Spring 2019

in chemistry

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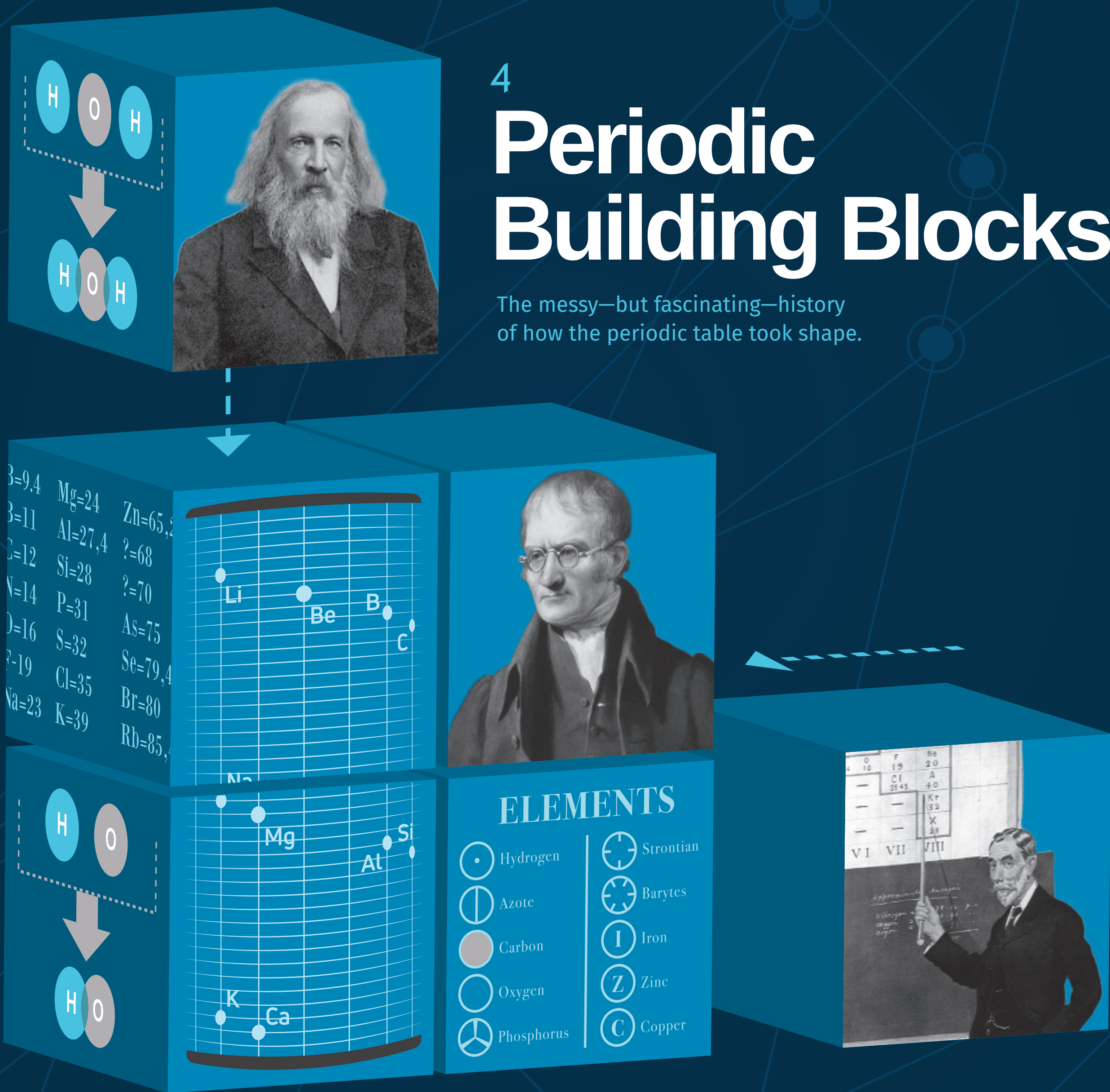

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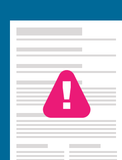

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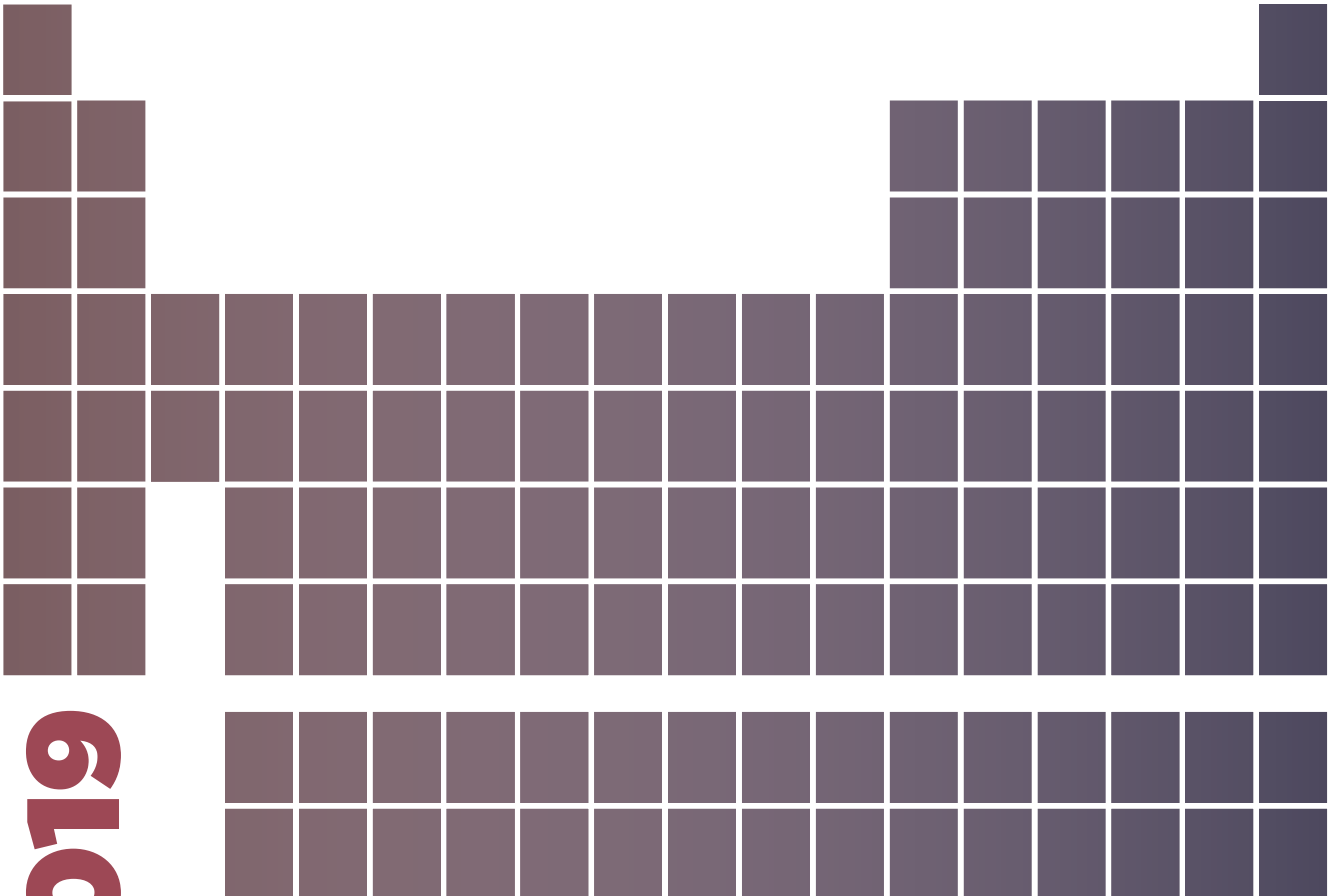

#IYPT2019

On 20 December 2017, the United Nations General Assembly proclaimed 2019 as the International Year of the Periodic Table of Chemical Elements (IYPT), commemorating milestones in the history of the Periodic Table, its development, and its importance in science, technology, and sustainable development.

Visit **www.acs.org/iypt** for more information and share how you plan to celebrate on social media using the hashtag **#IYPT2019**.

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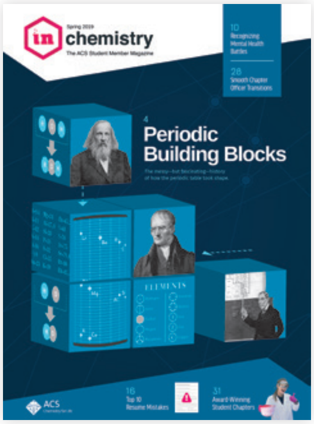

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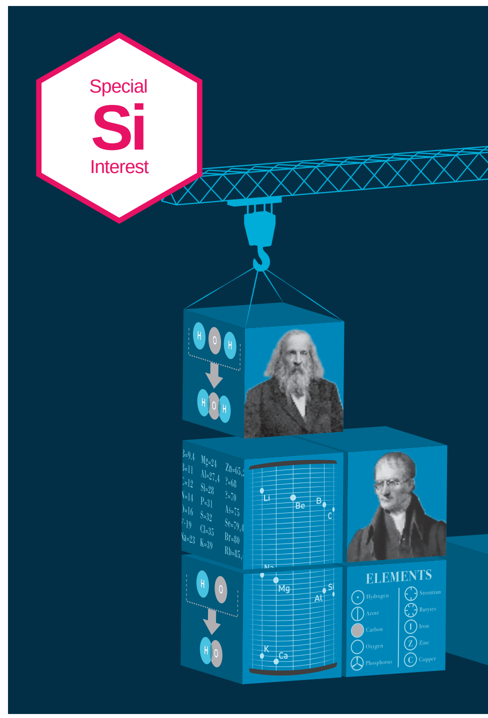

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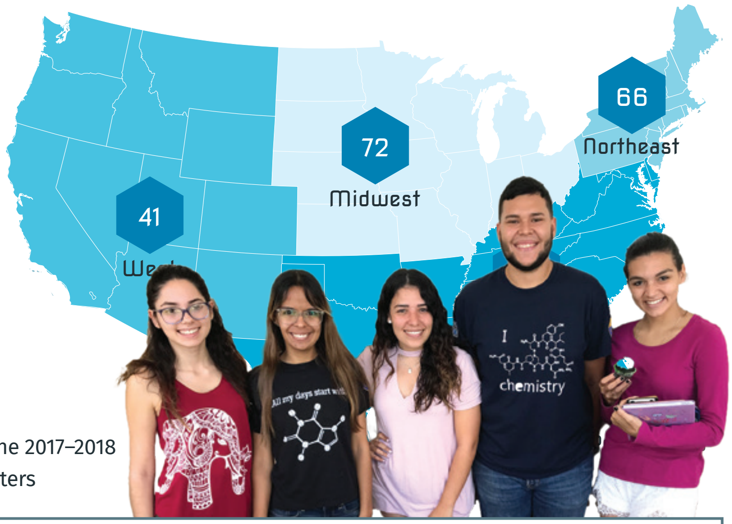

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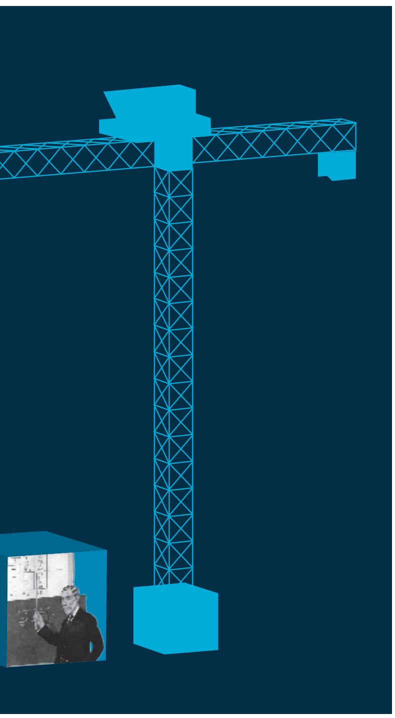

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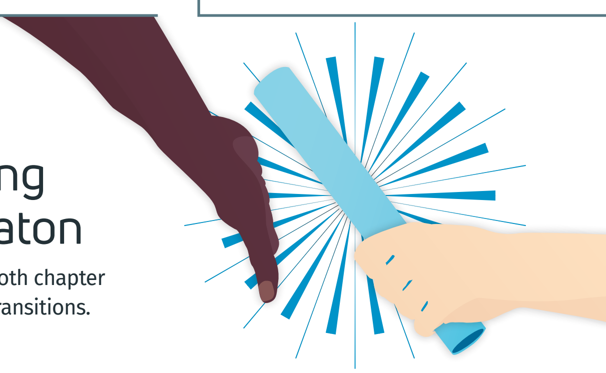

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Interest

Assembling the Modern Periodic Table

The messy road to periodic chemistry

By Julianna Poole-Sawyer

The periodic table is an elegant demonstration of properties of elements. You can determine the electron configuration of any atom, simply from its place. You can compare electronegativity, ionization energy, atomic radius, chemical reactivity, and more.

If I gave you all of the elements on cards and told you to recreate the periodic table, you probably wouldn't have much trouble. You would order them by increasing atomic number and create a new row when you hit a noble gas. If you know about atomic numbers and electron shells, recreating the periodic table is simple. However, the periodic table predates knowledge of atomic numbers and subatomic particles (yes, including electrons). It even predates knowledge of the noble gases.

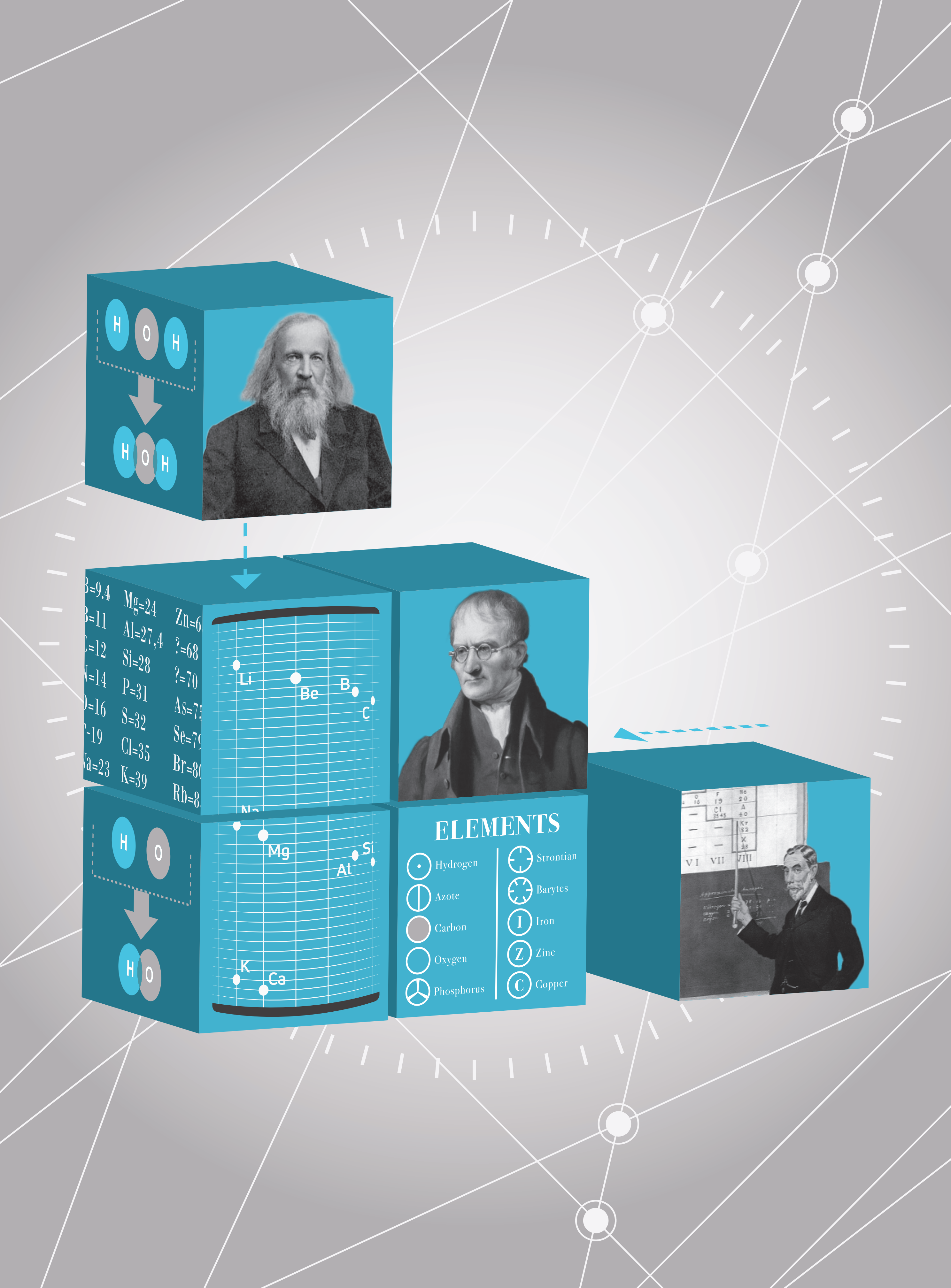
So how did Russian chemist Dmitri Ivanovich Mendeleev and the other creators of the periodic table (arguably six of them) bring order to the elements? How did they create a tool that would ultimately house 118 elements when they knew only 62 of them? And why does Mendeleev get all the credit?

Mass + reactions = periodic table

The modern periodic table didn't spring fully formed from the genius of Mendeleev; it was shaped by key discoveries about the elements. One such discovery was that of atomic masses. Here is where we will begin our journey to periodicity. The modern definition of atomic mass (the weighted average of the atomic masses of all isotopes of an element) was meaningless 150 years ago. Chemists didn't know about isotopes. In fact, many chemists held the view that atoms were the smallest units of matter possible. It would be 30 years after Mendeleev's periodic table that scientists found out atoms were composed of smaller bits and pieces. The idea of isotopes wasn't introduced until 1913, and neutrons weren't discovered until 1932.

So how did chemists of the 19th century define atomic mass? In 1803, English scientist John Dalton published an article in which he assigned hydrogen a weight of 1, and then used compounds of hydrogen to determine the relative weights of the other elements. For example, to determine the atomic mass of oxygen, he used the fact that 1 gram of hydrogen reacts with 8 grams of oxygen to make water. He then could use this ratio of 8:1 to determine the weight of oxygen compared with that of hydrogen.

The problem with this method is that Dalton didn't know the numbers of oxygen atoms and hydrogen atoms in a water molecule; he assumed water had a molecular formula of HO, leading to an incorrect relative atomic mass of 8 for oxygen.


H O H
H O H
Mg=24
Al=27,4
Si=28
P=31
S=32
Cl=35
K=39
?=68
?=70
Li
Be
B
C
Mg
Al
Si
K
Ca
H O
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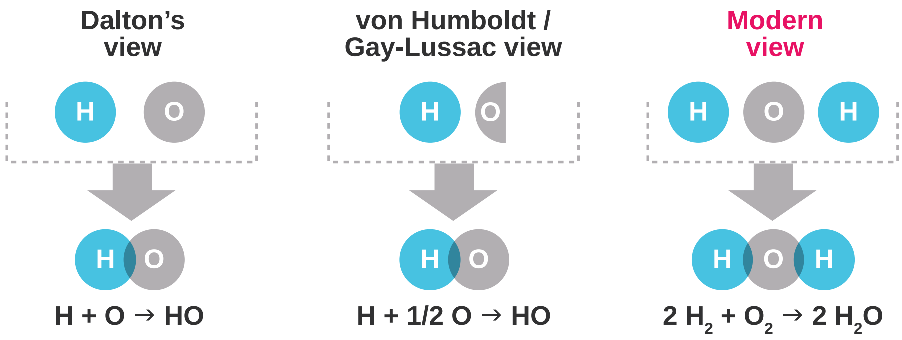
Special Si Interest



To add even more confusion, in 1805 Prussian scientist Alexander von Humboldt and French scientist Joseph Louis Gay-Lussac determined that two volumes of gaseous hydrogen always combined with one volume of gaseous oxygen to form two volumes of water vapor. The pair found numerous other simple ratios, resulting in Gay-Lussac suggesting that equal volumes of gases have equal numbers of particles, what we now refer to as Avogadro's law. The problem with this hypothesis was that for it to be true, somehow the gaseous oxygen had to be splitting in half. Many chemists, including Dalton, considered this possibility absurd: how could an atom—at the time believed to be the smallest unit of matter—split during the course of a chemical reaction?

The mystery was solved in 1811 by Italian scientist Amedeo Carlo Avogadro, who argued that gaseous oxygen is composed not of atoms of oxygen but of molecules of oxygen: O_2. Unfortunately, although he was an accomplished scientist, Avogadro was not an accomplished writer, and his hypothesis was not accepted for another 50 years.

The 1860s: a turning point

In September 1860, chemists from all over Europe met in Karlsruhe, Germany, for a conference of lasting importance. The goal was to systematize chemistry to choose strict definitions for terms such as "molecule" and "atom". At the conference, Italian chemist Stanislao Cannizzaro persuasively presented Avogadro's hypothesis of diatomic molecules and all of their implications for molecular formulas and accurate determinations of atomic masses. Cannizzaro's work left a palpable impression on two chemists in attendance: Julius Lothar Meyer and Mendeleev. A mere 22 years later, these men were jointly awarded the Royal Society's Davy Medal for the periodic systems they developed.

After the Karlsruhe conference, explorations of elemental periodicity exploded. Six different scientists, nearly simultaneously, took a hand in organizing the elements in the 1860s: Alexandre-Émile Béguyer de Chancourtois (1862), John Newlands (1863), William Odling (1864), Meyer (1864), Gustavus Detlef Hinrichs (1867), and Mendeleev (1869). Let's explore three journeys, of the most well known: de Chancourtois, Meyer, and Mendeleev.

The telluric screw

The first designer of the periodic table wasn't a chemist at all; he was a geologist and adept at systematizing. French scientist de Chancourtois had previously tried his hand at organizing minerals, geology, geography, and even language, creating a universal alphabet. In the 1860s, he turned his attention to the elements.

In 1862, de Chancourtois presented his periodic ordering of the elements to the Académie des Sciences in Paris, and he published his table in a paper in the journal *Comptes Rendus de l'Académie des Sciences*.

://
acs.org/iypt

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

Early efforts to organize the elements had focused on triads, with scientists going out of their way to arrange metals in groups of three. But de Chancourtois's system was a three-dimensional cylinder with the elements wrapping around it in order of atomic mass. This organization resembled a screw, with the elements on the threads. The element tellurium sat at the halfway mark; therefore, de Chancourtois called his system the telluric screw.

The elements weren't just ordered from lightest to heaviest, however. With each turn of the screw, elements with similar properties aligned vertically: lithium was in line with sodium and potassium, magnesium was in line with calcium, and fluorine was in line with chlorine, thus showing periodicity of chemical properties.

At the time of its publication, the telluric screw received little attention from scientists because the journal *Comptes Rendus* did not publish de Chancourtois's diagram of his system with his article, leaving an already complicated three-dimensional system explained only in words.

De Chancourtois's telluric screw also contained some peculiarities, which probably did not encourage acceptance of the system. First, many of the elements didn't line up according to their properties. For example, bromine isn't in line with chlorine and fluorine and instead is in line with copper and phosphorus. Second, de Chancourtois included some other chemicals besides the elements, such as some compounds and alloys.

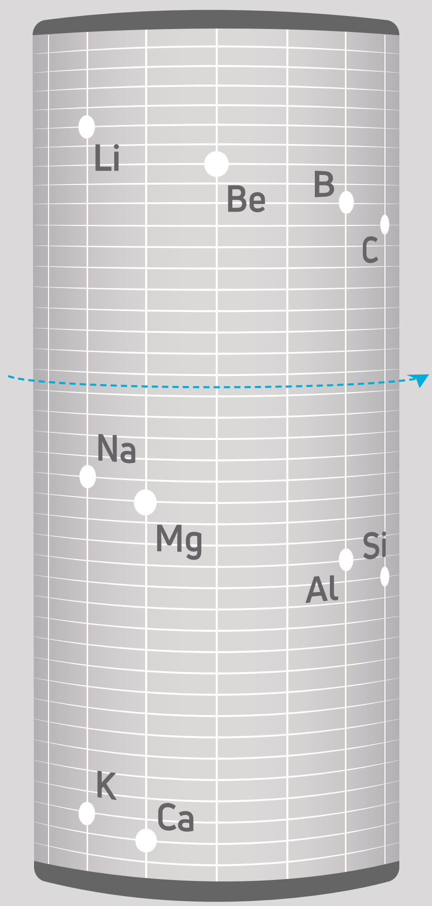
Despite this, de Chancourtois was the first to state that chemical properties correlate with atomic masses. In his article, he stated, "The properties of bodies are the properties of numbers."

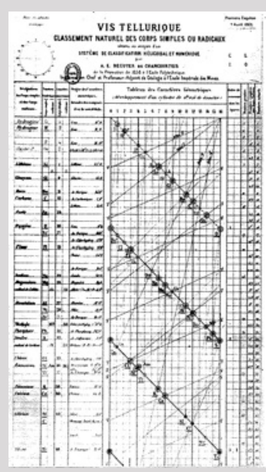
The facts in two dimensions

The next scientist of mention on our road to periodicity is German chemist Meyer. Meyer's epiphany occurred at the Karlsruhe conference when he learned of the work on atomic masses by Cannizzaro. He wrote that when he read Cannizzaro's article, "the scales fell from my eyes and my doubts disappeared and were replaced by a feeling of quiet certainty."

Meyer's breakthrough was presented in his textbook *Modern Theories of Chemistry and Their Significance for Chemical Statics* in 1872. In his table, Meyer organized the elements according to their atomic masses and valences, the latter of which had been discovered in the 1850s.

Meyer accounted for two important features that are usually attributed only to Mendeleev: he reversed the order of tellurium and iodine, and he left gaps. Without atomic numbers,





Around we go
Diagram of de Chancourtois's telluric screw (left) and the table that was left out by the journal *Comptes Rendus* (below)

Meyer’s arrangement of the elements was based on how they reacted (valence):			
4 werthig	3 werthig	2 werthig	1 werthig
Si (28.1)	P (31.0)	S (32.1)	Cl (35.5)
Unknown element	As (74.9)	Se (79.0)	Br (79.9)
Sn (118.7)	Sb (121.8)	Te (127.6)	J (126.9)
Other researchers would order the elements by atomic mass, not reactivity:			
Si (28.1)	P (31.0)	S (32.1)	Cl (35.5)
Unknown element	As (74.9)	Se (79.0)	Br (79.9)
Sn (118.7)	Sb (121.8)	I (126.9)	Te (127.6)

"J" is for iodine.

Werthig is valence. The valency of an element was originally a measure of its combining power with other atoms when it forms chemical compounds or molecules. The concept of valence developed in the second half of the 19th century and helped successfully explain the molecular structure of inorganic and organic compounds.

the placement of tellurium (atomic number of 52) and iodine (atomic number of 53) in the periodic table can be confusing. In order of increasing atomic mass, iodine, with a weight of 126.9 amu, should come before tellurium, with a mass of 127.6 amu, except that such an ordering doesn’t make sense when you consider their properties. Iodine is chemically more like chlorine and bromine, whereas tellurium is chemically more like selenium and sulfur. In constructing his table, Meyer decided that properties should override masses, and he put tellurium before iodine.

The second distinguishing characteristic of Meyer’s table is that he left gaps in it. Other scientists of the day tried to eliminate gaps in their tables, often by forcing elements into illusionary categories, but Meyer simply left blank spots in his. While he didn’t go so far as to predict the properties of then-undiscovered elements, he left a gap between silicon and tin, for example, that would later be filled by germanium.

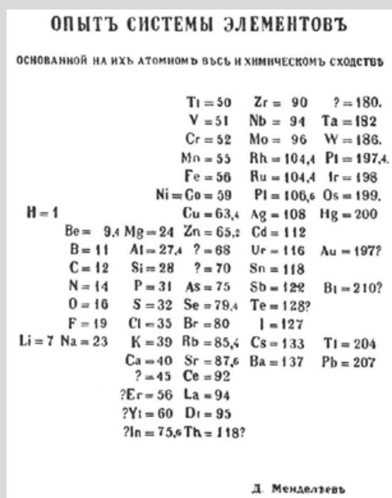
Interestingly, Meyer regarded periodicity and the similarities among elements in groups as evidence that elements were composed of smaller, more fundamental particles, an idea that Mendeleev himself never accepted.

Putting it all together

In February 1869, while writing the second volume of his chemistry textbook *Principles of Chemistry*, Mendeleev devised his own form of the periodic table. Popular accounts tell of Mendeleev shuffling and rearranging cards labeled with the elements and their properties, like a game of solitaire. Although historians have found no cards in Mendeleev’s archive, they have found myriad groupings of the elements, covered with scratched-out ideas and rearrangements. This work culminated in Mendeleev’s table in which he organized the elements

Taking shape

Mendeleev’s 1869 table.



ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ

ОСНОВАННОЙ НА ИХЪ АТОМНОМЪ ВѢСѢ И ХИМИЧЕСКОМЪ СХОДСТВѢ

			Ti = 50	Zr = 90	? = 180.
			V = 51	Nb = 94	Ta = 182
			Cr = 52	Mo = 96	W = 186.
			Mn = 55	Rh = 104,4	Pt = 197,4.
			Fe = 56	Ru = 104,4	Ir = 198
			Ni = Co = 59	Pl = 106,6	Os = 199.
H = 1			Cu = 63,4	Ag = 108	Hg = 200
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112	
	B = 11	Al = 27,4	? = 68	Ur = 116	Au = 197?
	C = 12	Si = 28	? = 70	Sn = 118	
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?
	O = 16	S = 32	Se = 79,4	Te = 128?	
	F = 19	Cl = 35	Br = 80	I = 127	
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207
		? = 45	Ce = 92		
		?Er = 56	La = 94		
		?Yt = 60	Di = 95		
		?In = 75,6	Th = 118?		

Д. Менделѣевъ

Author

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by increasing atomic mass and aligned elements with similar properties in rows. In 1869, Mendeleev printed 200 copies of his table and sent them to colleagues throughout Russia and Europe.

Mendeleev went beyond just creating a table, however; he argued that the organization of elements reflected an underlying periodic law. For example, while Meyer switched the placement of tellurium and iodine, Mendeleev switched them and argued that the atomic mass of one of them had to be wrong. (The atomic masses were not, in fact, wrong, because periodicity turns out to be based on atomic number, not atomic mass.) Mendeleev corrected the masses of several elements on the basis of his table, and these corrections were later experimentally validated.

While Meyer left gaps in his table, Mendeleev predicted that elements would be discovered that would fill those gaps. He went so far as to predict their atomic masses and properties, and he named them: eka-boron, eka-aluminum, eka-manganese, and eka-silicon ("eka" is Sanskrit for "beyond"). This was a bold move; chemists at the time were expected to be reporters of existing facts, not speculators on what might yet be discovered. Although he wasn't correct about all of their properties, when germanium, gallium, and scandium were discovered, chemists could see how they fit into the gaps of Mendeleev's table, providing further validation for Mendeleev's periodic law.

Mendeleev's position as the father of the periodic table was solidified in the 1890s with the discovery of noble gases. At the time, not only was it inconceivable that an element could be nonreactive, but there was no room for them in the periodic table. In 1894, argon was discovered by British scientist Lord Rayleigh and Scottish scientist William Ramsay. When the only proposed noble gas was argon, Mendeleev and other chemists argued that it was not a new element but triatomic nitrogen (N_3). After the discovery of helium, krypton, neon, and xenon, however, these inert gases couldn't be explained away. It wasn't until 1900 that Ramsay suggested the new elements be given their own group between the halogens and alkali metals. Mendeleev responded thus: "This was extremely important for [Ramsay] as an affirmation of the position of the newly discovered elements, and for me as a glorious confirmation of the general applicability of the periodic law."

The road to our modern-day periodic table was winding, full of dead ends and wrong turns. It required numerous discoveries, scientists, and experiments, as well as numerous failures and triumphs. It was, essentially, typical of science. Although we like to think of science evolving through lone geniuses like Mendeleev vaulting us toward progress, the reality of science is that it's messy, requires extensive collaboration, builds on the work of others, and revises hypotheses when new information comes to light. Mendeleev, Meyer, and the others were indeed incredible scientists, not because they figured everything out themselves, but because they were fully enmeshed in the illustrious enterprise we call science.

"The road to our modern-day periodic table was winding, full of dead ends and wrong turns. It required numerous discoveries, scientists, and experiments, as well as numerous failures and triumphs. It was, essentially, typical of science."

References

Akeroyd, F. M. (2003). Prediction and the Periodic Table : A Response to Scerri and Worrall. *J. Gen. Philos. Sci.*, 34(2), 337–355.

Gordin, M. D. (2004). *A Well-Ordered Thing: Dmitrii Mendeleev and the Shadow of the Periodic Table*. New York: Basic Books.

Scerri, E. R. (2007). *The Periodic Table: Its Story and Its Significance*. Oxford: Oxford University Press.

Scerri, E. R.; Worrall, J. (2001). Prediction and the Periodic Table. *Stud. Hist. Philos. Sci. A.*, 32(3), 407–452. https://doi.org/10.1016/S0039-3681(01)00023-1


College Life
Li
Mental Health

Minding Mental Health

Knowing when you need a break and when you need help

By Sarah Harte

Most of us know that it's important to take care of our physical health. We try to eat fruits and vegetables regularly, get some exercise on most days, and even shoot for those precious eight hours of sleep. However, few of us are taught the same lessons and strategies for taking care of our mental health. Family members, mentors, and professors aren't always comfortable with these topics themselves, so students can feel unprepared for the adjustments and challenges that they will face while in college. It can be even more difficult to determine the difference between coping with a normal level of stress and needing to seek help for more significant mental health problems.

The World Health Organization's (WHO's) definition of health highlights the positive aspects of health, noting that "health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". Further, WHO defines mental health as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community". Doesn't that sound like all of our hopes for college life, and beyond? If most of us strive for this state of being, why don't we talk about it more?

Changing the conversation about mental health

If you are like most college students, you and your friends and classmates spend lots of time talking about being stressed, tired, and overwhelmed. That is normal—college is hard, the chemical sciences are challenging, and there is an inherent vulnerability in learning that makes many people feel uncomfortable. Feeling stressed is a normal response to the pressures of school. Stress can even be helpful at times. A moderate amount of stress can help us focus, motivate us to study, and get us to class on time. Chronic stress, however, can be toxic and self-perpetuating. Stressed people don't sleep well. Sleepless people struggle more with solving difficult problems. People who can't solve problems lie awake worrying about them, and then it becomes even more difficult to tackle the work.

Life outside of the classroom can be challenging, too. Many students struggle with worries about paying for college and related expenses, making friends, feeling lonely and homesick, and feeling overwhelmed with being independent. Who knew keeping up with laundry and getting three meals a day could be so stressful? And don't even get me started on how difficult it is to manage roommate situations! To make things even harder, there is a culture on campuses and on social media that pressures people to look like they have it all figured out, when lots of people don't! In one recent survey, almost half of first-year college students reported that "it seems like everyone has college figured out but me".[1]

This perception can contribute to the belief that you have to perform perfectly to make it in college, or to the feeling that you really don't belong and soon everyone will figure that out! Perfectionism and imposter syndrome can contribute to harmful thought processes that are all too common on college campuses, fostering an environment of competition that hurts more than it helps. Both of these thought patterns include all-or-nothing thinking, which eliminates the space in the middle where learning and flexibility occur. One way to challenge these thoughts is to talk with professors, mentors, or family members—ask them whether they have struggled with these problems and what they have done to overcome them. You might be surprised how many of them felt just like you when they were in school and even still have to work to overcome harmful thought patterns.

Despite the normal experience of significant stress in college and what can seem like constant talking about that stress, we don't often talk about what to do about it, or how to feel better. This can create a feedback loop of negativity that can worsen the cycle with time. It is also true that our brains tend to focus more on the negative feedback we receive than the positive. It's no wonder that students start to struggle with managing all of these stressors in the college environment.

You can change this narrative. You can be the voice of resilience and support in your communities. This is a role that not only helps your community but also can help you to be more mindful of your own well-being. This doesn't mean that you need to be cheery all of the time; that's not how life goes. It is simply an opportunity to become more aware of the tendency to focus on the negative, and to work to notice and acknowledge your wins at least as often as you acknowledge your losses. When you count wins, it becomes easier to gain perspective and to know that all is not lost, that you've got this! A win can be as simple as showing up for a class that you are dreading, or earning a grade in the middle of the curve of a really difficult exam, or even managing to have some fun in the midst of midterms or finals.

When challenges are more than stress and adjustment

In addition to the already difficult experience of college, many students also struggle with mental health conditions. Surveys suggest that up to 39% of

Almost **40% of undergraduate students** struggle with some kind of mental health issue, such as anxiety, depression, or bipolar disorder.

1. *2015 online survey of college students in their second term conducted by Harris Poll on behalf of The Jed Foundation, The Jordan Matthew Porco Foundation, and The Partnership for Drug Free Kids; https://www.settogo.org/wp-content/uploads/2017/01/First-Year-College-Experience-Data-Report-for-Media-Release-FINAL.pdf*

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undergraduate students deal with some kind of mental health problem, such as anxiety, depression, or bipolar disorder. Most mental health issues begin at the same time of life as college, with 75% of mental health problems developing by the age of 24. It can be difficult to determine what is normal stress and what may be something more, but there are clues that you can keep in mind.

Anxiety disorders are the most common mental health conditions on college campuses. We all feel anxiety; think about the butterflies you feel in your stomach before an in-class presentation—that's anxiety. Anxiety disorders, however, are when anxiety gets out of control and causes significant disruption in day-to-day functioning. Anxiety disorders cause anxiety or fear to be out of proportion to what is going on, and that anxiety is difficult to control. People who experience anxiety can feel queasiness in their stomach, experience pressure in their heart or chest, have shaky or trembling hands, and have difficulty concentrating. Their sleep and appetite are usually affected—typically by getting less sleep and eating less, but it can also be the opposite: sleeping and eating too much.

Depression is the second most common mental health issue on college campuses. Depressive disorders are not simply feeling down or sad. They are conditions that cause a significant change in your mood that can last for a long time—even months—without help. People with depression often have a constant state of sadness or heaviness. They have a hard time doing the things that they used to really enjoy or spending time with people, and can find it difficult to take care of themselves—sleeping too much or too little, eating too much or not enough, and having a hard time leaving their room or getting to class.

Regardless of the type of mental health issue someone may be struggling with, people typically display some or all of the following warning signs:

> "There are times when professional help is needed, and the sooner someone is connected to professional help, the sooner they can start to feel better."

- They don't feel like hanging out as much
- Their mind seems to be somewhere else
- They talk about feeling hopeless
- They are taking more risks
- They are using more drugs or alcohol
- They are so anxious that they can't relax
- They have become negative about life
- They are acting weird or get mad for no reason
- Their eating or sleeping patterns change
- Their usual ways of dealing with things are not working
- They have thoughts or impulses of self-harm or harming others

Importantly, you don't have to be a mental health professional to recognize these signs and to intervene. If you see some of these characteristics in someone, you can be the one to help. Even the most severe mental health problems can get better when someone is able to access help, and you can be the one to assist someone in getting the help they need. You don't even need to know what to say; try saying, "I've noticed you seem down lately. Do you want to talk about what's going on?" or "Whenever you're ready to talk, I'm ready to listen." The important thing isn't what you say, it's that you start the conversation. Once you get the conversation started, keep the following tips in mind:

- Keep the conversation casual
- Listen and let them take the lead in the conversation
- Try to avoid offering advice
- Validate how they are feeling

- Don't push them to talk about anything they are not ready to share
- Let them know you are available and would never judge them
- Encourage them to talk to a professional

If you have any concerns that a friend is having thoughts of suicide, it is very important to ask about this directly. You can say something like, "Are you feeling like you'd like to give up on things or on life?" or more directly "Are you having thoughts about hurting or killing yourself?" You won't plant the idea of suicide into a person's thoughts by mentioning it. The benefits of asking someone whether they are having suicidal thoughts greatly outweigh the risks, and people report that being asked about this directly brings more relief than holding onto the thoughts and not talking about them. If your friend acknowledges suicidal thoughts, it's important to get help right away.

How to get help

Most students have some kind of emotional challenge while in college, and many cope with the support of friends, family members, faith communities, and other supporters. However, there are times when professional help is needed, and the sooner someone is connected to professional help, the sooner they can start to feel better. When you are not sure whether you can provide enough support to someone you are concerned about, it is always a good idea to encourage them to connect with a mental health professional—a counselor, social worker, or psychologist. Most college campuses have some kind of mental health support resources, which are often low-cost or free. These services follow federal confidentiality laws and are equipped to work with students to resolve their concerns, or connect them to the appropriate resources in the community. They often have late-night, after-hours, or 24-hour support by phone, so don't hesitate to find the help when you need it. Take a look at your university's resources to learn about the support services available on your campus.

Emergency Resources

Crisis Textline
Text HOME to 741-741

Crisis Textline for Students of Color
Text STEVE to 741-741

National Suicide Hotline
Call 1-800-273-TALK (8255)

LGBTQ Trevor Lifeline
Call 1-866-488-7386

Trans Lifeline
Call 1-877-565-8860

On-Campus Health Center
Check local center for hours

Although it is important to get professional help, emotional well-being is not only the work of the counselors on your campus, it is the responsibility of the whole community. Residential staff, academic advisors, librarians, facility managers, campus police, and faculty, among others, should be trained in recognizing when someone is in distress and be prepared to help connect students with support. So, if you're not sure where to start to get help, ask someone, anyone!

Outside of campus-based support services, there are several national emergency support lines that you can call or text when you need help (listed above). These lines are staffed by trained crisis counselors, who can help you feel better and connect you to local resources. Privacy can be hard to find in residence halls and university buildings, so lots of students find it more comfortable to text crisis counselors. These support lines serve anyone, in any type of crisis.

Author

Sarah Harte is the Assistant Director of Outreach at George Washington University's Colonial Health Center. A licensed clinical social worker in Washington, DC, she has worked in college mental health and she was an adjunct lecturer at the Columbia University School of Social Work.

CHEMISTRY FOR NEW FRONTIERS

AMERICAN CHEMICAL SOCIETY
NATIONAL MEETING & EXPOSITION
2019
MARCH 31–APRIL 4
ORLANDO, FL

CORE STUDENT PROGRAM

SUNDAY, MARCH 31	
8:00 AM – 5:00 PM	Student Hospitality Center
8:15 AM – 9:00 AM	Making the Most of Your First National Meeting
8:30 AM – 11:30 AM	Undergraduate Research Papers (Oral)
9:00 AM – 10:30 AM	Frontiers in Forensic Science
10:30 AM – 11:45 AM	Graduate School: The Ins and Outs of Getting In
11:00 AM – 12:30 PM	Chem Demo Exchange
12:00 PM – 1:30 PM	The Graduate School Experience: What to Expect
1:00 PM – 5:00 PM	Graduate School Fair
1:30 PM – 3:00 PM	Networking 101 Workshop *Sponsored by the ACS Younger Chemists Committee*
1:30 PM – 5:00 PM	Undergraduate Research Papers (Oral)
2:30 PM – 3:30 PM	Two-Year to Four-Year College Transfer Survival Guide
3:30 PM – 4:30 PM	International Year of the Periodic Table of Elements Workshop
7:00 PM – 8:30 PM	ACS Student Chapter Awards Ceremony
8:30 PM – 10:30 PM	Undergraduate Social
MONDAY, APRIL 1	
8:00 AM – 5:00 PM	Student Hospitality Center
8:30 AM – 11:30 AM	Undergraduate Research Papers (Oral)
9:00 AM – 10:00 AM	Improving Scientific Communication Skills Workshop
10:00 AM – 11:30 AM	Frontiers in Leadership
12:00 PM – 2:00 PM	Undergraduate Research Poster Session *Cosponsored by the ACS Division of Chemical Education and the ACS Divisions of Analytical, Biochemistry, Environmental, Inorganic, Medicinal, Nanotechnology, Organic, Physical, and Polymer Chemistry*
1:30 PM – 5:00 PM	Undergraduate Research Papers (Oral)
2:30 PM – 4:00 PM	Eminent Scientist Lecture Featuring Dr. Teri Odom, Northwestern University
4:00 PM – 5:15 PM	Chemists Celebrate Earth Week Workshop *Sponsored by the Committee on Community Activities*
4:00 PM – 6:30 PM	The Kavli Foundation Lecture Series
8:00 PM – 10:00 PM	Sci-Mix/Successful Student Chapter Poster Session

All events are sponsored or cosponsored by the Society Committee on Education Undergraduate Programs Advisory Board.
Program Chair: Scott Tremain, University of Cincinnati Blue Ash College (OH)

acs.org/UndergradMeetingInfo #ACSOrlando

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Careers
Ca
Resume Ready

THE JOB RESUME IS THE MOST IMPORTANT WINDOW into a candidate's professional experience and achievements. Here are the top 10 mistakes that could cost you a really great opportunity.

By **JOSEPH MARTINO**

TOP 10 Mistakes on Early-Career Industrial Resumes

As an ACS Career Consultant, I see a lot of mistakes on resumes for industry jobs, and some of them are quite common. The industrial culture is very different from the academic world, and it's easy for students to make missteps when transitioning to the workforce, beginning with the way they craft a resume. The job resume is the most important window into a candidate's professional experience and achievements. Here are the top 10 mistakes that could cost you a really great opportunity.

1 ▶ Having too many pages. It's totally normal for undergraduates to have one-page resumes. Depending on your research experience, summer jobs, and internships, you may need two pages. That's OK, but any more than two pages is overkill. If you need two pages, make sure that your name, phone number, and e-mail address appear on both pages. You never know whether a hiring manager will actually print out your resume. They receive a lot of applications, and pages could get mixed up in the shuffle.

2 ▶ Relying on spellcheck to catch grammatical and spelling mistakes. If you depend on your computer's spellcheck tool to correct grammatical and spelling mistakes, you are in big trouble! Spellcheck doesn't understand context, homonyms, or acronyms. So, that *amide* structure you identified using *NMR* could become an *amino* structure identified by *MNR*.

Your resume is the first demonstration of your ability to communicate well in writing and to pay attention to detail. That's why it's important that you carefully comb through each and every word, line, and paragraph, and that you have a fresh pair of eyes (a friend or mentor) do the same. Don't risk losing out on that dream job because of overlooked typos.

3 ▶ Writing everything you've done in the introductory summary. If you're a high-level executive, an executive summary is appropriate and expected. But for an undergraduate who is just finishing a bachelor's degree, a laser-focused summary or objective is sufficient; some consultants even advise omitting the summary. Your summary should specifically and exclusively hone in on the type of job that you're seeking. If you are too vague, a company may not readily see you in the job.

The Blueprint for an Industrial Resume

Ima Chemist

1313 Mockingbird Lane, Apt. 13
Mayfield, IL 15050

555-555-5555
ima.chemist@urocks.edu

in
www.linkedin.com/in/imachemst2

Objective

Seeking a bench medicinal chemistry position synthesizing, purifying, and analyzing organic compounds

Education

B.S. in Chemistry (expected May 2019), Rocks University, Mayfield, Illinois
Thesis: “The Use of Grignard Chemistry in the Formation of Precursor Alcohols”
Advisor: Professor E. X. Pert

Work Experience

Undergraduate Research Assistant
Rocks University
(2017–present)
Advisor: Professor E. X. Pert

- Synthesized array of chiral alcohols to use as precursors in carbohydrate syntheses using the Grignard reaction. Devised a microscale method to generate 20 precursors on a 50 mg scale used in a 12-step natural product synthesis.
- Mastered the use of a Schlenk line to transfer water- and air-sensitive Grignard reagents to reaction vessels. Applied skills in collaboration with other researchers, resulting in increased yields in multiple syntheses.
- Independently mastered the use of laboratory HPLC equipment to properly operate the instrument. Accomplished rapid analysis of quenched reaction materials and supplied data to graduate student colleagues to optimize reaction processes for better yield.

Library Assistant
Mendeleev Memorial Library
Rocks University
(2017–present)

- Developed a new form for requests for technical journals that increased efficiency of journal searches.
- Created an organization system to file returned technical journals to the library’s reserved journal stack that increased efficiency.

Volunteer Experience

President
American Chemical Society Student Chapter
Rocks University
(2017–2018)

- Led 50 undergraduate chemists in coordinating 12 events designed to communicate the value of chemistry to peers, students, and the general public; developed the professional skills of chapter members; and engaged more than 300 members of the general public.
- Coordinated recruiting efforts that led to a 15% increase in membership.
- Collaborated with faculty mentor to organize a seminar series for undergraduates, resulting in the highest attendance for a career talk in 2018.

Honors

ACS Salute to Excellence Award (2018)
Library Assistant of the Year Award (2016)

Languages

Spanish (fluent), **French** (working knowledge),
German (reading knowledge)

Create header for name and contact information to ensure that it appears on every page.

Customize the objective, experiences, and other qualifications to each position you are seeking.

• GPA: 3.75

List GPA only if 3.5 or higher, to distinguish yourself from candidates with similar experiences.

Arrange content so that the most important accomplishments are easy to find

2019–present
2018–2019
2017–2018

List research first, then other experiences in reverse chronological order.

A → B → C

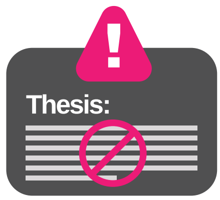
Concisely tell what value you bring to the job, using the challenge–action–result format, and incorporate any special skills.

"ethylenediaminetetraacetic acid"

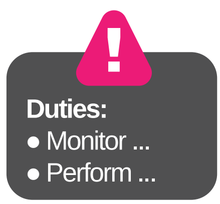
Use technical terms only when necessary.

List transferrable leadership and problem-solving skills.

4 ▸ Including your GPA. If you are seeking an industrial laboratory job, your scientific experience and accomplishments will speak more for you than your grade point average (GPA) will. If you have a GPA of 3.5 or higher, you should list it. GPAs are one way to distinguish between candidates with similar research experiences and successes. Otherwise, it is safe to omit your GPA. Remember, too, that a hiring manager will ultimately discover your GPA, because companies typically ask for college transcripts to verify your education.



5 ▸ Omitting your senior thesis, research project, or research advisor. If you worked on a senior thesis or a summer research project, you need to include that information in the education section of your resume. List your thesis title or project title and the name of your research advisor. Remember that chemistry is a profession driven by academic pedigree. There is a possibility that the hiring manager knows your research advisor. Also, if you do not list your research advisor's name, most hiring managers will see this as a red flag that you didn't get along with your advisor—and that means that the hiring manager may not get along with you. So do yourself a favor and list your advisor's name.



6 ▸ Listing only work duties. Let's say that you're an organic chemist. You carry out synthetic reactions in the laboratory, monitor them by thin-layer chromatography (TLC), perform crystallizations or flash column chromatography to purify them, and characterize the final product by nuclear magnetic resonance (NMR). Do you know how many organic chemists perform these duties? *Every single one.* There is no way that a standard list of duties will help you stand out from the competition.

Instead, spotlight your accomplishments. In a series of short sentences, explain the synthetic *challenge* you faced (e.g., "needed to synthesize an array of precursors for a Grignard reaction"), the *action* that you took to overcome that challenge (e.g., "devised a microscale method to generate precursors in inert atmosphere"), and the *result*

customize your resume

Be sure to tailor your resume—and not just the summary—to the position you are seeking. If you are applying for a position as a synthetic chemist, include your success with manipulating Grignard reagents in a Schlenk line. If you are going for an analytical position, start with the high-performance liquid chromatography (HPLC) and gas chromatography (GC) techniques you mastered independently. This shows how you will excel in the job and bring value to your employer.

(e.g., "generated 20 precursors to support a 12-step natural product synthesis"). The more tangible the result, the better. This will give you a bullet point on your resume that is measurable and will show the hiring manager the value that you bring to the job.

7 ▸ Including a word bank on your resume. Yes, a computer program will scan your resume before an actual person does, but remember that the computer can pick up words anywhere in your resume. To a reviewer, a word bank is a meaningless block that takes up valuable real estate. Instead, incorporate key words into your accomplishment-driven bullet points of technical and professional experiences.

8 ▸ Listing irrelevant extracurricular activities. You absolutely should list extracurricular activities (sports, clubs, volunteer work, mentoring, art, activism, etc.) that contribute to your growth and your potential, but make sure there is an obvious relevance to the position. Including extracurricular activities is an opportunity to showcase professional skills you've gained, such as collaboration, independence, teamwork, and communication. It's also a way to elevate your resume above those that list only technical skills.

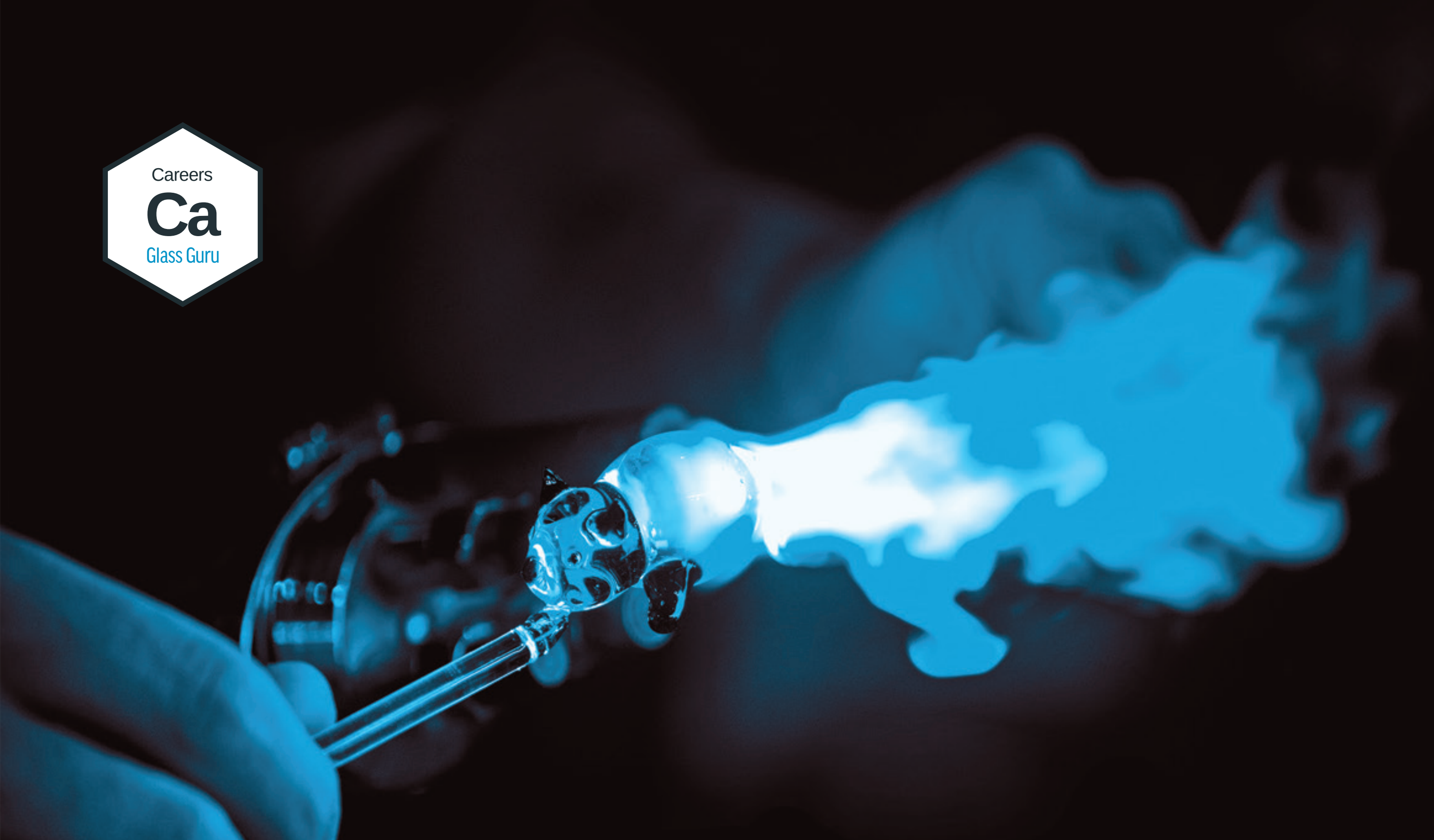
9 ▸ Stating that you speak English. If you are applying for a job in the United States and your application is in English, it is assumed that you are fluent in English regardless of what your first language is. However, if you are fluent in any non-English language, whether it's your first language or a language you acquired, be sure to list it.

10 ▸ Including a "References available upon request" statement. In the past, this was standard operating procedure. Times have changed, and now it's customary to supply references to the hiring manager when requested to do so. Therefore, there is no need to write this phrase on your resume.

DO YOU HAVE QUESTIONS ABOUT RESUMES? ACS offers personal career consulting for members. More than 60 volunteer consultants can help you craft your resume, prepare for an interview, and find the career that's right for you. Visit ***acs.org/careers*** for more information.

Author

Joseph Martino is an ACS Career Consultant and the 2019 Chair-Elect of the ACS Philadelphia Local Section. He earned an M.S. in chemistry from Villanova University and has worked in chemical manufacturing and pharmaceuticals.



THE GLASS GURU

By Michael Tinnesand

Michael Souza's entire career has been devoted to glass, a product that no chemistry student or practitioner can live without. He is a professional glassblower for Princeton University, and his experience in the field spans 40 years—first in industry and then in academia. He began his career as an apprentice at H. S. Martin, a company that makes custom glassware for science and industry.

How did you become interested in glassblowing?

My father was in the industry, so it was mostly by heritage that I got into the business. When I was young, he would take my siblings and me to his workplace and we were given various tasks—mostly menial work, such as sweeping up or cleaning equipment. But later we got to play with glass, and I began to learn some of the basics about how it behaves.

How does one go about studying glassblowing?

When I started glassblowing 40 years ago, it was not common to earn any kind of academic degree as part of an apprenticeship. It is much more common now for students to get some sort of academic background in chemistry, physics, and/or materials science as part of their entry into the profession.

Today, several two-year colleges offer glassblowing degrees, although many of them focus on glassblowing as an art. The most well known school in the United States for a scientific glassblowing degree is Salem Community College, in New Jersey. It offers a two-year Associate in Applied Science degree in Scientific Glass Technology, which provides the necessary skills and techniques to construct glass apparatus for scientific research in university laboratories as well as industrial research and production.

After graduating from a two-year program, students face a 7000–8000-hour apprenticeship period (approximately 4–6 years) to become an experienced tradesperson. It will take a decade more of experience before someone is considered a master glassblower.

The University of Montana Western, in Dillon, is the only school in the country to offer a bachelor's degree with a specialization in Scientific Glassblowing, a relatively new program.

Alfred University, in New York, is the only school in the United States that offers a graduate program in Glass Science. This program goes well beyond basic scientific glassblowing and covers aspects of materials science and engineering for master's and Ph.D. degrees.

What is an apprenticeship like? How is it different from an internship?

In my experience, apprentice positions combine work and training. The kind of training you get is highly dependent on the type of industry you are working in. In the glassblowing field, you get some help and instruction. It is not like formal school. There are no grades or testing, no set standard curriculum. You get the training you need to be a productive worker, and you are expected to perform like other employees. I found I had to move to several different companies during my apprenticeship to get the breadth of experience I was after.

Internships are similar, but not as rigorous or lengthy. They are usually tied to part of a broader education plan and aimed at giving the student some practical experience in a job. They are often unpaid, but that varies.

What types of jobs did you have in industry?

When I started 40 years ago, I was involved in the production of glass vacuum tube devices that were used in electronics. This was before the invention of solid-state transistors, so every radio, television, and amplifier used vacuum tubes.

This changed as old vacuum tube technology was replaced by semiconductors. I worked with an apparatus used to create silicon wafers and then process them into chips. We did a lot of work with pure quartz glass, an exotic form of glass that is 99% pure silica and can withstand temperatures of 6000–8000 °C. It is also very stable thermally. It is used to make glass crucibles, trays, and wafer holders (called boats) used in microchip processing.

How is your work in academia different from (or the same as) your work in industry?

Industry jobs are driven by the bottom line of profit or loss. An apparatus is only produced if there is a proven market and established production methods that indicate it will make money. In academia, the technology takes priority over cost. Scientific research is devoted to making new discoveries, and that sometimes means creating equipment that is also new and has never been made. It is impossible

Glassblowing, by the numbers

Current employment:	Average hourly wage:	Job openings per year:	State with the most glassblowers:	Top industry employer:
41,320	$16.25	4200	California	manufacturing

to quote a price in advance for making something that has never been made. Materials still have to be made at a reasonable cost, but the science doesn't move forward unless the right tools can be created.

Has the reliance on glassblowers by universities and research laboratories changed over the course of your career?

It was once very common for large university chemistry departments to have a dedicated scientific glassblower on staff. That is much less common now. There is a wider range of relatively inexpensive glass labware that is available off the shelf, and new materials have been developed to replace glass in some cases.

The work in academia has evolved to where the work is spread over several different departments and disciplines. At Princeton University, I work with physicists, biologists, biochemists, materials scientists, and others. Because the work is spread out, that can make it more difficult to administer and budget.

How do you go about a project—from idea to design to completion?

It always starts with ideas from the researcher and the needs they have for their experiments. Although they know the requirements for the end of the job, they are often unsure how to get there. By working together, we devise a plan that involves the types of materials and techniques I have available to create a device that meets their needs. Project designs rarely come in complete at the start. If things were that simple, the researcher could work with standard equipment that is available from regular product lines.

What is the most interesting glasswork you've done?

I've done recent work on making glass cells for a nuclear targeting experiment. The challenge of the job was to make the cells as thin as possible, with a wall thickness in the range of 20 micrometers (about one-fifth the thickness of a human hair), but still strong enough to withstand 300 psi (more than 20 atm) without bursting. The cells are all handblown by me. It required a series of tests to create the cells and then pressure-test them. If none exploded, it meant that they were still too thick. So we went on to the next thinnest one we could make.

What have you learned about the nature of glass in your experiences with glassblowing?

The most important lesson is that every ingredient that goes into the making of glass contributes to its final properties. There is infinite variety in the various formulations that can be made. Much of the materials science about the fundamental nature of glass is still poorly understood, and we are still learning how we can make glass that best suits our specific needs for different applications.

What do you find most rewarding about scientific glassblowing?

The opportunities available are as diverse and interesting as science itself. I find it very rewarding to work with researchers who have an idea of the apparatus they need to work on their experiments. It is a matter of creative teamwork between them and me. They know what they need for the science, and I know what is possible to design and create based on my knowledge of the materials science and my ability to work with glass and other substances. I've had the chance to participate in some of the most exciting research ever, from detecting magnetic fields on Europa (a moon of the planet Jupiter) to the search for dark matter in the universe. It is great to help in the work of creating new knowledge and the discovery of new ideas. This is a field where you can apply every bit of your scientific knowledge and curiosity over the course of your career.

__Michael Tinnesand__ is a science writer and education consultant who lives in Portland, OR.

Grad School
Gd
Mahmoud

Grad School

Building an International Chemistry Career in Grad School

BY ALLISON PROFFITT

What does it look like to build an international chemistry career? Alaa El Din Mahmoud has some expertise. A Ph.D. candidate, he began his career at Alexandria University in Egypt, and his academic journey has taken him to Greece, Germany, and beyond. Along the way, Mahmoud has received recognition for his teaching and his research. In 2013, he was recognized by Alexandria University during the Day of Excellence for scientific contributions in teaching and research, and he was awarded a National Commission Young Scientists Award from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Man and the Biosphere program.

Beginning the master's track

As an undergraduate, Mahmoud studied environmental sciences, an interdisciplinary degree that included coursework in chemistry, biology, and geology focused on sustainability. After he had acquired his bachelor's degree, he joined the academic staff in the department as a laboratory demonstrator. While taking on responsibilities for courses and workshops, Mahmoud began his graduate studies in environmental chemistry.

Mahmoud chose environmental sciences out of a strong interest in water and wastewater treatment technology. "It's crucial to understand, protect, and sustain our available natural resources for future generations," he says. "It should not be only our responsibility as specialists or government, but also as people all over the world."

During his master's work, Mahmoud published peer-reviewed papers. He attributes his success to the support he received from his supervisor, Professor Manal Fawzy. "She is very supportive and inspired me to be motivated," he says. After completing his master's degree, Mahmoud was promoted to be an assistant lecturer. As an instructor, he taught courses in environmental chemistry, but he took his position a step further by taking his students on field trips to give them an opportunity to understand both the practical and the theoretical sides of chemistry.

Mahmoud took students to two area lakes, Lake Mariout and Lake Edku, as well as scientific research stations to practice water and soil sampling techniques. "Other field trips have been done to industrial facilities to understand the application of environmental chemistry on a large scale and know more about safety and risk management," he adds.

Changing course for a Ph.D.

When it came time to advance to his doctoral work, Mahmoud wanted a change in location. He applied for a scholarship from the German Academic Exchange Service (DAAD), with funds from the Egyptian Ministry of Higher Education, to study Energy and Environmental Chemistry at Friedrich Schiller University Jena, in Germany. The program is a partnership between the Egyptian Ministry of Higher Education and Germany for students to continue their studies and research in Germany.

The Egyptian Ministry of Higher Education has several international partnerships with countries in the European Union, including France, Italy, Spain, and Sweden. Mahmoud chose Germany because German universities have outstanding reputations—the strongest in Europe, he says—and all Ph.D. programs are conducted in English. Mahmoud also believes that the green chemistry being done there is some of the most powerful in the world. For Mahmoud, Friedrich Schiller University Jena, one of Germany's 10 oldest universities, was the right place to earn his Ph.D.

The scholarship field was competitive, but Mahmoud was chosen and enrolled at the Center for Energy and Environmental Chemistry Jena. The scholarship covers more than just acceptance to the program. In Egypt, Mahmoud and other award recipients had courses on German culture and integration. The scholarship program also arranged for insurance and visas for the students. Once they moved to Germany, they had additional German language courses before beginning their research.

Settling in

Those language courses and cultural experiences have been invaluable in Mahmoud's transition. Most of the science is done in English, he says. So it would be possible for international students to speak their own languages and use English to converse in the laboratory. But you would miss out on so much, Mahmoud warns.

Mahmoud believes that students who want to be involved in research away from home should learn the local language to better understand the culture. According to Mahmoud, language is essential to being involved in activities, to understand what others are thinking, and the local faculty and students appreciate it. "They are happy you can speak their language," he says. "That shows that you appreciate everything here."

Understanding the language and culture also helps build connections with international students. The local language can become the common language for students from all over the world, allowing friendships and connections to be made.

It's natural, Mahmoud says, to be frustrated, afraid, and homesick at first. "Sometimes it's not going smoothly," he says, observing that many students want to give up and go home after about three months. "These are normal emotions!" But it's worth pushing through. "You have to deal with this; you have to adapt," he advises.

Beyond academics

After delving into the language and culture, Mahmoud soon looked for ways to be involved in the university community outside of his research. After he had been at the university for a year, he became an academic mentor for incoming undergraduates who were in the International Baccalaureate program. He also volunteered with a sports-buddy program offered by the university.

In addition, he was elected as a member counselor for Ph.D. students. In that role, Mahmoud helped organize social and scientific events. "We provide assistance with any issues concerning Ph.D. students, afford opportunities for academic and social networking, and serve as a listening ear for other students," he says. He was also invited by Dr. Anna Görner (the managing director) to present a talk titled "Critical Thinking and Environmental Management" at the Centre for International Postgraduate Studies of Environmental Management (CIPSEM) at Technical University Dresden, in Germany. "It was a real opportunity to meet—and discuss the emerging issues related to water and climate with—international professionals from such different sectors as universities, ministries, and agencies, to improve our knowledge base and skills," he says.

Staying the course

Of course, despite all his mentoring and community activities, Mahmoud is first and foremost a researcher. He focuses on wastewater treatment and management, which he says is a big area of concern for Germany. He is exploring various techniques for ecologically safe water treatment, specifically removing or degrading micropollutants. He has also been busy traveling to international conferences to share his work. "Participation in conferences and workshops has many merits.... Sharing your findings and knowledge is essential to update your ideas and make the world better," he says. "Also, to grow your network."

As a mentor, Mahmoud has this advice for students embarking on a Ph.D.: "You should have a plan to know what to do in the short term, and what you want to accomplish in the long term. Also, have your biggest dream and a plan for how to achieve it."

***Allison Proffitt** is a freelance writer based in Nashville, TN. She has worked for various ACS publications and in the Education Division.*

CHEMISTS CELEBRATE EARTH WEEK

APRIL 21 – 27, 2019

PLAN

Get free resources to plan exciting activities and events for your friends and community.

PARTICIPATE

Help your ACS local section with the Illustrated Poem Contest for K-12 students.

GET INVOLVED

Join forces with other organizations to coordinate and run outreach events.

bit.ly/inChemistryCCEW

Passing the Baton

Ensuring smooth chapter officer transitions

BY ALLISON PROFFITT

In any relay race, the most nerve-racking moment is the hand-off of the baton from one runner to the next. All eyes are on the two runners in the exchange zone, and everyone's hanging on to the hope of a smooth pass. Even though runners are trained for their leg of the race, in that moment, where timing is everything, the only thing that matters is precision and connection.

In a lot of ways, transferring chapter duties to new officers is similar. A chapter can go an entire year without significant hiccups and succeed in many areas. The chapter can grow in numbers. Students can excel at outreach and community building. A record number of people can attend a chapter-sponsored event. But when the officers and leaders behind those events graduate, all the knowledge and progress could be tossed out because no one took the time to share that knowledge. When the baton isn't passed to a new cohort of leaders, meeting attendance drops, opportunities are missed, and momentum is lost.

This slump can be avoided with careful year-to-year planning. Elite runners don't just run toward a teammate and wildly toss the baton, hoping that it will be caught. There's a rhythm, a meter, and a plan. Likewise, successful chapters set up a rhythm and a plan to transfer duties to incoming officers to keep the chapter on track.

Create a knowledge base

Faculty advisors are invaluable resources for a chapter, but ultimately it is a *student* chapter. Student officers need to be responsible for the organization's collective wisdom. That's why many chapters create a library of chapter documents: charter, bylaws, officer duties, event timelines, templates for letters and flyers, and so on.

At Tennessee Technological University, each executive committee member has a binder for their role, and it is passed from officer to officer, explains Amanda J. Carroll, the faculty advisor.

"In the binder for each position, there is a timeline and a list of activities related to that position, for reference," Carroll explains. "Each binder also contains a general timeline for events that are done every year. The binders also contain contact information for people in community groups we work with. Each executive committee member adds information to their binder throughout the year, so the information grows from year to year. Each binder helps transition new executive committee members into their roles, since it provides expectations for what needs to be done and when deadlines are," she says.

At Saint Joseph's University, the executive board is implementing a similar best practice, but in a digital format. "We are in the process of creating specific and detailed bylaws that we will be able to hand down from year to year. We also have created a shared Google Drive that we will be able to pass down to future years," says Elise Brutschea, one of the chapter's co-presidents.

If this seems overwhelming, your chapter can start by making sure that chapter bylaws are detailed and up to date. Then, create a master chapter calendar so that annual events don't sneak up on you. Next year's officers will be able to look at the calendar and note things like when to begin preparing for National Chemistry Week. You should also write down things as you do them, like who you contacted for guest lectures, so that next year's officers will know who to contact.

Build a people pipeline

Successful chapters always attribute at least part of their success to having active and engaged first- and second-year students, not just an excellent governing board of juniors and seniors.

At Saint Joseph's University, the traditional executive board of four juniors and seniors wasn't working. "Our involvement was very small when our board was structured this way," Brutschea says. "We decided to restructure the board to encourage more involvement in the club from first-year students through senior students."

The chapter doubled the size of the board. Now there are two co-presidents, a treasurer, and a secretary. These positions are elected in the spring. The chapter added a scholarship chair, a science outreach chair, a fundraising chair, and an external relations chair. Students are elected to these roles in the fall, and any chapter member is eligible.

"Electing some members of our executive board the year before allows our chapter to prepare over the summer and start [chapter] activities as soon as the school year starts," Brutschea says. "Electing the chairs in the fall semester allows first-year students the opportunity to be a part of the board," she adds. "We have seen that having a more diverse board, in terms of major and class year, helps encourage involvement. It also helps with continuity from year to year; having

Chapters
Cs
Transitions

created these new positions, we hope the younger students who were elected to the chair positions will move up to the president roles."

Creating a library for the chapter charter, bylaws, officer duties, and timelines can ease the transition.

The student chapter at West Virginia State University has only four executive officers, but the chapter has built succession into the election process. The role of vice president is usually filled by someone who is not graduating, explains Edgar Lopez-Torres, who serves as his chapter's director of fundraising for scholarships. The vice president is encouraged to serve as president the following year.

Some chapters will go a step further and have a period of overlap between incoming and outgoing officers. This allows the previous officers a chance to mentor the new officers and help them adjust to their new roles.

Rock your chapter's vote

How you fill leadership roles is equally important for smooth chapter transitions. At West Virginia State University, the chapter believes that having active elections keeps the whole chapter involved and invested in the future. The chapter holds a single set of elections in the fall; all chapter members are welcome to run, but running for office takes planning.

"For a student to run for an officer position, they need to present their ideas for what they wish to accomplish in their role and how they intend to go about this," explains Lopez-Torres. According to him, requiring would-be officers to develop and communicate their plans engages all of the chapter members. When officers are elected with goals and plans in mind, the chapter can help the officers achieve these goals, he says.

At Tennessee Technological University, members wishing to hold an officer position must be nominated by another chapter member, and then they present their vision for the role. "Each nominated person gives a short speech about why they want a certain position, and then we vote on that position," Carroll explains. A nomination process also spurs current officers and other members to encourage and mentor potential leaders.

The Tennessee Technological University chapter has an eight-member executive committee with four elected officers: president, vice president, secretary, and treasurer. The chapter also has four appointed committee chairs: green chemistry, fundraising, social, and education outreach.

"People wishing to obtain the chair positions submit an application we provide, with why they're interested in the position, what they think they can bring to the position in terms of skills and ideas, and their anticipated class schedule for the upcoming year," says Carroll. "The outgoing and incoming officers get together to select the chairs for the next year. We do this since the outgoing officers know what is needed to be successful in a position and the incoming officers will be working with them the next year."

Moving to the application process has "provided better opportunities for people to obtain positions they are best suited for," Carroll explains. "And it helped first- and second-year students have more success in getting involved in leadership roles, since they may not be as well-known as juniors and seniors."

Of course, none of these tips guarantees strong chapter transitions year after year, and not every approach will work for every chapter. But the best practices of successful chapters are worth considering, to keep momentum: create a reference library of foundational documents to follow, build a pathway of involvement for all chapter members, and invest in your election process so that leadership roles go to members with a vision for the chapter.

__Allison Proffitt__ is a writer based in Nashville, TN. She earned a bachelor's degree in the Communication of Science from Vanderbilt University and a master's degree in Science and Medical Writing from Johns Hopkins University. Prior to freelancing, she worked for various ACS publications and in the ACS Education Division.

Chapters
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Awards

Celebrating ACS Student Chapters

The ACS Society Committee on Education has selected 306 student chapters to receive special recognition for distinguished programs and activities described in their 2017–2018 annual reports. They will be honored at the 257th ACS National Meeting in Orlando, FL, on Sunday, March 31, 2019.

In addition, the ACS Green Chemistry Institute is recognizing 72 chapters that have engaged in at least three green chemistry activities as a way of integrating environmentally benign technologies in an academic setting.

Congratulations to the 70 Outstanding, 91 Commendable, 145 Honorable Mention, and 72 Green Chemistry award-winning chapters!

Award List Key

Erlenmeyer College, USA* ← Winning chapter, location
John Smith & Prisha Patel ← Faculty Advisor & Co-Faculty Advisor
Jane Johnson & Kevin Kim ← Chapter President & Chapter Co-President (or Chapter Vice President)

**Green Chemistry Student Chapter*

Honorable Mention

Adams State University, Alamosa, CO
Alexey Leontyev
Diane Arias

Agnes Scott College, Decatur, GA
Thomas Venable
Mahal Bugay & Taylor Strickland

Appalachian State University, Boone, NC
Lauren Woods & Jefferson Bates
Ian Trott & Jordan Carter

Arcadia University, Glenside, PA
Chester Mikulski
Ashley Donlin

Armstrong State University, Savannah, GA
Catherine MacGowan
Maria Huynh & Alexis Fields

Augsburg University, Minneapolis, MN
Michael Wentzel
Ellyn Peters & Taylor Mattice

Bard College, Annandale on Hudson, NY
Christopher LaFratta
Madeleine Breshears

Bates College, Lewiston, ME
Geneva Laurita
David Katzman & Xiaomeng Wang

Benedictine College, Atchison, KS
Gail Blaustein
Joseph Barnes & Joshua Caasi

Berry College, Mount Berry, GA
Lindsey Davis & Kevin Hoke
Cleo Evans & Kelsi Nichols

Brigham Young University-Idaho, Rexburg
Cindy Cooper
Krystyna Hartling

Chapters Cs Awards

Honorable Mention

Brigham Young University, Provo, UT
David Michaelis
Brigham Pope & Garrett Bourne

California State University-Fresno
Dermot Donnelly & Hubert Muchalski
Der Xiong

California State University–Northridge*
Kayla Kaiser & Ravinder Abrol
Marie Cannata & Michelle Ramos

California State University–San Marcos
Robert Iafe & Jacqueline Trischman
Sharai Mendez & James Oakley

California University of Pennsylvania
Kimberly Woznack & Gregg Gould
Caitlyn Williams & Lexi Thorpe

Catawba College, Salisbury, NC
ChaMarra Saner
Devan Shell & Trevor Williams

Centenary College of Louisiana, Shreveport
Thomas Ticich
Grace Doucet & Victor Robert

Central Michigan University, Mount Pleasant
Dale LeCaptain & Sharyl Majorski
Rebekah Adams & Tom Ostrom

Christian Brothers University, Memphis, TN
Dennis Merat
Michael Mendez

Claflin University, Orangeburg, SC
Angela Peters & Marlena Washington
Jira White & Ananya Gupta

Clarion University of Pennsylvania
Amanda Lockwood
Tyler Gates & Bethany Shetler

Concord University, Athens, WV
Darrell Crick & Kimberly Chambers
Corrina Robertson & Isaac Van Blaricom

Delgado Community College, New Orleans, LA
April Noble-Brooks
Andrea Rangel & Emily Edwards

Drexel University, Philadelphia, PA*
Daniel King
Matthew Levine & Prairie Yang

Drury University, Springfield, MO*
Madhuri Manpadi & Albert Korir
Rachel DeWeerd & Jessica Rockafellow

East Los Angeles College, Monterey Park, CA
Armando Rivera Figueroa & Kirk Olsen
Diana Reyes & Anthony Cantero

Eastern Illinois University, Charleston
Edward Treadwell & Rebecca Peebles
James Bosonetta & Angelina Herrera

Eckerd College, St. Petersburg, FL
Christoph Schnabel & Lisa Bonner
Brooke Trimmer & Sean Bradley

Elmira College, NY
Corey Stilts & Betsy Smith
Ashley Miller & Caroline Connolly

Emporia State University, KS
Diane Nutbrown & Eric Trump
Michael Stump & Dalton Doyle

Erskine College, Due West, SC*
Tiffany Hayden & Joel Boyd
Adam Hartley & Peggy Skerratt

Florida Gulf Coast University, Fort Myers*
Greg McManus
Nicole Giorgi & Rachel Burton

Florida Institute of Technology, Melbourne
Norito Takenaka & Boris Akhremitchev
Audrey Preston & Ryan Wheat

Foothill College, Los Altos Hills, CA
Kathleen Armstrong
Natsuko Egawa

Francis Marion University, Florence, SC
Jennifer Kelley
Caitlyn English & Corbin Witt

Gannon University, Erie, PA
Keith Krise & Christine Saber
Vincent Cross & Andrea Cygan

Georgetown University, Washington, DC
Diana Glick
Maria Huynh & Alexis Fields

Georgia Southern University, Statesboro
Amanda Stewart
Kristi St. Clair & Nathan Johnson

Gustavus Adolphus College, Saint Peter, MN
Amanda Nienow
Emma Santa

High Point University, NC
Michael Knippenberg & Meghan Blackledge
Rebecca Ulrich

Hiram College, OH
Carol Shreiner & Steven Romberger
Emily Hruska & Christian O'Neil

Houston Baptist University, TX
Saul Trevino
Sana Quadri

Hudson Valley Community College, Troy, NY
Danica Nowosielski
Benjamin Duell & Guiatango Bonsa

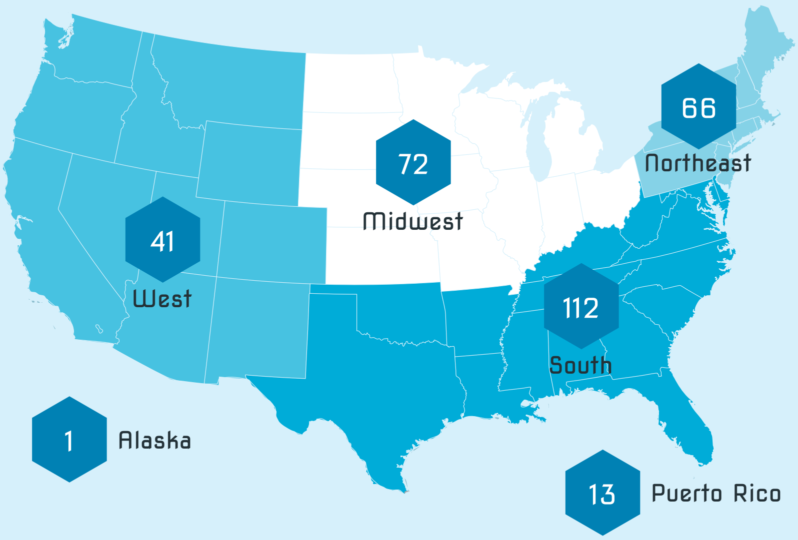
Humboldt State University, Arcata, CA*
Jenny Cappuccio
Emilia McCann & Tara Caso

Huntingdon College, Montgomery, AL
Maureen Kendrick-Murphy
Lindsey Selph & Caroline Cooper

Illinois State University, Normal
T. Andrew Mitchell
Samuel Kempel & Kaylee Kuzelka

Indiana University of Pennsylvania
Nathan McElroy
Jakyra Simpson & Laura Gearhart

2017–2018 ACS Student Chapter Awards



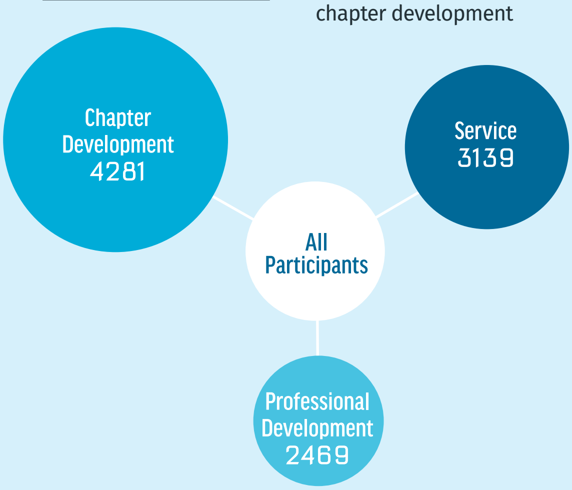
70 Outstanding

91 Commendable

145 Honorable Mention

Impact

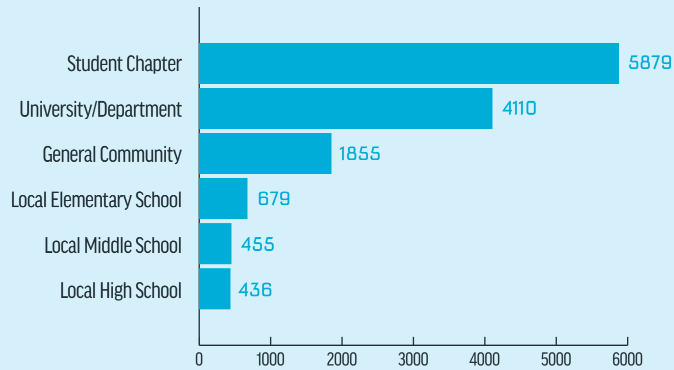
How award-winning chapters contribute to community and chapter development



Chapter Development	
Chapter Business Function/Fundraising	2381
Social	1724
Competition/Contest	176
Professional Development	
Hosting Presentation/Speaker	1249
Attending Scientific Meeting	520
Attending Presentation/Speaker	436
Attending Tour/Field Trip	195
Hosting and Attending Tour/Field Trip	69
Service	
Outreach/Service to Community	2106
Outreach/Service to University	1033

Events

Events by audience



Chapters with the Most Events

141 Salt Lake Community College

133 University of Toledo

110 Western Washington University

109 University of Utah

108 Mississippi College

Chapters
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Awards

Honorable Mention

Indiana University–Purdue University Indianapolis*
Keith Anliker & Lin Zhu
Shivansh Mahajan & Anna Martin

Inter American University of Puerto Rico–Metropolitan Campus, San Juan
Kenia Parga Rivera
Gabriela Robles

Kennesaw State University, GA
Nina Weldy
Katie Slavicinska

Lake Forest College, IL
Elizabeth Fischer & Dawn Wiser
Fillip Komornik & Christina Gimondo

Lander University, Greenwood, SC
K. Lisa Brodhacker
Vernon Clamp & Luis Altamirano

Lincoln Memorial University, Harrogate, TN
Ashleigh Thomas
Courtney Leatherwood & Candace Beeler

Lipscomb University, Nashville, TN
John Smith
Mallory Burns & Mina Waheeb

Lock Haven University, PA
Kyle Root
Scott Shreiber & Tyler Adams

Loras College, Dubuque, IA
David Oostendorp & David Speckhard
Ariel Carter

Louisiana State University and Agricultural and Mechanical College, Baton Rouge
Rendy Kartika & Matthew Chambers
Heidi Nowakowski & Madeline LeBlanc

Manhattan College, Bronx, NY
Alexander Santulli
Daisuke Kuroshima & Chris de la Bastide

Mansfield University of Pennsylvania
Scott Davis
Christopher Haines

Miami University, Oxford, OH
Dominik Konkolewicz
Rachel Serafin & Avnika Bali

Midland College, TX*
Patcheammalle Kesavan & John Anderson
Dorsey Bloomgren & Salman Mohiuddin

Minot State University, ND
Mikhail Bobylev
Jordan Torgunrud & Jonathan Gooding

Mississippi State University
Eric Van Dornshuld & Deb Mlsna
Alice Hanson & Thomas Rogers

Missouri Western State University, Saint Joseph
Shauna Hiley
Merle Phillips & Jacob Wagner

Moorpark College, CA
C. Steven Joiner
Erika Szaldobagyi & Amanda Davis

Muhlenberg College, Allentown, PA
Kathleen Herrera
Andrew Rice & Evan Geissler

Murray State University, Murray, KY
Kevin Miller
Abby Bratton & Samantha Daymon

Newberry College, SC
Christina McCartha
Kathryn Hayes & Hunter Berley

New Jersey Institute of Technology, Newark
Bhavani Balasubramanian & Miriam Gulotta
Helene Brochon & Naira Abou-Ghali

Norwich University, Northfield, VT
Page Spiess & Thomas Shell
Benjamin Pulminskas & Patrice Melikian

Nova Southeastern University, Fort Lauderdale, FL
Beatrix Aukszi
Elizabeth Feldman

Oakland University, Rochester, MI
Charlene Hayden
Jake Farnsworth & Mikaela Cantu

Ohio University, Athens
Mark McMills & Lauren McMills
Chani Ferrell & Harley Pairan

Ouachita Baptist University, Arkadelphia, AR
Sara Hubbard & Joseph Bradshaw
Alyson Cole & Jessica Cook

Presbyterian College, Clinton, SC
Evelyn Swain
Kendall McDill & Douglas Smith

Purdue University, West Lafayette, IN
Beatriz Cisneros
Melanie Free

Purdue University Northwest, Hammond, IN
Harold Pinnick
Ellis Moore & Mitchell Howell

Radford University, VA
Cindy Burkhardt & Kimberly Lane
Alexandra Hawks & River Fiedler

Rensselaer Polytechnic Institute, Troy, NY
Alex Ma
Jessica Patrick

Rider University, Lawrenceville, NJ
Jamie Ludwig
John Gulliver & Joshua Tamuzza

Ripon College, WI
Colleen Byron
Rylie Morris & Allison Reinhardt

Rollins College, Winter Park, FL
James Patrone
Alyssa DeLucia & Nikki Tarolla

Sacred Heart University, Fairfield, CT
Linda Farber
Stephen Baer & Renee Russo

Saint Anselm College, Manchester, NH
Nicole Eyet
Elizabeth Lomuscio

Saint Martin's University, Lacey, WA
Arwyn Smalley
Kyle Smith & Kaylin Fosnacht

Saint Mary's College, Notre Dame, IN
Jennifer Fishovitz
Morgan Matthews & Kyra Dvorak

San Diego Miramar College, CA
Gary Smith & Synthia Chang
Danielle Chilcote & Michael Troester

Santa Clara University, CA
Linda Brunauer
Jennifer Yin & Benn Bluestein-Veyra

Seattle Pacific University, WA
Karisa Pierce
Emily Deveau & Elisabeth McKinney

Simmons College, Boston, MA*
Shreya Bhattacharyya
Erin Mancini & Kayla Kilduff

Southeastern Louisiana University, Hammond
Thomas Sommerfeld
Shreya Bhatt & Shreeja Bhatt

Southeastern Oklahoma State University, Durant
Nancy Paiva
Elizabeth Landers & Dyani Shores

Southern Oregon University, Ashland
Anna Oliveri
Sarah North & Emily Dooley

Southwestern University, Georgetown, TX
Willis Weigand & Michael Gesinski
Morgan O'Neal & Alexandra Taylor

Spring Hill College, Mobile, AL
Lesli Bordas
Nicholas Weirath & Rebecca Pearlman

St. Ambrose University, Davenport, IA
Kelly Giddens & Joshua Stratton
Keegan Steele & Amanda Crocker

St. Louis College of Pharmacy, MO
Martin Perry
Dominique Vu & Jaynika Patel

State University of New York College at Cortland
Katherine Hicks & Andrew Roering
Ashley Evanchof & Brittany Parody

State University of New York College at Plattsburgh
Rajesh Sunasee
Christopher Smith & Richard Chandradat

Stern College for Women–Yeshiva University, New York, NY
Donald Estes & Chaya Rapp
Sara Wiener

Stonehill College, Easton, MA
Cheryl Schnitzer & Marilena Hall
Lindsey Gray

Texas A & M International University, Laredo
Kameron Jorgensen
Diego Cardenas & Melissa Nieto

Texas Lutheran University, Seguin
Alison Bray & William Davis
Madison Berger & Brittany Pollok

Texas Tech University, Lubbock
Dominick Casadonte & Michael Findlater
Joshua Twaddle & Amanda Helms

The Evergreen State College, Olympia, WA
Dharshi Bopegedera & Rebecca Sunderman
Faith Rasmussen & Ashley Sundin

The Ohio State University, Columbus
Noel Paul
Madeline Smotzer & Rachel Preston

The University of Memphis, TN
Nathan DeYonker
Adriauna Sanders & Karen Vuong

The University of Texas Rio Grande Valley, Edinburg
Shizue Mito & Kenneth Smith
John Valle & Ahyssa Cruz

Thiel College, Greenville, PA
Christopher Stanisky
Jessica Campbell & Ashley Mangel

Tiffin University, OH
Mark Sabo
Amanda Flotteron & Katalina Estright

Trinity University, San Antonio, TX
Christina Cooley
Hailey Taylor

Tufts University, Medford, MA*
Sergiy Kryatov & Karen O'Hagan
Arielle Mann & Erika Madrian

Chapters
Cs
Awards

Honorable Mention

United States Merchant Marine Academy, Kings Point, NY
Ping Furlan
Martin Dzurik & Zander Barton

Universidad del Sagrado Corazón, San Juan, PR
John Olmo
Marie Rosado

University of California–Santa Barbara*
Leroy Laverman
Stephanie Taylor & Brandon Light

University of Dallas, Irving, TX
Ellen Steinmiller
Patricia Hahn & Rebecca Mitton

University of Delaware, Newark
Eric Bloch
Zachary Jones

University of Illinois at Urbana-Champaign
Joaquin Rodriguez Lopez
Alexandra Lamtyugina

University of Iowa, Iowa City
Scott Shaw & Earlene Erbe
Danielle Chaney & Julie Breuer

University of Kansas, Lawrence
Roderick Black & Paul Hanson
Emmaline Lorenzo & Kerry Kao

University of Louisiana at Lafayette
Ryan Simon & August Gallo
Alyssa Bienvenu & Alexandra Arcement

University of Maine, Orono
William Gramlich
John Koller & Gabrielle Bock

University of Mary Hardin-Baylor, Belton, TX
Lin Gao & Brett Bishop
Amy Nguyen & Taylore Pleas

University of Maryland, College Park
Philip DeShong & Efrain Rodriguez
Seth Cohen & Sarah Bender

University of Massachusetts Lowell
Kwok-Fan Chow
Natalie Kogan

University of Michigan-Dearborn
Krisanu Bandyopadhyay
Rachel Holthus & Veronica Gerios

University of Minnesota, Morris
Joseph Alia
Destiny Schultz

University of New Mexico, Albuquerque
Lisa Whalen
Austin Rauch & Chris Hunter

University of North Carolina at Asheville
Oksana Love & George Heard
Jacob Chappell

University of North Florida, Jacksonville
Joshua Melko
Jenn Ruliffson

University of Portland, OR
Angela Hoffman
Mason Melbuer & Anthony Nguyen

University of South Alabama, Mobile
W. Matthew Reichert & Diane Roe
Shahrzad Badri

University of South Florida, Tampa
Kimberly Fields & Laura Anderson
Anna Hemminger

University of Southern Mississippi, Hattiesburg
Sabine Heinhorst
John Hood & Rose Curtis

University of Tampa, FL
John Struss & Laura Henchey
Lindsay Truesdale & Rachael Kurlander

University of Texas of the Permian Basin, Odessa
Samuel David
Sunghwan Ko & Angelica Johnson

University of Wisconsin–Eau Claire
Patricia Cleary
Andrew Dahl & Clorice Reinhardt

University of Wisconsin-Fox Valley, Menasha
Brian Rukamp
Mathew Price & Javier Ramirez Frias

West Texas A & M University, Canyon
Nick Flynn
Kyle Drinnon & Hannah Hedtke

West Virginia University, Morgantown
Joshua Osbourn
Josh Lokant & Joel Bracken

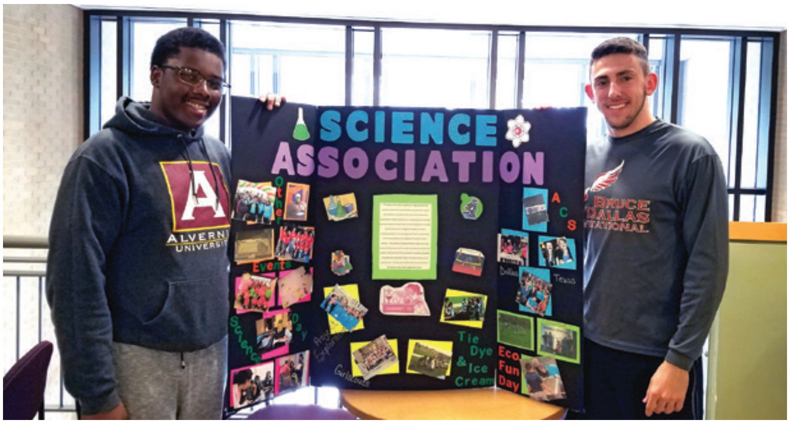
Wheaton College, Norton, MA
Christopher Kalberg
Malik Zaza & Lauren Cressey

Wichita State University, KS
Douglas English
Bernardo Villafana Ibarra & Hunter Picard

York College of Pennsylvania
Kathleen Halligan
Jonathan Denney

Youngstown State University, OH
Michael Serra
Harley Parker & Sam Kulifay

Commendable



Alvernia University, Reading, PA*
Rosemarie Chinni & Kevin Burns
Julian Stetzler & Ross Cosby

Aquinas College, Grand Rapids, MI
Elizabeth Jensen
Nicole Strobel & Martha Mata

Bethany College, WV
Scott Brothers & Lisa Reilly
Austin Paul-Orecchio & Charles Crate

Bradley University, Peoria, IL
Dean Campbell
Keri Martinez & Oliwia Los

California Polytechnic State University–San Luis Obispo
David Zigler & Gregory Scott
Marianne Meyersohn & Emily Wearing

California State University–Sacramento
Cynthia Kellen-Yuen & Benjamin Gherman
Christian Batres & Simon Mentukh

California State University–Stanislaus, Turlock
Gönül Schara
Jonathan Lo & Joseph Garfield

Cameron University, Lawton, OK
Elizabeth Nalley & Gary Buckley
Adewunmi Adebanjo & Marina Brown

Canisius College, Buffalo, NY
Phillip Sheridan
Anthony Berardi

Carlow University, Pittsburgh, PA
David Gallaher
Nicole Mousseau & Lizzie Shumaker

Carroll University, Waukesha, WI
Kent Molter & Michael Schuder
Rachel Kutzner & Deanna Daujatas

College of Mount Saint Vincent, Riverdale, NY
Pamela Kerrigan
Shimron Brown & Nicole DeSouza

Columbus State University, GA
Jonathan Meyers
Blake Pritchett & Tracee Guthrie

Eastern Michigan University, Ypsilanti
Timothy Friebe & Jose Vites
Justin Powers

Elon University, NC
Paul Weller & Karl Sienerth
Joel Harvey & Alexis Betsock

Emory University, Atlanta, GA*
Douglas Mulford & Jeremy Weaver
Ashley Diaz

Florida Southern College, Lakeland*
Jarrod Eubank
Suzanne Wilson & Inga Mauzy

Frostburg State University, MD
Benjamin Norris & Blair Knouse
Brian Day & James Larrimore

Georgia Gwinnett College, Lawrenceville*
Gillian Rudd & Rebecca Kalman
Ara Ko & Katie Coscia

Georgia State University, Atlanta*
Jyotsna Thota & Nilmi Fernando
Loretta Ngoe

Henderson State University, Arkadelphia, AR
Bradley Rowland & David Bateman
Carlie Clem & Colton Lechak

Hofstra University, Hempstead, NY
Scott Lefurgy
Anthony Sica & Matthew Saleem

Idaho State University, Pocatello
Joshua Pak & Caryn Evilia
Ben Poulter & McKenzie Mangun

James Madison University, Harrisonburg, VA
Isaiah Sumner & Debra Mohler
Kearney Foss & Ricky Flores

Kent State University, OH
Yaorong Zheng
Katherine Greskovich & Hala Daghlas

Knox College, Galesburg, IL
Diana Cermak
Rebecca Katz

Lincoln Land Community College, Springfield, IL
Jennifer Ramm & Michael Ramm
Victoria Hollinshead & Elizabeth Yucaneer

Millersville University of Pennsylvania
Lyman Rickard & Steven Kennedy
Joy Thames & George Pearson

Monmouth College, IL*
Audra Sostarecz & Michael Prinsell
Brandon Allen & Rachel Book

Morgan State University, Baltimore, MD
Louise Hellwig & Thomas Bakupog
Abdullah Abdul & Pierce Perkins

Nazareth College of Rochester, NY
Jane Shebert
Alexis Bell

Chapters
Cs
Awards

Commendable

Northeastern University, Boston, MA*
Kathleen Cameron
Duy-Khoi Dang & Kyra Perz

Northern Kentucky University, Highland Heights
Grant Edwards
Donna Odhiambo & Ben Cecil

Ohio Northern University, Ada
Kelly Hall
Kyle Dunnavant & Nathaniel McCutcheon

Pace University, New York, NY
JaimeLee Rizzo
Aramis Sostre & Luke Shapiro

Pacific Lutheran University, Tacoma, WA*
Andrea Munro & Jon Freeman
Xinhui Huang & Alex Klussmann

Park University, Parkville, MO
Donna Jean & Gregory Claycomb
Jessica Pham & Adrianna McMullen

Pasadena City College, CA*
Veronica Jaramillo
Darien Castrejon & Danyal Cave

Penn State University Park, PA
Lori Stepan & Joseph Houck
Emma Gogarnoiu & Laine Mosco

Pepperdine University, Malibu, CA
James White
Lina Mikaliunaite

Roger Williams University, Bristol, RI
Stephen O'Shea & Clifford Murphy
Meagan Hackey & Connor Sweet

Saginaw Valley State University, University Center, MI
Jennifer Chaytor & Adam Warhausen
Meredith Hengy & Olivia Bishop

Saint Louis University, MO*
Christopher Arnatt
Niyati Bhakta & Caitlin Salloum

Saint Vincent College, Latrobe, PA
Daryle Fish
Joshua Centore & Jordan Hungerford

San Joaquin Delta College, Stockton, CA
Julius Hastings
Sandra Hernandez & Amairany Donate

Seton Hill University, Greensburg, PA
Diane Miller
Margaret Gerthoffer & William Hoover

Shepherd University, Shepherdstown, WV*
Daniel DiLella
Courtney Glascock

Siena College, Loudonville, NY
Jodi O'Donnell & Jesse Karr
Elizabeth Smith & Zachary Farina

Slippery Rock University of Pennsylvania
Thaddeus Boron
Jacquelyn Stubenraugh & Taylor Ellis

South Dakota State University, Brookings
Nicole Grove
Franchesca Poppinga

South Texas College, McAllen
Ludivina Avila & Karlos Moreno
Cassandra Ventura & Martha Villegas

Southern Illinois University Edwardsville
Myron Jones
Hannah Lupton & Brittany Florea

Southwest Minnesota State University, Marshall
Noelle Beyer & Frank Schindler
Victoria Henry & Easton Popma

St. John's University, Jamaica, NY
Neil Jespersen
Alexander Ng & Ishmal Siddiqui

Stark State College, North Canton, OH
Amy Sanders
Silvia Botha & Tyler Knisley

State University of New York at Stony Brook
Christopher Johnson
J. Daly & Kathleen Nickson

Stevenson University, MD
Diane Payne & William Harrell
Stacey Wardenfelt & Olivia Apicella

Tarleton State University, Stephenville, TX*
William Whaley
Kacy Bullard & Caleb Murphy

Tarrant County College-Northeast, Hurst, TX
Kenneth Drake
David Truong

Taylor University, Upland, IN
Brandon Magers
Brielle Tilson & Jennifer Crim

Texas State University, San Marcos*
Cynthia Luxford
Ananda Diener & Jedavi Avila

The University of Texas at Dallas, Richardson
Stephanie Taylor
Rishabh Lohray & Kinnari Karia

Towson University, MD
Keith Reber
Kayla Martin-Culet & Ryan Dias

Truman State University, Kirksville, MO
Timothy Humphry & Barbara Kramer
Kyler Virtue & Brigitta Reth

Tuskegee University, AL*
Michael Curry
Megan Taylor & Quentoria Walton

Union University, Jackson, TN*
Randy Johnston & Joshua Williams
Logan Whitt & Minh Dong

Universidad Metropolitana, San Juan, PR
Nelson Morales-Penningston
Alondra Baez & Desiee Ciuro

University of Alaska Anchorage
Toshia Wrenn & Mark McCoy
Kaelan Byrd & Chelsea Marie Parrocha

University of Arkansas at Little Rock
Jerome Darsey
Sylvia Szwedo & Jenish Desai

University of California-Los Angeles*
Richard Kaner & Avalon Dismukes
Maya Nag

University of Central Arkansas, Conway*
Faith Yarberry
Shelby Margis & Samantha Turner

University of Central Oklahoma, Edmond
Dana Rundle & Cheryl Frech
Eric Cline & Kimberly Bennett

University of Cincinnati, OH
Daniel Waddell
Majdulynn Hussein & Caroline Tran

University of Connecticut, Storrs
Clyde Cady
Joe Zavorskas & Joshua Paolillo

University of Nebraska at Kearney*
Hector Palencia & Mahesh Pattabiraman
Ali Tanbouza-Husseini

University of Pittsburgh, PA*
George Bandik
Alexandria Gerber

University of San Diego, CA
Christopher Daley
Stephen Hyland

University of Southern Indiana, Evansville*
Brian Bohrer & Jeffery Seyler
Jessica Coleman & Cristina Laughlin

University of Tennessee at Martin*
Abigail Shelton & S. K. Airee
Sarah Max & Mychaela Kerbersky

University of Texas at Austin
Lauren Webb
Sofia Shubert

University of the Sciences in Philadelphia, PA
Catherine Bentzley & Vanessa Jones
Rebecca Colandrea

University of West Florida, Pensacola
Pamela Benz
Joseph Yount & Chau Tran

University of Wisconsin-La Crosse*
Nadia Carmosini & Basudeb Bhattacharyya
Elizabeth McMahon & Kathleen Becker

Utica College, NY
Michelle Boucher & Alyssa Thomas
Emilee Stevens & Lauren Impicciatore

Wayland Baptist University, Plainview, TX
Gary Gray & Robert Moore
Alana Quackenbush

Wayne State University, Detroit, MI
Jennifer Stockdill
Paul Marshal & David Klemet

Western Connecticut State University, Danbury
Nicholas Greco
Julio Bernal

Western Illinois University, Macomb
Brian Bellott
Nicole Walker & Killian Tracey

Wilkes University, Wilkes-Barre, PA*
Megan Youmans
Alisha Black & Rachael Hohol

Winona State University, MN
Jonathon Mauser
Domenic Ogno & Frank Beissel

Xavier University, Cincinnati, OH
Barbara Hopkins
Gabrielle Dangel

Outstanding

Angelo State University, San Angelo, TX*
Edith Osborne & Kevin Boudreaux
Samantha Mabika & Bailey Harvey

Barry University, Miami Shores, FL
George Fisher & Tamara Hamilton
Jocelyn Baquier & Qiwen Su

Belhaven University, Jackson, MS*
Philip Carlson
Somer Warren & Sydney Weber

Bucknell University, Lewisburg, PA
Patrick Martino
Susan Hartzell

California State University-Chico
Randy Miller
Cameron Rivas & Lindsey Rubottom

Chapters
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Awards

Outstanding

City Colleges of Chicago Wilbur Wright College, IL
Doris Joy Espiritu
Andrew Dobria & Bryan Espiritu

College of William & Mary, Williamsburg, VA*
Douglas Young
Christopher Travis

Colorado State University, Fort Collins
Benjamin Reynolds
Noah Knostman & Jake Neuwirth

Delta State University, Cleveland, MS
Sharon Hamilton
Ana Daisy Camarillo & Tory Roberson

Duquesne University, Pittsburgh, PA*
Jeffrey Evanseck & Ellen Gawalt
Emily Cooper & Sadiq Shaik

Eastern Oregon University, La Grande
Anna Cavinato
Quentin Durfee & Joel Jacobs

Florida International University-Biscayne Bay Campus, Miami*
Milagros Delgado
Kathleen Lugo & Jurgen Daye

Georgia College & State University, Milledgeville
Catrena Lisse
Melanie Schellman & Alexandra Hanna

Gordon College, Wenham, MA*
Irvin Levy
Quincy Dougherty & Anna Kjellson

Heidelberg University, Tiffin, OH*
Nathaniel Beres
Kevin Scrudders

Hillsdale College, MI
Matthew Young & Christopher Hamilton
Andrea Lee & Micah Heinz

Illinois Valley Community College, Oglesby
Matthew Johll & Promise Yong
Rion Schulz & Jacob Hall

Inter American University of Puerto Rico-Ponce Campus, Mercedita*
Edmy Ferrer Torres
Valeria Torres Mejias & Felix Rodriguez

Inter American University of Puerto Rico-San Germán
Angela Gonzalez
Gabriel Martinez-Bracero & Emily Garcia-Acosta

Mississippi College, Clinton*
Trent Selby
Jonathan Bethea & Aubrey Smyly

Morehead State University, KY*
Mark Blankenbuehler & Brandon VanNess
Tyler Sullivan & Amina Anwar

North Central College, Naperville, IL
Rebecca Sanders
Antonio LaPorte & Haley Kuck

Olivet College, MI
Susanne Lewis
Brooke Sturgeon & Jackson Kiess

Ramapo College of New Jersey, Mahwah
Sarah Carberry
Devashri Parikh

Saint Francis University, Loretto, PA*
Edward Zovinka
Paul Kasunic & Megan Snider

Saint Michael's College, Colchester, VT
David Heroux
Haley Poitras & Marissa Berry

Salt Lake Community College, UT*
Ron Valcarce
Sierra Cunningham & Ryan McFarland

Santa Monica College, CA*
Jennifer Hsieh & Travis Pecorelli
Tarik Meziab & Catalina Lee

South Dakota School of Mines and Technology, Rapid City*
Tsvetanka Filipova
Hannah Leppert & Joel Swanson

St. Edward's University, Austin, TX
Mary Kopecki-Fjetland
Jacob Belmares & Alexandra Ivan

Temple University, Philadelphia, PA
Steven Fleming
Kari Strouse & Lucas Popilock

Tennessee Technological University, Cookeville*
Amanda Carroll & Janet Coonce
Madison Dunn & Waverly DeLafontaine

Texas Christian University, Fort Worth*
Kayla Green & Heidi Conrad
Maddie Barnett

Texas Woman's University, Denton
Nasrin Mirsaleh-Kohan & Yunxiang Li
Rylee Valdez & Secilia Martinez

The College of New Jersey, Ewing
Benny Chan & Abby O'Connor
Allison Smith & Stephen Liang

The Pontifical Catholic University of Puerto Rico, Ponce*
Lizette Santos & Carmen Collazo
Ashley Guzman & Karla Medina Velez

The University of Utah, Salt Lake City
Holly Sebahar & Thomas Richmond
Amy Loret & Caitlin Coplan

University of Alabama at Birmingham*
Jacqueline Nikles & Gary Gray
Ryan Murphy & Emily Quarato

University of Arizona, Tucson
John Pollard
Leo Hamerlynck & Steven Le

University of California-Davis*
Perry Gee & David Olson
Steven Mok & Jeffrey Baptista

University of California-Riverside
Matthew Casselman
Eufrocina Linda Palaganas
& Jocelyn Rodriguez

University of California-San Diego, La Jolla*
Stacey Brydges & Thomas Bussey
Susanna Lee & Ernesto Garibay

University of Central Florida, Orlando*
Stephen Kuebler
Joshua Kreisel & Riley Olsen

University of Detroit Mercy, MI*
Matthew Mio & Kendra Evans
Danielle Maxwell & Mary Payne

University of Florida, Gainesville*
Ronald Castellano & Leslie Murray
Magan Powell

University of Houston, TX*
Mary Bean
Elia Garcia & Myndee Hong

University of Mary Washington, Fredericksburg, VA
Leanna Giancarlo
Chloe Morton

University of Michigan-Flint*
Jessica Tischler & Samantha Grathoff
Catherine Wilhelm & Daniel Corey

University of Mississippi, University
Emily Rowland
Alex Fratesi & Spencer Rushing

University of New England, Biddeford, ME*
Yiben Wang
Kathryn Chalmers & Jessica White

University of Northern Iowa, Cedar Falls
Colin Weeks
Nina Jocic & Nicole Bishop

University of Puerto Rico at Arecibo*
Maiella Ramos & Vanessa Montalvo
Kevin Rios Martinez & Luis Rodriguez

University of Puerto Rico at Cayey*
Marienid Flores-Colón
Alexandra Droz & Kiara Isaac

University of Puerto Rico-Aguadilla*
Brenda Ramos-Santana & Rafael Estremera
Cindy Lopez-Hernandez
& Maria Gonzalez-Lopez

University of Puerto Rico, Bayamón Campus*
Laura Santiago & Jessica Oyola Cintrón
Rosymar Gracia Colón & Nicole Estarellas San Miguel

University of Puerto Rico-Humacao
Juan Suarez
Abner Figueroa-Perez & Nayshka García Díaz

University of Puerto Rico-Mayagüez Campus
Jessica Torres Candelaria
Mirelys Barreto & Miraima Rodriguez Quinones

University of Puerto Rico-Río Piedras Campus*
Ingrid Montes
Lina Martir Ramirez
& Andrés González López

University of St. Thomas, Houston, TX
Crystal Young
Cody Luong & Nhi Nguyen

University of St. Thomas, St. Paul, MN*
Gabriela Uzcategui-White
& Codrina Popescu
Brittany Haas & Samuel Gentle

University of Texas at San Antonio*
Hector Aguilar
Sarah Altman & Elizabeth Garcia

University of Texas at Tyler*
Laura Boyd & Lauren Johnson
Jessica Bird & Christy Hjorth

University of Toledo, OH*
Brenda Snyder
Celine Schreidah & Michelle Klingberg

Virginia Polytechnic Institute and State University, Blacksburg*
Maggie Bump
Tyler Flournoy & Kyle Duca

Waynesburg University, PA
Evonne Baldauff & Robert LaCount
Jenna Gearhart & Courtney Kristoff

West Virginia State University, Institute*
Micheal Fultz & Thomas Guetzloff
Edgar Lopez-Torres

West Virginia Wesleyan College, Buckhannon
Joanna Webb & Edward Wovchko
Jeffrey McNeill & Dixie Shahan

Western Washington University, Bellingham*
Steven Emory & Elizabeth Raymond
Rachel Blazevic

Westminster College of Salt Lake City, UT
Robyn Hyde & Paul Hooker
Daniel Devore & Aaron Smith

Xavier University of Louisiana, New Orleans
Michael Adams & Candace Lawrence
Joshua Adkins & Andrew Andre

Chapters
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Spotlight

Saint Joseph's University

Location
Philadelphia, PA

Faculty Advisor
J. Scott Niezgoda

Members
53

Chapter Co-Presidents
Isabella Armento
Elise Brutschea

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How did you celebrate National Chemistry Week?

In celebration of the theme "Chemistry is Out of This World," we learned about Stephen Hawking's solar sail, which has the prospect of traveling to the star Alpha Centauri. Our members also made space-themed baked goods and sold them in the library during National Chemistry Week to raise funds for the chapter.

In what ways does your chapter contribute to the community?

A large part of our club is giving back to the community and teaching a love of science to others. In the fall, we participate in the Harvest Festival at the Wagner Free Institute of Science in Philadelphia, which is a Community Science Day that focuses on the science of autumn. Last semester, we had a Halloween science experiment that investigated the densities of different candies. Volunteers interacted with 40 young kids and their parents to teach them about science.

Also in the fall, we have a tradition of inviting high school students from a local Philadelphia public school to our campus for a solar cells experiment. These enhanced college visits are intended to get high school students excited about

Faculty Profile
J. Scott Niezgoda

How many years have you been a faculty advisor?

This is my first year.

Why did you become a faculty advisor?

Since I am a new faculty member, it is important for me to be very involved in the department. This was a great opportunity for me to get to know the students and the department better. Also, as someone with a strong background in science outreach, I hope to bring this to the forefront of the chapter.

What challenges have you faced in your position?

I want to be able to make this a student group that is enjoyable for students to participate in and keep this positive culture consistent from year to year.

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

I hope that the new lounge, the events, and the activities at meetings will bring different years of chemical biology and chemistry majors closer to one another. Also, it would be rewarding to see students active in outreach to underserved high school students; this is very important to me, and I hope to grow this new aspect of the club.

the prospect of college and about science. We divide the students into teams, and each team builds a blackberry solar cell; the winning team is determined by whose cell is the most efficient.

In the spring, we will be participating in the Philadelphia Science Carnival.

What is your most successful recruiting event or recruiting method?

Most of our members are chemistry, chemical biology, or biology majors. These three majors are relatively small, so everyone generally knows about our club. We send e-mails to the incoming students in these majors about our first club meeting (usually featuring free food and a fun activity). Students often join from word-of-mouth promotions... and they hear that our club is really fun.

Another way we recruit members, especially outside of the science majors, is at the fall semester Activities Fair, which promotes campus clubs and teams. We give away a 1000 mL graduated cylinder filled with fruit taffy candies to the person who comes closest to guessing the number of candies in the cylinder. The event gets us a long list of e-mails for prospective members!

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

Our philosophy to retain members is to provide a really fun and helpful year, every year. We host a variety of events—social, academic, volunteering—so there is always something for everyone. Not every student wants to get the same thing out of the club, so by having a variety of events throughout the year, we retain members.

What are your most popular or unique chapter activities?

Our most popular chapter activity is our club meetings. Every month has a theme, such as space chemistry, liquid nitrogen, holiday science, or food science. We try to have a social activity (like trivia) or an interactive experiment (like using a banana as a hammer or making stress balls with non-Newtonian fluids). Most of our active members attend every meeting, because they are so much fun!

What types of activities do you sponsor?

We sponsor social, academic, and volunteering events. Our social events include football parties, end-of-semester parties with faculty, and visits

Chapters
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Spotlight

Saint Joseph's University

Want to be featured?
Let us know you want the spotlight at *inchemistry@acs.org*.

to science museums in Philadelphia. Our academic events include LinkedIn workshops, seminars, luncheons with seminar speakers, and graduate school application workshops. Our volunteering events include various Philadelphia science community days and inviting high school students to campus for blackberry solar cell labs.

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

Our communication methods include Facebook and LinkedIn. Our Facebook page is more of a social page where we update our friends, alumni, and family members about various events. A LinkedIn group, however, allows us to communicate in a professional way with our alumni. We use it for networking, discussing careers and graduate school, and connecting current students with previous chapter members.

What is your most successful fundraiser to date?

Our most successful fundraiser is our Valentine's Day Test Tube Sale. We fill test tubes with pink, red, and white chocolate candies and sell them in the library over the course of a week for $1 each. These Chemistry Valentines are popular among all students, not just science students, and the fundraiser is always very successful. We end up making about $300–400 each year.

If your chapter has recently attended an ACS meeting, how did members benefit?

One of our chapter's main goals is to provide funding for our members to attend the ACS national meeting once a year. A lot of our members conduct research, and the opportunity to present their research at a national meeting is integral to their future at competitive graduate schools. Presenting research also allows for communicating with the scientific community, teaching others about what we have learned in lab, and getting new ideas for our research projects. We also have a poster for our student chapter. This poster allows us to promote with other ACS student chapters to hear about their ideas and events and to communicate our chapter happenings to them. Attending the national meeting allows our members to attend scientific talks and learn more about the current chemistry research. Members get to attend talks by prospective graduate school principal investigators, to learn more about their research.

Describe a recent challenge and how your chapter overcame it.

Two recent challenges our chapter faced were with continuity from year to year and with member involvement. In the past, the executive board has had to reinvent the wheel for the chapter, because the executive board was four members who are usually seniors. Our challenge with member involvement was a result of having mostly juniors and seniors participating in the club; younger students would not participate.

This year, we restructured our executive board. We created four chair positions (external relations, science outreach, fundraising, and public relations) in addition to the four current officer positions (a president and a vice president or two co-presidents, a treasurer, and a secretary). The current officers are elected every year in the spring for the following academic year, so the new officers have the summer to prepare for the fall. The new chair positions will be elected in the fall for the academic year, to allow and encourage first- and second-year students to run. We intend for these chair positions to move up into the other executive positions, especially president, to stimulate continuity from year to year. It will also increase the involvement of younger students.

The Periodic Table of Mistakes

Instructions

Find 25 mistakes on this periodic table.

inchemistry.acs.org

Find the answers to this periodic puzzle on the iC website.

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 He Helium 1.01																	2 H Hydrogen 4.00
2	3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 Omg Oxygen 16.00	9 Fl Fluorine 19.00	10 Ne Neon 20.18
3	11 Na Sodium 22.99	12 Mn Magnesium 24.31											13 Al Aluminum 26.98	14 Se Selenium 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.95
4	19 JK Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mg Manganese 54.94	26 In Iron 55.85	27 Co Cobalt 58.69	28 Ni Nickel 58.93	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Poison 74.92	34 Si Silicon 78.96	35 Br Bromine 79.90	36 Xe Xenon 83.80
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Yt Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Moleium 95.96	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Gold 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 126.90	53 I Iodine 127.60	54 Kr Krypton 131.29
6	55 Cs Cesium 132.91	56 Ba Barium 137.33	57* La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 Tg Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Silver 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89* Ac AACTium (227)	104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (272)	108 Hs Hassium (270)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)

58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tmi Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
90 Th Thorium 232.04	91 Pa Protact inium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Stinkium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)