

Arizona's Bioscience Roadmap Performance Assessment 2002-11

Presentation and Discussion

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Arizona's Bioscience Vision

Today's Look: Nine Years of Implementation

VISION: Arizona is one of the nation's foremost biomedical research and bioscience commercial centers, built around world-class research, clinical excellence, and a growing base of cutting edge enterprises and supporting firms and organizations.

What are the Biosciences?

Agriculture feedstock & chemicals



Drugs & pharmaceuticals



Medical devices & equipment



Hospitals



Research, testing & medical labs



Assessing Roadmap Progress

- Federal bio-related R&D funding to universities
- NIH R&D funding as the “gold standard”
- Specialization of industry and its concentration rates
- Private venture investments
- University-related start-ups
- Roadmap implementation progress



Metrics of Success: 2002-2010

Metrics	Performance	Comments
Bio Private Sector Jobs	↑ 41%	Arizona's growth exceeding U.S. (↑11%)
Bio Firms	↑ 27%	Arizona's growth exceeding US (↑20%)
Bio Avg. Wages	↑ 27%	Bio wages declined by 3.3% in 2010; average salary \$55.4K

Metrics of Success: 2002-2011

Metrics	Performance	Comments
NIH Funding	↑ 25%	Arizona outpacing top 10 States (↑20%) and U.S. (↑17%)
Bio Risk Capital	↓ 38%	Best performance since 2007 at \$69M in 2011
Bio University IP		
• Bio Startups	↑ 7 in 2011 vs. 3 in 2010	7 startups in 2011 60 total startups (2002-11)
• Bio Licenses	↑ Slightly more in 2011 than 2010	33 licenses in 2011 268 total licenses (2002-11)
• Bio Income	↓ Down 54% in 2011 from 2010 performance	\$.8M in 2011 \$17.9M total income (2002-11)

Biosciences Economic Impact

Key finding: *Economic impact of Arizona biosciences soared between 2002-09.*

- Annual total economic activity generated by bio increased 99% to \$28.8B
- Jobs from bio's total impact rose by more than 57,000 to 197,836
- Annual state/local taxes generated grew 98% to \$1.1B

Total & % change in direct/total impacts of entire bio sector, 2002-09 (\$ in millions)

Item	Direct Impact 2002	Direct Impact 2009	% Change 2002-09	Total Impact 2002	Total Impact 2009	% Change 2002-09
Output	\$7,975.70	\$15,613.86	95.8%	\$14,451.20	\$28,760.9	99.0%
Employment	72,855	92,787	27.4%	140,654	197,836	40.7%
Employee Compensation	\$3,203.60	\$6,656.31	107.8%	\$5,176.60	\$10,875.2	110.1%
State/Local Tax Revenues	n/a	n/a	n/a	\$566.90	\$1,120.6	97.7%

Biosciences Economic Impact

Key finding: Significant growth is projected to 2020 if Roadmap goals are attained.

- Bio sector would generate total impact of \$44.8B in 2020 (56% higher than 2009)
- 313,882 jobs would result from bio's total impact
- Bio sector would generate \$1.75B+ in state/local taxes

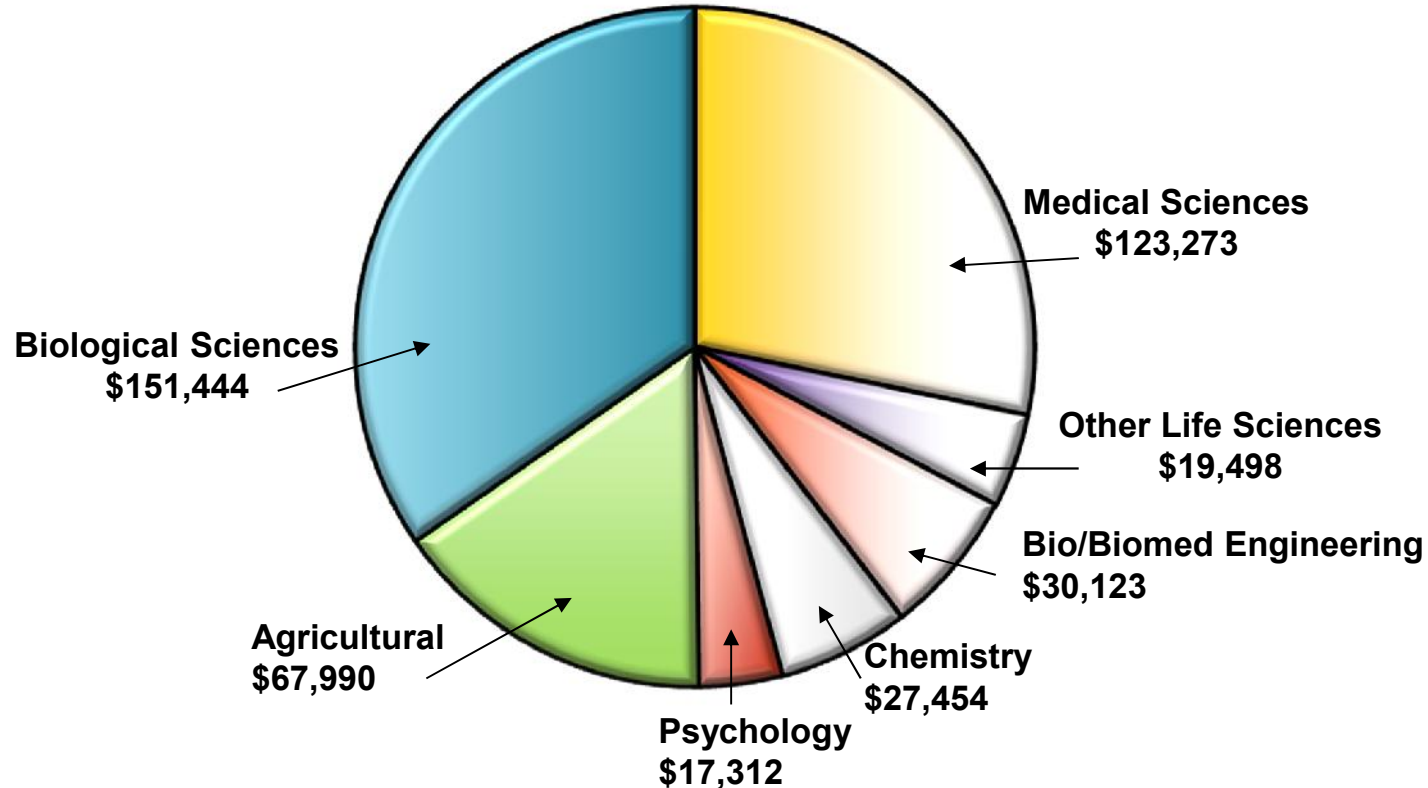
Contribution of entire bio sector (including non-hospital bio, hospitals, and academic research) to Arizona's economy in 2020 (\$ in millions; current 2009

Item	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Output	\$24,225.2	\$9,526.0	\$11,079.6	\$44,830.7
Employment	148,517	72,433	92,932	313,882
Employee Compensation	\$10,612.2	\$3,019.2	\$3,594.1	\$17,225.5
State/Local Tax Revenues	\$308.3	\$652.7	\$794.0	\$1,755.0

Biosciences Share of Academic R&D

Key finding: Biosciences account for half of Arizona academic R&D, led by biological sciences.

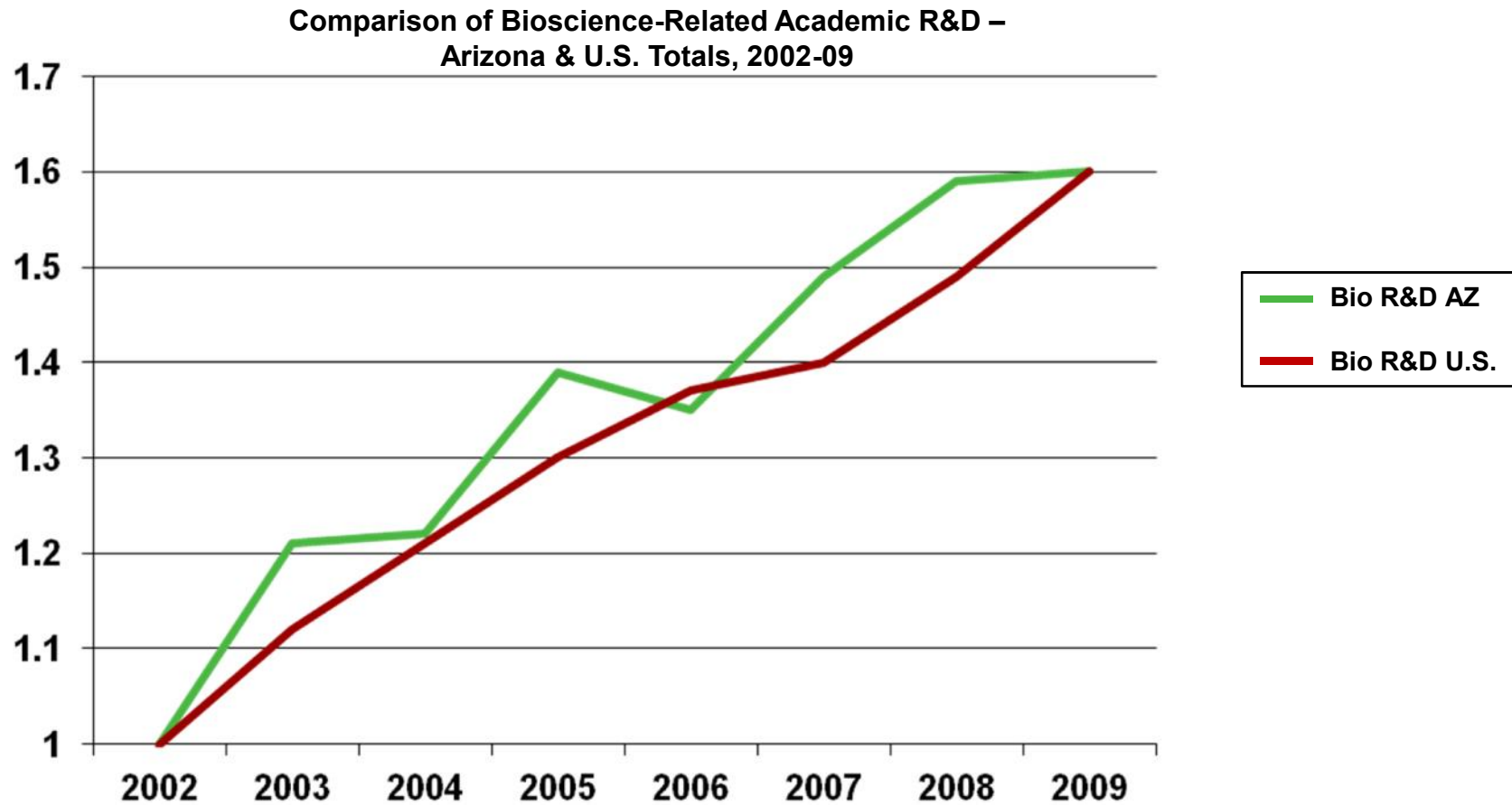
Arizona Academic R&D in Bioscience Related Fields, FY 2009 (\$ in Thousands)



Total bioscience-related R&D: \$437M
Total non-bioscience-related R&D: \$435M

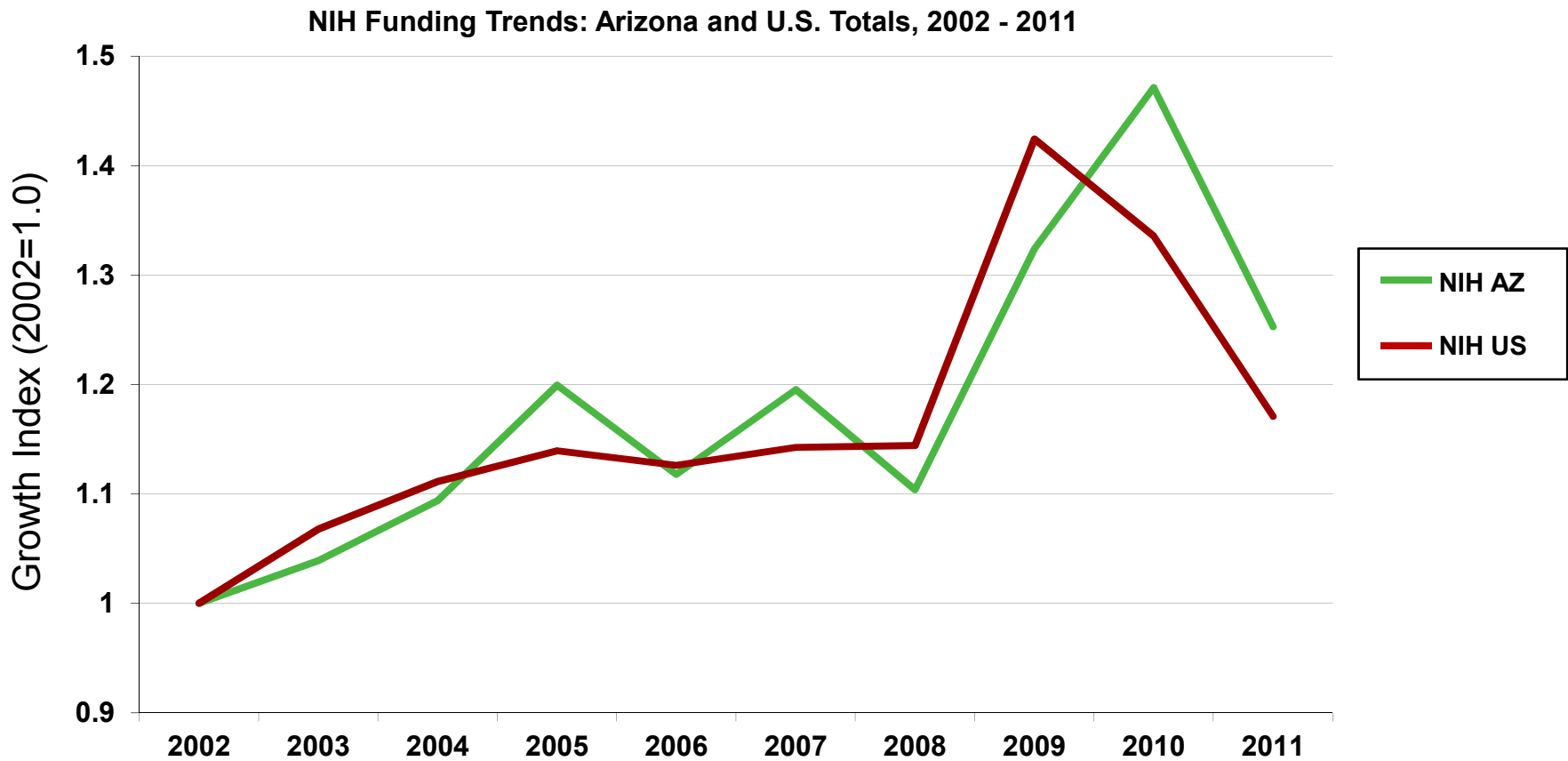
Bioscience Academic R&D Growth

Key finding: Arizona overall bioscience-related academic R&D reached a new high in 2009.



NIH Funding Growth

Key finding: Arizona growth index still exceeds U.S.



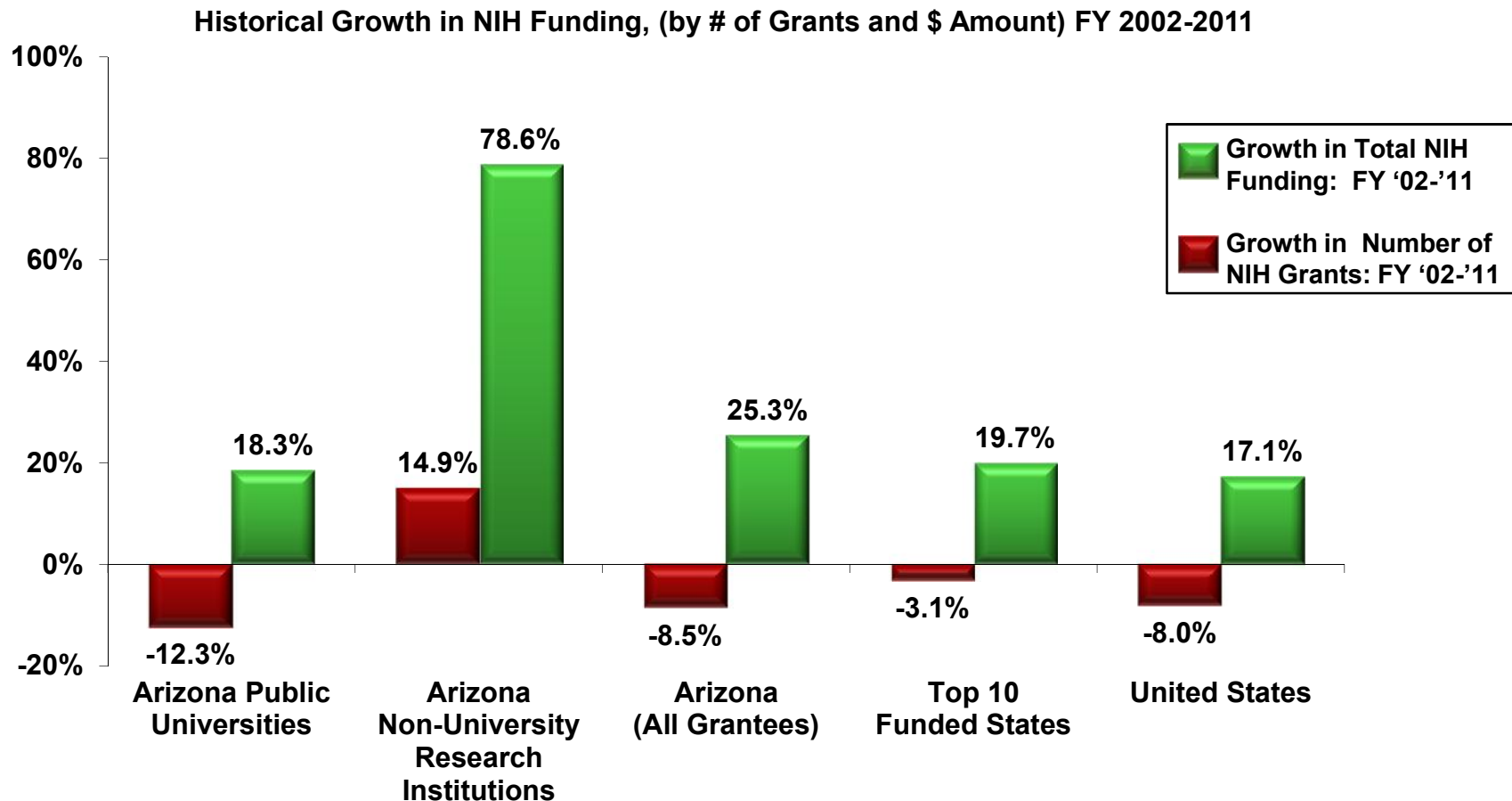
NIH Funding Growth

Key finding: Arizona NIH funding growth outpaced the nation during 2002-11 by 8% to 25%.



NIH Grants, Funding Growth

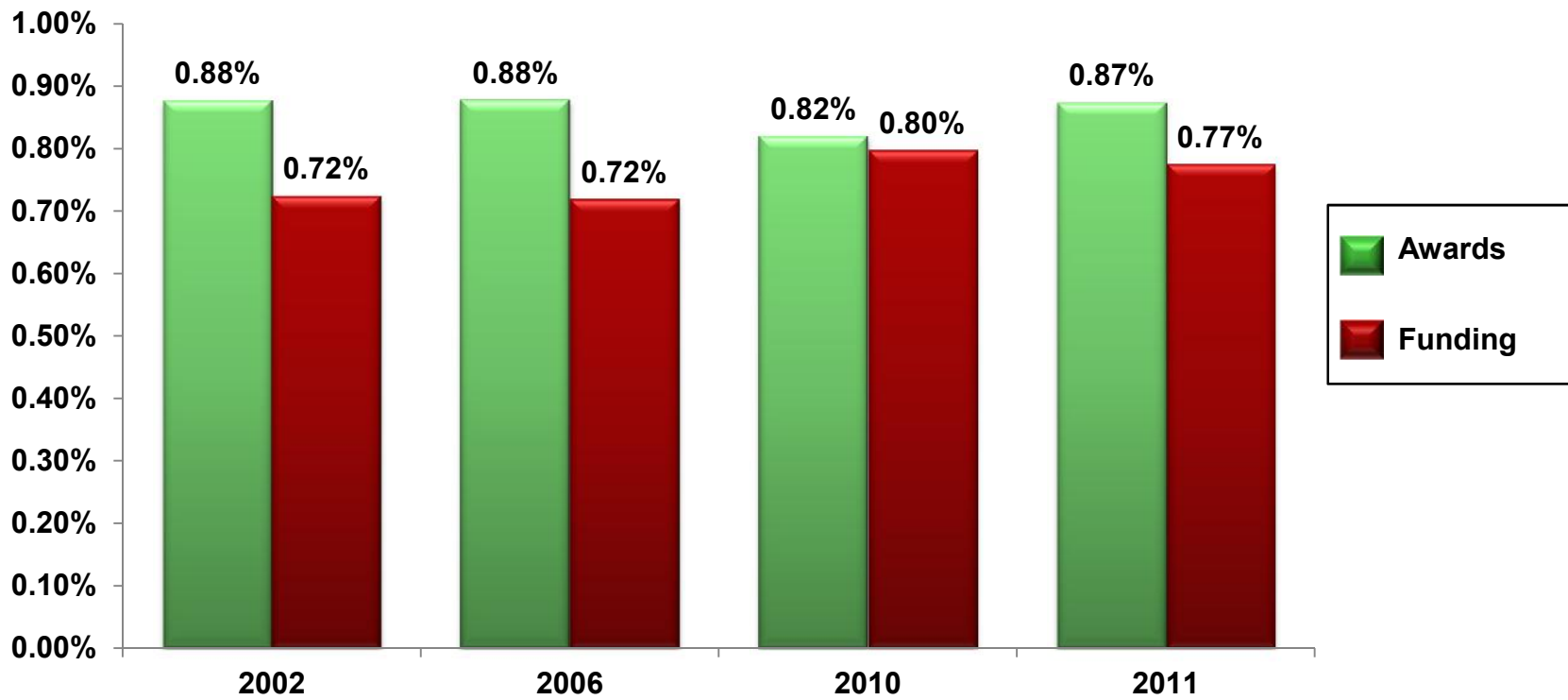
Key finding: Research institutes help Arizona's NIH growth to exceed both the Top 10 states and U.S. average.



Arizona Share of NIH Support

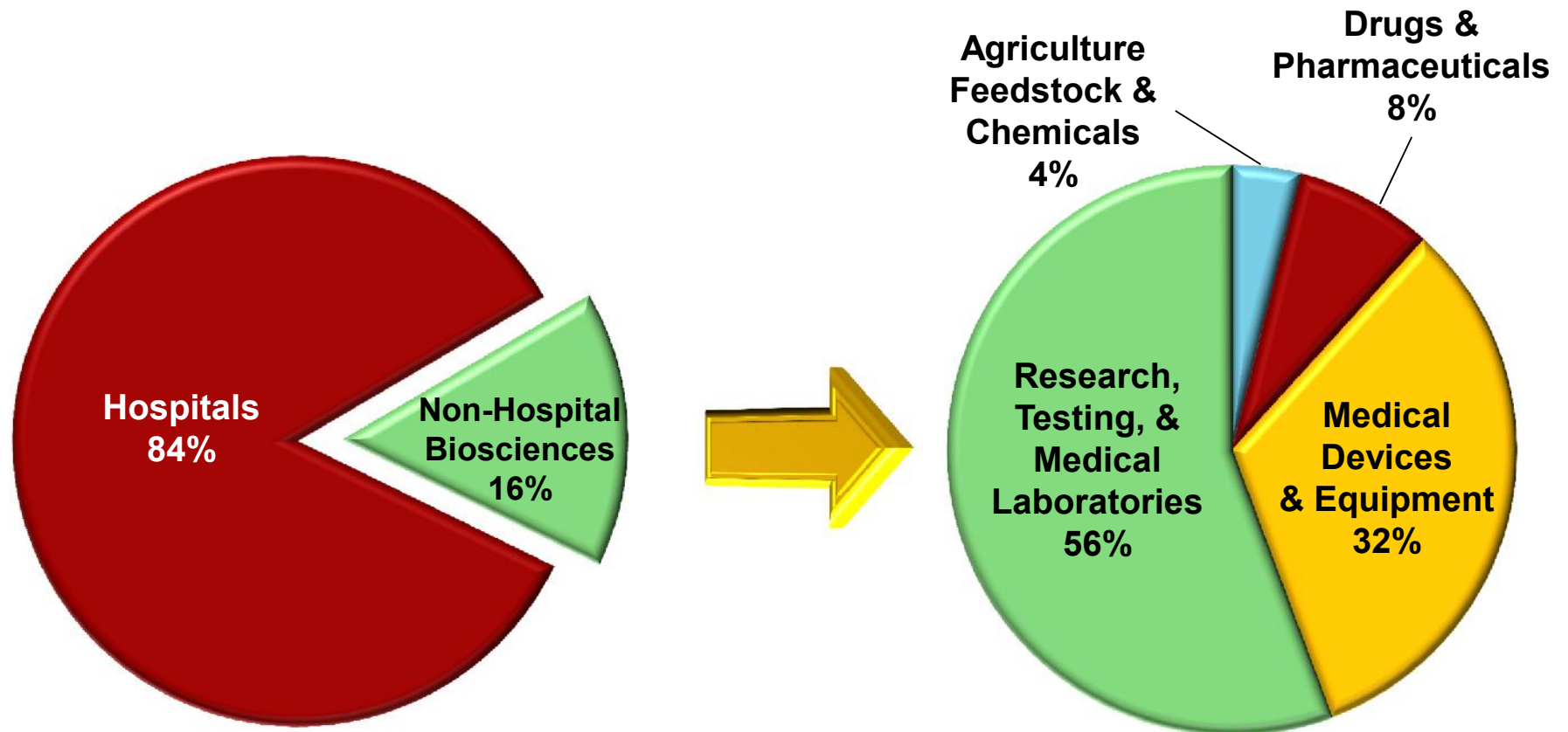
Key finding: Arizona share of funding rising, though well below population share.

Arizona Share of U.S. NIH Awards & Funding



Hospitals & Non-Hospital Sectors

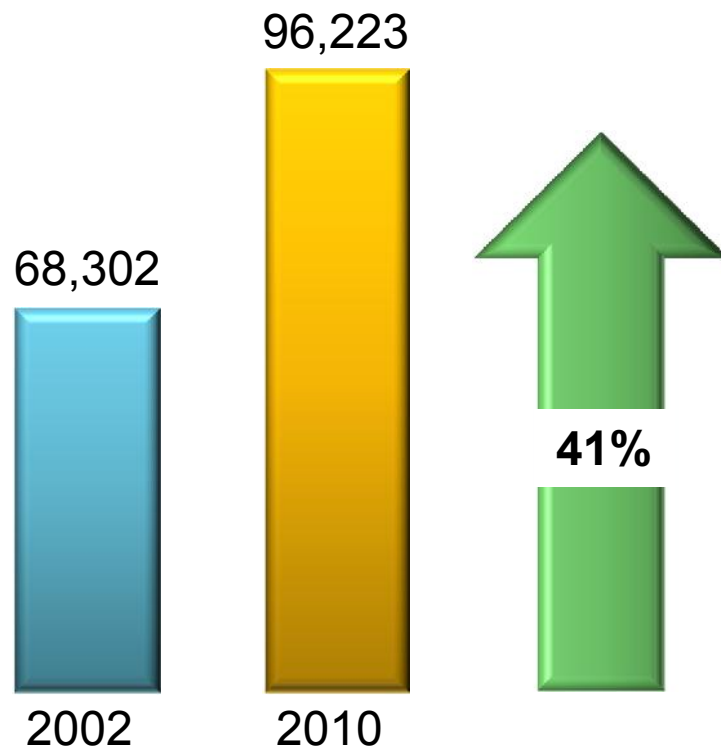
Key finding: Hospitals dominate Arizona's bioscience jobs.



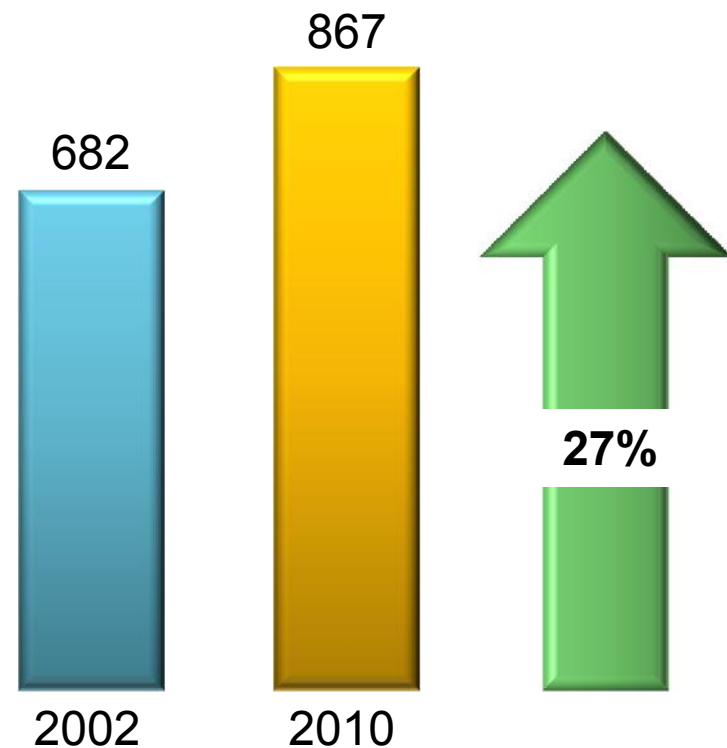
Employment & Establishments

Key finding: Arizona is experiencing rapid growth in bioscience jobs and firms.

AZ Bioscience **Employment**, 2002-10



AZ Bioscience **Establishments**, 2002-10

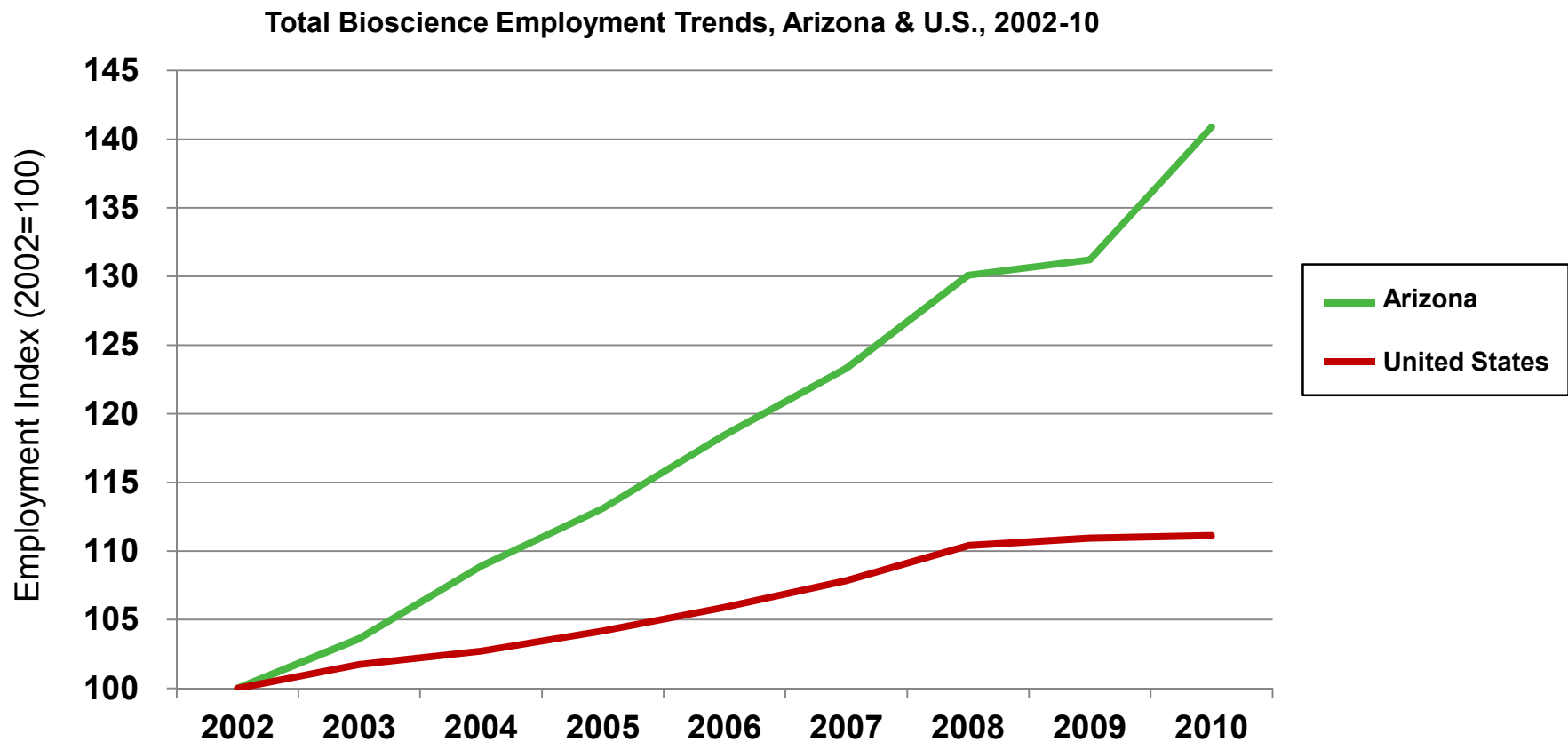


Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

Note: Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census.

Total Bioscience Job Growth

Key finding: Arizona has experienced much faster bioscience job creation than nation.

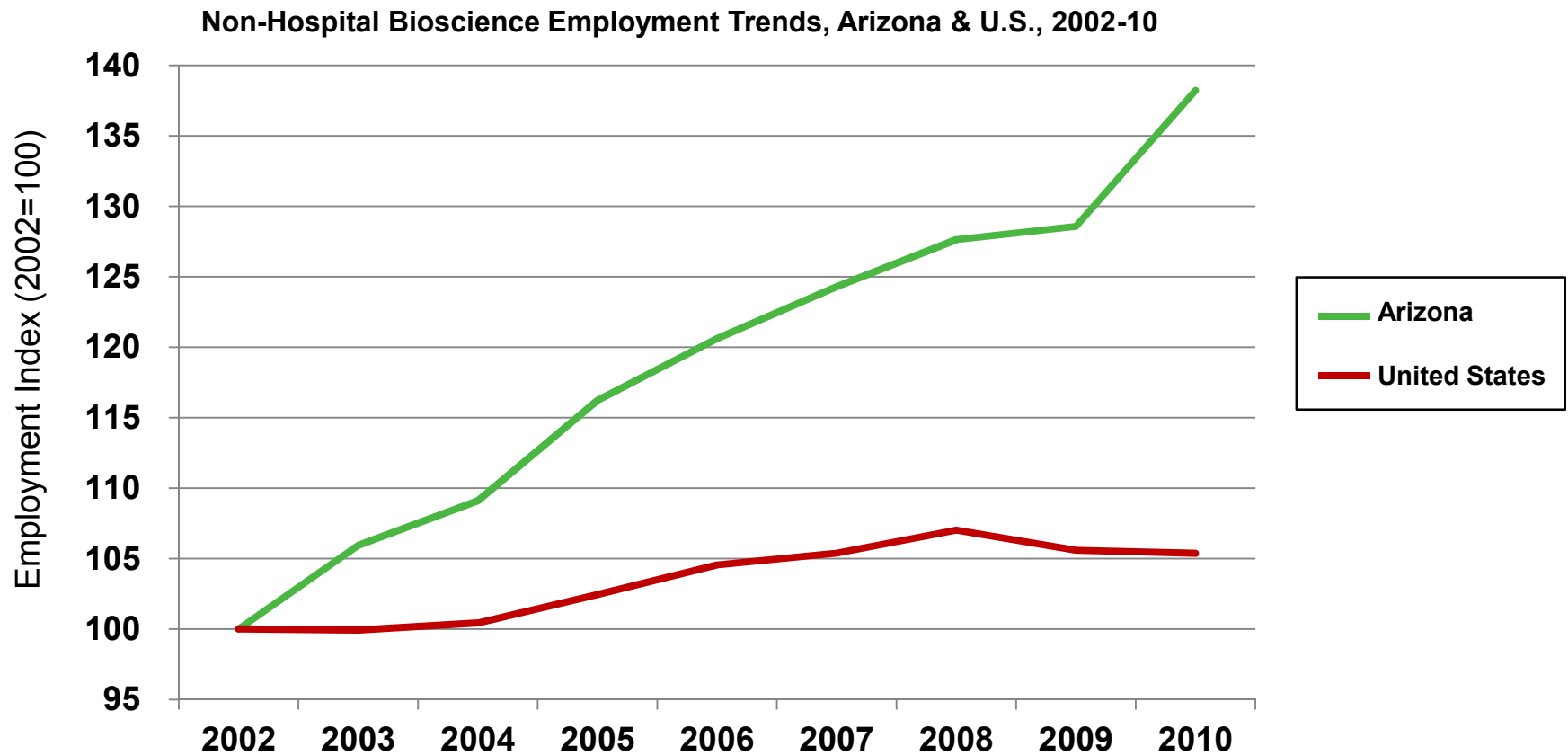


Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

Note: Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census. Employment data for the Medical Devices & Equipment subsector have been revised down for 2008 and 2009 to adjust for the overestimation by IMPLAN in a detailed industry that was not disclosed by BLS.

Non-Hospital Bioscience Job Growth

Key finding: Arizona job growth is similar in the non-hospital sectors.

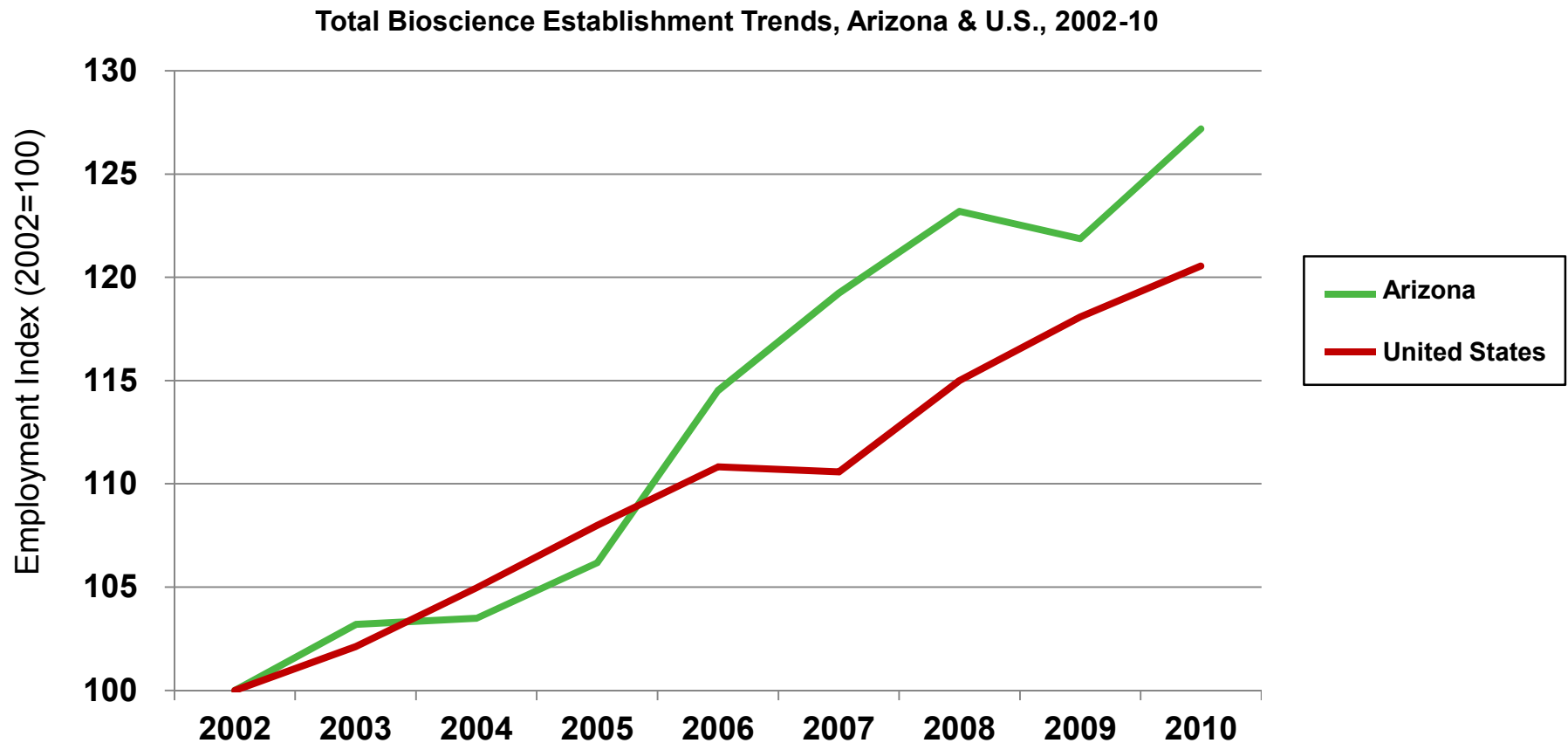


Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

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Total Bioscience Establishment Growth

Key finding: *Arizona has grown its base of bioscience establishments faster than the nation.*

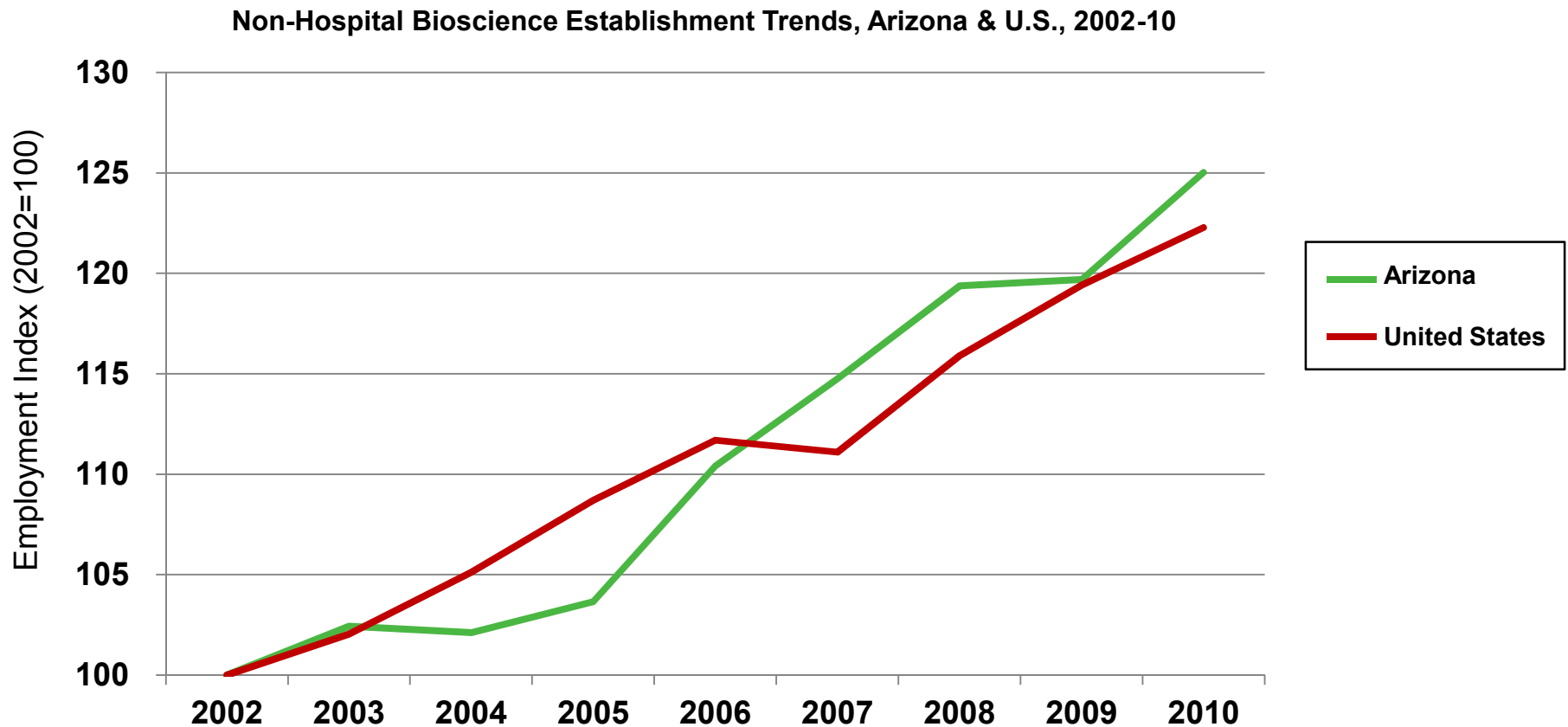


Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

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Non-Hospital Bioscience Establishment Growth

Key finding: *The growth of establishments persists with hospitals excluded.*



Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

Note: Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census. Employment data for the Medical Devices & Equipment subsector have been revised down for 2008 and 2009 to adjust for the overestimation by IMPLAN in a detailed industry that was not disclosed by BLS.

Growth in Jobs, Establishments by Sector

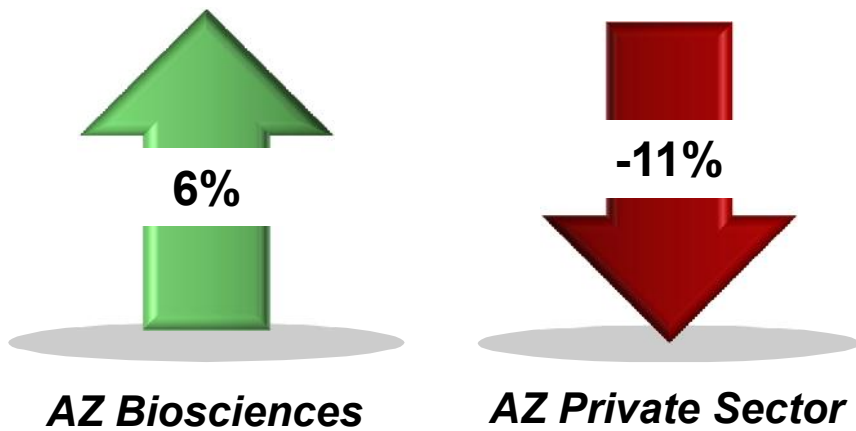
Key finding: Strong and steady growth among the four largest subsectors has boosted Arizona bioscience jobs by 41% since 2002.

Arizona Employment Metrics					
Industry Subsector	Establishments, 2010	Establishments Percent Change, 2002-10	Employment, 2010	Employment Percent Change, 2002-10	Location Quotient, 2010
Total Biosciences	867	27.2%	96,223	40.9%	0.87
Total Non-hospital Biosciences	756	25.0%	15,057	38.2%	0.61
Agricultural Feedstock & Chemicals	22	-35.3%	589	6.1%	0.30
Drugs & Pharmaceuticals	38	40.7%	1,181	24.8%	0.22
Medical Devices & Equipment	260	3.7%	4,901	28.1%	0.64
Research, Testing, & Medical Laboratories	436	48.8%	8,386	50.6%	0.86
Hospitals	111	44.2%	81,166	41.4%	0.95

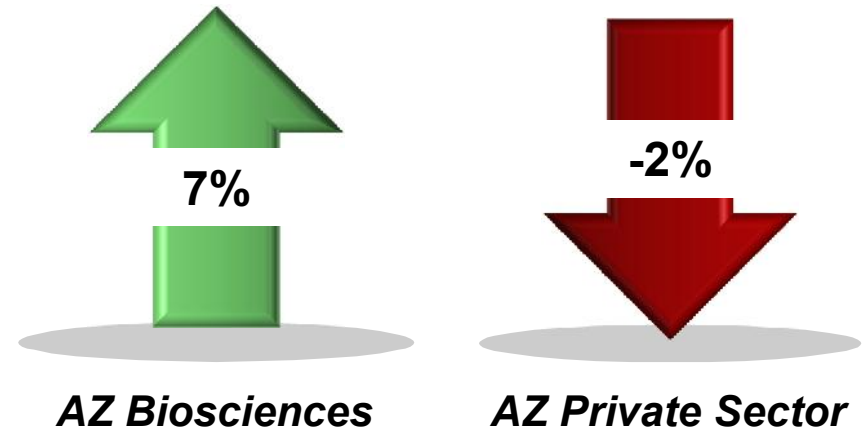
Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc. Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census.

Recession-Tested Job Growth

Recession (2007-09)



Recovery (2009-10)



Arizona Biosciences During Recession

Key finding: Despite deep private-sector job declines over the recession, Arizona bioscience companies continued to hire.

Business Cycle Focus: Employment in Arizona vs. U.S.						
Industry Subsector	Economic Expansion		Recent Recession		Post Recession	
	AZ Change 2002-07	U.S. Change 2002-07	AZ Change 2007-09	U.S. Change 2007-09	AZ Change 2009-10	US. Change 2009-10
Total Private Sector	19.8%	6.0%	-11.3%	-6.2%	-1.8%	-0.7%
Total Biosciences	23.3%	7.8%	6.4%	2.9%	7.4%	0.2%
Total Non-Hospital Biosciences*	24.3%	5.4%	3.4%	-0.2%	7.5%	0.0%
Agriculture Feedstock & Chemicals	0.8%	-6.0%	11.6%	0.7%	-5.6%	-2.2%
Drugs & Pharmaceuticals	17.1%	-0.1%	-8.7%	-4.8%	16.7%	-1.8%
Medical Devices & Equipment*	29.6%	1.0%	0.4%	-0.3%	-1.5%	-1.1%
Research, Testing & Medical Laboratories**	24.2%	16.9%	6.9%	3.6%	13.5%	2.2%
Hospitals	23.1%	8.6%	7.0%	3.7%	7.3%	0.3%

Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

*Employment data for the Medical Devices & Equipment subsector have been revised down for 2008 and 2009 to adjust for the overestimation by IMPLAN in a detailed industry that was not disclosed by BLS.

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Bioscience Wages

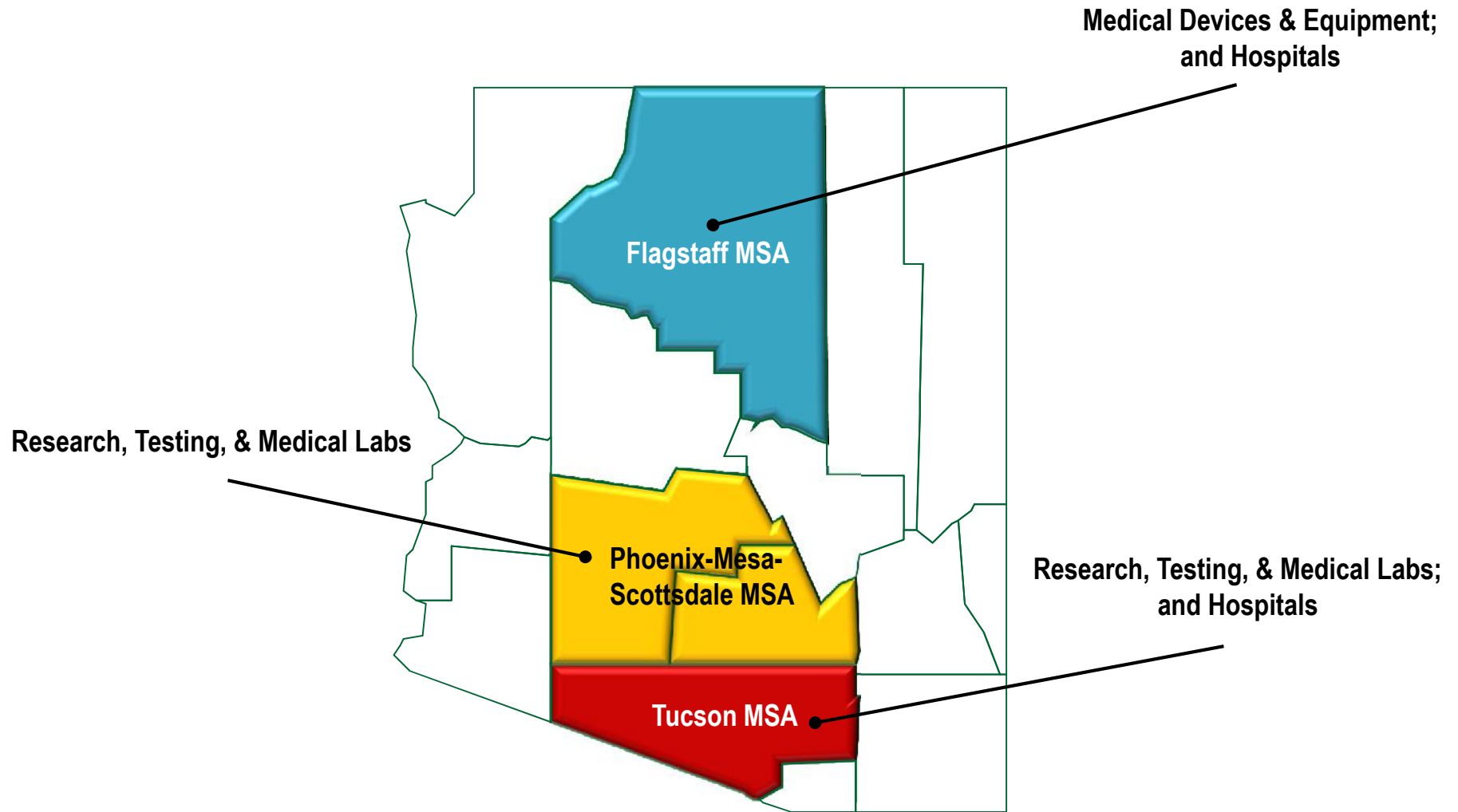
Key finding: Arizona bioscience workers earned 29% more per year than workers in the overall state private sector in 2010.

Major AZ Industries &	Avg. Annual Wages 2009	Avg. Annual Wages 2010	Change 2009-10
Management of Companies & Enterprises	\$72,674	\$72,198	-0.7%
Professional & Technical Services	\$64,396	\$66,207	2.8%
Manufacturing	\$61,909	\$65,409	5.7%
Research, Testing, & Medical Laboratories	\$60,859	\$61,828	1.6%
Hospitals	\$57,298	\$54,757	-4.4%
Total Biosciences	\$57,261	\$55,353	-3.3%
Total Non Hospital Biosciences	\$57,061	\$58,566	2.6%
Finance & Insurance	\$56,879	\$58,988	3.7%
Information	\$56,129	\$56,680	1.0%
Medical Devices & Equipment	\$54,397	\$56,651	4.1%
Drugs & Pharmaceuticals	\$51,064	\$49,788	-2.5%
Health Care & Social Assistance	\$47,291	\$47,107	-0.4%
Construction	\$44,110	\$44,207	0.2%
Transportation & Warehousing	\$43,749	\$45,726	4.5%
Agricultural Feedstock & Chemicals	\$43,054	\$45,664	6.1%
Total Private Sector	\$42,090	\$42,858	1.8%
Real Estate & Rental & Leasing	\$41,349	\$41,589	0.6%
Arts, Entertainment, & Recreation	\$33,358	\$33,978	1.9%
Retail Trade	\$27,813	\$28,473	2.4%

Source: Battelle analysis of BLS, QCEW data from MIG, Inc. Wages are in current dollars (not adjusted for inflation).

Note: Employment data for the Medical Devices & Equipment subsector have been revised down for 2008 and 2009 to adjust for the overestimation by IMPLAN in a detailed industry that was not disclosed by BLS.

Regional Bioscience Strengths



Flagstaff Metro Area

Key Bioscience Subsector	Establishments, Employment Level & Concentration (2010)	Regional Strengths/ Highlights
Medical Devices & Equipment	Establishments: 8 Employed: 1,924 Empl. Growth (02-10): 98% Location Quotient: 11.88	Flagstaff is highly specialized in medical devices, with nearly 12 times the national employment concentration The regional sector continues to grow at a rapid pace, up 98% since 2002
Hospitals	Establishments: 2 Employed: 2,787 Empl. Growth (02-10): 12% Location Quotient: 1.55	Flagstaff has specialized hospitals subsector with 55% greater concentration of hospital jobs relative to the national average and nearly 2,800 jobs

Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

Note: Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census. Employment data for the Medical Devices & Equipment subsector have been revised down for 2008 and 2009 to adjust for the overestimation by IMPLAN in a detailed industry that was not disclosed by BLS.

Phoenix-Mesa-Scottsdale Metro Area

Key Bioscience Subsector	Establishments, Employment Level & Concentration (2010)	Regional Strengths/ Highlights
Research, Testing & Medical Laboratories	Establishments: 314 Employed: 6,459 Empl. Growth (02-10): 50% Location Quotient: 0.90	Phoenix metro area has a large number of employed in research, testing, and medical labs – more than three-quarters of the state total The region has added 50% to its job base since 2002, driving state growth in the sector

Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

Employment data have been revised for Research, Testing, & Medical Labs back to 2002 to incorporate updates to share of Bioscience-related R&D from newly released data from the U.S. Economic Census.

Tucson Metro Area

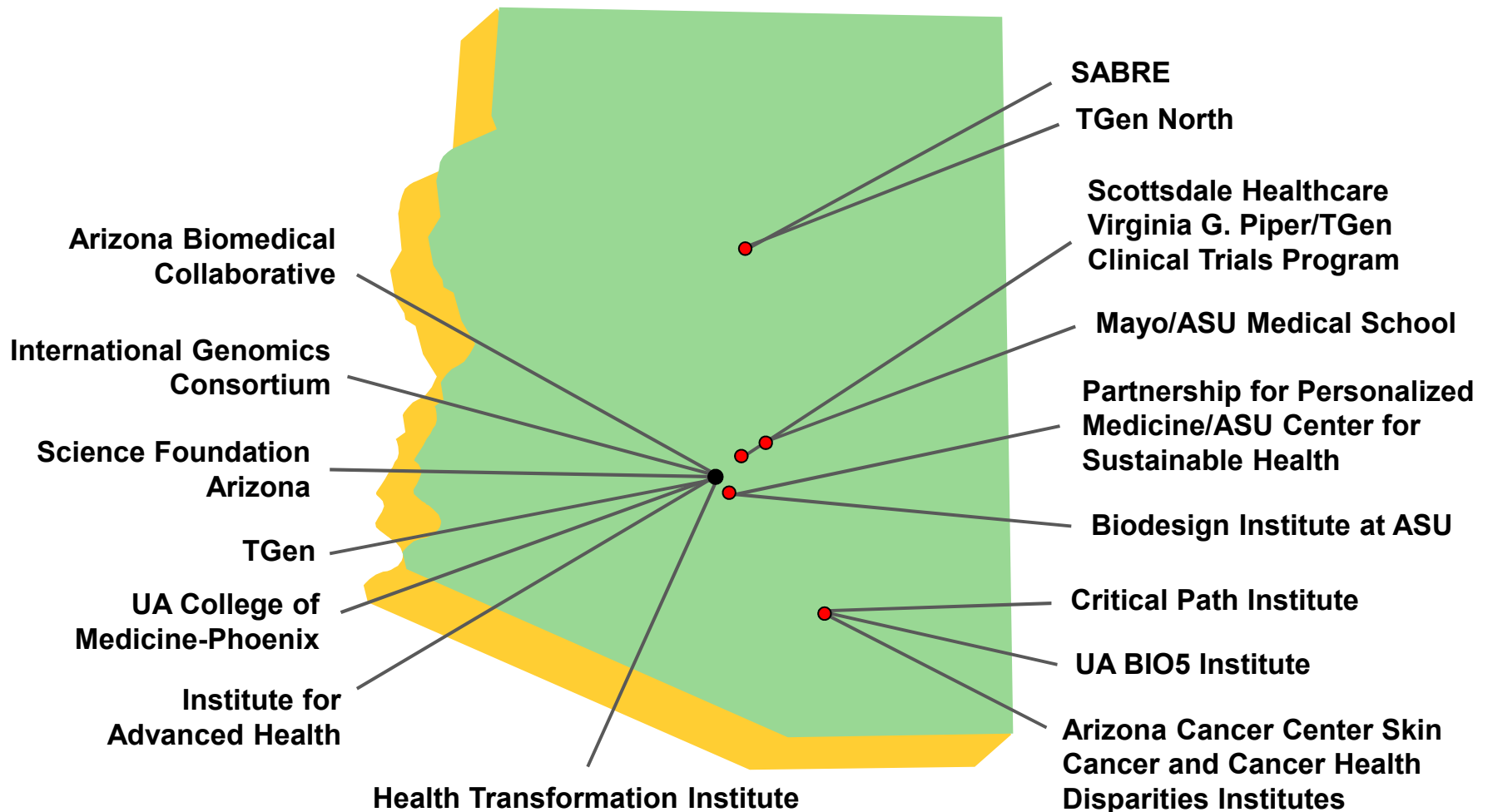
Key Bioscience Subsector	Establishments, Employment Level & Concentration (2010)	Regional Strengths/ Highlights
Research, Testing & Medical Laboratories	Establishments: 70 Employed: 1,243 Empl. Growth (02-10): 33% Location Quotient: 0.91	Tucson's research, testing & medical labs sector employment is well concentrated, nearly matching the national average The region has added nearly 20 establishments in the sector since 2002
Hospitals	Establishments: 16 Employed: 14,912 Empl. Growth (02-10): 20% Location Quotient: 1.25	Tucson has a large, growing, and specialized hospitals subsector with nearly 15,000 jobs Hospital employment is 25% more concentrated in and around Tucson relative to the national average

Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from MIG, Inc.

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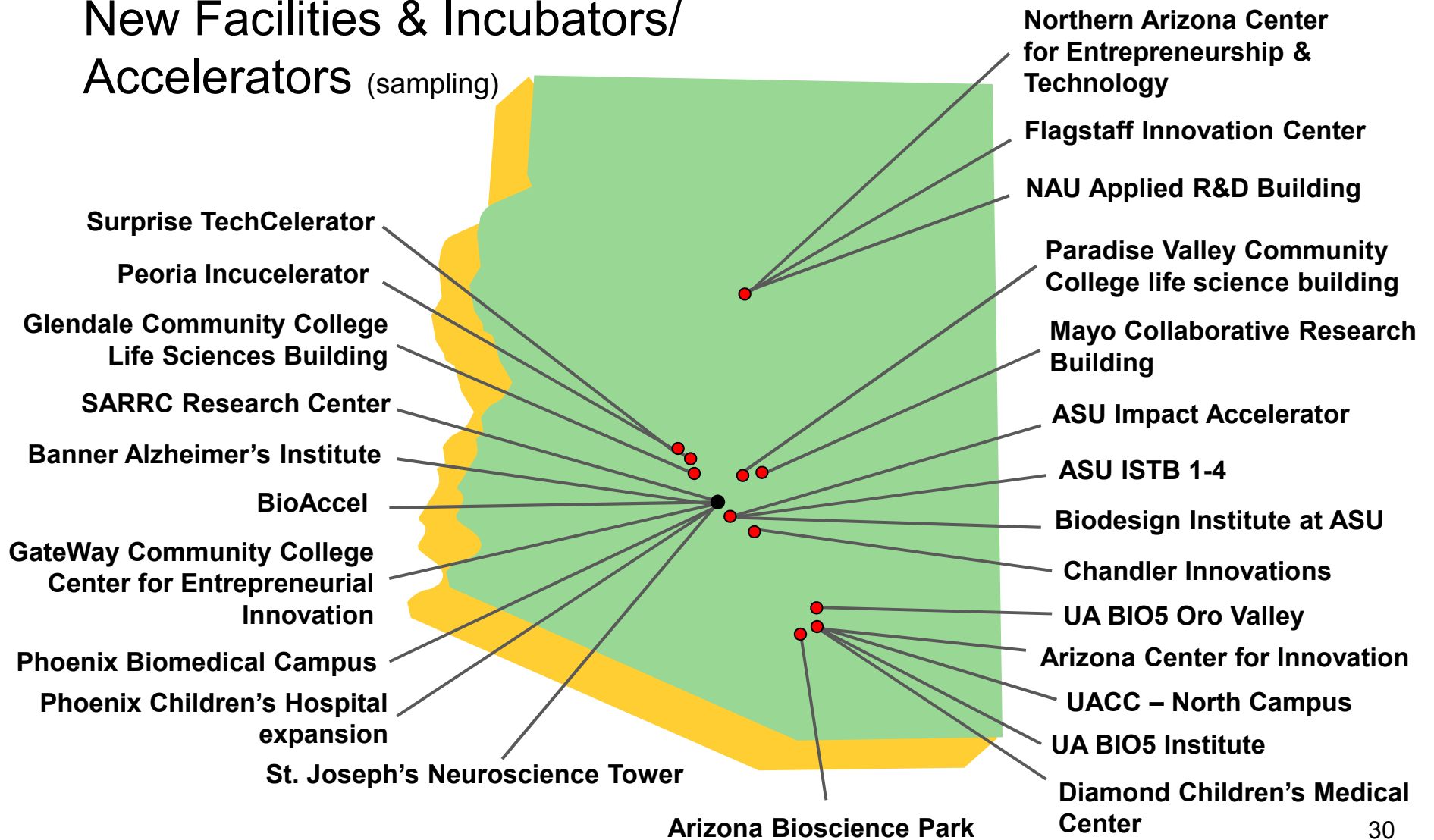
New Since '02

New Research Institutes & Entities (sampling)



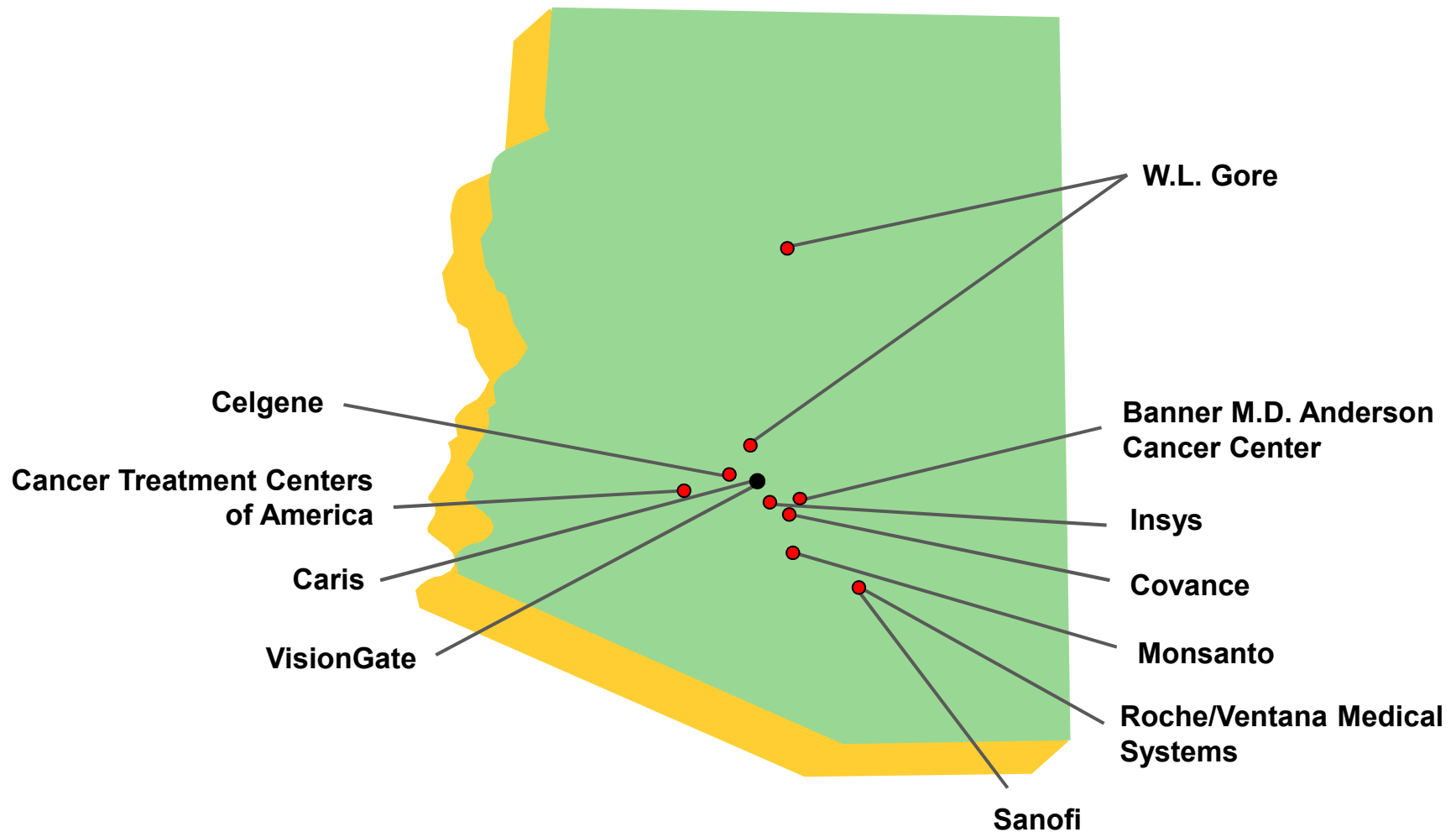
New Since '02

New Facilities & Incubators/ Accelerators (sampling)



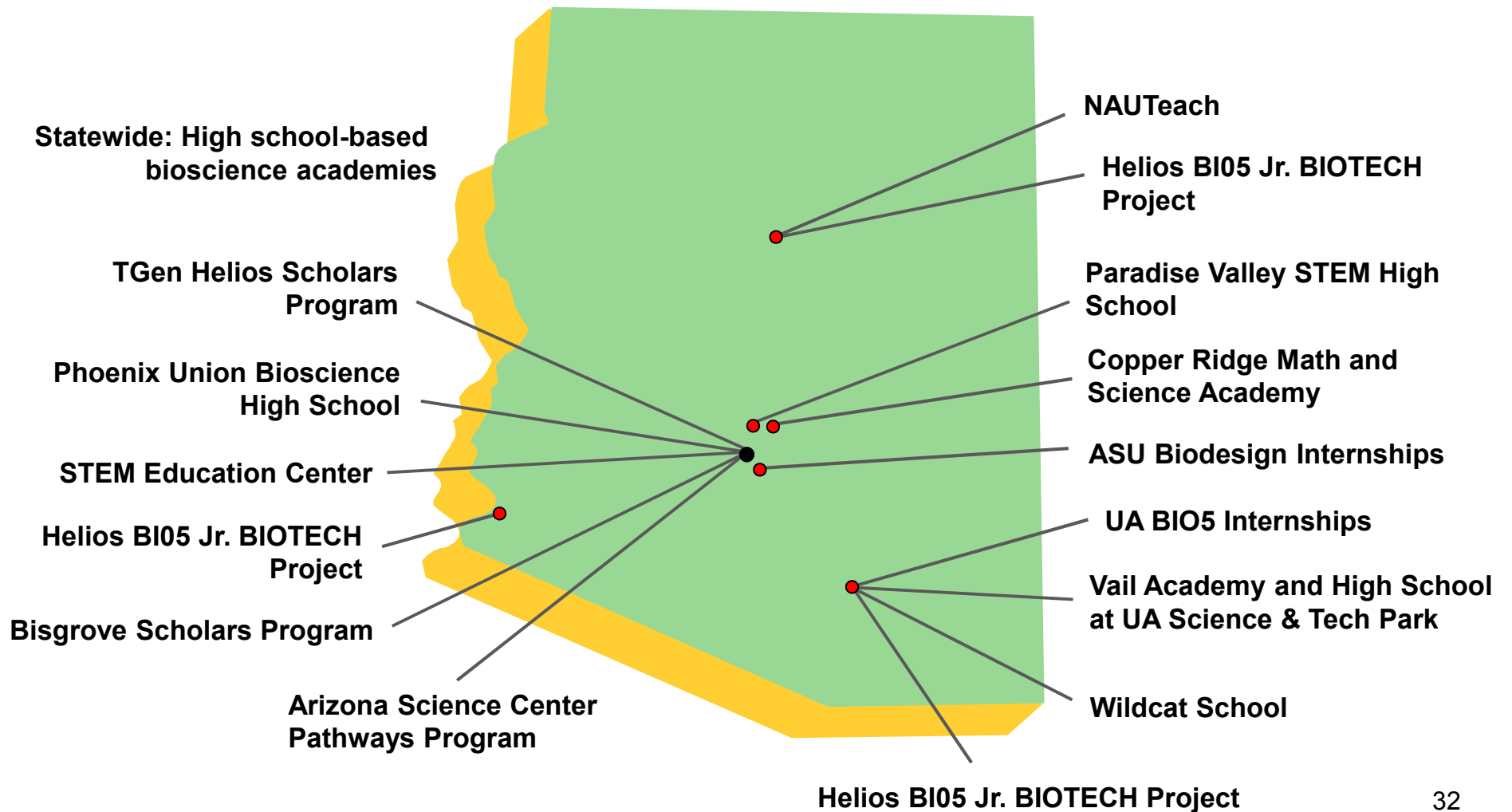
New Since '02

New or Expanded Major Companies (sampling)



New Since '02

New Schools and Education Programs (sampling)



Roadmap Implementation



Substantial Progress – 10









Progress – 8



Not Yet Implemented – 1






- Progress has been seen on nearly 95% of the actions included in the December 2002 Arizona's Bioscience Roadmap; nearly 53% of the actions have seen substantial progress.
- In 2011, two actions were downgraded from substantial progress to progress. One action was upgraded from progress to substantial progress.
- These changes are due to continued state funding cuts to higher education for research and education, and to Science Foundation Arizona.

Roadmap Strategies and Actions





Strategy 1	Action	Status	Comments
Build the state's research infrastructure of outstanding talent, modern facilities and equipment, around selective technology platforms and core competencies	Establish statewide fund to enhance bioscience research		State higher education funding cuts and cuts to Science Foundation Arizona have resulted in downgrading this action
	Stimulate research collaboration among universities/hospitals/other research organizations		Increased teaching hospital/university clinical research successes and new collaborations are increasing
	Establish a Matching Challenge Program to connect industry and researchers		Arizona Commerce Authority started program variation of this action
	Increase help to entrepreneurs to secure federal funds (SBIR/STTR)		Arizona Commerce Authority recently re-established FAST program for SBIR assistance
	Secure federal investments to build Arizona's bioscience capacity		Arizona less competitive in NIH post-stimulus funding
	Adequately fund higher education including bond financing for capital projects		State reductions in support to universities resulted in downgrading this action

 Substantial Progress
  Progress
  Not Yet Implemented





Roadmap Strategies and Actions

Strategy 2	Action	Status	Comments
Build a critical mass of bioscience firms by increasing the birthrate and reducing the death rates of Arizona's bioscience firms and encouraging the commercialization of research discoveries	Provide in-depth, comprehensive, entrepreneurial assistance support to start-up and emerging bioscience companies		Bio5-Oro Valley and AZ Core Labs in Flagstaff established
	Support prototype development and proof of concept activities from research to commercialization		Tech Launch Arizona at UA plans to increase such funding in 2012
	Invest at earliest stages of firm formation through an Arizona BioSeed Fund		A fund of funds was not implemented; action in danger of being downgraded in future
	Provide wet lab space through support of bioscience accelerators/incubators/wet lab space in and around research parks		Peoria Bioscience Incubator becomes fifth in Phoenix
	Provide a mechanism for Arizona universities to take equity in start-up companies		Tech Launch Arizona announced

Roadmap Strategies and Actions

Strategy 3	Action	Status	Comments
Offer a business climate and environment that supports, sustains, and encourages the growth of bioscience enterprises, small and large, to start, expand and remain in Arizona	Revise state/local economic development programs to support the growth, expansion and selective recruitment of biosciences firms		Implementation of Arizona Commerce Authority programs
	Establish Technology Zones around existing and proposed concentrations of bioscience and other technology industries		
	Form a strong statewide bioscience trade association with regional chapters		Sustainability is ongoing challenge
	Initiate a statewide image , marketing and business development effort to market Arizona as a location for bioscience firms		Arizona Commerce Authority should emphasize biosciences as a target area in marketing

Roadmap Strategies and Actions

Strategy 4	Action	Status	Comments
<p>Encourage the state's citizens to become a more informed citizenry in the biosciences and encourage young people to explore and pursue scientific and technical careers</p>	<p>Create capacity to understand and address health policy issues from review boards, central data banks, to ethics and public policy reviews</p>		<p>Arizona SciTech Festival statewide</p>
	<p>Address future talent pool by making improvements in science and math in K–12 through graduate education</p>		<p>STEM Centers established at UA and ASU; 4 Goldwater Scholars at ASU in 2010 & 11</p>
	<p>Encourage talent to remain in the state by expanding co-op and internship programs</p>		
	<p>Address the need to attract top graduate students to clinical research opportunities in Arizona</p>		<p>Second round and expansion of Bisgrove Scholars for post docs by SFAz, Mayo Medical School-ASU, Phoenix Biomedical Campus Expansion, MD Anderson and UA Cancer expansions</p>

Arizona Universities Tech Transfer

Key finding: Measures of bioscience tech-transfer at Arizona universities have shown steady progress since 2002.

Bioscience Technology Transfer Metric	Total, 2002-11
Invention Disclosures Received	1,219
Total U.S. Patent Applications Filed	830
U.S. Patents Issued	158
Licenses & Options Executed	268
Adjusted Gross License Income Received	\$17,869,964
Bioscience Startups from University IP	60

Arizona Bioscience Venture Capital

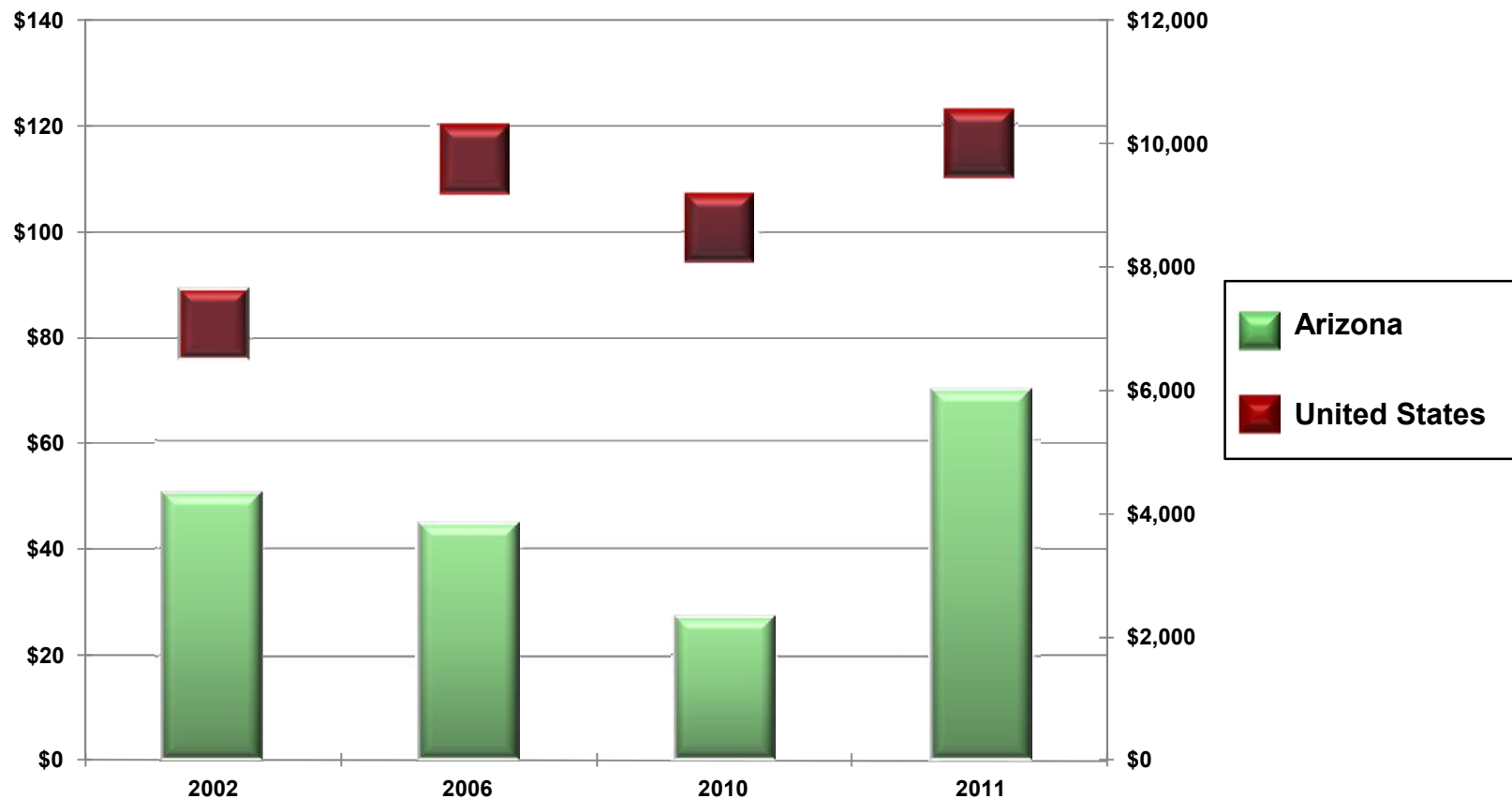
Key finding: Arizona gets fair share of deals but not funds.

Total VC Investments in Arizona and the U.S., 2002 - 2011							
Metric	ARIZONA				U.S.		
	Biosciences	All Industries	Bioscience Share of Total VC	AZ Biosciences as Share of US Biosciences	Biosciences	All Industries	Bioscience Share of Total VC
Number of Deals	88	336	26%	0.78%	11,224	43,742	26%
Number of Individual Companies Invested In	31	130	24%	0.87%	3,581	16,378	22%
Investment in \$Millions	\$540	\$5,536	10%	0.61%	\$89,185	\$392,310	23%

U.S. and Arizona Bio Venture Capital

Key finding: Arizona roughly follows national trends in bio venture capital investments.

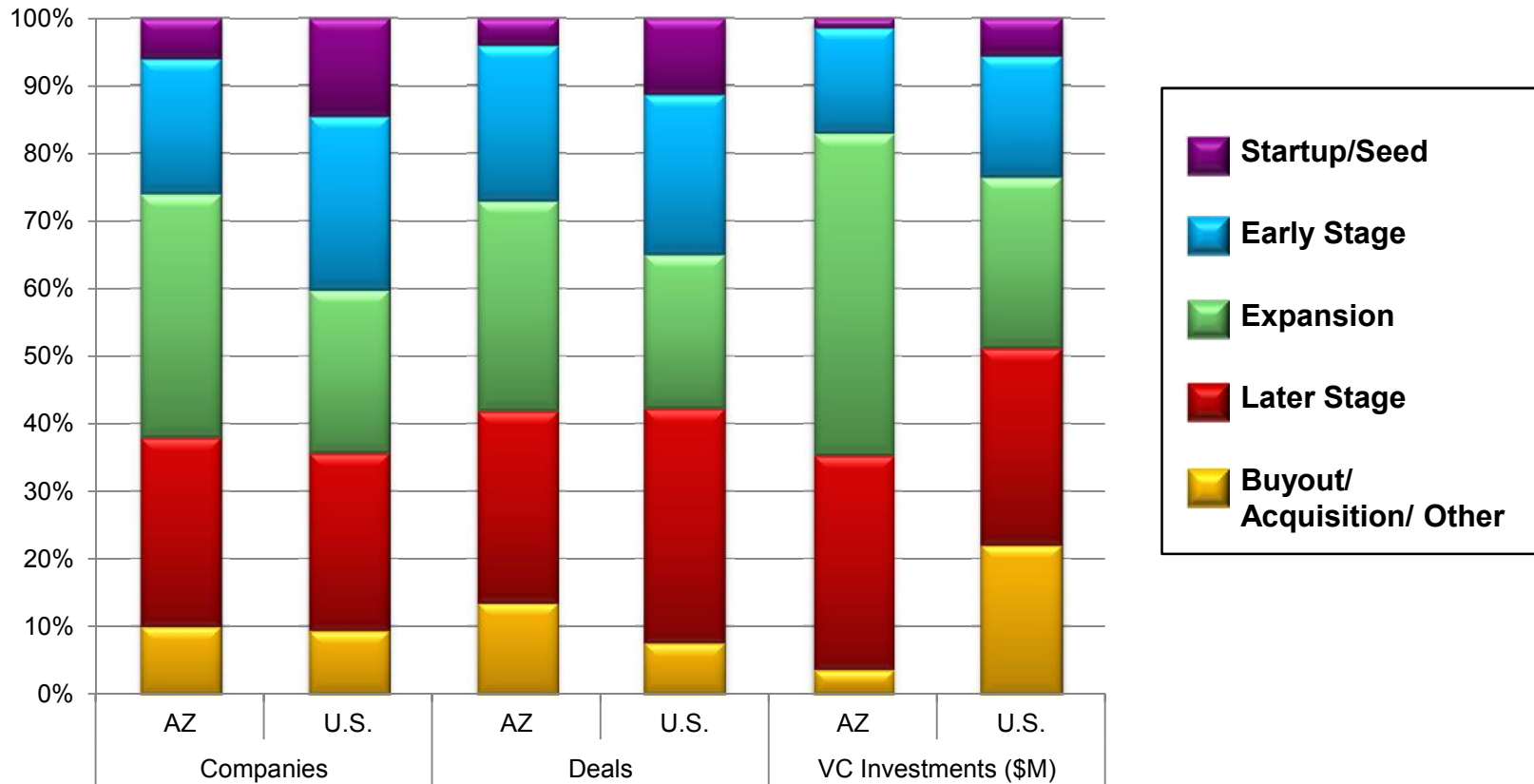
Comparison of Bioscience-related VC Investment Trends: Arizona & U.S., 2002-2011



Arizona Venture Capital by Stage

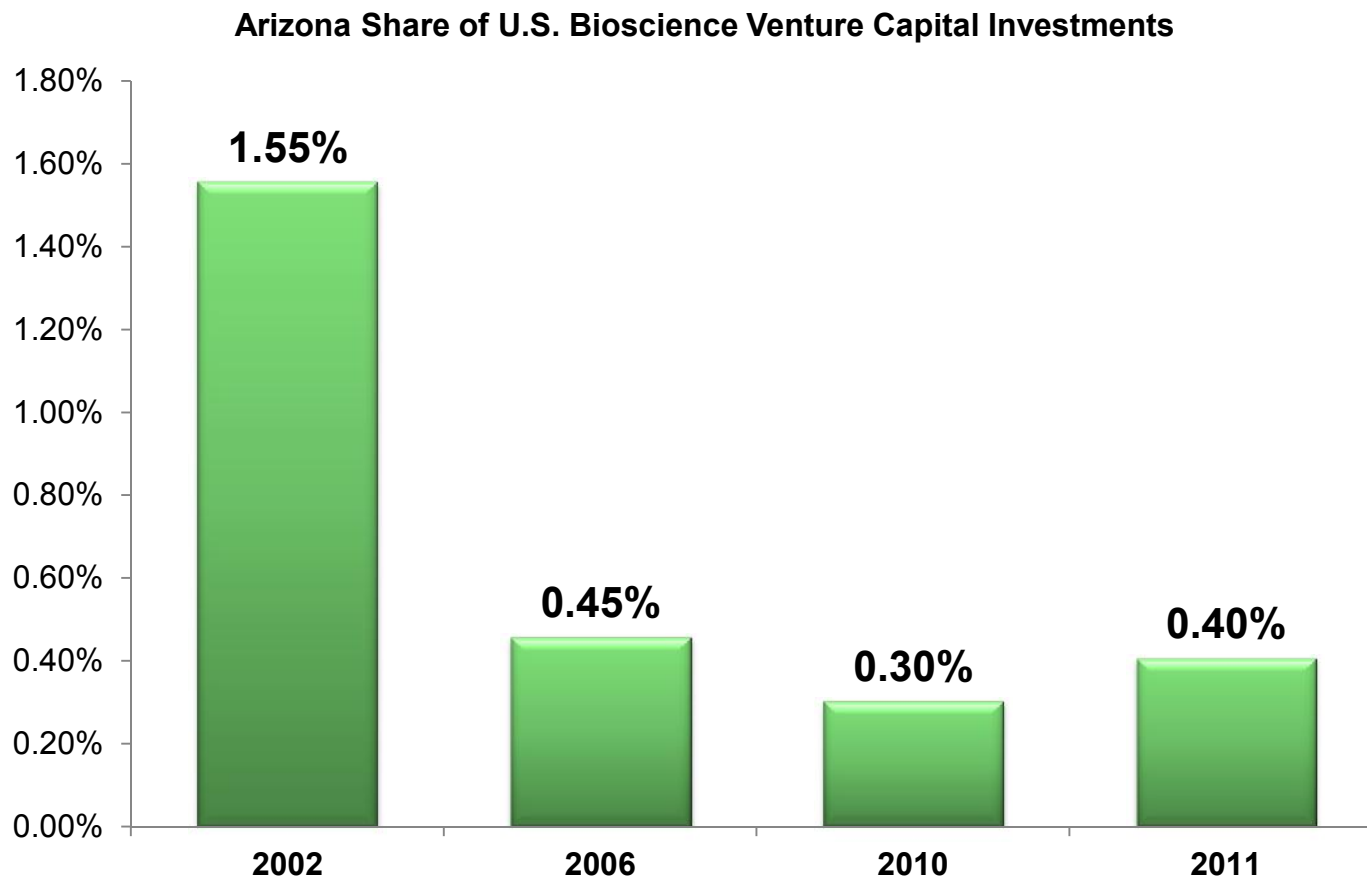
Key finding: Arizona is more focused on expansion, late-stage financing than the U.S.

Share of VC Investments in Biosciences by Stage for AZ and the U.S., 2002-2011



Arizona Venture Capital by Stage

Key finding: Arizona bioscience VC prospects for 2011 are looking up, though still less than half of state's population share.



Future Challenges

- Reach a critical mass of private firms and globally competitive research.
- Support and expand partnerships – sectors, institutions, public levels of government.
- Build future talent base.

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