



Fall 2019

chemistry

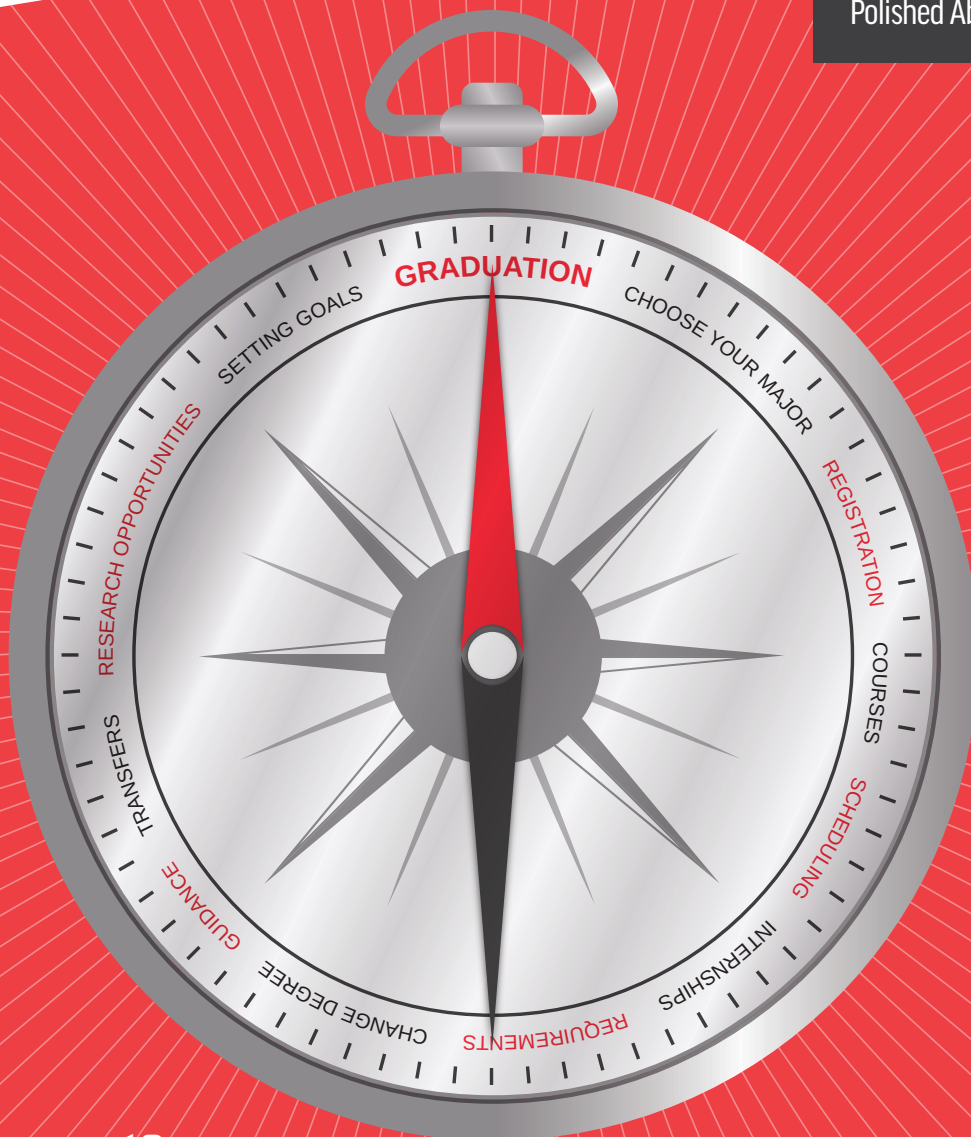
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CORE STUDENT PROGRAM

SUNDAY, AUGUST 25, 2019			
ALL LOCATIONS AT MARRIOTT MARQUIS SAN DIEGO MARINA, UNLESS OTHERWISE STATED			
8:30 AM – 3:00 PM	Student center	Marina Ballroom Salon D/E	
9:00 AM – 10:15 AM	Graduate school: The ins and outs of getting in	Marina Ballroom Salon D/E	
10:15 AM – 11:30 AM	The graduate school experience: What to expect	Marina Ballroom Salon D/E	
11:30 AM – 12:30 PM	All over the map: Exploring global opportunities <i>Cosponsored by the ACS International Activities Committee</i>	Marina Ballroom Salon D/E	 
12:30 PM – 2:00 PM	Networking 101 <i>Sponsored by the ACS Younger Chemists Committee</i>	Marina Ballroom Salon D/E	
1:30 PM – 4:30 PM	Undergraduate Research Papers (Oral)	Carlsbad	
2:00 PM – 4:10 PM	Our element(s): Younger chemists from around the world <i>Sponsored by the ACS Younger Chemists Committee</i>	Hilton San Diego Bayfront, Sapphire Ballroom MN	
2:00 PM – 5:00 PM	Graduate school fair	San Diego Ballroom Salon A/B	
5:00 PM – 6:30 PM	Reception featuring Derek Muller of Veritasium "The Uncomfortable Effort of Thinking" <i>Cosponsored by ACS ChemClubs, ACS-Hach Programs, American Association of Chemistry Teachers, and the Division of Chemical Education</i>	Marina Ballroom Salon D/E	 
MONDAY, AUGUST 26, 2019			
8:30 AM – 10:30 AM	Student center	Marina Ballroom Salon D/E	
10:15 AM – 11:00 AM	Ocean science: Research reflections at the marina <i>Cosponsored by the ACS Division of Environmental Chemistry</i>	Marina Ballroom Salon D/E	
11:00 AM – 11:45 AM	The job hunt: Do's and don'ts of applying and interviewing	Marina Ballroom Salon D/E	
12:00 PM – 1:30 PM	Eminent Scientist Lecture & Luncheon , Dr. Marya Lieberman "What if you could identify street drugs with a paper test card?" <i>Cosponsored by the ACS Division of Analytical Chemistry</i>	Marina Ballroom Salon G	 
2:00 PM – 4:00 PM	Undergraduate research poster session	San Diego Convention Center, Hall B	
8:00 PM – 10:00 PM	Sci-Mix: Successful student chapters	San Diego Convention Center, Hall B	 
EVENT TYPE:  Technical Session  Social  Grad School  Networking  Career			

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

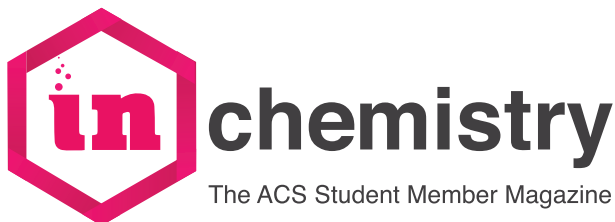
Chair: Michelle Boucher, Utica College (NY)

Program Chair: Valerie Goss, Chicago State University (IL)

acs.org/StudentMeetingInfo

#ACSUndergrad

   @ACSUndergrad



chemistry

The ACS Student Member Magazine

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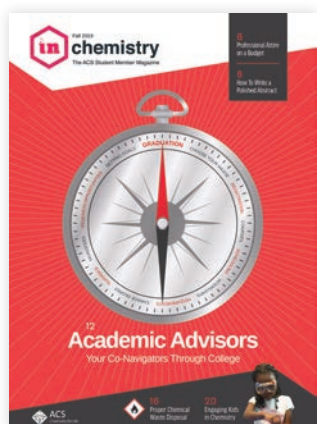
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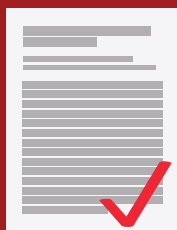


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HANDLE WITH CARE!

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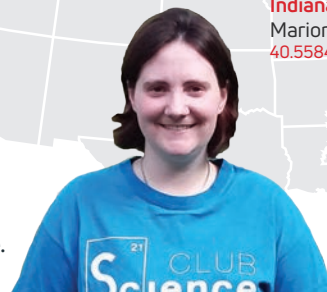


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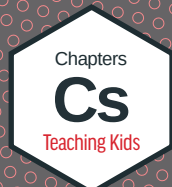
Chapters

Starting an ACS Chapter

A new president's experience.



Indiana Wesleyan University
Marion, Indiana
40.5584° N, 85.6591° W



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Chapters

Chemistry with Kids

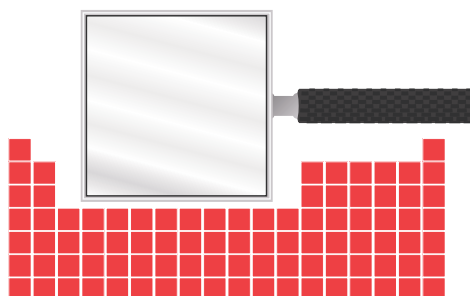
Learn effective ways to get smiles, spark curiosity, and impart knowledge when presenting chemistry to kids.

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IYPT: Element Scavenger Hunt

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See if you can figure out the missing elements in these puzzles.



BOSS TALK

with **Wendy Young**

Senior Vice President of Small Molecule Drug Discovery
Genentech

Wendy Young oversees an organization of about 400 scientists, who work to discover new medicines for patients. Wendy has spent the past 25 years engrossed in the discovery of molecules to treat cancer and cardiovascular and immunological diseases, and under her leadership, numerous compounds have moved into clinical trials.



What nontechnical skills do you value most in scientists at Genentech, and why?

It takes a strong team of individual, highly talented scientists working together to develop a new, innovative medicine. In those individual scientists, we value a wide variety of nontechnical skills: excellent communicators, good listeners, great collaborators, risk-takers, motivators, truth-seekers—and, most importantly, a clear passion for helping patients.

Women chemists face unique challenges in the workplace. What have you seen (at Genentech or elsewhere) that mitigates this situation?

Building a culture of inclusion starts at the top. I truly believe that Genentech has developed, and continues to nurture, an inclusive culture, and that our leadership

values all of its scientists regardless of gender, race, ethnicity, or background.

I don't deny that at times during my career, it has felt awkward being the only female in the room. But I appreciate that Genentech has spent more than a decade deliberately focusing on ways to develop women and to ensure that they have access to the kinds of opportunities, roles, and responsibilities to contribute at the highest levels.

Specifically, we've increased our efforts to recruit more women, and to develop them for broader responsibilities and leadership positions. We're also working with hiring managers to be cognizant of unconscious bias and to ensure that hiring decisions are based on true competencies. And we've created several internal groups aimed at evolving company

practices to better support women in the workplace: Genentech Women Professionals, Genentech Women's Officer Group, and Genentech Women in Science and Engineering (gWISE). gWISE is specifically devoted to identifying and addressing the unique challenges that women in R&D, including chemists, face.

Over the past decade, we have more than doubled the number of female officers (vice president level and above) at Genentech, from 15% to 40%. In this time, we've also brought 14 innovative new medicines to patients. Our continued focus on diversity of all types has been critical to these scientific advances.

When it comes to inclusion, I believe a company truly needs to walk the walk, not just talk the talk—and that the most important step a company can take is to ensure that

different perspectives are part of the conversation and people from all backgrounds feel valued.

For those of us outside of the biotech/pharma industry, can you think of an analogy that represents the level of difficulty in developing a commercially successful drug?

Drug discovery is incredibly challenging. Scientists are working to optimize and balance so many different properties—potency, solubility, cell permeability, stability, toxicity—all at once to make a promising new medicine. It takes a lot of trial and error and iterations to get it right. The closest analogy for me is the gymnast who must jump, leap, and twirl across a thin balance beam and then do a flip and dismount perfectly on both feet—time after time. When I see a gymnast accomplish this, I am always amazed, but I know it is the result of practice, time and again, by an experienced athlete. Drug discovery feels the same in many ways—there is trial and error, managing so many different variables, and also learning from mistakes, practice, and a can-do, never-give-up attitude.

You have spent substantial time volunteering on behalf of the ACS Division of Medicinal Chemistry (MEDI). What motivates you in doing so?

“I don’t deny that at times during my career, it has felt awkward being the only female in the room. But ... Genentech has spent more than a decade deliberately focusing on ways to develop women and to ensure that they have access to the kinds of opportunities, roles, and responsibilities to contribute at the highest levels.”

Being involved in ACS has been terrific on so many levels and more valuable than I realized it would be when I joined years ago. Initially, I saw it as an opportunity to “hang” with scientists I never would have met otherwise. But after so many years, I realize that I’m motivated to continue volunteering because I’m still benefiting tremendously from the ACS national meetings and MEDI programming. The meetings provide a fantastic opportunity to connect with world-class chemists and drug hunters. The wealth of information and camaraderie is so cool and inspiring. Face-to-face interaction beats reading the information from journals

any day. I leave each meeting with new friends, contacts, ideas, and information that will help us collectively push the frontiers of drug discovery and medicine development forward.

If you had to give advice to a young scientist, what would you tell them?

I have a short list: focus on what really matters; accomplish something important and keep amassing those accomplishments on your CV; be humble, honest, and transparent; be an inclusive leader; speak up; continue to improve your professional leadership skills; remember that all journeys have bumps in the road; and, finally, know what you stand for and be true to your values. When you know what you stand for, you can achieve anything.

The East Coast is where you received all of your higher education. What do you miss about spending time there?

I so miss warm summer nights! Growing up in New York, we would have evening barbecues and be outside for hours talking and playing games. Where I live in the San Francisco Bay Area, the sweaters and warm slippers come out when the sun sets. Summer can be chilly. I even have a heater under my desk at work, which I use in the summer, too. 🍷

This article first appeared in the ACS *Industry Matters Newsletter* on April 23, 2019.

Making Work Clothes Work for You and Your Budget

BY **INcHEMISTRY STAFF**

Dressing professionally seems simple: jacket, shirt, slacks, skirt, dress. Then you try it and suddenly you're faced with all kinds of quandaries: Are these pants dressy enough? Can I wear my favorite funky earrings? How can I afford a new suit? And what is "business casual" anyway?

Dressing for the workplace or professional events isn't always easy, and the choices you make have to take into account the image you want to project, the type of work environment you're in,

dress code policies, your personal style, and the business situation at hand.

Choosing the right attire for work can be a hassle, but there are ways to be appropriate and unique without blowing your budget.

What's appropriate?

Most professional situations will call for either "business attire" or "business casual". In general, formal activities, such as interviews, presentations, or power meetings with people two or three levels

above you, call for business attire. That's the full suit, business shirt or blouse, closed-toe dress shoes—the whole nine yards.

For professional activities in which you are just one of the crowd, such as a regular day in the office, a training course, or professional conferences (when you are *not* presenting), business casual is usually appropriate. Business casual is less formal than business attire. You can remove the tie and replace the jacket with a vest, sweater, or cardigan. But you

BUSINESS ATTIRE



BUSINESS CASUAL



still need to look put together so that you're taken seriously as a professional.

If you're not sure about what the expectations are or how traditional the dress code is, ask the human resources department, your boss, or colleagues.

When in doubt, dress up and dress conservatively. It is easier to turn a business outfit into something more casual on the fly (just take off the jacket) than it is to make a casual outfit dressier. Similarly, you can add flair to a navy suit with a fun tie or colorful jewelry, but you can't tone down prints and patterns as easily.

How on earth can I afford this?

If you've been a student your whole life, chances are you'll have to build a work wardrobe from scratch, without a lot of funding. Here are some tips for getting started without breaking the bank.

With limited funds, the most budget-friendly places to shop for good-quality work clothes are discount department stores like Marshalls, T.J. Maxx, and Nordstrom Rack, or outlet malls. You can also try searching the clearance racks at major department stores or visiting thrift stores and consignment shops.

If you're not sure about the look or fit you want, you can visit a store that specializes in customer service and tailored business clothing to get ideas for the types of pieces

Lab notes

If you will be entering a laboratory at any time, the U.S. Occupational Safety and Health Administration (OSHA) requires you to tie back long hair and wear long sleeves or a lab coat, long pants, and low-heeled (less than 1.5 inches) leather shoes that completely cover your foot. Industry takes these regulations very seriously, so plan your wardrobe accordingly.



that suit you best. Then go to stores that are more affordable to purchase what you like.

You do want to invest in one or two good-quality business suits and have basic items that can easily pair with other pieces of clothing. A dark suit, a versatile pair of pants, and a plain business shirt or blouse are good foundation pieces that you can rely on for any situation for years to come.

And remember: you do not need to build a whole wardrobe at once. Build slowly as your budget allows, and eventually you'll have what you need to get from week to week in the office.

These clothes aren't me!


Unless you've been wearing ties, dresses, and suits your entire life, there is a good chance that you will feel stiff and awkward the first time you wear professional clothes. There is a lot you can do to add your own personal style to your work wardrobe without sacrificing professionalism.

Start by making sure the pieces fit properly. Some stores (especially

those that specialize in men's suits) actually sell unfinished clothes and tailor them to fit you. Otherwise, most dry cleaners will do affordable alterations.

It's OK to add touches of your personality into your wardrobe, but your style should not conflict with the dress code of the office or laboratory. If you like bright, bold colors, wear them with simpler pieces that tip your ensemble closer to the conservative side. If you have brightly colored hair, make sure it is styled neatly so that it is not a distraction. If you have visible piercings, be sure to wear smaller jewelry.

If you're into fashion trends, stick to one or two trendy but work-appropriate items paired with more conservative basics. This is a less expensive approach that ensures your look does not overshadow the good impression you display in your work. You want people to notice you, not your clothes, hair, or accessories.

Starting with a few pieces and a little creativity, you can make your work wardrobe work for you. 



ACS & You

How To Write a Professional, Polished Scientific Abstract

BY BLAKE ARONSON

In the science world, you make your first impression long before you meet anyone in person. How? Through an abstract—that brief, powerful paragraph that describes your research.

Whether it's for a conference presentation, journal article, grant proposal, or dissertation, the abstract—as well as the title and the author listing—is the first window into the scope and purpose of your work. It tells the reader about the content of your research and the results of your experimentation. And it tells the reviewer or editor which session or journal you belong in, so potential collaborators can find you.

To show that your research is relevant and worth learning more about, you need to write a polished and professional abstract. Here's how to write titles, author listings, and text for abstracts that are informative and professional in any presentation format.

The title

Keep your title short and descriptive. Don't oversell or sensationalize your work; simply state what it is. If you absolutely must give detail, you can add a

?

ABSTRACT CHALLENGE

See if you can spot the errors in this online quiz:

bit.ly/iCabstract

subtitle, using a colon to separate it from the main title.

Reviewers start with the title to make sure they have you in the right session. For example, “C–H bond functionalization in long-chain alkanes” will be placed in an Organic Chemistry session, whereas “Iron oxide catalysts for hydrocarbon C–H bond functionalization” will be placed in an Inorganic Chemistry session.

Scientists use titles to see whether your work is relevant to them. If you write “Curing genetic diseases through molecular modeling”, you had better have the clinical trial data to back up your claim. “Molecular basis of multiple mitochondrial dysfunctions syndrome: Impact of substitution on the protein NFU1” will be of interest to other biochemists studying protein functionality.

Here are some additional technical tips for titles of scientific abstracts:

- » *Start with an adjective, a noun, or a verb. Never start with an article (e.g., “The”, “A”, or “An”).*
- » *Do not end with punctuation; your title is not a sentence.*
- » *Use plain text (no bold, italics, or special fonts).*
- » *Use sentence case. The only words that need to be capitalized are the first word of the title, the first word after a colon, and any proper nouns, acronyms (e.g., FT-IR), or element symbols in formulas (e.g., NaOH).*

The authors and affiliations

List the names and affiliations of everyone who contributed to the work, starting with you. If you are submitting the abstract for an oral or poster presentation, you are the presenting author and your name goes first. If you are submitting an article to a journal, your name will either go first or be highlighted in some fashion. (It depends on the protocols of the journal and the preferences of your research advisor.)

You also need to include your research advisor. With the exception of some very unusual

Anatomy of an Awesome Abstract

A professional abstract summarizes the scope of your research and shows why your study is worth learning more about.

HPLC analysis of contaminants on baby pacifiers

Dawn Young¹, Joey Fresh¹, Grey Oldman¹

1. The Pennsylvania State University, Department of Chemistry

Studies have shown that a large fraction of baby pacifiers have caffeine on them, especially those of first-born children. Because the caffeine is believed to originate with the parents, it is hypothesized that parents of multiple children might seek out pain relief in addition to stimulants. However, the most common analgesic—acetylsalicylic acid (aspirin)—can trigger Reye's syndrome in infants, leading to brain and liver damage. To determine the amount of contamination, pacifiers were collected from a local day care center. Organic contaminants were removed from the pacifiers by ethanol extraction. The resulting solutions were analyzed by HPLC. More than 90% of the pacifiers were found to be contaminated with acetylsalicylic acid. The complete results for all the pacifiers will be presented.

Abstract title

- Write a short, descriptive title in sentence case.
- Capitalize only the first word, acronyms, and proper nouns.

Authors and affiliations

(you, faculty advisor(s), co-worker(s))

- List the names and affiliations of everyone who contributed to the work.
- Be sure the lead author is the person who completed the study or will be presenting the work (usually you).
- The affiliation should be the complete name of your school, without any abbreviations.

Abstract body

Write a concise, high-level summary of 2000 characters or shorter. Use the third person and passive voice, and be sure to correct any grammar or spelling errors.

Key elements to include:

- Importance of your research
- Problem your work attempts to solve
- Approaches or methods used
- Overview, not details, of results

This abstract is for educational purposes only and is not based on a real study.



circumstances, your project is part of a larger body of research that is coordinated by your advisor. Your advisor helped you to develop your project, guided your interpretation of the results, and provided you with laboratory space and supplies, and your results will be incorporated into your advisor's overall body of research. So your advisor gets credit.

You should include anyone else who contributed significantly to the research, such as a labmate who performed some of the work or a colleague in another lab who assisted you with analyses.

Include your affiliation as well as that of your coauthors. Your affiliation is your school. For clarity, be sure to cite the complete name of your school, not an abbreviation or short form (e.g., use "California Institute of Technology", not "Caltech"). Unless you are collaborating with a group outside of your department or doing research at another institution, your coauthors will have the same affiliation as you.

The body

Abstracts are high-level summaries. They are typically no longer than 2000 characters (preferably shorter than 1000 characters). Using complete sentences, describe why

the work was done, what types of experiments were completed, and the results. You are writing for other scientists, so you do not need to explain common scientific terms, only techniques specific to your research. This guideline will help you stay within the character limit.

Keep it simple. Experimental parameters, data, graphs, references, and extensive discussion of the results are for your presentation or article. If you find yourself trying to include these details, you are saying too much. Some abstract submission systems, like the ACS Meeting Abstracts Programming System (MAPS), do not accept graphs, figures, or references, so you run the risk of being rejected from a symposium. There are instances when a graph or figure is necessary, but they are the exception.

Here are some key elements to keep in mind as you are writing:


- » *Why is your research important?*
- » *What problem does your work attempt to solve?*
- » *What specific approaches did you take or methods did you use?*
- » *What were the results?*
- » *How does your research add to the body of knowledge?*

Keeping the abstract general helps with the challenge: having to submit

your abstract before you complete your research. This is especially common if you are presenting at a technical conference, like an ACS national meeting, where submissions are due six to seven months before the conference. In this case, you can submit a short abstract of the work you are planning to do, and end with, "The results of this work will be presented."

Write in the third person using passive voice (e.g., "Microporous silicates were synthesized" rather than "I synthesized a series of microporous silicates"). In the scientific community, this is the more professional way to present research.

Finally, ***proofread, proofread, and proofread again***. Make sure that your sentences are clear and error-free. Have a peer, grad student, or experienced labmate (or two) review your abstract for clarity, grammar, and punctuation. Also, have your research advisor review and approve it. This work represents your advisor's lab, so your advisor should have a say in what you report.

Writing abstracts is a skill that is essential to both the research world and the business world (where it's called an "executive summary"). Start developing this skill now to set yourself up for success later. 

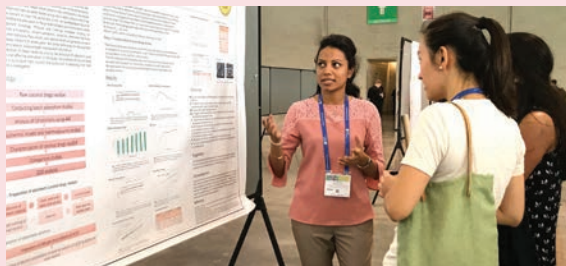
Blake Aronson is a program manager for ACS Student Communities. She works with undergraduate programs at two- and four-year institutions, as well as the SCI Scholars Program and other ACS initiatives.

Reference

How to Write an Undergraduate Abstract, by Elzbieta Cook. www.acs.org/content/acs/en/meetings/national-meeting/agenda/student-program/undergraduate-abstract.html

Tips for submitting an abstract for an ACS meeting

For ACS meetings, abstracts are submitted through the Meeting Abstracts Programming System (MAPS). Use these tips to avoid common MAPS mistakes.



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1

Pick the right session

Most undergraduate students present research at the Division of Chemical Education (CHED) Undergraduate Research Poster Session. CHED also sponsors oral sessions for undergraduate research. Other divisions may also organize student programming. Check with your research advisor to see which session is recommended for you.

If you want to present at the CHED Undergraduate Research Poster Session, select CHED as your program area. Next, select the appropriate research subdivision. For example, if your research is about protein structures, your subdivision is Biochemistry; if you analyze manganese complexes, your subdivision is Inorganic Chemistry. Do not select Chemical Education as your subdivision unless your research really does focus on developing pedagogies.

To present in the oral session, select a presentation type of "Oral Preferred". Be aware that the number of spaces for oral presentations is limited. If CHED can't fit you in, your oral presentation will likely be moved to the poster session.

2

Pick the right presenter

Undergraduate sessions are for undergraduate presenters only. If you are presenting in an undergraduate session, you **must** be designated as the presenting author. You can also have other presenting coauthors, if it is appropriate. You must include your research advisor as a coauthor, but not as a presenting author.

If your abstract does not list an undergraduate presenter and a research advisor coauthor, it will be moved to a different session or rejected.

3

Keep it simple

Remember that there are requirements for abstract submission systems. The ACS MAPS will not accept abstracts longer than 2000 characters or abstracts with graphs or diagrams.

Student Chapter Posters

CHED hosts a "Successful Student Chapters" section at the Sci-Mix poster session. If you want to present a poster on the great work your ACS student chapter is doing, you can submit an abstract through MAPS. Just be sure to:

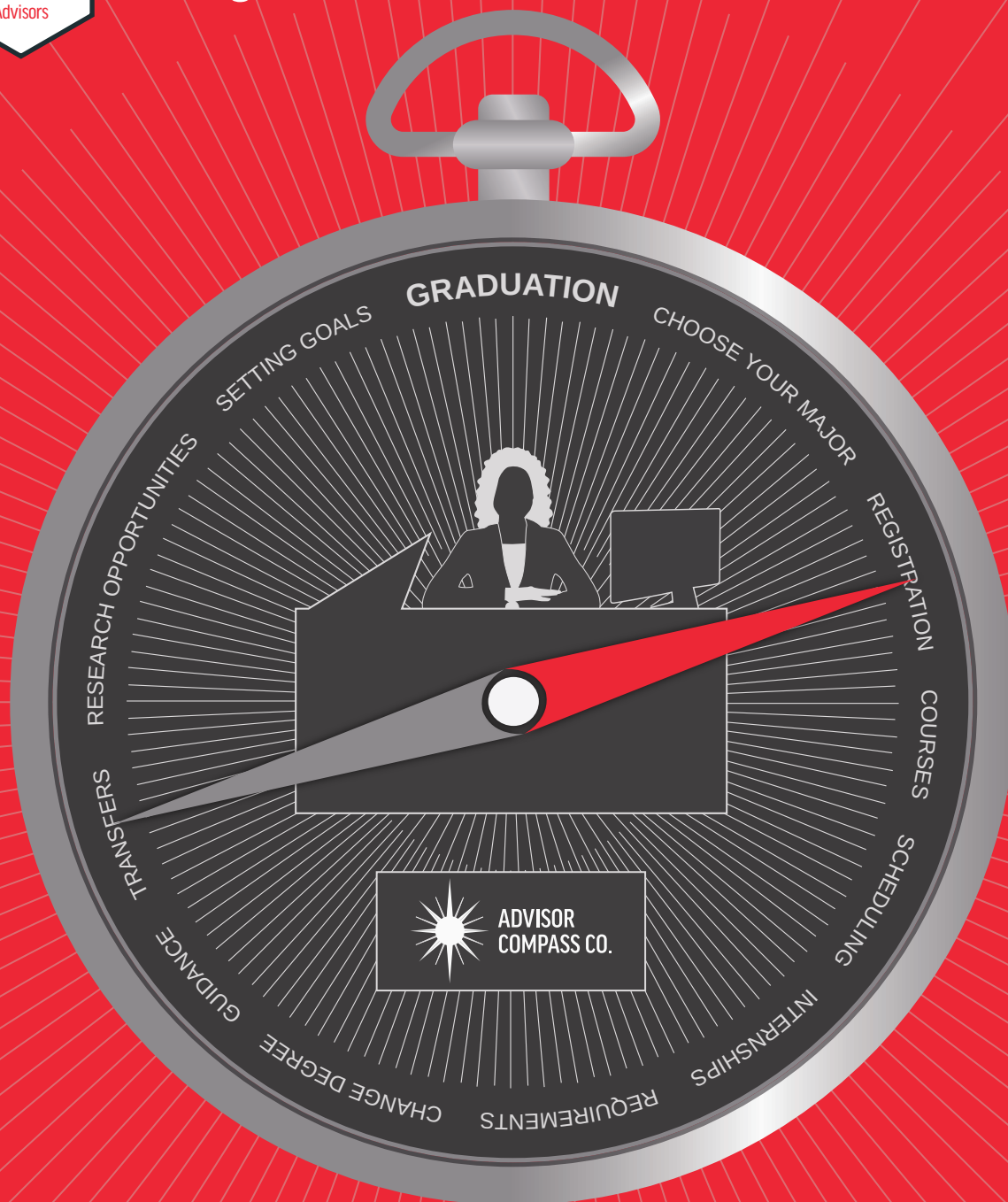
- » Use your abstract to summarize your chapter activities
- » Select CHED as your program area, and check the "Sci-Mix" box
- » Enter your chapter's faculty advisor as a coauthor

Need help submitting abstracts to ACS?

For general questions, email undergrad@acs.org. For technical concerns, email maps@acs.org or call 800-333-9511 (United States, Canada, and Mexico) or 614-447-3776 (outside North America).



College Life



ACADEMIC ADVISORS OFFER GUIDANCE THROUGHOUT your college career. Here's how to take advantage of this valuable resource. By **Amanda J. carroll**

Chart Your College Goals with an Academic Advisor

Academic advisors are a little like dictionaries: you have access to one, you know it's important, and you almost always try to figure things out on your own rather than consulting one. But a good academic advisor is a valuable resource who can help you chart your path through your undergraduate years and into your career.

I've been an academic advisor for a few years now. I help guide students toward their ultimate goals so they have a positive college experience. If you're wondering how academic advisors help you make the best decisions as you progress through your major, read on.

Why you have an academic advisor

As an academic advisor, my main role is to help guide students on their road to graduation. This may include giving big-picture advice, such as what degree and concentration to pursue (e.g., B.A. versus B.S., or biochemistry versus environmental chemistry). Or it may involve providing advice about requirements and strategizing about whether to add and/or drop courses, which of course comes with a host of paperwork that needs approval.

Early in your academic career, an advisor will help you learn about different chemistry majors and what you can do with a chemistry degree. Advisors also help you find opportunities to grow as a scientist, such as research positions for first- and second-year students.

An advisor can guide you in determining which courses are best for you, which sections fit into your schedule, and which resources are available to help you complete your degree on time.



Getty Images

Later in your academic career, an advisor will guide you through the process of applying for graduation and provide advice on determining what to do after graduation to successfully make the transition from being a student to being a professional.

You may have one advisor throughout your college career, or your advisor may change. Some universities or departments pair you with an advisor as an incoming first-year student, and that's the advisor you work with until you graduate. Or you may have one or two advisors in your first year and then transition to a new advisor once you declare a major. Your advisor may be dependent on your concentration within your major, and double majors often have two advisors—one for each major.

Advisors have different styles, strengths, and weaknesses, but their goal is always to help you. Even if you change advisors, you can still contact a previous one with questions.



Meeting up with your advisor: when, and how often?

How often you see your advisor is somewhat up to you. You will need to see your advisor at least once a semester for registration purposes (they will make sure your courses and degree requirements are on track).

But you can get more out of your advisor if you see them more often. I have some students who come by several times during the semester for advice or guidance on specific topics. Some ask for assistance when they are considering research or internship programs. They may stop by to get involved in extracurricular activities, like a teaching assistantship, a tutoring position, or joining our ACS student chapter.

A few of my advisees come by on a more frequent (sometimes weekly) basis, and they become my mentees. These meetings often entail stories of great successes or struggles, and the students require advice and guidance specific to their circumstances. For example, I've talked with students about getting into research, making top scores on class exams, and being selected as the winner of scholarships or awards. I've also had mentoring meetings about family struggles, mental health issues, failing courses, and withdrawing from the university. Each meeting is about finding the best solution for the student and helping them navigate the process for getting there.

What an advisor can and can't do

Understanding what your advisor can and can't do for you is important. We can offer you open and honest communication, but it is a two-way street. Let your advisor know what your plans are. If we know what your goals are, we can better help you achieve them. If your goals or plans change (or if you're unsure about what you want), let us know.

Advisors have a lot of institutional knowledge and experience, so if you don't understand something, feel free to ask clarifying or follow-up questions so that you and your advisor are on the same page.

Academic advisors make recommendations and steer you in the direction you need to go, but it's up to you to do the initial work. When you're scheduled for an advising appointment, show up on time and be prepared to share your needs and goals. If you're signing up for classes, you should come with a list of the ones you want to take. If you're concerned about your progress, bring some examples of your work to talk about. If you're interested in research opportunities or internships, ask your advisor about what they know, and then take that information and run with it.

Advisors work with many students and may not be available for long appointments during certain times of the semester (especially during registration season), so be respectful of their time. If you need to meet, make an appointment and let your advisor know why you are requesting the meeting. This allows your advisor to be prepared and ready to help you in the best way possible.

Ultimately, your advisor is there to advise you, but they can't make decisions for you. The ball is always in your court to weigh the pros and cons of a scenario and make the final call.

Author

Amanda J. Carroll is a lecturer, an academic advisor, and an ACS student chapter faculty advisor at Tennessee Technological University.

"I've had mentoring meetings about family struggles, mental health issues, failing courses, and withdrawing from the university. Each meeting is about finding the best solution for the student and helping them navigate the process to get there."



Special circumstances

Changing majors

If you're unhappy with your major, degree, or concentration, explore changing it—even if it's to something other than chemistry. I've had students express interest in changing their major but then second-guess themselves when they realized they would also change advisors. I assured them that following their passion would result in much higher career satisfaction and happiness. I also assure students that I can still help them to the best of my ability if they have questions. A few of them have taken me up on that offer, at least until they became more comfortable with their new advisor.

Changing schools

Whether you're transitioning from a two-year college to a four-year institution (like I did) or going from one four-year institution to another, you will face a lot of decisions and may run into some challenges. It can be stressful to leave an area, program, and advisor with which you have become familiar and comfortable.

Your current advisor can help you make an informed decision about which universities and programs may be a better fit for you. Make sure to reach out to an advisor at the new school (or schools) you are interested in. Talking to them about the transfer process, and especially about how credits are handled, can make the transition much easier. You can also ask about extracurricular activities and other opportunities available at their school.

I'm often contacted by transfer students looking for information about our academic programs and how their credits will transfer. The students who take the time to make these connections through calls or emails get information about more than they initially asked about, and they proceed with a greater sense of comfort about getting a new advisor and entering a new school.

Changing advisors

Sometimes your current advisor just isn't


ADVISOR or MENTOR?

Advisor is a formal role designated by an institution to guide students through the school's enrollment procedures. **Mentor** is a formal or informal role to provide advice on your career, academic choices, and personal concerns.

There are several types of mentors, who fulfill specific needs. These roles can be filled by one person or multiple people.

- **Academic mentors** help students to build their knowledge and skills through research opportunities, internships, cooperative learning (co-op) positions, and summer research experiences for undergraduates (REUs). Some opportunities are not obvious, so mentors direct students to jobs in the fields where a student's interests lie. Mentors can coach students on how to enter the workforce or how to apply to graduate programs.
- **Research mentors** not only supervise a student's research project but can also provide guidance about future academic and career paths, and help with many of the tasks of an academic mentor.
- **Personal mentors** provide overall guidance and support. Studying chemistry is difficult, and everyone has moments of doubt. But a good mentor can help get you through the tough experiences, encourage you to reach your potential, and expose you to opportunities that will propel you toward your goals.

working for you. You may not feel the right rapport, or the advice may not fit your needs. It's OK to seek out another advisor. Your advisor may even be able to help you find a good replacement. If they are unable to, seek assistance from other faculty members in the department.

Most academic advisors who are faculty members have been selected for this assignment because they care deeply about the success of students. Many volunteer their time for this role because they want to help students reach their full potential and achieve specific goals. Knowing there are people who are on your side and have a wealth of knowledge and advice to share is definitely to your benefit, so don't miss out. 



[inchemistry.acs.org](https://www.inchemistry.acs.org)

Read more
College Life articles
on the iC website.



Lab Life: Waste Disposal

How you dispose of chemicals has an impact that extends beyond the laboratory. Be smart about your chemical waste practices with these tips, and get guidance from instructors and research advisors before disposing of chemicals and lab equipment. For more information, visit acs.org/safety.

What is lab waste?

- Excess reagents or lab byproducts
- Degraded or expired chemicals
- Chemicals that are no longer needed
- Damaged or unusable labware

EXP 11/18



Consequences of improper disposal

- Fires, explosions when incompatible wastes react
- Injuries
- Damage to facilities and equipment
- Contaminated soil and drinking water
- Higher disposal costs

Storage tips

- Use OSHA-compliant chemical safety cabinets
- Learn which wastes can be stored together safely
- Label waste storage containers clearly and consistently

HAZARDOUS WASTE

ACCUMULATION

START DATE _____

CONTENTS _____

HANDLE WITH CARE!
CONTAINS HAZARDOUS OR TOXIC WASTES

Contributing Author: Rachel Bocwinski

REFERENCES

1. Managing Chemical Wastes in the High School Lab, by Jennifer Panther Bishoff
2. Lab Waste Drain Disposal, Montana State University

Common Hazardous Waste

Organic solvents

Carbon-based compounds

Heavy metals

As, Be, Cd, Cr(VI), Pb, and Hg

Corrosive liquids

Strong acids (pH < 4) and strong bases (pH > 10)

COMMON HAZARD LABELS



Radioactive*



Biological hazard*



Flammable



Environmental hazard



Corrosive



Carcinogenic

*Handled by separate protocols

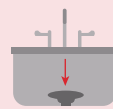
Disposal Routes



Containers labeled "hazardous waste"



Containers for broken/unusable glass and sharps



Laboratory drains for approved wastes



Regular trash for solid wastes placed in packages that will not spill or break



Be sure to verify laboratory waste procedures with your instructor, advisor, or supervisor. If you accidentally dispose of something improperly, tell the person in charge of the lab immediately.

Keeping It Green



Applying green chemistry principles may reduce the amount of hazardous waste generated.

Atom economy

Use reactions that generate fewer byproducts

Less hazardous chemical syntheses

Use procedures that require/produce fewer toxic materials

Safer solvents and auxiliaries

Use less toxic solvents and separating agents, or eliminate them

Opportunities and Events

Upcoming Meetings



Find meetings near you:
acs.org/meetings

ACS Fall National Meeting ▶

August 25–29, 2019

San Diego, CA

Midwest Regional Meeting

October 16–19, 2019

Wichita, KS



Getty Images

Southwest and Rocky Mountain Regional Meeting

November 13–16, 2019

El Paso, TX

5th Annual Frontiers in Green Materials Research Symposium

December 16, 2019

London, UK

ACS Spring National Meeting

March 22–26, 2020

Philadelphia, PA

Opportunities

November 30, 2019

SCI Scholars Application Deadline

acs.org/SCI

Industrial internships for chemistry and chemical engineering undergraduate students.

March 1, 2020

ACS Scholars Application Deadline

acs.org/Scholars



Scholarships for underrepresented minority students majoring in undergraduate chemistry-related disciplines. Application opens November 1, 2019.



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ACS Career Resources & Events ▶

acs.org/careers

Access resources to explore job opportunities and get career advice.

Outreach Training Program acs.org/OTP

Learn to plan and execute outreach events through in-person workshops and online courses.



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ACS Webinars acs.org/acswebinars

Learn from the best and brightest minds in chemistry through hundreds of webinars.



Chapters

Starting an ACS Student Chapter

What inspired you to start an ACS student chapter at your school? What was the main thing you hoped to accomplish?

I was inspired to start a chapter because I thought it was important to become part of something bigger and be involved on a bigger scale. I also thought it would be a good inspiration for our school and other clubs. The main thing I hoped to accomplish was to get our club more exposure and to connect with other schools so we could learn from each other.

Tell us how you established your chapter. What were the steps in your process?

First, I researched what it meant to be an ACS student chapter and what it entailed. Second, I talked to my faculty advisor and officers about what we would need to accomplish to become an ACS student chapter, types of events to schedule, and trying



out new experiments at events before becoming a chapter. Once it was decided that we wanted to become an ACS student chapter, I talked to the student members of our club about joining ACS to become ACS student members and helped them complete that process. Finally, I made sure that the club met all the requirements, planned for the future of the club, and filled out an application.

What role did your faculty advisors have in helping you establish the chapter? In what ways (if any) do they guide your chapter?

Our faculty advisor, Dr. Stephen Leonard, helped me understand and go through the requirements for an ACS student

chapter, find members to be ACS student members, and plan for our club events. Our faculty advisor helps plan, coordinate, and figure out experiments for events. He also helps advertise to students, gives advice, and helps me connect to the right people to get everything coordinated.

Tell us about your chapter officers. Who are they, and what are their responsibilities? How were they selected?

The chapter officers are Ashley Springer (president), Rebekah Hoffmann (co-vice president), Megan Ferris (co-vice president), Megan Bernth (marketing), and Kyle Pessefall (secretary). The officers have a love of science and volunteering.

We work well together and enjoy exposing other people to science. Officers are members of the club who volunteer themselves for a position, and the current officers decide on who they think would best suit the position and help further and benefit the club.

How did you recruit members? What strategy got you the most new members?

We recruit members through our marketing techniques and events. To get members and increase attendance, we use social media, personal emails, campus-wide emails, posters, word of mouth, chapel slides, T-shirts, and large signs, and we offer people opportunities to volunteer at events. We hold many fun



Want to be featured?

Let us know what your chapter is up to by emailing inchemistry@acs.org.

events throughout the year. Some are aimed at college students to bring in members, and others are volunteer events that give our members the opportunity to be involved in the community. Our events are the strategy we use the most to get new members.

What was your first event? How did it go, and what did you learn from it?

Our first event was the Fire & Ice event. During this event, we used molecular gastronomy techniques to make liquid nitrogen ice cream. To ensure safety, we had a trained faculty member, and members were trained to properly use all of the equipment and techniques. We repeat the safety precautions to all participants and, depending on the experiment, we inform campus police. We hosted the Fire & Ice event to generate excitement about science and our club and to build community at the beginning of the year. The event was

very successful because a lot of new students and existing members came to participate. We learned the best way to advertise for our events, the time and days that worked best for students, and what type of experiments students and members like.

What ACS resources did you use to get the chapter started and continue its activities? What other resources do you use?

We received an ACS Student Chapter Starter Grant, which allowed us to purchase needed materials for events and improvements. Our club is also supported by our school's Student Government Association, which gives us a budget to use to run our events. They also help expose our club to different resources.

What has been your biggest challenge so far, and how did you work through it?

The biggest challenge we face is making sure

our attendance is up and our members are staying involved. We work through it by advertising our events, changing things up, and adding new experiments to events to keep everyone interested and bring in new students.

What advice would you give someone trying to start a chapter?


I would advise them to never give up, have fun with it, use your resources, and make sure you are keeping everyone involved and up to date on the process. Don't be afraid to ask for help from people or other clubs.

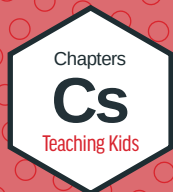
Has your chapter collaborated with other groups (e.g., university clubs, ACS student chapters, ACS Technical Divisions, or other professional societies)?

We have had the great opportunity to collaborate with different university clubs at our school and the local public library. With the

other clubs, we put on experiments and different booths at homecoming, the Riley Children's Hospital Dance Marathon, the greenhouse plant sale, and the new student orientation. We also have been involved with the local public library's Science, Technology, Engineering, Art, and Math (STEAM) event, where we set up kid-friendly experiments that community kids come in and participate in, which exposes them to the world of science.

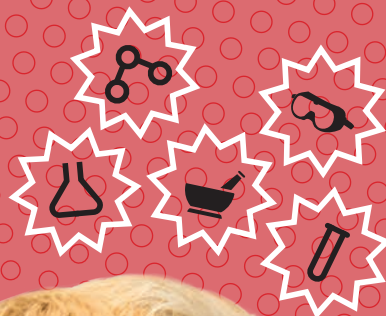
What do you hope to achieve next year?

We hope to continue expanding our membership and outreach programs. We would also like to collaborate with different ACS student chapters on different events. Also, we will be working on expanding professional development opportunities to officers and members by trying to attend ACS conferences and allowing our members and officers the chance to lead planning committees for events. 



Surefire Ways To Effectively Engage Kids in Learning Chemistry

BY PATRICIA GALVAN



Whenever you share your love of science through outreach activities with children, tweens, and teens, they believe they are in the presence of greatness. To them, you are a celebrity. Whether you visit a classroom, invite students to your campus, or capture their minds at a science center, library, or other public venue, you are a unique voice with intriguing information about how chemistry works in our everyday world.

Of course, as a volunteer ambassador of chemistry, you're not trying to be a celebrity; your goal is to get kids to learn and be just as excited about chemistry as you are.

So how can you design an outreach event that is both educational and exciting (and, of course, safe)? Read on to find out how to get those smiles, spark curiosity, and motivate kids to both learn and like chemistry.

Inspiration from education experts

The outreach you do in science centers, scouting programs, science festivals, and other events is called "informal education", and it's more significant than you may realize. The National Informal STEM Education Network (NISE Net) is one of several groups conducting research and developing practical resources in the field of informal science education (ISE). They boil down the goals of ISE to three key words: interest, relevance, and self-efficacy. When you organize outreach events, you want kids to



Photo by Linda Wang ©Copyright 2019 American Chemical Society

be *interested* in science, to see that science is *relevant* in their lives, and to develop confidence in their ability to learn and do science (*self-efficacy*).

Last year, ACS partnered with NISE Net to develop *Explore Science: Let's Do Chemistry* (acs.org/letsdochemistry), a series of chemistry activities that promote interest, relevance, and self-efficacy. Check it out to learn how to present tested activities, develop new ones, or identify what makes your favorite outreach activity so successful.

Framing the chemistry

If you are like me, you may have looked at the trio of *interest*, *relevance*, and *self-efficacy*, and asked, "Where's the chemistry?" Of course, chemistry content is the first thing to consider when designing hands-on activities. When you organize outreach events, make

sure you set them up so that kids have a positive and safe experience exploring a key chemistry concept or practice.

It is important for kids to see that you understand chemistry and can do neat things because you have this knowledge. Demonstrations that wow kids establish that you are a successful learner of chemistry, but they do little to increase your audience's experience learning chemistry. Hands-on activities, where kids explore and make discoveries with your guidance, build their self-efficacy as learners of chemistry.

Speaking the language

You *speak* chemistry. When you answer exam questions and write lab reports, your words are a culmination of everything you have learned so far. However, while your point-earning explanation is correct, it falls short when talking



Explore Science: Let's Do Chemistry is a series of free chemistry activities that promote interest, relevance, and self-efficacy. Check them out at acs.org/letsdochemistry.



Know Your Audience

Use the following general characteristics to plan your activities and your approach. Individuals vary greatly, so be prepared to adapt as needed.

Ages 5–7

Respond enthusiastically—Enjoy their energy, and stay calm to avoid escalating behaviors.

Openly curious—Capitalize on their curiosity. Ask questions that the demo or hands-on activity will answer. Expect to answer questions about science and your career. This may be the first time they have ever met a scientist!

Want your approval—Catch kids being good. If you point out students who are ready for chemistry because they are wearing goggles, other kids will suddenly rush to do that, too. Make eye contact, smile, and notice specifically what they are doing well (“I can tell that you used the dropper the way I showed you” or “Thank you for waiting patiently for everyone to be ready”). If you need to redirect their ideas, recognize their thinking and tell them what is correct (“I understand why you might think that but what actually happens is different”).

May or may not read yet—Provide strong visual cues with written words in context. Give instructions orally, and model what you want kids to do.

Ages 8–10

Easy to motivate—They are very willing to participate and love to help.

Curious—Provide an everyday experience, and then ask a question about it, and they will be curious right along with you.

Seek the approval of adults and peers—Calling individual kids out for being good is not effective as it is with younger children, but they do want to

shine. “I noticed that some students are very good at releasing just one drop at a time with the dropper, rather than squirts. Those of you who did this well, what are some strategies that you can suggest to others?”

Read and write with purpose—Kids at this age have some basic skills in place, so they can self-direct. Provide either written or oral instructions, but have kids paraphrase instructions rather than just reading them aloud. If you want them to write, provide plenty of room and time.

Ages 11–13

Engage best in small groups—At an event with stations, you will notice kids at this age travel alone or in single-gender groups.

Less likely to show that they like something—Twins and teens tend to internalize their enthusiasm. Know that you are making an impact, even though you likely won’t receive an enthusiastic response. Signs that they like something will come later when they talk with friends about the experience.

Seek approval more from peers than adults—They want your approval but might not respond because they are concerned about what others might think about them. Recognizing good ideas and behaviors is still important; it’s just better done individually or in small groups.

Expanding their vocabulary—They are adding words and concepts to their repertoire constantly. However, they often use words before they fully understand what they mean. It’s easy to misinterpret word usage

for understanding. Ask them guiding questions to get them to explain their thinking, and then add to that as appropriate. This will help them develop better understanding and help you gauge what they know and how to talk with them.

Ages 14–17

Settled and eager to hear what you have to say—High schoolers have more self-control, and much of the redirecting needed when the students were younger is unnecessary. Enjoy their attentiveness!

Require immediate relevance—With information so easily accessible (and so much they are required to know for school), teens tend to tune out what they don’t need to know. Provide explanations that apply to their immediate lives. Better yet, ask them to think of possible connections to consumer products or their own experiences. It’s much better if they find the relevance to their lives, so avoid telling them outright.

Finding their identities—High school students are testing out who they are and who they want to be. They also have a strong desire to be accepted by their peers and by adults. Nonchalantly accept them as they are and move on to what you want to talk about.

Considering their own careers—Teens are starting to make choices that will determine their careers. Share your experiences with chemistry and possible careers (if you have any ideas). It’s important to have a scientifically literate population, so your time and insight are valuable to all students.

with elementary and secondary school students. The best explanation for them should be a culmination of everything they have learned so far in science class.

How can you find out what kids know about chemistry? Before developing your program, consult acs.org/kidsandchemistry for general information on what's covered in U.S. schools. Because each state, district, and school has its own guidelines, you should also talk to your local school district or, if possible, a teacher.

When you're conducting the program, learn the kids' vocabulary by simply talking to them. Ask questions that don't have a right or wrong answer, listen to the words students use when they reply, and then adjust your explanation to incorporate their words and ideas.

Use their words to introduce new vocabulary. For example, you can say: "This is a word that high school (secondary) students use, but because you said _____, I know that you can handle it." Everyone loves a compliment, which will help students remember. Listen again as kids try to connect this new information to what they already know. Riff off their ideas by sharing a similar experience, and listen some more. Remember that conversations involve both talking and listening.

Facilitating learning

Good facilitation takes practice. Use the facilitation techniques below to invite participation, support exploration, and deepen understanding. Interestingly, the NISE Net researchers discovered



Photo by Linda Wang
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that the following steps occur several times during each successful interaction. Expect to spend most of the time supporting exploration, but know that you will need to restart and delve deeper in small bits throughout your interaction.

Facilitation, Step 1:

Invite Participation

- » Greet participants
- » Model good chemistry practices
- » Engage the whole group
- » Have fun!

Facilitation, Step 2:

Support Exploration

- » Let participants do the activity
- » Be flexible and attentive
- » Ask guiding questions
- » Listen and respond to students
- » Use simple, clear language
- » Offer positive feedback
- » Be encouraging


Facilitation, Step 3:

Deepen Understanding

- » Ask open-ended questions
- » Make connections to everyday life

- » Share what you know
- » Acknowledge what you don't know
- » Summarize key points to remember

You are in a unique position to have a lasting and profound influence on young minds. Students are flattered by your time and attention, and they are very interested in what you have to say. Guided hands-on activities, along with immediate positive reinforcement, allow them to make their own realizations and view themselves as capable of learning chemistry.

Using techniques from the field of ISE will allow you to influence opinions and understandings about chemistry. You can help kids experience success in learning something they once viewed as difficult or perhaps never considered before. Through your outreach efforts, you will make a lasting positive change in the lives of the kids you meet. 

Patricia Galvan is a program manager of Science Outreach for the ACS, where she manages the Kids & Chemistry program and provides kits and training for scientists who visit classrooms.



ACS
Chemistry for Life®



SCI SCHOLARS INTERNSHIP PROGRAM FOR UNDERGRADUATES



SUMMER 2020

Test-drive a career in the chemical industries with SCI Scholars. This competitive program provides 10-week summer internships to undergraduates interested in industrial careers.

**APPLICATION
DEADLINE:
November 30, 2019**

SCI Scholars is open to sophomores and juniors majoring in chemistry or chemical engineering. Students must be U.S. citizens or permanent residents and have at least a 3.5 GPA. Applicants selected for the program will receive:

- Up to \$10,000 for the internship
- \$1,000 for professional development
- Certificate
- Opportunity to recognize an inspirational high school teacher

All SCI Scholars internships provide exceptional workplace experience in the intern's field of study. Learn more at **acs.org/SCI**.

The Society of Chemical Industry (SCI) America International Group is a nonprofit organization dedicated to advancing excellence in the chemical industry. All SCI Scholars internships are with SCI member companies.





acs.org/iypt

Learn how the American Chemical Society and others will be celebrating the International Year of the Periodic Table.



United Nations
Educational, Scientific and
Cultural Organization



International Year
of the Periodic Table
of Chemical Elements

Celebrate the International Year of the Periodic Table of Chemical Elements (#IYPT2019) at a chapter event, meeting, or recruiting event with this fun scavenger hunt!

Objective

How well do you know the elements around you? Identify elements that make up your surroundings in a set amount of time.

How to play

Use the periodic table scorecard to mark off the elements that you find around you. The team or person with the largest number of identifiable elements wins.

Prizes

Visit the ACS Store (store.acs.org) to find prizes.

Use the periodic table to mark off elements that you find.

[illegible]

Number of elements found: _____

WHERE TO FIND ELEMENTS



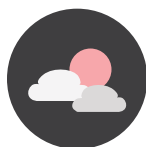
In the human body

About 25 elements are found in the human body. You can probably already guess the main components: carbon, hydrogen, oxygen, and nitrogen account for about 96% of your body mass. You'll come up with more elements if you consider the composition of teeth, bones, blood, and DNA.

But did you take cobalt into account? About 1 mg of cobalt is present in your body as vitamin B₁₂. It acts as a co-enzyme to help your body make red blood cells and DNA. Although there are cobalt minerals, the only sources of cobalt that humans can digest are in meat, eggs, and dairy products (which is why it's so important for vegans to take vitamin B₁₂ supplements).

Your body also relies on tiny amounts of sodium, potassium, chlorine, and calcium ions to regulate nerve activity. Neurons transmit electrical signals by controlling the relative concentrations of these ions inside and outside of the cell. The right concentrations produce a voltage difference in neuron cell membranes that transmits an electrical signal from one neuron to the next.

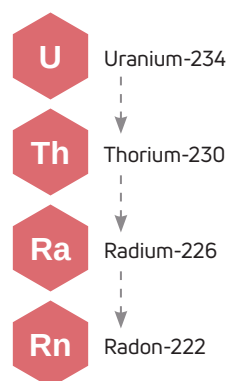
Can you identify the rest of the elements in your body?



In the air

No doubt, you are aware that oxygen and nitrogen comprise about 99% of the air we breathe. But there are a lot of other elements that account for that last 1%. Can you figure out what they are?

If you are in a room near the ground, you may need to consider radon. It is a noble gas. And yes, it's radioactive. Naturally occurring ²³⁴U decays into ²³⁰Th, which further decays into ²²⁶Ra, which produces ²²²Rn. This decay series takes place in the soil and in certain rocks, such as granite, gneiss, and limestone, which is how it may get into your air.



The half-life of this isotope of radon is just less than four days, so in an open area, it disperses quickly. However, radon is one of the densest gases in the atmosphere, so it can become concentrated in environments like mines, underground springs, and even basements. The U.S. Environmental Protection Agency recommends that all homes be tested for radon.



In your pockets

If someone has a smartphone, you can account for up to 70 elements. You've probably already guessed silicon in the circuits, and oxygen (bonded to the silicon) in the glass screen. The light displays rely on the same light-emitting diode (LED) chemistry as modern lights, so you can find a lot of the same elements there (see the next page).

But did you look for the neodymium, terbium, and dysprosium in the phone's vibrating unit? The vibration is produced by a very tiny, unbalanced motor. The motor spins when activated by the flux generated by a disk magnet. Rare earth magnets, such as Nd₂Fe₁₄B, are commonly used for this purpose because they are permanent and have a strong magnetic field. Neodymium and iron each have four unpaired electrons, so they are paramagnetic (attracted to magnetic fields) to begin with. In addition, rare earth metals are highly responsive to magnetic fields; terbium visibly expands and contracts in their presence. When these elements are combined in an alloy, they take on a crystalline structure that directs the magnetism of the individual components along a specific axis, making the material ferromagnetic (permanently magnetic), with a very strong magnetic field.

Don't forget any credit cards or key cards. Their paints and magnetic strips contain elements. The same goes for keys and any gems.

WHERE TO FIND ELEMENTS

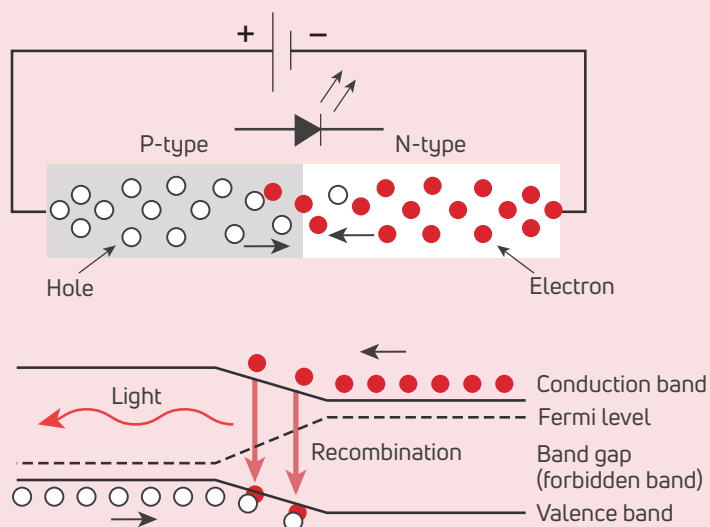



In a classroom

Did you check the lighting? Incandescent light bulbs use tungsten filaments, and fluorescent lighting excites mercury vapor to produce light. The newest lights rely on light-emitting diodes (LEDs). The light from LEDs is a result of the electronic band structure (the quantized energy of the electrons) of their composite materials. Incoming energy is absorbed by an electron in the valence band, which then jumps to the conduction band. This leaves a positively charged hole in the valence band. The hole and electron travel through the crystal lattice together. However, an impurity in the lattice disrupts the travel. The electron recombines with the hole and releases some energy. If the energy released is in the visible range, the material can be used in LEDs.

LEDs are made of a variety of elements, depending on the desired color. For example, red light is a result of europium doping. When small amounts of Eu_2O_3 are doped into yttrium oxides, the large europium atoms provide disruptions in the lattice of the smaller yttrium atoms. The

The inner workings of a light-emitting diode, showing circuit (top) and band diagram when a voltage is applied (bottom).



resulting wavelength is in the red region of visible light when activated by electrical energy. Divalent europium can produce a variety of colors, depending on the material it is doped into. The wavelength of the energy released depends on the composition of the crystal lattice. To vary the resulting wavelength, a lattice can be tuned by using different dopants. Components that emit different wavelengths can be combined to produce a desired light effect. 

What other elements can you find?

Once you start looking, you'll find a wide array of elements almost anywhere!

References

1. Elements in the Human Body. <https://askabiologist.asu.edu/content/atoms-life>
2. Composition of Dry Air. https://eesc.columbia.edu/courses/ees/slides/climate/table_1.html
3. The Chemical Elements of a Smartphone. <https://www.compoundchem.com/2014/02/19/the-chemical-elements-of-a-smartphone/>
4. The Chemistry of Gemstone Colours. <https://i1.wp.com/www.compoundchem.com/wp-content/uploads/2014/06/The-Chemistry-of-Gemstone-Colours-2016.png>
5. Periodic Table with pictures of locations of where to find the elements. <https://elements.wlonk.com/>
6. *The Disappearing Spoon and Other True Tales of Madness, Love, and the History of the World from the Periodic Table of the Elements* by Sam Kean. Back Bay Books; 2011.

Elemental Patterns

How well do you know your elements? Celebrate the International Year of the Periodic Table of Chemical Elements (acs.org/IYPT) by using the patterns below to determine which elements are missing.



←----- Fill in the answer!

Puzzle I

Set A	Al	B	Ga	In	Nh
Set B	C	Fl	Ge	Pb	Si
Set C	Sb	As	Bi	Mc	N
Set D	Lv	O	Po	Se	<div></div>

Puzzle II

Set A	Fe	Ni	Co	Cu	Zn
Set B	Cl	K	Ar	Ca	Sc
Set C	Au	Hg	Tl	Pb	Bi
Set D	In	Sn	Sb	I	<div></div>

Puzzle III

Set A

6		2
	Ga	
9		7

Set B

1		9
	I	
2		6

Set C

2		8
	Al	
6		9

Set D

1		4
	<div></div>	
1		2

Mega-challenge

Need a hint for the mega-challenge? Look at the bottom of the page.

Set A

H		B
	S	
H		Li

Set B

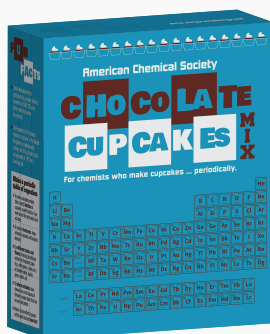
He		F
	Tb	
Li		Be

Set C

Be		B
	Sn	
H		B

Set D

H		Li
	<div></div>	
He		Be



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Find the answers to these puzzles on the iC website.

Liked these puzzles?

Get access to more puzzles when you purchase a box of ACS Periodic Table Cupcake Mix at bit.ly/PT-Cupcakes.

Hint: Look at the atomic numbers of the elements.



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