The Magazine for ACS Student Members
September/October 2009

in Chemistry

Examining the Options for Graduate School

ACS Chemistry for Life™

inChemistry

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SOS, INC.


KENT STATE UNIVERSITY, GRADUATE SCHOOL OF CHEMISTRY


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LINDA WANG

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Interesting Websites

ACS Graduate Students and Postdoctoral Scholars
Are you thinking about graduate school? Be sure to check out the online resources ACS provides for undergraduate students applying to graduate school, current graduate students, and postdoctoral scholars transitioning to careers in chemistry. **www.acs.org/grad**

Professional Science Master's (PSM) Degree Programs

The PSM degree enables you to obtain higher level skills in science and business, preparing you for science careers in business, government, or nonprofit organizations. PSM programs emphasize writing and communication skills, and most require a final project or team experience, as well as a "real-world" internship in a business or public sector enterprise.
www.sciencemasters.com/ScienceMastersHome/Students/tabid/53/Default.aspx

Public Speaking Tips from Toastmasters

If you have difficulty giving presentations or speaking in front of people, Toastmasters International offers a vast library of free information to help you become more competent and comfortable when speaking in front of an audience. **www.toastmasters.org/MainMenuCategories/FreeResources/NeedHelpGivingaSpeech/TipsTechniques.aspx**

Interesting Articles

Unprepared for Graduate School?
Jessica Letchford and Alison Wendlandt explore the challenging transition science students undergo as they adjust to the life and rigors of graduate school. *Yale Daily News,* April 22, 2009.
www.yaledailynews.com/articles/printarticle/28900

Tips for New Graduate Students: How Graduate School Is Different
Tara Kuther, Ph.D., in a series of articles on about.com, explores factors that are critical to being successful in graduate school — making the transition to graduate school, how graduate school is different, getting organized, and time management. **http://gradschool.about.com/od/transitions/Making_the_Transition_to_Graduate_School.htm**

Graduate School: A Stepping Stone to Your Career

By Joel I. Shulman


COURTESY OF JOEL SHULMAN

So, you've decided to go to graduate school in chemistry. Congratulations! But have you thought about why you are doing this? Yes, it's probably to advance your career as a chemist. But, what area will that career be? Academic? Industry? Government?

Many — or even most — first-year graduate students aren't sure what they want to do when they finish graduate school. That's okay; things will become clearer as your education continues. But you should be aware that there are opportunities available to you in graduate school that can both help you decide on your career path and facilitate your finding the job that's right for you.

If a career in academe is in your future, there are resources to help you in your quest. The ACS publication *And Gladly Teach* (available at www.acs.org) is an excellent resource for chemists considering academic careers. Many universities have a program called Preparing Future Faculty (www.preparing-faculty.org), which addresses the roles and responsibilities for research, teaching, and service in different campus settings.

If you become more certain you want an academic career, try to obtain experience in front of a class: being a recitation teaching assistant, replacing your advisor in a lecture class, or even teaching a course on your own. And consider taking an education course to learn more about pedagogy, assessment of student learning, and the technology available to the instructor.

The best way to learn about industrial research is to do it! Undergraduate internships offer a glimpse of what industry is like, but you can also consider doing a more advanced-level industrial internship while you are in graduate school. Many graduate advisors are open to letting you take three months to do this.

You'll learn how industry attacks problems in teams, how to communicate scientific information to people outside of your field, and how the basic research that is the hallmark of academe is reduced to practice by industry. You will also begin to establish a network of colleagues that will serve you well throughout your career. If you are interested in an industrial career, you might also consider taking a course in economics, management, or entrepreneurship while you are in graduate school.

As with industry, an internship in a government lab while you are in graduate school can go a long way to helping you understand this type of career. In addition to traditional laboratory opportunities, careers in science policy are available at government institutions.

For more information about careers in the federal government and in the private sector, go to www.students.gov or to www.acs.org/epic.

The bottom line is that graduate school is a time for learning, including developing the skills that will help you prepare for a most satisfying career! iC

Joel I. Shulman is adjunct professor at the University of Cincinnati, a position he began after a 31-year career at Procter & Gamble. He is a consultant to the ACS Office of Graduate Education and a workshop presenter for the ACS Department of Career Management and Development.

Share what's going on in your chapter! If your chapter would like to be featured in the ACS Student Chapter Spotlight, please contact Audley Burke at 800-227-5558, ext. 4565, or a_burke@acs.org.

COMPILED BY AUDLEY S.V. BURKE

Delta State University
Cleveland, Mississippi

Chapter president: Austin Childress
Number of chapter members: 23
Number of ACS student members: 8
Institution environment/ composition: Small, public, rural, 4-year institution
Chapter website: www.deltastate.edu/pages/2206.asp

Q What is your most successful recruiting event/method?
A We start the year with a pizza recruiting/informational party. We talk about the fun activities we'll do during the year and get input from students.

Q How else do you recruit members?
A We make flyers and post messages on bulletin boards to invite students to our meetings. This year we entered a campus pumpkin-carving contest as a group and exploded the design out of our pumpkin. It was exciting and fun.

Q How do you retain members?
A We keep meetings fun and offer activities for a wide range of students. Retaining members is easier in a smaller school like Delta State, where the students and faculty have a lot of interaction.

Q Does your chapter participate in National Chemistry Week?
A We celebrated last year's "Having a Ball with Chemistry" theme by honoring the Delta State student athletes taking chemistry classes. Each athlete was given a small gift and recognition in class.

Q Has your chapter presented research findings and/or chapter activities?
A Our chapter traveled to Nashville for a great SERMACS conference in November. Our members presented a research talk and two research posters, as well as an ACS student member chapter poster. We also participated in the liquid nitrogen ice-cream making contest, entering a tasty version of 'Mississippi Mud' ice cream.

Q How often does your chapter meet?
A We meet at least once a month to plan activities and discuss business.

Q What innovative methods of communication do you use?
A We use Facebook and text messaging to keep students informed about upcoming meetings.

Q What is your most successful fundraiser to date?
A Selling lab goggles to general and organic chemistry lab students has been our most successful fundraiser. This semester we are selling laminated study guides.

Faculty Advisor
Alline Somlai, 4 years

Q How did you become a faculty advisor?
A I volunteered for the challenge.

Q What challenges have you faced in your position?
A The most challenging aspect of being an advisor is keeping officers motivated and active as the semester progresses.

Q What has been the most rewarding aspect of your service as a faculty advisor?
A The most rewarding aspect is getting to know students outside of the classroom setting. Exposing students to a larger chemistry community helps them to realize all the opportunities that exist for chemists.

Q What inspired you to become an advisor? (Answered by Lacey Fitts, co-advisor)
A I have been involved with ACS in some capacity for the last 15 years, first as an undergraduate at Mississippi State with Bill Henry as my faculty advisor. He made it a lot of fun — bringing in chemists to speak with us, taking us to meetings, and even on a camping and white-water rafting trip. I stayed involved through graduate school, and last year I had the pleasure of advising for one of the charter ACS High School Chem Clubs. I'm very excited to be helping out this year at Delta State.

Q What has been the most rewarding aspect of your service as a co-advisor?
A The best part of my role as an advisor is helping students connect and develop a greater appreciation for chemistry. I try to keep it fun and make sure that they have many "nerd tools" in their arsenals. I want them to succeed and enjoy it.

DELTA STATE UNIVERSITY
Join in. Stand out.

DELTA STATE UNIVERSITY

Back row, from left: Tracey Peyton, Hayley Sligh, Kelly Price, Lindsey Huston, Tara Coleman, Austin Childress, Chuck Smithhart (faculty advisor), and Lacey Fitts (co-advisor).
Front row, from left: Kaitlin Ingram, Mary Ann Moore, Bonnie Williams, Hend Alboshaba, Elizabeth Rogers, Kristie Price, and Alline Somlai (faculty advisor).

Morgan State University
Baltimore, Maryland

Chapter president: Oyebola Oladeinde
Number of chapter members: 20
Number of ACS student members: 12
Institution environment/ composition: Large, public, urban, minority serving, 4-year institution

Q What methods do you use to retain members?
A One incentive is that we provide contacts for internships and job opportunities. We also try to involve the new recruits in all activities.

Q How do you ensure a smooth officer transition?
A After the election at the end of the spring semester, the new officers are briefed on what was done during the previous year and ideas are exchanged to see what can be improved for the next year.

Q How did you celebrate Earth Day?
A We celebrated Earth Day by working with our local ACS section in a community clean-up of nearby Herring Run Park.

Q In what ways does your chapter give back to the community?
A Our chapter participates in the Morgan Undergraduate Chemistry Help (MUCH) Program, in which our members go to nearby elementary schools once a week and lead a class in fun chemistry experiments to popularize science.

Q Is your chapter active in your institution's recruiting efforts?
A We assist at two university open houses per year, where we staff a chemistry table with demos in the arrival hall, and also serve as guides in the chemistry department.

Q What are your most popular chapter activities?
A Our most popular activities are field trips to scientific facilities


MORGAN STATE UNIVERSITY

such as the National Cancer Institute and the state forensics lab. We also have many speakers representing a wide variety of occupations in the field of chemistry; some of the speakers come from graduate and professional schools, and some are recent alumni who describe their career paths.

Q Do you collaborate with other clubs on campus on activities?
A Once or twice a year we collaborate with Bio Club, sponsoring a speaker of common interest.

Q How do you communicate with chapter members?
A E-mails and flyers have been the most effective communication tools. Our recent creation of a Facebook page for our chapter offers additional tools, such as discussions boards and the possibility of posting photos. Also, our president sends out a mass text message as a reminder shortly before meetings.

Q What is your most successful fundraiser to date?
A We raise most of our funds selling candy and sodas. This year we held a Valentine's Day raffle for a restaurant certificate and two goody baskets. This generated a lot of publicity for the club, as well as raising money.

Faculty Advisor
Louise Hellwig, 15 years

Q How did you become a faculty advisor?
A I became faculty advisor when the former advisor, my office mate, was looking toward retirement and asked if I would be interested in advising the chapter.

Q What challenges have you faced in your position?
A Some years there are many active members who show a lot of initiative and some years, for whatever reason, there are not so many involved members. The trick seems to be to build on the momentum when there's a particularly active set of officers and get freshmen and sophomores involved at that time, to give them experience under enthusiastic leadership.

Q What has been the most rewarding aspect of your service as a faculty advisor?
A The most rewarding aspect is developing more rapport with the students than is possible simply as their classroom teacher. I also love it when students get some great internship or employment opportunity as a result of our chapter's activities — for example, because of connecting with a visiting speaker.

Q What advice can you offer those new to the advisor position?
A Keep in touch with your officers and make sure the executive board meets regularly. Ideas flow when even a few officers get together. IC

ACS Program Helps

Students Develop Their Inner Leaders

By Eric R. Stewart

STRONG LEADERSHIP SKILLS REQUIRE A COMPLEX VARIety of management expertise and human insights that are not generally taught in colleges and universities — let alone in the typical chemistry class. Too often, leadership skills are obtained by trial and error, over the course of a long career and, most nerve-wracking of all, without a safety net.

Fortunately, as a student member of the American Chemical Society, you have a safety net. By participating in community outreach and holding officer positions in your student chapter, you can begin acquiring and testing your leadership skills in a friendly environment. In addition, taking courses through the ACS Leadership Development System or being selected to attend the ACS Leadership Institute can provide you with formal, proven leadership training, enabling you to bypass the frustrating trial-and-error phase.

Seizing opportunity

This past January, 15 student members who were current or former chapter officers received leadership awards to attend the 2009 ACS Leadership Institute in Fort Worth, Texas. Heather Harteis, now a senior at **St. Francis University**, was one of the scholarship recipients. Initially, she was excited to be chosen to go to Forth Worth as an ACS student member — although, she recalls, "I was nervous because this was the first conference I would be attending without my advisor or other students."

Why did she and 34 other students apply for the opportunity? The Institute teaches valuable skills that will help you not only in your role within your student chapter, but that will also continue to provide value as you progress in your career. "No matter your level of professional development," says LaTrease Garrison, assistant director of Local Section and Community Activities, "there's something in it for everyone."

"Without having a clue what to expect," Harteis remembers, "I went forward and tried to discover what it meant to be a leader. I took this as an opportunity to expand beyond my comfort zone to meet as many people as possible, and to learn their stories as chemists." Other student participants describe similar experiences. "The Leadership Institute was jam-packed with opportunities to meet a variety of people," recalls James Hodges, now a senior at **Clemson University**, "ranging from local section executives to the President of ACS."

ACS STAFF

Student leaders pause to pose with ACS president Tom Lane (center) and Nancy Bakowski from the ACS Undergraduate Programs Office (far right).

Inspiring others

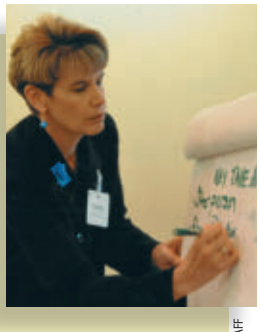
The Institute helps attendees acquire skills in leading volunteers, running committees, and inspiring peers to do their best. As a volunteer, you know how important developing this skill is to your chapter. After all, your fellow chapter members, like you, are all volunteers who are donating their time. You can't motivate them with financial rewards, so you need to find other ways — which is just one of the topics on the agenda at the ACS Leadership Institute.

Networking

The Leadership Institute also provides opportunities to expand your professional network by enabling you to meet actual chemists, chairs of ACS technical divisions, and current and past ACS presidents. "It was a great opportunity to meet different types of people all involved in chemical careers," explains Jessica Lee.

Victoria Treadaway, now a senior at **Linfield College**, was also a quick study in the value of networking. "This was my first chance to meet chemists in both industry and academia from across the country. It helped to give me perspective on the vast reach of the American Chemical Society."

About next year's Institute



ACS STAFF

The 2010 ACS Leadership Institute, to be held January 22-24, 2010 in Fort Worth, TX, will feature a dynamic mix of regional and national representatives, including student members, incoming technical division leaders, volunteers in local sections who are about to take on leadership roles, regional meeting planners, as well as new national committee chairs and YCC award winners.

According to Martha Lester, director of professional advancement at ACS, the 2010 ACS Leadership Institute is continuing the tradition of bringing together groups that used to meet separately for leadership training. "Previously, we offered as many as eight separate conferences for specific audiences, and the conferences focused on management skills," explains Lester. "In 2008 ACS launched the Leadership Institute, a transformed version of the leadership conferences, offering our volunteer leaders both management and leadership training." More event details and registration will be available in November at www.acs.org/leaderdevelopment, so check back often!

Apply for a Leadership Award

The ACS Education Division plans to offer a limited number of leadership awards to pay the costs for student leaders to attend the 2010 Leadership Institute. While all student chapter leaders may apply for these awards, preference will be given to sophomores and juniors.

After the application deadline (tentatively scheduled for early November), the Task Force on Undergraduate Programming will review all applications received and make selections. Award-winning students will be notified by the end of 2009 to allow time to make travel plans.

Information will be sent to all chapter faculty advisors about the application process. If you're interested, please ask your faculty advisor for details, or check the website at www.acs.org/undergrad.

The networking opportunities not only enabled the student participants to better understand ACS; the skills and information they gleaned along the way were also professionally applicable. "Scientists were eager to answer questions students had about various fields of interest in chemistry," Treadaway recalls. "I learned a lot about many different chemical careers, ranging from pharmaceuticals to selling instrumentation and everything in between." Lee adds, "The skills I learned at the conference have helped me be a better leader, and I have already been using these new skills to help others." The students were able to gather a wealth of advice about the varied career paths other Institute participants had taken — something that is especially important to young chemists who are trying to decide what to do in the world.

Being appreciated

For student participants, attending the Leadership Institute is also an eye-opening lesson in how valued they are as members of the Society. When **Tennessee Technological University** senior Dan Roubik arrived at his hotel in Fort Worth, he immediately ran into the chair-elect of his local section and was surprised at how enthusiastic the chair-elect was about getting to know the student members. Roubik recalls, "The more people I met, the more I realized how eager everyone was to get to know and try to help us younger chemists. I particularly enjoyed getting to meet present and past presidents of ACS. They went out of their way to interact with the students on both a professional and casual level."

Developing skills

Students attending the Leadership Institute participate in two facilitated courses from the Leadership Development System to round out their experience at the event. "As a result," says Garrison, "student members can use their experience at the Institute not only to help lead their chapter, but to also get a head start as they prepare to compete for jobs and placements. It really raises the return on one's investment in membership with ACS."

For Hodges, some of the most useful information came from the series of classes that he and other student members attended. "We learned ways to positively deal with opposition as leaders, and also various methods to motivate volunteers — not only in theory, but in practice as well. I feel as though I took away new leadership skills from the Institute that I previously had never tapped."

Sharing knowledge

The benefits students receive from leadership training continue to be reaped in chapters across the U.S. Treadaway, for example, is making sure to convey everything that she learned about ACS to her fellow student members. "Before attending the Leadership Institute, I had no idea how the structure of ACS worked," Treadaway admits, "and I have gained a greater respect for the professional society that I am a part of. I wanted to pass this, and everything else that I learned, to my fellow student members."

The true impact of the three-day Institute will one day also extend beyond the student chapter. Molly Croteau, now a senior at **Keene State College**, believes the 2009 ACS Leadership Institute and the many fascinating people that she met, "will be something I remember throughout the rest of my academic years as well as the rest of my life with any career path I choose to follow."

If you're interested in learning more about the ACS Leadership Institute, or in any of the other offerings within the Leadership Development System, please visit www.acs.org/leaderdevelopment. We hope to see you at next year's ACS Leadership Institute! IC

ERIC R. STEWART is a freelance writer and editor based in Arlington, VA.

SCIENCE ON SATURDAYS

Answering an SOS through Outreach

By Pamela M. Leggett-Robinson, Nichole Powell, and Albert Russell

HOW DO YOU judge whether an outreach program is successful? For the **Tuskegee University (TU)** ACS student chapter and its collaborative outreach partner, SOS, Inc., the true litmus test for success comes on Saturday mornings. If elementary and middle school students and parents are willing to wake up early on Saturday mornings to come to school and do science, that's a sure sign you're doing something right. That is the main goal of the SOS Program, helping young students get excited about learning science.

Know your target audience

SOS is an organization founded by four chemistry professors at TU, whose mission is to increase science literacy of students and parents and boost interest in science and science careers among K–12 students in the Black Belt region of Alabama. This is a region that includes some of the poorest counties in the U.S., which historically has had poor access to education. However, the SOS program is working to change the prospects of children in this area by enhancing their science experiences and by providing scientific instruction at a grade-appropriate level. According to Tiffany Taylor, a first-year medical student at **Baylor University** and former member of the ACS TU student chapter, motivating students and parents to participate in a Saturday morning science program isn't as difficult as it may seem. "Our program is offered in a disadvantaged area," Taylor explains, "and the participants are happy to get involved. We chose Saturdays because the kids start off the day fresh and alert. The end of the school day wouldn't work, because the kids would be too tired to pay attention, and holding it during a weekday wasn't viable either, as course schedules presented too many conflicts for TU students and faculty."

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Make it valuable

One reason the SOS program is successful is that, because all the activities align to state standards, the students are familiar with the scientific concepts since they have already been covered in class. The SOS program activities supplement the classroom lessons and provide the students with hands-on activities that give a real-world application to the concepts.

Another reason for the program's success is that chapter members and SOS have developed a great "trickle-down" marketing strategy that begins with the teachers. The SOS team contacts the school administrators and individual teachers and offers to provide the program at their schools. Then they follow up with the selected school administrators and teachers for a date and activity selection. The SOS team works closely with the ACS student members in preparing them for the designated activity. Students perform several "run throughs" of the activity prior to the scheduled program. Teachers not only send home flyers describing the program, but also encourage parents and students to attend the planned events. Taylor notes, "It's easier to get the parents involved if the teachers buy in to it. Then, the parents and the teachers talk to the kids and get them excited."

Set a goal

The SOS team contacts the administration or teachers to get a rough estimate of how many students to expect and the grade level of the students, and they try

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The anatomy of an SOS Outreach Program

Preparation for each actual event begins one-and-a-half weeks prior to the activity. This time allows for inventory recap, purchasing of materials and supplies, and an activity "run-through."

Each workshop follows this schedule:

8:30 – 9:00 am	Check In/Morning Snack
9:05 – 9:20 am	Demonstration
9:20 – 9:30 am	Break Out Time/Bathroom
9:35 – 11:00 am	Science Fun!!
11:05 -11:20 am	Wrap Up/Giveaways (All Students)
11:25 –11:35 am	Break
11:40 am – 12:00 pm	Lunch

All food is provided, and the only requirement of the school is to provide the students and the locale. All SOS program workshops are performed on-site.


SOS, INC.

to anticipate any difficulties that might arise.

By offering the program, SOS and the ACS TU student chapter are hoping to foster within children a lifelong appreciation of chemistry and its relevance to everyday life. Ultimately, by exposing the students at a young age to the different areas and professions of chemistry, more students will aspire to attend college and ultimately enter a field of chemistry.

Share in the benefits

The children aren't the only benefactors of this collaborative program. Undergraduate chemistry majors gain valuable exposure to the K–12 education system. The SOS program experience has interested students in National Science Foundation Graduate STEM Fellows in K–12 Education (GK–12) programs. Institutions with GK–12 programs provide fellowships for graduate students to work with the K–12 system, acquiring additional communication and interpersonal skills needed for professional and scientific careers in the 21st century.

Tahirah Farrer-Bradley, a GK–12 fellow who graduated from TU, is also a former ACS student member who developed a love of working with children while volunteering with the SOS program. She discovered she had a talent for presenting science in a way that was understandable to children of all age levels. Tahirah graduated with her master's in chemistry this past summer. She plans to enter the field of science education.

ACS student chapter members at TU gain skills in teamwork, critical thinking, and leadership through the SOS program by collaborating with professors and working with the K–12 teachers. They help to put together the program booklets, develop and perform science demonstrations, and learn to work with children. They also created a safety video that is shown at the beginning of each program.

One piece of advice that Taylor offers to other chapters seeking to expand their community outreach efforts: "Don't be afraid to reach out. People are appreciative and supportive when students want to give back to the community." IC

LEARN MORE ABOUT SOS

SOS, Inc. was co-founded in 2006 by Pamela M. Leggett-Robinson, department chair of science and associate professor at Georgia Perimeter College-Dunwoody Campus; Nichole Powell, assistant professor at TU; Albert E. Russell, assistant professor at TU; and Barbara Rackley, assistant professor and advisor of the TU ACS student chapter.

SOS received an innovative project grant from ACS Auburn Local Section, in both 2006 and 2007. The SOS program also received donations from Publix, Target, Lowes Stores, Kimberly Clark.

Since its inception, SOS has expanded to incorporate hands-on experiences for grades 9–12. In addition to providing the fundamental program, they also offer Girl and Boy Scout science badge activity days, teacher workshops, and research experiences for high school students and teachers.

To date, the program's themes have included

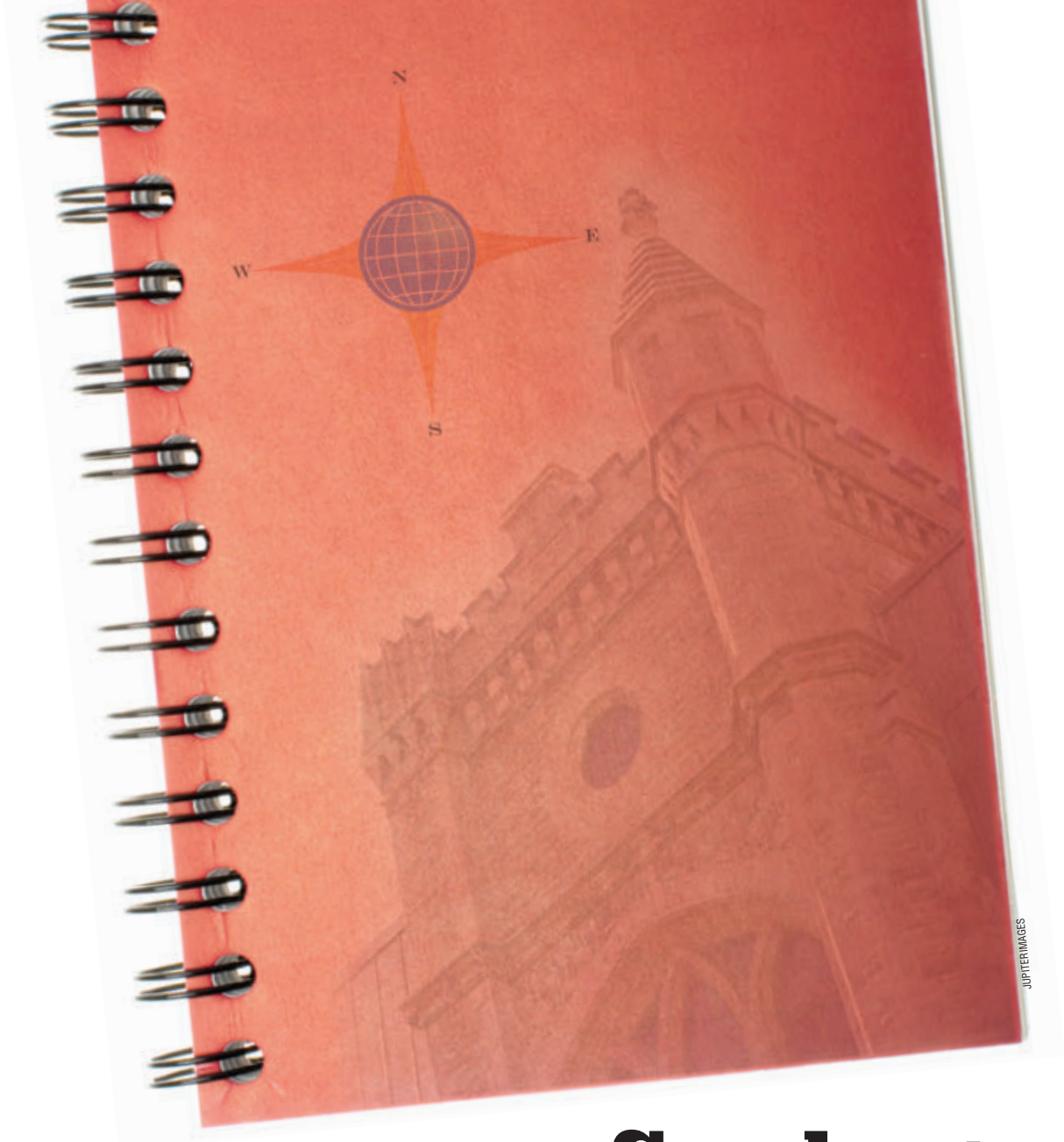
- polymer chemistry (milk plastic),
- optics (the color of light),
- acids and bases (food chemistry),
- insulation and static electricity (chemistry in the home),
- chromatography (what color is in my marker?),
- Newton's laws (balloon rockets),
- Pascal's law (balloon lifts), and
- solubility (edible crystals).

So that more children can have an opportunity to experience the program, SOS is seeking to expand its outreach efforts and to form partnerships with other local sections in Georgia and other ACS student chapters. To form these partnerships, local sections with student chapters are asked to contribute a $3,000-3,500 per year for operating costs. ACS student members are simply required to assist in developing activities for designated schools and to participate in the fun!

For more information, please contact SOS at Pamela.Leggett-Robinson@gpc.edu or at 770-274-5077.



Pamela M. Leggett-Robinson is program director of SOS and science department chair and associate professor of chemistry at Georgia Perimeter College-Dunwoody Campus. **Nichole Powell** is curriculum specialist for SOS, and assistant professor of chemistry at Tuskegee University. **Albert Russell** is legal and public relations consultant for SOS and assistant professor of chemistry at Tuskegee University.



JUPITERIMAGES

Not Your Average Graduate School Survival Guide

By Naresh Sunkara

AFTER DEFENDING MY DISSERTATION AND SENDING IT FOR publication, I thought about my graduate school experiences over the past five-and-a-half years, sat down, and began writing this article. I thought I should write about some of those experiences to help others avoid some of the common mistakes I and others have made.

But before you start thinking that this is yet another one of those millions of articles about succeeding in graduate school, think again, this article is different, because it is based on recent and real experiences. I have read some of those articles, many of which are not based on actual experiences. This article is.

Knowing what to expect

One thing that hasn't changed about graduate school, and may never change, is the fact that graduate school is tough! The professors and postdocs you work alongside may share with you some horror stories about their own experiences in getting their Ph.D.s, and by the time you finish your degree, you may have a few, too. A lot of those experiences can be

avoided by simply understanding what you are walking into. While I have seen several people succeed, I have seen a lot more drop out just because they were not adequately prepared. The fact is, only about 50% of the people entering graduate schools (in all programs) successfully complete their degree.

Before deciding to attend a graduate school, you need to come to terms with the fact that you will be committing five to six years of your life to learning. This is the average time to get a Ph.D., at least in the U.S. You may experience changes in your lifestyle, including having to live with limited financial resources and spending less time with family and friends. You will probably get less sleep, yet have an even greater need to stay focused. You must have a drive to work hard to achieve your goals and be willing to try new things. And you must be an independent thinker.

I've categorized graduate school into stages and have provided a few experiences I and my friends in graduate school had, and the lessons we learned along the way.

Tackling the first year

Once you have decided which graduate school to attend, the next couple of years are going to be critical. The sooner you finish your coursework, the better. In most schools, you have to pass the courses with a grade of B or better. You need to be aware that the coursework is going to be much more intense than during your undergraduate years. In addition to taking classes, most graduate students will also be teaching either laboratories or discussion sections. This can take up a lot of time, and necessitates good time management. You will need to balance time for your own studying with teaching and grading responsibilities, as well as your new job working in a research laboratory.

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Selecting a research advisor

One thing I would recommend to any graduate school aspirant is to consider schools that allow for rotations in different labs. This will let you experience different labs for a period of six to eight weeks — time that you can use to decide if you want to be a part of that research group.

If you are considering programs that don't have a rotation system, be sure to do a lot of groundwork. Not only speak with potential advisors, but talk to various students about the focus of the research, their experiences with the advisor, other group members and the lab culture. Remember that your first instinct about a lab or an advisor might not be the right one. Be patient! The advisor–student relationship is one major factor that will decide how smooth your ride is going to be.

Remember that not every good principal investigator is also a good mentor. Try and choose ones who are passionate about mentoring. Most advisors don't get trained to be mentors; more likely, they have been trained to be good scientists.

Also, consider your personal preferences. Are you a hands-on or hands-off person? Do you prefer working in a large or small group? What type of reputation would you prefer your advisor to have in his or her field, etc.?

Demonstrating your qualifications

Different schools call their qualification exams by different names and use different formats, but the goal is generally the same. In plain terms, they test your basic understanding of chemistry, generally in your field of specialization. Ask students who have passed their exams (and also those who didn't) about the format of their exams, as well as the hurdles they faced and their preparation techniques. Speak with your advisor about your strengths and weaknesses and work out a plan of action. It's also a good idea to talk to professors in the department about their exams, since they can give you a good idea of how to prepare. This is a way to develop a good rapport with faculty, and will assist you in deciding which professors you want to have on your dissertation committee.

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Becoming part of a community

The biggest mistake many graduate students make is spending so much time on their research that they isolate themselves from their lab mates, fellow graduate students, and postdocs in other labs and departments. Sometimes, they do this unintentionally because they are so busy, but other times they do so on purpose to accomplish their goals. Either way, isolating yourself can be detrimental to your progress.

Your fellow graduate students and postdocs can become part of your social circle and professional network. They can help to keep your morale up and help you find solutions, especially when you hit roadblocks in your research. It might not be easy, but maintaining an ongoing conversation with these peers will definitely help in the exchange of useful scientific ideas. Developing a community of support can also vastly improve your chances of graduating, because it can

provide you with valuable support when you are writing your dissertation and give you the drive you will need to finish it.

There is a growing concern about the sense of community that is lacking in many graduate schools across the country. Isaac Colbert, the retired dean of graduate students at MIT, recently spoke at a research conference at the University of Maryland Baltimore County about how he had taken on this issue at MIT, and how his efforts had brought about positive changes in the outlook of graduate students.

So try to reach out to fellow graduate students at various stages of their degrees, and take time to build relationships so that you don't become lost in your own world of research. You will be amazed to know how many of your peers went through the same hardships that you are facing. They might not always be able to help you directly, but sometimes, all you need is for someone to tell you, "IT'S ALL RIGHT!" That's human nature.

I was recently talking to a Ph.D. student who had started a family during graduate school and had to balance graduate work and family, which takes a lot of time management. This is something that prospective graduate students should consider if they are planning to start a family during graduate school. Some schools are supportive of this idea, and accommodate the students with paid leave, or may provide grading-type duties.


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So, try and be a part of a community and, if one hasn't formed yet, become a catalyst, start one! You will be amazed at how many other graduate students would like to be a part of it. Also, try and form some kind of support groups while writing your dissertation — a phase in which you will definitely want some support and drive to finish writing. The university counseling services may also provide focus, so don't hesitate to seek their help as well.

Working with your dissertation committee

The professors on your dissertation committee can help you immensely. The interactions that graduate students have with their committees might differ from school to school; however, my personal feeling is that many graduate students don't realize the kind of support that they can get from their committee members, whom they often see only at their exams or committee meetings.

Of course, professors are very busy — but it falls on you, the graduate student, to frequently update your committee members about your research progress and seek their advice when you encounter major difficulties with your projects. Ask your advisor about the feasibility of setting up a meeting at least once every three months. The committee members and your advisor can definitely provide the right direction. This way, you won't have unpleasant surprises at either your committee meetings or exams. Also, you will have to depend on these professors for letters of recommendation at the end of the degree. The better your professors know you, the stronger their letters will be.

Preparing an exit strategy

Determining when the research has reached an appropriate point for you to graduate and having an exit strategy after finishing your research are very important. This is another place where your advisor can play a major role.

It will help if you and your advisor talk throughout your graduate school tenure about what research you need to do and your various career options after finishing your Ph.D. If your advisor doesn't start this conversation, you should. After all, your advisor is your primary point of contact with the rest of the scientific world.


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Some advisors may say that you are on your own after finishing your degree. Others might want you to stay at the institution longer, because you are a good student who does good research. So, be careful while selecting your advisor. When researching graduate programs, ask other graduate students about the kind of assistance their advisor provides. Networking at conferences and other venues is an excellent way to glean this information.

These are a few of my thoughts about surviving graduate school. Hopefully, everything will go well for you — but chances are, you will encounter a few roadblocks along your graduate school journey. Your motivation, focus, balance, community, hard work, and perseverance are the tools you will need to get through graduate school. IC

Naresh Sunkara received his Ph.D. from the University of Maryland Baltimore County in December 2008. He is presently teaching at Montgomery College in Maryland and will be taking up a postdoctoral position at The University of California, Berkeley, in the fall.

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Research Projects:

KENT STATE UNIVERSITY, GRADUATE SCHOOL OF CHEMISTRY

A Matter of The Right Chemistry

By Kelly Boatright Sexton

NOT SO LONG AGO, I WAS A GRADUATE STUDENT slogging away in the laboratory, with no light at the end of the tunnel. The project that I had been working on for the past two years was a high-profile project that aimed to open up a whole new field for my laboratory. It was the type of project that seems to draw young idealistic graduate students in droves: exciting, risky … and going nowhere.

A big problem was that my project was outside of the core expertise and focus of my lab, with the end result being that I wasn't able to benefit from the guidance of the more senior graduate students and postdocs.

Fortunately, midway through my third year in graduate school, a postdoc in my lab proposed that I work on a small side project that would answer some questions that had resulted from his work. At first glance, my new project did not seem to be terribly exciting, but by this point I just wanted to get my hands on publishable data. The thought of standing in front of an almost completely data-free poster at yet another conference, talking about experiments that I planned to do (once I got the project working) was more than I could bear. Since I had little to lose except my time, I decided to give it a try.

With my new side project, I was working in an area that fell within the core competencies of my lab for the first time in my graduate career. Additionally, the postdoc who had proposed my side project was an advocate with a vested interest in my success. I received excellent technical advice from those around me and began churning out data in no time. As it turned out, the results that I generated were exactly the opposite of what we had anticipated, and my side project quickly became my main project. My research led to a controversial hypothesis that eventually became the cornerstone of my thesis and the springboard to several first-author papers in respected journals.

Fortunately, my story had a happy ending, and I was able to graduate in just under five years, despite the fact that not one single experiment from my first two-and-a-half years of research ended up in my thesis. But we have all heard horror stories of the seven- or eight-year dissertation and, while you can never completely control for this scenario, you can take precautions to avoid having it happen to you.

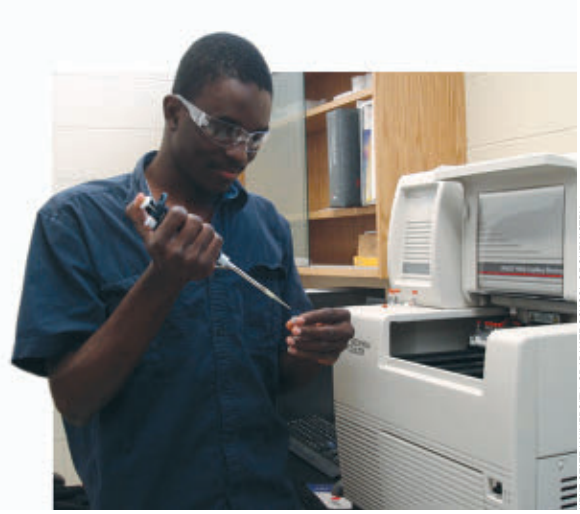
Take care in selecting a lab

For starters, it is crucial that upon entering graduate school you select the right lab. Do your research! Find out how many graduate students your potential advisor has trained. Where are they now? How long did it take them to get their Ph.D.s? Give them a call and find out first-hand what they thought of the lab. Of course, if you are considering training with a new professor, you can't rely on their past record, but you can inquire about their expectations of a graduate student working in their lab. If a potential advisor expects a minimum commitment of six years in order to complete your graduate studies, you should at least know that up front.

Evaluate potential projects

Once you are in the lab, you should choose your main project carefully. Ideally, this would involve hours of discussion with your advisor and other members of your lab, during which your technical skills and scientific aspirations are considered and carefully matched with potential projects.

In reality, the scenario may fall somewhere between your advisor telling you exactly what project to work on, or your advisor taking off for a few weeks to go on the conference circuit while you figure it out yourself.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Either way, if you have any choice in the matter, I would advise against selecting a risky project, particularly one that is of interest to no one in your lab except you and your advisor. It is great to be independent as a postdoc, but your job in grad school is to graduate!

The most efficient way to gain new technical skills and develop into an independent researcher is to learn from the more experienced members of your lab. By having a project that is synergistic with the overall research focus of the lab, you are setting yourself up for success.

Take on side projects

A wise researcher once told me, "You should always be doing 10 things at once — one of them will work!" While I don't advise overextending yourself, I do think it is a good idea for most graduate students to have a side project or two. In fact, if you have decided not to heed my warning regarding risky main projects, having a safe side project is even more crucial. In addition to providing a backup plan should your main project fizzle, a side project can allow you to pick up additional skills and techniques that you might not have encountered otherwise.


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I would recommend that your side project be one that is almost guaranteed to produce publishable results; try to pick the "low hanging fruit" of your lab. Often, a great opportunity for a side project is created by an exiting graduate student or postdoc. If possible, spend a few days chatting with them before they leave. Buy them coffee, take them out to lunch. You might be amazed at the new directions that they had in mind for their project that they will not be able to follow up on. An alternative source for side project leads is to read the dissertations of some of the recently minted Ph.D.s from your lab.

An additional benefit of a side project is that it will also allow you to retreat from your main project during periods of frustration. When you feel like setting your lab notebooks on fire, you can take a break and work on your side project for a few days (or weeks). Sometimes this can allow you the distance to frame the problem in a new way, resulting in a better approach when you return to it.


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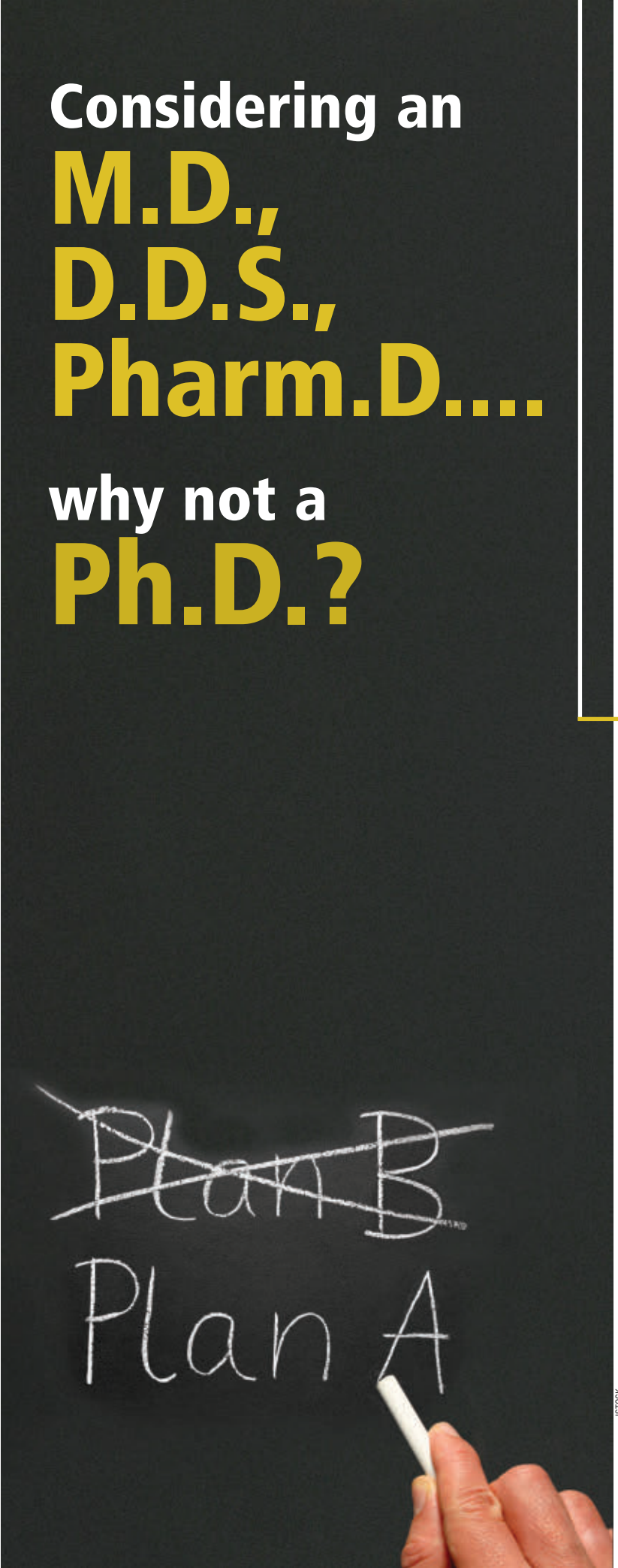
Make lemonade out of lemons

Finally, what should you do if you find yourself stuck with a project that is turning out to be a lemon? I would advise sitting down with an experienced and objective researcher and going over your progress to date. If they can't advise you on a new approach, perhaps they can help you to identify portions of your data that could be turned into a small publication. It may not be the splashy paper that you had envisioned, but even a modest publication can help you to gain the closure you need in order to move on.

Sometimes you just need to cut your losses. After a point, you do not learn anything more from beating your head against the wall over and over again with a failing project. Time spent on a project that is later abandoned is not wasted. Those years spent laboring at the bench while nothing worked? You were learning how to do research and gaining the skills that would allow you to take advantage of the opportunity when you finally had a project worthy of your devotion. iC

Kelly Boatright Sexton obtained her Ph.D. from the University of California, San Diego. She completed postdoctoral training at Stanford University in 2005 and is currently a Senior Licensing Associate in the Office of Technology Transfer at North Carolina State University.

Considering an M.D., D.D.S., Pharm.D.... why not a Ph.D.?



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By Michael A. Massiah

WHAT ARE YOU PLANNING TO do after graduation? Like many students majoring in the chemical sciences, you may be thinking about applying to medical, dental, veterinarian, or pharmacy school. Going to graduate school may not be your plan A, or even plan B. But maybe that's because you aren't aware of the educational, economic, and personal opportunities that await those who earn a Ph.D. in the chemical sciences. Earning a Ph.D. can be the best decision of your life — and here's why you should consider it as your "plan A."

Components of a Ph.D. program

REQUIREMENTS FOR OBTAINING A PH.D. VARY WITH DEPARTMENTS. FOR larger departments, the requirements can vary even within the different specialties, e.g., organic chemistry or physical chemistry. The websites of these departments should outline their requirements and list contact information. Do not hesitate to request a specific outline of the requirements.

Some programs require students to take qualifying exams at the beginning, mostly to gauge the students' knowledge and determine whether some courses can be waived. In some graduate programs, students rotate for eight to ten weeks in two or three labs, based on their research interests. If you opt for one of these graduate programs, simply select the labs whose research most interests you. Rotations allow you to determine whether the lab research matches your interests, and whether you can get along with lab personnel. This opportunity also allows you and the mentor to evaluate each other. By the end of your first year, you will have settled on a research advisor.

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Many graduate programs also require their graduate students to work as a teaching assistant for at least one year, usually with a lab course. This is a great opportunity to obtain useful teaching experience.

The second year involves selecting three to five faculty members with expertise in your research area to serve on a committee that will guide and monitor your academic and research progress. There will be an "exam" in which you present a paper, write and present a review article, or undergo an oral examination. If you fail here, most programs will give you a second chance. The next committee examination will usually be at the end of your third year, where you will present your research project, outlining what you have done and what additional research you intend to accomplish for your dissertation. The committee will ensure that you understand your project and material associated with it. Unless you have made poor progress, this "exam" usually functions to provide guidance and encouragement. The committee will approve your dissertation plan, the defense of which can be anytime after this, depending on the body of research you have accomplished.

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Ph.D. = freedom and flexibility

Being taught new material in the classroom can be awe-inspiring and exciting. Making scientific discoveries that become that new classroom material is priceless. One of the most exciting rewards of being a Ph.D. researcher is making scientific discoveries based on experiments you design. It's a career where you are in charge of your ideas, your vision, and your interests. You are a leader, teacher, mentor, and policymaker, whether you choose to work in the private sector or in the academic environment. If this appeals to you, then pursuing a Ph.D. will begin the journey.

A Ph.D. affords you the freedom to pursue research topics that you envision, and the flexibility to find jobs throughout the country or abroad. You have the freedom to choose your place of work based on how you want to contribute to the world.

You can opt for a career in academia as a lecturer, researcher, or both. Aside from academic positions, chemists can find jobs in the semi-conductor industries, hospitals, forensic science labs, water-quality and treatment plants, patent offices, and polymer, fertilizer, petrochemical, chemical, and pharmaceutical companies. Chemists also have the flexibility to be involved in jobs involving biochemical knowledge such as biotechnology, biomaterials, biofuels, and medicine. As an analytical chemist, you can work in water-quality control because you believe in improving and securing the well-being of people. You can influence the future direction of science policy with a position in government. The possibilities are many.

The $139,517 question

Did you know that, according to the Association of American Medical Colleges, the average educational debt owed by medical school graduates of the class of 2007 is $139,517? On the other hand, earning a Ph.D. degree in the chemical sciences is 'free,' in that financial support is provided in the form of tuition remission and stipends for research or teaching assistantships, often offered by the department or individual labs. Scholarships from government institutions such as the National Science Foundation or National Institutes of Health can also boost the amount of the stipend. However, while graduate programs try to accommodate student needs, it should be noted that the stipend — which is not a salary — might not be sufficient to live on, especially in bigger cities. You may have to find roommates, get support from your family, or take out student loans. However, the debt incurred is still significantly less than that of a medical student.

No matter which path you choose, potential salaries increase the higher your degree level. As a Ph.D., you enter at a higher position within a given employer, and have an increased chance for career advancement. Salaries for Ph.D.-level scientists with degrees in the chemical sciences can rival other professional careers (e.g., medical doctors, pharmacists, and veterinarians). The range in salaries will depend on the cost of living for spe-

cific locales. The salary range for Ph.D. chemists in pharmaceutical, chemical, and other industrial companies, as well as in government organizations, tends to be higher than the salary ranges for positions at colleges and universities. If you factor in the debt of obtaining some other professional degrees, the salary for Ph.D. scientists can be considered very good.

All that being said, salary should not be the dictating factor in whether to pursue a Ph.D.; it should be your interest in science and your drive to change the world.

Personal rewards

Though seemingly intimidating, pursuing a Ph.D. can be fun, with exciting learning opportunities. You can be a part of transformative research in nanotechnology, biotechnology, instrument development, renewable energy, genetics, structural biology, and drug synthesis, to name just a few possible fields. All of these areas lead to improving the quality of people's lives.

CLAFLIN UNIVERSITY

There are also journal clubs, seminars, discussions with seminar speakers, and socializing with fellow students and faculty. You may also be supported to attend and present your research discoveries at numerous national scientific meetings in cities across the U.S. At these conferences, you will meet and network with colleagues from across the globe who can become lifetime friends and contacts. Importantly and perhaps more rewarding, is doing the research that you love and publishing your discoveries, and using this knowledge to inspire future generations.

Ready, set, go apply

WHEN APPLYING TO GRADUATE SCHOOL, SELECT AT LEAST TWO GENERAL RESEARCH areas that interest you. Consider geographic locations where you'd like to live for the next few years. Then search online for institutions that have departments offering programs in your interest areas. Deciding between an academic or non-academic career is not important at this point. While choosing a well-known institution is important, the research impact of a department or even a specific lab within the department is more important. Some institutions have separate or combined chemistry and biochemistry programs. Do not limit yourself to areas in your undergraduate major; a chemistry major can select a biochemistry program, for example. Applications to three or four schools will likely provide you with the opportunity to "comparison shop" for the best fit for you.

After identifying a suitable program, download an application or complete an online application on the department's website. Deadlines will vary from mid-fall to mid-spring. However, applications can be sent at any time to many institutions. Simply contact the department by e-mail or phone and inquire about submitting an application. Most departments generally require your transcript, GRE scores, two or three letters of recommendation, and a personal statement. Consider writing faculty members with whom you may want to work a letter, explaining why you find their research interesting; this can increase your odds of being accepted.

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Some schools will offer an interview. If so, read a few of the research articles by your preferred faculty beforehand. Even if you don't understand all of it, you will have a few extra intelligent questions to ask.

If you did not get into the school of your choice, try again with other schools. In the end, a Ph.D. is a Ph.D. — no matter where you earn it — and doors will open for you after earning one.

When you earn a Ph.D. degree, you know that you have given and achieved the best and that you have the ability to grow intellectually. Whether you teach the next generation, develop the next more powerful semi-conductor, or design a novel drug, you will be contributing to the greater good. Going to graduate school can be the best academic time of your life, leading to a bright future. iC

Michael A. Massiah is an assistant professor in the Biochemistry Department at Oklahoma State University. He obtained his B.S. degree in chemistry from Haverford College and his Ph.D. in chemistry and biochemistry at the University of Maryland Baltimore County. His current research focuses on NMR structural studies of proteins associated with cellular differentiation.

Rxn's and SIn's

In this issue, the Reactions and Solutions blog offers tips to help you succeed in graduate school.

COMPILED BY LORI BETSOCK

➔ BLOG

Graduate School? It Starts NOW.

Your road to success in graduate school starts NOW, in your final years of undergraduate study. During my senior year, after much consideration, I dropped a second semester of biochemistry so that I could devote more time to completing a research project that I had started during the previous summer. This undergraduate research project was critical to my early success in graduate research. I was already familiar with many of the techniques and instrumentation. I also had a taste of the atmosphere of graduate school and had observed graduate students. I saw how the lazy ones attracted the ire of their advisor, and how praise was heaped upon the hard-working and productive students, even when they only achieved small victories toward their overall goal.

In some ways I am still paying for that dropped biochemistry course. Biochemistry is by far the weakest subject for me. When my class entered graduate school, we took ACS standardized examinations in each of the five sub-disciplines of chemistry. Guess which test was my lowest score? The GRE subject test in your field, even if it is not required for admission into your intended graduate program, might be a good indicator of where you still need more work.

Don't overlook these last few years of undergraduate study as time to prepare for obtaining an advanced degree. Whether you know it or not, you are preparing yourself for graduate school right now. Good luck!

Posted by Burt

Taking a Non-Traditional Master's Pathway

My first foray into graduate school didn't work. Originally, I thought I should go directly from undergraduate, to maintain the momentum of school. Little did I realize that I had burnt myself out as an undergraduate. I was more interested in going out and letting loose than studying. After the first year of being in a traditional grad program, I was finished. I decided to move on and enter the field.

After working three years in the pharmaceutical industry, a coworker introduced me to the world of online programs. I figured a traditional program didn't work out so well for me, I already had a steady job (with a steady paycheck), and wasn't eager to completely change directions, so I would give it a try. That's when I enrolled in a graduate program in drug chemistry.

Distance learning programs are a great option for those who are already in a comfortable (and stable) working environment and may not be quite suited for (or interested in) a traditional program. One of the best things about online programs is that you aren't required to "attend" class at a certain time so, when you sign on to do your schoolwork, you are more focused and engaged then if you were required to attend, say, a lecture at 8:00 am. Online programs do require a high degree of self-discipline and time management; but the rewards, such as flexibility, are definitely worth it.

Posted by Phil

Choose Your Graduate Advisor Wisely

An undergrad professor once told me, "Choose your advisor wisely — it's the most important decision you'll make. You only get one Ph.D." I was perplexed; I figured choosing my wife would be far more important. But he retorted, "You can always get a divorce!"

In graduate school, I initially joined a new assistant professor's lab. There were great benefits in starting a new group. I helped put together and set up the entire lab and launched a research project from the very beginning. While the research was making good progress, the initial proposed research was not what I had imagined when I first discussed the project with my advisor. I could not see myself continuing on for another four years of graduate school, let alone the rest of my life. Another professor agreed to take me, and the chemistry department allowed me to switch groups.

I now understand my undergraduate professor's wisdom about choosing an advisor. It's important that you enjoy the research, can communicate with your advisor, and fit in well with the group dynamics. These factors synergistically can either make a graduate experience miserable or positive and rewarding.

It's certainly acceptable to realize that graduate school is not for you, or to be unhappy with other aspects of your graduate education. Don't be afraid to take action. Graduate school shouldn't be an enduring period of misery.

Posted by Stephen

Following the Road Less Traveled

Upon finishing my bachelor's degree in chemistry, I was really unsure if graduate school was the right path for me. While I always enjoyed chemistry, I wasn't sure I had the drive or confidence to complete a Ph.D. I decided to work in industry for a couple of years, and then in a college setting for another year, to gain some perspective on possible

career paths. I quickly realized how much I enjoyed working with college students and helping them see that chemistry can truly be an enjoyable and rewarding subject. With my purpose restored, I entered into a Ph.D. program, hoping to ultimately obtain a faculty position.

Once I started graduate school, I had no idea the adventure that was in store for me. At the end of my second year, I made the very tough decision of transferring schools to follow my advisor, who had left to become the department chair at another institution. Following the "road less traveled" was initially the toughest thing I had ever done. However, it turned out to be an excellent decision. I formed a great relationship with my doctoral advisor, completed my degree in a reasonable time frame, and obtained a faculty position at a liberal arts institution after graduating. Now, I can impart my enthusiasm for chemistry to all who take my classes.

The field of chemistry is constantly in need of good educators. If you think you want to teach at the college level one day, then graduate school is the first step towards achieving that goal!

Posted by Will

Tips for Moving Up

I didn't know in high school or undergrad which career path I wanted to take, but I knew that I wanted to "move up." After I learned that not only is a chemistry Ph.D. "free" but also that I could earn a stipend, graduate school was an obvious choice. I chose my research group based on my interests and the recommendation of my undergraduate advisor. This was one of the most important decisions of my career. My Ph.D. advisor continually inspired me, and this inspiration helped me work through difficult times. I also knew from undergraduate research, teaching, and internships that I liked variety in my work, specifically a mix of synthesis, characterization, analysis, etc. I looked for a similar mix in my first job. I'm thrilled now to be able to contribute technically while also managing people, developing new projects, and teaching. The value of marketing and communication skills really stands out. Balancing these with good technical skills will give you an edge in the workplace.

I encourage you to carefully observe people who you can learn from, and always ask questions. It's an efficient way to learn and grow.

Posted by Jennifer

A Missed Opportunity: Industrial Internships

Looking back at my graduate school experience, five years after receiving my Ph.D., I wish I would have taken the opportunity to participate in a summer industrial internship. As an organic chemist in the pharmaceutical industry, only now do I understand how little I knew as a graduate student about life in industry. Talking with your chemistry department alumni who are currently working in industry provides insight into their experience; however, these conversations cannot provide the same understanding as being in the situation. Internships provide valuable information for those deciding what to do in life after graduate school.

While I certainly learned much technical expertise from talented colleagues at the start of my career, I feel that I would have greatly benefited in graduate school from a better understanding of the work environment and research process in industry. Although the thought of taking time away from your research may make both you and your advisor cringe, the efficiencies gained from learning the risked-based decision-making approach used in industry could provide great benefits in prioritizing experimental goals and objectives. In retrospect, I believe that an industrial internship would make a valuable addition to the graduate school experience.

Posted by Chris

Burt Hollandsworth is assistant professor of chemistry at Harding University in Searcy, AR. He obtained his Ph.D. at The Ohio State University in 2004.

Phil Machonis earned a master's degree at the University of Florida in 2008 and is a research associate with Mars Botanical, a division of Mars, Inc.

Stephen Canham is a third-year graduate student at the University of California, Irvine. His research is focused on the total synthesis of alkaloid natural products.

Will Case is director of introductory chemistry labs and general chemistry coordinator at the University of Richmond. He received a Ph.D. from Rensselaer Polytechnic Institute in 2007.

Jennifer Sample received a Ph.D. from UCLA in 2001 and is currently a senior scientist at the Johns Hopkins University Applied Physics Laboratory.

Christopher J. Ciolli is a scientist in process chemistry at Ricera Biosciences, LLC in Concord, OH. He earned his Ph.D. at the University of Wisconsin–Madison in 2004.

ISTOCK

By Lisa B. Marshall

As the show host for "The Public Speaker: Quick and Dirty Tips for Improving Your Communication Skills," I regularly receive questions from my listeners. Perhaps the most commonly asked question goes like this …

Most of the time I feel that I am reasonably articulate, but on occasion my sentences get sprinkled with the flavorless additives "um," "uh," and "er." I know it is a habit from childhood that I just can't seem to shake. Could you please help me?

Here's how I always respond: You know, like, OMG! Although it's difficult to completely rid yourself of "credibility killers" in your speech (e.g., like, so, you know, right, uh, ah), it's actually pretty easy to reduce them.

Technically, they are called disfluencies. According to Wikipedia, "disfluencies include any of various breaks, irregularities, or utterances … words and sentences that are cut off mid-utterance, phrases that are restarted or repeated … grunts or unrecognizable utterances occurring as 'fillers.'"

Um … you are not alone!

For those with trouble is in this area, you are not alone. Spontaneous conversation is notoriously disfluent. In fact, according to researchers, disfluencies sometimes represent up to about 20% of the "words" in everyday conversation. In fact, if you listen to President Barack Obama when he is "off teleprompter," you'll notice that he struggles with this, too.

Unfortunately, excessive use of filler words can have a significant negative impact on listeners. In 2009, when Caroline Kennedy announced her candidacy for Senator of New York, she used many "ums" and "ahs" during one particular interview with the *New York Times*, and she said "y'know" 139 times. You probably saw the YouTube video where she was mocked with a buzzer — 30 times in less than two-and-a-half minutes!

Research suggests that utterances of "ah" and "um" in spontaneous conversation signal an impending pause. However, when you are in front of an audience, long pauses in your speech give the impression that you are unprepared. Which, of course, is a bad thing.

As a public speaking coach, I notice filler words the most when people are nervous or are presenting a topic they are not comfortable with. In fact, for some people it's the only time these filler words show up. Unfortunately, that's usually when clear and confident communication is most important!

How to reduce credibility killers

How can you lessen your use of disfluencies? Again, I am suggesting reduction versus complete elimination.

Prepare and practice

My first suggestion is to prepare and practice as much as possible so that you can become more comfortable with the material. Practice, via video, is perhaps the single best way to relax and become more comfortable with your presentation.

That advice will help you in general; however, perhaps the most important step toward more *fluent* speaking is to become aware of your distracting speech habits.

The fastest way to find out if you have trouble in this area is to ask a close trusted friend (or pay a public speaking coach).

Another option is to post your practice videos to YouTube and wait for comments. But that might take too long, and you'd need to prepare yourself for potentially harsh comments.

Record

I think the BEST way is to record yourself. If you are comfortable with technology, I suggest using free audio editing software (Garageband on Mac and Audacity for PC). With this software you can see your words in audio format. For a more simplistic solution try Drop.io — with this you can call a phone number and it will record your voice. Then you can send the link to your "drop" (the recording) to your friends or teachers to review.

Even if you choose to not send your recording to other people, you'll be able to hear so much that you wouldn't normally hear just by playing back your recordings several times. It's important to listen specifically for your disfluences — maybe even go ahead and make a game of it. First just list them and then start counting them. If you are counting past three or four, you'll know you have a problem.

Listen

If recording seems like too much effort, just focus, for one full week, on listening — *really* listening — for distracters when you talk. Some experts like to suggest putting tiny "um" and "ah" stickers on your computer or cell phone as reminders. I recently attended a training session and the expert suggested wearing a rubber band around your wrist. The idea was to snap the rubber band every time a disfluency occurred.

After a week of listening, or recording and listening, (or worse, a week of snapping your wrist with a rubber band), you'll become acutely aware of your specific problems. And that's exactly what you need: awareness. You need to be able to hear your disfluencies in your mind before you blurt them out. I can't stress this enough. You need to be able to hear every time you use a filler word, or you won't be able to fix this problem.

Pause

If you've done your homework, you'll know when one of your credibility killers is just about to escape from your mouth. Then, all you need to do is to keep quiet. Of course, slowing down will also help. I know, it's easier said than done!

At first you may have awkward pauses in your speech, but that's still better — actually far better — than speech peppered with "likes" and "ums." I'm convinced President Obama is working on this very issue, and that's why you often hear long pauses in his speech. With patience and practice, eventually the pauses get shorter. With time, you'll be more fluent and have fewer "ums" and "ahs."

It's worth it to take some time to record and listen to yourself. Using filler words can have a significant negative impact.

Um, you know, don't let, like ums and ahs, kill your credibility, y'know? IC

It's not just an American thing

Did you know that people around the world fill pauses in their own way? My husband is a native Spanish speaker and when I was first learning Spanish I would listen closely while he was speaking with his mother. I couldn't understand why he used the word "esto" so frequently. I thought I just didn't understand. But it turns out, that for Spanish speakers, that's a common disfluency.

Then I researched it more, and found out that in Britain they say "uh," Hebrew speakers say "ehhh," and the Turks say "mmmmm." The Japanese say "eto" (eh-to) and "ano" (ah-no), while Mandarin speakers say "neige" (NEH-guh) and "jiege" (JEH-guh). In Dutch and German it's "uh, um, mmm." In Swedish it's "eh, ah, aah, m, mm, hmm, ooh, a, and oh." (Hmm, this is starting to sound a bit X-rated!)

ISTOCK

The most important step toward more *fluent* speaking is to become aware of your distracting speech habits.

Lisa B. Marshall is a communication expert for chemists. Visit her website at www.lisabmarshall.com.

5 Tips for Improving Your Classroom Volunteering Efforts

By Adam M. Boyd

IN CASE YOU HAVEN'T BEEN told recently, let me be the first to remind you: you are awesome. You are an undergraduate student dedicating yourself to the study of chemistry so that you can go on to solve challenging problems and improve people's lives.

You are unfazed by advanced organic synthesis; you're a member of the largest scientific society on planet earth, and you have that certain *je ne sais quoi.*

You're kind of a big deal

But here is something you might not know: no one — not even your mom — thinks you are cooler than do elementary school students. Simply by virtue of being yourself, when you enter an elementary school classroom, you are at the peak of Mt. Awesome.

So why am I telling you all of this? Well, it's because your status as the coolest person alive makes you uniquely qualified to serve as an ambassador for science in early education. Science is already exciting and fun, but when it's presented by you, it reaches new heights in the minds of young students everywhere. And, unfortunately, students across the country don't get enough exposure to chemistry at an early age.

Whether you are a seasoned pro or are just beginning to consider the possibility of volunteering your time in a local classroom, here are five tips that will help you to maximize the impact of your visit.

PHOTO BY ACS STAFF

TIP 1

Safety first

When you are choosing demonstrations, disposing of waste materials, and addressing students, safety must always be your first priority.

Be sure to choose demonstrations that are safe. Collaborate with the teacher to make sure that any special reagents you bring into the school are allowed, and that all necessary paperwork has been completed.

To ensure safety, plan to take all waste from your visit with you when you leave the classroom. This will prevent students from having any contact with possibly harmful waste.

Make sure to bring enough goggles with you for each of the students, the teacher, and (of course) your team. This will keep the students safe, and it will also help to drive home the idea that students should wear goggles when they are conducting experiments. By modeling this behavior, you'll also be increasing the coolness factor exponentially.

TIP 2

Coordinate efforts

While any volunteer effort has the potential to be impactful, you can maximize the success of your visit by coordinating with the teacher of the classroom you'll be visiting before your arrive.

Before your presentation, it's a good idea to talk about what the teacher might like you to cover, as well as what you feel comfortable presenting. You can also discuss the layout of the classroom, whether or not you'll have access to a sink or electrical outlets, and how many student admirers you should expect.

Knowing the exact number of students you'll be presenting to will help you to make arrangements for the proper amount of materials you'll need and the number of student members from your chapter you'll need on your team to give the presentation.

It's also important to remember that you will be working with the teacher, not displacing him or her. Remembering that the teacher is your partner is important in making your visit a successful one. The teacher is the expert when it comes to classroom management … and you will be the expert when it comes to science. By working together, you can make sure that students don't get sidetracked by playing with the slime they've just made and that they're able to focus on the next activity or important announcement.


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TIP 3

Make it relevant (and fun!)

You can super-charge your volunteer efforts by tailoring your demonstrations to coincide with the topics and standards the teacher is covering around the time of your visit. This way, your presentation can help to explain or build upon specific areas of the curriculum.

Also, keep in mind that teachers have tons of material they're expected to cover. If you are looking for an opportunity to volunteer in a classroom, and explain that you can customize your demonstrations to the unit they are studying, you are certain to increase the number of teachers vying for your services.

To the extent that you can, try to see yourself as a guest expert, who is helping a teacher to drive home some crucial points about a particular topic. If you can do that, you'll help the students to really understand the science material they are studying, and you'll help the teacher by giving them access to resources and content knowledge they might not otherwise be able to access.


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Of course, all that doesn't mean you can't make it fun! You know how to choose activities and demonstrations that kids will enjoy. Just be sure to factor in time for explaining the key points the teacher would like to emphasize. (See tip 4.)

To your captive audience, you will be a walking example of the fact that chemistry can be both fun and interesting. Try your best to strike that balance when you volunteer in a classroom.


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TIP 4

Explain it

Whenever you perform a demonstration or lead an activity, make sure that you explain the chemistry in ways that students can understand. This is another instance when collaborating with the teacher before your presentation can be helpful. If you know the topics the students are covering, along with the kinds of vocabulary words they're expected to know, it will be tremendously helpful in terms of framing your explanations in a way that will be appropriate.

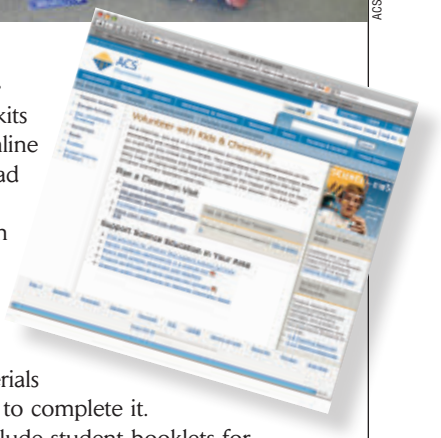
Alternately, if you've discussed with your teacher or school representative that your visit is going to be an extension of what the students have learned in class, be sure to introduce new concepts clearly and avoid overfilling your presentation with too many main points.

If you are introducing new content, you may also consider taking the initiative to make sure that the teacher has resources to help explain what was covered after you leave. You might decide to write up a brief outline of the activity and an explanation of the science behind it. This would help to extend the impact of your visit long after you leave.

TIP 5

Take advantage of ACS resources

If you are planning a visit to a classroom, you can take advantage of some pre-developed resources produced by ACS. Currently, there are three new Kids & Chemistry kits available online for download that walk you through a sample lesson, explicitly listing all of the materials you'll need to complete it. The kits include student booklets for the students to use during the lesson and even a teacher's guide that explains the chemistry behind the activities, so that the teacher can field questions from students after you leave. You can access information about the kits by visiting the Education section of the ACS website at www.acs.org/educ-ation. Click on the "Volunteer with Kids & Chemistry" link and then select "Make Your Own Science Activity Kits." All the booklets are offered as PDF downloads. You'll also find links to other Kids & Chemistry activities under the "Sample Activities Section."



If your student chapter already dedicates a good portion of its time to volunteering in local classrooms, keep up the great work. But if you've never thought about volunteering in a classroom, I hope you will consider it. Kids in your local area always stand to benefit from more interaction with awesome people like you. inC

Adam M. Boyd is a Senior Education Associate in the ACS Office of K–8 Science.


SALT LAKE CITY CONVENTION AND TOURISM

The Buzz from the Beehive State

By Chris Pollock

AGAINST THE SNOW-covered backdrop of the Traverse and Oquirrh Mountains, the 237th ACS National Meeting was held in Salt Lake City, Utah. In this awe-inspiring setting, more than 4,000 undergraduates attended the meeting.

We arrived in the Beehive State and were tantalized by the balmy T-shirt weather. But the next day, a dose of reality set in, as we dug our parkas from our suitcases and braved the snowy, frigid weather to attend the first day of undergraduate program events. For many of us, this was our first excursion into the professional world of chemistry. This was our opportunity to network with peers from other student chapters; rub elbows with some very well-known chemical scientists and explore some of the recent advancements in our chosen science.

To help students navigate through the literally thousands of symposia and other events offered during the meeting, the undergraduate program kicked off with a mini-orientation event titled, "Making the Most of Your First ACS Meeting." The undergraduate program chair, John Kaup, and a panel of undergraduates gave a short presentation about everything there is to do at a national meeting — and even managed to throw in a game of Salt Lake City trivia! Free breakfast and ACS goodies were also on hand to help prepare everyone for the busy upcoming day.

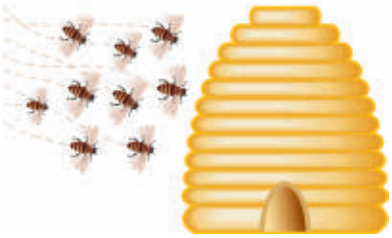

LINDA WANG/C&EN

Students from Eastern Oregon University participate in the Chem Demo Exchange.

Grad school, anyone?

After getting some great advice on navigating through the maze of events at the meeting, we headed for the graduate school events. One of the most popular events at national meetings, "Graduate School Reality Check" featured a presentation by Steven Stuart from Clemson University on the nuts and bolts of graduate school — how to get in, stay in, and ultimately, graduate with a Ph.D. in chemistry. Following the presentation was a Q&A session between the audience and a panel comprising current graduate students and representatives from academia and industry.

A networking social with representatives from various graduate school programs came next, giving everyone the chance to learn more about individual graduate programs throughout the U.S. and Germany. This event, combined with the Graduate School Recruiting Breakfast, helped demystify the graduate school application and selection process, and also gave us a better idea of what it takes to make it through graduate school.



Outreach and demonstrations

Between the Reality Check and lunch came the "Chemistry Demo Exchange," an event where student chapters performed their favorite demonstrations using only household chemicals. Dozens of chapters participated, and hundreds of visitors perused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Participants test new NCW experiments.

the booths to learn about the demos, network with other student members, and get ideas for student chapter outreach events.

Speaking of outreach, many chapters participated in the "Community Outreach Workshop." This event offered some great tips for chapters to spice up their demo shows to elementary students. It also included a lot of suggestions of how to "go green" while bringing chemistry to the community at large.

Getting technical

The first half of the technical talks of the undergraduate program took place during Sunday afternoon, and focused on the fields of chemistry that converge with art and archaeology. Talks ranged from how chemistry could be applied to archaeology in the eastern Mediterranean to the use of spectroscopy in the analysis of artwork. All three speakers did an amazing job of demonstrating that chemistry is, by its very nature, interdisciplinary — and also that it certainly isn't limited to traditional lab work. One presenter even did field work on Mediterranean islands!

The second symposium focused on nanotechnology and included presentations on gold and silver nanoparticles, the relation of nanotechnology to biology, and the properties and applications nanostructures. The nanotechnology presentations were all excellent and covered an exciting area of chemistry that is literally advancing every single day!

For a job well done

Probably two of the biggest highlights for many student chapters were the student chapter awards ceremony and undergraduate social. The awards ceremony, as always, was a high-energy event honoring the chapters that had earned Outstanding, Commendable, Honorable Mention, and Green Chemistry awards for the 2007–2008 academic year. This year's ceremony even boasted a keynote lecture from ACS President Thomas H. Lane! Immediately following the awards ceremony was the undergraduate social co-hosted by Westminster College, University of Utah, and Utah State University, where everyone had a chance to relax and unwind with plenty of food and music after a long day.

LINDA WANG/C&EN

Spelman College students participating in the Chem Demo Exchange.

Old favorite, new twist

One popular tradition at all national meetings is the undergraduate poster session, which puts a spotlight on undergraduate research. For the first time ever, however, all of the posters were presented during the same session, so well over a thousand students, faculty, and other meeting attendees filled the convention center on Monday afternoon! With everyone in the same place at the same time, the poster session was a perfect chance to not only present research, but also to explore the exciting research being done by other undergraduates and share ideas with others.

Buckyballs

This year's eminent scientist was Luis Echegoyen, professor of chemistry at Clemson University and director of the chemistry division at the National Science Foundation. Echegoyen's talk focused on "buckyballs" — C60, the third allotrope of carbon — and all of the fun and exciting applications and research going on with them. A terrific speaker, Echegoyen managed to make the lecture informative and humorous and provided a great overview of buckyball research.

Going corporate

Directly following Echegoyen's lecture was the "Corporation Associates Roundtable Reception." It provided an opportunity for undergraduates to sit down and talk directly with people who have successful chemistry-related careers in government and industry, and to get advice about school, internships, and job searches. This event was a real eye-opener about the many career paths that are available to those who have earned a chemistry degree. On top of it all, great food was provided as well, giving us even more reason to be there!

The national meeting — and especially the undergraduate program — in Salt Lake City was an enormous success, quirky weather and all! The events provided great opportunities for undergraduate students to network with their peers and scientific professionals. In the span of two days, we learned about graduate school options and talked to recruiters, attended technical symposia to learn about the latest advances in chemistry, and explored Salt Lake City itself. There really was something to appeal to everyone's interests.

If you didn't manage to get to Salt Lake City, however, all is not lost. Start making plans now to attend the next spring national meeting in San Francisco to experience everything that an ACS national meeting has to offer first-hand! iC

Chris Pollock received a B.S. degree at Clemson University and will be attending Cornell University in the fall in pursuit of a Ph.D. in inorganic chemistry.

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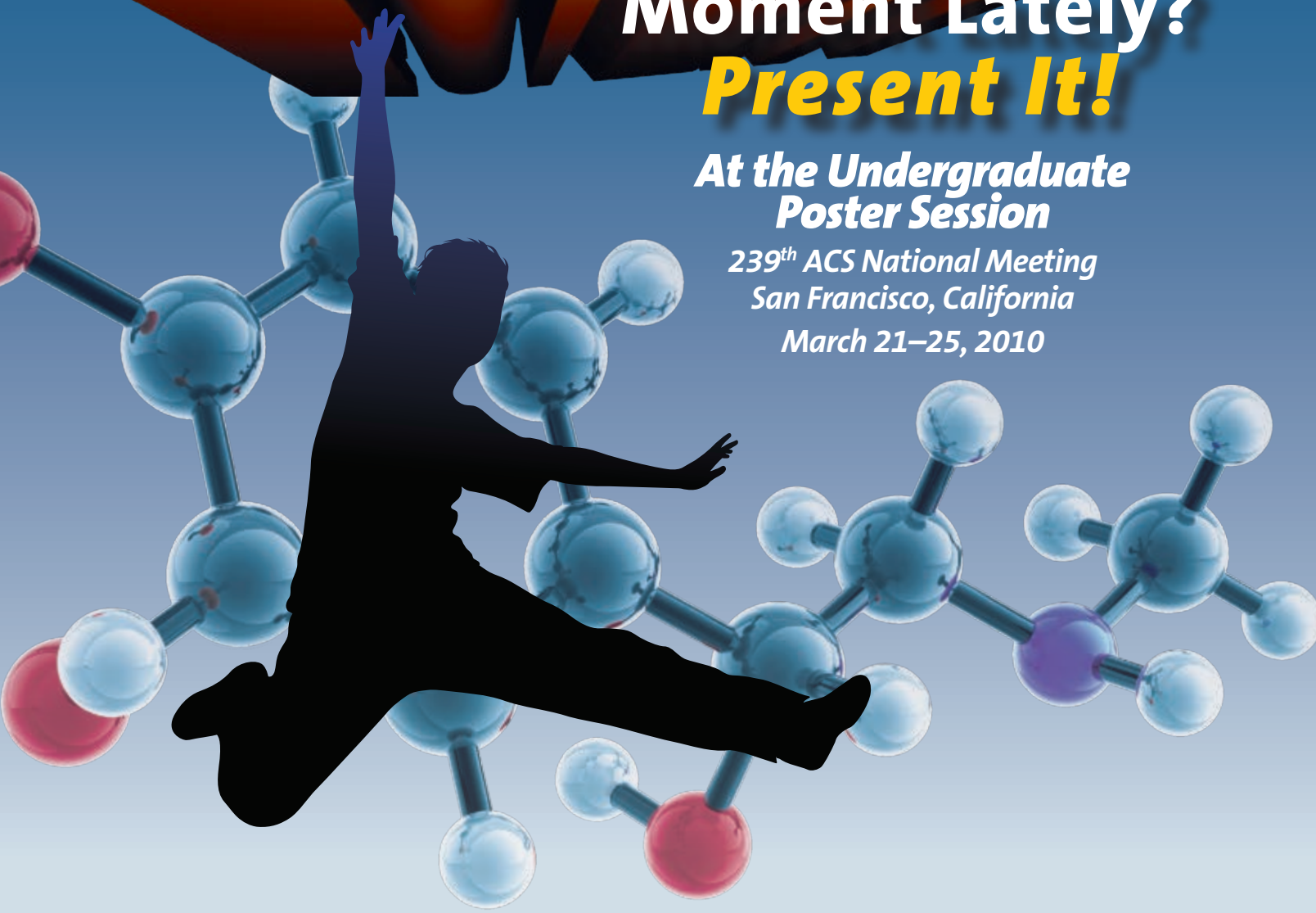

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