The Montana State University Magazine

MOUNTAINS & MINDS

FALL 2017

FALL IN

Tradition marches on with the Spirit of the West

ON THE COVER

Strike up the band and cheer for the 'Cats. The members of the Spirit of the West, including clarinet player Ian Barnes, a mechanical engineering major from San Diego, lead the charge. **SEE PAGE 12.**

KELLY GORHAM

Gnarled and bowed but still producing enough apples to make a batch of pies, Montana's heritage apple trees—some planted more than 100 years ago, such as these found in an orchard in Fromberg—hold secrets of survival and resistance that could improve the quality of modern apple trees. **SEE PAGE 36.**

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The Montana State University Magazine

MOUNTAINS & MINDS

Fall 2017 · Volume 11, Number 2

President Waded Cruzado
Publisher Tracy Ellig
Managing Editor Carol Schmidt
Art Director Bridget Ashcraft
Director of Visual Media Kelly Gorham

Assistant Editor Anne Cantrell
Creative Services Director Ron Lambert
Graphic Designers Kristen Drumheller, Alison Gauthier
Marketing Director Julie Kipfer
Photographer Adrián Sánchez-González
Production Manager Kay LaFrance
Writers Eliese Besemer, Denise Hoepfner, Marshall Swearingen

Contributing writers: Evelyn Boswell, Jeffrey Conger, Michele Corriel, Amanda Eggert, Colter Nuanez

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Editorial offices are located at:
Montana State University
431 Culbertson Hall · P.O. Box 172220
Bozeman, MT 59717–2220
Telephone: (406) 994-1966
mountainsandminds@montana.edu
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MONTANA STATE UNIVERSITY

CRUZADO ADRIÁN SÁNCHEZ-GONZÁLEZ

Dear friends,

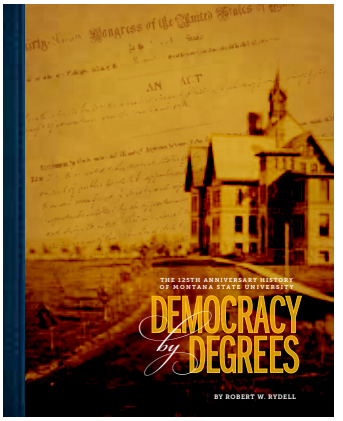
This fall has been, as most falls are, beautiful and busy on the campus of Montana State. In addition to welcoming the largest student body in MSU's history—16,703 students—we celebrated a glorious homecoming and completed a successful visit by the Northwest Commission on Colleges and Universities for MSU's seven-year accreditation cycle. The NWCCU accreditation team presented its list of commendations and recommendations in a brief summary. Reviewing the NWCCU team's commendations, I am proud and humbled by how evident it is that MSU has embraced its strategic plan, focused effectively on student retention and graduation, and lived by its shared governance principles, that our library has provided leadership to important statewide efforts and that Gallatin College MSU empowers all our students and the people of the state of Montana.

I'd also like to share another traditional fall event that you might not have heard about but which I always find inspiring. Each fall MSU honors classified and professional employees who are celebrating landmark anniversaries at the university. Called Milestones in Service, the event honors employees with 5, 10, 15, 25, 30, 35 and even 40 years of service. I find profoundly moving the comments from these employees about what MSU means to them and how they take seriously their dedication to the people of Montana. It is nice to be reminded that in the churn of our daily work at MSU, the people who make up this university have not lost sight of why we are here. We are stewards of the public trust. And we are fortunate to be involved in one of the most important human enterprises: educating succeeding generations. That is not lost on the men and women of Montana State University.

As I write, we are busily preparing to welcome you to the MSU quasquicentennial—the 125th anniversary of YOUR university. The year-long celebration kicks off with the Bobcat Birthday Bash, which is set for Feb. 16–17. We hope you accept our invitation to attend the wonderful festivities we have planned. Because an anniversary this noteworthy cannot be contained in one weekend, we will continue the celebration throughout 2018, highlighting one of MSU's colleges each month. More information about MSU's 125th anniversary celebrations are found in these pages and online at www.montana.edu/125. Also, be sure to check out the timeline in this issue of *Mountains and Minds* that demonstrates the intertwining of MSU's history with national and world events.

Warmly,

Waded Cruzado, president
Montana State University



DEMOCRACY BY DEGREES

Robert Rydell, historian and Montana State University history professor, focuses on the university's last quarter-century. **SEE PAGE 34.**

A YEAR OF CELEBRATION

MSU will celebrate its 125th anniversary through 2018 with a cavalcade of celebrations honoring colleges and key areas during each month of the year. Here is a list of the monthly celebrations.

January Bobcat Athletics
February College of Engineering
March College of Arts and Architecture
April College of Letters and Science
May College of Nursing
June Extension
September College of Education, Health and Human Development
October Jake Jabs College of Business and Entrepreneurship
November College of Agriculture
December Honors College

For more information, see **montana.edu/125**

SUBMIT YOUR MSU STORIES

Montana State University comes to life through the stories of our alumni, students and friends. We want to hear from you about how MSU helped you achieve your dreams. Did you meet someone important through MSU? Send us your image and story on our website now through Dec. 31. A selection of submitted photos and stories will be featured on the 125th anniversary web page **www.montana.edu/125/stories/**

PLEASE JOIN US

Poster Design by Kelsey Dzintars '09

ALL EVENTS ARE FREE AND OPEN TO THE PUBLIC

FEB. 16 **Awards for Excellence** Strand Union Building

FEB. 17 **Birthday Bash! Ice skating, Ferris wheel, music, food, campus tours, inspiring lectures** Centennial Mall, Romney Oval, SUB

FEB. 17 **Student winter games** Opening ceremony and more

FOR MORE INFORMATION, VISIT WWW.MONTANA.EDU/125

1 SHALE COURTESY OF ZACH ADAM **2 CORNISH** KELLY GORHAM **3 SAPPHIRE RING** ADRIÁN SÁNCHEZ-GONZÁLEZ **4 FLENNIKEN** KELLY GORHAM **5 MEYER** ADRIÁN SÁNCHEZ-GONZÁLEZ

AT MONTANA STATE UNIVERSITY

1 RESETTING THE EVOLUTIONARY CALENDAR

Zach Adam, former grad student, published a paper in *Geology* about his discovery of fossilized microorganisms in western Montana that predate by 200 million years fossils previously believed to be the oldest complex life forms in North America. The discovery resets the evolution of complex life forms. Adam is now a post-doc at Harvard.

Pictured: Zach Adam holds a sample of shale at an outcrop in western Montana.

2 MSU CONTRIBUTES TO NOBEL RESEARCH

MSU's LIGO Scientific Collaboration group, led by Neil Cornish, physics professor, (pictured) is part of an international collaboration that contributed to the first detection of gravitational waves. The discovery won the 2017 Nobel Prize in Physics for the collaboration's pioneers. The MSU LIGO team developed a novel method for extracting gravitational wave signals directly from LIGO data, helping confirm the nature of the signal and the consistency of the signal with the predictions of Einstein's theory of general relativity.

3 DESIGNING EXCELLENCE

Jason Baide, a senior majoring in studio arts from Bozeman, took first place in the prestigious Saul Bell International Jewelry Award for Emerging Artists held in Santa Fe, New Mexico, for his design of a chain-link sapphire ring (pictured).

4 NSF EARLY CAREER AWARD

Virologist Michelle Flenniken received a $500,000 CAREER Award from the National Science Foundation to continue her research on the defense mechanisms honey bees use against viruses. The CAREER Award is the NSF's most prestigious award that supports early-career faculty.

5 A FULBRIGHT YEAR IN RUSSIA AND TURKEY

James Meyer, history professor, spent a Fulbright Research Fellowship year in Turkey and Russia studying Nazim Hikmet, an important Turkish poet who lived and died in exile in Russia. Meyer's research is the basis for a scholarly book he is writing about Hikmet.

ACCREDITATION TEAM VISITS MSU

MSU hosted eight representatives of the Northwest Commission on Colleges and Universities for its seven-year accreditation visit. The team commended MSU for embracing its strategic plan, focusing effectively on student retention and graduation, incorporating shared governance principles, the MSU Library for providing leadership to important statewide efforts and Gallatin College MSU for empowering all students and the people of the state of Montana. The team also made recommendations, including that MSU focus more on assessment and communication of its efforts and that it continue to pay attention to deferred maintenance of campus buildings.

TWO DEANS NAMED

Alison Harmon, professor of food and nutrition and sustainable food systems who has also been serving as interim dean of the College of Education, Health and Human Development since 2015, was named dean of the college after a national search. Sarah Shannon, professor and senior associate dean for academic affairs at Oregon Health and Science University's School of Nursing, was named dean of the MSU College of Nursing. Shannon is the niece of Anna Shannon, who served as dean of the college from 1975 to 1990.

6 SEQUENCING WHEAT GENOME

Hikmet Budak, plant sciences and plant pathology professor, was a member of a team that decoded the complete genome sequence of wild emmer wheat, the original form of nearly all the domesticated wheat in the world, including durum (pasta) and bread wheat. Budak holds the MSU Winifred Asbjornson Plant Sciences Chair.

MSU ENROLLMENT SETS NEW RECORD

MSU has enrolled a record number of students once again this fall, while also establishing the highest graduation and retention rates, and other measures of student success. MSU's fall headcount is 16,703, a total that's 2 percent above last fall's count and one that marks 10 years of continuous enrollment growth for the campus, which has set enrollment records in 13 out of the last 15 years.

RESEARCH LOOKS AT HOW HONEY BEES FIGHT VIRUSES

Laura Brutscher, who recently earned a doctorate in the Department of Microbiology and Immunology, published a study on the mechanisms honey bees use to fight off viruses in *Scientific Reports*, an online open-access journal from the publishers of *Nature* that publishes scientifically valid primary research from all areas of the natural and clinical sciences. Brutscher tested honey bees to determine the genes that are involved in defending them against viruses.

FROGS AND TOADS HAVE ROLE IN RESTORING NATIVE FISHERIES

Niall Clancy, a 2017 graduate of MSU's Department of Ecology, has published research in the journal *Fisheries* that suggests that amphibians may help conserve native fish populations.

Clancy said that wildlife biologists tend to overlook amphibians because they aren't fully terrestrial and fisheries experts do the same because amphibians aren't fully aquatic. But in many flowing and standing waters, young frogs, toads and salamanders are the dominant vertebrates. They change water chemistry, redistribute nutrients and alter the habitat for fish and other aquatic organisms. Clancy noted that the amphibians can be both predator and prey and play a role so important they should be incorporated into strategies for conserving freshwater fisheries.

7 A NEW UNDERSTANDING OF TUMOR GROWTH

Ed Schmidt, microbiology professor, published research about a backup system in mammals that sustains the liver during a crisis and that may explain how cancerous tumors persist after treatment. The new findings were published in June in the journal *Cell Reports*.

MSU SCIENTISTS WIN GRANT TO STUDY HOW HUMAN BEHAVIOR IMPACTS SPREAD OF INFECTIOUS DISEASES

MSU professors Elizabeth Shanahan, political science, and Raina Plowright, microbiology, received $1.65 million from the National Science Foundation to research the ways human activity contributes to the spread of infectious diseases. The grant will help fund Plowright's research on pathogen spillover from bats to domestic animals and people. The grant focuses on urban bats in eastern Australia, where there has been an influx of fruit bats into towns and cities and, at the same time, Hendra virus has been spilling over from fruit bats into horses and people. Shanahan will study how scientific information is communicated to people at risk of disease spillover and how people talk about this risk.

8 YUNES RECEIVES AWARD FOR BLACK HOLE PROJECT

NASA awarded $750,000 to Nicolas Yunes, physics professor, for his project, "Exploring Extreme Gravity: Neutron Stars, Black Holes and Gravitational Waves." Yunes is a founding member of the MSU eXtreme Gravity Institute. Yunes said the award will also allow him to grow his research group within the eXtreme Gravity Institute.

DZINTARS WINS 125TH POSTER CONTEST

Kelsey Dzintars, a graphic designer who graduated from MSU in 2009 with honors and is now a professional designer, won $1,000 for her design. Her poster is being used to promote the anniversary throughout the state. Events begin Feb. 16, 2018, and will run throughout the year. The contest drew 114 entries from across the region.

9 MSU GRADUATE NURSING PROGRAMS RECOGNIZED

MSU College of Nursing graduate programs were recognized on the *U.S. News and World Report*'s 2018 list of the best graduate nursing schools. MSU's master's-level nursing program tied for No. 115, while its doctor of nursing practice program tied for No. 88.

ENGINEERING ADVISER ONE OF BEST IN THE WORLD

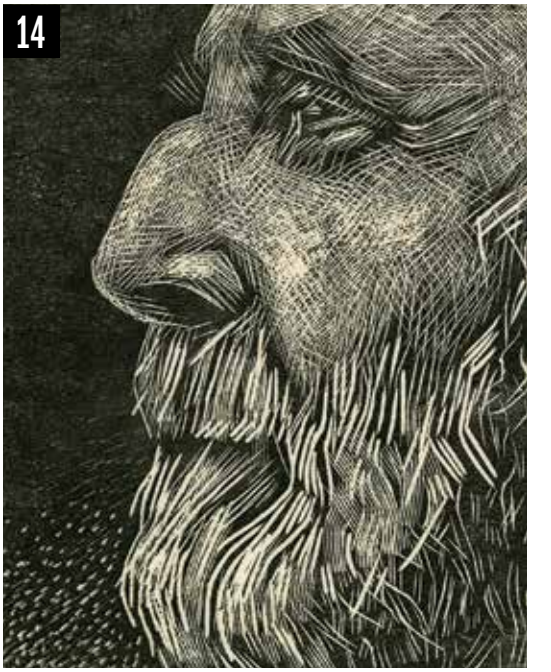
David Claudio received the Global Outstanding Faculty Adviser Recognition Award from the Institute of Industrial and Systems Engineers after being nominated by his students in the Department of Mechanical and Industrial Engineering. Claudio won the top honor for faculty advisers after he was selected from the best student advisers from IISE's 10 regions across the globe.

10 MSU RESEARCH SETS NEW RECORD

MSU research and contract expenditures from state, private and federal funding sources topped $130.8 million, marking the largest yearly total on record and a $12 million increase over the year before. Work in fields such as biochemistry, the environment, health and physics fueled the increase.

Pictured: Lauren Dupuis, a junior majoring in chemistry, works in Connie Chang's laboratory at MSU.

6 BUDAK ADRIÁN SÁNCHEZ-GONZÁLEZ **7 SCHMIDT** KELLY GORHAM **8 YUNES** PARKER HILTON
9 NURSES KELLY GORHAM **10 DUPUIS** ADRIÁN SÁNCHEZ-GONZÁLEZ



11 BRANNAMAN ADRIÁN SÁNCHEZ-GONZÁLEZ **12 HOLLINGER** ADRIÁN SÁNCHEZ-GONZÁLEZ **13 WHEAT** ADRIÁN SÁNCHEZ-GONZÁLEZ
14 DOIG WOODCUT COURTESY OF MSU DOIG ARCHIVE **15 MELVIN** ABBEY NELSON **16 HATZENPICHLER** ADRIÁN SÁNCHEZ-GONZÁLEZ

11 COVERING EXCELLENCE

Recent graduate Reata Brannaman, an instructor in MSU's College of Agriculture equine program who is a businesswoman and recognized horse trainer, appeared on the covers of two magazines: *America's Horse* and *Cowgirl*. Brannaman is the daughter of famed horse trainer Buck Brannaman, who once attended MSU and who has received an honorary degree from the university.

12 NEWMAN FELLOW

Michael Hollinger, a junior political science major from Nikiski, Alaska, was named a 2017 Newman Civic Fellow by Campus Compact for his work bringing attention to human trafficking in Montana. The national award recognizes and supports community-committed students who have demonstrated an investment in finding solutions for challenges facing communities throughout the country.

13 SOWING SEEDS OF AGRICULTURAL EXCELLENCE

MSU grad Norm Asbjornson gave $2 million in support of the Montana Plant Sciences Chair, the first endowed chair in the MSU College of Agriculture. The chair is named the Winifred Asbjornson Plant Sciences Chair in honor of Norm's hometown of Winifred. The Montana Plant Sciences Chair was conceived five years ago in cooperation with the Montana Grains Foundation and Montana farmers.

RESEARCHERS STUDY ROLE OF MICROBIOME IN COPING WITH ARSENIC POISONING

Two MSU researchers in different disciplines have teamed up to tackle the problem of arsenic poisoning, which is estimated to affect more than 100 million people worldwide, primarily through tainted drinking water.

Seth Walk, professor in the Department of Microbiology and Immunology, said that in the U.S., an estimated 350,000 people are exposed to arsenic at levels that are above safe drinking standards that, because arsenic is a toxin, can lead to or increase the risk of certain cancers. Walk is leading the five-year study with Tim McDermott, professor in MSU's Department of Land Resources and Environmental Sciences, to determine the role the human gut microbiome plays in detoxifying arsenic after it has been ingested.

14 DOIG COUNTRY

MSU held a successful four-day symposium about the life and work of the author Ivan Doig. MSU houses the archive of the late novelist, who is sometimes called the Dean of Western Writers and who wrote eloquently about his native Montana. Most of the archive can be accessed online.

NATIONAL RECOGNITION

MSU's *Mountains and Minds* magazine won a bronze medal in the national 2017 CASE Circle of Excellence competition. It is the fourth consecutive year the magazine produced in-house by MSU University Communications staff has placed in the top 12 university magazines in the country.

15 MSU GRADUATE RECEIVES HONORARY DOCTORATE

Dr. Paul Melvin, an MSU graduate who pioneered methods of orthopedic surgery, received an honorary doctorate during MSU's spring commencement. Melvin, of Helena, was a co-founder of the Great Falls Orthopedic Associates.

UNDERSTANDING CLIMATE EVENTS

John Priscu, MSU Regents professor in Land Resources and Environmental Sciences, published research in *Nature Ecology and Evolution* that suggests even abrupt, short-lived climate events can cause long-term changes in polar regions over several years and change the trajectory of an ecosystem. Priscu's research described how an abnormal season of intense glacial melt in 2002 triggered multiple distinct changes in the physical and biological characteristics of Antarctica's McMurdo Dry Valleys over the ensuing decade.

16 NASA EARLY CAREER FELLOW

Roland Hatzenpichler, biochemistry, who studies multicellular bacteria that live in salt marsh sediments with magnetic properties, was named a NASA Early Career Fellow. Hatzenpichler will use the award to study how the cells in the unusual multicellular organisms communicate and stick together.

MSU PLANT GROWTH CENTER CELEBRATES 30TH ANNIVERSARY

MSU's Plant Growth Center recently celebrated its 30th anniversary. The center has enabled hundreds of research projects that have contributed important knowledge to Montana and beyond, said David Baumbauer, Plant Growth Center manager. That work ranges from disease testing on seed potatoes, to biodiesel production with algae, to weed management, to starting vegetables from seeds for MSU's student-run vegetable farm, to studying pollinator-plant interactions, to developing wheat varieties that will perform well in Montana's varied landscape. The Plant Growth Center also features labs, classrooms and an insect quarantine unit.

Funded entirely by the 1983 Montana Legislature, construction on the MSU Plant Growth Center started in 1985. Part of the facility opened in the fall of 1986, and its formal dedication was held in April 1987.

CALENDAR

NOVEMBER

18 **Cat Griz Football at MSU**
22 **Mannheim Steamroller Christmas**

DECEMBER

4 **Western Lands and Peoples** Andrew Hansen
6 **President's Holiday Reception and Montana Hall Lighting Ceremony**
10 **Jersey Boys** Broadway in Bozeman
14 **Teach Montana Educators' Fair**
16 **Fall Commencement**

JANUARY 2018

3 **Outstanding Teaching, Research and Service** Education, Health & Human Development
9 **Spring Convocation**
9 **MSU Library Open House**
10 **Spring Semester begins**
10 **Rent** Broadway in Bozeman
31 **Paul Farmer lecture**

FEBRUARY

3 **International Food Bazaar**
13 **Kopriva Science Seminar** Raina Plowright
13 **Dirty Dancing** Broadway in Bozeman
15 **Almost Spring Job and Internship Fair** SUB Ballrooms
16 **Awards for Excellence** SUB Ballrooms
16–17 **Bobcat Birthday Bash**
17 **Julius Caesar: Military Genius and Mighty Machines** Museum of the Rockies

MARCH

1 **Nano Days/MicroDays Science Outreach Night**

APRIL

3 **Trout and Salmonid Lecture**
5 **College of Letters & Science Authors Reception**
7 **Pat Callis Symposium** Celebrating 50 years at MSU
12-15 **MSU Spring Rodeo**
20-21 **MSU American Indian Council Pow Wow**
26 **Teach Montana Educators' Fair** SUB Ballrooms
27 **Bobcat Fest** Downtown Bozeman

MAY

4 **College of Nursing Pinning Ceremony**
5 **Spring Commencement**

For a complete MSU calendar of events, visit
WWW.MONTANA.EDU/CALENDAR

KELLY GORHAM

BREAKING IT DOWN

A student break dancer rocks the Brick prior to entering MSU's 2017 convocation. This year's convocation featured author Bryan Stevenson and was held in honor of the incoming freshman class.

FALL IN

The Spirit of the West is on the march, bringing rhythm and music to MSU traditions

MARCHING BAND KELLY GORHAM

Members of the Bobcat Pep Band bring school spirit to a Bozeman business during MSU's annual Catwalk.

DILLARD KELLY GORHAM

PEP BAND KELLY GORHAM

essay by Eliese Besemer

It's fall and the Spirit of the West, Montana State University's beloved marching band, is ready for a new season. While classes officially began on Aug. 28, the 160 students in the band arrived more than a week early for the annual band camp, the weeklong, intensive training that gets the band members ready for the season. They learn drill, music and, for new members, how to march like a Bobcat.

As a former marching musician who has spent many an hour on the practice field out in the sun and rain (and snow and ice), the heat and bitter cold, I can say it's a lot of hard work. Blood, sweat and tears? Perhaps not. But, definitely chapped lips, blisters and sunburns. So why do it?

Well, it is truly one of the greatest college experiences a student can have.

For some, band is a way to stay involved as they go forward in their academic lives and careers outside of music. For others, it's all about school spirit. Beyond any of that, though, is the camaraderie. The friendships made in band can last a lifetime, and the sense of belonging and involvement can go a long way toward making a strange new place seem like home.

"I've met so many people for whom the band created strong attachments, not only for the university, but for the School of Music and music in general," said Keith Kothman, director of the MSU School of Music. "Many of them aren't even music majors. They are bioengineers, systems analysts or business majors, but they all have one thing in common. They're making lifelong connections because of their experience in the band."

Since Nathan Stark took over as the MSU director of bands in 2011, the Spirit of the West has grown from roughly 70 members, though the number is ever-changing. Stark said that one of the best things about having such a large group is that the band finally has enough members to spell out "MSU" and "Bobcats" on the field.

Having been part of one of those glorious old traditions, I can say it is one of my best memories. I still remember where I stood, in what letter, in which position on the field. After all, traditions, old or new, are another aspect of the joy of band.

For the Spirit of the West, some of those traditions include the pluming ceremony, where new members officially become members of the Spirit of the West; Catwalk, which is a spirit-building jaunt through downtown Bozeman at the beginning of the year, and the homecoming parade.

The high point of the season, though, is the Cat-Griz game. During halftime, the MSU and University of Montana bands combine, ending the show by featuring the roughly 300 members of both bands. It takes a great deal of rehearsing to integrate two groups into one cohesive unit. It's cold, possibly snowy, and the game comes at the end of a long season. But the music, the cheering fans, the friendship and sense of accomplishment are tremendous.

So, in the words of Ira Gershwin, "Let the drums roll out. Let the trumpet call. While the people shout, 'Strike up the band!'"Or, to use one of the band's favorite cheers, "Go, Cats, Go!" ▪

Ecology major Raylee Dillard from McDonough, Georgia, performs with the Spirit of the West Color Guard during the annual MSU Debut picnic in the Romney Quad.

MSU Band Director Nathan Stark has more than doubled the number of students participating in the Spirit of the West to allow more versatility in halftime formations.

ADRIÁN SÁNCHEZ-GONZÁLEZ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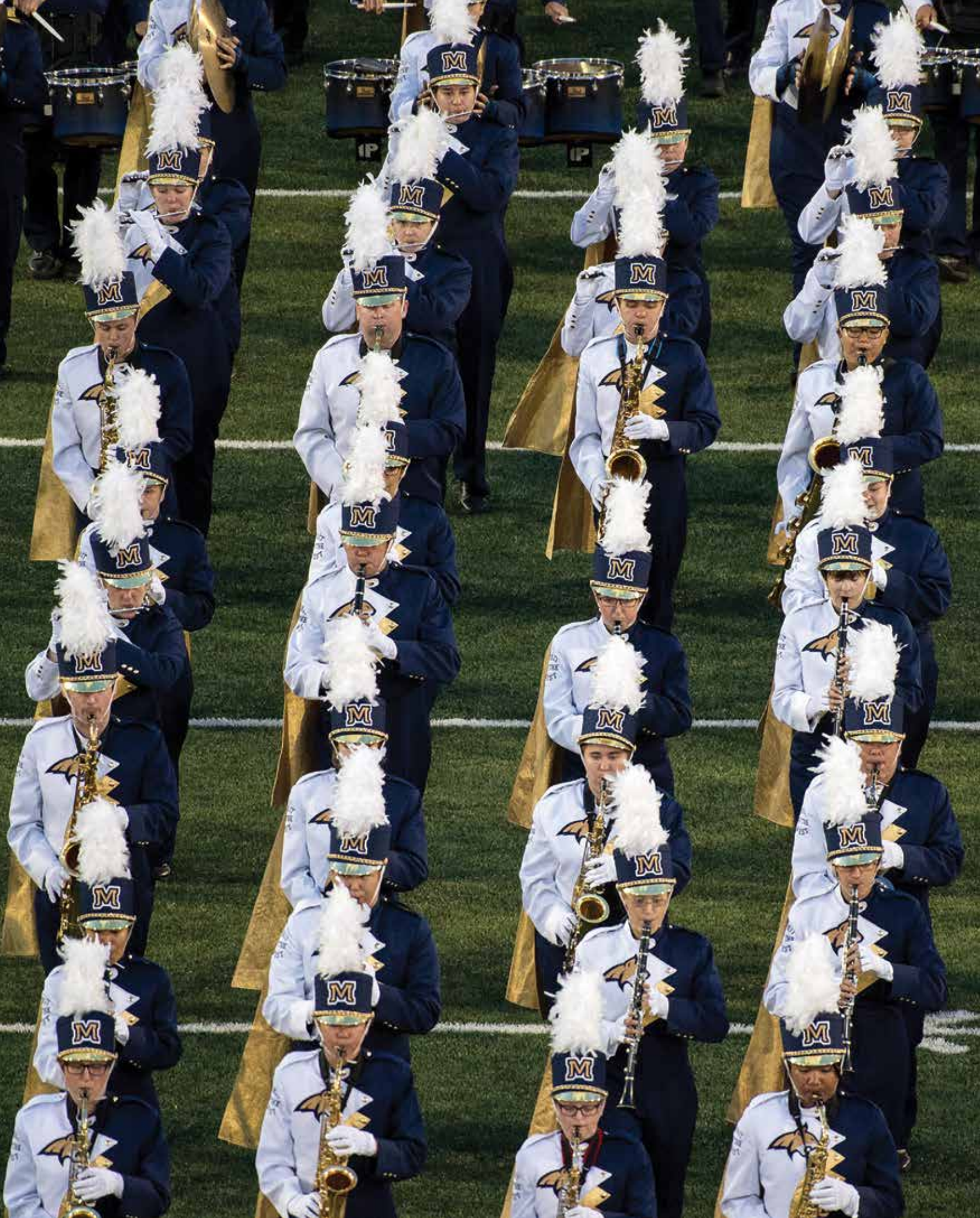


BAND ON FIELD COLTER PETERSON **PRE-GAME PROWL** ADRIÁN SÁNCHEZ-GONZÁLEZ

LEFT Musicians in the wind section walk the line during a halftime performance in Bobcat Stadium. **ABOVE** The band leads the Bobcat football team through a gauntlet of fans during the Bobcat Prowl, a new pre-game tradition.

ADRIÁN SÁNCHEZ-GONZÁLEZ

Trumpet player Jessica Johnson, an elementary education major from Belgrade, performs during a Bobcat football half-time show.

From roughly 100,000 feet above Oregon, the 2017 total solar eclipse appears as a moon-blotted sun casting a sunset-ringed shadow onto a sea of clouds. A team of high school students from Medford captured the image using a high-altitude ballooning system developed by MSU students.

MEDFORD HIGH SCHOOL STUDENTS

CHASING THE SUN

The MSU-led Eclipse Ballooning Project engineers a new angle on the 2017 eclipse

by Marshall Swearingen

As the sun rises over the MSU team's launch site at Idaho's Camas National Wildlife Refuge, team members Katherine Lee, left, and Darci Collins prepare a camera system they designed to capture images of the sun's atmosphere during the eclipse.

MSU TEAM, LEFT KELLY GORHAM DES JARDINS ADRIÁN SÁNCHEZ-GONZÁLEZ

Angela Des Jardins, an MSU physics professor and director of the Montana Space Grant Consortium, visualized the Eclipse Ballooning Project in 2013. It grew to include more than 55 teams across the country and gained NASA backing. Des Jardins directed the MSU team from a ground station at the small airport in Rexburg, Idaho.

It is Aug. 21, and the moon slowly consumes the sun over Rexburg, Idaho. Montana State University students tap away on laptops, preparing to show people around the world something they've never seen before.

"All MSU balloons are in the air," says David Schwehr, a senior from Billings majoring in computer science. He's tracking the flight paths of high-altitude balloons on his smartphone, using software he spent months programming.

The other half of this dozen-person team, stationed 30 miles northwest of Rexburg, has just launched a pair of large, helium-filled balloons, which carry cameras and other equipment. If all goes as planned, the balloons will drift over Rexburg and hit an altitude of 80,000 feet—twice as high as jets fly—during the 2017 total solar eclipse. The camera system will capture the moon's shadow crossing the Earth and transmit the video to the team in Rexburg, which will livestream it to NASA's website, which the agency specially prepared to handle millions of online viewers.

Nobody has ever done this before, and four years ago the task might have seemed impossible if these MSU students hadn't stepped up to the challenge. Since then, they've thrown themselves into designing and building this equipment, conducting test flights all over Montana and beyond and planning for the intensity of this day.

And today they're not alone: 54 other teams from across the country are also positioned along the eclipse's path, launching balloons equipped with the MSU-designed livestream system, plus myriad other experiments. Both individually and collectively, their undertaking—the MSU-led Eclipse Ballooning Project—is unprecedented.

Casey Coffman, another senior in computer engineering, checks the strength of the incoming video signal. "We're at two to three bars," he says.

Their years of hard work should be materializing by now on the screen—a space-like view of the jagged ridgeline of the Teton Range, the western horizon darkening under the advancing moon shadow. But as the sun becomes a crescent, they struggle to make the download.

The pace quickens as the moments careen toward totality—the two-minute period, starting at 11:33 a.m., when the eclipse will plunge Rexburg into midday darkness.

A total solar eclipse occurs somewhere on Earth about every one to three years. The alignment of the moon and sun creates a phenomenon so unusual and dramatic—stars emerge and the sun's violent atmosphere becomes visible as a feathery light ringing the moon—that many people devote their lives to pursuing it. In 2013, a group of photographers even chartered a jet to intercept a brief total eclipse over the Atlantic Ocean.

When Angela Des Jardins, an assistant research professor in the Department of Physics in MSU's College of Letters and Science, saw those images of the moon's shadow projected onto a sea of clouds, she instantly thought of balloons—the high-altitude balloons that MSU students and researchers have been launching since 2001 as part of a Montana Space Grant Consortium program called BOREALIS (an acronym for Balloon Outreach, Research, Exploration and Landscape Imaging System).

High-altitude ballooning had swelled in popularity in the 2000s, as universities across the country embraced it as an affordable and hands-on way to conduct science on the edge of outer space. Through BOREALIS, students at MSU and other Montana universities and colleges launched dozens of balloons to collect and analyze atmospheric dust produced by meteor showers, test radiation-tolerant computer prototypes and photograph sweeping mountains set against the glowing blue band of Earth's thin atmosphere.

Des Jardins thought: Why not use balloons to capture a near-space view of the 2017 eclipse? Why not involve teams across the country? And why not broadcast the video live? She started sharing the idea.

WHAT HAD STARTED AS A WILD IDEA TURNED INTO A NATIONWIDE UNDERTAKING.

"A lot of people told me I was crazy," she said.

Undaunted, she took the idea to NASA's Washington, D.C., headquarters in 2014. NASA declined financial support, but the next day, Des Jardins found better traction at an annual convention for NASA's Space Grant program, which supports education, research and public engagement projects at universities in each state. As wild as it sounded, her idea tapped a long-standing desire among the Space Grant groups to do something ambitious together.

"We had no idea how we would do it, but I had a feeling that we could figure it out," said Des Jardins, who is also the director of the Montana Space Grant Consortium. "I had seen what a bunch of motivated students could do."

Back at MSU, engineering students participating in summer internships and yearlong apprenticeships with BOREALIS began designing the video system they'd need. New technologies, including inexpensive-yet-powerful computer boards and compact radio transmitters developed for the burgeoning drone industry, gave the students a boost. Other parts they designed and built themselves.

"It was an open challenge," said Dylan Trafford, a Billings native who helped create early prototypes of the camera system while earning his dual bachelor's degrees in electrical and computer engineering. They were breaking new ground, making progress through trial-and-error. "One of my favorite things was, nobody ever said 'No, you can't do it that way.'"

With varying degrees of success, they tested the new system with launches from Bobcat Stadium, the Big Timber airport and Sen. Jon Tester's farm near Big Sandy, where a busload of local high school students helped inflate the balloons. Other ballooning teams across the country helped test and refine the equipment.

NASA took notice and changed course, awarding MSU a grant of more than $600,000. Now the project was official, and Des Jardins began to formally recruit other teams.

From 30 states they came to Bozeman for workshops in summer 2016. In the oval in front of MSU's Romney Hall, they assembled radio dishes, wired cameras and hooked up laptops. Then they packed the kits—each containing 250-some parts—into plastic tubs. Shane Mayer-Gawlik, who graduated from MSU in 2015 with a master's in physics and stepped into a leadership role with the project, loaded the tubs in a truck and shipped them to the teams' home institutions.

"Everyone left with everything working," Des Jardins said. "There was a great sense of camaraderie."

What had started as a wild idea had turned into a nationwide undertaking.

On June 21, 2017, while Des Jardins fielded questions from reporters in Washington, D.C., at a NASA-sponsored media briefing about the eclipse, the MSU team set up in Idaho for one of their final test launches.

Computer engineering major Uciel Garcia, an international student from Monterrey, Mexico, drove out the night before to camp with three teammates. He spent the previous two days building from scratch one of the video systems, using cameras like the ones found in

During a final practice run, MSU engineering students Garret Hilton, left, and Keaton Harmon handle one of the team's custom-built camera systems.

HILTON AND HARMON ADRIÁN SÁNCHEZ-GONZÁLEZ **MSU TEAM WITH BALLOON** KELLY GORHAM

A latex balloon undulates and lifts off the ground as the MSU team fills it with helium. They wore white gloves to protect the fragile material. The team launched three balloons in roughly an hour before the eclipse so that cameras and other equipment they carried would reach the desired altitude during totality.

cellphones, a small computer board and custom parts made on a 3-D printer.

Skylar Tamke, a graduate student from Billings who started working on the project while earning his bachelor's in electrical engineering, mounted one of the radio dishes to a tripod and checked the alignment. He explained that the dish needs to point exactly at the balloon to receive the signal. "Two or three degrees off and we'll miss at 20 miles."

The precision is necessary because the strength of the radio signal that transmits the video is capped at a fraction of what's used by emergency responders and other radio operators so that the ballooning teams don't have to get radio licenses. It's an example of the many constraints, including cost, that the team considered when designing a system that could be replicated for 54 other teams. Each kit costs only $3,500.

Coffman and another senior in computer engineering, Trevor Gahl, returned from buying 150 feet of cable and tools for rigging an internet connection because the Wi-Fi in the aircraft hangar wasn't working.

"You learn how to improvise at least one thing each trip," said Schwehr, who worked 17 years as a heavy equipment mechanic before coming to MSU. For his senior capstone project, he and two fellow students created the balloon-tracking software that all the teams, as well as air-traffic control centers, would use during the Aug. 21 eclipse.

"I've wanted to work on something that's sent to space, or close to it at least," said Tristan Running Crane as he plugged in a laptop. A member of the Blackfeet Tribe from Browning, he helped train the other teams during the summer workshops.

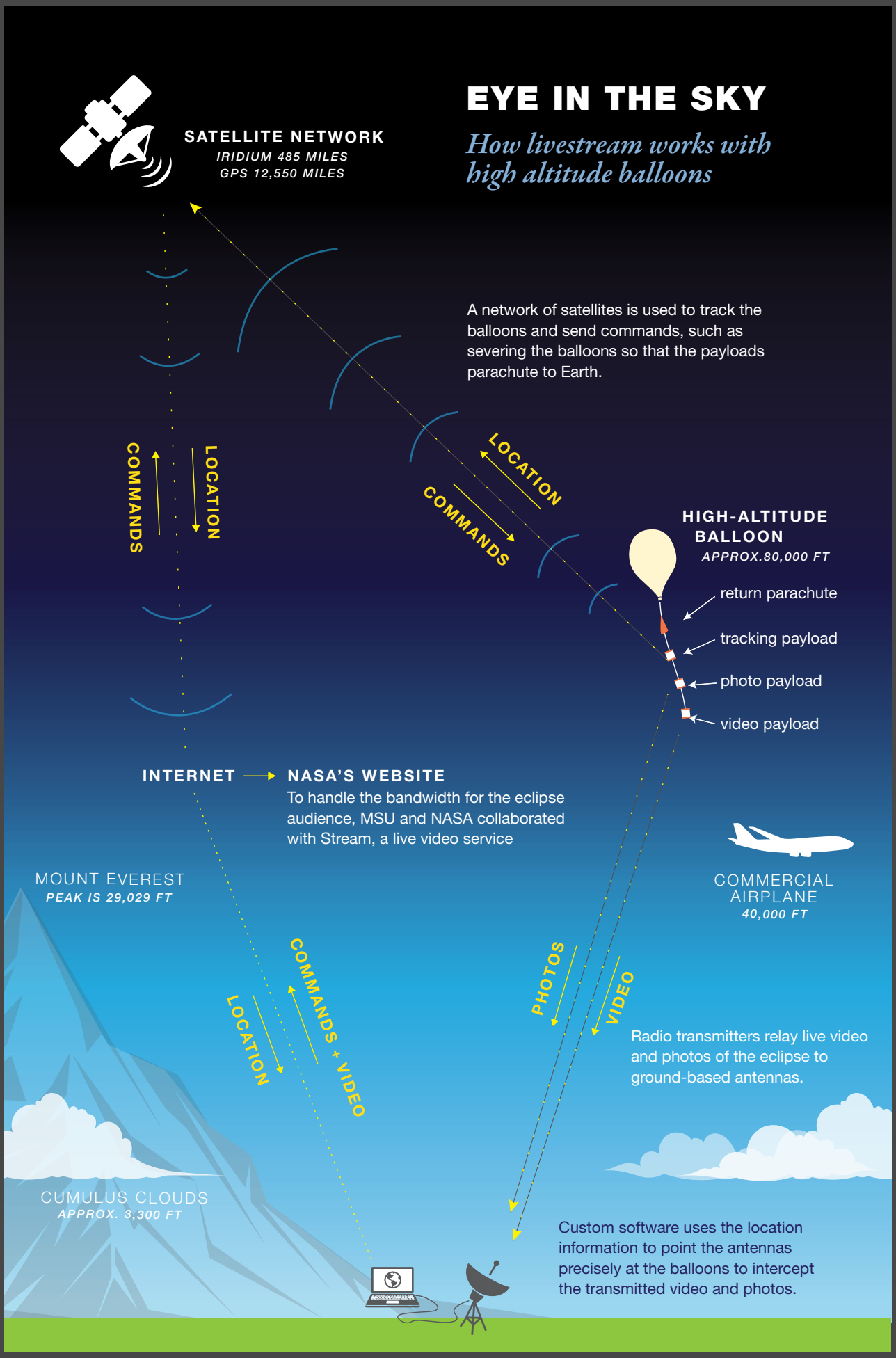
Sara Stafford, a junior from Fairbanks, Alaska, who was an electrician's mate in the Coast Guard before coming to MSU, selected the day's launch site west of Rexburg based on detailed wind predictions. As she muscled open the valves on the helium tanks, she explained: "It's a little bit of an art, getting the right amount (into the balloons)."

Micaela Moreni, a senior mechanical engineering major from Anaconda, checked the nylon cords that would tether the balloon to the shoebox-sized enclosures containing the cameras and tracking system. She designed the system that the teams used to cut the balloons free and send the cameras parachuting back to Earth.

Through all this, Randy Larimer

EYE IN THE SKY

How livestream works with high altitude balloons



KELLY GORHAM

The Eclipse Ballooning Project provided a platform for a variety of science activities:

Mars analog bacteria 34 teams used their balloons to carry samples of harmless bacteria impregnated on small metal tags as part of a NASA study to better understand how bacteria might behave on Mars if they survived the trip from Earth. Earth's upper atmosphere resembles the surface atmosphere on Mars, and the eclipse provided additional similarities.

Radiosonde Some of the livestream teams, plus an additional 12 specialized teams, launched 40 smaller balloons carrying devices called radiosondes, which measured temperature, pressure and other features of the atmosphere before, during and after the eclipse. The data will be used to answer questions about the atmospheric effects of total solar eclipses.

Other experiments Teams attached a variety of other instruments to the balloons to conduct their own experiments. Part of the MSU team used infrared cameras to capture images of the sun during the eclipse to study the composition and behavior of the sun's atmosphere, called the corona.

PICTURED During launch, a helium-filled balloon swings skyward while members of a team from University of Brasilia momentarily hold the camera payload to keep it from hitting the ground. The Brazilian students were part of an MSU exchange, an example of the eclipse project's wide-ranging collaboration.

While the MSU team's balloon was one of the few that didn't transmit images, it didn't prevent the members of the MSU team from taking a break from the experiment to enjoy the wonder of viewing a total eclipse.

ECLIPSE, LEFT ADRIÁN SÁNCHEZ-GONZÁLEZ SCHWEHR ADRIÁN SÁNCHEZ-GONZÁLEZ

MSU computer science major David Schwehr, center, troubleshoots the system delivering a livestream aerial video of the eclipse to NASA's website. Schwehr came to MSU to jump-start a new career after working for 17 years as a heavy equipment mechanic.

and Berk Knighton, MSU faculty and BOREALIS mentors whose expertise underpins the project, hung back as the students honed their routine.

"It's really about the student experience," Des Jardins said as the project drew national media attention in the weeks leading up to the eclipse. "That outcome is as important to us as the whole livestream thing."

The Space Grant programs routinely gather to share research and curricula and collaborate to send experiments into near-orbit using small rockets. But the Eclipse Ballooning Project may be the largest instance of cooperation, according to Des Jardins.

"We've built up relationships," she said. "It's raised the bar for what we can do with student teams."

The relationships extend to industry partners such as Google, which donated hundreds of balloons, and World View Enterprises, a private American near-space exploration company that provided opportunities for the MSU team to test the limits of its livestream video system during flights of the company's prototype high-altitude balloons, which are much larger and could soon be used to take humans 20 miles or more above the Earth.

The relationships, combined with the rigorous hands-on experience that the project demands from students, have also opened doors to careers.

Scott Miller, a computer engineering major from Kalispell who worked with Trafford on the earliest versions of the live image and tracking system, graduated in 2015 and took a job at NASA's Columbia Scientific Balloon Facility.

"We were working with mechanical engineers, computer science majors and physics majors," he said, reflecting on his BOREALIS experience. "Being able to communicate what the problems were and work with your colleagues—that's an awesome skill that I use every day now."

Tim Basta, a mechanical engineering major from Great Falls, was part of the test flights with World View during his senior year. After graduation, he was hired right away by the company. "Having that kind of hands-on and field-testing experience—it's a huge part of becoming an effective engineer," he said.

When Trafford graduated in 2016, his BOREALIS experience boosted him into a job with Lockheed Martin's spacecraft and satellite division.

"For me, that experience was huge—the freedom to experiment, to learn from failure," Trafford said.

"My signal strength's not bad but I can't get one packet," says Schwehr, speaking of the bits of data transmitted by the balloon cameras as the eclipse progresses.

The team's radio dishes are tracking the balloons, but no video is coming through. The students restart a laptop, check bundles of wires connected to the radio dishes. Computer code flies across the screen. But this eclipse isn't waiting for anyone.

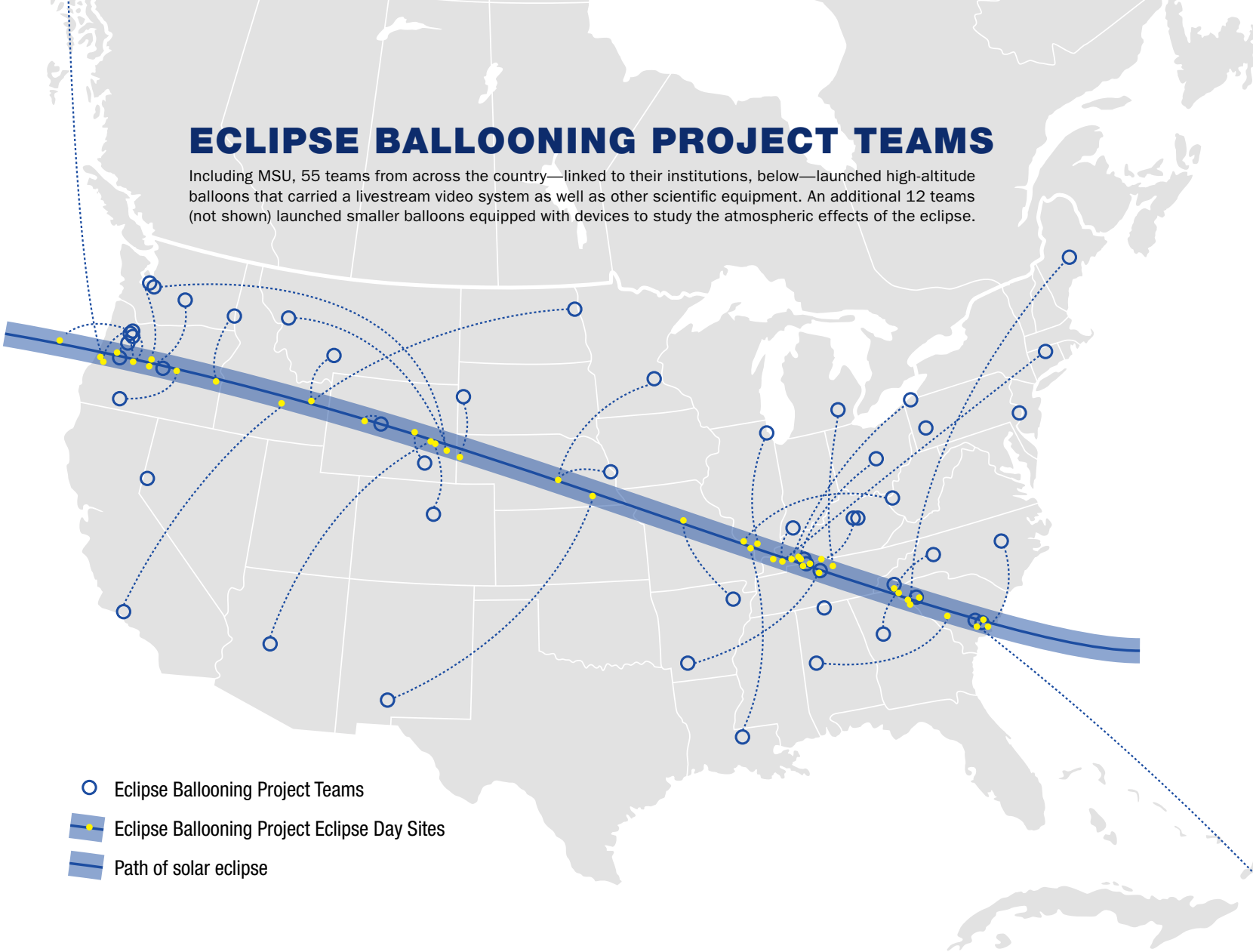
As the daylight dims to a shade that has no equal in dawn or dusk, signaling that totality draws near, the students exchange glances. Resignation mixes with excitement. Then they step away from the equipment they developed so carefully over the years, put on eclipse glasses, and walk out from under their shade awning and turn their gaze skyward.

Two osprey chatter, circling their nest atop a nearby telephone pole. A sudden chill permeates the air. Then, in the final second before the celestial bodies align, the last rays of sunlight flash on the edge of the moon.

The crowd's applause is involuntary, primal. The osprey fall silent. The red airport lights, sensing the darkness, turn on. The horizon in all directions glows with sunset

ECLIPSE BALLOONING PROJECT TEAMS

Including MSU, 55 teams from across the country—linked to their institutions, below—launched high-altitude balloons that carried a livestream video system as well as other scientific equipment. An additional 12 teams (not shown) launched smaller balloons equipped with devices to study the atmospheric effects of the eclipse.



as the sky sparkles with stars. The sun is otherworldly and yet starkly immediate for two minutes that feel out of time.

Then the sky is pierced again with light, and it's over.

"That made it all worth it, right there," Larimer says.

The afterglow of the experience lifts the team's spirits as everyone turns their attention to the television screen. They watch as the University of Wyoming's balloon, launched some 300 miles east of here, livestreams the eclipse shadow, which is racing across the Earth at supersonic speed. Other livestreams follow.

"I'm glad it worked for someone," Coffman says. "That's all I wanted."

In the coming days, the MSU team, along with others, will retrieve the camera payloads from fields and forests and download photos and videos recorded during the eclipse. They will learn that other teams had technical challenges, too—something they expected might happen given what they were attempting. They will try and diagnose what went wrong—batteries dying during flight due to a short-circuit; a software glitch in the on-board computer.

The way the project turned out for the MSU team—its failure to livestream—could be considered ironic, given MSU's major role in the undertaking. But in some respects it only magnifies why the story matters most.

"I wish it wasn't over," says Schwehr, who brought his 9-year-old daughter along to watch the eclipse.

He contemplates a job prospect at World View, says he wants to use his final semester at MSU to pass on his ballooning knowledge, the way that other students did for him. This team has learned immensely, and others can build on that, he says. So much more is possible now.

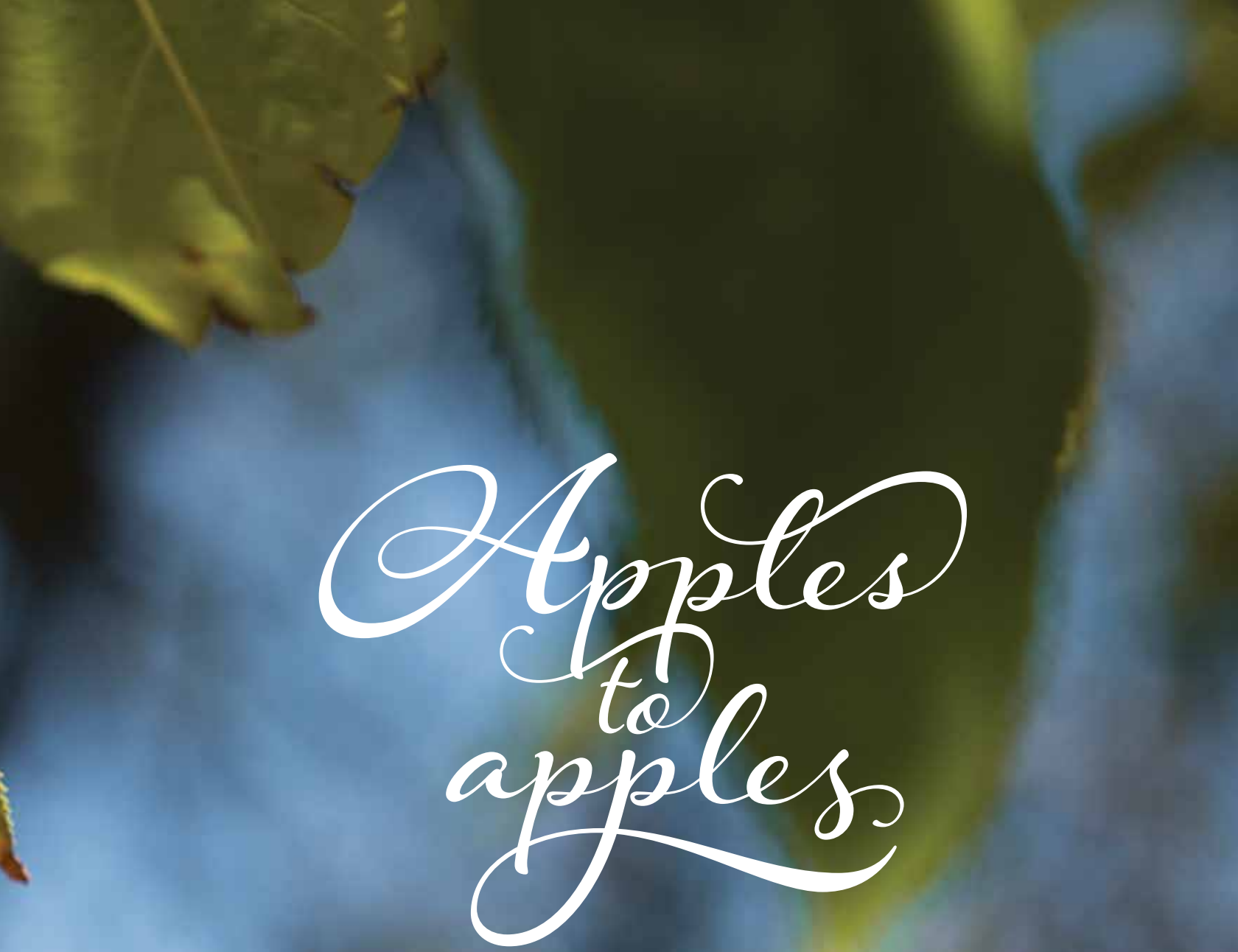
Those who experience a total eclipse struggle to describe its profundity. For these students, there's an added dimension, rippling through their time together and into their futures. The eclipse will be a shimmering memory, and a beginning for other stories.

As he thinks about it more, Schwehr says: "For me, I don't think it will ever really end." ▪

KELLY GORHAM

For only seconds during totality, the sun's light reflects off Earth and some details of the moon's surface are visible in addition to the jaw-dropping white corona—the hot, ionized gases known as plasma, surrounding the sun and other stars, that extends millions of kilometers into space. This rare phenomenon is called "Earthshine." On the bottom left of this image, a planet is visible as a small bright streak.

Crab apples hang from a tree in Fromberg, Montana.
This varietal was historically used for jam.



Apples to apples

MSU Extension team works against clock to bring Montana heritage apples to modern gardens

story by Evelyn Boswell · photos by Kelly Gorham · illustrations by Bridget Ashcraft

Beyond the log home of Chief Plenty Coups, past the cottonwood that overlooks the sacred spring are five tough apple trees.

Gnarled and bowed but still producing enough apples to make a batch of pies, they are the sole survivors of an orchard that Chief Plenty Coups planted near Pryor in 1903. Some say the legendary Crow planted several hundred fruit trees because he was impressed by the orchards he saw on his many trips to Washington, D.C. Others say the U.S. government ordered him to plant the trees and he obeyed.

Whatever the reason, Chief Plenty Coups planted an apple orchard that fed his family and the customers who frequented his store. But most of the trees eventually died, falling victim to drought, blight or insects. Some may have succumbed to black bears, deer antlers rubbing against bark or the terrific winds that blow through the area.

The hardy handful that have overcome those challenges stand together in Chief Plenty Coups State Park, 35 miles south of Billings and a mile west of Pryor.

"I love telling people about the apples and that they are eating something the chief planted 100 years ago," said Aaron Kind, manager of Chief Plenty Coups State Park and an MSU alum in anthropology.

Now a Montana State University team is doing what it can to identify and preserve those trees and others like them while creating opportunities for Montana entrepreneurs.

The fact that the trees are alive and producing apples after 100 years is important for a variety of reasons, say Toby Day and Brent Sarchet, founders of the Montana Heritage Orchard Program and both with MSU Extension. Day is the Extension horticulture specialist. Sarchet is the Extension agent for Lewis and Clark County.

The duo says that the Plenty Coups trees are historically and culturally significant because of their age and ties to the visionary Indian chief. They also are scientifically valuable because they may offer insights about survival and resistance that could improve the quality of modern apple trees. The fact that the heritage trees have lived for more than a century indicates that they may harbor special qualities, such as resistance to disease, drought and pests that could be introduced into modern apple trees to make them more resilient.

The trees are economically significant because pieces of the original trees have already been grafted onto new rootstock. When the new trees become available to the public, they will create opportunities for Montana nurseries interested in marketing trees and apples descended from Plenty Coups' orchard.

The Montana Orchard Program seeks to create opportunities for Montana nurseries interested in marketing trees and apples descended from Plenty Coups' orchard.

MSU Extension horticulture specialist Toby Day inspects an apple orchard at Chief Plenty Coups State Park near Pryor. One of the most well-known heritage orchards in the state, the orchard still produces apples that are baked into pies fetching top dollar in local fundraisers.

Such are the goals of the Montana Heritage Orchard Program that Day and Sarchet started about five years ago after conversations with master grafter Roger Joy of Corvallis. A three-year, $128,000 Specialty Crop Block Grant from the U.S. Department of Agriculture kicked off the plan to develop a self-supporting program where the profits and orchard DNA will be shared with Montanans who own heritage orchards. Day said while interest in heritage orchards has always been there, the recent introduction of DNA analysis to identify heritage apple varieties has added an important dimension.

THE ORCHARDS KEEP COMING

When they started the project, Day and Sarchet originally thought they might find 20 to 30 apple orchards that fit their definition of a heritage orchard. The orchards would contain at least six living trees more than 50 years old. They later changed that to 100 years and noted that one of the heritage orchards, the Wild Horse Island Orchard, has lost one tree since its declaration as a heritage orchard.

But the number of qualifying orchards has already surpassed 70, and reports of more keep coming. Most of the orchards documented so far were planted in the early 1900s and located in western Montana, but Day and Sarchet have discovered orchards from Eureka in northwest Montana to Willard in the southeast. Originating in East Coast nurseries, some of the trees were planted by railroad and barge companies competing for settlers. Many trees were planted by homesteaders. Some may have been planted accidentally by someone throwing mash over a fence or a wandering horse digesting apples.

Each of the orchards has an interesting backstory, with many of those posted on the Montana Heritage Orchard Program website at mtorchards.org. Day said more of the orchards have the same kind of development potential as Chief Plenty Coups' orchard.

APPLES ON AN ISLAND

Another storied orchard is located on Wild Horse Island on Flathead Lake. The island got its name from Salish-Kootenai Indians pasturing their horses there to keep them from being stolen. At 2,000 acres, it's the largest island on the largest freshwater lake west of Minnesota.

The evening before MSU Extension agents and Master Gardeners arrive on the picturesque island to learn more about the Montana Heritage Orchard Program, Day and Sarchet prepare by driving a boat from Lakeside to Wild Horse Island State Park.

Lewis and Clark county Extension agent Brent Sarchet, left, co-founder of the founders of the Montana Heritage Orchard Program, hands a sample to a Master Gardener student during a trip to a heritage apple orchard on Wild Horse Island. The budwood samples are taken for grafting to propagate from these trees.

After landing at Skeeko Bay, Day and Sarchet head up a trail that takes them past old foundations and antique haying equipment. They stop long enough to let a string of bighorn sheep cross in front of them. After kicking up a mile of dust, they reach 10 apple trees planted around 1913 by homesteader William A. Powers.

Each tree is protected by a triangle of wooden rails that Day and Sarchet, Master Gardener volunteers, orchard owners and the Montana Conservation Corps erected last year to protect the bark from the horses that roam Wild Horse Island. They haven't decided yet how to deal with the sapsuckers that stop by the island twice a year to drill holes in the bark looking for insects and sap. One tree has startling green leaves and branches that show at least 12 inches of new growth. Typical of many heritage apple trees, the branches rise from a partially rotted trunk rooted in pulverized soil.

"This is a very cool site—just the fact that it's here," Day said. "None of us in our wildest dreams would have believed that there was an orchard on Wild Horse Island."

Sarchet said they learned about the orchard from the Montana Preservation Alliance, which saves and protects historic places, traditional landscapes and cultural heritage. The Extension agent agreed that this orchard, like the one in Chief Plenty Coups State Park, has an interesting story behind it. It has historic and scientific significance and commercial possibilities.

Explaining the appeal, Day said, "This was a tree that was born in 1913 and lived on Wild Horse Island. I think people would buy it (if propagated)."

The fact that the Wild Horse Island apple trees grow in such dry conditions suggests that apple trees may not always need as much water as people think, Day added. The trees might offer lessons about drought resistance, as well as pest resistance and microclimates. They seem to be resistant to fire blight, a contagious disease that can damage an entire orchard in one season.

"You don't find fire blight in these trees," Day said. "It might be that it's isolated on this island, but the lack of fire blight is fairly common in these old orchards."

None of us in our wildest dreams would have believed that there was an orchard on Wild Horse Island.

—TOBY DAY

APPLE TREE MYSTERIES

Chum Howe, owner of a heritage orchard at Springhill Community near Bozeman, said his trees have served as a natural cathedral for some of the 1,800 weddings he and his wife Sally have hosted in the past 34 years. Twenty-six trees remain. Howe said they were planted around 1870 by a homesteader who probably wanted to sell fresh fruit in Bozeman.

"There was no way on Earth you could consume that many apples or apple cider on your own," Howe said.

Strolling across his yard, Howe talked about the bears that have invaded his orchard and have gotten tipsy by eating too many apples. Stopping at one tree, Howe demonstrated why visitors might be surprised that his trees are still producing apples.

"This is just sawdust inside," he said as he pulled out a handful of dust from the tree.

Day said rotten trunks and hollow branches are common for heritage apple trees. Because of that, he can't always tell the age of a tree by counting tree rings. In those cases, he looks for clues in historical records and oral accounts.

John Ross of Fromberg, for example, one of the biggest champions of the Montana Heritage Orchard Program, said his dad planted about 50 apple trees in 1951. Thirty of them are still living and producing McIntosh and Wealthy apples. The Fergus County Argus reported on Oct. 9, 1890, that James Philips had planted 400 apple trees at the mouth of Cave Gulch near Canyon Ferry. More than half of them were producing fruit that year, some of those varieties being Wealthy, Duchess, Tetolsky, Red Astragan, Ben Davis, Benoni and Rubicon.

Day said he can sometimes guess the age of an orchard by looking at the date someone filed homesteading papers. Since it takes a few years for new apple trees to start producing, he figures the settlers would have wanted to plant them as soon as possible.

Age isn't the only mystery when it comes to heritage apple orchards. Sometimes the owners don't know what kind of apple they are growing. Howe, for one, said he knows that one of his trees produces a Montana Banana. It's a yellow apple that's good for about three days, then turns mushy. But he doesn't know what the rest of his trees are doing. Every other year, which is how often his trees bear fruit, he picks large sweet apples, small tart apples, crisp apples and soft apples. Then he hauls them to Rocky Creek Farm to be turned into cider.

Day says the Plenty Coups orchard produces Duchess apples. Elsewhere in the state, he has seen Wealthy, Alexander, Haralson, Wolf River and McIntosh. But even a horticulture expert can be stumped. When he is, Day turns to genetic testing or takes a closer look at the harvested apples.

In the fall, Day compares harvested apples to known apples to see if they match. If he can't identify an apple, he figures he might be looking at an old variety that isn't sold anymore. The discovery might lead to a reintroduction of the apple or an investigation into the long-lived tree that bore it.

In the spring, Day takes budwood from heritage trees and gives it to MSU researcher Norm Weeden for genetic testing. Budwood is the newest growth of a stem or branch with vegetative buds that are used for grafting.

"He brings in cuttings that haven't leafed out yet," said Weeden, a professor emeritus in MSU's Department of Plant Sciences and Plant Pathology in the College of Agriculture. "We put them in the lab and allow them to start leafing out, then take the young leaves and extract DNA from them."

Once he has crushed the leaf and extracted the protein, he uses a technique called polymerase chain reaction, or PCR, to look at five different regions of the genome. He then compares those regions to the same regions in a known apple. If they match, he has identified the heritage apple. If they don't, he might have found a unique variety, one that disappeared from modern nurseries or maybe a mutation within a variety.

Apple identification can be challenging, especially when the DNA comes from a tree that's 100 years old, Weeden said.

"Apples are like people," Weeden said. "They are highly variable, even in the genome."

The gnarled trunk of a century-old tree stands on Wild Horse Island. The trees have weathered drought and browsing by hungry mustangs on the island, but still stand strong, even though the inside of their trunks are often reduced to dust.

Light shines through a Translucent Crabapple in Fromberg. Some apples from this orchard are now made into cider by Red Lodge Ale in Red Lodge.

PLENTY COUPS PIES

Bernadette Smith has worked at Chief Plenty Coups State Park for 19 years, first as a volunteer and now as an administrative clerk. She doesn't claim to be related to Chief Plenty Coups, but she, like Plenty Coups, is a Mountain Crow raised near the Pryor Mountains.

On a recent walk to the chief's orchard, Smith stopped at the sacred spring at the base of a large cottonwood. Earlier visitors left coins, a can of Skoal and a pocket New Testament as gifts. For her offering, Smith scooped up a handful of water, then tossed drops to the four directions of the wind and the remainder over her left shoulder.

Finally reaching the orchard, Smith said the trees didn't produce apples this year, but they grew enough last year that she and a crust expert from Alabama made five apple pies. Slices went for an "ungodly price" at a Friends of Chief Plenty Coups Association fundraiser last year.

In view of that, Smith said the idea for developing and selling Chief Plenty Coups trees could be a success.

"I think there would be massive interest because people from all over the world come here," Smith said.

That's good news for Day and Sarchet who are already developing a line of Plenty Coups trees. In 2016, Day gave new shoots from the original trees to the owner of Canyonview Nursery in Corvallis. Joy, the master grafter, then grafted the shoots onto new rootstock. He is growing those trees in his nursery until they are big enough to be sold.

One hundred trees that got their start in Chief Plenty Coups' orchard will be available in the spring of 2019 to Montana nurseries that sell bare-root trees, Day said. Three hundred trees with ties to the Ray Ranch south of Stevensville will be available in the spring of 2020. That orchard was planted around 1887. ▪

A heritage apple orchard planted in about 1870 stands in Springhill, north of Bozeman. These orchards were planted during a time when the Springhill Community was frequented by farmers from around the Gallatin Valley who brought their grain to natural spring-powered mills.

Velma Pickett works with students in the Guardians of the Living Water summer program on the Crow Reservation.

PARTNERS IN CHANGE

Center for American Indian and Rural Health Equity works with Montana communities to tackle the 'Herculean problem' of health disparities

story by Denise Hoepfner · photos by Adrián Sánchez-González

It is late July, smack in the middle of the dog days of summer, when children seeking relief from the heat are splashing in a lake or spraying themselves with a hose. But less than a mile away from the historic Little Bighorn River, a group of Crow Indian fifth- and sixth-graders are immersing themselves in water in a different way.

Twenty boys and girls gathered in a Crow Agency Public School classroom listen intently as Tim McCleary, a professor of Crow studies at Little Big Horn College, recounts the story of the tribe's origin. He tells them how the creator, Iichikbaalia, surrounded by water and tired of being alone, instructed four ducks to dive to the water's bottom and bring up some mud. One duck succeeded, and from the mud it carried in its bill, Iichikbaalia formed the Apsáalooke, or Crow, people.

Sharing oral history is but one activity at the Guardians of the Living Water summer camp and, during the school year, at the after-school program. Through activities and lessons that combine science, health and Crow culture, youth learn about the vital importance of water and how to become its stewards.

Water is sacred to the Crow. It is the font of their creation and where they draw strength, seek clarity and heal. It is the channel that connects one generation to the next. But over the past decades, agricultural practices, bacteria and natural mineral deposits have compromised some reservation water sources, risking the health of the Apsáalooke who drink from contaminated rivers or wells and damaging household plumbing from scale and mineral buildup.

To restore the reservation's water quality and educate the community about water health, concerned tribal members formed the Crow Environmental Health Steering Committee in 2004, bringing

...ENVIRONMENTAL HEALTH IS ALSO ABOUT **TAKING KNOWLEDGE AND USING IT TO MAKE CHANGES** OR DOING SOMETHING ABOUT WHATEVER HEALTH ISSUES ARE IDENTIFIED. THIS SUMMER WE HAD THE STUDENTS SHARE INFORMATION ABOUT WATER QUALITY WITH THEIR PARENTS.

—Vanessa Simonds

into the group researchers from Little Big Horn College and Montana State University, as well as other partners.

For the last dozen years, the committee has worked to identify and remediate the contaminants in the reservation's groundwater while respecting tribal water traditions and to determine how poor water quality affects the health of the Crow who drink, bathe and recreate in it.

With still much work to do, they have called upon a powerful but previously untapped resource: their children.

AGENTS OF CHANGE

Some public health campaigns have successfully used children as agents of change, said Vanessa Simonds, an MSU assistant professor of community health who earned her bachelor's degree in biomedical science from MSU in 2002.

"You hear about parents who quit smoking because their children come home and tell them how bad it is for them," she said. "It's a way to reach the children and, through them, the community."

Simonds, an enrolled member of the Crow tribe, lived on the Crow reservation for the first two years of her life while her father, John Watts, taught high school English and coached girls' basketball in Lodge Grass. Her family then moved to Bozeman, where her mother, Susan Stewart, finished her degree in art at MSU. Simonds grew up in Bozeman, and her father served for seven years as director of MSU's American Indian Research Opportunities program.

After graduating from MSU, Simonds attended the Harvard School of Public Health. There, she led and published a number of studies related to Native health and health disparities in well-respected journals, while earning a master's degree in epidemiology and a doctorate in public health intervention design for social change.

Simonds returned to Bozeman and MSU in 2014 and was seeking a way to benefit the community through her knowledge and experience when she was invited to a Crow Environmental Health Steering Committee meeting by one of its founders, Mari Eggers, an environmental scientist in MSU's Center for Biofilm Engineering.

Prior to the meeting, Simonds said she was considering the idea of using the committee's collected data to further the health literacy of the tribe's adults.

She was surprised, though, to learn the committee had another idea.

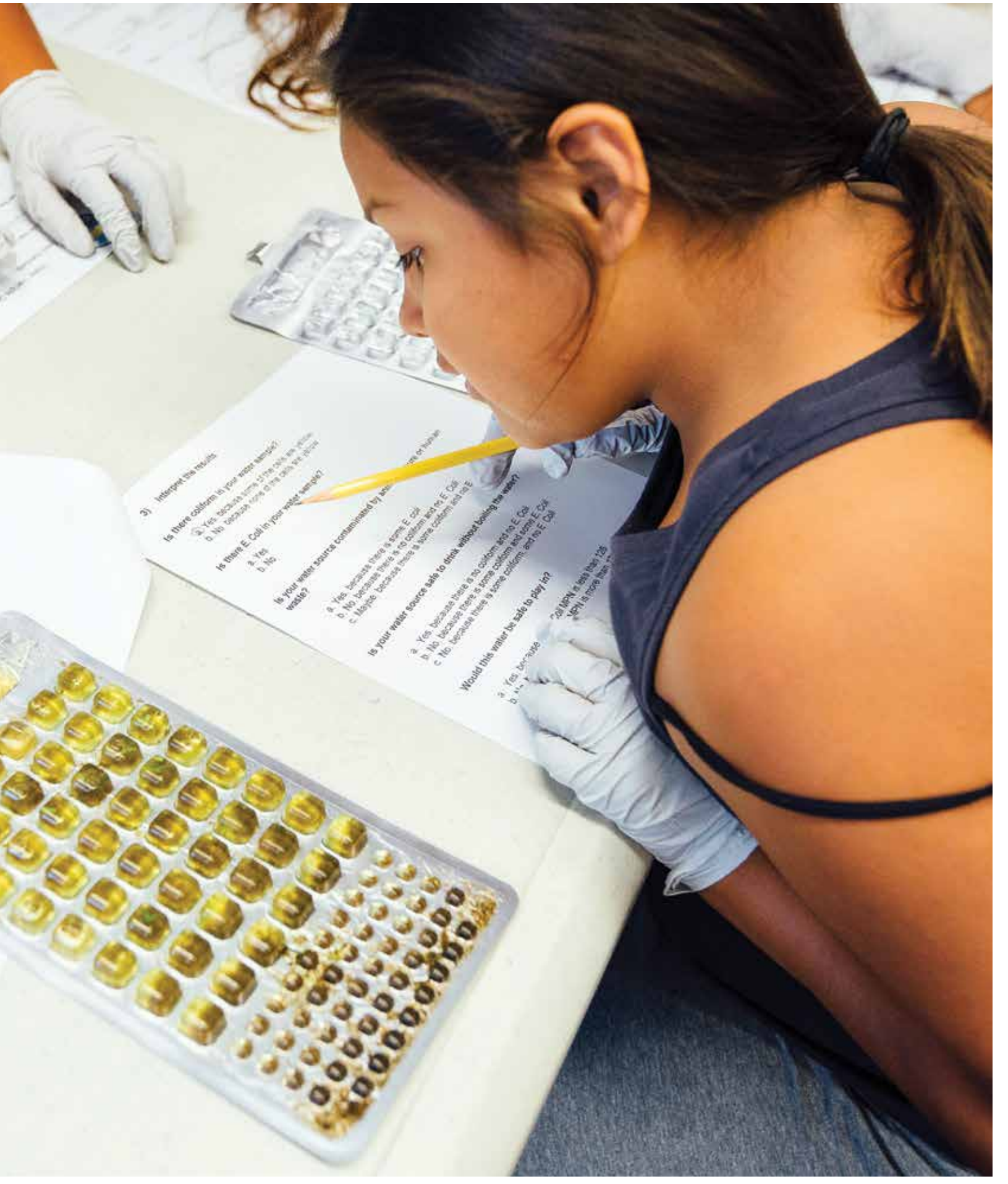
"They said, 'Our youth—we want to talk to our children,'" Simonds said. Together with founder and tribal elder John Doyle and longtime CEHSC member Sara Young, they conceptualized a program for youth to reach out and teach their parents about the water quality issues on the reservation.

GUARDIANS OF THE LIVING WATER

Seeking community partnership, Simonds formed a project committee where she heard from families who said they wanted a science-based summer camp for their children that incorporated Crow culture and centered on the reservation's treasured natural resources, like the Wolf Mountains.

Using that advice, Simonds worked closely with her graduate students and Jason Cummins, principal of Crow Agency Public School, to create

A student in the Guardians of the Living Water summer program on the Crow Reservation examines a sample of local water to determine the presence of bacteria, one aspect of a lesson in how to conduct research and present findings.


3) Interpret the results
Is there coliform in your water sample?
a. Yes, because some of the cells are yellow
b. No, because none of the cells are yellow
Is there E. Coli in your water sample?
a. Yes
b. No
Is your water source contaminated by
waste?
a. Yes, because there is some E. coli
b. No, because there is no coliform and no E. Coli
c. Maybe, because there is some coliform and no E
Is your water source safe to drink without boiling the water?
a. Yes, because there is no coliform and no E. Coli
b. No, because there is some coliform and some E. Coli
c. No, because there is some coliform, and no E. Coli
Would this water be safe to play in?

HEALTH DISPARITIES ARE A HERCULEAN PROBLEM THAT NO ONE CENTER CAN TACKLE ALONE. WE'RE ALL IN THE SAME BOAT SO WE HAVE TO FIGURE OUT HOW WE CAN MAKE THIS **ALL WORK TOGETHER**.

—Alex Adams

Guardians of the Living Water—a name bestowed upon the program by a Crow elder Grant Bulltail.

"He speaks eloquently about the energy of the living water and that water is life and has life and we should protect it," Simonds said.

The first summer camp was in 2015, a partnership between the Crow Environmental Health Steering Committee, Crow Agency Public School, Little Big Horn College and MSU.

"We focused on knowledge that first year," Simonds said. "But, environmental health is also about taking knowledge and using it to make changes or doing something about whatever health issues are identified. This summer we had the students share information about water quality with their parents. All the students went home, collected water samples from in and around their house, and tested them for the presence of bacteria. One of our goals is to get parents involved in learning about water quality."

In the fall of 2015, Guardians began its fourth-grade after-school program led by students from LBHC under the direction of Velma Pickett, environmental health literacy coordinator at the college. Pickett, who was raised on the Crow reservation and graduated from Dartmouth College, is also co-leader of the summer camp, which LBHC and MSU students help facilitate.

While the program aims to increase environmental health literacy in Crow youth so they can pass it on to their community, it also has other purposes: to create a passion for science and reinforce Crow culture.

"We think about building citizen scientists, and that is one reason I had a lot of buy-in from the schools and communities," Simonds said. "But, there's the cultural side, too, of understanding why water is important to the Crow people and instilling that into the youth to keep it alive."

One such project took place last fall, when after-school students were given cameras and sent into their communities to photograph the ways water is important to them.

"It was interesting to see what they were thinking," Simonds said. "They are really perceptive, and they see what's going on with the water."

Guardians is such a hit with students that one asked to stay in Crow Agency School after her parents moved away so she could keep attending, Simonds said.

Simonds continues to meet monthly with her steering committee, which provides guidance in all aspects of the program.

CAIRHE

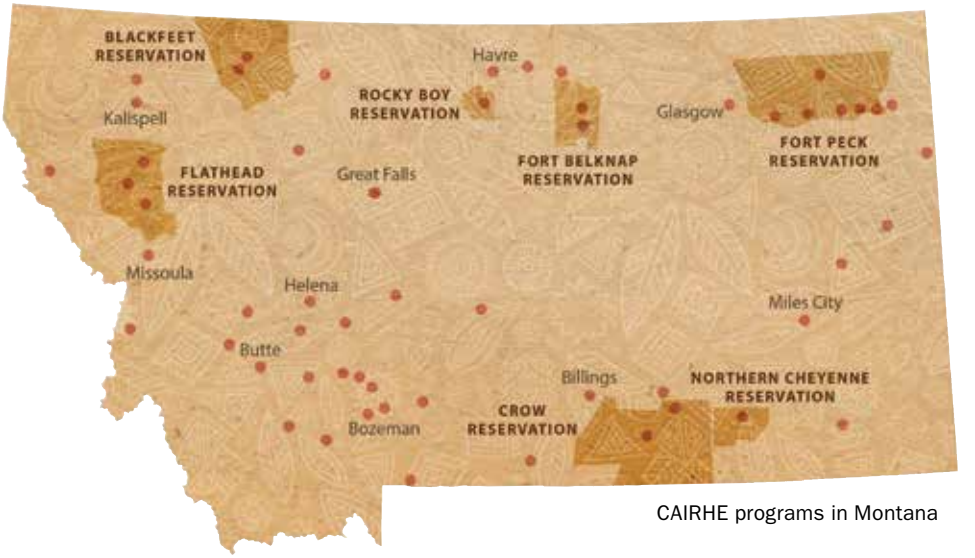
Guardians of the Living Water is supported by the Center for American Indian and Rural Health Equity, or CAIRHE, an MSU-based research center that promotes health equity in Montana's underserved communities.

Currently, 53 percent of the state's population lives in rural areas that lack essential health care services, and they face long distances and travel times to access those services, according to the Montana Department of Public Health and Human Services. To reduce those and other health disparities, including poor health outcomes among tribal and rural communities compared to the rest of the population, CAIRHE was created in 2014 through a grant from the National Institutes of Health Institutional Development Award program, or IDeA.

Along with Simonds' project, CAIRHE supports two more primary projects and six pilot projects. They address concerns including food security; dental, sexual and mental health; and substance abuse.

CAIRHE-sponsored projects involve community-based participatory research—that is, research done in partnership with the community. CAIRHE works on needs identified by citizens in each area, said Dr. Alex Adams, CAIRHE director who is based at MSU.

"The communities have advisory boards that work closely with investigators to frame the research and decide how it's going to be done, and have local people working on it with them," Adams said.



CAIRHE programs in Montana

Vanessa Simonds talks over research findings with students in the Guardians of the Living Water summer camp. The camp combines science and activities with Crow culture to promote environmental health literacy and is centered around the reservation's treasured natural resources.

"It's not someone coming in and saying, 'Hey, we think you need this.'"

A nationally renowned health equity researcher and medical doctor, Adams has headed CAIRHE since 2016, bringing with her vast expertise and deep connections gained from two decades as a leader in the field and a driving passion for health promotion and disease prevention partnerships with underserved populations.

To do this, she is building an infrastructure of local and national connections and programs that includes health providers, researchers, tribal college faculty, students and officials, other centers with shared goals, private foundations, government agencies and citizens from all walks of life. In September, CAIRHE took a big leap toward that goal by partnering with Montana INBRE for a health research summit attended by nearly 100 top health researchers, public health professionals and community representatives from across the region.

"Health disparities are a Herculean problem that no one center can tackle alone," Adams said. "We're all in the same boat so we have to figure out how we can make this all work together."

Simonds, whose work focuses on working with communities to design, implement and evaluate health interventions, said CAIRHE's support has been immeasurable in helping address a serious issue on the Crow reservation and in providing the opportunity for true partnered research that allowed her to develop relationships with Cummins, Pickett and others at Crow Agency Public School and Little Big Horn College who made the project possible.

"I learn so much through our activities, the stories I hear and the places we visit," said Simonds, who said she particularly values the project because it keeps her connected to her own roots. "Last summer, we went to Black Canyon and the Wolf Mountains. These are sites that are very significant to the Crow people. I don't always get a chance to visit these places when I'm occupied with my life here in Bozeman."

As some of those original Guardian students move on to middle school, Simonds is confident the knowledge and critical thinking skills they have learned, relationships they have built and experiences they have had, such as trips to culturally significant sites and stories they may not have otherwise heard outside of camp, will lead them to impact their communities. And that's an important pillar of the long-term CAIRHE mission.

"Our program provides these amazing, bright and engaged students with information about the water in their land and the basic issues that their water faces so that they not only take and discuss this information within their social networks today but perhaps in 10 years they will have been inspired by our program to become scientists, educators or political leaders," Simonds said. ▪

CLIMB ON

Longtime chemistry professor Pat Callis is the godfather of area climbing

story by Amanda Eggert · photos by Kelly Gorham

One winter day in 1970, Montana State University biophysical chemist Patrik Callis set out for a cross-country ski with a fellow professor when he inadvertently discovered cascades of ice floes lining the canyon beyond Hyalite Reservoir.

Callis, an avid climber, knew he had stumbled upon something special in the quiet, icy canyon. The area was ripe for ice climbing, which was just starting to gain footing thanks to innovations to the ice axe. He and a cadre of young climbing companions returned to the snowy, unplowed road numerous times, gear in hand, ticking off many first ascents in Hyalite, an area that's now celebrated as a North American mecca of ice climbing.

The list of Callis' early and continued contributions to the climbing community are both lengthy and admirable, but perhaps lesser known is his commitment to research and teaching at MSU. Callis, who's been described as a "giant among us" will celebrate his 50th year at MSU in 2018, making him the university's longest-tenured professor.

"The excitement of teaching has not gone away," said Callis, who turns 80 on March 17, St. Patrick's Day. "I'm still learning life sciences; I'm still learning biochemistry. Every year I have more biochemical information to give that's directly associated with physical chemistry, and somehow that just keeps teaching interesting and fulfilling. This seems to be directly linked to my research activities, which steadily became more biophysical over the last 30 years."

Callis became hooked on climbing as a teenager after a high school teacher showed slides of climbs on volcanoes in his native Oregon. Callis, an eager outdoorsman and climber of trees from a young age, thought it looked more doable and less dangerous than he'd previously imagined. He sought mentors and set out to learn how to move up the faces of mountains.

While nabbing first ascents up and down the West Coast, Callis was also spending a significant amount of time researching the quantum mechanics of

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—Mary Cloninger

molecules. After earning a doctorate at the University of Washington and completing postdoctoral research at Caltech, Callis accepted a professorship at MSU, which had impressed him with its commitment to research.

"When I (first) visited here, I was quite enchanted. That was my dream, to be in a place where you could do good science and be able to climb without spending too much time traveling," said Callis, who has well-known first ascents of ice and rock routes around Bozeman to his name, including "Cleopatra's Needle," a grade V multi-pitch icefall in Hyalite, and "Spare Rib," one of Gallatin Canyon's classic rock climbs.

Callis expanded upon his sense of early enchantment with the area in the introduction to "Bozeman Rock Climbs," the 1987 guidebook written by Bill Dockins and illustrated with hand-drawn maps that served as the first published guide to Bozeman's burgeoning climbing scene.

It was an unforgettably brilliant afternoon in late July 1968, with the Northern Rockies at their peak of lushness that marked my first encounter with the Gallatin Towers. Gayle (his wife) and I and two-year-old Kristina were literally high on the greens, golds and special incense of Gallatin Canyon…It was more than love at first sight. There was immediate recognition that this oasis of hard rock crags in a region of crumbling limestone would be the site of many enjoyable hours of exploratory rock climbing I had grown to love during the previous decade on the West Coast.

In terms of risk, Callis equates climbing with driving: Both are potentially dangerous activities that one can learn to negotiate intelligently. Callis' approach to risk has helped him to summit—and return from—big first ascents, like the north face of Mount Robson, the highest peak in the Canadian Rockies. He also has first ascents of numerous routes on Suicide Rock, near Idyllwild, California.

"Surviving the first couple years—that's where the luck comes in," he said. "I was lucky that my first regular climbing partner was a slightly older person who'd done quite a bit of climbing. He really calibrated me from the outset on how to climb safely. I think everybody should strive for such mentorship if they feel that urge to climb."

And where does that desire originate? Some climbers chalk it up to an "inexplicable urge to ascend," but Callis has a slightly more scientific understanding: "I think it's genetic, to some extent," he said, while also acknowledging that there's another, perhaps more mysterious, element. "It gets in your blood…. To me, it was just that free climbing and hiking translated into the beautiful mountain environment, which is just something in itself. Unless you've really gone up high on a mountain, it's hard to quite realize."

In 2001, Callis introduced Conrad Anker, possibly Montana's most well-known mountaineer, to many of the area's 5.11 climbs. Rock climbs are rated on a scale from 5.6 to 5.15; a 5.11 route requires both technical proficiency and considerable strength.

Callis and Anker had a mutual friend and climbing companion in the late Alex Lowe, an MSU graduate who remains legendary in mountaineering communities for his enthusiasm and stamina.

Two years after Lowe's death in 1999 in an avalanche on Shishapangma, a 26,335-foot peak in Tibet, Anker moved to Bozeman to be closer to Lowe's widow Jenni (whom he married in 2001) and her three sons. Callis and Anker were aware of one another's climbing accomplishments and took advantage of their proximity to climb together—which they still do, two or three times a year.

"Pat's a great example of the generational connectivity that climbing builds," Anker said, adding that Callis is the only climber he knows who has completed first ascents with both Yosemite iconoclast Warren Harding and Fred Beckey, one of North America's most prolific mountaineers.

"He just loves climbing. That's the best part of Pat—any day that he can get out climbing is a good day," Anker said.

Even Callis is surprised by his tenure on the crags and icefalls of southwestern Montana. "I couldn't not do it," he said of his vertical pursuits.

There was a period of Callis' fourth decade when he considered giving up climbing, buying into the notion that at a certain age he'd no longer be fit enough to do it well. Instead, he discovered that the opposite was true.

"I finally woke up to the fact that I was deteriorating because I wasn't climbing enough," he said. "That was an epiphany." He started climbing more and continues to climb at the same difficulty level as 30 years ago, although the famously modest Callis also acknowledges that some of the grades may have softened a bit.

In August, Callis completed his 23rd Bridger Ridge Run, a brutal 20-mile trail run along the spine of the Bridger Mountains. He holds the distinction of finishing the second-most Ridge Runs of any competitor.

"Something about it started to haunt me during the winter after [my first Ridge Run] and I found myself wanting to run

This fall the Montana University System Board of Regents named Pat Callis a Regents Professor, the highest honor in the system. Callis will present a Regents Symposium on his work on April 7.

it again, and again and again. It just keeps sort of luring me," he said.

The race was conceived by the late Ed Anacker, Callis' friend and fellow MSU chemistry professor. Anacker was instrumental in Callis' move to Bozeman, having taken a sabbatical from MSU to conduct research in a laboratory at the University of Oregon where Callis was finishing his graduate studies.

If challenge and high-alpine environments form the wellspring that keeps Callis on mountainsides, the process of discovery is what keeps returning to the Department of Chemistry and Biochemistry in the College of Letters and Science to conduct research and teach courses on physical and quantum chemistry.

Recently, Callis has become particularly interested in how enzymes accelerate biochemical reactions.

"I've been able to see that I have some ideas that are not out there in the literature, and I'm very busily and excitedly exploring these ideas right now," Callis said. He added that he is particularly thankful for the National Institutes of Health and the National Science Foundation, which had funded his research for 29 straight years, for supporting the graduate and postdoctoral students he mentored during that time. "My many colleagues within the department carrying out similarly sponsored programs have contributed greatly to my learning experience."

His colleagues note his scientific contributions are as significant as his athletic accomplishments.

"He is a giant among us, and yet he has such a gentle, calm demeanor that many people in the Bozeman community know him only as an outdoorsman and a nice person, having no idea how scholarly he is or how deep his contributions to the advancement of photophysics truly are," wrote Mary Cloninger, the head of the Department of Chemistry and Biochemistry, in her nomination letter for a creativity award Callis received in 2015.

"He's quiet, he listens and he's thoughtful. There's great positive energy around him," said Nicol Rae, dean of the College of Letters and Science.

"If you meet Pat, it doesn't look like he's been at MSU almost 50 years," Rae added. "Long may he continue."

This fall the Montana University System Board of Regents approved making Callis a Regents Professor, the highest honor in the system. Callis will present a Regents Symposium on his work on April 7.

And, Callis' students still appreciate both his patience and his ability to illuminate scientific processes.

Jacob Remington, a doctoral candidate in the Department of Chemistry and Biochemistry who has been working with Callis since he was an undergraduate, said Callis has a unique ability to explain difficult concepts in, say, quantum mechanics, while simultaneously revealing larger truths.

"I leave [Pat's] office thinking a little more deeply about what I went in there to ask, and it leaves me with a sense of wonder that the universe could possibly behave that way," Remington said.

"Pat has been a complete idol for me in terms of work-life balance—to become a full-time professor and still go outdoors a bunch. It's pretty inspirational." ▪

Bill Kollar, center, has mentored some of the National Football League's best defensive players in 29 years coaching in the league, including the Denver Broncos' Von Miller, left.

GRABBING THE (SUPER BOWL) RING

by Colter Nuanez

Bill Kollar says time at MSU was foundation of NFL coaching success

Bill Kollar wrestled plenty of Grizzlies during his standout career as a Montana State University defensive tackle in the 1970s before a long, winding life lived in the NFL that includes his current post coaching defensive line for the Denver Broncos.

But type 'Bill Kollar' into Google and you will realize it's not earning Senior Bowl MVP honors that pops up, nor is it that he's mentored some of the modern era's greatest defensive players. The bear for which Kollar is most famous for tackling is a real life 7-foot touring bear he grappled with back in 1975 for a whopping $50.

Kollar, the first Bobcat or Big Sky standout to ever earn Senior Bowl MVP honors back in 1974, first told the story of his stunt tussling with a real live beast when he was inducted into the Senior Bowl Hall of Fame in 2014 in honor of the 40th anniversary of his being named MVP of the annual college all-star game.

"I said, 'OK, ($50), that's pretty good," Kollar said. "I go downtown (Cincinnati) and there's probably 50 people there. I walk in and say, 'What's going on?' They said, 'Somebody's gonna wrestle a bear!' I said, 'I wonder who the heck's going to end up doing that?'"

The joke was on Kollar, at the time a young defensive lineman for the Bengals. The first time the two squared up, the bear put Kollar on his back, Kollar said recently. But, in Kollar's typical fiercely competitive fashion, he put the bear on its back when they faced up again, which is no surprise to anyone who watched Kollar wreak havoc during his legendary career with the Bobcats.

The Warren, Ohio, native became iconic by becoming only the second Big Sky player, and only MSU player, to ever have his name called in the first round of the NFL Draft. After eight successful but largely injury-ridden seasons as a player, Kollar began his coaching career as a student assistant while he finished his degree at MSU. In 1984, he joined

KOLLAR ICONSPORTSWIRE

The MSU Bobcats retired Kollar's number 77 in honor of the All-American and the MVP of the Senior Bowl all-star game. Kollar is the only Bobcat who has been drafted in the first round of the NFL draft.

KOLLAR MSU FILE PHOTO

John McKay's staff at the Tampa Bay Buccaneers, sparking a career as an NFL assistant that has included six total teams and 29 years.

As of late, Kollar has reached the pinnacle of coaching. He has spent time around NFL legends Deion Sanders, Brett Favre, Peyton Manning and Eric Dickerson. Kollar mentored NFL Defensive Player of the Year J.J. Watt during his time as the defensive line coach for the Houston Texans and Super Bowl MVP Von Miller since he joined the Denver Broncos staff in 2015.

He has worked for a wide array of the NFL's most memorable personalities, ranging from such iconic head coaches as Jerry Glanville, June Jones and Dan Reeves during his decade-long career with the Atlanta Falcons to offensive masterminds like Mike Martz during his five-year stint in St. Louis and Gary Kubiak in Houston and Denver where he played a hand in the Broncos' Super Bowl win in 2015.

Through all his travels and triumphs, Kolar has never forgotten the foundation upon which his success has been built.

"The influence my experience at Montana State had on my life is insurmountable," Kollar said in an interview in March before being inducted into the Montana Football Hall of Fame. Kollar graduated in 1985 with a degree in physical education from the College of Education, Health and Human Development. "The values I learned there and the camaraderie we shared as a football team was second to none.... My development there set me up for my NFL career. And the things I learned from being around coaches like Sonny Holland and Sonny Lubick set the stage for my life after football.

"Montana State is truly where it all started."

The 64-year-old has spent the second half of his charmed life coaching some of the NFL's most feared pass rushers. Watt, widely considered the top defensive player in professional football, credits

(MONTANA STATE UNIVERSITY) IS A GREAT UNIVERSITY. THE PEOPLE DOWNTOWN, THE SMALL-TOWN FEEL OF IT, THAT'S A GREAT THING FOR A LOT OF GUYS THAT GO OUT THERE AND NOT ONLY PLAY FOOTBALL, BUT TO **BE A STUDENT AND GROW AS A MAN**.

—Bill Kollar

Kollar directly for his impressive development. Miller has mentioned Kollar on several occasions as a huge influence on his ability to terrorize quarterbacks.

Kollar was once nearly as dominant as the men he mentors. Back in the early 1970s, former MSU and Idaho State head coach Mike Kramer was an offensive linemen for the Idaho Vandals. As a sophomore in 1972, Kramer tried to prepare himself to stop Kollar, one of the most disruptive forces in the Big Sky Conference. As he walked to practice on the week the Vandals were preparing to face the Bobcats, a pro scout told one of Idaho's assistant coaches that he'd timed Kollar at 267 pounds at 4.63 seconds in the 40-yard dash.

"I thought, 'Oh no'. Then, that Saturday, I never touched him. Literally never put a hand on him," Kramer said. "He had absolute raw speed. He was so darn fast."

Kollar is still considered to be one of the best players in school history. His No. 77 hangs atop Bobcat Stadium, one of four retired numbers at MSU. In 1973, Kollar earned All-America accolades and was selected for the Senior Bowl and the East-West Shrine Game. In 2014, he was enshrined in the Senior Bowl Hall of Fame, commemorating his 1974 MVP performance.

"He was so athletic," said Dennis Erickson, an assistant coach at Montana State during Kollar's playing days who went on to coach Miami to two national titles. Erickson is now retired after a 47-year career in coaching. "He created havoc along the line at all levels. He penetrated on seemingly every down and made plays all over the football field. In those days, he reminded me of Warren Sapp that I had at Miami. It was a different time, but that's how dominant he was."

Kollar came to Bozeman from Warren, a steel belt town in northeast Ohio known for producing tough football players. Joe Tiller, a former Montana State player and assistant coach who went on to have great success as the head coach at Purdue, brought Kollar, Leon Potkay and a handful of other fellow Ohio natives west to become Bobcats in 1970.

"I really love Montana, the openness, the mountains, the whole deal," Kollar said in an interview in 2014. "People in Montana are really easy to get along with. The university is a great university. The people downtown, the small-town feel of it, that's a great thing for a lot of guys that go out there and not only play football, but to be a student and grow as a man."

His first year in Bozeman, Kollar cut his teeth on the freshmen team. He watched MSU senior Gary Gustafson earn first-team All-America honors. The Cincinnati Bengals drafted Gustafson in 1971.

"Deep down inside, I thought to myself, 'I'd love to end up doing that someday,'" Kollar said.

By 1972, Kollar was a starter and a standout for Sonny Holland's Bobcats. He helped lead the Bobcats to the Big Sky Conference title that season, then earned All-America honors the next.

"He had an amazing physical ability that was so far advanced from the players of that era," said Brad Daws, an All-America selection himself for MSU in 1975. "Bill played right next to me. I can remember my hand coming out of my stance and Kollar already having two strides on me. And I wasn't a slow guy.… But he had that amazing combination of quickness for his size.

"It was comical how quick he was."

Kollar made enough plays to earn invites to the Senior Bowl and the East-West Shrine game, the two most prestigious post-season all-star games in the country. Both were right before the NFL Draft, so his outstanding performances helped his draft stock rise. He ended up landing with Cincinnati as the No. 24 pick overall, the second-highest selection to this day for a Big Sky product in the 54-year history of the league.

In the years since, he has played for and then coached with many successful and influential coaches, but he traces his style back to the men who mentored him at Montana State.

"Those guys had an enormous influence on my life," Kollar said recently. "When you are around guys who you really enjoy and you enjoy the way they coach, it branched me off into coaching and I've been able to hang around for as long as I have."

Montana State's defensive line has a rich tradition. Gustafson was the first in a long line of All-Americans that includes Daws, Mark Fellows, Dane Fletcher and Zach Minter. Caleb Schreibeis and Brad Daly won back-to-back Buck Buchanan Awards as the top defensive player in the FCS in 2012 and 2013 respectively, setting the bar even higher. But if you ask those who saw Kollar play, the bar was set long ago.

"I don't know if anyone touches him," Erickson said. "He was so great at Montana State, then he dominated the Senior Bowl, then he dominated the league. He is, without question, the best defensive lineman who has played at Montana State." ▪

ANDERSEN ADRIÁN SÁNCHEZ-GONZÁLEZ

FLIPPING THE CLASSROOM

Paul Andersen teaches science to millions using old school charisma and new wave technology

by Michele Corriel

Faster than a supercomputer. More powerful than the Hubble telescope. Able to leap tall questions with a single click. Look, up on the screen! …It's Paul Andersen, the Bozeman teacher who changed the course of classroom culture, creates YouTube videos for millions of students around the world and fights the never-ending battle for truth, science and a new way to learn.

Maybe Andersen isn't Superman, but the Montana State University grad is close. Science teacher extraordinaire, the pioneering Andersen turned his Bozeman High School classroom into a video game, was selected Montana Teacher of the Year and became one of four finalists for the national title. He continues to create YouTube videos with millions of international viewers. And, he has also combined his loves of science and teaching to travel the world helping other science educators up their game.

"For me, it's a job where I get to work with science teachers and I get to see the world," Andersen said. This summer he was in Dubai and Kuala Lumpur, and this fall he teaches in Singapore, Beijing and Addis Ababa, as well as other locations around the globe. "It's the best of all worlds."

Andersen grew up in Bozeman, where his dad taught math education at MSU, so when it was time for him to go to college he followed his father to MSU and became a high school science teacher. He has a bachelor's degree in biological sciences and a master's of science in science education, both from the College of Letters and Science.

Duties for his first teaching job, at Gildford's small Kremlin-Gildford High School on Montana's Hi-Line, included coaching, driving the school bus and occasionally directing the pep band, as well as teaching science. After seven years at Gildford, he landed a job in Bozeman, where he taught for the next 13 years.

Andersen explained that his methods for changing the way students learned locally, as well as around the world, started out as old-fashioned tutoring using what was then a new technology.

"I started out posting videos on YouTube about eight years ago, to give my students a little extra help," he said, adding that his videos and YouTube in general took off within a couple of years of each other. It became something of a hobby that he did every day. "Once you make a video and people watch it, you just want to do it more."

The videos were meant to help students

MY TRAVEL AND WORK ABROAD HAS BROADENED MY PERSPECTIVE. THE WORLD IS A **LARGE, COMPLEX AND BEAUTIFUL PLACE**. HOWEVER, THE FARTHER I GO THE MORE I APPRECIATE COMING BACK HOME TO BOZEMAN.

—Paul Andersen

taking the Advanced Placement Biology test. Since the test is the same around the world, Andersen found that his videos were being watched by a lot of students.

"On the back end of the YouTube channel, I can see who uses the videos and when.... The watching really spikes around the time of the AP test, which is taken on the same day everywhere," Andersen said. "The students found value in the videos, and my own success as a teacher stemmed from my students' successes."

On a typical day, Andersen's videos will get 80,000 views. On the day before the AP Biology test, the videos see almost a quarter of a million views.

"I think I'm good at explaining science and technology," he said. "It's what I love. Learning is exciting and it's something I hope I never lose."

During his years at Bozeman High, Andersen experimented with his own teaching style. Taking advantage of the culture of video games, he moved away from the traditional "static" method of disseminating information. Instead, he set up the classroom so those who learned quickly could move forward and those who needed more time with a lesson could stay as long as they needed.

The class would begin by watching a video, move to a reading assignment and then to a quiz. After passing the quiz the students would head off into the class for practical applications. The innovation was that a student could take the quiz as many times as needed. Instead of starting with an A and losing points over the year, all the students started at zero and worked their way up.

"When you play a video game you start at zero and expect to lose a 'life' as you learn," Andersen said—fail, learn, repeat.

But it also left room for improvement, both on the part of the students as well as the instructor. Sensing that the dynamic interaction between teacher and student was missing, Andersen tweaked his methods as the years went by. He made himself available to the students during class as well as after regular class hours, and he made sure his students knew that "science rules."

Magdalena Russell, a senior at MSU majoring in cell biology and neuroscience, had Andersen for her ninth grade honors physical science class and 10th grade AP Biology.

"It was the first time I was challenged by an exam and realized that I actually had to read the book and start studying for test," Russell said. It was also the first time the A student received an F.

"That really motivated me; after failing the test, I was able to learn the right skills from Andersen and got an A on the next one."

The year Russell had Andersen for AP Biology was also the first year he flipped the classroom.

"He was going to structure the class after the video game Angry Birds," she said. "We were able to work on biology projects and homework, where we would level up as we learned. It fostered a motivation to get to the highest level you possibly could, while learning along way."

Russell recently received the 2017 Goldwater Scholarship, the nation's premier scholarship for undergraduates studying math, natural sciences and engineering. She credits Andersen with getting her excited about science and said he still influences her plan to become a researcher and professor after she graduates.

"He's still, to this day, my most favorite teacher I've ever had," she said. "He really had a way of exciting students about biology."

John Graves, the lead faculty and associate director of the Masters of Science in Science Education program at MSU, has known Andersen since Andersen was his teaching assistant. Andersen also taught the technology course for Masters of Science in Science Education Program, working with Graves.

"Paul's always been on the innovative edge of instruction, always cared about students and worked to bring technology into the classroom as a way to connect students and teaching," Graves said. He said Andersen has the skill set, personality and "the pedagogical understanding as a teacher to capitalize on that. He has the ability to put it all together in one effective package. And he can connect across subject areas and content."

Andersen often credits his success to timing. Just as he was making his videos resources, Khan Academy, an online teaching site, and other online learning apps were starting to get traction among teachers and students.

"YouTube is a lot of luck," he said. "There's so much that you can get lost in the noise. Lucky for me I was one of the first ones, so people easily found me."

Also at around that time, there was a website called Teachers Pay Teachers, where instructors would post lesson plans and worksheets online. The catch: The downloads came with a fee.

"I thought it was awful," Andersen said. "People should just share good ideas. So I posted my videos without strings attached. The thing was, I wasn't prepared for was how technology changes everything. I was just trying to be a good teacher—now I have a brand new career."

He admits that while "the hardest part of leaving the classroom is that I miss the students," he believes that teaching teachers provides a great opportunity to impact student lives, "which is pretty special." And, it has given him a second life.

"My travel and work abroad has broadened my perspective. The world is a large, complex, and beautiful place. However, the farther I go the more I appreciate coming back home to Bozeman." ▪

To learn more about Paul Andersen, go to his website: www.bozemanscience.com

RUSSELL MAX HAMBERGER

RUSSELLING UP STUDENTS

Ronda Russell's hard work and a personal touch are the equation for admission director's success

by Carol Schmidt

It was the Saturday before the school year started when a beaming Ronda Russell posed for a photo with her kids—more than 3,000 of them.

The students who formed the "M" in the background were a large percentage of Montana State University's incoming freshman class. There were so many gold-shirted freshmen who showed up for the traditional M photo that the iconic letter burst over its boundaries, looking more like a pillowy caricature than a bold letter of the alphabet.

"Next year we'll have to spell MSU," organizers said of the number of students.

This abundance of incoming students has become a pattern in recent years. This fall, MSU set an enrollment record for the 10th straight year with 16,703 students. There are many contributing factors to the upswing in student numbers. It is the result of years of hard, focused work by a great many people. But chief

RONDA RUSSELL IS A WINNER. HER GOAL IS NOT TO BE BEAT IN ANYTHING. HER GOAL IS TO BE AT THE FOREFRONT. I THINK HER SUCCESS REFLECTS THAT.

—Jaynee Groseth

among the factors in growth has been a concentrated effort by the staff of the MSU Office of Admissions, which Russell directs. In fact, Russell and the members of her team have had a touch in enrolling each student that was part of the happy, golden M that billowed below her on Martel Field.

Russell has been living and breathing Bobcat blue and gold for so long that it's almost inconceivable to imagine that she ever was anywhere else. Yet, she grew up in St. Peter, Minnesota, 10 miles north of Mankato. Her father was a police chief and her mother an administrative assistant. She graduated from Concordia College, a small, private college in Moorhead, Minnesota. She had planned to enroll in medical school, but when she graduated she decided to become an admissions representative for her alma mater. Ronald Reagan was president. There was no internet, and a lot of university recruiting was done by mail. Yet, Russell says she still uses many of the recruiting techniques she learned at Concordia three decades ago, especially the emphasis on a personal touch.

"Who doesn't want to be treated well?" Russell asked. That question has become her admissions mantra.

That question also led indirectly to Russell's landing on the MSU campus. In 1983, after three years at Concordia, Russell planned to attend graduate school at another university in the region and thought her future path was set.

"I arranged a campus visit to the school I had chosen and when I arrived, things just did not seem right and I didn't feel a welcoming vibe," she said. "My visit experience changed my fate."

On her way back home to Minnesota, she stopped at Montana State, showing up unannounced in the office of Eric Strohmeyer, who was then in charge of the MSU counselor education program. Russell was a graduate assistant for two weeks before she saw that MSU was looking for a part-time director of orientation reporting to Rolf Groseth, then dean of students. She got the job and has been with MSU ever since. Jaynee Groseth, Rolf's wife, was director of admissions then and had recruited against Russell so knew her strengths.

"Her energy is what attracted me to her," said Jaynee Groseth, who gave Russell a second half-time position working for her. A couple of years later, the Groseths went to other jobs at MSU and admissions and orientation were combined, and Russell became director.

"Ronda's smart," Jaynee Groseth said. "She could see where this admission thing was going."

Russell's insights into where university admissions strategies are going today, as well as her ability to combine the personalization of a private university with the access and size of a public institution, are just two of the factors that make Russell a leader in the admissions field, according to Chris Kearns, vice president of student success and Russell's boss.

"I have never seen another admissions officer to equal Ronda," Kearns said. "And, I've been working with admissions officers for 18 years."

MSU's recent surges of enrollment have bucked a national trend that has seen many institutions fighting for new students. Factors include a healthy national economy, which means the workforce attracts more potential students than in times of downturn. Also, there was a dip in the American birthrate of kids that are now college-age, which is even more pronounced in Montana.

So, Russell's success might be considered surprising, especially to those who think that admissions is a young person's game. Admission directors must have their pulse on the wants and needs of a 16-year-old. And Russell is old enough that she now has children that age. Magdalena "Maggie" Russell is a senior at MSU who is the university's most recent Goldwater Scholar, which recognizes national excellence in STEM fields. Her son, J.J., is a junior in high school. Russell thinks her family perspective is an asset that helps her understand prospective students as well as the concerns of their parents.

Groseth said another of Russell's strengths is knowing how to build a strong team. Russell's office has grown from just a couple of employees to a small army of 27 that includes recruiters, counselors, planners, accountants and application evaluators of all ages. Among them is the Groseths' son, Anders, who now helps plan orientation.

Russell points out that some of these strengths came from lessons learned during hard years.

"We were the underdogs for so long that we got used to trying harder, staying stronger and running faster," she said. And, that is also the case for Russell, who admits to a strong sense of competitiveness.

Which may be one of the reasons that Russell is still at MSU, working as long and as hard as some of her employees who are several decades her junior.

"I like to sell MSU," Russell says with a shrug. "As long as this job is fun, I'll do it."

Jaynee Groseth puts it another way.

"Ronda Russell is a winner," Groseth said. "Her goal is not to be beat in anything. Her goal is to be at the forefront. I think her success reflects that." ▪

CONGER DOUG LONEMAN

THE DYSLEXIC ADVANTAGE

Changing how we think about dyslexia

essay by Jeffrey Conger

Being dyslexic is an invisible strength. It is like having a pair of X-ray glasses that allows one to see the universe in a new way. Through research of mapping the brain, we now know that dyslexia fosters many advantages. This I know first-hand because of my own dyslexia, but also through mentoring dyslexic undergraduate and graduate students at Montana State University.

When we think of dyslexia, most of us envision difficulty with reading or transposing letterforms. However, the secret of the dyslexic mind is that most have enhanced picture-thinking abilities. This increased visual understanding is a major asset in many professions, such as filmmaking, photography and graphic design. The heightened spatial understanding created by this portion of the brain is a benefit for architects designing a building, engineers solving a complex problem and pilots landing a commercial jet. The ability to quickly process the 3-D situation is a big plus on a sports field, court or track for athletes and coaches.

One fact that is often overlooked is that the area in the human brain that creates dyslexia is above the left ear. It functions like a microchip, processing both words and visuals. In the dyslexic mind, the visual processing of this part of the brain is often much greater than the verbal pathways. It is also known that dyslexics inherit this biological microchip from their parents. In this

WITH ONE IN FIVE PEOPLE OF THE GENERAL POPULATION BEING DYSLEXIC, MSU IS **FOCUSING ON THE STRENGTHS** OF THESE INDIVIDUALS BY DEVELOPING STRATEGIES THAT FOSTER THEIR SKILLS RELATED TO A CAREER PATH.

—Jeffrey Conger

way, one child in a family might have a dyslexic mind while the other has a traditional mind.

Across the state on MSU campuses, we are changing both the methods of instruction and the culture around dyslexia. One of the most effective ways to create change is by spotlighting dynamic stories of dyslexics with notable success. For instance, in the motion picture industry, this includes superstars like Jennifer Aniston, George Clooney and Steven Spielberg. Another noted creative dyslexic is John Lennon, who is known for his musical genius.

In entrepreneurship, research estimates that 35 percent of successful business owners are dyslexic. This is best seen by the list of dyslexic pioneers including Bill Gates, Steve Jobs and Charles Schwab. One high-profile entrepreneur who talks candidly about his dyslexia and its influence on his success is Sir Richard Branson, the founder of the Virgin Group. In May, Sir Branson launched a new nonprofit organization in London called madebydyslexia.org to combat the stigma around dyslexia.

Another unexpected advantage of the dyslexic mind is the ability to process complex data sets. This skill can vary from an astrophysicist who envisions the expansion of the big bang theory to a football quarterback reading a backfield in motion while trying to score a touchdown. Some might be surprised to learn that NFL Hall of Famer Joe Montana is dyslexic. Leading the 49ers to four Super Bowl Championships was his day-to-day job, and perhaps the benefit of increased peripheral vision known to be prevalent in the dyslexic mind is simply a coincidence. Other successful dyslexic athletes include legendary professional basketball player Kobe Bryant with his five NBA Championships and 33,643 career points, and Formula One driver Lewis Hamilton with four F1 World Championships.

With one in five people of the general population being dyslexic, MSU is focusing on the strengths of these individuals by developing strategies that foster their skills related to a career path. Through better understanding this learning difference and becoming agents of change, we can empower the next generation of visual thinkers.

The picture-thinking assets of the dyslexic mind are a natural fit for many career paths, especially in professions that rely on strong spatial understanding or 3-D processing. At MSU in Bozeman we offer degrees in engineering, architecture and graphic design that all require strong visual skills. We also are home to the Jake Jabs College of Business and Entrepreneurship with degrees in marketing, management and finance that require big picture thinking.

MSU Northern in Havre offers both specialized 2-year and 4-year diesel technology degrees that require mechanical visualization. MSU Billings offers a unique degree in outdoor adventure leadership and music business. At Gallatin College MSU, there are outstanding offerings in aviation and CNC machining technology, and at Great Falls College MSU there are excellent dental hygiene and EMT programs. In addition, all our MSU campuses offer college-level athletic programs and club sports that are often a perfect fit for the visual strengths of the dyslexic mind.

To make navigation of these two and four-year institutions easier there are several technological advancements available for dyslexic individuals. This includes text to speech software programs that utilize the benefits of listening to text or what is called ear reading. The two most common text to speech programs used by college students are Kerzweil 3000 and Read & Write Gold.

Other useful technologies include thousands of nonfiction and fiction books available on Audible.com. To assist with the challenges of spelling and punctuation there are powerful software options like Grammarly.com that go far beyond spell check and can proof a sentence for context. And new innovative tools like smart pens that literally record a lecture and can also transcribe handwritten notes into a type format.

Those looking for resources can find assistance at the Allen Yarnell Center for Student Success on the Bozeman campus or at one of the disability resource offices located on the affiliate MSU campuses. Individuals searching for online information can begin with the www.beatingdyslexia.com website, which was created by three dyslexic college students in England who wanted to make it easier for future students to succeed. It offers a free 90-second test for anyone to take that may indicate dyslexia. This is the perfect first step in transforming the powers of dyslexia into a strength that will maximize potential in succeeding in the university environment and also a sustained career path. ▪

Jeffrey Conger's introduction to learning differences was personal. The award-winning graphic design professor in the College of Arts and Architecture discovered during his own undergraduate experience that his approach to learning was different from others. Serving as the 2016–2017 Presidential Faculty Fellow, he has worked to bring an awareness about dyslexia to all four MSU campuses. He excerpts his presentation on learning differences in this essay.

To learn more about learning differences and resources at MSU, go to www.montana.edu/aycss/

KELLY GORHAM

The Spirit of Discovery Award for the Honors College, established by Liane and Lew Vadheim of Miles City in 2012, parents of MSU Marshal Scholar Bryan Vadheim, recognizes excellent faculty members who have taught in the Honors College. Ilse-Mari Lee, dean of the college, teaches one of the many courses that enrich the learning of honors students.

TEACHING HOW TO THINK OUT OF THE BOX

Support of inspiring professors positively impacts students

by Michele Corriel

As the saying goes, give a man a fish and he'll eat for a day, but teach a man to fish and he'll never go hungry. Such is the underlying value of the awards given to outstanding faculty. While there is no doubt students benefit from individual scholarships, gifts in support of faculty can impact students exponentially.

To that end, the Spirit of Discovery Award, the Mary Edsall McLaughlin Award and the Cox Family Fund for Excellence exemplify how upholding and rewarding faculty benefits the university as a whole and students universally.

The Spirit of Discovery Award for the Honors College, established by Liane and Lew Vadheim of Miles City in 2012, recognizes excellent faculty members who have taught in the college. The Vadheims' son, Bryan, became MSU's first Marshall Scholarship Award recipient in 2012.

The impetus to create the award occurred when the Vadheims brought Bryan to visit MSU and the dean at the time personally took them on a tour. Bryan excelled at MSU, and after he graduated from MSU with degrees in chemical engineering and economics, he went on to earn a master's degree from the London School of Economics as a Marshall Scholar. Bryan, who also earned a master's degree in climate science and policy from the University of Bristol, is now an economist in London.

"We both graduated from MSU," Liane Vadheim said. "We're excited by all the

WHILE THERE IS NO DOUBT STUDENTS BENEFIT FROM INDIVIDUAL SCHOLARSHIPS, GIFTS IN SUPPORT OF FACULTY CAN *IMPACT STUDENTS EXPONENTIALLY*.

MANY WAYS TO GIVE

With philanthropic intention and commitments that suit their finances, these donors have found a variety of ways to make impacts across campus.

GIFT OF MARKETABLE SECURITIES

TJ *and* **Maggie Lynch** *donated stock valued at $3,560*

IMPACT School of Film and Photography student support

PLEDGE OVER 5 YEARS

Russell Crawford *pledged a major gift utilizing his workplace corporate match program because he believes in the importance of students traveling for international experiences.*

IMPACT Travel abroad scholarships for business students

CHARITABLE GIFT ANNUITY

Doug *and* **Marsha Okland** *have established charitable gift annuities over the past four years.*

IMPACT KUSM Endowment for Montana PBS

OUTRIGHT GIFT

Buzz *and* **Judy Cowdrey** *contributed a current use gift in support of student-athletes.*

IMPACT Athletics sports excellence

BENEFICIARY OF RETIREMENT ACCOUNT

Janice Kathary Vigre *and* **Norm Vigre** *pledged to establish an endowment and designated MSU as the beneficiary of an IRA (estimated total gift $125,000).*

IMPACT Scholarships for microbiology and immunology students

To make your own impact, visit
MONTANA.EDU/WHATITTAKES

The MSU Alumni Foundation takes seriously the responsibility to honor the confidentiality of donors and their gifts to MSU. All donor and gift stories are published with the express approval of donors and affected family members.

things that MSU does, but we wanted to focus on the Honors College. It does a great job inspiring outstanding students."

Most importantly, the Vadheims felt the Honors College nurtures cross-fertilization.

"That can lead to all kinds of aha moments," she said. "These are students who are going to fix the world for us, and the fact that these good students are encouraged to synthesize their ideas made us want to thank the faculty in particular."

Realizing the extra effort honors faculty puts in to teach interdisciplinary classes and the added onus of having to challenge honors students, the Vadheims felt it only fitting to support them.

"We appreciate that the faculty has to be excited to do that—to encourage their students to think outside the box."

Blake Wiedenheft, the 2016 recipient of the Spirit of Discovery Award and an assistant professor in the Department of Microbiology and Immunology, teaches and mentors Honors College students by bringing his research into the classroom and the students into his lab.

"Dr. (Ilse-Mari) Lee is building one of the best programs in the country," Wiedenheft said, referring to the dean of the Honors College. "The Honors College gives me access to an incredible talent pool and allows me to recruit students that are now playing an important role in the research conducted in my laboratory."

Among his research projects, Wiedenheft makes use of CRISPR technology to develop new tools that can be used for the precise manipulation of DNA.

"We study what happens when bacteria get sick," he said. "Bacteria get infected by viruses, and by understanding the immune response that bacteria mount against these viruses, we have stumbled upon an innovative new technology that has the potential to cure genetic disease."

Wiedenheft said the Spirit of Discovery Award offers encouragement.

"We aim to inspire our students, and recognition through awards like this motivates me to do better," he said.

Wiedenheft fosters interaction by using participatory learning. His contribution to undergraduates at MSU is teaching them why what they learn in the classroom has profound impacts on a professional level.

"The Vadheims are special individuals," Wiedenheft said. "They're from Miles City and I'm from the Hi-Line. Having been a student in the public education system in the northeastern part of the state, I feel very strongly about giving back to Montana."

Wiedenheft has mentored close to a dozen students from the Honors College. Josh Carter was one of the honors students in Wiedenheft's lab and is MSU's most recent Rhodes Scholar. Alyssa Jones, a current honors student working in the Wiedenheft Lab explains how Wiedenheft supports students.

"If you want to put the work in, he'll help you to do that," she said. "He has a high standard, but he encourages students to reach that standard. The thing that stands out about him is that he can address different levels of experience. He can have a conversation with a graduate student and then turn around and explain what's going on to someone like me, who hasn't had that kind of experience."

Brothers Don and Richard McLaughlin established the Mary Edsall McLaughlin Award for the College of Arts and Architecture in memory of their mother to support faculty projects that address the visual exploration of place and quality, cu-

ADRIÁN SÁNCHEZ-GONZÁLEZ

James Joyce, assistant professor of film and photography, is the most recent recipient of the Mary Edsall McLaughlin Award for the College of Arts and Architecture. Established by her sons, Don and Richard, the award supports faculty projects that address the visual exploration of place and quality, curiosity and innovation, people and place.

riosity and innovation, people and place.

"My mother is an alumn(a) of Montana State College and her uncle was president at the time," Don McLaughlin said. August LeRoy Strand was an entomologist who served as president of what was then MSC from 1937 to 1942. "She always appreciated art and supported the arts in Butte where she grew up and lived. People in Butte often say if she were standing on a balcony with the Pope, folks would wonder who's standing up there next to Mary McLaughlin."

McLaughlin had a nursing background but later in her life became an accomplished watercolorist. Not only does the award stem from Mary McLaughlin's enthusiasm for art, but it's compounded by Don McLaughlin's passion for architecture. A 1967 graduate of the MSU School of Architecture, also in the College of Arts and Architecture, he recalls taking off a semester to ride motorcycles in Europe with some friends.

"When I walked into the Pantheon in Rome, I was driven to my knees," he said. "I realized what real architecture was and came back to finish my degree."

Without that trip he wouldn't have become an architect, he said. He notes that passion is something vital in the creative arts.

"I thought, if there could be an award that supported a trip to Europe to see the Pantheon—that would make a difference in a person's life," he said. "My brother and I are thrilled with the people who have participated in this award."

This year's recipient of the Mary Edsall McLaughlin Award, James Joyce, assistant professor of film and photography, used his grant to travel to Macedonia so he could better understand the lives of people marginalized by the European refugee crisis.

"The award gave me the time to sit down and really just focus on a creative work instead of being pulled into the different directions of teaching," Joyce said. "To be told this is your job, immerse yourself in the space, soak it up and think about the way your experiences will benefit the work you're creating is fantastic."

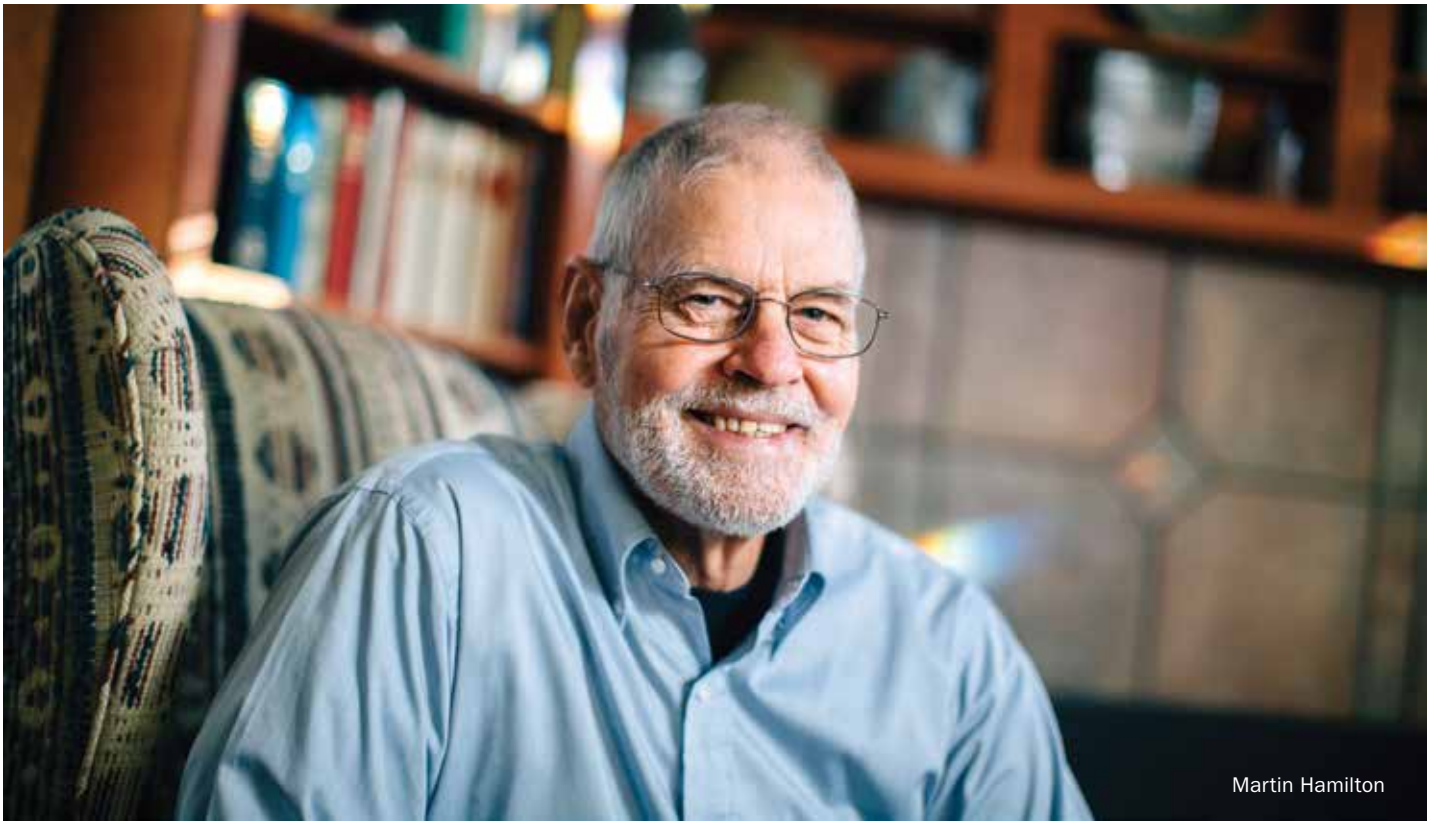
Jacqueline Centofanti, who is a senior majoring in film, appreciates Joyce for his dedication to excellence.

"As an instructor, he's teaching his students how to dive into the creative process in full force, to conceive the most genuine work that we can," Centofanti said. "He shows us how best to use the tools in the classroom to achieve one's most creative work, and that brings a lot of value to future filmmakers."

Another fund that supports faculty is the Cox Family Fund for faculty excellence, established in 1986 by Richard Cox and family to support faculty at both MSU in Bozeman and Billings.

"We wanted it to inspire young teachers," Cox said. "We believe in reward, and the award itself has become prestigious. We're quite proud of what we've done." ▪

Learn more or become involved at
MSUAF.ORG/WHATITTAKES



Martin Hamilton

HAMILTON ADRIÁN SÁNCHEZ-GONZÁLEZ

THE IMPACT OF GIVING

The Kenneth J. Tiahrt Math Support Fund, known as the Tiahrt Fund, is an old fund with a new name and revitalized purpose. Established in 2017, the Tiahrt Fund illustrates the impact of connecting multiple donors to a common goal over time. The Tiahrt Fund is the story of two men, one fund and a rallying cause that connects a group of inspired donors.

Kenneth Tiahrt joined the MSU Department of Mathematics, now the Department of Mathematical Sciences, in 1967. For the next 27 years, which included 16 years as the department head, Tiahrt was known as a dedicated mentor and farsighted leader as the department was expanded from its tradition of exceptional undergraduate and service teaching into graduate training through the doctoral level, fundamental and applied research, innovative education and professional service. Tiahrt retired in 1994 and passed away in 2014.

Martin Hamilton joined the Department of Mathematical Sciences at MSU in 1970. He holds bachelor's and master's degrees in statistics from the University of Wyoming, was a Fulbright Scholar in biostatistics at the University of Aberdeen in Scotland and earned a doctorate in statistics from Stanford University. Since retiring in 2002, Hamilton has served as Professor Emeritus of Statistics.

Hamilton has also served as an active member of the MSU Retiree Association and its advisory board where he advocated passionately for stronger support for all MSU retirees. It was through his work for the Retiree Association that Hamilton first became connected with the MSU Alumni Foundation.

"At this stage of my life (late 70s) I am looking back at this institution and considering how I can help make it even better," Hamilton said. "It's an amazingly powerful school."

Giving back has always been important to Hamilton. For example, he attended Stanford on a National Institutes of Health scholarship, and so after he graduated, he volunteered for the Commissioned Corps of the U.S. Public Health

I AM LOOKING BACK AT THIS INSTITUTION AND CONSIDERING HOW I CAN HELP MAKE IT *EVEN BETTER*.

—Martin Hamilton

PHOTOS, RIGHT ADRIÁN SÁNCHEZ-GONZÁLEZ

Service and was assigned work at NIH. "It was my way to give back to NIH and to serve my country during Vietnam," Hamilton said. He served for two years at NIH in uniform, as a scientist for the National Cancer Institute.

Hamilton and retired department head Ken Bowers worked with Beth Burroughs, current head of the Department of Mathematical Sciences, to establish a fund to support staff, graduate professionals and others in the department on an as-needed basis. The department already had a similar fund, the Mathematical Sciences Graduate Support Fund, endowed in 1999. However, it was not generating enough resources to fulfill its intended purposes. The fund had been established by gifts from alumni, friends, faculty and staff who had been rallied to the cause, in part, by Tiahrt.

Hamilton donated shares of mutual fund stock to get the fund up to a constructive level and worked with the department and Tiahrt's family to rename and broaden the support the fund could offer. In recognition of Tiahrt's high regard for all the personnel that supported the faculty in the department, the Tiahrt Fund provides resources for the professional improvement of graduate students, non-tenure track faculty and staff in the Department of Mathematical Sciences.

"I wanted it to support all the people who are really fundamental to the success of the department, but may not have other means to improve their professional careers," Hamilton said. "Ken made so many contributions that I thought he deserved the recognition."

Hamilton said he also hopes that naming the fund after Tiahrt might help to stimulate more giving from other donors inspired by Tiahrt's legacy to MSU. ▪

David and **Karen Street** established a charitable gift annuity to benefit the American Indian Student Center. In addition to supporting the building of the center and Native American students, the Streets have also supported programming for all students based on the Native concept of elders mentoring the next generation. The Street's benevolence is linked to David's great-great grandfather, Joseph Montfort Street, who was an agent in the early 1800s for Native Americans of the upper Mississippi Valley. He befriended Chief Wapello of the Meskwaki (Fox) Tribe. David said their gift honors his relative, whose legacy "we are proud to help perpetuate."

Cody and **Joycelyn Christman** designated MSU as a beneficiary of their estate. The Christman's estate gift will establish two endowed funds: One will support graduate fellowships for electrical and computer engineering students and the second will fund undergraduate scholarships for women pursuing electrical engineering degrees.

Mike and **Terri Simmonds** gave $10,000 in support of engineering design projects. Senior capstone projects often require students to work across disciplines, analyze costs and risks, design and build prototypes, models and finished products. Gifts, like the Simmonds' help provide student-teams the resources they need for materials, equipment, faculty advising and competition travel.

Craig and **Ellen Langel** have pledged a major gift to name a classroom in Jabs Hall, and to establish an endowment that will support a student scholarship and the Professional Advantage program for business students.
The Langels believe in the development of skills that the Professional Advantage program facilitates outside the classroom for students. They want MSU students to have an edge in the job market and throughout their careers.

FALL 2017 CAMPAIGN REPORT

CAMPAIGN

ACHIEVED

GOAL $300 million
SECURED $353,002,683

PEOPLE

ACHIEVED

GOAL $75 million
RAISED $118,331,169

PLACES

GOAL $125 million
RAISED $103,723,594

PROGRAMS

ACHIEVED

GOAL $100 million
RAISED $130,947,920

CAMPAIGN PROGRESS BY DIVISION

(as of September 30, 2017)

ATHLETICS

ACHIEVED

GOAL $25 million
RAISED $25,695,226

COLLEGE OF AGRICULTURE

ACHIEVED

GOAL $22 million
RAISED $26,461,735

COLLEGE OF ARTS & ARCHITECTURE

ACHIEVED

GOAL $7 million
RAISED $7,147,555

JAKE JABS COLLEGE OF BUSINESS & ENTREPRENEURSHIP

ACHIEVED

GOAL $45 million
RAISED $45,387,561

COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

ACHIEVED

GOAL $3.25 million
RAISED $3,945,907

COLLEGE OF ENGINEERING

ACHIEVED

GOAL $110 million
RAISED $119,409,815

COLLEGE OF LETTERS & SCIENCE

ACHIEVED

GOAL $30 million
RAISED $34,779,820

COLLEGE OF NURSING

ACHIEVED

GOAL $8.5 million
RAISED $13,821,936

MSU LIBRARY

ACHIEVED

GOAL $1.75 million
RAISED $4,034,269

GRADUATE SCHOOL

GOAL $300,000
RAISED $252,351

HONORS COLLEGE

ACHIEVED

GOAL $7 million
RAISED $7,088,903

DIVISION OF STUDENT SUCCESS

ACHIEVED

GOAL $2.1 million
RAISED $3,214,029

GREAT FALLS COLLEGE–MSU

GOAL $2 million
RAISED $1,687,498

MUSEUM OF THE ROCKIES

ACHIEVED

GOAL $7 million
RAISED $9,648,537

ADRIÁN SÁNCHEZ-GONZÁLEZ

CENTER OF EXCELLENCE

As of Sept. 30, ***What It Takes***—*The Campaign for Montana State University* has raised a total of $351 million.

"Our amazing alumni and friends continue to give generously and since last spring have given an additional $11 million in support of people, places and programs across our campus," said Chris Murray, MSU Alumni Foundation president and CEO.

With another year remaining before the campaign concludes at the end of 2018, a new master plan has been unveiled to renovate and expand athletic facilities on campus. This long-range plan for MSU Athletics addresses the increased training and academic demands faced by student-athletes and helps keep pace with the university's enrollment growth.

"Our goal is to create centers of excellence that embrace our mission to create champions—both on and off the field," said Leon Costello, director of MSU Athletics.

The first phase of the Athletics Facilities Master Plan includes the Bobcat Athletic Complex and an expanded Academic Excellence Center. This initial $16 million project, outlined in the master plan, will enhance the academic, health and wellness and sport-specific training services MSU offers Bobcat student-athletes.

To learn more about the plan, go to www.montana.edu/athletic-masterplan

"Contact us if you'd like to be a part of the effort and solution to provide Bobcat student-athletes the resources they need to succeed," Murray said.

FUNDRAISING PRIORITIES

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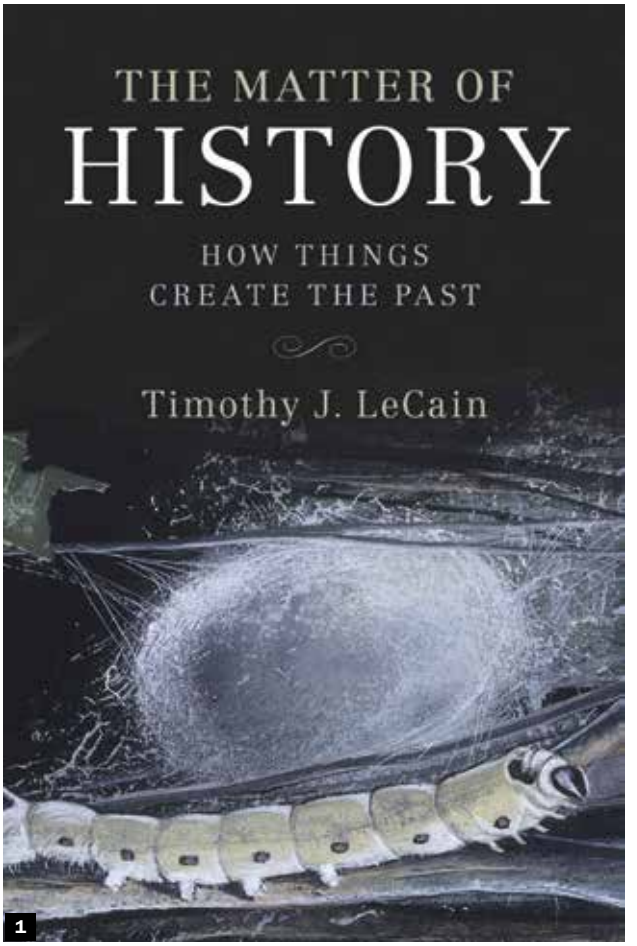
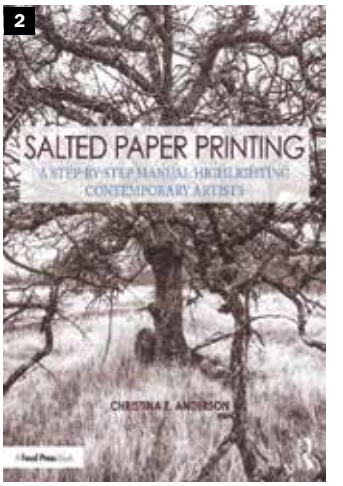
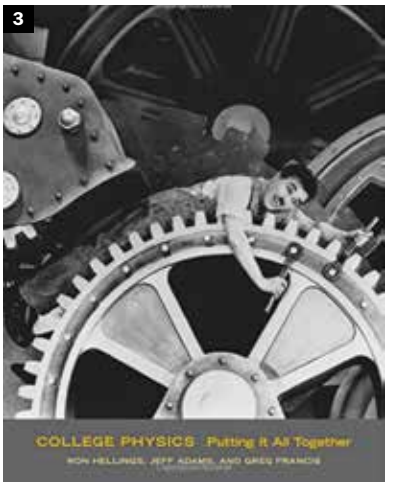
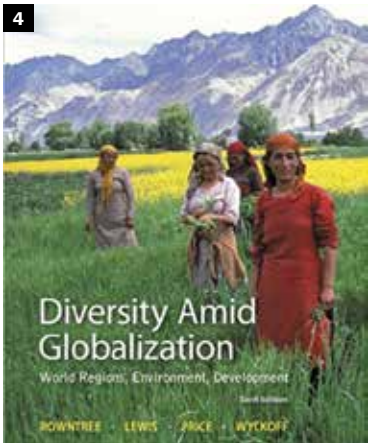
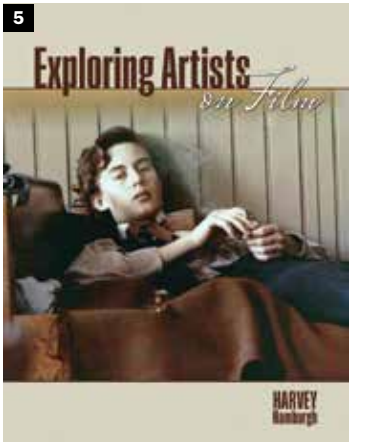










BOOKMARKS

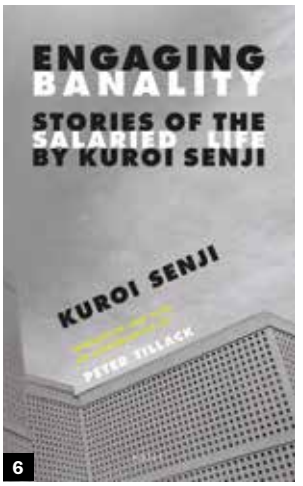
1 ***The Matter of History: How Things Create the Past*** *Timothy J. LeCain*
History professor LeCain argues that cattle, silkworms and copper drove the U.S. and Japanese nations towards a global 'Great Convergence' in the late 19th century.
Published by Cambridge University Press

2 ***Salted Paper Printing: A Step-By Step Manual Highlighting Contemporary Artists***
Christina Z. Anderson
Photography professor Anderson updates the 19th century process with 21st century digital negative methods. *Published by Routledge*

3 ***College Physics: Putting It All Together*** *Ronald Hellings, Greg Francis with Jeff Adams*
Hellings and Francis, both MSU professors of physics, and Adams, formerly of MSU, co-wrote this algebra-based physics textbook designed for the first year, non-calculus college course.
Published by University Science Books

4 ***Diversity Amid Globalization: World Regions, Environment, Development*** *William Wyckoff*
Geography professor Wyckoff is one of four authors of the fourth edition of this textbook that helps students understand connections and diversity between people and places. *Published by Pearson*

5 ***Exploring Artists on Film*** *Harvey Hamburgh*
Hamburgh, a professor emeritus in art has published a book that analyzes portrayals of art and artists throughout history in Hollywood and foreign feature films. *Published by Kendall Hunt.*



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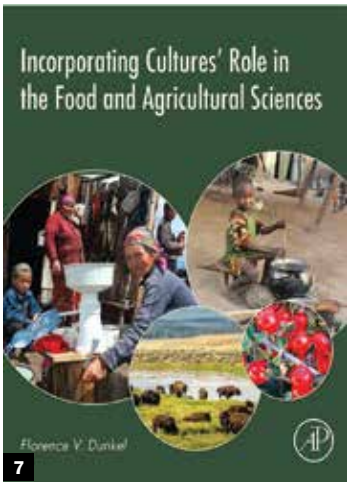

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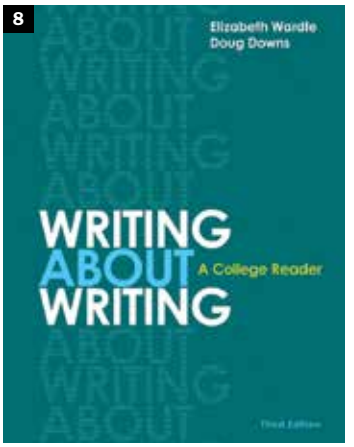

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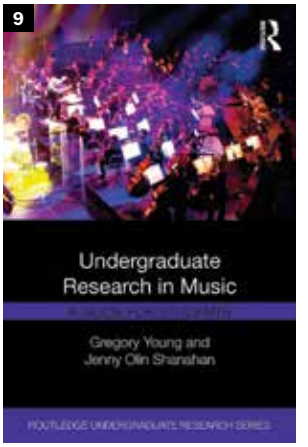

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6 ***Engaging Banality: Stories of the Salaried Life by Kuroi Senji*** *Peter Tillack*
The director of MSU's Asian Studies program translated three of the best-known works during Japanese writer Kuroi Senji's early career. *Published by Brill*

Child's Play and Ambient P *Jason Bolte*
The MSU music professor, composer and coordinator of the Music Technology program, published two albums. *Published by SEAMUS Records and Thrmnphon*

7 ***Culture-Smart Agriculture: Incorporating Cultures' Role in the Food and Agricultural Sciences*** *Florence V. Dunkel*
Drawing on her experience in Sanambélé, Mali, entomology professor Dunkel addresses the practical needs of the professors, administrators and students who often face challenges of working together with indigenous peoples. *Published by Academic Press*

8 ***Writing about Writing: A College Reader, third edition*** *Doug Downs*
English professor Downs is a co-author of this textbook that makes writing more accessible to students in introductory writing courses. *Published by Bedford/St. Martin's*

Collaborative Remembering: Theories, Research, and Applications *Michelle L. Meade*
Psychology professor Meade is one of five editors of this textbook that explores the topic of collaborative remembering across a wide range of fields, including developmental, cognitive and social psychology. *Published by Oxford University Press*

9 ***Undergraduate Research in Music: A User's Manual*** *Gregory Young*
Music professor Young is the co-author of this book that supplies examples of undergraduate research activities and case studies on projects in the various areas of music study. *Published by Routledge Undergraduate Research Series*

10 ***Sound thinking*** *Eric Funk*
Professor and composer Funk published this ebook about how music connects with everything. Drawn from his popular MSU music courses. *Published by Kendall Hunt*

CORONA

Hot, ionized gases known as plasma, surrounding the sun and other stars, extend millions of kilometers into space and are a visible feature during a total solar eclipse. The patterns in the corona are a result of high temperature and magnetic polarity.

RING OF FIRE

People anywhere near the path of totality taped eclipse glasses to their phones and jerry-rigged various attempts to photograph the rare experience of the total solar eclipse that crossed the United States this summer. Now-iconic images of totality—showing a white flared ring around a black disc—appear across the internet, news stations, newspapers, magazines and social media feeds. But how does a veteran photographer who spends his days leading a team that documents everything from cutting-edge research to NCAA sports at Montana State University capture such an experience? MSU's award-winning photographer Kelly Gorham explains how he shot the photos that impressed even the most experienced eclipse-chasing astronomers he found himself teaming up with outside of Rexberg, Idaho, this summer.

photo by Kelly Gorham

When did you begin planning to photograph the eclipse?

GORHAM Photos always benefit from pre-planning, and it's especially important with something as technical as an eclipse. I began planning for these photos more than one year ago and realized there would be numerous exposure changes over only a few minutes with 16 of those happening in 60 seconds. These calculations are necessary to capture the iconic features of an eclipse, although I was prepared to be happy if I captured only one. In the end, I had nine photos of the phases of the total eclipse.

See more of MSU's coverage of the eclipse, visit **WWW.MONTANA.EDU/MOUNTAINSANDMINDS/ECLIPSESIDESHOWEXTRAORDINAIRE**

Why did you go "old school" photographing the eclipse?

There are various automated tools from gear to software available for eclipse photography, but I try to never let tools dominate the message. In all my photography, I want to maintain as much intimacy with the subject as possible so I chose to forgo automation and use only a cheat-sheet I wrote for the timing of the exposures. Normally, it's advisable to use a remote cable or device to trigger the shutter, but it was important to me to feel my hand on the camera for a sense of ownership of these photos. The only additional tool beyond a camera, tripod and 400mm lens I used was a photographic solar filter to protect the sensor and myself from the sun.

What is one of your most lasting memories of the eclipse?

I was with the Eclipse Ballooning Project launch team at the Camas National Refuge in Hamer, Idaho, where I met a team of astronomers from the University of Brasilia. The Brazilians had a lot of cumulative eclipse experience and were initially skeptical of my back-to-basics approach. As totality began, there were issues with their automated equipment, so they lent assistance to me by calling out the timing so I didn't have to take my eye away from the camera. The team effort helped me capture nine different eclipse features surpassing my goal of at least one.

When I downloaded photos to send to media outlets within minutes of totality, there were tears and hugs all around for the result of the group effort and sheer exhilaration of the eclipse.

What is your advice to amateur photographers who wish to get good astronomy photos?

Astronomical photography is one of the more difficult genres. I always suggest people ask themselves if they will enjoy the experience more by just looking at the sky and appreciating the beauty rather than trying to photograph it. A simple way to try photos of the night sky is to find a dark location away from light pollution, mount the camera with a wide-angle lens on a tripod and try some long exposures. Part of the fun is the trial and error experience. ▪

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BOBCAT BIRTHDAY BASH

ALL EVENTS ARE FREE AND OPEN TO THE PUBLIC. FOR MORE INFORMATION, SEE PAGE 3 OR VISIT WWW.MONTANA.EDU/125

PHOTO BY ADRIÁN SÁCHEZ-GONZÁLEZ