the new board has been elected, we have a transition meeting with the old and new board members. The new board members also shadow the old board members so that they can see exactly what their position entails and what kind of responsibilities they will have.

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

A: Our chapter participated in our school's first Hunger Week. We also hosted a discussion about genetically modified organisms and their practicality and effectiveness in ending world hunger. Members also collected donations for our school's food drive, and judged science fair presentations at local middle schools.

Q: **What is your most successful recruiting event?**

A: We are co-affiliated as an ACS chapter and as a Society of Physics Students club, so we can target students who are interested in either field. Our members are not required to be either a chemistry or physics major to join, but must simply have a passion for science! We visit our chemistry and physics classes during the first few weeks of school to talk about our chapter's activities. Members also do fun science demos and recruit new members at our school's annual Quad Day.

Q: **What is your most popular or unique chapter activity?**

A: Our members' favorite event this year was "Who's Got the Chemistry?" Members paired up with friends or significant others and participated in a game show similar to *The Newlywed Game*. Our members had a lot of fun playing, and we even offered a prize to the couple who earned the most points.

Q: **What types of activities do you sponsor?**

A: We hosted several speakers this year, including speakers from Argonne National Laboratory and Northwestern University. One of our main goals is to prepare our students professionally, so we host résumé help sessions and mock interviews. We also have an annual Periodic Table of Cupcakes fundraiser, sponsor a Marshmallow Challenge, and make ice cream with rock salt!

PHOTO COURTESY OF BENEDICTINE UNIVERSITY

The Benedictine University chapter offers its members résumé help sessions and mock interviews to help them prepare for the professional world that awaits them after graduation.

Faculty advisor:
Kari Stone, 4 years
Andrew Wig serves as the physics faculty advisor.

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

Stone: We typically rotate the task of serving as faculty advisor for the chapter within the chemistry department. I have been serving in this capacity for almost my whole time at Benedictine University, and have been very proud of the work and accomplishments of our students. I simply sit back and let them take ownership.

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

Stone: Because students are so busy with other things in their lives, sometimes there are breakdowns of communication between students and faculty advisors.

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

Stone: The students have given the chapter a life of its own. I serve to mentor and advise, but the chapter really belongs to them. They decide which activities to do and when to meet, and also hold their own elections.

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

Stone: Relax and let the students take ownership. The students will do great things when they feel as though they are moving the ship.

SPOTLIGHT

Sarah Lawrence College

Bronxville, NY

COMPILED BY ROBIN LINDSEY

Chapter president: Julie Niklas **Chapter members:** 12 **ACS student members:** 98
Institution description: Small, private, suburban, 4-year

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

A: We volunteer at the college's Center for the Urban River at Beczak. We also do science demos and teach children new and exciting topics in health and science at the San Andrés Episcopal Church Health and Science After-School Program, in Yonkers.

Q: What are some of the interesting ways your chapter recruits members?

A: Members travel to various nearby states and cities to present research and give presentations about the work we do as students in the Sarah Lawrence College (SLC) science departments. We encourage non-members to attend as well, so they can see first-hand the benefits and rewards of being an ACS student chapter member. After tagging along with our chapter to a conference or two, non-members quickly sign up to be an official part of our chapter and gain the opportunity to present their own work in the future!

Q: What is your most popular or unique chapter activity?

A: Our most popular activity is the SLC Chemistry Carnival. This event is open to all students and local children of all ages. Together, we make edible slime and erupting volcanoes, present safe science demos such as "stuff a mole," teach magnetism through ferrofluid, and make things go "boom!" We hope to establish the Chemistry Carnival as a community tradition, where students and young children can learn how fun chemistry is!

Q: What types of activities do you sponsor?

A: We sponsor semi-annual poster symposiums to enable SLC students to showcase their research and hard work in front of SLC faculty and staff, family and friends, and Bronxville community members. This semester, we will also be sponsoring and hosting the Women in Science event on campus, featuring a series of talks from distinguished female scientists from the New York City area, a panel discussion, and an undergraduate and graduate poster session and luncheon.

PHOTO COURTESY OF SARAH LAWRENCE COLLEGE

The SLC chapter has formed close relationships with other STEM-oriented clubs to help their members explore career paths in other areas.

Q: How involved is your chapter on campus?

A: Since reactivating our chapter, we have established close relations with many clubs on campus, including the SciMath group, the Health and Science After-School Program, the Science Tutoring Club, the Brainwashed Club, and the Psychology Club. By doing this, we help our members explore career paths in other areas of science and chemistry. We also collaborate with these clubs to hold events, such as the SLC Chemistry Carnival. Other times, we invite another club to give presentations at our chapter meetings. iC

Faculty advisor:
Colin Abernethy, 10 years

Q: How did you become a faculty advisor?

Abernethy: I was asked to become a faculty advisor by a group of students who wished to reactivate our institution's student chapter.

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

Abernethy: Several years ago, our chapter started an outreach program that involved giving chemistry demonstrations to middle school students in Yonkers. I have really enjoyed bringing hands-on experiences in chemistry to young people.

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

Abernethy: Let the students decide what they want to do in their chapter, and don't try and run things yourself. As a chapter advisor, you are there to encourage students and help facilitate their activities. iC

PHOTO CHEMISTRY

Highlights from a Successful Year of Chapter Activities

ABOVE & RIGHT: Temple University (Philadelphia, PA) chapter members supported the Walk a Mile in Her Shoes to promote awareness about rape and sexual assault campus-wide.

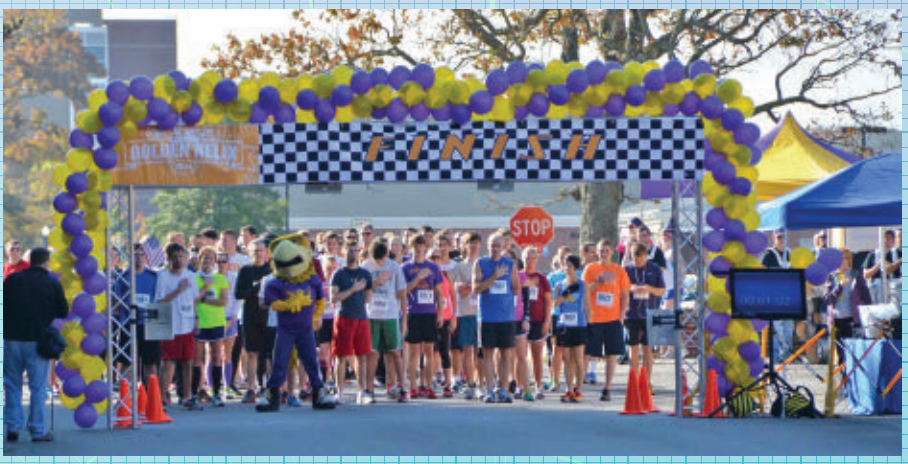
LEFT: Barry University (Miami Shores, FL) chapter members presented chemistry demos and hands-on activities during the National Chemistry Week Family Day event at the Ft. Lauderdale Museum of Science, which was sponsored by the South Florida ACS Local Section.

ABOVE: Members of the Saint Mary's College (Notre Dame, IN) chapter competed against the biology department in their biannual kickball game. The series ended in a 1–1 tie.

BELOW: The Brigham Young University-Idaho (Rexburg) chapter held its annual Chemistry Extravaganza to entertain and teach chemistry concepts to the wider Rexburg community.

ABOVE: Members of the Texas Christian University (Fort Worth) chapter constructed a Periodic Table of Cupcakes in the TCU Chemistry Library.

ABOVE: Faculty, staff, and students proudly supported the Lincoln University (MO) chapter's Nerd Day festivities.



ABOVE: The Tennessee Tech chapter sponsored the Golden Helix 5K Run, in collaboration with the American Society for Biochemistry and Molecular Biology Affiliate Network and Chemical-Medical Sciences Club. All proceeds were donated to a local charity.

RIGHT: For one of its social activities, the Waynesburg University (PA) chapter members got together and tie-dyed their lab coats.

LEFT: Eastern Oregon University (La Grande) students took part in the annual Walk for Warmth fundraiser to support families who faced home heating emergencies.

LEFT: Northern Kentucky University Highland Heights chapter members helped beautify their community by sponsoring a trash pick-up along a local stretch of highway.

ABOVE: To help celebrate their university's AutumnFest, the Duquesne University (Pittsburgh, PA) chapter made and distributed liquid nitrogen ice cream to nearly 300 students, faculty, and staff.

ABOVE: To kick off National Chemistry Week, members of the Muhlenberg College (Allentown, PA) chapter hiked along the Appalachian Trail to Bear Rocks.

ABOVE: St. John's University (Jamaica, NY) chapter members helped to promote Earth Day awareness by participating in the Walk the Brooklyn Bridge event.

LEFT: As part of an island-wide effort to motivate young students to become scientists, the Inter American University of Puerto Rico Metropolitan Campus (San Juan) sponsored a table at the annual Festival de Química (Chemistry Festival).

2015 ACS National & Regional Meetings

Great Lakes/Central Regional Meeting
May 27–30, 2015 • Grand Rapids, MI

Northeast Regional Meeting
June 10–13, 2015 • Ithaca, NY

Northwest Regional Meeting
June 21–25, 2015 • Pocatello, ID

250th ACS National Meeting
August 16–20, 2015 • Boston, MA

Midwest Regional Meeting
October 21–24, 2015 • St. Joseph, MO

Southeast/Southwest Regional Meeting
November 4–7, 2015 • Memphis, TN

Western Regional Meeting
November 6–8, 2015 • San Marcos, CA

For more information about upcoming ACS national and regional meetings, go to **www.acs.org/meetings**

Other Meetings of Interest

Two-Year College Chemistry Consortium ($2YC_3$)
May 22–23, 2015 • Kaneohe, HI
September 18–19, 2015 • Cottleville, MO
November 6–7, 2015 • Charlottesville, VA
www.2YC3.org

National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) Conference
September 22–25, 2015 • Orlando, FL
www.nobcche.org/conference

Society for the Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS) National Conference
October 29–31, 2015 • National Harbor, MD
www.sacnas.org

The International Chemical Congress of Pacific Basin Societies
December 15–20, 2015 • Honolulu, HI
www.pacifichem.org

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