

chemistrydistillations

2023 Newsletter of the Department of Chemistry at William & Mary

In this issue:

Professor Bev Sher Teaches 100th Section of Emerging Diseases Class

Focus on Instrumentation: X-Ray Diffractometer

Research Highlights



WILLIAM
& MARY

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DEPARTMENT OF CHEMISTRY

CHEMISTRY DISTILLATIONS

2023 Annual Report

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FACULTY

Chris Abelt, *Chancellor Professor*

Debbie Bebout, *Professor; Associate Chair; Director of Biochemistry Program*

John Bedford, *Assistant Teaching Professor; Director of General Chemistry Laboratories*

Randy Coleman, *Professor*

Elizabeth Harbron, *Floyd D. Gottwald Senior Professor; Director of the Charles Center*

Rob Hinkle, *Professor; Vice-Dean of Natural, Physical, and Computational Sciences & Interdisciplinary Studies*

Nathan Kidwell, *Associate Professor*

Lisa Landino, *Professor*

Dana Lashley, *Associate Teaching Professor*

Bill McNamara, *Wilson & Martha Claiborne Stephens Associate Professor, Director of Graduate Studies*

Tyler Meldrum, *Associate Professor; Director of Undergraduate Research*

Jeff Molloy, *Instructor, Director of Laboratories & Instrumentation*

Kate Perrault (Uptmor), *Assistant Professor*

Bob Pike, *Professor; Department Chair*

J.C. Poutsma, *Professor*

Jonathan Scheerer, *Garrett-Robb-Guy Professor*

Bev Sher, *Teaching Professor; Health Professions Advisor*

Isaiah Speight, *Assistant Professor*

Izzy Taylor, *Assistant Professor*

Dave Thompson, *Adjunct Professor; Chancellor Professor Emeritus*

Jordan Walk, *Associate Teaching Professor*

Kristin Wustholz, *Professor*

Doug Young, *Cornelia Brackenridge Talbot Term Distinguished Associate Professor; Health Professions Advisor*



Tribe Chemistry Faculty (L-R top-bottom): Speight, Abelt, Pike, Harbron, Bedford, Kidwell, Wustholz, Poutsma, Sher, Scheerer, Taylor, Perrault, Bebout, Meldrum, Landino. Not pictured: Coleman, Hinkle, Lashley, McNamara, Molloy, Thompson, Walk, Young

EMERITUS FACULTY

Gary DeFotis, *Garrett-Robb-Guy Professor Emeritus*

Richard Kiefer, *Professor Emeritus*

Stephen Knudson, *Professor Emeritus*

David Kranbuehl, *Professor Emeritus*

Gary Rice, *Professor Emeritus*

Bill Starnes, *Floyd D. Gottwald Senior Professor Emeritus*

STAFF

Dawn Alleman, *Administrative Coordinator*

Rochelle Coker, *Administrative Coordinator*

Nicole Freeland, *Administrative & Fiscal Supervisor*

Janet Hopkins, *Senior Laboratory Specialist*

Jeff Molloy, *Instructor, Director of Laboratories & Instrumentation*

Der-Hong Shieh, *Senior Laboratory Specialist*

Letter from the Chair

Welcome to our annual newsletter for the 2023-2024 academic year. It's one of the real pleasures of being chair to have the chance to write to our faithful alumni and friends to tell you what's been going on in the W&M Department of Chemistry during the last academic year. And a lot has been happening during the year since I last wrote to you. It all revolves around the people that make our department great: faculty, staff, students, and of course our alumni and friends. So let's get right to it!



Bob Pike, Department Chair

Faculty & Staff - Welcomes & Well-Wishes:

This year was another busy one for hiring of faculty and staff. As I've come to find out, among the most important duties of the department chair is to make sure that we hire the finest people available, enabling us to best serve our students, alumni, W&M, the community, and the larger chemistry network. During the last year, we hired two faculty members and two staff members, and said goodbye to one beloved staff member. Let's start with our new faculty members.

Isaiah Speight joined us this fall as Assistant Professor in Chemistry, teaching in our organic courses. Isaiah earned his B.S. in Chemistry from Norfolk State University, and his Ph.D. in Chemistry from Vanderbilt University. Prior to joining the faculty at William & Mary, he did a postdoctoral stint at University of California, Irvine and spent time as a Visiting Scientist at AbbVie. His research interests include organic synthesis and catalysis using mechanochemistry, sustainable chemistry, and 3D printing for new technologies. Welcome Isaiah!

Katelynn (Kate) Perrault (Uptmor) joined us this fall as Assistant Professor in Chemistry, teaching in our analytical and general chemistry sequences. Kate holds a Ph.D. in Forensic Analytical Chemistry from the University of Technology, Sydney, and performed postdoctoral research at the University

of Liège in Belgium. She previously taught and did research in Forensic Chemistry at Chaminade University of Honolulu before coming to William & Mary. Her research focuses on the chemical analysis of odors using multidimensional chromatography in forensic science, biomedical sensing, natural product analysis and other life science applications. Welcome Kate!

Claudia Smith retired at the end of calendar year 2022. Claudia joined us in 2011, coming over from Psychological Sciences. She served our department for 8 years as Administrative Coordinator, effectively scheduling courses, keeping department records, doing publicity, and helping department visitors. In 2019 during the pandemic, our previous Fiscal & Materials Manager, Susan Mulholland, moved to another campus office, and Bev Laws, Graduate Program Administrator, retired from her part-time position in Chemistry. Claudia took over the responsibilities of both these positions, while still carrying her duties as Administrative Coordinator in Chemistry. By the time she was hired as our new Fiscal & Materials Manager, a COVID-related hiring freeze prevented us from hiring a replacement Administrative Coordinator until early 2021. Thus, Claudia was the only administrative staff person in the department for an entire year, managing all three jobs beautifully. It was a happy day for her when Administrative

Coordinator Dawn Alleman was hired. We will miss Claudia's administrative and accounting skills, along with her kindness and patience. In retirement, Claudia is volunteering as a bike "mechanic" for a Williamsburg non-profit, visiting her family in the USA and Europe and helping her husband Greg get their sail boat in top condition. Enjoy your retirement, Claudia!

Nicole Freeland joined us in late February as the department's Administrative & Fiscal Supervisor, Claudia's position prior to retiring. Nicole previously worked in the Williamsburg/James City County School System as an Assistant Manager for Information Technology. Part of her former job was getting computers and tablets into the hands of students forced to be remote learners during COVID. Nicole also has long experience as a local 911 dispatcher, so is naturally calm in a crisis. We are thrilled to have her tending the books. She did a great job during her first months, during the student hiring marathon that leads up to summer research. Welcome Nicole!

Rochelle Coker joined us in July as a second Administrative Coordinator, moving up from the Applied Science Department, literally as her office used to be on the ground floor of the ISC! Rochelle has higher ed experience in graduate program administration,

record-keeping, and publicity – just the skills we need. We rearranged the departmental office so that both Dawn and Rochelle are on the front lines to welcome students and other visitors and answer their many questions. Welcome Rochelle!

A special note of thanks goes to our own alumna **Willough Sloan** ('23). Before Claudia retired in December 2022, she foresaw that Dawn would need some help in the spring semester, especially until we could hire and on-board our new fiscal staffer (Nicole Freeland was hired in February). We secured approval from the Arts & Sciences (A&S) Dean to hire Willough, who had just completed her Chemistry B.S. in December, as a temporary Administrative & Lab Assistant. Willough worked both in the main office with record-keeping and publicity, and also as a fill-in teaching assistant in our Orgo I Labs. With her diverse skill set and her ever-present smile, Willough was a great help to us at a time when we needed it. She hopes to be admitted to graduate school in the near future. We wish you good luck, Willough!



*Tribe Chemistry Staff (L-R top-bottom):
Nicole Freeland, Rochelle Coker,
Janet Hopkins, Der-Hong Shieh,
Dawn Alleman, Jeff Molloy*

My last word of thanks goes to our fine administrative and laboratory staff: **Dawn Alleman, Rochelle Coker, Nicole Freeland, Janet Hopkins, Jeff Molloy, and Der-Hong Shieh.** They keep our operation running smoothly and at full capacity.

Faculty Activities:

Here's a preview of a forthcoming farewell; **Randy Coleman** will be retiring at the end of the spring 2024 semester after 54 years of teaching, research, and mentorship at W&M. Of course, it's hard to overstate what a big change this is for us. Randy represents the best of what we have to offer. Our students, faculty, and staff will miss him sorely. I will miss him in another way since Randy has willingly taught at 8 am every day of the week with a class overload for as long as anyone can remember. He made my job of course scheduling a lot easier every semester. See page 20 for an invitation to Randy's final lecture on campus. It is open to the public and Randy's many dedicated alumni, family, and friends.

We congratulate **Kristin Wustholz** on her promotion to full professor at W&M. Kristin is a highly productive scholar, working in the field of single-molecule and surface-enhanced spectroscopy. Her lab elucidates the fluorescence and Surface-Enhanced Raman Scattering (SERS) properties of organic chromophores at interfaces and harnesses this information for applications in solar energy conversion, art conservation, as well as chemical sensing and imaging. In addition, Kristin is an award-winning and beloved teacher in physical chemistry and COLL courses. As evidence of her stature as a teacher, Kristin was recently awarded a Phi Beta Kappa Award for Excellence in Teaching. She is on a well-earned sabbatical in academic year (AY) '23-'24.

We applaud **Nathan Kidwell** on his promotion to associate professor. In his 6.5 years at W&M, Nathan has proved himself a superior scholar. His research program focuses on problems at the interface between chemical dynamics and molecular spectroscopy. He is interested in revealing a mechanistic understanding of the outcomes from energy absorption and flow for chemical

systems relevant to the atmosphere and energy for predictive modeling. Nathan has successfully taught physical chemistry and COLL courses. He is also the recipient of a Coco Faculty Fellowship at W&M for the 2023-2024 year. He too is enjoying a well-earned sabbatical in AY '23-'24

Bev Sher's 100th-section of her popular COLL-curriculum course "Emerging Diseases" is highlighted on page 6. This article was written by the A&S Dean's office outreach team. Bev's dedication to students and their futures is well known. She is a very busy pre-health sciences advisor, only recently sharing pre-health advisory duties with Doug Young and Shantá Hinton (Biology). Bev was solo in this role for many years, and has written many thousands of medical and graduate school recommendation letters. Thanks Bev & good luck Doug!

We salute **Doug Young** on being named a Plumeri Award winner for 2023. An update on our PRIME peer-mentoring program, is on the back cover. It expanded from Organic Chemistry I into General Chemistry I. Great thanks to Doug for conceiving and bringing the program into being.

Learn about our new X-ray Diffractometer, replacing the 18-year-old instrument which had been in steady use all those years. On page 10 you will find QR codes allowing you to view the instrument in action and the sort of cool chemical information that X-ray can provide. We are grateful to W&M for this purchase.

Alumni **Spencer Pugh '82** & his wife, **Bev Pugh '81** invite you to learn about their passion for undergraduate (UG) research and to support their endowment for chemistry summer undergraduate research. See page 12.

We're boasting about an exciting event called SCI-FRI. This outreach was spear-headed by **Tyler Meldrum**

with blessings and financial support from A&S Dean Suzanne Raitt. Doors of the ISC were opened for the local community to get a glimpse of what's going on inside. Dean Raitt was so impressed she mentioned it in her weekly email, "I was at SCI-FRI, a science open house for the W&M and Williamsburg communities. Kudos to Tyler Meldrum and many others for their work on this event, which was an amazing success in spite of the looming presence of [tropical storm] Ophelia. Little kids (and taller versions of little kids) were squashing strawberries, touching slimy things in tanks, stroking plants to make their leaves curl up, and watching liquids change from amber to blue to clear just by being oscillated." See event pictures on page 8.

I want to highlight 3 major faculty grants. New chemistry faculty **Isaiah Speight** is part of a successful \$2.0M National Science Foundation (NSF) grant to Texas A&M University's NSF Center for the Mechanical Control of Chemistry (CMCC). Isaiah, who received news of the center's funding days before officially joining our faculty, is the only CMCC Primary Investigator (PI) working at a non-PhD granting institution. The grant will support research on how the mechanical application of force can enable new advances in chemistry, with the potential to make industrial processes cheaper and more environmentally friendly.

Read more about the CMCC grant:

<https://new.nsf.gov/news/crushing-chemical-innovations-heart-newly-expanded>



Nathan Kidwell was awarded a prestigious NSF CAREER grant, "Quantum-State Control on Multidimensional Potential Energy Surfaces". His students will use advanced molecular spectroscopy and dynamics methods to study the bimolecular reaction pathways of

hydroxyl radicals (OH) with several classes of hydrocarbons. The goal is to characterize how the orientation and nuclear motions of the colliding molecules impact which pathway is followed. They seek to understand the fundamental interactions and outcomes from bimolecular collisions of OH radicals with complex hydrocarbons. In addition to training students in modern laser technology and analysis, Kidwell Lab students will engage UG and high school students in vertical profiling of the atmosphere using drone-enabled Raspberry Pi atmospheric sensors.



Kidwell Lab builds and deploys drones for atmospheric and water sample collection.

Jonathan Scheerer was awarded a National Institutes of Health (NIH) grant "New Methods to Prepare 1,4-Oxazin-2-ones and Applications in the Construction of Polysubstituted Pyridines" to address new ways to make pyridine ring systems. Pyridines are the second most prevalent structure imbedded within clinically-approved therapeutic molecules. Thus, new methods for the construction of pyridine motifs (especially those not easily made through other methods) is important to the biomedical sciences. Jonathan and his students will study synthetic applications directed at potentially biologically relevant structures.

Rob Hinkle and Doug Young are co-PIs on a new grant entitled "Synthesis and Biological Assessment of a Polyene Library via Glaser-Hay Reactions". Details on page 13.

Tyler Meldrum was named one of eight Henry Dreyfus Teacher-Scholars nationwide. This award honors young faculty in the chemical sciences who have created an outstanding independent body of scholarship and

are deeply committed to education with undergraduates. Each Henry Dreyfus Teacher-Scholar receives an unrestricted research grant of \$75K. Tyler's proposal, "Understanding Macroscopic Material Behavior by Measuring Microscopic Molecular Motion via Single-Sided NMR Relaxometry," seeks to connect macroscopic material behavior and microscopic molecular motion. His group will investigate strength of adhesion and NMR relaxation of materials under mechanical stress, with an eye towards improving material performance for aerospace, defense, and industrial applications. The Dreyfus award also allots funds towards developing innovative classroom experiences—Tyler is slated to develop a new COLL 100 course in a few years. Topics may include food as an avenue to learn chemistry or the science of "bad" chemicals such as poisons. Stay tuned to see what develops from this prominent award, and congrats Tyler!

Completing our updates, **Rob Hinkle**, continues as Vice-Dean of Natural, Physical, and Computational Sciences & Interdisciplinary Studies and **Elizabeth Harbron** remains as head of the Charles Center, overseeing UG research grants, honors, national fellowships, and scholars' programs. Thanks to **Chris Abelt** for serving as associate chair while **Debbie Bebout** was on sabbatical. **J.C. Poutsma** is co-chairing W&M's Faculty Affairs Committee.

I'd like to acknowledge our dedicated teaching faculty members: **Bev Sher**, **Jordan Walk**, **Dana Lashley**, and **John Bedford**. Teaching faculty are enormously important, collectively handling a large teaching load. Their service is being recognized by A&S with a better and clearer set of contracts and pathways to promotion. We appreciate what you do, and so do the 2,193 UGs in their classes in AY'22-'23!

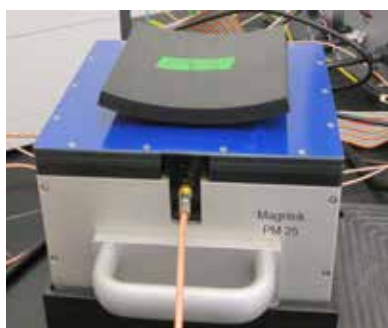
Research Highlights: Meldrum Lab



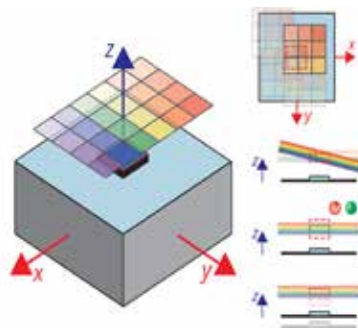
Getting an MRI often conjures a claustrophobic, loud tube in a hospital wing. Rather than the massive magnets used to probe human anatomy, Professor Tyler Meldrum's Lab uses two small, portable, single-sided magnets, a modular form of nuclear magnetic resonance spectroscopy (NMR). These devices can probe the molecular behavior of materials relevant to aerospace, industry, and art, without needing a tractor-trailer to get the instrument to the object of study.

When a sample containing hydrogen atoms is placed in a magnetic field, the hydrogen nuclei behave as though they're spinning; since they have a magnetic dipole, they produce a voltage that can be detected using a sophisticated FM radio. The signal this radio measures has a quantifiable intensity that changes depending on the material of interest. For example, water, as a liquid, has a long-lived signal owing to its molecules that can move and rotate towards and away from one another rapidly. In contrast, gels and solid polymers, with their hydrogen atoms more fixed in space, have a short-lived signal. The signal lifetime is quantified as a relaxation rate.

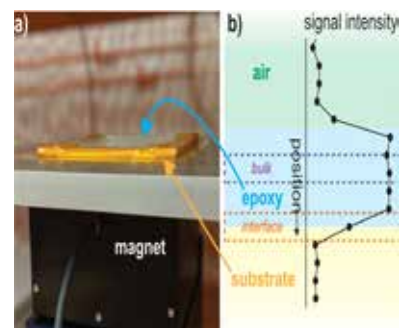
The Meldrum Lab Group has used these relaxation rates to characterize a range of materials. They have shown that adhesives that cure chemically (e.g., epoxy) have different cure kinetics in the region immediately adjacent to a surface (e.g., a "part" to be glued) than they do away from such a surface. They have investigated how organic solvents can swell coatings as they penetrate layers of paint, causing irreversible changes in the coatings themselves. They have also studied various art-related samples, including paints and paintings, elucidating molecular behaviors in curing and cured paints, with an eye towards a long-range understanding and conservation of art.



Single sided NMR instrument



Schematic of how the NMR reads samples



Profile of results from a paint sample



Prepped paint samples for analysis



WWW.MELDRUMLAB.ORG



From top L-R: Iggy Miagkov '22, Jacob Simonpietri '24, Tyler Meldrum, Sam Rubin '24, Gillian Zavaglia '22, Savannah Wood '24, Shinjer Li '24, Joyce Tate '23, Catherine Choo '23, Tyler Lee '23, Lyndi Kiple, MS '23.

Currently, the Meldrum Lab is focused on 3 main topics:

1. Develop techniques for these single-sided magnets, including methods to improve the quality of detected signals and spatial resolution of the method.
2. Continue to measure surface-adjacent samples to probe differences between chemical behavior near and far from various substrates.
3. Deploy molecular-scale computer simulations to connect the observed magnetic resonance data with our current understanding of molecular motion.

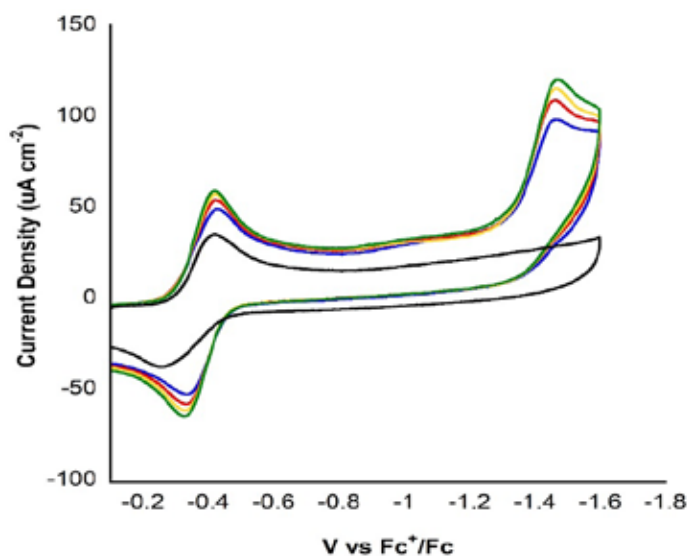
Research Highlights:

McNamara Lab

Our research focuses on developing earth-abundant transition metal catalysts for several renewable energy applications. Traditionally, we have been interested in the generation of hydrogen gas from water using solar energy. This strategy is part of “Artificial Photosynthesis” which aims to store solar energy in chemical bonds (H_2), rather than batteries. Hydrogen gas can be burned directly to give energy and clean water, or it can be combined with oxygen in a hydrogen fuel cell to generate electricity. Hydrogen is also used in many industrial processes, yet most of our hydrogen comes from refining fossil fuels. Therefore, it is important to find a renewable and efficient way to generate hydrogen gas.

For widespread applicability, we aim to utilize the most abundant transition metal, iron. Unfortunately, iron complexes can often be unstable in water and susceptible to decomposition. To this end, we have coordinated iron to a tetradentate redox active ligand containing antipyrine moieties, resembling more traditional salen ligands. The resulting iron complex is an active electrocatalyst for hydrogen generation at modest overpotentials and is stable in the presence of water.

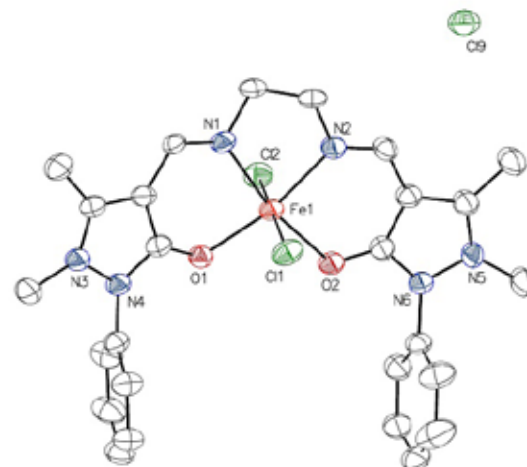
Additionally, when paired with a chromophore and sacrificial electron donor, the complex is an active photocatalyst for hydrogen generation. Furthermore, the catalyst can generate hydrogen gas from local water sources of varying salinity: VA Beach (salt water), Buckroe Beach (brackish water), and Lake Matoaka (fresh water). This work was supported by an NSF CAREER Award and was conducted by Jessica Cropley (MS '23), Amanda Mitchell (MS '24), Nicole Fritsch (BS '24), and Marissa Ho (BS '23).



Cyclic voltammograms showing catalytic activity of the Fe catalyst upon addition of acid.



The McNamara Lab victorious after solving the Colonial Escape Room in record time! From top L-R: Max Jaquint '24, Rachel Ponticello '24, Jake Swery '25, Charles Holladay '25, Shinwoo Jeon '25, Bill McNamara, Nicole Fritsch '24, Amanda Mitchell MS '24.



X-ray crystal structure of Fe catalyst containing tetradentate redox-active ligand.

Other ongoing projects in our lab include developing catalysts for the oxygen reduction reaction in hydrogen fuel cells, CO_2 reduction, and developing sensors for heavy metal detection in water.



An Interdisciplinary Problem of Global Importance

Teaching Professor Bev Sher Teaches
100th Section of “Emerging Diseases” Class

Teaching a course titled “Emerging Diseases” one hundred times may not be everyone’s idea of fun, but for Beverly Sher, Teaching Professor of Chemistry at William & Mary, it has been stimulating and inspiring. “Every time I teach it, it’s different,” she said. “What I love is when I look up at the clock and realize we should have stopped class 2 minutes ago and no one has noticed because our course discussion is going so well, students are so engaged. We talk about the sensation of flow – that’s what teaching this course is to me.”

Sher first taught the course at William & Mary in the fall of 1996. One hundred sections, nearly 1,500 students and two pandemics later, Sher’s interest in immunology and infectious disease is stronger than ever. From her students studying AIDS in the 1990s, SARS in 2003, the H1N1 pandemic in 2009, and most recently the COVID-19 pandemic, Sher has seen the global importance of this problem. “It links to other big ones – political instability, climate change. So much depends on who happens to be in power when the bad thing comes. It’s a fundamentally human problem.”

Vishakha Shah, ’25, took Sher’s course in 2021-2022. “Dr. Sher constantly asked extremely thought-provoking questions, which taught me how to critically examine information and develop a confident argument for what I believe in,” said Shah, who is pursuing a major in Kinesiology and Health Sciences on the public health track, and a minor in Biochemistry. “Every step of the way, I felt like Dr. Sher shared my passion for medicine and really cared about helping me express it. Ultimately, this class helped me understand medicine better and encouraged me to really think about what kind of physician I want to be and how I want to contribute to the field.”

Sher, a 2017 recipient of the Thomas Ashley Graves, Jr. Award for Sustained Excellence in Teaching, also taught the course for a semester at Richard Bland College as part of the Promise Scholars program. She emphasizes the

interdisciplinarity of the study of new or reemerging infectious diseases. “This course shows the value of the liberal arts curriculum. There’s something for everyone and everyone takes something different from it.”

A key lesson Sher hopes students glean from her course is learning that



In 2017 Sher was awarded the Thomas Ashley Graves, Jr. Award for Sustained Excellence in Teaching. *Photo by Stephen Salpukas*

science is a process, not a series of facts to learn. “It’s learning how to read in a critical, careful way; it’s new ways of learning and interpreting data. And it’s understanding that ambiguity is a part of it.”

Max Rackley, ’25, a neuroscience major, believes taking Emerging Diseases during freshman year set a strong foundation for future college classes. “This course not only offered a unique perspective into the world of public health but was also very relevant to life during the height of the COVID-19 pandemic. I quickly noticed similarities between the COVID-19 pandemic and previous infectious diseases discussed in Dr. Sher’s carefully selected books, journal articles, and documentaries. I learned that when it comes to preventing or mitigating an infectious disease, mistakes continue to be made as if lessons from previous outbreaks were not learned. This makes it seem like history is repeating itself. Thus, one of the most impactful takeaways I

took from Emerging Diseases was that if individuals, communities, and leaders do not collaborate, it’s not a question of if, but when we will have another global pandemic.”

Sher hopes her students have been able to use something from the course, “even if it’s just learning not to panic

when they hear crazy things on the news.”

To Sher, teaching is planting seeds. “You don’t know how many are going to germinate, in whom and when. But when you teach, you touch the future.”

For students like Rackley and Shah, there is no question that the seeds planted during Dr. Sher’s course have taken root.

“There isn’t a more dedicated and knowledgeable professor to teach Emerging Diseases than Dr. Sher,” said Rackley. “I learned many skills from this class that have carried over to other classes. The skill I value the most is translating complex, scientific jargon to a language people can understand without distorting the message. As someone who is very interested in pursuing an MD-PhD program working directly with patients, the ability to communicate confusing, potentially frightening medical terms and circumstances to patients is invaluable. I’m so grateful I learned this skill early in Emerging Diseases.”

article written by Abbie Schaefer, A&S Dean’s Office
Director of Communications & Special Projects



SCI-FRI: An open night of science for the community

On the evening of Friday, September 22, the Integrated Science Center showcased its STEM activities for the Williamsburg community. Faculty and students from all ISC disciplines: Chemistry, Biology, Psychological Sciences, Neuroscience, Applied Science, and Data Science, shared their scientific passion with the public. Highlights included research lab tours, biology greenhouse tours, a marine invertebrate touch tank, neurosensor displays, research posters, presentations by W&M undergraduates and grad students, and even a real brain that brave guests could touch! This event will become a community outreach annual tradition.



(Top) Guest and students gathering and discussing various research topics.
(Bottom) View from 2nd level in ISC



(Top) Guests exploring the touch tank.
(Bottom) Chemistry students in the lab with young guests.



Chemistry students made liquid nitrogen ice cream for guests.



Focus on Instrumentation: X-ray Diffractometer

Chemistry's new Bruker D8 Venture X-ray diffractometer replaces our original instrument which was purchased in 2005.

X-ray diffraction is arguably the most powerful technique chemists have for structure elucidation in the solid state. It is especially useful for inorganic chemists since nuclear magnetic resonance and mass spectrometry are often unsuitable for their samples.

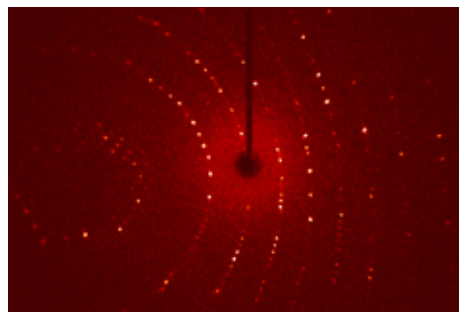
Here's the basic idea of how diffraction works: Electromagnetic radiation (light) separates (diffracts) into distinct wavelengths when it passes through a prism or reflects off of a grating, which consists of a series of closely spaced lines etched on a surface. This diffraction process is used in spectroscopy to separate visible, ultraviolet, and infrared light into specific monochromatic wavelengths.

X-ray diffraction takes advantage of this behavior using a solid crystal rather than a prism or grating. Because a crystal consists of a regularly spaced layers of atoms, ions, or molecules, it behaves much the same way as a grating, diffracting the X-ray light.

X-rays are chosen because their wavelengths are on the Angstrom scale, i.e. very close to the atomic spacings in the crystal. It is this similar size between the wavelength of the light and the spacing in the crystal that enables X-rays to diffract from the layers of atoms, ions, or molecules in the crystal. Importantly, the angle at which X-ray photons diffract is related to the spacing of the rows of atoms or ions in the crystal, according to a relation called Bragg's Law.

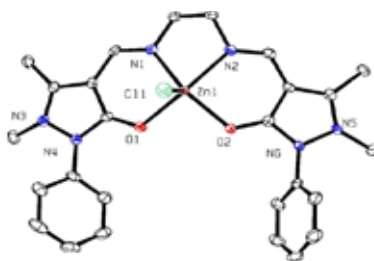
To determine the structure of a molecular or ionic compound, a tiny (few tenths of a millimeter) crystal of the compound is grown.

The sample crystal is mounted on the instrument and exposed to the X-ray beam. Many photographs, or diffraction patterns, are collected by the instrument forming a sphere around the sample. These photographs look something like stars in the night sky.



An X-ray diffraction photo; white spots show diffracted X-rays.

The complete 3-dimensional diffraction map of the crystal sample is converted mathematically into the complete atomic structure in 3D space. The generated 3D structure can be rotated and examined closely revealing the molecular architecture of the sample.



Completed X-ray structure of a square pyramidal zinc complex ion being studied in the McNamara Lab.

Chemistry's new instrument benefits users who make new molecules in their research and wish to understand the overall structures and details such as bond lengths, angles and through-space interactions (such as hydrogen-bonds). Users include organic chemists Abelt, Harbron, Hinkle, Lashley, Scheerer, and Speight in

addition to inorganic chemists Bebout, McNamara, and Pike.

Chemistry's new Bruker D8 Venture X-ray diffractometer is an upgrade from our previous instrument. It has brighter X-ray sources, a larger detector area, and additional ways to rotate a crystal while collecting data. The department is very grateful to Virginia's Higher Education Equipment Trust Fund for supplying the finances to procure this equipment, and to W&M administration for recognizing the need to replace our 2005 instrument.

Bob Pike maintains the equipment and solves X-ray crystal structures for collaborators at other colleges and universities. The new instrument is an incredible tool for exploring atomic structure! To see this process with your own eyes, use the QR links below to view instructional videos.



X-ray diffractometer in operation.



Diffraction patterns being collected.



Examining a sample's molecular structure.



Spencer Pugh '82 and Beverly Pugh '81

The Summer Laboratory Research Endowment Fund (Pugh Fund)

by Spencer Pugh '82

The summer between my sophomore and junior year – over 40 years ago, by the way – I didn't go home for a typical college student summer job. Instead, I was able to stay in Williamsburg and work in a chemistry lab at William & Mary with Professor S.Y. Tyree, doing ion chromatography studies of water samples taken from the Chesapeake Bay. For me, it was an incredible summer. With only two years of chemical education, I had the opportunity to do chemistry and get paid for it.

That hands-on lab experience was formative for me. It gave me a better perspective of what it meant to be a chemist and it positioned me well for summer research at a chemical company in Chicago the following summer. Looking back, after graduate school and many years of experience in R&D and business leadership, it's clear that that summer lab experience laid a foundation that shaped my career. It gave me tremendous respect for what it takes to generate trusted, practical chemical results – and for the people who have the skills and patience to do so.

Because of my amazing summer experience, I would like other developing chemists at W&M to have similar opportunities. To that end, my wife Beverly (W&M class of 1981) and I have worked with the Department of Chemistry and the Office of University Advancement to create the Summer Laboratory Research Endowment Fund, managed by the university. This Fund will provide the Chemistry Department with funds needed to support chemistry students who stay in town over the summer doing laboratory research. Bev and I started this Fund, but anyone can donate to it. If you have had a formative lab experience or you see the value of such experiences, I encourage you to donate to this fund to give others that same wonderful opportunity.

If you wish to give to the Pugh Summer Research Fund (#4953)
go to: www.wm.edu/as/chemistry/support/



Undergraduate Research by the Numbers

As Spencer Pugh mentions, Tribe Chemistry has always prioritized opportunities for undergraduate student research. Here are some numbers from the 2023 academic year regarding UG participation in faculty research labs.



Chemistry Research Fairs are regular research recruitment events, held the first Friday of each semester. In addition to faculty labs recruiting, CHEM and STEM clubs have tables to recruit members for their organizations.

Fall 2022	CHEM 290: Sophomore Research	40 students	15 participating faculty labs
	CHEM 390: Junior Research	37 students	
	CHEM 490: Senior Research	28 students	
	CHEM 495 / 496: Honors Research	9 students	
Spring 2023	CHEM 190: Freshman Research	15 students	17 participating faculty labs
	CHEM 290: Sophomore Research	52 students	
	CHEM 390: Junior Research	40 students	
	CHEM 490: Senior Research	28 students	
	CHEM 495 / 496: Honors Research	7 students	
Summer 2023	students working PT or FT employment	81 students	16 participating faculty labs

Commonwealth Health Research Board Grant

An internal collaboration between Professors Rob Hinkle and Doug Young was recognized with a Commonwealth Health Research Board (CHRB) grant. This collaborative project involves the discovery of novel antibiotics with a polyne core (triple bond). Using the synthetic expertise of the Hinkle Lab and the biochemical assays employed by the Young Lab, a library of compounds are being prepared with the alkynyl core structure and then screened for biological activity in bacteria, yeast, and cancer cells. The researchers hope to find antibiotics with new mechanisms of action to combat growing antibiotic resistance that represents a major issue facing our society in the near future.

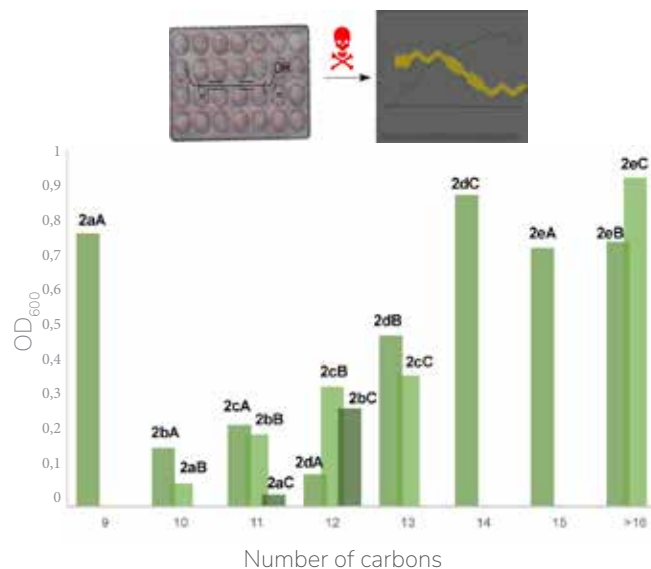
Figure illustrating synthetic routes to conjugated alkynes from a recent ChemMedChem publication. This article lists not only Hinkle and Young, but a grad student and seven UG authors! Article available here: <https://doi.org/10.1002/cmcd.202200455>.



Prof. Rob Hinkle



Prof. Doug Young



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DONATION OPPORTUNITIES

The Chemistry Department is grateful to our donors – both large and small. If you are interested in donating, we have many opportunities, including those that are dedicated to a specific purpose, such as equipment or summer research, and those that are for general or pressing needs of the department. Some funds go directly to the relevant needs, while others go to endowments that produce funds into the future. Here are a few funds that we'd like to highlight this year.

Student Opportunity Fund (#5173) – This fund directly supports research and presentation opportunities for undergraduates and grad students alike.

Chemistry Department Equipment Fund (#0027) – This fund directly supports equipment and instrumentation needs, allowing us to maintain up-to-date instrumentation for teaching and research.

Charles E. Flynn '34 Memorial Chemistry Endowment (#2331) – This endowment was established through the estate of Charles Flynn, its returns support the most pressing needs of the W&M Chemistry Department.

Pugh Summer Research Endowment Fund (#4953) – This endowed fund was founded by Spencer and Bev Pugh (see article page 12). The return from this endowment supports faculty-advised summer research for undergraduates, particularly those with laboratory and experimental aspects.

If you wish to give to these or
any of our donor funds, go to:

www.wm.edu/as/chemistry/support/





2023 Student Degrees & Awards

**Self-Designed Major*

Tanzim Noor Al Muhtasin

Chemistry / Minor Kinesiology & Health Sciences

Elizabeth Mariam Ancheril

Neuroscience / Minor Biochemistry, Andrews Teaching Assistant Award

Ryan Michael Anderson

Chemistry & Computer Science, ACS Certification
ACS Virginia Section Award, Honors

Yousuf Barezay

Chemistry, ACS Certification

Andrew James Beck

Chemistry ACS Certification

Caitlin Nicole Brady

Neuroscience / Minor Biochemistry

Marguerite Duffy Bright

Chemistry & Physics

Naya Kartrecc Burrow

Chemistry, ACS Biochemistry Certification
Outstanding Research Award, Honors

Taylor Marie Carhart

*Cognitive Brain Science / Minor Biochemistry

MC Chason

Chemistry, ACS Certification
Merck Index Award

Chris Neo Chun

Chemistry, ACS Certification
Andrews Teaching Assistant Award

Aidan Thomas Erwin

Chemistry, ACS Biochemistry Certification
CRC Handbook Award

Brian Michael Flood

*Biochemistry Major

Cody Michael Funk

Chemistry / Minor Math, ACS Certification
ACS Award Organic Chemistry, Honors

Sophia Hagos Haile

Chemistry, ACS Certification
Outstanding Service Award

Dylan Scott Hartman

Chemistry & Government

Marissa Ho

Chemistry / Minor Creative Writing, ACS Certification
Outstanding Service Award

Marlaina Grace Horewitz

*Biophysical Chemistry & Music

Grayson Robert Hoy

Chemistry / Minor Data Science, ACS Certification
William G. Guy Prize, Honors

Ethan Thomas Kang

Chemistry, ACS Certification
CRC Handbook Award

Delaney Aine Kirr

Chemistry / Minor Geology, ACS Certification
American Institute Chemists Award, Honors

Andrew Davis Kossan

Chemistry / Minor Music, ACS Certification

Madeleine Jane Lamb

Chemistry / Minor Sociology, ACS Certification

Tyler Madison Lee

Chemistry / Minor French, ACS Certification

Evan McLain London

Chemistry / Minor Biochemistry, ACS Certification
Merck Index Award

Kenya Gabriela Lopez

*Biomedical Engineering

Kristen Elisabeth Lorenzi

Neuroscience / Minor Biochemistry

Ignat Andreevich Miagkov

Chemistry & Computer Science, ACS Certification

Owen James Miller

Chemistry / Minor Math

Theresa Evelyn Molin

Chemistry

Jake Thomas Morrin

Chemistry & Classical Studies, ACS Certification
CRC Handbook Award

Ruby Walker Neisser

Chemistry / Minor Chinese Language & Literature, ACS
Certification, ACS Award Physical Chemistry, Honors

Molly Ann Poore

Neuroscience / Minor Biochemistry

Alexis Mackenzie Pugh

Chemistry, ACS Certification



Todd Michael Reynolds

Chemistry / Minor Math, ACS Certification
ACS Award Inorganic Chemistry

Tayli Barbara Shekleton

Chemistry / Minor German, ACS Certification

Willough Sloan

Chemistry / Minor Biochemistry, ACS Certification
Merck Index Award, Honors

Hannah Joy Smith

Chemistry & Philosophy, ACS Chemical Physics
Certification, CRC Handbook Award, Honors

Ian James Starr

Chemistry / Minor Biochemistry, ACS Certification
Merck Index Award

Sydney Joyce Tate

Chemistry, ACS Certification

Claire Elizabeth Vander Poorte

Chemistry, ACS Certification

Timothy Dennis Wells

Chemistry / Minor Environment & Sustainability,
ACS Certification

**Alexander Clark Williard**

Chemistry / Minor Biology, ACS
Certification
CRC Handbook Award

Roy Havea Wolfgramm

Chemistry

Brendan Andrew Woodworth

Biology & Chemistry

Maddy P. Zamecnik

Biology & Chemistry, ACS Certification

Shi Jun Zeng

Chemistry

Tom Yang Zhang

Chemistry & Classical Studies, ACS Certification
CRC Handbook Award



Master of Science 2023

Jessica Danielle Cropley: McNamara Lab, Armstrong Teaching Assistant Award

Iron Complexes with Tetradentate Aromatic Ligands for Photocatalytic Hydrogen Generation

John Patrick Davis: Kidwell Lab

Spectroscopy and Dynamics of Atmospherically and Combustion Relevant Collision Complexes

Grace Anne DeSalvo: Wustholz Lab

Environmental Dependence of Blinking-Based Multiplexing for Applications in Multicolor Super-Resolution Imaging

Lauren Cheyenne Green: Hinkle & Young Labs

Synthesis and Structure-Activity-Relationships of Differentially-Substituted Dienes and Triynes

Claire Elizabeth Robinson: O'Brien & McNamara Labs

Composition Analysis of Cloud Droplet Residuals by High Resolution Time-of-Flight Aerosol Mass Spectrometry

Lyndi J. Kiple: Meldrum Lab, Distinguished Thesis Award in Natural, Computational & Psychological Sciences

Characterizing Molecular Environments in Acrylic Paint via Single-sided NMR

Laurel Lee Anne Nicks: O'Brien & Poustma Labs, Alfred Armstrong Graduate Teaching Assistant Award

Effects of Ozonolysis and Photolytic Aging on the Chemical and Optical Properties of α -Pinene Secondary Organic Aerosols / Interfacing Eksigent Liquid Chromatograph to LTQ/Orbitrap Mass Spectrometer

Michelle A. Sturner: Bebout Lab

Synthesis and Characterization of Two Sets of Group 12 Complexes with Organic Ligands

Trinh Nu Nguyen Ton: Poustma Lab

Gas-Phase Proton Affinities of Proline- and Pipecolic Acid-Containing Dipeptides

Alumni News

James Holimon '65

After W&M, I attended Medical College of VA, achieving Doctor of Medicine in 1969. I trained in Anatomic and Clinical Pathology at MCV and at Case Western Reserve in Cleveland. I am Board Certified in Anatomic and Clinical Pathology. My career was in Lakeland, FL. My sub specialty was gynecological pathology. In the clinical laboratory I directed the chemistry labs. In 2006 I retired to Sapphire, North Carolina. My children live in Colorado, Florida, South Carolina and North Carolina (he is a chemist in the research triangle area). Through golf I have 2 close friends Jake and Josh Newman who are now students at W&M. My hobby is woodworking and woodturning, a picture of my work is included for the newsletter.



Sandra Thompson (nee Poteat) '90



Sandra just finished serving as President of the Junior League of Orange County in June. She continues to work as an intellectual property attorney at Finlayson Toffer Roosevelt & Lilly, LLP in Irvine, CA, working primarily with pharmaceutical companies and universities. www.ftrfirm.com/dr-sandra-thompson

Kate Beers '94

I'm still at the National Institute of Standards and Technology (NIST) for 23 years and counting; leading our Circular Economy program, and serving across government to advance sustainable chemistry and plastic pollution solutions. The foundation W&M gave me has served me well.

David Ehmman '96

From W&M, I moved to Boston and received a Ph.D. in Biological Sciences from Harvard University and then embarked on a career in pharmaceutical

research. After positions at AstraZeneca, Shire, and Takeda, this year I moved to a startup called Pretzel Therapeutics working on mitochondrial diseases. I live in Lexington, MA, with my wife and 3 daughters ages 10, 14, and 16. I'll never forget the Chemistry magic show entertaining with the Rainbow Connection and with gun cotton! www.linkedin.com/in/david-ehmann-2587315/



Janine Ladislav '03

Since graduating from W&M (20 years ago!), I obtained my PhD in Chemistry from the University of Pennsylvania, then my law degree from Boston College Law School. I lived in Boston for many years, practicing at Foley Hoag LLP, a general practice law firm that specializes in representing life sciences companies. Now, I am a Partner in Foley's New York office. My practice focuses on counseling clients on high-level global strategic intellectual property issues and devising strategies for patent prosecution. I live in New Jersey with my son, Elliott (3).

Barbara Besal '06

I'm in my 18th year working for Virginia Beach City Public Schools. I spent 16 years as a high school chemistry teacher, teaching general chemistry, AP Chemistry, and Legal Studies chemistry.



I was selected as the Teacher of the Year for my school for 2022, and I was a top 5 finalist for the citywide Teacher of the Year. I am now an Instructional Technology Specialist, helping teachers incorporate new technology into their classrooms and lessons. I referee volleyball and earned my national certification in 2021. My biggest news is that I'm now engaged to my fiancée Cate! She, her daughter Hazel (8), and I have lots of fun with polymer chemistry (thanks, Dr. Orwoll!) Hazel is a huge fan of making her own slime!

Bill Bylund '06

I was happy to look over the *Chemistry Distillations* and see the impressive progress at my alma mater. I am thankful to all of you, and your contributions to my success. Currently we're living in Camp Lejeune, NC. Unfortunately, I'm recovering from a spinal injury sustained in Ukraine. However, I'm hoping to continue as an emergency physician for the Navy. I really enjoyed my time at W&M, and am truly thankful to all of you! Best of luck to all!

Ryann Fame '06

The Fame Lab opened its doors in November 2022 in the Stanford Department of Neurosurgery. The transition to the West Coast and to leading a lab has been a wonderful challenge, but it's been a joy to share it with my dog and husband! Thanks W&M for preparing me for this fulfilling career and for modeling a healthy academic environment and community! <https://profiles.stanford.edu/ryann-fame>
<https://famelab.stanford.edu>

Deana Miller '07

Deana is still working as a pediatric hospitalist in Wilmington, NC, and was recently selected as the community pediatric hospital medicine national co-chair. That keeps her even busier! Her girls are now in first grade and the last year of preschool.

Sarah Bures (nee Bennett) '08



I am a lawyer in Richmond focused on energy regulation, as well as providing pro bono legal services. My husband and I just had our first child in May!

Chris Lee '09

I graduated from Tufts University School of Medicine in 2014, finished training in general surgery at Lahey Hospital and Medical Center outside Boston, MA, and a fellowship in plastic surgery at Dartmouth Hitchcock Medical Center in Lebanon, NH. Now I am a private practice plastic surgeon in Chestnut Hill, MA. I am specialized in reconstruction and cosmetic surgery of the face and body. I'm currently living in Boston, MA with my fiancé, Brendan, and dog, Quincy. @chrislee.md

Emily Mayhew (nee Eklund) '12



Emily is still enjoying life in East Lansing, MI, and working on the chemical basis of aroma and flavor perception. She reports a highly productive year: making a cute baby and a Science paper!! She hopes to make it back for homecoming one of these years. www.science.org/doi/10.1126/science.ade4401
www.science.org/content/podcast/reducing-calculus-trauma-and-teaching-ai-smell

Sofia Garakyaraghi '13

My husband and I welcomed our first daughter, Emma, in November and are loving being new parents! I'm working for the American Chemical Society as an Associate Publisher, leading the global editorial strategy for a portfolio of ACS Publications journals, including ACS Central Science, JACS Au, the materials chemistry portfolio and the agricultural and food science portfolio.

www.linkedin.com/in/sofia-garakyaraghi/

Kameron King (nee Adams) '13

She and her husband Patrick live in Washington, D.C. where she is a Postdoctoral ORISE Fellow with the U.S. Department of Defense Strategic Environmental Research and Development Program & Environmental Security Technology Certification Program. Her work focuses on mitigating per- and polyfluoroalkyl substances. She continues with her business BlackGirlScientist, LLC. www.theblackgirlscientist.com



Charlie Clark '14

Charlie recently became assistant professor of metabolomics and analytical technology at Leiden University, in the Netherlands. Charlie and his wife Claire Glisson (W&M '14) are expecting their first child later this year, and hope to return for 2024 William & Mary homecoming!

Henry Melzer '19

Henry is still in the classroom! He is an instructional coach implementing high dosage math tutoring in Washington DC public schools.



Stay in touch!

Contact us via
Alumni & Friends page:

www.wm.edu/as/chemistry/alumni/
or send your news & pictures
to chemistry@wm.edu

Memorial: Claire Robinson, MS '23

Claire Robinson (1994 – 2023) was a 2016 graduate of Christopher Newport University with a major in Chemistry and a minor in Biology. She was employed as a Scientific Programmer and Analyst at Science Systems and Analysis Inc. (SSAI) of Hampton, VA, from August 2016 until her death. She enrolled in the Chemistry Master's program at William & Mary as a part-time student in 2018, working with Prof. Rachel O'Brien in the area of aerosol mass spectrometry connected with her on-going interest and research in atmospheric science. She completed her degree in May 2023. In her work with SSAI, Claire was affiliated with NASA Langley and was co-author on multiple scientific publications.



She participated in an aircraft-based atmospheric layer measurement program, Sonde Measurement of Atmospheric Layers at Langley (SMALL). Her work utilized Advanced Vertical Atmospheric Profiling System (AVAPS) Dropsondes which are instruments that are dropped from an aircraft to collect atmospheric data. The position of the instrument is tracked by GPS and its data is transmitted to the aircraft. Claire's data is being used to produce high resolution vertical atmospheric profiles for scientific applications. Claire's atmospheric research was highly regarded. She was a fine researcher, a gifted student, and a kind person who was appreciated by all who knew her.

Professor Coleman is Retiring

After 54 years of teaching in Tribe Chemistry, Professor Randy Coleman is retiring in May 2024. Perhaps no other W&M professor has touched more lives than Randy, who has taught many generations of students at W&M. All are invited to Prof. Coleman's last lecture, (not at 8 am!)

Saturday, May 11, 2024, 10 am

Sadler Center Commonwealth Auditorium,
Reception follows in Tidewater Room



A Walk Down Memory Lane with Professor Coleman: Reflections on a Career of Connections

Join Professor Coleman as he reminisces and highlights his pre-college days, his undergraduate/graduate days, his five-plus decades at W&M in the classroom with the students he cares so much about, and his plans for life in retirement.

An endowment is being created in honor of Professor Coleman, the “Randy Coleman Chemistry Mentorship Endowment: Funds distributed from this endowment shall be used to provide support for mentoring activities involving students studying Chemistry at William & Mary.” More details on donating to this fund coming in future.

2023 Chemistry Diploma Ceremony Destinations:

Majors: 44 Chemistry, 10 Neuroscience, 1 Biology,

4 Self-designed majors: 2 w/ Biochemistry, Biophysical Chemistry & Cognitive Brain Science

8 Double Majors: 2 w/ Computer Science, 2 w/ Classical Studies, Chinese, Music, Philosophy & Biology

w/ Minors: 8 Biochemistry, 3 Math, 2 Data Science, Biology, Chinese Language & Literature, Creative Writing, Environmental Studies, French, Geology, Music, Sociology, Psychology, German

15 continuing to graduate school: Yale, Penn State, Vanderbilt, Princeton, Univ. of Michigan—Ann Arbor, George Washington University, Univ. Wisconsin—Madison, William & Mary

6 attending medical or other health-related school: Geisinger Commonwealth School of Medicine, Mississippi State College of Veterinary Medicine, Southern Illinois University School of Medicine

13 moved directly into the workforce: Virginia Tech Neuroscience Lab, Eurofins Lancaster Labs Aerosol Lab, USGS Student Services Contractor in Coscarelli Lab, Bloomberg LP Software Engineer, Mariners' Museum Conservation, Science Fellow, Continental Research & Development Chemist, AkzoNobel Aerospace Coatings Chemist

The Main Ingredient

by Bob Pike

Answers: www.wm.edu/as/chemistry/alumni/deptnewsletter/newsletter-archive/

ACROSS

1. Right away!
5. Academic resumes
8. Phone program
11. May honoree
15. The main ingredient is calcium phosphate
16. Term of endearment
17. None
18. Board game or one-time picture magazine
19. Actress Blancett
20. ___ little teapot
21. Maiden name signifier
22. Rickman or Turing
23. Pocket tool
26. Abandon
28. The main ingredient is methane
31. Eagle's home
35. Keebler's cartoon bakers
36. Practitioner ending
39. PSAT exams for instance
43. Put in the wrong data
45. Marks with a price
46. The result of 43 across
48. Disreputable
49. Drag into court
50. The main ingredient is calcium sulfate dihydrate

54. Married woman in Mexico, abbrev.
55. Shouts
57. Long-winded adventure story
58. "Bye now"
60. Conscripts
64. Roasted peanut choice
66. Armenia or Georgia prior to 1991
67. Harvey Fierstein or Gilbert Gottfried voice quality
69. Contemporaries
70. The main ingredient is pinene
74. Brain or spinal tumor
77. Groucho Marx trademark
81. Prefix referring to flight
82. Guerilla Guevara
85. It may be messenger, transfer, or ribosomal
86. ___ Contendere
88. We're ___ to win
89. Yo!

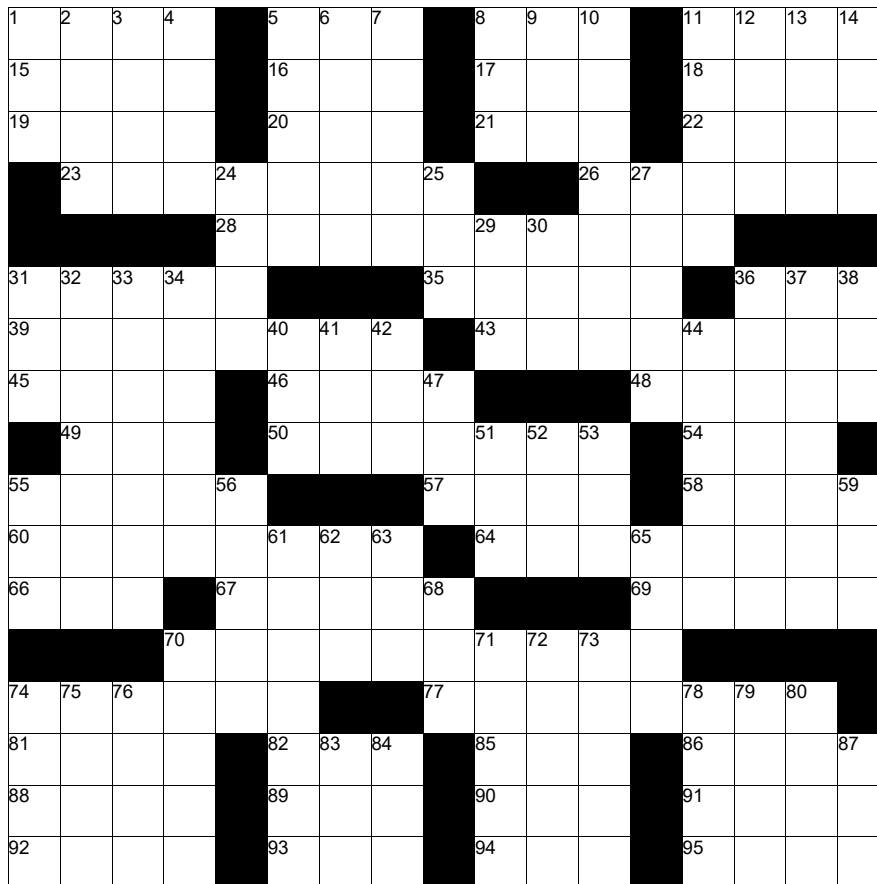
DOWN

1. Simple as ___
2. The main ingredient is potassium stearate
3. Up the ___
4. Rounded hammer end
5. It can be fine or everyday
6. Spew
7. Acronym for failure
8. Popular female middle name
9. Delicious-sounding chart
10. Frat aspirants
11. The main ingredient is silicon dioxide
12. Stir up
13. "Lucy" skeleton site
14. Ding on a Dodge
24. Patellar place

90. Middle-earth tree creature
91. The main ingredient is graphite
92. A bite to eat
93. She-sheep
94. See 40 down
95. Advantage

25. Before (poetically speaking)
27. Gently places
29. Donation
30. 2021 Super Bowl
31. On-point
32. Writing expungers
33. Gas pump choice
34. It speaks for ___
36. Move toward the correct answer
37. Tranquilizer
38. Yoda: "Do or do not, there is no ___."
40. With 94 across, a meas. of variance
41. Amino acid, aka Y
42. Peek through a keyhole
44. Settle into
47. Be indebted
51. Simpsons Kwik-E-Mart proprietor
52. "Hamilton" composer ___-Manuel Miranda
53. MLB's National or American playoffs, abbrev.
55. Football gain, abbrev.
56. Play the ukulele

59. How social media sites are supported
61. Ailment usually treated with drops
62. Beyond taste, touch, sight, hearing, & smell
63. Polymer industry grp.
65. Impersonator
68. Ending for triple-bonded hydrocarbon
70. The main ingredient is calcium phosphate hydroxide
71. Changed rubber in Britian
72. Suffix with Paris
73. Hoops channel
74. Viral ___-of-function research
75. Tonight Show host, 1992-2009
76. Bulb flower
78. ___ upon a time
79. The main ingredient is cellulose
80. Byproduct of smelting
83. Hack at
84. Hurricane calm spot
87. Bravo!



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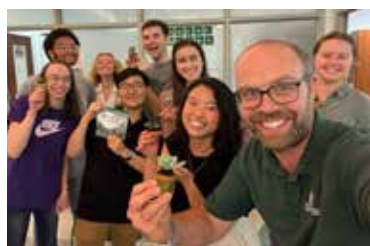
PRIME Update

The PRIME (Peer Retention and Inclusive Mentoring Experience) program is designed to provide a hybrid tutoring/mentoring experience to students in chemistry's introductory courses to help build a greater sense of community within the department, provide additional resources to these students, and to assist in the retention of students in chemistry. Typically, intro chemistry courses enroll 850 students each academic year.

Spring 2023 was the first iteration for the program, serving Organic Chemistry I (CHEM 206), it was well received by students. The mentors themselves designed fun activities, review sessions and games to encourage participation. Their pre-finals event was pet therapy, "Chemistry Cupcakes & Corgies!"



Pet therapy was a hit with Orgo I students. It turns out that Corgis are more popular than professors!!



PRIME mentor craft activity, pot painting + planting succulents for students' dorms!

In fall 2023, PRIME mentors worked with students taking General Chemistry (CHEM 103). The semester started off with a bang with an ice cream social, making liquid nitrogen ice creams with flavors dedicated to each of the CHEM 103 instructors (Bedford, McNamara, Perrault and Pike). Mentors hosted a series of "Sunday Scaries Study Sessions" focusing on problem sets, which were so popular they had to move into the large ISC 1221 lecture hall! No problem sets at "Crafty Chemistry," an event with fun activities like making slime, UV beaded bracelets and painting pots to plant small succulents as "dorm" plants. Contact Doug Young dyoungoi@wm.edu with questions or input for the program. Below are comments from participating students.

I was very thankful for the many mentor office hours available, because I was unable to make the majority of my own professor's office hours.

I've enjoyed it very much — the BINGO was a fun strategy to engage with the mentors.

The course was hard, but PRIME mentors, and especially review sessions, really helped.