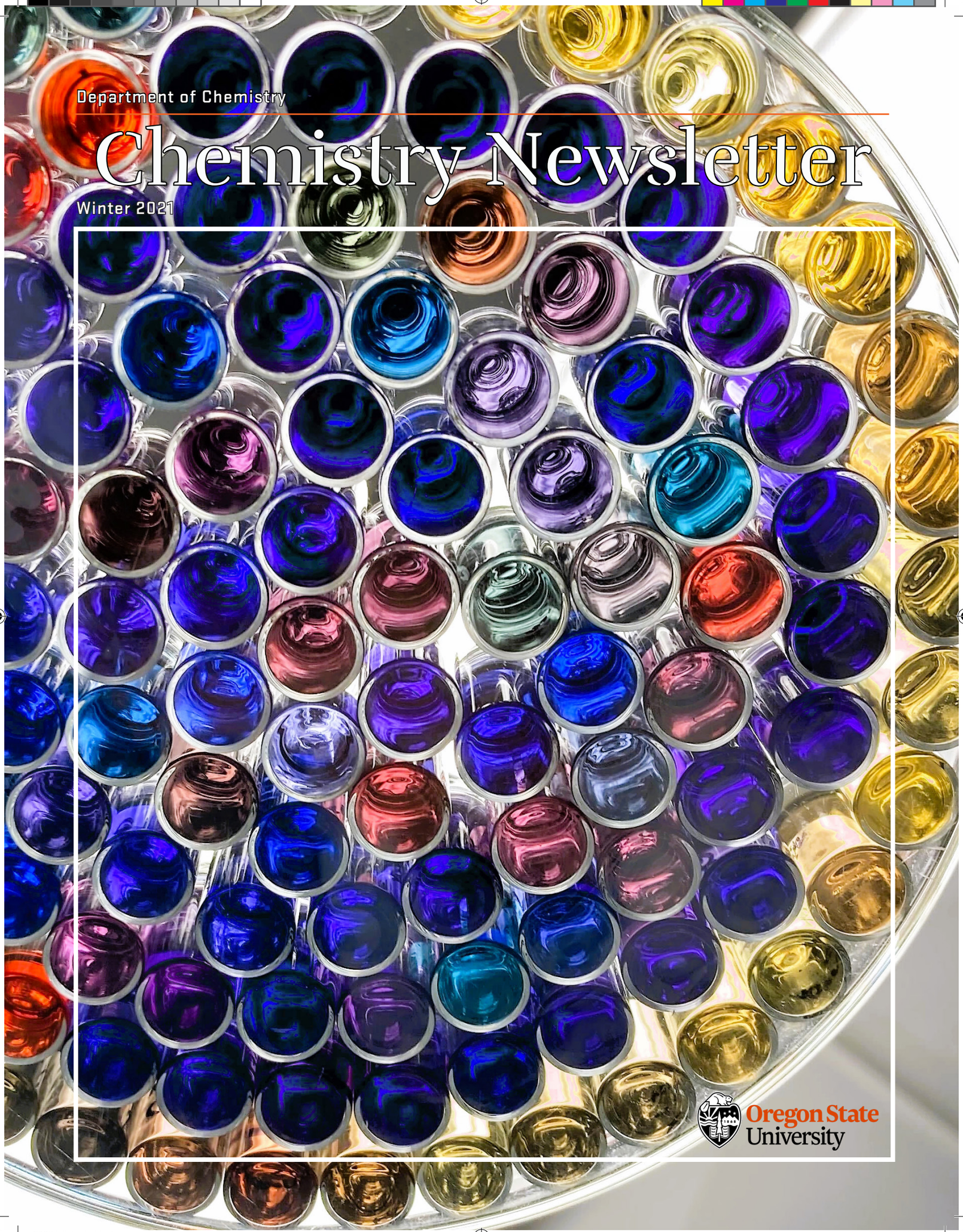

Department of Chemistry

Chemistry Newsletter

Winter 2021

Oregon State University

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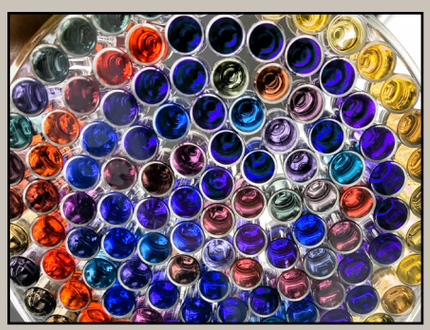
On the cover: Array of silver



nanoparticles with varying sizes and shapes that produce a tunable rainbow from the Mack Lab
Photo Credit: Citlali Nieves Lira

Expanded stories available online:
blogs.oregonstate.edu/erlenmeyer

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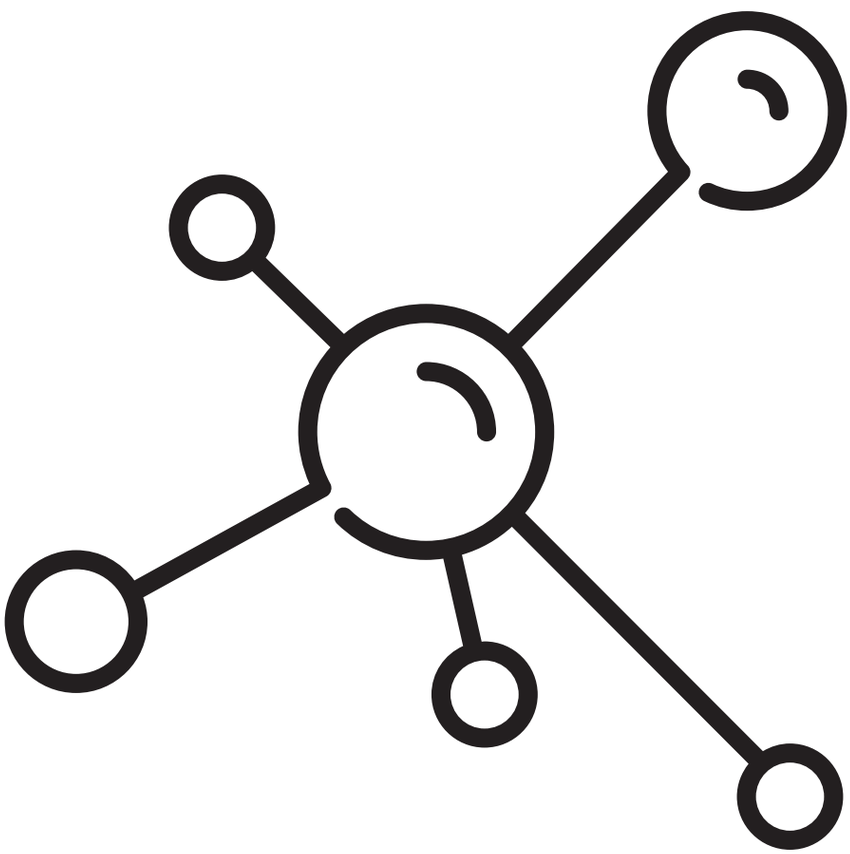

A MESSAGE:
From The Department Head

Hi Chemistry Department members and friends,

It's great to report to you that our Fall term has been a success – the return to campus went smoothly and faculty, staff and students were thrilled and grateful to be able to interact in person once more. There were no Covid outbreak clusters among our community members, and student learning and success seems to have benefitted from the re-introduction of face-to-face classes and activities. Some sad notes, however, were the loss of Professor **Steven Gould** and Distinguished Emeritus Professor and former Chair **Darrah Thomas** this year. In December, we had a memorial service to recognize Darrah's life and contributions.

I have some faculty transitions to report. **Doug Keszler** and **Kevin Gable** retired at the end of December and will join our emeritus faculty. I retired at the end of January and will be starting a position at Ford Motor Company, focusing on their EV battery development. Following a search led by Professor Steve Giovannoni (Head of Microbiology), **Wei Kong** has been selected and has agreed to become our Chemistry department Head starting in February. We are in good hands! We are also in the midst of searches for tenure-track and fixed-term faculty in organic chemistry, and so we will soon welcome new faculty members.

We welcome home a couple of our faculty members from extended time abroad on sabbatical. Welcome back to **May Nyman** (from Germany) and **Paul Cheong** (from South Korea). May was recently invited to serve on the Angewandte Chemie International Edition (ACIE) scientific advisory board, and while away she learned of a new $1.5M award on direct air capture of CO2. Paul's group is extending their connections in South Korea - his graduate student (Gisela Gonzalez-Montiel) was part of a student exchange program with Pusan National University under the Brain Korea / Korean National Science Foundation Initiative.

It's great to realize that our faculty research is highly interdisciplinary and we collaborate across traditional boundaries! To cite one example, **Chong Fang** and his research group have been collaborating with Oksana Ostroverkhova's group (in Physics) and Seri Robinson's group (in Wood Science and Engineering) on fungi-derived pigments, resulting in four joint papers this year. Additionally, Chong has an active collaboration with **David Ji** (at OSU Chemistry) and Alex Greaney (at UC Riverside Engineering) on a joint NSF CBET grant on new battery chemistry. It's wonderful to not also that Chong is the 2021 College of Science Milton Harris Awardee for Basic Research in Science.

Rich Carter has been working on policy at University level – specifically leading the movement to better recognize faculty innovation and entrepreneurship contributions in the promotion and tenure process. He's the lead author on a recent paper in Science detailing the issues and outlining a pathway forward.

Our integrated lab instrument renewal project is closing in on a final phase. So far we've raised (and spent) about $400,000 towards new instrumentation that supports this innovative, capstone lab experience for our chemistry majors. This is about 80% of way to our ambitious target, and it's a great pleasure now to walk through the labs in Gilbert Addition and see so many new tools for our students to learn about and then also use in their research projects. Thank you to all the donors, faculty and staff who made this happen, and I hope a few more donations will help us complete the "wish-list" purchases. A special thank you to students and friends of **Joe Nibler**, who, for his 80th birthday, surprised him with contributions to an endowed scholarship fund in his name. This will be used for a graduate scholarship to focus on laboratory experiment developments in the integrated lab, an effort which engaged Joe in much of his career.

Finally, I'm happy to share that Inpria Corp., founded by Doug Keszler, sold for an extraordinary sum of $514 M to JSR Corp. in November. The sale demonstrates well the value of the Department's groundbreaking research.

Hopeing you all had a happy, healthy and relaxing Winter holiday and break, and a wishing you a wonderful year to come!

Regards,
Mike

PREDICTING OPTICAL PROPERTIES OF COMPLEX SYSTEMS: Some recent research in the Zuehlsdorff Group

By: Tim J Zuehlsdorff

Light-matter interactions are at the heart of a variety of physical processes, including solvatochromism, bioluminescence, the triggering of photoreceptor cells in vision and photosynthesis. Computational approaches capable of describing these processes have a wide range of potential applications, from developing novel biomedical imaging approaches to designing next-generation solar cells. In practice, however, predicting even relatively simple light-matter interactions, such as absorption or fluorescence spectra of solvated dyes, can be very challenging. The absorption spectrum is strongly influenced by complex interactions between the dye and its solvent environment (see Fig 1), as well as the complex interactions between electrons and nuclei that give rise to vibronic features, and modeling both effects with sufficient accuracy is computationally demanding.

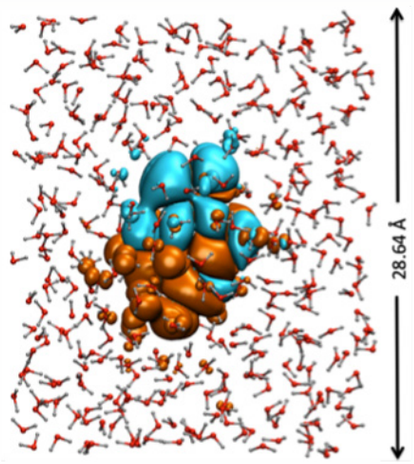

Figure 1: Excited state electron density of Alizarin in Water

In the Zuehlsdorff group, our aim is to develop the computational tools necessary to study light-matter interactions in a wide range of systems, from complex biomolecules to nanostructured materials[1,2]. A specific focus of ours is to understand how the immediate environment of pigments can change their optical properties, a problem that is relevant for understanding how light-harvesting complexes in plants convert sunlight into energy with very high efficiency. We address this problem by using approximate, highly efficient computational approaches to solving the time-dependent Schrödinger equation that run on Graphics Processing Units (GPUs), rather than conventional CPUs. This allows us to treat all electrons in our pigment and its surrounding environment purely quantum mechanically, which is vital for correctly modelling polarization effects.

Still, even using fast GPUs, calculating optical spectra requires thousands of individual calculations to model how the nuclear vibrations of the molecule couple to the electrons to crate the spectral shape. To address this problem, we aim to make use of machine-learning (ML) techniques: Training a ML model on a small set of possible configurations of the dye in its complex environment can be used to accurately predict the excitation energy of other configurations, dramatically reducing the computational cost associated with predicting spectra[3].

Recently, we have focused on addressing another challenging problem when attempting to predict absorption spectra in solvated dyes, that results from a breakdown of the Born-Oppenheimer approximation. This approximation asserts that, because nuclei are much heavier than electrons, their movement can be treated separately. However, in certain instances, specifically when two excited states of a molecule are very close in energy, this approximation can start to break down. The breakdown can cause specific spectroscopic features in the absorption spectra of simple organic chromophores, such as intensity-borrowing between excited states.

In our recent study in collaboration with the Chin group at Sorbonne Université, we demonstrated that a strong shoulder in the absorption spectrum of Methylene Blue was caused by the mixing of a bright (dipole-allowed) and a dark (dipole-forbidden) excited state[4]. Only by going beyond the Born-Oppenheimer approximation, fully accounting for the coupling of electronic states to each other and to nuclear degrees of freedom, both in the chromophore and the solvent environment, could we reproduce a spectrum in close agreement with experiment (Fig. 2). Specifically, we also found that the amount of mixing between the two excited states

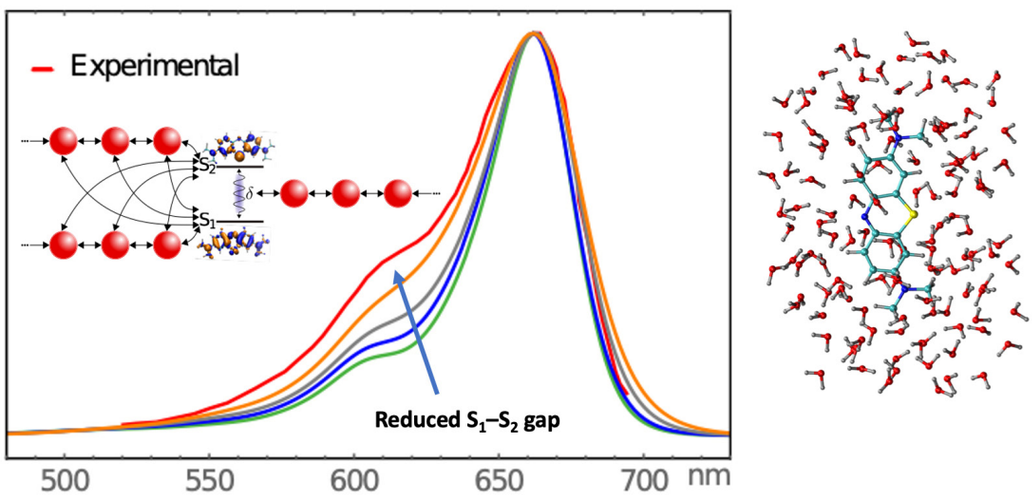

Figure 2: Absorption spectrum of Methylene Blue in water when including effects beyond the Born-Oppenheimer approximation

is strongly influenced by interactions between the chromophore and the solvent environment, suggesting that commonly used approximate computational treatments of the environments can lead to significant errors.

Future research of the Zuehlsdorff Group will focus on exploring nonadiabatic effects caused by the breakdown of the Born-Oppenheimer approximation in other systems. One specific target are porphyrin molecules, where the low energy absorption spectrum is caused by a mixing between two distinct electronic transitions. Furthermore, we are very interested in exploring how important nonadiabatic effects are in pigment-protein complexes, which represent a much more challenging example of chromophores embedded in structured environments. Our ultimate goal is to better understand how protein environments can fine-tune optical properties of embedded pigments, and the computational toolset we have developed over recent years is ideally suited for tackling these complex systems.

[1] T. J. Zuehlsdorff, S. V. Shedge, S.-Y. Lu, H. Hong, V. P. Aguirre, L. Shi, C. M. Isborn, "Vibronic and environmental effects in simulations of optical spectroscopy" Annu. Rev. Phys. Chem. 72, 165-188 (2021)
[2] T. J. Zuehlsdorff, A. Montoya-Castillo, J. A. Napoli, T. E. Markland, C. M. Isborn, "Optical spectra in the condensed phase: Capturing anharmonic and bibronic features using dynamic and static approaches" J. Chem. Phys. 151, 074111 (2019)
[3] M. S. Chen, T. J. Zuehlsdorff, T. Morawietz, C. M. Isborn, T. E. Markland, "Exploiting machine learning to efficiently predict multidimensional optical spectra in complex environments" J. Phys. Chem. Lett. 11 (18), 7559-7568 (2020).
[4] A. J. Dunnett, D. Gowland, C. M. Isborn, A. W. Chin, T. J. Zuehlsdorff, "Influence of non-adiabatic effects on linear absorption spectra in the condensed phase: Methylene blue", J. Chem. Phys. 155 (14), 144112 (2021).

Office Manager & Assistant to the Department Head, Paula Christie presents a retirement gift from the Department to outgoing Department Head, Mike Lerner at the Departmental Holiday Party.

Want to keep up with everything happening in the department? Check out our **social media**!

IMPROVED CHEMSTORES TO THE (COVID) RESCUE!

By: Rusty Root

Over the last several years, we have been on a continuous improvement mission with ChemStores. When I took over the store, we were functional but not fulfilling our Customers' needs or the Chemistry Department's budgetary goals for the store. Specifically, we had no stock of items we reported to carry and were not financially solvent.

Keeping products in stock

The number one complaint when addressing our customers' needs was that we were habitually out-of-stock on certain items. We did not have a matrix to measure our outs, so **Paul Weatherford** and I started tracking the number of SKUs with zero stock. We found that of the 2100+ items ChemStores stocks, we were "out" of 100 products. Now we had something we could focus on. We immediately focused on ordering "on time" according to our reorder points for each product. This focus immediately impacted the stores product availability; we had dropped our "out-of-stocks" to the 50s. When Paul left the Chemistry Department, and **Sierra Hansen** took over as the Storekeeper, we created tools to assist with reordering. The program looks at the entire inventory on hand, reports which items are at the below reorder point set by store management, along with which items are already on order, and prioritizes those items that need to be ordered. The use of the reordering tools dropped the "out-of-stock" from the 50s to the teens. Our customers were pleased.

Another area of improvement was the appearance and layout of the store. The store is a warehouse-style operation. But that did not mean it had to look like a warehouse. There have been considerable effort in moving overstock from the main store to into storage rooms. The store's layout has been a work in process, where we have grouped like items for easier shopping and convenience. There has been a lot of work on updating the signage of the rows, shelves, and product labels to assist the customer in locating items and determining what the product is.

Reaching solvency

ChemStore's goal is to be a breakeven work center. That means, it'd be financially self-sufficient, not necessarily needing to make a profit, but not costing the Department funds to operate either. The Arts and Science Business Center (ASBC), monitors and report the financial status of the ChemStores for us. This reporting was initially done on an annual basis. Once a year, we would hold our breath and see how we did. The news was not always good. We would make changes, but we had no way of knowing if we were making progress till it was too late. So we started collecting our own financial data and, with the assistance of ASBC, began reviewing the results quarterly. The quarterly reports gave us a better chance to adjust mid-year, but the granularity was limited. There was financial information outside of inventory purchases and sales that we just didn't have. I.e., Overhead costs with labor, rental fees, and such. So we started gathering information from Banner through Core reports to add that missing financial information and compare our data

with what was being reported to Banner. The adjustments to our reporting process were not minor, but we're happy to say our financial situation has dramatically improved. We now reliably report to Department Head, **Mike Lerner** to reduce any surprises at year-end.

ChemStores to the rescue

Over the past couple of years, the number one topic has been the COVID-19 Pandemic. We've had work suspensions, campus close-downs, remote classes, cleaning, personal protection requirement, etc. Through all of this, ChemStores has come to the rescue. When the pandemic became real to the U.S. and specifically Oregon, there was a huge demand and shortage of sanitizers, cleaning supplies, and personal protective equipment. The store jumped into action. With an inventory of ethanol, we created a recipe for surface sanitizer. Once we had the surface recipe, we modified it for hand sanitizer. The goal was to generate spray bottles for sale/distribution. We quickly discovered the materials, including spray bottles and aloe, were in also short supply. With the stores vendor network, ChemStores was able to minimize the product availability gap and keep production flowing. And yes, it was a lot of work. The Store Manufactured almost 2,500 gallons of surface sanitizer and over 1,000 gallons of hand sanitizer. Most of the product was packaged into 2,400 16 oz and 4,000 32 oz spray bottles. Beyond sanitizer, we also purchased and stocked KN95 masks, nitrile gloves, disposable face masks, face shields, and Clorox surface wipes.

When the university closed operations on campus, the ChemStores stayed open; critical research was still ongoing, and products were needed. When it was discovered that temperature-sensitive and time-critical deliveries were not being made on time, Chemstores, worked with Campus Printing and Mailing, UPS, FedEx, and other carriers, and took on the added responsibilities of receiving mail and packages for the entire College of Science as well as other departments on campus. **Jak Packtor**, ChemStores Warehouse worker, recorded all deliveries and contacted all recipients about waiting packages. Because of Jak's hard work, if there was ever concern that a package had been "lost", we could track the package from receipt at Gilbert to who and when it was picked up. There was no single instance of a lost parcel.

Current Economic impact

The current hurdle for Sierra Hansen and the ChemStores crew is the shipping delays and production shortages. There are currently 40 open purchase orders with 66 different products on order for ChemStores, with the oldest order being from April 13, 2021. In addition to the long delays, we've seen costs skyrocket. Nitrile Gloves have surged, vials now have lengthy delivery times, and pipette tips take forever. Sierra is searching for deals, finding new vendors, and working with existing vendors to get our customers' the products they need.

ChemStores future

I still have a goal of taking the sales of ChemStores products online. A customer could shop from their desk and purchase their items. Staff would gather the items, and the customer would pick-up in store. Once that process is operational, the next phase is to offer delivery of said orders, for a nominal fee, of course.

While the ChemStores team has come a long way to improving our professionalism in maintaining and operating ChemStores, we are not done. There is a saying that continuous improvement is a journey, not a destination; we are on that journey.

IN MEMORY:
Of those we've lost...

T. Darrah Thomas
April 8, 1932 - Aug. 7, 2021

T. Darrah Thomas died at home Aug. 7, 2021 of pancreatic cancer.

Darrah was born in Glen Ridge, N.J., to Woodlief and Jean Darrah Thomas April 8, 1932. His mother died when he was a young child and Darrah and his brother Woody were sent to stay with his mother's parents, Thomas and Rose Darrah, in Panama. Darrah's father remarried in 1935, and Darrah gained a stepmother, Frances, and a stepsister, Barbara. Darrah grew up in Chevy Chase, Md., and graduated from St. Albans School in Washington, D.C. in 1950.

Darrah showed an interest in chemistry from an early age – trying to make explosives with his chemistry set in his parents' basement. He received his Bachelor of Science from Haverford College in 1954 and then went on to graduate school at the University of California, Berkeley, where he met and married the love of his life, Barbara Rassweiler in 1956. At Berkeley, Darrah did research in nuclear chemistry with Nobel Prize-winning professor, Glenn Seaborg. He received his Ph.D. from Berkeley in 1957 and stayed on as an Assistant Professor until 1959. After Berkeley, Darrah worked for Brookhaven National Labs from 1959 to 1961. In 1961 he became Professor of Chemistry at Princeton University in New Jersey.

In 1971, now a father of four, Darrah became Professor of Chemistry at Oregon State University, in Corvallis, Ore., serving as Chairman of the Chemistry Department from 1981 to 1985 and Director of the Center for Advanced Materials Research from 1986 to 1991. He won many honors, awards and fellowships during his long career in science and was named a Distinguished Professor Emeritus in 1997. Though based in Corvallis, he worked closely with scientists from Europe, Japan and Australia studying the energy spectra of electrons.

Darrah was passionate about his research and continued to be active in his field and involved at OSU well past retirement. His latest contribution, published in early 2021, addresses precise measurements and accurate calibration, a topic that goes back to his early interest in spectroscopy. His longtime colleagues, Catalin Miron and Leif Saethre, wrote of him, "Darrah Thomas is an amazingly active and creative scientist, an eminent professor and mentor, a close collaborator and respected friend." He was also an inspiring and highly regarded teacher for generations of chemistry students at OSU.

Darrah had a brilliant analytical mind and a huge curiosity about how the world works. This applied specifically to his field of chemistry but also broadly to his interest in history, politics, technology, nature, and people. He had a razor-sharp sense of humor and was quick with an aphorism such as, "Never attempt to teach a pig to sing; it wastes your time and annoys the pig," or a quote such as this one from Mark Twain, "If you hold a cat by the tail, you learn things you cannot learn any other way."

Darrah also had many interests besides his research and teaching. He and Barbara shared a great love of the outdoors including camping, backpacking, and snorkeling. He was an avid bird watcher and fly-fisherman. He and Barbara also loved travel, good food and wine, opera, theater, museums, and reading. They

passed all these interests on to their children and grandchildren.

As the family spread out around the world, Darrah and Barbara's house in Corvallis became the gathering point for the family. There were big family reunions, meticulously scheduled in Darrah's spreadsheets. But the Thomas home was also a place where the grandchildren knew they were always welcome to drop in and find a good meal, interesting conversation, dry humor, thoughtful advice, and where they could always borrow some camping equipment, go for a bird walk with Darrah in the Wetlands, or just read a good book on the sofa.

Darrah's son, David and brother Woodlief, preceded him in death. He is survived by his wife, Barbara; his son David's widow Laurel and their children Abigail, Elizabeth, and Lydia; his son, Steven and his wife, Astrid and their children, Cecilia, Peter, and Rebecca, and their grandchild, Paula; his daughter, Kathleen and her husband, Kim and their children, Jesse, Jacqueline, and James; and his daughter, Susan and her husband, Peter. He is also survived by his sister, Barbara and many nieces and nephews.

His family would like to thank

the staff from the Mennonite Village, especially Angela, Cathy, Demie, Era, Jamey, Joan, and Susan, for their support and devoted care.

In lieu of flowers please consider donations to the Nature Conservancy or the Greenbelt Land Trust, where Darrah was an active donor and member.

Steve Gould passed away on November 12, 2021 due to complications following a lung transplant.

Steve was born in New York City to Robert and Ruth Gould, and lived in Washington Heights until he was 10. He had one brother, Jay Gould, who was 3 years older. The family moved to Los Angeles in January 1956, and Steve grew up a Southern Californian. He attended University High School, then graduated Cum Laude from UCLA in 1966 at the age of 20, majoring in Chemistry. He attended MIT from 1966-1970, earning a PhD in Organic Chemistry under the direction of Prof. George Buchi. Steve lived in Zurich, Switzerland, from 1970-72 as a Postdoctoral Research Fellow with Prof. Duilio Arigoni. He had a Fellowship from the American-Swiss Foundation for Scientific Exchange. He was married in 1972 and divorced his first wife in 1979.

Steve had a long and rewarding scientific career. Following his Postdoctoral work, he was employed by Syva Research Institute in Palo Alto, California from 1972-74. In 1974, he was appointed Assistant Professor of Natural Products Chemistry at the University of Connecticut, School of Pharmacy, and in 1981 he was appointed Associate Professor in the same department. He was a member of The American Chemical Society.

In 1982, Steve returned to the West Coast with an appointment as Associate Professor of Chemistry at Oregon State University, Department of Chemistry, advancing to Professor there in 1983. At OSU, Steve established a large research group studying antibiotic biosynthesis. In 1991, he was awarded the College of Science Milton Harris Award at OSU. He was a consultant to numerous pharmaceutical companies, including Lederle Laboratories and Novo Nordisk.

A blind date in 1986 brought Mary Marshall into his life. Steve introduced Mary to Judaism and SCUBA diving, and Mary introduced Steve to folk dancing. Steve and Mary were married under the chuppah in Corvallis, Oregon in 1988, and their wedding included Klezmer, Swing, and folk dancing.

From 1989-90, Steve took a Sabbatical funded by a Fulbright Fellowship at the John Innes Institute in Norwich, England, where he learned the molecular genetics of antibiotic-producing Streptomyces bacteria. He incorporated this work into his research group upon returning to OSU. In his time off work, Steve and Mary made the most of their year in the U.K. by traveling around the country, and making friends who remained close for the rest of Steve's life. They returned to England many times in later years.

In 1997, Steve accepted a position as Executive Director of Natural Products Drug Discovery, Merck Pharmaceuticals, in Rahway, New Jersey. In 2002, he became Chief Scientific Officer of Mera Pharmaceuticals in Kona, Hawaii, and San Diego, California. Due to professional circumstances beyond his control, Steve retired in 2003 in San Diego.

Not content to be retired, Steve reinvented himself in 2004 with a very successful new career as a landscape and wildlife photographer, establishing Steve Gould Photography. He was active in the San Diego art community and showed his work in galleries and exhibitions. Some of his images can be viewed online at www.stevegouldphotography.com In 2015, he was the photographer for a book called "San Diego, California: A Photographic Portrait" which was published as part of a national series.

Steve was active in the San Diego Jewish community, and a member with his wife at Congregation Beth Israel. He and Mary were members of the Chavurah Shabbat there.

Steve loved to travel, and he and Mary went on many adventures, including three times to South Georgia and Antarctica, a safari in Africa, and tours in Alaska and Europe. SCUBA was a major love, and they went diving in many of the most beautiful locations around the world: the Galapagos Islands, the Maldives, Indonesia, the Caribbean, Palau and Yap Islands, the Red Sea, the Sea of Cortez, and Hawaii.

Steve is survived by his wife of almost 34 years, Mary Marshall, by his nieces Robyn Siers and Jamie Shatwell, Robyn's husband, Bret, and his grand-nephews Bret, Tyee, Lukas and Jaxon Siers and Miles Shatwell, and by his cousins Deborah Krass, Stephanie and Don Bryan, Tamara Bryan Murphy, Nathan Bryan, Garrison Singer, Rita Philipson, Jill Philipson, Sue Bloom, and Warren Winn. Donations in his honor may be made to the Congregation Beth Israel Hunger Project.

UNDERGRADUATES OF THE QUARTER
Fall 2021

Elias "Eli" Henderson has been named one of the Fall 2021 Undergraduates of the Quarter and we couldn't be prouder.

Eli was born and raised in Eugene, Oregon, and graduated from South Eugene High School, home of the Axe. He stated that he likes all science, but chemistry is, "so cool with so many different applications that it seems like a good place to begin." When asked why he chose OSU, Eli said it was mostly a financial decision. "I didn't want to pay out of state tuition and OSU has a good science program so I knew it would be a good fit."

Eli said he wanted to get into doing science that wasn't in the form of the normal courses. He wanted to be able to have a goal for a project that he could study on his own time. To that end, Eli is currently researching with **Marilyn Mackiewicz** in the Mack Lab. The Mack Lab focuses on making metallic based nanoparticles for biomedical applications. Eli works specifically with Nickel. "I have been working on making Nickel nanoparticles that are suspended in water.

While he's not 100% sure what his plans are post-graduation, he is currently working towards a focus in education, and contemplating getting a masters on his way to a teaching license to teach high school.

Outside school, Eli likes to rock climb and explore Corvallis. When he's exploring, he likes to find the small stores around town and see what is going on.

His favorite book is The End of Boys by Peter Hofmeister, a book he says he's just finished re-reading. The author was his English teach in high school, and is about the author's life growing up in Eugene. "It feels very familiar to me," Eli says. His favorite food is the curry at Thai Chili. He likes to go in on Fridays, saying it's a good way to wrap up the week.

Eli says he's really appreciative of this opportunity, and we're so happy to be able to provide it for him.

Chloe Ramsperger has been named one of the Fall 2021 Undergraduates of the Quarter, and we couldn't be more thrilled. Chloe grew up in Redlands, California, where she attended Redlands High School, home of the Terriers.

When asked why Chloe chose Chemistry, she said, "Ever since I was young, I have had a growing passion for forensic science. Having access to television, I would constantly watch crime shows such as Crime Scene Investigation and Criminal Minds, wishing I was the investigator or the forensic scientist solving the crime. I never thought that wish could become my reality. With my growing interest in forensic science, I entered Oregon State University (OSU) as a chemistry major with an option in forensics. At the height of the Coronavirus pandemic, financial hardships forced me to take a step back from research, so I started working at a dental office. While working there, I realized how much I missed doing research and that Chemistry was something that brought me joy and it was something I could always look forward to. At that moment I quickly realized the medical field is not where I wanted my career to be, leading me to believe I should be and want to pursue a Ph.D. in chemistry.

During her junior year of high school, her uncle flew her up to Oregon to visit universities in the Pacific Northwest. While visiting OSU, she fell in love with the campus, and she knew it would allow for innovation and give her the best education in comparison to other schools. Her decision was made.

She is currently doing research in Dr. **Kyriakos Stylianou**'s Materials Discovery Lab (MaD Lab), which has considerable expertise in the synthesis and characterization of metal-organic frameworks (MOFs). Over the summer, Chloe received the Summer Undergraduate Research Experience (SURE) fellowship, by which she began researching numerous organic transformations that could benefit from the use of a heterogenous catalysis. While looking at the hydrocyanation for the conversion of alkenes to nitriles, she stumbled upon the Strecker synthesis for amino acids. She found a considerable amount of published research on this one-pot synthesis, but nothing seemed to involve the use of a MOF exhibiting strong Brønsted acidity that does not compromise the framework, be an environmentally friendly synthetic route, and be cost effective. While this work is still in its early steps, this preliminary work has demonstrated a successful conversion and high percent yield using a MOF with Brønsted acid sites. These preliminary results were used as the basis for the development of the project proposed for the NSF Graduate Research Fellowship Program.

Chloe was at a poster presentation session for careers in chemistry, Dr. **Rich Carter** asked her where she saw herself in the future, to which she answered, "a forensic odontologist". At that point he told her about Dr. Dipankar Koley's research group, in which they used electrochemical techniques to fabricate sensors and different polymers to study dental plaque biofilms and restorative dental materials. She immediately sought out a research position in his lab because she knew she would gain valuable experience to prepare her for graduate school and become an independent researcher and mentor.

After graduation, Chloe hopes to work in industry for the remainder of the 2021-2022 school year then move onto graduate school to pursue a Ph.D. in Organic chemistry.

Outside of school Chloe loves to rock climb, hike, play volleyball, and listen to music.

In closing, Chloe stated, "though my academic career seems to be entrenched, by copious opportunities I have received, it could not have been done without the academic support from my mentors and encouragement from my parents. My undergraduate career at Oregon State University has solidified my ambition to become an educator, mentor, and communicator to transform chemistry."

NEW FACES In the Chemistry Department

Josh Windham grew up in a small community southeast of Eugene called Fall Creek. He studied chemistry and microbiology at Oregon State. He's worked in IT and construction for the past few years. He decided to take a job as our newest Lab Tech because it seems more interesting than what he was currently employed at and was more relevant to the degree he was pursuing. Welcome, Josh!

Oregon State University

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