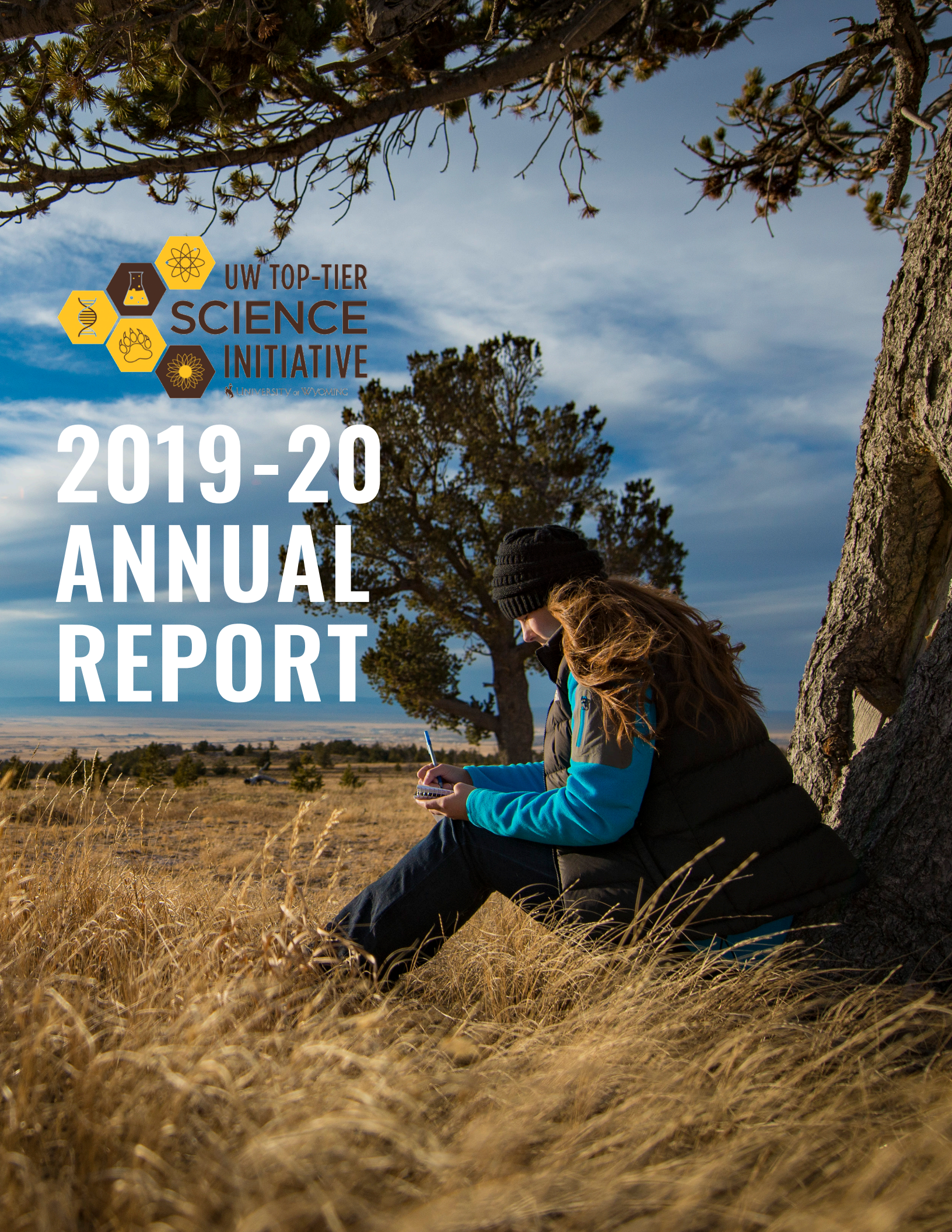

UW TOP-TIER
SCIENCE
INITIATIVE
UNIVERSITY of WYOMING
2019-20
ANNUAL
REPORT

REVOLUTIONIZING SCIENTIFIC EDUCATION AND DISCOVERY IN WYOMING

The University of Wyoming's Science Initiative enables world-class research and education that will strengthen the foundations of Wyoming's present and future economy. Through integrated, interdisciplinary science, Wyoming's current and future researchers and entrepreneurs will revolutionize areas of Wyoming's economy including mineral extraction, agriculture, tourism, resource management, and emerging technology, while also preserving Wyoming's greatest natural resources and unique biodiversity. The Science Initiative will provide UW students with a flexible, pioneering skill set, giving them the resources to invent a Wyoming future whose details cannot be fully known.

CONTENTS

CONTACT US

University of Wyoming
A&S Room 331
Dept. 3254
Laramie, WY 82071

(307) 766-4415
SI@uwyo.edu
uwyo.edu/science-initiative

Facebook University of Wyoming Science Initiative

WHO WE ARE

Mark Lyford, Director, UW Science Initiative; Senior Academic Professional, Lecturer, Botany

Greg Brown, Deputy Director, UW Science Initiative; Associate Dean, College of Arts & Sciences

Rachel Watson, Director, Learning Actively Mentoring Program; Senior Academic Professional, Lecturer, Chemistry

Jamie Crait, Director, Wyoming Research Scholars Program; Assistant Academic Professional, Lecturer, Botany

Karagh Brummond, Director, Engagement and Outreach; Instructional Professor

Tabatha Spencer, Program Coordinator, Sr., UW Science Initiative

Ryan Goeken, Project Coordinator, Sr., UW Science Initiative

Svetlana Sergojan, Project Coordinator, UW Science Initiative

PRAISE FOR THE SCIENCE INITIATIVE

"Having had ... involvement in the early stages of the effort, I am delighted to know [the Science Initiative] is continuing its focus on students."

- Dave Freudenthal, Wyoming's 31st governor (Co-Chairman of Science Initiative Task Force which visioned the initiative)

"I'm so proud of the accomplishments of the Science Initiative. Of course, watching the 'SI Building' become a reality is very exciting. What a wonderful state-of-the-art facility that will be for teaching and research! I'm especially grateful for the programmatic pieces such as the Wyoming Research Scholars, LAMP, and the seed grants. These investments in undergraduate research, active learning instruction, and new research endeavors represent long-term gains for the state in student recruitment, teaching excellence, and support for new research agendas. Wyoming has shown great foresight in supporting the Science Initiative and will reap benefits for many years to come."

- Dr. Paula Lutz, Dean of UW's College of Arts and Sciences

LETTER FROM THE DIRECTOR

The Science Initiative (SI) was founded on the principle that while modern facilities are crucial for STEM disciplines, student and faculty success will be realized with vibrant programs to support teaching and research. We held to this core principle throughout the 2019-2020 year, which was filled with successes in our signature programs, unexpected opportunities and developments, and unanticipated challenges with the spread of COVID-19.

Student success in the classroom is an SI hallmark, and 23 instructors attended the 2019 LAMP Summer Institute to develop active learning strategies, which are shown to improve student learning. To date, 97 UW and Community College LAMP 'grads' have engaged thousands of students in classrooms. This year we established a program where faculty conduct research about their students' learning. We continue to train undergraduate learning assistants, and many are studying to become K-12 teachers.

Another SI signature program is the Wyoming Research Scholars Program (WRSP), which supports undergraduate research, the ultimate form of active learning in STEM fields. In fact, science isn't simply 'knowing' - science is 'doing'. 101 students have participated since 2015, with 51 students conducting research this year. Many presented at national meetings and published in prominent journals. These experiences engage a diverse group of students and position them for future academic and job success. This year Jamie Crait initiated a Classroom-based Undergraduate Research Experience, where research is done in class settings, greatly expanding student research opportunities at UW.

SI outreach blossomed through the Roadshow and numerous presentations at high schools and service organizations. We touched over 1300 K-12 students with hands-on learning activities developed to meet Next Generation Science Standards and tailored to fit each teacher's curriculum. Rachel Watson inspired a remarkable collaboration across UW students, 7th grade teachers and students, and city and industry partners in Riverton to solve a local problem at a former landfill. These experiences show students that science isn't simply 'knowing' or 'doing', it's 'doing with a purpose'. We are thrilled to be adding Karagh Brummond to our team to support growing outreach needs, as well.

Ultimately, student success depends on faculty success. As LAMP supports faculty teaching, the SI also supports faculty as researchers. We initiated a first-round competitive seed grant program, where faculty obtain baseline data to increase external funding. Improving faculty research success increases student opportunities. This year construction began on the SI building. Scheduled to open Fall 2021, it will support cutting-edge interdisciplinary STEM research and education.

This spring, the spread of COVID-19 touched every aspect of our lives. Events were postponed or cancelled and research was disrupted. But amid the turmoil, we found innovative ways to continue as online became the new norm. Faculty and students presented research in a variety of online forums, including Second Life, an online virtual world. Many SI students shifted gears and developed rich online K-12 outreach modules. As we adjust to a new norm, we plan for a great year ahead, welcoming new cohorts of Research Scholars and LAMP Fellows, and looking to expand outreach across the state. Perhaps more important than ever, realizing Top-Tier Sciences at UW is paramount to address known and unknown challenges, foster economic diversification in Wyoming, and better the health and well-being of our citizens and natural resources.

Best Regards,

Mark Lyford

UW SCIENCE INITIATIVE YEAR IN REVIEW

ENGAGEMENT

The Science Initiative engaged with
5,123
people during
46
events in
18
WY communities

The SI Roadshow brought active learning to
1,345
K-12 students during
11
school visits

Faculty brought SI stories to
573
members of
13
service clubs

18
"Wyoming Needs More Cowboys" alumni events and high school assemblies

4
other active learning and career events

LEARNING ACTIVELY MENTORING PROGRAM (LAMP)

The LAMP Fellows program trained
23
instructors from
4
WY institutions

LAMP-trained professors taught
5,353
students in UW active learning courses

In response to COVID-19, UW moved all courses to online instruction for the final 6 weeks of the spring semester. A survey of UW instructors found that LAMP-trained instructors were more likely to report that their students mastered the same amount or more learning outcomes as compared to prior semesters, even in an environment of educational change and uncertainty.

WYOMING RESEARCH SCHOLARS PROGRAM (WRSP)

WRSP saw its largest cohort of scholars yet, with 51 scholars from 12 states

31
WY scholars from
12
WY counties

WRSP scholars did
10,928
hours of research

WRSP scholars contributed to
7
presentations at professional conferences
and
3
articles published in scholarly journals

In a final evaluation survey for graduating students, on average, WRSP scholars reported a
GREAT GAIN
in competence and confidence related to research skills

When asked to reflect on important experiences related to WRSP, one scholar said "Mentorship was a critical component of my WRSP experience. I learned the most while I was interacting with my faculty member or the graduate students who worked in her lab. They taught me basic facts and lab techniques, but more importantly, they taught me how to think like a scientist."

OTHER HIGHLIGHTS

UW faculty and students partnered with 60 7th grade students and their teachers from Riverton Middle School, the City of Riverton, and Inberg-Miller Engineers on a large, community-based project involving research into the possible phytoremediation of a decommissioned landfill in Riverton. Students worked directly with researchers and engineers, giving them a better understanding of future careers in STEM fields.

The Faculty Innovation Grant Program awarded
$1 MILLION
in seed grants to 13 interdisciplinary UW faculty teams to stimulate grant proposals to national funding agencies

Construction on the Science Initiative building has begun, with an anticipated open date of
FALL 2021

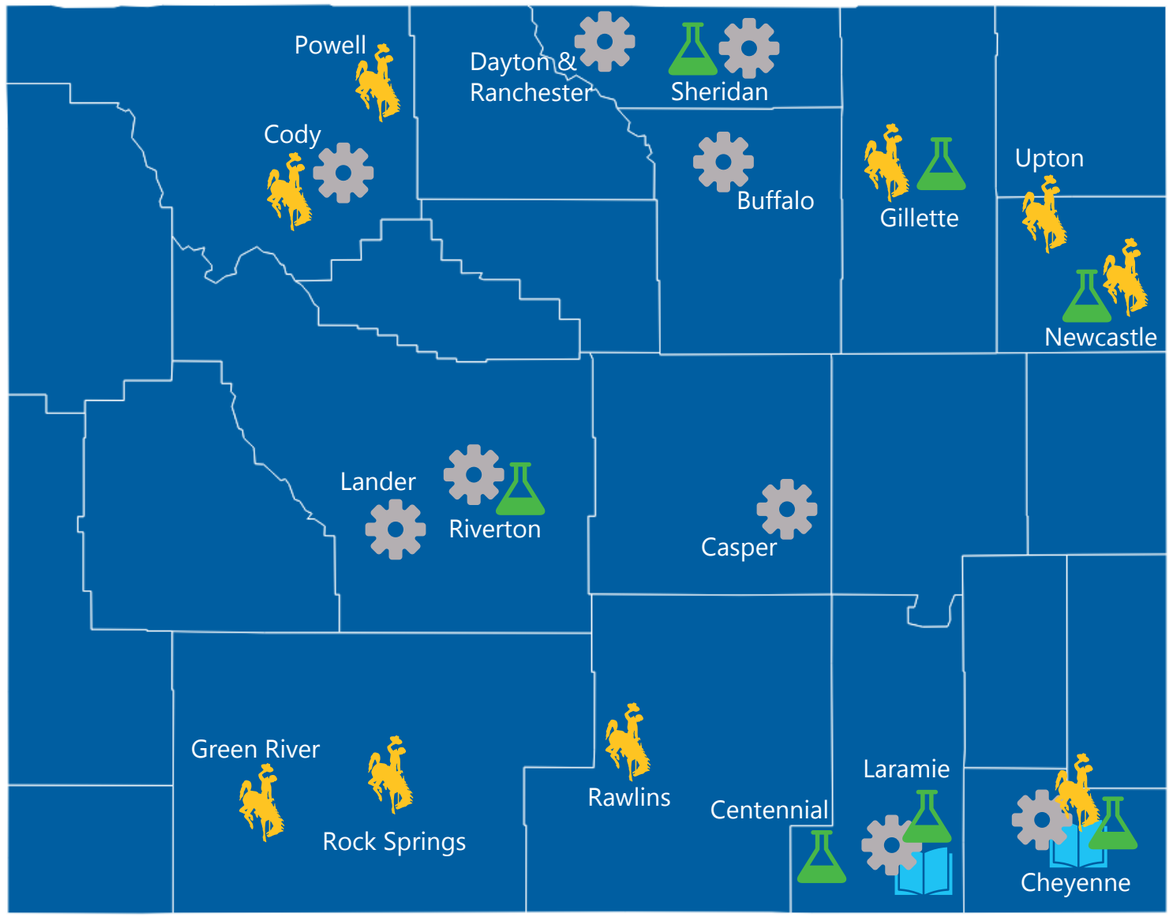
18
UW students gained research experience in the pilot year of the Course-based Undergraduate Research Experience (CURE)

STATEWIDE ENGAGEMENT (2019/2020)

THE SCIENCE INITIATIVE REACHED

18

DIFFERENT WYOMING COMMUNITIES



SCIENCE INITIATIVE ROADSHOW - Bringing active learning to K-12 classrooms

8/23/2019 - Riverton
9/19/2019 - Gillette
10/7/2019 - Riverton
11/4/2019 - Riverton
11/15/2019 - Centennial
12/5/2019 - Newcastle
1/14/2020 - Riverton
1/15/2020 - Riverton
2/3/2020 - Laramie
2/19/2020 - Sheridan
2/24/2020 - Cheyenne

"WYOMING NEEDS MORE COWBOYS" - Alumni events and student assemblies

9/19/2019 - Gillette
10/10/2019 - Cody
10/10/2019 - Powell
11/7/2019 - Rawlins
12/5/2019 - Newcastle
12/5/2019 - Upton
1/25/2020 - Rock Springs
1/25/2020 - Green River
2/20/2020 - Cheyenne

SERVICE CLUB VISITS - Bringing SI stories to Rotary and Kiwanis clubs

10/10/2019 - Cody Rotary
12/12/2019 - Laramie Rotary
1/7/2020 - Laramie Kiwanis
1/8/2020 - Laramie Sunrise Rotary
1/13/2020 - Casper Rotary
1/13/2020 - Buffalo Kiwanis
1/13/2020 - Ranchester & Dayton Rotary
1/14/2020 - Riverton Rotary
1/15/2020 - Lander Rotary
1/21/2020 - Cheyenne After Hours Rotary
1/28/2020 - Cheyenne Sunrise Rotary
2/6/2020 - Cheyenne Kiwanis
2/20/2020 - Sheridan Rotary

OTHER EVENTS

10/11/2019 - Laramie - Wyoming Latina Youth Conference - active learning experiences
10/24/2019 - Laramie - UW-STEM Speed Mentoring Event - brought UW alumni to campus to provide advice on employment to current UW STEM students
11/14/2019 - Cheyenne - Governor's Business Forum
11/15/2019 - Laramie - Science outreach event at Spring Creek Elementary School in conjunction with UW Science Kitchen

SI'S SIGNATURE PROGRAMS

LAMP

LEARNING ACTIVELY MENTORING PROGRAM

IMPROVING STUDENT RETENTION, SUCCESS, AND ENGAGEMENT IN UW STEM CLASSROOMS THROUGH COMPREHENSIVE, SUSTAINED MENTORING AND PROFESSIONAL DEVELOPMENT FOR FACULTY

SI'S SIGNATURE PROGRAMS

LAMP

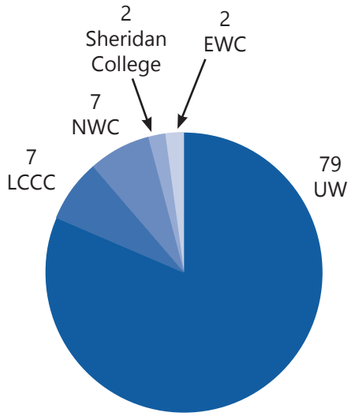
LAMP is a comprehensive, sustained mentoring and professional development program with an emphasis on how to best adopt active learning strategies in large-scale active learning classrooms at UW and in classrooms across the state's community colleges.

Program Goals:
1. Improve student retention, success, and engagement in STEM classrooms.
2. Enable all new and most existing STEM teaching faculty and teaching assistants at UW to become trained in active learning strategies by 2022.
3. Conduct research on active learning in STEM classrooms to investigate relationships between teaching practices and student success, literacy, engagement, and inclusion.
4. Establish professional development and collaboration opportunities for science instructors across the state, including community college instructors and K-12 teachers, to improve learning experiences for all Wyoming students.

LAMP FELLOWS THROUGH TIME (2016-2020)

The LAMP Fellows Program is an immersive, year-long educational development opportunity designed to facilitate instructors' incorporation of active learning techniques into the STEM courses they teach at UW and at community colleges across the state. The program began in the 2016/2017 academic year and enrolls a new class of educators each year.

97
total fellows from
5
WY institutions of higher education



Number of educators trained by institution.

Since 2016, 79 LAMP-trained educators at UW have impacted
16,617
students in
342
active learning classes

LAMP FELLOWS 2019/2020

The Summer Institute on Active Learning is the annual one-week long kick-off event for the LAMP Fellows Program. This year, the Summer Institute brought 23 educators from Wyoming institutions of higher education to Sheridan College to engage in mock active learning sessions so they could experience team-based learning and other forms of active learning in an authentic way. In addition to learning effective ways to implement active learning into their classes, Summer Institute participants also learned about the scholarship of teaching and learning (SoTL), which is the practice of systematically studying the effectiveness of active learning strategies implemented in classrooms.


Educators at LAMP's Summer Institute on Active Learning at Sheridan College.

Throughout the academic year, this year's cohort of fellows also took part in four all-day Saturday workshops and carried out research and assessment in their classrooms. In May, fellows presented about their findings and journey in active learning at a virtual poster session.

23
2019/2020 fellows

LAMP fellows by title, academic year 2019/2020.

TITLE	# OF FELLOWS
Assistant Lecturer	1
Assistant Professor	5
Associate Lecturer	1
Associate Professor	2
Graduate Student	8
Instructor	2
Lecturer	1
Professor	1
Program Coordinator	1
Research Scientist, Sr.	1

LAMP fellows by institution, academic year 2019/2020.

INSTITUTION	# OF FELLOWS
Laramie County Community College	1
Northwest College	4
Sheridan College	1
University of Wyoming	17

LAMP fellows by department or program, academic year 2019/2020. Two fellows belonged to more than one department.

DEPARTMENT/ PROGRAM	# OF FELLOWS	DEPARTMENT/ PROGRAM	# OF FELLOWS
Animal Science	1	Molecular Biology	1
Botany	1	Petroleum Engineering	1
Chemistry	4	Pharmacy	1
Ecosystem Sci & Mgmt	2	Physics	1
English	1	Physics & Astronomy	4
First Year Experience	1	Program in Ecology	1
Hydrologic Sciences	1	WYGISC	1
Mathematics	1	Zoology & Physiology	3

SI'S SIGNATURE PROGRAMS

LAMP

In the 2019/2020 academic year, 79 LAMP-trained educators at UW impacted

5,353

students in

127

active learning classes

Student enrollment by discipline in LAMP fellow-taught active learning classrooms, academic year 2019/2020.

DISCIPLINE	ENROLLMENT
Biological Sciences	2,759
Physical Sciences	1,463
Mathematics	357
Agriculture	204
Honors College	200
Air Force ROTC	158
Engineering	90
Environment & Natural Resources	62
Health Sciences	24
Social Sciences	22
Secondary Education	14

Student enrollment by subject description in LAMP fellow-taught active learning classrooms, academic year 2019/2020.

SUBJECT DESCRIPTION	ENROLLMENT
Life Sciences	2,015
Chemistry	919
Mathematics	357
Microbiology	279
Zoology & Physiology	242
Honors	200
Physics	169
Air Force	158
Geography	140
Molecular Biology	128
Soil Sciences	116
Petroleum Engineering	90
Food Science	84
Environment & Natural Resources	62
Astronomy	52
Geospatial Information Science Technology	48
Animal Science	48
Botany	45
Agricultural Economics	44
Pathobiology	27
Earth Systems Science	25
Pharmacy	24
Gender & Women's Studies	22
Secondary Education	14
Rangeland Ecology	11
Arts & Sciences	11
Renewable Resources	8
Geology	8
Agroecology	7

LAMP'S IMPACT DURING COVID-19-NECESSITATED ONLINE LEARNING

Among other campus entities who provided training on quickly transitioning to online learning environments necessitated by COVID-19 this spring, LAMP Director Rachel Watson provided personalized training to UW instructors on how to implement active learning strategies online. Also, in May of 2020, LAMP partnered with ECTL and the University's COVID-19 "Reflection, Assessment and Lessons Learned" sub-committee to send a survey to UW instructors, asking questions about the shift to online teaching – 252 completed the survey. 125 of these educators had engaged in ECTL training, and 27 had been part of the LAMP year-long training. UW educators were asked to compare student achievement in their emergency remote courses through learning assessments they had performed in the current semester and in prior semesters. A minority (25%) of educators with no previous educational development indicated that students mastered the same or more learning outcomes. Thirty-seven percent of instructors who had engaged in short workshops provided by the ECTL indicated that students achieved the same or more learning outcomes. This percentage increased to 47 for those educators in yearlong learning communities. However, a majority - more than 50% - of LAMP-trained educators assessed their students as having achieved or exceeded learning outcomes. This indicates that even in emergency online learning environments, the more immersive and sustained educational development provided by LAMP enables educators to facilitate student learning.

With feedback from UW instructors, LAMP will also be facilitating further training for online teaching, including a workshop called "Facilitating Lab and Fieldwork at a Distance" this summer, as UW plans to pursue a blend of online and in-person learning during the coming Fall semester.

LAMP SCIENCE OF TEACHING AND LEARNING SURVEY

In late 2019, 47 educators (37 were LAMP Fellows, nine were K-12 educators, three were mentors for LAMP Fellows, and one was a collaborator from UW's ECTL) who had taken part in LAMP professional development, responded to a survey and reported that the program had given them the community and tools to thrive in teaching and had inspired them to participate in and lead further development opportunities. Survey results showed that:

1. **LAMP educators are creating scholarship that supports student learning** - including 24 posters and presentations, nine journal articles, and eight grant proposals that incorporate active learning into STEM teaching and research.
2. **85% of respondents built new collaborations through LAMP** - these relationships impacted respondents' teaching, scholarship, and overall happiness by helping isolated educators feel like part of a community, providing educators with resources to transform specific courses, and boosting educators' professional and personal fulfillment and happiness.
3. **Respondents were inspired to further development -** seven reported increased understanding and confidence in course development and educational research, seven reported more awareness and understanding of other opportunities for growth, six reported increased passion for teaching, and four reported a desire to be a resource for others.

SI'S SIGNATURE PROGRAMS

LAMP

EDUCATOR'S LEARNING COMMUNITY

2019/2020 was the inaugural year for the **LAMP Educator's Learning Community (ELC)**, called "Leaving the Light On", which consists of seven prior LAMP fellows. The ELC is a continuing professional development group designed to allow LAMP fellows to extend their development past the initial year of LAMP training. The group carries out educational research in their current STEM classrooms, implementing active learning and measuring its impact on student learning and success in order to further catalyze change at UW through evidence-based active learning. Each ELC participant presented their research at the Original Lilly Conference on College Teaching in November of 2019 at Miami University of Ohio. Two of these projects measured outcomes that affected the entirety of the LAMP and ELC programs, respectively.

The first project was entitled "Measuring Changes in Students' Perception of Active Learning and Feelings of Inclusion". 126 students responded to an active learning survey and 45% related an increase in positive feelings about active learning, comparing results before and after active learning experiences at UW. Themes arising from the analysis included students' positive experiences with teamwork, engagement in the course material, and metacognition. The study also found a 4% increase in feelings of inclusion, comparing results before and after active learning experiences in classrooms at UW. Results showed a 6% increase in feelings of inclusiveness in females, a 3% increase in both white and non-white students, a 4% increase regardless of students' sexuality, a 7% increase regardless of disability, a 6% increase among non-transfer students, but a 2.5% decrease in inclusivity among transfer students. This study is ongoing and additional LAMP fellows will be joining the team to augment the group's ability to assess multi-semester data.

The second project was entitled "'Leaving the Light On': From Feeling Alone to Feeling Connected within an Educator's Learning Community". The project used social network analysis to show how participation in LAMP affected ELC members' connectivity within the university. Before LAMP training, five of the seven educators felt isolated. After LAMP training, six of the seven educators related increased community, connection and drive to reach out. Comparing connectivity before and after LAMP training, the network analysis indicated that fellows were getting information about teaching from twice as many sources, giving advice to more than three times the number of people, their network included 1.5x more people, and the network (among ELC members) was twice as connected.

In order to create more ELCs and to further catalyze change towards evidence-based, active, inclusive teaching practices at institutions across Wyoming, LAMP Director Rachel Watson has spearheaded a grant proposal to the Howard Hughes Medical Institute's (HHMI) Inclusive Excellence Challenge. This project includes 55 faculty, staff, and administrators, and 20 graduate students from across Wyoming. The focus of the grant proposal is to create ELCs at three of Wyoming's seven community colleges. ELC participants would participate in training courses, take part in a SoTL conference, and engage in a LAMP workshop. Community college students who are in STEAM courses taught by ELC-trained educators will also be surveyed. All of the students from this cohort who transfer to UW will then be welcomed as a community and formally enrolled in a course that teaches them the science of learning and directly involves them in undergraduate research and/or teaching. HHMI will distribute awards by September 2021, and each award will provide $1 million over five years.

LEARNING ASSISTANTS

The LAMP Learning Assistants Program began in Spring 2018 and provides UW undergraduate and teaching certificate students with opportunities to assist teaching in large introductory science courses taught in active learning classrooms at UW. Learning Assistants (LAs) act as peer mentors to help facilitate team-based and other types of learning. As many LAs are pursuing employment as K-12 STEM teachers, the program also integrates active learning into their training and gives them valuable teaching experience.

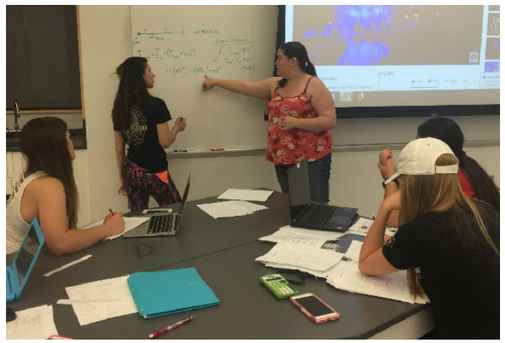
Since Spring 2018,

48

UW students have been LAs for

81

active learning courses



Learning Assistant leads small group student learning.

This academic year,

26

UW students have been LAs for

37

active learning courses

ROADMAP TO STEAM SCHOLARSHIP AWARDEES

In order to collaborate with K-12 teachers across the state, empower them through training opportunities, and establish connections to bring active learning throughout classrooms in Wyoming, the Science Initiative provides select scholarships to K-12 teachers to attend the Wyoming Department of Education's Roadmap to STEAM Conference. Since 2017, LAMP has awarded 31 scholarships to K-12 educators from 23 Wyoming schools to attend the conference.

LAMP director, Rachel Watson, second from left, selected seven Wyoming educators from three Wyoming K-12 schools to attend the 2019 edition of the Roadmap to STEAM conference in Laramie in August of 2019. Receiving scholarships were Alma Law, Riverton; Larissa Apel and Deborah Jensen, both from Rock Springs; Tasya Ravellette and Nanna Frazier, both from Riverton; and Kimberly Harper, from Rock Springs. Not pictured is Linda Shearer, from Douglas.

SI'S SIGNATURE PROGRAMS

WRSP

WYOMING RESEARCH SCHOLARS PROGRAM

PROVIDING UNDERGRADUATE STUDENTS WITH CUTTING-EDGE RESEARCH OPPORTUNITIES AND FACULTY MENTORSHIP

SI'S SIGNATURE PROGRAMS

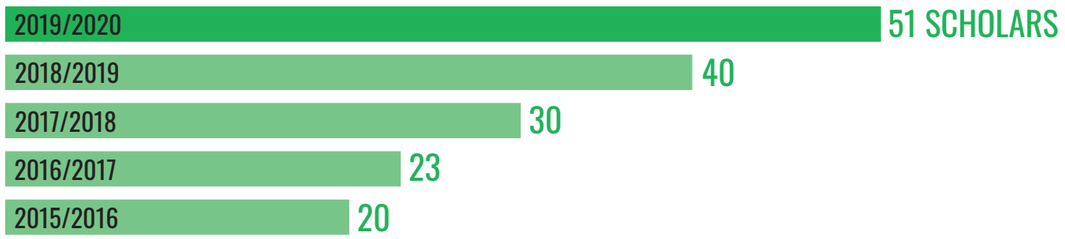
WRSP

The **Wyoming Research Scholars Program (WRSP)** pairs undergraduate students with faculty mentors to participate in their own cutting-edge research project starting as early as their freshman year. Research experiences through WRSP build confidence and competence in young scholars at a formative stage in their training.

Program Goals:

1. Attract high-achieving high school graduates and community college transfer students to UW.
2. Retain promising students in the sciences at UW through early involvement in hands-on science research, department seminars, and public outreach events.
3. Pair talented students with a faculty mentor who can model the scholarship, teaching, service, and outreach activities of a professional scientist.
4. Develop transferable professional skills such as science writing, data analysis, and oral communication through participation in research and public outreach events.

WRSP SCHOLARS THROUGH TIME (2015-2020)



101 total scholars

FROM

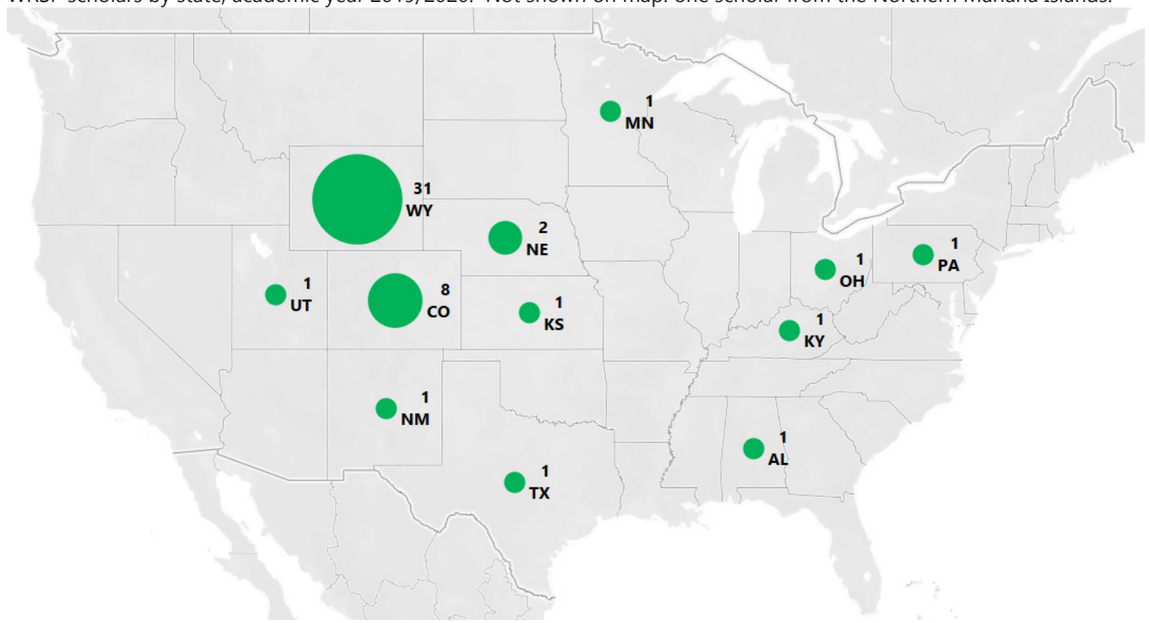
3 countries AND

24 US states and territories

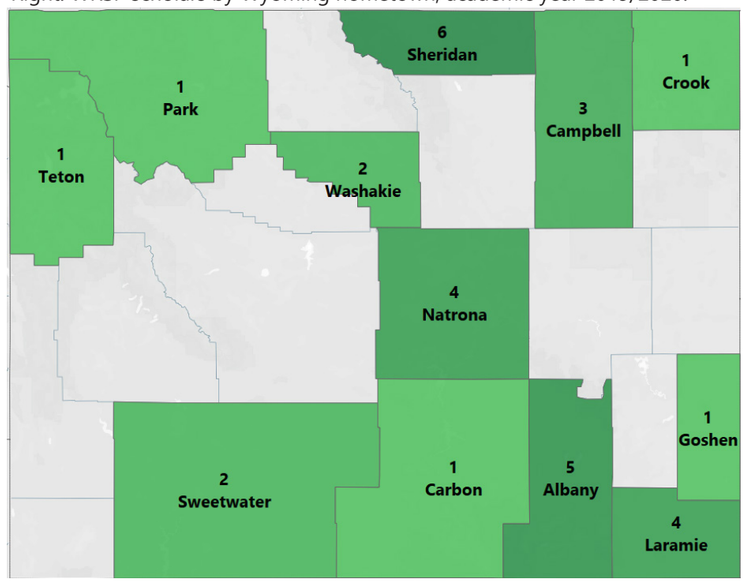
61 scholars from **17** Wyoming counties

WRSP SCHOLARS 2019/2020

WRSP scholars by state, academic year 2019/2020. Not shown on map: one scholar from the Northern Mariana Islands.



Below: WRSP scholars by Wyoming county, academic year 2019/2020.
Right: WRSP scholars by Wyoming hometown, academic year 2019/2020.



WY CITY	# OF SCHOLARS
Buford	1
Casper	4
Cheyenne	4
Gillette	2
Green River	1
Jackson	1
Laramie	4
Powell	1
Rawlins	1
Rock Springs	1
Sheridan	5
Story	1
Sundance	1
Torrington	1
Worland	2
Wright	1

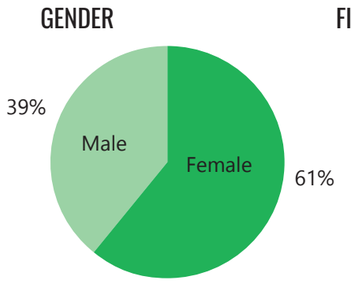
SI'S SIGNATURE PROGRAMS

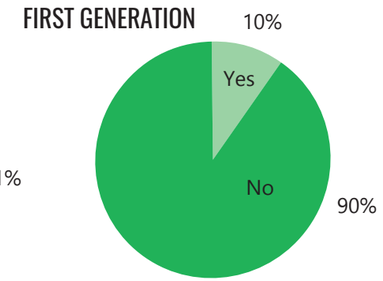
WRSP

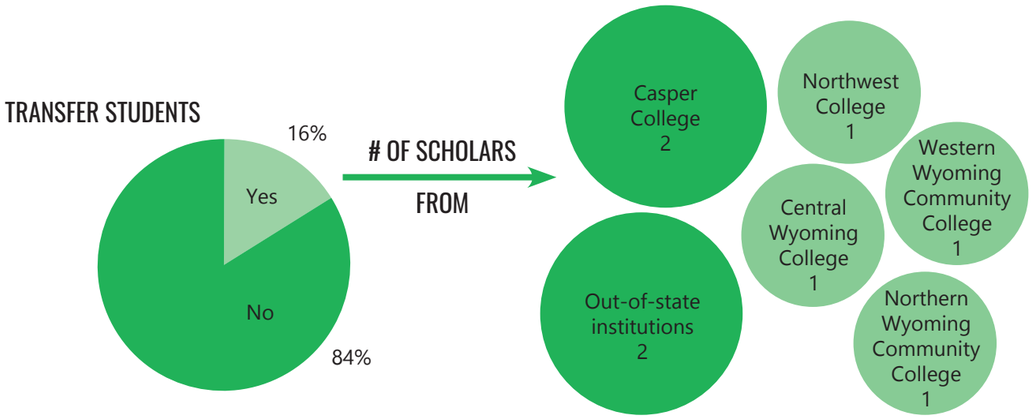
WRSP scholars did

10,928

hours of research







Primary majors of WRSP scholars, academic year 2019/2020.

PRIMARY MAJOR	# OF SCHOLARS	PRIMARY MAJOR	# OF SCHOLARS
Agroecology	1	Mechanical Engineering	2
Animal & Veterinary Science	2	Microbiology	4
Astronomy & Astrophysics	2	Molecular Biology	2
Biology	3	Petroleum Engineering	2
Chemical Engineering	1	Physics	5
Chemistry	4	Physiology	6
Computer Engineering	1	Pre-Pharmacy	1
Computer Science	1	Secondary Education - Biological Science	1
Electrical Engineering	1	Speech Language & Hearing Sciences	1
Environmental Geology & Geohydrology	1	Wildlife & Fisheries Biology & Management	2
Environmental Systems Science	2	Zoology	3
Geology	1	Zoology & Physiology	1
History	1		

WRSP SCHOLAR PUBLICATIONS AND PRESENTATIONS

The goals of WRSP include not only exposing undergraduate students to the work of a professional researcher, but giving them the opportunity and resources to actively contribute to these processes. This takes research from the theoretical to the practical realm and also gives students research products that greatly enhance their applications for further education and employment. Each semester, WRSP scholars report the products of their research, including publications, presentations, outreach, and other creative activities. This academic year, 16 scholars reported on their research activity. These data were augmented with online searches for other research products. This academic year, many professional conferences were cancelled, so the number of presentations and posters was limited; however, most WRSP scholars will present their research through a virtual symposium this summer.

List of presentations and posters presented at professional conferences to which WRSP scholars contributed, academic year 2019/2020.

PRESENTATION TITLE	EVENT/CONFERENCE NAME
Selection of an Optimal Invertebrate Taxon as a Baseline in Stable Isotope Analyses of Stream Food Webs	American Fisheries Society & The Wildlife Society Conference
Patterns of Gene Expression Underlying Salt Stress Tolerance in Vitis	Western INBRE Conference
What Brain Sites are Involved in Decision Making?	NIH IDeA Western Regional Conference
Decision Making: Identifying the Pathways used in Cognitive Decision Making	NIH IDeA Western Regional Conference
Individual Distinctiveness in Vocalizations of a Suboscine Songbird	American Ornithological Society Conference
New Approaches to Hydrocarbon Feedstock Conversion: Bifunctional Pd Complexes for Tunable Heterolytic C-H Activation	American Chemical Society National Meeting & Exposition
Bifunctional Pd Complexes for Tunable Heterolytic C-H Activation and Alkene Dimerization	American Chemical Society SWRM Regional Meeting

List of published articles to which WRSP scholars contributed, academic year 2019/2020.

ARTICLE TITLE	JOURNAL TITLE
Identification and Characterization of the Lactating Mouse Mammary Gland Citrullinome	International Journal of Molecular Sciences
Selective Modification of Tryptophan Residues in Peptides and Proteins Using a Biomimetic Electron Transfer Process	Journal of the American Chemical Society
Variable Hybridization Outcomes in Trout are Predicted by Historical Fish Stocking and Environmental Context	Molecular Ecology

SI'S SIGNATURE PROGRAMS

WRSP

WRSP SCHOLAR EXIT SURVEY

Beginning this academic year, scholars who exit the program (most by graduating) will fill out an exit survey, which asks questions about learning outcomes related to the research, teaching, and outreach that scholars took part in during their time in WRSP. Also included are questions about future educational and employment plans and questions about WRSP in general. Below are some notable results from the seven Spring 2020 graduates who completed the survey.

Out of 10, WRSP scholars gave the program an overall rating of

9.6

ALL 7

scholars plan to pursue graduate education and employment in their field of study. Scholars remarked that their involvement in WRSP gave them confidence related to, clarified their plans for, and gave them the skills they needed to be prepared for graduate school.

On average, scholars reported a

GREAT GAIN

in confidence and competence related to research skills

When asked to reflect on the impact of the program, one scholar said "I am more logical, confident, and a better problem-solver than I was prior to my participation in an undergraduate research experience."

WRSP'S RESPONSE TO COVID-19

The COVID-19 pandemic impacted numerous undergraduate researchers and their projects during the second half of the spring semester and into summer. WRSP assisted students during this crisis by providing guidance and updates on UW research policies. WRSP students were consulted individually about specific challenges imposed on their projects by shutdowns of on-campus research. Because students in the program represent a broad range of STEM disciplines, the level of disruption to student research varied significantly. Students with laboratory-based and field-based studies were advised to work remotely on alternative activities such as literature review, analysis of existing data sets, proposal and manuscript preparation, training in new techniques such as computer coding and GIS, and planning for future research projects. In addition, the deadline for 2020-21 WRSP applications was extended to accommodate COVID-related interruptions to student schedules, and orientation sessions for new students were moved to summer. Numerous spring research presentations were interrupted by the pandemic. For example, UW's annual celebration of undergraduate work, "Undergraduate Research and Inquiry Day", was cancelled and several students were unable to attend and present their results at professional conferences. Consequently, the SI is hosting a Wyoming Research Scholars Program Virtual Symposium in summer so that WRSP students will still have the opportunity to present their work. Workshops are being held to assist students with the preparation of oral presentations and online posters. WRSP will continue to assist undergraduate researchers and their faculty mentors throughout the summer and into the fall semester as they adapt projects to the challenges of the COVID-19 situation.

COURSE-BASED UNDERGRADUATE RESEARCH EXPERIENCES (CUREs)

In the Fall of 2019, CUREs were piloted at UW by WRSP Director Jamie Crait with assistance from two other UW instructors. CUREs have also been developed at other universities as a way to engage students in research at a "scale that is not possible through apprenticeships in faculty research laboratories." (Rodenbusch et al., 2016)[1]. Currently, UW's CURE program is being developed as a sequential, three-course series moving students towards more autonomy in research. The first course in the sequence introduces students to research through developing skills in primary literature analysis, data analysis and visualization, and scholarly communication. The second course gives students deeper knowledge in a specific discipline and training in research methods. The third course focuses on applying skills and knowledge in the context of a research project. After a student finishes the series of courses, instructors provide information on further research opportunities such as working in faculty labs or participating in internships. Students who finish the sequence will also have the opportunity to serve as peer mentors for new students.

The first course in the series was offered in Fall 2019 as Special Topics In: Introduction to Ecological Research. Beginning in Fall 2020, this course will be taught as a First Year Seminar. In Spring 2020, the second course in the series was offered as a Scientific Communication course listed under Life Sciences. The third course will be offered in Fall 2020. In the future, the Science Initiative aims to assist UW instructors in developing CUREs across the science disciplines and to ensure that all CURE courses meet core major requirements, integrating them effectively into students' majors.

CURE students place remote cameras to study wildlife at beaver ponds near Pole Mountain in Medicine Bow National Forest.

[1]Rodenbusch SE, Hernandez PR, Simmons SL, Dolan EL (2016). Early Engagement in Course-Based Research Increases Graduation Rates and Completion of Science, Engineering, and Mathematics Degrees. *CBE - Life Sciences Education*, *15*(2), 1-10.

SI'S SIGNATURE PROGRAMS

ROADSHOW

SCIENCE INITIATIVE ROADSHOW

BRINGING ACTIVE LEARNING TO K-12 STEM CLASSROOMS ACROSS WYOMING

SI'S SIGNATURE PROGRAMS

ROADSHOW

Teams of undergraduate and graduate students from UW, including WRSP Scholars and LAMP Learning Assistants, travel throughout the state facilitating hands-on learning in K-12 STEM classrooms using active learning techniques through the **Science Initiative Roadshow**. The teams from UW work with K-12 teachers to integrate learning experiences into existing curricula in order to achieve assigned learning outcomes. This collaborative approach exposes Wyoming students and teachers to innovative active learning techniques and creates links between UW and schools across the state to improve STEM teaching statewide.

THE SCIENCE INITIATIVE ROADSHOW THROUGH TIME (2017-2020)

Since 2017, the Science Initiative Roadshow has brought active learning to

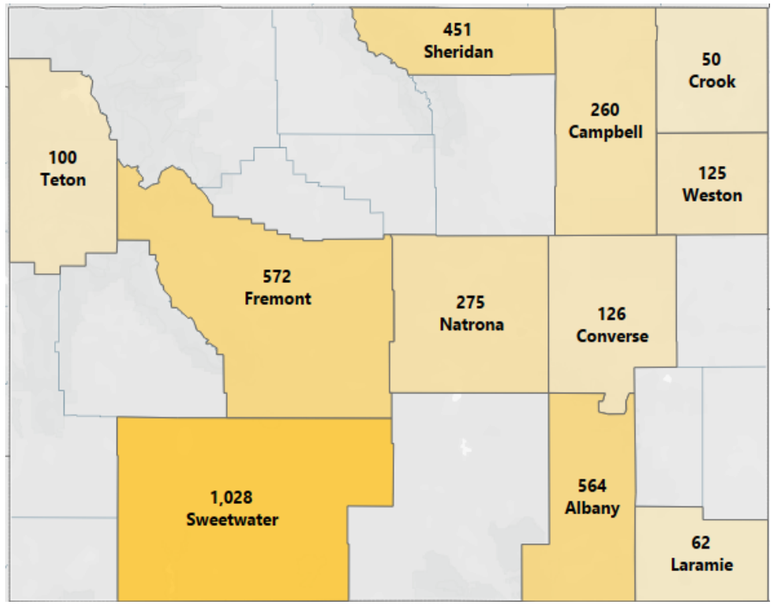
3,613

K-12 students from

11

Wyoming counties

Number of K-12 students reached, 2017-2020.



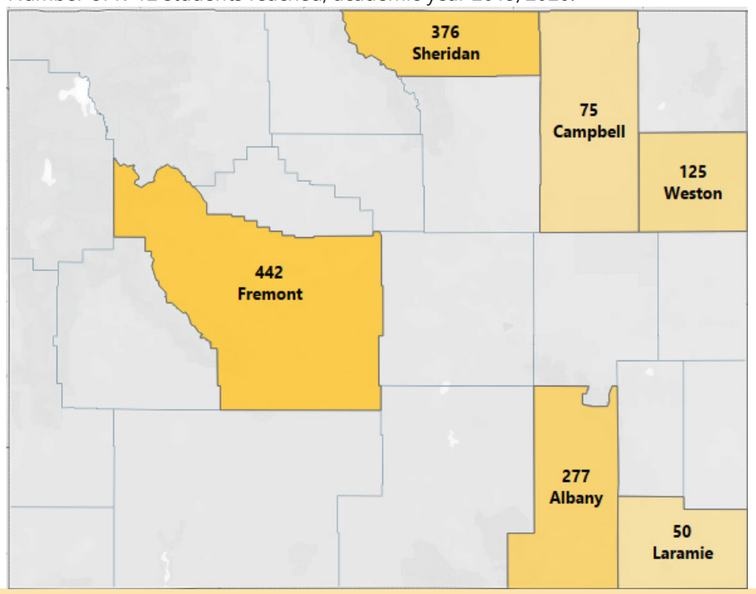
28
school visits

19+
schools

14
WY communities

THE SCIENCE INITIATIVE ROADSHOW 2019/2020

Number of K-12 students reached, academic year 2019/2020.



In the 2019/2020 academic year, the Science Initiative Roadshow brought active learning to

1,345

K-12 students from

6

Wyoming counties

DATE	CITY	SCHOOL	# OF STUDENTS
8/23/2019	Riverton	Riverton Middle School	60
9/19/2019	Gillette	Campbell County High School	75
10/7/2019	Riverton	Riverton Middle School	60
11/4/2019	Riverton	Riverton Middle School	60
11/15/2019	Centennial	Centennial Elementary School	7
12/5/2020	Newcastle	Newcastle Middle School	125
1/14/2020	Riverton	Riverton Middle School	182
1/15/2020	Riverton	Riverton Middle School	200
2/3/2020	Laramie	Laramie Junior High School	270
2/19/2020	Sheridan	Sheridan Junior High School	376
2/24/2020	Cheyenne	Pioneer Park Elementary School	50

SI'S SIGNATURE PROGRAMS

ROADSHOW

RIVERTON COMMUNITY-BASED LEARNING PROJECT

During the 2019/2020 academic year, UW faculty and students, including Rachel Watson's UW microbiology capstone class, partnered with 60 7th grade students and their teachers from Riverton Middle School, the City of Riverton, and Inberg-Miller Engineers on a large, community-based project involving research into the possible phytoremediation of a decommissioned landfill in Riverton. The landfill operated from 1971-1983 when there were fewer regulations on landfills, such as a required liner to prevent leaks. In 2013, the Wyoming legislature created a landfill remediation program to assist communities with landfills that pose a high risk to human health and to the environment. The Wyoming Department of Environmental Quality (DEQ) ranked the landfill in Riverton 10th out of 82 landfills with the highest need for remediation. Since then, the City of Riverton and Inberg-Miller Engineers have been researching solutions to remediate the site.

The Roadshow's collaborative project began in August 2019 with the first visit to Riverton Middle School. Rachel Watson and two UW graduate students led educational activities related to landfill waste, chemicals, bacteria, and native Wyoming plants that can be used for phytoremediation. In October, the 7th graders traveled to UW to visit the Rocky Mountain Herbarium and learn more about phytoremediation from UW professors and students. In November, Rachel Watson and her capstone students traveled to the landfill to collect samples and meet with the 7th graders. In December, Rachel Watson's microbiology capstone class presented two posters showing their findings related to the project and invited the Riverton students to the presentation through video to discuss findings and ask questions. In January 2020, the Roadshow took a final trip to Riverton to work with the 7th graders to brainstorm their ideas for individual and team projects, community involvement, and how best to go public with their interdisciplinary learning. Some UW students also continued research related to the project throughout the spring 2020 semester. To conclude the project, teachers from Riverton and researchers from UW plan to present on the year-long project at the Wyoming Department of Education Roadmap to STEAM conference this summer.

Riverton 7th graders and teachers, UW faculty and students, and Inberg-Miller engineers near the decommissioned landfill in Riverton.

At the outset of the project, Rachel Watson shared, "This collaboration is truly unique because it will allow the 7th grade students to work within their community on a meaningful project and to do so in an interdisciplinary way with community leaders and University of Wyoming student researchers. Not only are the students afforded a rich learning experience, but so too are the instructors and professors who will support their learning. Already I am working with the 7th grade teachers to design curriculum surrounding the old Riverton Landfill remediation. This curriculum will allow students to explore solutions involving phytoremediation, mycoremediation and bioremediation. Thus, they will learn deeply about the chemistry of the landfill leachate, the plant physiology of species that can accumulate these toxins, and metabolism of fungi and bacteria that can also degrade harmful chemicals. They will also learn about all of the future careers that are available in these areas; they will work with the actual researchers, engineers and city planners. This makes things that often seem far off and inaccessible into something tangible. Thus, this will be a truly holistic and life-changing learning experience for all teachers and students involved."

NEW FACULTY HIRE

This summer we will welcome Karagh Brummond to the SI team. Karagh received a B.S. in Neuroscience (Honors) from Regis University in Denver, Colorado and a PhD in Neuroscience from the University of Wyoming. Her PhD research focused on the neuronal control and encoding of speech using songbirds as an animal model, and her post-doctoral work was focused on reproductive neuroendocrinology. She is also involved in the Laramie community as an Alzheimer's Association Community Educator, a 500 Women Scientists movement coordinator, and performs public outreach through Brain Awareness Week to educate the community and the state of Wyoming on brain research. She comes to us from the UW Honors College, where she served as the Senior Project Coordinator for the Summer High School Institute, as well as teaching multiple courses. Karagh will be tasked with expanding the Roadshow and the CURE programs.

STUDENT-CREATED COMMUNITY OUTREACH PROGRAM FOR STEAM ENGAGEMENT (COPSE)

Science Initiative programs are catalyzing educational change in Wyoming by spawning other projects related to active learning and research. In March of 2020, six UW graduate students and one post-baccalaureate student, many of whom are LAMP-trained or former WRSP scholars, won a one-year, $16,860 UW Biodiversity Institute Novel Outreach & Education Grant. Rachel Watson is the faculty sponsor for the project, which is titled "Community Outreach Program for STEAM Engagement (COPSE)". The project will first administer training events to provide resources and opportunities for graduate student skill development in communication, education, and outreach assessment and build a sustainable community of UW students engaged in a variety of outreach activities. Next, this UW student community will develop an active learning program called Crossroads, integrating both science and art, which will focus on how diversity permeates the earth and universe at multiple scales. Crossroads will then bring the active learning program to six different K-12 schools across Wyoming. Involved K-12 students will create artwork related to what they have learned, which will be displayed at a festival at the Berry Biodiversity Center at UW. The public and select K-12 students and teachers will be invited to attend the festival, which will conclude the year's projects. UW students plan to continue the program after the initial year of Biodiversity Institute funding.

FACULTY INNOVATION GRANT PROGRAM

PROVIDING SEED GRANTS FOR NATIONAL-LEVEL FUNDING OPPORTUNITIES

SI'S SIGNATURE PROGRAMS

SEED GRANTS

SI'S SIGNATURE PROGRAMS

SEED GRANTS

In March of 2019, the Science Initiative launched a pilot version of the **Faculty Innovation Grant Program**, designed to stimulate and bolster submission of competitive interdisciplinary grant proposals to federal agencies.

These seed grants are expected to encourage 30+ competitive grant proposals over the next two years to federal agencies including the National Science Foundation (NSF), Department of Energy (DOE), Department of Defense (DOD), United States Department of Agriculture (USDA), National Institutes of Health (NIH), and United States Geographical Survey (USGS). Similar programs at other universities have yielded up to a 20 to 1 return on investment.

PI & UW DEPT	CO-PIs & UW DEPTS	PROJECT TITLE	TOTAL AWARD
***Mike Brotherton,** Physics & Astronomy	**Daniel Dale,** Physics & Astronomy **Ruben Gamboa,** Computer Science	Accelerating the computational investigation of supermassive sub-parsec binary black holes candidates	$45,000
Carrie Eberle, Plant Sciences	**Steve Paisley,** Animal Science	Establishing *Crotalaria juncea* as a new forage crop for the sustainable intensification of the Wyoming agricultural industry	$89,992
Brian Leonard, Chemistry	**Elliott Hulley,** Chemistry **William Rice,** Physics & Astronomy **John Ackerman,** Chemical Engineering	Understanding intercalation chemistry to design novel 2D materials	$90,000
Merav Ben-David, Zoology & Physiology	**Brian Cherrington,** Zoology & Physiology **Vikram Chhatre,** Molecular Biology	Genomic analyses of embryonic diapause in the Musteloidea with an eye towards improving assisted reproductive technologies	$77,366
Amy Navratil, Zoology & Physiology	**Jay Gatlin,** Molecular Biology	Understanding how the tubulin code regulates reproductive function of gonadotrope cells	$90,000
John Oakey, Chemical Engineering	**Daniel Levy,** Molecular Biology	Nuclear size in 3D cancer cell migration	$52,000
Ginger Paige, ESM	**Melanie Murphy,** ESM **Fabian Nippgen,** ESM **Brent Ewers,** Botany	Tracking eco-hydrologic changes in the hyporheic zone to improve water resource management	$88,740
****Daniel Laughlin,** Botany	**Dan Tekiela,** Plant Sciences	The first experimental test of a new paradigm in ecological restoration	$69,232
Catherine Wagner, Botany	**Bryan Shuman,** Geology & Geophysics **Amy Krist,** Zoology & Physiology **Annika Walters,** WY Game & Fish Cooperative Unit	The tempo of ecological and evolutionary change: response to predator introduction in alpine lakes of the Wind River Range	$89,537

PI & UW DEPT	CO-PIs & UW DEPTS	PROJECT TITLE	TOTAL AWARD
Don Jarvis, Molecular Biology	**Jason Gigle,** Molecular Biology **Jonathan Fox,** Veterinary Sciences	Assessing the impact of a viral contaminant on the biosafety profile of the baculovirus-insect cell system	$89,580
Simone Runyon, Geology & Geophysics	**Susan Swapp,** Geology & Geophysics **Erin Philips,** SER **Carol Frost,** Geology & Geophysics **Robert Gregory,** WY State Geological Survey	REE enrichment in Wyoming Roll-Front uranium deposits	$89,996
Te-Yu Chien, Physics & Astronomy	**Maohang Fan,** Petroleum Engineering and SER	Synthesizing graphene-related materials and carbon nanotubes from coal through microwave treatments	$90,000
Ellen Currano, Botany	**Laura Viette,** Geology & Geophysics **Mark Clementz,** Geology & Geophysics	Back to the future: interdisciplinary research on 50 million year old ecosystems will allow WY to better prepare for the year 2140	$82,931

* Recommended for external (NSF) funding
** Externally funded by USDA-NIFA

As of June 2020, the Science Initiative has received communication that research groups that were awarded seed funds have so far applied for six grants, including proposals sent to the National Science Foundation (NSF), the US Department of Agriculture-National Institute of Food and Agriculture (USDA-NIFA), the US Department of Energy (DOE), and the American Chemical Society (ACS). These grant proposals have requested a total of $2.4M.

Dr. Mike Brotherton's grant proposal, "The Wyoming AGN Reverberation Mapping (WARM) Project", is currently under consideration for NSF funding.

Dr. Daniel Laughlin's grant proposal, in partnership with researchers from Chapman University, "Applying trait-based models to achieve restoration targets in rangelands", was funded by USDA-NIFA for $480,000 over four years. The USDA-NIFA grant was secured three months after the SI seed grant was awarded, so SI funding was only used to kick-start research.

Multiple other grant proposals are currently under consideration by national funding agencies, and the SI expects 20+ more grant proposals to be submitted through 2021 as the majority of the proposals enter their second year of the two-year seed grant funding.

OTHER PROGRAMS AND METRICS

PARTNERSHIP WITH APACHE POINT OBSERVATORY

The Apache Point Observatory (APO), including 3.5 m, 2.5 m, and 1.0 m telescopes, is located in the Sacramento Mountains of New Mexico near Alamogordo. Since July of 2017, with the financial support of the Science Initiative, UW has been one of eight members of the Astrophysical Research Consortium (ARC), giving UW astronomical researchers access to the 3.5 m ARC telescope at APO for 40 half nights per year, of which 65% have had clear weather. Access to this telescope has opened up new kinds of science programs to UW faculty and students, as it has a suite of optical and infrared spectrographs with capabilities not available at UW's WIRO telescope.

While UW astronomers continue to apply for time on national telescope facilities, the number of public-access telescopes has shrunk over the last decade. Yet, abundant telescope access has become more of a hot commodity with the emergence of time-domain astronomy: the study of how astronomical objects change on a nightly or weekly basis. The study of extrasolar planets that can be detected either by the transit (eclipse) of a planet's host star or by the velocity wobble imparted to its host star demands repeated, nightly observations. UW astronomers are poised to be leaders in this field given the power of APO access coupled with the capabilities at WIRO.

ARC membership has also led to scientific exchanges with ARC's seven other member universities, and the capabilities of APO have also featured prominently in recent grant proposals to NASA and the National Science Foundation. Between July 2017 and December 2019, the UW Physics & Astronomy department took three training trips to APO which included three faculty members, one postdoc, 17 graduate students, and two undergraduate students. Use of APO has enabled the department to take on 10 faculty and student-led research projects, as well. Lastly, research at APO has contributed to the publishing of seven articles, four with faculty as primary authors (two of these had student co-authors), and three with students as primary authors.

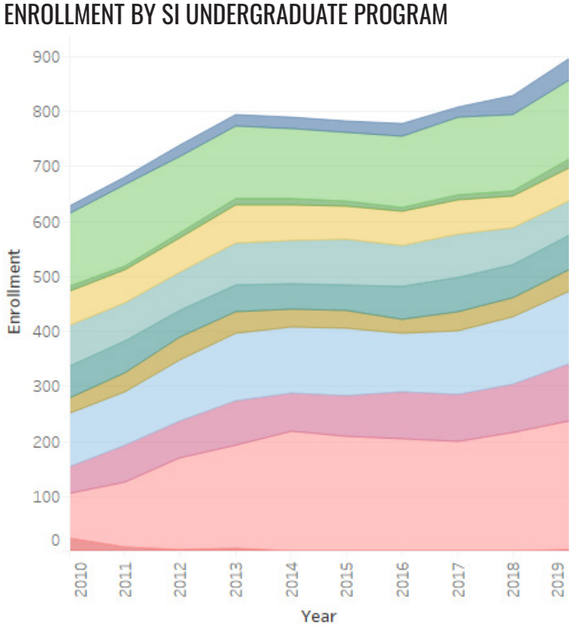
UW undergraduate Physics & Astronomy student and WRSP scholar, Logan Jensen at APO. Logan is from Greybull, WY and graduated with 2 degrees (Astronomy & Astrophysics and Physics) in Spring of 2018.

ENROLLMENT AND DEGREES AWARDED IN UNDERGRADUATE SCIENCE INITIATIVE PROGRAMS

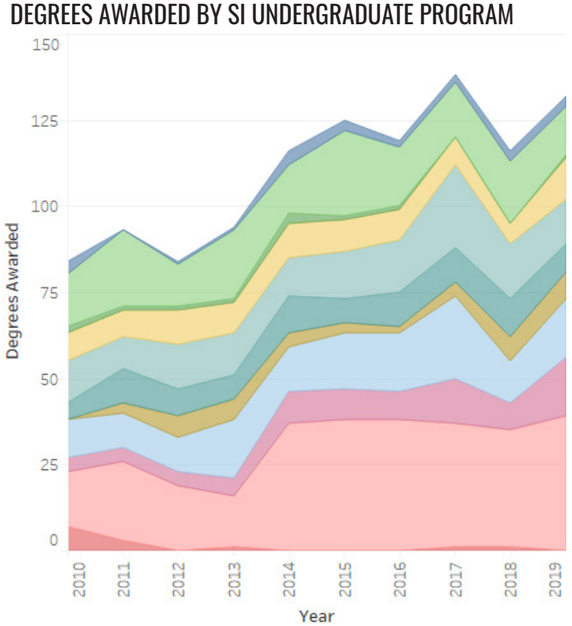
One of the Science Initiative's main goals is to attract, retain, and award degrees to undergraduate students in what have been identified as core science departments and programs at UW, which include Botany, Chemistry, Life Sciences, Microbiology, Molecular Biology, Physics & Astronomy, and Zoology & Physiology. These departments and programs include the following majors: Astronomy & Astrophysics, Biology, Botany, Chemistry, Microbiology, Molecular Biology, Physics, Physiology, Wildlife & Fisheries Biology & Management, and Zoology (Zoology & Physiology were previously one integrated major, but are now split into two).

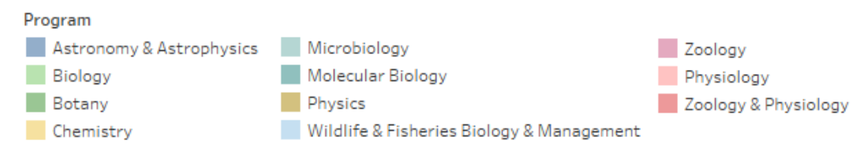
Enrollment numbers below are based on Fall numbers, and degrees awarded are based on Spring numbers from the same academic year (for example, Fall 2015 enrollment is shown as enrollment for 2016, and degrees awarded in Spring 2016 are shown as degrees awarded for 2016). For the purposes of this data, we can think of the Science Initiative as beginning in 2016 as programming for students began in Fall of 2015. At the time of publishing this report, data for 2020 was not yet available.

ENROLLMENT BY SI UNDERGRADUATE PROGRAM



DEGREES AWARDED BY SI UNDERGRADUATE PROGRAM





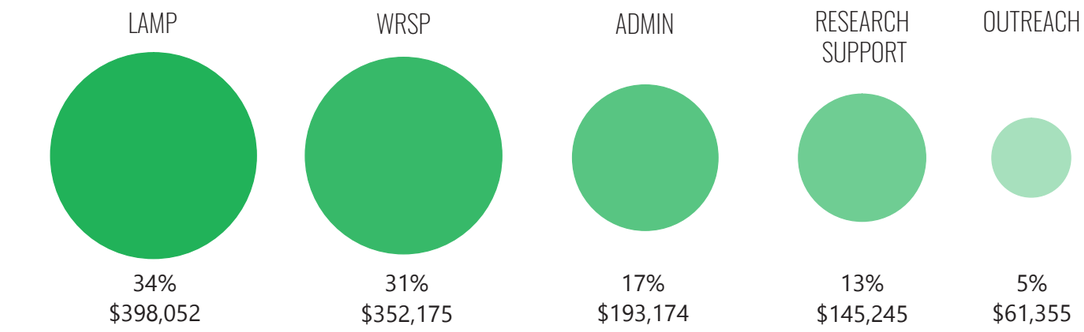
FINANCIAL STATEMENT

THE PAST YEAR

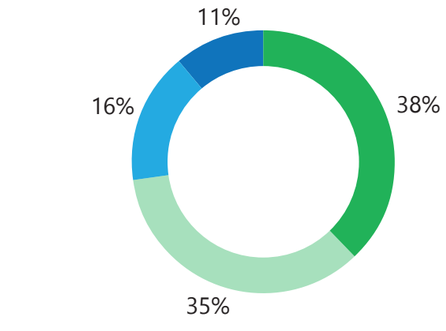
Our primary financial goals for the year included expanding and enriching our active learning and student research programs, increasing outreach to K-12 students and Wyoming communities, and providing seed funding for novel faculty research.

WHERE OUR FUNDING GOES (FISCAL YEAR 2019/2020)

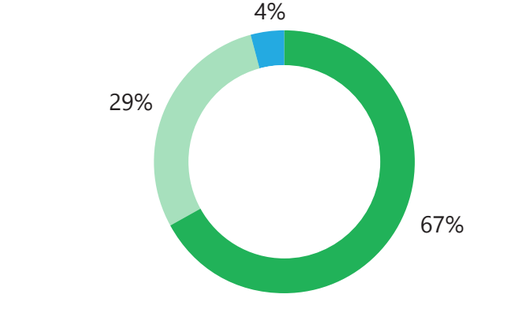
The Science Initiative is currently funded by an annually recurring state appropriation of $1.15M/yr. An additional one-time state appropriation of $1M was awarded to pilot the Faculty Innovation Grant Program. Designed to stimulate external funding proposals, the 2-year seed grants will be spent over the 19-20 and 20-21 fiscal years. 12 undergraduate researchers in the Wyoming Research Scholars Program are generously funded by the UW School of Energy Resources at a budget of $81K/yr for FY19-20.



RESEARCH EXPENSES BREAKDOWN



TEACHING EXPENSES BREAKDOWN



VISION FOR THE FUTURE

Science Initiative programs are currently supported at **23%** of the full funding outlined in the Governor's Task Force Report

Fiscal year 2019/2020 budget vs. target budget set by Governor's Task Force and Science Initative Leadership Team.

BUDGET SEGMENT	TARGET BUDGET	FY 19/20 ALLOCATED BUDGET	REMAINING ALLOCATION NEEDED	PERCENT FUNDED
Active Learning Training Programs (LAMP)	$398,000	$398,000	$0	100%
Undergraduate Research Programs (WRSP)	$900,000	$352,000	$548,000	39%
Administrative Staffing and Expenses	$506,000	$194,000	$312,000	38%
Outreach and Engagement	$200,000	$61,000	$139,000	31%
Research Support and Facilitation	$817,000	$117,000	$700,000	14%
Core Instrumentation Facility (CASI) Staffing	$510,000	$28,000	$482,000	5%
Specialized Building Staffing	$160,000	$0	$160,000	0%
PhD Scholars Program	$920,000	$0	$920,000	0%
Innovative Seed Grants*	$600,000	$0	$600,000	0%
Totals	**$5,011,000**	**$1,150,000**	**$3,861,000**	**23%**

*A one-time $1M was appropriated during the spring 2019 legislative session.

LOOKING AHEAD

In the next year, we will continue to work diligently to use our funds in an efficient and targeted manner. We plan to diversify our income with funding from private sources to support outreach to K-12 students and to increase the reach of active learning across Wyoming's community colleges. We are also adding an additional faculty member in order to increase our statewide impact and support undergraduate researchers. Finally, we are planning for new programming in conjunction with the opening of the new building in Fall 2021. We look forward to a vibrant future of transforming student learning, teaching, and research at UW and across the state, and we thank you for your continued support.


UW TOP-TIER
SCIENCE
INITIATIVE
UNIVERSITY of WYOMING