



ARIZONA'S
BIOSCIENCE
ROADMAP

2017 PROGRESS OF THE
Biosciences in Arizona



Arizona's Investments in Biosciences Deliver Results

Performance data attest to a growing Arizona bioscience sector. How can we accelerate the pace?

Arizona's commitment to the biosciences is paying dividends. Key measures tracked for Arizona's Bioscience Roadmap showed solid results in 2016 and 2017. Firm creation and expansion have continued, driving job growth, despite weak venture-capital funding. Research-performance barometers have rebounded, indicating future economic potential.

Progress in the biosciences over the Roadmap's 15 years is no accident. At important junctures, Arizonans have made long-term investments—a community college opening an incubator

Long-term investments have driven Arizona's progress in the biosciences. **Ensuring the long-term integrity of TRIF, a component of Prop. 301, can help the sector mature further.**

for new firms, for example; or a city dedicating prime real estate for a biomedical campus; or legislators authorizing construction of university research labs.

In 2017, Arizona did it again, as Gov. Doug Ducey signed

bills to recapitalize the Angel Investment Tax Credit and enable much-needed infrastructure improvements at our universities, including next-generation research facilities.

How does Arizona ensure that its bioscience sector matures further?

Today, one of the most high-impact tools we have is a component of Proposition 301: the Technology and Research Initiative Fund, or TRIF, which allows the universities to support high-potential seed research and proven lines of inquiry.

With state leaders agreeing to extend the sales-tax mechanisms of Prop. 301, it is now time for bioscience champions to stand up and ensure TRIF's long-term integrity.

ON THE AGENDA

Priorities for the next 12 months

1

Build long-term support for TRIF, Arizona's powerful tool to spark research and economic growth.

2

Streamline access to resources—including capital funding—by aligning roles of organizations that support bio sector.

3

Fortify state investment in education at K-12 and university levels to ensure workforce readiness.

Making an Impact

JOB

+58%

From 2002 to 2016, Arizona bioscience jobs grew at a breakneck pace.

WAGES

33% higher

In 2016, bioscience workers' annual wages were \$15,720 above Arizona's private-sector average.

FIRMS

1,446

The 2016 count of Arizona bioscience firms includes hundreds of small businesses.

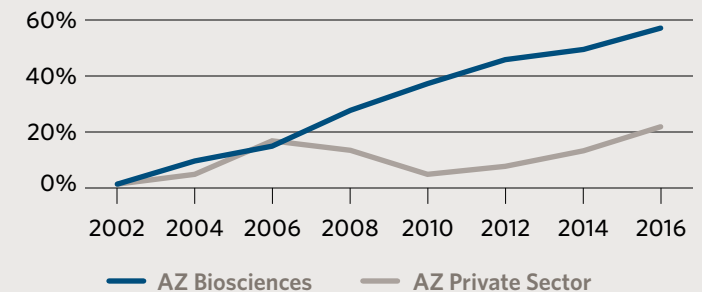
NIH GRANTS

\$189 million

The gold-standard measure of research funding rose in 2017 by 16%.

Bioscience Means Arizona Jobs

Bioscience job growth in Arizona has outpaced other sectors since the Bioscience Roadmap launched in 2002.



R&D

\$504 million

Data from 2016 shows the economic clout of Arizona universities' research-and-development activity in bio.

VENTURE CAPITAL

\$40 million

VC funding for Arizona bio firms stalled in 2017 as funding rose nationally.

TECH TRANSFER

+57%

Data from 2016-17 shows a sharp rise in university spinouts of bioscience research.

ARIZONA'S BIOSCIENCE ROADMAP

Arizona's Bioscience Roadmap is a plan through 2025 to make Arizona a leader in select bioscience fields.

A Steering Committee of state leaders in science, business, academia, and government guides the Roadmap.

Roadmap metrics are tracked and reported by TEconomy Partners, commissioned by the Flinn Foundation.

Cited data are most recent available, based on reporting from TEconomy Partners and U.S. Department of Labor.

→ 2017 HIGHLIGHTS

» PROMINENT LONG-TERM INVESTMENTS

Arizona Legislature authorizes \$1 billion for university research infrastructure: Arizona State University, Northern Arizona University, and the University of Arizona will utilize \$1 billion in bonding for new infrastructure and deferred-maintenance projects. The investment, supported by Gov. Doug Ducey and approved by the Arizona Legislature, enables the construction or expansion of bioscience research facilities to produce stronger research performance and economic impact.

Mayo Clinic School of Medicine welcomes inaugural class to new Scottsdale campus: The medical school, a partnership between Mayo Clinic and ASU, welcomes its first class of 50 students, selected from more than 3,000 applicants. The future physicians' educational program will include

patient-care training, biomedical research, and an optional master's degree in the science of health-care delivery.

Arizona Legislature approves \$10M for Angel Investment Tax Credit program: Angel investors can once again claim up to a 35 percent tax credit for investing in an early-stage Arizona biotech company. The recapitalization of the angel tax-credit program allows for \$2.5 million a year in tax credits for four years.







NAU receives \$21M NIH grant to study health disparities in the Southwest: The Southwest Health Equity Research Collaborative is established with a \$21.4 million grant from the National Institutes of Health—among the largest grants

ever awarded to the university. Studies will investigate how cancer spreads, possible cancer therapies, and staph-infection prevention.

» ENHANCE HOSPITAL RESEARCH, CLINICAL CARE

Phoenix Children's Hospital expands cancer center; announces Gilbert partnership with Dignity Health: Phoenix Children's Hospital's Center for Cancer and Blood Disorders opens a new 17,000-square-foot facility featuring exam, infusion, therapy, and recovery rooms for pediatric cancer patients. In Gilbert, Phoenix Children's will start construction next year on a five-story tower with two dozen labor and delivery rooms and an emergency department for pregnant women on Dignity Health's Mercy Gilbert Medical Center campus.

What Are the Biosciences?

-  Agricultural Feedstock and Industrial Biosciences
-  Bioscience-Related Distribution
-  Drugs, Pharmaceuticals, and Diagnostics
-  Hospitals
-  Medical Devices and Equipment
-  Research, Testing, and Medical Labs

HonorHealth conducting study of prosthetic heart valve: HonorHealth performs the first procedure in the Southwest on an elderly Arizona patient to learn whether a prosthetic heart valve can be implanted without requiring open-heart surgery and stopping the patient's heart.

ASU works with Mayo Clinic on proton-beam therapy program: The ASU physics department is working to enhance Arizona's first proton-beam therapy program on Mayo Clinic's Phoenix campus by improving the beam accuracy and making the therapy safer for cancer patients.

Dignity Health St. Joseph's to provide complex heart procedures in Phoenix: The Dignity Health St. Joseph's Hospital and Medical Center transplant team, which includes lung, liver, and kidney, begins a partnership with Cedars-Sinai Heart Institute in Los Angeles to begin offering ventricular-assist devices, interventions that often precede heart transplantation.

» PROMOTE ENTREPRENEURIAL CLIMATE

Tucson businessman to lead new venture-capital fund for UA startups: Fletcher McCusker, founder of Sinfonía Healthcare, will serve as the CEO of UA Venture Capital LLC to support the commercialization of UA science, services, and intellectual property.

Bioscience startups perform well at pitch competitions: GT Medical Technologies Inc., Life365 Inc., and Resonea are among six winners of the fall round of the Arizona Commerce Authority's Arizona Innovation Challenge. Scottsdale-based Smart Brain Aging wins the 1776 Challenge Cup Phoenix pitch competition to advance to the global finals, while Somatic Labs wins the inaugural ASU Innovation Open competition.

AZBio's annual Arizona Bioscience Week brings together entrepreneurs, researchers, leaders: The October festivities, including the annual AZBio Awards, coincide with the Biomedical Engineering Society annual meeting, which welcomes nearly 4,000 professional scientists, engineers, researchers, and students.

ASU, UA jump in tech-transfer rankings: ASU and UA both move up significantly in the Milken Institute tech-transfer rankings in the first report issued since 2006.

NACET launches Moonshot initiative: The Northern Arizona Center for Entrepreneurship and Technology in Flagstaff, home to bioscience companies such as Poba Medical, Symple Surgical, Anevas, and Axolotl Biologix, creates the Moonshot program to recruit next-generation entrepreneurs pursuing imaginative and ambitious commercial ideas.

Five Roadmap Goals:

-  **1: Form a hub of bioscience entrepreneurs and enterprises across Arizona**
-  **2: Increase the ability of research-performing institutions to turn results into products, treatments**
-  **3: Make Arizona a bio-talent powerhouse**
-  **4: Promote Arizona's convergence of research, health care, and commercialization to economic partners in neighboring states, Canada, and Mexico**
-  **5: Sustain and enhance the state's "collaborative gene" reputation**

» BUILD CRITICAL MASS OF COMPANIES

Tucson startups Calimmune, SinfoníaRx achieve exits that may top \$200M: Calimmune, a gene-therapy drug firm, is acquired by a major Australian drug company for \$91 million. Meanwhile, SinfoníaRx, which emerged from UA as a startup in 2013, is acquired by a New Jersey company for as much as \$131 million.

Companies receive FDA clearance for medical technologies: Among several firms receiving the green light from the U.S. Food and Drug Administration for new tools, Scottsdale-based NeoLight receives clearance for its jaundice-treatment device for newborn infants; EndoVantage of Scottsdale receives approval for its SurgicalPreview, a preoperative planning system for endovascular treatment of cerebral aneurysms; Oro Valley-based Ventana Medical Systems wins approval of a companion test for a drug for non-small cell lung cancer; and Accelerate Diagnostics of Tucson receives FDA marketing authorization for its antibiotic susceptibility testing directly from patient samples.

Arizona firms continue growth in capital, workforce: VisionGate, Solera Health, Styr Labs, and eVisit raise millions in venture capital to expand their businesses. Meanwhile, Phoenix-based Pinnacle Transplant Technologies, a regenerative medical company, announces a plan to double its workforce over the next three years.

Telemedicine firm GlobalMed expands in Asia: Scottsdale-based GlobalMed, which provides more than 3.5 million annual telehealth consults a year, signs a distribution agreement to sell its entire line of mobile telemedicine stations, medical devices, and software on the Chinese mainland as well as in Hong Kong, Macau, and Taiwan.

Paradigm Diagnostics opens new cancer registry study: Phoenix-based Paradigm Diagnostics, a spinout of International Genomics Consortium, raises \$7 million and opens a cancer registry study of the health and outcomes of patients using its multi-omics test.

» ADVANCE RESEARCH BASE

Critical Path Institute and TGen forge partnership to advance TB research: C-Path receives a \$1.1 million grant from the Bill & Melinda Gates Foundation to better understand tuberculosis drug resistance around the world. Also, the Tucson nonprofit launches its Type 1 Diabetes consortium to work toward the development of therapies for the disease's treatment and prevention.

Banner Alzheimer's Foundation receives \$5M grant for collaborative Alzheimer's research: Banner Alzheimer's Institute, Banner Sun Health Research Institute, the ASU-Banner Neurodegenerative Disease Research Center at the Biodesign Institute, and Translational Genomics Research Institute partner to create a public resource of molecular data for the fight against Alzheimer's disease. Meanwhile, Barrow Neurological Institute increases the number of clinical trials it facilitates related to Alzheimer's disease and other forms of dementia.

Valley fever test developed by Flagstaff researchers wins FDA approval: A test to detect Valley fever developed by Flagstaff researchers with TGen North is approved by the FDA. Meanwhile, UA secures a \$4.8 million federal grant to fund development of a candidate vaccine to protect dogs from the disease.

UA receives \$15M to address nation's needs for biofuels, bioproducts: UA receives a five-year grant of up to \$15 million from the U.S. Department of Agriculture to create the Sustainable Bioeconomy for Arid Regions Center to focus on biofuels, bioproducts, and renewable biological resources such as crops or algae. Separately, five Arizona scientists genetically engineer corn to prevent its contamination by aflatoxin, a major risk factor for cancer in the developing world.

TGen, HonorHealth, UA to develop early detection test for pancreatic cancer: A \$5.1 million federal grant will be used to study a non-invasive, rapid, accurate, and inexpensive blood test for pancreatic cancer, which displays no symptoms in its earliest stages and is the third-leading cause of cancer-related death. Meanwhile, TGen recruits Sunil Sharma, a premier gastrointestinal oncologist, to join its research leadership team and clinical partnership with HonorHealth.

ASU Biodesign Institute researchers testing world's first plant-based Zika vaccine: ASU researchers use tobacco plants to create a safe and cheap vaccine to stop the Zika virus, the mosquito-borne disease known to cause birth defects.

» EXPAND STEM EDUCATION, DEVELOP TALENT

UA College of Medicine-Phoenix receives full accreditation: The medical school is granted full accreditation by the Liaison Committee on Medical Education. Also on the Phoenix Biomedical Campus, UA opens its \$136 million Biomedical Sciences Partnership Building, which houses labs for cancer, molecular medicine, and other health research.

NAU to build new STEM building: The Arizona Board of Regents approves funding for a new \$139 million, 162,500-square-foot academic and research building at NAU that will be home to multiple STEM disciplines.

Arizona Department of Education launches pilot program to increase number of STEM teachers: The program funds professional-development programs for public-school teachers to receive additional certifications in high-need areas, such as science information and technology, as well as career and technical education.

Arizona students win major awards at STEM competitions: An Oro Valley student's research into a potential treatment for Parkinson's disease yields a scholarship to UA and a trip to the Nobel Prize ceremony. Meanwhile, middle-school students from Snowflake win a national STEM competition, earning \$170,000 in technology for their school.

Southern Arizona Research, Science and Engineering Foundation opens new center: The 62-year-old organization dedicated to STEM education celebrates the opening of its new Tucson center and welcomes more than 2,000 student projects at its annual science fair.



Examples of TRIF Impact

1

UA has leveraged TRIF dollars to draw \$100M from NSF for the CyVerse life-science cyber-infrastructure.

2

NAU invested early TRIF workforce-prep funds in a center for STEM teachers, then won \$3M in federal grants to do more.

3

ASU's first TRIF distributions spurred its formation of the Biodesign Institute, a hub for discovery with practical applications.

4

Fueled by TRIF support, in 2017 alone, UA's Tech Launch Arizona facilitated 105 commercial licenses and options.

5

To maximize reach, all three universities have made TRIF-supported core facilities accessible to private firms in the broader community.

6

TRIF-backed research has spun out dozens of companies, including diagnostics firms HealthTell from ASU and PathoGene (acquired by DxNA) from NAU.

→ Why is TRIF So Important?

TRIF is bigger than bio. It powers research in areas like national security, water, and energy; advances workforce development; and facilitates the translation of discoveries into new products and companies. Arizona's return on investment is extraordinary:

For every \$1 in TRIF support, our universities leverage \$5-\$7 more from external sources.



“ I see TRIF's impact up close, and it extends far beyond research in university labs. TRIF is vital to increasing future economic competitiveness. It also greatly expands students' participation in innovative, real-world projects that ultimately benefit all Arizonans.”

RON SHOOPMAN

CEO, SOUTHERN ARIZONA LEADERSHIP COUNCIL

ARIZONA BOARD OF REGENTS

CHAIR, ARIZONA'S BIOSCIENCE ROADMAP STEERING COMMITTEE