

Arizona's Bioscience Roadmap: Performance Assessment 2002-09

Presentation and Discussion

Walter H. Plosila, PhD

Senior Advisor, Technology Partnership Practice

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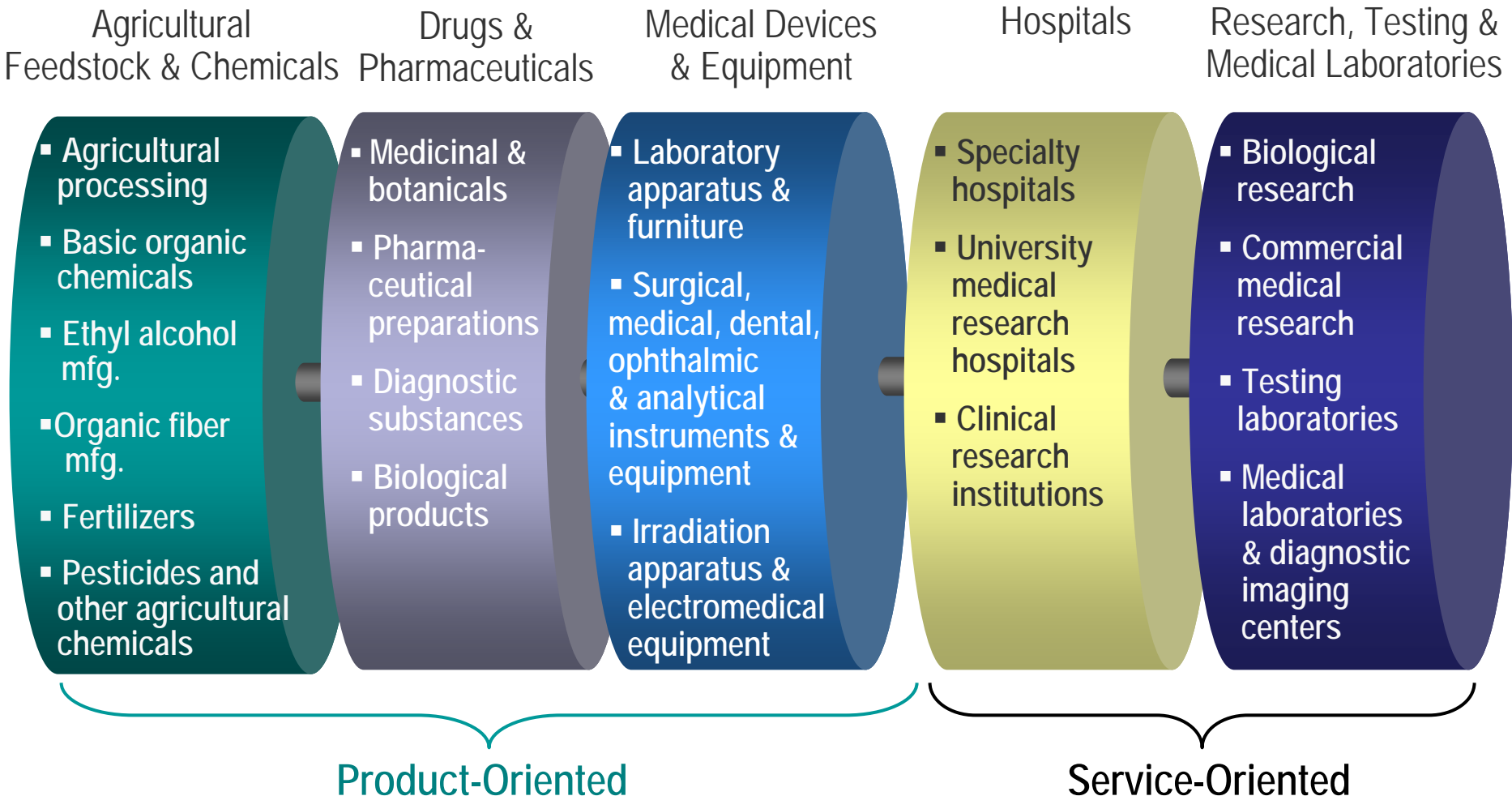
A Vision for Arizona in the Biosciences

Today's Look: Seven Years of Implementation



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.

Defining the Biosciences



Measures for assessing Arizona's Bioscience Roadmap progress

Best Practice Metrics To Measure Building a Biosciences-driven Economy

- ***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 - 2008

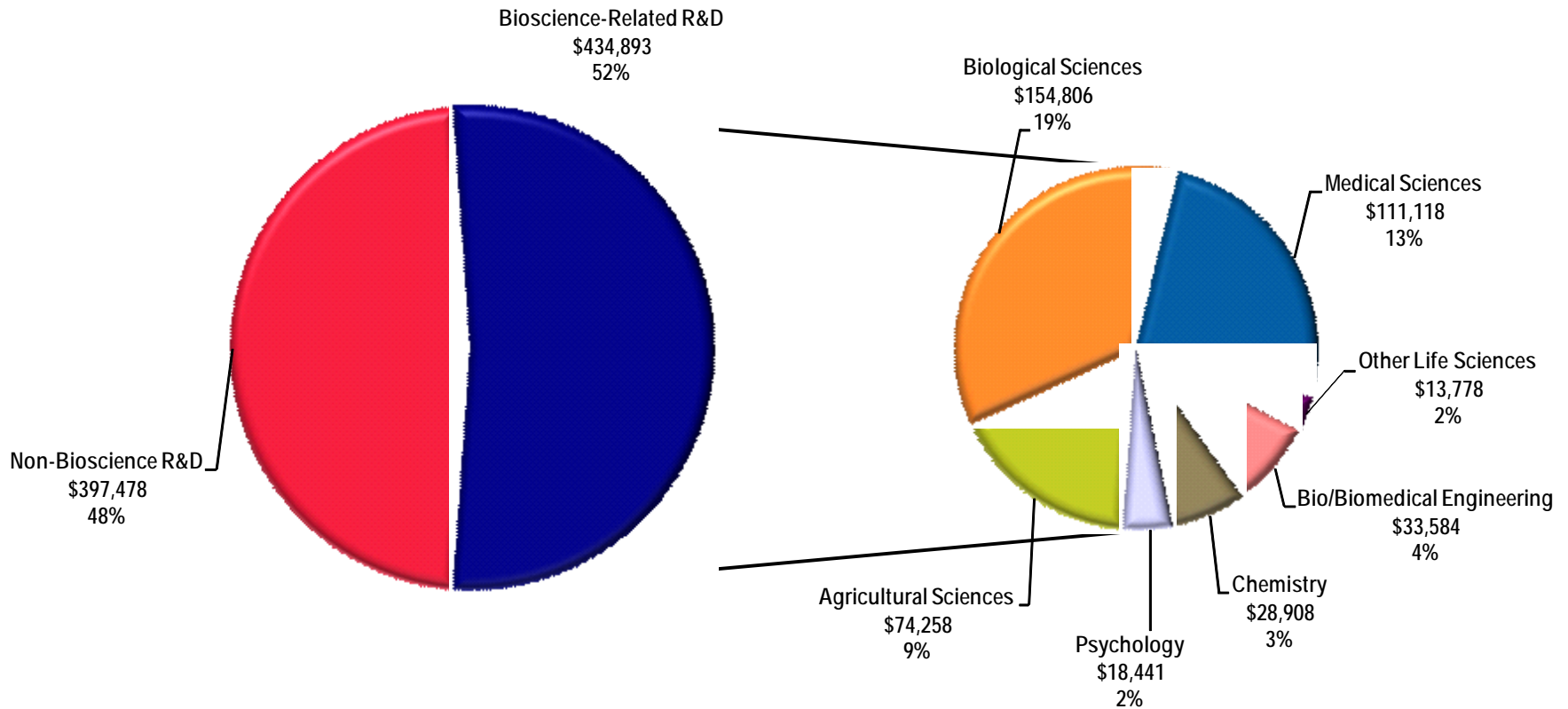
Metrics	Performance	Comments
NIH Funding	↑ 14% ('02-'08)	Arizona performance outpacing top 10 States (↑ 10%) and U.S. (↑ 11%)
Bio Jobs	↑ 31% ('02-'08)	Arizona's growth exceeding country U.S. (↑ 12%)
Bio Firms	↑ 32% ('02-'08)	Medical devices and research, testing and medical labs are key segments; U.S. (↑ 22%)
Bio Wages	↑ 43% ('02-'08)	Average salary: \$55.7K

Metrics of success: 2002 – 2009

Metrics	Performance	Comments
Bio Risk Capital	↓85% ('02-'09)	Reached 86% of goal in 2007 but only 16% of goal in 2009
Bio University IP		
• Bio Startups	↑Three fold Increase in '09	8 additional startups 09 and 50 bio startups ('02-'09)
• Bio Licenses	↑21.75% increase in '09	204 licenses ('02-'09)
• Bio Income	↓\$933,000 in '09	\$15 m. plus ('02-'09)

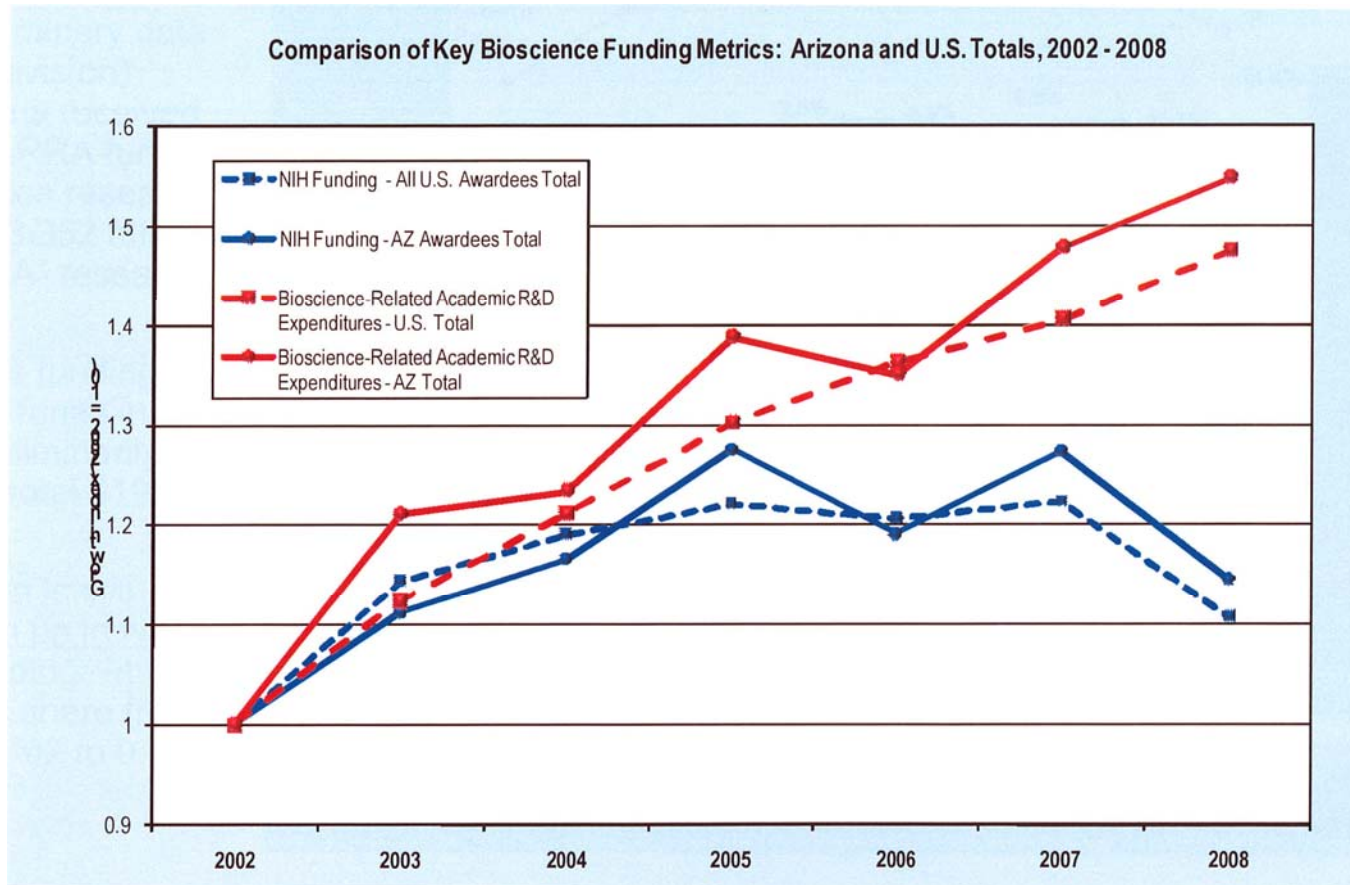
Biosciences Share of Arizona Academic R&D

Arizona Academic R&D in Bioscience Related Fields, FY 2008 (\$ in Thousands)



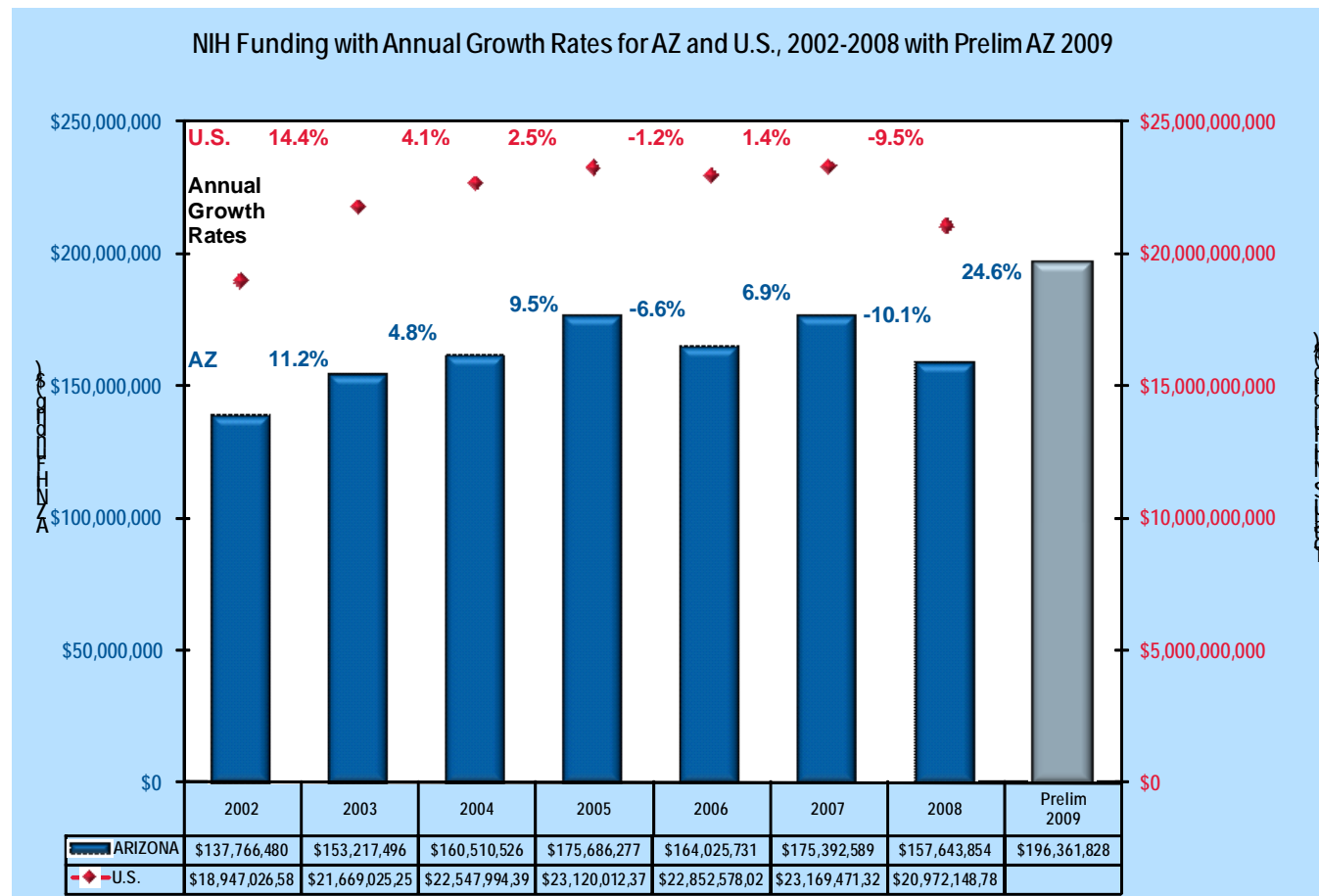
Trends in federal research grants

- Arizona overall bioscience-related academic R&D reached a new high in 2008.
- Steep declines in 2008 NIH funding at the national level are reflected in Arizona's performance, with current Arizona levels at a five year low.



NIH research grant funding trends

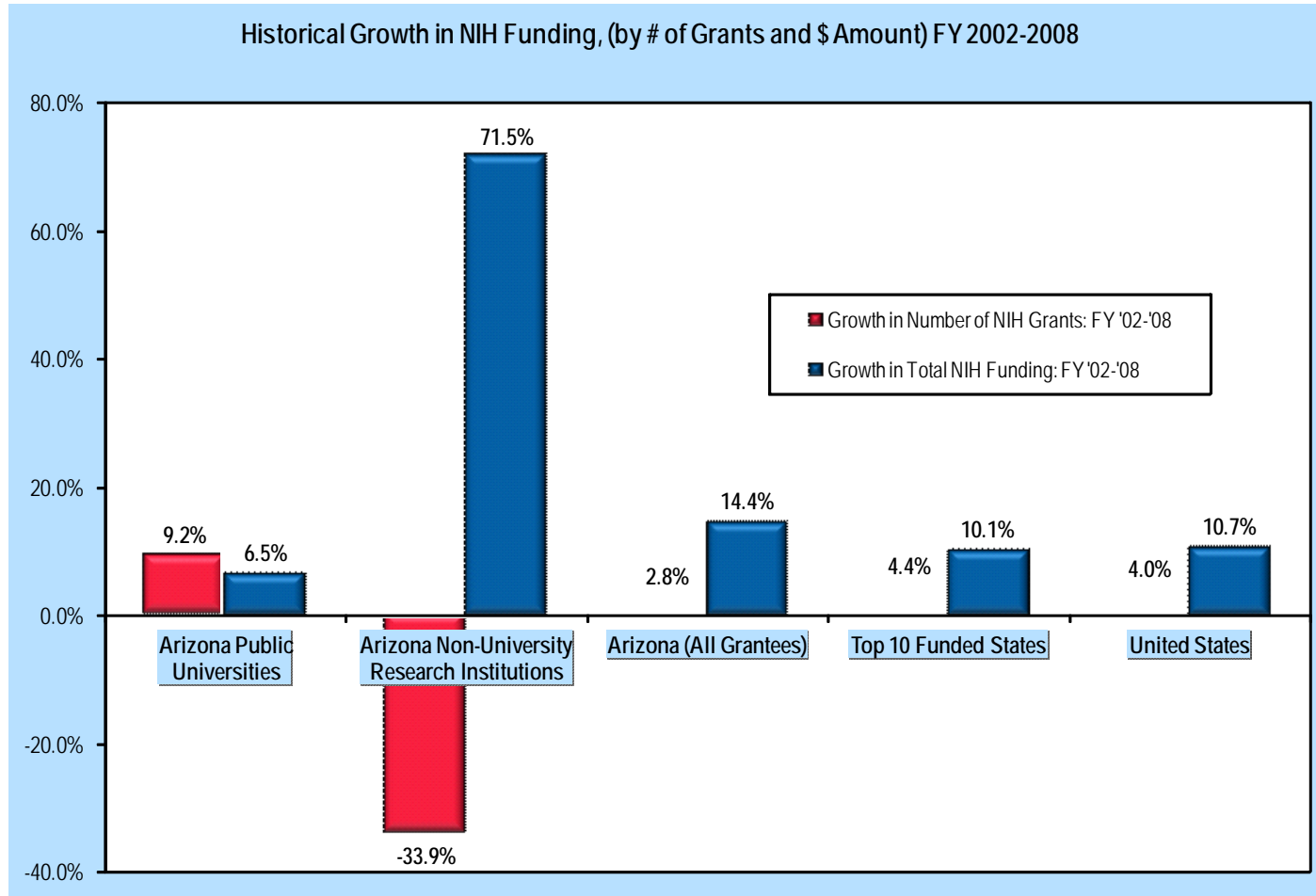
- Arizona has recorded strong growth in NIH funding—the gold standard of biomedical research funding
- Current preliminary data (subject to revision) shows Arizona received \$41.2 m in ARRA funding for biosciences research including \$33.352 million in NIH “ARRA” research funding..
- With stimulus funding, total AZ NIH funds in FY 2009 are preliminarily projected to total \$196.4 m.
- While Arizona is still playing catch up in NIH research funding—it has increased its share from 0.73% in FY '02 to 0.75% in FY '08



From FY '02 to FY '08 Arizona NIH funding growth outpaced the nation—growing by 14.4% compared to 10.7% for the nation.

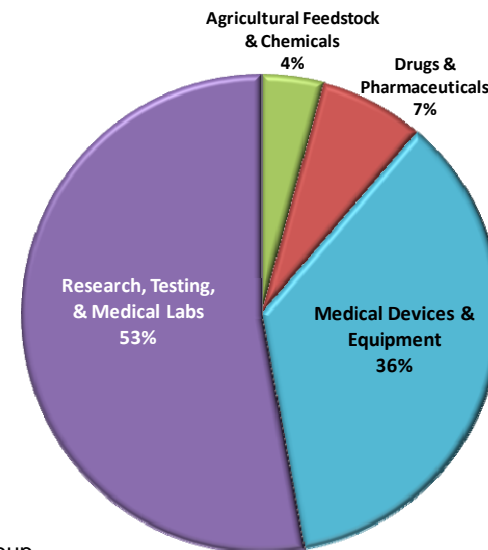
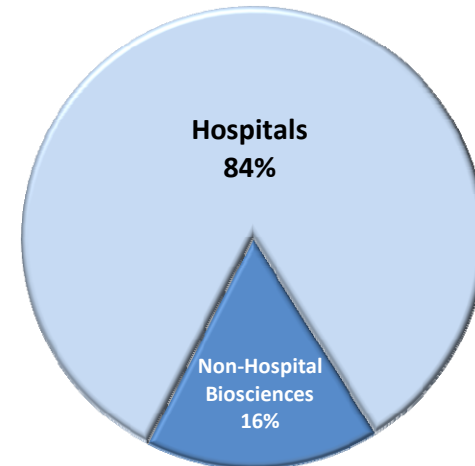
Trends in federal research grants

- Overall growth rate in Arizona NIH funding from FY '02 - FY '08 exceeds both the Top 10 states and U.S. average, driven primarily by significant growth in non-university performers.

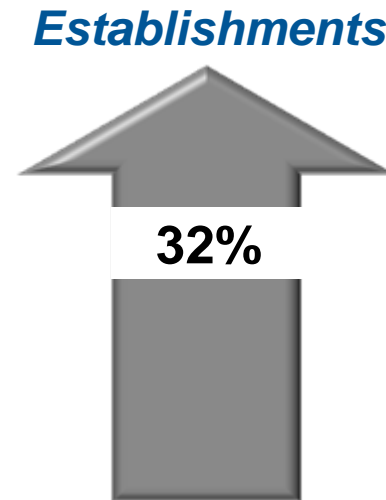
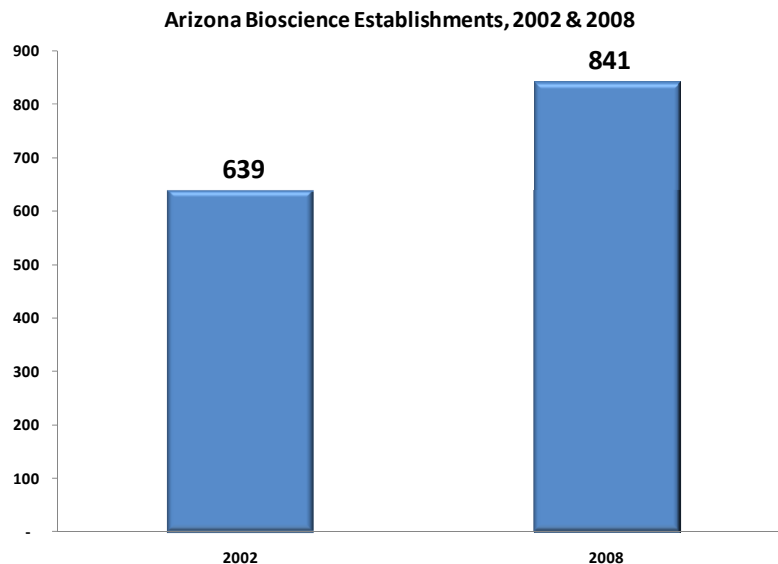
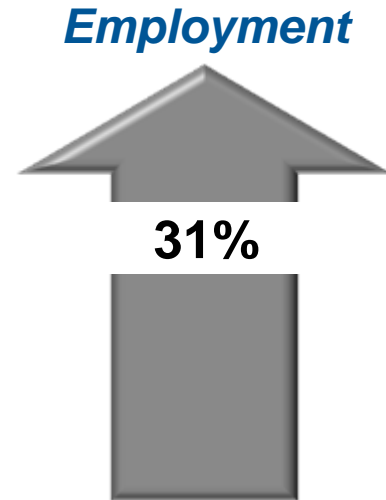
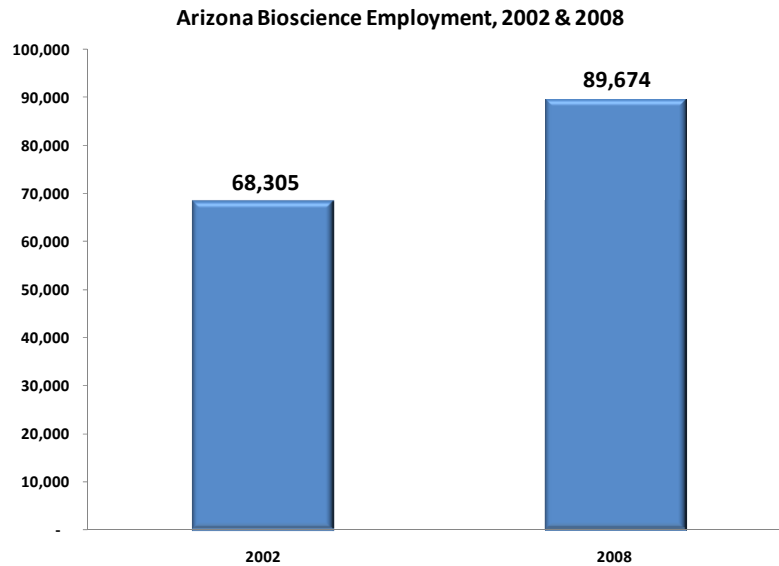


Hospitals dominate bioscience jobs -- with non-hospital bioscience sector growing as fast

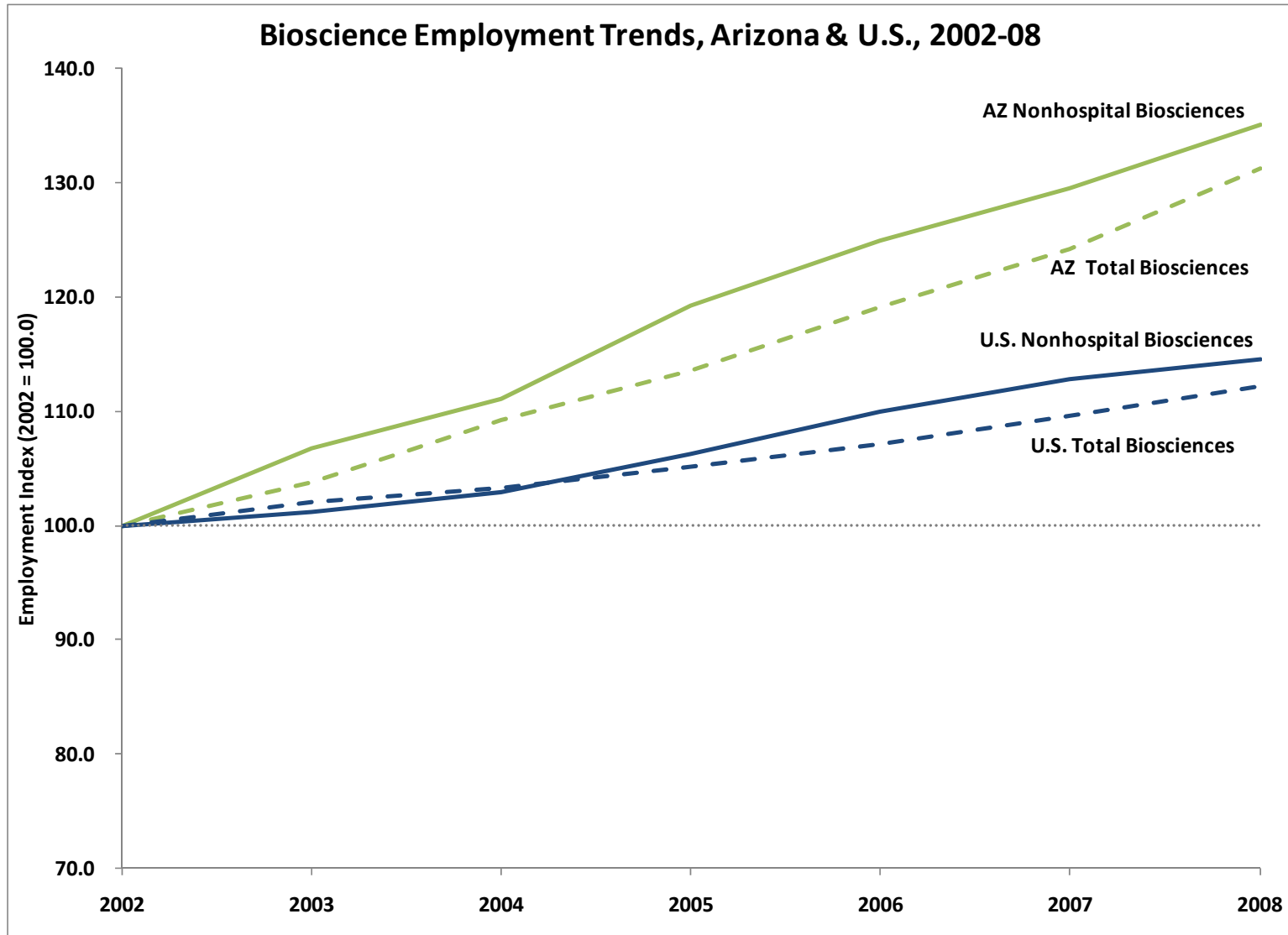
- **Overall employment in biosciences up by 31% or more than 21,000 jobs from 2002 to 2008**
- **Hospitals** account for the majority of Arizona Bioscience jobs—84 percent in 2008 with 31% job growth since 2002
- **Non-Hospital sector** job growth since 2002 up 35% (3,800 jobs) including:
 - **Research, Testing, & Medical Labs:** 53% of non-hospital employment and up 40% since 2002
 - **Medical Devices:** 36% of non-hospital employment and up 38% since 2002



Growth in Arizona bioscience employment and establishments over a 6-year period (2002-08)

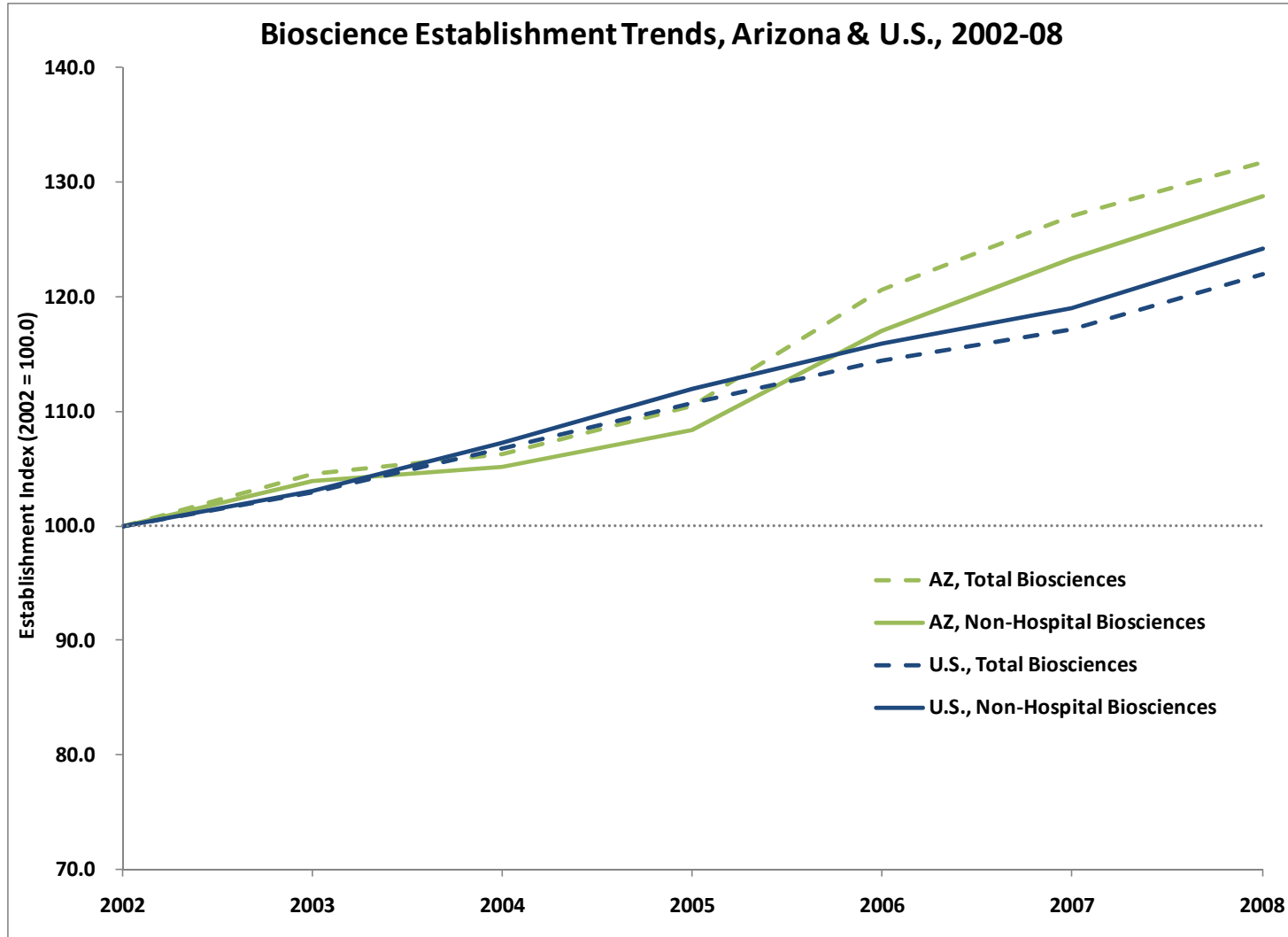


Arizona has experienced much faster job growth in the biosciences compared with the nation



Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from the Minnesota IMPLAN Group.

In recent years, Arizona has grown its base of bioscience establishments at a faster rate than the national sector



Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from the Minnesota IMPLAN Group.

Strong and steady growth among all 5 subsectors has boosted Arizona bioscience industry jobs by 31% since 2002

Arizona Bioscience Employment Metrics					
Industry Subsector	2008 Establishments	Percent Change Estab, '02-08	2008 Employment	Percent Change Empl, '02-08	2008 Location Quotient
Total Biosciences	841	31.7%	89,674	31.3%	0.78
Non-Hospital Biosciences	723	28.8%	14,717	35.1%	0.54
Agricultural Feedstock & Chemicals	22	-35.3%	619	11.6%	0.29
Drugs & Pharmaceuticals	38	40.7%	1,041	10.0%	0.17
Medical Devices & Equipment	265	5.7%	5,275	37.9%	0.64
Research, Testing, & Medical Labs	398	59.3%	7,782	39.7%	0.72
Hospitals	118	53.2%	74,957	30.6%	0.85

Arizona bioscience workers earn nearly \$14,000 per year more than workers in the overall State private sector in 2008

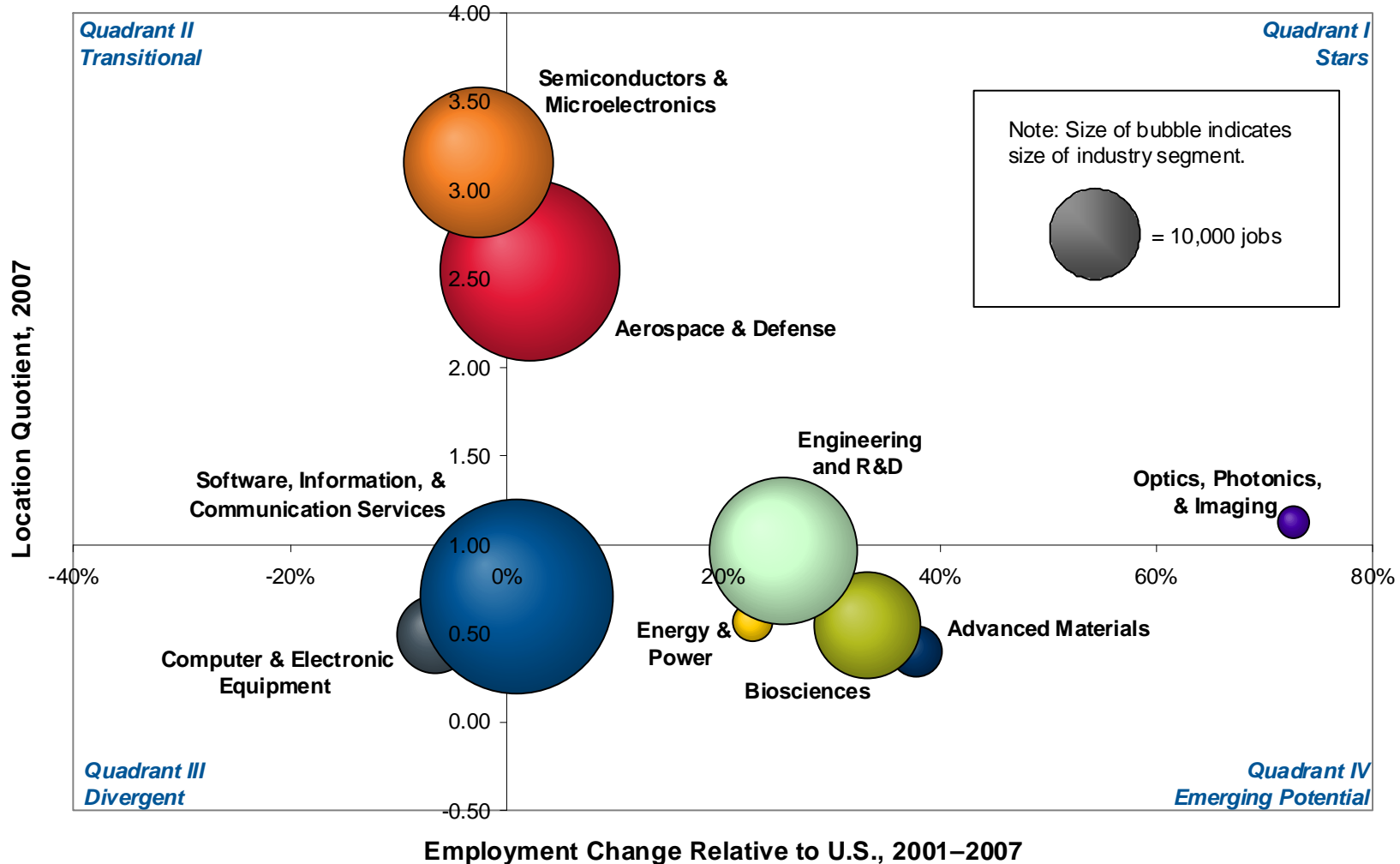
- **Average wages among State Bio workers increased significantly in the first year of the recession (up 6%)**
- **AZ workers in Drugs & Pharmaceuticals, however, experienced an average pay decrease over the year**

Major AZ Industries & Bioscience Subsectors	Avg. Annual Wages, 2007	Avg. Annual Wages, 2008	Increase, 07-08
Management of Companies and Enterprises	\$ 74,293	\$ 73,694	-0.8%
Research, Testing, & Medical Laboratories	\$ 60,471	\$ 63,924	5.7%
Professional, Scientific, and Technical Services	\$ 62,192	\$ 63,916	2.8%
Manufacturing	\$ 58,402	\$ 60,630	3.8%
Non-Hospital Biosciences	\$ 56,742	\$ 59,828	5.4%
Finance and Insurance	\$ 59,487	\$ 58,292	-2.0%
Medical Devices & Equipment	\$ 51,651	\$ 57,746	11.8%
Biosciences	\$ 52,526	\$ 55,749	6.1%
Hospitals	\$ 51,685	\$ 54,949	6.3%
Information	\$ 53,337	\$ 54,310	1.8%
Drugs & Pharmaceuticals	\$ 62,540	\$ 50,899	-18.6%
Health Care and Social Assistance	\$ 44,912	\$ 46,610	3.8%
Construction	\$ 42,526	\$ 44,416	4.4%
Transportation and Warehousing	\$ 44,154	\$ 43,395	-1.7%
Real Estate and Rental and Leasing	\$ 42,306	\$ 42,939	1.5%
Total Private Sector	\$ 41,044	\$ 41,920	2.1%
Agricultural Feedstock & Chemicals	\$ 40,449	\$ 41,110	1.6%
Arts, Entertainment, and Recreation	\$ 30,818	\$ 31,748	3.0%
Retail Trade	\$ 28,492	\$ 28,040	-1.6%

Source: Battelle analysis of BLS, QCEW data from the Minnesota IMPLAN Group. Wages are in current dollars (not adjusted for inflation).

Larger technology industry sectors are in transition, but biosciences represents key emerging technology industry sector.

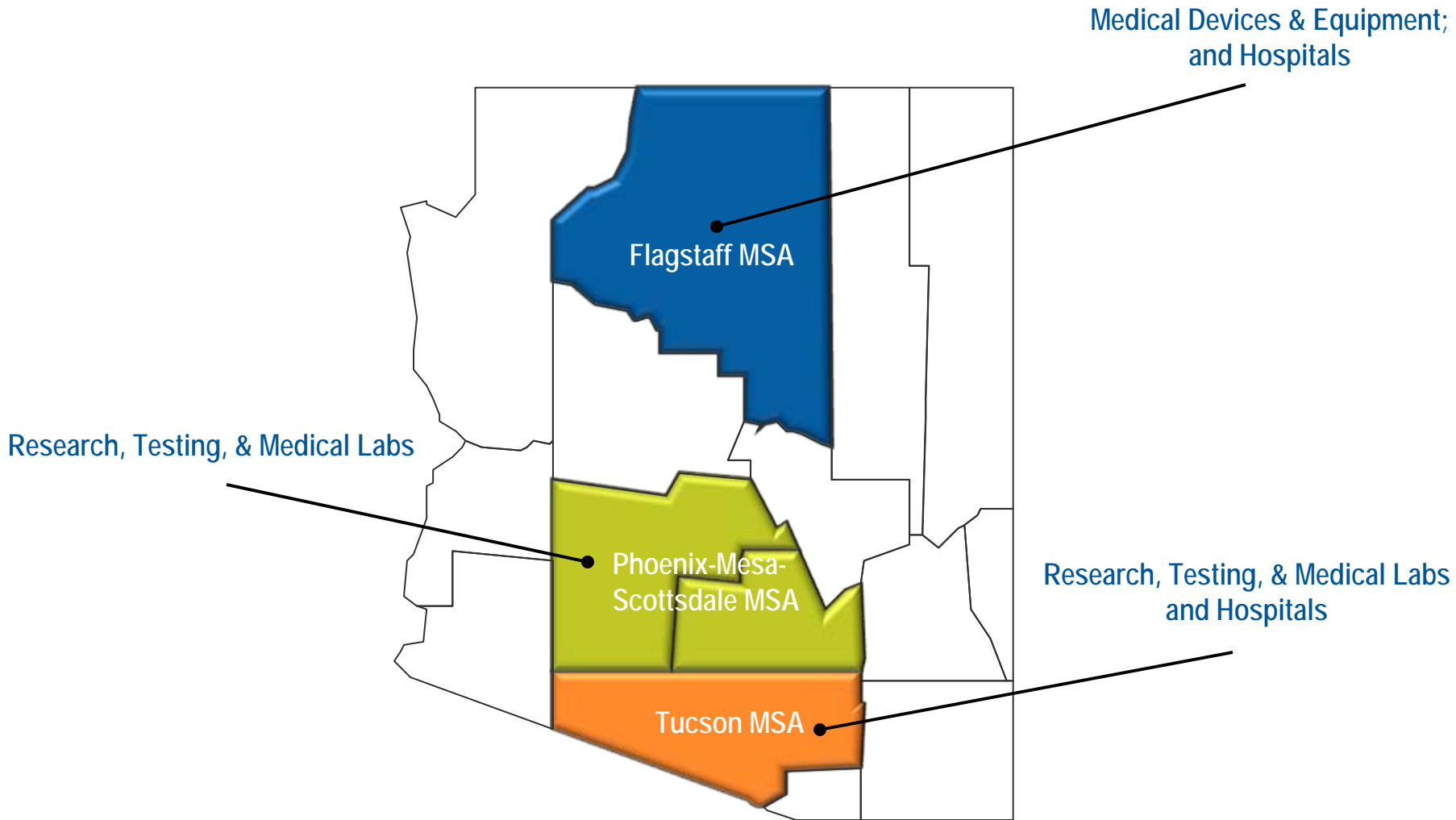
**Arizona Technology Industry Sectors:
Current Employment Size, Concentration, and Recent Performance, 2007**



Note: Engineering and R&D segment is included in this chart due to its importance as the early industry "home" for many technology start-ups.

Source: Bureau of Labor Statistics QCEW as provided by IMPLAN; Battelle calculations.

Metro area analysis highlights diverse regional bioscience strengths



Arizona metro areas demonstrate varied regional bioscience niches

Arizona Metropolitan Area	Key Bioscience Subsector	Establishments, Employment Level & Concentration (2008)	Regional Strengths/Highlights
Flagstaff	Medical Devices & Equipment	Establishments: 6 Employed: 1,761 Empl. Growth ('02-08): 81% Location Quotient: 10.81	<ul style="list-style-type: none"> Flagstaff is highly specialized in medical devices, with nearly 11 times the national employment concentration The regional sector continues to grow at a rapid pace, up 81% since 2002
	Hospitals	Establishments: 3 Employed: 2,740 Empl. Growth ('02-08): 11% Location Quotient: 1.53	<ul style="list-style-type: none"> Flagstaff has a specialized hospitals subsector with a 50 percent greater concentration of hospital jobs relative to the national average and more than 2,700 jobs.
Phoenix-Mesa-Scottsdale	Research, Testing, & Medical Laboratories	Establishments: 256 Employed: 5,603 Empl. Growth ('02-08): 30% Location Quotient: 0.71	<ul style="list-style-type: none"> Phoenix metro area has a large number employed in research, testing, and medical labs—nearly three-quarters of State total The region added 30% to its job base since 2002, driving state growth in the sector
Tucson	Research, Testing, & Medical Laboratories	Establishments: 82 Employed: 1,494 Empl. Growth ('02-08): 58% Location Quotient: 1.01	<ul style="list-style-type: none"> Tucson's research, testing, & medical labs sector employment is well concentrated, matching the national average The region has added 38 establishments in the sector since 2002
	Hospitals	Establishments: 15 Employed: 14,876 Empl. Growth ('02-08): 20% Location Quotient: 1.23	<ul style="list-style-type: none"> Tucson has a large, growing, and specialized hospitals subsector with nearly 15,000 jobs Hospital employment is 20 percent more concentrated in and around Tucson relative to the national average

Arizona's Bioscience Roadmap Implementation



Substantial Progress – 11









Progress – 6








Not Yet Implemented – 2

- Progress has been seen on nearly 90% of the actions included in the December 2002 Arizona's Bioscience Roadmap; nearly 58% of the actions have seen substantial progress.
- One action moved upward from "progress" to "substantial progress" in 2009. In addition, considerable activity occurred in 2009 to merit further review and potential ranking upgrades in coming years for two additional actions under Strategy Two "build critical mass of firms."
- However, potential actions by the State of Arizona in regard to key actions in Strategy One, "build research infrastructure" as well as in Strategy Two, "build a critical mass of firms" could result in the downgrading progress for five actions in these two strategies





Arizona Roadmap potential 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		
	Stimulate research collaboration among universities/hospitals/other research organizations		Actions in danger of downgrading in future years due to status of SFAz
	Establish a Matching Challenge Program to connect industry and researchers		
	Increase help to entrepreneurs to secure federal funds (SBIR/STTR)		
	Secure federal investments to build Arizona's bioscience capacity		Considerable success in securing "Stimulus" funds from NIH & NSF
	Adequately fund higher education including bond financing for capital projects		Action in danger of downgrading in future years due to state reductions in support to universities and economic development





Arizona Roadmap potential 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		Positive actions with incubators and AERO Fund of funds
	Support prototype development and proof of concept activities from research to commercialization		Positive actions with Impact Accelerator at ASU
	Invest at earliest stages of firm formation through an Arizona BioSeed Fund		Designation of Sun Mountain & TRAC Considerable progress in 2009; potential for upgrade review in future years
	Provide wet lab space through support of bioscience accelerators/incubators/wet lab space in and around research parks		Impact Accelerator at ASU; Incubators at Chandler, Surprise, Gateway; Research Parks at Flagstaff & Tucson
	Provide a mechanism for Arizona universities to take equity in start-up companies		

Arizona Roadmap potential strategies and actions

Strategy 3	Action	Status	Comments
<p>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</p>	<p>Revise state/local economic development programs to support the growth, expansion and selective recruitment of biosciences firms</p>		<p>Action in danger of downgrading in future due to state reductions in support to universities and economic development</p>
	<p>Establish Technology Zones around existing and proposed concentrations of bioscience and other technology industries</p>		
	<p>Form a strong statewide bioscience trade association with regional chapters</p>		
	<p>Initiate a statewide image, marketing and business development effort to market Arizona as a location for bioscience firms</p>		

Arizona Roadmap potential 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>Address future talent pool by making improvements in science and math in K–12 through graduate education</p>		<p>Widespread adoption of programs throughout the State through academies, specialized high schools, curriculum changes, etc.</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>		

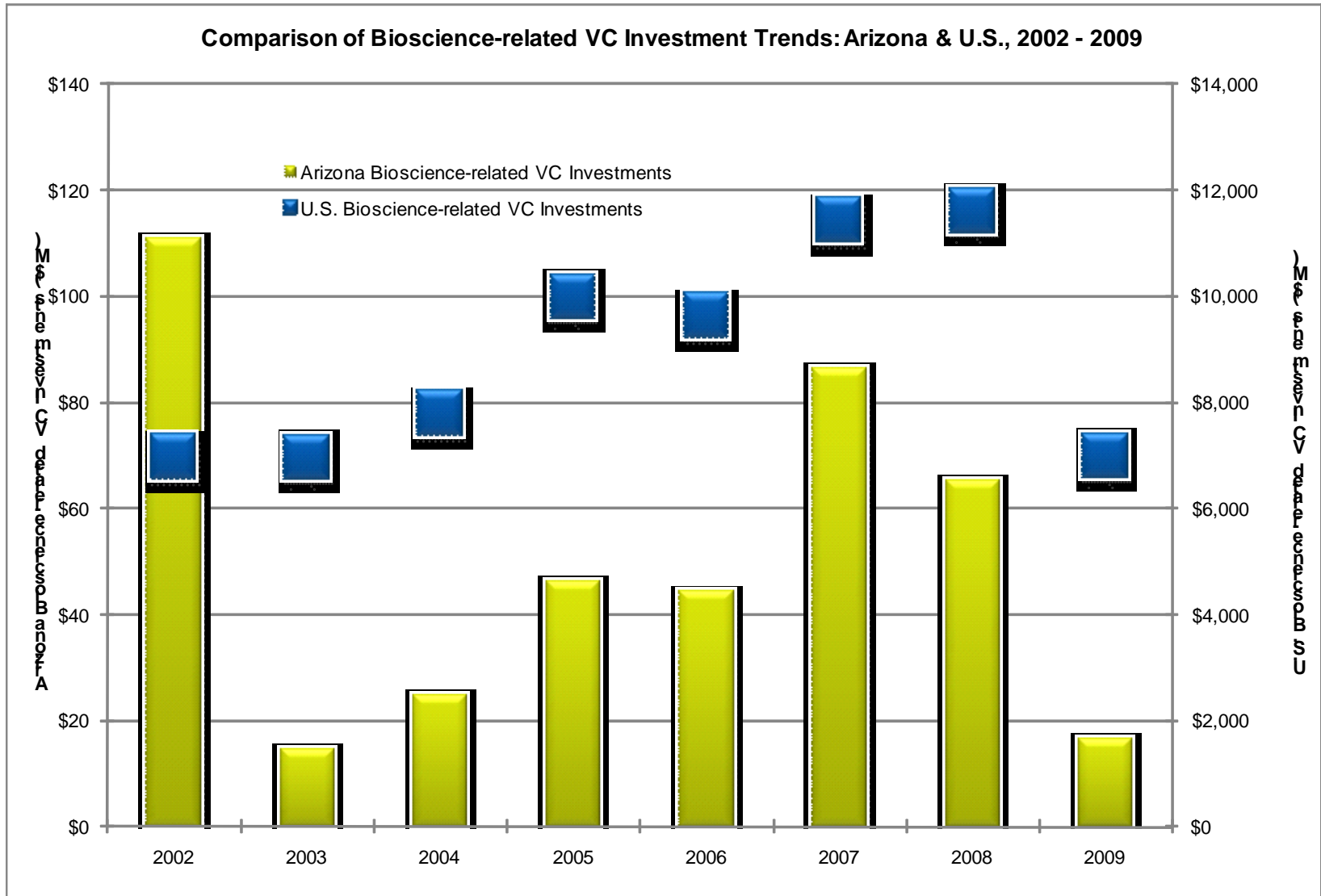
Arizona higher education progress in biosciences technology transfer: Growth in startups, licenses, patents, and income

Bioscience Technology Transfer Metric	Total, 2002-09
Invention Disclosures Received	898
Total U.S. Patent Applications Filed	609
U.S. Patents Issued	130
Licenses & Options Executed	204
Adjusted Gross License Income Received	\$15,374,284
Bioscience Startups from University IP	50

Arizona bioscience VC: Larger share of deals and companies in AZ – but .74% share of national pool

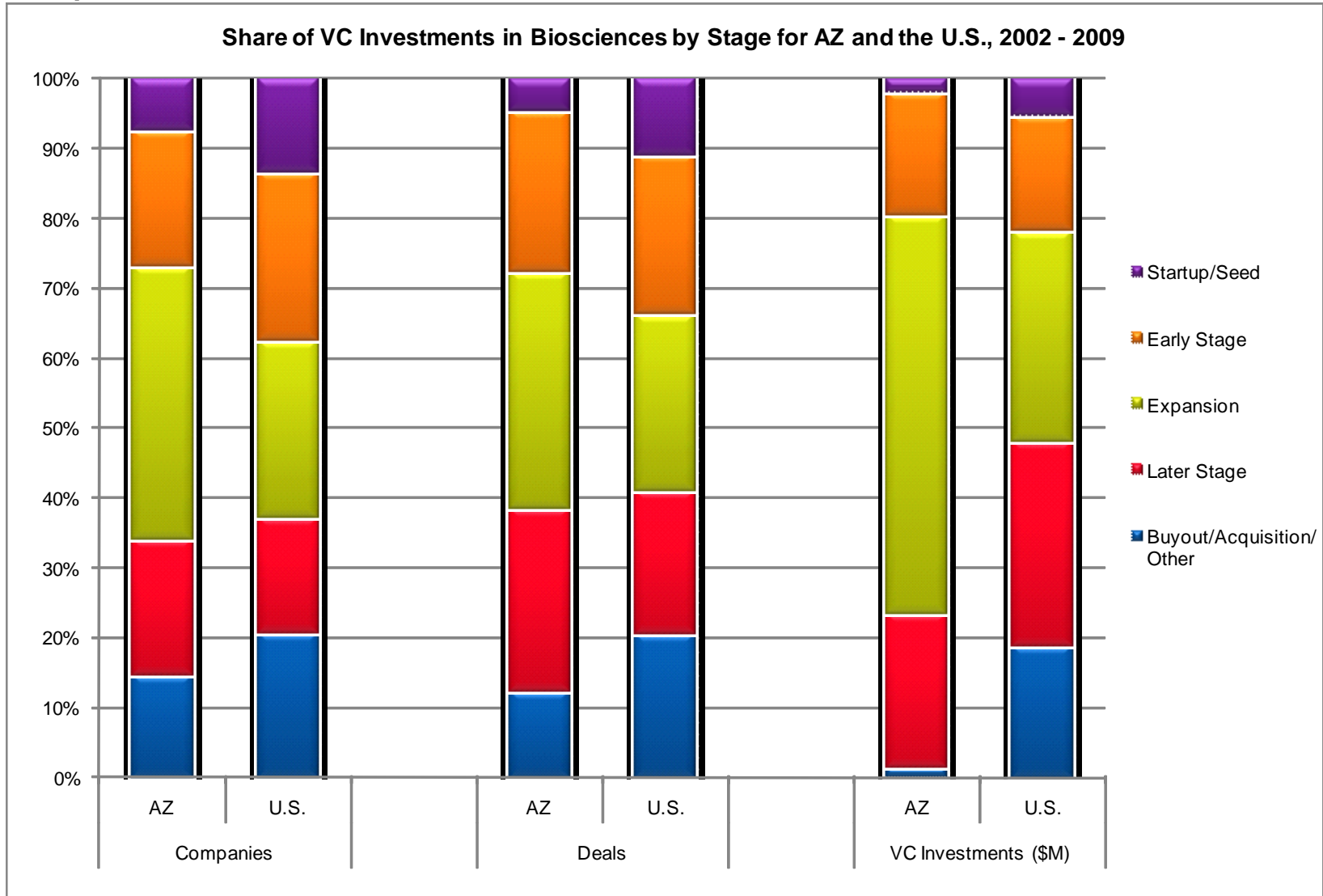
Total VC Investments in Arizona and the U.S., 2002 - 2009							
Metric	ARIZONA				U.S.		
	Biosciences	All Industries	Bioscience Share of Total VC	AZ Biosciences as Share of US Biosciences	Biosciences	All Industries	Bioscience Share of Total VC
Number of Deals	63	233	27%	.74%	8,501	34,331	25%
Number of Individual Companies Invested In	25	104	24%	.82%	3,049	13,674	22%
Investment in \$Millions	\$401	\$1,815	22%	.56%	\$71,319	\$321,025	22%

Arizona tends to follow the national trends in bio venture capital investments



Source: Thomson Reuters VentureXpert with Battelle Calculations

Limited Arizona VC investments focus more on later stages of firm financing -- compared to U.S.



Source: Thomson Reuters VentureXpert with Battelle Calculations

The bioscience sector grew significantly during the last 6 years and as a result annual economic impact has soared

- Annual total economic activity generated by the biosciences increased 46.6% from \$14.5 billion to \$21.2 billion
- Jobs from the total impact of the biosciences rose by almost 15,000 from 140,654 to 155,631
- **Annual state and local taxes generated grew 35% to \$765.7 million**

Total and Percent Change in Direct and Total Impacts of the Entire Bioscience Sector, 2002 - 2007 (\$ in millions)

Item	Direct Impact 2002	Direct Impact 2007	% Change 2002 - 2007	Total Impact 2002	Total impact 2007	% Change 2002 - 2007
Output	\$7,975.7	\$12,539.3	57.2%	\$14,451.2	\$21,185.0	46.6%
Employment	72,855	87,417	20.0%	140,654	155,631	10.6%
Employee Compensation	\$3,203.6	\$5,327.5	66.3%	\$5,176.6	\$7,830.2	51.3%
State and Local Tax Revenues	–	–		\$566.9	\$765.7	35.1%

Significant growth is projected during the 2007 – 2020 time period if the goals of the Arizona Bioscience Roadmap are attained

- The bioscience sector would generate a total impact of \$34.3 billion in 2020, 62% higher than 2007
- 252,676 jobs would result from the total impact of the biosciences sector
- The bioscience sector would generate more than \$1.2 billion in state and local taxes

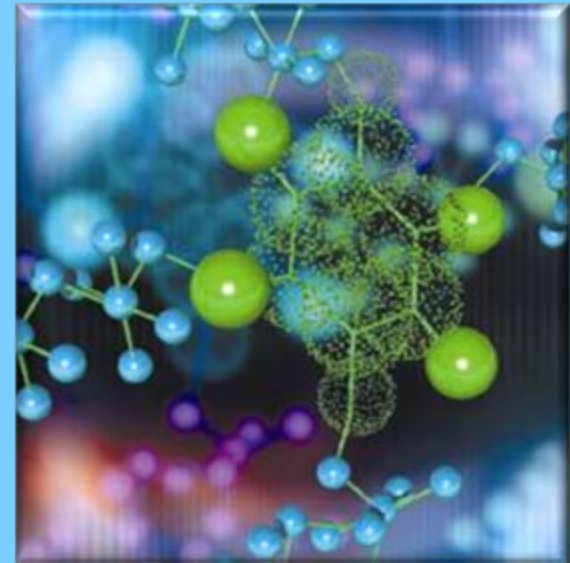
The Economic Contribution of the Entire Biosciences Sector Including the Non-Hospital Bioscience Sector, Hospitals and Academic Research To the Arizona Economy in 2020 (\$ in millions; current 2007)

Item	Direct Impact	Indirect Impact	Induced impact	Total Impact
Output	\$20,298.0	\$6,901.8	\$7,082.0	34,281.8
Employment	142,018	50,419	60,239	252,676
Employee Compensation	\$8,630.6	\$2,009.3	\$2,052.2	\$12,692.1
State and Local Tax Revenues	–	–	–	\$1,238.7

Source: Battelle TPP and IMPLAN

Challenges To Maintain Momentum for Implementation of Arizona's Bioscience Roadmap

- Maintaining and expanding the research infrastructure and funding for higher education (state)
- Addressing need for risk capital for bio entrepreneurs
- Maintaining the public share of the SFAz partnership funding (state)



Contact

Walter H. Plosila, Ph.D.

Senior Advisor

Battelle's Technology Partnership Practice

Voice: (330) 421-4283

E-mail: bfpfinn@roadrunner.com