

inChemistry

THE MAGAZINE FOR ACS STUDENT MEMBERS

April/May 2014



Forensic Chemistry Careers

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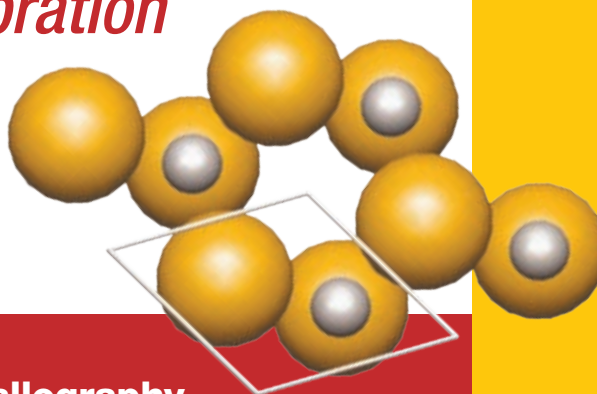
• **Work Habits of Highly Effective Chemists** PAGE 17



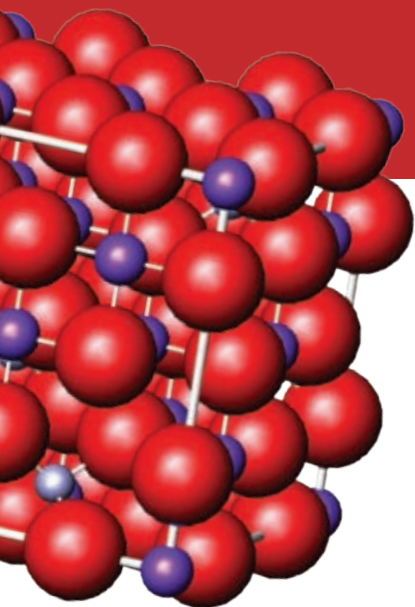
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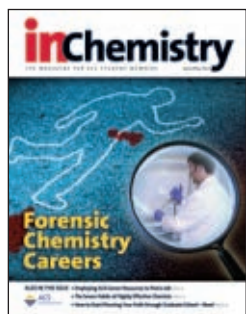
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EDITORIAL: Chemistry's Golden Age

BY SCOTT P. LOCKLEDGE

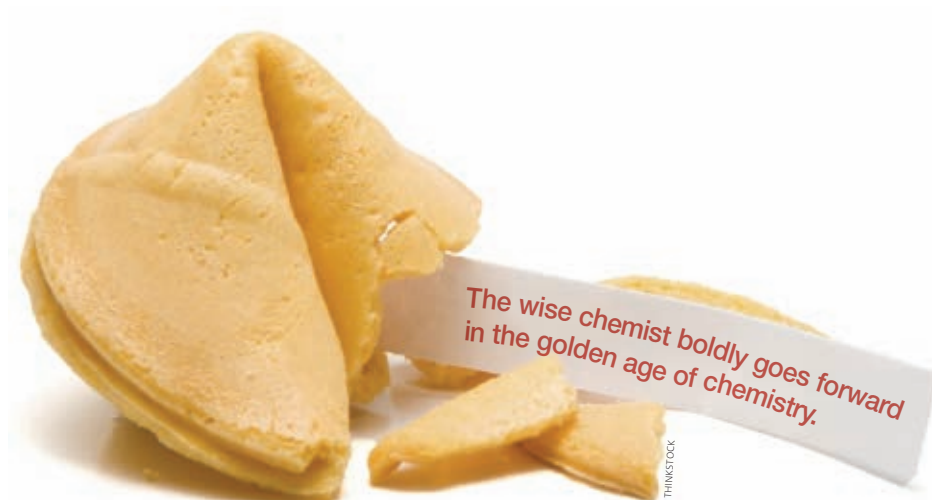
As an innovator and entrepreneur, I talk to many scientists. Recently, I have sensed from these conversations a pessimism about the future of the chemical sciences. Maybe it comes from the record high unemployment, the limited job opportunities for recent graduates, or the salaries lagging behind those of other professions. Maybe it is due to the weak economy, but I do not believe the chemistry sky is falling.

The 20th century brought “Better things for better living through chemistry,” as the DuPont slogan went. Think plastics, coatings, microelectronics, and textiles—all manner of “things” to improve the quality of our lives. If 20th-century chemistry was about things, what will define the next hundred years? And why should the chemical community feel great optimism?

While many fields will advance, the 21st century will be about fundamental and transformational innovations from the biochemical-medical fields. To paraphrase DuPont’s old slogan, the coming decades will bring “Better health for better living through chemistry.”

Consider this: In the past 60 years, we have identified the chemical basis for biology and transformed it from a descriptive endeavor to one that explains life through logical application of biochemical and genetic first principles. As chemists and chemical engineers disentangle the mystery of life, they will have unimaginable opportunities to discover and innovate. Here are a few areas where I expect groundbreaking activity.

The Biochemistry of Aging. The Prudential Financial billboard that reads, “The first person to live to 150 is alive today,” has been drawing attention. Prudential provides a convincing actuarial argument



to support the claim. From where will the medical innovations to extend life come? Likely, they will come from many areas. For example, resveratrol and related compounds mimic the effects of severe calorie restriction and extend life for a number of model organisms. Research deploying multiple-gene substitution shows life may be dramatically lengthened in model organisms as well. In fact, a Gordon Research Conference on cell death will be held this summer. Chemists, let’s continue to board this train and ride it.

The Biochemical Basis of Cancer. For the first time in history, we can prevent a cancer. Specifically, women can avoid cervical cancer by receiving the HPV vaccine. Other fascinating progress has been made in treating leukemia using gene therapy. Soon, we will think of chemotherapy and radiation treatments as primitive. Researchers are mapping a series of major cancers in the National Institutes of Health (NIH) Cancer Genome Atlas; their labors will no doubt lead to fundamental advances and therapies. Chemists will continue to play a vital role in the search for cancer cures.

Neuroscience and Brain Research. The NIH Human Connectome Project and the Brain Activity Map project (to start later this year) are ambitious efforts to understand the neural pathways that underlie human brain function. They will set the stage for future studies of many neurological and psychiatric disorders and possibly

lead to advances in artificial intelligence. At their core, these activities are exercises in discerning the biochemical and electrochemical pathways by which the brain functions. Again, chemists can and should play leading parts in moving these efforts forward.

Chemistry as Information Science. To sequence the 3 billion base pairs of the first human genomes cost about \$3 billion. Sequencing a complete human genome now costs about \$1,000. The genomes of nearly every major food, animal, and model organism have now been sequenced, at least in rough draft. This effort provides an enormous pool of data for young creative chemists with cross-training in information science and other disciplines to manage, mine, and develop first-principles understanding. New biomedical products and therapeutics will follow.

At no time has it ever been better to be a chemist or a chemical engineer than today. Never. As long as we push chemistry boldly forward and continue the stream of innovations that improve lives and the human condition, we will continue to enjoy public and private support of our efforts, and our science will flourish. **IC**



Scott P. Lockledge is CEO and cofounder of Tiptek, a manufacturer of probes for atomic force microscopy applications. Lockledge is also a member of the C&EN Advisory Board.

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ATOMIC NEWS

COMPILED BY ACS STAFF

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

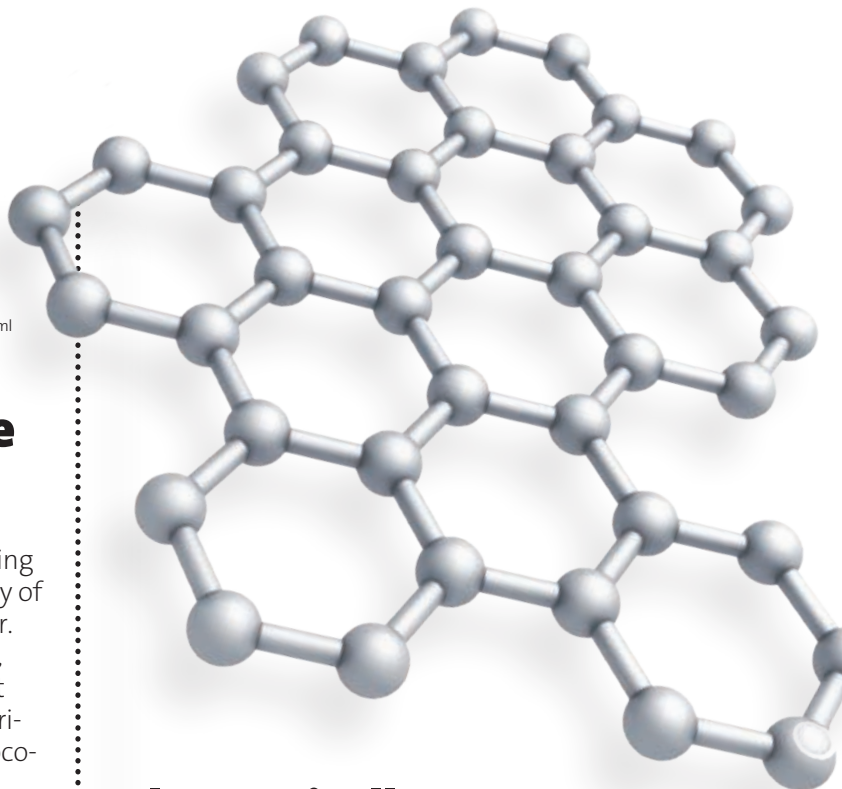
Finally, a way to authenticate premium chocolate

For some, nothing can top a morsel of luxuriously rich, premium chocolate. But until now, other than depending on their taste buds, chocolate connoisseurs had no way of knowing whether they were getting what they paid for. In the ACS's *Journal of Agricultural and Food Chemistry*, researchers from the Department of Agriculture report that they have found a method to authenticate the varietal purity and origin of cacao beans, the source of chocolate's main ingredient, cocoa.

Dapeng Zhang and colleagues note that lower-quality cacao beans often get mixed in with premium varieties on their way to becoming chocolate bars, truffles, sauces, and liqueurs. But the stakes for policing the chocolate industry are high. It's a multibillion-dollar global enterprise, and in some places, it's as much art as business. There's also a conservation angle to knowing whether products are truly what confectioners claim them to be. The ability to authenticate premium and rare varieties would encourage growers to maintain cacao biodiversity rather than depend on the most abundant and easiest-to-grow trees. Researchers have found ways to verify through genetic testing the authenticity of many other crops, including cereals, fruits, olives, tea, and coffee, but those methods aren't suitable for cacao beans. Zhang's team wanted to address this challenge.

Applying the most recent developments in cacao genomics, they were able to identify a small set of DNA markers called single-nucleotide polymorphisms (SNPs) that make up the fingerprints of different cacao species. The technique works on single cacao beans and can be scaled up to handle large samples quickly. "To our knowledge, this is the first authentication study in cacao using molecular markers," the researchers state.

Read more about the research: "Accurate Determination of Genetic Identity of a Single Cacao Bean, Using Molecular Markers with a Nanofluidic System, Ensures Cocoa Authentication," *J. Agric. Food Chem.*, 2014, 62 (2), pp. 481–487.



Electronically controlled drugs could minimize side effects

Potential side effects of many of today's therapeutic drugs can be alarming – just listen carefully to a drug commercial on television. These effects often occur when a drug is active throughout the body, not just where and when it is needed. But researchers are reporting progress on a new, tailored approach to deliver medicine in a much more targeted way. The study on these new electronically controlled drugs appears in the journal *ACS Nano*.

Xinyan Tracy Cui and colleagues note that in the lab, "smart" medical implants can now release drugs on demand when exposed to various cues, including ultraviolet light and electric current. These advantages are largely due to developments in nanomaterials that can be designed to carry drugs and then release them at specific times and dosages. Researchers have also experimented with loading anti-cancer drugs on thin sheets of graphene oxide (GO), which have properties that are useful in drug delivery. But current techniques still need to be perfected before they can be used as a part of routine medical treatments.

Cui's team incorporated GO nanosheets into a polymer thin film that can conduct electricity, loaded it with an anti-inflammatory drug, and coated an electrode with it. When they zapped the material with an electric current, they showed that it released the drug consistently in response. They could do this several hundred times. Also, by experimenting with the sizes and thicknesses of the GO sheets, the researchers could alter how much of the drug the nanosheets could carry. Cui said this approach could be useful in treating epilepsy, for example. In that case, medication already lying in wait inside the body could be released at the onset of a seizure.

Read more about the research: "Electrically Controlled Drug Delivery from Graphene Oxide Nanocomposite Films," *ACS Nano*, 2014, 8 (2), pp. 1834–1843.

20

The number of allotropes in sulfur. That's the most of any element except carbon.

-300°F

Temperature at which F_2O_2 will cause methane to explode. F_2O_2 literally makes ice catch fire. Mess with this chemical at your own risk!

50,965

tons of chemical weapons used during the First World War. These contributed to 1.1 million non-fatal casualties and 85,000 deaths, the most casualties from chemical weapons in a single conflict.

19.79

million, the average weekly U.S. television viewership of season 7 of "The Big Bang Theory."

CBS recently announced the show has been picked up for 3 additional years, guaranteeing it will air through the 2016–2017 season. Bazinga!

An answer to the perennial question: **Is it safe to pee in the pool?**

Advocates who preach "no peeing in the pool" now have scientific evidence to back up their concern. Researchers are reporting that when mixed, urine and chlorine can form substances that can cause potential health problems. Their study appears in ACS's journal *Environmental Science & Technology*.

Jing Li and colleagues note that adding chlorine to pool water is the most common way to kill disease-causing microbes and prevent swimmers from getting sick. But as people swim, splash, play — and pee — in the pool, chlorine mixes with sweat and urine and makes other substances. Two of these compounds, trichloramine (NCl_3) and cyanogen chloride ($CNCl$), are ubiquitous in swimming pools. The first one is associated with lung problems, and the second one can also affect the lungs, as well as the heart and central nervous system. But scientists have not yet identified all of the specific ingredients in sweat and urine that could cause these potentially harmful compounds to form. So Li's team looked at how chlorine interacts with uric acid, a component of sweat and urine.

They mixed uric acid and chlorine, and within an hour, both NCl_3 and $CNCl$ formed. Though some uric acid comes from sweat, the scientists calculated that more than 90% of the compound in pools comes from urine. They conclude that swimmers can improve pool conditions by simply urinating where they're supposed to — in the bathrooms.

Read more about the research: "Volatile Disinfection Byproducts Resulting from Chlorination of Uric Acid: Implications for Swimming Pools," *Environ. Sci. Technol.*, 2014, 48 (6), pp. 3210–3217.

Improving detection of radioactive material in nuclear waste water **with nano-graphene**



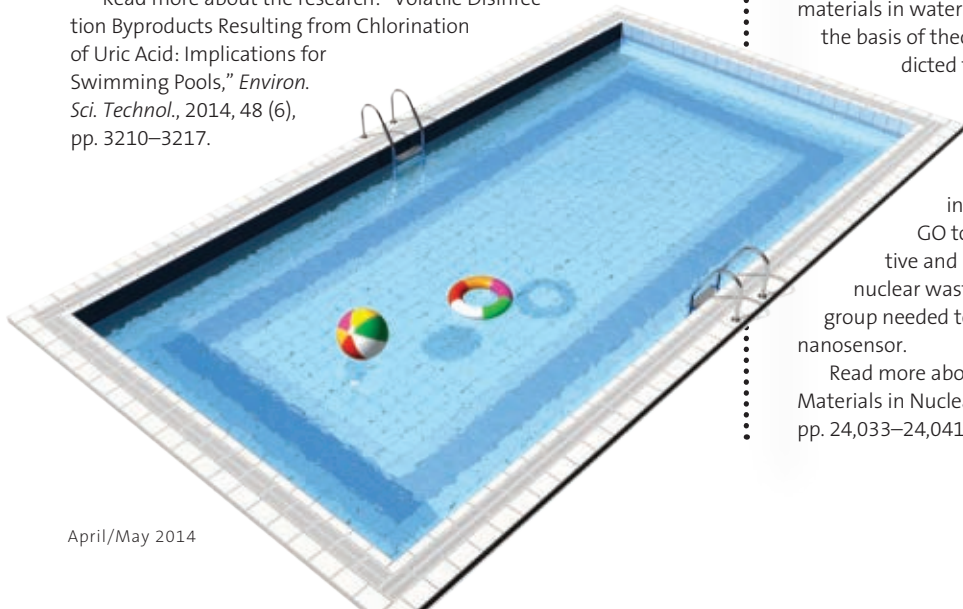
As the Fukushima crisis continues to remind the world of the potential dangers of nuclear disposal and unforeseen accidents, scientists are reporting progress toward a new way to detect the radioactive materials uranium and plutonium in waste water. Their report on the design of a highly sensitive nanosensor appears in ACS's *The Journal of Physical Chemistry*.

Jorge M. Seminario and Narendra Kumar note that it is highly likely that radioactive uranium and plutonium have leaked into the soil and groundwater near nuclear facilities. This contamination poses a serious threat to the environment and human health. Although detecting these materials even at low levels is important for determining whether a leak is occurring, traditional methods of doing so are not effective. But recently, scientists have discovered that radioactive materials in water can clump onto flakes of graphene oxide (GO). On the basis of theoretical models and calculations, researchers predicted that GO could sense and identify extremely low levels — single molecules — of various substances.

Seminario's team set out to see how best to adapt this for uranium and plutonium sensing.

Using the latest advances in supercomputing, they modeled several different variations of GO to figure out which one would be the most sensitive and selective in detecting uranium and plutonium in nuclear waste water. They concluded that a carbonyl functional group needed to be added to the graphene to act as an effective nanosensor.

Read more about the research: "Design of Nanosensors for Fissile Materials in Nuclear Waste Water," *J. Phys. Chem. C*, 2013, 117 (45), pp. 24,033–24,041.



248th ACS National Meeting CHEMISTRY & GLOBAL STEWARDSHIP

AUGUST 10 – 14, 2014 • SAN FRANCISCO, CA



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To register, go to www.acs.org/GradSchoolRecruiters.



ACS
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Sunday, August 10

Hospitality Center

9:00 AM – 5:00 PM

Nuclear Energy Stewardship Panel

9:30 – 10:30 AM

Graduate School Reality Check, Part I: Getting in

10:30 – 11:45 AM

Graduate School Reality Check, Part II: You're in — Now What?

11:45 AM – 1:00 PM

ACS Diversity Panel: Defining Diversity and Supporting Students

12:30 – 1:30 PM

Chemistry Plus Purpose: Careers on the Road Less Traveled By

1:30 – 4:30 PM

Networking Social with Graduate School Recruiters

2:30 – 5:30 PM

“Journey to the Dork Side,”

Featuring Comedian Dr. Pete Ludovice

7:00 – 8:00 PM

Monday, August 11

Hospitality Center

9:00 AM – 5:00 PM

Opportunities for International Careers and Studies

9:00 – 11:00 AM

Networking Basics for Students

11:00 AM – 12:00 NOON

Eminent Scientist Luncheon and Lecture

with Dr. Martin Mulvihill, Executive Director, Berkeley Center for Green Chemistry, University of California

12:00 NOON – 1:30 PM

Undergraduate Research Poster Session

2:00 – 4:00 PM

Undergraduate Speed Networking with Chemistry Professionals

4:00 – 5:30 PM

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

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

Chair: Matthew J. Mio, University of Detroit Mercy, MI

Program Chair: Greglynn Gibbs, Penn State Berks, Reading, PA



Taking the Next Step: Employing ACS Career Resources to Find a Job

BY ACS STAFF

With the end of the spring semester quickly approaching, thoughts about graduation and taking the step after undergrad are likely weighing on your mind. What is your Plan A — is graduate or professional school in your future? If not, how do you decide among the many career options that come with a degree in chemistry? And what if Plan A falls through — have you developed an alternative, Plan B?

As an ACS student member, you're already moving in the right direction. Now is the time to begin taking advantage of the wide range of career and graduate school resources that ACS offers to help make your graduate school or career aspirations a reality — and set your Plan A or Plan B into motion.

Exploring your options

The new ACS College to Career website at www.acs.org/CollegeToCareer is a great place to start! Currently, the site explores 37 different career areas, ranging from traditional options such as applied research, food chemistry, and materials chemistry to other options “off the beaten path” that you might not have considered, including careers involving social impact and activism, the military, and technical writing. Graduate school resources, including articles, DGRweb, and the *Graduate & Postdoctoral Chemist* magazine and blog, are also available.

In addition, the Next Steps section is a valuable “how to” guide. For some students, taking that next step might involve understanding the hows and whys of available options. For example, the “Get Research Experience” area explains why obtaining research experience is so important in your college career. The “Develop Your Network” area explains what networking is and gives tips on how to network.

For others who are farther along in the decision-making process and are ready to take action, the Next Steps section provides resources you'll need. For example, you can access the Get Experience database of internships and research experiences and DGRweb, a database to help you explore graduate school programs. There are also articles and videos to help you hone your job hunting and career skills, as well as tips to help you develop your professional network within your student chapter, ACS local section, and at ACS meetings.

GPS for graduate students

Whether you're exploring graduate school options or have already gained admittance to a program, you'll want to tap into the resources for graduate students offered by the ACS Office of Graduate Students and Postdoctoral Scholars (GPS) at www.acs.org/grad. Here you'll find information on awards and fellowships, meetings and other events, professional development and networking opportunities for graduate students, and career planning. There is also a wealth of information on taking the GRE, writing essays for graduate school applications, professional science master's programs, and preparing for graduate work in chemistry.

Career Pathways Workshops

ACS Career Pathways Workshops are available at ACS national and regional meetings. These free workshops will help you discover the career path that best matches your talents, goals, and personality. The courses focus on the four main career pathways that are available to chemical professionals: higher education, industry, government, and entrepreneurship. You'll learn about the types

of careers available, the job markets, and hiring trends in each pathway. In the final workshop, Acing the Interview, you'll learn successful interviewing techniques, address difficult interview questions, and participate in several mock interviews.

ACS Webinars

The ACS Webinar Series connects you with subject matter experts and global thought leaders in chemical sciences, management, and business who address current topics of interest to scientific and engineering professionals. Each weekly webinar is 60 minutes long and includes a short presentation followed by a question-and-answer session. The Careers Channel contains 53 previously recorded webinars on a variety of topics, including résumé building, keys to a successful career, alternative careers in chemistry, and networking. All recordings of ACS Webinars are available as a free benefit to current ACS members; live weekly ACS Webinars continue to be available at no cost to the general public.

ACS Career Consultants

If your next move is getting a job, another valuable ACS career resource is the Career Consultant Program. Through this program, which is free to ACS members, a team of volunteer ACS experts can assist you via e-mail or phone with any questions you might have concerning job search strategies, interviewing techniques, and salary negotiation. In addition, a career consultant can review your résumé to ensure that it is well organized and highlights your most important skills. ACS Career Consultants are also available at ACS national meeting Career Fairs and at regional meetings.



InterviewStream online tool

Would you hire you? Take a mock interview and find out. ACS offers InterviewStream, a unique online tool that helps you practice the art of interviewing. You'll learn how to identify your strengths and weaknesses and improve verbal and non-verbal communications in the interview setting *before* your actual interview. This free member resource is available at www.acs.interviewstream.com.

Tap into national meetings

ACS also offers an on-site and virtual Career Fair at each ACS national meeting. The Career Fair helps you showcase your talents to a broad range of prospective employers. In addition, you can get help in preparing a résumé that stands out from the crowd, building an effective job search strategy, and fine-tuning your interview skills.

At the virtual Career Fair, you can chat one-on-one with ACS Career Consultants, find open positions, submit applications and résumés, review career and company information, interview and chat with employers, and more.

The ACS Career Fair is free, but you must be an ACS member and register for the national meeting to participate in the on-site activities. Both ACS members and non-members can participate in the virtual Career Fair.

C&EN Jobs

You've likely heard of the Monster and CareerBuilder job websites, but did you know that ACS also has a jobs website for jobs in the chemical sciences? *C&EN Jobs* is free to ACS members and is online at chemistryjobs.acs.org/jobs. *C&EN Jobs* is also active at ACS national

meetings through the Career Fair, where it hosts career development workshops, résumé reviews, mock interviews, employment interviews, and career counseling sessions.

Investing in yourself

In these busy final weeks of the spring semester and throughout the summer, set aside some time to invest in yourself. Try to dedicate at least an hour each week to learning about your graduate school and career options. Develop a Plan A and a Plan B. Remind yourself that as an ACS student member, you're heading in the right direction. Now is the time to take the next step. Be proactive, and make use of the wide range of career and graduate school resources that ACS offers to transform your graduate school or career aspirations into a reality. **IC**

A Chemist on a Mission

Rolande Hodel's Inspiring Work with AIDSfreeAFRICA to Empower Africans Fighting HIV/AIDS

BY ERIC STEWART

As serious as the problem of AIDS is in the United States, it pales in comparison with the AIDS situation in Africa — specifically, among the countries south of the Sahara Desert. There are many causes of the crisis there, including poverty, inadequate access to education and medical care, and the lack of a basic pharmaceutical infrastructure, to name a few.

In fact, the problem of AIDS in Africa has been growing in severity since the 1980s. Like many people, Rolande Hodel, a chemist living and working in New York, was familiar with the problem, but it remained a somewhat distant concern, both geographically and intellectually. That changed for her in 2003, when she happened to hear a speech at the United Nations.

This is the story of how Hodel found her life's work and launched AIDSfreeAFRICA (www.aidsfreeafrica.org), a nonprofit focused on helping Africans take greater control over the fight against AIDS. It could seem an almost overwhelming struggle, but Hodel is upbeat and undeterred.

A unique career path

As a girl growing up in Germany, Hodel once aspired to be a mathematician and later gravitated to chemistry. She decided to pursue an advanced degree in chemistry and returned to Hochschule (the equivalent of going to college in the United States). Later, she moved to the United States, earned her master's in chemistry, and then worked for a while as a synthetic bench chemist at a pharmaceutical company focused on drug delivery.

Still searching for something more, she decided to pursue her Ph.D. at the City University of New York. "While I was working on my doctorate, I wasn't exactly sure what I wanted to do with it," she recalls. "But I knew that I wanted to travel internationally and have impact on people through my work."

In the process of exploring her options, she joined the organization Servas International and volunteered to serve as a representative helping people who came to a conference Servas was participating in at the United Nations. While there, she inquired about the possibility of employment with a United Nations agency. That particular opportunity did not pan out, but she did happen to attend a speech that changed her life.

The speaker was the former president of Brazil, Luiz da Silva, who gave an inspiring talk about how his country had managed to begin making its own AIDS drugs. His controversial actions allowed

Brazilian companies to break the patents of several drugs designed to combat AIDS. In the process, he angered pharmaceutical companies but also staved off a potentially devastating epidemic in his country.

"His story started me thinking about how I could help Africans bring about a similar change in their countries," recalls Hodel. "Within two years, I was visiting Cameroon to learn where I could help, and in 2006, I established my nonprofit and really got to work."

Strategies for success

As its website explains, AIDSfreeAFRICA is a community of professionals dedicated to empowering Africans to become self-sufficient in producing affordable pharmaceuticals, diagnostics, and tests. To succeed, the organization provides technical advice and management expertise, develops and delivers training, provides donated equipment and supplies, and offers access to capital.

Hodel is the organization's driving force, working nine months of the year from her home in New York, and the balance of her time is spent in Africa, traveling within Cameroon to meet and negotiate with various business and government leaders. She also connects with and builds networks among universities, pharmaceutical companies, and other organizations in the United States and Africa. In addition, over the past few years, her organization has "adopted" the small village of Esu, establishing its first-ever clinic, among other developments.

Hodel pursues her mission through her own organization and also by being involved with other groups that have similar areas of focus. She's still involved with the Servas organization, for example, and also is on the board of directors of the group Chemists Without Borders (see sidebar on next page).

When interviewed recently, Hodel noted that she was working on a grant that would allow her organization to build a second structure that will enable computer and Internet access for Esu villagers. "If our grant is approved," she notes, "the village women in particular will be able to become trained to accessing information on HIV/AIDS for their community education work."

Her group has also applied for a donated container of used





PHOTO COURTESY OF ROLANDE HODEL

Rolande Hodel meeting with the Esu Family Health Association, a group of villagers affected by HIV/AIDS. This group was founded by AIDSfreeAFRICA in December 2011.

Gauging the Epidemic

According to amfAR, The Foundation for AIDS Research, 70% of all people living with HIV (the virus that causes AIDS) are located in sub-Saharan Africa. Among these 25 million individuals are 88% of the world's HIV-positive children. In 2012, 1.6 million people in the region became newly infected, and 1.2 million adults and children died of AIDS, accounting for 75% of the world's AIDS deaths.

computers and medical equipment from a business in Hong Kong. She's already working with Cameroonians to develop and deliver training for villagers in how to use computers to find information on AIDS prevention and treatment.

Teaming with students

To achieve her group's mission, Hodel oversees all of its key activities — from fundraising, alliance-building, and sharing technical expertise to many of the day-to-day aspects of running the organization. But at the core, her job is all about finding resources and putting them to effective use.

Among Hodel's favorite resources are chemistry students at colleges and universities, who are helping her organization in myriad ways.

For example, some students are collecting and donating used scientific books. "Textbooks are really expensive over in Africa," observes Hodel, "and even if a book is two or three years old, in Cameroon, that's a brand new book. We now have a container with over 1,000 donated textbooks, and my contacts in Cameroon are asking for books on other topics as well."

Chemists Without Borders

According to its website, Chemists Without Borders (CWB) "solves humanitarian problems by mobilizing the resources and expertise of the global chemistry community and its networks." CWB is a global support network of volunteers working to ensure that people everywhere have affordable, reliable access to essential medicines and vaccines, as well as safe water, sustainable energy, and safe processes in work environments where chemical hazards exist.

One of the organization's current efforts, the Arsenic Filter Project in Bangladesh, is a case in point. Arsenic in water supplies has been proven to cause serious and even life-threatening health problems. CWB is collaborating with Professor Abul Hussam of George Mason University to develop and distribute composite iron matrix filters that remove arsenic from contaminated drinking water. Learn more at www.chemistswithoutborders.org.

Other student groups are helping Hodel communicate via social media, volunteering to manage the organization's Twitter account and Facebook page, while others are raising funds to donate to the organization. Hodel has an arrangement with an African woman who produces jewelry that students in the United States can sell on campus to raise funds for AIDSfreeAFRICA. She adds that the size of the donations isn't the point — "Whether it's \$100 or \$1,000, it's all money," she adds with a laugh.

"I love the energy of young people," she says. "They have media savvy, are comfortable with fundraising, and are able to communicate with their peers and other audiences." Hodel says that the best way for interested students to get involved with AIDSfreeAFRICA is to contact her via the group's Facebook page (www.facebook.com/AIDSfreeAFRICA).

Personal strengths

What keeps Hodel going? When asked about the traits that help her succeed, Hodel observes, "I do not need comfort, and I have a dream which I follow and never waver from. I listen even to the unspoken, involve people, ask for help, and get it." She adds that she's had to learn a variety of new skills on the job, including working through legal and tax issues, writing grants, and even building a website. However, she says, "through the process of earning my doctorate degree, I truly 'learned how to learn,' and that's allowed me to overcome all the obstacles I've encountered."

Hodel is philosophical about her career and is happy to share her lessons learned. "One recommendation I often give young people is to take a break from school to go abroad and gain some perspective. The Peace Corps does a wonderful job of training students interested in undertaking overseas experiences. Going to another country and staying there for an extended period is not for everyone, of course. But it can be a very rewarding way to help others and share insights about our respective cultures, and you will learn more about yourself than you thought possible." **IC**



Eric Stewart is a freelance writer and editor living in Arlington, VA.

Don't Be a Jerk

Some Obvious (and Not So Obvious) Tips on Coming across Well in Interviews

BY DAVID HARWELL

The title of this article is intentionally obnoxious in order to make the following point — in stressful situations, people tend to behave badly, which will most certainly limit their professional progression.

Take, for example, the interview process. Interviews are stressful situations. You are asked to go to a place where you have never been and to meet with people you don't know — people whose role is to be very judgmental about *you*. Interviews are essentially designed to induce stress, since employers want to see what it would be like to work with you, and a stressful situation like an interview gives them a great deal of insight into your worst behavior. The key is to keep your composure and to be likable.

Looking beyond technical competency

While the interview should be about your technical competencies, interviews are also about interacting with you on a personal level. Interviewers may be asking you about NMR or HPLC techniques, but they are also sizing you up. They are thinking about whether they would want to work with you for hours on end. What will it be like to depend on you for part of a group project that could determine the success or failure of their organization? You will have to demonstrate your ability to work well with others — or at very least, the interviewers. That means you can't clam up or become defensive. A defensive posture can be misinterpreted by your interviewer as a sign that you're standoffish, abrasive, or worse.

Decisions are emotional at their root. They may be informed by logic and facts, but human beings tend to revert back to primal instincts in making decisions. The one at the core of the "Do I like this person, or is he/she a jerk?" determination is, "Will he/she hurt me?" The interviewers' decisions will be based on their level of trust in (or fear of) you. In the short amount of time an interview is conducted, the level of trust they form will likely be determined on the basis of your openness and consistency.

Likability goes a long way

Likability is important for much more than interviews. Over 70% of termination decisions — that is, when employees get fired from jobs — are based on the individual's inability to get along with others or to accommodate organizational culture, although the paperwork probably won't say as much. In reality, if someone messes up and we like them, we are likely to give them a second chance. If the offender is a jerk, then disappointing performance may be just the excuse needed for termination.

Beware of the Kardashian model

As a Millennial, you may not have experienced many people displaying good workplace behavior. Since you were born, popular culture has been dominated by reality television where people act badly for dramatic effect. The worse they act, the further ahead they seem to get. Please note that this is *not* how the real world works, and most of the behaviors exhibited on reality television were encouraged by producers seeking salacious moments that could be used to promote viewership and ratings. So don't believe it. Reality television is not real, and reality show celebrities are not proper role models for social behavior. If you display these behaviors at work, you are likely to be escorted to the nearest exit.





Six Tips for a Good Conversation

1. Make the other person the topic of conversation.
2. Ask questions you're truly interested in hearing answered.
3. Keep the conversation relevant to what they're talking about, and don't go off on a tangent (or you'll kick yourself later for it).
4. Be yourself and be personable.
5. Find common interests, either personal or professional.
6. If you connect with the person, ask them for a business card so you can follow up (and then do follow up!).

Source:


<http://ownyourambition.com/7-tips-for-networking-conversation-comfort/>

and strive for continual improvement. Informal meetings centered on topics not related to a job are the best place to start, because it won't matter if things go badly there, and you can always walk away and start anew with another group the next day. Start small before you go big, and set yourself up with some easy wins in the beginning.

The thing to remember is that most people, especially chemists, are good at heart and want you to succeed. The people on the other side of the table are just as likely as you to be miserable during a bad interview. To avoid the discomfort during an awkward interaction, they are likely to throw you a lifeline. If you feel yourself sinking, look to them for help. You can even ask, if help is not obvious — ask them to repeat or rephrase the question. After all, they may be sinking too.

In summary, your interactions with others matter just as much, if not more than, your technical competencies. You don't have to be a perfect human being, and you don't have to be the most popular either. You just need to be likable, communicative, and trustworthy.

And remember, it's just a conversation with another person who either has the gift of the gab and won't stop talking anyhow (in which case, you may have to practice the art of making a graceful exit) or is in the same boat as you, feeling a bit shy or intimidated — and you could be a breath of fresh air!

By following these easy steps, you'll find yourself feeling more comfortable and authentic with your conversation, and people will remember you for it. 

Real-world practice makes perfect

So how can you project the beautiful person that you really are, instead of coming across as a jerk? It will probably take practice. Go to receptions, meetings, and any other event that gives you the chance to interact with other professionals. Observe the effects of your actions. You may find that you have some bad habits that stop conversations short, such as interrupting or only talking about yourself. Don't do them again. Other actions may cause people to flock to you, such as recalling previous comments the person said and focusing on making others feel important. Those are the habits you want. There will also be actions that fall in between those extremes. Make a mental note of the good, the bad, and the better,



David Harwell is assistant director of the ACS Department of Career Management and Development.

Planning Your Path through Graduate School

How to Start Planning Your Future Career — Now!

BY AMY M. HAMLIN

The beginning of graduate school can be both exciting and stressful. It is the start of a new chapter of your life, filled with many new opportunities and experiences. There may be many things to consider, such as where to live, which group to join, what research project to tackle, how to survive your first-year classes, and how to prepare for those qualifying exams, just to name a few. But while you are figuring out how you are going to balance all of these decisions and goals, you should also begin considering your life *after* graduate school.

It may seem like graduation is far away and that you have plenty of time to figure out what you are going to do afterward. You may also feel that it will be easier to just put off preparing for your future career until after you pass your qualifying exam, finish your teaching requirement, or make some progress on your thesis project.

However, there are many reasons why you should start preparing *now* for life after graduate school, including but not limited to the following.

Maintaining motivation

Most importantly, having a plan will help you stay motivated (which is often the most difficult part of the graduate school experience). It is easy to lose the excitement you feel at the beginning; once classes and exams are over, the weeks can easily get lost among endless experiments and long nights in the lab. At times it may seem that your thesis work or research project will never be complete. But if you have a plan and clear milestones to meet throughout your graduate career, it is a lot easier to remain motivated and positive.

Hearing opportunity knock

Having a plan can help you make the most of every opportunity. If you know where you want to go when you graduate, then you can evaluate which skills, both inside and outside of the lab, you need to acquire, and you'll have sufficient time to do so.

Articulating your career goals

Lastly, planning your future career now will prepare you for future discussions regarding your career goals, especially during employment interviews when you eventually start applying for jobs. Being prepared will help reduce the stress and allow you to walk into each interview with more confidence.

Getting started

So, now that you know why you should start planning your path through graduate school (and your life afterward) as early in your graduate career as possible, you may be asking, "Where do I start?"

Reflecting

First, you must reflect on your career goals. Why did you decide to attend graduate school, and what do you want to do with the knowledge you will obtain? It is not necessary to decide on your exact answer now, but it is good to at least have in mind a general direction (academia, industry, or government) and to be open to other possibilities. It is also okay to change your mind later; as you grow as a scientist throughout your graduate career, you may realize that your interests and skills are better suited for a different path than you originally planned.

Planning your graduate career

Next, you need to develop your graduate career plan. This often starts with your choice of research advisor and thesis project. Before you even join a research group, you should have a discussion with the advisor about your career goals and how the group can assist you in meeting them. Ask about where group alumni are now and what careers members are considering. Also ask current group members what the group does to help grad students and postdocs develop skills outside of the lab, such as presentation and communication skills. Last but not least, inquire about what resources will be available as you begin the job or postdoc application process.

Once you join a group, make sure to sit down with your advisor and have an open and honest conversation about what will be expected from you, along with what your advisor can do to help you become a better scientist. You should outline a plan that includes departmental requirements (classes, teaching, seminars, qualifying exams, etc.) as well as other expectations, such as mentoring undergrads/younger students, publishing, attending confer-





ences, and applying for jobs or postdocs. Other topics to address include a timeline for when you should write your thesis, which semesters you will be teaching, when you will meet departmental requirements, and when you hope to graduate. It is a lot easier to remain motivated throughout graduate school when you have a deadline for graduation; in addition, you won't find yourself in the position of waiting around in your fourth or fifth year (or beyond!) for your advisor to tell you that you can leave.

Assessing your progress

Throughout graduate school, you should talk with your advisor often, both formally and informally, about how you are progressing toward your goals and how your advisor might be able to better assist you. Remember, your advisor can be a great source of guidance and advice, so if your career plans change or you are not sure about which direction you are heading after graduate school, be sure to bring it up and get his or her advice.

I recommend taking time — at least once a semester — to reflect on the direction in which you are heading and your

progress. Doing so gives you an opportunity to set new goals for the upcoming semester, such as submitting a manuscript, improving your presentation skills, or putting together your CV or résumé and job talk presentation. Often, unexpected events may change your plan. For example, research projects could take longer than expected, a discovery might lead to a new side project, seminars or qualifying exams could get rescheduled, or you might have to teach an extra semester. Make sure your plan is flexible enough to incorporate these unexpected changes.

Developing a network

While your advisor and other group members are great sources of guidance and advice, it is also important to network with scientists outside your department and university. Networking may not come easily to you, but you will have many opportunities to practice. Meeting with seminar speakers, having discussions with visiting scientists, and attending scientific meetings are all great ways to practice networking. Take every opportunity to ask people about their passions in science, how they got to where they are today, and other advice they may be willing to share.

Attending scientific meetings is an important part of your graduate education. Not only does it give you a great opportunity to network with other scientists and learn about different types of research, but it also allows you to improve your presentation skills. If you are beginning your job search, attending meetings also lets you gather information about companies and meet with possible employers. Some conferences also offer career guidance classes, networking sessions, and short courses on a variety of topics.

But remember that attending conferences does take some planning. Often, abstracts for presentations are due weeks or even months before the meeting, and it may take some time to gather and complete the necessary forms to apply for a travel grant. Planning early in your graduate career about which conferences you want to attend (and when) will help you to meet deadlines and will also give you sufficient time to secure travel funds.

Developing your professional skills

Here's some more advice you'll thank yourself for following: take every opportunity you can to improve your speaking and writing skills. Practice giving presentations to your research group and to your department, and also arrange to give presentations to non-scientists, such as volunteering at a local school to teach kids about chemistry or presenting a seminar to university students outside your department. Employers are looking not only for talented scientists but also for individuals who can communicate what they've learned to both scientists and non-scientists. Also, take advantage of opportunities to write manuscripts and fellowship applications, as these are more great ways to improve your communication skills.

Gaining leadership experience during your graduate career is also essential and can happen in various ways. You may choose to participate in a graduate student organization at your school

or help with recruiting and planning weekend visits for prospective students. Or you could volunteer in your community or get involved with your ACS local section. These activities are not only great ways to put leadership skills on your résumé but are also excellent opportunities to network with other scientists and learn about different career opportunities in chemistry.

Getting ready for the interview

It is never too early to start preparing for the job/postdoc application process. The earlier you begin, the more confident you will be when you start applying. It is as simple as starting your CV or résumé your first year of graduate school and then updating it whenever you receive an award or publish a paper. Putting together a presentation about your thesis project and adding slides as your project progresses also save you time when you are rushing to put an application together. Sign up for LinkedIn and make sure to keep your profile updated. By preparing early, you will be ready whenever an opportunity arises.

Partnering with ACS

There are many resources available to you as you plan how to get the most out of your graduate career. Be sure to check out ACS's Graduate Students and Postdoctoral Scholars Office's website, www.acs.org/grad. There you can find numerous resources to help you network with other graduate students,

find career planning resources, learn about fellowships, travel grants, and upcoming meetings, and also discover ways to get involved in ACS through technical divisions or planning committees.

ACS also offers Career Pathways Workshops at local and national ACS meetings, as well as at some universities. These workshops allow you to explore the different opportunities available to chemists and obtain guidance on how to put together a teaching philosophy or résumé, how to ace an interview, and other topics. If you cannot attend these sessions in person, ACS also offers numerous career webinars (www.acswebinars.org).

To be a successful scientist, you need to master more than just lab skills. While completing a research project is your main goal in graduate school, it is also important to develop communication and leadership skills along the way. Setting goals and developing a plan on how you are going to gain the necessary skills and experiences will allow you to get the most out of your graduate experience and prepare you for your future career. **IC**



Amy M. Hamlin is a graduate student at the University of California, Berkeley, studying synthetic organic chemistry. She is currently a member of the ACS Graduate Education Advisory Board.



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The Seven Habits of Highly Effective Chemists*

* *With Apologies to Stephen Covey*

BY ALLISON PROFFITT



At the end of 2013, ACS launched an incredibly rich resource: the College to Career site, which features profiles of nearly 100 chemists as well as many career resources. Representing careers in almost every possible field relating to chemistry, these researchers, teachers, writers, salespeople, and law enforcement officers each shared a bit about their work, their career path, and some pearls of wisdom they've collected over the years.

One of the most interesting questions asked the featured individuals to look back at their careers and identify which essential habit they wish they had adopted earlier. The results reveal a big-picture to-do list for students transitioning into their careers.

Everyone's experience was a bit different, but several themes emerged. These are the seven habits that working chemists say they wish they'd started in school.

1. Get your e-mail under control.

"I check e-mail only two to three times a day."

MARTIAL TAILLEFERT
Professor, Georgia Institute of Technology

"I am totally reliant on flagging e-mails for follow-up, then clearing the flag later as I complete the tasks. It helps me stay organized."

ALLISON DICK
Associate Projects Analyst, Chemical Abstracts Service

2. Set priorities from the start, and learn to say no.

"Plan each day and say no to last-minute requests."

OLUWATOYIN ASOJO
Associate Professor of Pediatrics-Tropical Medicine, Baylor College of Medicine

"I complete tasks as soon as I receive the assignments."

KIMBERLY M. JACKSON
Associate Professor, Biochemistry, Spelman College

"Learn to say no to requests that will take more time and energy than they are worth, or when your plate is full. Develop the ability to focus on the mission and not let setbacks dissuade you from proceeding."

BRYAN BALAZS
Associate Program Leader, Lawrence Livermore National Lab



Allison Dick

"I use calendars and make lists constantly to make sure I stay on top of things. As you progress in any profession, you must be able to work on multiple projects at the same time. Keeping everything on schedule means never losing sight of deadlines for each activity. Though there are always things in every job that are not the most exciting, they still need to be done in a certain length of time."

CHRIS BRADLEY
Assistant Professor, Mount St. Mary's University



Fatima Rivas

"Begin each project with the end in mind."

FATIMA RIVAS
Assistant Member,
Faculty, St. Jude
Children's Research
Hospital

"Attempting to organize after the fact is challenging. I find it useful if I categorize and

manage information (documents, articles, ideas, projects, etc.) in the beginning. It also helps guide me and provides me with a goal when managing larger projects such as developing new products."

ELAINE NAM
Chemistry Staff Scientist, Vernier Software and Technology

"I write task lists as well as assigning start or due dates, and I assign a priority status for each task (three priority levels). Prioritization makes such a difference in keeping me doing the most important things all the time. A simple task list doesn't have the same effect. When I was younger, I just got things done, but wasn't as good at analyzing the worth of each task."

KAREN MCMILLAN TKACZYK
Freelance Translator, McMillan Translation

3. Learn more math!

"I wish I had spent more time doing my homework in calculus classes; I could use the expertise now! A lot of what we do is the fundamental science that helps us to develop better theories and models to predict how minerals will react to changing conditions, for example, to better evaluate the potential environmental impact of a spent nuclear fuel storage site or deriving ways to sequester toxic contaminants. We do a lot of peak integration and taking the derivative of curves to analyze data from experiments and simulations too."

ANDREW STACK
Research Staff, Oak Ridge National Laboratory

"I wish I had studied more statistical data treatment."

WILLIAM DOUB
Research Chemist, U.S. Food and Drug Administration

4. Prioritize your physical health: exercise and get the right amount of rest.

"Exercise regularly. It is important to reduce the stress in your life and gives you time to think about things."

STEPHANIE WETTSTEIN
Assistant Professor, Montana State University

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

JENNICE OZMENT
High School Chemistry Teacher

"I wish that I had started working out in the morning much earlier in life so that I could have accomplished and done so much more."

LEAH NEMETZ
Special Agent, Federal Bureau of Investigation

5. Refine your communication skills and invest in relationships.

"I wish I had started as an undergrad attending national ACS meetings and engaging as a volunteer in local sections, divisions, and committees of the ACS. ACS meetings have given me the opportunity to present my research work and to learn from my peers. I have developed as a professional and have built my professional network by volunteering in local sections, divisions, and committees of the ACS. I have developed my leadership skills by agreeing to lead subcommittees and committees."

AL RIBES
Six Sigma Master Black Belt; Dow Chemical Company



Al Ribes

"I've become better at filtering information that I need to remember from that which I don't. I've also developed the skill of speaking with authority about those topics in which I actually have some degree of expertise."

JOHN CORT
Senior Research Scientist, Pacific Northwest National Laboratory

"I've learned to properly communicate my research, so as not to overstate (or understate) my results. Phrases like 'this strongly suggests' or 'this may contribute to' provide a buffer that keeps you from stating possible inaccuracies to your audience."

OWEN COMPTON
Research Investigator, DuPont

"I understand how important relationships are in getting things accomplished. One can demand that things get done, but in today's environment people are overburdened. People will stretch to help a friend but not a stranger."

CESAR GARZA
Principal Engineer, Samsung

"I make a special effort to meet new people, help them out as much as I can, and record all the details about them in my address book. I look at my volunteer work, with ACS and with other organizations, as part prospecting for new clients and part sharing my love of chemistry and careers with others. If you're going to belong to an organization, you need to get involved, not just send in your dues. That's where the real benefits come in, in the connections you make with other professionals."

LISA M. BALBES
Freelance Technical Writer and Editor

6. Set aside time for reflection.

"One of the best things that I have started to do is to reflect on my work, experimental design, my results, and on where the field that I am in is going. Early on I thought that just doing experiments was the

way science was done. I wasted a lot of time and effort that would have been better used in other ways because I just worked and did not analyze and reflect. This is what I try to instill into my students. Understand the why, what, how of science."

HECTOR H. HERNANDEZ
Assistant Professor of Chemical Engineering, Masdar Institute of Science and Technology

"Before I go home each night, I jot down a few lines about what I did that day. It's helpful to remind myself of some of the smaller projects I've worked on for annual reviews or résumé updates, or just to remember ideas I want to go back to pursue later."

MICHELLE SCHULBERG
Principal Process Engineer, TEL NEXX, Inc.



Hector H. Hernandez

"I keep a spreadsheet log of important activities that I've completed."

CYNTHIA HUDDLE
Editorial Scientist, Chemical Abstracts Service



"I break up projects or tasks into concrete steps, estimate how much time each will take in a realistic manner, then book each task into my calendar. Also I book in planning time in my calendar in the beginning of the week and assign time for myself to reflect at the end of the week. Also not missing a coffee break at least once a day seems to help in order to take a break to recharge!"

STACY TREY
Scientist, SP Technical Research Institute of Sweden

7. Take risks and be open to change.

"Be open to new experiences and take risks. It's a big world out there."

PHILIP RODENBOUGH
Returned U.S. Peace Corps Volunteer and currently a Graduate Student at Columbia University

"When faced with a challenge or a new task, don't shy away. Determine what you need to know to get it done, figure out how you will come to know those things, and take action."

PETER RYE
Senior Scientist, Agilent Technologies

"Be brave. In the last year, I have been more willing to try new things and take on new challenges. I think that I would have gone farther in my career if I took this approach earlier."

DENISE WALTERS
Senior Manager, Pfizer Consumer Healthcare

"Ask questions about everything all the time."

STACY GLIDDEN
Senior Research Scientist, Mathy Technology & Engineering Services

"'The One Who Fails the Most Wins.' Success and failure are steps toward achievement, and both lead to innovation. My first significant project at Abbott failed. That learning experience (and many thereafter) have improved my decision-making process and benefited my career progression."

CHRIS CIOILI
Technology Manager for Product Integrity, The Lubrizol Corporation



Allison Proffitt is a freelance writer and editor based in Nashville, TN.

COLLEGE
to CAREER

Become a Forensic Chemist: Be a part of solving crime!

BY ACS STAFF

A mysterious white powder, a blood smear, and a moldy ham sandwich — completely unrelated items to most. But they could be meaningful for forensic chemists, who analyze physical evidence and samples for clues to solve crimes. Television shows such as *Bones*, *NCIS*, *CSI*, and *Dexter* have glamorized forensic scientists and made the field more popular, so competition can be intense. However, if you have a strong desire to shape the world of justice by using science to solve crime puzzles, then a career in forensic science could be worth pursuing.

20 Education

A strong background in chemistry and instrumental analysis and a good grounding in criminalistics are vital. An undergraduate degree in forensic science or a natural science is required for work in crime laboratories, with extensive course work in mathematics, chemistry, and biology. More advanced positions, such as lab managers and supervisors, might require a master's degree. A Ph.D. is often *preferred* for advancement to positions such as lab director, but it is *required* for forensic research positions at academic institutions.

Those interested in working with trace evidence, such as glass, hairs, and gunshot residue, should focus on instrumentation skills and take courses in geology, soil chemistry, and materials science. If forensic biology, such as DNA analysis, is preferred, take microbiology, genetics, and biochemistry courses. Those interested in the toxicological aspects of this work, such as obtaining and interpreting toxicology reports, should study physiology, biochemistry, and chemistry.

Work space

About 90% of forensic chemists work in labs associated with a federal, state, or local police department, medical examiner's office, forensic services lab, or branch of the Federal Bureau of Investigation (FBI). There are a few private labs that carry out forensic analyses.

On an average day, forensic chemists apply knowledge from diverse disciplines such as chemistry, biology, materials science, and genetics to analyze evidence found at crime scenes or in the



bodies of crime suspects. Forensic chemists often don't know the nature of the sample before they analyze it. As a result, they use criminalistics, the qualitative examination of evidence using microscopy and spot testing, and analytical toxicology that looks for evidence in body fluids through a range of instrumental techniques from optical methods (ultraviolet, infrared, and X-ray spectroscopy) to separations analyses (gas chromatography, high-performance liquid chromatography, and thin-layer chromatography). Mass spectrometry is also frequently used since it provides the strongest evidence in court. The results of their work are used in police investigations and court trials, at which they may be called upon to provide expert testimony and explain their findings to a jury.

Is this career a good fit for you?

Versatility and patience are the most often cited qualities of a forensic chemist. Forensic chemists must be able to spend hours rigorously applying analytical techniques to evidence, meticu-

Quick Facts

- **OPPORTUNITIES** — Job outlook is guardedly optimistic. There's an increasing application of forensic science techniques to examine, solve, and prevent crime.
- **EDUCATION NEEDED** — Requirements vary by employer, but forensic science undergraduate and graduate degrees are recommended.
- **SALARIES** — Median annual wage: \$52,840 (Bureau of Labor Statistics, 2012).

lously documenting each step and then defending their work in a court of law. They must also be able to clearly and concisely respond to challenges to their findings. Integrity is an important characteristic because it is not unusual for the different parties in a case to try to influence the forensic chemist's findings. Since they often work with body parts and at crime scenes, an ability to remain unemotional and unaffected is crucial.

Career path

Forensic science technicians receive 6 to 12 months of on-the-job training to learn DNA analysis and receive up to 3 years of training for firearms analysis. In some cases, they must pass a proficiency test before being allowed to handle cases on their own. Throughout their career, they must stay up-to-date on advances in both collection and analysis of evidence.

Most forensic chemists spend their career working at a federal, state, or county lab associated with the medical examiner's office. However, there are different types of careers available, including those in other fields of forensic science, academia, or administration. Chemists can also move up within an organization to a position as the director of a crime lab supervising other forensic scientists rather than being involved in day-to-day analysis. A director is also responsible for case review and general lab management.

Future employment trends

The forensic science field is guardedly optimistic about job prospects as there is greater use of DNA analysis, which is creating more jobs. However, popularity in the media is increasing interest

in, and therefore competition for, forensic science careers. Since new forensic labs are rarely created, openings in existing labs caused by promotion or retirement are the main source of positions for new scientists. Increasing pressure on governmental budgets also works to decrease the number of available openings.

A variety of duties

Although government crime labs tend to be structured and very professional environments, forensic chemists' days vary. The majority of the time you're in your lab, but you could go testify in court or assist a Drug Enforcement Agency (DEA) agent in the field. Forensic chemists are sometimes called to investigate clandestine labs — concealed labs that were manufacturing methamphetamines, ecstasy, or other drugs.

Preparing for a career as a forensic chemist has specific educational requirements. Although some forensic chemists at the DEA have upper-level chemistry training, the minimum requirement is a bachelor's degree. Many institutions offer B.S. and advanced degrees in forensic science. Biological chemistry and forensic science training can help as well. Besides the academic requirements, government forensic chemists must undergo a full background check and security clearance, as the specifics of a forensic chemist's work are confidential. All candidates, including candidates for internships, are screened for any criminal record or history of drug use. A strong chemistry background and a clear background check aren't the only preparation you need for a career in forensic chemistry. Particularly true at the DEA, forensic chemistry is a field that includes extensive on-the-job training.

Finding experience

As with all careers, some experience certainly helps. Exposure is the main key, so begin to find ways to get some forensic laboratory experience. The DEA has a Student Career Experience Program designed to let students get an "up close and personal" view of life in a crime lab. Each of the DEA's nine labs has at least one such position. The labs generally develop relationships with local universities that suggest student candidates.

There are also opportunities on local levels. City and state governments run crime labs, and many offer opportunities to shadow local law enforcement officers. Some internships won't be advertised but are still available to interested students who seek them out. If you aren't able to set up any formal experiential learning programs, you could try to contact a forensic chemist and set up an informational interview to discuss his or her job. **IC**



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

TECHNICAL SKILLS REQUIRED

- Excellent experimental technique and a strong background in instrumentation and quantitative/qualitative analysis are the main technical skills used in this field.
- Being detail-oriented is crucial for a forensic scientist, since the slightest detail can make a huge difference in the interpretation of a sample.
- Critical thinking skills and problem solving skills are required to interpret the results of chemical tests and help determine exactly what happened at the crime scene.
- Forensic scientists often have to explain their findings to other law enforcement officers or provide expert testimony in a court of law, so excellent oral communication skills—even under duress—are required.
- Written communication skills are required for preparation of detailed reports that will stand up to intense scrutiny by both sides of the law.



Chemists in the Real World: Jared Roop

**M.S., CHEMISTRY
CRIMINALIST – TOXICOLOGY, MISSOURI STATE
HIGHWAY PATROL**

During his final year of graduate school, Jared Roop began an internship with the Missouri State Highway Patrol (MSHP) Crime Laboratory. He worked as a lab technician, performing various duties throughout the lab to help make each section run smoothly. About five months into his internship, one of the employees who worked in the Toxicology section resigned. Roop applied for the opening and was hired.

Roop received his M.S. in chemistry with a focus on analytical chemistry (specifically, electrogenerated chemiluminescence) from Missouri State University in May 2012.

What is your major responsibility in your current position?

I test biological fluids (particularly blood and urine) for the presence of alcohol and/or drugs and then write reports of my results that can be used in a court of law. The types of cases I work include DWI (driving while intoxicated), DUI (driving under the influence of drugs), violent crimes where alcohol or drugs might be a factor (i.e., homicide or sexual assault), and coroner cases involving a deceased individual. I am also occasionally required to attend court in order to report my results in front of a judge and/or jury.

Please describe your typical day on the job.

My days vary widely depending on what tasks I have to accomplish. Most of the experiments I perform take close to a full 8-hour day. After performing an experiment, the following one to three days could be spent analyzing the data, depending on the nature and magnitude of the experiment. After data analysis, I might spend half of a day writing reports for those cases. Every case that is worked is peer-reviewed; the flip side of this is that I spend probably 5–10% of my week peer-reviewing the work of my colleagues. Some days are completely filled with court-related work. This might entail studying the results in a case for which I have been issued a subpoena, as well as traveling to court in a location a few minutes to several hours away.

Typically, how many days each month do you spend away from your workplace on travel?

One to five days, generally related to testifying in court cases.

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

All of my confirmation experiments are performed on either a headspace gas chromatograph (HS-GC) or a gas chromatograph/mass spectrometer (GC/MS). These are the workhorses of our lab,



PHOTO: COURTESY OF JARED ROOP

and so understanding them and their software programs is critical. Also, being comfortable with Microsoft Office is important for the presentations we might give (PowerPoint) and the spreadsheets we keep for various reasons (Excel). Our set of mechanical pipets play a crucial role in the success of toxicology, so familiarity with them is key.

What do you like most about your job?

My job allows me to use the scientific degrees I have in a practical way. Every day I realize why I learned certain things in school — such as performing simple extractions — and I see those concepts applied to a real-world setting. I collaborate with my co-workers, as well as solve problems and complete projects on my own. It's interesting to see how many different processes can be used in presumptive testing [to determine whether a sample is either definitely not a certain substance, such as blood, or could be] and confirmative testing [done to confirm the results of presumptive testing]. I feel that my job matters in the sense that my reports and testimony can bring an unbiased truth to a legal situation that needs to be resolved.

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

Take advantage of any internship opportunities you have. Prior to interning with the crime lab, I had no idea of the appeal of forensic toxicology. Internships also help in building a professional network, which is also critical to success.

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

Court testimony is a major part of a career in forensic sciences that most people do not think about. Being able to communicate effectively and essentially teach what you do to a judge, jurors, and legal counsel who have little to no training in your field is very important. Scientists who enjoy explaining their work might find forensics more appealing than they originally thought. **IC**

SPOTLIGHT

Southern Connecticut State University

New Haven, CT

COMPILED BY ROBIN LINDSEY



Chapter president: Evan Turek **Chapter members:** 15–20 **ACS student members:** 8
Institution description: Small, public, suburban, 4-year

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

A: We hold elections each spring, and our new officers shadow officers finishing their term for the remaining four weeks of the semester.

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

A: We provide tutoring for students in the chemistry department, lead tours of the chemistry department, do chemical demonstrations for high school students, and serve as judges at the Southern Connecticut Regional Science and Engineering Fair.

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

A: Our chapter hosts an annual seminar speaker. This event is free to the public, and we provide light refreshments. Last year we hosted a seminar on global warming, led by a local meteorologist.

Q: What methods do you use to retain members from year to year?

A: Our student chapter pays ACS membership dues for our members. We provide pizza and drinks at every other meeting, and design T-shirts with a chemistry theme for members every year. Other activities that have kept members interested include bowling against the other science clubs and visiting a local brewery.

Q: What is your most successful fundraiser to date?

A: Goggle and notebook sales have been very effective fundraisers for several years. We visit chemistry lectures and labs during the first two weeks of the

semester to make sales. We buy these items in bulk and sell them for half the price that the university bookstore charges, while still making a decent profit.

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

A: We went bowling with other SCSU science clubs. We are also planning basketball and softball games against the chemistry faculty and a visit to the University of Connecticut chapter. Every year our chapter participates in the department's repast, a social dinner where we reserve a portion of a local restaurant. During this event, chemistry faculty give awards such as the top student in organic, analytical, inorganic, and physical chemistry, as well as the top graduating senior, top graduate student, and the student with the most positive outlook on life.

Q: Describe a challenge your chapter recently faced and how members overcame the challenge.

A: Recently our university raised requirements for obtaining semester funding. We divided the extra work among chapter officers. Our vice president, treasurer, and secretary did a great job in contacting the university repre-

sentatives to ensure the new requirements were met.

Q: Describe a special project the chapter recently did or is now doing.

A: Members are especially excited to play pickup basketball against the chemistry professors.

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

A: Many members visited NERM 2013, which was held right here in New Haven. We enjoyed seeing the many different research projects that occur across the nation's universities, as well as how many chemists are involved in the ACS. It opened our members' eyes to how much the ACS has to offer for young chemists. **IC**

Faculty advisor:

Adiel Coca, 4 years

Q: Why did you become a faculty advisor?

Coca: I enjoy interacting with students and there is no better way than this position.

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

Coca: I particularly enjoy getting to know students better by attending chapter social events.

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

Coca: Make sure the chapter has a smooth transition from year to year. Encourage new officers to learn from outgoing officers before they graduate. **IC**



The SCSU chapter uses a variety of methods to increase attendance at chapter meetings, including providing free food, paying ACS membership dues, and designing and providing member T-shirts each year.

PHOTO COURTESY OF SOUTHERN CONNECTICUT STATE UNIVERSITY

SPOTLIGHT

University of North Georgia

Dahlonega, GA

COMPILED BY ROBIN LINDSEY



UNG
UNIVERSITY of
NORTH GEORGIA™

Chapter president: Zachary Husk **Chapter members:** 47 **ACS student members:** 15
Website: www.facebook.com/groups/17795547856/?fref=ts **Institution description:** Small, public, suburban, 4-year

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

A: Our chapter, The Society of Chemistry Students (SCS), maintains a set of standard operating procedures and copies of all documentation created each semester. This allows for each new set of officers to access past officer information, making year-to-year officer transitions much easier.

Q: Do you have any unique positions?

A: SCS recently created task force leader positions. The positions allow for regular members to participate as leaders of small groups that work on specific projects or goals (i.e., local chapter interactions). SCS recognizes the importance of developing skills such as leadership, management, and communication, and these positions allow for our members to strengthen those skills.

Q: Is your chapter active in efforts to recruit prospective students to your university?

A: For at least the past three years during the fall and spring open house events, SCS officers and members have attended to invite students to join our chemistry department and SCS. We also attend other smaller social events to increase participation within our organization.

Q: What is your most successful recruiting method?

A: Our chemistry demonstrations events are very successful, with large attendance, so we always make a point to talk a little bit about the chapter and what we do. Normally the chemistry demonstrations spark an interest in prospective members and they attend more chapter events once they see that the organization welcomes those with a general interest in chemistry, as well as chemistry majors and minors.

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

A: Thanks to funding from Aeon Clinical Laboratories, SCS is able to provide member awards each semester. These awards include ACS memberships, graduate school application fee waivers, the Merck Index for Organic Chemistry Student Award, and others. Most of these awards are based on attendance, so our members stay involved with the organization so that they have a chance of receiving these awards.

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

A: Our organization stays in touch with other clubs such as Society of Physics Students, Beta Beta Beta, and Mu Epsilon Delta.

Although we don't always send out a direct invitation, the officers of these clubs know that there is always an open invitation to join SCS during any of our events. These clubs also extend the same invitation for SCS to collaborate and join their events. **IC**

Faculty advisor:

Ryan Meier, 1 year

Q: How did you become a faculty advisor?

Meier: The previous faculty advisor was promoted to another position at a different university. I enjoyed being involved with our chapter in my first year at the university and thought this would be a great way to stay involved with the chapter and our students.

Q: What challenges have you faced in your position?

Meier: The biggest challenges I have faced stemmed mainly from the fact that I am only in my second year of teaching here, and I have had to learn a lot about our policies and managing the chapter's finances.

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

Meier: Being able to get to know our majors and chapter members on a more personal level. I normally only teach general chemistry and inorganic chemistry, so I only see students when they first enter the program and when they are finishing. This gives me an opportunity to get to know our students better throughout their time in our program. It's very rewarding to see the students grow over the years. It has also been great to see the passion the students have for chemistry. **IC**



Each semester, the University of North Georgia chapter provides awards to members, and because most awards are based on attendance, members are highly involved in chapter activities.

PHOTO COURTESY OF UNIVERSITY OF NORTH GEORGIA

SPOTLIGHT

Utica College

Utica, NY

COMPILED BY ROBIN LINDSEY



UTICA

COLLEGE

Chapter president: Heather McManus **Chapter members:** 22 **ACS student members:** 20
Institution description: Small, private, suburban, 4-year

Q: Is your chapter active in efforts to recruit prospective students to your university?

A: We host a table during Accepted Student Days, where we talk about what we like most about our chemistry department and the biochemistry major at Utica College. We also show off a little bit with some demonstrations (liquid nitrogen ice cream, dry ice bubble tank), give departmental tours, and invite accepted students to shadow us in our classes.

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

A: At the Festival of the Arts event on campus, our student chapter has had a table where we showcase the event's theme through chemistry. This past year we had a table on chemistry and food, where we used molecular gastronomy techniques to make informative and delicious treats (deconstructed "s'more" pasta, fizzy fruit, inside-out sushi, liquid nitrogen ice cream). We had quite a few students become interested in our chapter after these events — who wouldn't want to be involved with a club that can make marshmallow noodles?

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

A: We host a "Will Think for Food" room during the study day before finals each semester

and stock the room with beverages, doughnuts, pizza, cookies, and chemistry tutors. Students can hang out, snack, and get their chemistry questions answered all day. Faculty also come by to snack and offer advice to the tutors or the students studying. More than 70 students participated this past semester!

Q: What is your most successful fundraiser to date?

A: Our bake sales, where we also sell liquid nitrogen ice cream, have been very successful. We also have raffled off one of the member-get-a-member periodic table throws (small blankets) that our advisors donated. Students were very excited about the chance to win a throw!

Q: Describe a special project the chapter recently did or is now doing.


A: We have worked with our analytical/instrumental chemist on outreach events with high school students, using the infrared and NMR spectroscopy. We developed, with a lot of help, a forensics-themed lab where students have to determine if the residue in the bottom of a glass is alcohol or ethylene glycol and if a suspicious white powder is a sleeping pill or Tylenol. We ran this lab with a group of students from the Oneida Indian Nation, and we all had a great time (by the way, between the ethylene glycol and Bena-dryl, it was murder)! 



PHOTO COURTESY OF UTICA COLLEGE

Creatively participating in their college's annual Festival of the Arts has enabled the Utica College chapter to more successfully recruit and retain members.

Faculty co-advisors:

Michelle Boucher, 8 years

Alyssa Thomas, 5 years

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

Boucher: When I came to Utica College, students were interested in reactivating our student chapter, which had become inactive a few years before. One of the most exciting parts to our reactivation was discovering that our chapter was founded in 1976 and our chapter documentation was signed by then-ACS-president Prof. Glenn Seaborg.


Q: What challenges have you faced in your position?

Boucher: One challenge has been how to change my advising style depending on the personality of each group of officers. Some years our students are extremely extroverted and self-motivated, while others have great ideas but need a little more confidence and guidance to help them along.

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

Thomas: I first met the student chapter during my interview at Utica College. From the moment I set foot on campus as a faculty member, they were inviting me to become involved. It was completely natural to join Michelle as a co-advisor of the chapter, and we have been having a great time with the students ever since!

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

Thomas: Getting to see our students interact with younger students through outreach is priceless. I love seeing how my passion for chemistry ignites something in them that they in turn share with others. 

Here's to a Great Mocktail Party!

How the Mercer University Student Chapter Kicked Off the Academic Year in Style

BY KEVIN JILES AND JENNIFER LOOK

Recruiting new members every year can be a challenge for student ACS chapters. In order to let more students know about the Mercer University ACS chapter and our activities, we organized a “Mocktail Party” at the beginning of the academic year.

We invited six different science-oriented student organizations to co-host our party. In the end, chemistry, biology, engineering, and pre-health clubs all participated, which attracted a broader audience than our traditional chemistry events. We also invited professors from these departments, so that students and instructors had a chance to get to know one another outside of a formal classroom setting.

Our event took place early in the semester, providing a relaxed, casual environment. Everyone got a chance to get to know their new classmates and professors, as well as the various campus clubs. Although we also participate in a university-wide student organization fair to introduce students to ACS, our smaller, science-focused Mocktail Party provided more chances for conversation with like-minded individuals.

Each student organization that participated in this event had a chance to display its creativity in designing a unique mocktail drink. Participants sampled crimson beverages served in iced syringes from the pre-medical society and fresh berry concoctions for a botanical treat. Meanwhile, our chapter added a chemical twist to our drinks by serving our “solutions” in food-grade test tubes. We offered yellow and blue fruit punch, in honor of the ACS colors (the recipes in the sidebar were adapted from Parents.com).



Kevin Bucholtz, chair of Mercer's chemistry department, discusses classes and undergraduate research opportunities with a group of students.

Easy, effective, and affordable!

At this event, students and professors were able to have meaningful conversations while enjoying delicious beverages and snacks. Students and professors alike gathered around tables, talked about classes, and discussed research opportunities. The evening was filled with smiles and laughter as students and professors made sustainable connections. Over 100 students and professors attended, and dozens of new people learned about our club and signed up for our mailing list. Furthermore, our chapter was able to spend less than \$100 on this large-scale event because of the number of organizations that were co-sponsors.

To gauge the success of our event and to improve similar events in the future, the participating organizations sent a survey to the professors who attended. Nearly every professor who attended gave us valuable feedback, much of which was positive. One professor even complimented our endeavors by saying, “Thanks for the wonderful idea and event!”

For next year, our chapter hopes to continue and improve this event. First, we plan to have event greeters. These volunteers will



Students and faculty members enjoy mocktails, snacks, and friendly conversations.



ACS MOCKTAIL RECIPES


Blue Tropical Twist Mocktail

- 1 gallon of blue fruit punch drink (such as Berry Blue Typhoon Hawaiian Punch)
- 25 oz. coconut milk
- 25 oz. pineapple juice
- 25 oz. ginger ale

Gold Mock Champagne

- 2 liters of ginger ale
- 46 oz. pineapple juice
- 64 oz. white grape juice

explain the event and pass out cards with the names and contact information for all of the participating clubs. The cards will also include two perforated sections that can be torn off. One of the sections will allow the students to vote on their favorite beverage of the evening (the organization with the most popular mocktail will receive a prize). The second perforated section will be a short survey/comment card. This would allow participants to easily express their opinions about the event before leaving.

If your organization is hosting a similar event, make sure to plan ahead. Finding co-sponsors not only cuts the cost for your club but also helps build useful relationships between student organizations. Getting to know the leaders of the other science clubs on campus helped us to coordinate other events this year. It was a lot of fun and a great way to attract new members. 



Volunteers fill plastic test tubes with Blue Tropical Twist solution at the ACS student chapter table.



Kevin Jiles is a senior biochemistry major at Mercer University and president of the ACS student chapter. He plans on attending medical school next year.

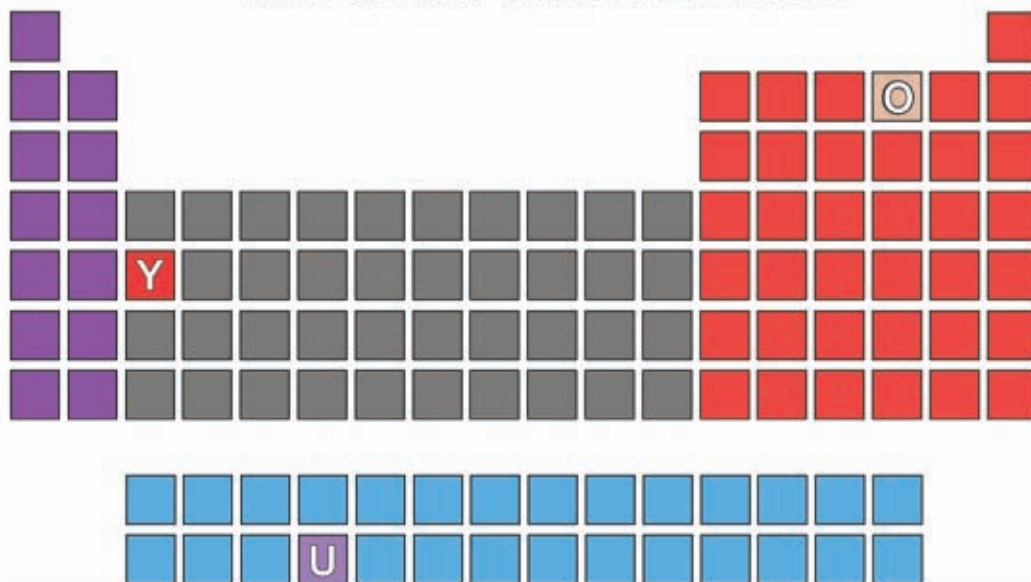


Jennifer Look is an assistant professor of chemistry at Mercer University and co-advisor of the Mercer ACS student chapter. When not organizing ACS parties, she is involved in environmental and organometallic chemistry research.



Blue Tropical Twist Mocktail (LEFT) and Gold Mock Champagne, served in plastic test tubes.

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