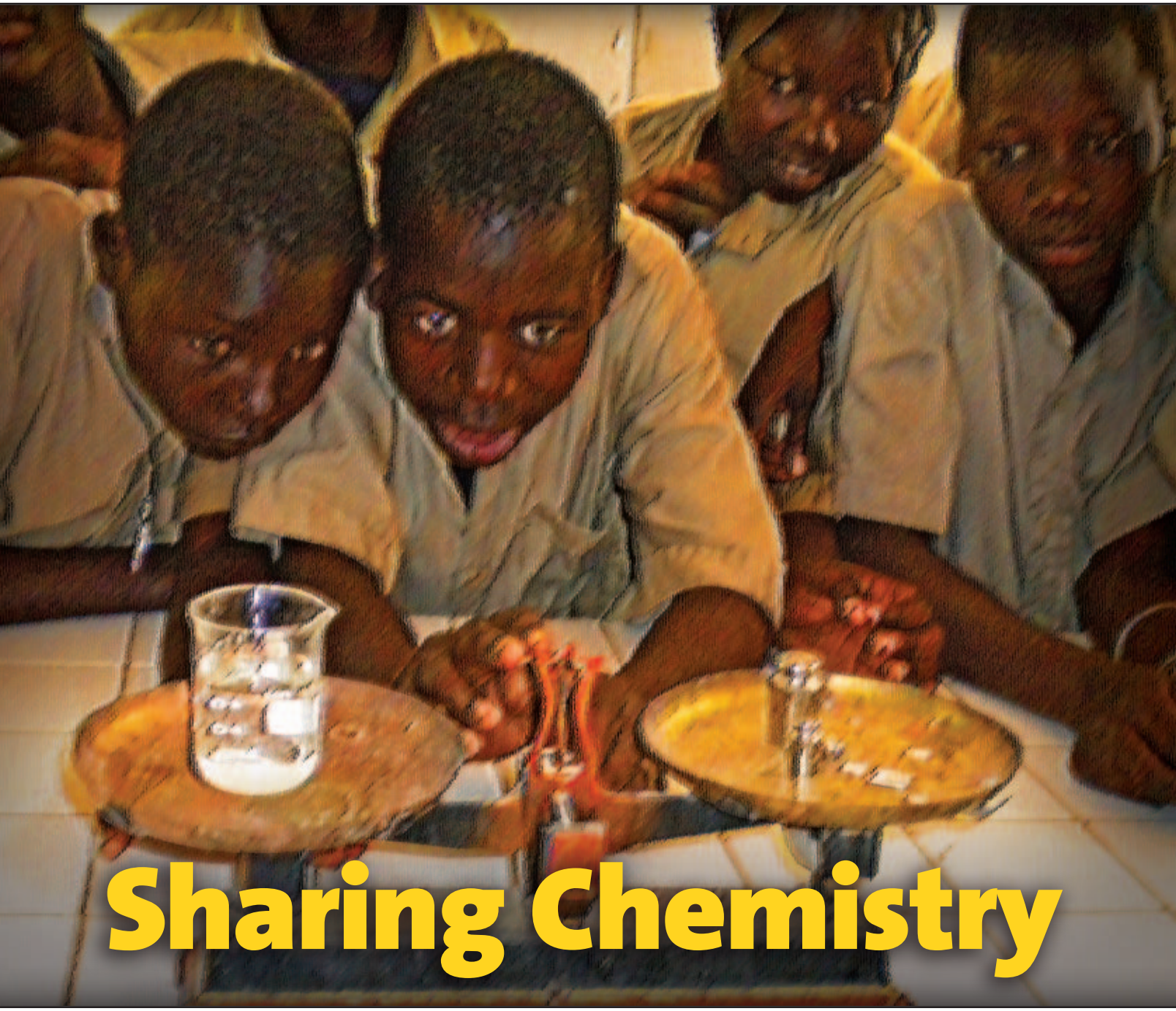
inChemistry
THE MAGAZINE FOR ACS STUDENT MEMBERS
February/March 2014



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ACS Chemistry for Life®

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THE MAGAZINE FOR ACS STUDENT MEMBERS

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PHOTO COURTESY OF PHILIP RODENBOUGH

Cover: Students participating in a chemistry lab in Koupéla, Burkina Faso.

CONTENTS

A Note about the Cover Photo
ACS strongly supports complying with all applicable lab safety requirements. The lack of protective eyewear on the students depicted in the cover photograph is troubling. As detailed in the accompanying article, the extreme poverty in Burkina Faso renders such compliance extremely difficult. ACS urges everyone to use protective eyewear whenever they are in a lab. For more information, please consult the materials on the website of the ACS Committee on Safety, including the materials on Chemical Safety in the Classroom. http://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/chemical-safety-in-the-classroom.html

ACS
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American Chemical Society Scholars Program

Pathways to Success in the Chemical Sciences

Inviting African-American, Hispanic, & Native American students to apply for renewable scholarships for the 2014–2015 academic year.

Up to $5,000 will be awarded to under-represented minority students who want to enter the field of chemistry or chemistry-related fields, such as environmental science, toxicology, and chemical technology. High school seniors and college freshmen, sophomores, or juniors are eligible to apply.

Eligible applicants include those who are interested in:

- **pursuing four-year degrees in the chemical sciences**
- **transferring from two-year colleges to four-year colleges to pursue chemical science degrees**
- **pursuing two-year degrees in chemical technology.**

For more information, and to access the online application form, visit:

www.acs.org/scholars

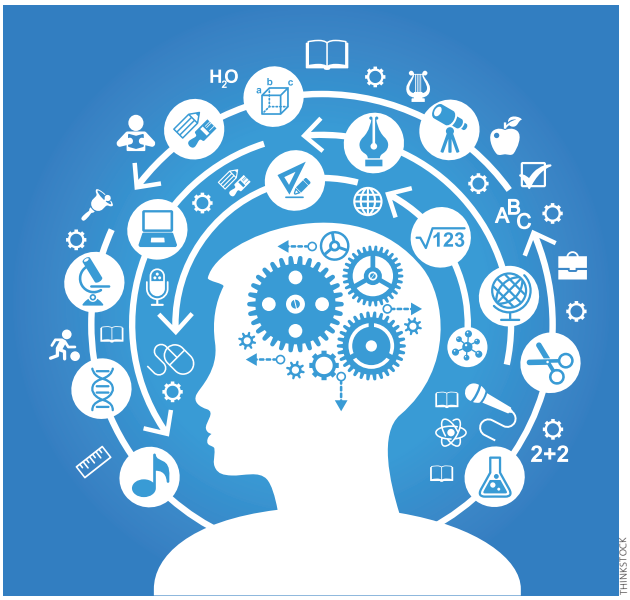
Application deadline is March 1, 2014.

Approximately 100 scholarships will be awarded.

EDITORIAL:
K–12 Science Education Needs Your Help

BY THOMAS J. BARTON

One of the great pleasures in my career was teaching organic chemistry to undergraduate students. Why? Probably first and foremost, because I'm a ham. Secondly, I love getting to know the students, who almost inevitably are open to new ways of looking at things. Another reason is that teaching is in my blood: my dad, mother, and sister were all teachers. Lastly, teaching satisfies for me a fundamental aspect of life, as I have long believed that if a significant portion of your life did not in some way involve helping people, then there wasn't really a good reason for you being here.



I have many passions, but if I had to pick one to put at the top of the list, it would be improving the quality of K–12 science education in the United States. Annual international competitions have long revealed that the average performance of our students in such vital areas as reading, math, and science is well below that of many other industrialized nations. There are many contributing factors: lack of parental emphasis on STEM education; school years that are too short; ineffectiveness of government (state and federal) education programs; and teacher unions that focus more on seniority than performance, to cite just a few. These factors are controversial and difficult to address, but that shouldn't be a reason not to discuss them.

So, why should you be concerned about elementary and secondary science education? I assume that one of the reasons you are taking chemistry is that you understand its significance and benefits in our daily lives. If that is correct, then you are in a position to share the importance of chemistry with others — and I hope you will do just that. ACS has two excellent outreach programs that offer resources to help you communicate with nonscientists about the value of chemistry in education. One is Chemistry Ambassadors (**www.acs.org/ChemistryAmbassadors**); the other is ACS's legislative network, Act4Chemistry (**www.acs.org/Act4Chemistry**). I encourage you to check out both.

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. Use this knowledge to explain to others why it's critical that our students graduate from high school with a good grounding in science. The goal isn't to turn all students into scientists; the goal is to give them the tools necessary to make informed decisions on issues such as the environment, energy, and other important areas.

The National Science Board's biennial report, *Science and Engineering Indicators 2012*, notes that public understanding of science and technology is a cause for concern: "U.S. survey data indicate that many Americans provide multiple incorrect answers to basic questions about scientific facts and do not apply appropriate reasoning strategies to questions about selected scientific issues."

As I have written on several occasions, we currently have an ever-increasing technological world with an ever-decreasing level of technological literacy. This is not sustainable. Do your part to make change happen!

Please don't hesitate to share your thoughts with me at **barton@iastate.edu** or in person at a future meeting. Best wishes for the future. iC

Thomas J. Barton, *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.*

About Thomas J. Barton

Tom Barton entered Wharton County Junior College as a journalism/prelaw student on a music scholarship for voice and clarinet — then opted to take a course in chemistry and enjoyed it. Although he eventually gave up the clarinet, he still loves to sing today (mainly for his church and his two cats). His other pastimes include golf, fishing, motorcycling, flying, sailing, and languages, to name a few. He and his wife, Betty, have lived in Ames, Iowa, since 1967 (but enjoy spending their winters in places like Mexico, Thailand, and Nicaragua). iC

ATOMIC NEWS

COMPILED BY CHRIS ZEIGLER

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

Making a common cosmetic and sunblock **ingredient safer**

Using a particular type of titanium dioxide (TiO_2) — a common ingredient in cosmetics, food products, toothpaste, and sunscreen— could reduce the potential health risks associated with the widely used compound. The report on the substance appears in the ACS journal *Chemical Research in Toxicology*.

TiO_2 is generally considered a safe ingredient in commercially available skin products because it doesn't penetrate healthy skin. However, research has shown that TiO_2 can cause potentially toxic effects when exposed to ultraviolet light, which is in the sun's rays. To design a safer TiO_2 for human use, the researchers tested different forms of the compound, each with its own architecture.

They tested TiO_2 powders on pig skin with indoor lighting, which has low ultraviolet light. They discovered that rutile, one of the two most commonly used crystalline forms of TiO_2, easily washes off and has little effect on skin. Anatase, the other commonly used form, was difficult to wash off and damaged the outermost layer of skin even in low ultraviolet light. The findings strongly encourage the use of rutile to produce safer TiO_2-based cosmetic and pharmaceutical products.

Read more about the research: "Crystalline Phase Modulates the Potency of Nanometric TiO_2 to Adhere and Perturb the Stratum Corneum of Porcine Skin under Indoor Light," *Chem. Res. Toxicol.*, 2013, 26 (10), pp 1579–1590.

Toward a urine test for **detecting blood clots**

Detecting dangerous blood clots, which can cause life-threatening conditions such as strokes and heart attacks, has been a coveted and elusive goal. But scientists are now reporting progress in the form of a simple urine test. Their study, in which they demonstrated that the test works using laboratory mice, appears in the journal *ACS Nano*.

Blood clots — clumps of platelets and fibrin proteins — can threaten to choke off blood flow and lead to a wide range of serious and sometimes fatal conditions, including atherosclerosis and stroke.

Usually, blood clots are a good thing. They form a plug that stops the bleeding after an injury. But sometimes a clot forms when it really isn't needed, such as when a person sits too long on a long-distance flight and develops deep-vein thrombosis. In that case, a clot forms in the leg, blocking blood flow and causing leg pain. But it also can dislodge and move throughout the body to the heart or even the brain, which is life-threatening. Diagnosing a blood clot, or thrombosis, is tricky, however, and current clinical tests aren't always reliable. Sangeeta Bhatia's team wanted to develop a simple and more reliable way to test for these obstructive blood clots.

They describe development and testing of synthetic biomarkers — lab-made materials for detecting what is going on in the body. They conjugated peptides onto the surface of nanomaterials that are similar to those already approved and used in clinical settings. They injected the nanomaterials into mice. The peptides break up if a blood clot is actively forming, and those peptide fragments were detected in a simple urine test. "Our results demonstrate that synthetic biomarkers can be engineered to sense vascular diseases remotely from the urine and may allow applications in point-of-care diagnostics," the researchers state.

Read more about the research: "Nanoparticles That Sense Thrombin Activity as Synthetic Urinary Biomarkers of Thrombosis," *ACS Nano*, 2013, 7 (10), pp 9001–9009.

Maximizing broccoli's cancer-fighting **potential**

Spraying a plant hormone on broccoli boosts its cancer-fighting potential, and researchers say they have new insights on how that works. They published their findings, which could help scientists build an even better, more healthful broccoli, in ACS's *Journal of Agricultural and Food Chemistry*.

Eating broccoli regularly has been linked to lower rates of prostate, colon, breast, lung, and skin cancers. In this superfood, glucosinolates (GSs) and the substances that are left when GSs are broken down can boost the levels of a broccoli enzyme that helps rid the body of carcinogens. One way to increase GSs is to spray the plant hormone methyl jasmonate on broccoli. To determine which GSs and their products actually boost the enzyme levels when broccoli is treated, researchers tested five commercial types of broccoli by spraying them in the field with the hormone. They found that sulforaphane is the major contributor toward enhanced cancer-fighting enzyme levels, although other substances also likely contribute.

Environmental conditions played a role, too. This information could be used to identify superior broccoli and to breed even more healthful broccoli plants.

Read more about the research: "Influence of Seasonal Variation and Methyl Jasmonate Mediated Induction of Glucosinolate Biosynthesis on Quinone Reductase Activity in Broccoli Florets," *J. Agric. Food Chem.*, 2013, 61 (40), pp 9623–9631.

ALL PHOTOS IN ATOMIC NEWS: THINKSTOCK

65%
of the human body's mass is made up of oxygen. This means an average woman's body contains about 38 kg of oxygen.

The melting point of a diamond and also the highest melting point of any element.
3550°C

10
The number of naturally occurring isotopes of tin. It is the highest such incidence of any element.

2.4×10^{-23}
The number of seconds in a hydrogen-7 isotope's half-life. It is the shortest known half-life of any isotope.

.0122
The number of atomic units by which molybdenum's atomic weight was reduced when IUPAC recently changed the weights of 19 elements.

Recycling valuable materials used in televisions, car batteries, and cell phones

Many of today's technologies, from hybrid car batteries to flat-screen televisions, rely on materials known as rare earth elements (REEs) that are in short supply, but scientists are reporting development of a new method to recycle them from wastewater. The process, which is described in a study in the journal *ACS Applied Materials & Interfaces*, could help alleviate economic and environmental pressures facing the REE industry.

Zhang Lin and colleagues point out that REEs, such as terbium — a silvery metal so soft it can be cut with a knife — behave in unique ways as super magnets, catalysts, or superconductors. That makes them irreplaceable in many of today's tech gadgets and machines. Market watchers expect global demand to rise to at least 185,000 tons by 2015. Although some of these elements are actually plentiful, others are indeed in short supply. According to reports, terbium and dysprosium supplies may only last another 30 years. Attempts so far to recycle them from industrial wastewater have proven expensive or otherwise impractical. A major challenge is that the elements are typically very diluted in these waters. The team knew that a nanomaterial known as nano-magnesium hydroxide, or nano-$Mg(OH)_2$, was effective at removing some metals and dyes from wastewater. So they set out to understand how the compound worked and whether it would efficiently remove diluted REEs, as well.

To test their idea, they produced inexpensive nano-$Mg(OH)_2$ particles, whose shapes resemble flowers when viewed with a high-power microscope. They showed that the material captured more than 85% of the REEs that were diluted in wastewater in an initial experiment mimicking real-world conditions. "Recycling REEs from wastewater not only saves rare earth resources and protects the environment, but also brings considerable economic benefits," the researchers state. "The pilot-scale experiment indicated that the self-supported flowerlike nano-$Mg(OH)_2$ had great potential to recycle REEs from industrial wastewater."

Read more about the research: "Recycling Rare Earth Elements from Industrial Wastewater with Flowerlike Nano-$Mg(OH)_2$," *ACS Appl. Mater. Interfaces*, 2013, 5 (19), pp 9719–9725.

Baking blueberries changes their polyphenol content — and possibly their health **benefits**

Blueberries are called a superfood for their high polyphenol content, but when served as warm, gooey pie filling or when lending bursts of sweet flavor to a muffin, their "super" health benefits change. Scientists studied how cooking and baking affect the increasingly popular fruit's polyphenols and reported their mixed findings — levels of some of these substances rose while others fell — in ACS's *Journal of Agricultural and Food Chemistry*.

Ana Rodriguez-Mateos and colleagues note that eating blueberries is associated with several health perks, including improved thinking, reduced risk for heart disease, and reduced inflammation. Research suggests that polyphenols lend the fresh fruit these benefits. But consumers don't always enjoy blueberries raw. Some methods of processing, such as juicing and canning, lower polyphenol levels by 22–81%. However, no studies have tested whether using blueberries in breads, muffins, or pies affects their polyphenol content. Rodriguez-Mateos' team sought to test the stability of these health-promoting compounds during cooking, proofing (when the dough rises before baking), and baking.

They found that all three processes had mixed effects on blueberries' polyphenols — which include anthocyanin, procyanidin, quercetin, and phenolic acids. For example, anthocyanin levels dropped by 10–21%, while the levels of smaller procyanidin oligomers got a boost and those of larger ones dipped. In addition, phenolic acid levels increased, while other compounds such as quercetin remained constant. The researchers note that the retention of certain polyphenols observed in their study might be due to the use of yeast, which may act as a stabilizing agent during baking. "Due to their possible health benefits, a better understanding of the impact of processing is important to maximize the retention of these phytochemicals in berry-containing products," the researchers state.

Read more about the research: "Impact of Cooking, Proving, and Baking on the (Poly)phenol Content of Wild Blueberry," *J. Agric. Food Chem.*, Article ASAP, DOI: 10.1021/jf403366q.

POWER YOUR FUTURE!

Undergraduate Program

SUNDAY, MARCH 16

Hospitality Center
8:30 AM – 5:00 PM

Undergraduate Research Papers (Oral)
8:30 AM – 5:00 PM

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

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

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

Chem Demo Exchange— Household Chemicals
11:00 AM – 12:30 PM

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

Technical Symposium: The Many Faces of Energy Research
1:00 – 2:30 PM

Careers in the Energy Industry Panel
2:45 – 4:00 PM

Workshop: Improving Scientific Communication Skills
2:45 – 4:00 PM

Workshop: Making Demos Matter
4:00 – 5:30 PM

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

Undergraduate Social
8:30 – 11:00 PM

ACS Chemistry for Life®

247th ACS National Meeting & Exposition

Dallas, TX ■ March 16–20, 2014

MONDAY, MARCH 17

Hospitality Center
8:30 AM – 5:00 PM

Undergraduate Research Papers (Oral)
8:30 AM – 5:00 PM

Technical Symposium: Materials Science and Energy Research
9:00 – 10:30 AM

Workshop: Chemists Celebrate Earth Day Research Events
9:45 – 11:45 AM

How to Network 101
10:45 AM – 12:00 NOON

Undergraduate Poster Session
12:00 – 2:00 PM

Eminent Scientist Lecture
2:30 – 3:30 PM

Undergraduate 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 18

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

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. For more information contact Lori Betsock at l_betsock@acs.org. To register, go to **www.acs.org/GradSchoolRecruiters**.

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: Christopher Bradley, Mount St. Mary's University, Emmitsburg, MD

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

ACS Launches the College to Career Website for Undergraduates

BY ACS STAFF

www.acs.org/content/acs/en/careers/college-to-career.html

As an undergraduate chemistry major, you've developed a certain passion for your chosen science. But how can you develop this passion into a career that you find equally fascinating and challenging?

If you're like many undergraduates, you probably have a ton of career-related questions... or perhaps you're not even sure what questions to ask?

College to Career, a new ACS website for undergraduate students, is designed to help you to answer many career-related questions — and then take the next steps to launch a successful career involving the chemical sciences. The site is now available at www.acs.org/CollegeToCareer – and it's totally free to use.

Exploring chemistry careers and fields

The College to Career website offers career resources specifically designed for chemistry undergraduates. For starters, it provides a wealth of information on 36 traditional and non-traditional careers relating to chemistry — and even more career options will be added in the future. The site also enables you to explore career options within the five major disciplines of chemistry: analytical, biochemical, organic, inorganic, and physical.

To help you learn more about career options that are available at various degree levels in chemistry, College to Career also features more than 70 career profiles of real-world chemists. In their own words, these chemists provide detailed insights into their individual career pathways. Courtesy of ACS Webinars, you'll also find short video clips highlighting alternative career options.

Take the next steps

Once you've explored career options in chemistry, the Next Steps section of the website will provide you with a variety of resources to get your career off to a great start.

As you may know, research experience has become a prerequisite for gaining entry into a graduate program and obtaining many entry-level jobs in chemistry. As a result, you'll find the Get Research Experience section to be an especially helpful and important resource. This section's Get Experience database contains leads on summer internships, research experiences, and co-op opportunities for undergraduate chemistry students.

By pursuing these experiential opportunities, you can learn to conduct research under the guidance of a faculty supervisor, mentor, or advisor — and also work independently or with a research group. You can also expand your knowledge and lab skills, and experience chemistry in a real-world setting. These positions also enable you to begin to develop your network with professionals, graduate students, and postdoctoral scholars.

The Further Your Education section helps you to determine what level of education you will need to reach your career goals. Whether you're looking for a bachelor's program, transferring to a four-year college, or planning for graduate school, you'll find helpful information for identifying a program that fits your needs... and succeeding once you've been accepted!

Having a solid grasp of chemistry concepts and laboratory skills is essential to your success in a chemistry career, but that's not all you need. The Job Hunting and Career Skills section is a complete resource that will help you successfully compete for a job, and once you're hired, excel in your position. This section contains a variety of career resources, such as career interest assessment tools, proven tips on résumé writing and job interviewing, up-to-date facts about the chemical industry, and access to the ACS Career Consulting program — a valuable ACS member benefit.

The fourth area of the Next Steps section is called Develop Your Network. Access this section to find out why networking is important, read articles and tips on networking, and learn about the networking opportunities that ACS offers.

Start on your career path today!

For most chemistry undergraduates, choosing a career that will be the best personal fit (and the most rewarding, intellectually and financially) is neither simple nor easy. But by taking a little time looking through the College to Career site, you can greatly reduce the amount of time and effort needed to find the best path forward. You can also save yourself the expense and frustration of starting down a career path that really isn't for you... and ultimately, end up happier with your career decision. iC

ACS Chemistry for Life®

www.acs.org

Make It Count: Valuable Experiences for Working Students

ADAPTED WITH PERMISSION FROM ONLINECOLLEGES.NET

Enrolled college students who also maintain part-time or full-time employment are a common part of today's academic climate. According to a recent report from the U.S. Census Bureau, more than 70% of U.S. students held down jobs during their four years of undergraduate study, and roughly one in five logged 35 hours or more per week throughout the school year.

Clearly, a routine that effectively balances school and work with family and social life is crucial for employed college students. However, it's also important for all undergraduates to gain experience in the professional field they are studying during their program, and for many employed students, their current occupation does not match their long-term professional goals.

This article provides some tips and ideas for students who wish to gain valuable skills and experience vital to their prospective career — without sacrificing that much-needed paycheck.

The life of a working student

Before pursuing professional opportunities related to their degree path, students should ensure they are able to make such a commitment. For this reason, University of Pennsylvania professor Laura Perna recommends that students curtail their weekly work schedules. "While working more than 15 hours per week may be financially necessary," she told *U.S. News & World Report*, "I suggest that students first be sure that they have taken full advantage of all available sources of financial aid, especially financial aid in the form of grants."

That being said, it's still important to note that some employment options are more beneficial to students than others. Robin Dizes, manager of career development services at Peirce College, told Fox Business that certain opportunities — such as paid internships and temporary positions in a student's chosen field — often lead to promising career leads after graduation. "If you choose employment that meets your needs, you will be more likely to continue to work there long-term, and long-term employment is attractive to employers, builds your résumé, and allows you to have stability in your career," she said.

An additional reality is that many students are required to take on jobs unrelated to their field just to finance their tuition payments, pay rent and bills, and provide for extracurricular activities. Rather than jeopardizing their primary means of support, academic experts urge students to seek out opportunities that will assist their career plans without consuming large amounts of time or energy.

Internships

Internships are highly coveted among college students, for several reasons. First, they enable students to experience firsthand the working environment they plan to enter once they have obtained a degree. Additionally, these positions allow students to network with professionals in their field, learn practical skills not taught in the classroom, and collaborate with other interns to hone their teamwork skills. And in many cases, internships can also lead to entry-level positions for students once they graduate.

However, there are also some drawbacks to internships. Time commitment is a major factor; most internships require 20 hours or more per week — and since the majority of these opportunities do not award any monetary compensation, students must forgo paid work to satisfy their demands as an intern. However, even paid interns often encounter another problem: the work they perform is vastly different from that performed by hired employees. Interns often assist with housekeeping, office logistics, and other menial tasks that may have little (if anything) to do with their prospective career. Finally, the quality of the internship is important; some companies seek interns with the genuine desire to train them and expose them to working conditions in their future field, while others simply view them as free laborers.

Students can learn about different internship opportunities by reaching out to their professors and corresponding with officials at their institutions' career centers; information is also available through nationally oriented websites like InternMatch.com and Indeed.com. However, *Forbes* contributor Frances Bridges says the key to landing a desirable internship is through thorough research of the industry as a whole. Students should look into hiring practices and business philosophies of all the major companies and organizations in their field, as well as the companies' stock market performance, popular products, and other constantly changing variables. Students who can intelligently discuss the current state of their prospective profession fare best during intern interviews.

Tutoring

Undergraduate students often opt to tutor children and adults in their local community, as well as their collegiate peers; some specialize in group classes, while others tutor clients one-on-one. Many student chapters provide opportunities for their members to tutor through their chemistry departments. Some chemistry students also pursue independent tutoring gigs (based on the demands of their individual schedule) that allow them to gain experience in their field and earn a little money on the side. The

PHOTO: THINKSTOCK

key components to being a successful tutor are identifying the educational demands within one's local community, creating a viable lesson plan, and delivering satisfactory services that generate positive word of mouth.

College career centers usually provide resources for students who wish to tutor; additionally, web users can register with online tutor referral agencies like TutorGeek and TutorMatch to locate potential clients. Community outreach is also crucial; tutors should create a website with information about their services, post advertising flyers on job boards, and print business cards. Home-based tutoring is somewhat frowned upon because of safety and liability issues. For this reason, students are urged to contact their local library or community center to inquire about reserving conference rooms on a regular basis. Digital tutoring is also a popular alternative to face-to-face sessions.

Volunteering

In lieu of paid opportunities, many students obtain skills and experience through unpaid volunteer work. Your student chapter or ACS local section often needs volunteers for outreach or other chemistry-related events. Aspiring medical students can donate their time to blood banks and other medical establishments, and student teachers spend their time assisting educators in the classroom. Volunteering is especially useful for students in any major who don't have any professional experience and are hoping to bolster their résumé — particularly opportunities that allow the student to travel abroad.

Huffington Post contributors Steven Weddle and Billy Beltz urge prospective overseas volunteers to thoroughly research all potential opportunities before signing up. "You're about to make a very serious commitment in terms of time, money, and impact on others," they note. "Questions to ask include: Is your program fee going to good use? Will you actually add meaningful value to your project? Will you be safe?" They recommend visiting reputable sites like Volunteer Forever to learn more about viable international opportunities.

For those who wish to volunteer stateside, the University of New Hampshire encourages college students to contact different organizations within their local communities; websites like www.volunteer.gov provide detailed, area-specific information about different opportunities. And while all volunteer work is inherently rewarding on a karmic level, students should prioritize opportunities that help them build the skills they need to succeed and gain insight into the industry they'll enter upon graduation.

Other ways to gain experience

In addition to internships, tutoring services, and volunteer projects, students can prepare themselves for the workforce by attending seminars, conferences, and other events associated with their future career. These gatherings often provide outlets for attendees to learn new skills, network with professionals in their field, and learn more about the current state of their industry. ACS offers special low student rates to attend regional and national meetings (www.acs.org/meetings). Massive open online courses (MOOCs) may also be useful; these free web classes typically don't award credit, but they do impart valuable skills and proficiencies to students who complete the coursework. Coursera, edX, and Udacity are some of today's leading MOOC providers.

But even with all of these options, students should seek out as much wisdom as they can from their current job, even if that job isn't related to their degree or career path. Every position carries transferable duties and responsibilities; for example, restaurant workers must excel at customer service, office assistants gain a good grasp of the inner workings of business operations and corporate culture, and employees in retail learn about sales, marketing, and financial management. And regardless of the position itself, every place of employment offers the chance for students to network with co-workers, clients, and customers.

Juggling academic responsibilities and work obligations can be frustrating, and these demands ostensibly leave little time for other pursuits. However, there are plenty of professionally oriented opportunities available to today's students that require minimal time commitment, but still manage to reward them with the skills, experience, and expertise required to excel in their field once they've earned their degree. The trick is knowing where — and how — to find them. iC

Peace through Chemistry

Chemistry Concepts Were Only One Aspect of What I Shared through the Peace Corps

BY PHILIP RODENBOUGH

The local high school in Yembering has no chemistry lab. No beakers, no flasks, no chemicals. I suppose you might not find this surprising, given that Yembering uses well water instead of indoor plumbing, gas-powered generators in place of an electrical grid, and dirt roads in lieu of paved ones.

Yembering, a typical small village in the Republic of Guinea in West Africa, is where I spent much of my term of service as a public high school chemistry teacher with the U.S. Peace Corps. I had joined the Peace Corps because I wanted to help people in need, but I would be lying if I said I wasn't also looking for adventure. My time there was filled with inspiring ups and disheartening downs — but looking back, I wouldn't trade it for anything.

Forécariah

Guinea is a beautiful country with diverse natural regions, from mountains to savannahs and forests. My first stop in Guinea was the Peace Corps training town, Forécariah, a small community in the country's hot and humid coastal region.

Like all the other incoming volunteers, I lived with a host family, who helped me acclimate to the culture. My particular family consisted of a man, his two wives, and two children (one by each of the wives). We ate rice with peanut sauce, potatoes, and the occasional chicken. The quality and preparation style of the food took some getting used to: I had to watch out for pebbles in the rice. Water came from a well, and although there was wired electricity, the town turned it on only sporadically.

During the day, I attended intensive training classes with my fellow new volunteers, run by Peace Corps staff and experienced volunteers. Although I had tutored freshman chemistry as a junior and senior in college, this experience was proving to be relevant and helpful.

As I would be teaching in French, the national language of Guinea, I also took some French language lessons. I had previously studied French, but this was not true of all incoming volunteers. Complete immersion allowed us all to learn to communicate effectively. In addition to language skills, I was instructed in how to teach and how to run a chemistry classroom in Guinea. We all learned about cross-cultural communication, and generally how to live and be happy in our new environment. Toward the end of the 12-week training session, we conducted a summer school for the community of Forécariah, where we eagerly practiced our new teaching skills.

Koupéla

In a normal Peace Corps experience, after training I would have settled down in another nearby town, where I would conduct my two years of service. Instead, Guinea experienced unexpected political turmoil and violence, so shortly after a program-wide evacuation, I ended up continuing my service in Burkina Faso, a landlocked country 200 miles east of Guinea, located just south of the Sahara Desert. Incoming volunteers generally should not anticipate such abrupt changes, but the Peace Corps does value flexibility in its volunteers. Burkina Faso is not far from Guinea, and also has important cultural similarities (including its national language of French). I started my real service in a medium-sized town called Koupéla, and it was always very hot there.

I lived in a small, three-room house made out of concrete. I shared a courtyard with another identical house, in which lived an elementary school teacher and his family. Out in the courtyard was a hole-in-the-ground bathroom and a shower area, each partially enclosed but open to a sky that virtually never rained. Most

PHOTOS COURTESY OF PHILIP RODENBOUGH

LEFT: **The author teaching chemistry in Koupéla.**
CENTER: **Students hard at work on their morning chemistry studies.**
RIGHT: **Students participating in the afternoon computer lab.**

importantly, there was our shared water spigot, a true luxury.

I was very fortunate to have sympathetic neighbors. They came to my rescue many times, including one night when bats snuck into my house. My full-size electric fan was my most valuable possession in Koupéla: I could hardly sleep without it (although many of my fellow volunteers managed without such extravagances). The electricity would occasionally cut out at night, and I would immediately wake up drenched in sweat.

Koupéla is located at a regional transport intersection, so every morning after my oatmeal breakfast, I'd hop on my bike and ride down the busy interstate road to the school where I taught.

In many ways, teaching in Africa is similar to teaching in the United States. You get up in front of a class, talk about chemistry, draw on the chalkboard, try to encourage some student activities, assign homework, conduct tests, and try out labs. I taught two sections of what would be roughly the equivalent of 8th grade physical sciences in the United States. The school was fortunate to have a small science lab with some glassware and even a few essential chemicals.

Previous Peace Corps volunteers had put together a booklet on local methods for science experiments, which served as a useful guide. We did distillations, talked about the planets, and played with batteries and light bulbs. My classes in Koupéla had about 80 students each. All the students rode their bikes to school (like I did), but all the other teachers rode their motorcycles to school. Don't expect to operate motor vehicles as a volunteer, however: the Peace Corps strictly forbids it.

I taught my science classes in the morning and ran the school computer lab in the afternoon. The computer lab was the only room in the school with air conditioning. The computers were ancient: they had been donated a few years back by a non-governmental organization, or NGO. Despite the organization's efforts to train teachers to maintain the lab, the computers had quickly fallen into disrepair and disuse.

I fixed up the computers as best I could. I started holding regular hours and training student leaders to manage the lab by themselves. At first I didn't give much thought to my fellow teachers' lack of interest in the lab. It wasn't until after several months that I learned that one of the lead teachers ran the private for-pay cyber-café (computer lab) down the street from the school, creating a serious conflict of interest. I suppose this fact

was overlooked by the NGO that donated the computers. This is one of the advantages of the Peace Corps model of service: complete and sustained immersion into a community leads to a depth of understanding that is unmatched by development organizations seeking to simply swoop in and drop off aid.

When summer came, I helped train incoming Burkina Faso volunteers and worked at a U.S. embassy program teaching English to students in the capital. At the end of summer, the Peace Corps program in Guinea decided to open up again. I opted to return to Guinea to finish out my second year and help reestablish the program (again, a very unusual circumstance).

Yembering

I served my second year in a tiny village called Yembering, high up in the mountains of Guinea. I was happy to have some relief from the heat of Koupéla, but Yembering was two hours from the nearest paved road, had zero wired electricity, and water came from the village hand pumps or wells. The bush-rats there were both enormous and terrifying, especially when they took up residence in my outdoor latrine.

I lived on the school grounds in Yembering, in a building just a few yards behind the classrooms. My school encompassed both middle and high school grades, and I taught chemistry at both levels. There were far fewer supplies in Yembering, so my classes and I got creative. We electrolyzed water with little more than some D batteries, plastic water bottles, copper wire, and the graphite from a couple of pencils.

The evenings in Yembering were peaceful and beautiful. I spent them chatting with the improbable friends I had started to make in Yembering. We sipped tea and simply relaxed under the vast and luminous starlit sky.

In Yembering especially, there were times that I felt discouraged. What good was talking about organic chemistry in an impoverished community that faces so many other more important challenges? I had students coming into class who were clearly malnourished. The dropout rate was atrocious: from 120 students in the lowest grade to only 20 in the highest. Our school didn't even have enough enrollment to have a senior class: students who wanted to complete their high school education had to go to the distant regional capital. Despite my best efforts, academic discourse often felt hollow. I had to convince myself that I was really teaching critical thinking, and that these skills would transfer to other aspects of my students' lives. I'm still not completely sold.

In fact, the chemistry that I taught was not the primary way I helped the students in my classes. Instead, the main benefit of my time in the Peace Corps was the cultural exchange, and in that sense I benefited at least as much as (if not more than) the communities that I served. I got to experience a completely different way of life, and in turn, a handful of Africans got better acquainted with American culture through me. This cultural exchange is in fact spelled out in the official goal of the Peace Corps, which is only one-third technical assistance. The other two-thirds are Americans learning about the world, and the world learning about Americans. Of course I had known about these goals for a long time, but I find they have even more meaning in hindsight. My favorite memories in the Peace Corps have little to do with the organization itself, my job, or the various exotic events I witnessed; rather, they center on a handful of incidental evening conversations where I embraced local friendliness and appreciated our shared humanity.

Part of the reason I wanted to return is so that I could experience those hot and lazy starry nights again, sipping tea, talking with unlikely friends about everything and nothing.

New York

Coming back to the United States was challenging. I dived straight into graduate school, in the middle of New York City, no less. For the first few months I struggled to adjust and return to the American pace of life. I've since found a good balance, but "reverse culture shock" is real and should not be underestimated.

In many respects, I had exactly the adventure that I was seeking. I saw monkeys and elephants. I lived without modern luxuries. I rode my bike through endless miles of dirt road to obscure and hidden places.

But Africa is still calling me! So, I've sought out new volunteer opportunities that I can pursue while in grad school. I'm part of the UN Online Volunteering program, and I'm an eIntern for USAID through the U.S. Department of State Virtual Student Foreign Service program. Essentially I'm building a career trajectory that will send me back to Africa. Mostly this is because I want to participate in much-needed development work there.

But once again, I would be lying if I didn't say that part of the reason I wanted to return is so that I could experience those hot and lazy starry nights again, sipping tea, talking with unlikely friends about everything and nothing.

Learn more about the Peace Corps at www.peacecorps.gov/, and learn more about Philip's experience in particular at http://philgoestoguinea.blogspot.com/.

Philip Rodenbough *is pursuing his Ph.D. in chemistry at Columbia University, and hopes to work in science advising for international development. Follow him on Twitter: @prodenbough.*

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Analyzing Your Career Chemistry

BY NANCY MCGUIRE

In the daily deluge of class assignments, lab projects, and campus life in general, it's easy to lose track of where you're going in the long run. Perhaps you've realized that what first drew you to chemistry doesn't motivate you anymore. Or it could be that the job market isn't looking for what you have to offer, or that you're considering postponing graduation another year or two to take some courses to build up your weak areas. Or perhaps your interests are all over the place, and organizing them into something that resembles a job description seems impossible.

This is a tough job market. Job ads list such specific requirements, and you may wonder how any one person could have all those skills. You could send out hundreds of applications and grab the first job offer that comes along, but will that get you where you want to go?

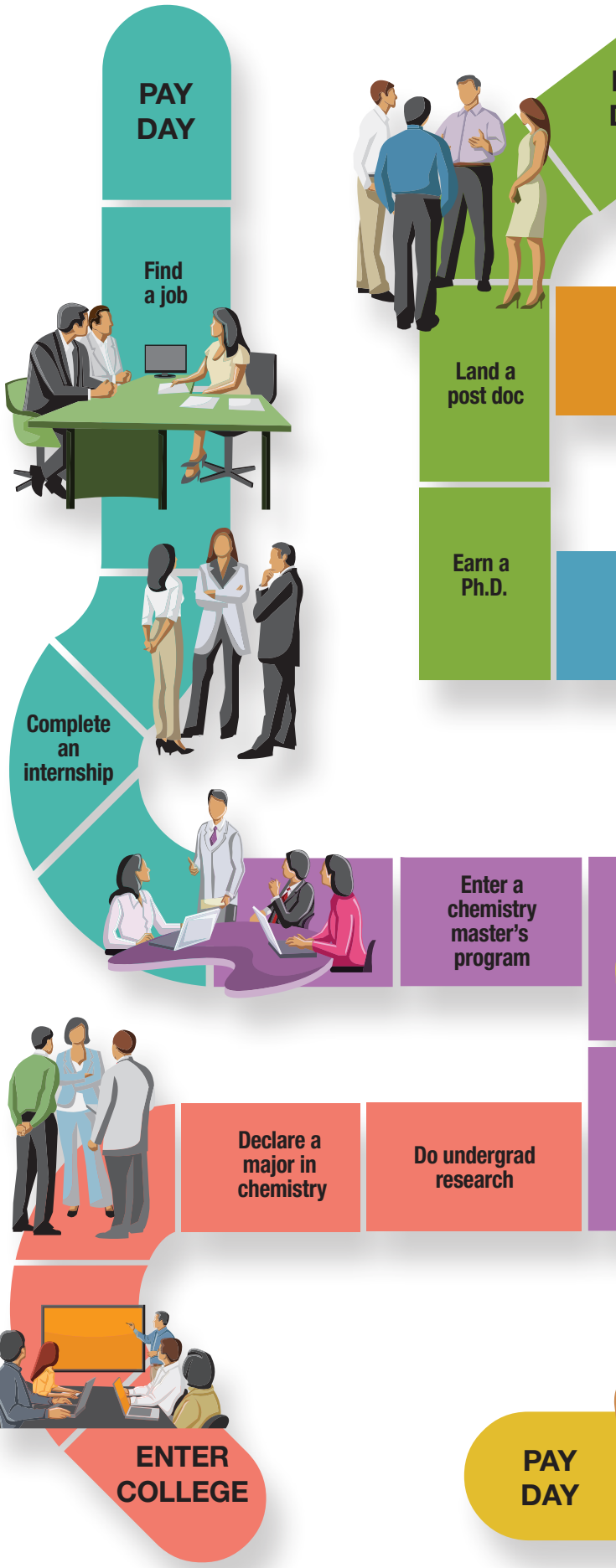
Draw your own map

Taking stock of what you're good at and what you love to do lets you look beyond the job titles and "knowledge, skills, and abilities" lists for opportunities that let you be *you* at your best. This approach helps you stand out from the crowd, and it provides you with a creative outlook and resiliency in a challenging job market.

Developing this mindset can require a mental shift. School life rewards students for being their best in every subject. Straight-A students get recognition, scholarship money, and their choice of top universities. Weak areas must be strengthened, deficiencies addressed. How can you balance a chemical equation if you can't do simple arithmetic? However, the more advanced you get, the harder it is to be excellent at everything. Just trying to manage all of your academic commitments can leave you feeling paralyzed and overwhelmed.

Fortunately, a little specialization is good for you, and it's good for business, too. In their book *Now, Discover Your Strengths*, Marcus Buckingham and Donald O. Clifton report that the most successful managers enable their employees to do what they are best at every day. They don't focus exclusively on correcting their employees' weak areas, and they don't assume that anyone can be good at anything if they simply get enough training. Highly successful people like Bill Gates and Warren Buffett focus on the things that require their strongest skills and interests. They find colleagues who have skills that complement theirs, rather than trying to be good at everything.

How can you find what you're really good at and what you enjoy doing, and then shape that into a career plan? Richard



Take advantage of ACS career resources

ACS CAREER PATHWAYS WORKSHOPS

ACS Career Pathways workshops represent another effective way to discover the career path that best matches your talents, goals, and personality. The program begins with an introductory half-day workshop where you'll learn about the career pathway options available to chemical professionals. Next, you can choose among four workshops that focus on academic, government, industry, and entrepreneurial career pathways to continue exploring and developing your personal career pathway plan. The third phase of the program focuses on interviewing, giving you the skills you need to ace your next interview and begin a new career.

ACS WEBINARS

If you find yourself considering employment outside the lab or classroom, you can learn about alternative careers in chemistry via ACS webinars (http://acswebinars.org/career-ondemand) or live seminars (http://www.acs.org/content/acs/en/meetings.html). In these presentations, chemistry graduates working as lawyers, public policy experts, art conservators, border security agents, and writers talk about what it's like to work in their fields. iC

Nelson Bolles' book *What Color is Your Parachute?* takes you through a series of exercises designed to identify the skills you most enjoy using, and places where you can put those skills to use.

Even if you're certain that you want to spend the rest of your career designing photoluminescent quantum dots, it's worth considering other options. It's a real rarity to find someone who has spent an entire career doing only one thing. Identifying your best skills on the most basic level can open up career options you might not have thought of otherwise. Having a road map can also help you home in on areas where you can strengthen a few specific skills.

What's your style?

The type of organization you work for and your role in that organization should fit well with your preferred work style. If you're comfortable doing many different tasks simultaneously, you might want to work for a small company, a small group within a larger company, or even run a solo operation. If you prefer to focus on just a few specific areas of inquiry, working in a larger team will let you specialize in your strengths.

If you're really outgoing, you might try to find a role that lets you interact with colleagues, co-workers, and customers. Or, if you're the solitary type, you could find satisfaction doing field studies in remote locations or analyzing large databases in front

of a computer screen. Risk-takers often enjoy the adventure of working for a start-up company, while those who need a more secure income gravitate toward more established businesses.

If you enjoy tending to the details and making sure that everything is done according to protocol, you could work in a medical diagnostics laboratory or process evidence for use in legal cases (think CSI labs and environmental cleanup operations). Product development chemists enjoy refining and optimizing processes or prototypes. If you chafe at routine and repetition and you like working on open-ended questions, then basic research might be your field.

Every team needs people whose styles complement each other: idea generators, practical planners, visionaries, detail people, programmers, theorists, people persons, and marketing wizards, to name a few.

Do your research

How will you find a role that fits you well? Ask questions of yourself and others, observe, and listen.

A few years ago, two friends and I were dissatisfied with our careers, and we formed an informal support group. I promised my friends that I would spend two hours alone every Saturday morning at a nearby coffee shop (so I couldn't procrastinate by doing housework or watching television). I would spend this time reading relevant books and writing in my journal.

I spent this time away from friends and family — anyone who was eager to load me up with free advice on "what you need to do." I turned off my cell phone and any Internet connections, to thwart my urge to check my messages or look at funny cat pictures. I used this time to create an inventory of the things that made me happy and were fun to do, and what I wanted more of in my working life (as well as types of functions and responsibilities I wanted to minimize).

Start exploring

Looking inward shows you what's inside your own mind. Reaching out helps you move past the limits of your own knowledge and imagination, and puts you in contact with people you'll be interacting with throughout your career. The best way to find things out and make yourself visible to potential employers is to contact people in your field and ask questions.

This can seem very daunting. Whom should you contact? Why would they want to talk to you? When you get right down to it, this is part of your undergraduate research, and it's your job to be asking these questions. Building your network can be an enjoyable way to expand your horizons. Meeting and maintaining contacts online and in the "real world" can make you the go-to person when potential employers come looking for promising prospects. This is something you can start during your freshman year — but it's never too late to begin.

Start small — pick a few faculty members, grad students, or postdocs from your department who are working on things you're interested in and with whom you feel comfortable. Do your homework — what problems are they trying to solve? Have they published a paper recently? Have they just returned from an interesting conference? Write down a few specific questions in advance. Tell the person that you are doing some career planning, and ask if he or she would be willing to meet with you one-on-one for about a half hour to talk about their work. Not everyone is receptive to this kind of meeting, but those who understand the concept of networking will be happy to share their ideas with you.

This is very different from an interview with a recruiter or a hiring manager. You're doing this to learn what's going on in your field, sharpen your sense of direction, and learn what things you need in order to get where you're going. Even if you don't directly land a job this way, you will be better informed when you do go on a job interview.

Close your discussion with two questions: "Is there anything that I haven't asked about that you think I should know?" and "Who else should I be talking to about this?"

Send the person a note of thanks afterward (tell them in person if you see them regularly), and mention two or three specific things that you learned from them. Taking notes during your meeting will help you remember these things, but don't get so involved in your note-taking that you drop out of the conversation.

Stay in contact with the people with whom you really hit it off. Send them an interesting article now and then, or tell them if you've gone to their seminars or seen them mentioned in the press. If you see these people often, ask them how their work is going.

Expand your network

Attend ACS local section and regional meetings. Find people who are presenting research in your field. Contact them in advance to request and schedule half-hour meetings during the conference.

Establish e-mail contact with researchers who publish on topics that interest you. Follow them on Facebook or Twitter and respond to their posts when you have something relevant to say. Set up a LinkedIn profile and join several discussion groups: the online version of dressing up in your "business attire" and mingling with professional colleagues at an international conference. Reach out to people all the way up the hierarchy in your field, and you might be surprised who responds. If you ask well-thought-out questions and make intelligent comments, you'll establish yourself as someone worth paying attention to.

Your first job after graduation might be exactly what you envisioned. More likely, it will be a first step in a long journey. Your road map will help you know when you're moving in the right direction. 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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COLLEGE to CAREER

Become a High School Chemistry Teacher

Introduce Chemistry Concepts and Inspire Future Careers

BY ACS STAFF

Teaching allows you to share your passion for chemistry with others. Many educators say the most satisfying aspect of their work is helping to shape the lives and minds of students. Successful high school chemistry teachers are well-organized and disciplined enough to apply structure to a flexible but demanding teaching schedule.

On an average day, high school chemistry teachers facilitate student learning and understanding of chemistry through guided inquiry, direct instruction, investigations, problem solving, and discussion. Teachers are also responsible for class preparation, classroom management, as well as developing and grading assessments, and meeting with students and parents outside class. High school educators may teach between four and six classes comprising 20 to 30 students each. They may also lead field trips, organize after-school activities, and provide tutoring outside of class.

High school chemistry teachers often develop curriculum objectives for their classrooms using state and national science teaching standards, guidelines from national science organizations, and local input. Objectives are used as a planning guide for daily lessons that might include guided lectures, modeling laboratory investigations, projects, and group inquiry.

Quick Facts

- **OPPORTUNITIES —** Despite budget limitations, science and math subjects remain in demand in many high schools. In some areas of the United States, increases in student enrollment and projected retirements should contribute to a favorable job market for teachers.
- **EDUCATION NEEDED —** Typically a bachelor's degree in chemistry, a teaching certificate (requirements vary by state), and proficiency in other sciences and math are required. Additional courses in education may also be required. Specific requirements vary by state and type of school.
- **SALARIES —** Median annual wage: $55,050 (2012).
- **WORK SPACE —** High school teachers work in public, private, and parochial high schools, with several hundred to several thousand students from 9th to 12th grade. Schools are located within city limits, in the suburbs, and in more rural areas.

Is this career a good fit for you?

High school chemistry teachers agree that it is important to feel enthusiastic about the subject and to have a sincere interest in student development. They must have mastery of chemistry content and a variety of strategies for facilitating student engagement and deep understanding of that information. They are able to support students in making connections between classroom learning and the world around them. High school teachers must be willing to create an environment that enables all students to have an opportunity to learn chemistry. They should demonstrate patience, flexibility, fairness, and humor. Teachers must also enjoy working with teenagers and the special challenges that come with that age group.

Excellent chemistry teachers are themselves lifelong learners and are willing to collaborate and share their expertise with other education and science professionals.

Future employment trends

Despite budget limitations, science (particularly chemistry and physics) and math remain in demand in a considerable number of high schools. Increases in student enrollments and projected retirements should contribute to a favorable job market for teachers.

The job market for chemistry teachers is competitive. In some parts of the country, there is a severe shortage of qualified science teachers. In some instances, high school teachers may be asked to teach related courses (e.g. physics, mathematics) depending on the size of the school and course needs. iC

Lisa M. Balbes *of Balbes Consultants LLC also contributed to this article.*

Chemists in the Real World: Jennice Ozment

HIGH SCHOOL CHEMISTRY TEACHER
WALTON HIGH SCHOOL, COBB COUNTY, GA

Jennice Ozment has been teaching high school chemistry at Walton High School in Cobb County, Georgia, for six years. She spent 20 years working in the paper and oil and gas industries before transitioning into teaching. Two semesters' worth of tertiary oil recovery research as an undergrad helped to launch her career, which steadily progressed into positions of increasing responsibility with international research projects and achievements during this tenure. However, the company she was working for in 2004 was shut down, and Ozment decided to stay at home, immersing herself in volunteer activities at her sons' high school.

At about the same time, she was diagnosed with a neurological condition affecting her motor abilities that made a return to industry difficult. Fortunately, her involvement at the local high school led to substitute teaching, which turned into a full-time teaching position. Ozment says her own high school teacher, Mrs. Johannessen (Mrs. Jo), ignited her interest in chemistry. She now seeks to do the same for the next generation. She says, "I like to see a student's eyes light up when they 'get it'."

She received the Hach-ACS scholarship for chemists who want to change careers and become teachers, and she credits the ACS for allowing her to explore this opportunity. She earned a Master's of Arts in Teaching in chemistry, and has served as the lead on-level chemistry teacher at Walton High School. She also serves as the chief chemical safety officer at the school, where she is in charge of making sure safety equipment is in proper working order, chemicals are inventoried and stored correctly, and that the faculty is properly trained.

PHOTO COURTESY OF JENNICE OZMENT

THIS IS HOW SHE WORKS:

How did you decide to become a chemist?

My high school chemistry teacher, Mrs. Jo, ignited my interest in chemistry. She was very positive, patient, and an incredible teacher. I took two years of chemistry from her and was her lab assistant my senior year. Not only did she teach me chemistry, she showed me how a great teacher cares about her students, doesn't give up on them, and continually gives them positive feedback. She attended my wedding, held our firstborn son in her arms, and has been my friend for these last 34 years. Mrs. Jo has always been and will always be an inspiration to me.

Please describe your typical day on the job.

I arrive at school around 7:45 and have cafeteria duty from 8:05 to 8:15. School starts at 8:20. I teach 2 classes in a row from 8:20 to 10:30 and then have 55 minutes for planning. I teach another class from 11:35 until 12:30, and then I get 55 minutes for lunch. I teach 2 more classes from 1:35 to 3:30. I am usually at school until 6:00 pm setting up experiments and/or demos, cleaning up experiments and/or demos, making copies, tutoring, planning, grading, or doing paperwork.

What apps/ software/ instrumentation/ tools can't you live without?

Microsoft Office, SigmaPlot, and Edmodo.

How many hours do you work in a typical week?

I put in around 80 hours a week. I'm usually at school 10–11 hours a day, and then I go home and grade papers or work on lesson plans for about 3–4 hours each night and 10–15 hours on the weekends. The environment is insanely busy!

continued on page 22

continued from page 21

What is your work environment like?

I have a classroom that holds 28 student desks, my desk and demo table, 7 lab benches, a safety shower and eye wash station, a fume hood, a handicap lab station, and some cabinet storage on the walls. It is my classroom—I do not have to share it. We average 1.5 labs per week.

I also have 2 desktop computers, 2 bookcases loaded with reference materials, all kinds of plastic storage bins filled with items to do demos or labs, 30 hanging lab aprons for my students, and my goggle cabinet. Inside are 30 psychedelic colored goggles, and the outside, well, you just have to look at the picture!

Lastly, in the front of the room by my whiteboard and smartboard are my "gadgets": lava lamp, glitter lamp, plasma ball, fiber optic light, wave machine, and 2 phosphorescent lamps, all lined up on a table.

And how could I forget? My "Ashes of Problem Students" jar—with ashes!

What is your best productivity trick?

Work the week between Christmas and New Year's; no one else does, and you will get tons of things done. Getting in early or staying late gives you time to get things done before the work day and interruptions begin or after the work day and interruptions end.

PHOTOS COURTESY OF JENNICE OZMENT

What's the best career advice you've received?

Your greatest strength can also be your greatest weakness. For example, my greatest strength is the fact that I am extremely organized, which means I usually don't miss anything when I'm doing a project. But being organized is also my greatest weakness. I tend to focus so much on staying organized and making sure all the t's are crossed and the i's are dotted that I miss the big picture. I lose my ability to "think outside the box" and to perhaps make a significant contribution.

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

I want to help people succeed.

What essential habit do you have now that you wish you'd started much earlier?

Not sleeping in so long on the weekends. You can really get a lot done with a few extra hours in the morning.

What is your favorite ACS resource?

Journal of Chemical Education. It's a great source for new demos and inquiry ideas. Love it! iC

Interviewed by **Allison Proffitt**, *a freelance writer and editor based in Nashville, TN.*

SPOTLIGHT

Duquesne University

Pittsburgh, PA

COMPILED BY ROBIN LINDSEY

Chapter presidents: Sarah Kochanek and Sarah Richards **Chapter members:** 89 **ACS student members:** 87
Website: www.duq.edu/acs **Institution description:** Small, private, urban, 4-year

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

A: We train younger members as executive board apprentices. The semester prior to their official nomination, they sit in on executive board meetings and help make decisions for the chapter. This allows the apprentices to learn from the executive board and become more involved in activities.

Q: **How did you celebrate National Chemistry Week (NCW)?**

A: For NCW, our chapter volunteers at the Carnegie Science Center in Pittsburgh and demonstrates various experiments to elementary through high school students, such as hydrogen rockets, ferrofluids, and properties of micelles. To spread awareness of NCW on campus, we sell hot dogs, drinks, and cupcakes decorated as the periodic table to other students as a fundraiser and play "Human Whack-A-Mole" where both students and professors act as the "moles" in a real-life game. This year, we raised approximately $300 through this event.

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

A: Outreach is one of our chapter's highest priorities; we realize that it is just as important to give back to the community and teach younger kids about science as it is to earn a worthwhile education for ourselves. In addition to volunteering at the Carnegie Science Center, we visit a local elementary school to teach a science lesson to 3rd grade students, and we sponsor a local ACS High School ChemClub.

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

A: Pi Day is one of our chapter's favorite events. In addition to selling a complete periodic table of cupcakes, we hold a Pie Your Professor contest. Professors from the department of chemistry and biochemistry volunteer to be pied, and then students vote on which professors will be pied. The three professors with the most votes get pied by a student on Academic Walk at exactly 3:14 p.m.

Q: **What local ACS student chapters have you collaborated with?**

A: Thanks to a Student Inter-Chapter Relations Grant from the ACS, Duquesne sponsored PuRSUE (Pittsburgh Regional Seminar for Undergraduate Excellence). This seminar series was held monthly and featured undergraduate students from local universities who presented their scientific research to peers, graduate students, and faculty. Not only did this event give undergrads the opportunity to practice presenting their research, but PuRSUE also acted as a foundation for furthering collaboration among local universities.

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

A: At the beginning of each new school year, we sell modeling kits, lab coats, goggles, and lab notebooks to incoming freshmen. Not only is this a valuable fundraiser for our chapter, but the items are sold at a reduced price compared with the campus bookstore to assist students. This fundraiser helps us to sponsor other outreach events and chapter activities throughout the year. This year's sales raised approximately $1000. iC

PHOTO COURTESY OF DUQUESNE UNIVERSITY

Recent Duquesne University community outreach events include performing chemical demonstrations at the Carnegie Science Center in Pittsburgh, teaching a science lesson to 3rd grade students, and sponsoring an ACS High School ChemClub.

Faculty advisor:
Jeffrey D. Evanseck, 6 years

Faculty co-advisors:
Ellen S. Gawalt, 1 year
Paul G. Johnson, 25 years

Q: **What challenges have you faced as faculty advisors?**

Evanseck: There is definitely a learning curve on how to harness the creativity and energy of the students. It takes significant effort to build an effective core of motivated and directed students; however, once it is formed, then the process is easy.

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

Evanseck: Beyond any doubt, the success of the students is the most rewarding aspect of being ACS faculty advisors.

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

Evanseck: If your institution values undergraduate education and professional preparation, then definitely get involved and make the effort to create an active ACS chapter. It will initially take effort, but is well worth it in the long run. iC

SPOTLIGHT
Aquinas College
Grand Rapids, MI

COMPILED BY ROBIN LINDSEY

Chapter president: Marissa Saladin **Chapter members:** 12 **ACS student members:** 8
Website: www.aquinas.edu/chemistry/chemistry_society.html **Institution description:** Small, private, urban, 4-year

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

A: We hold our officer elections for next year very early. Nominations are in February and the actual election occurs in March. From this time on, we begin transferring responsibilities to the new officers. We are currently compiling a notebook that maps out the year's responsibilities and a Google Drive folder with agendas and activities to pass on to the new executive board.

Q: **Do you have any unique positions?**

A: Each officer plans and organizes at least one major event for the year. By choosing an activity of interest, each officer can better support the chapter by using their talents and passions. We also have a publicist who advertises our activities and successes across campus.

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

A: Our chapter celebrates the feast of our science building's namesake, Albertus Magnus, by hosting nearly 100 4th graders to experience a day of fun science experiments and activities. This year, we invited four other clubs to join us, so we had a range of stations from frog dissection to the classic exploding gummy bears.

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

A: We hold the biannual Aquinas Chemistry Society and Math Club vs. Beta Beta Beta and Alpha Epsilon Delta kickball game and cookout at the beginning and end of each academic year. Needless to say, a little bit of competition over a golden rubber duck trophy doesn't hurt either!

Q: **What is the most effective communication tool that your chapter uses to promote chapter activities?**

A: We use a variety of tools to reach out to our chemistry students. We post flyers and we have our Facebook group to send out messages online. Our college uses CourseConnect for teachers to give out information and assignments online. We've created a class page for our chapter and contact all new general chemistry students each year to encourage them to get involved.

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

A: We hosted a Science Lock-In, an all-night study party in our science building. In addition to having a place open for the annual exam cram, we had several professors volunteer their time to host exam review sessions. We also had a variety of activities and games for study breaks and breakfast in the morning for those that survived the entire night.

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

A: We attend the national meeting every year and attend local section meetings when they are within a reasonable distance. Our chapter members are able to do a lot of networking and attend graduate school events at the national meeting. At the local section meetings, we are able to see what careers are available in chemistry in our area and we are able to network and learn about possible future employment or internship opportunities. iC

PHOTO COURTESY OF AQUINAS COLLEGE

Each year, the Aquinas College chapter celebrates the feast of Albertus Magnus, their science building's namesake, by inviting 4th graders to their college to enjoy a day of fun science experiments and activities.

Faculty advisor:
Elizabeth Jensen, 9 years

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

Jensen: I have always been interested. When I was hired at Aquinas, I started attending the student chapter meetings. After a few years, my colleague who had been the advisor asked me to take on the role so he could do other things.

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

Jensen: Think ahead, because the students do not always have the perspective necessary to plan out an entire academic year and they will need help. A few years ago, I wrote up a list of expectations for the officers. I meet with the incoming officers near the end of each academic year and discuss this list with them. We set goals, assign committees, and plan the work that needs to happen over the summer break. I think this helps everyone get organized and be ready for fall semester to start in August. iC

SPOTLIGHT

University of Maryland, Baltimore County Catonsville, MD

COMPILED BY ROBIN LINDSEY

Chapter president: Monica Pruitt **Chapter members:** 305 **ACS student members:** 99
Institution description: Small, public, suburban, minority-serving, 4-year

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

A: We hold an end-of-the-year officer election in late May. Only ACS student members who have demonstrated outstanding dedication and commitment to the chapter can be nominated for officer positions. ACS members then vote for their officers. After elections, we hold officer training sessions focusing on duties and expectations for the upcoming year.

Q: **Do you have any unique positions?**

A: We have a public relations liaison who is in charge of publicizing the activities of the chapter via social media, campus-wide electronic bulletin postings, and creating flyers/posters for events.

Q: **How did you celebrate National Chemistry Week? Chemists Celebrate Earth Day?**

A: Chapter members spread chemical joy to the rest of the campus through a bake sale and science night. We also sold beaker mugs and a chemistry-themed T-shirt, which were both a huge hit. We also chalk the sidewalk along Academic Row for the UMBC community to admire. At our science night we do hands-on chemistry activities with grade school students, which gives our members a chance to explain basic chemistry to the kids.

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

A: We sponsor science nights at local elementary and middle schools and participate in stream cleanups at Patapsco Valley State Park. Our chapter also raises funds for Pennies for PUR, an ACS initiative, and Children's Safe Drinking Water program, and we participate in the Relay for Life event sponsored by the American Cancer Society each spring.

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

A: We participate in the UMBC Involvement Fests three times a year, during the summer, fall, and spring semesters. New students can get information about our club and we have a poster highlighting the activities we have.

Q: **What are some of the interesting ways your chapter recruits and retains its members?**

A: After the Involvement Fests we have a chapter get-together to introduce new members to returning members. Our favorite and most successful event is our Fall Saccharide Social. We make s'mores over a fire, play games, and have a good time as new members meet existing members and faculty.

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

A: We collaborate with the Environmental Awareness Club to put together an event for Earth Day. We have worked with the Maryland Local Section to conduct science nights. We also attend some of the local section monthly meetings so that members can experience the professional talks as well as the networking opportunity.

PHOTO COURTESY OF UMBC

UMBC sponsors science nights at local elementary and middle schools and community service activities, including stream cleanups, raising funds for ACS's Pennies for PUR, and participating in the American Cancer Society's Relay for Life.

Faculty advisor:
Tara Carpenter, 6 years

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

Carpenter: I became the faculty advisor when we reinstated our chapter. I was excited to help our students share their passion for chemistry with the campus and the community. I was active in my club as an undergraduate and participated in outreach as a graduate student. Advising the club was a natural extension of my experience and interest.

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

Carpenter: Make your expectations known from the start, but be there for them when they need guidance. Resist the temptation to do things for the students, and instead help them develop their time management and leadership skills. It is rewarding for everyone.

Faculty co-advisor:
Stephen Mang, 2 years

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

Mang: I had previous experience with science demonstrations in elementary, middle, and high schools from my grad school career. I wanted to help the chapter expand their science nights and other outreach activities.

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

Mang: Working with students who are actually interested in chemistry, and helping give them the opportunity to share that interest with young kids. Many of the elementary school children in our area do not have too many positive scientist role models, so helping to expose them to college students who are interested in chemistry is very rewarding.

Fun, Fire, and Food!

How We Help Local Boy Scouts Earn Their Chemistry Merit Badges

BY MARIE MELZER AND KALEIGH WILEY

One day each fall and spring, the chemistry building at Old Dominion University (ODU) is taken over by 60 members of the Boy Scouts of America (BSA) from the Virginia Tidewater area and their Scoutmasters. The boys spend the day fulfilling the requirements of the BSA Chemistry merit badge, while encountering a few extra surprises that entertain, educate, and excite everyone involved about chemistry.

ALL PHOTOS COURTESY OF OLD DOMINION UNIVERSITY

Non-Newtonian fluid (cornstarch + water). ACS student member: Deanna Pollard.

Challenges of the Chemistry merit badge

Merit badges have been an integral part of Scouting since the start of the program in the United Kingdom in 1907. The Chemistry merit badge was created in 1911 when Scouting began in the United States, and was one of the original 57 merit badges issued by the BSA. There are only 11 original merit badges still active, and at the end of 2012, the Chemistry merit badge ranked around 72nd of 130 offered merit badges.

To a chemist, the Chemistry merit badge requirements (listed on the BSA website as a set of activities and research requirements) are simple to accomplish. The Scouts are required to conduct a few experiments, record their observations, and — oh yeah — have a full understanding of chemical safety, MSDS sheets, the classical divisions of chemistry, and how government agencies depend on chemists. They must also visit a laboratory and interview a practicing chemist. For Scouts (and Scout leaders) without a background in the sciences, these requirements are often daunting, confusing, and hard to understand.

In 2010, a local Scoutmaster contacted the ACS student chapter at ODU seeking a partnership to help the Scouts complete this merit badge. Since then, our chapter has hosted seven Chemistry merit badge events at ODU, with roughly 350 Scouts earning the merit badge, and "Scouts' Day" has become one of our favorite ways of reaching out to the community. In fact, our biannual event is posted on www.meritbadge.info, a website created by Scout leaders to list merit badge events across the United States and even several other countries, providing opportunities for Scouts to earn their merit badges while experiencing a variety of settings, such as our university laboratories.

In adapting the merit badge requirements into a full morning of activities, we felt the list needed some embellishing. And how do chemists embellish? To name a few, we added fire, color changes, glow-in-the-dark solutions, and liquid nitrogen ice cream! We then transformed the requirements of the BSA Chemistry merit badge into a four-lab rotation.

What our day looks like

In order to corral and ensure the safety of 60 excited Boy Scouts, we run a very tight schedule. Each Scout is assigned to a team at check-in — Oxidizers, Flammable, Water Reactive, and Poisonous — and the entire troop is sent to an auditorium for introductions,

orientation, and a safety lecture. After the safety lecture, each group rotates through four labs: fun, fire, kitchen, and environmental. After everyone enjoys lunch and dessert on us, the boys interview a few chemists and — *voila!* — they have earned their merit badge.

Safety talk

We tell the Scouts that the safety talk is the most boring, but most important, part of the day. An undergraduate ACS student gives a short talk explaining safety equipment, MSDS sheets, the proper storage, disposal, and handling of chemicals, government agencies, and the classical divisions of chemistry. This half-hour briefing fulfils many of the badge's requirements and prepares the Scouts for the lab environment.

Periodic table of cupcakes.

Kitchen lab

The kitchen lab includes many more required elements of the merit badge — chemistry of starches and sugars in onions (taste-test of raw, browned, and caramelized onions), separation of mixtures, the importance of concentration (why you don't brush your teeth with household bleach), and chemical versus physical change. One favorite additional demonstration includes a discussion of stomach pH using hydrochloric acid (HCl) and milk of magnesia ($Mg(OH)_2$, magnesium hydroxide): we add a few drops of the universal indicator to a solution of HCl, which turns dark red, showing that the stomach is very acidic. Milk of magnesia is then added and, as the solution turns basic, it goes through the entire color range of the universal indicator. This experiment is a dramatic demonstration of the pH range of "stomach neutralization." Another fun addition to the kitchen lab is "rubber eggs." We soak eggs in vinegar (acetic acid) overnight, allowing the egg shells, which are made of calcium carbonate, to react with acetic acid to break down and dissolve the shell. This chemical change results in a rubbery egg that can bounce!

Onion chemistry (starches to sugars) — raw onion, browned onion, and caramelized onion.

Environmental lab

The environmental lab consists primarily of a lecture about environmental chemistry, types of chemical pollution, and the role of government agencies. The Scouts see the effects of acid rain firsthand through a demonstration of the interaction of HCl with concrete. Without a proper background in chemistry, the Scouts can fulfill the requirements covered in this lab by using Internet and book sources, but are unlikely to understand all they are reading.

A Scout Leader's Perspective

In 2003 my son (stepson) Blake moved up from Webelos to Boy Scouts. I subsequently became a Scout leader and merit badge counselor. I noticed how difficult it was for Scouts to complete some merit badges (such as Chemistry, Oceanography, and Law) and that most of these merit badges were being taught in a classroom or at summer camp. Imagining these encounters, all I could picture was a Scout in uniform listening to Charlie Brown's teacher saying "WAWAWAWA" — and the Scout not getting anything positive. I realized that our community could support these and other merit badges, thereby introducing Scouts to colleges and businesses. I contacted the chemistry department at ODU to see if they could help us with the Chemistry merit badge, and thus a partnership began.

In addition to the Scouts earning their Chemistry merit badge, they also come away with a positive impact from the host facility. The boys see the college students in a casual learning environment, and learning becomes easy and non-threatening. The students welcome questions, and the boys oblige with much curiosity. This opens many doors to Scouts who were not particularly interested in chemistry or college, and allows them to gain a new perspective for their future.

Since working with the ODU ACS Club, I have had numerous parents comment on what a great event it is and the positive impact it has had on their boys. Several have commented that their Scouts are now actively thinking about going to college, or taking chemistry classes in high school. I may not know the long-term impact of this program, but I do know that I have helped expose the Scouts to a world beyond television and video games.

Joe Colby, *Committee Chair and Merit Badge Counselor, Troop 256.*

Flame tests.

ALL PHOTOS COURTESY OF OLD DOMINION UNIVERSITY

Liquid nitrogen ice cream making. Shown are members of the ACS student chapter: Elizabeth Journigan, Caitlyn Conway, and Emily Kowalczyk.

In contrast, during our lecture the Scouts learn about the chemistry of greenhouse gases and the use of phosphates in fertilizers in a clear, easy-to-understand format.

Fire lab

The discussion of physical and chemical change continues in the fire lab. The only merit badge aspect of the fire lab is the reaction of an iron nail with copper (II) sulfate. As the iron nail becomes plated with copper metal, the boys are able to observe firsthand the chemical change occurring and the different forms of copper: a blue copper (II) sulfate solution and a metallic copper plating. From there the excitement builds, along with the exothermic nature of the reactions. We show them how fireworks exploit the emission spectrum of various compounds through colored flames, "sacrifice" a gummy bear in a very exothermic redox reaction with potassium chlorate, and conduct a colorful combustion reaction in a five-gallon plastic water jug. The fire lab never fails to elicit "oohs" and "ahhs" from Scouts and Scoutmasters alike.

Fun lab

The fun lab was added, um... for fun! The demonstrations in this lab range from a glow-in-the-dark luminol solution, to a non-Newtonian fluid that can be formed into a ball, to making fake snow. This lab is more hands-on than other labs, and the Scouts are encouraged to engage in the chemistry — and in the fun. The finale of the lab is the infamous elephant toothpaste experiment, where the reaction of potassium iodide with hydrogen peroxide releases voluminous oxygen gas, which forms bubbles in the added dish soap, causing massive amounts of colored foam to shoot out of the graduated cylinder.

Each of these labs has been carefully planned and practiced to maximize safety, learning, and "wow factor." Although we place a graduate student or faculty supervisor in each lab, the undergraduates conduct the experiments, engage with the Scouts, and explain the chemistry behind the demonstrations. The Scouts' thoughtful and curious questions challenge the ACS undergraduates to interact with them on a level they can understand — and get excited about.

Lunch and dessert

After the lab rotations are over, we provide the Scouts and Scoutmasters a pizza lunch, liquid nitrogen ice cream, and a "periodic table of cupcakes." Excited conversations about the day can be overheard in all directions as the participants talk about all they have encountered that day and continue to ask questions.

Interview a chemist

After the boys are carb-loaded, they go and sit in a room with a panel of chemists to interview. This is a very open-ended activity. The panelists introduce themselves and their careers, and then the floor opens for questions. Naturally inquisitive and fueled by all they have learned (and eaten) throughout the morning, the Scouts always have more questions than we have time for interviews — which is good!

And this is just a quick overview of an insanely fun, educational, crazy, and rewarding day. During a time in the semester when students are bogged down with long hours of homework, midterms, and lab reports, this day reminds them about the fun and excitement of chemistry. While we are honored to provide the requirements for the Boy Scouts to earn their merit badge, the ACS undergraduates are also served by the opportunity to teach others and enthuse the younger generation about chemistry... and the opportunity to make liquid nitrogen ice cream is always a bonus!

Marie Melzer *earned her Ph.D. from Georgetown University, Washington, DC, lectures full-time at Old Dominion University, Norfolk, VA, and is faculty advisor of the ODU ACS student chapter.*
Kaleigh Wiley *is a senior chemistry major at Old Dominion University, and is president of the ODU ACS student chapter.*

REACTIONS

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