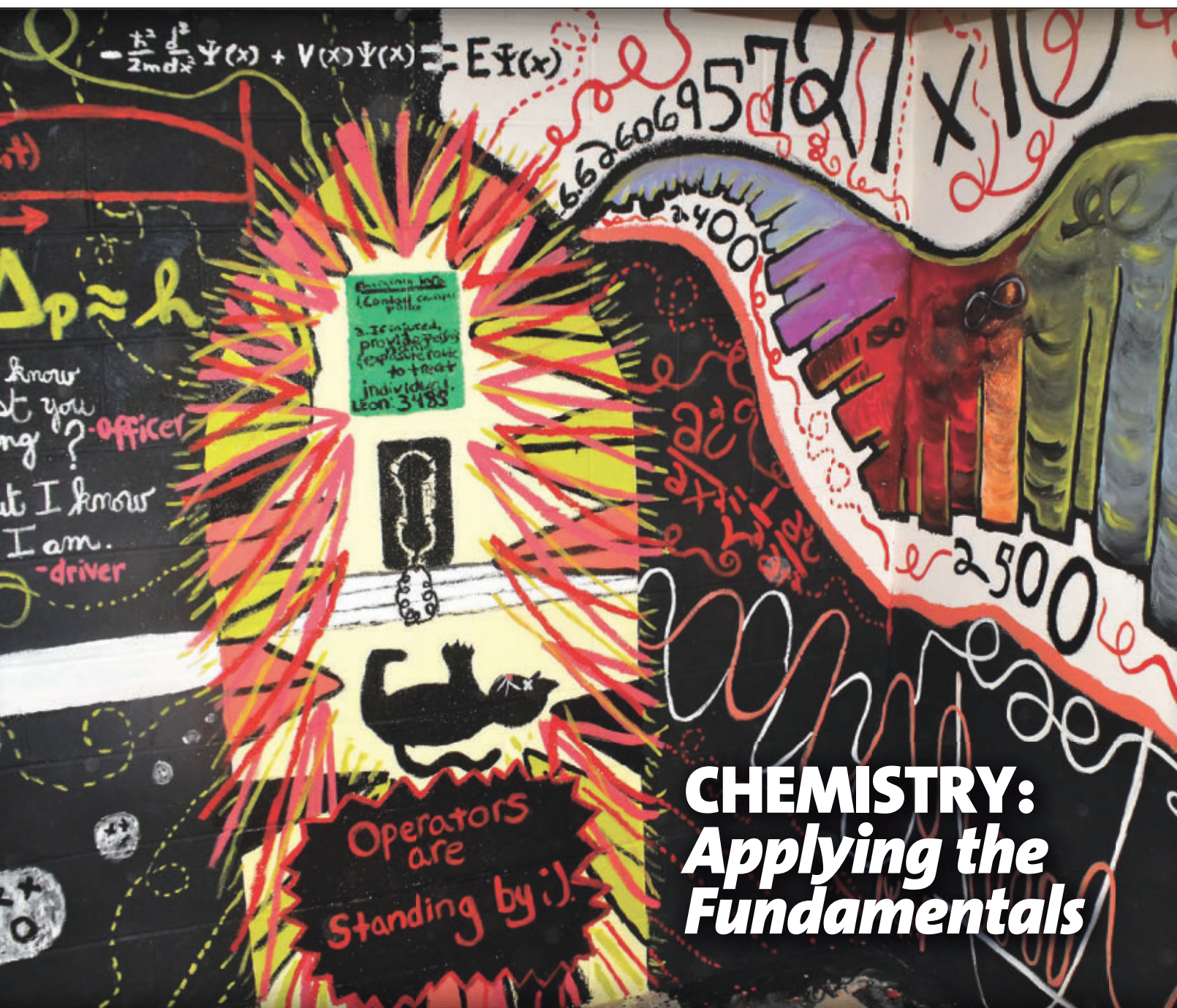


# inChemistry

THE MAGAZINE FOR ACS STUDENT MEMBERS November/December 2011



## CHEMISTRY: *Applying the Fundamentals*

**ALSO IN THIS ISSUE**

- Where to Find Experience Opportunities in Chemistry
- Cancer Research Gets Personal
- Award-Winning Chapters and Grant Recipients



2011

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**MANAGING EDITOR** Lori Betsock

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**COPY EDITORS** Eric R. Stewart  
Karen Müller

**DESIGN & PRODUCTION** Plum Creative Services

**DIRECTOR, EDUCATION DIVISION, ACS**  
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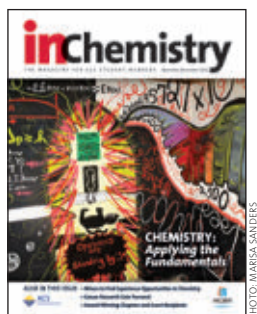
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Cover: The quantum tunnel mural at the College of New Jersey, painted by students enrolled in the college's 2011 summer research program. 30

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# EDITORIAL: Set Yourself Up for Professional Success


BY LISA M. BALBES

**A**t the 241st ACS National Meeting in Anaheim, CA, the ACS Committee on Economic and Professional Affairs reported that job growth in chemistry-related professions is expected to remain slower than average and that chemists will face increased competition for jobs at all levels. This means that, as companies cautiously hire new employees, simply having the right technical skills is no longer enough to secure your future. It's also essential to possess nontechnical skills and a professional network, and as current students, you should begin acquiring both now.

Take advantage of opportunities to try new things inside and outside of the lab to expand your nontechnical skills. Take a class in a new field. Organize an event or serve on a committee to build leadership, project management, and organizational skills. Present a talk or write a paper to build your communication skills, or serve as a treasurer to increase your business acumen. These activities will teach you skills and provide real experience to add to your résumé. Employers don't care if you got paid or not, as long as you have experience. At worst, you may learn that you don't like performing a certain kind of task and that you don't want to do it again. This, too, is very valuable.

While the job market is not great, there are opportunities. Many companies are choosing not to advertise positions, in order to avoid a flood of résumés from unqualified candidates. Instead, they are asking their employees to recommend friends or associates who could fill a need. In most cases, candidates who come in through referrals are "pre-vetted" and are thus a better fit for the corporate culture.

This is why it's imperative to have a professional network. The more people who know and will recommend you, the better off you will be. Take every opportunity to meet new people, and talk to them about their careers. Ask them about their responsibilities, what they like and don't like, how they got started, and what advice they have for a newcomer. Find ways to build mutual professional relationships over the years.

While you are learning and planning, enjoy the journey. You will most likely have many jobs and many careers over your lifetime, and they will often appear in new and unexpected ways. Be alert for and open to possibilities as they present themselves. Often, it is the side roads that are the best part of the trip and that eventually lead to much more interesting places. 



**Lisa M. Balbes, Ph.D.**, is chair of the ACS Committee on Economic and Professional Affairs. She has been a freelance technical writer and editor for almost 20 years and is the author of *Nontraditional Careers for Chemists*.

## ASK ACS

*Have questions relating to ACS student chapters or other programs at ACS? If so, e-mail us at [undergrad@acs.org](mailto:undergrad@acs.org) and we'll find your answer!*

**Q:** How can we have a link to our chapter's website added to the "Find an ACS Student Chapter" webpage?

**A:** Send an e-mail request to [undergrad@acs.org](mailto:undergrad@acs.org) or to Robin Lindsey at [r\\_lindsey@acs.org](mailto:r_lindsey@acs.org), or phone 1-800-227-5558, ext. 4480. Your chapter URL must link directly to your student chapter's website. Please allow two weeks for the updated information to appear on the page.

**Q:** How do I request a list of student members for my chapter?

**A:** To receive a student member list with the most current information available, student presidents, vice presidents, and faculty advisors can contact the ACS Undergraduate Programs Office at [undergrad@acs.org](mailto:undergrad@acs.org) or 1-800-227-5558, ext. 4480 or ext. 6166. You can expect to receive your list two to three business days after submitting your request. Chapter members who did not provide information about their institutions will not appear in the listing. If outdated or incorrect addresses appear on the list, please send any changes or corrections to [service@acs.org](mailto:service@acs.org).

**Q:** How early can we begin working on our 2011–2012 chapter report? How early can I upload my report to Manuscript Central?

**A:** The updated chapter report templates are now available at [www.acs.org/undergrad](http://www.acs.org/undergrad). You can also begin uploading attachments and photos through Manuscript Central as they become available.

**Q:** What is the process for submitting a chapter report?

**A:** Gather all of the information on the chapter officers, faculty advisors, and events held throughout the year. Go to [www.acs.org/undergrad](http://www.acs.org/undergrad) and download the appropriate forms. Upload completed forms, photos, and supporting documents to the ScholarOne website at <http://mc.manuscriptcentral.com/saacs>. If you need account information or have questions, contact the Undergraduate Programs Office at [undergrad@acs.org](mailto:undergrad@acs.org).



**Robin Lindsey** is a program administrator in the ACS Undergraduate Programs Office. She finds Ask ACS answers for you.



# How to Get Experience

## Check Out the New ACS Resource for Locating Experience Opportunities in Chemistry

BY CYRELLE GERSON

### How did you spend your time last summer?

- ☐ **A.** Catching up on all of the episodes of “Jersey Shore”
- ☐ **B.** Chatting with friends on Facebook and keeping the world informed of my every move
- ☐ **C.** Getting paid for valuable, practical experience working as a chemist (or scientist or engineer) at a university, company, or government or non-profit organization

**I**f your answer was A or B, congratulations on having a good time. If your answer was C, stand up and give yourself three cheers for taking the first giant step in your professional career. If you answered A or B, or simply want more help finding practical experience in the field of chemistry, know that ACS has developed a new resource to help you get experience.

### Why research experiences are important

You may be studying chemistry because you enjoy learning the science, you like the lab work, or you have a career in mind that you think requires a strong background in chemistry. However, until you get some professional work experience, you can't really know what it's like to be a chemist or what possibilities await you.

Professor Michelle Richards-Babb of West Virginia University has noted that summer experience opportunities for undergraduates are an excellent way for undergraduates to get a taste of graduate school research and to determine if scientific research is something they enjoy doing. She has observed that during their 10-week experience, students often progress from being dependent on their faculty advisor and graduate students to being independent researchers who can

fully understand, explain, and contribute to their research projects.

Working in an industry or in a government position allows you to find out firsthand what the organization is like and may help get your foot in the door for future employment.

Another benefit is that most experience opportunities in chemistry are paid positions that offer competitive compensation for undergraduate students.

### Where to find experience opportunities

To help you find experience opportunities in chemistry, ACS has developed **Get Experience**, a free, searchable online database at <http://getexperience.dreamhosters.com>. It contains information on research experiences, internships, co-ops, and other chemistry-related opportunities for undergraduate chemistry students.

This new site is structured as a job board and includes specific research experiences, internships, co-ops, and other opportunities that are available globally in private companies, academic institutions, government agencies, and nonprofit associations. Each posting includes a description of available positions and contact, application, and compensation information. You can browse for experience opportunities by job type, salary, category,

or date posted. Get Experience is also very convenient and easy to use.


### When to start searching

New experience opportunities for summer 2012 will begin appearing on the Get Experience site in mid-November through early spring 2012. If you visit the site before then, you may notice that some of the listings show up as “expired” because the application deadline has passed. This is because we are still receiving updated information on opportunities that were listed for summer 2011. However, you should still review these to get an idea about the type of opportunities that you might find on the site for next summer.

According to Richards-Babb, acceptance for these positions is very competitive. She encourages you to submit your application as early as possible before the deadline posted.

The applications usually ask for a brief written statement about why you want to participate in the program. Even though the money may be attractive, don't use that as your primary reason. Take some time to learn about research or other work that is being conducted at the institution or organization (for example, by studying their website or looking at corporate reports for a company). Then describe which aspect of their research or other work is appealing to you and why.

### What are you waiting for?

Many experience opportunities will have application deadlines as early as February 2012, so start looking now and come back often. With a bit of persistence on your part, at the end of next summer you will be able to say that you had a great “day job” working as a chemist, while catching up on “Jersey Shore” and Facebook in the evenings. Not a moment wasted! 



Cyrelle Gerson is a freelance eLearning and Web developer located in Arlington, VA. Previously, she managed the distance education programs in the

ACS Education Division for almost 25 years.

# It's All about Teamwork

## *Collaboration on Display at the 2010 Joint SWRM/SERMACS Regional Meeting*

Every ten years, a joint ACS Southwest (SWRM) and Southeast (SERMACS) Regional Meeting is held in New Orleans, LA — and for the 2010 program, I had the honor of serving as student chair.

Planning for the undergraduate program began far in advance, with a committee consisting of student chapters from Xavier University of Louisiana (XULA) and Loyola University New Orleans (LOYNO), and the Louisiana Local Section Younger Chemists Committee (LLSYCC). The collaboration among the three organizations took a little time to develop, but to successfully organize such a large event and densely packed program, it was imperative that we all worked together and pooled our resources.

### Getting started

Because of the event planning experience our chapter at XULA gained from hosting the undergraduate social at the 235th ACS National Meeting in 2008, the SWRM/SERMACS planning committee asked us to help organize its undergraduate program. We took on the challenge, knowing that this meeting had the potential for high attendance. From the outset, we knew we wanted our program format to be similar to undergraduate programs presented at ACS national meetings.

The XULA student chapter recruited volunteers from its student body to be the planning chair and committee members. Once we had a committed group, mostly juniors at the time, we started brainstorming theme ideas for the undergraduate program — ultimately choosing the “Art of Chemistry.” Having a theme gave us a unifying element for planning and made it easier to select program events. For event ideas, we looked at previous ACS

undergraduate programs at national meetings and saw that there were typically certain recurring events, including a keynote speaker and programs with hands-on activities. We developed a plan that included similar events in our program.

Our next step was to apply for an Undergraduate Programming at Regional Meetings Grant from the ACS Undergraduate Programs Office to obtain the funding we needed to execute the program. Once we had funding, we started planning the remainder of our program.

Most of our planning occurred the summer before the meeting, which was challenging since many of the committee members were busy doing summer research or extracurricular activities. We communicated constantly with each other through e-mail and text messages. Each committee member was also the chair of a subcommittee and had specific goals and tasks to achieve. For example, the chair of advertising had to design the promotional flyer by July.

By the time the fall semester began in August, the program was largely in place and each subcommittee had a list of specific items remaining to be done. Every subcommittee's to-do list was checked and overseen by the undergraduate program chair and our advisor, who were in constant communication. It was our job to communicate our needs to both individuals.



For instance, we requested a large conference room at the hotel to house the entire undergraduate program and refreshments for breaks and social events. We also communicated frequently with the national ACS Undergraduate Programs Office, who helped us with funding and provided a staff member to assist during our undergraduate program.

Once the chair of the SWRM/SERMACS planning committee approved all our events, we recruited more help from XULA chapter members. It was challenging to convince some students to commit time to help us, because many of them were freshmen who had never been to an ACS meeting and had no experience with the work that needed to be done.

### Collaborating with others

We also sought help from other area universities that had active ACS student chapters. LOYNO and the LLSYCC both agreed to join the Undergraduate Program Planning



Committee. LOYNO students helped run the program, and the LLSYCC helped us plan the Undergraduate Happy Hour Social. The collaboration proved invaluable for XULA students because the meeting was scheduled during finals and we had to depend on the students from the other university to fill in while many of our chapter's students were taking finals.

## The meeting

XULA chapter members set up an undergraduate hospitality booth to help inform undergraduate attendees about the undergraduate program at the meeting and about the city of New Orleans. Having a booth made it easy for attendees to get the information they needed. It was also easy for us to manage as we needed only one volunteer to staff the booth. We set up shifts for volunteers to greet and help the attendees.

The booth was also the home base for a scavenger hunt. The hunt was a fun way for undergraduate attendees to learn how to take full advantage of the meeting's programs and events. Inna Dizon of LOYNO was a booth volunteer and remembers, "The experience itself was

very interesting because we got to meet people we didn't know, and we built connections with chemistry students like us who were part of the undergraduate program." She provided attendees with brochures, stickers with chemistry-related jokes, and scavenger hunt sheets. Dizon adds, "It was fun giving out high fives to fellow young chemists."

The next part of our program consisted of two panel discussions, "Making the Best of the ACS Meeting" and "Making a Successful Transition to Graduate School," followed by the "Organic Made Simple" workshop. In the first event, panelists led a question-and-answer discussion about what to see and do at the meeting. In the second event, panel members answered questions about chemistry graduate school programs. The workshop was an hour-long session, where attendees received helpful hints and strategies for preparing for their first semester of organic chemistry.

## The main events

The two central events of the program were the "Art of Chemistry" seminar and the Chemistry Community Outreach

Sullivan, an XULA student member who helped to organize the seminar, observes, "The seminar was great in that everyone was able to see how art and chemistry have more in common than most would think."

The Chemistry Community Outreach Exchange also involved collective input from many different universities. Earlier in the year, we sent out a blast e-mail inviting many of the schools in the two regions to participate in the exchange. We asked them to submit an experiment relating to the theme and to bring the supplies needed to demonstrate it to the attendees. At the exchange, the LLSYCC, University of the South, Sewanee, the LOYNO and XULA student chapters, and XULA's chapter of Phi Lambda Upsilon demonstrated kid-friendly experiments designed to excite students of all ages about chemistry. This was a great way for student chapters to exchange ideas and experiments, very similar to the Chem Demo Exchange at the ACS national meetings.

The two social events during this meeting were the LLSYCC-sponsored happy hour social and a trip to the New Orleans Museum of Art.

## Lessons learned

Taking on the challenge of planning the 2010 Joint SWRM/SERMACS Regional Meeting gave us an opportunity to develop and strengthen our leadership skills as individuals and as organizations. We were faced with unforeseen challenges, but when times got tough, we knew we had the support of our advisor, the SWRM/SERMACS planning committee, and each other to carry through with the meeting. This experience has generated great enthusiasm and motivation among all of the ACS student chapters in the Greater New Orleans area to become more active and continue to join forces for future ACS functions. *inc*

*This article was written by the student chair of the 2010 SWRM/SERMACS undergraduate program. The author graduated from Xavier University of Louisiana in 2010.*



LOYNO chapter members practice demos at the Chemistry Community Outreach Exchange.

Exchange. The seminar featured three main speakers: Sarah Weaver, from XULA, and Kathleen Crago and Eduard Crago, both from LOYNO. Weaver spoke about aspects of chemistry in art and provided a brief history of pigments dating back to their origin from crushed stones. The Cragos spoke about a course they teach at LOYNO and explained how artists rely on chemistry to produce their marvelous paintings and other artwork. Afterward, the audience engaged in hand-on activities, including making pigments, crayons, and ultraviolet-sensitive bracelets, and used electricity to change niobium wire to different colors. Kirbye



# 243RD ACS NATIONAL MEETING

*Featuring Special Programming on the Chemistry of Life*

## AN AMAZING ADVENTURE IN CHEMISTRY!

### SUNDAY, MARCH 25

#### Undergraduate Hospitality Center

8:00 a.m. – 5:00 p.m.

#### Making the Most of Your First ACS National Meeting

8:00 – 8:45 a.m.

#### Careers in Academia Workshop

9:00 – 10:30 a.m.

#### Technical Symposium – Chemistry in a Cup o' Java

9:00 – 10:30 a.m.

#### Chem Demo Exchange

10:30 a.m. – 12 noon

#### Graduate School Reality Check, Step I: Getting in

1:00 – 2:00 p.m.

#### Graduate School Reality Check, Step II: You're in – Now What?

2:00 – 3:00 p.m.

#### Symposium: IYC Student Chapter Grants – Impacting People Worldwide Through Science

2:00 – 3:00 p.m.

#### Networking Social with Graduate School Recruiters

3:00 – 5:00 p.m.

#### Making Demos Matter Workshop

3:30 – 5:30 p.m.

#### Student Chapter Awards Ceremony

7:00 – 8:30 p.m.

#### Undergraduate Social

8:30 – 11:00 p.m.

### MONDAY, MARCH 26

#### Undergraduate Hospitality Center

8:00 a.m. – 5:00 p.m.

#### Graduate School Recruiting Breakfast

8:00 – 10 a.m.

#### Outreach Workshop: NCW Ideas

9:45 – 11:15 a.m.

#### Technical Symposium: Nuclear Power Generation – Lessons from Fukushima Daiichi and Future Directions

9:45 – 11:15 a.m.

#### Undergraduate Research Poster Session

12:00 noon – 2:30 p.m.

#### Eminent Scientist Lecture

3:00 – 4:00 p.m.

#### Networking Reception with Industrial Chemists

4:00 – 5:30 p.m.

#### The Kavli Foundation Lecture

5:30 – 6:30 p.m.

#### Sci-Mix/ Successful Student Chapter Poster Session

8:00 – 10:00 p.m.



SAN DIEGO, CA • MARCH 25–29, 2012

# UNDERGRADUATE PROGRAM

## Explore Graduate School Opportunities

The graduate school events provide great opportunities for undergraduates to network with graduate students and recruiters representing a diverse variety of graduate programs and to learn about meeting the challenges of graduate school.

### ATTENTION: GRADUATE SCHOOL RECRUITERS!

Network with highly qualified undergraduate students who are interested in learning more about your graduate school programs. Register to participate in the graduate school recruiting events. For more information contact Lori Betsock at [l\\_betsock@acs.org](mailto:l_betsock@acs.org).

All events are sponsored or co-sponsored by the Society Committee on Education Task Force on Undergraduate Programming.

**Chair:** Charles Baldwin, Union University, Jackson, TN

**Program Chair:** Michael R. Adams, Xavier University of Louisiana, New Orleans, LA

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



**ACS**  
Chemistry for Life™

# How to Ace Your Chemistry Exams

BY CARL B. "BURT" HOLLANDSWORTH

**B**y now you've probably figured out that college chemistry exams are different from exams in your other courses. Bright students who ace sociology midterms or biology lab practicals are sometimes left befuddled by a challenging chemistry test.

An examination in any subject is a reflection of the professor who designed it. This means that each assessment instrument is unique in design and difficulty. However, despite the inevitable differences, there are some general characteristics most chemistry tests share. By understanding these characteristics, you'll know how to better prepare for future exams.

## The challenge factor

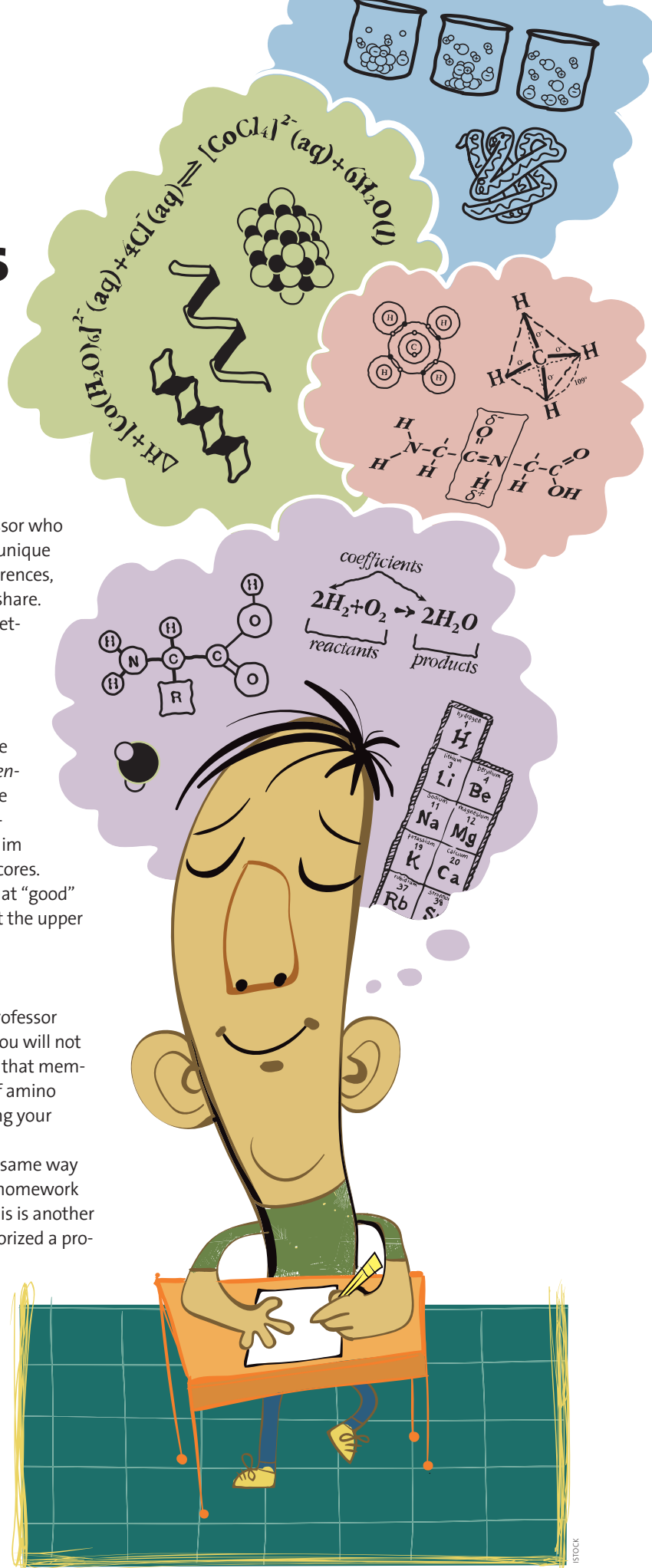
Many chemistry professors write exams to challenge the top 25% of the class and to *really* challenge the middle 50% of the class. They aim for a difficulty level that will help them *differentiate* the very well prepared and talented students from those who are less prepared. While many tests are designed to produce a particular average grade, chemistry professors often aim for a particular *spread* in grades, from very low to very high scores. There is less emphasis on an average, and the end result is that "good" (and even "great") students need to study smarter to score at the upper end of the spread.

## Beyond rote memorization

Chemistry tests rarely reward memorization. Frequently, a professor will provide a list of useful equations and constants so that you will not waste time memorizing. While most professors would agree that memorizing a few key facts is useful (e.g., names and structures of amino acids, a list of strong acids), they are more interested in testing your ability to think critically.

Questions in chemistry courses will rarely be asked in the same way twice. If a problem was worked in a lecture or assigned on a homework set, expect to see similar "tweaked" questions on the test. This is another way to ensure that an ill-prepared student who simply memorized a process will stand out and not receive full credit.

Consider electron density — arguably the most important concept in all of chemical reactivity. It is possible to label any electron-poor species an acid and every electron-rich species a base. However, you will achieve much more success by learning to recognize the general characteristics of electron-rich (filled orbitals, nonbonded electron pairs, negative charge) and electron-poor (empty orbitals, positive charge) species than by trying to memorize and categorize every single chemical species as acidic





# 10 Tips for Success

**Knowing that chemistry tests are often different from those in other disciplines is half the battle. Here are some quick tips for maximizing your performance on chemistry test day.**

**1 Master the basics skills and concepts.** Learn how to convert chemical names to formulas and write balanced equations. Start all problems with a balanced equation, if possible.

**2 Practice.** Work through enough practice problems so that it will be impossible for your instructor to write a test question from an angle that you have never seen. Master the reading comprehension problems in each chapter of your textbook or course note packet, as well as previous homework problems (especially if answers were provided). Buy a student solutions manual for your textbook and check the process needed to obtain correct answers. When you get stuck (and you *will* get stuck!), seek help. Pay special attention to multistep problems.

**3 Use several study methods.** When preparing, don't rely on a single partner, group, practice test, review sheet, or review session. Spend time working end-of-chapter problems, making and reviewing note cards, and reviewing class notes and answers to homework. Set up a study plan well ahead of schedule and give yourself not only enough time to study all of the topics, but also enough time to mix up your study methods.

**4 Use old exams wisely.** If your instructor provides copies of old exams, use them as a guide to the types of questions that might be asked — and also how much work you will be expected to complete in the allotted time period.


**5 Take a practice test a few days before the actual test.** Be sure to take the test under similar conditions to those allowed for the real test. Your performance might give you an idea of any areas that need more attention.

**6 Avoid using study guides in a “checklist” approach.** Too often, students who use study guides ignore the extra problems that need to be worked for each topic. For instance, if you see “predicting boiling points” on your organic chemistry study guide, you may feel like you already know enough and can get by with memorizing the general order of boiling points for each functional group. However, you may forget that the boiling point of organic compounds can also differ based on molecular weight, shape, and number of each functional group present. Working a few sample problems will likely remind you of the subtle details of broad concepts.

**7 Gather intelligence.** Find out how much time will be allowed for the test, the topics that will be covered, and the format of the questions. Professors will usually be happy to share this information, especially if their test is heavy on one type of question (for example, all multiple choice or all short answer).

**8 Thou shalt not cram!** Use your study time the night before (or day of) a test to work a few final problems for which you can definitely find the correct answers and that integrate several concepts. Typically, such questions can be found at the end of the chapters in your chemistry textbook, labeled “Concept Review” or “Special Questions.”

**9 Consider taking a math class along with chemistry each semester.** Doing so will help you keep your math and logical thinking skills fresh and give you practice with scientific notation, logarithmic and exponential functions, and algebraic equations. Learn math skills that will provide an advantage in your chemistry courses. Several semesters of calculus and a course in differential equations help tremendously in physical chemistry, for example.

**10 Learn from your mistakes.** When an exam is returned, find out where and how credit was lost for each question. If the instructor posts a key, make a copy. Check each answer and if you still do not understand how to arrive at the correct answer, seek help. If you misunderstood a particular concept, go back and study that concept in your course notes or textbook, or seek further explanation from your instructor during office hours. If you misunderstood a particular type of question, seek help and then practice doing similar types of questions until you can easily solve them. 

or basic. Learning the characteristics allows you to compare and contrast multiple species, predict reactivity, and balance reactions... while memorizing the concept does not.

## Testing cumulative knowledge

Many chemical concepts and chemistry problem-solving skills are cumulative. Core skills — such as writing balanced equations, using the unit-factor method, and converting chemical names to chemical formulas — are often required for every test, not just the first. In fact, you could be penalized for failing to grasp skills or concepts that were either taught early in the course or are expected to be remembered from previous courses.

For instance, to predict likely intermolecular forces for a molecule, you need to understand covalent bonding, Lewis structures, and polarity. The intermolecular forces are used to predict physical properties such as boiling and melting points. Many disciplines have cumulative concepts, so this is not unique to chemistry.

## Math- and logic-intensive

Chemistry requires you to integrate concrete math skills with very abstract chemical concepts. Even in organic chemistry and other courses that never require you to use a calculator, you need to use reasoning that is similar to that found in mathematics and computer science. While it's generally true that students who enjoy math will have an easier time in math-intensive courses, such as general or physical chemistry, it is even more likely that students who enjoy working through thought problems with a progression of logical arguments will enjoy greater success on chemistry exams than those who don't.

## Multistep mastery

Many chemical concepts and problems are multistep in nature. An error early in the process will quickly lead to an incorrect answer. Drawing the Lewis structure for a polyatomic ion is a great example. You might have to first convert the name of the ion into a formula, then determine or know the charge of the ion, count the number of valence electrons, arrange the skeletal structure with the correct atom in the center, subtract the correct number of electrons for the skeletal structure, add the remaining electrons to the outer and central atoms, and then draw multiple bonds if needed. Then you check the structure for an expanded octet and draw resonance forms if necessary.

If you skip any of the steps or perform them incorrectly, the entire process fails to yield a correct structure. Drawing an accurate Lewis structure is the cornerstone of valence bond theory and allows for prediction of the most likely geometry, bond angles, and hybridization in molecules and ions. Failing to learn how to perform each step in a multistep process could have far-reaching consequences in general chemistry and throughout your undergraduate career.

## Multilevel thinking

Chemistry professors tend to write exams similar to the ones they took as undergraduates and as graduate students. This


results in tests that require simultaneous mastery of both meticulous detail and broad basic concepts.

You might encounter a test on ionic bonding that requires you to produce a Born–Haber cycle for a given ionic compound. To solve the problem, you must understand the concept of a Born–Haber cycle in enough detail to balance each equation in the cycle, include correct states on each reactant and product, and provide the correct name for each step's enthalpy change. Attention to detail is required to write accurate, balanced equations and for the correct manipulation of enthalpy changes to calculate an unknown. And yes, significant figures count.

A similar problem involving a Born–Haber cycle for a very simple compound like NaCl was probably shown in a lecture, or assigned as a homework problem. However, on a test the student is often expected to extend the concept to a more difficult compound like  $\text{Al}_2\text{O}_3$  (three ionization energies required, not just one, etc.). Not only will a professor choose a more difficult compound; they might also ask a student to solve for an enthalpy change in a different part of the cycle. Examples in lecture may have shown the solution for the lattice enthalpy, whereas the test gives lattice enthalpy and asks the student to solve for ionization energy or electron affinity. For full credit, you must immediately extend what was learned in lecture and apply chemical knowledge to a novel problem, all while paying careful attention to details.

You're also expected to understand the big picture behind the details. To expand on the last example, lattice enthalpy can be used as an objective way to compare ionic bond strength in a variety of ionic compounds. You might be required to go beyond simply solving a mathematical problem — perhaps applying the results of a Born–Haber cycle calculation to compare the strength of bonding in a series of compounds or simply understanding that lattice enthalpy is greater in ionic compounds with higher charge-to-size ratios because of the steps involved in the cycle. Your professor might expect you to know why lattice enthalpy is a better measure of ionic bonding strength than another criterion, such as enthalpy of formation. Notice that a professor can test one concept on a variety of levels, none of which requires rote memorization.

## Preparation, practice, payoff

Although chemistry examinations might be somewhat different from examinations in other subjects, they are not impossible to master. Prepare well ahead of time, work plenty of practice problems, vary your study methods, and follow up when the test is returned. You will not only master the concepts that will help you in the short term on your next test, but you will also master important concepts and skills that will be required in subsequent coursework. 



**Carl "Burt" Hollandsworth** is an assistant professor of chemistry at Harding University in Searcy, AR.



## Department of Chemistry



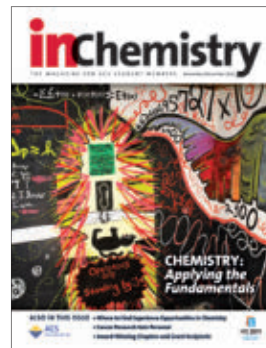
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# Cancer Treatment Gets Personal

## *Discovery of Mutations Leads to Better Drugs*

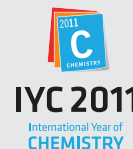
BY CYNTHIA WASHAM

In 1996, then 25-year-old world champion bicyclist Lance Armstrong learned he had advanced testicular cancer that had spread to his lymph nodes, lungs, and brain. His odds of survival were about 40 percent — yet Armstrong not only beat cancer, he went on to win the Tour de France a record seven times.

In contrast, three years after Armstrong's diagnosis, 38-year-old Washington Redskins center Dan Turk also developed testicular cancer. Like Armstrong, he sought care from leading specialists, but sadly, Turk lost his battle with cancer a year later.

At the time, given the understanding of the disease, it was difficult to explain why Armstrong lived and Turk died. Now, however, research has shown that cancer is actually many different diseases, each of which is probably unique at the molecular level. This realization started a revolution in how cancer is treated, and pushed us closer to a cure.

This special feature is presented in recognition of the International Year of Chemistry and efforts to bring worldwide focus to issues concerning the chemistry of health.

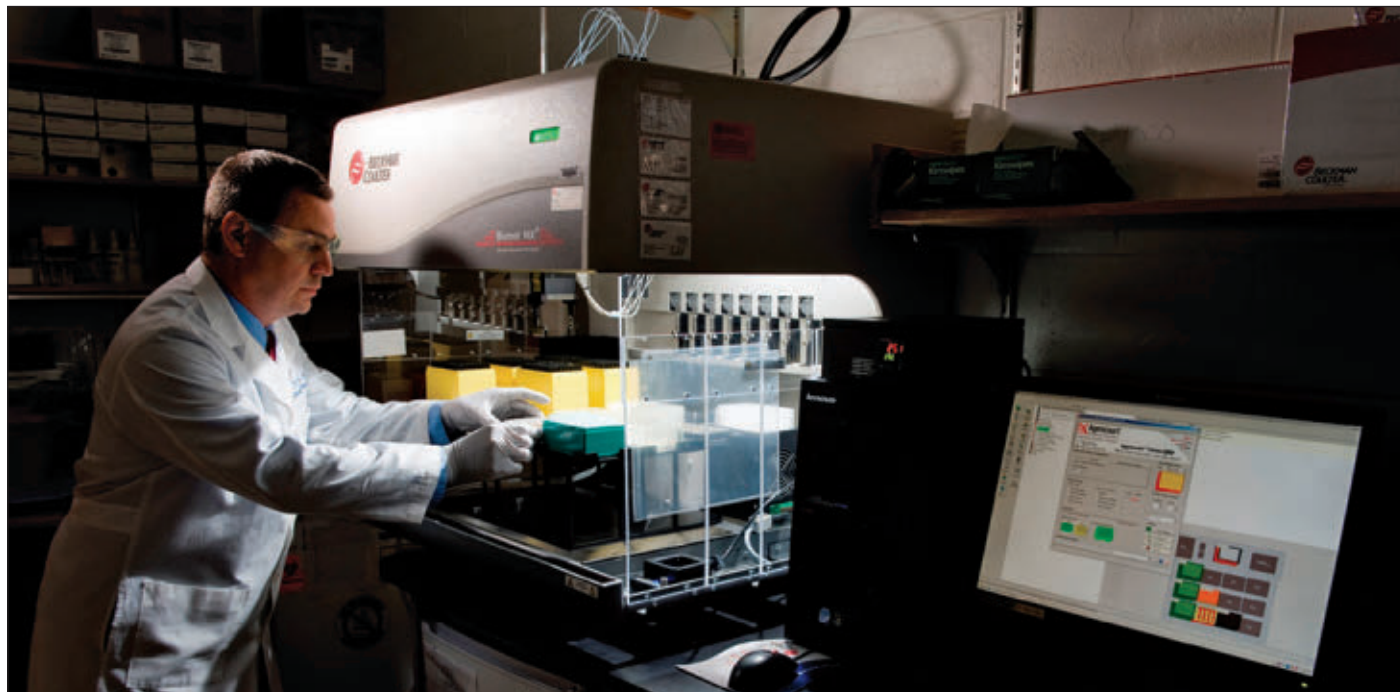


### The old approach

To understand the new approach, consider first the old. Cancer, in a nutshell, is cell growth run amok. It's treated with surgery, radiation, chemotherapy, or a combination of these. Surgery and radiation are designed to home in on the tumor; chemotherapy, in contrast, can destroy cancer cells that break away from the tumor and spread elsewhere.

Drugs used in conventional chemotherapy indiscriminately destroy cells that are growing especially fast, which can include prolific healthy cells as well as cancerous ones. Chemo's shotgun attack leads to dreaded side effects such as anemia, nausea, and hair loss. A more serious drawback of chemotherapy is that many cancers resist it. Until recently, doctors had no way of knowing who would and who wouldn't respond.

That started changing some three decades ago, as research began to unravel the chain of molecular mutations that cause



Darrell R. Borger, co-director of the translational research lab at Massachusetts General Hospital.

cancer. They discovered that normal-looking cells in a tumor's microenvironment mutated in a way that enabled cells to multiply out of control. If those changes can be blocked, it would be possible to stop cancer in its tracks.

"Several mutations are essential in driving cancer," says Darrell R. Borger, co-director of the translational research lab at Massachusetts General Hospital. "Those mutations might be very different from one person to another, even in the same type of cancer. We're trying to get drugs that can effectively target those mutations."

## Identifying 200 cancer genes

One of the first mutations targeted was an overabundance of receptors for the hormone estrogen in the cells of some breast cancers. When estrogen binds to estrogen receptors (ERs) in the cell, the hormone-receptor complex triggers the expression of genes that promote cell growth.

That discovery led to the drug tamoxifen. Unlike earlier cancer-

treating drugs, it was created for a specific set of patients, those over-expressing ERs. Tamoxifen inhibits the growth of breast tumors by blocking the ERs, thereby reducing the amount of tumor-promoting estrogen in the cells.

On the heels of ER studies came the identification of the aggressive human epidermal growth factor receptor 2 (HER2), which is implicated in about 25 percent of breast tumors. HER2 receptors relay signals that control cell division. Their discovery led to the drug trastuzumab, better known by the brand name Herceptin, which targets HER2. The success of tamoxifen and Herceptin sparked a massive effort to identify the approximately 200 human cancer genes and their mutations. The National Cancer Institute and the National Human Genome Research Institute in 2005 launched the Cancer Genome Project to lead the way.

Research so far has led to the identification of approximately 150 mutations in 14 cancer genes. While these genes represent a

## Outsmarting Cancer: Researchers work to overcome drug resistance

Nearly all new discoveries are centering on cancer genetics. While it may seem that science has finally found cancer's Achilles' heel, the view from the trenches isn't quite so rosy. For example, the widely heralded, targeted lung cancer drug erlotinib extends patients' lives by only several months, while Herceptin cures breast cancer in just over half of HER2-positive patients — and that's assuming it's given early in the disease.

The reason that even the most promising treatments fail to cure many patients lies in cancer's incredible complexity. For every discovery of a potential cure comes a discovery of how cancer can evade that cure. "The cancer genome is very unstable," explains Cynthia Ma, director of developmental therapeutics in breast oncology at Washington University in St. Louis, "and cancer cells can develop resistance to targeted therapy."

Many scientists are trying to find out why. A team from Memphis and Ontario may have found a piece of that puzzle in a study they published early this year in the journal *Nature*. They discovered that cells taken from leukemia patients don't have just one cancer-causing mutation. Rather, they have distinct families of cells with different types of mutations. That could explain why even cancers treated with targeted drugs relapse. The dominant family, which shows up in genetic profiling, may succumb to treatment, only to be supplanted by a different family with a resistant mutation.

When cancer that's been treated spreads, biopsies may be tough to obtain. Some researchers hope to overcome that roadblock with a blood test for mutations. "We're looking for less invasive techniques," notes Darrell R. Borger of Massachusetts General Hospital. "One way is to look for circulating tumor cells

in the blood." His lab is experimenting with a blood test in a partnership with Johnson & Johnson, which is developing technology to count and genetically profile cancer cells circulating in the blood. These "escapees" can spread cancer to other organs.

Researchers at the Mayo Clinic in Minnesota, meanwhile, are digging deeper to find a reason why the body sustains destructive, cancerous mutations. Lead researcher Zhenkun Lou found that a poorly understood gene called MMSET normally "recruits" proteins to repair breaks in DNA. When MMSET fails, mutations proliferate on the path toward disease. "The function of MMSET was unclear until our study," Zhenkun says, "but it was known to be over-expressed in a lot of cancers, including multiple myeloma and brain cancer."

"If you have over-expression, you could repair DNA more efficiently. That's why these cells don't respond to treatment." Zhenkun and his colleagues made their discovery after subjecting cells to radiation, then conducting assays to measure chemicals secreted by dead cells. They realized that cells over-expressing MMSET were impervious to radiation that killed other cells. "If we can find an inhibitor of MMSET," Zhenkun observes, "we can treat cancer with a combination of it and chemotherapy or radiation."

The bottom line is that the answer researchers are looking for may be just as complex as the cancers they're studying. Curtis Harris, chief of the Laboratory of Human Carcinogenesis at the National Cancer Institute, makes it his job to stay up on all the latest cancer research. Harris sees promise in inhibiting MMSET, as well as dozens of other targeted therapies coming down the pike — but he also suspects that the best weapon against a disease as wily as cancer will be a combination of treatments. "Because there are multiple drivers of an individual's cancer," he explains, "combination therapy directed at several molecular targets may lead to the best results." **inc**



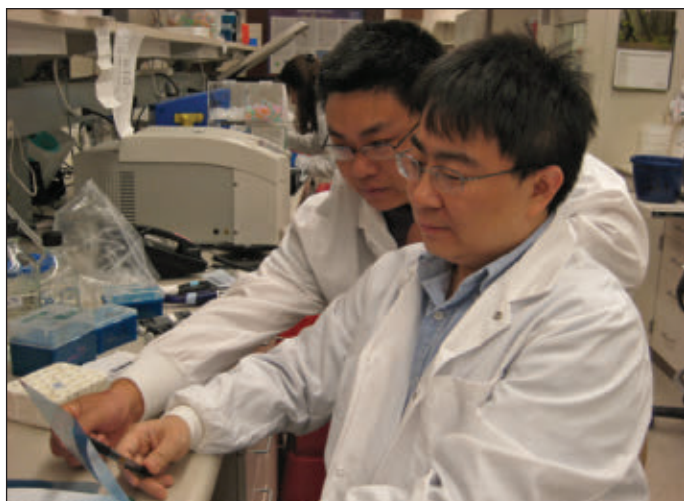


PHOTO COURTESY OF ZHENKUN LOU

Zhenkun Lou, lead researcher at the Mayo Clinic (seated), and colleague Huadong Pei.

small fraction of the 200 cancer genes, they account for many of the most common forms of cancer.

Two years ago, Massachusetts General built the country's first hospital lab for genetic profiling. Researchers initially examined only lung, colorectal, and brain tumors. As targeted drugs expanded to treat a wider variety of cancers, so did testing. Borger's lab now offers profiling for every cancer patient at the Boston hospital, and similar labs are now cropping up in cancer centers across the country.

In the new version of the profiling process, after a pathologist examines cells collected during a biopsy, his or her analysis is sent to Borger's lab, where DNA, RNA, and microRNA are extracted and then multiplied to create enough for analysis. Technicians heat the DNA to separate the double helix into two single strands and add an enzyme to initiate a polymerase chain reaction (sometimes called DNA cloning), which in turn builds two new DNA strands. Each new DNA molecule now consists of one original and one copied strand. With more heat and the addition of a Taq polymerase enzyme, the new molecules multiply again to create four molecules, then eight, sixteen, and so on. In just a few hours, one DNA molecule can grow to more than a billion, providing Borger and his team with enough material to determine whether the tumor's mutation matches any of the growing arsenal of targeted cancer-treating drugs.

## Attacking on many fronts

Like the roots of cancer, targeted drugs are varied. Herceptin is one of several signal transduction inhibitors that block enzymes and growth factor receptors that promote uncontrolled growth. Herceptin also belongs to another class of targeted drugs called monoclonal antibodies, synthetic molecules that mimic natural antibodies and stimulate the immune system to attack cancer cells.

Still other targeted drugs block angiogenesis, or the formation of blood vessels. These drugs, including the widely used Avastin, stem from research started half a century ago, when Judah Folkman speculated that a cancer tumor produces a substance that

## How to Explore Career Opportunities in Medicinal Chemistry

Medicinal chemistry offers a wide array of career opportunities in industry, government, and academia. Most chemists in traditional research careers are Ph.D. chemists, while chemists with B.S. degrees generally serve as research technicians. Many positions require chemists to use their research skills to formulate, produce, and analyze new compounds. To learn more about careers in medicinal chemistry:

- Do online research and reach out via LinkedIn or Facebook to people who work in medicinal chemistry fields. Engage them in a chat and ask them how you can learn more about positions similar to theirs.
- Intern or assist in a lab to gain experience, find out what interests you, and learn about the types of positions that are available.
- Network with medicinal chemists at ACS local section, regional, and national meetings. Ask them why they went into the field, what they like about it, and how you can prepare for a career in medicinal science.
- Schedule a meeting with a technician, researcher, or manager at a local company or government organization to learn more about career opportunities and the skills you'll need to acquire to qualify for these opportunities.
- Meet with a professor in the School of Pharmacy to learn more about the research they do and other careers in this field.
- Investigate graduate school programs in medicinal chemistry on the ACS DGRweb at <http://dgr.rints.com/>.

sparks the development of blood vessels and that without this blood supply the tumor would be destroyed.

Folkman worked on his theory in relative obscurity for more than 20 years before discovering natural proteins that inhibit angiogenesis. This discovery, in turn, led to the development of drugs that mimic that inhibition.

Conventional chemotherapy or radiation also is commonly prescribed along with targeted therapy. Targeted drugs work to stop tumor growth, while the other treatments destroy the tumor. As the Cancer Genome Project uncovers more cancer genes and mutations, Borger and other scientists will be able to identify them in biopsied cancer cells. His hope is that therapies that target those mutations will keep pace.

"When we profile lung cancer or colorectal cancer, we can identify mutations in 60 to 70 percent of the cases," he says. "We want to tell every patient we can pair their cancer with therapy. But at present, the question is, 'Is there a drug available?'" **irc**



Cynthia Washam is a freelance writer based in southern Florida.

# Experience Chemistry: Find Your Path

## The Hows and Whys of Doing Undergraduate Research

BY SHANNEN CRAVENS

**W**hether you are thinking about applying to graduate school or medical school, or are looking for a job right after your undergraduate studies, you have likely heard that participating in undergraduate research is essential to your career. But do you understand why you should participate in research at such a young age and, more importantly, do you know how to get involved? I began doing research at the very beginning of my undergraduate career, and I hope a little window into my own personal experience will help answer some of the questions you might have about what it is like to do research as an undergraduate.

### Taking the first step

When I was looking at institutions for my undergraduate studies, I knew I wanted to do research, so I chose my university based on the opportunities it had. The University of San Diego is a primarily undergraduate institution, which means that most departments on campus do not have a graduate program. In the Department of Chemistry and Biochemistry, all of the research that is conducted is done through a partnership



between professors and undergraduates. That's right: there are no graduate students in our labs! In fact, one of the graduation requirements is to do a semester's worth of research. That might make it seem, especially to students at larger institutions, that I had it easy when it came to choosing a research lab, but I can assure you that I went through some of the same trials and tribulations most students face.

It was actually my academic advisor who first suggested that I begin a research experience toward the end of my first semester.

That seemed like a daunting task. How can you decide which lab seems right for you? Well, the honest answer is you cannot until you are actually in the lab.

Most universities have department websites where you can see a synopsis of the research each professor is currently conducting. My biggest piece of advice to you here is do not rely on the website alone. If a topic interests you, take the extra step and make an appointment to talk with the professor. That is what I did, and you might be amazed by how much a professor's current interests may have evolved from what is posted on the website.

### DGRweb: A Valuable Resource

ACS's DGRweb (<http://dgr.rints.com>) is the searchable online version of the ACS Directory of Graduate Research. It is the most comprehensive source of information on chemical research and researchers at universities in North America. You can run institutional searches to get a list of faculty active in graduate research and faculty searches to get information on specific research areas and contact information for faculty, including e-mail addresses and links to webpages.



Keep in mind that you should not be afraid to join a lab that might not have been your first choice, or one that is completely out of your comfort zone. I initially wanted to work in an environmental chemistry or polymer lab, and I actually ended up in a DNA nuclear magnetic resonance (NMR) lab! Now that's a change!

So, how did I choose that lab? I sent out e-mails, scheduled appointments, and spoke with professors in their offices about the projects they had available. The DNA project I eventually chose was a collaboration with someone in the department who was on sabbatical, but I was put in touch with her and received a copy of her most recent manuscript. I slept on the decision for a while and realized I could not stop thinking about that manuscript. That is what convinced me to sign up — even though I knew next to nothing about DNA or NMR.

### Moving forward

Research experience is most beneficial when you are invested in the work you are doing. Sometimes you may have to start out as a glorified dishwasher, if that's what it takes to get your foot in the door of a research team whose work fascinates you. But before you make such a decision, be sure that you will have the opportunity at some point in the near future to get enough training to work on the aspects of the project that interest you.

As mentioned earlier, I've been doing research for years, and I have actually been working in the same lab, so I have seen first-hand how one's responsibilities can change over time. Initially, I worked side by side with my research advisor for my entire work schedule, but over time, I saw less and less of her. After about a year of training me and watching as I made progress on the project, she handed control over to me and simply made herself available to answer questions or help me troubleshoot. I eventually set my own schedule and kept her up to date with my progress. After completing my project at the beginning of my senior year, I was given the responsibility of training the new students who joined the lab.

These experiences working in labs have taught me that it's important to work hard to become a valued member of your lab. If you do not feel like you are making progress, you might want to consider working for someone else.

### Funding considerations

If you need to be earning money while doing research, take a look around your university. Some institutions have grant programs for students, meaning that you can be paid to do summer research experiences. If your school

does not have such a program, your research advisor might be able to help you apply for external grants, or your department might have grant money of its own that the administration would be willing to allot to you. The bottom line is: ask around.

There is also the option of doing research off-campus. My university has a program that funds students to do research at graduate institutions, but if your university does not have something similar, there are plenty of universities and government laboratories across the country that offer research experience internships (REIs). REIs are typically open to all undergraduates and simply require the submission of an application. I worked at the University of Washington for one summer, and it was a fantastic experience! I got my first glimpse of what it is like to live



Shannen Cravens during her senior-year research project, preparing to run an NMR experiment.



outside of California, but more importantly, I was introduced to what it would be like to be a graduate student. That experience really set in stone my decision to apply to graduate school.

### Reaping the benefits of experience

So why add to your already stressful workload by putting in hours of research every week? I can honestly tell you that the extra responsibility is worth it in the end, and the benefits go far beyond getting to apply what you have learned in lecture and lab to a real-world problem. You will learn to cope with failure. That is really a make-or-break point for a lot of students when they're deciding whether graduate school is right for them.

Can you handle working on a project that might not succeed, no matter how hard you try for weeks on end? Well, you won't know until you try. I went through that disappointment several times with my own project. I definitely felt like throwing in the towel on multiple occasions, but my interest in the work I was doing kept me going. I just kept reminding myself: Wouldn't it be amazing if this actually did work? Well, after a while, it finally did.

I did not think about this myself when I decided to do research, but I've learned since that you can publish as an undergraduate. After two and a half years of hard work, which included plenty of month-long periods where simply nothing worked, the project I had started in my freshman year resulted in a publication that I helped write. Now, not every project results in something that is publishable (or can even be finished during your undergradu-

ate career), but the success and worth of your undergraduate research experience should not be measured in the number of publications you produce. By being involved in a research lab, you have the chance to present your work at national conferences. I have presented a poster at two ACS meetings, and both were great experiences!

Is undergraduate research experience worth your time? I hope you can see that, yes, it truly is beneficial. My research experience has shaped my career choice, made me a more competent and confident scientist, and established a great mentoring relationship with my research advisor — which is never a bad thing if you are looking for recommendation letters and someone to help you through your college career.

My final words of advice are to not be afraid to push yourself beyond the edges of your comfort zone. The best things in life tend to be things you have never experienced or even planned to experience, so challenge yourself to go beyond your normal routine and try something new. Also, do not be afraid to leave the lab you are working in if you have no interest in the project. Find something that works for you and, above all else, have fun! **irc**



**Shannen Cravens** graduated from the University of San Diego last spring and was president of the USD student chapter. She is now a first-year graduate student at Johns Hopkins University in Baltimore, MD.

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## SPOTLIGHT

# Inter-American University of Puerto Rico

San Germán



COMPILED BY ACS STAFF

**Chapter president:** Andrea Quiñones-Morales **Number of chapter members:** 39 **Number of ACS student members:** 15  
**Chapter website:** [www.facebook.com/people/Estudiantes-De-Quimica-Interamericana/824065649](http://www.facebook.com/people/Estudiantes-De-Quimica-Interamericana/824065649) and [http://twitter.com/ACSET\\_SanGerman](http://twitter.com/ACSET_SanGerman) **Institution data:** Large, private, suburban, minority-serving, 4-year institution

18

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

**A:** We meet to hear the ideas and opinions of each candidate, and then we vote. Communication is the key to ensure an easy transition. Unless we have good communication between leaders and members, it's difficult to have good leadership. Usually, we elect the new officers before each semester ends, so outgoing officers mentor new officers.

**Q: Do you collaborate with High School ChemClubs?**

**A:** We mentor a chemistry club at our Campus High School. We help the high school students with assignments, activities, and science fair projects. The high school students also participate in some of our activities.

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

**A:** Our most successful event to recruit is the Student Association "Open House" organized by our university. We also do

a "member-get-a-member" campaign, which encourages interaction among our students. Additionally, we present our experiences at the ACS national meeting. Because it is always a great experience, it has also become a great member recruitment tool.

**Q: What innovative methods of communication are used to inform chapter members of activities?**

**A:** We text information and promote our chapter activities to our members. Since we began sending the text reminders close to the date of the activity, member participation has improved.

**Q: What is your most important fund-raiser to date?**

**A:** Our most successful fund-raiser was the "Typical Puerto Rican Christmas Lunch." The event is very festive, and it features traditional Puerto Rican music and decorations. We offer faculty, students, and university administrators an opportunity to buy tickets before they go on sale to the public. Each year, we sell more than 175 lunches. *irc*

### Faculty Advisor:

Angela González, 6 years

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

**González:** The biggest challenge has been helping our students to believe in themselves. We show them all the potential and the tools they have and encourage them to use these tools, especially when they say they don't know how to do something or are hesitant to use their English. This last part has been a special challenge, but it has been great to see how they find ways to overcome those difficulties. I'm also very lucky because our faculty and especially our lab technician, Ms. Nilda Caraballo, also help with our activities.

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

**González:** The most rewarding aspect as an advisor has been to see students grow to become professionals and behave accordingly. I have found that during our trips to ACS national meetings, they grow so much!

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

**González:** As an advisor, you'll feel proud of your students' accomplishments, their growth, and their engagement. But, always remember, it is their chapter. If they work, that's great, and if they do not work, that's fine too. My role as advisor is to guide them, present them with opportunities, and help with paperwork. Being a mentor does not mean doing their work. *irc*



PHOTO COURTESY OF INTER-AMERICAN UNIVERSITY OF PUERTO RICO

Since the Inter-American University of Puerto Rico, San Germán began sending text reminders about upcoming chapter activities, member participation has improved.

# SPOTLIGHT

## Tennessee Tech University

### Cookeville

COMPILED BY ACS STAFF



**Chapter president:** Megan Monteen **Number of chapter members:** 42 **Number of ACS student members:** 21  
**Chapter website:** [www.tntech.edu/chemistry/acsaffiliates/](http://www.tntech.edu/chemistry/acsaffiliates/) **Institution data:** Large, public, rural, 4-year institution

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

**A:** We give each officer a booklet that explains the duties of their office and what is expected of them. The new officers read the previous year's chapter report to guide them in planning activities for the new school year.

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

**A:** We have two social chairs, and this year we created a Freshman Liaison position to encourage more freshmen to become active in the chapter.

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

**A:** We always make a Periodic Table of Cupcakes for a fund-raiser, and try to do something each year we have never done before. We have a party on Mole Day. Earth Day usually involves cleaning up a park or creating flower beds on campus.

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

**A:** We had a silent auction of balloon art and sold liquid nitrogen ice cream to raise over \$700 for the Cookeville Children's Museum.

**Q:** What is your chapter doing to celebrate 2011 as the International Year of Chemistry?

**A:** We had a "Water Wednesday" for kids at the Cookeville Children's Museum, and helped a faculty member who organized an energy poetry/art contest, which also tied in with Earth Day. For the fall semester we have been doing activities with kids involving health and wellness.

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

**A:** We have a one-credit freshman interactions course, and the course requires the chemistry majors to attend at least two chapter meetings.

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

**A:** Balloon twisting is our most unique activity. We do it for fund-raising events and at the ACS meeting during the outstanding chapter poster session at Sci-Mix. **irc**

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

**A:** We have movie nights throughout the year. We have sponsored paintball, bowling, and various parties over the course of the school year. We recently made tie-dyed T-shirts as a chapter activity and will also do this as a fund-raiser.

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

**A:** We collaborate often with the ASBMB student chapter and the Chem-Med club.

**Q:** What is your most successful fund-raiser to date?

**A:** We sell goggles and notebooks to most of the lab sections of our chemistry courses. **irc**

**Faculty Advisor:**

Dan Swartling, 6 years

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

**Swartling:** I was chosen by the chairman to succeed the previous advisor. I was someone who had a good rapport with the students and wanted to try new and different things with the chapter.

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

**Swartling:** The biggest challenge has been getting freshmen interested in joining the chapter. This year, the chapter created a Freshman Liaison position to encourage more freshmen to join the chapter.

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

**Swartling:** It has been very rewarding to watch students develop into effective leaders and to take students to the ACS meeting each year to present research posters and to attend the undergraduate mixer.

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

**Swartling:** Don't be afraid to let the students lead and come up with activities to do; don't be afraid to step in when needed to guide the students towards the goals they have set for themselves as a chapter. **irc**



Tennessee Tech University chapter members attended the 241st ACS national meeting in Anaheim, CA, where they received a "Commendable Award" plaque at the Student Chapter Awards Ceremony.

PHOTO COURTESY OF TENNESSEE TECH UNIVERSITY



## ***Congratulations to the winners of the 2010–2011 Student Chapter Awards***

**I**t is a tremendous honor for me to help celebrate the many accomplishments of the ACS student chapter members and their faculty advisors throughout the country. In this International Year of Chemistry, you have spread a greater public understanding and appreciation for science through your many outreach events in your communities and on your campuses.

Through your participation in student chapter activities, you have gained valuable professional skills that will serve you well throughout your career.

As the International Year of Chemistry winds down, I encourage you to continue your award-winning ways. These personal experiences, combined with your outreach to the next generation, hold great promise and set the stage for exciting careers and important contributions that advance the chemical enterprise and address world needs.

We need to work together now more than ever. We need to communicate the central role chemistry plays in developing a sustainable future and how chemical research is crucial for solving our global problems involving energy, food, water, and health. Thank you for all you have done in advancing the mission of ACS.

Here's wishing you all the very best for a safe, happy, and healthy holiday season. Looking forward to seeing you in 2012!



Nancy B. Jackson, President, American Chemical Society

# SPECIAL RECOGNITION FOR 2010–2011 PROGRAMS

The ACS Society Committee on Education has selected the following student chapters to receive special recognition for the programs and activities described in their 2010–2011 annual reports. They will be honored at the 243rd ACS National Meeting in San Diego, CA, on Sunday, March 25, 2012.

We congratulate the 36 Outstanding, 87 Commendable, and 106 Honorable Mention award-winning chapters.



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Elizabeth Raymond & Steven Emory

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Donald Mencer & Adriana Dinescu

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Armando Rivera Figueroa

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Michele Davis McGibony

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Jyotsna Thota

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Noelle Beyer & Frank Schindler

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Donald Estes & Chaya Rapp

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Dallas New & John Ferguson

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Tara Carpenter & Stephen Mang

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Bruce Anderson

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Marion Franks

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**Texas Christian University, Fort Worth**

Sandi Dang & Charles Ochoa  
*Kayla Green*

**Texas Tech University, Lubbock**

Malik Al-Afyouni  
*Christopher Bradley*

**The College at Brockport, State University of New York**

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*Stephen Godleski*

**Transylvania University, Lexington, KY**

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*Karen Steelman & Faith Yarberry*

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*David Weiss*

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*Tyson Miller*

**University of Kentucky, Lexington**

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*Beth Guiton & Marc Knecht*

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Benjamin Burruss  
*Leanna Giancarlo*

**University of Nevada, Las Vegas**

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*Marykay Orgill*

**University of Portland, OR**

Rachel Feeny & Kimberly Schuldt  
*Angela Hoffman*

**University of St. Thomas, Saint Paul, MN**

Sarah Hansen & Nicholas Serratore  
*Mithra Beikmohamadi*

**University of Texas at El Paso**

Jacqueline Gamboa Varela  
*Bonnie Gunn & James Becvar*

**University of the Sciences, Philadelphia, PA**

Chi Tang & Angelica Johnson  
*Catherine Bentzley & Vanessa Jones*

**University of West Florida, Pensacola**

Sharon Blackwell  
*Arun Royappa*

**University of Wisconsin-Platteville**

Eric Conard  
*Tim Zauche*

**Utica College, NY**

Marietta Guzda & Jordan Jackson  
*Michelle Boucher & Alyssa Thomas*

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*Linda De La Garza*

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*Maggie Bump*

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*Helen Boylan & Sarah Kennedy*

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*Paul Hooker & Robyn Hyde*

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Sarah Prebihalo & Bridget Gavaghan  
*Barbara Hopkins*

**Yale University, New Haven, CT**

Maxwell Kushner-Lenhoff & Colin Lu  
*Kurt Zilm & Kristina Thorson*

## 2010–2011 Green Chemistry Student Chapters

Student involvement in applying green chemistry principles and practices is essential to the integration of environmentally benign technologies in academia and industry. The ACS Green Chemistry Institute® distributes a Green Chemistry Award to ACS student chapters who have engaged in at least three green chemistry activities during the academic year. Listed below are the 46 recipients of the 2010–2011 Green Chemistry Award, by institution.

*Angelo State University, San Angelo, TX*

*Augustana College, Sioux Falls, SD*

*Barry University, Miami Shores, FL*

*Bellevue College, WA*

*Central Michigan University, Mount Pleasant*

*Christian Brothers University, Memphis, TN*

*Colorado School of Mines, Golden*

*Delta State University, Cleveland, MS*

*Ferris State University, Big Rapids, MI*

*Florida International University-  
Biscayne Bay Campus*

*Gordon College, Wenham, MA*

*Hendrix College, Conway, AR*

*Idaho State University, Pocatello*

*Illinois Wesleyan University, Bloomington*

*Middle Tennessee State University,  
Murfreesboro*

*Millikin University, Decatur, IL*

*Northeastern University, Boston, MA*

*Northwestern University, Evanston, IL*

*Pacific Lutheran University, Tacoma, WA*

*South Texas College, McAllen*

*Stern College for Women-Yeshiva University,  
New York, NY*

*Suffolk University, Boston, MA*

*Tarleton State University, Stephenville, TX*

*Texarkana College, TX*

*Union College, Schenectady, NY*

*University of Arizona, Tucson*

*University of California, San Diego*

*University of Central Oklahoma,  
Edmond*

*University of Colorado, Denver*

*University of Houston, TX*

*University of Mary Hardin-Baylor,  
Belton, TX*

*University of Michigan-Flint*

*University of Minnesota, Morris*

*University of Pittsburgh, PA*

*University of Puerto Rico at Aguadilla*

*University of Puerto Rico at Arecibo*

*University of Puerto Rico, Humacao*

*University of Puerto Rico, Mayagüez*

*University of Puerto Rico-  
Río Piedras Campus*

*University of San Diego, CA*

*University of Tennessee at Martin*

*University of Texas at Tyler*

*University of Toledo, OH*

*West Virginia State University, Institute*

*Western Washington University, Bellingham*

*Wilkes University, Wilkes-Barre, PA*



## 2011–2012 Innovative Activities Grants (IAG)

For the 2011–2012 academic year, the ACS Society Committee on Education has selected the following 10 IAG proposals to receive funding. The ACS Undergraduate Programs Office is pleased to announce the winning chapters.

KEY: <i>Chapters</i>	Student Project Directors	Faculty Advisors	Project title	Amount
<b>Ball State University, Muncie, IN</b> Mallory Dobson • Jason W. Ribblett <i>Experiences in Chemistry</i> \$500	<b>Spring Hill College, Mobile, AL</b> Lauren “Elise” Franklin • Carolyn Simmons <i>Partners in Science – Spring Hill College &amp; Pillans Middle School</i> \$250	<b>University of Mary Hardin-Baylor, Belton, TX</b> Viktoria Meadows • Darrell Watson <i>Helping Create the Chemists of Tomorrow</i> \$200		
<b>Bard College, Annandale-on-Hudson, NY</b> Madison Fletcher • Christopher Lafratta <i>Bridging the Gap: Getting 8th Graders Interested in Science</i> \$500	<b>Stern College for Women-Yeshiva University, New York, NY</b> Avigail Soloveichik • Donald Estes <i>Project TUSA &amp; Chemistry in Food</i> \$100	<b>University of the Sciences, Philadelphia, PA</b> Hiu Yan Cheng • Catherine Bentzley <i>Elemental Education and Beyond</i> \$500		
<b>Northwestern University, Evanston, IL</b> Teresa Mills • Shelby Hatch <i>Northwestern Chemistry Fair 2011</i> \$200	<b>Temple University, Philadelphia, PA</b> Angela Snow • Frank Spano <i>Inner City Community Chemistry Outreach</i> \$250	<b>University of Tennessee at Martin</b> Brandon Gindt • S. K. Airee <i>UTM SMACS Network with Local High Schools for a Tour of Oak Ridge Museum and Graphite Reactor</i> \$250		
	<b>Saint Francis University, Loretto, PA</b> Travis Rosmus • Edward Paul Zovinka <i>Radon Community Testing</i> \$445			

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## 2011–2012 Community Interactions Grants (CIG)

For the 2011–2012 academic year, the following nine CIG project proposals have been awarded to provide pre-college minority students with enriched hands-on science activities, while giving ACS student members an opportunity to enhance their skills as future teachers and mentors.

KEY: <i>Chapters</i>	Student Project Directors	Faculty Advisors	Project title	Amount
<i>Barry University, Miami Shores, FL</i> Susana Chan • <i>George Fisher</i> <i>Science Outreach to Minority-Serving Elementary Schools</i> \$200	<i>Spring Hill College, Mobile, AL</i> Lauren “Elise” Franklin • <i>Carolyn Simmons</i> <i>Partners in Science – Spring Hill College &amp; Pillans Middle School</i> \$500	<i>University of Michigan-Flint</i> Samantha Grathoff • <i>Jessica Tischler</i> <i>Chem Club Demo Academy</i> \$350		
<i>Lake Forest College, IL</i> Maria Zawadowicz • <i>Elizabeth Fischer</i> <i>Measure of Our Success</i> \$355	<i>Stern College for Women-Yeshiva University, New York, NY</i> Avigail Soloveichik • <i>Donald Estes</i> <i>Facts, Fun, and Most Importantly, FOOD!</i> \$300	<i>University of Puerto Rico-Río Piedras</i> Johary Rivera-Meléndez • <i>Ingrid Montes</i> <i>The Magic of Chemistry Shows</i> \$250		
<i>Penn State Berks, Reading, PA</i> Heather Young • <i>Greglynn Gibbs</i> <i>Family Fun Night with Chemistry</i> \$300	<i>University of Arkansas at Little Rock</i> Christopher Finlay • <i>Jerome Darsey</i> <i>UALR Promise Neighborhood Science Project</i> \$200	<i>Xavier University of Louisiana, New Orleans</i> LeaAnn Love • <i>Mike Adams</i> <i>Science Saturdays at Xavier University</i> \$395		

# Caution: You Are About to Enter a Non-Normalized Zone!

## *The College of New Jersey Quantum Tunnel*

BY MARISA SANDERS

Last summer, members of The College of New Jersey (TCNJ) Student Chemists Association (SCA) collaborated with TCNJ Mentored Undergraduate Summer Experience (MUSE) participants to paint the TCNJ Quantum Tunnel in the basement of the institution's chemistry building. Inspired by Donald Hirsh's quantum chemistry course at TCNJ, the tunnel stands as a unique hot spot for chemistry majors and anyone else who wants to learn about quantum mechanics. *inc*



Marisa Sanders is double-majoring in chemistry and English at TCNJ and is president of the SCA.

The wall located at the entrance to the tunnel reads, "Caution! You are about to enter a non-normalized zone." It lists the postulates of quantum mechanics — the conditions for entering — and a clue that the quantum tunnel is beyond the confines of normalcy and classical classroom learning.

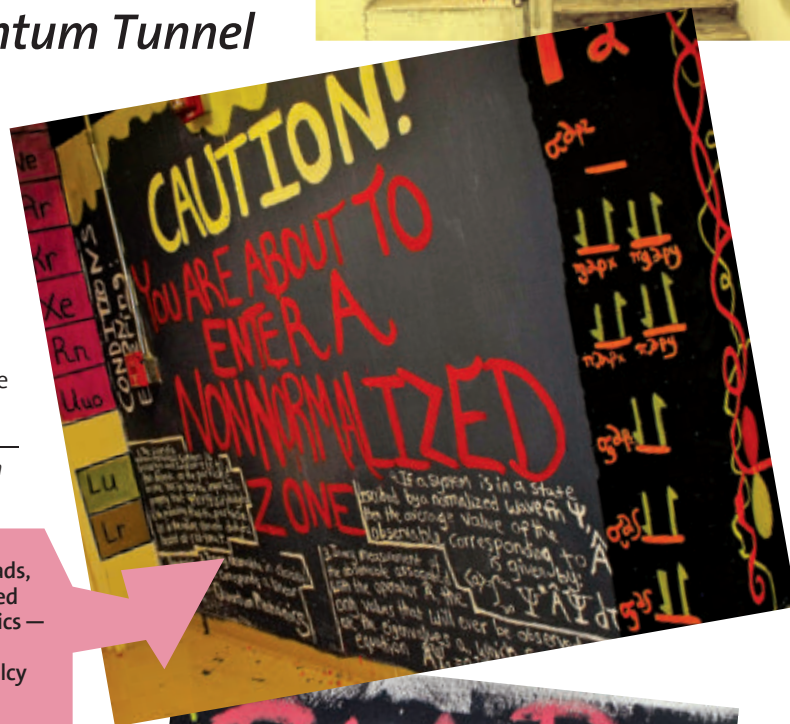
The pi molecular orbitals of butadiene are depicted in fluorescent paint.



PHOTOS COURTESY OF TCNJ



BEFORE



Several quantum models, including the rigid rotor, harmonic oscillator, and particle-in-a-box, are shown.



**AFTER**

**EXIT**

Author Marisa Sanders channels psi, representing a wave function.

The orange banisters leading to the quantum tunnel have "0" and "a" on each end, representing the limits within which functions in quantum chemistry are often integrated.

Jesus Melendez creates a Periodic Table of Elements for the quantum tunnel.



Call for Applications

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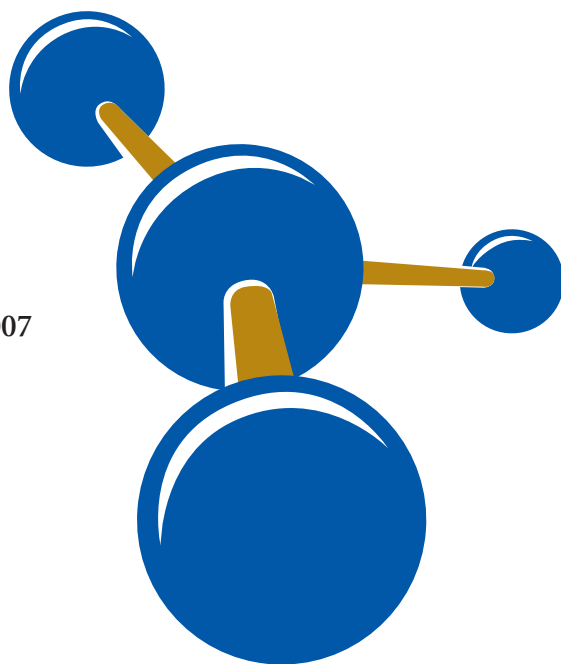
# South Dakota State University

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Disclaimer: The winner of the contest will be notified via the ACS Network. The winner reserves the right not to be publicized in C&EN. The C&EN staff reserves the right to select the issue date(s).

