

# BioSciences

## Industry Summary

### Industry Definition

The biosciences are a broad and emerging industrial sector that promises to be a major driver in the 21<sup>st</sup> Century economy. In general, the biosciences can be defined as establishments engaged in the application of science and technology to living organisms, or their parts or products as tools, to alter living or non-living materials for the production of knowledge, goods and services. Although the application of bioscience technologies has the potential to impact many industries, the sector is generally concentrated in pharmaceutical and medicine manufacturing, medical devices and equipment manufacturing, agriculture (such as the development of new varieties of crops, fertilizers, and pesticides), testing and diagnostic laboratories, and research and development in all of these fields.

### Industry Profile

As defined in this report, the biosciences industry contains 24 separate sub-sectors engaged in manufacturing, services, and research and development. Nationwide, only 0.7% of firms fall into the biosciences, but these firms account for 1.4% of employment and 2.5% of wages. The research and development sub-sector makes up the largest percentage of bioscience employment (32.1%), and includes both for-profit and not-for-profit research in fields such as agriculture, electronics, biology, chemistry, health, and medicine. Pharmaceutical manufacturing is the second largest bioscience sub-sector by employment (14.2%), followed by non-medical testing laboratories (9.0%), medical laboratories (8.6%), surgical and medical instrument manufacturing (6.7%), and surgical appliance and supplies manufacturing (5.5%).

### Industry Trends

Bioscience contributes nearly 1.6 million jobs to the U.S. economy and makes up 57,000 establishments with \$113 billion in wages. Within the industry, employment in scientific research and development is expected to grow 8.7% annually between 2004 and 2014, followed by medical and diagnostic labs (4.1%), and non-medical testing labs (3.8%, which is a component of the larger architectural and engineering services industry). On the manufacturing side, employment in medical equipment and supplies manufacturing is expected to increase 5.8% annually during the same period. This is followed by pharmaceutical and medicine manufacturing (3.3%) and electromedical and therapeutic apparatus manufacturing (3.1%, which is a component of electronic instrument manufacturing). Indeed, within manufacturing the biosciences are one of the few bright spots in a sector that is expected to shed over 700,000 jobs nationwide between 2004 and 2014.

Numerous factors are influencing the growth of the biosciences sector both in the U.S. and abroad. These include a rapidly aging population base in industrialized nations who will require growing levels of healthcare, aggressive investment in biosciences research from both the public and private sectors, growing dependence on genetically-engineered agricultural products, homeland security efforts to develop and stockpile vaccines to combat bioterrorism attacks, growing emphasis on the development of biofuels as a substitute for petroleum, and the continued evolution of faster and more sophisticated information technologies to aid in biosciences research and development.

## Workforce Profile

The majority of bioscience firms in the Greater Phoenix region are small to medium in size. Over 60% employ fewer than 20 workers, however, these firms account for only 13.8% of employment. Medium size firms with 20 to 499 workers account for most of the remainder of regional employment, with three firms (Medtronic Microelectronics, Medegen Holdings, and Barrow Neurological Institute) employing over 500 people apiece.

## Workforce Trends

In 2005, the average wage in the biosciences sector nationwide was \$71,545, which is nearly 77% greater than the average U.S. wage of \$40,499. In terms of employment growth in biosciences related occupations, the U.S. Bureau of Labor Statistics projects a 34.1% increase in medical scientists (34.1%) between 2004 and 2014. This is followed by biomedical engineers (30.7), environmental engineers (30.0%), biological scientist (17.0%), agricultural and food scientists (12.8%), materials engineers (12.2%), chemical engineers (10.6%), and electrical and electronics engineers (10.8%). Medical scientists and biomedical engineers are among the 30 fastest growing occupations between 2004 and 2014 as identified by the BLS, and with the exception of preschool teachers and paralegals, nearly all of the remainder of the 30 occupations fall into the medical, information technology, and engineering fields and contain components that may have biosciences related applications.

# Occupational Summary

## Local Occupational Trends

Like the nation as a whole the biosciences sector in Greater Phoenix accounts for only a small percentage of firms and employment, but has in recent years been the recipient of significant regional investment. This includes the establishment of the International Genomics Consortium and Translational Genomics Research Institute, the University of Arizona College of Medicine in Downtown Phoenix, and the Biodesign Institute at Arizona State University. Like the nation as a whole, occupations in the biosciences are expected to grow at high rates in Greater Phoenix in the coming years. Demand for medical scientists in the region, for example, is projected to grow 52.9% between 2003 and 2013, followed by other biosciences related occupations such as environmental engineers (45.1%), life scientists (35.9%), biomedical engineers 35.2%, and chemical engineers (19.0%). Technician level occupations in the biosciences are also expected to grow at double-digit rates in Greater Phoenix in the years to come. This includes environmental engineering technicians (45.8%), biological technicians (22.1%), chemical technicians (17.6%), and electrical and electronic engineering technicians (10.3%). Employment in these occupations are often considered gateways to higher paying jobs in the biosciences once training has been acquired. Turnover in the biosciences sector in Greater Phoenix is 17% for chemists, 7% for engineering technicians, and 6% for electrical and electronic engineering technicians.

## Occupation Forecasts

The consolidation of wage data, occupational forecast data, and other data elements from the U.S. Department of Labor permits the further detailed analysis of biosciences occupations based on user defined thresholds. An initial set of nine occupations were found to be employed by organizations in the biosciences industry segment. Of these nine occupations, all were determined to be largely associated with the biosciences and were further filtered into the following four occupational tiers.

**Tier I.** Tier 1 occupations are those which have been determined to meet three critical criteria as follows.

- **High Wage:** Offer an hourly wage in excess of \$17.00 per hour. This \$17.00 per hour threshold is presently being used by the Arizona Department of Commerce and the Greater

Phoenix Economic Council in determining the low end of their “high wage” business attraction initiatives.

- High Demand: Project an annual demand (growth plus separations replacements) of over 100 positions **valley wide** between now and 2013, the most recent forecast period by the Dept of Labor.
- High Skill: Generally required a two-year college degree or equivalent.

**Tier II.** Tier II criteria are as follows.

- Low Wage: Offer an hourly wage less than \$17.00 per hour.
- High Demand: Project an annual demand (growth plus separations replacements) of over 100 positions **valley wide** between now and 2013, the most recent forecast period by the Dept of Labor.
- High Skill: Generally are required by employers to have a BS Diploma or more.

**Tier III.** Tier III criteria are applied as follows.

- Low Wage: Offer an hourly wage less than \$17.00 per hour.
- High Demand: Project an annual demand (growth plus separations replacements) of over 100 positions **valley wide** between now and 2013, the most recent forecast period by the Dept of Labor.
- Low Skill: Generally are required by employers to have a HS Diploma or less.

**Tier IV.** Tier IV criteria are applied as follows.

- High Wage: Offer an hourly wage more than \$17.00 per hour.
- High Demand: Project an annual demand (growth plus separations replacements) of over 100 positions **valley wide** between now and 2013, the most recent forecast period by the Dept of Labor.
- Low Skill: Generally are required by employers to have a HS Diploma or less.

### Occupations by Tier Level

The following four charts reflect the filtered occupations according to the wage and skill criteria. For reference purposes, all the relevant occupations were placed in the applicable tier based on wage and skill level. Occupations selected for detailed analysis are shown in the shaded areas on the following charts for each tier. Due to the relatively small number of occupations in the biosciences sector, several occupations selected for detailed analysis have annual demand figures of less than 100.

Tier I Shaded Occupations = High Wage, High Demand, High Skill Occupations Selected For Individual Profiling							
SOC Code	Occupational Title	Percent of Employers Requiring HS Diploma or Less	Job Zone	Mean Wage	Annual Growth	Annual Separations	Total
17-2031	Biomedical Engineers	0%	n/a	\$22.96	n/a	1	1
19-1021	Biochemists & Biophysicists	n/a	n/a	n/a	1	1	2
19-1022	Microbiologists	0%	4	\$24.17	2	2	4
19-4021	Biological Technicians	14.32%	4	\$16.63	2	2	4
17-2041	Chemical Engineers	0%	4	\$33.74	3	4	7
19-4031	Chemical Technicians	22.75%	3	\$18.43	4	6	10
29-2011	Medical & Clinical Laboratory Technologists	6.08%	4	\$22.80	45	32	77
19-4000	Life, Physical, & Social Science Technicians	n/a	n/a	n/a	48	42	90
Tier II Shaded Occupations = Low Wage, High Demand, High Skill Occupations Selected For Individual Profiling							
SOC Code	Occupational Title	Percent of Employers Requiring HS Diploma or Less	Job Zone	Mean Wage	Annual Growth or Decline	Annual Separations	Total
None							

Tier III Shaded Occupations = Low Wage, High Demand, Low Skill Occupations Selected For Individual Profiling							
SOC Code	Occupational Title	Percent of Employers Requiring HS Diploma or Less	Job Zone	Mean Wage	Annual Growth or Decline	Annual Separations	Total
29-2012	Medical & Clinical Laboratory Technicians	44.82%	2	\$14.39	106	70	176
Tier IV Shaded Occupations = High Wage, High Demand, Low Skill Occupations Selected For Individual Profiling							
SOC Code	Occupational Title	Percent of Employers Requiring HS Diploma or Less	Job Zone	Mean Wage	Annual Growth or Decline	Annual Separations	Total
None							

## Occupational, Experience, Education, and Training Summary

Occupational Code	Occupational Title	Job Zone	Mean Wage	Annual Project Openings	Preparation Programs Offered At		
					WestMec	Maricopa Community Colleges	Some state and private universities
17-2031	Biomedical Engineers	n/a	\$22.96	1			Yes
19-1021	Biochemists & Biophysicists	n/a	n/a	2			Yes
19-1022	Microbiologists	4	\$24.17	4			Yes
19-4021	Biological Technicians	4	\$16.63	4		Yes	Yes
17-2041	Chemical Engineers	4	\$33.74	7			Yes
19-4031	Chemical Technicians	3	\$18.43	10		Yes	Yes
29-2011	Medical & Clinical Laboratory Technologists	4	\$22.80	77	Yes		Yes
19-4000	Life, Physical, & Social Science Technicians	n/a	n/a	90	Yes	Yes	Yes
29-2012	Medical & Clinical Laboratory Technicians	2	\$14.39	176		Yes	Yes

## Job Zone Key

<b>Job Zone</b>	<b>Overall Experience</b>	<b>Education</b>	<b>Job Training</b>
<i>Job Zone One: Little or No Preparation Needed</i>	<i>No previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a cashier even if he/she has never worked before.</i>	<i>These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license.</i>	<i>Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.</i>
<i>Job Zone Two: Some Preparation Needed</i>	<i>Some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed. For example, a teller might benefit from experience working directly with the public, but an inexperienced person could still learn</i>	<i>These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.</i>	<i>Employees in these occupations need anywhere from a few months to one year of working with experienced employees.</i>
<i>Job Zone Three: Medium Preparation Needed</i>	<i>Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing</i>	<i>Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.</i>	<i>Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.</i>
<i>Job Zone Four: Considerable Preparation Needed</i>	<i>A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.</i>	<i>Most of these occupations require a four - year bachelor's degree, but some do not.</i>	<i>Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.</i>
<i>Job Zone Five: Extensive Preparation Needed</i>	<i>Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training t</i>	<i>A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).</i>	<i>Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.</i>