The Reaction Times

VOLUME I MAY 2018 QUARTERLY

First Issue of The Reaction Times

Welcome to the first issue of *The Reaction Times*, celebrating the UMass Chemistry community! Congratulations, and a big thank you, to Amanda Bennett, who suggested the name and wins a $20 Amazon gift certificate. The impetus for this 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 and to see their achievements recognized.

We see this newsletter as an opportunity not just to highlight the accomplishments of our community, but as a chance to get to know the individuals behind the accomplishments. We're pleased to share our inaugural issue with you, and happy to help shine a light on our department's students, staff, and faculty.

Editorial staff:
Eyasha Pandey
Christie L. C. Ellis
Mahdieh Yazdani
Amanda Bennett
Kay Fenlason
Ricardo Metz

Design and editing:
Brigette McKenna

Congratulations, 2018 Senior Chemistry Majors!

Antony Abi-Elias
Rashad Almadani
Peter Antonucci
Justin Campbell
Abigail Candee
Megan Crane
Luis Cristian
Thomas Drews
Ethan Dunleavy
Marina Franc
Spencer Keoppel
Zachary Kirsch
Julia Lenef
Haote Li
Slawomir Madro
Emily Mai
Daniel Marco
Alexandra McEnroe
James Millet
Patrick Moquin
Aidan Murphy
Katrina Nguyen
Casey O'Brien
Jennie Paik
Eyasha Pandey
Erin Phillips
Katherine Poisson
Matthew (Donnie) Rollings
Christopher Roy
Nicholas Russo
Zachary Schafer
Allyson Shea
Jem Sibbick
Jeffrey Tsai
Justin Vadenais
Andras Watzker
Cooper Wharton

Fall 2018
Danzhu Liang
Marzbed Margossian
Tudor Muntean
Julie Novelli
Alexander Santoro
David Turnbull
Andreos Valle

2018 Undergraduate Award Winners

Academic Awards

CRC Freshman Chemistry Awards
- Justin Baker
- Tiernan Kennedy
- Casey Phillips
- Jeremy Quercia

Robert Maxwell Williams Memorial Scholarships
- Gabrielle Farulla-Bastian
- Maura Haley
- Yiwen Xie

American Chemical Society Analytical Chemistry Award
- Thomas Kumlin

Royal Society of Chemistry Certificate of Excellence Award
- Tiernan Kennedy

Edward Shapiro Scholarships
- Lucas Ghilardi
- Cameron Kaminsky
- Jennie Paik
- Alexandra Sahagian
- Yuying Zhang

Jay A. Pirog Scholarship
- Lynh Le

John A. Chandler Memorial Scholarship
- Sara Chedid

George R. Richason, Jr. Memorial Scholarship
- Mark Anthony Leon-Duque

Thomas R. "Casey" Stengle Scholarship
- Sarah Brown

American Chemical Society Hach Scholarships
- Gisele Andree
- Kareem Mohamed-Aly

Research Awards

Oliver Zajicek Memorial Scholarship Award
- Gisele Andree

American Chemical Society Inorganic Chemistry Award
- Christopher Roy

American Chemical Society Organic Chemistry Award
- Julia Lenef

American Chemical Society Physical Chemistry Award
- Gisele Andree

Mr. Tompkins Award
- Matthew (Donnie) Rollings

Undergraduate Research Award
- Matthew (Donnie) Rollings

Bradspies Research Fellowship
- Mark Anthony Leon-Duque

Professor Jack Ragle Research Fellowship
- Gisele Andree

Tarselli Family Research Award
- Isabella Jaen Maisonet

Departmental Awards

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

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

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

Positron Award
- Katrina Nguyen

American Chemical Society Membership Awards
- Zachary Kirsch
- Jem Sibbick

Connecticut Valley Section of the American Chemical Society Student Award
- Julia Lenef

American Institute of Chemists Award
- Katherine Poisson

Departmental Recognition Awards
- Katrina Nguyen
- Casey O'Brien

Richard W. Fessenden Awards
- Marzbed Margossian
- Casey O'Brien

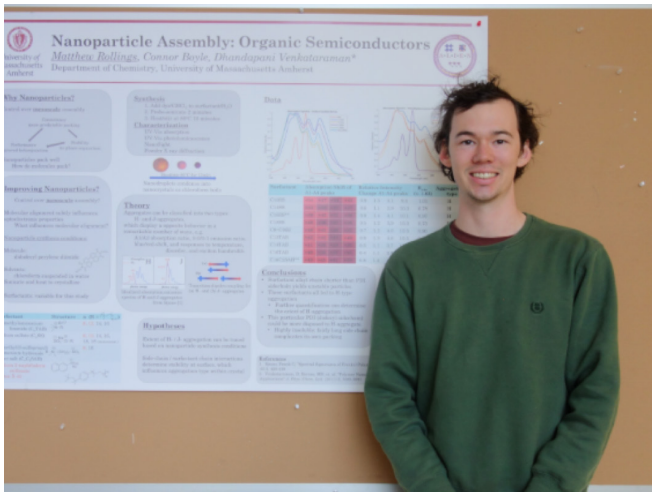
Senior Class Award
- Matthew (Donnie) Rollings

See all the pictures from the Senior & Awards Dinner https://www.umass.edu/chemistry/undergraduate-students/senior-awards-dinner

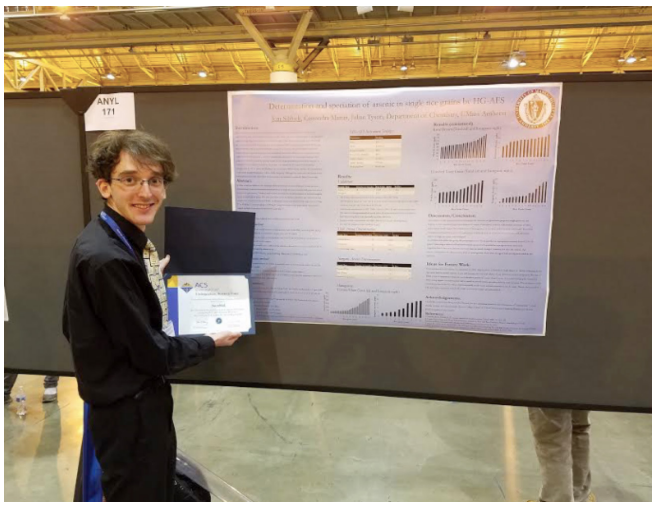
Undergraduate Research

Nanoparticle Assembly: Organic Semiconductors

by Matthew (Donnie) Rollings



My research in the Venkataraman (DV) lab focuses on improving organic electronic materials. I use didodecyl perylene diimide (PDI), a semiconductor molecule that can be used in electronic devices like solar cells and thermoelectrics. These devices often demonstrate improved performance and consistency when made using nanoparticles instead of from bulk solution. I make PDI into nanoparticles and try to change their structure by varying the surfactant, a crucial component of nanoparticle synthesis. We think that the interaction between the side chains of the surfactant and PDI directs aggregation as the droplets crystallize. I measure the UV-Vis absorption and photoluminescence spectra of the nanoparticles and classify the results using a theory of aggregation developed by Prof. Frank Spano at Temple University. The type of aggregation influences the optoelectronic properties of the material; determining the surfactant effect on aggregation could therefore make available a new 'knob' to turn to achieve just the right device characteristics, starting at the material level. All nanoparticles were found to have significantly altered spectral features from the isolated PDI dissolved in chloroform. Nanoparticles made from differing surfactants did demonstrate unique spectral profiles, although the differences were more subtle and a relationship has not yet been determined. To aid in this process, the PDI side chain will be varied to provide a second axis of comparison.



Determination and Speciation of Arsenic in Single Rice Grains

by Jem Sibbick

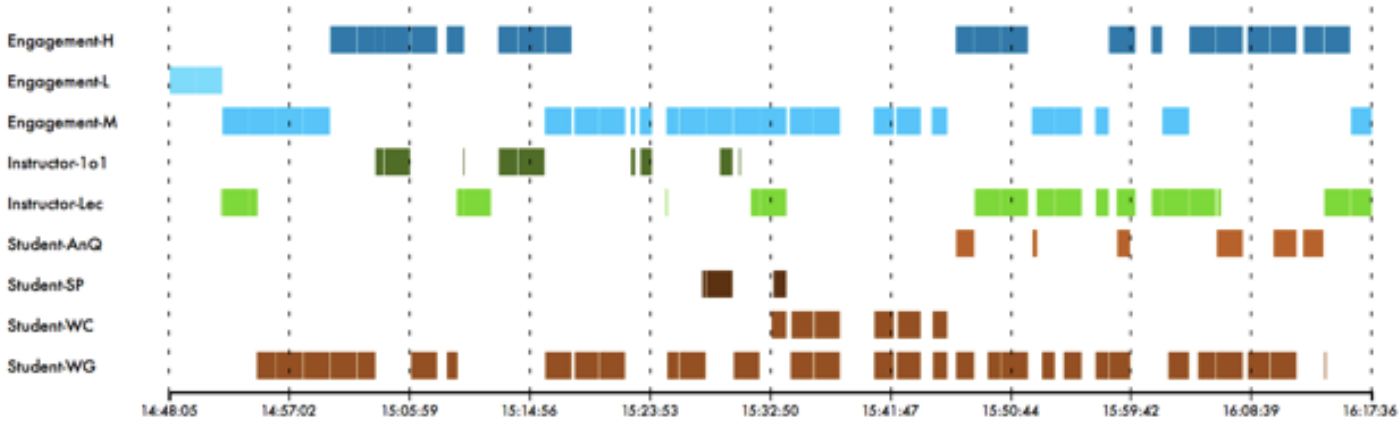
In many parts of the world, the issue of environmental arsenic contamination has been a cause of concern for scientists for some time. The presence of arsenic in water supplies and foodstuffs such as rice has the potential to increase rates of cancer and heart diseases for large populations. Due to its particular biochemistry, the rice plant is adept at absorbing arsenic from the soil. Rice is one of the most commonly consumed foods on earth; as such, many methods have been developed in the analytical community to perform arsenic determination and speciation analysis in rice. Most groups will do this by taking a large sample of rice consisting of many grains and grinding the sample into powder. It is typically assumed that the rice grains are homogeneous—that all rice grains have a similar concentration of arsenic. Working with Professor Julian Tyson, I tested this assumption by developing a validated method of arsenic determination and speciation in single rice grains using hydride-generation atomic fluorescence spectrometry. My research indicates that the assumption of homogeneity is not as valid as previously assumed, with total and inorganic arsenic levels demonstrating wide variation between single grains, from a factor-of-two up to a factor-of-five difference.

Undergraduate Research

Evaluation of Flipped Format Method in General Chemistry Courses

by Eyasha Pandey

Believe it or not, not all chemistry research is done in a lab! This semester, I am working with Professor Gabriela Weaver to determine the effectiveness of a flipped-classroom vs. a traditional lecture-based format. A flipped-classroom format consists of students watching the lecture on their own time and meeting with the professor once or twice a week for a 90-minute problem solving session. In these sessions, students are broken up into groups and presented with problems that utilize the material that was taught in the online lectures. There is a five minute quiz to ensure students watched the lecture, followed by a short recap of the main concepts. Then, the groups are left to work together, with teaching assistants and the professor walking around to answer any questions. At the end of the session, the problem set is reviewed by groups presenting their solutions to the whole group. This format has been implemented at Purdue University where Professor Weaver used to teach. I have been analyzing the recordings of these sessions and determining the optimal way to run them. Many factors are considered, like how time is broken up, whether the whole group is engaged, and what kinds of problems to present. The flipped-classroom format for general chemistry courses has proven to be more effective than lecture-based and in the coming years we hope to implement flipped classrooms in more chemistry courses.



A common chart used to display the activity of students as a session goes on. On the y-axis there are multiple categories while the x-axis shows time. This is made using the Generalized Observation and Reflection Platform from the University of California Davis.

John Maher Wins CNS Outstanding Staff Award

John Maher is a Systems and Networking Administrator with the joint Chemistry and Biochemistry and Molecular Biology IT group who has worked behind the scenes to set up the fundamental infrastructure that shapes how we do things technologically, and to make sure that it all works smoothly. He was instrumental in setting up the shared Chemistry and BMB network which is used by "everybody"—staff, faculty, research labs, and students—for sharing files and printers, archiving data, etc. He also set up the LDAP directory system used to access the departmental wireless, file servers, Wordpress sites, meeting room booking, and a million other useful things. The CNS Outstanding Staff Award is given to 1-3 people each year and recognizes the crucial role played by staff members in facilitating the success of the College of Natural Sciences. Congratulations to John!

Graduate Student Awards

Ryan Landis Wins $20,000 in Innovation Challenge Finals

Ryan Landis, a graduate student in the Rotello group, was awarded $20,000 in seed money for the company he founded, Phytos Therapeutics, in the finals of the Innovation Challenge, a campus-wide entrepreneurial competition. Ryan's research seeks to eliminate drug-resistant bacterial and fungal infections in the biomedical and agricultural sectors using polymeric nanoassemblies. These assemblies consist of synthetic or natural polymers engineered to stabilize plant oil extracts (phytochemicals) in water, dramatically enhancing their anti-microbial properties and commercial potential. Packaging phytochemicals within the nanoassemblies improves their solubility in biological conditions and enables their ability to penetrate infectious biofilms. Encouragingly, these nanoassemblies kill drug-resistant pathogens without any observed accumulated resistance over time. Initially, Phytos is developing these nanoassemblies into a 2-in-1 fungicide/insecticide spray for agriculture crops. The seed money will allow Phytos to rent space in IALS co-laboratories facilities where they can continue R&D in collaboration with the Stockbridge School of Agriculture. Congratulations to Ryan!

A word from Ryan after the competition:
"This entire process has been humbling and I have been truly enlightened from the experience. I am very grateful to many graduate, professor, and staff members in the UMass Amherst Chemistry Department, the Berthiaume Center for Entrepreneurship, the Isenberg School of Management, the UMass Institute for Applied Life Sciences, and the Stockbridge School of Agriculture, UMass Amherst. Without their advice, insight, and connections, I would not be where I am today. I cannot begin to describe my appreciation for their support, thank you.

The war on infectious disease is very real and Phytos Therapeutics will remain your soldiers on the front lines until the threat is addressed."

Christie Ellis Wins CNS Excellence in Diversity and Inclusion Award

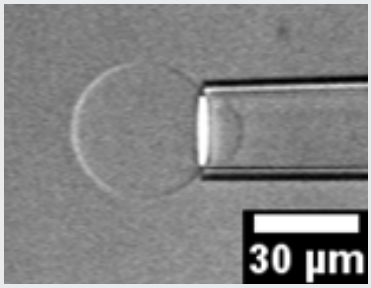
Christie L.C. Ellis, a graduate student in the Venkataraman (DV) group, has been awarded the inaugural College of Natural Sciences Excellence in Diversity and Inclusion Award for 2018. This newly created award seeks to "recognize and honor excellence and achievement in promoting a climate of diversity and inclusion within the college." Christie has done extensive work with Graduate Women in STEM (GWIS), notably as Editor-in-Chief of *GWIS Quarterly Magazine* (GQM) and as a chair of the #SafeAtWork campaign. Launched in August 2017 with a special edition of GQM entitled, "Broken Silence: Student Accounts of Sexual Violence in STEM," the #SafeAtWork campaign aims to address sexual harassment and violence in STEM graduate programs. As a leader of this campaign, Christie has increased campus engagement with this issue by hosting a town hall where community members could speak directly with university administrators and by creating and running workshops for students and faculty such as "Peer Defense," "Know Your Rights," "Male Allyship," and "What to Do When Graduate Students Say #MeToo." She also served on the Chancellor's Task Force on Sexual Violence in STEM, which recently concluded with a comprehensive report to Chancellor Subbaswamy detailing recommendations to improve culture, increase effectiveness of training, clarify and simplify the reporting process, and prevent retaliation. In addition to her work with GWIS, she also serves on the Title IX Education Subcommittee, the Chemistry Equity and Diversity Committee, and has worked with the Girls, Inc Eureka! program. Congrats to Christie for this award!

Graduate Research

Softbites—A Softer Side of Science

by Arash Manafirad

At the New England Complex Fluids conference back in April 2017, I met Arthur Michaut, a PhD student at Harvard Medical School. Together with a couple of other graduate students and postdocs, we initiated a project about soft matter. We called it "Softbites"—A Softer Side of Science. Soft matter is an interdisciplinary field that studies the chemistry and physics of various kinds of materials that are neither liquid nor solid. Now Softbites, with its swiftly-growing, enthusiastic group of writers, aims to bring digestive summaries of soft matter articles to their younger and public audiences. It's been a tremendous experience for me to be part of this project. Writing and interacting with people has broadened my perspectives about scientific communications and collaborations. Ironically, I realized that if one could explain a scientific subject at the freshman level that means they really understand the subject. That was my biggest challenge. Now, if you have a soft spot for the science of bubbles, liquid crystals and other squishy materials, then I highly recommend and also invite you to share your passion with us in the Softbites project.
https://softbites.org/



A light-responsive giant unilamellar vesicle

I'm interested in membrane biophysics, and in the image above I'm holding a light-responsive giant unilamellar vesicle (lipid bilayer) under constant membrane tension. Then by UV-irradiating it, I measure the water permeation coefficient across the membrane. The extent to which the tongue moves in or out relates to water permeability. The technique that I'm using is called micropipette aspiration.

Developing Molecules that Adapt and Respond to Their Environment

by Emil Samson

My name is Emil Samson and I have had the honor of receiving the National Science Foundation Graduate Research Fellowship (NSF GRFP). I previously conducted research on stimuli-responsive bulk polymeric materials in the Guan lab at UC Irvine, and am currently a first-year chemistry graduate student working in Professor Thayumanavan's lab.

My current research project aims to develop molecular design guidelines towards autonomous systems that can mimic complex systems in nature. Ever wonder how white blood cells know when, where, and how to move when you're sick? Well, the chemistry behind it all boils down to the binding affinities between the surface ligands on the cell and the sugar molecules it binds to within the blood capillaries. Using their autonomous response as motivation, I am designing an amphiphilic expansile nanogel (eNG) in hopes of understanding this phenomenon. My eNG will have similar ligand mimics, and also a light-triggerable molecule that allows the eNG to switch from being water-loving to water-hating. This switch will cause the eNG to swell when it loves water, and shrink when it hates water.

Two interesting questions arise from developing this bio-inspired system: (1) What can we deduce about the binding affinities of the eNG when we vary physical characteristics such as size? (2) Can we use this knowledge to develop artificial and adaptive systems that can mimic white blood cells? I will address these questions by investigating how the size of the eNG and its surface attachments affect its movements along a sugar-receptor gradient. By understanding the fundamentals that govern this adaptability and responsiveness accomplished in nature, we will be one step closer to developing next-generation autonomous systems (i.e., artificial immune systems).

My Journey to Grad School
by Christie L. C. Ellis

My path to graduate school was far from straightforward. I attended a "classical" high school that focused on literature and the arts, and surprised most of my teachers when instead of pursuing the English degree they thought I was best suited for, I decided to attend Carnegie Mellon University for Chemistry—a move motivated partially by a budding curiosity for science and research and partially by the perception that a STEM degree would give me a more stable career.

As an undergrad, I was a research nomad—I worked in five different labs studying everything from bacteriophage genomics to solid-state protein NMR to synthetically modified RNA to catalyst development to electron-transporting polymer synthesis. I found that it didn't matter so much what problem I was working on—I thrived on the problem solving. While I enjoyed academic research, I planned to go into industry, so I found internships at Dow AgroSciences and Vertex Pharmaceuticals. There—in addition to doing some cool applied research—I found that most people doing the type of science I wanted to do had their PhDs. So, since I liked research and felt it was the best career move—plus finding out that STEM graduate students are paid a stipend and can defer their student loans—I decided to apply to PhD programs.

I was intent on joining the PhD program at Boston College until I came to my very last graduate school interview—at UMass Amherst. The research here was not what I planned to pursue, but I knew that my interdisciplinary skills would allow me to adapt to a new field. What ultimately led me to choose this program was the culture. I knew that I would need a supportive mentor and lab group and a collaborative and engaged community to do my best work—so I chose the community that I saw here over my preconceived ideas of what I thought I wanted to study, and I have never regretted it. In fact, I'm not even doing the same work now as when I started my work in Professor DV's lab—I've gone from making organic polymer nanoparticles to doing electrochemical spectroscopy on inorganic materials! My career plans have changed, as well—I found a way to merge my old love of writing with my new passion for science by pursuing a career as a public science communicator.

So, if I could give a few pieces of advice to folks considering graduate school, they would be to keep an open mind and not limit yourself by arbitrary lines of discipline, make sure you build and maintain a support network, and find creative ways to leverage the unique skills you learn on the way to getting your PhD.

Staff Snapshots

Tania Wellen
by Eyasha Pandey

Many of you have probably seen Tania Wellen running around weekly seminars, ensuring everything goes smoothly. Tania is the Alumni and Seminar Coordinator of the Chemistry Department.

Tania is originally from the mid-Atlantic coast and attended the University of Maryland at College Park majoring in American Studies. "American Studies is a historical review of American culture and traditions," she explained. "It set me up for a communications-based role." Tania worked on logistics for non-profits before starting as coordinator here in October 2017. As seminar coordinator, Tania said her daily schedule "consists of several part-time jobs." Although the professors formally invite guests, Tania coordinates all the logistics for the speaker, including travel plans and hotels. She is also who you want to thank for all the amazing refreshments!

"Come to seminar!" Tania said when I asked her if there was anything she wanted to emphasize. Seminars are generally on Thursdays at 11:30am in LGRT 1634. Though geared more towards graduate students, undergraduates are heavily encouraged to attend and learn. Plus, there is always plenty of food! "There is lots of overlap with biology, biochemistry, and physics; it is not just chemistry," she described. There are about thirteen speakers per semester and it really is an excellent opportunity to gain an understanding of what the finest minds in academia do. Additionally, if there is a scientist or professor you want to invite to UMass, you can email Tania at twellen@chem.umass.edu to find out how to invite them. The seminars are planned almost a year in advance so make sure to plan ahead!

Staff Snapshots

A Day in the Life of a Lab Technician

by Amanda Bennett

It's 7am and I'm opening the orgo lab. I grab late lab reports from the submission dropbox, chug my coffee down, and enter the lab. The lab, a stretch of five modules with an adjoining prep room, has pockets that smell faintly of bananas—remnants of our esters lab. I start my opening routine—tidying up balances and benches, refilling reagents, shutting off forgotten thermometers. I take a background on one of our IRs for an ester makeup, grab buckets of ice for each section, then pull numbered unknown vials—students will be identifying an alcohol, aldehyde, or ketone for lab this week—from our boxes and boxes of pre-prepped unknowns. I bundle corresponding NMR data with rosters for the morning's lab along with unknown sets, and put it all out for our TAs, who have started to trickle in. I'm thankful for the company; it feels odd when the lab is quiet. It's rarely quiet: with the exception of Monday morning, lab is always in session, both mornings and afternoons, and we've added evening hours on weeknights this semester so students can take melting points. There's a large volume of students who are cycling through the labs this spring—500 students in Chem 269 (organic lab for non majors), plus lab for majors on Thursday afternoons and inorganic lab on Tuesdays—and a lot of moving pieces. Not long after I let our somewhat sleepy-eyed orgo students into the lab, I'm also on the move.

I work as a roving lab technician, supplementing Traci, our tech in the organic teaching labs, and Aidan, our full-time tech in gen chem. I also maintain ISB 118, a small lab tucked away from our other labs in the building, where faculty can prep demonstrations for lecture or grab one of our pre-assembled demo boxes. On this particular day, I'm on my first leap from orgo to gen chem; I'll later jump back to orgo and then gen chem again to close out my day. By the time I arrive in gen chem, the morning labs are already wrapping up. The space consists of two runs of labs running parallel, with prep space and storage in-between. I love the gen chem prep lab because so much is oversized—it's like the Costco of labs. The first time I went looking for a weigh boat I was shown a collection of recycled hollowed-out containers. Our stash of spatulas are mostly the size of spoons; we work with 20L carboys when prepping; when we have to pour from our giant graduated cylinders it feels like a workout. As room after room of Chem 111 students finish up, Aidan and I move through each of the labs, refilling reagents, cleaning, and pulling out pH meters and stir plates for the afternoon 112 lab. Though I feel like I'm always on the move and that *something* is always cropping up, there's also a soothing sense of repetition to the work. There are mundane tasks I enjoy: in gen chem, it's "fishing," which is what we call retrieving stir bars that have been poured down the lab drains, and in orgo, it's cutting box upon box of TLC plates. I've grown to appreciate the one sink tap in gen chem that when used sounds like a dinosaur, the assorted colors and shapes of the stains on the laboratory floors, and the joy of knowing exactly how much NaOH is needed to make 20L of .02M solution without having to do the math from making (and titrating!) carboy after carboy.

When I make my way back up to orgo, it's also transition time. Our excellent team of student workers have already started cleaning the lab, equipped with acetone and water as well as dustpans to sweep up the wayward sand that skitters from the sand baths into the nooks and crannies of every hood. Traci is working on pushing back the 269 materials and setting up the 342 prep. I check the usual suspects of items we tend to run low on—clean 5mL round bottoms, workable clamps, "baby" filter paper, and acetone, which we pump by the drum. Working here has made me so appreciative of how much planning, preparation, time, effort, and expense it takes to smoothly run a large volume laboratory. Later, when I'm back in gen chem, and working on titrating yet another carboy of NaOH, I'll reflect on how in spite of any hiccups (not being able to have coffee with me at all times, having hands that often smell a little bit like gloves, constant fear that we are going to run out of something mid lab), it's truly a pleasure to be a part of the mechanism by which so many students are doing and learning science.

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.