

ARIZONA'S
BIOSCIENCE
ROADMAP

THE LATEST PROGRESS OF THE
BIOSCIENCES
IN ARIZONA



ADVANCING THE BIOSCIENCES AND IMPROVING HEALTH OUTCOMES

A Robust Ecosystem Propels Arizona Biosciences

By nurturing elements throughout our ecosystem—from startups to smart policy—Arizona fosters a thriving bioscience sector.

Across many industries over the last 30 years, economists and management strategists have set aside simplistic sector models. Gone is the description of fixed sets of competitors jostling for customers and profits. More intricate, fluid ecosystem models have ascended—and with them, ecosystem strategies.

Nowhere is an ecosystem framework more valuable than in the biosciences.

For a state to develop a potent bioscience sector, it must attend to every part of the ecosystem: the research pipeline; infrastructure and common resources; entrepreneurial networks; cornerstone institutions; workforce development; policy incentives; public-sector investments; private-sector capital formation. No element can be overlooked.

Since 2002, our state’s ecosystem strategy has been defined, and refined, by Arizona’s Bioscience Roadmap. Through its metrics, we have tracked performance

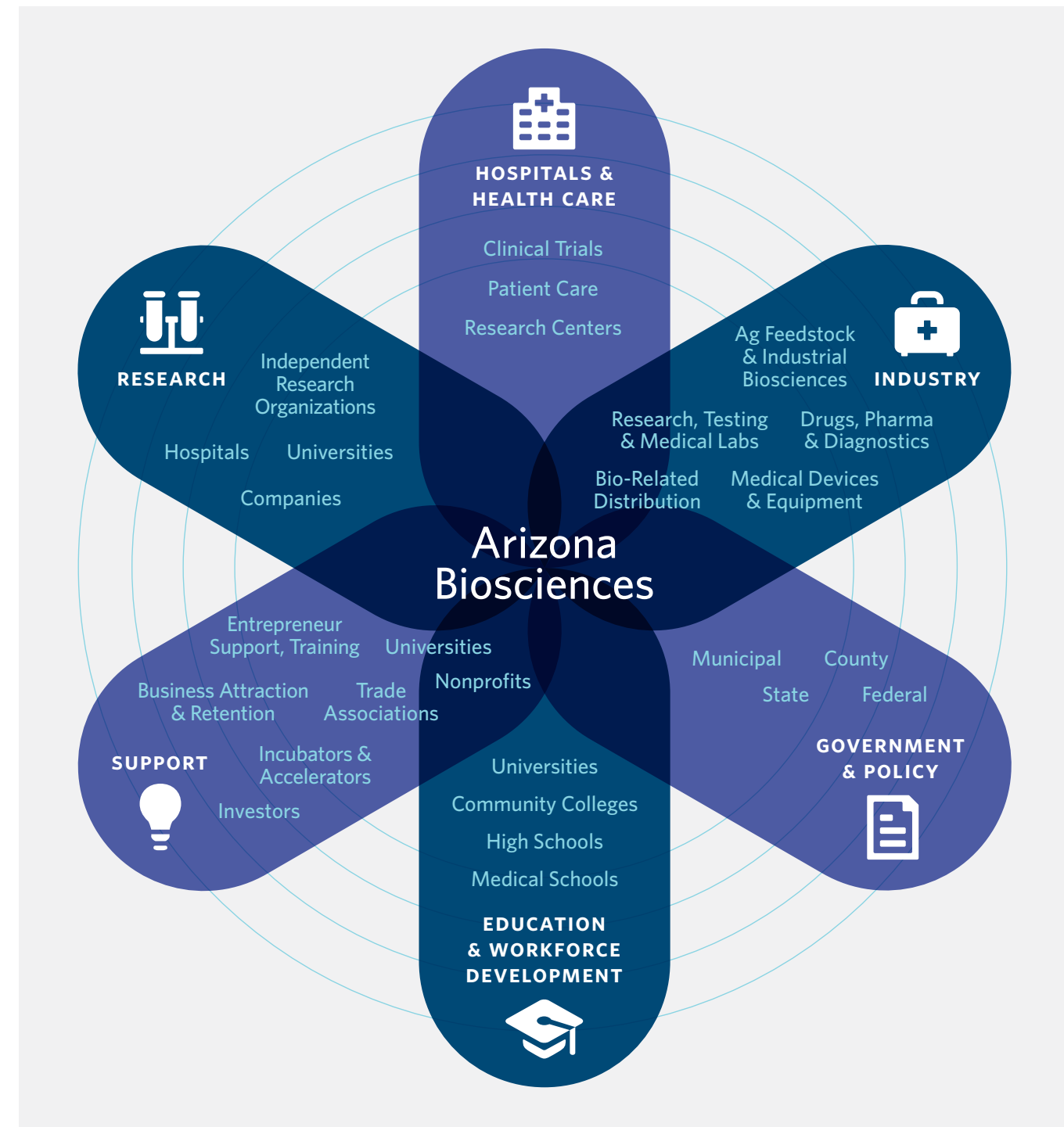
and identified areas of particular strength, promise, and concern.

Where we’ve made complementary ecosystem investments, we’ve seen success: record NIH research funding for Arizona in 2018, and good news for top startups seeking risk-capital funding.

Where we’ve made complementary ecosystem investments, we’ve seen success. A recent big win: In 2018, Arizona received close to \$240 million in National Institutes of Health funding, a record. There were multiple drivers—star scientists; Proposition 301’s TRIF mechanism

for university seed research; ambitious university-hospital partnerships. Another example: Paradigm Diagnostics, an International Genomics Consortium spinout, hit \$8.9 million in Series B funding, a year after announcing a contract enabling Arizona’s Medicaid enrollees to access its cancer test.

To reinforce the Roadmap and its performance metrics, it’s time to map the ecosystem more thoroughly—to identify where we must engage in further activation, and where the next great opportunity resides.



→ RECENT HIGHLIGHTS

» PROMINENT LONG-TERM INVESTMENTS

Arizona Legislature extends sales tax, TRIF: The Arizona Legislature passes and Gov. Doug Ducey signs a 20-year extension of Proposition 301, the education sales tax that collects about \$667 million a year for Arizona’s K-12 schools and universities. The extension includes the Technology and Research Initiative Fund for university research and infrastructure, which brings in up to \$80 million for the three state universities.

University of Arizona awarded \$60M for ‘All of Us’ national study: UA and Banner Health receive \$60 million from the National Institutes of Health over five years to collect information on the health of 100,000 people, especially Native Americans, Hispanics and Latinos, and senior residents—part of NIH’s goal to enroll 1 million people nationwide.

Arizona State University Biodesign Institute opens third research building: The \$120 million, 188,000-square-foot facility on the Tempe campus hosts the ASU-Banner Neurodegenerative Disease Research Center and will house the world’s first compact x-ray free-electron laser, making research more accessible to scientists.







New four-year medical school coming to Phoenix: Nebraska-based Creighton University announces plans to build a \$150 million, four-year medical-school complex adjacent to Dignity

Health St. Joseph’s Hospital and Medical Center, including nursing, physical therapy, pharmacy, and physician-assistant training programs. Creighton also forms an alliance to train medical residents at St. Joseph’s and Maricopa Integrated Health System.

» ENHANCE HOSPITAL RESEARCH, CLINICAL CARE

New hospitals being built around Phoenix area: A Maricopa County board votes to issue \$450 million in bonds to replace the aging Maricopa Medical Center in Phoenix. Construction begins on the Dignity Health and Phoenix Children’s Hospital Women’s and Children Pavilion in Gilbert; HonorHealth starts construction on its sixth hospital, the \$170 million HonorHealth Sonoran Medical Center in north Phoenix; Mayo Clinic announces a \$648 million expansion on its Phoenix campus; and Banner Health announces plans to build its first Chandler hospital.

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**

Cardon Children’s, UA Steele Children’s treat neuropsychiatric disorders: Banner Health’s Cardon Children’s Medical Center in Mesa, in partnership with UA’s Steele Children’s Research Center, becomes the second location in the United States to treat and conduct research into neuropsychiatric disorders historically misdiagnosed or undiagnosed in children.

Mayo Clinic Arizona part of drug trial that leads to first FDA-approved migraine treatment: Several Mayo Clinic clinicians and researchers take part in a study of erenumab, which the FDA approves to prevent migraine headaches. Previously, drugs would only treat symptoms.

App created at A.T. Still University to stop overuse of antibiotics: A professor from the Mesa osteopathic medical school creates Prognosis SOMA: Antibiotics, a game-like app that educates students and clinicians on appropriate antibiotic prescriptions.

» PROMOTE ENTREPRENEURIAL CLIMATE

Arizona Bioscience Week features awards, investors conference: The Arizona Bioindustry Association honors researchers and entrepreneurs at the annual AZBio Awards, hosts the White Hat Investors conference, assembles women leaders in biotech, and welcomes family-office investors to a forum.

GPEC wins \$750K federal grant to assist medical-technology entrepreneurs: The Greater Phoenix Economic Council partners with ASU, the Center for Entrepreneurial Innovation and Partnership for Economic Innovation on a three-year program to help startups develop wearables and health-innovation products.

UA, Phoenix partner on InnoVention accelerator at Phoenix Biomedical Campus: Phoenix provides seed money to a newly announced medical technology accelerator program for UA medical, law, engineering, and business students in downtown Phoenix, and in Scottsdale the Mayo Clinic-ASU MedTech Accelerator launches.

Pitch competitions attract bioscience entrepreneurs statewide: Pitch competitions including the Arizona Innovation Challenge, Street Pitch, Sharks in Space at Moonshot at the Northern Arizona Center for Entrepreneurship and Technology, Startup Week in Phoenix, IdeaFunding with Startup Tucson, and Venture Madness provide cash awards and connections for Arizona startups. Meanwhile, ASU and UA host their own pitch competitions for students.

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**

Universities continue to spin out new companies: ASU launches 17 new startups in fiscal year 2018, while 16 startups emerge from UA as tech-transfer numbers increase statewide. Among the new firms: Illuminos Therapeutics, developed by UA and ASU faculty who collaborated with the Translational Genomics Research Institute, and licensed from UA to develop treatments for neurodegenerative diseases such as Alzheimer's.

» BUILD CRITICAL MASS OF COMPANIES, RAISE VENTURE CAPITAL

Paradigm Diagnostics raises \$9 million for profiling test: Paradigm Diagnostics Inc., a spinout of International Genomics Consortium, adds new funding—now at \$8.9 million—in its Series B round to market its genetic-profiling test, PCDx. Other firms raising capital include Phoenix-based Parafin International and Tempe-based Vomaris Innovations, Inc.

Tucson investment fund raises money for UA startups: UAVenture Capital Fund LLC, founded to help commercialize UA technology, raises \$20 million for its first fund and invests in six UA startups, including bioscience firms, and fundraising begins on a second fund of \$100 million.

NeoLight to partner with HonorHealth to advance its jaundice treatment device: Phoenix-based NeoLight, maker of a portable phototherapy device to treat jaundice in newborns, and HonorHealth Research Institute agree to partner on clinical studies of the device.

Global medical company named first IDEA Tempe anchor tenant: Becton, Dickinson and Co. breaks ground on a 120,000-square-foot building that will serve as its southwest headquarters, adding between 150 and 200 new jobs. The company will anchor the 18-acre IDEA Tempe biotechnology campus, projected to cost \$400 million and include 1 million square feet.

Pharmacy company opens compounding facility in Phoenix, creating nearly 400 jobs: California-based Central Admixture Pharmacy Services Inc., or CAPS, launches a facility to produce drugs for hospitals and clinics, creating jobs for pharmacists, chemists, and microbiologists. Meanwhile, local companies such as WebPT and Solera Health continue to expand with new acquisitions and larger headquarters, respectively.

BMSEED named to prestigious accelerator program: BMSEED, or BioMedical Sustainable Elastic Electronic Devices, developing technology to help patients with traumatic brain and spinal-cord injuries and neurodegenerative diseases, is one of 128 companies worldwide to participate in the MassChallenge accelerator in Boston.

» ADVANCE RESEARCH BASE

TGen studies target improved outcomes for cancer, other diseases: TGen secures several grants for research, including new ways to detect and track metastatic melanoma, prevent breast cancer metastasis, and identify treatments for diabetic blindness. TGen also continues development of a rapid blood test to detect cancers and a study of CTE in living football players. The institute also announces plans to build a cell-therapy manufacturing facility in Phoenix.

Critical Path Institute begins pilot to monitor drug-resistant pathogens: Tucson-based C-Path partners with Flagstaff-based TGen North to address antimicrobial resistance. The project will leverage existing genomic, informatic, and database technology developed by C-Path and TGen to effectively respond to AMR threats in Arizona. C-Path also establishes a clinical-trial database to accelerate development of drugs to treat kidney-transplant patients, and launches a consortium to facilitate data sharing and standardization to advance Huntington's disease therapeutics.

Barrow Neurological Institute receives \$50M for brain-cancer center: The new Ivy Brain Tumor Center at BNI announces a clinical-trial program to target glioblastoma. The gift from the Ben and Catherine Ivy Foundation will finance trials for up to 750 patients over 10 years.

ASU leads international cancer research network, conducts vaccine studies: The Arizona Cancer and Evolution Center is formed with an \$8.5 million grant from the National Cancer Research Institute. Meanwhile, a \$6.4 million grant funds a clinical trial of a cancer vaccine for dogs, and researchers develop a norovirus vaccine from the tobacco plant.

UA researchers to study asthma, cerebral palsy, pulmonary fibrosis: UA receives \$4.4 million to study pulmonary fibrosis treatments, \$3.6 million to establish an international consortium of asthma researchers, and \$3 million to study the one-third of people with cerebral palsy who don't have the typical risk factors. Researchers also develop a new biopsy needle that can gather seven times as much tissue.

ASU, Banner study finds herpesvirus may contribute to Alzheimer's development: The ASU-Banner Neurodegenerative Disease Research Center and other researchers identify a pair of herpesviruses that appear overrepresented in the brains of Alzheimer's disease patients.

» EXPAND STEM EDUCATION, DEVELOP TALENT

Northern Arizona University plans STEM facility, opens new lab: NAU receives approval for a \$139 million, 162,500-square foot building for science, technology, engineering, and math disciplines. Meanwhile, the university's Human Performance Lab opens with a biomechanics lab, the Center for Bioengineering Innovation, and physical-therapy classes.

Connect2STEM kicks off annual Arizona SciTech Festival: The UA College of Medicine-Phoenix hosts more than 200 exhibits and thousands of youth at an interactive event, the first of more than 2,000 STEM events in rural and urban settings statewide.

STEM event encourages girls to pursue science careers: The sixth annual Girls in STEM event at the Arizona Science Center in downtown Phoenix welcomes 112 fourth- to eighth-grade girls to a day featuring problem-solving workshops, female mentors, and information about STEM careers.

UA Colleges of Medicine hit highs for residency matches: Nearly 200 medical students at the two UA Colleges of Medicine match for highly competitive residencies. Amid a shortage of residency slots in Arizona, 38 residents from the Tucson medical school and 29 from the Phoenix college will train in-state.



A Full Agenda for the Steering Committee

The members of the Steering Committee overseeing implementation of Arizona's Bioscience Roadmap have embraced that responsibility.

In 2018, they launched four project teams to advance and accelerate the Arizona ecosystem:

ENTREPRENEURSHIP

Strengthening connections among first-time entrepreneurs, more seasoned founders, and the startups they are driving from concept to going concern.

The first gatherings of the "Flinn Biopreneur Network" are underway.

LEGISLATIVE RELATIONS

Building stronger ties between members of Arizona's bioscience community and policymakers at the state capitol, toward legislation that boosts innovation and, more importantly, advances Arizonans' health and economic opportunity.

RISK CAPITAL

Bridging the gaps between entrepreneurs and investors through opportunities for early/mid-stage firms to learn from investors, seasoned entrepreneurs, and pitch training.

TALENT

Understanding and addressing the supply-and-demand relationships between bioscience firms and educational providers.

→ Leading the Way

Two standout executives are the new leaders of Arizona's Bioscience Roadmap Steering Committee. The committee chair is **Mark Slater**, vice president of research at HonorHealth and chief executive for HonorHealth Research Institute. The vice chair is **Eve Ross**, who led public policy and strategic initiatives at W.L. Gore & Associates until her 2017 retirement.



Principles of Action

One of the longstanding assets of Arizona's bioscience sector has been its reputation for having a "collaborative gene." As newcomers discover, wherever you come from, you can contribute to advancing the biosciences in Arizona. That culture of welcome is especially evident among members of the Steering Committee. What those leaders accomplish together and with the broader community is driven by the principles of their work: inclusion, engagement, action, and advocacy.

ARIZONA'S BIOSCIENCE ROADMAP



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

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

Roadmap metrics are tracked and reported by outside experts, commissioned by the Flinn Foundation.

CONTENT IN THIS REPORT CURRENT AT DATE OF PUBLICATION, APRIL 2019.