

A group of five people, including three men and two women, are crouching in a field of tall, dry grass. They are wearing hats and casual clothing, and appear to be working together on a project. One man is holding a small plant, and another is holding a clipboard. A white bucket is on the ground. In the background, there is a large, rounded hill under a clear blue sky.

SCIENCE INITIATIVE ANNUAL REPORT

2023-24

REVOLUTIONIZING SCIENTIFIC EDUCATION AND DISCOVERY IN WYOMING

The University of Wyoming’s Science Initiative & Science Institute enable 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 Institute & 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.

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WHO WE ARE

Jay Gatlin, Executive Director, UW Science Institute; Professor, Molecular Biology

Mark Lyford, Associate Director of Engagement, UW Science Institute; Senior Academic Professional, Lecturer, Botany

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, Co-Director, Engagement and Outreach; Instructional Professor, Honors College

Erin Klauk, Co-Director, Engagement and Outreach; Assistant Lecturer, Geology & Geophysics

Tabatha Spencer, Executive Business Manager, UW Science Institute

Ryan Goeken, Information Specialist, Sr., UW Science Institute

Jay Fahlsing, Administrative Associate, UW Science Institute

Amanda Patton, Administrative Associate, UW Science Institute

Qian Yang, Assistant Research Scientist, Center for Advanced Scientific Instrumentation

Tim Deibert, Research Technician, Center for Advanced Scientific Instrumentation

Carmela Rosaria Guadagno, Director, Plant Growth & Phenotyping Facility; Associate Director, Controlled Environment Agriculture Center Operations

Michael Baldwin, Facility Manager, Plant Growth & Phenotyping Facility; Controlled Environment Agriculture Specialist

LETTER FROM THE DIRECTORS

Dear Friends of the Science Initiative,

The University of Wyoming's Science Initiative has demonstrated exceptional impact in advancing STEM education and outreach across the state during the 2023-2024 academic year. Through its signature programs, the Initiative engaged over 5,700 university students in active learning courses, while the Wyoming Research Scholars Program provided 46 talented undergraduates with valuable research opportunities, resulting in multiple peer-reviewed publications and conference presentations. The Initiative's commitment to statewide engagement was exemplified by its Roadshow program, which brought hands-on STEM activities to more than 6,700 K-12 students and seniors across Wyoming communities, while its Learning Actively Mentoring Program continued to transform teaching excellence, with 15 LAMP-trained educators receiving prestigious teaching awards. With full funding now secured through legislative appropriation, the Science Initiative is positioned to continue revolutionizing scientific education and discovery in Wyoming.

The newly established Science Institute marks an exciting expansion of the Initiative's mission, launching 10 innovative research centers and projects focused on strengthening Wyoming's economy through interdisciplinary science. With an initial investment of \$2.375 million in seed funding, these centers and projects have already demonstrated remarkable success. The Institute's state-of-the-art facilities, including the Plant Growth & Phenotyping Facility and the Center for Advanced Scientific Instrumentation, are creating unprecedented opportunities for cutting-edge research, while the award of eight PhD fellowships is helping to build a pipeline of top scientific talent for Wyoming's future. Moving into the future, the Science Institute will continue to facilitate the realization of the Science Initiative's goals and catalyze new scientific discoveries that address Wyoming's needs.

At the heart of these achievements is an extraordinary team whose passion for science and STEM education shines through in everything they do. The amazing work of program directors Rachel Watson, Jamie Crait, Karagh Brummond, and Erin Klauk, who have poured their hearts and souls into creating transformative experiences for students at UW and in communities across the state, is fundamentally transforming the way science is taught and communicated throughout Wyoming. Supported by a fantastic group of dedicated staff members who work tirelessly behind the scenes, their commitment to excellence, innovation, and service continues to elevate STEM education and research at UW and across our great state.

Best Regards,

Mark Lyford
Associate Director of Engagement

Jay Gatlin
Executive Director



CONTACT US

University of Wyoming

SIB Room 2030
Dept. 4325
Laramie, WY 82071

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

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Wyoming Science Initiative



GIVE TO THE SCIENCE INITIATIVE

HELP SUPPORT STUDENT SUCCESS IN THE CLASSROOM, IN THE
LABORATORY, AND AROUND THE STATE:

www.uwyo.edu/giveonline



ENGAGEMENT



The SI Roadshow brought active learning to **6,736** PreK-12 students and senior citizens during **37** outreach and inreach events in schools and other venues, more than doubling our reach over last year

A grant for **\$37K**

from the Wyoming Department of Health Aging Division, entitled “Engaging the Aging Brain in STEM: Fostering Socialization and Health Promotion in Older Individuals through the Science Initiative Roadshow” will allow the the SI Roadshow to bring engaging science activities to seniors throughout the state.



The Roadshow collaborated with the Engineering Outreach Program, Mobile Makerspace, Science Kitchen, and School of Computing to offer STEM Days at Hanna-Elk Mountain and Saratoga schools. These STEM Days include a plethora of different hands-on activities for students of all ages and expose them to a wide variety of science disciplines and applications.

WYOMING RESEARCH SCHOLARS PROGRAM (WRSP)

WRSP included 46 scholars from 12 US states



24 WY scholars from **10** WY counties

WRSP scholars did **12,388** hours of research



WRSP scholars contributed to **13** articles published in peer-reviewed journals and contributed to **24** presentations at professional conferences

“I feel like being part of this program (WRSP) taught me invaluable research skills that I couldn’t have gotten without it. It also allowed me to work in 2 labs during my time as an undergrad because I was getting paid and didn’t need to hold another job. I deeply appreciate the opportunities WRSP has given me. The skills I learned in this program have made me a better student and worker generally as well.”
- WRSP alumnus, Psychology

“Being a part of WRSP has allowed me to complete a research project that I am passionate about by giving me the financial means, education, support, and encouragement I needed to succeed!”
- WRSP alumnus, Anthropology

LEARNING ACTIVELY MENTORING PROGRAM (LAMP)



The LAMP Fellows program trained **35** instructors from **6** WY institutions of higher education

This year, **15** LAMP educators were awarded teaching awards. Some of these included:

UW LAMP Fellow Danny Dale was awarded the **George Duke Humphrey Distinguished Faculty Award.**

UW LAMP Fellows Kayla Burd, Bree Doering, Lori Howe, Joe Russo, & Jon Prather were awarded the **Promoting Intellectual Engagement (PIE Award).**

CWC LAMP Fellow Bill Finney was awarded the **CWC Innovative Educator of the Year Award.**

LAMP-trained professors taught

5,763 students in UW active learning courses



CREATION OF THE SCIENCE INSTITUTE

10 research centers and projects were funded at a total of **\$2.375M**

This seed funding, along with PhD fellows support, and investment in core facilities, will help stimulate external research funding for projects focused on strengthening diverse sectors of Wyoming’s economy and conserving important natural resources.



8

current UW graduate students were awarded prestigious PhD fellowships for 3 years of graduate studies. These fellows will support research within the Science Institute’s centers as well as take part in Science Initiative educational programs. In the future, these fellowships will fund 19 students annually and will be awarded to incoming PhD students. This will help to build a pipeline of top talent to UW, increase the number of graduate degrees UW awards, and enrich our programming for years to come.

Since late 2023, funded research centers and projects are so far affiliated with projects totaling

\$39M in extramural funding, published

40 peer-reviewed articles, and supported the research of **68** students and **6** post-doctoral researchers

SI'S SIGNATURE
PROGRAMS



LEARNING ACTIVELY MENTORING PROGRAM

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

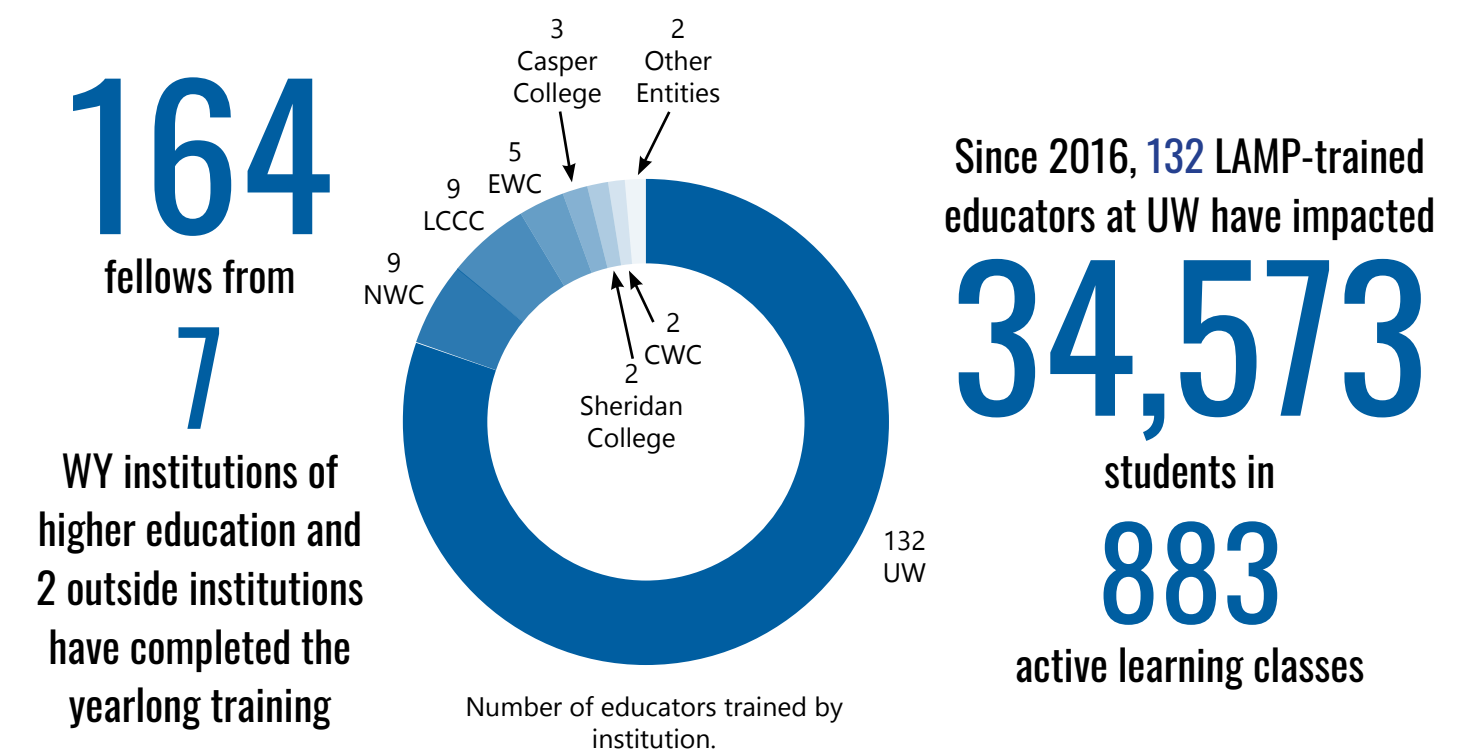
LAMP is a comprehensive, sustained mentoring and professional development program with an emphasis on how to best adopt active learning strategies in large-scale active learning classrooms at UW and in classrooms across the state’s community colleges.

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.
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 (2016-2024)

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 enrolled a new class of educators each year until 2020, when classes began enrolling every other year.



LAMP FELLOWS 2023/2024

During the 2023-2024 academic year, the sixth class of LAMP Fellows implemented and assessed their planned active learning strategies. The educators were supported in their work through four workshops: September – Utilizing Assessment Data to Evolve Instructional Design, October – Mapping your Curriculum onto Inclusive Pedagogical Practices, January – Coming Full Circle to Complete your Teaching and Learning Philosophy, and March – Aligning Values, Outcomes, Pedagogies and Assessments. On May 3rd, the LAMP Fellows presented their final posters detailing their active learning strategies and assessment data. Their projects ranged from *Transitioning Quantitative Chemical Analysis to an Active Learning Class* (Kui Chen, UW) to *Immersive Inquiry in Medical Microbiology: A Journey from Curiosity to Accomplishment* (Marie Yearling, LCCC).

The 2023-2024 LAMP Fellows class was the most accomplished LAMP class to date. Of the 34 Fellows accepted into the program, 33 completed their final project and earned their LAMP certificate. This is a success rate of 97%. Moreover, a majority (73%) of the LAMP fellows completed an updated teaching philosophy expressing their pedagogical growth. This exceeds even the most successful prior LAMP classes by 36%. We credit the increased success of the LAMP fellows to two factors: 1) We added spring 2023 asynchronous curriculum that allowed fellows to master the basic learning outcomes prior to the Summer Institute, 2) We enhanced our own use of Universal Design for Learning.

HHMI INCLUSIVE EXCELLENCE GRANT UPDATE

In 2023-2024, we published an institutional ethnography for our five community colleges. Our graduate assistant (Rosemary McBride) was able to utilize our institutional ethnography data to perform a qualitative social network analysis depicting the relationships between and amongst our community college and university educators. Our learnings about institutional hierarchies and networks from these research studies have informed our evidence-based development and nurturing of learning communities.

We have nurtured the outcomes of inclusive excellence communities at 3 of our 5 community colleges and will launch at the other two this coming year. Our educators are meeting the outcomes and were able to share their inclusive excellence work at a statewide gathering that we held at LCCC on May 14th.

Our NWC/UW Learning Community continued to assist with the NWC Student Showcase in Powell, now in its second year. This year, 72 students, supported by their faculty mentors, presented research, creative work or innovation.

Based upon our learning at our statewide gathering in May, we have planned a summer mini-retreat and workshops to allow educators to enunciate the relationship between grit, growth mindset, and self-assessment/self-regulation and to use grit and growth mindset as more equitable metrics to select students for opportunities. We will continue biweekly learning community meetings for our launched communities and we will be launching our full learning communities at Casper College and Eastern Wyoming College. We are also researching the impacts of the inclusive excellence learning communities on our members using both quantitative survey data and a qualitative phenomenological study.

In the 2023/2024 academic year, 60 LAMP-trained educators at UW impacted

5,763 students in

165 active learning classes

Student enrollment by discipline in LAMP fellow-taught active learning classrooms, academic year 2023/2024.

DISCIPLINE	ENROLLMENT
Biological Sciences	1,984
Physical Sciences	1,673
Engineering	582
Health Sciences	443
Psychology	231
Mathematics	202
Environment & Natural Resources	178
Honors College	170
Agriculture	148
Social Sciences	97
Disability Studies	38
Education	17

Student enrollment by subject description (including subject descriptions with an enrollment of 10 or more) in LAMP fellow-taught active learning classrooms, academic year 2023/2024.

SUBJECT DESCRIPTION	ENROLLMENT
Chemistry	1,398
Life Sciences	1,242
Kinesiology	370
Zoology & Physiology	344
Construction Management	309
Microbiology	238
Psychology	231
Mathematics	202
Honors	170
Geospatial Information Science Technology	136
Plant Sciences	99
Environment & Natural Resources	87
Architectural Engineering	87
Speech-Language Pathology	66
Computer Science	65
Earth Systems Science	63
Molecular Biology	62
Botany	62
Anthropology	59
Astronomy	54
Physics	50
Agricultural Economics	49
Electrical Engineering	45
Civil Engineering	39
Wyoming Institute for Disabilities	38
Criminal Justice	32
Pathobiology	28
Outdoor Recreation & Tourism Management	28
Engineering Science	28
Geography	27
Agricultural Education	14

EDUCATOR’S LEARNING COMMUNITY

In the spring of 2024, eight LAMP Fellow graduates were selected as members of the LAMP Educator Learning Community: Cedar Wiseman, Ashleigh Pilkerton, Amy Peterson, Jacob Layer, Kiana Henny, Kayla Burd and Reshmi Singh. These LAMP Fellows are joined by two undergraduate LAMP learning assistants, Dawson Poteet and Jaden Cook. The LAMP ELC is co-led by LAMP Director Rachel Watson and ECTL’s Director of Online and Digital Teaching, Christi Boggs. Together the ELC educators are learning about theories of change & resistance, and becoming trained as agents of change, catalyzing increased adoption of active learning in their home departments, units and divisions. Additionally, each member is engaged in an original SoTL (Scholarship of Teaching and Learning) study. Studies range from *Developing a Calculus Concept Inventory for Assessing Problem-Solving Ability* (Cedar Wiseman) to *Team-Based Learning in a Large Course: Preliminary Data in a General Psychology Classroom* (Kayla Burd). All studies have been submitted for peer review and inclusion in the Original Lilly Conference on College Teaching in November in Oxford, Ohio.

LEARNING ASSISTANTS

The LAMP Learning Assistants Program began in Spring 2018 and provides UW 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 of 2018, 147 UW students have served as LAs for 287 active learning courses. This academic year, 44 UW students have been LAs fo 59 active learning courses.

LAMP FELLOWS MAKE BIG IMPACTS AND ARE AWARDED WITH HIGH HONORS

Prior LAMP fellows continue to utilize their training to impact students at UW and across the state, gaining recognition for their transformative contributions. This year, 15 educators from across the state earned teaching awards, listed below:

- **Danny Dale** (UW Physics & Astronomy) – George Duke Humphrey Distinguished Faculty Award
- **Kayla Burd** (UW Psychology), **Bree Doering** (UW Anthropology), **Lori Howe** (Honors College), **Joe Russo** (School of Teacher Education), **Jon Prather** (UW Life Sciences) – Promoting Intellectual Engagement (PIE) Award
- **Randa Jabbour** (UW Plant Sciences) – Mortar Board Top Prof, Mid-Career Graduate Faculty Mentoring Award
- **Chris North** (UW Botany and Life Sciences), **Amy Navratil** (UW Zoology & Physiology) – College of Agriculture, Life Sciences & Natural Resources Outstanding Educator Award
- **Corrine Knapp** (UW Haub School of ENR) – Outstanding Graduate Mentor Award
- **Amy Peterson** (UW Communication Disorders) – Honors College Capstone Mentor of the Year
- **Michelle Blakely** (UW Pharmacy) – American Association of Colleges of Pharmacy (AACP) UW Faculty Member of the Year, UW Alpha Nu of Phi Lambda Sigma Faculty Member of the Year
- **Ahmed Abdelaty Ahmed** (UW Civil & Architectural Engineering & Construction Management) – Associate Schools of Construction (ASC) Regional Teaching Award
- **Ali Baas** (ACSD1) – 23-24 Whiting High School Teacher of the Year (Laramie)
- **Bill Finney** (CWC Chemistry and Physics) – CWC Innovative Educator of the Year Award

SI'S SIGNATURE
PROGRAMS



WYOMING RESEARCH SCHOLARS PROGRAM

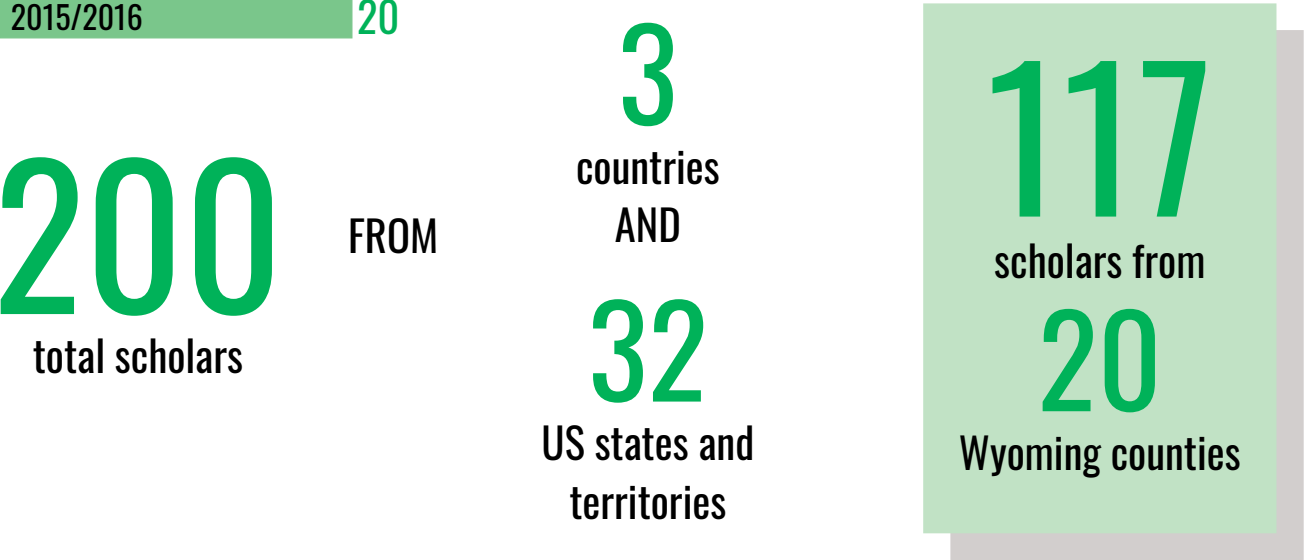
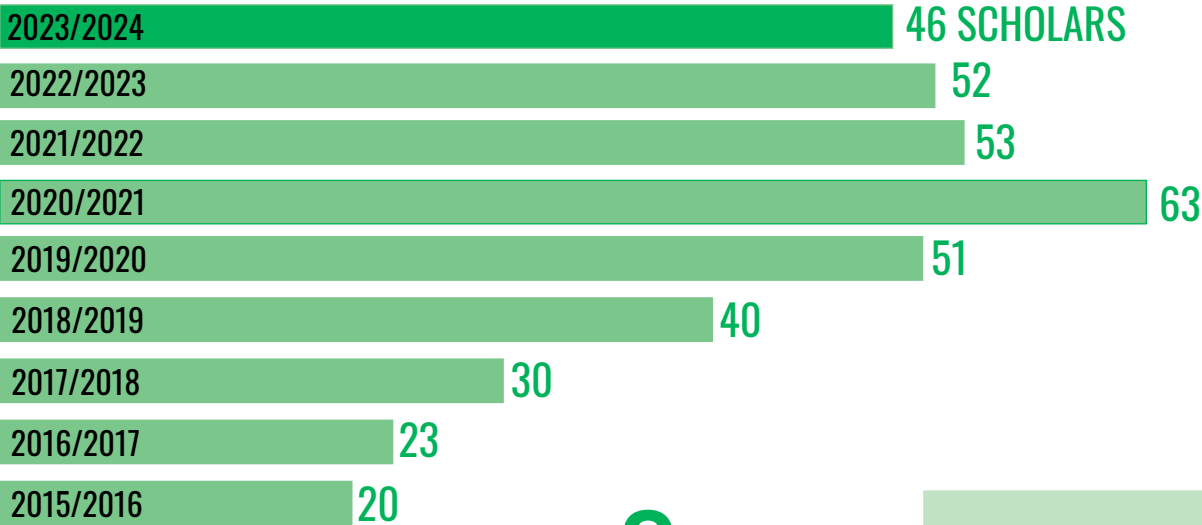
PROVIDING UNDERGRADUATE STUDENTS WITH
CUTTING-EDGE RESEARCH OPPORTUNITIES AND
FACULTY MENTORSHIP



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.

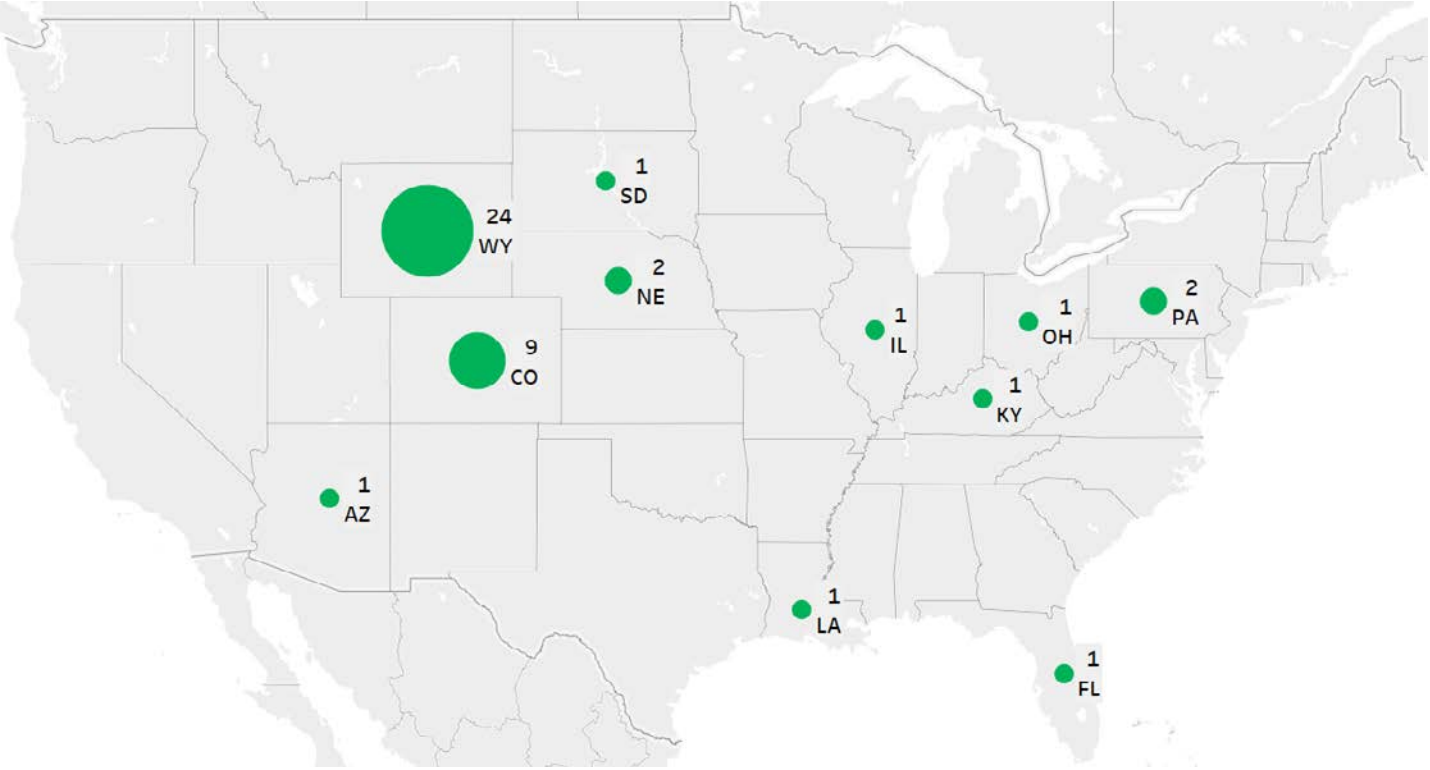
- Program Goals:
- 1. Attract high-achieving high school graduates and community college transfer students to UW.
 - 2. Retain promising students in the sciences at UW through early involvement in hands-on science research, department seminars, and public outreach events.
 - 3. Pair talented students 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 (2015-2024)

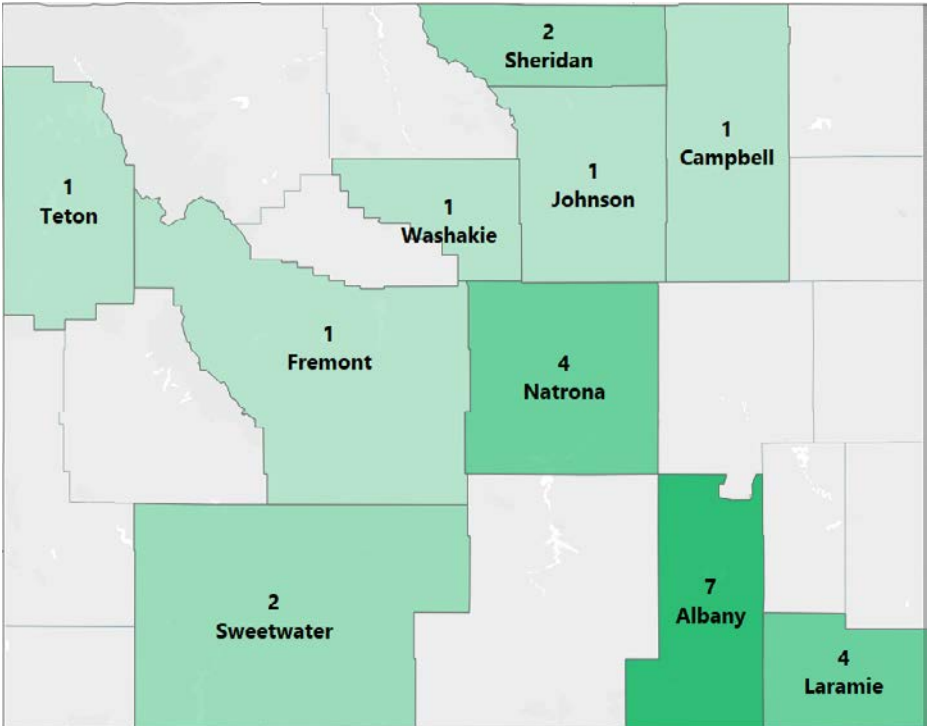


WRSP SCHOLARS 2023/2024

WRSP scholars by state, academic year 2023/2024. Additionally, 2 scholars from Alaska participated in WRSP.



Below: WRSP scholars by Wyoming county, academic year 2023/2024.
Right: WRSP scholars by Wyoming hometown, academic year 2023/2024.



WY CITY	# OF SCHOLARS
Buffalo	1
Buford	1
Casper	4
Cheyenne	3
Gillette	1
Granite Canyon	1
Jackson	1
Lander	1
Laramie	6
Rock Springs	2
Sheridan	2
Ten Sleep	1

WRSP scholars did

12,388

hours of research

10 WRSP scholars were named as authors on 13 published articles, and scholars gave 24 presentations at professional conferences

Most common primary majors of WRSP scholars, academic year 2023/2024.

PRIMARY MAJOR	# OF SCHOLARS
Molecular Biology	8
Zoology	7
Environmental Systems Science	4
Wildlife & Fisheries Biology & Management	3
Chemistry	3
Anthropology	3
Psychology	2
Physiology	2
Physics	2
Mechanical Engineering	2
Geology	2

WRSP SCHOLAR EXIT SURVEY

Each semester, scholars who complete their fellowship with the WRSP (most by graduating) fill out an exit survey which asks questions about learning outcomes related to their WRSP research and outreach. Also included are questions about future educational and employment plans and questions about WRSP in general. Below are some notable results from the 14 Spring 2024 graduates who completed the survey.

On average, scholars reported a

GREAT GAIN

related to their

- Understanding of the overall process of research
- Ability to communicate and present research and scientific findings
- Confidence in ability to do research
- Comfort in discussing scientific concepts

9.4

average overall rating of the program

Scholars reported that

STRENGTHS

of the program include

- Trainings on science communication
- Resources to attend professional conferences
- Flexibility of the program
- Paid experience so they were more able to focus on coursework and research

WRSP was definitely one of the highlights of my undergraduate experience. While I learned the fundamentals behind molecular biology in my classes, exposure to these theories and techniques in practice in a laboratory setting prepared me for a future career in the field more than any one course I took. Helping with ongoing research also made me feel like I was really contributing to something greater during my undergraduate years, so I definitely appreciated that.

WRSP ALUMNI SURVEY

In the fall of the years 2020, 2021, 2022, and 2023 we sent a survey to all alumni of the WRSP that asked questions about alumni’s current employment and education status and any comments they had on how WRSP affected their research, education, and employment journey. Below is a summary of the data.

- 93 out of 154 total alumni responded (60% response rate)
- In total, respondents were from 21 states and territories. 57 of the 93 alumni respondents were from Wyoming (61% of total respondents), and 13 were from Colorado (13% of total respondents)
- Wyoming alumni were from 25 different hometowns - 12 respondents from Cheyenne, 11 from Laramie, 4 from Casper, and 3 from Sheridan and Rawlins each.
- 11 out of 57 alumni originally from Wyoming stayed in Wyoming after finishing WRSP (this excluded students that are still pursuing their bachelor’s at UW and exited WRSP before graduating). It is possible that WY students that left the state for graduate school may return, as well. 7 alumni originally from other states stayed in Wyoming after finishing WRSP.
- 56 alumni attended or are currently attending graduate school (60% of total respondents). 26 alumni pursued Masters degrees, 20 pursued PhDs, and 10 pursued other advanced degrees (such as JDs or MDs). 12 of these alumni attended UW for their advanced degree (21% of total alumni that pursued an advanced degree).
- Of respondents that included employment information:
 - + 17 were employed in private industry related to STEM
 - + 17 were employed in a STEM academic field (higher education)
 - + 2 were STEM K-12 teachers
 - + 4 worked in a non-STEM field, and
 - + 1 started a non-STEM-related business
- When asked how the WRSP has helped them to achieve their goals, respondents said the following were important:
- WRSP helped them develop crucial skills in research, leadership, general professional skills (like resume building and applying to jobs), as well as speaking and communication
 - + WRSP helped them get into graduate school
 - + WRSP helped them attain employment
 - + WRSP helped them make connections with other researchers and develop a sense of belonging
 - + WRSP made research accessible through being paid to do research and being given resources to travel for research and professional conferences

COURSE-BASED UNDERGRADUATE RESEARCH EXPERIENCES (CUREs)

Instructors Jamie Crait and Christopher North continue to teach the LIFE 1101 CURE, engaging students in research in beaver pond ecosystems in the Medicine Bow National Forest. With the completion of the Student Collaborative Research, Outreach, and Learning Laboratory on the 4th floor of the Science Initiative Building in late fall of 2024, we look forward to build out CURE courses even further with the use of this groundbreaking space, as well as support from a dedicated laboratory manager. We continue to work with faculty across campus to imagine CURE course sequences across the disciplines, as well.

SI'S SIGNATURE
PROGRAMS

ROADSHOW

SCIENCE INITIATIVE ROADSHOW

BRINGING ACTIVE LEARNING TO
K-12 STEM CLASSROOMS ACROSS
WYOMING

Teams of undergraduate and graduate students from UW, along with UW and WY community college faculty and staff, in collaboration with partners across the state, facilitate in-person and virtual learning in PreK-12 classrooms and senior communities across the state using active learning techniques through the **Science Initiative Roadshow**. In K-12 classrooms, the teams from UW work with teachers to integrate learning experiences into existing curricula in order to achieve assigned learning outcomes. This collaborative approach exposes Wyoming students, teachers, and community members to innovative active learning techniques and creates links between UW and schools across the state to improve STEM teaching statewide.

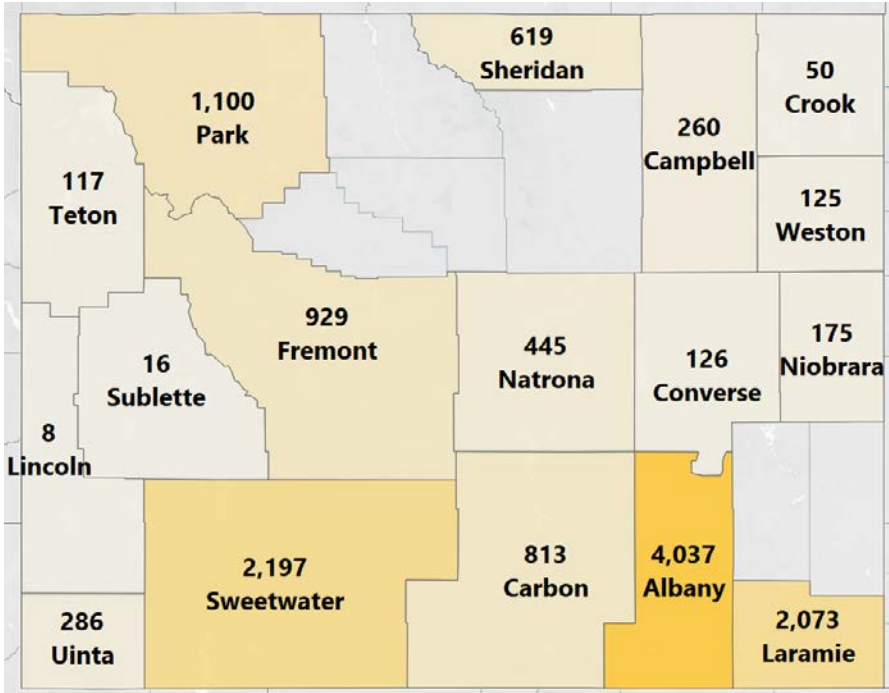
THE SCIENCE INITIATIVE ROADSHOW THROUGH TIME (2017-2024)

Number of PreK-12 students and seniors reached, 2017-2024. Students who took part in some in-reaches may not be included in the map as they came from various counties.

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

14,763

K-12 students & seniors from 17 Wyoming counties



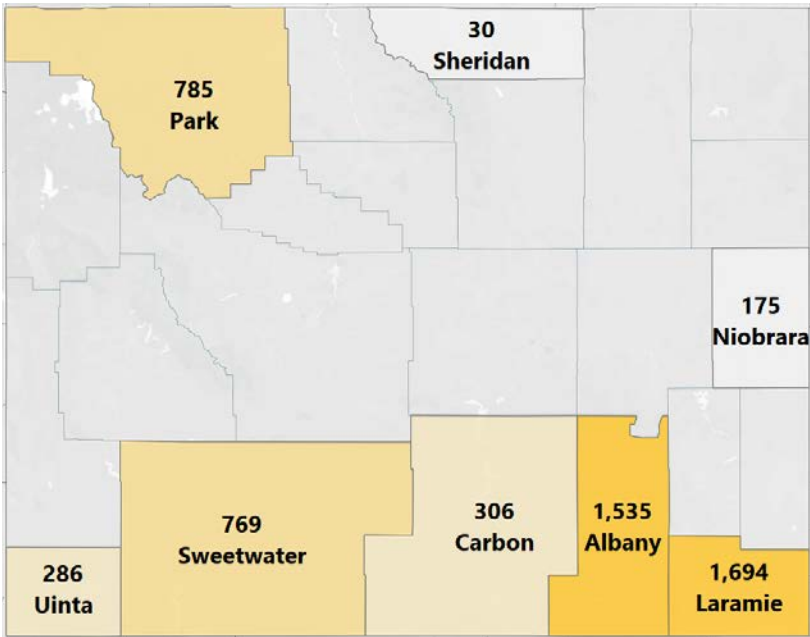
121 outreach & inreach events

55+ schools & afterschool programs

25 WY communities

THE SCIENCE INITIATIVE ROADSHOW 2023/2024

Number of PreK-12 students and seniors reached, academic year 2023/2024. Students who took part in some in-reaches may not be included in the map as they came from various counties.



In the 2023/2024 academic year, the Science Initiative Roadshow brought active learning to

6,736

PreK-12 students & seniors from 8 Wyoming counties

During academic year 2023/2024, the SI Roadshow led educational activities during 37 separate programs. Schools or other programs served were (by county):

Albany – Annual STEM Carnival, WY Latina Youth Conference, inreach visits, ECEC Pre-K, Spring Creek Elementary, Linford Elementary, Beitel Elementary, UW Lab School, Snowy Range Academy, Laramie Middle School, Laramie High School

Carbon – Encampment K-12 School, H-E-M Junior/Senior High School

Laramie – Discovery Days event (served many schools throughout Cheyenne), Girl Scouts Day of Science, Dildine Elementary, Miller Elementary

Niobrara – Eastern Wyoming Nature Center (for K-12 students in Lusk)

Park – All preschools in Cody, Livingston Elementary School

Sheridan – The Hub on Smith (senior community in Sheridan)

Sweetwater – Girls in STEM Saturday in Green River, Desert View Elementary, Truman Elementary, Rock Springs High School

Uinta – Aspen Elementary



THIS YEAR IN THE ROADSHOW

This past year the Science Initiative Roadshow and Community Engagement Program was all across Wyoming bringing hands-on STEM activities to K-12 classrooms, preschools, and even to older adult senior centers. The program reached 6,736 individuals in the state, traveling to locations including but not limited to Cody, Rock Springs, Encampment, Hanna, Green River, Evanston, Lusk, and Sheridan. The Roadshow reached new counties in the state this past year, closing the gap to only 6 counties the Roadshow has yet to visit in Wyoming. Many elementary schools had the Roadshow host STEM Days, where students were able to rotate through 10-12 different STEM stations throughout the day, learning concepts from Geology to Anatomy, Physics, Chemistry, and more. Partnerships with external and internal programs such as the Wyoming Game & Fish Department and UW Science Kitchen were instrumental in making these STEM Days a success! Finally, the Roadshow is excited to be adding visits to older adult-serving facilities in Wyoming, where we have facilitated 1-2 hour hands-on workshops including activities on pollination and geology.

GRANTS AND DONATIONS BRING THE ROADSHOW TO NEW PEOPLE AND PLACES

The Roadshow was recently awarded a grant from the Wyoming Department of Health's Aging Division to expand their hands-on STEM activities and lessons into older adult-serving locations in the state. The grant is focused on increasing socialization and engagement in older individuals by offering hands-on, science-based activities that are focused on topics and learning opportunities of interest to this demographic. In addition, the Roadshow delivers these activities with UW students, both undergraduate and graduate, allowing older individuals the chance to engage in socialization with younger individuals that come from many of the same rural towns in Wyoming. When possible, the Roadshow also looks to incorporate cross-generational opportunities, bringing K-12 students and older individuals together to perform these STEM activities.

The Roadshow was also awarded a generous donation from Williams Technologies to continue their K-12 outreach work in Wyoming communities - specifically those located in Sweetwater, Sublette, Uinta, and Lincoln counties. The Roadshow had an extremely successful spring delivering STEM Days and classroom visits in many of these locations and looks forward to even more scheduled events in fall of 2024. The Roadshow also received generous donations from Rocky Mountain Power and Dominion Energy to foster statewide K-12 partnerships that continue to help us build sustained networks in Wyoming.

SECOND ANNUAL STEM CARNIVAL

The 2nd annual UW STEM Carnival on September 8, 2023 was a huge success, bringing about 1,150 individuals to the UW campus to explore and learn STEM. Of these attendees, we had about 650 K-12 students attend from the local community as well as Goshen and Carbon counties. The carnival featured 42 interactive STEM tables highlighting the STEM programs on UW's campus. In addition to the tables, the carnival specifically featured the UW Engineering Education and Research Building where participants could get an up-close view of the laboratories inside the facility including the Drilling Simulator, Cybersecurity Lab, Driving Simulator, Innovation Wyrkshop, Hydrocarbon Lab, Artificial Intelligence Lab, and the Water Quality Lab. Additional activities also included the UW Geology Museum and UW Planetarium. The Science Initiative is excited to continue to partner with the UW President's Office to offer this highly beloved community event and looks forward to the 3rd annual UW STEM Carnival on Friday, September 6th, 2024 featuring the UW Statewide Agricultural Research and Extension Centers.

STEM CARNIVAL GALLERY





CREATING THE SCIENCE INSTITUTE

CREATING THE SCIENCE INSTITUTE

INTRODUCTION

In 2023, the Research and Economic Development Division (REDD) established the Science Institute, which is responsible for implementing Science Initiative as well as other STEM research and outreach activities. The Science Institute will also manage the Science Initiative and its programs, instrumentation, and plant and animal facilities. As a part of its focused strategy to develop Wyoming-relevant and nationally competitive expertise, it developed interdisciplinary research centers to address specific areas of relevance to Wyoming and UW, awarding seed grants to launch these centers, and awarding fellowships to PhD students to conduct research in these centers. In doing so, the Science Institute continues to further the research mission of the university, providing support to help drive the core sciences to top-tier status and invigorate the state’s economy in crucial areas.

IDEATION

In the fall of 2023, REDD put out a call to researchers at UW to participate in a 3-day Center Ideation Jump-start Event, which took place October 23-25, 2023. 96 UW faculty members from 30 departments across campus applied to be a part of the ideation event. Selected faculty members were invited to the event, where mentor faculty members led directed conversations in which participants thought critically about new ideas for transdisciplinary research that would benefit Wyoming. Participants did not come to this ideation event with pre-determined research center teams or ideas – the purpose of the event was to create these ideas in real time. During the ideation event, ideas for research centers were formed among a group of scientists spanning across disciplines. Approximately one month after the ideation event, faculty teams (including external collaborators from Wyoming community colleges and other institutions across the country), submitted their proposals for consideration. These proposals included information about how the research would impact Wyoming’s future and that of UW, how the project would build on UW research strengths and on Science Initiative education and outreach programs, and how faculty planned to continue to fund the project through extramural funding after Science Institute funds were used.

IMPLEMENTATION

Following the ideation event and review of proposals, funds from the Science Institute have been disbursed to fund 10 different research centers and projects. Funding for centers is \$300,000, spread over 3 fiscal years. Funding for other projects is \$100,000 spread over 2 fiscal years. Two of these projects have differing funding amounts from the above. A description of each center or project follows. It is important to note that information regarding the start and end date and the funding amount only refer to funds disbursed by the Science Institute. These centers and projects were chosen to be funded based on many factors, including their potential for financial sustainability into the future after Science Institute funds are spent, meaning centers and programs will be seeking extramural funding to continue their research.

CENTERS

Center for Wildlife, Technology & Computing – WyldTech

uwyo.edu/science-initiative/wyld-tech

Start & End Date – 1/1/2024 – 6/30/2026

PI Name & Department - Michael Dillon – Zoology & Physiology, Program in Ecology & Evolution

Funding Amount - \$300,000

Description – WyldTech’s vision is to leverage new technologies, big data, and computational advances to understand and conserve Wyoming’s wildlife on working and changing landscapes.

Center for Energy Materials

Start & End Date – 1/1/2024 – 6/30/2026

PI Name & Department - John Hoberg – Chemistry

Funding Amount - \$300,000

Description – The Center for Energy Materials will add value to Wyoming resources by developing advanced technologies for rare earth element extraction (REE) and separation, creation of REE-based permanent magnets, and REE-based catalysts, helping to diversify Wyoming’s economy.

Center for Quantum Information Science & Engineering – QISE

Start & End Date – 12/1/2023 – 6/30/2026

PI Name & Department - Jifa Tian – Physics & Astronomy

Funding Amount - \$300,000

Description - QISE will advance technological components of quantum sciences and computing, and also positively impact material science and engineering as well. QISE is also developing education programs at both the undergraduate and graduate levels, helping create a workforce in the QISE field at UW and across the state.

Center for Controlled Environment Agriculture - CEA

uwyo.edu/research/si/centers/cea

Start & End Date – 10/1/2023 -6/30/2026

PI Name & Department - Liping Wang – Civil & Architectural Engineering & Construction Management

Funding Amount - \$300,000

Description - Controlled Environment Agriculture (CEA) is a technologically advanced and intensive form of agriculture where plants grow within a controlled, enclosed environment to optimize horticultural practices. It includes several indoor farming styles from single-level greenhouses to more compact vertical farming. CEA can produce a high yield of crops per unit area all year round, creating a resilient and robust supply chain for fresh produce to build nutrition security in remote areas. CEA will support research and education in the field, generate a skilled workforce, build out training and applied learning for faculty, teachers, and students, and upgrade facilities at UW and partner community college campuses.

Center for Rural Community Resilience & Innovation

Start & End Date – 7/1/2024 – 6/30/2027

PI Name & Department - Jeff Hamerlinck – Wyoming Geographic Information Science Center

Funding Amount - \$675,000

Description – The Rural Community Resilience & Innovation project utilizes modeling and socio-technical approaches to establish a framework for understanding and addressing problems faced by rural communities over the next century. This research will lay a foundation for Wyoming to anticipate future scenarios and help communities prepare for a resilient and inclusive future. The project will also create modular lesson plans to engage rural youth in technological advances.

CREATING THE SCIENCE INSTITUTE

PROJECTS

Innovations in Ranching

Start & End Date – 1/1/2024 – 6/30/2025

PI Name & Department - Dana Dittoe – Animal Science

Funding Amount - \$100,000

Description – The Innovations in Ranching project will develop a real-time monitoring biomarker sensor (collar) to continuously track livestock health and production remotely, with the aim to improve herd health, production, and food safety.

Advanced Carbon Valorization

Start & End Date – 1/1/2024 – 6/30/2025

PI Name & Department - Maohong Fan – Energy & Petroleum Engineering

Funding Amount - \$100,000

Description - Carbon sequestration has been used to help stem the tide of climate change, but can be very expensive. The Advanced Carbon Valorization project seeks to create a way to utilize captured carbon dioxide for the generation of value-added products. The team would develop a carbon-neutral system for converting CO2 to ethylene (C2H4), an important compound in the production of many widely-used chemicals, therefore turning an expensive process into a revenue-generating one.

Living Materials

Start & End Date – 1/1/2024 – 6/30/2025

PI Name & Department - John Oakey – Chemical & Biomedical Engineering

Funding Amount - \$100,000

Description – The Living Materials project seeks to develop living materials, drawing upon nature for inspiration, to replace complex and inefficient practices in agriculture and construction. Three research areas, working in coordination, will help to develop materials to perform carbon sequestration and create plant growth substrates.

Earth Bench – Large-scale perturbation experiments in the Earth system

Start & End Date – 1/1/2024 – 6/30/2025

PI Name & Department - Daniel McCoy – Atmospheric Science

Funding Amount - \$100,000

Description - There is considerable uncertainty regarding the magnitude of regional and global environmental change that is currently predicted. The Earth Bench project would advance understanding of the sources of uncertainty in environmental change, enabling communities to prepare for it while also providing avenues for understanding mitigation efficacy.

Community Oriented Research & Policy

Start & End Date – 7/1/2024 – 6/30/2025

PI Name & Department - Jean Garrison – Politics, Public Affairs & International Studies

Funding Amount - \$100,000

Description – The Community Oriented Research & Policy project seeks to create a Center for Public Policy where experts in science, technology, and society can incorporate community stakeholders into policy-relevant research. The center would integrate community voices in all phases of policy-relevant research, flipping from a model that imposes new ideas in science and technology onto the state to a model that incorporates community stakeholders from the outset.

OUTCOMES FROM SCIENCE INSTITUTE CENTERS AND PROJECTS SO FAR

As of July 2024, Science Institute- and REDD-funded centers and projects have

- become affiliated with projects totaling ~\$39M in extramural grant funding,
- published 40 peer-reviewed articles,
- given 28 presentations at professional conferences,
- and supported the work and research of 23 undergraduate students, 45 graduate students, and 6 post-doctoral researchers.

PHD FELLOWSHIPS

The Science Institute has begun to award PhD fellowships to current UW graduate students. The fellowships will attract high-quality graduate students to UW, increase the number and quality of PhD students graduating from UW, train the next generation of leading scientists, and help stimulate an increase in successful research grant proposals from UW’s researchers (with a special emphasis on Science Institute-funded centers). This year, 8 fellowships were awarded to students, for a duration of 3 years. These students will receive training in and assist with research in Science Institute-funded Centers. In the future, a total of 19 graduate students at a time will benefit from ongoing funding of these fellowships, and fellowships will be awarded to incoming students. These fellows will also support research in future Science Institute-funded centers. Their fellowships will also be enriched by participation in Science Initiative programming, giving them access to invaluable training in teaching, research mentorship, and outreach. For this first cohort of 8 fellows, LAMP Director Rachel Watson has created a learning community.

SHARED RESOURCE RESEARCH FACILITY UPDATE

The Science Initiative Building currently houses two shared resource research facilities: The Plant Growth & Phenotyping Facility (PGPF, which includes the rooftop greenhouses and other facilities on the 5th floor) and the Center for Advanced Scientific Instrumentation (CASI, spread throughout the building). In early 2025, a third shared facility, MORF (Model Organism Research Facility) will be finished, as well. These facilities are centralized, shared research resources that provide access to instruments, technologies, services, and expert consultation and training to researchers. Both CASI and PGPF are set up to both serve and train UW researchers from all across campus, as well as researchers from outside institutions and organizations. Users pay for time on instruments, space used, and training, making centers financially sustainable for years to come.

THE PLANT GROWTH & PHENOTYPING FACILITY (PGPF)

The Plant Growth and Phenotyping Facility includes a sprawling 6,400-square-foot complex of Research Greenhouses (with a total of 12 different bays) and an adjacent Research Penthouse housing two spacious walk-in chambers and a range of laboratory spaces meant to support the activities of all users. The research spaces are equipped with state-of-the-art technologies to provide tight environmental controls for plant growth and additional phenotyping applications.

This academic year, personnel hired include:

- Carmela Rosaria Guadagno - Director, as well as being the Associate Director of the Center for Controlled Environment Agriculture (CEA)
- Michael Baldwin - Facility Manager, as well as being a Specialist for the CEA

UW research teams, both funded by the National Science Foundation, are using resources at the PGPF for research:

- Dr. Eunsook Park and her team are studying molecular and cellular mechanisms in fungal-plant interactions.
- Dr. Carmela Rosaria Guadagno and her team are growing a panel of different genotypes of cotton to dissect the mechanistic underpinnings of water dynamics under drought to inform productivity models.

THE CENTER FOR ADVANCED SCIENTIFIC INSTRUMENTATION (CASI)

CASI is a staffed facility that houses state-of-the-art instrumentation that enables analyses of a diverse range of specimens. Vibration and light-sensitive instrumentation, including several confocal light microscopes, TEM and FIB-SEM electron microscopes, and a micro-CT are housed in spaces on the 1st floor of the SIB. These rooms are designed to minimize vibrations and are electromagnetically shielded, ensuring high-quality imaging. Instruments that are less sensitive to vibration are housed in the CASI showcase and can be found on the third floor of the SIB, and currently features a single crystal X-ray diffractometer (XRD).

Personnel in CASI include:

- Jay Gatlin has been serving as the Interim Director of CASI, but as of his hiring as the Science Institute Director, we will be searching for a full-time director for CASI.
- Qian Yang is serving as Assistant Research Scientist for CASI, overseeing technician work for electron microscopes.
- Tim Deibert is serving as a Research Technician for light microscopes on an hourly basis temporarily. After hiring a permanent director, CASI will strategize hiring needs for another permanent technician, as well.

Highlights of CASI's usage include:

- In the last year, with the successful installation of three new major instruments, CASI now operates seven fully functional major instruments. These instruments have seen high demand, with a total of 4,685 hours of booked usage. The center currently serves 45 research groups and 136 registered users.
- CASI hosted two electron microscope operation classes this fall, enrolling 30 students, as well as five advanced electron microscopy operation workshops, with a combined attendance of 33 participants. Following the introduction of a fee-for-usage/service model in July, CASI generated \$21,816.34 in revenue by the end of September.
- CASI-supported research projects, totaling 31, span federal, state, and internal grants. This activity has already contributed to 13 publications (as reported to us). Further, CASI engaged in five outreach presentations to other UW departments, fostering broader awareness of our capabilities. Three large group lab tours were also conducted, reaching Wyoming community colleges, high school students, and out-of-state graduate students.
- Finally, CASI submitted one NIH grant proposal and ongoing efforts for two additional submissions.



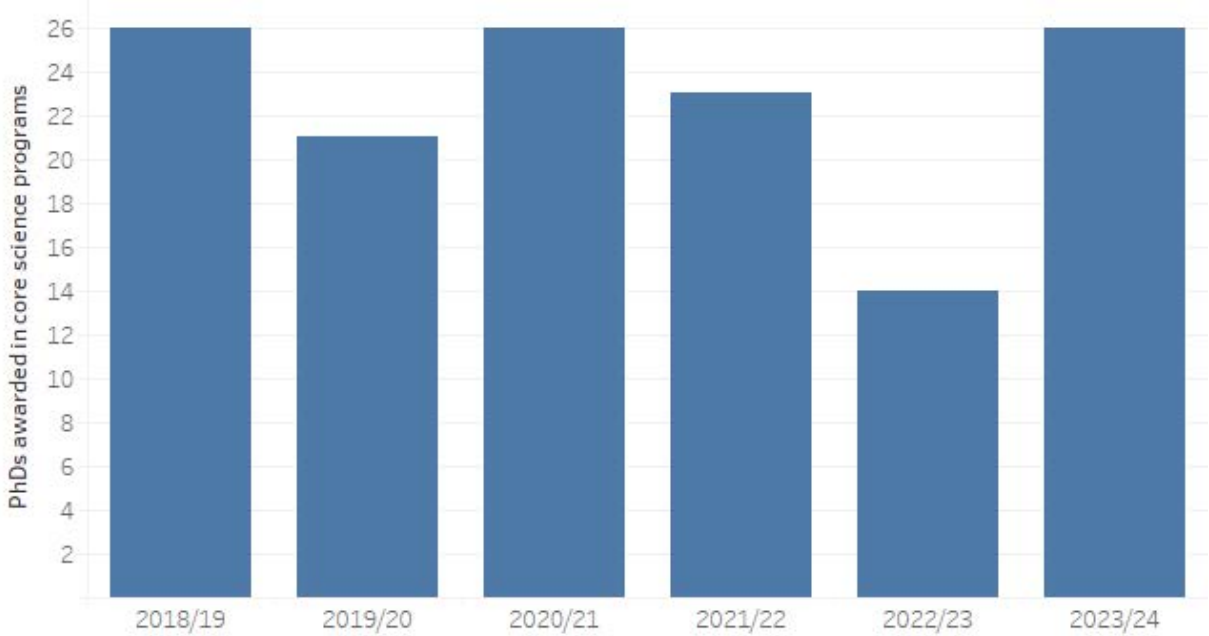
GOALS & METRICS

At the outset of the Science Initiative, the Governor’s Task Force agreed upon 7 guiding metrics for assessing the impacts of programming related to student outcomes and success, science teaching, and research funding and productivity. These foundational metrics were formulated to collectively lead the UW core sciences into the top quartile of its competitor institutions, and are relevant to the full implementation of both Phases I and II as outlined in the Governor’s Task Force Report. The Science Initiative has recently passed from Phase I to Phase II, so baselines for measuring metric data have been established. As implementation of Phase II continues, changes from the baseline can be measured. Also, as priorities and goals for the university as a whole take shape, appropriate peer institutions will be selected to measure overall competitiveness of the core sciences at UW. The below will outline assessment for select key metrics, most affected by our most recent budget increase to full funding.

METRIC 4

Increase the number of doctoral students graduated in each Science Initiative department by 25% after full implementation of the Science Initiative.

With the creation of the Science Institute, funding has been allocated to 19 PhD fellowships to increase enrollment and degrees awarded in core science departments. This funding will help significantly in helping SI academic programs reach this goal.



In the last 6 academic years, an average of 23 PhD candidates have graduated from UW core science departments (including graduates of the following programs: Molecular Biology, Physics, Botany, Chemistry, Molecular & Cellular Life Sciences, Program in Ecology & Evolution, Hydrologic Sciences, and Neuroscience). This number has held fairly steady, except for academic year 2022-2023, but numbers for 2023-2024 returned to above average. We expect to see the number of PhDs awarded in these departments increase as PhD fellows begin to graduate in the coming years.

In the 6-year period above, PhD degrees awarded by SI core science departments have accounted for 26% of the total PhDs awarded at UW, and 10% of the total doctorate degrees awarded at UW (this includes PhDs, EdDs, DNPs, JDs, and PharmDs).

METRIC 3

Increase the 5-year undergraduate graduation rates for core science majors by 100% after full implementation of the Science Initiative.

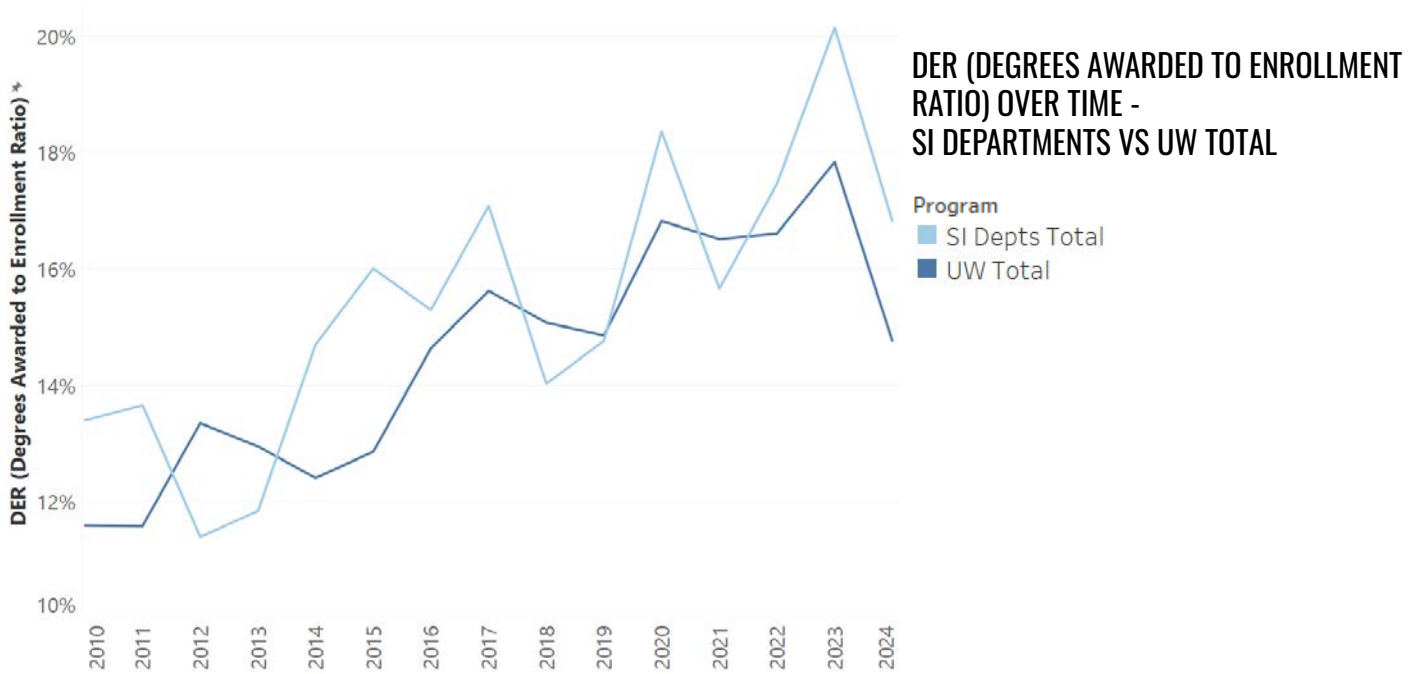
One of the Science Initiative’s main goals is to attract, retain, and award degrees to undergraduate students in what have been identified as core science departments and programs at UW, which include Botany, Chemistry, Life Sciences, Microbiology, Molecular Biology, Physics & Astronomy, and Zoology & 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).

Two years ago we provided an analysis of enrollment trends for these core science departments and for UW as a whole. Enrollment for UW undergraduate programs continues to decrease since a high point in 2013, but has slowed down since 2021 and 2022. Core science program enrollment has also decreased during this time, but absolute numbers of students have not decreased as much as total undergraduate enrollment. With these decreases in enrollment, we expect to see a delayed decrease in the number of degrees awarded.

UNDERGRADUATE ENROLLMENT - SI DEPARTMENTS VS UW TOTAL

Program	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
SI Depts Total	627	681	737	794	789	781	778	808	827	894	877	811	796	690	660
UW Total	9,523	9,643	9,708	9,730	9,590	9,604	9,519	9,237	9,307	9,322	9,197	8,534	8,093	7,961	7,708

The silver lining is that a general upward trend in Degree to Enrollment ratio (DER) continues over time. DER for SI department programs is approaching 20%, with the average of the last 3 years being 18%, and for total UW undergraduate programs 17%. This metric shows that the last decade has seen a marked increase in undergraduate student success through degree completion at UW and in SI academic programs.



GOALS & METRICS

METRIC 6

Increase dollar value of grants and contracts by 25% indexed to federal research funding levels after full implementation.

Funding for centers and projects from the Science Institute for research and PhD fellows, in conjunction with core facilities, such as the Science Initiative Building (including CASI, rooftop greenhouses, etc.) and others planned for the future (renovated spaces and the proposed new observatory on Jelm Mountain) are expected to augment research collaboration and capacity in STEM fields and contribute to increases in grant funding, as well.

For the purposes of this data, the university fiscal year was used, which begins in July and ends in June of the following year (so FY 2024 spans from July 1, 2023 to June 31, 2024). Originally, the Science Initiative focused mainly on those defined as the core sciences, including the departments of Botany, Chemistry, Molecular Biology, Physics & Astronomy, and Zoology & Physiology. As time has gone on, however, programs within the Science Initiative and Science Institute have gained capacity to support a larger diversity of STEM programs across campus (while continuing to serve core science departments). Therefore, grant funding numbers for all STEM programs and the original SI core science programs can be found in the table below.

As large-scale 4-5 year programs phase in and out, amounts within certain programs may fluctuate, but the general trend seen is an increase in funding over the period from FY 2019 - 2024. During this time STEM programs at UW have seen a 59% increase in funding, while original SI core science programs have seen a 26% increase in funding (although there was a pronounced spike in FY 2023 for SI core science programs).

Grant funding for STEM programs and SI research program by university fiscal year.

PROGRAM SEGMENT	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
All STEM programs	\$80,507,889	\$91,883,645	\$119,210,945	\$99,864,216	\$103,112,096	\$127,850,273
Original SI programs	\$12,354,955	\$12,277,234	\$16,089,787	\$16,354,940	\$19,978,332	\$15,538,707

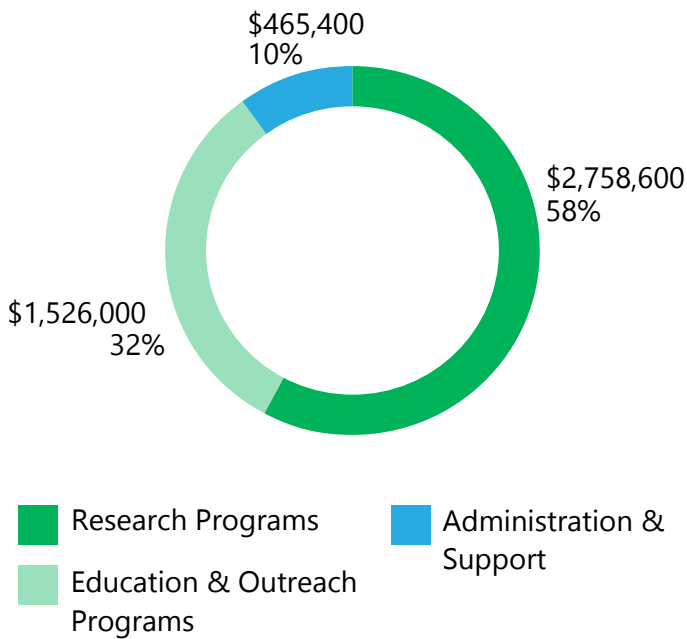


FINANCIAL STATEMENT

THE PAST YEAR

Our financial goals for the year focused on utilizing the fully-funded Science Initiative programmatic budget following the Wyoming Legislature approving an increase to \$4.75M per year in annual support. We were able to increase direct student support by hiring additional undergraduate learning assistants for active learning classrooms and awarding the first cohort of Science Initiative PhD Fellowships. The additional funding also allowed us to kick-start seed funding for competitive external project proposals by awarding 3-year seed funding support to four new research centers and 2-year seed grants to four projects. The additional funding, along with completion of major scientific equipment purchases through Phase 1 of the Wyoming Innovation Partnership, allowed us to open two new shared instrumentation facilities this year. Both facilities are fully operational and have started training users, granting user access, and generating revenue to offset operational costs.

BUDGET BREAKDOWN BY FUNCTION



Fiscal year 2024 budget and fiscal year 2025 proposed budget for the Science Initiative.

BUDGET SEGMENT	TOTAL ANNUAL BUDGET	% OF FUNDING
Learning Actively Mentoring Program (LAMP)	\$400,000	8%
Wyoming Research Scholars Program (WRSP)	\$900,000	19%
Outreach and Engagement (SI Roadshow)	\$226,000	5%
Graduate Fellows Program	\$932,600	20%
Innovative Seed Grant Program	\$600,000	13%
Research & Core Facilities Support ¹	\$1,226,000	26%
Program Administration & Support	\$465,400	10%
Totals	\$4,750,000	100%

¹Includes dues for CASI service contracts and purchase/repair funds, CASI staffing, greenhouse staffing, and vivarium staffing, etc.

DONATIONS, GIFTS, & GRANTS

Through external gifts and grants, the Science Initiative and Science Institute have been able to expand the reach of their programming to new areas and populations within the state, strengthening existing programs to enrich student learning and success, research, and outreach.

Active external grants for the Science Initiative and Science Institute.

PROJECT NAME	FUNDING SOURCE	PROJECT FUNDING AMOUNT	DURATION OF FUNDING
IMPACT STEM Transfer: Inclusive and Meaningful Partnerships for Cultivating Transformation in STEM Transfer	Howard Hughes Medical Institute (HHMI)	\$883,668	11/1/2022 - 10/31/2028
WIP Phase II: Controlled Environmental Agriculture Industry Program (CEA)	Wyoming Governor's Office	\$600,200	9/29/2023 - 6/30/2025
Engaging the Aging Brain in STEM: Fostering Socialization and Health Promotion in Older Individuals through the Science Initiative Roadshow	Wyoming Department of Health	\$37,348	3/21/2024 - 9/30/2025
Total Funding		\$1,521,216	

Donations and gifts totaled \$36,375 for FY 24, with 92% going to the SI Roadshow Fund, and 8% going to the General SI Discretionary Fund. In addition to these funds, the Research and Economic Development Division provided funds to the Science Institute to invest in personnel and programs that were not supported through Science Initiative funds.

THE FUTURE

In the next year, we will continue to ramp up the initiative programs and will begin utilizing the newly constructed facilities. This will include funding additional undergraduate research awards to students; hiring additional personnel to mentor student researchers and develop and implement course-based undergraduate research; and selecting the second of three total Science Initiative PhD Fellowship cohorts. The Model Organism Research Facility will also begin operations.

