Science Initiative News

Spring 2023

Program Updates

Applications for the 2023-24 LAMP Summer Institute and Yearlong Training were due on January 17th. Nearly 50 outstanding candidates applied. Successful applicants will be notified of their acceptance by April 3rd and the first workshop will be held in late April. The Summer Institute, centering on problem-based learning, will be held outside of Casper, WY from May 16 – 20. Five educators are nearing the end of their immersive year in the LAMP Educator Learning Community (ELC). Each of these educators completed a full SoTL research study which was presented at the Lilly Conference on College Teaching at Miami University in Oxford, Ohio. A full press release can be found in the UW News. During the Fall 2022 semester, 22 new LAs joined the LAMP Team, and all enrolled in the Best Practices in Active Learning course. For the first time, more than half of the new LAs opted to perform their own scholarship of teaching and learning (SoTL) research. The LA team for Organic Chemistry studied the difference in student satisfaction and learning across two sections of O Chem. This team of young scholars will present their research at the April 21st LAMP Coffee & Curriculum session.

The Science Initiative Roadshow has been traveling the state visiting with 950 students last fall and already touching 290 K-12 students this spring across four outreach events in four separate counties in Wyoming. The Roadshow has designed outreach lessons covering topics in neuroscience to energy, plate tectonics, and radioactivity. We are excited to welcome on board eight paid outreach assistants this spring who will be instrumental in designing, implementing, and evaluating the outreach and hands-on lessons delivered in the K-12 classrooms. The Roadshow is looking forward to seven more scheduled events this coming spring and offering a professional development and hands-on experience for K-12 teachers at the upcoming Level Up Conference sponsored by the Wyoming Department of Education.

IMPORTANT DATES

- LAMP Coffee & Curriculum is back this spring with select Friday sessions from 8-9am. On April 14th, we will welcome special invited guests, Henry L. Roediger III and Mark A. McDaniel (authors of Make it Stick: The Science of Successful Learning). Their session is entitled Techniques that Foster Effective Active Learning. A full schedule of sessions is available.
- Save the Date for the next University of Wyoming STEM Carnival, Friday, September 8th. This year we will be featuring the brand new Engineering Research and Education Building.
- WRSP applications for academic year 2023-24 are open on the WRSP website.
- Undergraduate Research & Inquiry Day will be held Saturday, April 22 - more information is available here.

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UW TOP-TIER SCIENCE INITIATIVE
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Program Updates, Cont'd.

In spring 2023, several Wyoming Research Scholars will be presenting results from their projects at professional conferences, and even publishing their findings in peer-reviewed journals – a real feather in the cap for these talented students! WRSP students have always been important ambassadors for undergraduate research and student success at UW, and they are ramping up statewide engagement this spring. Several students helped with the State Science Fair in March, engaging in K-12 STEM outreach with the SI Roadshow, and participating in the Women in STEM conference at UW on May 16. The Wyoming Undergraduate Research Coalition, a student club led by undergraduate researcher students, is in full swing and will be hosting workshops throughout the semester on a variety of topics, such as grant writing and preparation for conference presentations.

Active Learning Classroom (ALC)

This semester, the Active Learning Classroom (ALC) is again full of active learning in introductory science courses. Nine course sections are being taught in the ALC. This semester, Ginka Kubelka is teaching one section of Organic Chemistry II; Jamie Crait and Christopher North are co-teaching one section of General Biology, while Christopher is teaching another section solo; Kassandra Willingham is teaching both General Microbiology and Medical Microbiology; Randa Jabbour, Robert Greenwald, and McKenzie Barth are teaching a section of Agroecology; Jacob Layer is teaching a section of Human Anatomy; and Amy Krist is teaching two sections of Animal Biology. In total, 17 Learning Assistants are assisting with active learning courses in the ALC, and 866 students are enrolled in these courses.

Honors for LAMP Fellows at UW and WY Community Colleges

Each year, students from UW's chapter of the Mortar Board pay tribute to their favorite faculty member. Out of 17 faculty members honored, 4 were LAMP Fellows, including Kassandra Willingham, Joe Russo, Ginka Kubelka, and JJ Shinker. Thank you all for the profound and positive impact you have on UW's students!

We are also pleased to announce that Deepthi Amarasuriya,

LAMP Fellow and Assistant Professor of Physics at Northwest College, has been named the inaugural Endowed Chairperson in Science at NWC. Endowed chair funds will support Deepthi's creation and implementation of innovative curriculum for students in Physics courses. Many congratulations to Deepthi!

Featured WRSP Mentor & Scholar

Dr. Thomas Boothby
Asst. Prof., Molecular Biology

Max Packebush
WRSP Scholar

The Boothby lab's research broadly focuses on how organisms are able to survive in extreme environments. To this end, they focus on understanding the biology of an emerging but valuable model, the tardigrade. Tardigrades, or water bears, are a group of microscopic animals capable of surviving a number of extremes including being frozen, heated up to boiling temperatures, irradiated, the vacuum of outer space, as well as extreme drying. Boothby lab researchers are interested in how these animals protect themselves, their cells, and their cellular components from the stresses induced by these environmental perturbations, as well as how we can use the knowledge we learn from tardigrades to address societal issues.

One such issue is the stabilization of pharmaceuticals. Many pharmaceuticals are inherently unstable and must be preserved using a "cold-chain" of refrigerators or freezers. This can be extremely logistically and economically burdensome, especially in remote or underdeveloped parts of the world where access to electricity and other infrastructure limits cold-chain access. The Boothby lab is working with DARPA and NASA to better understand how certain proteins from tardigrades, called Cytoplasmic Abundant Heat Soluble (CAHS) Proteins, function during desiccation to protect the animals, and refining methods to apply these proteins to the dry storage and stabilization of life-saving pharmaceuticals.

Current WRSP scholar Max Packebush has worked as a member of a team in the Boothby lab to develop methods for stabilizing Human Blood Clotting Factor VIII (FVIII). FVIII is an important pharmaceutical used in cases of extreme trauma and bleeding as well as to cope with certain genetic diseases such as hemophilia A (affecting ~1 in 5000 males). The team has developed methods for the dry storage of this life-saving pharmaceutical that allow for its storage under repeated desiccation cycles, which simulate fluctuations in humidity and partial rehydration experienced in the field, as well as stabilization methods for elevated temperatures (up to 95 degree Celsius). In the summer of 2022, Max presented data from this project at the prestigious Gordon Research Conference on Intrinsically Disordered Proteins, and in the fall of 2022 at the American Society for Gravitational and Space Research meeting. Max is also first author on an article, "Natural and engineered mediators of desiccation tolerance stabilize Human Blood Clotting Factor VIII in a dry state", currently in pre-print.

People in SI

WRSP Scholar

Brock Parker
Hometown: Gering, NE
Majors: Physics, Astronomy & Astrophysics
Faculty Mentor: Chip Kobulnicky

Brock has been working to reduce spectrographic data from the Apache Point Observatory (APO) Astrophysical Research Consortium Telescope Echelle Spectrograph (ARCES) in preparation for the new echelle spectrograph at the Wyoming Infrared Observatory (WIRO). Upon its completion, he will begin to characterize and calibrate the new instrument, culminating in a commissioning report that will be published for the public. Brock also works with a large, multi-institution team on the Fiber-fed High Resolution Echelle spectrograph (FHiRE). FHiRE's goal is to precisely measure the masses of extrasolar planets using radial velocity in support of previous photometric follow up projects that have retrieved planetary radii. The combination of the results will result in accurate measurements of planetary density, allowing for testing and verification of current planetary evolution. Brock has also been named as an author on a research article published in The Astronomical Journal, and is named on several other articles in pre-print.

Roadshow Outreach Assistant

Elizabeth Lungren
Hometown: Ten Sleep, WY
Major: Molecular Biology

Elizabeth has served as a Roadshow Outreach Assistant for over a year. Coming from a rural Wyoming school herself, Elizabeth enjoys being able to help educate students from around the state about science and topics that they would not normally cover in class. Her favorite memory has been watching students really take an interest in activities and have fun while learning. Outside of her Roadshow work, Elizabeth is also a part of Wyoming Research Scholars Program and works with Dr. James Pru (Reproductive Biology) studying male reproductive physiology using the mouse model.

LAMP Learning Assistant

Erin Bentley
PhD Candidate in Ecology
Faculty Mentor: Rachel Watson

Erin was the Learning Assistant for the Microbiology Capstone course during the Fall of 2022. She spearheaded a science-art collaboration called the Owens Lakebed Project. This project melded, sculpted, and morphed ways of knowing as we framed the landscape through lenses of film, chemistry, microbiology, geology, environmental justice, photography, and 3-D art. Members of The Optics Division of Metabolic Studio invited scholars and educators from UW and Laramie HS to experience their process of using Owens lakebed as a key step in their development of photos. The UW Capstone students explored the microbiology and chemistry of the soil and water as it interacted with print fixation. Students of the Laramie HS Advanced 3-D Art class created their own land-based art in response. During the final showcase, held at the UW Art Museum, Erin collected data measuring attendees' perceptions of the integration of art and science.

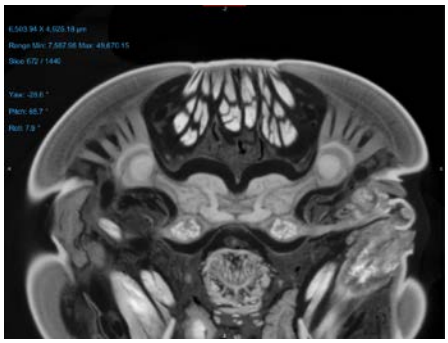
LAMP Fellow

Ginka Kubelka
Associate Lecturer, Chemistry, UW

Dr. Ginka Kubelka completed the LAMP Yearlong Training Program in 2019-2020. Curriculum during this year focused on transformative learning and Ginka certainly embodied that emphasis in her instructional design. She converted her organic chemistry courses to team-based learning (TBL) courses in which her students watch short, recorded lectures prior to coming to class and then spend class time doing the really hard work! They immerse in intense problem-solving and Ginka supports their work, salting their effort with guiding questions and advice. Utilizing Learning Assistants (LAs), Ginka is able to ensure that her student teams always feel supported. LAs for her class not only facilitate student learning but they also study the impact that the course structure is having on the students' satisfaction and learning. Ginka was also a member of the 2022-2023 LAMP Educator Learning Community. She completed a SoTL study reporting on the use of knowledge surveys to assess students' changes in self-assessed competence, and she presented this research at the Lilly Conference on College Teaching in Oxford, OH.

Spotlight on Research in the Center for Advanced Scientific Instrumentation (CASI)

So far, CASI has been equipped with 3 instruments - a Micro-CT Scanner (purchased with state grant funds through the Wyoming Innovation Partnership and the Wyoming Data Hub), a Spinning-Disk Confocal Microscope (purchased with INBRE grant funds), and an X-Ray Diffractometer (purchased with INBRE grant funds). These instruments have served many researchers spanning a wide gamut of applications, some of which are highlighted below. Two electron microscopes will also be added to CASI in the near future.



Cockroach brain anatomy

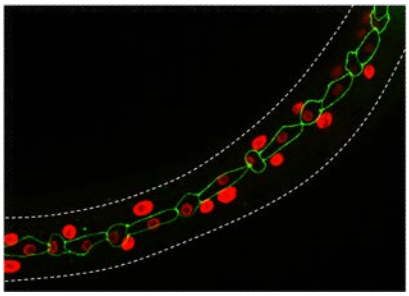
Micro-CT Scanner

The Micro-CT has seen heavy use in its first 5 months. The primary user has been Dr. Todd Schoborg, Assistant Professor in Molecular Biology. His group is using it to understand mechanisms of brain growth and development. He has also collaborated with both national and international research groups to help advance our knowledge of cancer cachexia (University of Oslo, Oslo, Norway), Alzheimer's and other related dementias (Michigan State University), and the material properties of artificial tissue scaffolds intended to be used in orthopedic procedures. Additionally, he has partnered with two start-up companies, Backyard Brains (Ann Arbor, Michigan), and Unlocked Labs (Laramie, WY). Backyard Brains aims to bring neuroscience education to elementary schools, using cockroaches to demonstrate how the nervous system works. Unlocked Labs, an IMPACT 307 & WyCEI startup company, has been using the scanner to assist in their development of probiotics for the treatment of gout and kidney stones.

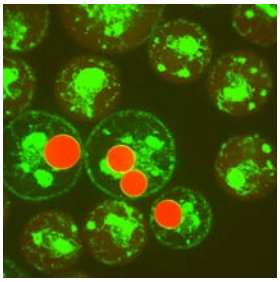
Spinning-Disk Confocal Microscope

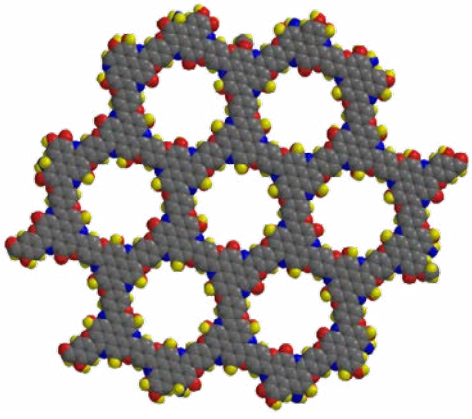
Researchers from multiple laboratories in Molecular Biology have been using the spinning-disk confocal microscope in many applications.

Dr. Owen Funk, a postdoctoral research associate in Dr. David Fay's lab, is using the model organism *C elegans* to explore the biology of syncytia, giant multinucleate cells found throughout nature. Multiple nuclei are often associated with developmental defects or cancers, but many tissues (human muscles, placenta, osteoclasts and more) contain multiple nuclei without any issues. The *C elegans* epidermis is a syncytia containing 139 nuclei, and an ideal system to explore fundamental mechanisms governing gene expression in multinucleate cells. The image to the right shows the epidermal cell boundaries marked in green and nuclei in red of a developing larva. The ability to visualize these cellular structures in a live worm allows us to ask fundamental questions about what's happening in this atypical cell type.



Timothy Deibert, a laboratory assistant in Dr. Jay Gatlin's lab, is researching the role the nuclear-associated aster plays in nuclear scaling. Cell-free extracts are encapsulated in oil droplets using microfluidic technology to provide researchers with a discrete volume allowing for precise measurements. Using labeled membranes and a fluorescently labeled NLS he is able to observe the rate at which the nucleus grows under various conditions during interphase.





X-Ray Diffractometer

The X-ray diffractometer is being used by multiple lab groups in the Chemistry department. By examining how X-rays diffract through crystals, the diffractometer can determine the molecular structure of compounds with atomic-level precision. This technique is routinely utilized to characterize the structures of catalysts, proteins, and many other solid-state materials. In the Hoberg group, for example, it is used to characterize Covalent Organic Frameworks, materials with molecule-sized pores that are used for size-selective filtration and purification (image at right).