

Overcoming Obstacles



Forging Ahead

Arizona's growing bioscience sector scored notable gains in 2009 despite a deep international recession and severe state budget cuts. In the seventh year since introduction of the 10-year plan that is *Arizona's Bioscience Roadmap*, entrepreneurs were buoyed by: a coveted "fund of funds" to assemble venture investment in Arizona, multiple high-tech business incubators and accelerators, major companies adding jobs, and a new organization to bring discoveries to the marketplace. Several institutions named new leaders, and a core asset found a powerful research partner.

The *Roadmap* is propelled by an extensive committee network of statewide science, business, and policy experts, plus local leaders who guide regional roadmaps in northern and southern Arizona based on the specific strengths and dynamics of their communities.

In 2010's difficult landscape, an urgent *Roadmap* need will center on the protection of existing investments:

Construct Health Sciences Education Building: Infrastructure investments enable our public universities to secure grants, increase clinical research, and build partnerships. Meeting the healthcare needs of Arizona's population requires State authorization for construction of a major facility for more medical students and researchers on the Phoenix Biomedical Campus.

Safeguard Science Foundation Arizona: More than 50 percent of SFAz's efforts are directed at the biosciences, including education, research, and business-university partnerships. Success over the past two fiscal years includes: 2-1 leverage of state funds; outreach to more than 50,000 students; and formation of 11 new bioscience establishments. Building on these achievements requires sustained legislative appropriations for SFAz.

Support Bioscience Education and Training: A strong talent pool is critical for local bioscience establishments to grow as well as for out-of-state firms to choose Arizona. Our state's future bioscience workforce is a product of our K-12, community college, and university programs, which must receive funding commensurate with their importance.

Sustain TGen: TGen is a major contributor to Arizona's growing bioscience research and industry base. Its researchers have leveraged public and private investment into millions of dollars of additional funds, and they collaborate with industry, medical centers, and universities across the globe. Maintaining support will help sustain this "anchor" of Arizona's bioscience initiative.

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
- ▶ Research and facilitation provided by Battelle
- ▶ Commissioned and coordinated by the Flinn Foundation
- ▶ Translational research component co-sponsored by Arizona Biomedical Research Commission
- ▶ Details available at www.flinn.org

Road Test

An update of *Roadmap* progress in late 2009 revealed the following data on key measures.

R&D Expenditures: Bioscience-related academic research and development expenditures at Arizona's universities reached an all-time high of \$435 million in 2008. This represents a **54.8%** gain since 2002, besting the top-10 states (49.6%) and the U.S. (47.5%).

NIH Grants: Arizona funding from the National Institutes of Health, the industry gold standard, suffered its greatest one-year drop in 2008, 10.1%, since the *Roadmap* launch in 2002. This reflects declining NIH budgets and is consistent with a national drop of 9.5% in 2008. During 2002-08, Arizona's NIH funding **grew faster (14%)** than the top-10 states (10%). Federal stimulus funding from NIH released in 2009 is showing substantial recovery, and appears likely to yield a record year in NIH awards for Arizona.

Jobs: Arizona bioscience jobs continued to grow at a significantly faster rate than the nation. Bioscience employment **increased 31%** during 2002-08, adding 21,370 jobs for a total of 89,674. The U.S. recorded a 12% gain during this period. In 2008, bioscience jobs in Arizona grew 5.8% while the state's overall private sector lost 3.2%.

Firms: The number of bioscience establishments in Arizona **increased 32%** during 2002-08, rising from 639 to 841. This compares to a 22% gain for the U.S. The fastest-growing subsector is research, testing, and medical labs at 59%.

Wages: Bioscience workers in Arizona earn an annual salary of \$55,749, on average, compared to \$41,920 for all private-sector industries. Arizona bioscience wages grew 6% in 2008 and **increased 43%** during 2002-08.

Venture Capital: Arizona's levels dropped 25% in 2008 compared to the year prior, mirroring a national decline in venture capital investments. The 2008 total of \$65.2 million still ranks as the **second-most productive year** since the *Roadmap* launch, trailing only 2007. Substantial additional drops are expected in 2009 for both Arizona and the U.S. due to the international economic recession.

Entrepreneurialism: During 2002-08, 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.

Implementation: Of the 19 actions items recommended by Battelle in 2002 to achieve over 10 years, **progress has been made on 17**, including substantial progress on 11.

2000-02

- › Prop. 301 passage secures \$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
- › TGen created following \$90 million fundraising effort; IGC locates in Arizona
- › *Arizona's Bioscience Roadmap* launched

2003

- › ASU's Biodesign Institute established
- › Arizona Biomedical Collaborative created
- › Legislature approves \$440 million to build university research facilities
- › State's bio cluster group reorganizes as Arizona BioIndustry Association

2004

- › UA, ASU agree to partner on medical school in downtown Phoenix
- › \$100 million for bioscience/healthcare training approved for Maricopa Community Colleges

2005

- › Critical Path Institute founded in Tucson
- › Legislature passes angel tax credit
- › NAU introduces SABRE research consortium

2006

- › Science Foundation Arizona forms, receives \$35 million from State
- › Biozona brand debuts
- › Phoenix Bioscience High School opens

2007

- › W. L. Gore purchases land for Phoenix expansion
- › Classes begin at UA College of Medicine-Phoenix in partnership with ASU
- › TGen, ASU Biodesign Institute join Nobel laureate Lee Hartwell to launch Partnership for Personalized Medicine
- › TGen spinoff MPI purchased by Caris Diagnostics

2008

- › Roche buys Ventana Medical Systems for \$3.4 billion, starts local expansion
- › BIO5 wins \$50 million grant to establish iPlant cyberinfrastructure
- › Investors form TRAC, a \$20 million fund for Arizona bio companies
- › Luxembourg awards TGen and Partnership for Personalized Medicine primary contracts in \$200 million bio project
- › Arizona BioIndustry Association and BIO-SA merge, form AZBio
- › Legislature passes expanded R&D tax credit
- › NACET, high-tech incubator, opens in Flagstaff

2009

- › BioAccel, known initially as Catapult Bio, launches to boost bio startups
- › TGen forms strategic alliance with Van Andel Research Institute
- › Covance opens Chandler drug-development facility
- › ASU, Chandler, GateWay Community College, Surprise, UA secure millions for new high-tech incubators, accelerators, and research parks
- › Manager selected for Arizona Fund of Funds
- › UA breaks ground on Arizona Bioscience Park



Build Research Infrastructure

- **IGC steps up role in Cancer Genome Atlas:** The International Genomics Consortium receives notice that it will assume a larger role in the Cancer Genome Atlas project, a development that should allow IGC to triple its current workforce of 45. New federal funding of \$275 million will assist IGC and others nationally to expand current research on brain, lung, and ovarian cancer into a study of 20 or more types of cancer. IGC manages the Atlas project's Biospecimen Core Resource, a centralized laboratory that reviews and processes samples and associated data.
- **C-Path paves way for diagnostics lab:** Tucson's Critical Path Institute takes a leadership role in planning a National BioSignatures Laboratory (NBL). The lab would qualify and validate biomarkers as diagnostic tools before they are submitted to the U.S. Food and Drug Administration for approval.
- **Biodesign adds star power:** The Biodesign Institute at Arizona State University welcomes Alan Nelson, a prominent expert in imaging and technology commercialization, as its new director, and Joshua LaBaer, a pioneer in the field of proteomics, as a Piper Chair and director of the Virginia G. Piper Center for Personalized Diagnostics. Nobel laureate Lee Hartwell is announced as head of Biodesign's new Center for Sustainable Health.
- **BIO5 names new director, plans hires:** Fernando Martinez, a Regents professor and internationally recognized expert on childhood asthma, is named director of the University of Arizona's BIO5 Institute. Dr. Martinez had served nine months as BIO5's interim director. UA also announces that \$6 million will be made available to BIO5 over the next three years to hire rising stars in translational medicine.
- **TGen teams up with Michigan institute:** TGen announces a strategic alliance with the Van Andel Research Institute of Grand Rapids, Mich., boosting TGen's resources and research capacities. TGen's president and research director, Jeffrey Trent, adds role as VARI's president and research director.
- **Phoenix Children's Hospital opens neuroscience institute:** Phoenix Children's Hospital, in the midst of a major expansion, launches its Children's Neuroscience Institute under the leadership of an internationally renowned pediatric neuro trauma expert, the newly recruited P. David Adelson, who oversees 40 researchers and caregivers, as well as a \$14 million clinical trial funded by the National Institutes of Health.
- **NAU-UA cancer collaboration gets \$15.7M:** The Partnership for Native American Cancer Prevention, a collaboration between NAU and the Arizona Cancer Center at UA, receives a \$15.7 million award from the National Cancer Institute to study and mitigate cancer disparities among Native Americans.
- **TGen, UA form drug-discovery center:** TGen and UA's College of Pharmacy receive \$7.5M from the National Institutes of Health to launch the Southwest Comprehensive Center for Drug Discovery and Development. The center will alleviate bottlenecks between the discovery of promising drugs and getting them into practice.

Build Critical Mass of Firms

- **Covance opens Chandler research lab:** Covance Inc., one of the world's largest contract-research organizations, opens a \$175 million drug-development laboratory in Chandler. The facility may ultimately provide 2,000 high-wage jobs.
- **Banner, M.D. Anderson plan cancer hospital:** Banner Health and the University of Texas M. D. Anderson Cancer Center break ground on the M. D. Anderson Banner Cancer Center in Gilbert, on the campus of Banner Gateway Medical Center. The \$90 million facility will open late in 2011.
- **AERO hires manager for \$200M fund of funds:** A coalition including the Arizona Economic Resource Organization and numerous Arizona-based public and private organizations hires Sun Mountain Capital to assemble and manage a \$200 million venture-capital "fund of funds" to back startup Arizona firms in the biosciences and other high-technology sectors.
- **BioAccel debuts, boosts bio startups:** BioAccel, an independent nonprofit based in Phoenix, debuts to help usher commercially promising discoveries from Arizona laboratories to the marketplace. The organization, initially known as Catapult Bio, provides funding, business expertise, and educational opportunities to entrepreneurs and early-stage companies. Its first two grants are \$500,000 to Casework Genetics, which has licensed forensic DNA technology from TGen, and \$200,000 to Kemeta LLC, a Mesa firm developing tools to track fat metabolism.
- **TRAC funding reaches seven bio firms:** Arizona venture fund TRAC issues its seventh investment to early-stage Arizona bioscience companies, totaling nearly \$5 million. Established in 2008, TRAC is Arizona's first venture fund established to target early-stage bioscience companies operating in Arizona or planning to move to the state.
- **Top firms expand:** Three of the bigger names in the biosciences continue to grow in Arizona. W.L. Gore & Associates furthered the development of its new 40-acre campus in north Phoenix. Ventana Medical Systems, a member of the Roche Group, continued an ambitious expansion of its 60-acre headquarters in Oro Valley, while nearby sanofi-aventis opened a \$40 new million facility. All three are undergoing significant workforce expansions in Arizona.
- **Abraxis opens facility:** Los Angeles-based Abraxis BioScience Inc. opens a state-of-the-art \$70 million manufacturing facility in west Phoenix that will create an estimated 200 jobs. The new facility, operated by the firm's Abraxis Health subsidiary, will manufacture the blockbuster nanotechnology chemotherapy drug Abraxane and serve as the development site for multiple compounds using Abraxis' proprietary technology.

Enhance Business Environment

- **Millions invested in Chandler, Phoenix, Surprise incubators:** The city of Chandler approves \$5.7 million to establish the Innovations Technology Incubator, a bioscience and high-technology business incubator, at a former Intel R&D facility west of the Chandler Fashion Center. In Phoenix, GateWay Community College secures \$6 million to build a bioscience business incubator on its campus at 40th and Washington streets. Funding comes from the Economic Development Administration of the U.S. Department of Commerce, the city of Phoenix, and GateWay's share of a voter-approved bond. In Surprise, city officials announce the first tenants of its new 60,000 square-foot AZ TechCelerator, as well as formation of the Surprise Angel Investment Forum.
- **Stimulus grant enables UA Bioscience Park groundbreaking:** The University of Arizona receives a \$4.7 million federal stimulus grant from the Economic Development Administration of the U.S. Department of Commerce for the next stage of development of the Arizona Bioscience Park, which will ultimately include laboratory space, a bioscience business incubator, a bioscience high school, and other facilities. Groundbreaking occurred in December.
- **Biodesign launches own accelerator:** The Biodesign Institute at Arizona State University unveils a new way to move research discoveries more quickly toward commercialization: creating its own accelerator. The ASU Foundation begins a \$5 million fundraising effort to support the Impact Accelerator, which will create and incubate startup companies from the most promising technologies being developed at Biodesign.
- **Flagstaff incubator graduates first client:** The Northern Arizona Center for Emerging Technologies, opened in late 2008, graduates its first company, biotech startup SenesTech Inc. Formerly NACET's largest client, SenesTech moves into an 8,400 square-foot space at the Flagstaff Airport Business Center, also home to TGen North and Machine Solutions Inc.
- **SFAz holds onto funding:** Amid a yearlong statewide budget crunch, Science Foundation Arizona successfully argues for a restoration of \$18.5 million in funding temporarily swept by the Arizona Legislature.
- **AZBio hands reins to biotech entrepreneur:** The Arizona BioIndustry Association hires Robert Green as its new president and CEO. Green, a mainstay in the southern Arizona biosciences landscape, has led several biotech firms, most recently Integrated Biomolecule Corp.
- **Studies tally bio's impact:** An economic-impact study of Arizona's bioscience sector by Battelle Technology Partnership Practice finds that in 2007 the biosciences accounted for \$12.5 billion in revenues, more than 87,400 jobs, and \$765 million in state and local taxes. A Tripp Umbach study reveals that TGen generated an estimated economic impact of \$77.4 million in 2008, including a direct economic impact of \$44.5 million, more than twice its 2006 economic impact of \$21.7 million.

Prepare Workforce, Educate Citizens

- **Helios, UA launch middle-school education program:** Helios Education Foundation awards a \$750,000 grant to establish UA's Jr. BIOTECH program, a STEM (science, technology, mathematics, and engineering) education project that connects middle-school science teachers with the resources and training necessary to lead hands-on, inquiry-based classroom activities.
- **Grant supports researcher-teacher partnerships:** Research Corporation for Science Advancement announces \$120,000 in grants to improve science education in Arizona. The program creates individual partnerships between eight UA researchers and eight local high-school science teachers.
- **PSM degrees expand at Arizona universities:** The Alfred P. Sloan Foundation awards a \$40,000 grant to broaden the Professional Science Master's degree programs at Arizona's three public universities. PSMs are critical elements in the STEM education infrastructure, designed to meet growing industry needs for applied scientists, engineers, and mathematicians and to provide rewarding careers for undergraduate science and math majors.
- **NAU, Mesa ease path to biotech degree:** NAU and Mesa Community College announce an articulation agreement by which students will be able to earn a cost-efficient undergraduate degree in biotechnology, completing 75 credit hours at MCC, then transferring those credits to NAU toward a bachelor of science in biology with a certificate in biotechnology.
- **Arizona Science Center earns NIH grant:** The Arizona Science Center receives a \$1.2 million National Institutes of Health grant to support the "Pathways" program, which will offer opportunities for hands-on learning about the human body and advances in biotechnology. Barrow Neurological Institute at St. Joseph's Hospital and Medical Center and several other institutions will collaborate with the Science Center on the project.
- **Major life-sciences building opens at community college:** Paradise Valley Community College opens a \$17.4 million, 35,000 square-foot life-sciences building, enabling the college to double its biosciences course offerings and begin teaching anatomy courses that include cadaver dissection.
- **Phoenix to host renowned student science competition:** Phoenix learns it will host the Intel International Science & Engineering Fair in 2013, 2016, and 2019. The city hosted the competition, which draws 5,000 registrants, in 2005.
- **NAU Teach draws strong student interest:** NAU Teach, a program at Northern Arizona University to steer math and science majors into K-12 education, begins its second year with a full introductory class of 68 students – and 50 more on the waiting list.
- **SFAz grant helps remake Biosphere 2:** A \$1.5 million grant from SFAz to UA's B2 Institute is matched by the Phileology Foundation to make Biosphere 2 a unique training center for STEM educators.