

TECHCONNECT

ARIZONA'S TECHNOLOGY MAGAZINE

NEW ERA FOR INNOVATION

- 06 Research Relief
- 07 High Powered
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BIG IDEAS LIVE HERE.

#1 Entrepreneurial Activity (Fast Company, 2013). #2 Skilled and Available Workforce (CNBC's America's Top States for Business, 2014). #4 Overall innovation (Fast Company, 2013).

ARIZONA. #1 IN THE NATION FOR ENTREPRENEURIAL ACTIVITY.

Arizona is home to big ideas. We lead the nation in business startups and are a nationally ranked best state for business. We are #2 for skilled and available workforce and #4 for overall innovation. How do we attract so many innovative thinkers? By offering the perfect climate - for business and lifestyle. Find out why Arizona is the best place in the country to launch or grow your big idea at azbigideas.com.



Delivering more than power.™



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Arizona Vision

AMERICA'S BEST PLACE FOR BUSINESSES AND ENTREPRENEURS TO SCALE THEIR SUCCESS

a rizona provides an unmatched platform supporting the world's leading companies and emerging startups, from top manufacturing giants to high-technology innovators. Businesses, both large and small, have a strong foundation of support in Arizona and we will continue to build on important policy reforms that attract high-wage job creators to the state.

As Governor, I am focused on making Arizona the best place in the country to live, work, recreate, get an education and start or grow a business.

That's why I have made it my mission to reduce regulations, cut burdensome taxes and strengthen Arizona's pro-business environment

to assist companies of all sizes.

Demonstrating this commitment, Arizona has created a robust suite of economic development tools and pro-business reforms supporting our dynamic business and innovation ecosystem. This foundation assists global companies, innovators and entrepreneurs to scale up their operations and achieve real growth.

This environment has been a catalyst for expansion that has earned Arizona the reputation as the nation's leader in entrepreneurial activity, and continues to attract the world's top companies. In February, Arizona welcomed two giants in their respective industries that have made significant commitments to the state.

“Arizona has created a robust suite of economic development tools and pro-business reforms supporting our dynamic business and innovation ecosystem.”

Apple made a 30-year commitment to Arizona by establishing a \$2-billion Global Command Center for the company's global networks bringing 150 quality jobs to Mesa and the Greater Phoenix region. The new project represents one of Apple's largest investments in its history, and the first time the company will invest in a corporate operation outside of Cupertino, California. Likewise, Chicago-based Northern Trust, a global financial services leader with a prestigious 125-year history of excellence, broke ground on a new \$95-million operational center in Tempe. The company will create 1,000 jobs supporting its national and international banking business to meet its long-term growth needs and demands for services.

Arizona's strategic geographic location provides access to major regional and international growth markets. Combined with modern transportation infrastructure, top-ranked universities, leading medical research centers and a high-skills talent pool, Arizona delivers world-class advantages for top businesses like these to thrive.

This growth trend doesn't stop here. Our state's vibrant grassroots entrepreneurial community has transformed Arizona into a hub for innovation, technological development and research breakthroughs with companies sprouting successful operations statewide.

Opportunities for entrepreneurs are accelerating exponentially. Joining foundational programs including the Arizona Commerce Authority's Arizona Innovation Challenge, a bi-annual business plan competition supporting technology commercialization for startups, Arizona's community of more than 50 accelerators and

incubators are supporting entrepreneurs and assisting technology, IT, biotech and manufacturing companies. They are helping these businesses advance from idea to commercialization while providing technical expertise, mentorship and funding.

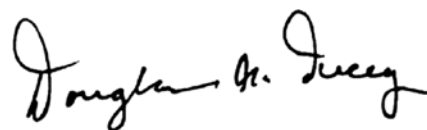
Additionally, Venture Madness, an annual bracket-style pitch competition that completed its second year in March, has attracted promising startups from across the Southwest region. And we are thrilled with Arizona's newest addition to the entrepreneurial scene, Phoenix Startup Week, which culminated its inaugural event last month. The community-driven series of events hosted nearly 2,300 entrepreneurs with more than 160 educational sessions for startups across Valley.

These important developments continue to fortify Arizona's infrastructure assisting startup formation and business growth, leading the way for more jobs and more opportunity for all Arizonans.

The ongoing work of my administration, our state legislative leaders, cities and towns, our economic development community, academic institutions, and business people strengthen our state and are making Arizona a preferred choice for companies to accelerate.

The vision is clear. I will continue to advocate for economic competitiveness and long-term growth that will let the world know - Arizona is the place to be.

Sincerely,



Gov. Doug Ducey,
State of Arizona



RESEARCH RESCUE

Regents consider options as universities deal with budget cuts

When it comes to research at the university level, every dollar of funding is critical in the pursuit of success. But when the universities face their own funding challenges, the pressure is on to keep that research on track.

This is the situation that Arizona State University, Northern Arizona University and The University of Arizona could be dealing with in light of the recently passed 2016 state budget that trims funding to the universities by \$99 million. Even before the reduction, the Arizona Board of Regents (ABOR) had been talking with university administrators about options.

As co-chair of Gov. Doug Ducey's transition team and former chief of staff for Gov. Jan Brewer, ABOR President Eileen Klein can appreciate what the governor is facing. It's understandable that for the short term, this is needed for the state budget, she says. Still, it's "frustrating" that Arizona has returned to a state

of budget tightening, Klein says, especially since it already has had bigger cuts and larger tuition increases compared to other states.

In such an atmosphere, federal government research grants are important. "We don't want to lose ground on the research portfolio," she says. But there's a need to look beyond those options. Time is being spent exploring universities' partnering on private sector research and investment. A prime example is the merger of University of Arizona Health Network with Banner Health. "It will be terrific for advances in bioscience research," she says. And with such a deal, "we're not counting on the state to (financially) prop up hospitals."

LEGISLATIVE OPTIONS

At the Legislature, there is already public policy activity in motion. HB 2484 would eliminate the statute that requires ASU to distribute licensing and patent income derived from certain patents. This requirement is moot given that all three universities' relevant policies and procedures are controlled by ABOR's Intellectual Property Policy. Also, under an amendment to HB2484, universities would be allowed to keep all of the proceeds from their technology transfer operations.

The biggest impact on budget cuts could be at the undergraduate level. The goal by 2020 is for 30,000 bachelor's degrees to be granted annually, with the majority in STEM. Helping is the fact there are Arizona high schools strong in producing college-ready students, Klein says, but there is a need for more high schools producing college-level students. Fortunately, the governor is targeting K-12 students for success. Regardless, the degree target will be especially challenging in Arizona since the state's students are more financially needy than their counterparts elsewhere, Klein says.

Still, she remains hopeful for finding solutions to potential budget trims. "He has challenged us to be bold in our thinking," Klein says of the governor's directive. ■



LINK TO THE FUTURE

SRP pursues options for powering high-tech growth

Very few industries recognize the value of a robust, reliable and affordable supply of electricity more than members of the technology community. Without appropriate planning for energy requirements, businesses cannot operate efficiently or continue to expand and serve their customers.


Arizona's utilities have become essential partners for the technology industry, fostering economic development in communities statewide by appropriately investing in energy infrastructure. A good example is an ongoing effort by Salt River Project (SRP) to add to its ability to serve the growing need for energy in an area known as the Price Road Corridor (PRC).

Located in south Chandler, the PRC is already home to numerous large technology businesses and it is the city's intention that the area continue to develop. While businesses in the PRC today enjoy adequate and reliable service, the area needs significant new infrastructure to allow for growth. Understanding there is no substitute for proper preparation, SRP is working to site new high-voltage transmission lines and high-capacity electrical substations in the area to serve future expansion.

According to SRP's Tom Novy, the project manager, the land available in the PRC makes the area a power delivery "hot spot" and current transmission capacity in the area will not be sufficient to serve projected growth in the future.

While much needed, siting new electrical facilities like power poles, power lines and substations can be difficult. SRP has worked to address the public's concerns by pursuing the route alternative on the Gila River Indian community. Locating the majority of the power lines there provides the community with the ability to enhance its 69kV system and allows the Gila River Indian Community Utility Authority to more adequately serve its customers.

Remaining items to finalize the alternative include tribal council and SRP board approvals, and a grant of right of way across the allotments issued by the Bureau of Indian Affairs. To permit the remaining route segments on non-tribal land, SRP recently filed an application for a certificate of environmental compatibility with the Arizona Corporation Commission.

It is not easy or inexpensive but, ultimately, building the infrastructure necessary to support the expansion of high-tech businesses benefits the communities where they are located and the state's economy as well. When Apple recently decided to locate a huge global data center in Mesa, the decision was based, in part, on SRP's ability to deliver energy for the new operation under a very tight deadline. It is that type of flexibility and planning that SRP is trying to achieve with the PRC transmission project to ensure Chandler's continued economic growth. 



HEALTHY DEFENSE

Avoid becoming the next data breach headline

WRITING BY ✕ CHRIS BOWEN


Anthem, Community Health Systems, New York Presbyterian Hospital/Columbia University Medical Center. These are just a few organizations out of the hundreds that have made headlines due to breaches of patient health information. With health data now considered 10 times more valuable than financial data, such cases will continue to pervade the news cycle.

Rather than become the next notorious example of a massive data breach, many organizations are moving their data—and management of it—to the cloud. Before you take the same step, be sure you partner with the right cloud provider, one that practices a multi-layered, defense-in-depth security strategy that includes the following:

- **Physical** – Entrust your data only to top-tier data centers with 24/7 perimeter sensor-monitoring and badged or biometric entry into secure areas.
- **Network** – While this layer is generally present in healthcare organizations, one or more areas are often out-of-date if managed internally. Look for cloud providers that use enterprise-grade hardware, advanced firewall configuration, SSL VPN security, intrusion

detection and prevention, and threat management response.

- **Application** – This layer can be easily exploited if secure coding practices, code reviews, change management and code versioning are ignored or done improperly. A top-tier cloud provider will abide by sound change management principles and provide tools to enable application firewalls, provide patching support, and deploy regular system vulnerability scans and malware protection.
- **Data** – Data security often is the primary focus of security efforts even though security at all layers is important. Items of concern include backup, at-rest and in-transit encryption, retention, destruction, archiving, security information and event management (SIEM), and lifecycle management.
- **Server** – Ask your cloud computing provider what it does to monitor file integrity, patching, role-based access controls, SIEM and proactive vulnerability management.
- **Devices** – This is often the Achilles' heel for internal security because many devices are outside IT's control. Talk to your cloud provider about securing data from mobile and medical devices, and discuss BYOD policies and best practices.
- **User** – This is the most difficult to manage because it requires changing behaviors rather than simply upgrading technology. It involves using two-factor authentication, preventing social engineering and performing ethical hacking as well as corporate policy and continuous education.

As the last line of defense, healthcare organizations need to make data security a high priority. They can do so in a way that offloads much of the daily responsibilities to a cloud provider that already has the mechanisms in place. And that's good news for everyone. 



CHRIS BOWEN is chief privacy/security officer and founder of ClearDATA, which provides HITRUST CSF-certified, HIPAA-compliant cloud computing used by more than 300,000 healthcare providers to store, manage, protect and share their patient health information and critical applications.



TOOLS FOR TALENT

Repurpose marketing tactics to attract top tech pros

WRITING BY ✕ SHEILA KLOEFKORN



Despite a strong technology legacy, Arizona isn't usually uttered in the same breath as Silicon Valley or Cupertino. Technology juggernauts like Apple, Facebook and Google have global reputations and deep pockets that exert a gravitational pull on top technology talent, leaving other markets to struggle to fill technology positions. When your company is ready to expand, you don't want delays from personnel shortages.

Luckily, many of the same tools that you use to communicate with your customers can also help you engage prospective hires. Inbound marketing and social media are excellent tools for getting prospective buyers thinking about your company. With some tweaking, you can leverage those same tools to get prospective hires thinking about you as well.

WHAT MAKES YOU SPECIAL?

One of the tools of marketing is the unique value proposition. The same effort that you put into conveying the strengths of your product should be put into describing the culture of your company to job candidates. What's special about working for you?

Remember that it's easy to simply say you reward top talent because virtually everyone does. Push beyond the platitudes and find the stories that show why it's great to be on your team. Show how diverse your team members are and how they have what your prospective clients want. Pin down what makes your company special and pitch it.

EMBRACE SEO

Whenever someone with the skills you need is seeking a job, you want to maximize the chance

that you're on their radar. The great news is the modern job seeker turns to the exact same resource for job openings as the modern consumer does to learn about products: the search engine.

Make sure your job listings are supported with the same SEO best practices that drive your sales machine. Talent can't consider working for you if they don't know you exist. Prioritize putting yourself in front of qualified job seekers.

ENGAGE SOCIALLY

Every day in social media channels, talented professionals are talking about the issues that shape your industry. Your company needs to be engaged in those conversations. When members of your company weigh in on the pressing issues in your field, you convey to others that you are passionate about the things that move them. Cultivating an active online presence for your company will attract attention from the movers and shakers that you want on your team.

With just a few simple steps, you can repurpose the same strategies that engage your future customers to entice your future hires. As more and more Arizona companies embrace these strategies, we'll all enjoy a synergistic effect. We'll grow the pool of technology professionals in our own backyard, building Arizona's reputation as the Silicon Desert in the minds of all. 📧



SHEILA KLOEFKORN is CEO of KEO Marketing Inc. She was recently recognized as one of the Top 10 Business Leaders of the Year by the Phoenix Business Journal. Sheila can be reached at skloefkorn@keomarketing.com.



BUT WAIT, THERE'S MORE

*Tax credit
updates
hold promise
of further
economic
development*

For Pinnacle Transplant Technologies of Phoenix, the Arizona Angel Investment Tax Credit program has offered a chance to provide a secure return for investors. For Cancer Prevention Pharmaceuticals, it caused investors to get serious. "It was the thing that pushed them over the line to invest," says Jeffrey Jacob, CEO of the Tucson-based company.

Moreover, for 120 small businesses statewide, the program has brought approximately \$58 million in certified investments since beginning in 2006. In addition, the Arizona Research and Development (R&D) Refundable Tax Credit program has been responsible for raising of early-stage capital by companies responsible for high-paying, knowledge-economy jobs.

Supporters of the two programs are now seeking approval for upgrades from the Arizona Legislature. They offer opportunities for economic development without adding unproven risk to the state budget.

Thanks to the Angel Investment program, Pinnacle Transplant Technologies has doubled its workforce over the last 18 months with an average salary of \$54,000 plus full benefits including a 401(k) match program. "The investments allowed us to enter the market and become cash flow positive, says CEO Russ Yelton, adding that staff at the tissue graft bank now totals 65 associates and there are plans to add another 40 this year.

There have been 213 unique companies that

have taken advantage of this initiative to become certified for the program. These small businesses on average employed 4.5 employees each at the time of certification and paid an average of \$61,900 per employee per year. These positions are quality jobs, generating an average job multiplier effect of approximately 2.3 on Arizona's economy.

HUGE IMPACT

Outcomes from the \$18.7 million in tax credits approved to date include more than \$340 million in seed capital, venture capital and other sources of financing raised by 94 of the 120 certified businesses in addition to the original investments received under the program. Also, the certified businesses have had a combined economic impact estimated at \$1.3 billion on Arizona's economy. For 2015 alone, the economic impact is expected to be \$332.7 million.

Growth in capital and payroll also is the story at Cancer Prevention Pharmaceuticals. In addition, participating in the R&D tax credit program "helped us advance some key programs that were in jeopardy due to lack of capital at the time," Jacob says.

Companies gained the ability to receive a partial refund of the R&D tax credit when Senate Bill 1254 was passed during the 2010 legislative session, enhancing the original legislation that had been in place since 1992. Under the R&D refundable tax credit program administered by the Arizona Commerce Authority, a qualifying company became eligible to apply for a partial refund of up to 75 percent of its current year's tax credit minus the current year's tax liability.

In the first four years, more than 120 applicants have received a credit. These applicants generally employed 31 employees each, spent \$263 million on R&D in Arizona, invested nearly \$100 million in capital investment and paid an average of \$77,000 per employee per year. In addition, the total economic impact from 2011 through 2013 has been more than \$2.26 billion, with an average return on investment of 13.1 to 1.

Both tax credit programs are under consideration for changes by the Legislature. In their 2014 session, legislators extended the sunset date of the

Angel tax credit from 2016 to 2021. However, there were no additional funds allocated to the program. The Arizona Technology Council would like to see it recapitalized at the \$5 million level.

BEYOND REFUNDABLE CREDIT

The Council not only wants the R&D refundable tax credit to be continued but expanded as a further inducement for raising early-stage capital by Arizona companies responsible for high-paying, knowledge-economy jobs. At its current cap of \$5 million per year, technology companies with operations in Arizona that have used the credit have reinvested the funds through additional R&D and hiring talent in Arizona. The Council supports expanding the credit by \$2.5 million for four years.

Jacob knows what such changes can bring. The higher the tax credit amounts, the better for both companies and investors. "It is very difficult for Arizona to compete with other states unless they put 'real money' into this space," he says. For example, Texas has a \$3 billion applied R&D grant program solely focused on cancer, which has caused companies—even Cancer Prevention Pharmaceuticals—to consider relocating there since individual grants worth \$5 million to \$20 million are being offered, Jacob says.

Besides the tax credit programs, the Arizona Legislature also is considering separate measures in each chamber that would allow equity crowdfunding programs to let individuals invest in companies by purchasing securities, similar to stock. Currently, 15 states have enacted legislation regarding the crowdfunded security offerings while 17 states, including Arizona, are currently considering such legislation. There is no anticipated fiscal impact to the state General Fund associated with this legislation.

"Competitive, business-friendly states are those that provide a stable and predictable environment for commerce," says Steven G. Zylstra, president & CEO of the Arizona Technology Council. "We urge lawmakers to support this legislation that is of particular importance to encouraging existing businesses to expand." ■



A PLATFORM TO SCALEUP^{TECH}

*Innovators and manufacturers find
Arizona offers what they need to grow*

in order to build an innovation economy, an appropriate mix of government, industry and academic interaction is needed to create the right environment. A culture of innovation and entrepreneurship also is a must, with relevant role models to stimulate and inspire the ecosystem and fuel growth.

Arizona is doing this and generating a real buzz in the process. It has successfully created an environment to nurture talent, grow businesses and attract corporations from elsewhere. In fact, some are even calling Arizona the next Silicon Valley.

One example is the annual Arizona SciTech Festival, which takes place in February and March with more than 800 events to stimulate collaboration among students, community and business in the next generation of science, technology, engineering, arts and math (STEAM). Then there is Phoenix Startup Week, which

embraces more than 160 free educational events created by entrepreneurs for entrepreneurs.

The state is quickly becoming a hub for innovation and ideas through vibrant startup programs at its universities, as well as support from the startup ecosystem's growing number of incubators, accelerators and co-working spaces that are catalysts for new venture formation.

Continuing on the startup theme, the Arizona Commerce Authority (ACA) in conjunction with Invest Southwest annually holds Venture Madness, a unique competition that pits 64 early-stage growth companies against one another in a bracket-style, head-to-head competition. According to ACA President and CEO Sandra Watson, "Venture Madness is a unique program among the many opportunities Arizona offers to early-stage growth companies. Engaging with these companies is an important part of our mission to strengthen and expand Arizona's overall economy."

To spur innovation, the ACA annually commits \$3 million in grant funding through its Arizona Innovation Challenge (AIC) program to

help innovative startups and early-stage companies commercialize their technology and accelerate their businesses. Each company awarded can receive up to \$250,000 in grant funding. In total, the ACA has awarded 44 grants to Arizona's entrepreneurs since 2011. Regarding the state's initiatives supporting its pro-business environment, Watson says, "Arizona developed a blueprint for success four years ago that streamlined our tax and regulatory environment, established a suite of programs for companies of all sizes, and put us on the map as a global contender for major business expansions."

USING FUNDING FOR GROWTH

Kutta Technologies is a good example of how Arizona is able to nurture its companies. The company originally won an AZ Fast Grant competition in 2003, which allowed it to win a federal Small Business Innovative Research grant for unmanned air vehicle technology. Ten years later, Kutta Technologies now is controlling full-sized unmanned helicopters for the U.S. Navy to support the Autonomous Aerial Cargo/Utility System (AACUS) program.

The focus of AACUS is to allow troops on the ground to request supplies and medical evacuations with an intuitive user interface on iPads and Android tablets. Kutta Technologies, working in partnership with Aurora Flight Sciences, developed the human machine interface technologies for the main operating base and combat outpost. The application runs on an off-the-shelf iPad Mini, and allows a U.S. Marine in the field to request needed supplies and denote the actual locations of where precisely to drop them.

Once the request for supplies is made, it is routed through the system and the software autonomously generates a safe route to the landing zones. The safe route takes into account terrain, the airspace allocated to the mission and other mission-specific parameters to ensure a successful resupply.

"ACA's support meant we were able to better facilitate the commercialization of our technology and get to volume production. The funding is a big help," says Doug Limbaugh, CEO of Kutta

Technologies. "Arizona is also well-positioned for collaboration with other high-tech companies and there is a well-educated workforce that provides companies the ability to grow rapidly."

RECOGNIZING A COMPLETE ECOSYSTEM

Apple is making a new \$2-billion investment in Mesa to set up a Global Command Center for its global networks, representing one of the company's largest investments in history.

Northern Trust, a 125-year-old leading financial institution, has also recognized the state's pro-business environment. It opened a new operational center in Tempe with plans to employ 1,000 full-time employees over the next three years. From here, it will provide multiple financial business and banking services, with staff performing a wide variety of roles across Northern Trust's business units and functions.

Orion Health, a population health management company, recently opened a new North American research and solution center in Scottsdale. It will focus on providing decision support to clinicians and patients, and solution support for its clients' population health initiatives across the country. "Orion Health chose Arizona as the location for our 'Center of Excellence' due to its growing healthcare and bioscience industries, and the extensive talent pool from nearby universities," says Executive Vice President David Bennett. "It is an exciting time to be a part of the Cure Corridor in Scottsdale, as Arizona has created an environment that fosters innovation and collaboration, one that we can continue to build on in the years to come."

Arizona has been able to implement a plan to nurture talent and skills, creating a melting pot for startups, high-growth tech companies and established companies while providing a dynamic business environment for an economy to stimulate growth through innovation, entrepreneurship and manufacturing. 🇺🇸



NITIN DAHAD is editor and co-owner of The Next Silicon Valley, a website focused on technology-based innovation and regions around the world.



A FAREWELL TO INVESTMENT BANKER 'CHIP' FISHER

In his career, “Chip Fisher had his fair share of success. As a young lawyer, he joined National Car Rental, where he was point man for acquiring more than 75 licensee businesses to help build a worldwide organization. He went on to become the largest franchise holder in the Dollar Rent-Car system. As a top executive at Jostens, he directed the efforts resulting in more than 75 acquisition and divestiture transactions.

For some people, that would be enough. But there was more to come when in 1997 he joined the Minnesota-based investment banking advisory services firm that would eventually carry his name: Greene Holcomb Fisher. As managing director, he came to Arizona to open an office—and captivate nearly everyone he met. “He had a great quality about being able to connect with people on a personal level,” says Matt Greeson, who was Fisher’s colleague in Arizona. Many are left with their personal memories after Orville Earl Fisher Jr.—known simply as “Chip”—died Jan. 29, just five days after his 71st birthday. He had been battling melanoma.

Fisher leaves a network of fans and friends

here and in Minnesota. Arizonans started getting to know him when he opened the Arizona office in Scottsdale’s Kierland area in 2004. At the time, he found the market didn’t have an understanding of investment banking so he spent his time educating others. “For a few years, it was a lot of running around the Valley, meeting with anyone he could,” says Greeson, who joined the effort after interviewing with Fisher in 2005.

MORE THAN BUSINESS

Industries served by the firm include technology and telecommunications, healthcare, and energy and infrastructure. Although Greene Holcomb Fisher has specialists in the sectors, Fisher would work where needed. After all, “Chip was a *banker*,” Greeson says. One person who saw Fisher in action was Steven G. Zylstra, president & CEO of the Arizona Technology Council. “Chip was a consummate professional who was highly respected and an extraordinarily proficient investment banker,” he says.

But for many, he was a friend. For his office partner, that meant being at Fisher’s home for afternoons at the pool and keeping the pizza oven going since children were a bond—Fisher’s grandchildren are the same age as Greeson’s son.

In fact, Fisher’s home was where many got to know him better. Even as he was getting the office here established, he came to be known for parties of dinner and cocktails at his house. Greeson recalls being at a party where 40 people—corporate attorneys, business owners, high-powered people—all waited for their host to arrive. Fisher eventually rolled in off the golf course and welcomed them to his house. And because it was his house, he told them, he would first take a shower before joining them. “You were just a friend of Chip’s,” Greeson says. Zylstra adds: “His friendly demeanor and optimism made him a well-liked figure in the community. He will be sorely missed in Arizona’s technology and entrepreneurial ecosystem.”

Fisher’s colleagues at the firm will join others in missing him. “To anybody who had the opportunity to meet him, he will have left an impact,” Greeson says. 🇺🇸

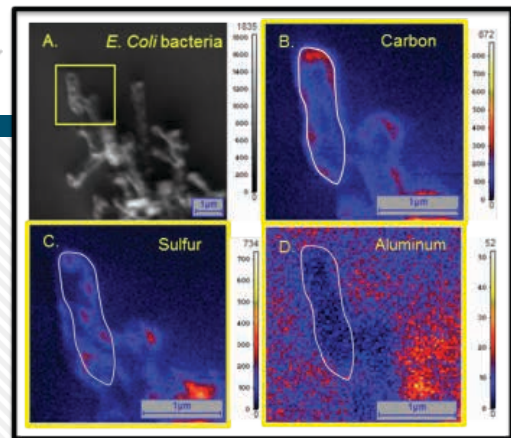


NanoSIMS images show the location of elements in *E. coli* treated with natural antibacterial clay. The data confirm which elements are critical to the antibacterial process and shows the resolution of trace element mapping by SIMS. Images by Maitrayee Bose

NO SMALL FEAT

WRITING BY × NIKKI CASSIS

Grant recognizes major contribution of joint nano facility



two secondary ion mass spectrometry laboratories in Arizona State University's Bateman Physical Science Complex were recognized as hotbeds of scientific research, thanks to the expertise of researchers in ASU's School of Earth and Space Exploration and Department of Chemistry and Biochemistry.

Professors Richard Hervig, Lynda Williams and Christy Till of the School of Earth and Space Exploration, and professor Peter Williams and postdoctoral researcher Maitrayee Bose of the Department of Chemistry and Biochemistry have been awarded \$1 million over the next three years to operate their joint laboratories as a national facility for research into the earth sciences using this high-sensitivity microbeam analysis technique.

Secondary ion mass spectrometry (SIMS) is an analytical tool permitting measurements of elemental concentration and isotope ratios on extremely tiny areas so chemical and isotopic variability on scales from a few micrometers down to several nanometers can be determined.

The spectrometers use beams of ionized atoms to focus on spots as small as 50 nanometers in size, which is less than one-thousandth the width of a human hair. The ions strike the surface and blast off and ionize atoms, which then are separated by mass and measured in sensitive detectors capable of counting individual ions. The process of scanning the beam over the surface creates a high-resolution

chemical and/or isotopic image of the sample.

Currently, ASU has one of the most extensive arrays of SIMS instrumentation and SIMS expertise in the world. The ASU researchers have been consistently on the leading edge of innovation in micro-elemental analysis.

SIMS research at ASU dates back to 1984 with the acquisition of a Cameca (Paris) ims3f ion microscope capable of analysis in few-micrometer areas. A more modern and more powerful ims6f microscope was added in 1999. That was followed by acquisition of a Cameca NanoSIMS instrument in 2011, with the capability to analyze areas as small as tens of nanometers.

This combination of instruments enables applications to a broad range of scientific problems, including analyses of a wide variety of natural and synthetic inorganic materials from this planet and others, semiconductors and even biological materials. "We have been operating as an NSF-funded national facility since early 2007," says Hervig, a professor in ASU's School of Earth and Space Exploration and director of the ASU SIMS facility. "The 2015 renewal allows us to continue to operate as a facility, and makes the NanoSIMS instrument as well as the existing 6f SIMS lab accessible to students, researchers and faculty." 📷

NIKKI CASSIS is director of marketing and communications as ASU's School of Earth and Space Exploration.



ANOTHER DIMENSION

WRITING BY × **THERESA BIERER**

Lab turning ideas into marketable objects

if you ask John Tester about Northern Arizona University's technological strides during the past few years, be prepared for a long answer. In addition to teaching classes, the associate professor of mechanical engineering heads up the university's RAPIDLab, home to 3D printers and other machines used to turn research ideas into prototypes. "One of the reasons you do 3D printing is you don't have to set up a machine for machine parts and buy all the tools. Instead, you have the computer-aided design, push a button and it prints out," says Tester, who calls the process quicker and more accurate than traditional manufacturing systems.

RAPID stands for realization of advanced design, products and intelligent designs.


During the past five years NAU's innovation capacities grew with the purchase of 3D printers, a portable coordinate measuring machine and a computer numerical control machine that makes complex parts. The technology was paid for in part by the Governor's Office of Economic Recovery and the state's technology, research and initiative funds.

Tester and the lab's support personnel have worked on numerous projects, including a device that extracts a bullet's hammer-strike fingerprint to help law enforcement identify guns used for a crime and a tool to identify the presence of chemicals and compounds in water.

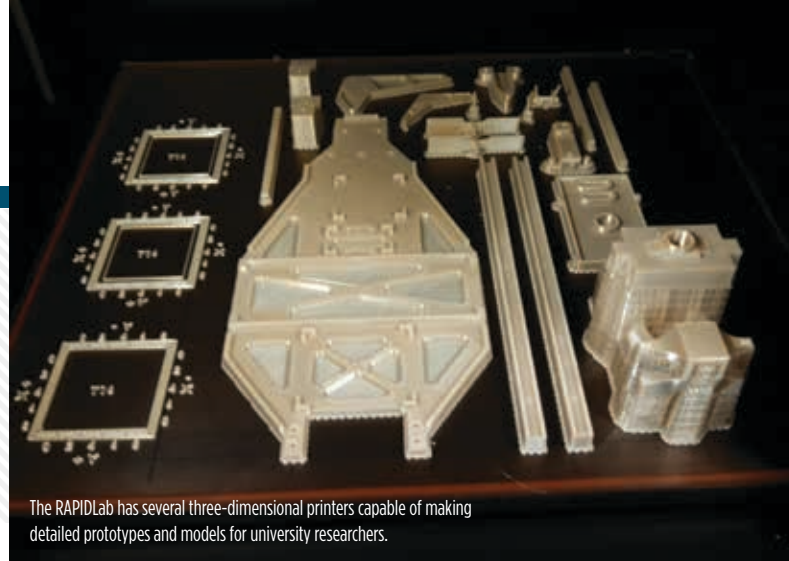
Five years ago, when Kiisa Nishikawa had a concept that could lead to creation of a prosthetic, she sought out Tester's engineering help. "I haven't been doing so much of the rapid proto-

typing and 3D printing. We've been developing algorithms and actuators based on our ideas about how muscles work," says Nishikawa, referring to technology in a foot-ankle prosthesis. "The project is actually to make the motor in the prosthesis work as though it were a muscle." NAU and Nishikawa are in the third year of a collaboration with a prosthetics company called iWalk.

Nishikawa's example of turning an idea into a product, facilitated by the RAPIDLab's engineering and manufacturing expertise and an interdisciplinary group of academics, is part of the university's mission. Lesley Cephas, director of Intellectual Property and Technology Transfer, says NAU has an obligation as a public university to further expertise and research capacity that benefits citizens and the economy of Arizona. "More and more, research is becoming an important part of the economic impact that the university has on the region and state, not just in conducting research but also in the form of research outcomes that can result in the creation of jobs in addition to revenue that comes back to the university and to the creators of intellectual property," she says.

NAU contributes about \$30 million each year in research-related expenditures, says Cephas, who expects the university's innovation and research to play even bigger roles in the future. For Tester, Cephas has provided vision for the RAPIDLab mission, and his former mentor, retired mechanical engineering professor David Hartman, the credo: "We design and build neat stuff." 

THERESA BIERER is NAU Public Affairs' coordinator.



The RAPIDLab has several three-dimensional printers capable of making detailed prototypes and models for university researchers.



INVESTMENT PAYS OFF

Study reveals UA Tech Park's economic impact on the region

a

study documenting the significant economic impact of The University of Arizona Science and Technology Park (UA Tech Park) and its contributions to Pima County's economy has been released.

The report indicates the UA Tech Park and its resident companies have an annual economic impact of \$2.33 billion on Pima County's economy. Tenants generated \$106 million in state and local taxes in 2013.

The study also reflects that UA Tech Park is a center for high-wage jobs. The average wage of a tenant's worker was \$91,145, which is about twice the Pima County average of \$46,363. In 2013, these tenants paid \$567.5 million in direct wages to their employees.

The UA Tech Park remains one of the largest employment centers in the region. It hosts 45 companies and organizations that employ nearly 6,500 skilled workers and draws employees from throughout the Tucson region, not just immediately adjacent areas and neighborhoods.

Biannually, UA Tech Park tenants are surveyed to quantify the economic impact. The current study, authored by independent consultant Dr. Vera Pavlakovich-Kochi, analyzes the economic and tax revenue impact of the UA Tech Park in Pima County for calendar year 2013. The full report can be accessed online at <https://techparks.arizona.edu/parks/ua-tech-park/economic-impact>.

For the past 20 years, Tech Parks Arizona has helped advance The University of Arizona technology innovation and commercialization through the UA Tech Park. In doing so, it has contributed in significant ways to the economic

development of Southern Arizona and the Tucson metropolitan area. The Park's contribution to the region extends far beyond the number of tenants, wages paid or tax revenue generated. Its primary impact is helping to advance new technology that expands and diversifies the local and state economies.

Over the past few years, the UA Tech Park has emerged as a major center for the testing, evaluation, demonstration and application of university and industry-generated technology. Validating technology concepts before they reach the market is a critical need of both industry and university researchers.

Tech Parks Arizona is part of Tech Launch Arizona (TLA), an office of integrated teams creating an ecosystem of invention and commercialization throughout Arizona and beyond. TLA generates social and economic impact through bringing the inventions of the University of Arizona from the lab to the marketplace. The Tech Parks support this innovation ecosystem by offering something unique to businesses: connectivity to the people and resources of The University of Arizona. They also offer a place where new companies based on UA inventions can mature and make the leap from the lab bench to the marketplace. 

One of the nation's premier research and development facilities, UA Tech Park is a unique environment dedicated to the transfer of technology from the laboratory to the marketplace.



GENETIC SUPERHIGHWAY

WRITING BY × STEVE YOZWIAK

Discovery may uncover treatments for disease that strikes girls, young women



Dr. Jeffrey Trent, TGen
president and research director

a groundbreaking TGen-led study that discovered the likely genetic cause of a particularly deadly type of ovarian cancer—one that strikes girls and young women—was included in the recent annual report of the American Society of Clinical Oncology, which with 35,000 members is the world’s leading professional oncology society.

“Clinical Cancer Advances 2015: ASCO’s Annual Report on Progress Against Cancer” is reserved for the world’s top research breakthroughs. The inclusion of this study led by TGen (Translational Genomics Research Institute) reflects the major medical discoveries and economic benefits of TGen, located at the heart of the Phoenix Downtown Biomedical Campus.

An international team led by TGen found nearly all the patients in this study lost the function of a key gene called SMARCA4, revealing a “genetic superhighway” that drives this disease. Small cell carcinoma of the ovary, hypercalcaemic type (SCCOHT) usually is not diagnosed until its advanced stages. It does not respond to standard chemotherapy and most patients die within two years. It has affected girls as young as 14 months and women as old as 58 years, with a mean age at diagnosis of only 24 years old.

“Inclusion of our study in ASCO’s annual report underlines the importance of this discovery and the anticipation of developing new

treatment options,” said Dr. Jeffrey Trent, TGen president and research director, and the study’s senior author. “The correlation between mutations in SMARCA4 and the development of SCCOHT is simply unmistakable.”

By applying its groundbreaking work in genomics, TGen led a study that included Mayo Clinic in Arizona, Scottsdale Lincoln Health Network, Johns Hopkins University, St. Joseph’s Hospital and Medical Center, Evergreen Hematology and Oncology, Children’s Hospital of Alabama, the Autonomous University of Barcelona, British Columbia Cancer Agency, University of British Columbia, and the University Health Network-Toronto.

“It is a great honor to have our work highlighted by ASCO as one of the year’s biggest cancer research advances,” said Dr. Aleksandar Sekulic, an author of the study and a physician-scientist with a joint appointment as assistant professor at TGen and the Mayo Clinic in Arizona. “More importantly, we hope this work will benefit the patients suffering from SCCOHT. Identifying the genetic driver in SCCOHT is key to understanding the disease mechanisms, which in turn may help us develop better treatments for the patients afflicted with this cancer.” 📧

STEVE YOZWIAK is the senior science writer for the Translational Genomics Research Institute.



INVESTMENT IN INNOVATION

WRITING BY × WILLIAM HARRIS

Aligning government, industry & academia

the Grand Ballroom at the Arizona Biltmore was packed recently with business, education and community leaders convening to gain insight from leaders and legends in the world of technology and innovation about what it will take for Arizona to compete in the 21st century. The event was a tribute to Erich Bloch, a man who played a transformational role in the world of technology and was a founding board member of Science Foundation Arizona.

Celebrated as a visionary on the national and international stage, Erich Bloch offered this assessment: “Competitive states or nations have modern, effective partnerships between industry, academia and government. Science Foundation Arizona creates an advantage for Arizona as every state needs a matchmaker to connect industry and universities to create economic value.”


Bloch knows of what he speaks. While he is credited with changing the world of computing with his innovation of the IBM 360—named one of the Top 3 Business Accomplishments of All Time along with the Model T and Boeing’s 707—his wisdom extends beyond technological systems.

With the country in the grip of recession in the 1980s, Bloch’s agenda in his role at the National Science Foundation (NSF) was increasing the nation’s economic competitiveness. He developed the concept of Science & Technology Centers and managed to convince President Ronald Reagan, who was planning to shut down the NSF, to instead double its budget and

launch the centers nationwide. Under Bloch’s leadership, the Science & Technology Centers revolutionized technology transfer and interdisciplinary research.

John E. Kelly, the IBM senior vice president and director of IBM Research who was keynote speaker at Bloch’s tribute event, echoed Bloch’s support for strategic matchmaking when describing what makes a region competitive in the eyes of an IBM or other major player. “When states and regions commit themselves to aligning the goals of universities and industries—when they provide the incentives to make that relationship successful—everyone wins. Investment flourishes. Innovation thrives. And economies grow.”

Kelly said the challenge for Arizona’s leaders is to do today what Bloch and his peers did for our generation. “Perhaps Erich Bloch’s most enduring legacy is as a champion of the triad of partnership between industry, government and great universities that made America the technology capital of the world. We can still be that country if we stay true to his example. We can make another golden era possible.”

If ever there were sage voices Arizona should listen to, these are the voices. And now is the time. 



WILLIAM HARRIS is president and CEO of Science Foundation Arizona.

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Arizona Business Bank focuses on the financial needs of the community, and is staffed with banking professionals empowered to make decisions and deliver personalized products and services. It is part of CoBiz Financial, a multibillion-dollar financial holding company that allows customers to take advantage of a family of financial services to guide them through all stages of their financial lifecycle—both personally and professionally. www.azbizbank.com

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Bravo is a financial technology that developed a cashless tipping app to help service professionals capture loss of revenue for those instances of no cash in a private non-disruptive transaction. It has a patent pending technology with the layers of security that allow paying/receiving tips without exchanging personal information. Bravo is already developed and launched with users in several valet parking, drivers, and hair and nail salons in Arizona. trybravo.com

The Care Fund provides mortgage and rent support to financially and resourcefully support Arizona families who endure financial hardship while experiencing extended illness or injury of their children. www.thecarefund.org

Catalyst Computer Technologies provides the same IT services as a Fortune 500 company but at a price created for small and medium-sized businesses. Its services include managed services, disaster recovery and

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The city of **Surprise Economic Development** staff is committed to the constant pursuit of improving the quality of life and business in Surprise and the Greater Phoenix Area. www.surpriseaz.gov

Talent Advisory Group works with employers in small, medium to large technology-driven industries that are looking to recruit top quality professionals for their organizations. talentadvisorygroupplc.com

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The University of Arizona STEM Learning Center serves as a nexus where researchers, educators, business and industry, community organizations, and regional policy leaders join forces to realize an economic and civic future that holds at its heart the rich economic and human potential of STEM innovation. www.coe.arizona.edu/tls

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