



Spring 2021 Newsletter

Letter from the Department Head

Greetings alumni and friends!

I hope this newsletter finds you and your loved ones safe and healthy. Although it's been a difficult year for most of us, I have several exciting news to share about the department. In fact, 2020 has been another productive year for many of our faculty. Two of our junior colleagues, Michael Taylor and Caleb Hill received the prestigious NSF CAREER award recently. While Michael's project was awarded \$703,000 to probe optically controlled protein proximity labeling, Caleb's work will focus on developing methods for targeted, high-throughput single-entity analyses with the \$600,000 funding. Additionally, our proposal to the NSF-REU program was recently recommended for funding for \$351,000 over 3 years. Kudos to both Brian Leonard and Elliot Hulley for spearheading this effort! John Hoberg and Bruce Parkinson were also part of a successful NSF STTR phase I grant last year for their work on COF-based membranes for refrigeration. Last but not the least, Rachel Watson's team was invited to join the phase I of HHMI's Inclusive Excellence 3 Learning Community (IE3LC). This effort is a major initiative involving folks from across campus led by Rachel who is the director of the UW Science Initiative Learning Actively Mentoring Program.


I am happy to welcome Laura Oliveira who joined our department last fall as an assistant professor in the inorganic division. Laura joins us after her post-doctoral work at the University of Warwick, UK, and is building a research program on computational design of inorganic materials.



I am also delighted to report that Dr. Robin Rogers will be joining the department on March 1, 2021, as an adjunct faculty to continue his work with the UW spin-off, Wyonics LLC. Among other recognitions, Dr. Rogers is a fellow of the American Chemical Society and American Association for the Advancement of Science. I would also like to welcome Jesse Grosinger and Rachel Dobjeleski who recently joined our shared office staff to help us better coordinate business operations. Last year, the department welcomed 10 new graduate students who will be pursuing a doctoral degree in Chemistry. The department now has 34 students enrolled in its graduate program and expects to welcome another 10 students in 2021.

Now for some challenges ahead. A major decline in the state revenue has forced a reduction in the departmental budget by 10% with another 10% cut forecasted for the upcoming year. Our request for a new faculty hire was also turned down amidst the financial challenges that UW and the state are facing.

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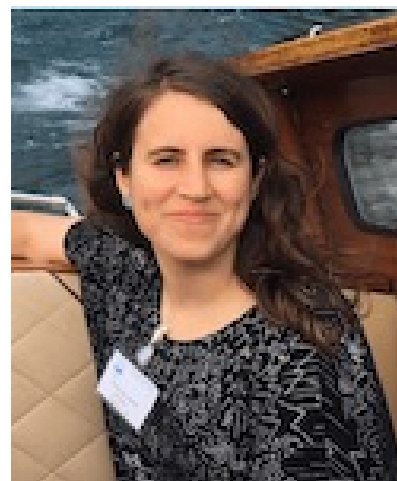
New Faculty & Staff

This is particularly unfortunate for Chemistry as we have lost 10 colleagues in just the last 6 years to retirements, resignations and reappointment denials and is currently down to 13 research faculty and 4.25 APLs. This has forced us to cancel our advanced general chemistry curriculum (CHEM 1050 and 1060 that served majors and engineering) due to faculty shortage. In addition, the department continues to struggle with the maintenance and billing of several of its major research instrumentation including a MALDI-MS, an XPS and possibly a TEM system due to lack of personnel support. While these instruments remain key to ongoing research activities in the department and across campus, a lack of proper oversight renders their continued operation difficult and uncertain.

On a somber note, David Nelson passed away on November 15th, 2020, at age 89 after a brief illness. He was a professor of Chemistry at UW from 1962 until 1997. David loved his family and friends, his dogs and the outdoors. He was generous and kind with an endless curiosity and will be greatly missed. We also continue to deal with the teaching and research challenges posed by the COVID pandemic. Nevertheless, the Chemistry faculty has done a commendable job adapting to online teaching and continues to develop innovative approaches to high quality instruction. In this regard, I would especially like to mention the efforts of our APLs, Carla Beckett, Ginka Kubelka, Kui Chen and Navamoney Arulsamy, to maintain high quality of laboratory instruction for the lower and upper level chemistry classes.

And finally, a huge Thank You to all our alumni and friends for their generous donations over the years. These funds continue to support our mission of teaching, research and service in impactful ways. Your gifts go toward awards, student travel to meetings and helping students with financial needs among supporting us meet other goals. So please continue to help us out with your generous donations at <http://www.uwyo.edu/chemistry/giving.html>. Also, please continue to send us your stories and accomplishments by email or otherwise to help celebrate them with our community.

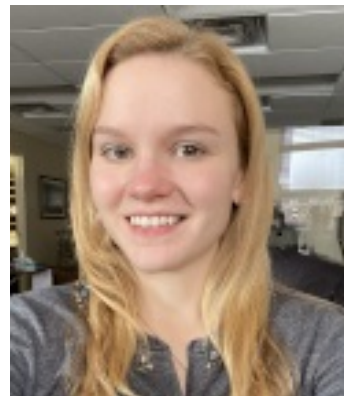
Best Regards,
Debashis



Dr. Laura de Sousa Oliveira
Assistant Professor
Inorganic Chemistry

B.S.s, 2010, New Mexico Institute of Mining and Technology (Socorro, NM)
Ph.D. 2017, University of California, Riverside (Riverside, CA)
Postdoctoral Researcher, 2017-2020, University of Warwick (Coventry, UK)

Jesse Grosinger
Office Associate Senior
Laramie, WY



Rachel Dobjeleski
Office Associate
Longmont, CO

UW's Caleb Hill Receives NSF CAREER Award to Study Chemistry at the Single-Entity Level

Dr. Caleb Hill is developing analytical methods that will allow scientists to characterize the chemical behavior of individual reactive entities, such as nanoparticles. He and his team will then apply these methods as tools for discovery of new, cost-effective catalyst materials for water splitting, carbon dioxide conversion or fuel cells.

Caleb Hill, an assistant professor in UW's Department of Chemistry, received a big boost toward this research endeavor when he was recently notified he will receive a \$600,000 Faculty Early Career Development (CAREER) Program Award from the National Science Foundation (NSF).

"Chemical systems are traditionally studied at a macroscopic scale, using methods which can tell us on average how fast reactions are occurring," Hill says. "Many systems with important applications in energy conversion and storage, however, are highly heterogeneous, which makes them difficult to study using these traditional methods.

"By developing tools to study heterogeneous systems, such as nanoparticles, at the single-entity level, we will be able to vastly improve our understanding of how to design materials for a specific purpose," he says.

Hill will receive continuing grant funding for his project, titled "CAREER: Methods for Targeted, High-Throughput Single-Entity Analyses." The grant starts March 1 and ends Feb. 28, 2026.

The research will be conducted in Hill's laboratory at UW, he says.

Spreading Knowledge

As part of the NSF CAREER Award, Hill will conduct some public outreach. Hill says these outreach activities are designed to raise interest in STEM (science, technology, engineering and mathematics) fields by teaching students the basics of measurement science.

"We will be initiating an education outreach/inreach program focused on measurement science," Hill says. "The goal of this program is to teach K-12 students about the basics of scientific measurements and allow them to carry out their own analytical projects using the extensive infrastructure at UW."



The CAREER Program offers the NSF's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Such activities should build a firm foundation for a lifetime of leadership in integrating education and research.

"This award will give my group the freedom to explore exciting new avenues of research," he says.

The Chemical Measurement and Imaging Program within the Division of Chemistry of NSF recommended Hill for the award. Budgeted over five years, the grant funding will support Hill, his graduate students and undergraduate students to carry out research and travel to conferences so the students will be able to share and discuss their work with researchers from other institutions.

Hill's laboratory at UW focuses on the development and use of combined electrochemical and spectroscopic tools to probe chemical behavior at the single particle, or even single molecule level, with an emphasis on electrocatalytic and photoelectrochemical materials relevant to renewable energy systems.

Hill received his Ph.D. in physical chemistry from the University of Alabama and his bachelor's degree in chemistry from Jacksonville State University. Before joining UW, he was a postdoctoral fellow at the University of Texas-Austin from 2014-16.

UW's Michael Taylor Receives NSF CAREER Award to Study Biology Through Organic Chemistry

A University of Wyoming researcher wants to design chemical reactions that can be used as a noninvasive method to study not only how proteins in a cell pack together in real time, but also how this packing can dynamically change when a cell is in a stressful environment. Obtaining this information will enhance knowledge of basic biological processes and this, in turn, is critical for the advancement of other areas of science, such as drug discovery, says Michael Taylor, an assistant professor in UW's Department of Chemistry.

Taylor received a big boost toward this research endeavor when he was recently notified he will receive a \$703,000 Faculty Early Career Development (CAREER) Program Award from the National Science Foundation (NSF).

Taylor receives the funding for his project, titled "CAREER: Optically Controlled Protein Proximity Labelling." The grant begins Jan. 1, 2021, and ends Dec. 31, 2025.

"In a nutshell, we want to use organic chemistry as a tool for studying biology. We will be developing chemical reactions that can operate within living cells," Taylor explains. "These chemical reactions are designed to make nonnatural chemical bonds with specific regions of the proteins inside of a cell, which we call 'labels.'

"Since these labels are nonnatural, any protein that possesses one of these labels is relatively easy to detect," he continues. "Additionally, the reactions that we will develop require light to proceed, which means that we can control where and when the reaction takes place by simply turning a light bulb on or off." The research will be conducted in his lab at UW.

Spreading Knowledge

As part of the NSF CAREER Award, Taylor will conduct some public outreach. Taylor says outreach activities will include interactive educational activities designed to broaden

interest in STEM (science, technology, engineering and math) and at the middle school level.

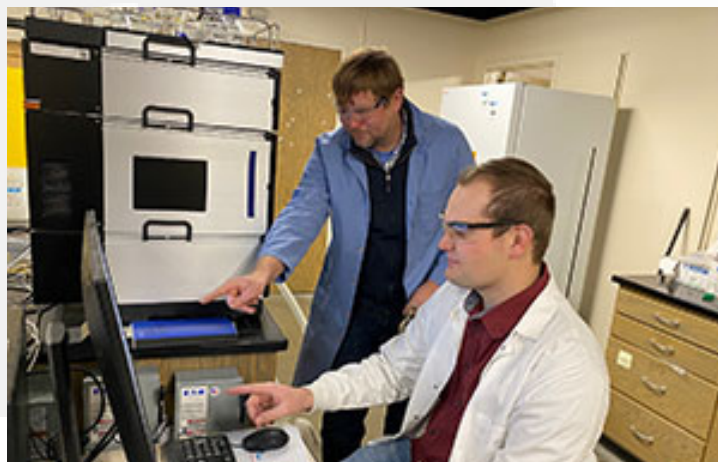
"We also will design interactive demonstrations for local Girl Scout troops that actually use the chemistry developed in this proposal," Taylor says. "Many of the compounds that we make look really neat and do cool things when you shine light on them.

The CAREER Program offers the NSF's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Such activities should build a firm foundation for a lifetime of leadership in integrating education and research.

"The final support is very much appreciated. Rest assured, we will put it to good use," Taylor says. "It will allow my lab to continue to expand into a very exciting area of interdisciplinary research at the interface of chemistry and biology."

The Division of Chemistry within the NSF recommended Taylor for the award. Budgeted over five years, the grant funding will support Taylor, his graduate students, undergraduate students in his lab to conduct the research, travel costs and equipment. Travel funds will be used to disseminate the results of this grant at various science conferences, Taylor says.

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Taylor's areas of interest include new methods for the chemical modification of biomolecules; organic reaction design for in situ generation of therapeutic compounds; and new organocatalytic strategies for the synthesis of high value chemicals.

Taylor received his Ph.D. in organic chemistry from the University of Delaware and his bachelor's degree in biochemistry from Salisbury University in Salisbury, Md. "Biology is really just chemistry on a grand scale. There are millions and millions of highly reactive biomolecules within a single cell," he says. "So, designing a chemical reaction that only looks at one small part of this complicated puzzle and completely ignores the rest presents a considerable, but very exciting challenge. There are very few chemical tools out there that can truly achieve this."

Ginka Kubelka and Debashis Dutta Complete the LAMP Yearlong Training

Throughout the 2019-2020 year, 23 college educators completed their yearlong training in the Learning Actively Mentoring Program (LAMP). Amongst these educators was Chemistry's Ginka Kubelka and Debashis Dutta. Both Kubelka and Dutta learned to implement student-centered, inclusive, evidence-based pedagogies. They redesigned their courses and assessed student learning in their redesigned courses. Both professors saw growth in student understanding and confidence from pre- to post-semester. Ginka Kubelka implemented a particular type of active learning called Team-based Learning (TBL). When asked about this strategy, one student commented, "group work has made my learning a lot easier and made the info stick." Kubelka was named the April LAMP Fellow of the month and is featured on the LAMP webpage.



Wyoming's Howard Hughes Medical Institute's Inclusive Excellence Ecosystem led by Rachel Watson

Rachel Watson is the PI for the University of Wyoming's Howard Hughes Medical Institute's Inclusive Excellence Challenge (the HHMI IE3). Three hundred and seventy-four institutions submitted pre-proposals and UW's proposal was one of ~180 pre-proposals that advanced to the next stage of the competition. At that time, the HHMI team very thoughtfully turned the lens of inclusion inward onto their own process. On the backdrop of social reckoning, they realized that they needed to re-envision the inherently exclusive granting process to embody a more inclusive approach. They have thus invited the successful pre-proposal institutions to be a meaningful part of assisting in restructuring of their process. On the fourth of February, 2021, we received a letter from the HHMI Director (David Asai) and Convener of the HHMI IE3 Team (Susan Musante) formally inviting our participation in the IE3 Learning Community and providing a \$30,000 grant to UW for our work. UW is fortunate to be one of only fifteen institutions nationwide to be part of a national learning community re-envisioning inclusive collaborations between 2-year and 4-year institutions. I aim to continue to be an inclusive leader of our Wyoming IE3 Ecosystem and we hope to be leaders in moving into the second phase of this process.

Dr. Brian Leonard collaborates with a team from Physics, Petroleum Engineering, and the School of Energy Resources on Coal to Graphite Conversion

Using copper foil, glass containers and a conventional household microwave oven, University of Wyoming researchers have demonstrated that pulverized coal powder can be converted into higher-value nano-graphite.

The discovery is another step forward in the effort to find alternative uses for Wyoming's Powder River Basin coal, at a time when demand for coal to generate electricity is declining due to concerns about climate change.

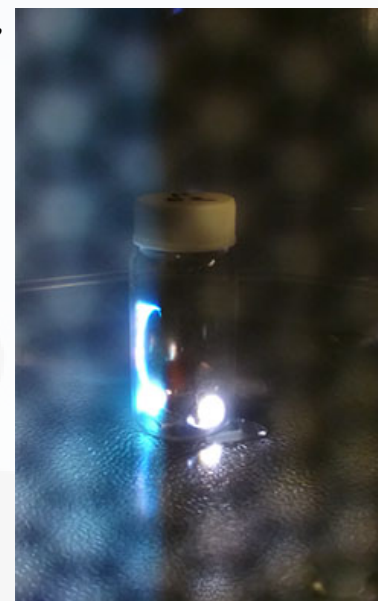
In a paper published in the journal *Nano-Structures & Nano-Objects*, the UW researchers report that they created an environment in a microwave oven to successfully convert raw coal powder into nano-graphite, which is used as a lubricant and in items ranging from fire extinguishers to lithium ion batteries. This "one-step method with metal-assisted microwave treatment" is a new approach that could represent a simple and relatively inexpensive coal-conversion technology.

"This method provides a new route to convert abundant carbon sources to high-value materials with ecological and economic benefits," wrote the research team, led by Associate Professor TeYu Chien, in UW's Department of Physics and Astronomy.

Others involved in the project were Professor Jinke Tang, in the Department of Physics and Astronomy; Associate Professor Brian Leonard, in the Department of Chemistry; Professor Maohong Fan, in the Department of Petroleum Engineering and the School of Energy Resources; graduate students Rabindra Dulal, of Nepal, Joann Hilman, of Laramie, Chris Masi, of Syracuse, N.Y., and Teneil Schumacher, of Buffalo; and postdoctoral researchers Gaurab Rimal, of Nepal, and Bang Xu, of China.

While previous research has shown that microwaves can be used to reduce the moisture content of coal and remove sulfur and other minerals, most such methods require specific chemical pretreatment of the coal. In their experiment, the UW researchers simply ground raw Powder River Basin coal into powder.

In a microwave oven, sparks are generated inside a glass vial containing coal powder and copper foil as part of an experiment by UW researchers. They successfully converted the coal powder to nano-graphite, demonstrating a novel and inexpensive coal-conversion technology. (UW Photo)



Dr. Zhou Research Group

Zhou's group continues the research effort on the growth of rare earth-based oxides and oxide-supported metal particles as catalytic materials for their applications in dry reforming of hydrocarbons as well as desulfurization reactions. The group currently has two graduate students in Chemistry (Daniel Braedt and Jintao Miao). We would like to congratulate Linze Du who successfully defended her PhD thesis in fall of 2020. Last year, our work on the growth and characterization of Ni particles supported on CeO₂(111) thin films with Mn or Ti dopants were published in *Applied Surface Science* and featured on the cover of Volume 699 in *Surface Science*, respectively. Congratulations to Daniel on his patent submission on the design of modular reaction control system for live monitoring of long-term and/or multi-channel reactions. Congratulations to Jintao on his patent work on the design and study of ceria-supported metal catalysts for dry reforming of methane. The group is thankful for the financial support from Wyoming Carbon Engineering Initiatives, the School of Energy Resources at UW.



Student and Staff Awards



Outstanding Freshman Award: Hunter Groll

Outstanding Sophomore Award: Emma Muller

Outstanding Junior Award: Cailin Brugger

Outstanding Senior Award: Rylie Pilon

Undergraduate Award in Analytical Chemistry: Abigail Blesi

Undergraduate Award in Inorganic Chemistry: Abby Hamilton

Undergraduate Award in Organic Chemistry: Terrin Bond

Undergraduate Award in Physical Chemistry: Caleb Hoopes

**Walter F. and Barry D. Gadesk
Scholarship:**

Emmanuel Odogwu

**Rebecca Raulins Undergraduate
Research Prize in Chemistry:**

Hillarie Arellano

Arthur Gray Janssen Award:

Mikkael Chick

**R. Owen Asplund Undergrad
Research Award:** Abigail Blesi

**Edgar Bailey Smith Chemistry
Scholarship:** Leah Passafiume

Heady Scholarship: Gregg Gross

**R. Owen Asplund Academic
Excellence Award:**

Adriauna Pendergrass

Outstanding A&S Graduates:
Caleb Hoopes & Rachel Tenney

**Congrats to Dr. Franco Basile,
recipient of the 2020 UW
Extraordinary Merit in
Research Award**

**Congratulations to Dr. Bruce Alan
Parkinson on receiving the 2020
David C. Grahame Award from
the Electrochemical Society!**

The Physical and Analytical Electrochemistry Division David C. Grahame Award was created in 1981 to encourage excellence in physical electrochemistry research and to stimulate publication of high quality research papers in the Journal of The Electrochemical Society. The recipient is a currently active ECS Member who made some recent outstanding scientific contribution to physical electrochemistry.

Returning REU Program Open to Community College Students, Faculty for Research in UW Chemistry Labs

Community college students and instructors -- preferably from Wyoming institutions -- have the opportunity to work in a University of Wyoming laboratory for 10 weeks this summer as research fellows.

The UW Department of Chemistry is offering a summer research fellowship for students from community colleges through a National Science Foundation Research Experiences for Undergraduates (REU) grant. The three-year grant is for \$351,000 and will run through summer 2023. UW is the host REU site.

The fellowship program is open to students majoring in a science or engineering field at a community college -- preferably from Wyoming, although students from around the country are welcome to apply. The program runs from late May to late July. Under the grant, nine participants -- seven students and two faculty members -- will be selected for the fellowship program.

Fellowships include a \$6,000 stipend for the summer, \$200 for travel and \$2,000 for meals during the program.

The deadline to apply is Wednesday, March 17. To apply, visit the website at www.uwyo.edu/chemistry/reu.html.

"The fellowships provide students a unique opportunity to work in a research lab," says Brian Leonard, a UW associate professor of chemistry. "This is a great opportunity to become familiar with the UW campus, meet other students from around the state and the country, and to get hands-on research experience."

Leonard and UW chemistry Associate Professor Elliott Hulley are co-principal investigators of the fellowship grant.

The program allows students and faculty members to contribute to chemistry research on projects that include energy, materials and bio-related topics. The hands-on research experience includes a variety of activities -- such as seminars, minicourses on ethics and writing, and energy-related field trips -- to educate and train students for future careers as scientists.



Previous year's REU group

"Each student will work closely with one of the participating faculty mentors selected for their research accomplishments," Leonard says.

Extracurricular activities, such as camping trips; a visit to the National Renewable Energy Laboratory, located in Golden, Colo.; a Colorado Rockies baseball game; and other planned events are available to the research fellows.

UW's REU site is specifically focused on serving students and faculty from local community colleges, and has a significant, scientific impact on students in Wyoming and surrounding states, Leonard says. The program effectively engages first- and second-year undergraduates who are early in their college careers and exposes them to graduate-level chemistry research projects.

"These research experiences provide a more in-depth view of chemistry research and potential job opportunities that exist after pursuing a degree in chemistry," Leonard says. "The students in this program will have several opportunities for professional development, including training in ethics, scientific communication, and preparation of resumes and graduate school application materials."

Past participants have published papers, transferred to UW to complete their undergraduate degree work in chemistry, and many have gone on to graduate school in chemistry.

UW Chemistry Graduate (2014) Dr. Alyssa Webster Seeks Leukemia Cure at Fred Hutch

Webster is the inaugural recipient of the Brave Fellowship, a new research fellowship at Fred Hutchinson Cancer Research Center funded by Brooks Running on behalf of the Brave Like Gabe Foundation. The goal of the fellowship is to develop scientific leaders who will advocate for a diverse and inclusive biomedical research workforce focused on rare cancer research.

Webster studies acute myeloid leukemia, which accounts for 1% of all cancer diagnoses in the U.S., according to the American Cancer Society. Her goal is to develop new, targeted drugs that can cure more people with this relatively rare cancer.

"What I'm currently working on is developing drugs for the treatment of acute myeloid leukemia, more commonly known as AML. AML has about a 25% survival rate over five years, and it's also a rare blood cancer. ...

My research is focused on what is going on within the [AML] cells. Within acute myeloid leukemia, it has been found that there is a specific protein called sirtuin 2 that exists at higher levels within AML cells versus normal blood cells. The goal of my research is to make specific, targeted drugs that will target this protein and prevent it from carrying out its normal activities, because high levels of this protein have been associated with invasiveness of cancers, migration of cancers, drug resistance. It plays a big role in how cancers progress."

We've done now the basic research to support this project, and my hope is that we're going to be able to move into more realistic models. Currently we've only done research on established cell lines, which we normally do our experiments on. But this next year, we're going to be moving into patient samples, which is exciting because it's more of a real-world experience and

gives us more real-world information. If our drugs can effectively act upon sirtuin 2 in these cells, it's going to be really promising and moving even closer to a therapeutic drug treatment option for acute myeloid leukemia. So, it's really, really exciting.



Excerpts and text drawn from the following articles:

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<https://www.uwyo.edu/uw/news/2021/01/uws-caleb-hill-receives-nsf-career-award-to-study-chemistry-at-the-single-entity-level.html>

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<https://www.uwyo.edu/uw/news/2020/12/uws-michael-taylor-receives-nsf-career-award-to-study-biology-through-organic-chemistry.html>

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<https://www.electrochem.org/grahame-award>
excerpted from <http://www.uwyo.edu/uw/news/2021/01/uw-researchers-turn-coal-powder-into-graphite-in-microwave-oven.html>

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<https://www.uwyo.edu/uw/news/2021/02/fellowships-open-to-community-college-students,-faculty-for-research-in-uw-chemistry-labs.html>

Pg. 9

<https://www.fredhutch.org/en/news/center-news/2020/09/alyssa-webster-brave-fellowship.html>

