

ARIZONA'S
BIOSCIENCE
ROADMAP

THE LATEST PROGRESS OF THE
BIOSCIENCES
IN ARIZONA



ADVANCING THE BIOSCIENCES AND IMPROVING HEALTH OUTCOMES

Arizona's Bioscience Community Rises to Meet the Moment

On the heels of the most successful year yet for Arizona's bioscience sector, a global crisis strikes.

Never before have so many indicators looked so good. As the data and achievements presented in this report illustrate, the most recent chapter in Arizona's bioscience story is almost entirely good news. Our research enterprise has been performing better than ever, with all-time highs for National Institutes of Health funding and university R&D. Tech transfer is looking up. Risk capital has set a record. And bio jobs and wages have continued to grow faster than the private sector as a whole.

Today, though, we are confronting our greatest public-health emergency in a century, one that has brought devastating economic consequences. The closing of offices and shops, restaurants and schools, theaters and gyms has crushed our neighbors' livelihoods, even as it has given our clinicians and hospital systems a better chance to save lives.

Arizona's bioscience community has responded. Medical students are graduating early to join the front lines—with some of their professors alongside them. Startups are repurposing their technologies to develop new diagnostics, and major firms are pivoting to manufacture PPE. Our universities and research institutes are adding capacity to test for infections and antibodies. They're conducting genomic surveillance of community spread. They're prototyping new devices for ICUs. And they've joined the pursuit of a vaccine.

These actions to beat back COVID-19 in Arizona are possible only because of 20 years of choices from the public and private sectors. Governors, university presidents, CEOs, mayors, investors, research leaders, legislators, voters—they all chose to support the biosciences to strengthen and diversify our economy and improve health outcomes. Arizona has many hard months ahead. Bio will help us navigate them and grow again on the other side.

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» Making an Impact

THE LATEST DATA



JOBS

+8.3%

From 2016-2018, Arizona bioscience jobs grew faster than the state's overall growth rate of 6.2%.



AVERAGE WAGES

35% higher

In 2018, bioscience workers' annual wages were nearly \$18,000 above Arizona's private-sector average.



WAGE GROWTH

+4.9%

From 2017-2018, wages for bio workers nationally jumped 4.1%. In Arizona, they rose even faster.



NIH GRANTS

\$263 million

The gold-standard measure of research funding hit a new high in 2019—in dollars and national share.



R&D

+25%

Bio R&D at Arizona's universities grew at more than twice the national rate of 12% from 2016 to 2018.



VENTURE CAPITAL

\$198 million

VC funding for Arizona bio firms hit a record high in 2019 even as bio funding slipped nationally.



PATENTS

+51%

In 2018-2019, Arizona universities received 180 patents—48% in bio—up from 119 in the previous period.



STARTUPS

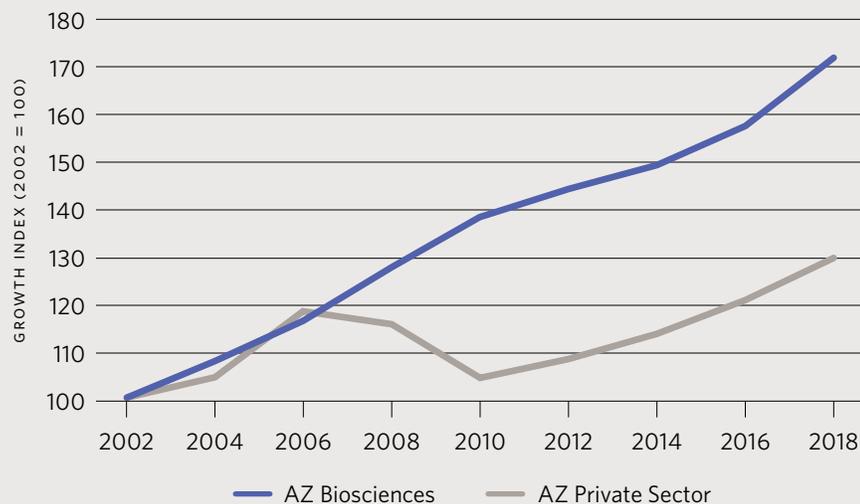
32

The new bio firms created from university IP in 2018-2019 represented 52% of all university spinouts.

Arizona Employment 2002-18

Bioscience job growth in Arizona has outpaced the private sector since the Bioscience Roadmap launched in 2002.

Source: TEconomy Partners LLC analysis of Bureau of Labor Statistics, QCEW data from IMPLAN Group LLC



» Prominent Long-Term Investments

Wexford research facility breaks ground on Phoenix Biomedical Campus

Wexford Science and Technology broke ground on a \$77 million, 200,000-square-foot research center on the Phoenix Biomedical Campus, to be anchored by Arizona State University. The Center for Entrepreneurial Innovation will open the CEI LabForce incubator in the building, which was designed to inspire innovation and entrepreneurial activity.

Creighton University medical school starts construction at Park Central

A new 180,000-square-foot building under construction at Park Central will house Creighton’s first 100 medical students as it builds out a health-sciences campus that will also include nursing, pharmacy, occupational therapy, physical therapy, and physician assistant students. Park Central, a former shopping mall, is being reimagined with a focus on technology, innovation, and design.

\$50 million donation to ASU designated to fund dementia research

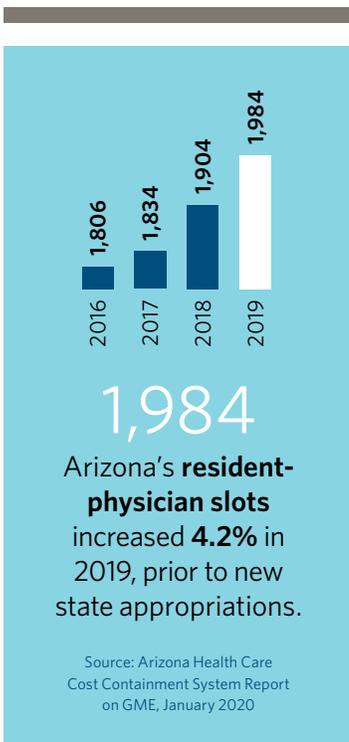
Arizona State University receives a \$50 million gift from Charlene and J. Orin Edson to support dementia research, including a focus on causes and education to help patients, caregivers, and families. The gift will be divided between the renamed Edson College of Nursing and Health Innovation and the Biodesign Institute.

Arizona Legislature funds additional residency slots

For the first time in over a decade, Arizona directs new dollars to increase the number of residency positions for new doctors, prioritizing rural and underserved urban locations, a move projected to draw down more than \$30 million in additional federal Medicaid dollars over three years.

New state funding provides tuition-free education for future rural doctors

Governor Doug Ducey signs legislation to fund tuition waivers for about 100 University of Arizona College of Medicine students in Tucson and Phoenix who agree to serve as primary-care physicians in rural or underserved areas for at least two years after medical school.



RECENT HIGHLIGHTS

» Enhance Hospital Research, Clinical Care

New Banner hospital tower opens in Tucson

The \$446 million, nine-story, 672,000-square-foot patient tower at Banner-University Medical Center Tucson opens with new private patient rooms, larger operating rooms, additional intensive-care beds and upgraded telemedicine options. Banner MD Anderson Cancer Center prepares to open an extension of its Gilbert clinical facility at Banner-University Medical Center Phoenix.

Navajo Nation welcomes first cancer center

The cancer-treatment center on the Navajo Nation, operated by the Tuba City Regional Health Care Corp., sees its first patient. The center offers chemotherapy, screenings, and culturally appropriate care, including translators and personalized support.

Barrow to add facility, leads clinical trials

Barrow Neurological Institute starts construction on a new five-story research facility adjacent to Dignity Health St. Joseph's Hospital and Medical Center in Phoenix. The research and treatment center also announces the third phase of an international clinical trial to test deep-brain stimulation in Alzheimer's disease patients, while the Ivy Brain Tumor Center at Barrow continues its glioblastoma studies and trials.

HonorHealth starts construction on Neuroscience Institute

The \$44 million HonorHealth Neuroscience Institute, under construction in Scottsdale, will diagnose and treat brain- and spine-related disorders, as well as multiple sclerosis and ALS. The 120,000-square-foot facility is scheduled to open in spring 2021. HonorHealth also announces plans for the \$39 million, 120-bed Via Linda Behavioral Hospital, to be built on the Salt River Pima-Maricopa Indian Community.

Valleywise opens west Phoenix hospital

Valleywise Health, formerly known as Maricopa Integrated Health System, reopens a renovated hospital in the Maryvale neighborhood of Phoenix that had been closed since 2017. The hospital includes an emergency department, radiology services, lab, pharmacy, and behavioral-health center.

Banner Alzheimer's Institute, Mayo Clinic College of Medicine, ASU publish CTE-study results

A multi-institution team of Arizona researchers reports that an experimental brain scan can detect abnormal proteins in the brains of living former National Football League players. The protein-based biomarkers represent a key gauge of players affected by chronic traumatic encephalopathy, or CTE, typically caused by repetitive brain injuries.



Arizona ranks

42nd

We have work to do. Despite major hospital expansions, Arizona has not matched its population growth.

Source: Kaiser Family Foundation, State Health Facts Report, 2019

» Promote Entrepreneurial Climate

ASU, UArizona spin out 32 companies

In fiscal year 2019, Arizona's public universities continued to spin out new companies, with bioscience startups making up more than half of the new firms from Arizona State University and the University of Arizona. Meanwhile, a study reveals UArizona startups generated more than \$585 million in economic impact over a three-year span.

Arizona Bioscience Week features conferences, awards

The fourth annual weeklong celebration included scientific and investor events and forums featuring women in biotech, the discovery of new medicines, and bioscience entrepreneurs, plus the annual AZBio Awards. Meanwhile, bioscience firms excelled at startup competitions held throughout the state.

Moonshot at NACET establishes rural program for entrepreneurs

The Northern Arizona Center for Entrepreneurship and Technology in Flagstaff offers startup-business training in rural communities throughout northern Arizona, including for the Hopi Tribe and Navajo Nation, to train underserved entrepreneurs.

Oro Valley bioscience incubator celebrates groundbreaking

A long-planned project, the Oro Valley Innovation Labs, in partnership with the University of Arizona and others, starts construction at the Oro Valley Innovation Park. The 4,000-square-foot incubator will offer business training to scientists in fields such as cancer research and medical devices and will feature state-of-the-art labs. Meanwhile, construction nears completion on the FORGE at Roy Place business-innovation hub in downtown Tucson.

Arizona ranks 18th on "Best States for Business" list

Forbes magazine awards Arizona a top-20 ranking for the second straight year in its annual assessment based on business costs, labor supply, regulatory environment, economic climate, growth prospects, and quality of life. Arizona ranked third among all states for growth prospects.

CEI named Incubator of the Year by global association

At its annual conference, the International Business Innovation Association recognizes the Center for Entrepreneurial Innovation, based at GateWay Community College, as the Technology & Science Incubator of the Year.



50%

In spring and fall 2019, the Arizona Innovation Challenge made 20 funding awards—half to bio firms.

» Build Critical Mass of Companies, Raise Risk Capital

Solera Health, VisionGate close on largest bioscience capital deals

Solera Health raises \$42 million for its health-care network that connects physicians, patients, and insurance companies with non-medical wellness organizations, while VisionGate, developer of the Cell-CT 3-D cell-imaging and analysis platform for cancer detection, raises \$36.6 million.

OncoMyx Therapeutics Inc. raises \$25M to develop cancer-fighting virus

The Arizona State University startup on the Phoenix Biomedical Campus will use its infusion of funding to develop an oncolytic-virus therapeutic program to treat hard-to-cure cancers.

GT Medical Technologies raises \$10M, completes first targeted therapy case

The Tempe firm, founded by a team of Barrow Neurological Institute clinicians and researchers, raises \$10 million to help commercialize its GammaTile Therapy, an FDA-cleared, surgically targeted radiation therapy designed to delay tumor regrowth for patients with all types of recurrent brain tumors. Later in the year, GT Medical Technologies uses its therapy for the first time at an Arizona hospital.

FDA clearance boosts firm

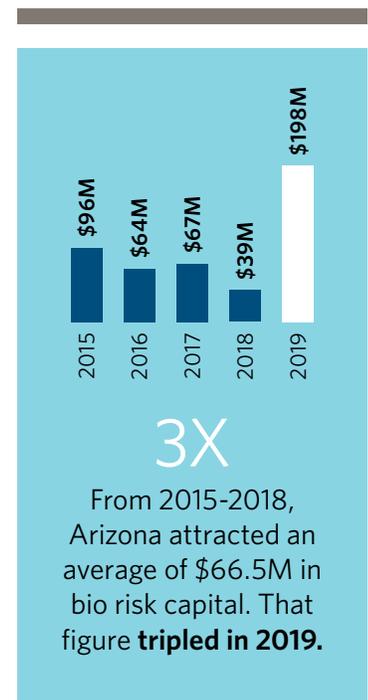
Among Arizona bioscience firms earning U.S. Food and Drug Administration clearance for their products is Resonea, for its in-home sleep-apnea screening app, Drowzle.

UAVenture Capital backs university startups

The Tucson-based fund supporting University of Arizona technology spinouts invests in MediCarbone, the patent holder of a flexible carbon-fiber fabric inserted inside and around a fractured bone, and iCrx, which has developed a portable device that uses laser technology to determine a patient's eyewear prescription within 12 seconds.

BioLab Sciences receives billing approval from Medicare, Medicaid Services

The Scottsdale-based regenerative-biotechnology company will have its MyOwn Skin product for wound care included in the Centers for Medicare and Medicaid Services billing codes, making it more accessible to patients and increasing revenue projections for the firm.



» Advance Research Base

ASU's Biodesign Institute awarded nearly \$40M for weapon-exposure detector

The \$39 million project funded by the U.S. Defense Advanced Research Projects Agency will enable creation of a field device that can detect whether a person has been exposed to weapons of mass destruction, including biological agents, radiation, chemicals and explosives; the technology could be adapted to detect diseases. Meanwhile, Arizona State University receives a large grant and donation to help fund construction of its Compact X-ray Free Electron Laser, the first in the world.

TGen working toward treatments for cancers, rare disorders

Translational Genomics Research Institute receives \$6.1 million in grants to study deadly lung diseases, identifies a method of starving pancreatic-cancer cells, discovers a gene linked to a rare condition that causes disabilities, and partners on a study that finds a human breast-cancer drug may work against the most common canine lung cancer.

C-Path partners on new data platforms, standards

Tucson-based Critical Path Institute appoints Joseph Scheeren as its new president and CEO and continues its work to improve drug development and support innovative clinical-trial designs for rare disorders, while releasing a global standard that specifies how to structure data and outcome measurements in HIV clinical trials.

UArizona Cancer Center grant addresses cancer among Native Americans

The University of Arizona Cancer Center, in partnership with Northern Arizona University, receives \$6.85 million from the National Cancer Institute to continue a longstanding collaboration on cancer research, training, and prevention for Arizona tribes.

Southwest Autism Research and Resource Center study improves autism detection

The average age of autism detection in the five-year SARRC study of children is 22 months, much earlier than the reported state average of 55 months. The earlier screening and detection could mean less intensive treatment for children diagnosed with autism.

NAU, TGen leading fight against West Nile virus in southwestern U.S.

Researchers pursue a line of inquiry that involves extracting DNA from frozen mosquitoes to trace the mosquito-borne disease to its source and determine the areas with the highest number of infections. The research shows West Nile virus is most prominent in Maricopa County and has become permanent in Arizona.

NORTHERN ARIZONA UNIVERSITY 196

ASU
Arizona State University 41

U
THE UNIVERSITY OF ARIZONA 35

In the NSF's 2018 R&D rankings, NAU closed in on the **top 20%** of 915 institutions. ASU and UArizona were **top 5%**.

» Expand STEM Education, Develop Talent

Class size expands at UArizona College of Medicine-Phoenix

Starting in 2020, the medical school's class size will increase to 100 students from 80 students—the first expansion since 2012. In Tucson, the UArizona medical school's 2019 graduating class has eight members of American Indian tribes—the highest number in its history.

New UArizona veterinary school secures go-ahead to open

The American Veterinary Medical Association signs off on the opening of the University of Arizona College of Veterinary Medicine in Oro Valley—the state's first public veterinary school. The college will welcome its first students to its Doctor of Veterinary Medicine Program in fall 2021.

New NAU research center to increase STEM diversity

Northern Arizona University's Center for Materials Interfaces in Research and Applications (MIRA), whose faculty specialize in various scientific fields, seeks to increase the number of women and minorities in STEM education and research.

ASU, Science Center use federal grant to bring STEM to rural areas

The Rural Activation and Innovation Network, funded by the National Science Foundation, is bringing STEM resources and programming to four rural Arizona regions to engage children, families, and organizations in the STEM disciplines. The Arizona Science Center hosts its annual Girls in STEM event to encourage fourth- through eighth-graders to pursue a science career.

Arizona SciTech Festival draws more than 500,000

The annual festival, a program of the SciTech Institute, features more than 2,000 events and 800 organizations in 80 cities and towns across the state, attracting more than a half-million people to events at universities, schools, museums, national parks, military bases, and more.

NAU repeats with three Goldwater Scholars

For the second straight year, Northern Arizona University produces three winners of the Goldwater Scholarship, the nation's highest undergraduate award for students in math, computer science, natural science, and engineering. Arizona State University and the University of Arizona also secure three Goldwaters each in 2019.

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Arizona's future depends on a strong STEM pipeline. Our economy, our health, and our well-being require it, now more than ever.”

Chevy Humphrey
The Hazel A. Hare
President and CEO
Arizona Science Center

ARIZONA'S BIOSCIENCE ECOSYSTEM



CONTENT IN THIS REPORT CURRENT AT DATE OF PUBLICATION, APRIL 2020.