

The Reaction Times

VOLUME VI

MAY 2021

Spring Edition

Chemistry at Home

For our Spring Edition of *The Reaction Times*, we asked the department to share their experiences involving “Chemistry at Home.” With many of us spending more time than usual in our living often-turned-working space, we wanted to hear about how chemistry was continuing, happening, and evolving for our faculty, students, and staff. We were thrilled at the rich and varied responses we received. For some, “chemistry at home” meant the actual *doing* of chemistry at home, with makeshift labs cropping up in basements and kitchens! We are excited to share Ed Voigtman’s piece on “exercising curiosity” via constructing an echelle spectrograph, as well as Julian Tyson’s update on his work developing methods of determining arsenic compounds in rice—from his home!

For many faculty, teaching assistants, and students, the idea of “chemistry at home” has been a process of adaptation. Our research labs became puzzles in efficiency, with students coming in shifts and with new flows in lab traffic to ensure social distancing. For those of us in teaching labs, we wondered: how do you teach organic chemistry techniques like recrystallization and extraction via video? *Can* you? What’s the percent yield (so to speak) on what a student will retain and be able to utilize moving forward when labs are no longer virtual? How do we calibrate and recalibrate? Graduate student TA Muhammad Abdullah’s piece on the Honors General Chemistry labs showcases how experiments were redesigned so students could do chemistry at home safely and affordably. This is one example of the many, many ways our department has adjusted to “chemistry at home.”

Many of us have likely been asked about our interest in chemistry: why we have chosen to study, research, and learn about it. For some, it’s the ubiquity and centrality of chemistry. Chemistry is most everywhere, from the chairs we refurbish, to the unexpected visitors found under our garages (as shared by Mike Mingroni here). For others, chemistry is utilitarian: a way to solve problems. Some might view chemistry as a way to make connections and as a way of helping to understand the world, which seems particularly poignant given the events of this past year. There *is* something reassuring about the periodic table—the structure and organization, the way things can be predicted across rows and down columns. For some, better understanding chemistry can enrich our “at home” hobbies like painting and baking, as mentioned by the graduate students featured in this issue.

This past year has been difficult and unprecedented. We appreciate those who contributed to this issue and the way these pieces showcase the evolving curiosity of the members of our department. Perhaps some of us have felt busier than ever, with the world, including our small slice of it—our labs, offices, classrooms—changing so dramatically, whereas some of us have felt things slow, with more time to ask questions and to reflect, as we anticipate a return to something that feels like normalcy. We suspect that for many people somehow both of these things manage to be true. We hope to see you all again soon and hope you continue to study chemistry—for both questions and answers!

Chemistry at Home: Constructing an Echelle Spectrograph

by Ed Voigtman

For the past several months, I have been constructing, in my basement, an echelle spectrograph (ES). I became interested in this project when a friend asked for some help: he had been working for several years, with relatively little success, to construct a demonstration ES that would fit in a shoebox. This turns out to be a tough requirement because small size means short optical paths and this generally works against achieving high spectral resolution: dispersion needs room to work.

Echelle spectrographs are a specialized type of spectrometer, invented in the 1940s, that can efficiently achieve very high spectral resolution of incident light, leading to applications in astronomy and multi-element chemical analysis. A commercial ES is typically very expensive: even lab-constructed instruments can easily cost \$4000 or more, not counting ancillary components such as a high resolution CCD camera for recording the “echellegrams,” i.e., echelle spectrograms.

My goals in this project are 1) to construct, using *relatively* inexpensive optical components, a working ES fitting on a standard 8” x 10” optical breadboard, 2) to photograph the echellegrams with my inexpensive camera, 3) to demonstrate the viability of using a small telescope and inexpensive multimode fiber optic to get light into the ES, 4) to obtain echellegrams for various light sources, including LEDs (desk lamps, flashlights, individual small LEDs of various colors), compact fluorescent lamps, the sun, the moon, tungsten filament light bulbs, fluorescent and phosphorescent substances, an argon spectral lamp and so on, and 5) to see the echellegrams with my naked eye.

These goals pretty much rule out achieving high spectral resolution, but this is no great loss since the last goal was *a priori* paramount. To varying degrees, all these goals have been accomplished, but there is lots of room for improvement. My latest version echelle spectrograph is shown to the right in figure 1.

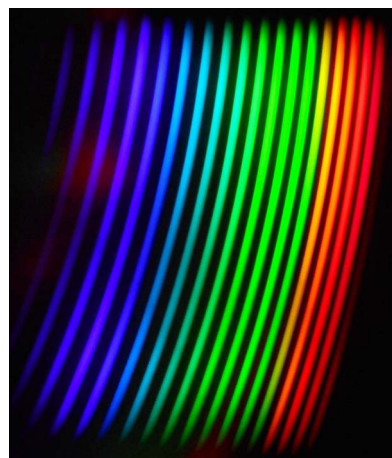


Figure 2

Light enters on the left side, via the 600 μm silica optical fiber, and is then collimated with a Thorlabs achromatic doublet f/3 lens. The collimated light illuminates the echelle grating, which is inclined at roughly 25°. The Thorlabs echelle grating is blazed at 75° and is ruled at 79 lines/mm. The grating efficiently disperses the incident light into the grating's higher diffraction orders, resulting in heavily over-lapped order spectra. The high dispersion prism (Edmond Optics, 50 mm on edge, uncoated N-SF11) performs cross-dispersion of the grating's output, effectively separating the over-lapped order spectra. The resulting echellegram may be photographed with the camera. Alternatively, the camera may be replaced either with a small telescope, which gives a magnified but small field of view or echellegrams may be seen by the naked eye, giving a large and quite beautiful view that has, thus far, eluded all my attempts to capture on camera.

A few sample echellegrams are presented here. The first one is for an LED desk lamp with its white light output as the input to the 600 μm silica optical fiber on the ES, shown in figure 2.

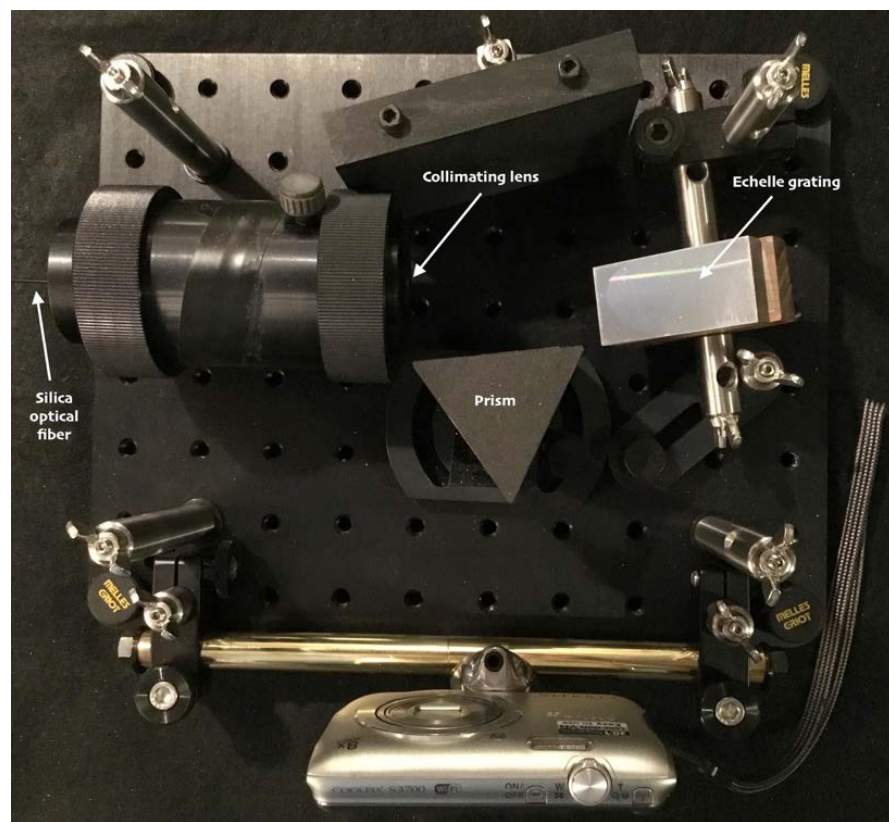


Figure 1

The widths of the diffraction order bands (“colored arcs”) depend on factors such as the degree of collimation of the incident light. The figure 3 was photographed with maximum magnification (“zoom”) on my camera.

The two previous echellegrams were for the white light from an LED desk lamp. By using a green laser pointer (at 532 nm), a red laser pointer (at 650 nm), and some polarizers, beam splitter cubes, diffuser, lens, *etc.*, it is possible to combine the white light and two laser beams and use them as the light input to the ES. A typical result is shown in figure 4.



Figure 3

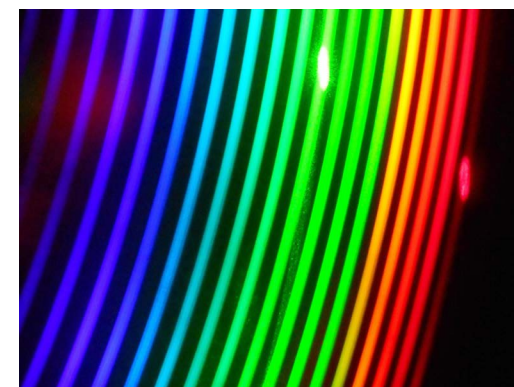


Figure 4

The green spot is 532 nm and the red spot is 650 nm. I have no idea why the spots are elongated or kind of tilted: I assume I am doing something not quite right and need to work on it. A larger field of view reveals that both the green and red spots appear in 6 or so diffraction orders that I can see if I use my eye as the detector, and get it *very* close to the prism, so I have apparently not yet achieved the cross-dispersion I would like to have. Bottom line: resolution is far from high at this point, so there is plenty of room for improvement.

A compact fluorescent lamp (CFL) contains mercury vapor and, in operation, the visible spectral region mercury emission lines are present in the CFL's light output, along with the desired white light. A sample CFL echellegram looks like figure 5.

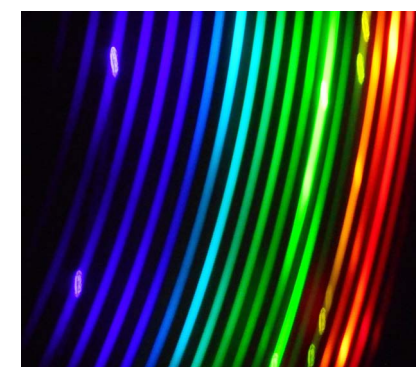


Figure 5

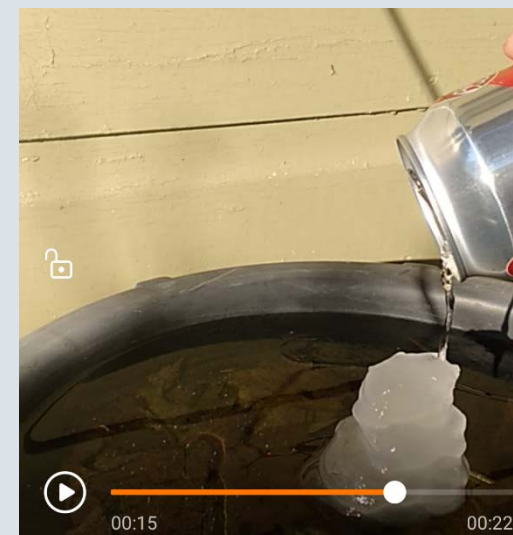
The major mercury emission lines, in nm, are at 404.7, 407.8, 435.8, 502.5, 546.1, 577.0, 579.0, 615.2, and 623.4. The echellegram appears to show the 435.8 (violet), 502.5 (cyan), 546.1 (green), 577.0 and 579.0 (yellow doublet), 615.2 (orange) and 623.4 (orange) lines. These lines range from sharp only, diffuse only, or both. Note also the repetition of spectral lines in different diffraction orders. In quantitative applications, which are not of concern to me, these would be dealt with via windowing and calibration.

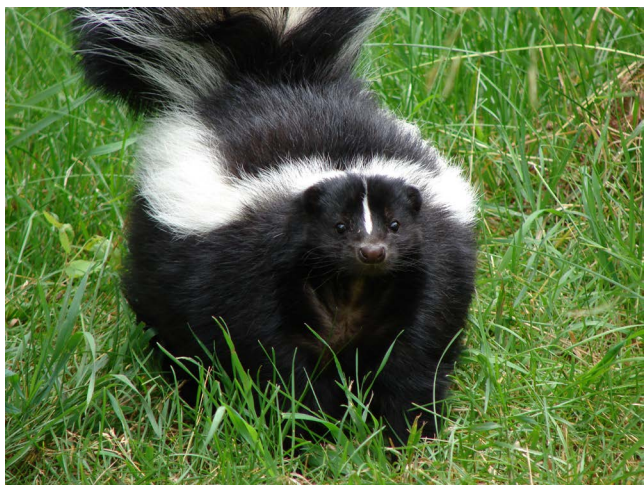
At this point, there are many things to do and explore as I teach myself about echelle spectrographs. I am in the early stages of interfacing a small telescope to the input fiber optic and I need to interface my argon spectral lamp. Polishing fiber optic ends is something else I need to get moderately good at doing. There are lots of little scientific questions that can be studied, but my main goal in that regard is just to exercise my curiosity.

Chemistry at Home: Undercooled Liquid By Stefano Fedeli

I accidentally left an open can of seltzer water inside the car overnight. During the night, the external temperature dropped down to around -7 °C. In the morning, I poured the leftover content into a bucket of ice water. With great surprise, I saw the instantaneous formation of a slush as soon as the seltzer water touched the icy surface. As I continued to pour the seltzer, the stalagmite continued to form!

Basically, the seltzer water left in the car was an undercooled liquid. The principle: even if the temperature drops below the freezing point, the substance remains liquid. This is possible if the liquid lacks a “starting point” from where the formation of the ice crystals can begin (center of nucleation). However, as soon as the liquid touches the ice in the water of the bucket, it finds multiple starting points (the ice crystals already present) and the freezing happens immediately.





Chemistry at Home: Combatting Skunk Odor by Mike Mingroni

We all know the smell. Whether it creeps into your open window on a warm summer night, or works its way into your car vents on your way home from work, the most unpleasantly recognizable smell is that of a skunk. It's a stench that sticks inside your nostrils and, most of the time, slowly dissipates after a short amount of time. But what happens when you find yourself, and all of your possessions, bathing in that awful odor for days? I found myself in this predicament, when a neighboring construction project sent all the neighborhood critters into a frenzy, and a skunk sought shelter under my garage. After making its home, the skunk proceeded to defend its nest from intruders by releasing its pungent repellent, sending a highly concentrated smell through our crawlspace, ascending into my apartment.

Naively, I believed the smell would dissipate over time, but after a day without relief, I became proactive. I turned to candles (which would prove as useless as a garden hose in a forest fire) and air fresheners just mixed in the air, creating a "fresh cotton" skunk battle that would linger for a few minutes before the putrid odor won out. After four days of failed attempts at aromatizing my living quarters, the smell finally diminished to a tolerable undertone. Then it struck again. Only this time, it woke me from a dead sleep at 3 AM and it returned 10 times as strong. A smell so overwhelming that was akin to holding your head in a bag of 100 aggravated skunks, trampling through a field of rancid onions that had been fertilized with rotten eggs. I immediately opened every window, let the 20 degree air flow, threw on five layers of sweatshirts, and dug into the chemistry.

The sheer potency of skunk smell deterred many chemists from tackling the chemical culprits behind the defensive spray. Thomas Aldrich provided early elemental analyses at Johns Hopkins in the late 1800's, characterizing the secretions as a sulfur-containing compound. But it wasn't until the late 1970s when Kenneth Anderson at the University of New Hampshire bravely undertook the endeavor, and identified (E)-2-butene-1-thiol and 3-methyl-1-butanethiol as the prime offenders. In addition to these compounds being highly volatile, skunk smells can be detected by the human nose at 10 ppb, and they also secrete S-(E)-2-butenyl thioacetate, which can break down into thiols in the presence of water, resulting in a second smelly aftershock following a timely rainstorm. This is why the myth of the tomato bath was debunked: moisture from the tomato juice cause the thioesters to become thiols which overwhelm and fatigue the olfactory receptors, and the smell is replaced by tomato. It may seem that the skunk smell is gone, but an outside spectator entering the situation will tell you otherwise. So thiols are the culprit! That said: how do we get rid of a volatile sulfur containing small molecule seeping through the floorboards?

The answer: oxidation! The oxidation of a thiol results in a sulfonic acid, which has almost no odor. The chemist credited with the solution to deskunking was an Illinois chemist named Paul Krebaum, who worked in a watch factory, where the electroluminescent interface produced hydrogen sulfide as a byproduct. He developed a method in his factory to rid the smell using 30% hydrogen peroxide and 6M sodium hydroxide, but when his cat was attacked by a skunk, he had to adjust it to a pet-friendly formula, and thus came up with a household solution (pun intended). That formula is 1 quart 3% hydrogen peroxide, ¼ cup of baking soda, and a small squeeze of liquid detergent.

With a recipe in hand and after a quick trip to Walmart to buy a quart of peroxide, I got to spraying. I moved room to room spraying and the relief to my nose was immediate. As the day continued, the epicenter of the spray continued to waft skunk through the basement, which would rise into the apartment. I sat ready to circulate with the power of oxygen in hand to neutralize it, until the smell of the house returned to its usual smell of Yankee Candles and eucalyptus diffusers. When we had the unfortunate third occurrence, we were armed with an ozone generator hoping to apply the same chemical principles and I'm pleased to report that we had a neutral smelling house within three hours of first signs of the smell. Now, if only I could use chemistry to trap our stinky little houseguest...

Chemistry at Home: Grad Student Hobbies

Kaitlyn Chhe: A star-baker is on the rise! Since the pandemic, Kaitlyn has been honing her baking skills and exploring different baked goods from around the world. Her housemates made her a star-baker request box for baked goods so that she could work her way up to hopefully applying to be on the Next British Baking Show. Some of her creations include flan, British high tea (finger sandwiches and scones), key lime and fruit custard pies, apple cider donuts, and even Fillipino pandesal! Looks like she's just about ready to apply, don't you think? Maybe in the future she'll open a bakery named Bleat Bakery, so be on the lookout! Follow her food adventures @no.1fud on instagram. :)



Jessa Makabenta: Since the pandemic, Jessa's love for space has not halted. Her appreciation for nature remains intact, when she continues to find time for mini solo trips. She has spent her time walking on frozen water at Puffer's Pond, watching the sky change color during sunset, and star-gazing after her work shift. Bringing her love home, she recently picked up painting as a hobby. Her paint-by-numbers Van Gogh's *Starry Night* and 500 piece aurora borealis puzzle hang in her common room wall. Everyone in the house loves the new decor!



Pintu Kanjilal: In his undergrad years, Pintu spent his extracurriculars painting murals and nature scenes using watercolor as his medium. Since moving to UMass, he's been busy working and has mainly captured his experience through photography as it was more convenient. His photography skills improved remarkably, earning him a commission to take engagement photos for one of his batchmates! With the world slowing down from the pandemic, Pintu finally found time to paint again. Specifically, he's been experimenting with acrylic paint, learning a new technique called acrylic flow. His paintings (shown here) all capture the essence of the forest with cell-like structures. By mixing silicon oil with paint thinner, water, and acrylic paint, bubbles slowly form and pop into the paint pattern that was poured. If you're in the market for new wall art, please commission him for a painting!



Chemistry at Home: Refinishing Touch

By Erik Nordquist

My wife Zoe and I refinished a few old wooden chairs this summer, definitely an at-home chemistry project. Removing the previous finish from the backs and legs was necessary in order for the primer and paint to adhere to the wood. The organic solvents (including a glycol ether, dimethyl adipate, and dimethyl glutarate) in the liquid sandpaper we used strip the glossy finish from the wood surface. This is particularly useful on tricky surfaces like chair backs and legs where manual sanding is impractical. On the surface of the seat, we also wanted to remove the old stain, so I physically sanded to remove the previous clear coat and stain, then re-stained with our desired color and applied a fresh layer of polyurethane. The finished products have new life alongside the dining table my great-grandfather made in the 40s, also refinished and painted to match..



Chemistry at Home: Determination of Inorganic Arsenic in Rice

By Julian Tyson

On February 4, 2021, the Subcommittee on Economic and Consumer Policy Committee on Oversight and Reform of the US House of Representatives issued a report with the eye-catching title, “[Baby Foods Are Tainted with Dangerous Levels of Arsenic, Lead, Cadmium, and Mercury](#).” Not surprisingly, the major [news media](#) took note. This is not the first time that the public’s attention has been drawn to problems with baby food. The nonprofit group Healthy Babies Bright Futures issued a [report in 2019](#) on “heavy metals” in baby foods. One simple version of the story is that baby food is made from rice, and [rice is contaminated](#) with arsenic compounds that are known to have various adverse health outcomes.

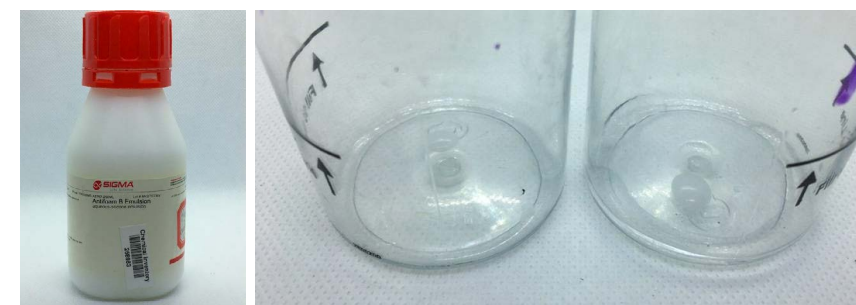
For a number of years now, students in my research group have been developing methods of determining the various arsenic compounds in rice. Procedures that we have considered involve microwave-assisted digestion, HPLC separation, and quantification by plasma-source mass spectrometry or by hydride generation atomic fluorescence spectrometry. In recent years, encouraged by [Chemists Without Borders](#), we have been devising a method for use in situations where advanced chemical instrumentation is not available, such as a university in Bangladesh or even in consumers’ kitchens. Our approach has been to adapt a colorimetric method that is the basis of commercially available test-kits for the measurement of arsenic in drinking water. With the arrival of COVID-19, experimental work was relocated, and the latest results, presented here, have been obtained in the basement of my home.

The Underlying Chemistry: Arsenous and arsenic acids (H_3AsO_3 and H_3AsO_4) extracted from the rice by dilute H_2SO_4 , react with hydrogen on the surface of powdered zinc to form arsine (AsH_3), which is transferred to the headspace by the sparging action of the hydrogen gas, formed as the zinc dissolves in the acid. Arsine reacts with the mercuric bromide on the test strip to form a yellow-brown product with an unknown composition. Methylated arsenate compounds, which are also present in rice, react to form methylated arsines, but these do not impart a color to the strip.

We use the Hach EZ arsenic test kit. Here’s how the procedure goes:

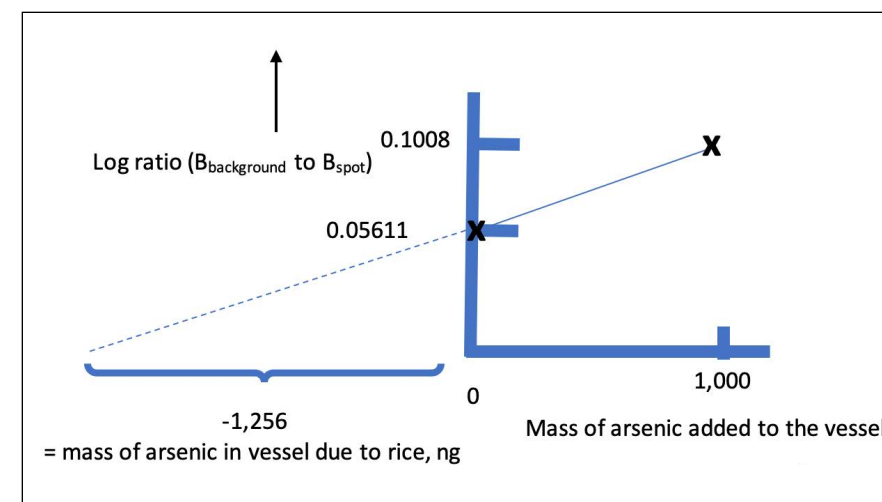


1. Prepare filter paper discs. Assemble two lids with cotton wool plugs, discs, and test strips.



3. Add 2 drops antifoam to each of two reaction vessels. Add 1.0 mL of 1000 $\mu\text{g L}^{-1}$ standard to one reaction vessel (in 100 mL, this is a standard addition of 1000 ng or 10 ppb).

Shake centrifuge tubes and pour contents of two tubes into each reaction vessel. Swirl to dissolve standard addition and mix antifoam.



6. Digital image analysis via Mac Digital Color Meter, (native R, G, B values). Obtain four B values for background (at each “corner”) and calculate average. Obtain B values in center of spot for rice (R) and rice plus 1000 ng (R + 10). Calculate the values of $\log(B_{\text{back}}:B_{\text{spot}})$. Assume a linear function of the mass of arsenic. Calculate mass of arsenic in vessels due to the rice. Divide by mass of rice (10.0 g) to get concentration in ng g^{-1} (equivalent to $\mu\text{g kg}^{-1}$, ppb) = 130 ppb. After 5 hours, the values were 0.0644 and 0.1147, corresponding to -1,282 ng.

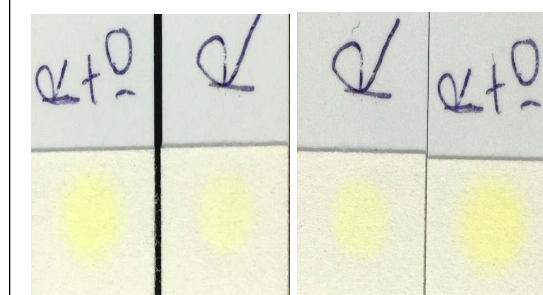
Our next step is validation by the analysis of rice whose inorganic arsenic content is known. This, unfortunately, is non-trivial.



2. Weigh 5.0 g of ground (coffee grinder) rice into four 50-mL centrifuge tubes. Add 50 mL of 0.25 M H_2SO_4 to each. Cap loosely. Heat in boiling water bath for 1.0 h. Cool to room temperature.



4. Add one sachet of zinc powder (1.7 g) to each vessel and cap immediately. Swirl gently to mix and leave for 3 h.



After 3 hours

After 5 hours

5. Remove strips and reseal lid flap. Take digital image (iPhone 6S) in LED light box (DUCCLUS Mini). Return strips to reaction vessel lids for a further 2 h. Remove and photograph.

Graduate Students

GCA and APDC Hold Virtual Events to Encourage Community Growth During the Pandemic By Kim Bolduc

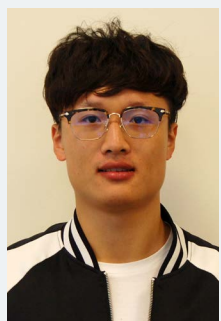
Graduate student organizations at UMass tasked with encouraging student socialization and personal growth have continued to host events true to their missions despite the limitations of the ongoing COVID-19 pandemic. The Graduate Chemist Association (GCA) and the Association for the Professional Development in Chemistry (APDC), have successfully held a number of events including trivia nights, research seminars, mental health awareness discussion groups, and many more.

The Graduate Chemist Association, or GCA, would typically hold a myriad of events inviting students to gather on the UMass campus as well as off-campus. Undaunted by the pandemic, GCA has moved all of their events into a virtual format. Last July GCA successfully held a trivia night titled “The Great Chemists Quarentrivia Challenge” that was conducted over Zoom. Questions ranged from programming and chemistry to pop culture and food. The impressive attendance and success of this event prompted GCA to organize another trivia event for prospective students during UMass’s visit weekend in February. Both prospective students and current graduate students alike had fun answering questions like, “Is a hot dog a sandwich?”

In a joint effort to build connections in the UMass chemistry community, GCA and APDC have partnered to spearhead a mental health awareness initiative. Spurred by reports on the poor mental health of graduate students, GCA and APDC met with representatives from the Center for Counseling and Psychological Health (CCPH) at UMass to craft events that encourage graduate students to share their concerns and support one another. The first event, “Failing Proudly,” was modeled on events held by graduate students at other universities. The goal of this event was to invite graduate students to examine their experiences of failure and learn to see failure as an important, necessary, and ever-present tool for growth. The second event, titled “Naming Our Difficulties: Labmate Relationships,” originated from a department-wide survey sent to all graduate students. Prompting graduate students to share their stressors, the form returned an overwhelming number of responses detailing concerns over labmate relationships, PI relationships, time management, and more. GCA and APDC reworked the responses into anonymous case studies that graduate students were then invited to work through and discuss during the event. Future events will also draw upon the form responses.

According to their commitment to student research, APDC held a completely virtual ResearchFest in August that featured 30-40 poster presentations. Four student speakers also delivered 30 minute research talks, with Babgen Manookian’s talk earning him the top prize. The UMass chemistry community was also delighted with a keynote speech by Dr. Rajdeep Kalgutkar, a Lead Research Specialist at 3M. The event garnered over 100 attendees and was very successful. In the interim period before the next ResearchFest in the summer of 2021, APDC has reimagined their usual “Pizza Parley” event, where graduate students share pizzas and discuss their research, as the Virtual Research Summit Series (VRSS). This completely virtual event invites graduate students to present their research in a casual, conversational setting. Questions between graduate students often lead to a fruitful discussion about how barriers in research may be overcome or new avenues may be explored. More recently, APDC has also revived the “Coffee Hour” with visiting speakers from the Drug Design class. All of these events have and will continue to be advertised via email, so be sure to watch for emails from APDC and GCA!

Peidong Wu Receives 2021 PPG Fellowship



Research summary: Targeted delivery of therapeutics using supramolecular nanoassemblies are attractive prospects in tackling life-threatening diseases such as tumors. I have been working on developing suitable polymer scaffolds for drug delivery and optimizing their release kinetics upon intracellular stimuli, tumor targeting specificity and quality. Active targeting of the drug delivery vehicle can be achieved by conjugation of targeting ligands such as antibodies to the nanoassemblies. Compared to conventional antibody drug conjugates (ADC), antibody directed nanoassemblies could provide great potential to overcome the limitation of ADC. With the support of a PPG fellowship, I will be further working on pre-targeting strategy for an improved targeting specificity and quality meanwhile look into novel cargos such as PROTAC in treating specific tumors. Overall these studies will give us more insights into principles for the next generation targeted therapy.

Kim Bolduc and Nathaniel Kuzio Receive NSF Graduate Research Fellowship Honorable Mentions



Kim Bolduc

Futuristic materials such as room-temperature superconductors, materials with hardness values that surpass diamond, and permanent magnets that outperform current rare earth magnets, are all being actively pursued in the field of materials discovery. High-pressure has been shown to be a unique tool that could be used to synthesize and recover novel phases, such as the hexagonal-close packed phase of iron. The objective of my research is to design and perform in situ XRD experiments to probe the crystal structure of materials in the nanoseconds before, during, and immediately following the rapid compression and decompression caused by shockwaves.



Nathanael Kuzio

Proteins are some of the key drivers of biological processes, making them of great interest to us here in the Hardy Lab. An area that we hope to explore and expand upon is the methodology used to track and label specific proteins to further understand their roles within biochemical pathways. Previously, our lab discovered a bis-N-oxide compound that has the ability to react with cysteines adjacent to positively charged amino acids (a motif we have termed Cys-(+)) in an extraordinarily selective manner. The research I proposed is to investigate the potential of our bis-N-oxide probe to be used as a selective labeling technique via introduction of the Cys-(+) motif into a protein target of interest.

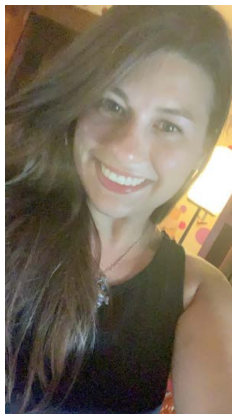
Muhammad Abdullah Teams Up with Dr. Paradise for “At-Home” Chemistry Labs

Running an undergraduate chemistry lab that keeps everyone physically distanced is one of the grand challenges academic institutions are wrestling with during the COVID-19 pandemic. When COVID hit back in March 2020, many UMass chemistry labs transitioned to remote learning using virtual laboratory simulators. However, online laboratory learning cannot fully replace traditional in-person labs. To bring hands-on experience, Prof. Paradise and I teamed up (virtually) to develop “at-home” experiments for Honors’ college general chemistry CHEM-121H. One of the primary challenges we encountered was using affordable and non-hazardous chemicals that were still able to provide hands-on activities for students to build their technical skills. Commercially available at-home lab kits are generally a bit expensive, and with the escalating global crisis, we did not want to put any financial burden on the administration or the students. Therefore, we decided to design experiments from scratch using household chemicals.



For me in particular, it was a wild ride as we had to think about experimental design and data collection, analysis, and what skills students would acquire in each experiment. It was important to make sure we included all those elements essential to the course’s learning objectives. Some of the key experiments we developed and executed successfully encompassed acid-base titration, solubility trends, and polymerization reactions. Despite having some difficulties at earlier stages, we were able to calibrate our expectations of what can be done practically and how precise (or, as the case may be, imprecise) we could be. The TAs did an intensive job facilitating discussions regarding precision from student to student to understand the variability of the tools and solutions that everyone has available in their homes. This gave the students an usual but still fruitful experience doing labs at home.

Undergraduates



Transferring to UMass as a Chem Major

Hey! My name is Sage, I'm 25 years old, and I'm currently a senior in chemistry. I transferred to UMass in Fall of 2019, after completing two associate programs at Holyoke Community College. I really enjoyed the four years I spent at HCC, largely due to the diverse and inclusive environment. Many of the students I encountered at HCC were nontraditional students, or students from underrepresented groups. Some of these students were high school dropouts, young parents, had unsupportive families, or had a family that was unable to help them financially. Transferring to a university is stressful for several reasons, but it feels nearly impossible without the proper resources, support, or financial backing. Some of the challenges and stressors associated with transferring include: starting with a GPA of 0, being behind in the undergraduate course sequence, not knowing anyone, not knowing where anything is, and not knowing what resources are available. Unfortunately, the unprecedented challenges associated with COVID-19 make transferring even more stressful; Fall of 2020, not a single student transferred into the chemistry department.

I feel very fortunate that my first semester at UMass was in person because it gave me the opportunity to network. That one semester of networking led me to my research mentor, Ruthanne Paradise, who has been my greatest lifeline and advocate. This is now my third consecutive semester conducting research with Dr. Paradise, I work for the school as a quality control analyst, and I'm a member of the Chemistry Department's Diversity, Equity, and Inclusion Committee. My first concern as a member of the DEI Committee was making sure that chemistry transfers have the proper resources to succeed. Since becoming a DEI member, I've been working with the department to create and expand upon resources for transfer students.

As a nontraditional student that transferred to UMass, it's important to me that other transfer students have the necessary resources to succeed at the university level. In order to simplify the transition for transfer students, I've put together a success packet for the Department of Chemistry. Providing resources for transfer students is critical for creating a more diverse, equitable, and inclusive environment at any university. This resource has been forwarded to Holyoke Community College, Greenfield Community College, and Springfield Technical Community College to reassure chemistry transfers that there are resources available for a smooth transition. I'm also working with the department to create a website for chemistry transfers, which will include all of the necessary content for future students to succeed.

If other transfer students have any suggestions, I'd love to hear them! Also, if you want to talk to a fellow transfer or need some advice, feel free to reach out. My email is sageclark@umass.edu.

GRADUATING SENIORS

Jacob Baush*	Albert Flater*	Douglas Pazitka-Dorado*	Summer 2021
Irina Biloiul*	Haley Gerber*	Olivia Pietrobuono	Gregory Buchanan
Justin Blundell	Casey Hannigan*	Xinzhe Ren*	Samantha Napolitano
Daniel Chambers	Tristan Heck*	Brayan Rondon*	
Ziming Chen	Nicholas Heller	George Ryan*	Fall 2021
Sage Clark*	Brandon Italiano*	Emily Saltzman*	Alexander Gauthier
Amelia Cochran*	Cameron Kaminsky*	Lorene Stasiuk	Alexander Hill
Rachel Cohen*	Tiernan Kennedy*	Fhaheem Tadamarry*	Ellen Kernan
Julianna Drenzo	Samuel Knight*	Ryan Thai*	Wenwei Liang
Hannah English*	Stephanie Lamkin	Brianna Trabucco*	
Bohan Feng	Karan Monesh Hinduja*	Sashi Weerawarana*	

* American Chemical Society certification

2021 Undergraduate Chemistry Awards

Research group noted in parenthesis.

Academic Awards

American Chemical Society (ACS) Hach Scholarships

Jacque Yee (Walsh) and Wyatt Mitchell (Walsh)

ACS Undergraduate Award in Analytical Chemistry

Liam Murphy

CRC Press Chemistry Achievement Award

Owen Doyle, June Liu, and Marissa Romano

Edward Shapiro Fund

Justin Kieu, Terry Nguyen, Britta Swedin,

Mason Tomko, and Nhu Tong

Jay A. Pirog Scholarship

Ryan Pham (Min Chen)

John A. Chandler Memorial Scholarship

Jacque Yee (Walsh)

Michael Bruno Scholarship

Ryan Pham (Min Chen)

Robert Maxwell Williams Memorial Scholarship

Angela Hinck and Joseph LaMarca

Royal Society of Chemistry Certificate of Excellence

Amelia Cochran (Martin)

Thomas R. "Casey" Stengle Scholarship

Grace Rogers

Research Awards

ACS Undergraduate Award in Inorganic Chemistry

Garrett Miskell (DV)

ACS Undergraduate Award in Organic Chemistry

Ryan Thai (Farkas)

ACS Undergraduate Award in Physical Chemistry

Irina Biloiu (Metz)

Chemistry Undergraduate Research Fund

Garrett Miskell (DV)

Dr. Uche Anyanwu Memorial Fund

Sage Clark (Paradise), Ethan French (Lin),
and Tristan Heck (Metz)

J.F.B. Fund for Undergraduate Research

Wyatt Mitchell (Walsh)

Mahoney Undergraduate Summer Research Award

Zachary Danaceau (Vachet)

Mr. Tompkins Award

Amelia Cochran (Martin) and Mason Tomko (Hardy)

Oliver Zajicek Memorial Scholarship Award

Zachary Danaceau (Vachet)

Professor Jack Ragle Endowed Fund in Chemistry

Timothy Yesepkin (Auerbach)

Roger G. Bates Chemistry Fund

Owen Kuklinski (Knapp)

Sir Harold W. Kroto and Steve F.A. Acquah GEOSSET Award

Jacque Yee (Walsh)

Tarselli Family Research Award

Gabrielle Ho (Rotello) and Alanna Mahar (Hardy)

Departmental Awards

ACS-Connecticut Valley Section Student Award

Amelia Cochran (Martin)

American Chemical Society Membership Awards

Amelia Cochran (Martin) and Ryan Thai (Farkas)

American Institute of Chemists Award

Tiernan Kennedy (Thompson)

Departmental Recognition Award

Tiernan Kennedy and Ryan Thai (Farkas)

Distinguished Undergraduate Instructor Award in Honor of Earl J. McWhorter and George R. Richason, Jr.

Bret Jackson

Distinguished Graduate Teaching Assistant Award in Honor of George R. Richason, Jr.

Nicholas Manganaro

Distinguished Undergraduate Teaching Assistant Award in Honor of George R. Richason, Jr.

Ryan Thai (Farkas)

Positron Award

Amelia Cochran (Martin)

Richard W. Fessenden Award

Ryan Thai (Farkas)

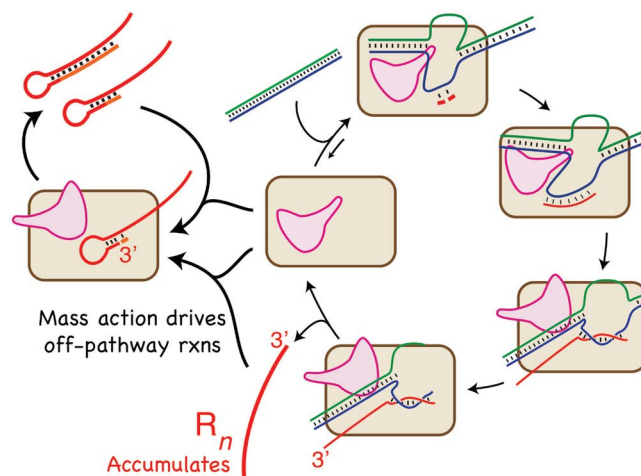
Senior Class Award

Ryan Thai (Farkas)

Faculty

Improved RNA Synthesis

Craig Martin: Last year, just prior to the COVID-19 outbreak, Professor Craig Martin's research group received a grant from the National Institutes of Health, under their Focused Technology Research and Development announcement, aimed at improving the synthesis of RNA for mRNA therapeutics. Little did we know how quickly the entire world would become conversant in the mRNA vaccine component of this exciting new field! His laboratory has also recently received support from a Massachusetts Technology Transfer Center Acorn Award and a Manning Innovation Program Phase I Research Fellow Award. New mechanism-based approaches to synthesis will yield significantly improved yield and purity of RNA, at lower costs, benefitting not only mRNA therapeutics and vaccines, but also other emerging technologies, such as CRISPR, that require highly pure RNA.



Steve Acquah, Chemistry Adjunct Faculty, is mentioned for his quote speaking to the power of communication and forming connections. He took part in the Royal Society of Chemistry (RSC) membership drive. "Challenge yourself to make a difference in the lives of other members of the RSC. We all have problems, but after discussing them you feel energized, you know you are not alone experiencing these problems, and it's a really good feeling to be connected."

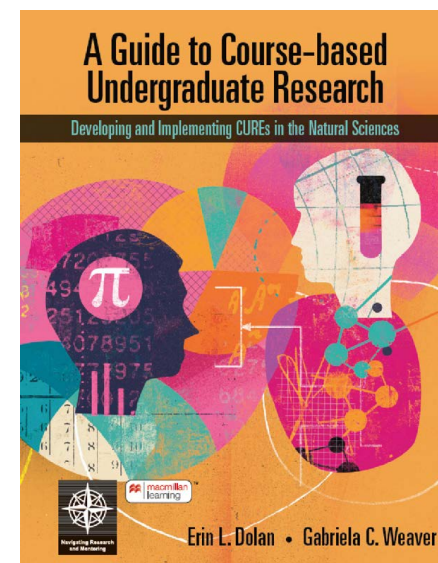


Former Department Head Checks In

Louis Quin: Since retirement in 1996, I have held appointments as a Distinguished Visiting Professor (1997) at University of North Carolina-Wilmington, and then as Adjunct Professor until 2020. I also served as James B. Duke Professor Emeritus at Duke University. I wrote four books during this time, the last in 2014. For six years I taught the most watered-down version possible of Organic Chemistry at the Osher Lifelong Learning Institute for senior citizens at Duke University. I was named the North Carolina Distinguished Lecturer by the North Carolina section of ACS in 1999. I was selected as a Fellow by national ACS in 2013. In 2019, I was honored as a Distinguished Alumnus by my undergraduate college, The Citadel, The Military College of South Carolina, where I was a cadet during WW2.)

Gabriela Weaver Co-authors New Book

Prof. Gabriela Weaver has published a new book entitled: "A Guide to Course-based Undergraduate Research: Developing and Implementing CUREs in the Natural Sciences." The book's co-author is Erin Dolan, Professor of Biochemistry & Molecular Biology and a Georgia Athletic Association Professor of Innovative Science Education at the University of Georgia (<http://research.franklin.uga.edu/erindolan/>).



Amazon description:

Course-based Undergraduate Research Experiences (CUREs) are being championed by high profile organizations (American Association for the Advancement of Science, 2011; Olson & Riordan, 2012) for their potential to engage undergraduates in research at scale. CUREs are learning experiences in which whole classes of students address a research question or problem with unknown outcomes or solutions that are of interest to the scientific community. A growing body of evidence demonstrates the benefits of CUREs for student learning, development, and persistence in the natural sciences (Corwin, Graham, & Dolan, 2015; Gentile, Brenner, & Stephens, 2017; National Academies of Sciences, Engineering, and Medicine, 2015; Rodenbusch, Hernandez, Simmons, & Dolan, 2016). This guide will walk you through designing and implementing an Undergraduate Research Experience.

Thank you to everyone who sent in accomplishments and story ideas. Please email comments, achievements, and ideas for our next issue to reaction-times@chem.umass.edu.

The impetus for *The Reaction Times* newsletter was a series of discussions members of the Equity & Diversity Committee had with undergraduates, graduate students, postdocs, faculty, and staff, who indicated that they would like to learn more about others in the UMass Chemistry community.

Editorial staff: Amanda Bennett and Richard Vachet. Design and editing: Brigitte McKenna