



Overview and Summary of Recent Initiatives

Over the last 2 years, Arizona has concentrated investment and efforts in building its research infrastructure and supporting the development of the state's emerging bioscience industry sector. The state continues to implement its Arizona Bioscience Roadmap developed in 2002 with support from the Flinn Foundation. Arizona's strategy focuses on strengthening the state's bioscience research base in the areas of neurological sciences, cancer therapeutics, bioengineering, and bioimaging and developing a critical mass of bioscience companies by encouraging the commercialization of bioscience discoveries and providing a supportive environment for start-up, emerging, and expanding bioscience companies. The state has developed comprehensive business plans for each of the targeted scientific platform areas.

Recent developments to implement the Bioscience Roadmap include the following:

- The passage of legislation in 2003 to authorize \$440 million for construction of university research facilities, primarily in the biosciences, has resulted in a dozen buildings that are either completed or under construction.
- A one-of-a-kind institute has debuted in Tucson with the promise of reshaping the way prescription drugs and medical devices get from concept to market. The **Critical Path Institute (C-Path)**, an independent, nonprofit organization founded by the University of Arizona (UA), the U.S. Food and Drug Administration, and SRI International, aims to improve the drug-development system to produce therapeutics using methods that are faster, safer, and smarter.
- The **University of Arizona and Arizona State University (ASU)** have agreed to work jointly to launch an extension of the **UA medical school in downtown Phoenix**. The unique arrangement involves the UA Colleges of Medicine and Pharmacy and ASU programs including its College of Nursing. A Governor-appointed commission is guiding its formation.
- **Northern Arizona University (NAU)** received approval from the Arizona Board of Regents to launch a new bioscience institute focusing on translational research—the **Strategic Alliance for Bioscience Research and Education (SABRE)**.
- The **Maricopa County Community Colleges system** successfully passed a \$950 million bond issue that includes more than \$100 million for bioscience and healthcare training.
- The Legislature passed an angel investor tax credit.

- The **Scottsdale Clinical Research Institute** was established, providing a clinical research site for institutions including the Translational Genomics Research Institute (TGen) and the Arizona Cancer Center.
- The network of committees implementing the Bioscience Roadmap has expanded to 16, comprising more than 250 individuals. The Steering Committee has broadened to represent more than 60 statewide institutions involved in the biosciences. In addition, a “virtual coalition” of key institutions was formed to help fully implement the Roadmap, pulling in the strengths of the state’s bioscience trade associations and regional business leadership groups.

In a recent development, Arizona’s business leadership groups have formed **Science Foundation Arizona**, a nonprofit entity that would build and strengthen the state’s medical, scientific, and engineering programs and infrastructure. The organization would be supported financially by the business community.

Arizona philanthropist Jerry Bisgrove, chairman of the **Stardust Charitable Group**, has pledged to donate \$100 million over the next 4 years to the foundation contingent upon the State of Arizona providing \$150 million over the next 5 years. In March 2006, the Arizona House of Representatives passed legislation to create a \$150 million Arizona 21st Century Fund. The foundation and the 21st Century Fund would support research, attraction of internationally recognized scientists, creation of early-stage tech firms, and related activities. The legislation is now under consideration in the Arizona Senate.

Building Bioscience R&D Capacity

Recent state investments in facilities

The Biodesign Institute at ASU was established in 2002 to improve human health and quality of life through biosystems research, especially via understanding molecular assembly and how its design rules can inspire new applications in medicine, agriculture, environmental management, and national security. The multidisciplinary research institute has 12 research centers across the fields of biology, chemistry, physics, medicine, agriculture, environmental science, electronics, materials science, engineering, and computing. Two of four planned facilities have opened, accounting for nearly 350,000 square feet of advanced research space. Eventually, 800,000 square feet will be completed.

BIO5 is the UA’s collaborative bioresearch institute bringing together scientists from five disciplines—agriculture, medicine, pharmacy, basic science, and engineering—to solve complex biological problems. BIO5 creates science, education, and industry partnerships to disseminate knowledge and apply the knowledge gained to treat disease, feed humanity, and preserve livable environments. BIO5’s future home, the Thomas W. Keating Bioresearch Building, provides 177,000 square feet of space for researchers and students to interact, discover, analyze, and invent.

The \$25 million, 110,000-square-foot **Mayo Clinic Collaborative Research Building** in Scottsdale opened in 2005 to house Mayo research operations as well as collaborative efforts currently involving **TGen Drug Development Services (TD2)** and the new U.S. headquarters of **InNexus**, a Canadian drug-development firm.

Research programs

The **Arizona Biomedical Research Commission** advances medical research by contracting with individuals, organizations, corporations, and institutions to carry out peer-reviewed scientific projects within Arizona. With \$12 million in annual funding, the program awards contracts for projects researching the causes, epidemiology and diagnosis, formulation of cures, medically accepted treatment and prevention of diseases, including drug discovery and development; and oversees the projects to assure contract compliance. The commission advances biotechnology by funding translational research projects and assisting in the removal of impediments to inter-institutional biomedical research collaborations.

A combination of public and private sources pledged \$120 million in 2002 to support the development of **TGen**, a nonprofit biomedical research institute focused on developing earlier diagnostics and smarter treatments. Today, TGen has more than 25 active research teams focused on many common diseases and disorders and has created two spin-off entities to help accelerate its research. The first, TD2, uses *in vivo* and *in vitro* models and genomic analyses to provide services to evaluate the safety and efficacy of pre-clinical compounds. The for-profit Molecular Profiling Institute Inc., co-developed with the **International Genomics Consortium**, is a specialty reference laboratory that helps cancer patients worldwide by profiling patients' tumors or other biologic materials utilizing the latest discoveries from genomic and proteomic research. TGen currently employs 200 people and has established numerous collaborative relationships statewide, nationally, and internationally.

Moving Technology into the Marketplace

Commercializing university technology

Arizona Technology Enterprises LLC (AzTE) is the technology venturing arm of ASU and NAU. AzTE actively assesses, licenses, and launches spin-out companies based on ASU and NAU inventions. AzTE also manages the ASU Catalyst Fund, which provides investments in the range of \$25,000 to \$50,000 to fund proof-of-concept activities surrounding industry/academia collaborations. The fund was initially seeded with \$425,000 in FY 2004.

The **UA Office of Technology Transfer** assists faculty and staff in matters related to intellectual property and bringing the inventions and discoveries developed within the university to market. **UA Foundation Technologies and Research LLC** manages the development of medical-treatment patents donated by Procter & Gamble.

Supporting bioscience entrepreneurs and emerging companies

ASU Technopolis, an initiative of the Office of Vice President for Research and Economic Affairs, offers programs to educate, coach, mentor, and connect innovators and entrepreneurs. The program offers one-on-one coaching for entrepreneurs, a 6-week Launch Prep Entrepreneurship Course, The Mentoring Program, workshops on accessing federal funding programs such as SBIR and STTR, individualized Investor Connections, and other specialized programs throughout the year.

See description below for the **Arizona Center for Innovation** at UA.

Phoenix Biotechnology Accelerator provides affordable, flexible leases and access to equipment for start-up biotechnology companies in downtown Phoenix.

The **Arizona Business Accelerator** in Phoenix encourages innovation and development of knowledge-based products and resources. It provides business-development resources and hands-on assistance to convert technology and life-sciences ideas into commercially viable business.

Making Capital Available

Pre-seed and seed capital

In 2005, the Legislature passed a bill to stimulate investment in early-stage technology firms, enabling angel investors to secure tax credits of 30 percent for investment in technology firms and 35 percent for investments in biotech firms or firms located in rural areas.

Providing Space for Bioscience Companies

Incubators

Arizona Center for Innovation is a 12,500-square-foot, nonprofit, high-technology incubator located in the UA Science and Technology Park in Tucson. The center, which provides a full array of business development services, focuses on companies in six areas, one of which is the life sciences. The incubator includes 8,000 square feet of chemistry/wet-lab and laser-lab space.

Under development

A three-story, 35,000-square-foot, multitenant wet-lab facility is planned at **Papago Park Center** in Tempe. Up to 80,000 square feet of additional wet-lab space may be added to the plan. The project is set for completion in early 2008.

Bioscience research parks

The 320-acre **ASU Research Park** is home to 35 business and high-technology companies with more than 3,000 employees and 1.7 million square feet of existing facilities. The park was recently chosen to house the Flexible Display Center, an ASU-led research consortium developing portable electronic devices for a U.S. Army initiative. The center will be housed in the ASU MacroTechnology Works Building, a 275,000-square-foot facility that is a public/private partnership focusing on commercializing technologies in the flexible arena, including medical sensing and diagnostics. The ASU Research Park has 42 acres of undeveloped land, and plans are underway to develop a hotel and convention center.

The **UA Science and Technology Park** is home to 30 high-technology companies and organizations with more than 6,000 employees. Its facilities include 2 million square feet of developed space, located on a 1,345-acre site. Plans are underway to develop considerable new space—including multitenant office buildings, laboratory science buildings, residential housing, and retail and hotel space—over the next 5 to 8 years. Expansion plans include wet-lab space.

Under development

Under development in downtown Phoenix is the **Phoenix Biomedical Campus**, a 15-acre academic and research park. When fully developed, the campus is proposed to contain 1 million square feet of laboratories, offices, classrooms, and other facilities. The six-story headquarters of **TGen** anchors the development. The \$29.4 million first building of the **Arizona Biomedical Collaborative**, a joint venture

of ASU and UA, is under construction. Also underway is the UA College of Medicine Phoenix campus to be housed within three historic buildings that are under renovation.

The **Arizona Bioscience Park** in Tucson will encompass more than 65 acres with an estimated 3.1 million square feet of space, 2.4 million of which is laboratory/office space. The park will provide an important link in the development of life sciences in the southwestern United States to other significant advances in global biomedical research.

SkySong, a research and office park supported by ASU and the City of Scottsdale, is under construction and expected to open in spring 2007. The 1.2-million-square-foot, \$320 million facility will house private companies as well as ASU entrepreneurial support programs.

The **Applied Research and Development Building** being planned at NAU will provide 70,000 square feet for high-tech research. The facility will consolidate much of the university and Flagstaff community research activities and provide wet- and dry-lab space for commercial use. It will house the Northern Arizona Technology and Business Incubator. The projected cost is \$18 million, and the facility is expected to be completed in 2006.

Addressing Talent Needs

Recruiting management talent

The Virginia G. Piper Charitable Trust has pledged an investment of \$50 million over 5 years to attract to the Phoenix area 10 of the world's most distinguished leaders in the development of personalized medicine. The **Piper Chairs** will be leading scientists, engineers, and clinicians in the fields of bioscience, nanotechnology, and advanced information technology.

Specialized postsecondary programs

The **Maricopa Community Colleges District**, the nation's largest community college system, has introduced several new bioscience programs at various colleges in response to the recommendations of a 2003 comprehensive study of bioscience workforce needs in the greater Phoenix area. Efforts are underway to enhance linkages and facilitate transitions between K-12 and postsecondary bioscience programs.

The **College of Law at ASU** launched in 2005 a master's program in genomics law, the first of its kind in the nation.

K-12 outreach programs

Several **Arizona high school districts** are introducing or expanding bioscience-related programs to their science curriculum, most notably Chandler Unified, Gilbert Unified, Mesa Unified, and Tempe Unified. **Individual high schools** within other districts are also strengthening their bioscience-related curriculum.

Arizona's **community colleges and public universities** are providing their expertise to teachers and students interested in the biosciences:

- **Job Path's Biotechnology Summer Institute** is being offered at **Pima Community College** to introduce high school students to the basics of biotechnology. It is funded by a grant from the U.S. Department of Labor.

- **ASU's BIOREACH** project provides materials and equipment to middle school and high school teachers who want to teach biotechnology to their students.
- **NAU's** biological sciences department focuses its summer science workshop for K-12 teachers on biotechnology. Based on the success of the workshop, there are plans for similar bioscience workshops in the future.
- The **UA's BIOTECH Project** provides technical support for Arizona middle school and high school teachers to conduct genetics experiments with their students. The project is run through UA's molecular and cellular biology department.

The **Scientific Enrichment Program** at Barrow Neurological Institute of St. Joseph's Hospital and Medical Center in Phoenix offers three programs: (1) a cancer biology seminar that introduces students from 60 area high schools to a variety of topics pertaining to cancer biology and the process of scientific discovery; (2) a hands-on laboratory experience for a limited number of highly motivated students; (3) a workshop program for local high school teachers, providing an opportunity to learn the latest scientific technology and assistance in introducing such techniques in the classroom.

The **Arizona Bioengineering Collaboration** of the Arizona Science Center has trained more than 260 Phoenix-area middle school and high school teachers in state-of-the-art bioengineering and biotechnology practices. The program involves workshops developed by center education staff in collaboration with industry experts, university scientists, and science and technology teachers from local middle schools and high schools.

Phoenix Union Bioscience High School, a magnet school, will launch in 2006 near the Phoenix Biomedical Campus in downtown Phoenix. Programming will be provided for students within the Phoenix Union High School District. Total enrollment will eventually reach 400.

Pending Proposals

The House of Representatives is considering legislation (HB 2477) to create a public/private fund to strengthen scientific research. The bill would establish the **Arizona 21st Century Fund** by providing \$150 million over 5 years, to be matched by private funds.

Legislation is pending that would boost by 10 percent the size of the state **tax credit for research and development** done by Arizona companies through Arizona universities. (HB 2677, SB 1065)

Arizona will unveil in 2006 a **translational research model** that will focus on collaborations with special populations, streamlining IRB and HIPAA processes, and harmonizing key business practices.

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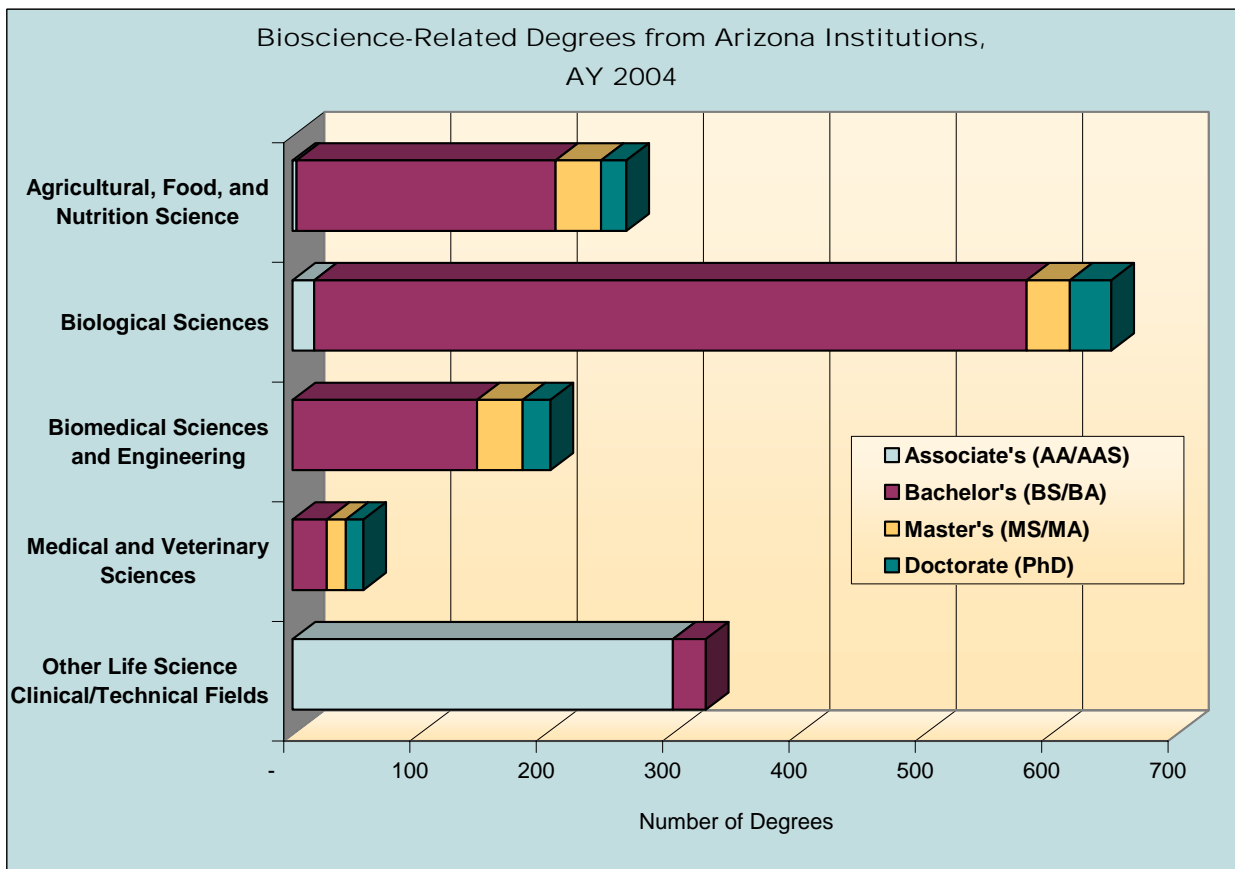
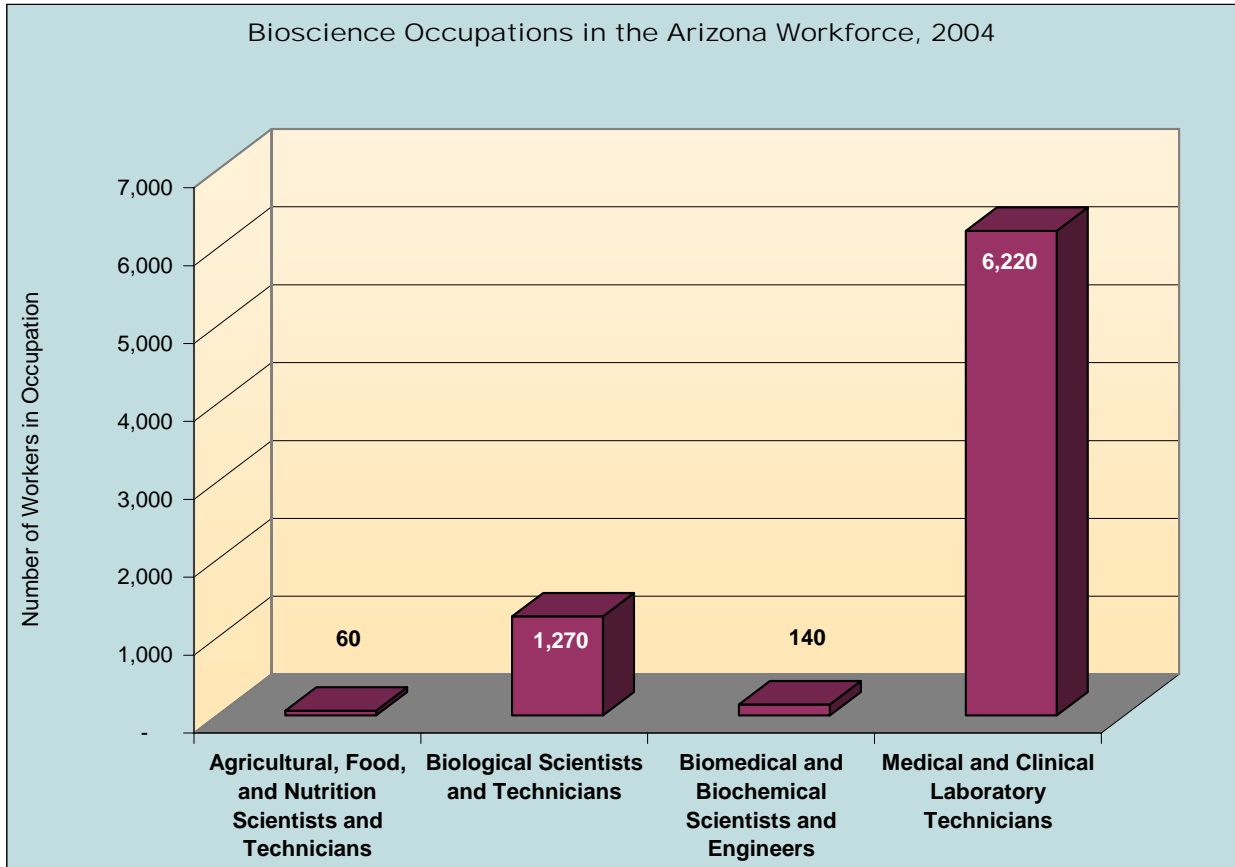
The Arizona BioIndustry Association is the statewide organization that promotes the growth of the bioindustry through partnering and collaborative relationships among education, business, private, and public sectors. It serves as the networking, advocacy, education, and communications group for Arizona's bioindustry.

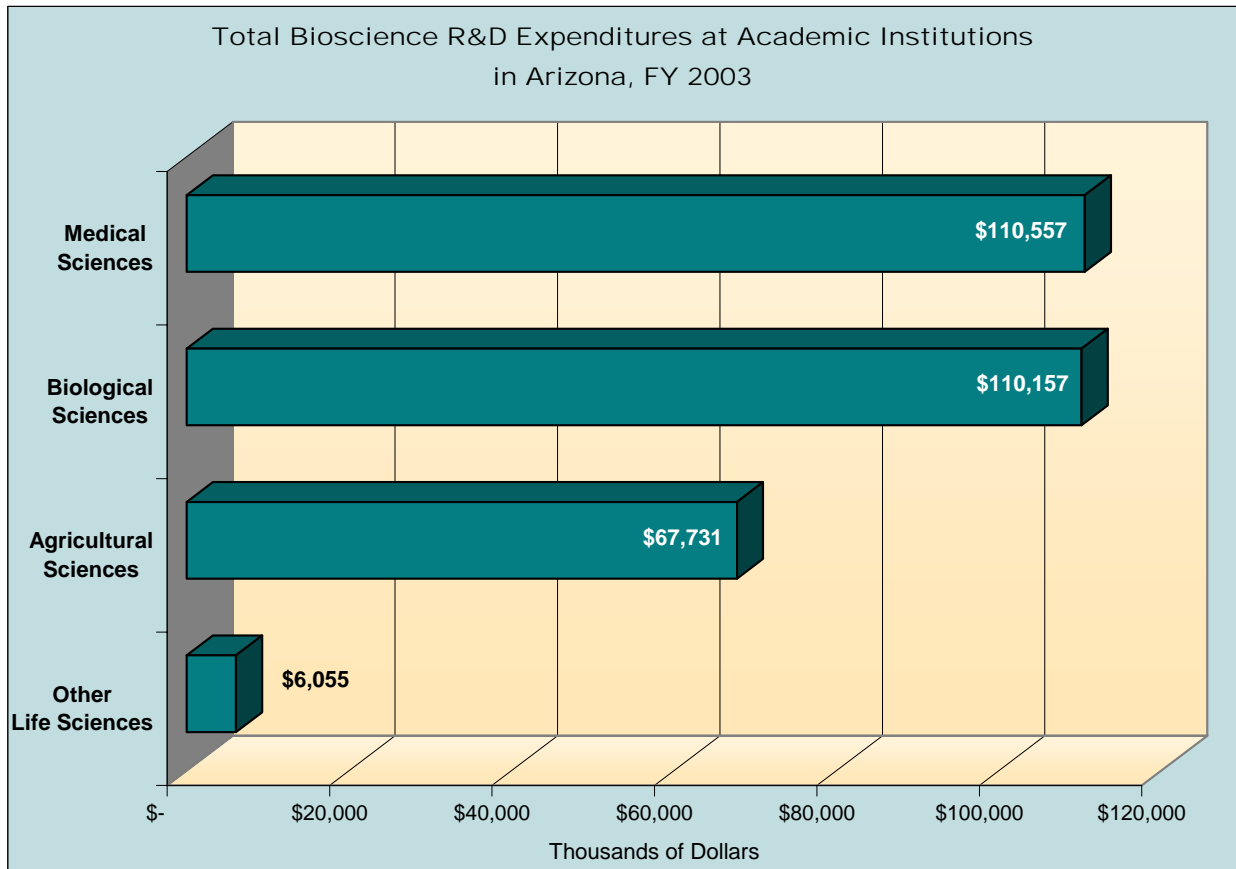
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Industry Subsector	Arizona	United States
Agricultural Feedstock & Chemicals		
Establishments 2004	20	2,111
2001-2004 Establishment % Change	-19.3%	0.4%
Employment 2004	585	104,893
2001-2004 Employment % Change	-17.9%	-6.9%
Share of U.S. Employment	0.6%	100.0%
Location Quotient	0.31	n.a.
Average Annual Wage 2004	\$40,352	\$63,383
Direct-Effect Employment Multiplier	4.20	10.91
Total Employment Impact	2,456	1,212,094
Drugs & Pharmaceuticals		
Establishments 2004	26	2,589
2001-2004 Establishment % Change	-7.1%	-0.6%
Employment 2004	952	313,207
2001-2004 Employment % Change	-15.4%	2.7%
Share of U.S. Employment	0.3%	100.0%
Location Quotient	0.17	n.a.
Average Annual Wage 2004	\$56,147	\$79,303
Direct-Effect Employment Multiplier	4.41	9.51
Total Employment Impact	4,201	2,731,321
Medical Devices & Equipment		
Establishments 2004	254	15,190
2001-2004 Establishment % Change	3.2%	0.2%
Employment 2004	4,263	411,460
2001-2004 Employment % Change	6.4%	-3.6%
Share of U.S. Employment	1.0%	100.0%
Location Quotient	0.57	n.a.
Average Annual Wage 2004	\$45,428	\$56,449
Direct-Effect Employment Multiplier	2.59	4.56
Total Employment Impact	11,027	1,817,705
Research, Testing, & Medical Laboratories		
Establishments 2004	279	20,565
2001-2004 Establishment % Change	9.1%	19.4%
Employment 2004	6,122	413,550
2001-2004 Employment % Change	22.3%	8.2%
Share of U.S. Employment	1.5%	100.0%
Location Quotient	0.82	n.a.
Average Annual Wage 2004	\$52,330	\$65,414
Direct-Effect Employment Multiplier	2.17	3.15
Total Employment Impact	13,291	1,272,936
TOTAL PRIVATE SECTOR		
Establishments 2004	125,782	8,156,137
2001-2004 Establishment % Change	7.5%	4.8%
Employment 2004	1,979,283	109,249,195
2001-2004 Employment % Change	4.6%	-0.7%
Share of U.S. Employment	1.8%	100.0%
Location Quotient	n.a.	n.a.
Average Annual Wage 2004	\$36,211	\$39,003

Source: Battelle calculations -- based on Bureau of Labor Statistics QCEW data from the Minnesota Implan Group, RIMS II Employment Multipliers from the Bureau of Economic Analysis, and the Census Bureau's Economic Census.

Note: n.a. = metric is not applicable.





	Arizona	United States	Rank
University R&D Expenditures, FY 2003			
Total (\$ thousands)	\$617,978	\$40,104,621	20
Life Science R&D (\$ thousands)	\$306,392	\$24,062,088	26
Percent of Total R&D	49.6%	60.0%	
Life Sciences Per Capita	\$54.90	\$82.74	
Change in Life Sciences FY 1999–2003	68.5%	52.7%	
NIH Support to Institutions, FY 2004			
Total (\$ thousands)	\$160,870	\$22,556,459	27
Per Capita Expenditures	\$28.83	\$77.56	
Change in Expenditures FY 2000–2004	47.5%	53.2%	
Higher Education Degrees in Bioscience Fields, AY 2004	1,499	111,329	29
Bioscience Occupations in the Workforce, 2004	7,690	616,140	24