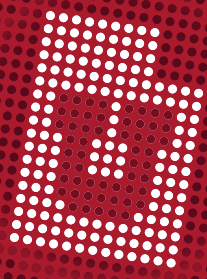


2020 INNOVATION REPORT

THE UNIVERSITY OF UTAH®

The true impact of innovation.

This report is presented by the Partners for Innovation, Ventures, Outreach & Technology (PIVOT) Center at the University of Utah. It covers FY2020 data and information about the Center for Technology & Venture Commercialization (TVC), which was fully integrated into the PIVOT Center prior to this report.

To stay up to date on future exciting announcements about U innovation, follow the PIVOT Center at ***https://linkedin.com/company/upivotcenter/***

Of the many lessons we have learned over the past year, the importance of research universities during times of crisis is near the top of the list. By the time the coronavirus pandemic shut down our campus in March, University of Utah researchers were already in search of ways to identify, trace, treat and prevent COVID-19.

Today there are more than 130 coronavirus-related research projects, many of them involving interdisciplinary teams, in progress or completed at the U. This work is one reason our FY2020 sponsored research awards reached a milestone of $603 million. Our inventors and innovators are vitally engaged in the pandemic response, and if they come up with new processes, products or businesses with market possibilities, the PIVOT Center will be ready to provide assistance.

The new PIVOT Center reflects the priority we place on infrastructure and support needed to drive innovation and economic vibrancy. Our efforts were recently recognized by the Association of Public and Land-grant Universities, which awarded the U the Innovation and Economic Prosperity designation. This designation, held by fewer than 70 universities across the country, signals excellence in talent, innovation and economic contributions.

Those qualities also played a role in our recent invitation to join the Association of American Universities, a prestigious group of 65 leading research institutions at the forefront of scientific inquiry and educational excellence. We are on the national stage because of the quality and caliber of our faculty and the innovative work they are doing to advance knowledge and address grand societal challenges. And, as you'll learn in this report, PIVOT is key to all we do.

Ruth V. Watkins
President
University of Utah

"The new PIVOT Center reflects the priority we place on infrastructure and support needed to drive innovation and economic vibrancy."

This past year has been unlike any other. The world has faced monumental challenges, which continue to test us at every turn. It is especially during times like these that we appreciate the importance of innovation.

Solutions to our greatest challenges can only be developed and implemented by innovative thinking and means.

While I'm always excited to play a small role in supporting the U's great innovators, I've been particularly energized this year by the incredible response from our researchers and clinicians in seeking solutions to prevent, diagnose and treat COVID-19.

As the U continues to successfully grow our research infrastructure, we must also do the same for innovation. This year's annual report highlights recent investments by the U in our innovation system and the partners with whom we collaborate. We're excited to unveil our biggest investment this year — our Partners for Innovation, Ventures, Outreach & Technology (PIVOT) Center, which launched at the end of 2020. TVC will continue its efforts as a fully integrated team within the PIVOT Center, while enjoying the center's expanded and enhanced role in boosting innovation at the university through economic engagement.

This past year also provided us an opportunity to think about what really matters and how we measure it. One of my favorite quotes is from William Bruce Cameron, which hung over Albert Einstein's desk at Princeton University. It has guided my own thinking for several decades.

"Not everything that can be counted counts, and not everything that counts can be counted." —William Bruce Cameron

This quote inspired us to explore how we measure success at PIVOT. What you will see in this report, and in the coming years, is that simply counting outputs, like patent applications filed, licenses signed and startups launched, does not truly tell the story of the impact that the U's innovation is having on society. While we will continue to report on traditional metrics, you can expect to see more qualitative measures and stories of how we measure the true value of what we're creating.

Thank you to our partners and stakeholders who continue to support innovation at the U. I look forward to working with many of you in the coming year, and I hope you enjoy the stories that you've helped make possible.

Keith Marmer, DPT, MBA
Chief Innovation & Economic Engagement Officer
University of Utah

"Solutions to our greatest challenges can only be developed and implemented by innovative thinking and means."

CONTENTS

Features

Profiles

ALTITUDE LAB: A VITAL NEW ELEMENT IN UTAH'S INNOVATION ECOSYSTEM.

From wet lab space to VC funding, the Altitude Lab incubator is growing a vibrant, diversified life sciences community.

Chris Gibson, co-founder and CEO at Recursion, doesn't mince words. "Starting a company is hard."

And he would know. Recursion, a digital biology company in tech-enabled drug discovery, is a 2013 University of Utah startup. So he understands firsthand all of the hurdles you have to overcome — especially in biotech. And finding wet lab space is one of the biggest. That's because it has to be a controlled environment, carefully designed and constructed to avoid spillage and contamination.

"Nothing is more frustrating for a founder than having everything you need to launch your idea except for one little thing," says Gibson. For him, that little thing was certainty around lab space — a reliable place to conduct their experiments and prove the viability of their innovations. They were often on 30-day leases, which created a lot of stress, took a lot of time and slowed them down.

That thought has always stayed with Gibson, and he hoped that one day he could contribute to the industry by creating more wet lab space for others. "And that's what Altitude Lab is all about," he says.

"Something as simple as not having that space to do our experiments could easily have killed the company."

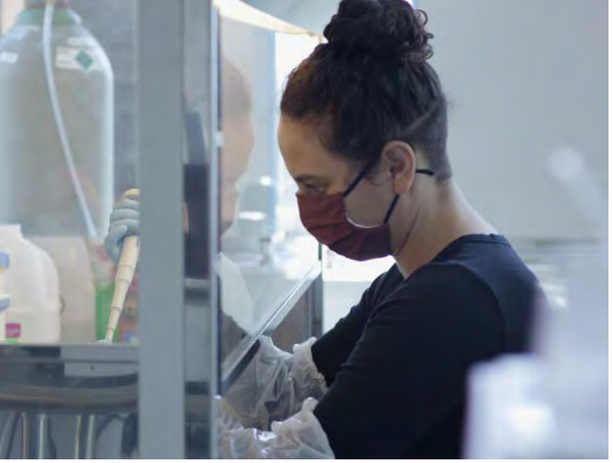
Chris Gibson
co-founder & CEO, Recursion

The perfect combination of place, process and people.
Altitude Lab was founded by a public-private partnership between Recursion and the PIVOT Center at the University of Utah. "We're providing the physical space that life-science founders need to build that critical proof of concept experiment and that critical data set that gets a partnership and next stage of funding," says Chandana Haque, Altitude Lab's executive director.

It's a nonprofit incubator where founders don't have to worry about infrastructure or the constant hunt for real estate. That frees them to focus on their discoveries and the path to market. "In life sciences, you have to discover something, you have to build it and have it stand up to regulation here in the U.S. and the rest of world. The challenges are endless," says Haque.

Altitude Lab gives founders access to 14,000 square feet of wet labs with instrumentation, office spaces, networking rooms, lounge areas and game areas — all the great places in which companies are built. On top of that, the PIVOT provides access to important elements that make the journey smoother: grant funding, educational resources, networking resources, industry partners and coaching.

A community where ideas can flourish and grow.
Tina Larson, president and COO of Recursion and an Altitude Lab board member, comes from San Francisco's biotech hub, which she describes as a rich ecosystem of venture capitalists, professors, CEOs and scientists from dozens of companies — all interacting over lunch, on the streets and via phone. It's exactly the kind of environment she's helping to create here in Salt Lake City. "You need all those people and experiences to come together to create a true, world-changing industry," she says.



"What really makes this partnership special is such easy access to important people. I pick up the phone and in minutes I have experts from every field here at the university accessible to me. That will be available to our founders, too."

Chandana Haque
executive director, Altitude Lab

altitude ▲ lab

The Altitude Lab incubator is based on a few core beliefs: Breakthrough work takes breakthrough spaces. An ecosystem of innovation depends on diverse founders. A sustainable system for growth is centered on founders first.

Jonathon Bates, executive director of real estate administration for the University of Utah, says Altitude Lab will be a key tool in creating and sustaining that kind of innovation ecosystem in Salt Lake City. "It will provide the opportunity to connect, share your vision and thought process, and have others bring something new to the conversation — increasing those planned and unplanned interactions." The incubator is an integral part of the university's strategic vision for a 21st-century research park. One that's not only more vibrant, but has more opportunities for researchers, students, faculty and industry partners to collaborate.

"What I love about Salt Lake City and Utah is that there's this aspiration for growth at every end of the environment," says Haque, adding that the innovations that come out of the lab will have a ripple effect across Salt Lake City, the state and the country.

Diversity as an engine for innovation.
One of Altitude Lab's founding principles is a focus on diversity and inclusion. They view the modern biotechnology company as having founders, leaders, employees and board members from diverse backgrounds and with diverse perspectives. "If you want to build a responsible business in health care, you can't ignore it," says Haque, adding that diversity starts by employee four, five and six — not down the road as you grow.

Larson points out health care is a very female-forward industry, but there's still a big gap in women leading companies and having board seats. "Beyond gender, if you look at racial diversity and other forms of diversity, there's such a huge gap in terms of what we can build."

"Under-represented founders see the world in a different way, and studies have shown that they're more capital efficient," adds Haque. By bolstering this community and demonstrating that Altitude Lab really is an ally in their journey, she hopes to take life sciences and technology to the next level. To be part of the program, Altitude Lab asks everyone else to become an ally, too.

And it's not just talk. Eighty percent of Altitude Lab's current companies are led by minorities or women, and 50 percent of their grants will go to underrepresented

THE IMPACT OF INNOVATION

73

Licenses in FY20

Every license represents strong potential for commercialization and social impact. Revenue generated from these licenses goes back into the innovation ecosystem at the U, supporting the inventor, operations and more research.

founders who don't have access to traditional funding, but have the skill set, the intellectual talent and the drive to build an amazing company.

Expanding Utah's impact as a life sciences innovation hub.
Having walked the same path as today's biotech founders at the university, Gibson speaks from experience when he says there's a great foundation of support from all of the leaders at the PIVOT Center — as well as the broader university community. He envisions Altitude Lab building on Salt Lake City's strong innovation ecosystem — attracting the next generation of biotech founders.

"If we can create 12 more Recursions that have the same kind of ambition and same kind of impact, we'll put Salt Lake on the global map, not just as a tech hub, but a life science hub," says Gibson. And that's exactly what Altitude Lab intends to do.

Learn how to get involved with lab at ***http://altitudelab.org*** and connect a new generation of diverse founders to essential entrepreneurial resources.

CRACKING THE CODE FOR SOFTWARE COMMERCIALIZATION.

Customizing a private-sector model to accelerate time to market.

The phone started ringing long before the press releases went out. When universities across the country got word of what was happening at the University of Utah with Summit Venture Studio, it didn't take long to generate excitement.

What was all the buzz about? Experienced software entrepreneurs, in collaboration with the PIVOT Center at the University of Utah, had figured out how to overcome the challenges of developing, launching and scaling software startups at a university. This new enterprise for accelerating the go-to-market process in a university setting was an industry first.

Increasing success, decreasing risk.

"We have so many new, high-potential software products and features that have been developed by the amazing researchers at the university," says Peter Djokovich, who founded Summit Venture Studio with Taylor Bench. Using some of the millions of dollars in research funding the university receives, they've invented products as varied as automated clinical trial consent software that significantly reduces launch time to AI platforms that optimize prescriptive data analysis.

"But while inventors have their specific product or subject expertise, they often don't have the tools, experience and network to turn their ideas into actual businesses," Djokovich adds. "And it's rare to succeed without those resources."

That's the big challenge facing university innovators. To find success, you have to be best to market and fast to market, both of which require an entire infrastructure of support — including innovation management, product development, market validation and investor backing.

Djokovich says there's a science to the process of building and scaling a business. And scaling is especially important. To succeed quickly, you need experience. "It's often the 'how' more than the 'what' that makes a company successful."

To find that better "how," Bench and Djokovich integrated the best from both of their different backgrounds — Bench's deep experience in discovering and validating software inside universities, plus Djokovich's successful private-sector commercialization model, customized for a university setting. This combination created a process for getting ideas and innovations to market that's not just faster, it's often years faster. And there are few, if any, programs like it nationwide.

SUMMIT
VENTURE STUDIO

The U established this novel software development accelerator and investment fund to overcome commercialization challenges in accelerating time to market for university-originated software.

"It's often the 'how' more than the 'what' that makes a company successful."

Peter Djokovich
co-founder and managing director,
Summit Venture Studio

"The studio develops and transforms high potential ideas into proven, battle-tested and market-ready product offerings that reduce the risk for industry-exit partners," explains Bench.

Faster to market. And ROI.
Many innovators think they have to find that singular idea. Or, to use one of Bench's analogies, that grand slam, unicorn invention. But the studio uses a model that allows them to also focus and devote resources to the singles, doubles and triples that, in baseball, score the runs and win the games. At the studio, these consistent "base hits" are the new product lines in already established markets or new features in a popular product. These kinds of innovations enhance ROI and reduce investor risk.

"Often, a $1 million to $3 million revenue business is very lucrative from a profit and return on investment perspective — versus a $100 million business," says Bench. "If you develop a technology that can be added to an existing product that already has thousands of customers, the profits are high and the risk is low." And that's key. Software can be very speculative, expensive to develop and take too long to get to market. And it may never hit the scale you want — making software development uniquely risky. But if you can get an idea into the marketplace rapidly, and get real customers to pay for it, it's a safer investment.

One of the key advantages with the studio is that they're not doing things in a linear fashion. They're looking at multiple projects at once and using a range of shared services, processes and platforms they can replicate instead of reinventing the wheel for each new idea. And that gets them to market much faster.

"We're building a community and connecting people, and showing the world the value of the industry expertise that is held at the U."

Taylor Bench
co-founder and managing director, Summit Venture Studio

The place for unparalleled partnership.
Bench and Djokovich say the key to making the Studio/PIVOT Center collaboration happen — and to its ongoing success — is the unwavering, top-down support from the university administration and board of trustees.

They also credit the innovation community at the University of Utah and in Salt Lake City, and the investor network of the PIVOT Center. "We're building a community and connecting people, and showing the world the value of the industry expertise that is held at the U," says Bench.

Djokovich agrees. "The amount of creativity here is far beyond anything I could find myself in my searches. The support for the PIVOT Center is very innovative and always has been."

The ideas are here. The industry expertise is here. And the support and investor infrastructure are here. Few, if any, other universities have that complete combination for software commercialization. "If there ever was a place to start this, this is it," adds Djokovich.

To learn more about this innovative go-to-market process, visit ***http://summitventurestudio.com***.

Dr. Nicole R. Robinson, founder and CEO of Cultural Connections by Design, addresses an audience on creating cultures of belonging.

CHANGING THE GAME IN DIVERSITY EDUCATION.

Drawing upon her background in teaching music educators, Nicole R. Robinson invented an innovative way to truly teach diversity.

When Nicole R. Robinson invented her game, she wasn't setting out to start a company — she was working to solve a problem. She saw much work taking place in the realm of diversity training, with very little lasting change. Drawing from her education background, she knew that the way people learned about diversity and inclusion needed to evolve from a "training" process to an "educational" process.

Diversity "training," she says, doesn't truly invoke self-reflection, realization or, most importantly, appropriate action. *Education*, she says, means something more.

"Training provides people with a specific process to implement if they encounter a similar situation again. But here's the problem: when it comes to diversity, no two situations are identical," Robinson explains. "If the incident centers around the same issue, it probably involves different people. If it involves the same people, it could have a different context."

Instead, Robinson argues, people need to be *educated* about diversity. An educational process teaches a concept, not just a prescribed skill. It contextualizes why we're even where we are, historically and socially. And it provides people with the tools to navigate the complexities of cultural landscapes.

"I don't change organizations; I help people change, and changed people change organizations," she explains.

Of course, in launching ***Cultural Connections by Design***, a diversity education consulting company and University of Utah startup, Robinson herself underwent a transformation — from educator to entrepreneur. She was serving as the Beverley Taylor Sorenson Presidential Endowed Professor in music education and as associate vice president for Equity and Diversity at the University of Utah. There, Robinson developed a game that helped her music education students understand the many nuances of diversity and inclusivity they'd encounter in music classrooms as school demographics became increasingly diverse.

A participant using Robinson's proprietary card game and digital app during a session.

While she initially crafted the game to serve as a teaching tool for future educators, demand for her sessions grew and were requested at colleges and universities across the nation. Robinson attended a Lean Canvas business bootcamp through the PIVOT Center and mastered the skills she'd need to scale an ingenious idea to a thriving operation.

Soon, she was also conducting her seminars in the corporate world — sparking the founding of her company, which now presents to organizations ranging from Harley Davidson to Domo to the U.S. Department of Education.

When asked about her leap of faith, Robinson says, "Many people have dreams and hopes they never actualize because of fear, and I believe you have to press through the fear. They search for the evidence that the leap will be successful, but the numbers and metrics will never be perfect enough to make a leap comfortable. You take the leap. You move forward. On some days you wake up and say, 'What the heck did I do?' … But you just keep moving forward."

And move forward she did, thanks to her drive, determination, and a unique ability to fill a need in diversity through education and gamification.

"It's not what we're teaching that makes us different; it's our approach to the way people learn," explains Robinson. Subjects like diversity, inclusion, identity, power, privilege and intersectionality are complex and can be challenging to grasp. Moreover, seminar attendees all come from their own unique backgrounds and levels of understanding.

"As a music educator, I had to teach very complex music concepts to kindergarten students. It helps that I understand the science behind learning. I know how to meet people where they are and connect them to concepts quickly while keeping them engaged. The appeal of our process is that it opens space for a deeper dive into learning, but in a fun and engaging way."

By huddling in groups and working together to map out the power dynamics (and disparities) behind gender, race, religion, class and other factors — as well as how these dynamics can intersect — participants can bring what they know to the table and grow as they go.

As Cultural Connections by Design continues its own exceptional growth and broadens its reach nationwide, Robinson's goals not only pertain to her business but to the people it touches.

"I tell participants, 'Your responsibility is to dismantle the systems of oppression, starting with a sphere of influence — in your family, in your community, in your job,'" she says. The goal is a bold one, as it should be. Because, as Robinson knows, anything is attainable if you start small and think big.

For more information visit ***https://ccbydesign.org***.

"Cultures of belonging do not happen automatically. To shift the cultural paradigm, there must be systematic processes, specific actions and measurable goals."

Dr. Nicole R. Robinson
founder & CEO, Cultural Connections by Design

A graduate student and staff member listen attentively as Robinson presents her game concept to the University of Utah PIVOT Center.

WHAT HAPPENS WHEN DOCTORS CAN PREDICT THE FUTURE.

Mark Yandell is putting health care practitioners a step ahead through the power of AI, a wealth of data, and a big dose of entrepreneurial innovation.

Today, you call the doctor when you get sick. But tomorrow, the doctor may call you to say when you're going to get sick — and tell you what you can do.

Dr. Mark Yandell
U professor and entrepreneur

It's a bold assertion, but one Mark Yandell is uniquely positioned to make. As a professor of both human genetics *and* biomedical informatics, Yandell has an exceptionally unique blended skill set as a scientist and academic — plus a penchant for entrepreneurial genius.

Yandell has co-founded Backdrop Health to make it possible for doctors to evaluate a patient's risk for different health outcomes — and to better understand how to keep patients healthy. The key: learning health trends and outcomes from the contents of electronic health records. And doing it at superpowered scale.

Modern electronic health records document everything that happens to a patient, from major procedures to aspirin doses. There's a vast amount of information in these records that can be put to good use — if it can be understood.

And while the University of Utah has long been a leader in harnessing electronic data to improve health care, Yandell saw an opportunity to take it even further with Backdrop.

Backdrop's software, called "CoDE," short for "Comorbidity Discovery Engine," uses AI technologies to mine information for patient electronic health records in order to create a statistical model — a "health backdrop." Using every factor from lab tests, procedures, diagnoses, demographics, timing, and genetic testing data, CoDE can create a comprehensive predictive model that can show practitioners likely clinical outcomes, risk factors, and disease trajectories.

Names and Personal Health Information (PHI) are left out of it, keeping patients' identities private. But the big picture is there, created from millions of patient electronic medical records.

"We can extract from this body of medical records many statistical facts about patients: how tall or heavy are they? What percent have diabetes? What percent have diabetes *and* cataracts? How many of those are women? By using AI to look at this massive data set, you can pull insights from the numbers and see what's 'normal' versus 'outlying,' and you can predict clinical outcomes with unprecedented precision," Yandell says.

Yandell identifies as a scientist first, but he's also a software engineer and entrepreneur — and acknowledges all these roles are probably born from the same kind of curiosity.

"Academia is a great place to come up with new ideas and software applications, but commercialization doesn't usually come from academic settings. If you really want your software to grow up and walk out of the house on its own, you've got to commercialize — and that means raising capital," says Yandell. "Ultimately, nothing has been more rewarding professionally than watching these technologies go from half-crazed ideas to thriving companies — like hot-rods that were sitting in a garage finally getting out on the racetrack."

To bring the idea of Backdrop Health to life, Yandell turned to the PIVOT Center. He made a formal disclosure of these innovations and refined with the PIVOT team, and it was clear that a startup company would make sense to bring this solution to market. The team introduced Yandell to Jerry Rudisin, PIVOT Center Entrepreneur in Residence, who soon became Backdrop co-founder and CEO.

Rudisin knew that a commercial company would be the best way to toughen a solution like Backdrop's for daily use by health care systems, pharmaceutical companies, and insurers — it would need to be rock solid and secure. A commercial company would also be the best way to deploy this solution and maximize its potential to transform health care, improving the health of tens of millions and reducing costs worldwide.

Rudisin sees PIVOT as a resourceful and committed partner in the company's growth. "The PIVOT Center is proactive in finding meaningful innovations, including those few that can be the basis of a successful standalone company. PIVOT was easy to work with in negotiating the technology license, but their support only started there. They continue to provide feedback, make introductions to potential investors, customers, partners, and future executive staff, and are terrifically supportive. PIVOT really wants to see Backdrop succeed," says Rudisin.

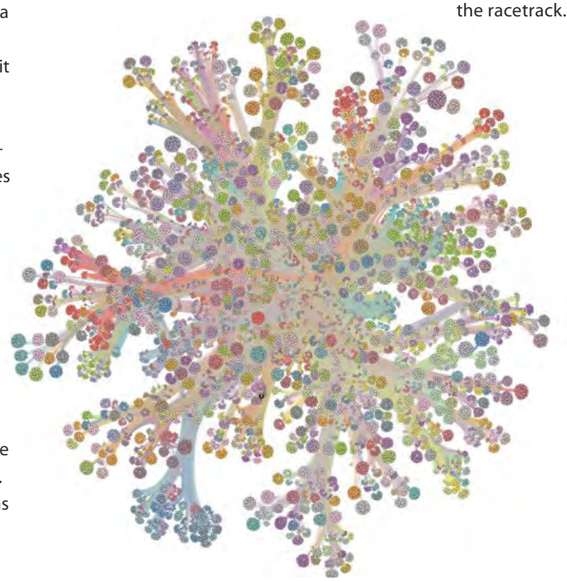
Every bit of that support will come in handy as Backdrop grows — and as its software pushes the intersection of AI and health care to new limits.

THE IMPACT OF INNOVATION

14
Startup Companies in FY20

- **8 Life Sciences**
- **2 Software**
- **2 Engineering**
- **2 Health care Education**

All of these companies have two things in common: an excellent foundation and a meaningful shot at success. Almost one-third of them came out of PIVOT's Entrepreneur in Residence program with experienced management teams.



The University of Utah's health 'backdrop.'

This figure represents the University Hospitals' electronic health records database as a backdrop network. Circles represent clinical variables such as health conditions, medical procedures, medications and lab tests. The lines connecting them denote comorbidities—pairs of linked clinical variables; for example, headache and aspirin. Clinical variables (circles) with similar patterns of comorbid linkages lie near one another in the backdrop network.

Vicki Farrar of Light Line Medical presenting at the Entrepreneur & Investor Life Science Summit, an annual event held by BioUtah and the PIVOT Center.

A TECHNOLOGY LIFELINE.

How serial entrepreneurs Vicki and Denny Farrar are helping to save lives, one innovation — and startup — at a time.

Vicki and Denny Farrar run companies. Quite prolifically, in fact. Between the two of them, they've co-founded and led 15 of them. These range from Myriad Genetics, which Denny co-founded, to Light Line Medical, which has Vicki at the helm, plus a head-turning roster of successful life sciences companies that have developed everything from the first digital hearing aid to stem cell therapy innovations.

So, when they talk business, you listen. The Farrars, who both come from legal backgrounds, have a keen sense for intellectual property with shining potential. They know how to protect it. And they know what it takes to bring that idea to life.

Vicki was drawn to her current company, Light Line Medical, when she saw a brilliant life-saving invention — and the need for experienced leadership to drive the nascent company's leap to commercialization. There was not only business at stake — there was a chance to avert the global antibiotic resistance apocalypse making infection prevention more and more difficult.

Light Line has developed a way to use non-UV *visible* light to kill the microbes that cause catheter-related infections, delivered via a fiber optic inside a catheter in a patient's body. Catheter-related infections are not only common but they're also severe, difficult to treat, and can result in death. It's a terrible risk to have associated with dialysis, urinary and vascular catheters as well as endotracheal tubes.

The Light Line peritoneal dialysis system™, just one solution from the Light Line™ phototherapy system.

With a firm belief in the power of Light Line's invention, Vicki stepped up and tenaciously worked for months to secure funding. She knew that a great idea isn't enough alone — in fact, it's just one early step toward a successful startup. She drew on her every resource, including her longstanding relationship with the PIVOT Center, where inventors, executive leaders, industry experts and investors all intersect in circles of connection.

Mark Ehlert, a device veteran who is an investor and member of Light Line's Board of Directors, explains how the PIVOT Center serves as a hub where all the right elements come together to give startups like Light Line the lift they need.

"Here, investors' ties to the University of Utah are important — knowing there's a PIVOT Center to connect startups with resources," he says. It was through these connections that he developed not only a familiarity with Vicki and Light Line, but also an understanding of the Farrars' track record.

"Vicki and Denny have the knowledge to get companies off the ground. In fact, investors get involved based on reputation as much as what the company has to offer. It takes someone like them, with the vision to understand the technology and the ability to focus on where that tech needs to go, to understand what capabilities to seek in their team," he explains.

With a clear eye on her goals, a sharp presentation, and deep reserves of energy and resolve, Vicki took her pitch all the way to the global Keiretsu Forum, where she impressed — and succeeded. In fact, Light Line was recently handpicked by hundreds of angel investors as one of the top three Most Valued Companies at the forum.

Light Line is poised to continue its growth and its impact on patients in hospitals everywhere, and Vicki credits the people, resources and atmosphere in Utah as setting the company up to soar.

"PIVOT understands the business reasons why we want to do things. They understand the challenges of a startup. In fact, one of the best things about being in Utah has been their flexibility. They're always willing to be adaptable, to revise, to get you what you need," says Denny.

"The reason Denny and I are here in Utah is, the technology is so good — and it's easier to license. My companies wouldn't have existed in California," Vicki says.

Fortunately, the collaborative and business-friendly atmosphere at the University of Utah is here to stay. And fortunately for Utah, it seems the Farrars are too.

THE IMPACT OF INNOVATION

$203M +

in Follow-on Capital Raised by PIVOT Center Startups in FY20

"Capital raised is a validation of the commercial promise of our companies."

Keith Marmer
the U's chief innovation and economic engagement officer

If money talks, then this number tells the true potential of the companies, the people, and the processes coming out of the University of Utah PIVOT Center.

UNPACKING THE MYSTERIES OF HUMAN MEMORY — AND FIGHTING TO PROTECT IT.

How inventor and memory researcher Jason Shepherd is turning an unexpected experimental result into hopeful innovation in Alzheimer's research.

Memory research pioneer Jason Shepherd has conducted plenty of experiments in his day. But one unexpected result stands out. It's shaped the next steps of his career — and the next developments of scientists' understanding of neurodegenerative disorders like Alzheimer's.

An associate professor of neurobiology at University of Utah Health, Shepherd and a technician in his lab were examining a protein called the Activity-Regulated Cytoskeleton-Associated (ARC), which is a gene required for memory in the brain. When they looked at images of the protein, using a high-resolution electron microscope, they surprisingly saw large and spherical structures that looked like *viruses*.

This observation would eventually have significant implications on our understanding of where this gene evolved from — and what ancient properties it might share with viruses, notably including the ability to form a capsid (or protein shell).

"It was one of those rare moments in an experiment where you have a solid hypothesis and were expecting one result, but we got such a different result that we thought, 'Either this is mind-blowingly interesting, or there was something terribly wrong with the experiment,' " says Shepherd.

"At that point, we could have said, 'This observation is just too crazy — why would we even follow up on it?' We could have tossed it out. But, the lesson here was persistence. We followed up on the surprising results, because you never know where they'll go," he says. "It's so hard to track down how the brain works, particularly. So sometimes, if not all the time, the big discoveries come from unexpected directions."

The ARC protein is essential for long-lasting information storage in the brain and has been implicated in neurodevelopmental disorders, yet we have much more to learn about how this gene works — and when it doesn't. "There are quite a few aspects of this gene that make it a good puzzle," says Shepherd. "And if we can understand what it's actually doing in the brain, we get a good handle on how memory works."

Fueled by a National Institutes of Health Director's Transformative Research Award and a Chan Zuckerberg Initiative Early Career Acceleration Award, Shepherd is now diving deep into the implications of his discovery. His theory is that the capsid biology his lab discovered could also be involved in eliminating toxic proteins from brain cells. (When Alzheimer's occurs, toxic proteins aggregate and eventually kill cells because they cannot be eliminated from the cells. As this happens, these proteins also spread from one cell to another, furthering the havoc.) If researchers could manipulate the ability of cells to eliminate these toxic proteins, they could effectively slow the spread of disease in the brain.

Not only does Shepherd hope to discover ways to slow the disease's progression, but he's also hopeful that some of his research will lead to ways to test for markers of the disease far before brain damage has set in.

"While it's extremely hard to reverse brain damage, we could do more if the disease is caught very early on," he says.

This research could hardly be timelier: the number of people living with Alzheimer's is rapidly growing. While an estimated 5.8 million Americans over 65 have the disease today, a dire 13.8 million are expected to suffer from Alzheimer's by 2050 as the disease becomes more prevalent and the number of seniors in the population grows.

"I decided I wanted to pursue knowledge in this realm, because, what makes us who we are? Memory. Memory shapes our personalities, our experiences. And if we can understand this part of brain function, we can understand so much more about human behavior," says Shepherd. "However, sometimes science takes us down rabbit holes like this one. Who would have thought a brain gene required for memory evolved from an ancient virus-like ancestor?"

Indeed, these observations led Shepherd to submit a patent to potentially use these capsids for gene therapy, another unexpected spinoff from these studies.

To that ambitious end, he's drawing on the supportive working environment among university faculty and resources like the PIVOT Center that help catalyze Utah's growing life science infrastructure. When he found the University of Utah, he deemed it "the total package." (It doesn't hurt that he loves to ski.) While he works to secure Utah's place on the map, he'll be changing the way we think about memory research.

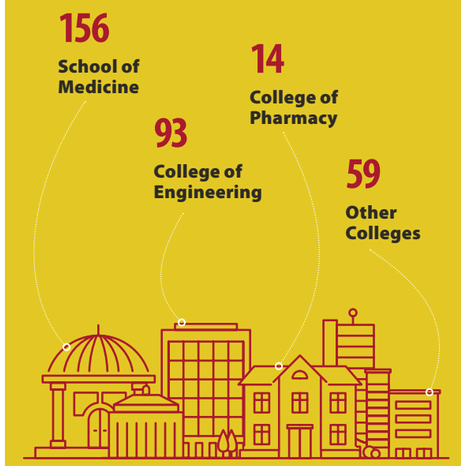
THE IMPACT OF INNOVATION

345 Inventors in FY20 *from* **18** Colleges

and

115+ Institutes and centers at the U

98 First-time inventors in FY20



As the numbers show, there is a broad innovation community at the University of Utah and immense commitment to public good. Each of these 345 inventors has a story to tell, but we only have room in this report to share a few.

A WHOLE NEW WAY TO OPERATE THE INNOVATION PROCESS.

Expert leadership, rapid manufacturing, advanced testing facilities and operating suites come together in an innovative model for bringing orthopaedic inventions to market.

The University of Utah Orthopaedic Center sits high on the mountainside overlooking Salt Lake City. While its view is impressive, what's inside is even more so: A brand new, 10-station operating theater equipped with all the latest equipment for surgical procedures. The only thing missing is live patients. Instead, world-class faculty at the University of Utah School of Medicine perform mock surgeries on cadavers — testing new orthopaedic devices that their fellows, residents, students and faculty have invented.

Wade Fallin
executive director, Louis S. Peery, MD Orthopaedic Innovation Center

A short distance across town lies their prototype lab. But it's no ordinary lab. Instead of printing 3D plastic prototypes, it produces actual products using the same kind of equipment you'd see on a commercial medical device manufacturing floor.

It's all part of the ***Louis S. Peery, MD Orthopaedic Innovation Center (OIC)***, which is reinventing how a university moves new products out of the lab and into the market. With support from the PIVOT Center at the University of Utah, it provides everything an orthopaedic inventor could want.

Where university innovations meet the private-sector process.
For Charles Saltzman, chair of the University of Utah Department of Orthopaedics, innovation is as essential as research, education and clinical service for fulfilling their department's mission to improve care for orthopaedic patients. He envisioned a place where they could all come together — a place that would allow their clinical and research faculty to collaborate, ideate, design, manufacture, test and commercialize innovations that improve patient outcomes. And so, in partnership with PIVOT, the Louis S. Peery, MD Orthopaedic Innovation Center was born.

The next step was finding experienced talent to lead the OIC. Turning to the private sector, Saltzman and the PIVOT team tapped Wade Fallin to be executive director. Fallin is a nationally recognized, successful serial entrepreneur and orthopaedic device inventor with over 240 issued patents. That, and his passion for medical device innovation, made him the perfect fit.

"Innovation functions as a bridge from unmet needs and research findings to clinical practice and better patient care."

Wade Fallin
serial entrepreneur, device inventor and new executive director, Louis S. Peery, MD Orthopaedic Innovation Center

The OIC is building on Fallin's successful orthopaedic innovation model and putting the necessary resources behind it. This includes a team of experienced industry experts, supported by the latest technology for designing, manufacturing and testing their inventions. "What I'm doing here at the Orthopaedic Innovation Center is what I was doing in the private sector since 1996," says Fallin. Only now, he and university inventors have the full backing of industrial-grade resources and the PIVOT Center's innovation and relationship management.

A focused innovation factory — with a commercialization engine.
There is a surge of promising orthopaedic technologies coming out of the University of Utah. During the last six months, more than 40 different projects have been suggested by the faculty, and the OIC has already initiated work on six of them, providing a streamlined pathway from invention to commercialization.

The partnership between the OIC and the PIVOT Center provides support during the entire life cycle of new medical device product development. It begins in the OIC's Innovation Studio where students, residents, fellows and faculty can interact with the engineering team to innovate new surgical and patient care solutions. In the OIC's Prototype Shop, precision computerized numerical control (CNC) machining, coupled with post-machining processes, produce commercial-quality products. These are then tested in the Surgical Knowledge Integration (SKI) Lab, where faculty provide valuable feedback. When necessary, the devices can also go through biomechanical testing in the Harold K. Dunn, MD Orthopaedic Research Laboratory, adjacent to the SKI Lab.

Using the OIC's quality system, the entire product development process is conducted under full compliance with the FDA Quality System Regulations.

The OIC's Prototype Shop houses $2 million in equipment providing capabilities to manufacture anything you'd see in an operating room.

Dr. Charles Saltzman
chairman, University of Utah Department of Orthopaedics

By the time a device comes to the University of Utah PIVOT Center for commercialization, it's been design-verified and validated, it has manufacturing processes established, it's been approved by the FDA and is market ready. The PIVOT team then provides the support, connections and network required to take the device to market.

With the critical groundwork done and contractual agreements already in place to foster direct, industry-sponsored programs, innovators can hit the ground running when they start the commercialization process.

Casting the mold for orthopaedic innovation.
"The Orthopaedic Innovation Center gives us the ability to not only envision better surgical tools, instruments and devices, but actually create them rapidly, test them almost immediately, and iterate with unparalleled speed and accuracy," says Saltzman. "We've created an innovative model with top surgeons, imaginative trainees and very experienced engineers enthusiastically collaborating on a daily basis to improve our field of surgical care," says Saltzman.

Saltzman credits leadership at the University of Utah for making the OIC happen: university President Ruth Watkins, Vice President for Research Andy Weyrich, Senior Vice Presidents Michael Good and Dan Reed, and Keith Marmer, executive director of the PIVOT Center, which Saltzman says has been an incredible partner.

It's a partnership that gets Fallin up in the morning. "I love seeing technology make a difference for patients," he says. Now that the OIC is up and operating, he's in an even better place to do that.

To learn more about the Louis S. Peery, MD Orthopaedic Innovation Center, email ***wade.fallin@hsc.utah.edu*** or visit ***https://medicine.utah.edu/orthopaedics/innovation/labs/oic/***.

THE IMPACT OF INNOVATION

56

Patents Issued in FY20

Each of these patents represents a truly novel discovery and a measure of the innovation coming out of the University of Utah.

PIVOT Center
Partners for Innovation, Ventures, Outreach & Technology
THE UNIVERSITY OF UTAH