ARIZONA'S BIOSCIENCE ROADMAP

2014 PROGRESS OF THE Biosciences in Arizona

ADVANCING THE BIOSCIENCES AND IMPROVING HEALTH OUTCOMES

FLINN FOUNDATION

A PLAN FOR HEALTH AND PROSPERITY

FOLLOWING AN ENCOURAGING FIRST DECADE, the state's long-term plan to develop a thriving bioscience base—Arizona's Bioscience Roadmap—was updated in 2014 to extend to the year 2025, with the aspiration of Arizona becoming a global competitor and national leader in specific areas of the biosciences.

The second-decade Roadmap includes numerous recommendations to further strengthen Arizona's research infrastructure, commercialize research into products, jobs, and firms, create an entrepreneurial hub, develop and retain bio-talent, and more. The year 2014 saw progress on all fronts, punctuated by a spate of achievements involving the first of the updated Roadmap's five goals—forming a hub of bioscience entrepreneurs and new enterprises across Arizona. In fact, the Flinn Foundation focused on this as a theme of its 2015 annual Bioscience Roadmap luncheons.

During 2014, early-stage bioscience companies successfully earned funding through a number of programs tailored to attract and foster the startup entrepreneur. These included the Arizona Commerce Authority's Arizona Innovation Challenge and AZ Fast Grant programs, the bracket-style Venture Madness competition, BioAccel's Solutions Challenge, the Flinn Foundation's Bioscience Entrepreneurship Program, and others.

Incubators and accelerators continued to open and expand throughout the state, collaborating with cities, colleges, universities, and federal agencies to enable entrepreneurs to have the necessary space, labs, and services to grow their business. The Arizona Commerce Authority hired a bioscience portfolio manager, a new position created to serve as a statewide resource to assist startup firms in securing risk capital and obtaining needed services. And Arizona's first-ever bioscience capital conference was held to link these budding companies from throughout the southwest with investors.

Arizona's Bioscience Roadmap:

- **Arizona's long-term strategic plan to become globally competitive and a national leader in select fields of the biosciences**
- **Launched in 2002; updated in 2014 to extend through 2025**
- **Guided by state leaders in science, business, academia, and government**
- **Metrics to be released publicly every other year**
- **Commissioned and coordinated by the Flinn Foundation**
- **Research and facilitation by Battelle**

The research that will ultimately lead to new innovations continued to expand throughout Arizona. In Phoenix alone, the downtown Phoenix Biomedical Campus saw continued construction on new buildings and infrastructure while the Arizona Biomedical Corridor in northeast Phoenix took steps forward with a $1 billion developer commitment. Tucson is benefiting from strong gains at Tech Launch Arizona where university research is leading to new intellectual property and companies. The same goes for the Phoenix area through Arizona Technology Enterprises, while Northern Arizona University opened two new centers of research in 2014.

Yet despite these continuing advancements, the Roadmap's vision for Arizona's bioscience sector will not be realized overnight. Challenges are posed by traditionally low levels of risk capital invested in the state's young bioscience firms,

cutbacks in federal research funding, and budget constraints at the state level.

The updated Bioscience Roadmap includes numerous strategies and suggested action steps to address these and other challenges, as well as to take advantage of Arizona's distinctive strengths. In the past year, the Roadmap's Steering Committee of statewide bioscience leaders identified eight key priorities as the initial focus. The list includes addressing funding needs for companies and university research, improving and expanding both STEM and graduate medical education, and raising the profile and visibility of the bioscience sector.

Support of the Roadmap's recommendations will not only help to strengthen and diversify Arizona's economy, but enhance the health outcomes of the people of Arizona, both young and old.

What Are the Biosciences?

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

2014 HIGHLIGHTS

» Prominent Long-Term Investments

Banner Health merges with UA Health Network: The $1 billion-plus merger enables Phoenix-based Banner Health to acquire the University of Arizona Health Network's two-hospital system and additional assets, and become the primary clinical partner for the UA Colleges of Medicine in Tucson and Phoenix. The merger gives Banner Health its first presence in Tucson and provides needed capital for UA health programs and facilities.

Arizona Biomedical Corridor preparations advance: Land acquisitions continue to advance to make way for development of the massive Arizona Biomedical Corridor in northeast Phoenix. Developer KUD International announces plans to invest $1 billion in the campus, partnering with Mayo Clinic, Arizona State University, and the city of Phoenix. The campus, next to Mayo Clinic Hospital, could ultimately support up to 30,000 workers in biomedical research, education, and industry.

Construction accelerates on Phoenix Biomedical Campus: Construction begins on the Biosciences Partnership Building, a 10-story, $136-million research building expected to create about 360 new health professional jobs. Meanwhile, the 5-story outpatient clinic of the UA Cancer Center at Dignity Health St. Joseph's and a new 8-story parking garage are expected to open by the end of 2015.

Arizona's Bioscience Roadmap receives update through 2025: The long-term strategic plan originally commissioned by the Flinn Foundation in 2002 is updated with the goal of Arizona becoming globally competitive and a national leader in select areas of the biosciences by 2025. The plan is compiled by Battelle and Flinn with input from Arizona science, business, academia, and government leaders.

Enhance Hospital Research, Clinical Care

Banner Alzheimer's Institute partners with pharmaceutical giant: Banner Alzheimer's Institute and Swiss company Novartis announce a partnership to test two experimental drugs that aim to prevent Alzheimer's disease in older, high-risk adults. The study is supported in part by a $33 million grant from the National Institutes of Health. The Phoenix-based Institute also continues its landmark study of an extended 5,000-member Colombian kindred in which nearly half of the individuals are almost certain to contract Alzheimer's at an early age.

Phoenix Children's Hospital, Patrick Soon-Shiong form partnership: The new Chan Soon-Shiong Children's Precision Medicine Institute at Phoenix Children's Hospital will use the billionaire entrepreneur's genomics-data-based technology to make more accurate diagnoses and better target treatments for young cancer patients.

Barrow Neurological opens treatment center for Lou Gehrig's disease: A new center opens at Barrow Neurological Institute at St. Joseph's Hospital and Medical Center to provide treatment for ALS, or Lou Gehrig's disease, and other neuromuscular diseases such as muscular dystrophy and multiple sclerosis.

St. Joseph's Hospital receives $19 million gift: St. Joseph's Hospital and Medical Center will use a $19 million gift from local philanthropist John Norton—the largest in its history—to expand the thoracic and lung transplant program by recruiting national experts in thoracic and cardiac surgery, pulmonology, and related disciplines.

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

Promote Entrepreneurial Climate

Bank to lend $100 million to Arizona biotech companies: Silicon Valley Bank commits to lending at least $100 million to technology and life science companies based in Arizona over the next five years. The California-based bank, which opened in Tempe in 2012 and is expanding its local operations, has a track record of helping local biotech companies.

BioAccel Solutions Challenge awards startups: The inaugural BioAccel Solutions Challenge, featuring six companies pitching potential investors in the "Scorpion Pit," awarded $100,000 each to two winning companies to help advance their technology into viable commercial products. BioAccel also creates a $2 million venture fund to support its portfolio companies that merit additional investment.

State hosts first bioscience capital conference: The White Hat Investors 2014 conference attracts 34 bioscience companies from across the southwest to pitch to investors, granting foundations, and venture capital firms. This inaugural event was held in Phoenix and presented by the Arizona BioIndustry Association.

Bio companies perform well at statewide competitions: Bioscience companies were well represented among the winners at Arizona Commerce Authority-sponsored competitions including the spring and fall Arizona Innovation Challenge, AZ Fast Grant, and the inaugural Venture Madness contest presented by Invest Southwest. Bio firms also fared well in contests of the state's universities and others.

NACET breaks ground on new accelerator: The Flagstaff-based Northern Arizona Center for Enterpreneurship and Technology breaks ground on a new accelerator facility that will feature wet and dry labs, an area for light manufacturing, and office space for startup companies. The new 28,000-square-foot facility will complement the organization's incubator.

» Build Critical Mass of Companies

Arizona rises in national bio rankings: Arizona advances to the second tier in a category of the national bioscience industry rankings specific to number of establishments, per the biennial Battelle/Biotechnology Industry Organization report.

Theranos to bring 500 new jobs to Scottsdale: The lab-testing company that is establishing wellness centers in Walgreens pharmacies announces the opening of an office at SkySong in Scottsdale and the hiring of about 500 employees in sales, operations, and clinical laboratory.

Ulthera acquired by German pharmaceutical company: Merz acquires Mesa-based Ulthera, a medical device company whose products use ultrasound technology to perform face and neck lifts, for up to $600 million.

Arizona sees growth in guayule industry: Phoenix-based Yulex Corp., which makes guayule-based rubber materials, opens a new seed and genetics center in Chandler that will support the global commercial development of guayule worldwide for medical, consumer, industrial, and bioenergy applications. Meanwhile, Bridgestone Americas, a subsidiary of the Japanese tire giant, opens a Mesa facility that will produce rubber from guayule grown in Pinal County.

SynCardia wins prestigious honor: SynCardia Systems wins the 2014 New Economy Award for Best Medical Device Company from *The New Economy,* a London-based quarterly publication. The Tucson-based company, the manufacturer of the world's only approved Total Artificial Heart, receives Food and Drug Administration approval for its Freedom portable driver that can be used by clinically stable patients as a bridge to transplantation.

Teleost Biopharmaceutical moves to Tucson, partners with UA: Teleost, which uses a UA invention to develop products to help protect against and treat skin maladies, moves its headquarters to Tucson from Boulder, Colo. UA licenses the invention to Teleost with the help of Tech Launch Arizona, which helps commercialize inventions that emerge from university research.

Orion Health chooses Scottsdale for division headquarters: The global provider of health care software selects Scottsdale for the North American and United Kingdom headquarters of its health care populations division. Orion plans to hire 100 within the next year and up to 400 over the following three years.

» Advance Research Base

ASU scientist's research helps lead to Ebola vaccine: A study on a tobacco-derived drug in the early 2000s to fight the Ebola virus by Charles Arntzen, a researcher at ASU's Biodesign Institute, was instrumental in the development of an experimental treatment used on American aid workers suffering from the recent outbreak of the virus.

C-Path receives grants, funding through Gates Foundation, FDA: The Critical Path Institute receives three multi-year, multi-million-dollar grants from the Bill and Melinda Gates Foundation to advance tuberculosis treatments. In addition, the Tucson-based group receives its second five-year grant from the FDA—up to $10.5 million—to improve and accelerate the development and regulatory review of drugs.

NAU, UA receive federal grant for Native American cancer research: The Partnership for Native American Cancer Prevention, a collaboration between Northern Arizona University and the UA Cancer Center, receives a $13 million grant renewal from the NIH to study cancer disparities in tribal populations. The grant also supports partnering with the Hopi, Navajo, and Tohono O'odham communities to provide education on how best to prevent, detect, and treat cancer.

FDA accelerates approval of UA-led valley fever drug: The FDA prioritizes approval of the antifungal drug Nikkomycin Z, or NikZ, the first medicine specifically formulated to treat and potentially cure valley fever. The drug was developed by UA researcher John Galgiani.

NAU debuts research centers: NAU launches two additional research centers—the Center for Bioengineering Innovation and Center for Ecosystem Science and Society.

Biomedical Campus, Biodesign pack economic punch: Studies released in 2014 reveal that the UA College of Medicine-Phoenix was responsible for $961 million of the Phoenix Biomedical Campus' $1.3 billion economic impact in 2013, while ASU's Biodesign Institute had a $1.5 billion impact in its first decade of operation.

Drug tests yield favorable results: Scottsdale Healthcare and TGen researchers demonstrate a significant improvement in overall survival among patients with advanced, previously-treated pancreatic cancer through a new drug. Meanwhile, a drug combination tested by Mayo Clinic Arizona is found to extend remission substantially among patients with multiple myeloma.

TGen discovers root of rare ovarian cancer: TGen leads an international research team that finds the cause of a rare type of ovarian cancer that most often strikes girls and young women. The team includes local partners Mayo Clinic, Scottsdale Healthcare, and St. Joseph's Hospital and Medical Center.

Paradigm launches cancer panel, forges new partnerships: Paradigm, a spinout of the Phoenix-based International Genomics Consortium, launches its next-generation cancer test that sequences both DNA and RNA with hopes of better care and treatment for cancer patients.

» Expand STEM Education, Develop Talent

Partnership creates new biomedical diagnostics school: ASU, Ireland-based Dublin City University, and Ventana Medical Systems of Oro Valley partner to create a new International School of Biomedical Diagnostics that provides research, teaching, and service in this emerging field.

Arizona SciTech Festival continues expansion: The 2014 Arizona SciTech Festival, the state's third annual celebration of science and technology, expands to more than 500 events statewide. The festival expects to continue its growth to more than 800 events in 2015.

Flagstaff STEM celebration draws huge crowd: The inaugural Flagstaff Community STEM Celebration attracts about 4,000 people to NAU's Walkup Skydome. Students, businesses, research groups, and government agencies attend the event filled with gadgets and interactive displays focusing on science, technology, engineering, and math.

NAU launches occupational therapy doctoral program: Arizona's first occupational therapy doctoral program begins at the Phoenix Biomedical Campus. The NAU program in this high-demand field produces therapists that help injured, ill, or disabled people develop, recover, and improve their everyday skills.

UA leading effort to improve ease of securing STEM internships: UA, Pima Community College, and several Tucson-area high schools improve the access of students in STEM fields to employers in the Tucson region. The STEM internships will provide students with hands-on training and an incentive to stay in Tucson after graduation.

Veterinary medicine receives major boost: Midwestern University in Glendale opens its new $180 million College of Veterinary Medicine with an inaugural class of about 100 students, while UA receives approval to introduce a veterinary medicine degree program.

GCU launches College of Science, Engineering and Technology: Grand Canyon University starts its new college by offering an information technology program with an emphasis in health IT. The Phoenix institution, which the year before created a STEM advisory board, is also developing an electrical engineering program and will offer electives in biomedical engineering.

STEM charter school opens in central Phoenix: SySTEM Phoenix welcomes its first class to the school that uses STEM areas to teach critical thinking and problem-solving skills.

By the Numbers

The most recent data profile of Arizona's bioscience sector...

JOBS:
106,846 (23,545 non-hospital)

FIRMS:
1,382 (1,266 non-hospital)

AVERAGE WAGE:
$62,775 ($85,571 non-hospital)

NATIONAL INSTITUTES OF HEALTH FUNDING:
$182 million

BIOSCIENCE-RELATED ACADEMIC RESEARCH & DEVELOPMENT:
$463 million

BIOSCIENCE VENTURE CAPITAL:
$37 million

UNIVERSITY TECH TRANSFER:
4 bioscience startups, 25 licenses, $1.8 million in adjust gross license income

SOURCES:
Battelle 2014
NIH, VC, tech-transfer data: 2013
Jobs, firms, wage, R&D data: 2012

BIOSCIENCE TIMELINE Tracking the progress of Arizona's bioscience initiative

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 Biodesign 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/health care training approved for Maricopa Community Colleges
- Phoenix Biomedical Campus established

2005–06

- Critical Path Institute founded in Tucson
- Legislature passes angel tax credit
- 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

- Arizona Competitiveness Package creates Arizona Commerce Authority
- Banner MD Anderson Cancer Center opens in Gilbert
- Mayo Clinic, ASU announce medical school partnership

2012

- City of Phoenix pursues second biomedical campus in north Phoenix with Mayo Clinic, ASU
- Inaugural Arizona SciTech Festival attracts 200,000 participants
- Banner Alzheimer's Institute wins $15 million NIH grant, launches $100 million drug study
- New state laws boost university commercial research, STEM education, algae research and production, job growth
- UA opens Health Sciences Education Building on Phoenix Biomedical Campus, includes NAU allied-health programs
- BioInspire incubator opens in Peoria; Arizona Furnace statewide accelerator debuts

2013

- Construction begins on UA Cancer Center at Phoenix Biomedical Campus in partnership with St. Joseph's Hospital and Medical Center
- Accelerate Diagnostics moves to Tucson from Denver
- Tech Launch Arizona opens at UA
- FDA, European counterpart approve C-Path's new Alzheimer's disease simulation tool
- FDA approves late-stage pancreatic cancer drug combination tested by TGen, Scottsdale Healthcare
- UA BIO5 receives NSF renewal of $50 million iPlant Collaborative grant
- Scottsdale introduces "Cure Corridor" brand
- SynDaver Labs announces expansion to Phoenix, plans to hire 500-1,000
- Chandler-based Insys Therapeutics reigns as nation's top initial public offering of year

2014

- C-Path receives three Gates Foundation grants to advance TB treatments
- Arizona's Bioscience Roadmap receives update through 2025
- Banner Health and UA Health Network pursue merger
- NAU debuts two centers for research, including bioengineering
- Lab-testing firm Theranos opens office in Scottsdale, plans to hire 500
- Banner Alzheimer's Institute, Novartis announce study of two experimental drugs
- ASU Biodesign research instrumental in fighting Ebola virus
- KUD International announces $1 billion investment to develop north Phoenix biomedical campus
- AZBio hosts White Hat Investors, state's first bioscience capital conference
- Phoenix Children's Hospital and billionaire Patrick Soon-Shiong partner on genomics-based institute for seriously ill children
- Construction begins on Biosciences Partnership Building on Phoenix Biomedical Campus

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