

**BIOTECHNOLOGY  
INDUSTRY AND OCCUPATIONAL INFORMATION  
GULF COAST REGION**

**Prepared for the Gulf Coast Workforce Board**

**Prepared by  
Workforce Solutions  
Joel C. Wagher  
September 2, 2004**

## Table of Contents

	Page
Industry and Occupational Information	1
Table 1 Biotechnology Industries	3
Table 2 Biotechnology Occupations	4
Industry Employment of Selected Occupations	5
Dictionary of Occupations Listed	7
Some Definitions of Biotechnology	8

**BIOTECHNOLOGY**  
**INDUSTRY AND OCCUPATIONAL INFORMATION**  
**GULF COAST REGION**

---

---

Hi-Tech is the old bubble; the new sparkle that no one wants to miss out on is the biotech expansion. Fast growth and high pay are the expectations for economic development. What is it and whose definition of biotechnology will drive the economic numbers?

In the mid-1980s the congressional Office of Technology Assessment defined biotechnology as “any technique that uses living organisms, or substances from those organisms, to make or modify a product, to improve plants or animals, or to develop microorganisms for specific uses.”<sup>1</sup> The “biotechnology industry” is not a specific industry but is a combination of industries like the Gulf Coast region’s “energy sector” in that it crosses many industrial sectors. Where the “energy industries” are located in mining, manufacturing, transportation, wholesale trade and others, the “biotechnology industries” are located in agricultural services, manufacturing, research, testing laboratories and others. Research and publication papers should be reviewed closely to determine how the biotech numbers are defined.

A study by Ernst & Young defines biotech narrowly, limiting the industry to pharmaceuticals and research. Texas Healthcare & Bioscience Institute uses a broader definition that also includes medical devices.<sup>1</sup> Other definitions for “biotechnology industries” include agricultural feedstock and chemicals, academic health centers, research hospitals and other industry sectors. Because it is not a specific industry, biotechnology employment projections are not produced by the Department of Labor, Bureau of Labor Statistics – consequently, the numbers do not give us a good representation for where Biotech is headed.

To get a more specific look at biotechnology, one could review the data on the occupations considered to be specific to biotech: biochemists and biophysicists, biological technicians, microbiologists, biomedical engineers and others. The employment projections for these occupations are available. Of course these occupations are not the only ones within the biotech sectors. The staffing patterns of the industries will include computer programmers, technical writers, security guards, bookkeeping clerks and other occupations that one finds in any business.

Industries that could be included in a definition of biotechnology industries are found in Table 1. The employment numbers are from employers’ Quarterly Census of Employment & Wages (QCEW) reports for unemployment taxes. Data from the Department of Labor, Bureau of Labor Statistics and the Texas Workforce Commission for the first quarter 2003 was used for the table. The Gulf Coast region’s rough total of 21,624 jobs was less than 1% of the total Gulf Coast region QCEW employment. Texas had a total of 68,791 jobs, less than 0.7%, and the national total of 1,976,053 jobs was 1.6% of the total QCEW employment for the nation.

One should note the footnote concerning Research and Testing. These two sectors are in the total number of jobs for the “biotechnology industry”, but due to the classification system, adding them to the total inflates the true number in biotechnology.

---

<sup>1/</sup> *Vista*, Federal Reserve Bank of Dallas, Spring 2003

---

---

This is because biological testing is only one “industry” within Testing Laboratories (NAICS<sup>2</sup> 541380). Testing Laboratories include establishments primarily engaged in performing physical, chemical, and other analytical testing services, such as acoustics or vibration testing, assaying, biological testing, calibration testing, electrical and electronic testing, geotechnical testing and others. The Gulf Coast region’s energy and aerospace industries would also have employment in this sector. This is also true for the employment in Research and Development in the Physical, Engineering, and Life Sciences (NAICS 541710). This industry comprises establishments primarily engaged in conducting research and experimental development in the physical, engineering, and life sciences, such as agriculture, electronics, environmental, biology, botany, biotechnology, computers, chemistry, food, fisheries, forests, geology, health, mathematics, medicine, oceanography, pharmacy, physics, veterinary and other allied subjects. It is unknown how many biotechnology industries are in these two sectors or their total employment.

Another way of looking at biotech employment is to look at the occupations in biotechnology. Just as hospitals hire nurses and doctors, and transportation firms hire truck drivers, pilots and material handlers, biotechnology industries hire biological technicians, biochemists & biophysicists, agriculture & food science technicians and other occupations. Table 2 lists some of the occupations found in the biotechnology industries and their projected employment. As stated earlier, biotechnology industries also employ computer programmers, technical writers, security guards, bookkeeping clerks and other occupations. As we look at the projected employment for the Gulf Coast region, the total of 6,280 jobs is far less than the rough total of 21,624 for the biotechnology industries identified in Table 1, which includes all occupations in the industries.

One can not overlook the distortion that Testing Laboratories (NAICS 541380) and Research and Development in the Physical, Engineering, and Life Sciences (NAICS 541710) bring to the numbers. One would only be guessing to say that biotechnology industries make up one-third of the jobs in these two sectors. Even that could be on the high side of a guess considering the strength of energy and aerospace in the Gulf Coast region. With the guess that one-third of the employment in these two sectors is in biotechnology, it would drop the number of jobs in the biotechnology industries for the Gulf Coast region down to around 14,700 jobs, or 0.6% of first quarter 2003 employment. For a comparison, the Health Care and Social Assistance sector had 9.4% of the total jobs in 2003.

Using the information in Table 2, one finds that the Gulf Coast region had 24.4% of total Texas employment in 2000 and 32.8% of the employment for the occupations listed. The Gulf Coast region had a higher concentration of the listed occupations than it did of total employment for the state. Not listed are the national numbers which shows that Texas had 7.2% of national employment and about 7% of the employment for the occupations listed. The ten-year growth rate for the listed occupations in the Gulf Coast region is lower, 15.2%, than the total projected growth rate for all occupations in the region, 18.8%.

---

<sup>2</sup> North American Industry Classification System

Table 1

			Gulf Coast	Texas	U. S.
			March 2003	March 2003	March 2003
	NAICS	Industry Title	Jobs	Jobs	Jobs
<b>Agricultural Feedstock &amp; Chemicals</b>	311221	Wet Corn Milling	<41	120	8,165
	311222	Soybean Processing	<41	<1022	10,841
	311223	Other Oilseed Processing (pt)	<41	577	2,289
	325193	Ethyl Alcohol Manufacturing	<1,651	<1,552	3,875
	325199	All Other Basic Organic Chemicals	3,693	8,207	34,875
	325221	Cellulosic Organic Fiber Manufacturing	<57	57	11,085
	325222	Noncellulosic Organic Fiber Manuf.	<57	5	27,168
	325311	Nitrogenous Fertilizer Manufacturing	25	256	8,675
	325312	Phosphatic Fertilizer Manufacturing	151	151	8,182
	325314	Fertilizer (Mixing Only) Manufacturing	203	960	8,545
	325320	Agricultural Chemicals Except Fertilizer	1,040	1,575	17,487
	424910	Farm Supplies Merchant Wholesalers	630	6,339	106,433
<b>Drugs &amp; Pharmaceuticals</b>	325411	Medicinal and Botanical Manufacturing	<158	322	23,945
	325412	Pharmaceutical Preparation Manuf.	936	7,493	227,466
	325413	In-Vitro Diagnostic Substance Manuf.	<158	289	13,965
	325414	Other Biological Product Manufacturing	249	993	25,955
<b>Medical Devices &amp; Equip</b>	334510	Electromedical Apparatus Manufacturing	788	1,654	560,022
	334516	Analytical Laboratory Instruments	621	1,798	32,793
	334517	Irradiation apparatus Manuf.	ina	39	11,230
	339111	Laboratory Apparatus and Furniture	63	719	14,757
	339112	Surgical and Medical Instrument Mfg	446	3,070	103,939
	339113	Surgical Appliance and Supplies Mfg	571	4,995	88,432
	339114	Dental Equipment and Supplies Mfg	23	84	15,491
<b>Research &amp; Testing*</b>	541380	Testing Laboratories	5,262	10,812	143,535
	541710	R&D Physical/Engineering/Life Sciences	5,016	15,702	466,903
Total for listed "bio-industries"			21,624	68,791	1,976,053
Percent of total QCEW (Covered) employment			<1.0%	<0.7%	1.6%
<b>Total QCEW (Covered) Employment</b>			<b>2,271,867</b>	<b>9,188,951</b>	<b>126,728,293</b>

To prevent disclosure of an individual employer, some data is suppressed, but knowing the aggregate total and some of the other detail industry sectors within the aggregate, one can get an idea of the missing employment numbers. Example: For the Gulf Coast region, Wet Corn Milling, Soybean Processing and Other Oilseed Processing (part) NAICS codes 311221, 311222 and 311223 show employment of less than 41. This is the result of knowing that the aggregate of NAICS 3112, Grain and Oilseed Milling was 715 and that a sub-sector, NAICS 31121, Flour Milling and Malt Manufacturing had employment of 674. That left 41 jobs for the other sub-sectors. We do not know for sure where these 41 jobs are located so we say that each sub-sector has less than 41. A sub-sector could have '0' and all of the 41 jobs could be in one sub-sector. This detailed information is not released by the Texas Workforce Commission to the Board. The 41 jobs are added to the total of listed "Bio-industries" to get the rough total of 21,624 jobs.

\* Research & Testing: covers acoustics, electrical and electronic, geotechnical, engineering etc., not just biological.

Source of Data: U. S. Department of Labor, Bureau of Labor Statistics and Texas Workforce Commission

Table 2

**Gulf Coast Region Occupational Projections**

SOC <sup>3</sup>	Occupational Title	Annual Average Employment				2002
		2000	2010	Change	Growth Rate	
19-4011	Agriculture & Food Science Technicians	110	130	20	18.2%	114
19-1011	Animal Scientists	30	40	10	33.3%	32
19-1021	Biochemists & Biophysicists	500	650	150	30.0%	530
19-4021	Biological Technicians	690	750	60	8.7%	702
17-2031	Biomedical Engineers	170	240	70	41.2%	180
19-2031	Chemists	2,480	2,690	210	8.5%	2,522
19-1099	Life Scientists, NEC	1,000	1,220	220	22.0%	1,044
19-1022	Microbiologists	470	560	90	19.1%	488
<b>Total</b>	<b>0.2% of Gulf Coast employment for 2000</b>	<b>5,450</b>	<b>6,280</b>	<b>830</b>	<b>15.2%</b>	<b>5,612</b>
TOTAL	Gulf Coast employment (2000) 2,533,030					

**Texas Occupational Projections**

SOC	Occupational Title	Annual Average Employment				2002
		2000	2010	Change	Growth Rate	
19-4011	Agricultural & Food Science Technicians	590	710	120	20.3%	614
19-1011	Animal Scientists	320	330	10	3.1%	322
19-1021	Biochemists & Biophysicists	1,300	1,710	410	31.5%	1,382
19-4021	Biological Technicians	2,320	2,510	190	8.2%	2,358
17-2031	Biomedical Engineers	520	710	190	36.5%	560
19-2031	Chemists	6,340	7,150	810	12.8%	6,502
19-1099	Life Scientists, NEC	3,600	4,190	590	16.4%	3,718
19-1022	Microbiologists	1,550	1,830	280	18.1%	1,606
<b>Total</b>	<b>0.2% of Texas employment for 2000</b>	<b>16,540</b>	<b>19,140</b>	<b>2,600</b>	<b>15.7%</b>	<b>17,060</b>
TOTAL	Texas employment (2000) 10,393,760					

<sup>3/</sup> Standard Occupation Classification

## **Industry Employment of Selected Occupations Gulf Coast Region**

The figure in parentheses indicates the approximate percentage of the occupation employed in that industry.

### **SOC 19-4011 Agricultural and Food Science Technicians**

NAICS 4249 Miscellaneous Nondurable Goods Merchant Wholesalers (19.6%)  
NAICS 5419 Other Professional, Scientific, and Technical Services (16.5%)  
NAICS 3116 Animal Slaughtering and Processing (13.1%)  
NAICS 5417 Scientific Research and Development Services (11.7%)  
NAICS 3119 Other Food Manufacturing (9.5%)  
NAICS 3115 Dairy Product Manufacturing (6.3%)  
NAICS 3118 Bakeries and Tortilla Manufacturing (2.7%)  
NAICS 3112 Grain and Oilseed Milling (2.3%)

### **SOC 19-1011 Animal Scientists**

NAICS 4249 Miscellaneous Nondurable Goods Merchant Wholesalers (9.7%)  
NAICS 1121 Cattle Ranching and Farming (3.8%)  
NAICS 1151 Support Activities for Crop Production (3.3%)  
NAICS 1114 Greenhouse, Nursery, and Floriculture Production (2.5%)  
NAICS 1119 Other Crop Farming (2.0%)

### **SOC 19-1021 Biochemists and Biophysicists**

NAICS 5419 Other Professional, Scientific, and Technical Services (43.5%)  
NAICS 5417 Scientific Research and Development Services (28.6%)  
NAICS 3251 Basic Chemical Manufacturing (18.0%)

### **SOC 19-4021 Biological Technicians**

NAICS 3251 Basic Chemical Manufacturing (29.3%)  
NAICS 9190 Federal Government, Except Education (19.3%)  
NAICS 5419 Other Professional, Scientific, and Technical Services (11.4%)  
NAICS 3254 Pharmaceutical and Medicine Manufacturing (7.6%)  
NAICS 5417 Scientific Research and Development Services (7.4%)  
NAICS 4249 Miscellaneous Nondurable Goods Merchant Wholesalers (4.5%)  
NAICS 6215 Medical and Diagnostic Laboratories (3.0%)

### **SOC 17-2031 Biomedical Engineers**

NAICS 5413 Architectural, Engineering, and Related Services (41.2%)  
NAICS 3391 Medical Equipment and Supplies Manufacturing (12.5%)  
NAICS 5419 Other Professional, Scientific, and Technical Services (11.8%)  
NAICS 5417 Scientific Research and Development Services (9.2%)

## **Industry Employment of Selected Occupations Gulf Coast Region**

### **SOC 19-2031 Chemists**

NAICS 5419 Other Professional, Scientific, and Technical Services (31.1%)  
NAICS 5417 Scientific Research and Development Services (20.8%)  
NAICS 2111 Oil and Gas Extraction (13.4%)  
NAICS 3259 Other Chemical Product and Preparation Manufacturing (5.3%)  
NAICS 3251 Basic Chemical Manufacturing (3.9%)  
NAICS 3254 Pharmaceutical and Medicine Manufacturing (3.4%)  
NAICS 3255 Paint, Coating, and Adhesive Manufacturing (3.3%)  
NAICS 3241 Petroleum and Coal Products Manufacturing (3.0%)

### **SOC 19-1099 Life Scientists, All Other**

NAICS 6113 Colleges, Universities, and Professional Schools (73.0%)  
NAICS 6112 Junior Colleges (20.6%)  
NAICS 7121 Museums, Historical Sites, and Similar Institution (5.4%)

### **SOC 19-1022 Microbiologists**

NAICS 3251 Basic Chemical Manufacturing (38.0%)  
NAICS 6215 Medical and Diagnostic Laboratories (18.0%)  
NAICS 3254 Pharmaceutical and Medicine Manufacturing (6.2%)  
NAICS 5419 Other Professional, Scientific, and Technical Services (5.0%)  
NAICS 5417 Scientific Research and Development Services (2.6%)

## Dictionary of Occupations Listed

### **19-4011 Agricultural and Food Science Technicians**

Work with agricultural scientists in food, fiber, and animal research, production, and processing; assist with animal breeding and nutrition work; under supervision, conduct tests and experiments to improve yield and quality of crops or to increase the resistance of plants and animals to disease or insects. Include technicians who assist food scientists or food technologists in the research, development, production technology, quality control, packaging, processing, and use of foods.

*Illustrative Examples: Inseminator; Feed Research Technician; Dairy Technologist*

### **19-1011 Animal Scientists**

Conduct research in the genetics, nutrition, reproduction, growth, and development of domestic farm animals. *Illustrative Examples: Dairy Scientist; Poultry Scientist*

### **19-1021 Biochemists and Biophysicists**

Study the chemical composition and physical principles of living cells and organisms, their electrical and mechanical energy, and related phenomena. May conduct research to further understanding of the complex chemical combinations and reactions involved in metabolism, reproduction, growth, and heredity. May determine the effects of foods, drugs, serums, hormones, and other substances on tissues and vital processes of living organisms.

### **19-4021 Biological Technicians**

Assist biological and medical scientists in laboratories. Set up, operate, and maintain laboratory instruments and equipment, monitor experiments, make observations, and calculate and record results. May analyze organic substances, such as blood, food, and drugs.

*Illustrative Examples: Biotechnologist; Wildlife Technician; Specimen Technician*

### **17-2031 Biomedical Engineers**

(Orthopedic Designer) Apply knowledge of engineering, biology, and biomechanical principles to the design, development, and evaluation of biological and health systems and products, such as artificial organs, prostheses, instrumentation, medical information systems, and health management and care delivery systems.

### **19-2031 Chemists**

Conduct qualitative and quantitative chemical analyses or chemical experiments in laboratories for quality or process control or to develop new products or knowledge. Exclude "Geoscientists, Except Hydrologists and Geographers" (19-2042) and "Biochemists and Biophysicists" (19-1021).

*Illustrative Examples: Inorganic Chemist; Chemical Analyst*

### **19-1099 Life Scientists, All Other**

All life scientists not listed separately.

### **19-1022 Microbiologists**

(Cytologist) Investigate the growth, structure, development, and other characteristics of microscopic organisms, such as bacteria, algae, or fungi. Include medical microbiologists who study the relationship between organisms and disease or the effects of antibiotics on microorganisms. *Illustrative Examples: Bacteriologist; Virologist*

## Some Definitions of Biotechnology\*

**Classic:** The word "biotechnology" was first used in 1917 to describe processes using living organisms to make a product or run a process, such as industrial fermentations.  
(Robert Bud, *The Uses of Life: A History of Biotechnology*)

**Warm and Fuzzy:** Biotechnology began over 10,000 years ago when humans began to plant their own crops, domesticate animals, ferment juice into wine, make cheese, and leaven bread.  
(AccessExcellence handout)

**Grandiose yet Vague:** Biotechnology is the process of harnessing 'nature's own' biochemical tools to make possible new products and processes and provide solutions to society's ills.  
(G. Kirk Raab, Former President and CEO of Genentech)

**Webster's Unabridged:** The aspect of technology concerned with the application of living organisms to meet the needs and ends of man.

**"bio.org":** Although biotechnology is over 10,000 years old, the "New" Biotechnology can be defined as "the use of cellular and biomolecular processes to solve problems or make useful products".

Biotechnology: A Collection of Technologies

**"Dot.gov":** Biotechnology is the application of technologies, such as recombinant DNA techniques, biochemistry, molecular and cellular biology, genetics and genetic engineering, and cell fusion techniques, using living organisms, to manufacture products including antibiotics, insulin, and interferon, to improve plants or animals, to develop microorganisms for specific uses, to identify targets for pharmaceutical development, or to transform biological systems into useful processes and products.

(National Science and Technology Council, July 1995.)

**Warning!** Be aware that the word **Biotechnology** has a range of meanings and connotations. It is also politically charged, and means different things to different people.

\*Indiana University-Purdue University Indianapolis  
<http://www.biology.iupui.edu/biocourses/Biol540/1intro2k4.html>