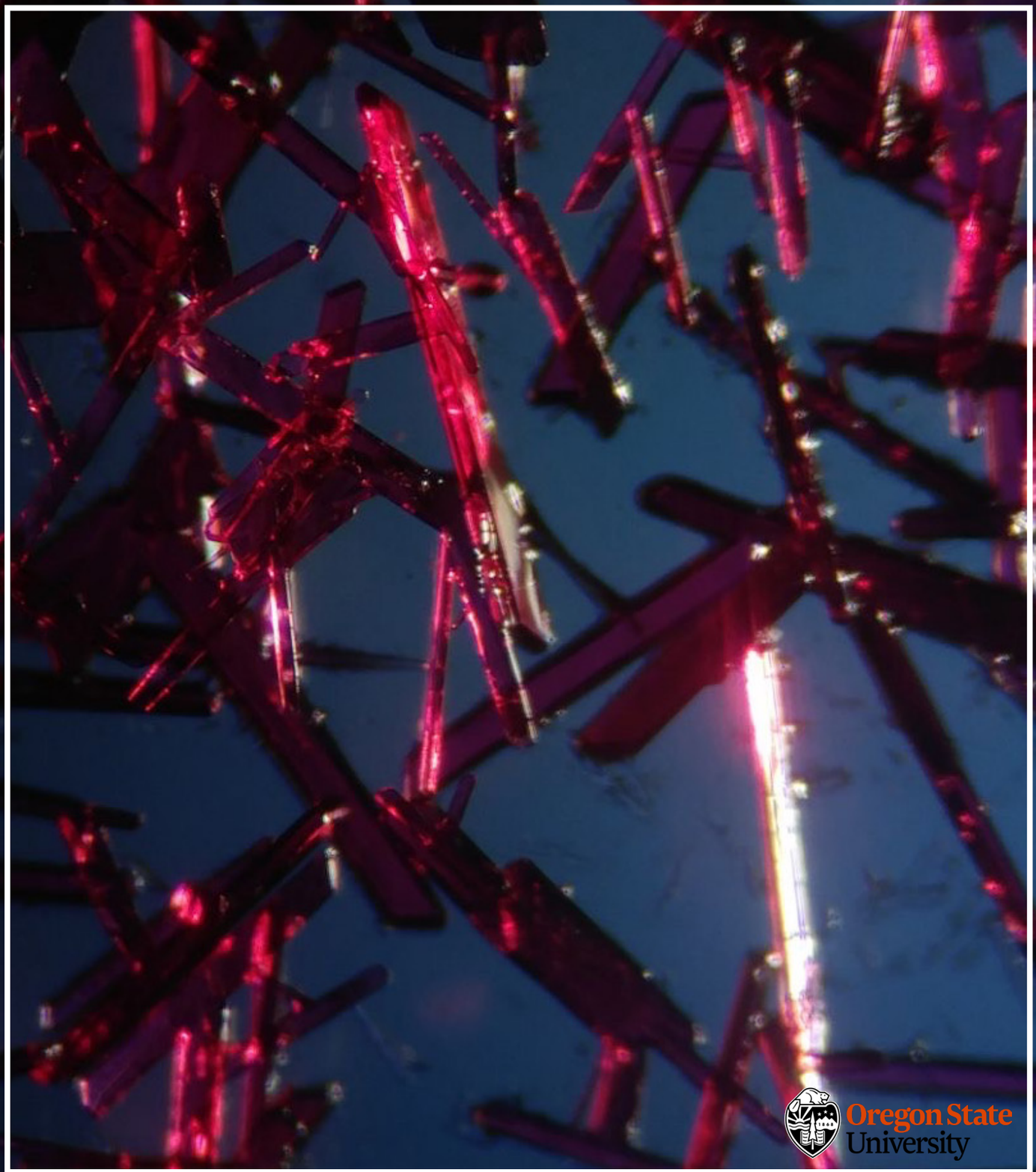
Department of Chemistry

Chemistry Newsletter

Winter 2022



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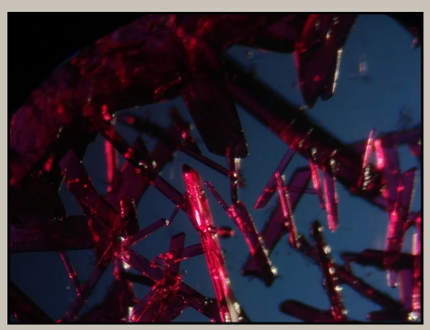
On the cover: Microscopic photo



of tetraaminecarbonatocobalt (III) nitrate crystals created during undergraduate research.
Photo Credit: E Hernandez

Expanded stories available online:
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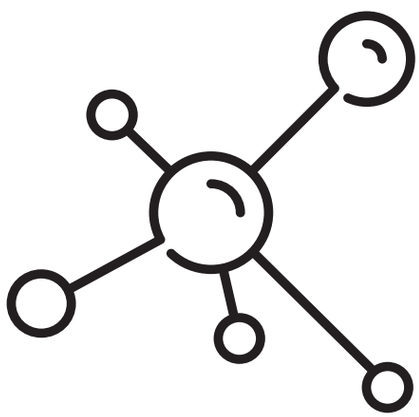
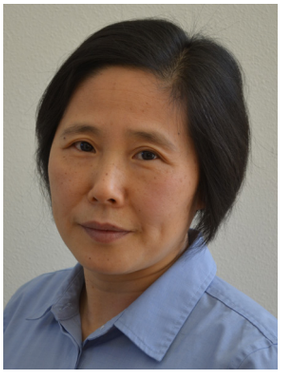


A MESSAGE: From The Department Head



Fall of 2022 sees yet another record year of student enrollment, both on-campus and online. The need for staffing the classrooms, particularly the service courses, is a major test of the department's ability to adapt to the new environment. With some forewarning from the departments and the colleges we serve, we started our first summer teaching boot camp, training interested senior graduate students, postdoctoral fellows, and research associates for temporary teaching positions. This effort provided us with some flexibility in course offerings and we survived the first term of the academic year without shutting off any interested students, freshmen or otherwise, for chemistry classes across the whole campus.

The year 2022 is also marked by tremendous successes in research breakthroughs, publications, grants, and awards at the departmental, college, and university level. A few snippets of these successes are included in the newsletter with more to come. Patents and startup companies, hallmarks of entrepreneurial activities, have also become a theme of our enterprise.

The impact of COVID is long-lasting, and after a whole year of in-person classes we are still learning and adapting to the vast range of student preparedness and the different expectations of our services. Clashes between strict academic standards and student performance and behaviors are boiling up nationwide, culminating with the event at New York University concerning the firing of an organic chemistry instructor. In this tumultuous time students and faculty alike are facing ever more tests of their integrity, faith, and compassion.

We are in the midst of intense recruiting since the summer of 2022, two for fixed-term instructors and two for tenure-stream faculty members. Four committees, one for each faculty position, have been busy conducting preliminary screenings, zoom interviews, and on-site interviews. The low number of faculty members in the department means that almost every faculty member is now on one or even two recruiting committees. For this reason, other committee activities have been dormant over the past few months, and we will resume our regularly scheduled events in the winter of 2023. So far we have conducted four on-site interviews for the organic instructor position, and two on-site interviews for the integrated lab/online physical chemistry instructor position. The committees have made their recommendations for these positions and we are in the process of deliberating offers. Recruiting for the tenure-track faculty members is in the stage of on-site interviews, with a total of 10 candidates ranging from analytical to physical and organic chemistry. At the time of this publication we will have completed four on-site interviews with analytical candidates and two on-site interviews with physical candidates, with more to come after the new year.

The past few months have seen a series of leadership changes, from the department to the dean's office, to the president of OSU. This series of leadership changes means that different procedures and policies may be implemented. In particular, faculty recruiting is now following a much more defined procedure, involving the deans office from the wording on the evaluation matrix, amd every step of the interviewing process, to the final decision for hiring. This has been a learning experience for the new head and the chairs of the committees. As we navigate through this interview season we are learning the best practices for inclusive excellence to ensure that we recruit the most qualified and diverse candidates. With the concerted efforts of all the committee members we have made tremendous progress in the past few weeks, and with the enthusiastic participation of all faculty members and students during the on-site interviews in the next few weeks, I am confident that we will present OSU chemistry as a cohesive, inclusive, and a collaborative community for prospective new faculty members.

Thanks to the joint effort between Professor **Joe Nibler** and Professor **Mike Lerner**, fundraising for the *Christine Pastorek and Emile Firpo Integrated Lab Fund* is unofficially underway. Starting in the 1980s, the integrated lab series has trained thousands of students for industry and academia, and we honor the legacy of our first director, Dr. **Christine Pastorek**, and her partner **Emile Firpo**, for their tireless effort in helping our students reach their highest potential. For more information or to donate early, please email hannah.hegerberg@osufoundation.org, and stay tuned for the official fundraising kickoff announcement this spring.

In a report to the dean's office, I stated that a major challenge facing the department is the facility situation. Gilbert Hall is past its useful life as a laboratory facility with inadequate electrical supply and frequent power outages, and without adequate environmental control including temperature, air quality, and water supply. At the university level, a new building named the *Jen-Hsun and Lori Huang Collaborative Innovation Complex (CIC)* is due to open in 2025. The building will house a state-of-the-art cleanroom to advance discovery and learning to support the semiconductor industry, and it will also house a series of characterization tools including the X-ray facility. A few faculty members currently housed in Gilbert Hall may acquire some spaces in the new building, which would be a welcome change. I also explored with the acting dean about a new building for the department, and the dean is helping with the search for a major donation to start the discussion.

In Fall 2022, the College of Science officially launched its strategic plan, involving four goals and 16 action items. Some of these goals and actions align with the long-range plan developed under the leadership of our previous head, Professor Michael Lerner – thank you Mike for another long-lasting contribution to the department. In support of the college's strategic plan and the new CIC building, we anticipate more hires soon. An exciting time is indeed coming for the department!

There is an ancient Chinese story about chopsticks: one stick is easily broken, but a bunch of sticks is much stronger. As I watch the faculty and students coming together for the recruiting events – we overflow the seminar room and I cannot help thinking that in this challenging time when others are lamenting on the COVID "hangover", we are coming together as one unit, with one common goal: to make OSU chemistry stronger than ever.

THE MULTIFUNCTIONAL MOLECULAR PROBE: A new way to selectively detect copper ions

By: Dipankar Koley

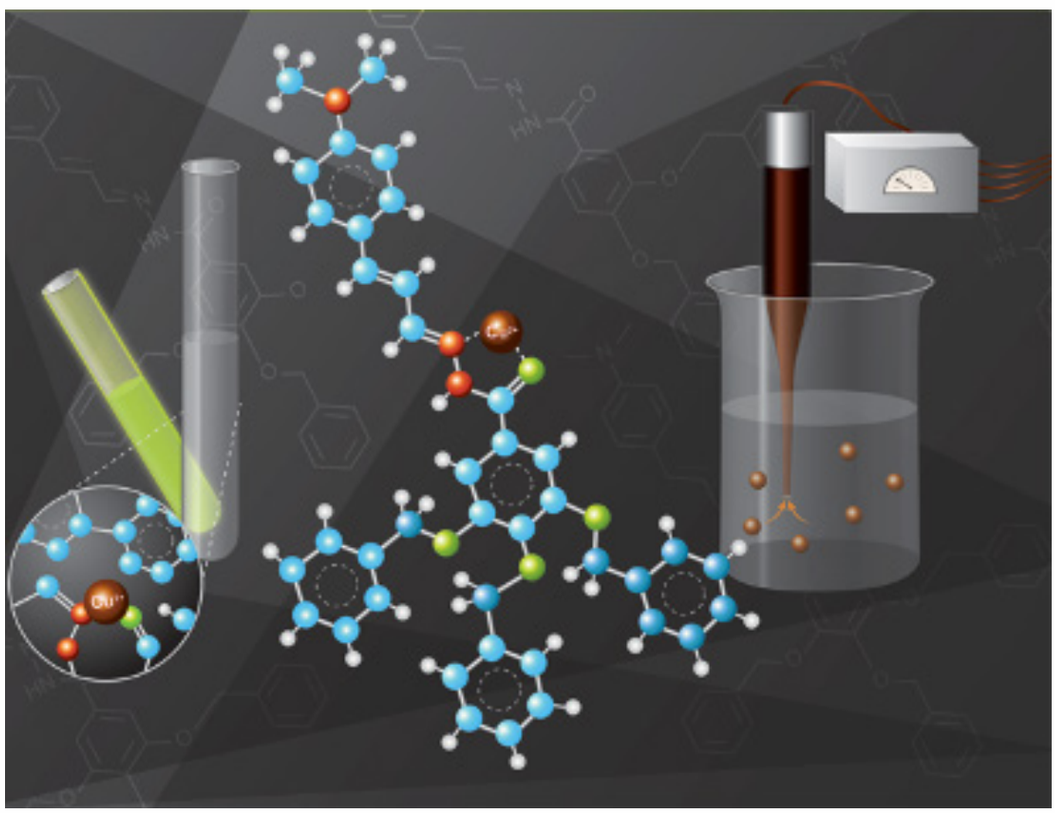
Copper is an essential nutrient for plant and animal life. It is found in small amounts in almost all water sources, including surface water, groundwater, and drinking water. Copper is commonly found in water as a result of the erosion of natural deposits and the leaching of copper pipes and other man-made materials. Although low levels of copper are not necessarily harmful, exposure to high concentrations of this metal can cause nausea, vomiting, and diarrhea. In extreme cases, copper poisoning can lead to death.

Additionally, copper is an important part of many biological processes. It is a cofactor of many enzymes and is involved in regulating metabolism and activating proteins. The amount of copper in our bodies is the third most of any transition metal. The amount of Cu^{2+} in blood serum is 10–25 μM, and the amount in the synaptic cleft is 30 μM. Still, eating too much copper can lead to Alzheimer's, Parkinson's, Wilson's, and Menke's diseases. The US Environmental Protection Agency says that there can be no more than 1.3 mg/L (20 μM) of Cu^{2+} in drinking water. This means that water samples with copper concentrations above this level are considered unsafe for drinking. Therefore, it is important to test for the presence of this metal in drinking water samples to protect public health.

Traces of Cu^{2+} can be detected by atomic absorption spectrometry and inductively coupled plasma mass spectrometry. These analytical approaches necessitate sample pretreatment, bulky and expensive tools, and highly trained personnel. Additionally, remote monitoring of the analyte is difficult. On the other hand, potentiometric ion-selective electrode (ISE) analysis is easy, low-cost, and portable because of its compact size.

Koley lab has reported in their latest research article in Analyst (see reference 1 below) how they made a new Cu^{2+} ionophore molecule that is selective for copper ions against major alkali and alkaline earth metal ions, as well as transition metal ions. The molecular design includes reversible binding with Cu^{2+} using a dendritic moiety with an attached cinnamaldehyde component (see Figure 1). This allows them to make a multifunctional dendritic molecular probe for selective and sensitive detection of Cu^{2+}. The dendritic molecular probe can act as an ionophore for potentiometric methods. Adding a cinnamaldehyde moiety to the ionophore makes it a fluorescent molecular probe that can find Cu^{2+} ions. Selective and reversible binding to Cu^{2+} was used to make a solid-state micro-ISE by adding this multifunctional ionophore into a unique carbon-based membrane previously developed in the Koley lab (see reference 2). This made it possible to detect Cu^{2+} quickly and with high selectivity. A potentiometric method is a method of measuring the potential difference between two electrodes in an electrical circuit. A fluorometric method is a type of analytical method that is used to measure the concentration of a chemical compound by measuring the amount of light emitted when the compound is exposed to ultraviolet or similar light sources.

With the fluorometric method, Cu^{2+} can be detected as low as 15 nM. When tested against common metal ions such as H^+, Na^+, K^+, Ca^{2+}, Mg^{2+}, and Zn^{2+}, it shows that it prefers Cu^{2+} ions. As an ionophore, the molecular probe was used to make a carbon-based solid-state microISE that could detect and quantify Cu^{2+} in the drinking water sample.



The figure was adapted from the Analyst cover art.

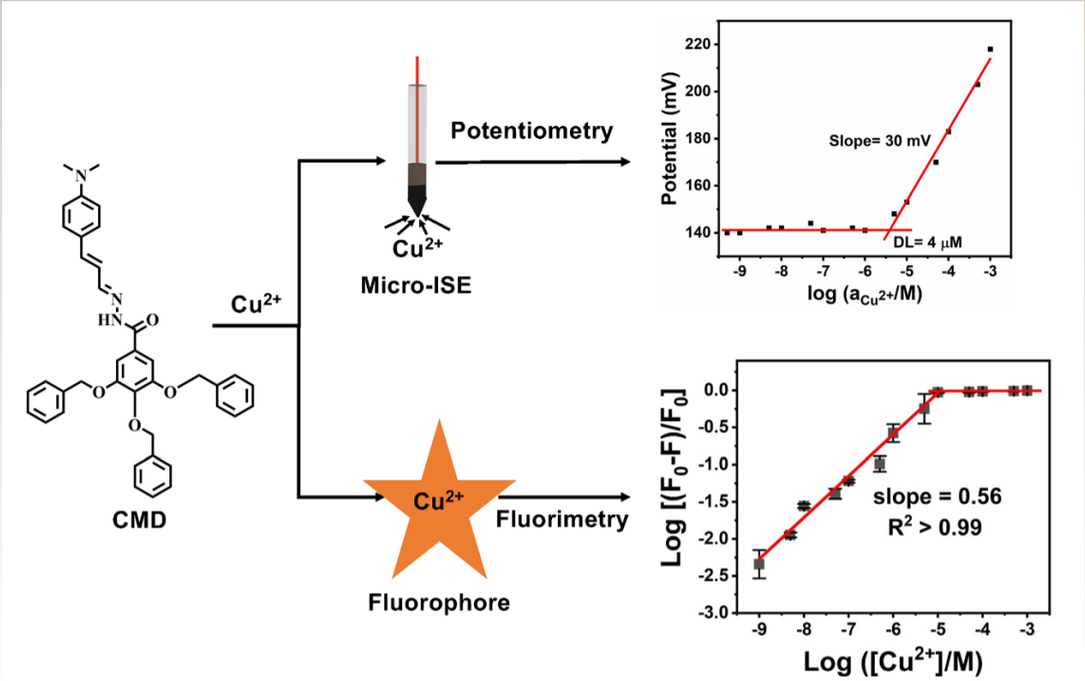


Figure 1: The multifunctional probe shows the potentiometric and fluorometric response at different concentrations of Cu^{2+} ions. The probe can selectively detect as low as 15 nM Cu^{2+} fluorometrically and 4 µM Cu^{2+} potentiometrically.

The selectivity of the ionophore is better than that of the commercial ionophore by at least one order of magnitude and works quickly (1.5 s). In the lab, researchers are also exploring the possibilities of using this ionophore as a Cu^{2+} microISE chemical probe for scanning electrochemical microscopy (SECM) studies besides the potential use of this molecule as an optode by recording the fluorescence response from a PVC-based ion-selective membrane in the near future.

Koley lab members have used this molecular probe to determine the Cu^{2+} content in tap water collected from the main campus of Oregon State University (OSU). The amount of Cu^{2+} present in hot tap water on the campus of OSU (Gilbert addition) was found to be 38.0 ± 1.7 µM using ISE, 38.9 ± 0.9 µM using fluorimetry, and 38.0 ± 0.9 µM from ICP-OES. This indicates that the multifunctional fluoroionophore can reliably measure the amount of copper present in water samples.

This multifunctional probe for detecting and quantifying copper ions in water samples has a patent application pending in the United States and is open to commercialization in the near future.

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1. Sheet, P. S.; Park, S.; Sengupta, P.; Koley, D. Multifunctional Dendritic Molecular Probe for Selective Detection of Cu2+ Ions Using Potentiometric and Fluorometric Techniques. Analyst 2021, 146 (23), 7109–7117. https://doi.org/10.1039/D1AN01417J.

2. Ummadi, J. G.; Downs, C. J.; Joshi, V. S.; Ferracane, J. L.; Koley, D. Carbon-Based Solid-State Calcium Ion-Selective Microelectrode and Scanning Electrochemical Microscopy: A Quantitative Study of PH-Dependent Release of Calcium Ions from Bioactive Glass. Analytical Chemistry 2016, 88 (6), 3218–3226. https://doi.org/10.1021/acs.analchem.5b04614.

NEW FACES:
Devonte Casey

by: Devonte Casey & Grace Winningham

Devonte Casey was born in Albany, OR and moved to the Beaverton/Portland area when he was seven years old. After he graduated from high school, he decided OSU would be a great fit, and moved back down to the area. Devonte has three brothers, one soon to be graduating with a degree in architecture and design, and two currently navigating middle school. He says that it has been a blessing to see them grow up over the years. Devonte's mom has worked in public health for over 15 years as Director of the NW Tribal Dental Support Center at the Northwest Portland Area Indian Health Board (NPAIHB). She is "by far one of the biggest role models in my life," he gushes, adding that she has accomplished so much all while raising three children on her own. His dad and stepmom live in Albany with his 12 year old brother, Taj, and welcomed Devonte into their home during the pandemic, allowing him to save money and figure out his next move.

Most of Devonte's background is rooted in biology and marine biology, but he found himself becoming more interested in chemistry as he progressed through the various courses he took for his degree. He chose the Department of Chemistry at OSU in hopes of grounding himself further in the content that wasn't regularly practiced in his biology courses. Devonte saw working with the department as a great way to build his skillset and fill gaps around working in a lab environment. As a lab technician for the Gilbert Addition, he's responsible for preparing solutions that are used in laboratory courses, issuing lab equipment/glassware to students, and making sure that the students are complying with lab safety regulations.

Devonte's favorite aspect of the job is preparing solutions. When he himself was a student in the labs, he was always used to solutions being ready to use before class, but now he has the opportunity to see and experience the work that goes into preparing experiments for students. Overall, seeing how much effort goes into making sure the labs and experiments run as smoothly as possible has been an eye-opening experience for him.

Devonte's identity extends beyond just his work as a lab technician, however. He is also an enrolled citizen of the Confederated Tribes of Siletz Indians, located about 13 miles northeast of Newport, Oregon. His mom grew up on the reservation where much of Casey's family still resides. "(She) did a lot to make sure that my brothers and I were still involved with our beautiful culture even though we lived in the city," he adds. His tribe's people and culture are a fundamental part of his identity and have a profound impact on how Casey views and interprets the world around him. "We are still here," he says, "thriving and carrying on traditions that have been passed down for generations."

Outside of the lab, his hobbies include playing Pokemon, taking care of his "neverending" collection of houseplants, and reading lots of manga and fiction books (If anyone has good magical realism book recommendations, let him know!) He also serves as a mentor for Black youth in the Albany area, with the goal of giving Black youth a safe place where they can be themselves and see other people who look like them. They meet about every other week to hang out and build a community of support. If he could have any superpower, he would choose the ability to talk to animals since "they have some profound secrets to life on Earth." Plus, he would love to speak to marine life and find out whether or not the lost city of Atlantis exists.

DEPARTMENTAL HOLIDAY PARTY
Building Commraderie Among our Colleagues

By: Brayden Tuers

On Nov. 30th, the Chemistry Department celebrated their annual holiday party, bringing faculty, students, and staff alike in the LPSC Student Street for a community-oriented festivity. Alongside a colorful catered buffet and drink station, the gathering hosted a cultural desserts table where guests were invited to bring their own homemade treats unique to their backgrounds.

Coming from an entirely fresh-eyed perspective on this tradition, student **Sultana Rumi** spoke on her sentiments towards the party and its multicultural accents.

"As an international student, this holiday party concept is totally new to me, so I enjoyed it a lot. My favorite part of this party is having different types of food and dessert from different countries...I feel that this type of community gathering is very important for breaking ice in a new place and making new bonds with people," said Rumi.

An atmosphere of relief and camaraderie filled the halls as the guests lined up for their food, gleefully chatting and reminiscing about another bustling year at Oregon State. For a department which spends a considerable portion of their professional lives alone in goggles and lab coats, this opportunity to personally connect with others in the same niche was warmly welcomed.

"People in the chemistry department are usually busy with their lab work, so this kinda gathering will be a good refreshment for them," said Rumi.

SPOTLIGHTING THE HISTORY and future of the Chemistry Department

By: Brayden Tuers

Since 1939, Gilbert Hall has housed the heart of Oregon State's Chemistry Department, encapsulating its prestigious history while grounding its path towards the future. Upon entrance into the historical building, visitors might notice the rows of faculty photos which adorn the first-floor walls, commemorating the academic contribution of past students and faculty with their named headshots.

In a recent initiative led by the Department's Equity, Justice, and Inclusion Committee, this display of historical homage will be seeing major advancements in Gilbert Hall over the next year. While the current posters only display the photos of students, current faculty, and emeritus faculty, the EJI committee is working to create new posters which will do much more than just showcase their smiles. In an effort to layer the headshots with the proud distinction and character of these individuals, these new posters will incorporate aspects of their personal stories and scientific achievements.

Conceived by EJI representative and Assistant Professor of Chemistry **Marilyn Mackiewicz**, the principal mission of this project is to illuminate the diversity within the department while also paying homage to the unique stories and achievements of every individual. Notably, the department has lacked diversity for much of its past, an unfortunate fact which is evinced by the current faculty wall. However, while the history of the department may have been rather homogenous, Mackiewicz notes that this is no longer the case.

"Our department is changing. We have women instructional faculty, we have students from different gender identities, students from different diverse backgrounds...this is not a predominantly white, male department anymore," she said.

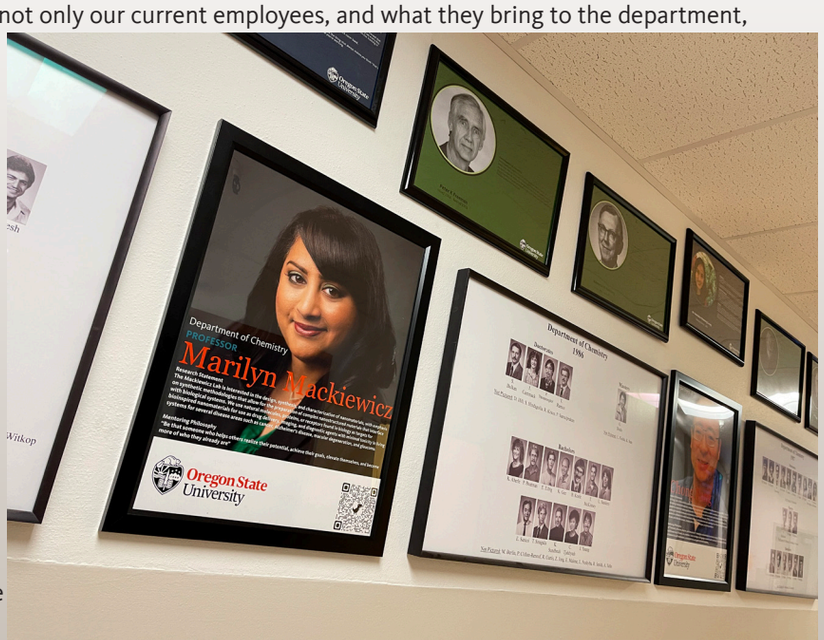
In order to overshadow this uniform past with its diverse trajectory, the EJI Committee hopes that these new posters will highlight its current features in a much more meaningful and comprehensive way. By including every group—research faculty, instructional faculty, emeritus faculty, students and staff—these posters will acknowledge every part of Gilbert Hall's rich and multifaceted complexion.

Luanne Johnson, a fellow EJI Committee representative and the departments Media and Events Coordinator, spoke on this objective. "[Our] overall goal is awareness. We have amazing people in our department doing amazing things every day to benefit all of mankind....and having another avenue to bring awareness to what our people have done, are doing, and will do in the future is a great goal," she said.

While EJI Committee faculty members have been instrumental in bringing this project to fruition, numerous students on the committee have also greatly contributed to this effort. Chemistry Grad student **Alyssa Johnson** shared her personal hopes for the project. "I think this gives students that are taking classes in Gilbert a chance to kind of see what the department is offering. And maybe they'll see someone that either looks like them or, or does interesting research that they would want to interact with more," she said.

While inclusively representing the department's contemporary features is a main goal, the EJI Committee doesn't want to sweep its history under the rug. Instead, the committee feels that it can represent the important features of both eras by including contribution stories for every highlighted individual.

"With this project, we have expanded upon not only our current employees, and what they bring to the department, but also, our past employees, and what their contributions to science and to our department were. History is important, but you need more than just the 'who' to understand where we came from, and which direction we need to go," said Luanne Johnson.



For months, the committee has been painstakingly scouring archives, reaching out to related individuals, and designing the visual layouts in order to create the most detailed and holistic posters possible.

While it certainly hasn't been a simple effort, one thing is for sure: these highlights are a momentous first step in advancing the department forward.

"I want people to know...that there are people who care about this, and there's different dimensions to diversity...and that we're making changes to be an inclusive department with inclusive culture," said Mackiewicz.

SURE AWARD WINNERS:
Undergraduate Student Research in the MaD Lab

The College of Science, Summer Undergraduate Research Experience, known as SURE Science, offers scholarship support so students gain a stimulating research experience that enhances their academic experience. This past Summer, 2022, Chemistry was lucky enough to have 3 such award winners, Jacob Lessard, Matthew Nguyen, and Timothy Walz. We sat down with our three winners to talk about their research, and their experiences as SURE Awardees.

A senior in Chemistry, **Jacob Lessard** has always had an interest in how life works at the molecular level, and appreciates how chemistry allows him the ability to investigate both material and biological sciences. After taking an integrated lab course, CH 462, taught by Dr. **Kyriakos Stylianou**, Lessard felt inspired to reach out and demonstrate his interest in his professor's research, particularly the use of metal-organic frameworks (MOFs) as photocatalysts.

Now, he's been doing research for 10 months in the Materials Discovery Lab, studying MOFs as photocatalysts for the synthesis of deuterated drug molecules. Deuterated drugs replace key hydrogens with deuterium, creating a stronger bond with carbon and resulting in slower oxidative metabolism of the drug, without significantly altering drug function. Lessard describes that this reduced rate of metabolism can allow for the same drug exposure to be experienced from lower doses, and can reduce the formation of toxic metabolites. However, this is easier said than done—traditional deuterated drug synthesis is challenging and requires many steps, long reaction times, and many chemical components—making the process time consuming and expensive. Lessard's research into MOFs could open the doors to reduced synthetic cost and increased access to deuterated drugs that would provide patients with essential and even life-saving care.

Currently, Lessard has a primary role in project design, MOF synthesis and characterization, conducting photocatalytic reactions, and collecting NMR results. Receiving the SURE award allowed him to focus solely on his research, allowing him to spend more time in the lab over the summer without the burden of taking on a second job to pay the bills. "Receiving the award made me feel like the research I was doing was valued," he adds. The experience strengthened his synthetic and communication skills, allowed him to work and communicate with a variety of grad students, and get to know Dr. Kyriakos who Lessard describes as "always supportive of his students' work and passionate about new and impactful projects." He adds that the SURE program is "an excellent resource for aspiring researchers," and hopes that future students are able to receive the same support that he has received through the program.

Outside of research, Lessard enjoys watching sports, hiking, camping, cooking, and traveling. He plans on attending graduate school to further his studies, and would like to continue focusing on materials chemistry and catalysis.

Matthew Nguyen had never really considered anything to do with the field of chemistry until he took AP Chemistry, senior year of high school. "I'd never enjoyed a class as much as that one up until that point," he recalls, "I think what drew me to it was the challenge of the field." Now, as a sophomore, he's been involved in chemistry research in the Materials Discovery Lab for almost a year and a half. There, Nguyen studies metal organic frameworks (MOFs), crystalline structures that are made up of metal ions connected by organic molecules.

Currently, Matthew is working on two different projects. The first is researching the kinetics of a nickel-based MOF integrated in polymers. This MOF has an affinity for water capture, giving it potential to be used as a desiccant for laboratory use (keeping equipment/materials dry), a water harvesting solution for arid climates, or as a water content sensor with various applications. The second project focuses on a cerium-based MOF that contributes to the degradation of heavy metals through photocatalysis, providing a potential solution to deal with toxic wastewater.

Despite the exciting potential applications that could come from these projects, research is bound to feel frustrating at times. "It's easy to feel a bit downtrodden when you're measuring out reagents for your seventh synthesis of the day," Nguyen admits. Winning the SURE award helped him feel validated that the work he was doing had value and deserved to be recognized. Now, he feels more motivated than ever, adding, "They say that success breeds success – it feels much more feasible than it did before to win grants and prestigious awards."

Outside of research and his schoolwork, Nguyen likes playing ultimate Frisbee, competing in rock climbing competitions, and working as an officer for the Vietnamese Student Association on campus. He hopes to get his PhD in Chemistry with a focus on materials science or to pursue a research heavy MD career.

Timothy Walz, a senior in Chemistry, grew up in a small town east of Salem called Sublimity. At the age of ten, Walz recalls a presentation at his elementary school that was so cool he knew he wanted to do chemistry for the rest of his life. From there, chemistry research was an easy decision, not only as a logical next step in his career but as a way to honor that bright eyed ten year old fascinated by science.

Now, Walz has been doing research for almost a year under the advisement of Dr. **Kyriakos Stylianou**. Currently, he is working on a project to more greatly understand the stability of metal-organic frameworks (MOFs) in water. "This is done by creating the MOFs and characterizing them, submerging them in deionized water for one day, drying them, and finally

performing characterization again," Walz explains. This research explores a new route to remove CO2 from the atmosphere and oceans as well as exploring novel catalysis pathways. "Because of the scalability and tunability of MOFs," he describes, "this research along with other research like it could be invaluable to solving problems like global warming." The work he completed over the past summer through SURE will lay the groundwork for future research by contributing to a rating system for the stability of MOFs, allowing other scientists to determine which MOFs are best for their specific application.

The SURE program allowed Walz to jumpstart his career, giving him the tools to begin research much earlier than expected. The program helped him hone laboratory skills, work closely with a small team, and grow his confidence. Timothy adds, "Teamwork on a project such as this can be extremely motivating and rewarding because people are available to work with and push your boundaries." He credits his PI for helping him build confidence in the lab by slowly introducing new responsibilities and tasks at a rate that was challenging but not overwhelming. "For me, SURE was an invaluable tool that helped me determine that I wanted to go to graduate school and continue to be involved in research," Timothy notes. He suggests that anyone interested in SURE should take the opportunity in order to grow and understand more of what research is all about.

F: Prof. Kyriakos Stylianou
L-R: Matthew Nguyen, Jacob Lessard, Timothy Walz

CHEMISTRY DEPARTMENT LAUNCHES IUCCP:
the Industry-University Collaborative Conference Program

By Citlali Nieves Lira and Marilyn Rampersad Mackiewicz

We are pleased to introduce a new conference program in the Department of Chemistry at Oregon State University (OSU) called the Industry-University Collaborative Conference Program (IUCCP), which is strategically and intentionally designed to bring undergraduate and graduate students (domestic and international), industry representatives, faculty, and alumni together. The concept was derived and designed by Citlali Nieves Lira, an inspiring undergraduate student committed to building, that is guided by the faculty advisor, Dr. Marilyn Mackiewicz. The conference that Citlali Nieves Lira and Mackiewicz are planning to host is a 2-day conference IUCCP is expected to build a much stronger and needed connection to our alumni and industry partnerships that benefit our graduates. The 2-day conference will be packed with professional development (PD), networking opportunities, science communication, and interviews. On Day 1 of the conference, students will have an opportunity to attend PD skills workshops focused on networking, inclusive leadership, negotiation strategies, resume building, and conducting interviews. They will also attend presentations by alumni and career development panels and will end with a reception where students can engage and practice those networking skills with alumni and industry representatives. On Day 2, students will do oral or poster presentations to alumni, other students, faculty, and industry representatives looking for interns or hires. Toward the end of Day 2, there will be onsite interviews, dinner, and awards for student presenters. Sponsors' contributions will be recognized with named awards to recipients.

Our "Overarching Goal" is to build partnerships with industry and alumni to help connect our graduates (domestic and international) with internship and career opportunities outside OSU. IUCCP is the first of its kind in the chemistry department and the College of Science. Our students and faculty do great science at OSU and produce highly skilled graduates that deserve visibility, recognition, and jobs after graduation, and we expect it to grow in the next 5+ years. Particularly on our international graduates who wish to find jobs in the US. Students will be able to build key professional development skills and communicate their science to diverse audiences, have access to internships and job opportunities, and find mentors in potential alumni and industry representatives. We expect this to be a value-added asset to getting a degree in chemistry at OSU. Through these partnerships, we expect to learn from our alumni how our department is doing and what we could be doing better to serve the needs of our students and community and learn from the industry what skills our graduates will need to be equipped with changing landscape and growth in technology and automation. The IUCCP program provides a sustainable strategy for ensuring the retention of our graduates in the program when they know they have a future job opportunity. We are moving towards building a stronger chemistry beaver network! Join us.

If you are interested in learning more, or supporting the IUCCP with a donation please contact, Marilyn Mackiewicz at marilyn.mackiewicz@oregonstate.edu.

INSTRUCTOR SPOTLIGHT: Lou Wojcinski

By Lou Wojcinski and Grace Winningham

Lou Wojcinski is from Akron, Ohio and spent the first 28 years of his misspent youth there. After a BS in Chemistry it was off to complete a PhD in Chemistry at The Pennsylvania State University, a few gigs in between and finally to a position as an Instructor at Oregon State University.

The Wojcinski family currently consists of Lou, his wife Suzanne Dubnicka, three dogs, and a cantankerous old (she is almost 19) cat.

Lou chose the Department of Chemistry at Oregon State University because it has so many resources to help students become whoever it is they want to be. "There are just so many people who work hard to make the department a space where students want to be." The chemistry major has degree options that allow students to choose an area of specialization, including forensics, environmental chemistry or education. And when students have those sorts of options they can construct an experience that is meaningful to them. The Department has so many other resources like the Mole Hole and TAs that are truly invested in helping students learn chemistry and be successful—and all of that makes being an instructor at OSU more enjoyable. The faculty, the staff, the graduate and undergraduate students really do make Oregon State a great place to be.

"This job is about so much more than the chemistry and there have been so many experiences that have made this job meaningful," Lou notes. The last couple of years Lou has served as a marshal at OSU commencement, which on the surface, may sound a little bit boring. But students who he hadn't seen in a few years would come up to him and thank him for class. Two students in particular told him that if it weren't for his class, they would not have made it through their first term. For the past two years Lou has used short writing assignments in classes to give students a chance to write about themselves. And through these assignments Lou has learned so many things about his students that build a true sense of community and belonging in class. In those assignments, students have expressed both the pressure and the pride that comes with being first generation to go to college. Students who want to use what they learn to help people with eating disorders, who want to improve the financial situation of their family, who want to develop more sustainable agriculture practices. All of these things bring meaning to teaching for Lou.

More recently, Lou has been surprised to discover that so many of the things that are important to students' belonging and persistence has nothing at all to do with chemistry. The overarching goal of Lou's teaching is to increase the persistence of students in STEM so that they can be whoever and whatever it is they want to be. That persistence that is so important has less to do with chemistry and more to do with whether or not the work is meaningful to students. Everyone faces doubt at some point, and in those moments of doubt, students will persist if the work has meaning to them. When students get a low grade, if the work is meaningful to them they will find a way to move forward. If they miss class and need to get caught up, the same holds true. If the work is important to the students, the students will find a way to complete the work and continue. That may not be so much of a surprise as it is a change from what Lou thought about teaching earlier in his career.

So many people have played a role in Lou's decision to pursue a career in the teaching and learning of chemistry. He attended his first Biennial Conference in Chemical Education and felt overwhelmed by the number of different things focused on teaching and learning, and the number of people passionate about it. "It was just sort of an infectious thing," Lou describes. Additionally, at home Lou has had countless valuable conversations with his wife about teaching that have helped him become a better educator.

Over the course of his life Lou has learned a lot (or at least hopes that he has) from some challenging and difficult experiences. As a kid, Lou saw his mom fight a courageous battle with cancer that she would ultimately lose. Through multiple surgeries and numerous radiation and chemo treatments, Lou's parents always made sure that the kids were alright. Lessons about sacrifice, about the true meaning of courage, about moving forward when it seems like everything is telling you not to. These things, you don't get past them. There isn't any closure. You just move forward and carry what you can. Lou hopes that he has learned from that, and that he is a better man for it. He also hopes that his experience will allow him to show kindness and empathy towards students going through similar hardships. For challenges that are a little less "heavy," ask him about marathon running. Just make sure that when you start the conversation you have either lots of time. Because once you get him going on that, he isn't easily stopped.

To the extent that Lou is a successful teacher, the idea that serves him well is to meet students where they are so that he can help them become who they want to be. "There is a saying in dog training that you need to train the dog in front of you, not the dog you want. And the same is true for our students. We need to recognize them for who they are, not what we want them to be. And when we do that, we show the students that they have value as who they are. And from there, they can learn from a place of confidence so that real learning and real growth can happen."

The choice that Lou has made that has had the most value in his life is his choice of partner. And that is the most valuable choice by a lot. What is truly astounding is that she chose him. Moment of weakness? However it happened, Lou is eternally grateful that it did happen.

Lou believes that teaching should truly be focused on the students, a thing that is easy to say and hard to do. Students come into our classes with aspirations that are theirs. With apprehensions that are theirs. And if we can build spaces where students are recognized as their true selves, if we can help them focus on and achieve their goals, if we can help them navigate the uncertainties, our students will be successful on their terms. Those things provide meaning to the students. And if it is meaningful to the students, it is meaningful to Lou.

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GRADUATE STUDENT SPOTLIGHT
Alyssa Johnson

By Alyssa Johnson and Grace Winningham

Alyssa Johnson is a graduate student from Lincoln City, Oregon, studying Inorganic Chemistry here at Oregon State. When she was in high school she wanted to become a forensic chemist, thanks to her interest in the television shows NCIS and CSI. Alyssa would talk to her grandpa about it all the time, and she even started undergrad as a forensic chemistry major, switching to traditional chemistry later for the flexibility it would provide her after graduation. Ever since Alyssa was a kid, she was interested in science and chemistry, having fond memories of creating "experiments" with her grandma, namely making cookies and homemade playdoh.

Instead of choosing someone that has influenced her the most, Alyssa notes that all of the people around her have helped mold her into who she is today. From teachers, to members of the community who reached out during difficult times, they all have had an influence on who she has become and how she tries to lead her life. Alyssa mentions that there are so many instructors she really enjoyed working with. Dr. **Cassie Siler**, Dr. **Rick Nafshun**, Dr. **Michael Burand**, **Paula Weiss**, and more have all fostered her excitement for teaching. She loves working with **Margie Haak** and being able to ask conceptual or technical questions about class. Alyssa adds that working with Dr. **Dennis Drolet** has been lovely, as he is "such a lively individual", and working with Dr. **Lou Wojcinski**, Dr. **Tim Zuehlsdorff**, and Dr. **Paul Cheong** while being a TA for honors general chemistry was also enjoyable. One of Alyssa's favorite courses was Dr. **Mas Subramanian**'s Solid State Chemistry course, because of his ability to introduce so many applications and structures being used in devices we commonly interact with. She has also loved taking PAC classes to keep her active through the year.

Although Alyssa had to switch groups two years into her degree, what felt like a setback actually gave her the opportunity to get a teaching certification and discover a love for teaching. She attributes her academic success to learning how to ask for help, and knowing that it isn't a sign of weakness to reach out. People are rooting for you to succeed, but unless you tell them what you need, they can't help you. Another choice that has been valuable to her, Alyssa adds, is taking a full 24 hours off work once a week, to prioritize mental health needs and improve all areas of life. She also tries to bond with her cohort outside of work so that their connections remain strong even after graduation.

Due to her excellence as a student and TA, Alyssa received the opportunity to become the Head Teaching Assistant (TA) for the chemistry department, allowing her to work closely with instructors on course development and receive the chance to be an instructor for general chemistry. The Head TA role is tailored towards helping other TAs navigate being a teaching assistant. She helps design presentations used in lab, write project descriptions, participate in weekly TA meetings, and trains TAs before each term so they are adequately prepared to support the class. The position has helped her see the other side of the classroom and everything that goes into a course. Getting to be an instructor in two classes as a graduate student is a rare experience, and solidified Alyssa's desire to become a teacher after graduation. She wants to help students understand chemistry topics so that it doesn't seem so scary, and notes that OSU has helped make that dream a reality.

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Lou came by his teaching philosophy in a way that might seems unconventional. In the Netflix series "Coaches Playbook" (teaching philosophy by TV is a little odd), Doc Rivers described the philosophy of ubuntu. Ubuntu is a Bantu word that means something like humanity toward others, or our collective humanity. For Doc Rivers and his teams, it translates into the idea that "I cannot be all that I can be, unless you are all that you can be." By first creating space for students to become all that they can be, Lou is able to be all that he can be. That is the goal.

In the area of STEM teaching and learning, Lou believes that increasing attention will be paid to the psychological and sociological aspects of teaching. A great deal of work has been done on sort of the connectedness ideas of concepts in science disciplines. The idea that you need to understand concept A to understand concept B. And to be clear, all of that work is important. The questions we will start exploring are questions about how we can create environments where students can persist in STEM. Students will persist if they feel like they belong in our classes. We need to help students develop a sense of autonomy so that they recognize that they determine outcomes. And we need our students to be able to appreciate their mastery of skills and concepts. All of the content and all of the learning depends on belonging, autonomy and mastery. Academia needs to have more conversations about these ideas.

Lou has been vegetarian for 24 years (maybe surprising) but in a previous existence, he ate 50 wings in just over 8 minutes (shocking).

As a hobby (or obsession) Lou is an avid runner. If you are crazy enough to go looking, you can find him doing that on the Campus Way bike path or other roads and trails around Corvallis.

YOUTH EXPLORE, INVESTIGATE AND DISCOVER at fun-filled annual Juntos Chemistry Camp

By: Hannah Ashton (originally printed in IMPACT Magazine)

On a sunny June afternoon, 20 high school students from across Oregon stood in a college chemistry laboratory watching a balloon. Their eyes widened as it began to shrink and turn into a wrinkled but rigid ball of rubber. No magic was involved — just liquid nitrogen.

The students were a part of the Juntos Chemistry Overnight Camp (JCOC), an annual event designed to introduce Latino high school students to STEM, particularly chemistry, while providing a sampling of college life at Oregon State University.

"Chemistry is a central science that impacts everyday lives. Everything that we eat, touch, see or hear, there is some chemistry involved," said co-organizer Professor **Chong Fang**, a leading chemist in implementing femtosecond laser spectroscopy. "The high school students get an authentic taste of why we love the subject through the two-day JCOC event that is action-packed, engaging, informative and fun."

The fifth annual camp brought students from seven different counties across Oregon, including Deschutes, Jefferson, Polk, Yamhill, Multnomah, Marion and Lincoln. This year's camp was jointly funded by OSU Open Campus in addition to a National Science Foundation grant.

Campers stayed in Tebeau Hall, a residence building dedicated to the first African American male to earn a degree at Oregon State. After settling into their rooms and then heading to Linus Pauling Science Center (LPSC) auditorium, campers listened to Fang and Department of Chemistry Head **Wei Kong**, who shared their own experiences in STEM.

Throughout the two days, students participated in a sample introductory general chemistry lab investigating the colors of Gatorade corresponding to different flavors. They met University Distinguished Professor **Mas Subramanian**, the Oregon State chemist who discovered YInMn Blue, the first blue pigment in over two centuries, now a Crayola crayon called "Bluetiful". Students also visited Fang's ultrafast spectroscopy lab for molecular "movies" in LPSC and performed a second chemistry lab analyzing the "hardness" of drinking water. New this year, undergraduate researcher **Citlali Nieves Lira** in chemist **Marilyn Mackiewicz**'s research lab gave a presentation on "How to Pay for College" that was well received by the campers.

This gives me more motivation to try harder in school," one camper said.

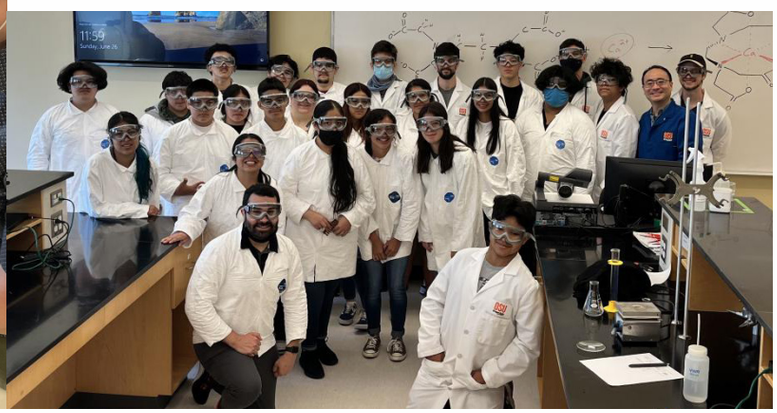
A yearly favorite, day one of camp finished with a science-themed Jeopardy competition involving the shrinking balloon and Elephant toothpaste, a seemingly "explosive" reaction of a foamy substance created by the catalytic decomposition of hydrogen peroxide.

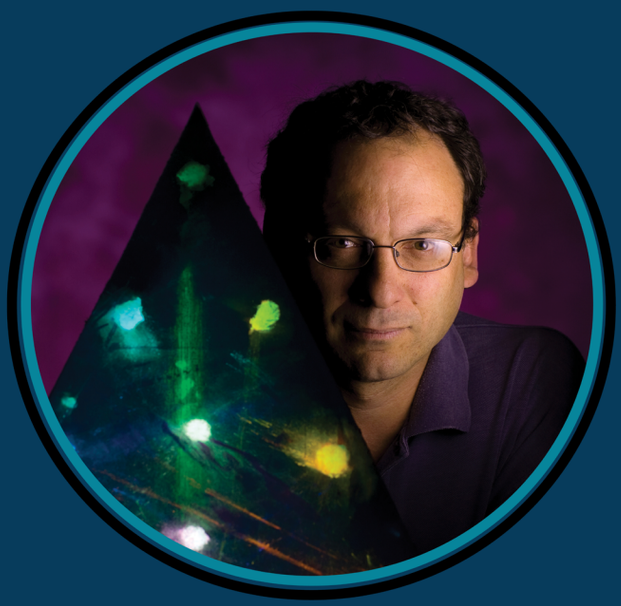
Before Saturday dinner on campus, an afternoon dessert also involved a little science, using more liquid nitrogen to create homemade ice cream.

"I love co-hosting this camp because students from various parts of Oregon with varying degrees of interest in post-secondary education and STEM get a sneak peek of what it's like to be a college student," said **Jose Garcia**, Open Campus and Juntos program coordinator. "Students come with pre-conceived notions of what residence halls, classrooms, recreation facilities and laboratories might be like and experience such spaces around campus for themselves. They can, more realistically, imagine themselves in those environments in the future."

In addition to Fang and Garcia, campers were accompanied by Chemistry graduate students **Taylor Krueger** (lead chaperone), **Jay Solaris**, **Seth Johnson** and **Logan Lancaster**, all part of the Fang Research Group.

The high schoolers described their camp experiences as "interesting," "fun" and "family feeling." Many decided they would apply to Oregon State in the future.





Background:
After my PhD at OSU I worked at Sylvania Lighting for four years doing phosphor R&D - mostly for plasma display. But I really wanted to teach (and live in the Pacific Northwest) so I applied to CWU when this position came open.

Favorite OSU Memories:
At my PhD defense I had a temperature of like 102. It was an out-of-body experience.

Research:
I think teaching is one of the most rewarding jobs a person can have. Watching students grow from confused first-year into chemists is a lot of fun. I also enjoy exposing students to materials chemistry in the research lab - it's a topic undergraduates don't see a lot of.

In my 21 years at CWU I have had the pleasure of conducting research with a number of talented undergraduates. Five of these students have gone on to OSU to get PhD's in materials chemistry.

I got my first job at Sylvania because I was one of the few people they interviewed that actually had experience with phosphor science. It is still what I do in my lab every day. Almost all of the research work I've done as a professional begins with the training in materials chemistry I received under Prof. Keszler at OSU.

Passions Outside Work:
I love to play music - I'm the bass player in a classic rock cover band.

Advice for Current Students:
Find what you are passionate about. Pursue the thing that always makes you think "that's really cool!". Then you will never feel like you're working.

Anthony Diaz

Professor of Chemistry
Central Washington University

Oregon State University

ANDREW CLIFFORD Awarded NSF GRFP

Working under **Wei Kong**, chemistry department head, **Andrew Clifford**'s research focuses on using Serial Single molecule Electron Diffraction Imaging, or ss-EDI, to explore the structure of proteins. The majority of proteins have structures that remain a mystery. Existing methods have limitations that prevent them from being used. By using the ss-EDI technique, he hopes to surmount these challenges. This technique uses electrons to take several pictures of a molecule in different orientations to capture its structure. "I hope to work on different-orienting molecules using a laser with elliptical polarization," he said.

Clifford graduated from the College of Idaho where he studied chemistry and mathematics. He was also member of the swim team where he earned multiple All-America honors and set several school records.

Clifford chose to come to Oregon State for his Ph.D. because of the supportive research environment. "I was impressed with how kind and inviting Dr. Kong and the other physical chemistry PIs were. I also love Corvallis and how accessible cycling, hiking, fishing and surfing are," said Clifford. One unexpected perk of campus has been seeing the many flowering trees and bushes bloom in the spring. "I'm tragically allergic to them, but they are beautiful."

Clifford is also the recipient of the Provost's Distinguished Fellowship and Scholarship.

Chemistry Ph.D. student Andrew Clifford.
Read the whole article here: https://chemistry.oregonstate.edu/impact/2022/06/graduate-students-and-alumni-snag-top-nsf-fellowships

UNDERGRADUATES OF THE QUARTER
Fall 2022

By: Taylor Linsday & Grace Winningham

Taylor Linsday grew up in a small town bordering the northwest corner of Albuquerque called Rio Rancho, New Mexico. She chose OSU at first because she was initially drawn to major in Earth Sciences with an Ocean Science option, but quickly changed to chemistry in order to challenge herself and get a broader degree.

Taylor got into research with the help of one of her experimental chemistry professors, who put her in contact with researchers after she mentioned her love of mathematics one day in class. Now, Taylor works in Dr. **May Nyman**'s group as an undergraduate involved in their carbon capture project. Currently she assists in the synthesis of several tetraperoxo structures so their carbon capture abilities can be characterized.

Outside of academic pursuits, she enjoys swimming, rock climbing, and playing the flute (or a member of its family) in band ensembles. Taylor is a part of OSU's Spirit and Sound marching band in the fall and during the offseason plays in the basketball and campus bands.

Her favorite book is either The Outsiders or The Lost City of the Monkey God. Some of her all-time favorite foods include sopapillas, green chile, tamales, enchiladas, or any Mexican cuisine.

Looking to the future, Taylor plans on attending grad school here in Oregon but is still figuring out what she wants to focus on studying in that time.

We're so proud of Taylor and everything she's accomplished while at OSU, and we can't wait to see what she does in the future.

By: Jacob Lessard and Grace Winningham

Jacob Lessard grew up in Grants Pass, Oregon and attended Grants Pass High School. He has always had an interest in how life works at the molecular level and appreciates how chemistry allows him to investigate both material and biological sciences.

Growing up in Oregon, OSU stood out to Jacob due to its reputation for science education and the abundant research opportunities available. After taking an integrated lab course taught by Dr. **Kyriakos Stylianou** (CH 462), Jacob felt inspired to reach out and show interest in this professor's research, particularly the use of metal organic frameworks as catalysts for the synthesis of organic molecules. Since then, he's been performing research under Dr. Stylianou in the Materials and Discovery lab, focusing on studying metal organic frameworks as photocatalysts for the synthesis of deuterated drug molecules.

Outside of school, Jacob enjoys watching sports, hiking, camping, cooking, and traveling. His favorite book is Siddhartha by Hermann Hesse, and his favorite food is jambalaya.

After graduation, Jacob plans on attending graduate school and continuing his focus on materials chemistry and catalysis.

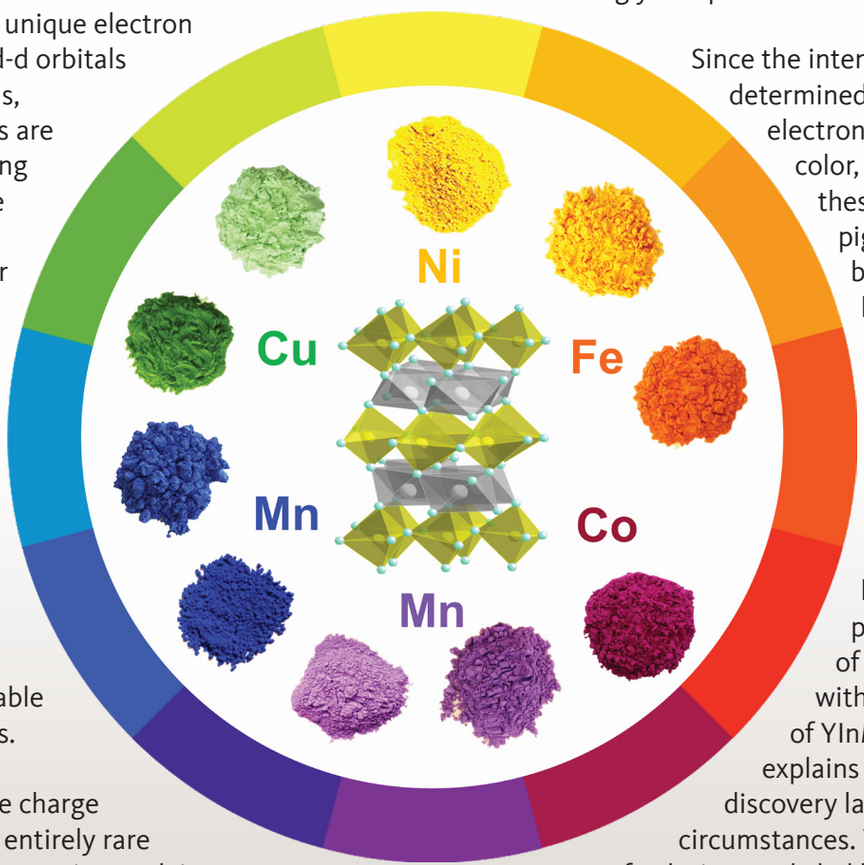
We couldn't be more proud of Jacob, and wish him all the success in his current and future research and education.

SUBRAMANIAN AND LI Publish in Nature Review Materials

By: Brayden Tuers

In their most recent publication, featured in Nature Review Materials (Impact Factor 70): *Challenges in the rational design of intense inorganic pigments with desired colors*, **Mas Subramanian** and **Jun Li** clarify the immense natural hurdles that stand before the development of inorganic pigments, summoning chemists to the horizons of rational design.

Due to the unique electron transitions in the d-d orbitals of transition metals, inorganic pigments are capable of absorbing wavelengths in the visible spectrum and reflecting their complementary colors. Notably, the crystal structures of these d-d electrons are inclined to charge transfers which produce distinctly vibrant colors with high stability and favorable resistance qualities.



While these charge transfers aren't an entirely rare phenomenon, Subramanian explains that the preponderance of compounds which can cause them tend to absorb wavelengths in the ultraviolet spectrum—unobservable to the human eye. Furthermore, the energetics of these transitions are often difficult to quantitatively compute and predict, forcing scientists into a game of trial-and-error.

Even in the case that visible color can be generated, the intensity of this color is intractably variable. Subramanian explains that the intensity of a color is determined by the probabilities of d-d electronic transitions, which are, in fact, a quantum violation. Since these two orbitals don't exhibit wave function parity, they breach the Laporte selection rule. In special cases, d and p orbitals can mix in coordination polyhedrons and essentially modify this rule, yet this is rare in the chromophore structures which create pigments. According to Subramanian, calculating these transition probabilities is also exceedingly complex.

Since the intensity of a pigment is determined by the same obscure electronic processes as color, harmonizing both of these characteristics in a pigment is a meticulous balancing act in the lab. Oftentimes, Subramanian adds, some serendipity is necessary.

While the precise methodology of pigment creation has seen impressive progress at the hands of his team, beginning with the 2009 discovery of YInMn Blue, Subramanian explains how this past discovery largely banked on fluke circumstances. YInMn was the result of a design study led by Subramanian to synthesize multiferroics, not inorganic pigments. Nonetheless, after this chance discovery over a decade ago, Subramanian has since embarked on a quest to demystify the chemistry of these colorants.

Closing the publication, Subramanian alludes to the optimistic prospects of this lengthy quest: while it may be difficult, it's certainly not impossible. You can read the article in its entirity here: https://rdcu.be/VtFZ.

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