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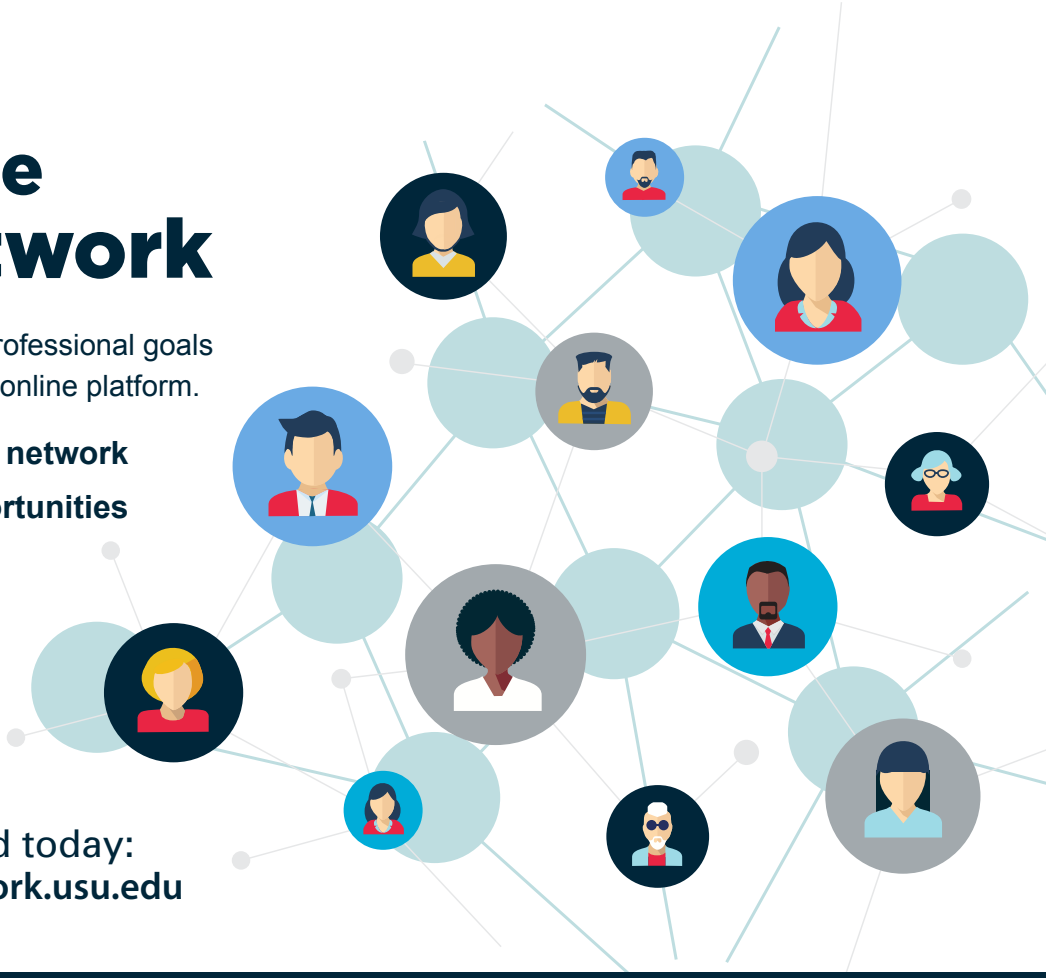

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A NOTE FROM NOELLE //

# *R1 All the Way*

USU President Noelle E. Cockett. Photo by Levi Sim.

**When students first enroll in college,** they are often asked by family members, "What do you want to do?" I think a better question is, "What do you want to be?"

At Utah State University, it's not just the degree that matters, it's how you learn to navigate the world.

I remember being an undergraduate in Montana and feeling confused about my career options. I didn't know what a resume was when I enrolled in college. I didn't know that faculty at my college conducted research or that research was something I could ever do.

It wasn't until late in my junior year when a genetics professor looking at my transcript suggested I consider graduate school. At the time I had no idea what graduate school was. I do not know how my life would have unfolded if that one professor I connected with in college had not illuminated a different pathway for me.

At USU, participating in undergraduate research is the norm, not the exception. We are the second-oldest undergraduate research program in the country, behind MIT. Our long legacy and emphasis in this area has been recognized with one of three Council on Undergraduate Research national awards in 2020. And, in December, USU was recognized by the Carnegie Commission on Higher Education as an R1 "very high research activity" institution — the highest research classification by Carnegie for premier research institutions in the United States. This is a seal of approval for the quality and quantity of research that we do and the doctoral students that we graduate.

The impacts of USU's research and creative works are immeasurable. While research is considered an economic driver in regions of higher education institutions, it also helps a university attract and retain exceptional faculty and students.

When you combine USU's land-grant mission to make education accessible to all people with our longstanding commitment to and success in research, you can see how easy it is for USU undergraduates to engage in meaningful and impactful work. For example, we have students from across several disciplines employed by USU's Space Dynamics Laboratory, which is one of only 14 U.S. Department of Defense University Affiliated Research Centers in the country that specialize in developing and maintaining essential engineering and technology important to the country's security. I think it's pretty darn cool that our students routinely participate in designing devices for use in space.

Our students are encouraged to ask big questions and given the resources to explore answers. Every USU college and discipline provides students with the opportunity to conduct research or develop creative works that will impact their life. I know it did for me.

Impact is the heart of the land-grant institution. We make a difference in people's lives through basic and applied research that has an impact on individuals, families, communities, and society. Those impacts are transferred to every Utah county, every day through the work of USU Extension. Whether it is identifying agricultural pests or determining which seeds to plant or reducing water consumption or developing healthier relationships, USU Extension can help.

Sometimes basic research, which is often conducted over years, if not decades, doesn't have a recognizable impact. But sometimes the things that you aren't sure will come out of basic research produce lifesaving results. For a decade, researchers at USU's Institute for Antiviral Research worked on RNA vaccines and were not certain when they would ever be used. And then the COVID-19 pandemic occurred, and those years of incremental research played a huge part in the approach used for COVID-19 vaccinations.

I am proud of the work we do at USU and of the people we are helping our students become. They learn early on at USU that asking good questions and exploring answers is a worthy pursuit. That is the Aggie way.

*Noelle E. Cockett*
Utah State University President

Tempted? This peanut butter cup cookie is the product of Crumbl's test kitchen. And, yes, it is big enough to share. Photo by Levi Sim.

# *Why focus an entire issue of* Utah State *magazine on tiny things? Because sometimes they make the biggest impact.*

For instance, Reagan Wytsalucy, '16, M.S. '19, an Extension agent in San Juan County and assistant professor of agriculture and natural resources, is helping to bring needed light to the Navajo Nation. She is partnering with Watts of Love, a nonprofit that provides small but bright solar-powered lights to places in the world where electricity is scarce or unaffordable. On the Navajo reservation, nearly 30% of homes do not have electricity. This last fall, Wytsalucy and Watts of Love worked with local chapters to identify the households most in need and delivered more than 200 lights. They plan to distribute thousands more throughout 2022.

The last two years of the COVID-19 pandemic have proven challenging on a number of fronts. And during particularly cold and stressful moments this past winter, I baked cookies and delivered them to my neighbors. And nearly every time, the person answering the door couldn't help but smile when looking down at the 2-year-old delivery person holding up a tray of warm cookies. A single cookie can uplift flagging spirits. A cookie can create and strengthen connections.

In our cover story, "A Craving: Building a Bakery Empire," the founders of Crumbl seemed to understand this intuitively when they launched the first location without fully cementing their business plan first. But Sawyer Hemsley '18 and Jason McGowan knew their idea of a tech-driven bakery could work, they would just figure out how later. And what began as a quest to develop the recipe for the perfect chocolate chip cookie — the backbone of this cookie empire — evolved to weekly offerings that rotate, bringing new flavors for the masses to feast upon and available by clicking an app. Crumbl now has more than 340 locations across the country, proving how right the cookie entrepreneurs were about their mission: "Bring friends and family together over a box of the best cookies in the world." And it's quite tasty.

Kristen Munson
Editor, *Utah State* magazine

# CONTENTS //



Photo by Eli Lucero.



*Watch for these QR symbols throughout the magazine to view web extras such as videos, conversations, and survey data.*

**On the Cover:** Crumbl co-founder Sawyer Hemsley '18 paid homage to his alma mater by overseeing the creation and release of the Aggie Blue Mint cookie last October, based on one of the Aggie Creamery's most popular ice cream flavors. Photo by Levi Sim.


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## *Where is This?*

Photo by Levi Sim.

First right answer wins Aggie gear. And while you're at it, letters to the editor are always welcome!

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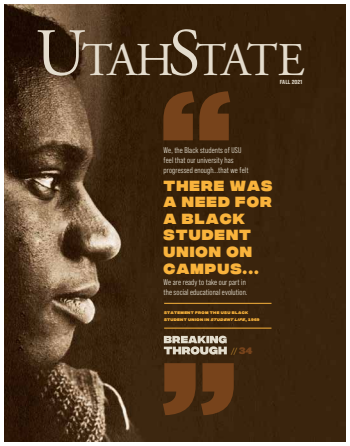
## FALL 2021: BELONGING




### HUMBLED FOR THE RECOGNITION

Thanks to Jeff Hunter for his reporting, along with Levi Sim for the photos in the "Breaking Through" article. The research was noteworthy and provided a viewpoint from Black students attending USU. Sid, Tyrone, George, and I are humbled to have this recognition in shaping awareness at USU from the mission of our first BSU 50+ years ago.

The article reminded us about other Black students who should be highlighted: Zetta Satterwhite Browning — drill team Aggiette; Jennifer Ball — cheerleader; Sims Walker — a BSU officer who handled press calls related to the protest against BYU; Bernard Bradley (actor Badja Djola) — who lost his athletic scholarship because he participated in the protest; Malcolm Wharton, second BSU President and photographer whose photos of Black and brown students appeared in USU yearbooks, ads, and student newspaper. We also talked about our encounters with visiting celebrities as part of Black Emphasis Weeks, foreign students who supported our efforts, and the first reunion in 1980 where President Stan Cazier honored the organizers with plaques.

We are grateful for contributing to the rich history of USU and this article encourages our support of and participation with President Noelle Cockett.

**— Roietta Fulgham, M.S. '71**

### AN IMPORTANT STORY

Kudos on a great cover and a great cover story!

Nicely done by Jeff Hunter. An important story that needed to be told. I have heard many of these stories from Ross Peterson and it is good that a part of USU history is covered through the *Utah State* magazine. Confront reality so that we can become better. Thank you.

**— Dave Patel, '91, M.A. '93**

### A MUCH-NEEDED ARTICLE

I would like to thank *Utah State* magazine for the article "Breaking Through," about the first Black Student Union. My generation had too much bigotry, but I'm proud to say I'm not a part of that anymore.

When I went into the service in 1973 (U.S. Army), I was sent to Fort Ord, CA, and had my first introduction to Black men, Black drill instructors, as well as fellow soldiers. This is when I lost all of the bigotry and ignorance that I had grown up with from my younger days, which were handed down from my father's generation. I discovered that the men I was to serve with were, and still are my brothers, and we each would have given our lives to save each other — that was what we vowed to do. My oath of enlistment has no expiration date on it, and I still consider all members of the military — whatever color or sex or persuasion they may go by — as my sisters and brothers.

It's only going to be through accepting each other as equals that the wrongs of this world are ever going to right themselves.

The article was much needed, especially for these times.

**— Kim McCammon, '83**

### STORIES SHARED WITH GRACE

Commendations to the Black USU graduates who shared their experiences not with bitterness but with grace. The underlying theme of the cover story "Breaking Through," of course, was that it was not an easy journey but one lonely and brave.

Why should being a great athlete be the best qualification for acceptance at USU? Macarthur Lane states that "all of a sudden I started to realize that I was smart enough to graduate." Hats off to Coach Mills who insisted he graduate. One can document in case after case where young men were used and abused in college sports simply to raise funds and pride for universities. Isn't it time to stop building huge stadiums or would-be colosseums rather than halls for learning, literacy, listening, and growth?

Still needed is to highlight what is being done today. Breaking through is not only surviving and finding careers and success. Breaking through as I read this phrase, is establishing symposiums, inclusive education, reconciliation, and change.

Kudos to Ross Peterson, who for so long has led Martin Luther King Jr. celebrations while others worried about tenure. With the establishment of the Diversity and Inclusion Task Force in 2019, let us all inclusively strive to overcome.

**— Mary I. Piette, reference librarian emeritus, Utah State University**

### BLACK STUDENT UNION QUESTIONS

After the fall 2021 issue dropped in mailboxes, a few alumni reached out with questions about USU's Black Student Union. We wanted to take a moment to clarify some common misconceptions.

**1. USU's Black Student Union is not new.** USU's BSU, like many that exist at colleges in the United States, was formed during the Civil Rights Era for individuals to share their cultures and to promote equal rights for minority groups. USU's BSU was founded in 1969.

**2. USU's BSU is not a separate building.** The organization does not have its own facility. It does, however, hold events like its annual Soul Food Dinner.

**3. USU's BSU is open to everyone.** The BSU does not limit membership to Black individuals. The organization welcomes people of all races, religions, sex, national origins, etc.

### COINCIDENCE?

Today, I read in the *Utah State* magazine President Noelle E. Cockett's "Note" about hiring practices at USU to provide racial favoritism, her support of establishing a Latinx Cultural Center, and creating a position for vice president of diversity, equity, and

inclusion. That was interesting to see how another university just created such a position. Is there an influence that is coordinating the establishment of such positions at University campuses?

In *Y Magazine*, which I also receive, I read that they established "The Committee on Race, Equity & Belonging." They were creating an Office of Diversity and Belonging. It would be an interesting study to conduct with universities across America to see if this kind of committee has been established in 2020–2021 in a myriad of universities thanks to the influence of an unseen power. This is coincidental with the push for Critical Race Theory to be accepted.

**— Bliss W. Tew, '78**

*Editor's note: President Noelle E. Cockett's letter advocated for the equal opportunity for all persons and for hiring practices to reflect the state's growing diversity. The creation of a new leadership position focusing on diversity, equity, and inclusion was a key recommendation from an internal university task force. This move also aligns with the Utah System of Higher Education's priorities on higher education enrollment and completion to reduce disparities for underrepresented students.*

## COURSE CORRECTION DESIRED

The message from President Cockett and the entire fall 2021 edition of *Utah State* was clear. The university is now at a point where race, ethnicity, gender or sexual preference is accepted as the fundamental characteristic defining each person. Shocking, sad, and disappointing. Once loyalty to a neo-Marxist ideology, such as Critical Theory, becomes paramount to educating the student body in truth and excellence, you have failed the university and its primary mission. However, it's not too late to correct course and many Aggies of all stripes hope for that eventuality. We also look forward to the day when the defining characteristic of all individuals will be what matters most, the content of their character. Rev. King's dream is still revered and it's still alive. May we all be bold enough, as he was, to pursue it.

**Charles & Kathleen Minter, '77**

# *From the Web*

### *From* BREAKING THROUGH

While at USU I was the photo editor of "Student Life" and had the opportunity to cover several notable Black speakers on campus: [Muhammad] Ali, James Farmer, Julian Bond, and Dick Gregory. … I was also fortunate to photograph basketball players Marvin Roberts and Nate Williams. I believe a fellow photographer, Malcolm Wharton, whose work appeared with mine in the USU literary publication, "The Crucible," gained prominence in photography. I also remember when the Prophet, Seer, and Revelator of the LDS Church apparently had a revelation that Blacks could hold the ministry after the U of Wyoming once again refused to play in Utah. **— Alvin Reiner, Natural Resources '72**

The article describes your and your fellow Black student-athletes experience during that period so objectively and straightforwardly it made for enjoyable reading regardless of the subject matter. **— Michael Phillips**

### *From* BE IN THEIR CORNER: SUPPORTING THE BLACK STUDENT UNION

A Black Student Union is divisive and brings back a form of segregation. This is not the direction a university should support or fund! **— Alden Vala '71**

## WINTER 2022 *(digital)*: FINS, FEATHERS, AND FUR

### *From* WORKING WITH THE LAND

I would love to have a conversation with John Ferry and how they were able to make this work — cattle grazing practices, water efficiency improvements, and strategic partnerships — [to] increase bird habitats and health in the surrounding environment, according to a local duck club and the U.S. Fish and Wildlife Service for the Bear River Bay.

**— Jannett Heckert**

### *From* LET'S RIDE!

Glad to see coverage of the rodeo programs. Competing for the USU rodeo team back in the early '70s was a highlight of my college career.

**— Rod Miller '75**

### *From* RESTORING DEGRADED WATERS, ONE PEST AT A TIME

Thanks for at least TRYING to get the BDAs [in the] Price River! A great article. I love the example you cited of the flash flood debris creating a spontaneous wetland. We need more of these!

**— Lise Brunhart**

### *From* COLLISION COURSE: BIRDS AND THE BUILT ENVIRONMENT

Interesting article about a problem that is both sad and somewhat intractable. Towards the end of my time at USU we put stickers with hawk silhouettes on some buildings and pedestrian bridges. It was reported at the time that bird collisions/deaths were reduced. I'm glad to hear that efforts are still being made to reduce the number of collisions/deaths.

**— John Swenson Harvey '85, M.S. '87**

### *From* THE EVOLUTION OF BIG BLUE

Thanks for helping us relive so many memories with USU sports and especially Big Blue. ♥

**— LuWana Hunt**

**We welcome your thoughts.** *Please email letters to* mageditor@usu.edu. *Please include your full name, address, phone number/email address, and class year, if available, for confirmation of your identity. Letters should be 200 words or less and respond directly to an article in a recent issue of Utah State magazine. Letters may be edited for length, style, and clarity, and fact-checked as appropriate. While* Utah State *magazine endeavors to publish all letters that meet the guidelines, space is limited, and letters from members of the Utah State community that contribute to a diverse range of perspectives will be prioritized. Letters that violate USU's Principles of Community will not be considered.*

# RESEARCH

## Space Dynamics Laboratory Earns Record $1 Billion Contract

**The Air Force Research Laboratory** (AFRL) announced that USU's Space Dynamics Laboratory was awarded the AFRL's largest-ever contract for space-related technology development and mission support in November 2021. **The contract, worth up to $1 billion** over the next decade, includes space-related research and development activities for AFRL and its mission partners.

## Utah Legislature Awards $5 Million for Technology Partnership

**The Utah Legislature** recently funded a $5 million initiative pairing Utah State University and Utah Valley University with local industry leaders such as Adobe, Northrop Grumman, and USU's Space Dynamics Lab, to produce a pipeline of students trained to anticipate opportunities and emerging security challenges in the technology sector. **The Deep Technology Talent Initiative (DTTI) supports the Intermountain Intelligence, Industry, and Security Consortium (I3SC),** a university-industry partnership led by USU's Center for Anticipatory Intelligence and UVU's Center for National Security Studies. Program offerings will include secure computing, artificial intelligence, security analytics, cybersecurity, anticipatory intelligence, and security studies.

Tanji Johnson '21 measures seedlings in the Salt Lake City campus greenhouse. Photo by Levi Sim.

*This project will bring together cutting-edge science, Indigenous knowledge, community-based innovations, and new insights from industry, governments, and nonprofit organizations. It takes big-picture thinking to tackle complex problems. We're excited to be part of this great venture.*

**— Courtney Flint,** USU professor of environment and society, on a new $15M National Science Foundation-funded project called the Transformation Network aiding communities in the Intermountain West in becoming more equitable and resilient. Flint leads USU's team and is supported by Jessica Schad, associate professor of sociology. They will conduct research on community well-being and the role watershed organizations play in regional sustainability.

## USU Joins Ranks of Premier Research Institutions

**In January, Utah State University joined the highest ranks of research institutions in the country** by earning the **R1 Classification in the latest Carnegie Classification of Institutions of Higher Education,** a designation synonymous with academic excellence, innovation, and impact. Using data from 2019 and 2020, the system categorized about 3,900 colleges and named just 137 institutions as R1. USU had record-high research funding in the 2021 fiscal year, receiving awards totaling $368.5 million, including $124.5 million generated by researchers on campus and $244 million from USU's Space Dynamics Laboratory. USU joins the University of Utah as only the second institution in Utah to receive R1 status.

"Having two strong Carnegie R1 research institutions in Utah opens doors to new private and public partnerships and provides tremendous opportunities for workforce development and economic growth in the state," says Utah System of Higher Education Commissioner Dave R. Woolstenhulme. "This is a proud moment for Utah."

## $10 Million to Boost Resiliency in Regional Water Management

**As a 20-year drought** lingers in the United States and climate patterns shift, at least one thing is clear — the old way of managing water can't keep up. Pressure from expanding cities, inefficient irrigation practices, drought, and declining water tables have resulted in a system in distress. But a $10 million grant from the U.S. Department of Agriculture will fund a multi-institution team of experts as it investigates how to make regional water management more resilient. USU will receive $1.8 million to support **Sarah Null,** associate professor of watershed sciences, and several co-investigators.

Water markets build flexibility into the system by allowing water to be leased or sold without changing or selling water rights and can encourage water conservation. The idea ties into Utah's 2020 Water Banking Act to promote Utah's agricultural economy and a healthy environment.

"Water markets are established and working well in places like California and Australia," says Null. "The approach is promising to re-allocate water within Utah's water law, but there's a lot we still don't understand about how it will work — how recharge and evapotranspiration shift during droughts and floods, why farmers choose to enter or avoid water markets, when surplus water could be purchased for environmental water uses, and the tools that farmers need to make better decisions in real time."

## Using Drones for More Sustainable Almond Farming

**Stress in agriculture** isn't altogether a bad thing. Almond trees, for example, need some stress at the end of the growing season to improve the quality of the nuts, explains **Alfonso Torres-Rua,** an assistant professor of civil engineering at Utah State. He leads a project funded by the Almond Board of California to make almond production more sustainable. It uses drone technology from USU's AggieAir project to scan orchards and estimate the appropriate amount of water use and stress per tree and pinpoint the ideal level of water management — enough to flower and form fruit, but not so much that they don't experience needed stress.

> *What's important about this study is that it shows how much variation there is in the impacts of climate change on visitation to public lands across the country — there are substantial differences whether you are talking about outdoor recreation in Oregon or in Florida.*
>
> **— Lead Author Emily Wilkins,** about a 2021 study from USU's Institute of Outdoor Recreation and Tourism that used 14 years of geotagged social media data from across the continental U.S. to document where and when people were getting outside to visit public lands. Trends were combined with climate data to map regional variations in activity and found that outdoor recreation in warmer seasons is expected to decrease by 18% over the next 30 years and as much as 50% in the southeastern U.S. by 2050.

## Home of the Greatest Snow on Earth. Sometimes.

**Utah ski resort managers** are adapting to declining powder days by adopting new ways to do business, according to new research from **USU's Climate Adaptation Science program.** Since 2018, the average low temperature during the ski season at Utah's 14 resorts has increased by at least 2.6°C, and by as much as 6.7°, and a shorter and warmer ski season directly affects the bottom line.

Some managers report using adaptive tactics like joining ski conglomerates, increasing lift capacities, and making artificial snow, which come with significant costs. Managers also report continued uncertainty about the lack of adequate water for snowmaking and climate projections. Although snowmaking can extend ski days in the short term, water supply, temperature constraints, infrastructure, and operational costs may make this an unsustainable strategy for some areas in the long term. Other business strategies managers are using involve working to offer a broader array of activities and recreation options during shoulder seasons, such as mountain biking and festivals.

"Although it's a challenge, managers at Utah ski resorts are learning to adapt to the changing climate," said Jordan Smith, director of the Institute of Outdoor Recreation and Tourism and coauthor on the paper. "It's an important trend to track because warming temperatures will eventually force us all to make adjustments in the way we live, recreate and do business."

## Nearly $2 Million to Study Cherries

**Tart cherry sales in Utah** yield between $7 million and $21 million annually. A team of researchers at Utah State University and Michigan State University was recently awarded $1.97 million from the U.S. Department of Agriculture to study more efficient ways of managing the crop despite obstacles such as drought, pests, low yield, and soil health.

The study spans eight different orchard blocks in Utah and includes research into different methods of efficiently collecting crop data, including through ground-based and ATV-mounted sensors and through drones. The team uses the data to create three-dimensional pictures of orchards for analyzing characteristics such as canopy density, soil health, and disease and pest outbreaks.

"This project is an excellent example of the innovations that are going into the farming industry," says Brent Black (center right), who is leading the study.

## The Next Generation of Police Training is Here: Virtual Reality

**While there is no substitute for actual experience,** USU Eastern Police Academy has the next best thing for cadets — a virtual reality training system. The school is the only department in the state with this technology from Apex Officer, says **Scott Henrie,** director of the academy and a professor of criminal justice.

In the 1980s, Henrie's officer training consisted of a projector screen with a video tape of one static situation. Now, with the three-dimensional virtual reality simulator and customizable programs, officers can test various scenarios, each time with different objectives, setups, and locations. This allows officers to practice de-escalation scenarios, use of force, and implicit bias situations, all prior to joining a law enforcement agency.

"We've brought the environment from a stationary screen to about as real as it can be, short of a person actually doing it," Henrie says. "We use this system to enhance the training they are already doing. With this system, we can stop, back it up and re-run it. This gives them more opportunity to work on situations."

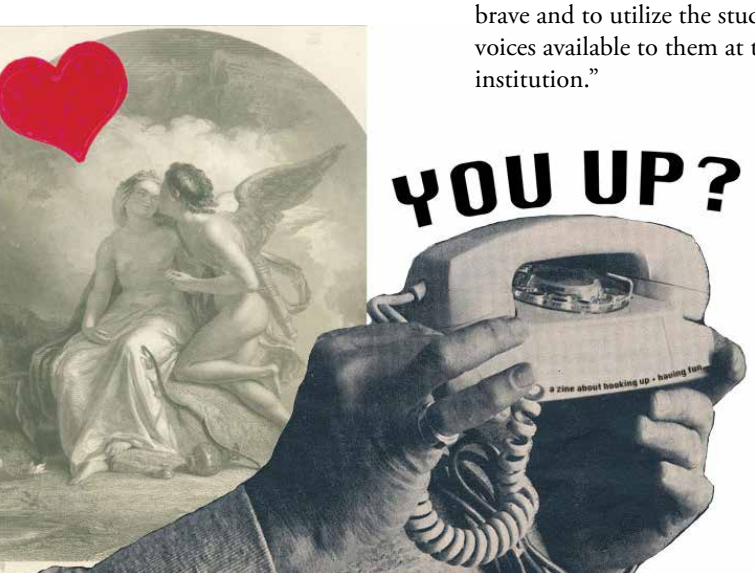
## USU Blanding Builds Hogan to Honor Student Body

**In Navajo culture,** a Hogan is a holy sanctuary for performing ceremonies and keeping life in balance. It is considered to be a living being, *iina'*, which, when treated with respect, will protect its inhabitants. In fall 2021, **USU Blanding** completed construction of a Hogan on campus to honor the culture of its majority Native American student body.

Hunter Warren and Bree Littlecrow (pictured left) enjoy the Hogan in the afternoon after the blessing ceremony. Photo by Levi Sim.

## Involving Students in Sexual Assault Prevention Communication

**In 2019, Avery Edenfield,** assistant professor of rhetoric and technical communication at USU, approached the Office of Equity and the Sexual Assault & Anti-Violence Information Office about including undergraduates in campus prevention campaigns. Afterward, an entire academic course was born. The first collaboration occurred in 2020, and students helped developed a zine and the "It's Enough" campaign. Last year, students created another violence prevention zine and a social media campaign about consent within long-term relationships. Partnerships like this are rare at universities, but this is one USU will continue in 2022. "It is often intimidating to try new efforts, especially given the delicacy with which conversations around sexual misconduct must happen," says **Emmalee Fishburn,** a senior prevention specialist at the Office of Equity. "We encourage prevention professionals to be brave and to utilize the student voices available to them at their institution."




*Dissonances add interest, and when we've passed through those painful dissonances, the return to consonance is that much more satisfying. There is a pretty intuitive connection to our lives here. I suspect many of us have found that when we address difficult issues, our lives can have more meaning.*

**— Timothy Chenette,** the 2021 Honors Outstanding Professor, who delivered the 46th Annual Honors Last Lecture, entitled "Listening to Dissonance."

*View Timothy Chenette's last lecture.*



## New USU Institute to Focus on Land, Water, and Air Issues

**A lead gift of $7 million** from the Janet Quinney Lawson Foundation established USU's new **Janet Quinney Lawson Institute for Land, Water, and Air,** an interdisciplinary center focused on sharing evidence-based research on Utah's natural resources with state decision makers.

"Janet was not only a huge supporter of the university and the incredible research produced at USU, she also had a deep love of Utah landscapes and was committed to ensuring that they were able to be enjoyed by generations to come," said Ellen Rossi, a family board member. "My grandmother would be so proud to see this institute become a reality, knowing the broad impact that its work will have throughout our state."

A group of seed donors, including My Good Fund, Chevron, and the Janet Quinney Lawson Foundation, supported the early stages of designing the institute, which released its first summary report to the Governor's Office on Dec. 14. The document serves as a snapshot of key issues and concerns, from threats of wildfire to water management, and is meant to help develop strategies for sustainable growth and well-being in the state.

## $41.25 Million to Support Contemporary Agriculture

President Noelle E. Cockett thanks sisters Mary Bastian and Emily Markham for their historic gift.

**As Utah's Agricultural Land** is converted to commercial and residential developments, the Bastian family's gift of $41.25 million to Utah State University — the largest single donation in USU history — aims to honor and preserve the state's farming past, present, and future.

**The Bastian family, in concert with USU Extension, founded the Bastian Agricultural Center** to educate an increasingly urban population about contemporary agriculture through programs in science, engineering, and technology applied to agriculture. The center will be located at the Salt Lake County Equestrian Park and Event Center in South Jordan. The Bastian family previously gave an additional $6 million toward the initial creation of the center.

"Being a successful farmer requires determination, hard work, courage, and a great love of the land," says family representative Jake Anderson. "It also requires being a creator, an entrepreneur, and a scientist. These are all qualities that the Bastian family wishes to pass on for generations to come through the creation of the new Bastian Agricultural Center."

The center will include four major areas of focus: natural resources; science, technology, engineering, and math (STEM); plant production and education; and equestrian, livestock, and animal production. The site will include an area for a farmer's market, demonstration gardens, dry farming plots, orchards, equestrian programs, and serve as a location for 4-H youth activities.


**Cross Country** concluded one of its best seasons in school history by **placing 28th** at the NCAA Division I Cross Country Championships.

**The USU Cycling Club earned its first ever national titles** at the 2021 USA Cycling Collegiate Mountain Biking National Championship in October. Senior Trevor McDonough earned individual titles in both the men's club Dual Slalom and the men's club Downhill.

**Women's Volleyball** defeated Wyoming in five sets on Nov. 22 to secure the Mountain West regular season title, its **first MWC championship in program history.**

**USU Eastern Volleyball** captured its **first-ever Scenic West Conference title.**

**Gymnastics** competed in the 26th NCAA Regional Championship and ended the season with their **first Top-25 ranking since 1999.**

Image courtesy of USU Football.

## Aggie First Scholar Program Boosts Retention Rates

**It's one thing to enroll in college, it's another to persist and graduate.** In 2015, **Heidi Kesler,** USU's director of student retention and completion, began examining why first-generation college students had 10% higher attrition rates than their peers from families with higher degrees. A common assumption was that finances were the biggest barrier, but the data showed otherwise.

"We needed a program that socialized the students to higher ed, in addition to helping them with their finances," Kesler explains.

In a 2016 pilot program, a dozen students were paired with first-generation mentors further along in their education to meet for regular meals. Nearly 100% continued college.

Afterward, USU created two classes to better acclimate first-generation students to what Kesler calls "the hidden curriculum" of the university — how USU is structured, the resources available, and the importance of self-advocacy and networking opportunities. "We talk about worthiness, that you have accomplished the things necessary to be admitted so you do deserve to be here."

**Charity Maeda '16,** program coordinator for Aggie First Scholars, knows a thing about imposter syndrome.

"My mom didn't really know what else to say other than 'good luck, I love you,'" she says, describing being dropped off at her dorm her first year at Utah State. "I was really left on my own to figure out, How do I do this? Where is the dining hall? Which bed is mine?"

During Maeda's first semester she failed all but one class and was ready to quit. But her parents told her to stick it out and reassured her that she really did belong in college. Maeda began asking more questions, got involved in student government, and became a residence assistant.

"I think that is why I am also very passionate about the work that I do," she says. "Because I do know what it is like." Maeda now oversees the retention and persistence of all first-generation students at USU — about 20% of the student body. She was hired to scale up the original program, and in fall 2021, launched a program with two pathways to support first-generation students. So far, the results are promising.

"Of the first-gen students who are actively taking the two courses, they are 15% more likely than their other first-gen students to be retained," Maeda says.

Maeda attributes a lot of the success to the student leaders in the program, many who volunteer their time to help their peers succeed.

"That is one of the ways in which I think our program is different," she says. "It's first-gen students leading other first-gen students."

An art piece with "You Got This!" written in flowy black script and signed by students from the program is framed and hangs in Maeda's office.

"I like to have it in my background because it helps ground me and remind me that I do," she smiles. **— Kristen Munson**

Photo by Levi Sim.

# GETTING TO KNOW USU, ONE POLAROID AT A TIME

**What can you tell from a photo** trained on a pair of dark skinny jeans and feet wearing white ballerina sandals? What can you surmise about the owner? What about the person in the black skater shoes and Old Main socks pulled up to mid-shin? What is his story?

Clara Alder wants you to know the details. Last April, she competed in the annual Miss Utah State University pageant — and won — on a platform designed to build a more inclusive and honest environment. One where students could share their joys and their struggles with their peers without judgement.

The thing about Miss USU is she has the ability to present a project and an advisory board to have that project come to fruition, says Alder. "I really wanted to highlight the names and the stories of the individuals on campus."

It stems from a philosophy her dad, Nate Alder '91, shared with her as a kid: "Everyone has a name and everyone has a story." It's a lesson she took to heart.

Sometimes on a college campus, even ours, she continues, "we can feel a little but lost in the masses." The Aggie Stories Project is her way of bringing the lives of people we pass every day, often without notice, into greater focus. One photo at a time.

Alder, the traditions director for the Student Alumni Association, began collecting stories and photos at the fall Hello Walk. Initially, the idea was that people would submit their stories anonymously to encourage participation and simply photograph their shoes. But some people wanted to make the Polaroids their own and show their faces smiling with new friends and have their names attached.

So far, more than 150 Aggies have documented their stories, which will be shared this spring on the association's social media pages.

"We want it to be ongoing," Alder says. A

**— Kristen Munson**

# Thriving on Trust

By Kristen Munson

Photos by Levi Sim

**It seems every startup story begins in someone's garage. Thrive Foods is no different.**

Before the freeze-dried food empire had products in retail giants like REI and Costco, its founders began more simply — selling shelves for organizing one's pantry. The original prototype was a contraption Jason Budge '02 engineered to help rotate food supplies at home while waiting out an 18-month noncompete agreement with a pest control company.

"He stepped out of the garage and he looked like a mad scientist with sawdust flying behind him," laughs Steve Palmer '16, Thrive's CEO and cofounder.

The hefty device gave the two college friends their first big break at Costco selling units on a trial basis. And while shelves took off locally, Budge and Palmer shifted to focus on the products on them.

"To be honest, we had no business putting food in cans," admits Palmer from the floor of Thrive's warehouse in American Fork, Utah. "If you had told me 20 years ago what we would be doing, I wouldn't believe you. The science behind freeze drying foods is way over my head. It's not rocket science, but it feels close."

Speaking of rocket science, Thrive had a contract with NASA sending foods to the International Space Station. A few hundred pounds, Palmer says, not exactly fueling the company, but "how many berries can you eat in space?"

"We need to start talking to Musk," he jokes.

Or is he? Palmer's role at Thrive is scoring the big gets. He is the analytical wizard driving the company's expansion while Budge is considered the creative heart. The Utah County company has about 200 employees and, in January, received backing by two private equity firms along with Mercer Foods, which specializes in freeze-dried fruits and vegetables.

Despite the growing investment in freeze drying foods, the technique is not new. Freeze drying is a slow dehydration method that uses low temperatures to freeze organic tissue, as well as reduced pressure to sublimate ice without damaging cellular walls so that foods retain their original shape and flavor. The process is the preservative.

Freeze drying can be traced to the Incas who stored foods high in the Andes Mountains, squeezed out the water at lower altitudes, and dried them. Freeze drying went commercial in the 20th Century to feed astronauts in space and troops on the field. Palmer and Budge wanted to bring it to the masses with emergency food rations.

"We quickly learned this is a Utah thing," Palmer says. "Not everyone stores a lot of food."

While Thrive initially found steady success in 2011, sales slipped two years later. Palmer and Budge realized that the emergency food market relied on factors outside their control — factors like who holds political office, the geopolitical climate, events like Ebola outbreaks, Palmer trails off. "Emergency food, although it has a place, it's hard to forecast the next coronavirus, the next earthquake in Haiti. It's also not a really good way to wake up in the morning."

The next few years involved branching out to stabilize the company and make pivoting easier when markets shift. Thrive retained its emergency food line but added ones for probiotics, and pet food, and another for backpacking, including PEAK Refuel high-protein packaged meals.

"We use freeze dried as a platform," Palmer explains. "Thrive Life is just one

Thrive cofounders Steve Palmer (left) and Jason Budge started one of the largest freeze-dried food companies in the country.

of our brands. If we're going to survive as a company, we have to be very smart, very strategic in what we do."

While equipped with six massive driers — each the size of a school bus — more are coming. Some of that expansion is driven, in part, by luck.

"We could not have been more positioned for success with the pandemic," Palmer says sheepishly, adding that he suffers from "survivor's guilt" because of it.

People got pets during the COVID-19 pandemic, went outside more, thought about their health, and began cooking from home. And many people have kept up these habits.

"Business is alive," Palmer says. "It's always moving and these industries, they change overnight."

Luck is an ingredient. Luck, and including the right people.

Thrive is an Aggie enterprise. The company settled in Utah County where fans bleed a different shade of blue, but it "was founded on friendship and trust in Logan," Palmer says. (He joined USU's Board of Trustees in the fall.)

In the late '90s, Palmer and Budge met in student government at Utah State University (Palmer was ASUSU president in 2001) and played in competing bands. Music connected them with Eric Morgan and Jason Norton, two Aggies who would eventually play pivotal roles at Thrive, too. But it's not just the founders that have staying power at the company. The second person hired at Thrive — a guy who began packing boxes — now runs social media for the backpacking division. (The line got an unexpected boost after Joe Rogan mentioned it on his podcast.)

"You get to see these people that you love grow," Palmer says.

There is a sense of real affection for the employees on the floor. As Palmer strolls through the warehouse in dark jeans and a navy sweater vest, he reassuringly squeezes the shoulder of a man driving a forklift. The man leans over and parts his hair, revealing a white scar from a recent car accident. Palmer leans in and says something inaudible. The man smiles and Palmer walks on through aisles actively being emptied to make room for the expansion.

"Part of being successful is knowing what you're not good at," he says when asked if he is a foodie.

Budge and Palmer hire the difference.

Palmer opens a door to a testing center where Katie Hall is reviewing paperwork from a previous batch. She opens a small freezer, revealing a tray of alfredo sauce. Food scientists like Hall develop new products and test every freeze-dried batch for quality control. Most come out fine. But when they don't, the team investigates what went wrong. Yesterday something did. Palmer asks Hall what she thinks the problem was. Likely too much cream in a recipe, she says.

"The best way for the culture to grow," Palmer explains later, "is to not hide from mistakes."

> **“The best way for the culture to grow is to not hide from mistakes.”**
>
> **— Steve Palmer**

Hall is sifting through a drawer of sweet snacks of cookie dough, confetti cake, and cheesecake bites when Andrew Naylor, the company’s chief food scientist, walks in to chat about probiotics.

“His whole job is to keep things alive,” Palmer says.

“A lot of times you try to kill bacteria [in food]; this isn’t one of those things,” Naylor says.

Foods take from 6 to 55 hours to fully dry, and the probiotics take the longest because they need to be handled gently. Workers in the probiotics section wear bunny suits, gloves, and booties in the station to avoid cross-contamination of products — a $100,000 mistake.

Palmer heads upstairs to The Thrive Way room, a large, carpeted meeting area where the motto “We Fuel Life’s Important Moments” and principles of the company are painted on the walls. Off the room is a gym where an employee walks on a treadmill as snow pelts U.S. Highway 89.

Palmer phones Budge to see if he can make an appearance. A few minutes later, Budge enters the test kitchen dressed in a blue flannel shirt and jeans and smiling like he is both guilty and about to tell a joke.

After Palmer leaves to attend his daughter’s basketball game, Budge fact-checks Thrive’s history.

In college we never set out to be entrepreneurs, he says.

The friends just knew they wanted to go into business together. They originally decided on pest control because it was a continuation of work they were already doing together. The shelves Budge built were his solution for his family’s food storage problem. They wondered if this could be their opportunity and called a local Costco to give a demonstration. Palmer calculated that they needed to sell 63 units a month to stay afloat.

“Our vision was small,” Budge says. “Clearly it’s expanded.”

Initially they had to do it all, from handling the finances, and sales, even construction and delivery of the units.

“In hindsight, it was a bridge to getting us where we are today,” Budge says.

The vision for Thrive’s future is coming into focus. While Budge sees further expansion possible, as the company has grown, so have the founders’ intentions. They considered what more to do with their money. On a personal note, Budge sees deeper involvement in the company’s philanthropic arm, Thriving Nations, a partnership to build more sustainable education and agriculture in a remote region of Kenya. On the business side, Budge sees increased domination of the market.

“When people think freeze-dried they will think Thrive,” he says.

It’s nothing the friends ever predicted. Even their own fathers doubted the business would work. When we started, our dads were flipping burgers at the opening and shaking their heads in doubt, Budge says, smiling.

In the end, Budge agrees with Palmer. Thrive’s success, while sustained by a willingness to hustle, has involved considerable timing and luck. And friendship.

“Business would be very difficult if we didn’t have this world of trust in one another,” Budge says. “Trust is the ultimate human currency.” **A**

# Expect Delays:

## How Global Supply Chains Got So Messed Up

By Kristen Munson

In the early days of COVID-19, homebound Americans descended upon stores, scooping up what remained of flour, yeast, and toilet paper supplies. Two years later, ripple effects from the pandemic continue to plague businesses. While shortages have shifted to building supplies and computer chips, for weeks last fall container ships were stalled at sea, laden with goods but nowhere to unload them. The pandemic disrupted business as usual, revealing the fragility of global supply chains. **Vijay R. Kannan,** the Vernon and MaRee Buehler Endowed Professor in the Jon M. Huntsman School of Business and a supply chain expert, explains how to build resiliency into the system.

### You have studied supply chain management since the mid-1990s. Have you seen anything like what we've experienced the last two years?

No, this is unique. Supply chain disruptions happen all the time because of events like hurricanes and labor strikes. Typically, these disruptions tend to be somewhat localized geographically and to affect either supply or demand. This is the mother of all disruptions. Not only do we have demand impact and all these supply issues, it is everywhere at the same time.

### What are the major sources of delays, and have they changed since the start of the pandemic?

If you think back to 2020, there was a sudden shutdown, and some industries like hotels, airlines, and rental car companies went off a cliff in terms of demand, while other industries like household cleaning products, fitness equipment, and home office equipment had demand go through the roof. And demand also shifted. Items packaged for organizational consumption were now needed at the home and retail level, so there were mismatches between product availability and where the demand was.

### But why are we experiencing them almost two years later?

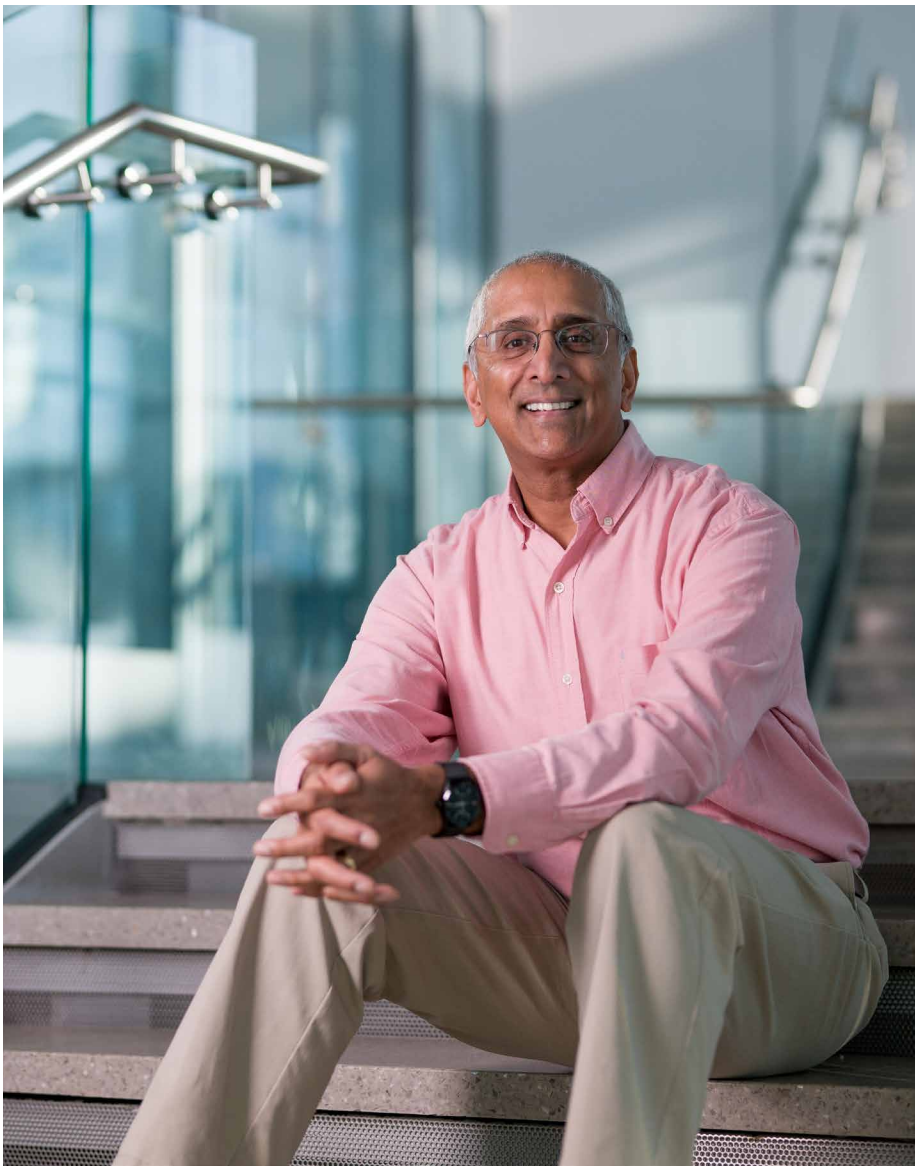
There is a phenomenon in the supply chain world called the bullwhip effect. Imagine a whip in your hand. Even if your hand only moves a little, at the end of the whip you tend to see a lot more movement. And it takes time for that energy to flow to the end of the whip. But if you look at the whip, it has waves that get bigger as you go further back. That is what we are seeing right now. Changes in demand have ripple effects that get amplified throughout the supply chain as organizations try to protect themselves against uncertainty. And these supply chains may have 10 or more levels. Now throw in the logistics challenges. Shortages of shipping containers, capacity to unload inbound ships at ports, places to store inventory, and truck drivers to move goods mean additional product delays. And these are also driving up prices, which only adds to demand volatility.

### How long is it going to take to go back to normal?

A lot of what I am seeing and reading is it might take to the end of 2022, perhaps longer.

### Can you give an example that illustrates the problem?

Car rental companies. Many got rid of their fleets to pay down debts. For months there was no demand; then as vaccines became available people wanted to travel again. We saw rental prices of $500 a day in some places because there were no cars. And why are there no cars? Car makers cut production because there was no demand. When it did reappear, they ramped up production but didn't have some major parts, particularly the electronics. And why not? Semiconductor producers downsized capacity because there was no demand. Then they saw major increases in demand in different



Vijay R. Kannan, the Vernon and MaRee Buehler Endowed Professor in the Jon M. Huntsman School of Business, studies supply chain management and suggests companies map their entire supply chain to understand where potential pinch points are. Photo by Edward Harimoto.

sectors, but didn't have the capacity to meet it. Eventually this will settle down, but it takes time and investment for companies to increase production in terms of labor, materials, and physical infrastructure, so there is this delayed effect.

**In August, retail giants like Target and Walmart invested in private ships to bypass clogged ports. Are we moving to a new type of supply chain management where being nimble is more valued?**

When we talk about supply chains being super optimized, what we are talking about is optimization around cost. And that has made companies less agile or resilient. The current challenges could cause organizations to be a little more thoughtful, intentional, and future-focused about the design of supply chains. **A**

## Moving forward, what do we need to do to add SAFEGUARDS TO SUPPLY CHAINS?

**1. Don't focus so much on cost.** This is a tough one for many consumers, but companies should reconsider producing largely in stereotypically low-cost parts of the world. There is a tendency to focus on China, but organizations have chosen to produce there to take advantage of cost efficiencies that benefit consumers. Since the late 1970s, China has focused on building supply chain infrastructure to promote domestic economic development. Nowadays, however, the cost differentials of production, labor, real estate, and shipping have shrunk, making China less attractive in relative terms than other locations but not unattractive.

**2. Don't have all of your eggs in one basket. Diversify your locational risk.** Organizations should develop sourcing options and supply chain infrastructure in different locations that can provide the level of quality, expertise, and responsiveness needed. For example, don't produce everything in southeast Asia if there are locations closer to the markets being served where you have shorter lead times.

**3. Map your entire supply chain.** One problem highlighted by COVID but not a COVID issue is the lack of transparency in supply chains. Most organizations don't have end-to-end visibility of who the players are and what the pinch points may be, so they are not in a position to react if things go south. Supply chain mapping means you have a complete schematic understanding of the entirety of the supply chain and run sensitivity analyses to identify the need for countermeasures in response to risk factors. When things are running smoothly we don't always consider, What if something went wrong? We need to change our thinking to, If it becomes a problem, are you ready to respond?


# *Pinned:* A Look Inside USU's Insect Library

By Kristen Munson

Photos by Eli Lucero

Winding through a labyrinth of hallways in the basement of the Biology and Natural Resources building, the Utah State University Insect Library appears just when one feels entirely lost.

**CLOSE-UP OF ICHNEUMONID WASPS**
"Ichneumonids and parasitoid wasps are really important for biological control so you don't need to use as many pesticides," explains Brandon Claridge, a doctoral student in biology. Ichneumonids are also poorly known in the United States, he says. "It's hard to overstate just how little we know, just in terms of like basic diversity, what species occurs here and how many there are. The opportunities for research are pretty wide open."

**CLOSE-UP OF GRASSHOPPER**
While the USU Insect Library began as a repository for agricultural pests in Utah, this beauty is native to Central and South America and is about as a big as an adult hand.

Row upon row of tall metal cabinets enclose wooden drawers divided into smaller white boxes, containing spider wasps, velvet ants, and bees suspended in mid-air by fine steel pins. These walls hold the stories of more than 6 million species, thousands of which have no name.

The collection started small in the early 1900s with agriculturally significant specimens such as grasshoppers and other rangeland insects, says curator James Pitts, a professor of biology who studies spider wasps. As the collection changed hands, so did the focus. In the '20s, entomologists tucked insects native to Utah into its drawers. By the '60s, the collection shifted to neotropical specimens, and the USDA Bee Biology and Systematics Laboratory, led by Frank Parker, began sharing its specimens.

The collection today has more than doubled in size and has more than 70% wasps, in part because before 2016, the American Entomological Institute, a private collection of the biggest collection of ichneumonid wasps in the United States, relocated to USU. At the time, it was languishing in a remote pocket of Florida, Pitts says. "It's a very important group, but no one in the United States was getting trained [in it]."

Now, every summer, undergraduates and graduate students mount another 50,000 specimens for the collection. But why pin so many? Apart from assessing species variation, Pitts says, the collection may help scientists determine how species evolved and if their populations are

changing over time. These old insects still have value, he says.

In 2019, the first global review of insect populations found that nearly half are declining and nearly a third may go extinct within a few decades, due primarily to habitat loss and pollution. Perhaps envisioning a world with fewer bugs is easy, even appealing for many people. But what about animals that depend on them for food, plants that require pollinators to fruit, or agricultural pests without predators? While scientists have noted bee populations at risk, the status of other Hymenoptera, such as ants and parasitoid wasps, "remains practically unknown to this date," Pitts explains.

And as insect populations disappear off the map, some perish without being described or understood.

"This is our back log," he says, opening the freezer, revealing bags of insects cast in ice. Many are from Parker, who, despite retiring, still donates thousands of specimens each year. Pitts estimates the cache represents about 200,000 specimens waiting to be defrosted, separated, and pinned.

Eventually, they may get their due — like *Anthophora pueblo*, a bee first described by USU doctoral student Michael Orr in 2016. He studied nests collected by Parker in Utah's San Rafael Desert where the bees burrowed into sandstone walls, potentially providing added protection from microbes, flooding, or erosion. It just took 40 years to uncover.

When entomologists like Pitts and Parker collect Hymenoptera in the field, they set malaise traps that attract bugs by the hundreds, snagging them in pouches mounted at the top. The "bycatch," Pitts notes, is sent to other insect libraries that specialize in those species.

He tilts forward a drawer of Diapriidae, wasps so tiny they are visible on the pin only by their wings.

"And they get even smaller," he says. "We don't even know what they do."

Pitts slides open a drawer of black and tan velvet nocturnal wasps collected in South America. Several boxes have lime green tags affixed to them.

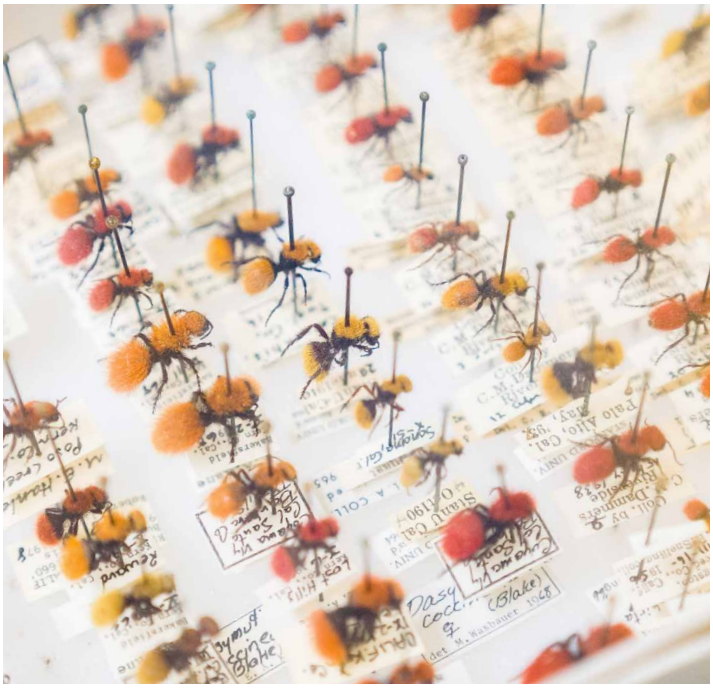
"Each one that has a number is a specimen that doesn't have a name," Pitts says.

At least, not yet. **A**

**TRAY OF SPHECIDAE**
These are undetermined apoid wasps, also known as sphecid wasps. The largest pictured is a Chalybion, a genus of mud dauber wasp that parasitize spiders.

**CLOSE-UP OF VELVET ANTS**
A male and female pair of velvet ants or Mutillidae. Without genetic data, matching them can be difficult. While they look like ants, they are actually wasps. Only males have wings.

**CLOSE-UP OF DIPHYUS FROM LOGAN CANYON**
Brandon Claridge rarely goes hiking without a net to collect specimens — many of which turn out to be undescribed. It also serves as a teaching moment. Many people are surprised at how little we know of insects, he says. "There is this one species that occurs along the foothills outside of Green Canyon and a little inside Green Canyon," he says. "I have never seen it in the collection here … The only thing I know of it right now is that it is right along our foothills. People probably see it every summer, but it is just something that is a complete unknown to everyone but me. Hopefully, I can get around to working on it and making it available for people to do research on it." Photo by Brandon Claridge.



**TRAY OF VELVET ANTS**
There are more than 400 species of velvet ants, which prey on bees. For many nocturnal species, scientists don't even know what the females look like. That is why work like James Pitts' on Mutillidae (velvet ants), which examines the genetic data to build evolutionary trees, can be used to not only link males and females of a given species, but see how certain traits evolve, Claridge says. "You can determine the biogeographic history, how they dispersed, how their distribution has been shaped by tectonic history or mountain building." Photo by Levi Sim.

# The Lara Project:

## An Attempt at **Unraveling** the Universe

By George Spencer

**Theoretical physicist Lara Anderson '03, M.S. '04 is flying.** Her mind and ballpoint pen are moving at what seem to be the speed of light.

A blustery November day finds this Rhodes Scholar and associate professor at Virginia Tech teaching in the sleek metal-and-glass New Classroom Building, tearing through equation after equation related to coupled oscillation on an overhead projector.

"The game plan is we're going to try to plug in z, which I'm going to define as the set of coefficients A1, A2, e to the i omega t," says Anderson to the assembled juniors and seniors. "Write that as a vector — e to the i omega t. I want to plug that into my matrix equation, and x double dot is minus k x."

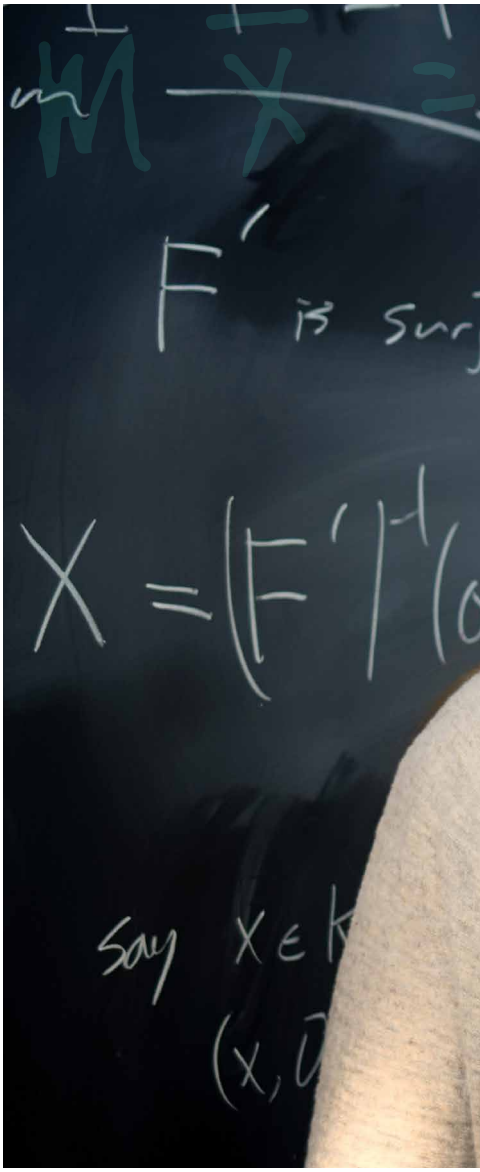
Some people have big ambitions. Anderson's are small. Super small. Her field of interest — string theory — burrows the mind down to the most infinitesimally minute iotas of reality. It holds the promise of unifying incompatibilities between Einstein's theory of General Relativity and quantum mechanics in a framework that governs all forces and all matter.

As Anderson tells it, one-dimensional strings, not atoms, are nature's fundamental building blocks. They are a millionth of a billionth of a billionth of a billionth of a centimeter long, so tiny that if an atom were enlarged to the size of our solar system, a string would be as tall as a telephone pole.

One more thing — strings are weird. Imagine an ultrasubmicroscopic party hosted by Timothy Leary, narrated by Dr. Seuss, and drawn by M.C. Escher. Strings can be matter or energy, depending on how furiously they vibrate. Strings nestle inside other small thingamajigs — shape-shifting donutoidal entities called Calabi-Yau manifolds. These have dimensions beyond length, width, and depth. Maybe 10. Maybe more. It is all unimaginably unimaginable — at least to the minds of non-physicists.

"String theory miraculously overcomes 100-year-old problems of quantum gravity," says Anderson, who, not surprisingly, was class valedictorian. "The catch is we don't know if that's actually a theory of our universe. It has incredible mathematical consistency. It has proved itself to be very able to shed very deep insight not only into physics but into mathematics. But we don't know yet in a verifiable way if that's really the physics that we're going to see in nature. We don't know if this is how nature really works."

Anderson, who was home-schooled and is the daughter of Andy Anderson, principal lecturer of biology, is one of those people who excels at almost everything. She holds black belts in Kempo Karate and Aikido. She plays Bach on the violin. (But her favorite piece is Schubert's Ave Maria.) She makes furniture. ("It's been a fun opportunity to get lots of power tools," she says.) She gardens, growing plants and vegetables from heirloom seeds. ("I like being able to



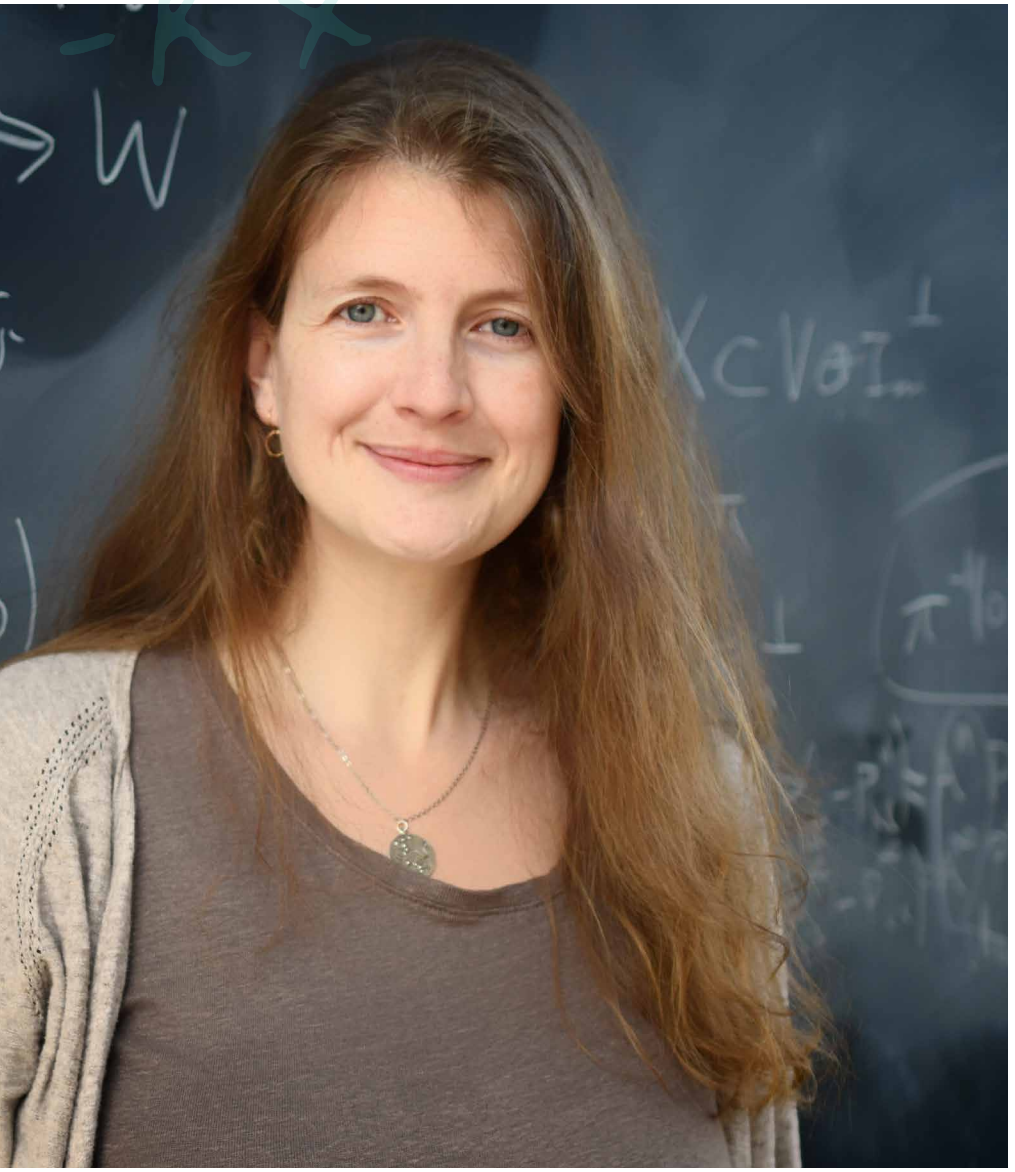
take things apart at a detailed level. The mechanistic 'take it apart — put it back together' is appealing," she muses.)

When asked what she is not good at, she replies, "I'm terrible at lots of things I don't find important — appearances, video games, bowling. The list is long." Singling out time management as her chief bugaboo, she confesses, "I'm always over-optimistically committing to too many things."

Most of all, for someone so otherworldly smart, Anderson is down-to-earth. She cuts a low-key profile. If the Einsteinian stereotype of a male physicist brings to mind an image of a zany-haired, disheveled gent who jostles chalk in the pockets of his suede-elbowed tweed jacket, she sports a dark T-shirt, jeans, and a black leather jacket around campus.

"If there were international rock stars of science, that would not be me, but I'm proud of the work I'm doing," she says. "I'm productive. I'm in there pitching, as it were."

Her string theory colleague Washington Taylor, a professor of physics at the MIT Center for Theoretical Physics, begs to differ. "In the subfields of string phenomenology and string geometry, Lara is one of the top people in the U.S. and worldwide. She's one of the people making the most interesting and exciting advances," he says.



Theoretical physicist Lara Anderson '03, M.S. '04 is one of the leading scholars studying string theory. Photo courtesy of Laura Schaposnik.

**Anderson's life changed** the day her parents took her to Salt Lake City's Hansen Planetarium (now the Clark Planetarium). She was 12, and she didn't know what physics was. Stephen Hawking designed that day's star show. It was about the history of the universe — the Big Bang, the expansion of the universe, and black holes.

"I watched this story of how people could figure out things about the universe just by thinking about them. It was so beautiful and amazing," she recalls. "I walked out wanting to be a physicist. Of course, I had no idea what that meant, but I loved the ideas. I loved those big, beautiful, sexy ideas."

Fast forward to her first year at Utah State, where physics professor Jim Wheeler saw potential bursting from her like high-energy photons from a star about to go supernova. Soon she worked as his unofficial research assistant as many as 20 hours a week, helping him write papers on such things as supersymmetric gravity theory, a field beyond the grasp of many grad students.

When Wheeler applied for a grant based on that research and listed her as a colleague, one of the decisionmakers chastised him, saying, "You can't teach an undergraduate supersymmetry."

"It had already been done," says Wheeler with a chuckle. The head of physics department noticed his tutelage of the precocious Anderson and dubbed their relationship "The Lara Project."

Looking back, Anderson says, "He took a wild gamble. Being a professor now myself, it was a little crazy for him to throw all that work at an undergrad, but it was amazing." As if that were not enough extracurricular activity, she spent three years developing a mini-controller system for a physics department experiment on how water boils in zero-gravity. It flew in 2001 aboard Space Shuttle Endeavor.

"It was exciting to send my fingerprints into space," says Anderson.

Below: Anderson with her dad Andy Anderson, a principal lecturer of biology at USU, during an undergraduate awards ceremony. Right: USU physics professor Jim Wheeler saw potential in Anderson and invited her to participate in undergraduate research.

**Contrary to stereotypes,** theoretical physicists do not spend their days in solitude thinking deep thoughts. Besides teaching, writing code, and doing computer modeling and programming, Anderson collaborates with international colleagues.

She travels. A lot. The first year of her son's life he flew with her 100 times to academic events. When she learned that Virginia Tech did not allow childcare as a research trip expense, she lobbied the provost and president and won a change in the policy.

Anderson never had a female physics professor when she was in college, and she estimates that of all physicists in the world studying high-energy particles, fewer than 5% are female. She would like that to change. Toward that end, she chairs her College of Science's committee for diversity and inclusion, and she recently organized an American Physical Society conference for undergraduate women in physics on campus.

"The sort of white male homogeneity of the field is to its detriment," she says. "People who think differently are really valuable. It's self-perceived that you have to be super-smart to get into this, and that's definitely a deterrent, because a lot of women and minorities haven't been raised with the confidence that they could do this. That's something I've worked to try and dispel. This is like any other job. It's just a question of getting in there, pitching, and trying it piece-by-piece as required. Being a super genius — not required, okay?"

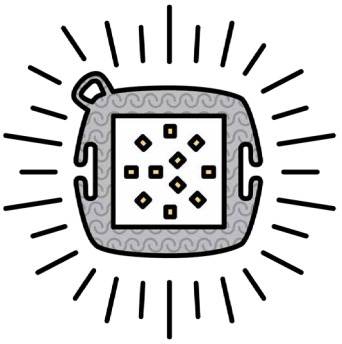
But perseverance helps. In her 2003 commencement address, Anderson summarized what she learned at Utah State: "Work on the hard stuff. Be devoted to the truth. You know more than you think you do. Just try."

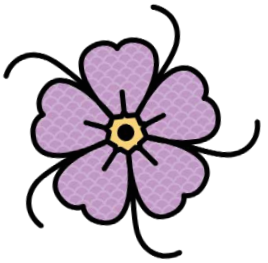
A sign on her office door titled "Stress Reduction Kit" testifies to the difficulty of her work. The kit consists of a circle in which the words "BANG HEAD HERE" are written. Underneath the instructions one reads: "Repeat as necessary or until unconscious."

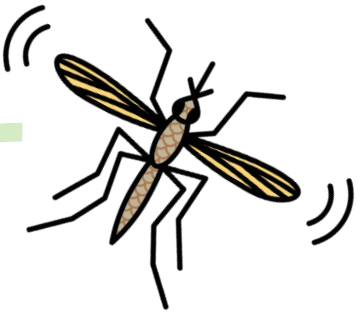
Though hundreds of the world's physicists are trying to unravel string theory's mysteries, no breakthroughs may come soon. Undaunted, Anderson tells an anecdote about Michael Faraday, a pioneer in the field of electromagnetism: "Back in the 1800s he did a demo for the Royal Society in London. A member of parliament in the audience asked, 'This is all very pretty, but what is this going to be good for?' Faraday famously answered, 'Sir, I do not know, but someday you will tax it.'"

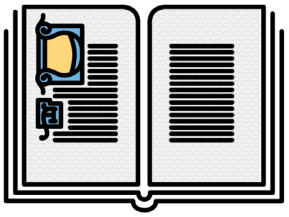
Her belief that string theory could revolutionize life keeps her going. "Every time we have discovered new fundamental interactions in nature, there have been tremendous practical consequences — whether that's through semiconductors and modern computers or atomic energy," she says.

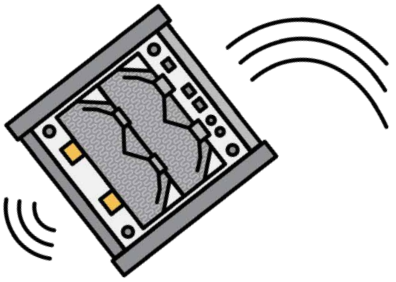
But Anderson has found one problem associated with the study of string theory — being a theoretical physicist is a conversation killer. "I can definitely say that saying you're a particle physicist is not cool at parties. Jazz pianist goes down much better," she explains. "I have an Egyptologist friend. That goes down really well. People like talking about mummies much more." **A**











# {Tiny} Stories, BIG Impact

What do mosquitoes, solar lights, hearing aids, microloans, small satellites, books, and one small flower have in common? Their impact far outweighs their diminutive size.

# A Little Light

By Kristen Munson

Illustrations by Elizabeth Lord '04.

## Night on Navajo Nation lasts long.

Nearly 30% of households of the country's largest Native American reservation lack electricity and about 40% need to shuttle in water because they can't just switch on the tap.

For Reagan Wytsalucy '16, M.S. '19, assistant professor of agriculture for USU Extension, a single two-by-two-inch square will bring much-needed light to the reservation. The devices are the invention of Nancy Economou, founder of Watts of Love, which provides solar powered, transportable lighting to pockets of the world where electricity is scarce. Until now, this has meant distributing the lights in developing countries.

We work with a local partner to identify the hidden poor, and that often includes the Indigenous people of a country, Economou explains over a video call from her Chicago office. The Watts of Love team trains recipients how to care for the lights, as well as teaching financial literacy. In developing nations, recipients save an average of $155 a year — 30% of their annual income — funds previously spent on candles, batteries, or kerosene. The lights are charged using either a solar panel or a micro USB, and, depending on the setting, can last for 120 hours. There is even a strobe setting for emergencies. The lights allow people to stay productive after the sun goes down.

The light is really just a tool for people to start saving money and investing in themselves, Economou says. "The goal is to make people successful exactly where they are, elevate the children's education, give them a bigger dream for themselves and their families, and the resources to be able to do that."

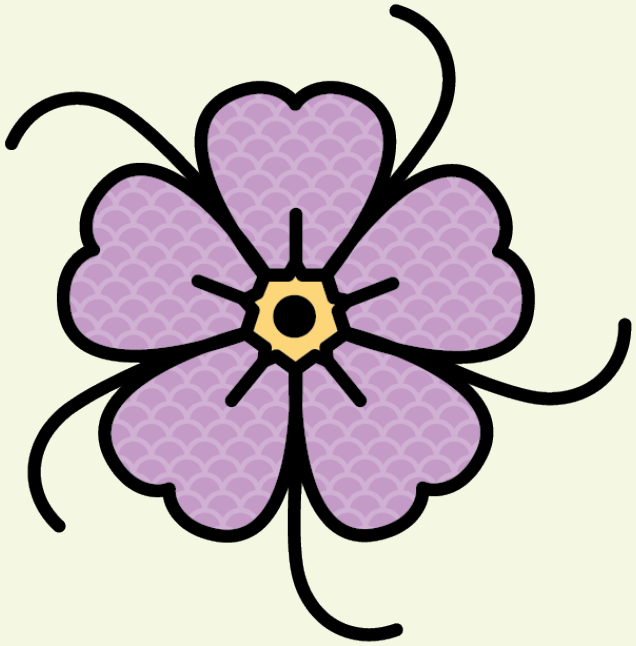
San Juan County is Utah's largest by area and its poorest. Nearly a quarter of residents live below the poverty line. In August, Wytsalucy met Economou to identify whether or not there was a need for the lights on the reservation. "Everybody may want a solar light, but who truly needs it?" Economou explains. "When I go to Malawi, it's like every single person has won the lottery. Are people [on the reservation] going to look and say, This is it?"

The Navajo Nation spans parts of three states and 27,413 square miles. There is limited cell service and internet, making connecting during emergencies problematic.

"People will travel hundreds of miles to get to a grocery store," Wytsalucy says. "They will also travel hundreds of miles to get to the nearest emergency medical facility. … [These lights are] going to improve people's lives through safety."

Wytsalucy and Watts of Love worked with local chapters across Navajo Nation to determine the households of greatest need, including individuals without electricity, the elderly, homes with school-aged children, people with disabilities, and livestock producers. In November, they distributed more than 200 lights at three sites, including Shonto, Ts'ah Bii Kin, and Naatsis'ann Chapter. But they quickly realized every home on the Navajo Nation needs a light.

"Our goal in 2022 is going chapter house by chapter house and bringing a light to every single home," Economou says.



# A Rare Find

By Jeff Hunter '96

When Leila Schultz first came to Utah State University in the fall of 1973, it was all the assistant curator of the Intermountain Herbarium could do to wait until spring so she could experience some of the unique plants the state has to offer.

"Ten percent of the species that we have here are considered quite rare," she says. "It's one of the most interesting floras in the United States."

After consulting with longtime herbarium curator Arthur Holmgren, Schultz put the Maguire primrose at the top of her list of native plants to try and see when in bloom in springtime. First classified by botanist Louis O. Williams in 1936, the Maguire primrose, or *Primula maguirei,* was named for Bassett Maguire who founded the Intermountain Herbarium in 1932. At the time, the perennial had never been seen outside of Logan Canyon, primarily in a few areas surrounding a 9-mile-long corridor of U.S. Highway 89.

The Maguire primrose ranges from about 2 to 4 inches in height, and its flowers are typically lavender in color. Normally found in bloom from late April to the third week of May, the plant has been spotted at elevations between 4,800 and 6,000 feet, mostly on north- and east-facing dolomite cliff faces and boulders where moss is prevalent.

It was on a difficult-to-reach cliff face near Wood Camp Hollow Campground that Schultz had her first encounter with the plant in 1974.

"You usually have to do a lot of bushwhacking or use a spotting scope to find it," Schultz says. "And you're never at a place where you just stand and touch it. That's pretty rare."

In an effort to determine if the Maguire primrose is endemic to Logan Canyon, Schultz has searched numerous places throughout Utah, Idaho, and Wyoming with similar conditions. But as far as she knows, the plant has never been spotted anywhere else, and because of its scarcity the Maguire primrose was listed as a threatened species in 1985.

At the time, the proposed widening of the highway in Logan Canyon was considered the plant's primary danger, with rock climbers coming next. However, local climbing groups largely embraced conservation of the plant, while environmental groups successfully lobbied against the highway expansion.

Schultz now views the Maguire primrose's biggest threat as a recent proposal by the Utah Division of Wildlife Resources to introduce mountain goats to the Bear River Range, a non-native species renowned for its climbing abilities.

"They'll hop around and find those places," she says. "It's as plain as the nose on my face that the Maguire primrose will be among the plants that are eaten." Technically retired since 2006, Schultz winters in her native Oklahoma but returns to Cache Valley each spring to teach field classes. The author of the popular *Pocket Guide to Sagebrush,* Schultz hopes to continue sharing the Maguire primrose and the flora of Utah with students for years to come.

"I certainly won't leave it until I have to," she says.

# Microloans in a Micro-Country

By Jeff Hunter '96

It's a bit like LeBron James getting excited about jumping into a basketball game at the local rec center, or Meryl Streep being giddy about performing with a local theater company. But Andrea Barlow Gooch '14 clearly holds as much passion for seven-figure transactions on Wall Street as she does overseeing the distribution of small loans in a tiny, remote country.

"I have to get my work-work done so I can go do my fun work," explains Gooch, a portfolio manager with Wells Fargo's Managed Solutions and Investment Implementation group and founder of Kindling Kiribati, a nonprofit organization that provides small loans for women of the tiny island nation of Kiribati in the South Pacific.

"That's the shocking thing," adds Gooch, who was named USU's Young Alumna of the Year last fall. "By day, I'm trading in the millions of dollars, easy, and I don't even blink. And by night, the loans for the Kiribati project are about $250, but they're completely supporting a woman and her entire family because unemployment is so high down there."

Gooch graduated from Utah State University with bachelor's in finance and economics and minors in international business and political science. While in school, she embraced a variety of educational experiences, including studying abroad in Peru, a political internship in Washington, D.C., the Huntsman Scholar Program in Europe, and the Small Enterprise Education and Development program in Ghana.

Gooch also served a mission for the Church of Jesus Christ of Latter-day Saints for nearly 18 months in Kiribati, a collection of small islands spread over more than a million square miles of the central Pacific Ocean. The country has just 119,000 residents, most of whom reside on Tarawa, a long, narrow atoll that was the site of a fierce battle in World War II.

"Almost everywhere you stand, you can see the ocean from both sides," Gooch points out.

Even before completing her mission, Gooch was formulating plans to create a nonprofit to help the women of Kiribati. And after finding success working for Goldman Sachs and then Wells Fargo, she founded Kindling Kiribati with help of a board comprised of other USU graduates and professors, including JD Borg, David Herrman, and Brent Thorne.

The organization's goal is to help women become self-reliant by taking business courses and applying for small loans to start and grow businesses. In addition, Kindling Kiribati has an internship arrangement with USU — halted during the pandemic — that Gooch hopes to restart this summer.

As of December 2021, the 503(c)(3) loaned upward of $20,000 to more than 60 different women and employed three full-time workers in Kiribati. In the future, Gooch wants to extend the organization's reach to humanitarian efforts, such as sanitation and clean water.

"We're really hoping to grow just beyond microlending and find other ways that our program can be more effective in supporting Kiribati," says Gooch. "With the exception of motherhood, nothing's given me more fulfillment day-to-day.

"It never feels like work."

# Here Comes the Boom

By Marcus Jensen

**At 4 a.m. on Dec. 21, 2021, 10 members of Utah State University's Get Away Special (GAS) team,** watched its CubeSat satellite — about 10 cm cubed, roughly the size of a small Amazon package — leave Earth's atmosphere from Cape Canaveral aboard a spacecraft on its way to the International Space Station. This is the first GAS project to leave Earth's atmosphere since 2001.

It's definitely a relief that it is up there," says senior Jack Danos, student GAS team coordinator. "It's a huge milestone."

Danos and his team completely assembled the satellite and delivered it to NASA in late July and waited together as the space station deployed the CubeSat on Jan. 26. The satellite has an experimental boom, about a meter long, designed to inflate and deploy from the satellite as it was put it into low-earth orbit. The boom is a proof of concept experiment to show that inflatable structures can be deployed in space.

"We knew it would be about 40 minutes before the antenna deployed and began operating," Danos, says. "So much could go wrong. Would the satellite open to allow the antenna to move into position? Would the batteries work?"

Within an hour, a radio operator from Argentina shared a recording from the satellite playing the first bars of "The Scotsman"— evidence that the CubeSat was functioning as intended, so far.

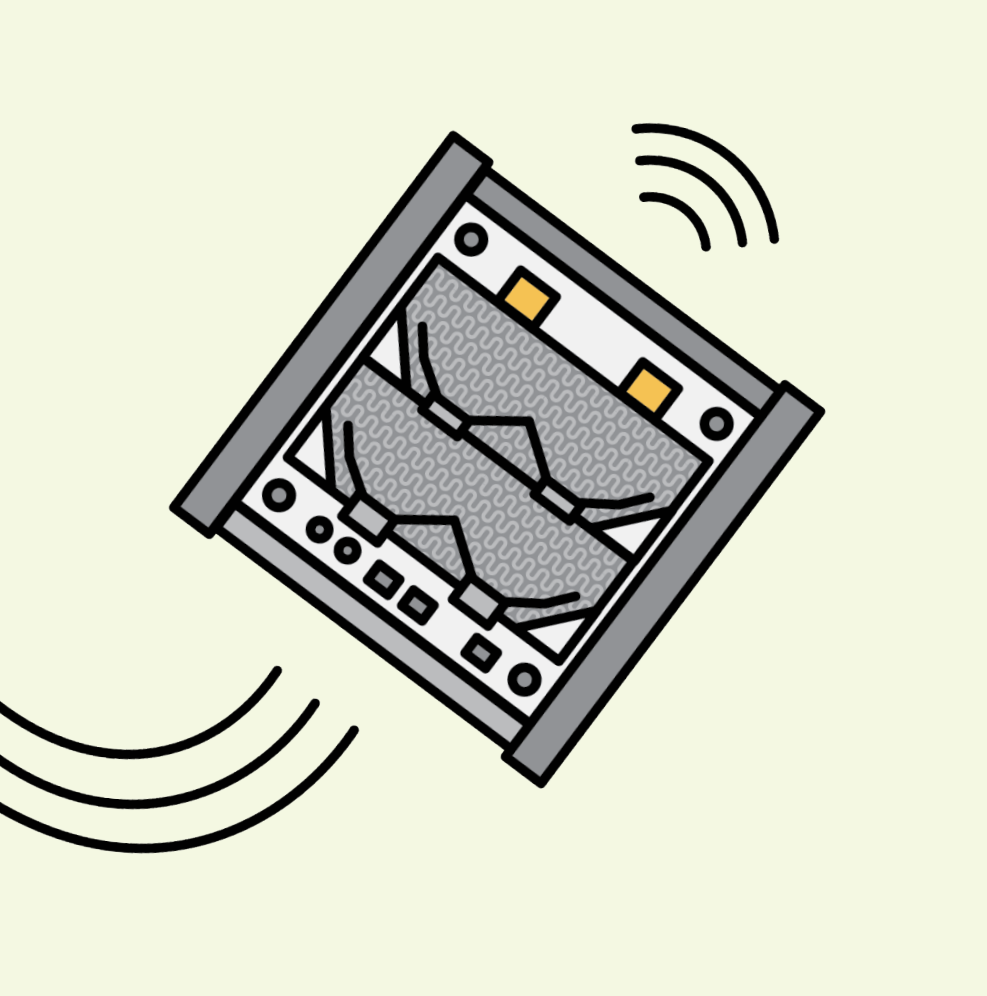
"You can build something that starts out small, flexible, and compact that expands in space into a large, rigid object," Danos explains. "It has a lot of applications, whether it be solar sails or building actual structures in space, such as habitats."

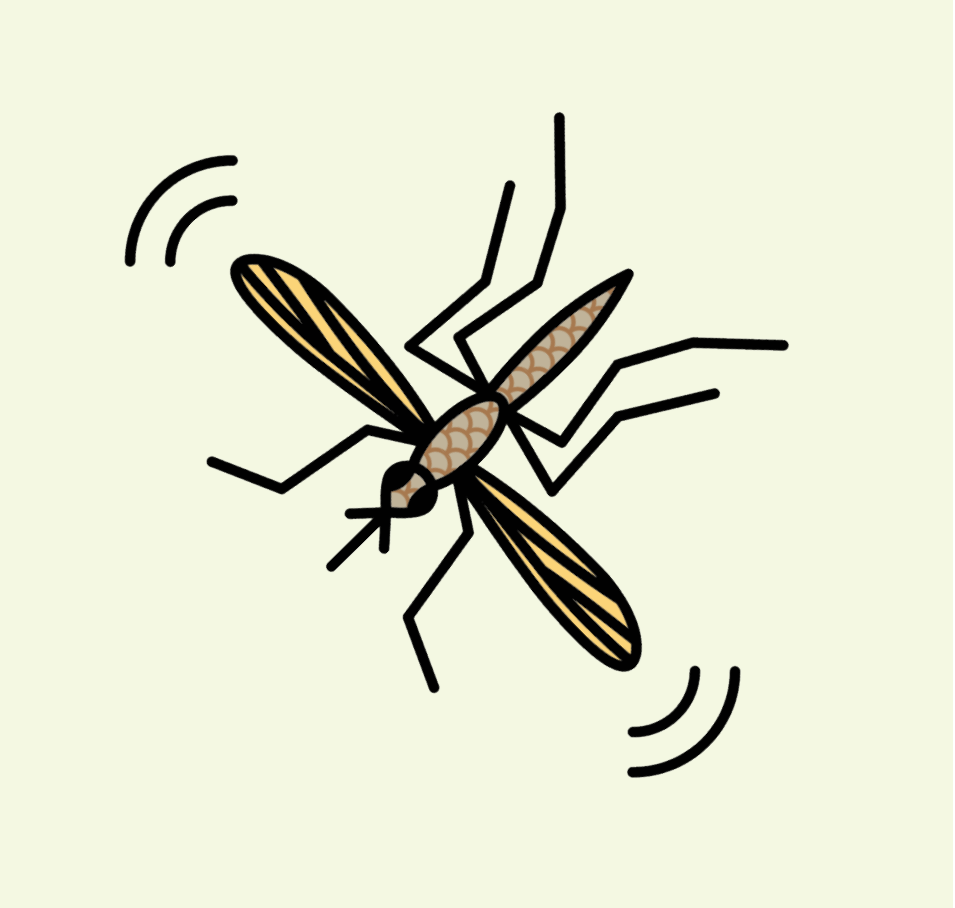
From its first payload launch in 1982, USU sent several projects into space aboard NASA space shuttles. After the Challenger Space Shuttle disaster in 2001, NASA discontinued its Get Away Special program, but that did not stop USU's GAS team from continuing to experiment. The team sent several projects into the atmosphere using high-altitude balloons and did experiments aboard NASA's Vomit Comet zero-gravity simulation plane.

NASA announced its CubeSat initiative in 2013, and the GAS team quickly submitted a proposal to have a satellite put into space. NASA approved it in 2014 and the team has been hard at work ever since creating a design and completing the components. For the next six years, students cycled through the GAS program, and many thought the day the project would go into space would never come.

"When I joined the team, everybody thought that this was not actually going to ever go into space," Danos admits. But the focus has been on making the satellite a reality.

"As far as we can tell, our team is the first team to be made entirely of undergraduate students," Danos says. "That's something that nobody else gets the opportunity to say. Words can't really describe how cool of an opportunity it is for somebody who loves space."





# A Mighty Pest

By Kristen Munson

Over the course of a mosquito's life, it may travel, on average, 75 meters from where it began. That doesn't sound like much, but for the world's deadliest animal, it's enough to continue the transmission cycle of diseases like yellow fever, dengue, malaria, and Zika that infect — and kill — millions of people worldwide each year.

Norah Saarman, assistant professor of evolutionary biology at Utah State University, recently devised a new technique using machine learning and spatial mapping technologies to track and predict mosquito movement to give local abatement efforts a chance against *Aedes aegypti.* The species is native to Africa and thrives in both standing pools of water in the forest and discarded car tires in the city. Since the 1600s, the species has hitched a ride on human transportation systems, spreading wherever it is warm and wet enough.

"I really do want my work to inform something that improves someone's lives or at least maintains some resource of value to people," she explains.

Saarman first examined dispersal patterns using genetic data to track marine animals like the giant Pacific seahorse to understand where populations were threatened. She transitioned to insects as a postdoctoral researcher at Yale University.

"Vectors are almost the opposite problem," Saarman explains. "Instead of trying to promote their movement and promote their population size, you're actually trying to do the opposite. It's like the other side of the same coin."

By understanding where *Aedes aegypti* live, how they disperse, and integrating factors such as transportation networks, satellite imagery of greenspace, elevation, human population density, and temperature, Saarman's team can help local mosquito abatement officials fine tune where their efforts will be most successful. She is partnering with collaborators in South America to test a new mosquito abatement method using Wolbachia, a common bacterium found in about 70% of insects that naturally blocks the transmission of many viruses that cause diseases in human hosts.

"It's almost like vaccinating mosquitoes," she says.

Wolbachia is passed down through preferential inheritance and can rapidly spread across a mosquito population, Saarman says. Knowing where and when to release mosquitos with Wolbachia is another tool for keeping harmful diseases in check. The concept has already been tested in places such as Jakarta and Australia in smaller, flatter cities. Saarman, whose work is supported by the Office of Research Catalyst Seed Grant, sees her modeling skillsets helping communities in more diverse landscapes.

"Once a disease becomes locally transmitted it is very hard to break the cycle," she says.

And climate change continues to shift the traditional ranges of mosquito populations.

"Those ranges are often limited not by 75 meters," Saarman says. "You often get sporadic colonization but the winter may pull it back. As our winters warm and we get fewer cold, cold days or don't get down to those low temperatures, that is the limiting factor that is kind of scary to think about. We may get populations that are sustaining further and further north."

# One Small Gift

By Jeff Hunter '96

In the early days of the pandemic, audiologist Joe Dansie Au.D. '10 was at work at Peak ENT Associates in Provo when a delivery came to his home. Dansie's 13-year-old son put aside his schoolwork to answer the front door. He returned with a question for his mother.

"'The FedEx lady wants to know where you want the packages,'" Dansie recalls. "She thought, That's weird that she even asked. Just leave them on the porch like every other package that comes to us. Then, about 20 minutes later, he returns and says, 'OK, she's out of room. Where do you want the rest?'"

"I have a full-size pickup," Dansie adds, "and the boxes of donated hearing aids ended up filling up my entire truck."

Hearing aids are not something that one would normally recognize as having a considerable amount of bulk, but thanks to the efforts of the Hear for A Purpose Foundation, their storage and distribution can actually be a challenge.

Started in 2016, the foundation is a 501(c)(3) primarily comprised of audiologists who graduated from Utah State University. Last October, the group spent four full days in the Dominican Republic helping to fit 193 donated hearing aids valued at around $250,000, as well as providing other free audiology services.

"In the U.S., we're really fortunate that we have access to hearing healthcare," Dansie says. "Even though hearing aids can be expensive, at least we have the avenues for it to happen in most scenarios. But down there, there's a limited number of people who are even trained to fit or program hearing aids or do hearing tests. And the amount that a hearing aid costs is the same as it would be in the U.S., so it's almost insurmountable for them to even get access to hearing healthcare."

Last fall's mission, the fifth trip the group has made to the Dominican Republic, included USU professor Heather Jensen and alumni Quin Card '05, M.S. '15, Sarah Cordingley '10, Au.D. '14, Brittany Bown '14, Au.D. '18, Candi Bown '85, Au.D. '88, and Chalese Buttars '11, as well as Tiffany Dansie and Buttars' husband, Tony Garcia, who served as translators. Dan Keller '04, Au.D. '08, Curtis Thomas '81, M.S. '95, John Foster '05, Au.D. '09, and Brittany '12, Au.D. '16, and Pedro Garcia have also gone on some of the trips, which are all-volunteer efforts where the participants pay for their own travel.

The foundation plans to return to the Dominican Republic for another clinic this fall.

"This is our way of grounding ourselves and reminding ourselves why we went into audiology," says Card, who currently works for a hearing-aid manufacturer that has donated equipment for the missions. "This is the fun, feel-good part, and that sometimes gets lost in your day job. You kind of get caught up in the mundane and kind of take things for granted, and then you are able to go to a place where this is not the norm and be reminded of the amazing technology we have.

"Being able to share that with people who don't usually get it is really rewarding."

# Faith You Can Hold

By Jeff Hunter '96

While trying to describe the size of an unusually small book found in Special Collections and Archives at the Merrill-Cazier Library, Alexa Sand takes a long minute to look around for something with similar proportions

"It's truly tiny," says Sand, an art history professor and associate vice president for research. "About the size of a charging block for your iPhone. So, it's really little."

At just 37 millimeters by 31 millimeters, the diminutive book certainly looks like something more fitting for a dollhouse. But it's a facsimile of a manuscript known as the Psalter of Saint Ruprecht, which is believed to have been produced in the third quarter of the 9th century.

The original psalter — a volume that includes the Book of Psalms from the Old Testament — is housed at St. Peter's Abbey in Salzburg, Austria, and is one of the smallest books in the world remaining from the Middle Ages. The individual letters are no more than 1.5 mm high spaced only around 1.2 mm apart.

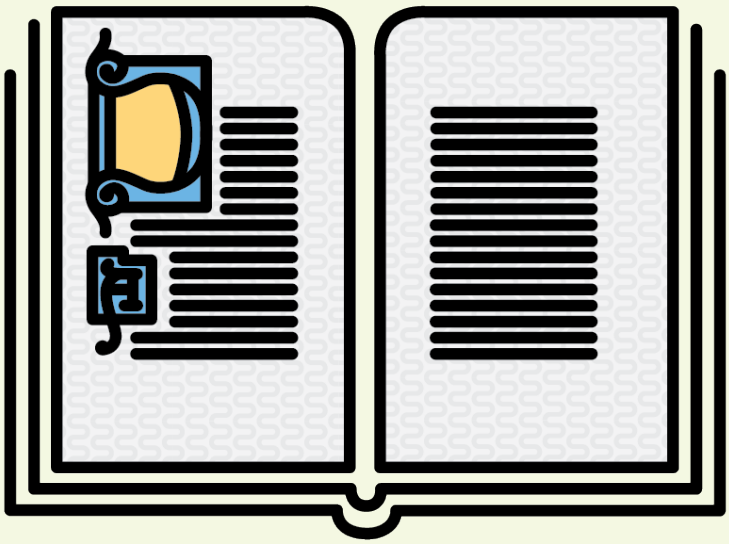
Jennifer Duncan, USU's interim dean of libraries and rare book curator, says that Utah State students find the miniature psalter "charming" when they have a chance to see and handle it. "They love the small things, and it also lets us talk about how personal these devotional items are," she says. "And students are very interested in thinking about the connection between an object and individual."

A companion piece to the library's replica of the Psalter of Saint Ruprecht is another book that is significantly larger — 103 mm by 74 mm, close to the size of a deck of cards. However, this psalter is authentic, and was likely produced on vellum (prepared animal skin) around 1270 for the Diocese of Liège in what is now Belgium. It is referred to as the Liège Hours, with "hours" referencing the eight set times a day that monks or nuns would gather to recite prayers.

The university purchased it from a rare book dealer about 10 years ago. And while it difficult to open fully due to it being tightly rebound long ago, the small psalter is adorned with a number of colorful illuminations, some displaying scenes such as the betrayal of Christ and King David in prayer.

"As a medievalist, the resources we have here at Utah State are great for my research," Sand notes. "But what is more exciting is that if we can have students touching and handling items and putting on exhibitions with these objects, they get so much more excited about art history, museum studies, and archival work by doing rather than just sitting in a classroom.

"It's like the difference between teaching chemistry with a lab and teaching chemistry without a lab," Sand adds. "It's really hard to produce chemists if they've never been in a lab." **A**



# A CRAVING

## BUILDING A BAKERY EMPIRE

By Jeff Hunter '96

Photos by Levi Sim

IT ALL STARTED WITH A DESIRE TO **OPEN A COOKIE SHOP THAT SOLD THE PERFECT CHOCOLATE CHIP COOKIE.** FIVE YEARS AND 343 **CRUMBL** STORES LATER, SAWYER HEMSLEY '18 AND CO-FOUNDER JASON MCGOWAN ARE LIVING THEIR MISSION TO BRING PEOPLE TOGETHER "OVER THE BEST BOX OF COOKIES IN THE WORLD."

**LAURIE HEMSLEY** isn't afraid to admit that she was skeptical when she first heard about her son's ambitious business plan heading into his senior year at Utah State University.

And she wasn't exactly alone.

"I remember it very vividly," Hemsley says of the moment in 2017 when her son, Sawyer, first revealed that he and his cousin, Jason McGowan, were about to act upon the entrepreneurial idea they had been mulling over for a while.

"We were sitting around the table having Sunday dinner when he just said, 'We're going to open a cookie shop.' And everyone reacted with, 'That's the dumbest thing. It will never go. Blah, blah, blah.' And he was like, 'Yeah. Well, I'm going to do it.'

"… But that's how Sawyer and Jason are," Hemsley notes. "They're both really driven people, and they don't let people tell them they can't do something. I almost think that it brings out the opposite. 'You're going to tell me I can't do that? Well, you watch.'"

Less than five years later, the original "cookie shop" Hemsley and McGowan opened is no longer around. The old wooden structure at the south end of Logan was torn down a few years ago to make way for a new business development.

But that hardly means that those doubters were proven correct. Rather, there are now two of those cookie stores in Logan — one at each end of town — along with 26 other locations in the state of Utah alone.

Known as Crumbl, the company has thrived and franchised, with people from coast to coast now familiar with not only its tantalizing chocolate chip cookies, but a revolving selection of other unique cookies served up in distinctive pink boxes.

As of January 2022, there are 344 Crumbl stores in 42 different states, and around a dozen of them are owned by Laurie Hemsley, her husband, Lance, and/or Sawyer's three siblings. Needless to say, Sawyer Hemsley's family and friends — several of his old college roommates from USU also own franchises — came around to embrace the idea of "a tech-driven bakery."

"We quickly found out that if we were going to do this, we were going to have to go big," Sawyer Hemsley proclaims. "We have the passion for cookies, as well as for the concept and the brand. And we did have our trials in the very beginning, and a lot of people didn't believe that this would even work.

"But," he adds with a big smile, "we didn't care."

Caramel popcorn is just one of the many cookie flavors that Crumbl has created, tested, and now sells.


Sawyer Hemsley (left) and Jason McGowan pose with Crumbl's iconic pink boxes at the company's headquarters in Orem, Utah.

“ WE’RE A TECH-DRIVEN BAKERY. WE CAN ADAPT AND INNOVATE AND DO WHAT IT TAKES IN ORDER TO BE SUCCESSFUL.” – SAWYER HEMSLEY


## YOU WIN SOME, YOU LOSE SOME

Growing up in Southeastern Idaho, Sawyer Hemsley served as the student body president at Preston High School. He got involved in student politics again at Utah State after serving a mission in Mexico for the Church of Jesus Christ of Latter-day Saints, but following a stint as student events vice president, Hemsley took an even bigger swing and ran for student body president in the spring of 2017.

He lost.

But in retrospect, losing was probably the best thing that could have happened to Hemsley.

While attending the Stadium of Fire fireworks show in Provo the previous summer, he had shared a business idea with McGowan, who is married to his mother's niece, Whitney. McGowan has a strong entrepreneurial spirit in him, along with a talent for technology that had already led to the creation of some highly successful apps and a great job with Ancestry.com in Lehi.

A native of Alberta, Canada, who moved to the U.S. after serving a mission in Las Vegas, McGowan was intrigued by the idea of opening a cookie shop in Logan where the products could be purchased via an app and then delivered to the customer's front door. But he also wanted to make certain the opportunity was right.

Hemsley, who now had some extra time after losing the election at USU, was able to secure an advantageous month-to-month lease on an older building in Logan that was slated to be torn down in the not-too-distant future. So, all they needed was a recipe for what they anticipated as being "the best chocolate chip cookie in the world" and the equipment to bake them in.

"We didn't have the concept fully baked out," McGowan says without acknowledging the obvious pun. "We didn't have the recipe. And we didn't have any of the stuff. We just knew that there was a need, and we both had a passion to do something great and build something awesome."

In an effort to come up with recipe of the company's signature cookie, McGowan and Hemsley started gathering the chocolate chip cookie recipes of friends and family members,

while borrowing additional ideas from the internet. Utilizing the oven in the Hemsley home in Preston, the duo cranked out numerous batches of cookies, then did taste tests with friends, relatives, and outside some local stores.

Eventually they discovered that 70% of folks sided with Hemsley that milk chocolate chips were the way to go (McGowan is a semi-sweet fan), and that conventional home ovens weren't really ideal for baking the large, 6-ounce cookies that they wanted to sell. So, in a huge leap of faith, Hemsley and McGowan purchased some commercial-size ovens and other equipment even before they had their business plan solidified, and soon they were selling cookies.

Actually, a lot of cookies. All chocolate chip and sold in batches of four at a time.

"It was crazy; they didn't even have all the stuff you're supposed to have to open a store," Laurie Hemsley recalls. "But they found out what they needed and hurried and got it. It was just kind of overnight. My husband and I went down to help, and it was so busy and so much fun. We had a line out the door and the deliveries were going crazy. We had so many that we had to start calling up friends and family and asking them if they could come help deliver."

Hemsley, who graduated from USU with a degree in communications studies and a minor in marketing, ran the first store in Logan, while McGowan took care of the technology side of the business while still living and working in Utah County. But things went so well in the first few months that Hemsley gave up an internship at a marketing agency in Arizona to help grow the company.

"We honestly didn't think it would be a career for any of us," Hemsley admits. "We just thought it was a fun side hustle that I would do in college. But the buzz was there. And with all of the excitement it created in the Cache Valley community, we saw a lot of hope in this business."

McGowan says a major milestone for him was when he was home one day in Provo and found himself thinking, I really need a chocolate chip cookie.

"I was craving my own product, so I drove two hours up there to go and get one of my own chocolate chip cookies," McGowan notes. "That's when I knew for sure this had legs because if I was craving one after having had them a million times, I knew there must be something special there."

## IN THE PINK

It needs to be noted that the co-founders of the burgeoning cookie empire known as Crumbl do know how to spell. They didn't run out space on their company's original sign, and while Jason McGowan is from north of the border, Crumbl is not some Canadian way to spell "crumble."

"When I was trying to come up with a name, I was thinking of the action you take when you eat a cookie and what takes place," Hemsley explains. "And I said to myself, When you eat a really delicious and yummy cookie, you're going to want to eat every last crumb. So, I started to play around with the word crumble.

"We dropped the 'e' because we felt like it was more brandable, a little more sexy, if you will," he adds. "It's a little more edgy. And C-R-U-M-B-L looks better on the box."

Oh, yes. The box.

While Crumbl's distinctive pink came courtesy of a 1959 Cadillac owned by a Hemsley family friend in Preston (a vehicle now owned by Sawyer Hemsley that is used in parades and at promotional activities), "99%" of the instantly recognizable long, pink box that holds four chocolate chip cookies came courtesy of a small group of USU marketing students who won a case competition hosted by a professor.

"One of the core things that we're about at Crumbl is the experience," McGowan says. "It's how things look and how its smells when you come to the store. And how you can see people cracking the eggs. That's the experience. So, we thought we needed to come with a box that's unique and special and different."

Crumbl now sells single cookies, as well as the traditional four-pack and a box of a dozen. In addition, Crumbl also makes ice cream and has developed its very own chocolate chips, which Hemsley and McGowan anticipate will be available in retail stores someday.

While the company rotates flavors each week, like Rocky Road pictured above, one cookie never goes out of style — the chocolate chip.

> “WE DIDN’T HAVE THE CONCEPT FULLY BAKED OUT... WE DIDN’T HAVE THE RECIPE. AND WE DIDN’T HAVE ANY OF THE STUFF. WE JUST KNEW THAT THERE WAS A NEED, AND WE BOTH HAD A PASSION TO DO SOMETHING GREAT AND BUILD SOMETHING AWESOME.”
>
> – JASON MCGOWAN

And in December 2018, the company dramatically changed its menu selection. While its signature chocolate chip cookies are always available, Crumbl now unveils a new lineup of four or five unique cookies each week that are created in the test kitchen of the company’s headquarters in Orem.

“Our mission is to bring friends and families together over the best box of cookies in the world, and we take that so seriously. Like no one will ever beat us at having a better cookie,” McGowan says. “We’re just so adamant about that.”

## THE TASTE OF SUCCESS

Jason McGowan is the proud father of seven children under the age of 11.

“We go big. Whether it’s Crumbl or my family, we go all out,” he declares.

That’s likely why after opening a second Crumbl location in Orem, McGowan and Hemsley decided to start franchising within their company’s first year. Hemsley convinced his parents to open the next store in Bountiful, and since then, it’s been a “whirlwind,” with new Crumbl locations opening practically every week.

“It’s really hard and tiring, especially the first month. I would have to say that it almost kills you,” Laurie Hemsley says with a chuckle. “It is hard, but it gets easier the more you get people trained. Things start falling into place, and it gets really good.”

Sawyer Hemsley, the company’s COO, points out that there is a distinctive and positive vibe that he and McGowan, who serves as the CEO, aspire to be found in every Crumbl store. The interior of Crumbl locations are clean and bright, with white counters and walls accented in black and pink.

“We get to see the happiness and joy because a lot of people use Crumbl as a channel to make someone’s day brighter,” McGowan says. “And when people come in, they’re usually not coming in here hangry. They’ve probably already eaten, and they’re coming in for a treat. The whole culture and atmosphere in the store is of brightness.”

“Just to reiterate,” Hemsley declares in mid-interview. “What I want you to understand is, we’re not a bakery. We’re a tech-driven bakery. We can adapt and innovate and do what it takes in order to be successful.”

Crumbl proved that in the early days of the COVID-19 pandemic when the company organized a “war room” to help figure out how to navigate a unique time in history. It helped that the company already delivered its delicious “comfort food,” but by creating a new app in just two weeks, it also made it easier for patrons to pay for the cookies and then pick them up curbside.

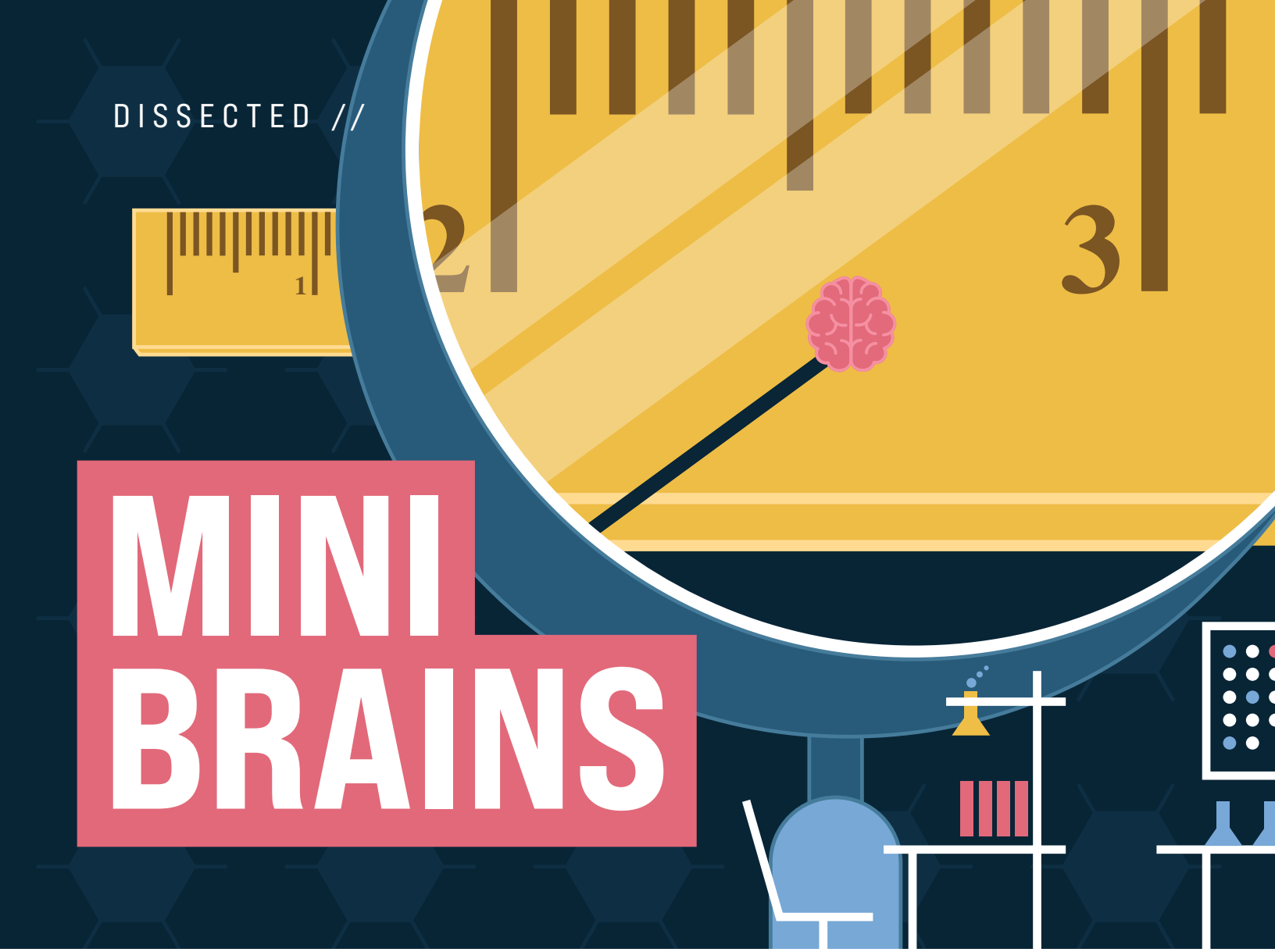
“Our sales just skyrocketed after we launched it,” McGowan says. “It was amazing. It was a watershed moment for the company.”

For Utah State Aggies, another watershed moment came in October 2021 when Crumbl released the Aggie Blue Mint cookie. Based on the beloved Aggie Blue Mint ice cream available at the Aggie Creamery, Hemsley says it took a year to develop the chilled cookies and cream cookie topped off with minty buttercream.

While Hemsley was “super adamant” about the creation of the Aggie Blue Mint cookie, McGowan admits to being a little nervous about selling it around the country. However, it sold well outside of Utah while more than doubling sales in Cache Valley, leading to the Aggie Blue Mint cookie still being sold in Logan on the weekends.

“We were going to run it under a different name because we didn’t think that Utah State would allow us to use Aggie Blue Mint, but we were able to get permission, and that was like the happiest day for me because I knew we would be able to show that Aggie pride and connect with Aggies in all of these different states,” Hemsley says with a grin.

“Utah State is a huge part of our story because Aggies supported us and helped give us our start, and I never want that to be lost. And Aggie Blue Mint was developed so we could share that story with the nation.” A




Illustrations by Emeline Humphries '18.

By Matilyn Mortensen '19

The human brain is full of unknowns — from its billions of neurons to its cerebral folds. Using micro-engineered materials and devices, the research of **YU HUANG,** a biological engineering assistant professor at Utah State University, may unlock some of these mysteries. Huang leads the MicroBrain Laboratory and focuses on biomedical microelectromechanical systems, or Bio-MEMS. His particular interest is the micro-tissue engineering of neurons, tumors, and stem cells, and has won the support of the National Institutes of Health's (NIH) largest single grant awarded to university researchers.

## BUT WHAT IS A MINI BRAIN?

Mini brains are also called brain organoids. These millimeter-sized brain models are generated from stem cells and replicate essential human brain architectures and functions.

## HOW DO SCIENTISTS MAKE A MINI BRAIN?

They are created from stem cells and develop the six layers of the human cortex, the region of the brain responsible for advanced cognitive functions like thought and speech.

## WHAT CAN WE POTENTIALLY LEARN FROM MINI BRAINS?

Mini brains illustrate how a typical brain develops and how a variety of diseases or disorders, such as Alzheimer's or brain cancer, impact the brain.

Recently, Huang received a $1.8 million grant from the NIH to use mini brains to study cerebral folding, a human-specific structure thought to support higher-level brain functions, such as social interactions and linguistic abilities. Huang and his collaborators, Kevin Moon and Jia Zhao of USU's math and statistics department, want to better understand how a brain develops this unique architecture under spatial constraints.

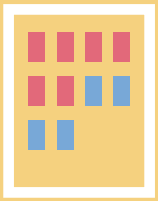
Huang will use brain organoids fabricated inside a tiny 3D-printed microchip to replicate a spatially constrained environment like the skull and trace the structural changes of these organoids that may shed new perspectives on the biological and physical forces that help shape a human brain.

# HOW TO GROW MICROBRAINS

Growing a microbrain in a standard petri dish is like putting them in an ocean where they have room to stretch out, Yu Huang says. His team has devised novel techniques to shrink the developing chambers to more realistically simulate the environment of a brain and automate the growth process — an outcome he expects in the next few years.

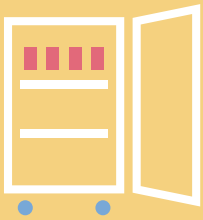
## STEP 1:

**Researchers grow an embryonic stem cell inside cell culture microwell plates.** Think petri dishes, but much smaller. The lab further mimics physical constraints developing brains face using a polydimethylsiloxane microdevice similar to the polymers used on solar panels. The team creates the devices with a 3D printer.



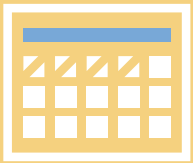
## STEP 2:

**The plates are placed inside incubators.** Every other day, researchers use a pipette to nurse up to a few dozen stem cells with a media solution optimized with proteins, growth factor, and pH balanced to nourish the growing cells. They replenish about 50 to 70% of the solution to remove toxins that may build up in the plates.



## STEP 3:

**Depending on the experiment, it may take 4 to 12 weeks for the organoids to grow to about 100 microns in size, about the width of a fine grain of sand.** For instance, preliminary results of Huang's NASA-funded study of growing mini brains in microgravity showed that it took significantly longer for the cells to develop than their ground-controlled specimens.



## STEP 4:

**Viewing the growing mini brain structures involves inserting miniature microscopes into the arrays to monitor them.** Once the organoids are complete, researchers remove the minibrains and insert dye into the structures for viewing under a fluorescent microscope where fine details in the brain structure are examined.

# A GIANT 1%

By Lael Gilbert

**For most of summer 2020,** Bella Wetzler '23 and others from the Lutz research team worked and camped in relative isolation among the towering old-growth forests of Yosemite National Park. It was June, in the midst of the pandemic, and the team of eight students and seasonal employees had agreed to limit contact with the outside world so they could move forward with measuring and monitoring every woody stem on the 60-acre research plot.

The group just returned to camp one evening for dinner when a fast-moving windstorm began churning branches of sugar pine and white fir high overhead. A wildfire had burned the area seven years earlier, and Wetzler was well aware of the danger strong winds could pose, toppling snags that weighed upward of 10 tons. What she didn't expect were the pine cones.

"Sugar pine cones are huge," she says. "They can get up to 22 inches long. The wind started knocking them out of the trees, and it sounded like bombs were dropping all around us."

Everyone scrambled for their hard hats, she says, and no one was hurt.

The group was working three forest plots that Jim Lutz, associate professor of wildland resources at Utah State University, meticulously assesses every summer, as he has for the past 13 years. Lutz studies Big Trees — not necessarily the heavyweight species like coast redwood or giant sequoia — but the biggest trees in any given forest, the top 1% of matriarchs by weight, those with trunks reaching more than 4 feet in diameter in old-growth forests of the West.

There aren't actually many of the old-growth forests left, which makes big trees a challenge to study. Most in the United States were harvested long ago, the bulk of the time-strengthened wood in the widest-diameter trunks converted to ship masts, struts for bridges, beams for buildings, and cash. In remaining forests across the world, big trees make up a fairly small proportion of roots-in-the-soil on any given acre; but that small group carries a lot of weight, both ecologically and literally.

Big trees define the forest, says Lutz. They are, it turns out, something of a foundation to forest ecology: they create microenvironments of moderate temperature and humidity under their canopies; provide habitat for birds, animals, and insects; change conditions for understory plants; and determine in large part which plant species flourish and which ones don't. And when big trees are damaged after severe wildfire, or perish from an attack by insects or disease, they often die in spectacular fashion, thundering to the forest floor in a mass of trunk and tangled branches, pulling down their neighbors and opening canopy space to the sky in a way that rapidly changes the forest. In addition to creating important habitat for things like moss and mammals, the demise of a big tree stimulates new forest structure and variety for what would otherwise be closed and monotonous growth.

Lutz actually started his career as an engineer, and then wandered into investment banking. You'd expect there to be an existential crisis at some point in this narrative that propelled him to leave the bustle of his London office and head to the mountains to commune in the forest. But it was less a philosophical crisis, he says, and more practical strategy. He appreciates his meandering career path; his diverse background informs the way he approaches science.

Take these forest plots, for instance. In a methodology reminiscent of engineering fastidiousness, Lutz monitors the health and survival of trees by examining 170 acres of old-growth forests at three sites in the western United States where the team surveys, identifies, and measures every single stem greater than one centimeter in diameter. Every year Lutz and his students monitor each of these 100,000 trees for health. If a particular tree is struggling, it's noted. If it dies, technicians like Wetzler do a post-mortem evalu-

Tucker J. Furniss M.S. '16, Ph.D. '21 prepares to measure a sugar pine that survived the 2013 Rim Fire in the Yosemite Forest Dynamics Plot. Photo by Sara J. Germain.

ation armed with a hatchet and a knife to determine the cause of the death.

Many factors affect the health of big trees, but Lutz has found, among other things, that connections to a strong mycorrhizal network — the underground exchange of nutrients between fungus and plants — particularly benefits large trees. Trees offer sweet products of photosynthesis to the fungi connected to their roots, while fungi enhance a tree's nutrient uptake from the soil, shift nutrients between trees, regulate genetics to produce better-armed trees, and even allow inter-tree communication.

Big trees are, by definition, genetically successful, says Lutz. Survival over the centuries proves that these trees are the right species with the right genes in the right spot at the right time. These are proven genes, the kind that should be passed on to future generations — and big trees are designed to do just that. While a young 6-foot tall tree might produce a cone or two in any given year (or commonly none at all, since young trees focus most of their energy on growth rather than reproduction), a 200-foot tree is more-or-less laser-fixated on genetic reproduction, producing thousands upon thousands of cones, acorns, seeds, or nuts every year, each a neat little package of genetic information with higher-than-average likelihood for survival and success. If a big tree disappears, that prolific source of genetic reproduction goes with it; a small tree simply cannot replace the ecological role of a big one in the forest, Lutz explains.

And neither can small trees help all that much with climate change. Trees by weight are about half water. Of the remaining dry weight, about half is made up of carbon pulled from the atmosphere into long-term storage where it can't cause trouble. Young trees have slender trunks, and much of the carbon they hold is in their annually-shed or easily-burned leaves and slim branches. Small trees add little to net carbon storage. The largest 1% of trees around the world are holding half of all forest carbon.

All those seedlings planted on Arbor Day? They don't do good in the carbon equation, says Lutz, and in parts of the West they may actually be increasing fire danger, creating a ladder of easily-consumable fuel to pull wildfire from one tree to the next.

Big trees, on the other hand, have a good, solid heft to their trunks and thick bark. Their trunks don't easily burn. When a tree puts on just a little extra height, the amount of carbon it stores increases exponentially, depending on the species. A sugar pine with a 2-foot diameter (considered a medium-sized tree) has a dry weight (if the wood is completely dried) of about 2 tons. Double the diameter to 4 feet, and the dry weight of the tree jumps to 10 tons. Nudge up the diameter to 5 feet, and the sugar pine's dry weight would be a whopping 20 tons.

The biggest 1% of trees, in fact, contain half of the earth's forest biomass, Lutz says. The western United States has some of the heaviest forests in the world. Incredibly, with all our fascination with these majestic trees in culture, commerce, and religion, their role in forest ecology is not well studied or well understood. In some places in the East, big trees were removed from the landscape so long ago that it's hard to even know how those original forests might have functioned, Lutz says.

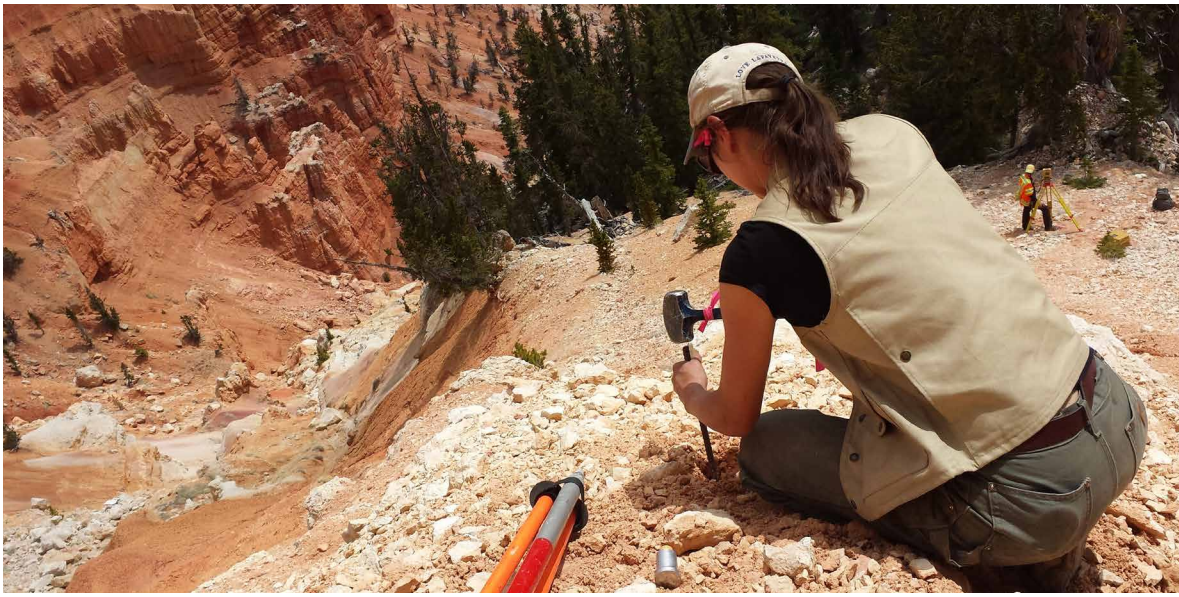
"A lot of major assumptions have been made about how these old forests work. Our big plots let us examine what we've assumed about these forests, and we've already come up with contradictions to accepted theory," he says. "If our society decides we want to have more primary forests, this work will help to restore them. We'll be better able to understand the structure and processes that affect them."

There's really only one thing that can restore big trees to forests — and that is time. Big trees take hundreds of years to mature. There's no way to skip that process, says Lutz. Young trees replanted in cleared forests won't add significant heft to their trunks for another 50 years. A limber pine planted today in Logan Canyon might finally tower over the Cache National Forest in the year 2321 if it remains healthy and protected from human activity. But trees planted 50, 100, and 200 years ago, the really big ones you find on the landscape now, are supporting forest ecosystems today. It's clear to Lutz where our priorities should be.

"Engineers and investment bankers tend to be optimists and problem solvers," he says, traits he transferred from his previous careers.

Lutz considers himself an informed realist — in a world where every ecological system has been touched by humans, he doesn't expect perfection, that fairytale forest of pre-European settlement that some people want to see restored. But he would like to see society put more emphasis on natural systems to achieve the "best possible and practical future." When it comes to protecting our forests, it's all about protecting and promoting the big trees, he says. **A**

The biggest **1% OF TREES,** in fact, contain half of the earth's forest biomass.



Left to right: Undergraduate Bella Wetzler evaluates the health of a small bristlecone pine; Jim Lutz, associate professor of wildland resources, sets a transect line near a cliff of Cedar Breaks during the establishment of the Utah Forest Dynamics Plot; Erika Blomdahl M.S. '18 and current Ph.D. student sets a survey marker during the establishment of the Utah Forest Dynamics Plot. Left and center photos courtesy Tucker J. Furniss M.S. '16, Ph.D. '21; right photo courtesy of USU Ph.D. student Sara J. Germain.

Alexis Ault, associate professor of geology, shows the microcrystalline texture of hematite that formed when a fault moved. It's only visible with a scanning electron microscope. Photo by Casey McFarland.

# Stitching Together an Ancient Story

By Kristen Munson

## The machine hisses like a bike tube deflating.

"First we need to let the air out," says Fen-Ann Shen, adjusting a valve on the scanning electron microscope (SEM) to create a vacuum inside. The 7,000-pound instrument parked in the basement of the Science Engineering Research building is worth more than many American homes.

With gloved hands, Shen, manager of Utah State University's Core Microscopy Facility, plucks a sample from a shelf of gold nanoparticles on a carbon plate that resembles a typewriter key no longer in use. She tilts it forward and the disc flashes in the light.

"I am going to show you inside this," she says.

The SEM uses a beam of electrons to scan the surface of samples down to the atomic level, revealing topography the human eye could never detect. The experience is akin to flying over farmland at 40,000 feet and seeing the latticework of roads and fields below.

"Our vision sees down to 100 microns," Shen says, adjusting knobs for magnification and tuning the focus.

Fine details emerge showing the structure of the gold nanoparticles. At 200,000 times magnification, they look like pebbles on a beach, revealing how our eyes can be unreliable narrators of the world. Afterward Shen combs the shelf for a piece of hematite about a centimeter wide that shimmers like a shard from a mirror.

"This is Alexis's," she says. "From a small sample, she can discover a lot."

## Piecing Together a Story

**The Alexis** that Shen is referring to is Associate Professor of Geology Alexis Ault, a pioneer of new thermochronology tools she uses to study fault surfaces down

to nanoscale and even atomic levels. Her work stitches together a fault's earthquake history and the mechanisms of rock deformation, which can help scientists better understand geographic threats in a region.

The Wasatch Fault is about 240 miles long and active. And on March 18, 2020, a 5.7 magnitude earthquake in Magna, Utah, rattled buildings along the Wasatch Front, reminding residents of that fact, and causing upwards of $70 million in structural damage. Ault's team doesn't study modern earthquakes like these. They investigate the rock record of fault activity between 1 and 5 million years ago using thermochronology — the study of how rocks and minerals are shaped by temperature and time.

"If you can build a chronology of fault events, and you can backdate what the slip rate is on those events, you start to have a clearer picture of where we are heading," she explains.

Ault's team is looking for the bigger picture by starting with incredibly small details. They study the minerals coating fault surfaces, like hematite, a common iron oxide found in fault zones, to date earthquakes, as well as ascertain how shallow rocks in the subsurface may actually control how earthquakes stop.

When an earthquake occurs, part of what allows the surface to continue to slip are transformations on the fault surface, Ault explains. Sometimes material gets so hot or is so ground down that it becomes amorphous and loses its structure. Using the SEM, her team found textural and geochemical evidence that some amorphous slip surfaces quickly grow crystals, which may stabilize the material.

"What is so special about this mineral [hematite] is the textures that you can see with the scanning electron microscope give us clues about the conditions of when that mineral first formed," Ault explains from her office. "It's like its life story is in that texture."

And it's a story that takes time to uncover.

## Finding Her Way

**Alexis Ault** wasn't that kid with a rock collection. Geology was a course she took because it fulfilled a science requirement for her undergraduate education at Wellesley College. At the time Ault enrolled, she was lost. She comes from a family of physicians and initially thought she would be one, too. Ault switched to political science but was uncertain of her path. An introductory geology course shook something loose.

Faculty can be transformative for students, Ault says.

The professor kept her engaged and helped her gravitate towards something. She took another geology course and eventually worked with Meg Thompson, professor emerita of geosciences, who taught her to think like a scientist.

"Meg Thompson changed my life," Ault says. "She bled over everything I wrote. She taught me how to write scientifically. It was these experiences that set me on my path."

As an undergraduate, she was hired as the field assistant for another mentor, Rebecca Flowers, then an MIT doctoral student and now a professor of geological sciences at the University of Colorado Boulder. She traveled with Ault to remote Saskatchewan to collect samples of rocks nearly 2 billion years old.

We were two women in the middle of nowhere Canada, moving around by float planes, Ault says, smiling. "I learned so much. I learned about geology. I learned how to build a Zodiac boat. I learned how to cook."

Spending weeks together in the wilderness over two summers forged a friendship and mutual respect that led to Ault becoming Flowers' first Ph.D. student at Boulder.

"Alexis, she is super enthusiastic, super inquisitive and curious, always upbeat, always excited about the geology and what's coming next, always wanting to learn new things and integrate lots of information," Flowers recalls. "I think those are part of who Alexis is, and you can sort of just see that all the way through her trajectory to where she is now, where she is still super excited and driving science in new directions."

> "The textures that you can see with the scanning electron microscope give us clues about the conditions of when that mineral first formed ... It's like its life story is in that texture."
>
> — **Alexis Ault**

At the time, Flowers was exploring erosion histories across the interior of continents believed to be stable, she explains.

Ault specialized in a dating technique called uranium-thorium-helium that measures helium produced from the radioactive decay of trace amounts of uranium and thorium present in some fault rocks.

Alexis started to decipher these cryptic missing records using thermochronology, Flowers says, "and I think it was some of the first work of its kind that was exploiting these new advances in uranium-thorium-helium."

While Flowers' group continues work in this vein and develops different techniques to study deeper time histories, Alexis moved on to tackle different problems.

"You don't want to just be a copy of your adviser," Flowers says. "You want to grow into who you are as a scientist, and a person, and start your own projects, and start a whole new area of scientific research that other people follow you in. I think that is what Alexis is doing with all of her hematite work. She is doing, I think, really creative and innovative and groundbreaking work that she is really driving."

Alexis Ault with her research group in San Ysidro, New Mexico in fall 2021 on their way to a conference in Santa Fe. From left to right: Jordan Jensen, a Ph.D. candidate at USU; Ema Armstrong, MS '21, Ph.D. candidate; and Alex DiMonte, a master's student who will return to earn his Ph.D. with Ault in the fall.

At USU, Ault trained her focus on fault rocks closer to the surface, wondering what story they might tell through their textures. With support from a 2017 Faculty Early Career Development CAREER Award from the National Science Foundation (NSF), she is stitching that story together using uranium-thorium-helium dating along with new imaging techniques. She is also involving area middle school students in the process to ensure they know about where they live, and, maybe, what they can become.

Ault's lab parses hematite collected from fault scarps near Brigham City, Utah, as well as from the southern portion of the San Andreas Fault in California. But why focus on this common iron oxide?

Hematite's textures tell its story — not all minerals do that, Ault says.

"Did it experience an earthquake? Did it just continue to creep [along a fault]?" she asks. "The most amazing thing, I think, is potentially because of the textures that developed when the mineral first formed, that sets the stage for how it continues to behave."

Ault is the principal investigator of a 2021 NSF grant to study fault rocks along the southern San Andreas Fault to learn if there is something about them that promotes particular actions such as slow slip, which relieves pressure but doesn't trigger earthquakes. Ault's collaborations with experts in rock deformation will help build better hazard maps of active fault regions.

"For me, that is the kicker," she says. "Is there something about the rocks that primes the pump to deform in a certain way? … At the end of the day, this matters because there is a very real need to understand the earthquake hazards in places like the Wasatch corridor … and along the San Andreas Fault. In seismically and tectonically active areas, the earthquake hazards to humans can be significant."

## Looking for Clarity

**Eight years ago,** the images Ault submitted with her work to a journal weren't crisp. And the arguments she was making required clarity. Her paper was rejected, but an editor suggested she continue working on her ideas and gather better evidence.

Ault, a new faculty member at USU, contacted Fen-Ann Shen to use the SEM "as soon as possible," she says. She likens the work to slicing a piece of cake — but using a beam of ions to shave a rock fragment so thin you can pass a beam of electrons through it.

Once her sample was under the SEM, Ault saw textures and grain morphologies that reminded her of polygonal grains present in quartz deformed 25 kilometers below the surface of the Earth. But her sample was from rocks gathered from much shallower depths.

This is the image I was seeing, Ault says, pointing to her laptop screen.

"Note these scale bars, this is nanometers," she says. "You cannot see this with the old type of SEM. It takes this type of instrument. This is what I saw. And I was like 'Oh my goodness. This is a sign of heat!' And one way that you can have rocks get hot, if an earthquake has happened, is friction-generated heat.

"And that changed everything. That moment has changed everything."

Ault's office overlooks the Bear River Mountains, and her shelves display a mix of the geology department's mineral samples she salvaged, rocks of various hefts she hauled back from her own field work, and posters from endurance mountain bike races she won. Ault doesn't hide the fact that she wants to do well in everything she touches.

Her students notice that as well.

Robert McDermott Ph.D. '20 was Ault's first doctoral student at USU.

Now a Mendenhall Postdoctoral Fellow at the U.S. Geological Survey in Alaska, he considers how to describe Ault.

"Her passion for what she does, it just really motivates you," he says. "She pushes you, but part of it is just sort of inherent in the interactions with her, too. You come out of a meeting with her and you are jazzed to go do some science."

Like Ault, McDermott stumbled into the field. But after his first class in college he realized that he enjoyed studying for the tests and found himself reading about geology in his spare time.

"I kind of felt like my mind was being blown and like someone was handing me the key to understanding this totally ancient world all around you," he explains. "When I realized this is an academic pursuit, that I could be really happy doing this for a career, I'm constantly amazed at my luck."

After listening to Ault at a conference, one of McDermott's mentors suggested he apply to study faults with her.

"Nobody else was doing what she was doing," McDermott says. "She was doing things that geologists had wanted to do for a long time, but in a new, unique way that was providing amazing insights. I recognized that and was like, 'I want to do that too.'"

## Meaningful Contributions

**Madison Taylor '19** has similar memories of working with Ault.

"She is such a hard worker, and she just has so much passion it is kind of impressive and intimidating, but in a good way," Taylor says. "I think she does a great job at engaging her students and empowering them to conduct research for themselves."

Taylor first met Ault in a geoscience communications course and was impressed by the in-depth comments she would leave in the margins. It was precisely what she wanted from a professor — feedback on how to improve.

"My life is spent in track changes," Ault laughs.

But she is serious, too.

Ault's identity is forged through her work and encouraging her students to explore new terrain. She pushes them. And she praises them.

"She discovered textures that we have never seen before," Ault smiles, recounting research Taylor conducted as a 2019 Peak Fellow at USU. She analyzed hematite samples from the Hurricane Fault to observe the textures and determine their cause and how to date those textures to learn more about the fault slip. Taylor now works as a geologist for an environmental consulting firm in Washington and credits Ault for teaching her how to ask good questions.

"That is a really good way to learn more and engage on a deeper level," she says.

These days, Ault finds herself asking new questions and partnering with experts from other disciplines to study hematite in natural faults and how it deforms in the lab under various conditions. It means moving into new territory. And, even for Ault, that can be hard.

"To make meaningful contributions to science, and to society in applying the tools that I am an expert in to fault rocks, I have to understand earthquake mechanics, all of these things that are new for me," she admits. "This is not my training. And that is exciting, but also an intimidating space."

She pauses before carefully continuing.

"My job is everything to me, and I try and get it right and to teach my students to get it right," Ault says. "I do push them. But I am learning right alongside them." **A**

Left to right: Geologists Rebecca Flowers and Alexis Ault in the Northern Madison Range of Montana during field work to collect rock samples containing zircon, which Ault examined using a scanning electron microscope with special detectors to "date" using radioisotopes. These zircons could only be discovered by "zooming in," and the data from these tiny grains gave us the "big picture" evidence of mountain building about 1.7 billion years ago, Ault says. Photos on this page courtesy of Alexis Ault.

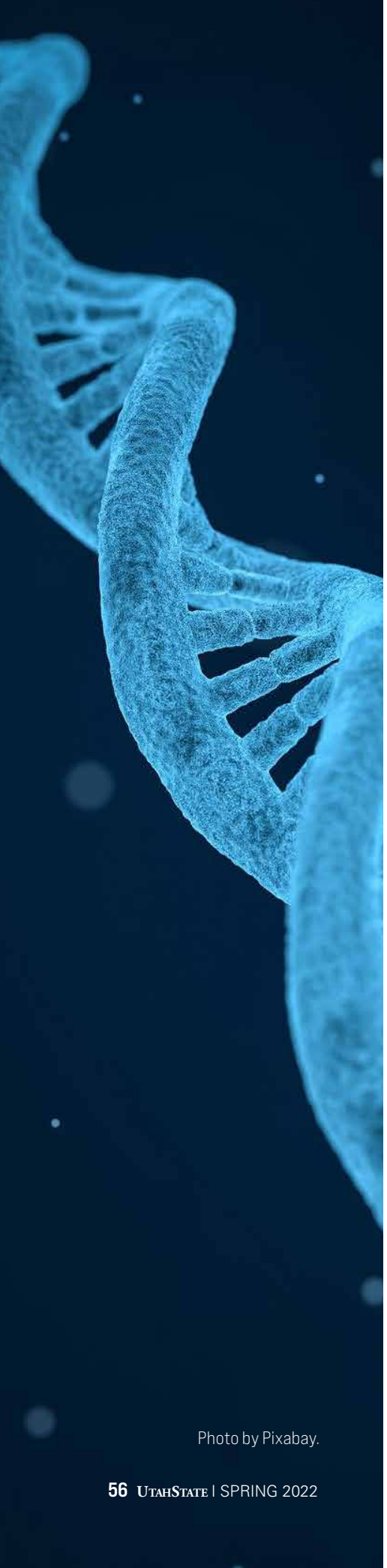


Photo by Pixabay.

# Editing the Course of Health

By Kristen Munson

**Does the idea of genetic engineering make you feel hopeful about the future or queasy about where it's headed?** When you hear about genetically modified organisms, does your mind jump to the end of humanity as we know it? Then let's start smaller with something like a Syrian hamster.

The truth is humans have spent centuries shaping the traits of our foods (and pets) using selective breeding to create sweeter corn, French bulldogs, and the banana we know and love today. We developed new plant strains through cross breeding, exposure to radiation, and introducing bacteria for pesticide resistance. However, these methods have often lacked a key factor — precision.

"It was more of a guess or a hope," explains **Ryan Jackson, '05, Ph.D. '12,** assistant professor of biochemistry in his March 2021 Science Unwrapped talk, "A CRISPR Understanding: How Genetic Engineering Will Impact Our Lives Now and in the Future."

Jackson studies the mechanisms of bacterial immune response against viral infections with a goal of uncovering new gene-editing tools akin to those used in CRISPR-Cas9 systems, a natural self-defense method discovered in bacteria in the late 2000s and adapted as an instrument for gene editing. But what exactly is CRISPR, and will it prove as revolutionary as predicted?

In 2019, 34-year-old Victoria Gray became the first patient in the United States to undergo an experimental treatment using CRISPR to treat sickle cell disease, a debilitating condition she had since childhood. The procedure involved removing her blood stem cells to disable the gene and replanting them in her bone marrow. She now lives symptom free. Will Gray's experience be scalable to the masses?

For Jackson and **Zhongde Wang,** a professor of transgenics, molecular biology, and stem cell research at USU, genome editing technologies hold immense power by making tiny tweaks to DNA — if used appropriately. The two professors break down what they see on the horizon.

**In 2020, Jennifer Doudna and Emmanuelle Charpentier were awarded the Nobel Prize in chemistry for their work pioneering CRISPR-Cas9 into a gene-editing tool. Why is this technology such a big deal?**

**Ryan Jackson:** CRISPR stands for clusters of Regularly Interspaced Short Palindrome Repeats, which describes a curious pattern observed in the DNA of bacteria — the same sequence of DNA is repeated over and over, but in between the repeats are unique sequences called spacers. Although this pattern was first observed in a lab strain of *E. coli* in 1987, it wasn't until 2005 that scientists discovered the unique spacer sequences were identical to parts of virus DNA. This observation led scientists to wonder if CRISPR could be a memory of encounters with viruses that could be used to fight off future infections.

In bacteria, the CRISPR DNA containing the virus sequence is transcribed into an RNA component that combines with a protein called Cas9. The part of the RNA that is identical to the virus sequence binds to virus DNA. Once the virus DNA is bound, the Cas9 protein cut the

virus DNA before the virus can damage the cell. Jennifer Doudna and Emmanuel Charpentier were the first to show Cas9 could be reprogrammed with a synthetic RNA to make a precise cut in DNA. CRISPR lowered the barrier for gene editing because it is cheap, easy to use, and it works. You can buy Cas9 to cut genes in cells from asparagus to aardvarks; you just need a little bit of training.

## CRISPR-Cas-9 is used because of its precision delivery. What happens when it misses the mark?

**RJ:** It really depends on the location of the off-target. If the off-target location is in the middle of an essential gene, then the edited cells will die and the organism will still have the disease you are trying to treat. But, for instance, if we accidentally cut a gene that flags the immune system when a cell becomes cancerous, then we could potentially cure you of one genetic disease (e.g. sickle cell disease) but give you another in its place (e.g. leukemia). The biggest fear is that we are editing in places that we don't know what we are doing and could pass that harm to future generations. That is why scientists have drawn a hard line at not editing the human germ line, and why I am not surprised a tomato is the first commercially available CRISPR product. The risk is low in agriculture. You can just burn the crop when you are done. You can't do that with human health.

## Dr. Wang, your lab developed the world's first genetically engineered Syrian hamsters using CRISPR to study conditions from hantavirus infection to cystic fibrosis. Why did you decide to modify hamsters instead of mice or rats, the typical stand-ins for human disease models?

**Zhongde Wang:** Let's talk about why mice and rats are used a lot — it is not because they are better for models. There are strains that are genetically very pure (inbred), which are good for studying genetic correlations with a phenotype. Other reasons that mice and rats are often used are that genetic engineering techniques were first established in these species and that more experimental reagents are available. Animals like hamsters, guinea pigs, and naked mole rats offer some unique advantages, as well as some disadvantages for human disease modeling. Hamsters show very similar disease progression as humans for pancreatic cancer and many other diseases but were somewhat neglected because there was no way to edit their genome. That was a huge technical block until our lab took up the challenge.

## You have more than 30 different genetically modified hamster models for examining the mechanisms for infection from hantavirus to colds in immunosuppressed people. How do you select where to put resources?

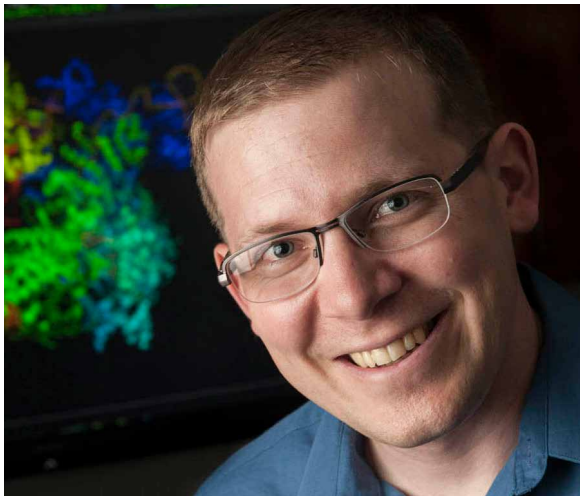
**ZW:** You want to address very significant questions. There are urgent needs for modeling diseases and many models that are not good. I review the literature and talk to scientists to identify what are the urgent needs in human disease modeling with animal models such as hamsters. I also like to collaborate and have been working with many experts in viral infection. And by working with others we don't have to reinvent everything. For us, we just want to develop the techniques to edit the genome.

## These days you are excited about working with naked mole rats. Why?

**ZW:** Naked mole rats live cancer free, never age, and rarely get sick. Older females reproduce just like the young ones. Behaviorally, a naked mole rat colony in the wild can be a few hundreds of animals, but there is only one queen and other animals form teams by playing specific roles in maintaining the colony. Naked mole rats can tolerate zero oxygen for 18 minutes. Think about stroke and heart attack victims. People say 100 years is long enough to live because you don't want all the diseases, body pain, and memory loss that can come with age. Naked mole rats are amazing in defying aging, and we can learn a lot from them. I joke that my lab motto is "Live and work like a naked mole rat."

## We've talked about some of the risks of gene editing. In the next 30 years, where do you think we will see the greatest improvements because of gene editing?

**RJ:** I will get a little bold with my predictions. I bet diagnostic tools will be amazing. We will be able to know very quickly what diseases we are facing. I think a lot of genetic diseases will be on the table to be cured and certain cancers will be much less scary. We will be able to target and take them out. If I am being optimistic, genetic engineering gives us tools to face a lot of challenges, like tackling the energy crisis, drought, and climate change. We could be manipulating genomes of plants to help us make fuels. My guess is the



Ryan Jackson studies the mechanisms of bacterial immune response with a goal of uncovering new gene-editing tools. Photo courtesy of Montana State University.

Zhongde Wang has developed several genetically engineered animals from the first Syrian hamster to guinea pigs that are used for modeling human disease, including treatments for COVID-19. Photo by McKay Jensen.

future is probably going to be better than anything I can predict.

**ZW:** Some people have concerns about editing animal genomes for biomedical or agricultural applications, but I would say that gene editing is extremely accurate, and it can solve a lot of problems that can otherwise not be solved. To me, what is amazing is what is possible with tiny changes in the genome. On the agricultural side, mastitis is the most expensive disease in the dairy industry, and it has been established that genetics plays important roles in mastitis-susceptibility. We could do genetic selection to select certain cows that are more resistant to mastitis, but that takes a long time and tends to co-select other undesirable traits, such as low milk production. On the other hand, gene editing is very efficient and precise to bring about the genetic changes in a fraction of time that would otherwise be required by conventional breeding. I think improving mastitis-resistance would be helpful not only for animal welfare, but also for the environment because you won't need as many cattle to produce milk.

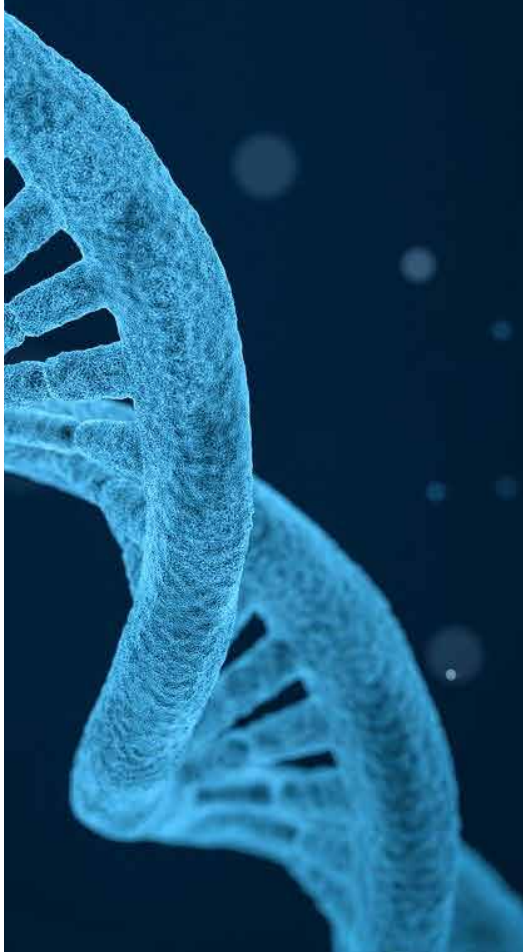
## Speaking of livestock, Dr. Wang, you are a proponent of using cattle and sheep as bioreactors to generate therapeutic antibodies. Why?

**ZW:** Production of therapeutic antibodies or recombinant protein by cell culture-based bioreactors is currently too expensive. Not many companies have bioreactors large enough to produce kilos of antibodies, and the cell cultures currently used are prone to bacterial infection. To produce a therapeutic antibody for hundreds of millions of people for something like HIV you have to make a sufficient amount at low cost. Using genetically engineered cattle and sheep, or other large farm animals, can produce better antibodies and in greater quantities.

## Some people are concerned that tools like CRISPR could be used in the wrong way. Are our ethics keeping pace with the science?

**RJ:** I think our knowledge of the mechanisms is outpacing the ethics. But this is kind of how technologies have always been. Some of our greatest advancements in energy and transportation were because of war. I also think we are doing better on this issue than we ever have. As far as I know, everyone is trying to use CRISPR responsibly. The other thing is that nature fights back. Although we have learned a lot, there are selective pressures we haven't thought of yet, so when people say I bet we can get rid of the mosquito, I bet we can't. As smart as we think we are, we will probably keep learning. A

**Victoria Gray** became the first patient in the United States to undergo an experimental treatment using CRISPR to treat sickle cell disease, a debilitating condition she had since childhood ... She now lives symptom free. Will Gray's experience be scalable to the masses?



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Crystal Fowler holds treated and untreated onion seeds that she tested for viability in the Logan campus greenhouse. Photo by Levi Sim.

# *Small Seeds, Big Savings*

By Kristen Munson

As a kid, Crystal Fowler '21 was the person watering her family garden in Apple Valley, Utah.

"I wasn't aware of how much I enjoyed it at the time, but it makes sense now," she says.

Last summer, the senior biological engineering major spent weeks germinating nearly 700 onion seeds in the Crop Physiology Laboratory to understand how slight differences in weight affects viability.

In Utah, onions are one of the biggest produce crops, she explains. "Looking at this for Utah was kind of a big thing because it could help a lot of onion farmers here. We tried to pick [a cultivar] that was the old tried-and-true onion that is grown in Utah."

The study was part of a 2021 Undergraduate Research and Creative Opportunities grant she was awarded and she suspected it would demonstrate a link between higher seed weights and increased germination rates as similar studies of vegetable seeds have before. Fowler divided the seeds into raw and primed categories and tested them across seven temperature settings. Things did not go as expected.

"We didn't find any evidence that separating seeds via the size made any difference in the viability," she says. "We were expecting to see the difference just because it's pretty much universally accepted that larger weight would equal more viability."

However, they did find that primed seeds behaved differently around 12 degrees Celsius than raw seeds — an unexpected result. The discovery launched a second experiment examining how temperature differences throughout the day affect viability. During the initial study, the temperatures were constant, and that's not exactly representative of the natural world, Fowler admits.

Potentially, growers may not need to grade seeds by weight anymore, she says. "It would save them money and time if they don't have to do all that grading for all of those seeds."

But how did this bioengineer end up in a greenhouse planting onions?

"I really wanted to look at different types of life, and that includes plants," she says. "I feel like there is a lot of plant research that hasn't been done yet, either. I am just so interested in plants and their mechanisms because they are so different from people and have all these cells that we usually don't study in my major."

Fowler hopes to continue studying plants in graduate school for agricultural engineering and mulling over the possibilities. Maybe she will dig deep into soil and water interactions. Perhaps investigate ways to engineer plant physiology to express different traits, she muses. Another possibility: growing plants in space.

"That sounds so cool and it seems like a huge problem that is going to take a lot of people to work on," she smiles. "It kind of seems like that is where our future is going." **A**

# IN MEMORIAM // *Through Feb. 1, 2021*



## 1940s

Helen Badger '45, Jan. 10, UT
Douglas H. Campbell '49, Oct. 23, UT
Phyllis A. Chatwin '40, Dec. 10, UT
Marian I. Christensen (Feulner) '41, Sept. 18, UT
Dorothy R. Cowley '48, Jul. 21, UT
Alice A. Fife (Ackroyd) '47, Sept. 7, UT
Elaine A. Harris (Adams) '43, Aug. 30, NV
Ruth N. Kelley (Holmes) '49, Nov. 19, UT
Elizabeth L. Liechty (Gardner) '48, Sept. 18, CO
Dwayne E. Manful '49, '64MED, Jan. 3, UT
Marion T. Moore '49, Aug. 2, TX
Helen B. Morris (Bradshaw) '49, '68MS, Jan. 21, UT
Glen C. Olsen '49, Nov. 27, ID
Ella C. Porter '48, Sept. 11, UT
Colleen Springer (Hall) '48, Jan. 3, WY
Robert S. Welch '49, Aug. 17, UT
Shirley C. Welch (Chandler) '49, Sept. 15, UT
Kenneth L. Woodward '48, Dec. 24, CA
Alice Wyatt (Snooks) '45, Jun. 11, UT

## 1950s

Lianne Gibson Aiken '57, Nov. 12, UT
Vern L. Ashcroft '56, Jul. 24, UT
Ulene Atkinson '58, Jan. 1, UT
Arnell S. Atwood (Swenson) '59, Jan. 8, UT
Clyde F. Baugh '55, Jun. 14, CA
Perry Clinton Beckley, Jr. '59, Sept. 17, CA
Karen Dunn Black (Dunn) '58, Sept. 16, AZ
Wesley Blood '59, '77PHD, Aug. 5, UT
Loren F. Bohner '53, Jun. 18, UT
Eunice H. Borgholthaus '53, Oct. 31, UT
Calvin R. Bybee '51, '57MS, Sept. 21, UT
Richard B. Campbell '57, Aug. 12, ID
Duane G. Chadwick '52, '78MS, Nov. 13, UT
Connie Chatlin (Chugg) '59, Jul. 2, UT
Reed L. Clayson '54, Jul. 29, UT
Lloyd A. Clement '54, Nov. 1, UT
Max Cologna, Jr. '56, Jun. 20, CA
Stanley S. Cunningham '54, Dec. 5, UT
Robert H. Daines '56, Nov. 2, UT
Franklin C. Dallimore, Jr. '51, Jul. 1, UT
Keith Dalton '56, Aug. 12, AZ
Ronald Hokanson Dana '56, Aug. 2, CA
Goldy Dawson (Mehas) '54, Jul. 26, WY
Carl H. Durney '58, Nov. 29, UT
Robert J. Engelhard '50, Sept. 21, WI
Willard G. Erickson '51, Dec. 2, UT
Marlin A. Fairbourn '54, Nov. 18, UT
Anna R. Field (Robinson) '50, Sept. 18, UT
Annette Gardner (RAY) '59, Aug. 17, UT
Dillard H. Gates '56PHD, Oct. 24, WA
Shirley W. Gilbert (Wangsgard) '59, Dec. 24, ID
Robert C. Gustaveson '51, '54MS, Nov. 2, UT
Darrel W. Guthrie '51, '63MS, Sept. 14, UT
Blaine D. Hales '58, Aug. 26, UT
Rodney N. Hall '57, Sept. 23, ID
Lorenzo Duane Hallows '50, Aug. 27, UT
Deane Harrison '54, Oct. 16, UT
Bartley G. Hatch '50, Nov. 3, OR
Merlin O. Hatch '59, Sept. 18, UT
Carroll O. Hodges '58, Jul. 26, UT
Max R. Hogan '51, Dec. 31, CA
Dee Hubbard '52, Nov. 13, UT
Elma A. Huber (Zollinger) '54, Sept. 8, OR
Blaine A. Hyer '56, '66MED, Jan. 11, UT
Bob Inama '59, '65MS, Aug. 9, ID
Joseph B. Jensen '58, Sept. 27, UT
David L. Jeppesen '57, Aug. 30, UT
Roland W. Jeppson '58, '61MS, Sept. 29, UT
Pearl C. Johnson (Cox) '54, Dec. 25, UT
Harold Dwane Jones '53, Sept. 17, AZ
Keith Jones '59, '73MBA, Jun. 10, UT
LenaMae Muehlfeit Korth (Muehlfeit) '52, Jan. 2, UT
Margo M. Krusi '55, Sept. 28, UT
Bob D. Landeen '50, Jul. 21, ID
Annie F. Larsen '51, Sept. 28, UT
R. Paul Larsen '50, Oct. 5, UT
Glen R. Larson '54, Aug. 26, AZ
Richard H. Lemmon '59, Aug. 7, UT
Merlin Leonhardt '55, '56MS, Jan. 18, UT
Warda A. Lewis '58, Sept. 6, UT
Norman W. Long '51, '63MED, Oct. 20, UT
Robert L. Marsh '54, Nov. 22, UT
Gerald W. Mathis '57, Jul. 31, NV
Dwight McCallum '55, Oct. 27, MD
Norman D. Mecham '56, Nov. 1, TX
Vernon N. Miller '52, Nov. 15, UT
Joanne Morris (Milnar) '52, Oct. 1, TX
Paul D. Nelson '53, Sept. 5, ID
Marilyn Shuldberg Nielson '50, Sept. 14, UT
Maxine Nyland '55, Sept. 10, UT
C. David Nyman '59, '75MM, Aug. 8, UT
Dee L. Olsen '58, '60, Sept. 29, UT
Dorothy Nowell Olsen '52, Oct. 1, UT
Kirt M. Olson '55, Dec. 13, TX
Clark H. Oviatt '58, Aug. 25, UT
Reed B. Painter '53, '56MS, Jun. 23, UT
Mary Helen T. Parsons (Tweedie) '53, Aug. 29, UT
Merlin Gene Paul '59, '73MAC, Nov. 1, UT
Paul W. Petersen '50, '63MS, Jan. 1, UT
Glenn H. Peterson '54, Jul. 8, UT
Karl Raymond Peterson '59, '89MS, Oct. 30, UT
Ramona Peterson (Nielson) '50, Oct. 3, UT
Boyd J. Redden '57, Sept. 24, UT
Garth S. Richards '57, Sept. 26, NV
Rollo C. Richards '50, Aug. 3, UT
Sandra L. Rigby '57, Nov. 26, OR
J. Paul Riley '53MS, '67PHD, Jul. 1, UT
Reid E. Robison '50, Jan. 8, UT
Ivan D. Rowley '59, Jun. 17, UT
Oris C. Rudd '51, '64MS, Nov. 28, ID
Floyd E. Saltern '57, Dec. 14, NV
JoAnne Sandall (Wood) '56, Oct. 31, UT
Lynnwood Emmett Savage '59, Sept. 12, UT
Hawley Lincoln Schaaf '57, Sept. 20, IA
Edward L. Schrandt '57, Jul. 10, UT
D. Merrill Shupe '57, Jul. 19, CA
Derral L. Siggard '57, '60MS, Dec. 27, UT
DeWayne W. Simmons '55, Nov. 16, UT
Paul Hancey Skabelund '59, Dec. 28, UT
Carole G. Sorensen (Gates) '53, '69MED, Oct. 15, UT
George Sterling Spencer '59, Dec. 19, UT
Viona Stabenow '50, Aug. 7, CO
Melvin J. Stanford '57, Jan. 22, UT
Neldon D. Stanley '50, Jan. 11, UT
Leta B. Steinitz (Bailey) '53, Jan. 8, UT
Reid S. Stewart '56, Aug. 29, UT
Lafarr Stuart '57, Jul. 26, AZ
Calvin K. Sudweeks '50, Dec. 29, UT
Joycelyn Tarbet (Westover) '55, Jul. 21, UT
Kent Taylor '57, '62MS, Oct. 30, UT
Richard Lee Taylor '59, Jun. 19, UT
Dewayne A. Terry '57, Oct. 22, AZ
Dawna Daines Thayne (Daines) '57, Sept. 22, UT
Dale L. Tribe '50, Jan. 7, UT
John R. Wall '53, Nov. 16, UT
Mamie R. Walsh (Lewis) '54, Dec. 16, FL
Douglas S. Warren '59, Dec. 24, UT
Sam E. Warren '57, Oct. 20, FL
Albert B. Watson '54, Dec. 3, UT
Gerald D. Weast '55, Aug. 22, ID
Arthur N. Webb '50, Jun. 29, UT
Lynn T. White '51, Nov. 4, UT
Nate Woodhouse '50, Oct. 5, WA
William Jack Worlton '53, Dec. 20, UT
Sidney Ball Wyatt '59, Jun. 23, UT
Ambassador Ardeshir Zahedi '50, Nov. 18,
Keith W. Zobell '58MS, Oct. 30, UT

## 1960s

Grant LaMar Allen '68, '69MED, Oct. 19, UT
Richard B. Barnes '61, Aug. 5, AZ
Ivan K. Beane '67, Jul. 19, UT
Paul K. Bevan '64, Jul. 4, UT
David W. Bingham '64, Jul. 12, UT
David A. Black '65, '68MS, Jun. 20, UT
Don Lee Blanchard '64, '68MS, Sept. 4, UT
Grant W. Boam '66, Oct. 4, UT
Catherine Boyce (Stephens) '61, Oct. 27, UT
Clyda Brattos (Allred) '60, Jul. 7, UT
Ralph D. Brower '64, Aug. 15, UT
Gerald L. Bruno '61, Jun. 25, CA
Bruce K. Bryan '69, Sept. 25, OR
Rama Buchanan (RICHARDS) '60, Nov. 23, UT
Richard A. Buist '62, '66MBA, Nov. 28, UT
Richard L. Burbidge '68MS, Sept. 26, UT
Andrew R. Bybee '64, Aug. 17, ID
Anson Bowen Call III '64, '71MAC, Jan. 3, UT
William K. Callahan '66, Jun. 18, AZ
Homer Capener '61, Oct. 31, UT
Robert L. Capener '68PHD, Sept. 4, UT
Ivan E. Carson '69, Sept. 14, ID
Larry H. Charlton '64MED, '70EDD, Jan. 3, UT
Carole J. Chatterton (Williams) '60, Oct. 2, ID
Robert J. Checketts '67, Sept. 1, UT
Fred Matt Christensen '62, '67MS, Sept. 25, UT
Joseph G. Christensen '64, Aug. 5, UT
Stephen W. Christensen '67, Aug. 6, AK
Mildred Denton Clay (Denton) '65, Nov. 25, ID
Robert E. Colson '61, Jul. 16, UT
Michael J. Connelly '60, Oct. 4, TX
Sarah M. Cook '64, Aug. 30, UT
Virginia Cooley (Neddo) '63, '68MED, '96, Dec. 23, UT
Jerald C. Crittenden '65, '75MS, Sept. 7, ID
Ellwood B. Crosier '63MS, Jul. 21, WA
David P. Dahle '69, Dec. 21, UT
Vaughn R. Daines '64, Jan. 9, UT
Dean W. Davis '69, Dec. 18, ID
Hugh S. Davis '68, '72MED, Jan. 11, UT
Janet R. Davis '62, Oct. 19, ID
Glenn Dayton '62, Jun. 30, ID
Carol A. Dickey (Kent) '61, Jul. 24, UT
Barbara T. Dorigatti (Thompson) '62, Dec. 18, UT
Garry E. Dymock '62, Aug. 18, UT
Stephen T. Ellis '67, Jan. 8, UT
Charles D. Elzinga '64, Nov. 19, UT
Kay Bateman Ensign (Bateman) '67MS, Jan. 10, UT
Judith Ann Eriksson (Whitaker) '63, Jan. 23, UT
Larae P. Ewing '61, Sept. 10, UT
Ruth M. Foster (Maughan) '63, Oct. 1, ID
Kendall Ray Frandsen '66, Aug. 10, UT
Ellis C. Goebel '63, Oct. 2, AZ
Jay Harris Goodfellow '65, '73MS, Oct. 13, UT
Brent W. Graham '67, Oct. 22, UT
Janice Gunnell (Ashton) '64, Jan. 7, UT
Donald A. Gurr '63, Dec. 14, UT
Timothy Ursel Hale '64, Sept. 25, UT
Theodore D. Hanks '63, Nov. 23, NV
Joseph A. Hanny '60, Aug. 20, ID
Thomas J. Harding '65, Jul. 13, UT
Lavina Harper '62MS, Sept. 20, UT
Ann M. Hayes '69, Aug. 3, ID
James M. Hellyer '62, Jun. 30, CA
David E. Hieber '62, Sept. 13, FL
Marlene Hill (Evans) '62, Aug. 21, UT
Rowland Hinton '64, Aug. 13, UT
Nancy Hobbs (Pace) '66, Oct. 9, UT
Harmon S. Hodgkinson '65, Nov. 28, CO
Ronald L. Hollingshead '68, Dec. 21, CO
Elaine P. Hunter '65, Dec. 9, UT
Garn Oliver Huntington '60, '77MS, Jan. 2, UT
Arthur Jenkins '61, Nov. 1, UT
Orson E. Jensen '64, Sept. 24, UT
Reinhard A. Jockel '65, Dec. 7, UT
Larid Dee Johnson '64, Sept. 2, WY
Gail Jones '69, Dec. 29, UT
Gerald V. Larsen '62, Jul. 23, UT
Alvin K. Larson '61, '69MS, Oct. 29, AZ
Ralph V. Larson '64, Nov. 1, UT
John R. Lee '67, Jul. 13, AZ
Leon Lewis '62, Sept. 6, UT
Claude K. Lister '63, Jan. 15, CO
Rod Lister '66, Oct. 28, UT
Sharon Lofthouse '68, Jul. 18, UT
Darlene K. Lowder '61, Nov. 28, ID
Samuel S. Lower '62, Nov. 27, UT
James L. Martsch '64, Aug. 18, ID
John C. McCarthy '62, Jul. 12, CO
Kolette M. McClurg '67, Oct. 9, UT
Thomas M. McKee '69, '73MS, Oct. 2, CO
Darlene G. Mecham '63, Jul. 29, FL
John R. Michaelsen '60, Jul. 27, UT
Jeanie H. Michie-Timm (Haselman) '68, Nov. 11, UT
Paul E. Moser '67, '68MS, '71PHD, Jun. 28, ID
Paul D. Murray '62, Dec. 31, AZ
Eileen Nessen (Agee) '65, Aug. 4, UT
Karen Layn Nielsen (Alvord) '62, Dec. 17, NV
Paul M. Norton '67, Jan. 1, UT
John Frederick Nye '61, Dec. 8, UT
Judge Dean F. Olsen '60, Oct. 12, UT
William Olson '63, Aug. 29, UT
David Lincoln Orme '61, Dec. 17, VA
Jane Anderson Palmer (Anderson) '65, Sept. 13, CO
Alan R. Peterson '64, Oct. 28, ID
Jerry P. Peterson '60, '69MS, '74SPEA, Dec. 23, UT
Linda Lee Peterson '64, '68MFA, Jun. 26, UT
Rebecca Sue Peterson (RASMUSSEN) '64, Jan. 9, UT
Stephen S. Petrick '63, Aug. 31, PA
Afton I. Pintar (Banks) '66, Jan. 2, UT
Merlene G. Poloni (Jowell) '64, Jul. 23, UT
James Philip Pugsley '68, '84MS, Dec. 25, UT
William Woodbury Quist '62, Jul. 10, UT
Steven Garn Rasmussen '67, Aug. 9, UT
Steve Sheldon Rawlings '69, Sept. 29, ID
Swendolyn G. Redden '66, Jun. 16, UT
Senator Harry Mason Reid '61, Dec. 28, DC
Gary V. Rice '62, Jun. 16, WY
Bill Richardson '69, Aug. 25, OR
Roger M. Richins '62, Jul. 23, UT
Vicki Lynn Ricketts (Woodward) '69, '98MED, Jan. 6, UT
Ward B. Roberson '65MS, '68PHD, Jan. 12, AR
Golden G. Roper '65, Jan. 23, UT
Carl H. Sakaki '68, Jul. 6, HI
Carl H. Saloman '60, Aug. 25, FL
Eldon B. Schwartz '64, Aug. 13, UT
Lana P. Seamons '64, '67MS, Dec. 15, UT
Nancy Rose Sellick (Moulton) '69, '92MS, '96EDS, Jul. 23, UT
Sally A. Sessions (Huber) '61, Jun. 13, AZ
Eleanor L. Slaugh (Lawrence) '66, Oct. 8, CA
Carol H. Smith (Hatch) '65, Oct. 22, UT
Sheila Steiner (Thorderson) '65, Aug. 9, UT
Vern G. Stembridge '61, Jul. 3, UT
Earl Reed Stephens '60, Sept. 1, UT
Leonard Stephenson '63, '71MBA, Nov. 2, UT
Tina Stewart (Hollands) '68, Aug. 5, ID
C. Gene Sturzenegger '63, Jan. 7, UT
Dorene Mae Sudweeks (Collett) '60, J ul. 21, UT
Charlie G. Summers '64, '67MS, Aug. 12, UT
Vernon Summers '64, '66MS, Sept. 22, UT
Dewaine E. Symons '61, '76MS, Jun. 29, UT
Gary L. Taylor '67, '69MS, Sept. 15, UT
Patricia B. Taylor '69, Sept. 2, UT
Randy Taylor '61, Jul. 20, UT
William L. Taylor '65, '68MBA, Oct. 25, CA
Michael S. Taysom '65, '66MS, Jun. 21, ID
Alma Willis Tingey '66, '81MED, Oct. 7, UT
Marvin N. Tolman '64, '75EDD, Nov. 3, UT
Grant Vest, Jr. '60, '64MS, Jul. 18, UT
Roger E. Wade '62, Aug. 28, UT
Zane K. Wall '61, Nov. 2, UT
Brent Wallis '68, '78MS, Jul. 16, UT
Ronald M. Walters '66, Dec. 17, ID
Garwood H. Walton '61, '62MBA, Aug. 27, UT
Wendy Wangsgard '60, Sept. 23, CA
Richard Manning Webster '65, '68MS, Aug. 28, UT
Glen A. Weight '62, Aug. 21, UT
James C. Whitmore '69, '76MS, Nov. 24, ID
Michael H. Whitworth '67, Aug. 22, OK
Janet B. Wilcox '67, Oct. 20, UT
Barry T. Williams '66, Oct. 6, ID
Deanna Fonnesbeck Wilson '62, Jan. 12, CO
Rodger B. Woodward '66, Jan. 2, ID
Susan Wright '69, Jul. 24, ID

## 1970s

Vikki Aleen Allred '75, Nov. 12, UT
Dale Andra '71, Aug. 10, UT
Charles M. Atkinson '75EDD, Jul. 20, WA
James E. Barnes '73, '76MIE, Dec. 12, WA
Suzanne K. Beasley '76, Dec. 10, UT
Douglas Giles Beck '76, '77MS, Jan. 4, ID
Richard Jon Bell '79, Oct. 12, UT
Keith E. Bingham '78, Jul. 16, UT
Ronald R. Bishop '71, '73MS, Dec. 14, NE
Walter Glenn Bleak '70, Oct. 24, UT
Lawrence W. Bull '74MS, Oct. 30, UT
Sandra Heath Burridge '74, Nov. 24, UT
Ann Buttars '71, '78MS, Sept. 9, UT
Glen J. Bybee '73, Aug. 6, UT
Anne C. Caine '78, Jan. 3, UT
Ray Lamar Carlson '73, Oct. 2, ID

Saxon Reese Castle '70, Nov. 11, UT
Paul B. Chance '73PHD, Nov. 15,
Roderick L. Chapman III '72, Dec. 25, NH
Jay E. Christensen '72MED, Oct. 12, UT
Pam Christie (Boynton) '79, Aug. 9, VA
Michael M. Crane '79, Jan. 15, UT
William Arthur Crosby '72, '81MED, Nov. 2, UT
Kayleen Campbell Curtis '77, '98MS, Aug. 18, UT
Don Alan Davis '77, '00MBA, Dec. 12, WY
Thomas E. Davis '73, Jan. 6, UT
Billy J. Dye '74, Nov. 18, UT
Michael S. Eldredge '72MA, Oct. 26, UT
David H. Findlay '76MS, Nov. 17, UT
Kathryn Fuentes (Whittle) '79, '86MS, Dec. 17, CA
Marsha Grange Fuhriman (Grange) '74, Sept. 28, UT
Carol C. Gabrish '71, Nov. 22, UT
Alfonso E. Garcia, Jr. '78, Nov. 8, UT
Donald Gerszewski '78, Jun. 26, UT
Naida L. Goodwin (Larsen) '71, Jan. 19, UT
Kent P. Hackley '71, Jan. 19, UT
John T. Hamilton '78, Jul. 3, MT
Joan N. Hammer '71MMA, Jul. 9, MN
Joseph Karl Hancock '77, Jun. 16, UT
Craig Mathew Hauzen '75, Sept. 6, UT
William C. Holm '77MS, Nov. 1, MN
Robert Corey Jenkins '77, '79MS, Nov. 15, UT
Heber C. Jones '70MS, Aug. 3, UT
Lionn Dean Kirk '78PHD, Nov. 27, AZ
William Knittle '77, Oct. 11, TX
Steven Roger Krantz '77PHD, Jan. 2, KS
Glen L. Lewis '73MS, Oct. 26, UT
Denise Lindsay (Christensen) '76, Jun. 18, UT
Thomas L. Marsden '71, Sept. 6, UT
Gerald W. Mather '71, Nov. 6, UT
John Virgil McCaleb '75, Dec. 10, NM
Scott McKinlay '77, Jan. 17, UT
Manfred Bob Moeller '72, Dec. 10, UT
Kevin J. Morrison '77, Dec. 8, ID
Roger Chase Murdock '75, Nov. 4, UT
Bernice Neibur Nalder (Neibur) '71MS, Oct. 28, ID
Theron C. Olsen '74, Dec. 14, UT
Vern J. Osmond '70, Jun. 26, UT
Sally Jane Pando (SKIDMORE) '75, Aug. 17, UT
Brent Richards Payne '71, Sept. 7, UT
Celese Boudreaux Peters '73, Sept. 26, UT
Mary A. Petersen '75, Jan. 11, UT
Meriel B. Peterson (Bedke) '70, '80MS, Nov. 5, ID
Steve L. Poppleton '70, Dec. 7, ID
Evelene Rice (Hansen) '76MS, Oct. 7, UT
Robert W. Schara '76, Dec. 24, UT
Charles James Skidmore '75, '83, Nov. 7, UT
Brent V. Sorenson '77, Dec. 12, UT
Ray Monson Sorenson '73, Jan. 17, UT
Gerald Alan Stillings '74MS, Jun. 29, IN
Lanaun Swift (Hall) '71, Aug. 17, UT
Mary K. Ulibarri (Kirschner) '79MS, Aug. 5, UT
William G. Vaught '77PHD, Dec. 14, MO
James Michael Walker '70, Nov. 7, UT
Lloyd Walker '77, '86MS, Jul. 2, UT
Robert Jay Whitman '70, Sept. 19, UT
Mark Eugene Wilkey '78, Oct. 8, UT
Elgin B. Williams '70, Jun. 20, UT
Thomas Lynn Wiser '72, Sept. 11, ID
Ulrich E. Zeisler '74, Oct. 15, UT

## 1980s

Patrick Allen '84, Jun. 22, TX
Kristine Allred '89, Sept. 9, UT
Gary D. Bagley '85, Aug. 27, UT
Brenton M. Bauer '83MS, Sept. 10, UT
Linda S. Baum '87MED, Jul. 17, UT
William Wayne Cairns '82, Jan. 3, ID
Frank C. Carley '88, '90MS, Nov. 17, UT
Frances B. Christensen (Barlocker) '82MED, Nov. 14, UT
Bonnie Clark (Boucher) '85, Dec. 24, UT
Mitchell G. Clark '83MSS, Dec. 11, NV
Philip H. De Groot '87PHD, Aug. 31, OH
Afton Kay Earley '88, Oct. 6, UT
Brian R. Finney '80MBA, Dec. 1, CA
Robert Gordon '80, Aug. 18, UT
Muretta R. Grimm '81, Nov. 9, UT
Nanette Gutshall '84, Oct. 14, CA
Stefani L. Hanson '81, Jul. 17, IA
Carol F. Hardy '86, Sept. 2, AL
David A. Henderson '88MED, Dec. 13, UT
Burke R. Heusser '89, '90, '91MS, Nov. 18, CO
James K. Ivory '88, Nov. 19, UT
Patricia W. Labrum '86, Oct. 14, UT
Karen Louise Lyman (Lyman) '80MED, Aug. 25, NY
Sharon J. Martinez '87, Oct. 20, UT
Nancy D. McDonald (Sayles) '85MS, Aug. 9, UT
Jean Byron Newville '87MED, Oct. 8, UT
Mark C. O'Neill '85, Sept. 20, WA
Donald Petersen '80MS, Oct. 31, UT
Brenda T. Peterson '80MS, Nov. 18, WA
Randal Kay Reed '82, '85MS, Aug. 25, UT
Dirk W. Sabin '83, Aug. 16, CT
Dale Ray Settje '80MS, Sept. 1, OR
Lynn S. Sharp '81, Dec. 13, NM
Jane P. Skidmore '81, Jun. 23, UT
Dorothy Stone '81MS, Jul. 31, OR
Allen D. Svalstad '82MED, Nov. 19, MT
Jennifer Jackson Walker '89, Nov. 2, UT
Thomas C. Wardell '88, Aug. 1, WV
Claudia Keeley Webb (Keeley) '85, Nov. 9, UT
Robin White '89, Aug. 12, UT
George R. Williams '83MS, Dec. 18, UT
Joseph R. Wynn '88, Jan. 1, UT
Rex D. Yarger '89, Oct. 10, UT

## 1990s

David L. Baron '91, Jan. 19, UT
Patricia A. Browning '93, Sept. 26, UT
Eric J. Carey '91, Jan. 5, CO
Chad Williams Christmas '93, Oct. 16, UT
Bret L. Corbridge '95, Sept. 20, ID
Annette K. Eddy '98MS, Sept. 20, UT
Leslie Eickemeyer '97MED, Jun. 24, WA
Gregory W. Gassman '95PHD, Jul. 1, OR
Judith L. Giles '92MED, Nov. 15, UT
Kirsten Gwilliam '91, Oct. 25, UT
Nathan John Hardy '95, Sept. 30, UT
Rick L. Heyrend '96, Aug. 1, UT
Kirt W. Hoggan '91, Dec. 5, UT
Fern C. Hughes (Chacon) '96, Oct. 20, ID
Timothy V. Jones '98, Nov. 19, UT
Az Knapp '98, Jul. 1, CA
Susan Lemon '94, Sept. 8, UT
Brett J. Mathews '96, Aug. 24, UT
Cindy J. Maw '95MED, Aug. 8, UT
Melanie Ann Morgan '90, Jun. 12, UT
Kenny W. Olsen '92, Jan. 20, UT
Samuel Eugene Peterson '95, Oct. 31, WY
John W. Pinkston, Sr. '93, Jul. 13, UT
Mardrene R. Robinson '99, Sept. 17, UT
Carl Richard Smith '97, Sept. 15, CA
Cynthia K. Smith (Kinder) '90, Sept. 20, UT
Phyllis E. Smith '94, Oct. 1, CA
Margaret Southards '92, Dec. 1, UT
Lewis D. Stilson '96, Oct. 29, UT
Jeffery G. Tilton '95, Dec. 7, OK
Robert B. Wadsworth '96, '99MS, Sept. 24, UT
Heidi Weaver '95, Jun. 27, ID
Karen L. Weeks '99, '04MS, Aug. 1, UT

## 2000s

Nile F. Adams '02MBA, Dec. 30, UT
Sherry Argyle '01, Dec. 16, UT
Sylvia L. Bailey '03, Nov. 24, UT
Taylor M. Black '16, Jul. 31, UT
Amanda L. Borup '06, Sept. 7, AZ
Norman E. Clark '02, '05MS, Oct. 25, UT
Wayne C. Cobia '01, Jul. 3, UT
Naté Dearden '06, Sept. 9, UT
Larry N. Dew '00MBA, Sept. 13, UT
David E. Drorbaugh '02MSS, Sept. 4, UT
Elizabeth Ashley Egnew (Nieuwland) '07, Jul. 30, UT
Virginia Norris Exton '08EDD, Sept. 29, CO
Jonathon Michael Fauver '02, Jun. 15, UT
Greg M. Fisher '07MAC, Dec. 10, UT
Eric R. Godfrey '09, Aug. 15, UT
Christy Hallesy '00, Aug. 15, UT
Vicki L. Harding '01, Oct. 1, UT
Allen B. Henrie '08, Jul. 12, UT
Connie Johnson '07, Oct. 15, UT
Liesl J. Leyba '05, Jan. 4, UT
Linda Lynch '07MED, Jul. 26, UT
Mark B. Major '02, Oct. 8, MT
Andy Curt Marchello '05, Nov. 23, UT
Marci Moulton '00, Aug. 30, UT
Charles Munyan '05, Nov. 10, UT
Linda Nate '00, '05MS, Oct. 19, UT
Paul T. Nelson '02, Jul. 12, WV
Birgitta H. Richardson '06, Oct. 22, UT
Adam J. Rounds '09MBA, Jun. 14, UT
Kristy A. Sorensen '05MS, Jun. 15, AZ
Travis S. Thurgood '06, Jan. 18, UT
Denise K. Tweddell '00, Jul. 9, UT

## 2010s

John Kenneth Aalders '18, Jan. 5, UT
Brian D. Barnes '14, Jun. 27, KS
Ryley Bresee '17, '18MS, Dec. 6, UT
Scott D. Giancheta '19, Jul. 12, UT
Larry Gene Gittins '12, Jan. 19, UT
Matthew Eugene Harmon '17, Oct. 1, UT
Kristen Joy Hone '18, Jun. 12, UT
Elizabeth Jones '15, Jan. 1, CO
Charles Greg Jorgensen '10PHD, Dec. 31, UT
Michaela Price '19, Sept. 29, UT
Joe Richard Slansky '16, Sept. 30, UT
Rosanna Pitcher Wheatley (Pitcher) '10, Aug. 14, UT
Kevin P. Whitaker '13MA, Jan. 11, UT

## 2020s

Connor Del Clay '20, Nov. 14, UT
Kallie Edwards Peterson (Edwards) '20, Aug. 15, UT

## ATTENDERS

Joy Abbey (Munk) Dec. 21, UT
Benson Close Adams Jun. 29, WA
Joel David Adamson Sept. 6, UT
Wade R. Adison Jul. 25, UT
Arthur Aguayo Jul. 25, UT
Amye Grace Allen Nov. 13
Jason R. Almond Jan. 19, UT
Floyd Anderson Sept. 4, UT
J. Max Anderson Aug. 12, UT
Jan Afton Anderson (Garnder) Sept. 30
Lori L. Anderson Jun. 23, UT
Rachel M. Anderson Jan. 4, UT
Ray E. Anderson Dec. 29, UT
Virgil Reese Anderson Jun. 23, UT
Eilene Ashby (Workman) Dec. 10, UT
Holden Aston Dec. 1, ID
Mike Atwood Jul. 21, UT
Aleesha S. Bailey Aug. 2, UT
Don W. Bailey Dec. 24, UT
Lee W. Bailey Jul. 9, UT
Michael S. Bailey Oct. 13, UT
Nellie Anne Baker (Bay) Aug. 2, UT
Valene R. Baker (Robins) Oct. 25, UT
Verdis L. Barker Jun. 22, UT
Elva Marise Barrett Oct. 19, UT
Frank W. Basso Nov. 30, UT
Karlene Bauer (Humphrey) Nov. 27, UT
Michele Bauer Jun. 10, ID
Bruce Burton Baugh Nov. 9, UT
Gerald D. Bell Oct. 30, UT
Dick Bentley Jul. 16, UT
Sharon B. Bergeman Aug. 24, UT
Kent J. Bigler Sept. 16, UT
Kenneth Bird Dec. 22, UT
Ella J. Bishop (Carlson) Sept. 3, ID
Karen Black Aug. 11, WY
Loraine E. Black (Walker) Nov. 2, UT
Ben Blackburn Sept. 11, UT
Ricky D. Blackburn Dec. 17, UT
Marion Bloomquist (Johnson) Jul. 16, UT
Norma Anderson Bodily (Anderson) Sept. 18, UT
Marilyn Boman (Haslam) Jul. 25, UT
Arlene J. Bonello (Jowell) Nov. 25, UT
Tyrone Bonner Jun. 22, UT
Ryland Bradley Jul. 1
Bruce Neil Brown Jan. 18, UT
Jackie Lee Brown Dec. 17, UT
Janet P. Brown Jul. 12, UT
Laurel F. Browning (Frandsen) Jun. 30, UT
Maranda Cluff Burkey (Cluff) Jul. 19
Richard M. Burr Aug. 28, NJ
Arthur Powell Burton Jun. 29, TN
Lois Buxton (Stevenson) Oct. 16, UT
Charles K. Call Nov. 29, UT
Lawrence L. Carrillo Jul. 19, UT
Robert D. Carroll Sept. 3
Cecil J. Case Sept. 15, UT
Julie Case (Anhder) Oct. 5, CO
Michael J. Caudle Sept. 30, ME
Lupita Cazares Dec. 15, UT
George C. Chambers Jul. 2, UT
Gordon Lynn Chase Aug. 10, UT
Michael E. Chavez Dec. 19, NM
Betty Jean Christensen (Fletcher) Jun. 29, UT
J. Parker Christensen Aug. 15, UT
Mark Clair Christensen Dec. 18, UT
Alvin E. Christian Oct. 5, MD
Michael J. Christman Jul. 14, UT
Dennis N. Clark Dec. 24, UT
Shirleen Thompson Clark (Thompson) Aug. 16, UT
Gayle Condie Aug. 21, UT
Rozann H. Cooley Nov. 29, UT
Maureen Wright Copatch Nov. 5, UT
Dee Irving Coulam Jul. 8, UT
Stephen Harry Covalt Jan. 23, UT
Reed Richard Cowan Oct. 9, UT
Bryan D. Cox Jul. 13, UT
Seth W. Coyne Jul. 1, UT
Marilyn Blatter Crawford Aug. 6, NV
Linda W. Croft (Welch) Aug. 27, UT
Lewis M. Crofts Jan. 6, AZ
Joan B. Crus (Barber) Nov. 25, UT
Clinton Cuch Sept. 6, UT
Lary Boyd Cullimore Nov. 15, UT
Norman V. Curtis Nov. 25, UT
Craig Boyd Dahl Aug. 18, UT
Juleen Dalton (Burr) Aug. 27, UT
Zachary Darbro Jul. 5, UT
Dean M. Davies Aug. 31, UT
Carma Hunsaker Davis Nov. 12, UT
Larry Draper Davis Jan. 5
Michael Austin Davis Jul. 22, UT
William E. Davis Jan. 11, UT
William Kendall Dawson Jan. 11, UT
Klaas E. DeBoer, Jr. Sept. 16, UT
Fay H. Decker (Hopkins) Jan. 12, UT
Philip DeGroot Aug. 31, OH
Daniel Luz Diaz Jul. 12
Patrick Thomas Doherty Dec. 2, ID
David Lawrence Donnelly Sept. 22, WA
Heather A. Dougherty Oct. 31, UT
Donald Lee Easton Sept. 1, UT
Beverly Elkington (Currell) Jul. 23, UT
Beverly B. Elliott (Bingham) Aug. 16, ID
Carlos L. Elwood Jun. 11, UT
Muriel Elizabeth Elzey (Meyer) Sept. 27, UT
Cheryl Ann England (Allred) Aug. 12, ID
Erica Ann Erekson Dec. 22, UT
Joel Erickson Oct. 28, UT
Ricardo Escandon Dec. 27, CA
Robert H. Etzel Nov. 7, UT
Jana D. Every Aug. 28
James M. Ezell Dec. 11, UT
Kelly Bruce Fausett Jan. 12, UT
Joe H. Ferguson Dec. 17, UT
Vicki D. Ferrero Aug. 31, UT
C. B. Fife Nov. 26, UT
Sally T. Finch (Tueller) Jan. 8, DE
Davis Arthur Fincham Nov. 4, UT
Marilyn Fugate Dec. 25, UT
Dallas Wayde Fullmer Jul. 14, CA
Donna P. Galloway (Pate) Jan. 9, NM
Ranae Garber (Simonson) Sept. 30, UT
Corbett Garcia Aug. 5, UT
Evaleen George (Hulet) Oct. 9, WY
Joseph Wynn Gibbons Jun. 13, UT

Victor E. Gilbert Dec. 6, UT
Antonio Gonzales Dec. 14, UT
Kathleen Goodin Sept. 8, UT
Marlayne Gordon Nov. 6, UT
Robert Gordon Sept. 8, UT
Max J. Gregory Aug. 14, UT
Carrie L. Gremel Aug. 15, UT
R. Scott Gressmen Sept. 20, UT
Vincent W. Grimmett Sept. 4, UT
Jay Henry Gubler Jan. 3, UT
Glenn A. Hackwell Oct. 30, WY
Milo Rohde Hadlock Jun. 13, UT
Ahmad R. Haffar Jul. 26, GA
Melvin Hales Jul. 8, UT
Bertha Halling (Criddle) Jan. 4, UT
Carolyn Hancock (Price) Sept. 7, ID
April K. Hansen (Kirk) Sept. 5, UT
Pace Hansen Jan. 11, UT
Ted Neil Hansen Sept. 27, UT
Vern Michael Hansen Nov. 22, UT
Leon H. Harkins Dec. 19, NC
Charles L. Harris Nov. 3, UT
April K. Haynes Sept. 12, TX
Alexa J. Hedden Jun. 22
Vandell W. Henderson Aug. 19, WA
Diane Henrie Oct. 26, UT
Wendie Joy Herland (Woodward) Sept. 11, UT
Ada Jane Hillier (Pugmire) Aug. 16, ID
Brett M. Hillier Sept. 13, CA
Ronald Scott Hofler Sept. 5, UT
Georgia K. Hohlios (Konakis) Oct. 13, UT
Tom Holdaway Sept. 26, UT
Roger F. Holland Sept. 20, UT
Laurel Holman Jan. 5, UT
Eric C. Holmes Dec. 22, MT
Paul Graydon Holt Dec. 28, UT
Luana Tingey Hood Nov. 26, UT
Jeff W. Horrocks Aug. 15, UT
John S. Huefner Jan. 15, UT
Vonzzaa Dursteler Humphreys Nov. 25, UT
Gary V. Hunsaker Nov. 14, UT
Ray C. Hunsaker Nov. 18, UT
Boyd P. Israelsen Oct. 9, UT
Jace D. Jarman Oct. 10, UT
Donna C. Jenkins (Crookston) Dec. 29, UT
Gary A. Jensen Nov. 29, UT
Todd A. Jensen Sept. 20, UT
Barbara Eleanor Johnson (White) Sept. 17, UT
Billy M. Johnson Oct. 26, UT
Boyd Johnson Sept. 20, UT
Wesley D. Johnson Aug. 3, UT
Gaylan Isaac Jones Jun. 13, AZ
Gayland B. Jones Oct. 14, UT
Vatia O. Jones (Oviatt) Jan. 22, AZ
Jennifer N. Jorgensen Sept. 12, UT
Vickie L. Jost Jan. 6, UT
Myrna L. Kantor (Longhurst) Sept. 1, UT
Sherrie Wallin Kasteler (Wallin) Jan. 5, UT
Ches Katseanes Sept. 28, ID
Jason Kava Jun. 13, NE
Mary Katherine Keele Jan. 14, UT
Robert Keller Jun. 14, UT
Christine Kelly Nov. 18, UT
Connie Kelson Jan. 22, UT
Alton B. King Nov. 2, UT
Stan Knight Jun. 26, UT
Mallory B. Knop Jun. 20, UT
Guy C. Koss Dec. 20, UT
Robert Krajnc Nov. 11, NV
John R. Krauss Sept. 17, UT
Karl Kraync Aug. 28, UT
Nicholas Lameman Jul. 23, UT
Dale Lowell Larson Sept. 6, UT
Deborah A. Larson (Brey) Oct. 10, UT
Robert Lee Larson Oct. 11, UT
Gregory Scott Leavitt Dec. 9, UT
James B. Lee Dec. 26, UT
Arlene Lemon (Cox) Sept. 24, UT
Sherman Dee Lewis Nov. 3, UT
Kate Liechty (Hilby) Aug. 16, UT
Marilyn Lindley Hopkins (Jensen) Dec. 2, UT
Dorothy L. Lloyd (Hiss) Oct. 11, UT
Tara Lee Logan Dec. 28, UT
Rueben Looney Jul. 15, CO
Bennie Lee Loud Dec. 15, PA
Dave Lyman Jan. 1, ID
Kenneth Mark Lynch Oct. 1
June Mabey Jul. 20, UT
Donna Mackay Sept. 2, UT
Laurel Deene Madsen Jul. 2, UT
Helen Mallard (Stettler) Aug. 17, UT
Cherie Mangum Jul. 22, AZ
Bob Frank Martinez Aug. 17, UT
Michael Joe Martinez Nov. 19, UT
Jerilyn Mathis Jan. 10, UT
William Maxwell Aug. 24, UT
Michael Velyn McClellan Jun. 17, UT
Kirt McFarland Sept. 18, AZ
Delisa D. McManus Nov. 30
Dean W. Meacham Aug. 26, UT
Robyn Merkley Oct. 15, UT
Sheila Koeven Meservy Jun. 14, UT
Marcia Meyer Sept. 27
John Michaelson Jul. 27, UT
Leonard F. Miller Nov. 29, UT
Robert L. Miller Nov. 27, CA
Robert W. Moffitt Nov. 3, UT
Revoe Moss (Nay) Oct. 20, UT
Jayne Mott (Dansie) Oct. 2, UT
Reed Murdock Nov. 20, ID
Milton Clarkson Murphy Jun. 16, OH
Spain Musgrove, Jr. Aug. 24, MD
James Levi Myers Jul. 28
Gary Naillon Sept. 12, KS
Alice Nelson (Bateman) Aug. 13, UT
Carol Nelson Sept. 1, UT
Doloris Nelson Jun. 10, UT
Donna T. Nelson (MacPherson) Sept. 13, UT
Kaye Nelson (Willmore) Jan. 24, UT
Mark J. Newey Nov. 4, WA
Geraldine Newland Jul. 27, UT
Rose M. Nichols (Wright) Oct. 20, ID
Robert Alma Nielsen Dec. 26, UT
Tracy Kae Nielsen Sept. 22, UT
Mark A. Nisonger Nov. 3, UT
Jared D. Nordgran Jul. 31, UT
Sandra Sally Nuttall (Anderson) Sept. 2, UT
Larita Oaks Jan. 18, UT
Paul L. Olmstead Sept. 21, UT
Jan Olpin (Cummings) Dec. 23, UT
Rulon L. Olsen Oct. 25, UT
Norma Jean O'Neil Jul. 18, UT
Don Ray Oveson Aug. 6, UT
Diane Oviatt Jun. 24, UT
Brent Clark Page Jun. 21, UT
Catherine Paiz Nov. 14, UT
Michael S. Paiz Jun. 11, UT
Van James Paletta Nov. 11, UT
Kosmas Pappas Aug. 17, CA
Thomas Raymond Parker Oct. 26, UT
John M. Peak Sept. 6, NV
Dyann M. Pearson Oct. 5, KY
Judy C. Peczuh Jan. 7, UT
Edwin H. Pedersen Jun. 14, UT
Gerald Pergola Aug. 28, UT
Rolynn Perri Jan. 9
Beverly Petersen (Jensen) Oct. 4
Betty L. Peterson Aug. 16, UT
Clarice Peterson (Anderson) Oct. 9
Tyson R. Peterson Aug. 15, CO
Kenneth R. Pierce Jul. 21, UT
Kent D. Pilling Jul. 12, UT
Tabitha Ivy Pitts Jul. 30, UT
Sandra McCann Poulsen Jun. 20, UT
Colton Samuel Powell Nov. 25, UT
Robert Bleak Powell Jun. 18, ID
Shirley Prettyman Jan. 22, UT
Jim Pugliese Sept. 27, UT
Donald Fay Pugmire Jun. 16, UT
Nikki Ann Purcell (Schuller) Oct. 29, UT
Clinton Glade Quilter Jul. 20, CA
Paul Steven Quist Jul. 30, UT
Stanley Tingey Randall Jun. 24, UT
Renee A. Ransom Dec. 28, TX
LuAnne Rasmussen (McCLellan) Oct. 17, ID
Rodney Allen Rasmussen Jul. 13, UT
Kathy A. Reeder (Allred) Jul. 22, ID
Martin Charles Reeder Nov. 24, UT
Russell R. Reeder Dec. 6, UT
Ione M. Reese (Marchant) Jan. 18, UT
Scott Reese Dec. 15, UT
Derrell G. Reeves Jan. 2, UT
David Reflexia Dec. 15, UT
Keith Reid Sept. 7, AZ
Bob Lee Richards Jul. 21, UT
Bartley Richardson Sept. 29, UT
Royal J. Rigby Dec. 18, UT
Richard D. Riggle Oct. 24, UT
Dale K. Roberts Jan. 4, CO
John Elton Roberts Jun. 27, UT
Thayne R. Rodabough Jul. 10, UT
LaRee K. Rogers (Keller) Jul. 2, CA
Frank L. Sacco Aug. 7, UT
Marilyn P. Sanders Nov. 21, CA
Judy Sanderson Sept. 23, UT
Barbara G. Savage Sept. 15, UT
Laurie Eileen Schwegler Sept. 28, UT
Neal John Scovill Sept. 27, UT
Gordon J. Seamons Jan. 8, UT
Michelle Watts Seamons Sept. 26, UT
Parviz S. Shahbazifirooz Dec. 5, UT
Doris Shaw Jul. 11
Donna Shimmin Jun. 13, UT
Leslie Silvester (Graham) Jan. 3, ID
Richard Lynn Simmons Oct. 24, UT
Richard Porter Simmons Jun. 19, AZ
Cecy Bastos Slaugh Nov. 1, CO
Scott Brunson Smedley Sept. 10, UT
Ellen Larsen Smith Oct. 29, UT
Estle L. Smith Sept. 1, UT
Brent Marriott Snow Aug. 30, GA
Edward Merlin Soderstrom Jun. 13, MN
Steve Star Jun. 17, CA
Raymond A. Stefanski Jun. 27, WI
Nada Stevenson (Cardon) Jul. 12, UT
Jeffrey Squire Stiver Dec. 9
Carol Jean Stoker (Esperson) Aug. 24, UT
Andrew Ray Stokes Oct. 20, UT
Jennifer Storms Jan. 7, ID
Cheryl L. Stott Sept. 8, UT
DeAnn Stringham Nov. 22, UT
Marion Stuart Aug. 2, UT
Paula M. Swaner (Margetts) Nov. 30, UT
James Bryce Syndergaard Dec. 11, UT
K. Denton Taggart Sept. 27, UT
Thomas Tahguv Aug. 26, UT
George L. Talbot Nov. 2, UT
Spencer Z. Taylor Sept. 23, UT
Staci L. Taylor (Jackson) Jun. 16, UT
Robert W. Tew Aug. 13, CA
Ray Thomas Dec. 10, UT
Charlene Z. Thompson (Zollinger) Jul. 1, UT
Kip O. Thompson Oct. 25, UT
Leland Lafayette Thompson Dec. 28, UT
Peter A. Thomsen Oct. 16, CT
Kevin B. Thurston Sept. 3, UT
Richard P. Trujillo Dec. 12, UT
Sam J. Trujillo Oct. 24, UT
Patsy Tryon Nov. 7, UT
Leona Turley (Fairbourn) Jul. 23, AZ
Dorothy Kae Turner Nov. 4, OR
Joseph W. Turner Nov. 14, CO
Helen Pearl Valdez Jun. 17, UT
Joanne B. Van Boerum (Kilts) Sept. 21, UT
Marilyn M. VanWagoner (Mead) Jan. 24, UT
Wendy Jo Vazquez (Loveland) Jul. 18, UT
Jose Luis Velasquez Sept. 9, UT
Diana Lien Velis Aug. 9, UT
Weston Vernon III Aug. 8
Bob Craig Walker Oct. 5
Cheryl Alene Walker Dec. 6, UT
Robert D. Wallace Jan. 14, UT
Jana Lee Wangsgard (Taylor) Jul. 8, UT
Lynn V. Wardle Jul. 15, UT
Jason P. Watkins Sept. 5, UT
Reynold K. Watkins Aug. 30, UT
Tana L. Wertman Jul. 15, UT
Marie M. White (Maughan) Jul. 22, UT
Mary Helen White (Hardy) Aug. 18, UT
Orley Ray White Dec. 22, MT
Rachel Lynne White Sept. 28, UT
Ray L. White Dec. 11, UT
Gary S. Williams Oct. 10, UT
John Roden Williams Jun. 15, UT
Sharon Williams (Shaw) Dec. 4, UT
Stacy Lynn Willson Dec. 17, AZ
Alan C. Wilson Jan. 1, UT
Dean W Wolf Jul. 19, UT
Larry D. Wood Nov. 23, UT
Deanne Woolstenhulme (Larsen) Dec. 24
Patricia B. Worl (Lockyer) Aug. 2, AL
Ellis Worthen Jan. 19, UT
Jarom H. Worthen Oct. 26, UT
Clavelle Wycherly Jul. 7, WA
Audrey Della Young Nov. 21, VA
Yvonne M. Young (Migliore) Nov. 28, UT
Vera Christena Zilles Jan. 14, UT
Charlie Zoolakis Aug. 9, UT

## EDUCATORS

Virginia Norris Exton Sept. 29, CO
Oris C. Rudd Nov. 28, ID
Ronald M. Lanner Jan. 6, CA
Michael S. Sweeney Jan. 15, OH
Duane G. Chadwick Nov. 13, UT
Dewaine E. Symons Jun. 29, UT
Gordon Lynn Chase Aug. 10, UT
Reynold K. Watkins Aug. 30, UT
Lloyd A. Clement Nov. 1, UT
Roland W. Jeppson Sept. 29, UT
Roland James Nickle Sept. 16, UT
Richard Young Jan. 7, UT
Kayleen Campbell Curtis Aug. 18, UT
Kay D. Baker Oct. 18, UT
Grant Vest Jul. 18, UT
James Philip Pugsley Dec. 25, UT
David B. Stephens Aug. 21, UT
Gary Amano Dec. 23, UT
Jeanette J. Derry Jun. 18, WA
Thomas Ernest Toone Jul. 7, ID
Connie Pehrson Sept. 23, UT
J. Paul Riley Jul. 1, UT
Hugh Palmerlee Stanley Sept. 23, WA
Bonnie Clark Dec. 24, UT
Nanette Gutshall Oct. 14, CA
Boyd P. Israelsen Oct. 9, UT
Brent Clark Page Jun. 21. UT
Connie Johnson Oct. 15, UT
William F. Stinner Sept. 20, CA
Lawrence H. Siebers Sept. 1, UT
Glenn Greenhalgh Jul. 5, UT
Kristy A. Sorensen Jun. 15, ID
Marlayne Gordon Nov. 6, UT
Leonard Grassli Jul. 7, UT

# Journey to the Stars:

## 6 Decades of the Space Dynamics Laboratory

By Jeff Hunter '96

**Utah State University certainly has a significant amount of reach. From the main campus in Cache Valley, USU's influence stretches across the rest of the Beehive State via its Statewide Campuses. But it's undoubtably in space where Utah State reaches the farthest.**

**And the Space Dynamics Laboratory (SDL) has had a lot to do with extending that scope of influence over the past 64 years.**

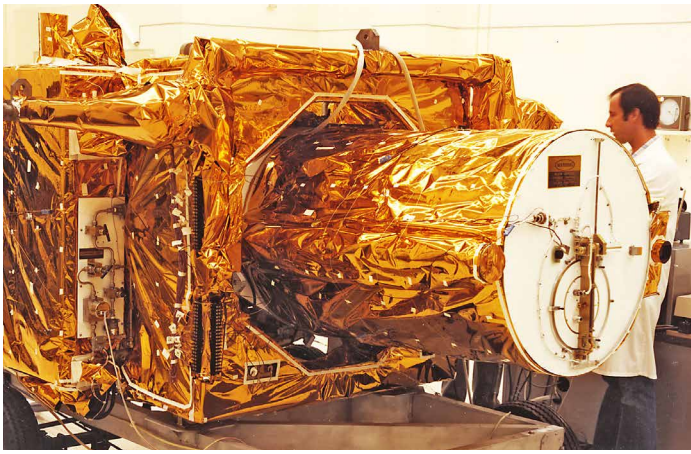
"We are true blue Aggies and are proud of our long affiliation with USU," says SDL President Jed Hancock, Ph.D. '04, M.S. '04. "SDL was created and grew within the halls, classrooms, and laboratories of USU's College of Engineering, and the lab continues to benefit from our ties to the university."

Located in North Logan at USU's Innovation Campus, the Space Dynamics Laboratory materialized out of a merger of Electro-Dynamics Laboratories and the University of Utah's Space Measurements Laboratory in 1982. Originally known as the Upper Air Research Laboratory, the programs and most of the staff of what would become known as the Space Measurements Laboratory were transferred to USU in 1970. A dozen years later, the SML consolidated with the EDL, which had been in operation since 1958 as part of USU's College of Engineering, under the guidance of former EDL director Allan Steed.

"The name Space Dynamics Laboratory (SDL) came natural," former SDL [president] Douglas Lemon wrote in Journey to the Stars: A History of Utah State University's Space Dynamics Laboratory. "'Space' from the Space Measurement Laboratory and 'Dynamics' from the Electro-Dynamics Laboratories. Integration of capabilities that had started 12 years earlier with Kay Baker's and his colleagues move from [the] U of U to USU became complete."

An independent, wholly-owned nonprofit subsidiary of USU, SDL's customers include the likes of NASA and the U.S. Department of Defense. The lab, which was designated a University Affiliated Research Center (UARC) 25 years ago, employs more than 1,000 people. In addition to the main facility in Cache Valley, SDL has field offices in New Mexico, Ohio, Alabama, Texas, California, and Washington, D.C.





Clockwise from top: This image from SDL's WISE sensor, which was launched in 2009, shows a cluster of stars; USU advisors and students from the first Get Away Special (GAS) project for NASA; Brent Bartschi looks over the CIRRIS instrument, which was launched from the Space Shuttle Columbia in 1982; the CIRRIS 1A instrument sits in the bay of the Space Shuttle Discovery in 1991. All photos courtesy of the Space Dynamics Lab.

Staff members prepare the SABER instrument for launch in 2001. Photo courtesy of the Space Dynamics Lab.

Utah State alum Jed Hancock Ph.D. took over as president of SDL in July 2021. Photo by SDL/ Allison Bills.

"We are **true blue Aggies** and are proud of our long affiliation with USU."

**— SDL President Jed Hancock, Ph.D.**

"As one of 14 Department of Defense UARCs in the nation, SDL maintains essential engineering, research, and development capabilities and long-term, strategic relationships with the DoD and other government agencies that lead national security and science missions," Hancock explains. "As such, SDL operates in the public interest rather than in the interest of corporate shareholders. UARCs are crucial partners in developing advanced defense technologies while sustaining critical engineering and scientific expertise."

SDL typically employs about 150 USU students, many of whom become full-time employees at the laboratory. Hancock himself completed his bachelor's and master's in electrical engineering at USU. Through its Student Scholar Program, students are provided with hands-on work experience at the company.

"SDL's student employees regularly put theoretical concepts learned in the classroom into real-world science and engineering projects," Hancock says. "The majority of our student employees are pursuing engineering degrees, but we also hire a large percentage of students who fill business support roles."

The Space Dynamics Laboratory's cutting-edge research and development for space and tactical mission systems includes sensor systems, small satellites, ground systems, mission operations, artificial intelligence and machine learning, unmanned aerial systems, and cyber analytics.

In the early '80s, designing, building, and testing the Cryogenic Infrared Radiance Instrumentation for NASA's Shuttle program put SDL on the map. The instrument was developed to provide spectral and spatial measurements of atmospheric emissions and first flew on the Space Shuttle Discovery in May 1991. While the list of SDL's successful programs and projects is long and noteworthy, the lab recently garnered attention with the arrival of the NEOWISE comet, which was visible to the naked eye during the summer of 2020. NASA's Wide-field Infrared Survey Explorer (WISE) telescope, which was launched in 2009 after being built and tested at SDL, first discovered the NEOWISE comet in March 2020.

And last November, the Air Force Research Laboratory announced that it had awarded its largest-ever contract for space technology development to USU's Space Dynamics Laboratory. The $1 billion, 10-year contract is for research and development of space-based technologies.

"SDL aspires to become the Nation's finest UARC and mission leader," Hancock adds. "Our vision is to solve critical national and scientific challenges for a secure and prosperous tomorrow." A

# Get Involved and Stay Connected

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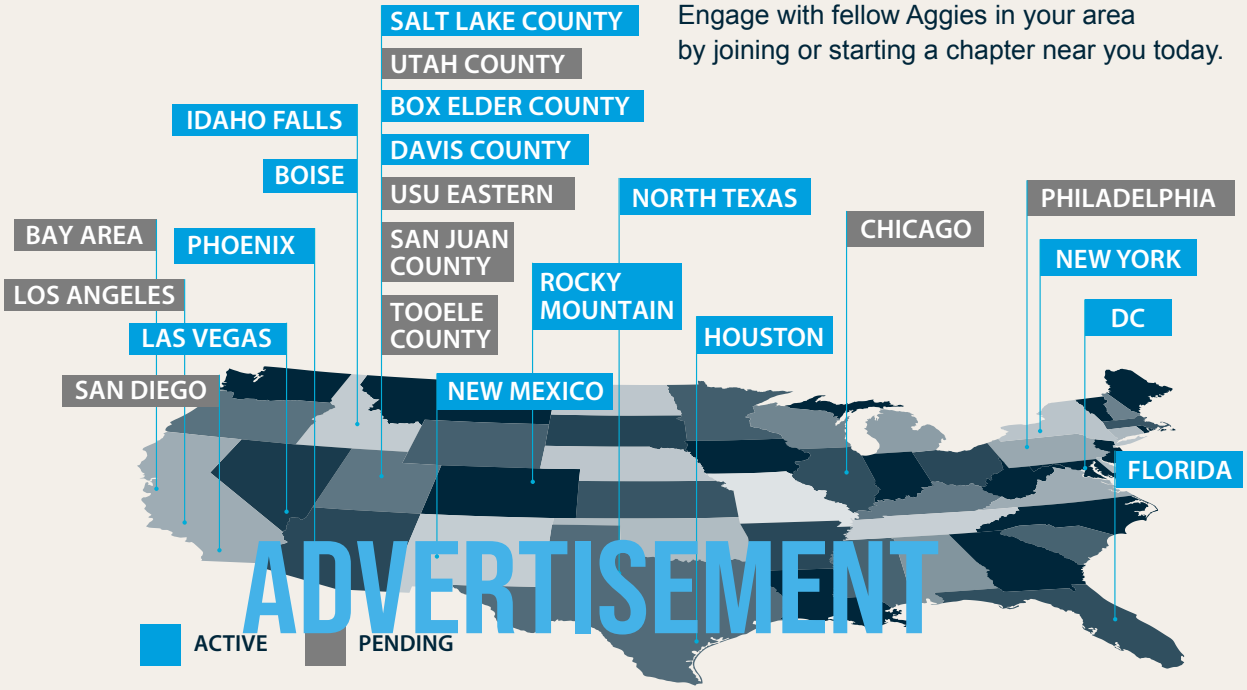


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