

A Bridge Crossed

FINAL DATA OF THE ROADMAP'S FIRST DECADE



Platform to Prosperity

With the first decade of Arizona's Bioscience Roadmap in the books following a productive tenth year, the state has crossed the bridge from 2012 to the next era of its bioscience initiative. In 2012, among many points of progress, Arizona made major advancements in its cancer-fighting infrastructure, formed new incubators and accelerators and expanded existing ones, introduced competitive grant programs for startup firms through the Arizona Commerce Authority, took strides toward becoming a global leader in algae research and commercialization, debuted one of the nation's largest statewide science and technology festivals, added a major facility to the Phoenix Biomedical Campus, pursued a second biomedical campus in north Phoenix, and advanced development of clinical research programs supporting personalized medicine.

The Roadmap is propelled by a statewide Steering Committee of science, policy, and business experts, including leaders of regional bioscience initiatives in northern and southern Arizona. As the Roadmap enters its next chapter, the Steering Committee's endeavors will include updating both the Roadmap and a Policy Principles document that frames key policy steps needed to continue advancing Arizona biosciences in the years to come.

In 2013 and beyond, top Roadmap priorities will include...

Increasing Arizona's competitiveness for R&D funding: In response to tightening public and private purses, Arizona must market its unique resources with greater intensity, increase its collaborative culture at all levels, recruit top scientists, and bridge the bench-to-bedside process in order to maintain its competitiveness and increase the pipeline of discoveries that propel patient care innovations and economic development.

Achieving critical mass in industry: Over the Roadmap's first decade, Arizona developed a proliferation of academic and private research institutions. Although the state has seen major growth in its bioscience industry base, it must intensify commercialization efforts in order to reach the desired critical mass of bioscience companies. A key challenge is to bolster funding for early-stage bioscience firms in an era of dwindling venture capital and limited government budgets.

Developing tomorrow's workforce: Arizona has found innovative ways to strengthen and expand education in STEM areas – science, technology, engineering, and math. These investments in today's youth must be furthered and accelerated to develop the future workforce needed to meet the rising demand for qualified workers in the biosciences, as well as other knowledge-economy industries.

Arizona's Bioscience Roadmap

- Arizona's long-term plan to bring its bioscience sector to national competitiveness
- Driven by an extensive collaboration among statewide leaders in science, business, and policy
- Translational research component in partnership with Arizona Biomedical Research Commission
- Research and facilitation provided by Battelle
- Commissioned and coordinated by the Flinn Foundation
- Details available at www.flinn.org

Road Test

An update of Roadmap progress by Battelle in early 2013 revealed the following data on key measures. Data listed represent the most recent available.

Jobs: From 2002 to 2011, Arizona bioscience jobs **increased by 45%**, adding more than 30,700 jobs for a total of 99,018. The U.S. posted a 12% gain during this span. In 2011, jobs in Arizona's non-hospital subsectors grew by 14%. During the economic recovery (2009-11), Arizona bioscience jobs increased by 11% compared to no gain across the state's private sector.

Firms: The number of bioscience establishments in Arizona **rose 31%** from 2002 to 2011, increasing from 682 to 892. This compares to 23% growth for the U.S. The research, testing, and medical-labs subsector remains the largest in Arizona, with 466 establishments, and since 2002 has expanded the fastest, growing 59%.

Wages: Bioscience workers in Arizona earn an average annual salary of \$56,328, compared to \$44,098 for all private-sector industries, or 28% higher. From 2002 to 2011, Arizona bioscience salaries **increased 44%**.

NIH Grants: From 2002 to 2012, Arizona's funding from the National Institutes of Health **grew slightly faster** (19%) than the overall U.S. (18%), but much less than the top-10 funded states (31%). Arizona had consistently outpaced the top-10 states in growth rates until 2012, when it slipped as a result of increased competition nationally for constrained NIH funds. Arizona's share of the national NIH funding pool remains nearly the same as it was in 2002.

R&D Expenditures: Bioscience-related academic research and development expenditures at Arizona's universities reached a record **\$452 million** in 2011. This represents a 55% gain since 2002, though trails overall U.S. growth of 74%. Arizona's growth had outpaced the nation until 2009.

Venture Capital: Arizona's 2012 levels dropped 68% from 2011 to **\$22 million**, while national VC investment declined by 49%. The amount of private risk capital invested in Arizona bioscience firms was the lowest since 2009, following marked improvement in 2011.

Entrepreneurialism: From 2002 to 2011, Arizona's universities have shown cumulative **steady gains** in bioscience intellectual property – invention disclosures, patent applications, patents issued, licenses and options executed, gross license income, and bioscience startup companies. During this period, Arizona's public universities spun off 67 bioscience startups, generated nearly \$19 million in adjusted gross license income, and received 180 bioscience patents.

Implementation: Of the 19 actions recommended by Battelle in 2002 to achieve over 10 years, **progress has been made on all 19**, including substantial progress on 10.

2000-02

- Prop. 301 passage secures estimated \$1 billion over 20 years for university research
- Flinn Foundation commits to 10 years of major funding of Arizona biosciences
- BIO5 Institute, then known as IBSB, debuts at UA
- Bioindustry Organization of Southern Arizona forms in Tucson
- IGC locates in Arizona; TGen formed
- Arizona's Bioscience Roadmap launched

2003-04

- ASU's Bidesign Institute established
- Legislature approves \$440 million to build university research facilities
- State's bio cluster group reorganizes as Arizona BioIndustry Association
- \$100 million for bioscience/healthcare training approved for Maricopa Community Colleges
- Phoenix Biomedical Campus established

2005-06

- Critical Path Institute founded in Tucson
- Legislature passes angel tax credit
- NAU introduces SABRE research consortium
- Science Foundation Arizona forms
- Phoenix Bioscience High School opens
- Virginia G. Piper Charitable Trust commits \$50 million to personalized medicine

2007-08

- Classes begin at UA College of Medicine-Phoenix
- Caris Diagnostics purchases MPI, created by IGC with TGen as its initial business collaborator
- Roche buys Ventana Medical Systems for \$3.4 billion
- UA BIO5 wins \$50 million grant for iPlant Collaborative
- Legislature passes expanded R&D tax credit
- NACET high-tech incubator opens in Flagstaff

2009-2010

- BioAccel launches to boost bio startups
- Abraxis BioScience (since acquired by Celgene) opens \$70 million Phoenix site
- ASU, Chandler, GateWay Community College, Surprise, and UA devote millions to new high-tech incubators, accelerators, and research parks
- W. L. Gore begins \$130 million expansion in Phoenix
- IGC secures \$59 million for key role in Cancer Genome Atlas project
- Roche announces major expansion of Oro Valley's Ventana Medical Systems; neighboring Sanofi US opens new, larger facility

2011

- Chan Soon-Shiong Institute for Advanced Health announces plan for Phoenix headquarters and \$200 million investment in health-data infrastructure
- Governor signs Arizona Competitiveness Package creating Arizona Commerce Authority and providing business incentives
- \$109 million Banner MD Anderson Cancer Center opens in Gilbert
- Mayo Clinic and ASU announce partnership to establish medical-school campus in Scottsdale

2012

- City of Phoenix pursues second biomedical campus in north Phoenix with Mayo Clinic and ASU
- Inaugural Arizona SciTech Festival attracts 200,000 participants
- New state laws pass to boost university commercial research, STEM education, algae research and production, job growth
- UA opens Health Sciences Education Building on Phoenix Biomedical Campus; NAU allied-health programs included
- BioInspire medical-device incubator opens in Peoria; Flagstaff secures \$4 million to build new accelerator; Arizona Furnace statewide accelerator debuts
- UA Cancer Center gets final approval to build major facility at Phoenix Biomedical Campus through partnership with St. Joseph's Hospital and Medical Center



2012 HIGHLIGHTS Build Research Infrastructure

UA Cancer Center-Phoenix receives construction go-ahead: The Arizona Board of Regents gives final approval to the construction of the \$100 million University of Arizona Cancer Center-Phoenix clinic at the Phoenix Biomedical Campus, a partnership with St. Joseph's Hospital and Medical Center that will provide outpatient cancer services from the six-story, 230,000-square-foot facility.

Phoenix pursuing second biomedical campus: The City of Phoenix approves plans to work with Mayo Clinic and Arizona State University to develop a second biomedical campus on land surrounding Mayo's hospital in north Phoenix.

Major Alzheimer's prevention trial begins: Banner Alzheimer's Institute, under the leadership of Eric Reiman, launches a \$100 million clinical trial of an experimental drug that could help to delay or prevent the onset of Alzheimer's disease. The study focuses on members of an extended family of 5,000 in Colombia who are genetically predisposed to the disease.

Arizona advances in algae research: Funding from Science Foundation Arizona enables ASU's Polytechnic campus to expand its algae lab fivefold to become the world's largest university algae research facility. ASU also receives a \$15 million grant from the U.S. Department of Energy to lead the first national algae biofuel testbed. At UA, a new species of algae is named after researcher Patrick Ferris.

Brain cancer foundation relocates to Scottsdale: The Ben and Catherine Ivy Foundation, the nation's largest privately funded brain cancer foundation, moves to Scottsdale. The foundation awards the Translational Genomics Research Institute (TGen) \$10 million to conduct genomics research into glioblastoma.

Child-affliction programs proliferate: Phoenix Children's Hospital creates a \$50 million institute of molecular medicine to assist children with difficult-to-treat and rare cancers through whole-genome sequencing with the help of TGen. The hospital also partners with Mayo Clinic on a new liver-transplant program, the first in the Southwest focusing exclusively on children. In addition, TGen introduces the Center for Rare Childhood Disorders to enable whole-genome sequencing to be used to help children suffering from ailments that have been difficult or impossible to diagnose.

TGen, SHC mark drug approval, research dollars: The FDA gives expedited approval of Vismodegib, a new skin-cancer drug first tested by Dan Von Hoff at Scottsdale Healthcare through a partnership with TGen. Meanwhile, Dr. Von Hoff co-leads a national "Dream Team" that will benefit from the more than \$81 million pledged for pancreatic cancer research during the entertainment industry's "Stand Up To Cancer" celebrity telethon.

Arizona lands new leaders: Top talent recruited to the state includes UA President Ann Weaver Hart, who now leads the state's largest public research institution; Carolyn Compton, president and CEO of the Critical Path Institute (C-Path) and formerly a top scientist at the National Cancer Institute; and Raymond DuBois, executive director of the Bodesign Institute at ASU, who served as a senior administrator at MD Anderson Cancer Center in Houston.

2012 HIGHLIGHTS **Build Critical Mass of Firms**

Mesa-based Ulthera expands: Ultrasound device-maker Ulthera announces plans to establish its global headquarters and bring 100 new jobs to a new location in Mesa. The decision to remain in Arizona was aided by an award from the Arizona Competes Fund, a \$25 million pool administered by the Arizona Commerce Authority designed to help companies stay in or move to the state.

Companies move headquarters to Arizona: Tucson lands Denver-based Accelr8 Technology Corp., which makes systems to rapidly identify and classify bacterial infections, while Kedem Pharmaceuticals, a Canadian firm, moves its headquarters to Mesa and announces plans to open a laboratory in Scottsdale.

Medical centers boom in Gilbert: The U.S. Department of Veterans Affairs announces plans to open a 60,000-square-foot regional medical center in Gilbert in 2014, while nearby Banner MD Anderson Cancer Center announces a \$63 million expansion to nearly double its current size to 240,000 square feet.

Mayo to build new cancer center: Mayo Clinic announces plans for a new \$130 million, 217,200-square-foot cancer center building on its north Phoenix campus. The structure, which will consolidate Mayo's Arizona cancer operations, will be built atop its \$182 million proton-beam therapy building currently under construction.

Algae firm breaks ground on new facility: Heliae, a Gilbert-based algae technology firm, receives \$15 million in funding from one of Asia's wealthiest men, Anthoni Salim, and breaks ground on a new facility to mass-produce algae. Heliae launched in 2008 as a spinout of ASU with support from Science Foundation Arizona.

IGC creates nonprofit spinout: The International Genomics Consortium and the University of Michigan announce the formation of the nonprofit Paradigm, which will provide molecular analysis for doctors and scientists.

Soon-Shiong Phoenix firm accelerates tumor analysis: Billionaire biotech entrepreneur Patrick Soon-Shiong's NantHealth, based in Phoenix, builds a supercomputer-based high-speed fiber network to greatly speed the genomic analysis of a cancer tumor. In addition, Soon-Shiong's NantWorks acquires Boston Life Labs, a Phoenix company that specializes in the remote monitoring of a patient's vital signs and other medical data.

C-Path teams with MS society: C-Path and the National Multiple Sclerosis Society launch the Multiple Sclerosis Outcome Assessments Consortium to develop new standards for assessing outcomes in clinical trials of MS therapies.

Valley Fever Center adds Phoenix location: The UA Valley Fever Center opens at St. Joseph's Hospital and Medical Center as a partnership between the hospital, UA College of Medicine-Phoenix, and Valley Fever Alliance of Arizona Clinicians.

Transplant program debuts: The Virginia G. Piper Cancer Center at Scottsdale Healthcare opens a Cancer Transplant Institute featuring a new bone-marrow transplant program.

2012 HIGHLIGHTS Enhance Business Environment

New laws protect companies, promote STEM, algae, and jobs: A new Arizona law will enhance university research by protecting the intellectual property of companies that contract with universities for clinical trials. Also enacted are three measures to boost STEM education, two bills to afford algae the same benefits as other agricultural products, and an economic package to spur job growth.

Commerce Authority programs boost bio startups: The Arizona Commerce Authority launches a \$3 million innovation challenge to spur growth of startup technology companies. Several bioscience and health care firms are among the 12 recipients of first-year grants of up to \$250,000. ACA also awards \$184,000 in Fast Grants to 25 Arizona companies to assist in initiating the commercialization process.

Incubators expand: Early-stage bioscience firms are afforded greater opportunities to grow via several new or expanded science and technology incubators.

- BioInspire, specializing in makers of medical devices, opens in Peoria with six startup companies. BioAccel and the city of Peoria offer initial funding, mentoring, office space, and laboratory access to the startup businesses.
- GateWay Community College in Phoenix opens the Center for Entrepreneurial Innovation, a business incubator with wet-lab space.
- Chandler Innovations expands its facility by 50 percent to 63,000 square feet.
- The Arizona Center for Innovation at the UA Science and Technology Park opens upgraded facilities and launches new programming made possible by a \$1.5 million federal grant.

Startup companies receive seed money, office space: The Arizona Furnace accelerator launches to commercialize ideas developed at the state's universities and research institutions. Furnace selects 10 companies to receive \$25,000 each in seed money supplied by the Arizona Commerce Authority and BioAccel, plus access to incubation space.

Flagstaff lands funding for accelerator: The city of Flagstaff receives a \$4 million federal grant to help build a new accelerator facility next door to the existing incubator, Northern Arizona Center for Entrepreneurship and Technology, with plans to attract startup companies and employ 300 people.

Oro Valley passes business-friendly regulations: In a move to help businesses establish themselves in Oro Valley with more speed and ease, the town council approves an Economic Expansion Zone for Innovation Park, home of Oro Valley Hospital, Sanofi, and Roche Group subsidiary Ventana Medical Systems.

New diagnostics group seeks to educate stakeholders: National personalized medicine leaders, including Ventana Medical Systems CEO Mara Aspinall, launch DxInsights, an industry organization that seeks to educate healthcare stakeholders about diagnostics and their impact on medical care and cost.

2012 HIGHLIGHTS Prepare Workforce, Educate Citizens

Massive UA facility opens in Phoenix, attracts NAU: UA opens the Health Sciences Education Building on the Phoenix Biomedical Campus, enabling the size of the newest class of the College of Medicine-Phoenix to increase to 80 students, and housing Northern Arizona University's physician assistant and physical therapy programs.

SciTech Festival draws 200,000 people: The first Arizona SciTech Festival, featuring dozens of festivals, workshops, competitions, and presentations across the state, attracts 200,000 participants over six weeks in February and March, making it one of the largest such festivals in the nation. The event was organized by the Arizona Technology Council, ASU, and Arizona Science Center.

Arizona STEM Network kicks off: Science Foundation Arizona launches the Arizona STEM Network to transform the state's educational system for science, technology, engineering, and math. The program is bolstered by a \$4 million donation by the Helios Education Foundation – including \$1.6 million for a pilot-schools program to help fund curricula and teacher training – and a \$2.1 million commitment from Phoenix-based Freeport-McMoRan Copper & Gold Foundation.

St. Joseph's welcomes Creighton med students: Forty-two medical students attend the first classes of Creighton University's School of Medicine Regional Campus at St. Joseph's Hospital and Medical Center in Phoenix.

College to expand science education: Central Arizona College secures the largest grant in its history with a \$3.3 million award from the U.S. Department of Education to increase student participation in STEM areas in Pinal County.

New polytechnic high school opens in Tucson: Vail School District in Tucson opens Andrada Polytechnic High School, whose offerings include courses in bioscience and health care, while UA makes plans to develop Esteem High School, specializing in STEM areas and entrepreneurship, at Arizona Bioscience Park.

UA COM-Phoenix receives separate accreditation: UA College of Medicine-Phoenix receives preliminary separate accreditation from the national Liaison Committee on Medical Education. The College also adds the Southwest Center for HIV/AIDS to its roster of internship rotations beginning in 2013.

ASU, Battelle team up to promote STEM learning: ASU begins developing applications for computers, tablets, and mobile devices that will be distributed to Battelle to assist the research organization in promoting STEM education and learning nationwide.

NAU nursing students to train at cancer center: Cancer Treatment Centers of America and NAU sign a deal to enable nursing students to train at the company's cancer center in Goodyear.