

FOOD SAFETY AND BIOTECHNOLOGY CAREERS in the SOUTH CENTRAL VALLEY

A labor market profile of community college programs in Fresno, Kern, Kings, Madera and Tulare counties



Introduction

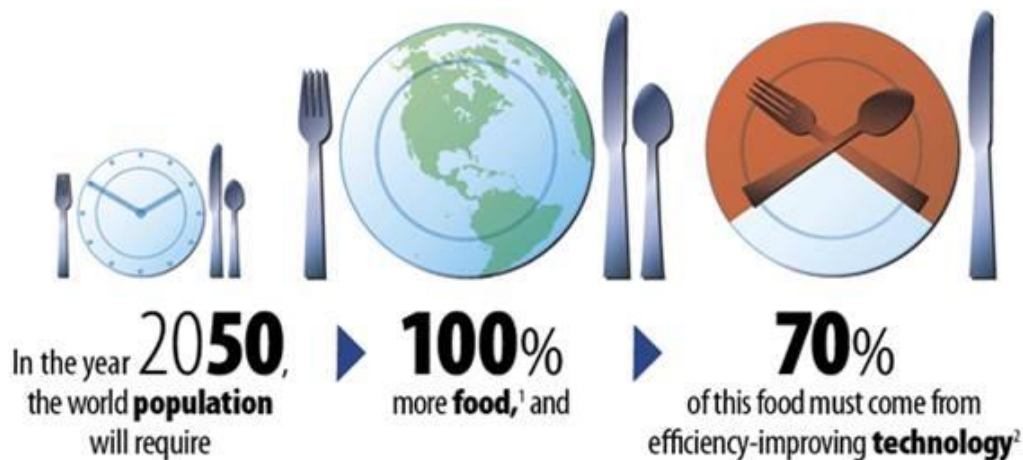
Food safety applies to a broad range of activities aimed at eliminating potentially severe health hazards and entails the prevention of contamination and food-borne illness through the safe handling, preparation and storage of food. These activities involve the safe growing, storing, transporting, processing and preparation of all types of fruits, vegetables, dairy and meat.¹

Foodborne illnesses can be severe, or even fatal, and pose a particular threat to young children, older adults, pregnant women and people with weakened immune systems.² Each year, 48 million people get sick from food-borne pathogens, according to the Centers for Disease Control and Prevention.³ Government agencies play an important role in food safety and are tasked with setting food safety standards, conducting inspections, ensuring standards are met and maintaining enforcement programs.⁴

Food safety is also recognized by the World Health Organization (WHO) as an essential public health function. The WHO recommends food safety policies and actions encompass the entire food chain, from production to consumption.⁵

Biotechnology is linked to food safety through the use of various scientific techniques to produce desired traits in plants, animals or microorganisms through genetic modifications. Since its introduction to agriculture and food production, biotechnology research has resulted in new tools for improving agricultural productivity.⁶ Biotechnology also can be used to improve the nutritional quality of food. Environmental and population pressures are expected to expand the role of biotechnology in food production in coming years (Exhibit 1).

Exhibit 1 – The future of the global food system and biotechnology⁷



¹ "About IAFP." International Association for Food Protection. Accessed November 26, 2016. <https://www.foodprotection.org/about/>

² University of Maryland Medical Center. Accessed November 26, 2016. <http://umm.edu/health/medical/ency/articles/food-safety>

³ "Estimates of food-borne illness in the United States." Centers for Disease Control and Prevention. Accessed November 26, 2016. <https://www.cdc.gov/foodborneburden/>

⁴ "What government does." FoodSafety.gov. Accessed November 26, 2016.

<https://www.foodsafety.gov/keep/government/>

⁵ "Biotechnology/Innovation." TDR for research on disease of poverty, World Health Organization. Accessed November 26, 2016. <http://www.who.int/tdr/diseases-topics/biotechnology-innovation/en/>

⁶ "Background on Food Biotechnology." International Food Information Council Foundation. Accessed November 26, 2016.

http://www.foodinsight.org/Background_on_Food_Biotechnology

⁷ BIOtechNow. Accessed November 26, 2016. <http://www.biotech-now.org/wp-content/uploads/2011/04/50-100-70-plates.jpg>

Biotechnology also involves nanotechnology since genetic modifications and manipulations occur at the atomic and molecular level.

The following labor market information provides workforce demand and educational program analysis for the purpose of supporting food safety and biotechnology program conversations at community colleges in the South Central Valley. It is recommended that regional colleges work with department advisory boards and local industry partners to reach consensus.

Occupational Overview

Food Safety and biotechnology occupations include technicians, technologists and scientists. Depending on the level of education and area of emphasis, workers may conduct a wide range of activities. O*Net Online has identified the following activities as being associated with occupations related to food science:

- use chemistry, microbiology, engineering and other sciences to study the principles underlying the processing and deterioration of foods;
- analyze food content to determine levels of vitamins, fat, sugar and protein;
- discover new food sources;
- research ways to make processed foods safe, palatable and healthful; and
- apply food science knowledge to determine the best ways to process, package, preserve, store and distribute food.⁸

Technicians and technologists may also assist biological and medical scientists in laboratories. According to O*Net Online, technicians and technologists may conduct the following tasks in laboratory environments: set up, operate and maintain laboratory instruments and equipment; monitor experiments and make observations; calculate and record results; and/or analyze organic substances, such as blood, food, and drugs.⁹

Exhibit 2 displays the TOP codes and title options currently available to California Community Colleges for training and pathways that apply to one or more of the 14 occupations related to food safety and biotechnology identified by this study. See Appendix B for specific job descriptions.

⁸ "Summary Report for: 19-1012.00 - Food Scientists and Technologists." O*NET Online. Accessed November 26, 2016.

<http://www.onetonline.org/link/summary/19-1012.00>

⁹ Ibid.

Exhibit 2 – TOP codes related to food safety and biotechnology

TOP Code	Program	SOC Code	Occupation
010100	Agriculture Technology and Sciences, General	194011	Agricultural and Food Science Technicians
		191012	Food Scientists and Technologists
010400	Viticulture, Enology and Wine Business	194011	Agricultural and Food Science Technicians
		191012	Food Scientists and Technologists
011300	Food Processing and Related Technologies	194011	Agricultural and Food Science Technicians
		191012	Food Scientists and Technologists
040100	Biology, General	191029	Biological Scientists, All Other
		191099	Life Scientists, All Other
		119121	Natural Sciences Managers
040200	Botany, General	191029	Biological Scientists, All Other
		119121	Natural Sciences Managers
040300	Microbiology	119121	Natural Sciences Managers
040700	Zoology, General	119121	Natural Sciences Managers
043000	Biotechnology and Biomedical Technology	194021	Biological Technicians
		519061	Inspectors, Testers, Sorters, Samplers and Weighers
		194099	Life, Physical and Social Science Technicians, All Other
		292012	Medical and Clinical Laboratory Technicians
049900	Other Biological Sciences	499062	Medical Equipment Repairers
		191029	Biological Scientists, All Other
		191099	Life Scientists, All Other
093460	Biomedical Instrumentation	119121	Natural Sciences Managers
		499062	Medical Equipment Repairers
093470	Electron Microscopy	194099	Life, Physical and Social Science Technicians, All Other
		292011	Medical and Clinical Laboratory Technologists
095400	Chemical Technology	194031	Chemical Technicians
095500	Laboratory Science Technology	194021	Biological Technicians
		194031	Chemical Technicians
		519061	Inspectors, Testers, Sorters, Samplers and Weighers
		292012	Medical and Clinical Laboratory Technicians
095600	Manufacturing and Industrial Technology	519061	Inspectors, Testers, Sorters, Samplers and Weighers
095680	Industrial Quality Control	519061	Inspectors, Testers, Sorters, Samplers and Weighers
120500	Medical Laboratory Technology	292012	Medical and Clinical Laboratory Technicians
170100	Mathematics, General	119121	Natural Sciences Managers
170200	Mathematics Skills	119121	Natural Sciences Managers
179900	Other Mathematics	119121	Natural Sciences Managers
190100	Physical Sciences, General	119121	Natural Sciences Managers
190200	Physics, General	119121	Natural Sciences Managers
190500	Chemistry, General	119121	Natural Sciences Managers
191100	Astronomy	119121	Natural Sciences Managers
191400	Geology	119121	Natural Sciences Managers
191900	Oceanography	119121	Natural Sciences Managers
192000	Ocean Technology	194099	Life, Physical and Social Science Technicians, All Other
193000	Earth Science	119121	Natural Sciences Managers
199900	Other Physical Sciences	119121	Natural Sciences Managers
490200	Biological and Physical Sciences (and Mathematics)	119121	Natural Sciences Managers

Projected Employment Growth

Overall, the 14 food safety and biotechnology occupations identified by this study are projected to experience moderate job growth over the next five years (2016-2021), increasing overall employment by 7% in the South Central Valley.

The 14 identified occupations currently employ about 9,000 workers in the five-county region.

- The largest occupation is inspectors, testers, sorters, samplers and weighers, with 3,040 current jobs. This occupation has a modest projected growth rate of 6% and the greatest projected increase in employment, adding 194 new jobs in the region over the next five years.
- The largest occupation requiring an associate degree is medical and clinical technicians. This occupation has the second highest growth rate, 13%, when replacement needs are taken into account. Projections show 219 openings over the five-year period.

Exhibit 3 details the employment outlook for each of the 14 food safety and biotechnology occupations in the South Central Valley. The data are sorted in descending order by projected annual openings.

Exhibit 3 – Projected occupational growth for the South Central Valley

SOC Code	Occupation	2016 Jobs	2021 Jobs	% Growth*	Annual Openings**
51-9061	Inspectors, Testers, Sorters, Samplers and Weighers	3,040	3,234	6%	119
29-2012	Medical and Clinical Laboratory Technicians	869	976	12%	44
29-2011	Medical and Clinical Laboratory Technologists	659	743	13%	34
45-2011	Agricultural Inspectors	962	992	3%	31
13-1041	Compliance Officers	1,253	1,314	5%	30
19-4011	Agricultural and Food Science Technicians	576	596	3%	24
19-4031	Chemical Technicians	282	321	14%	17
19-4099	Life, Physical and Social Science Technicians, All Other	242	261	8%	15
19-4021	Biological Technicians	337	357	6%	14
49-9062	Medical Equipment Repairers	206	234	14%	10
19-1012	Food Scientists and Technologists	182	194	7%	9
19-1029	Biological Scientists, All Other	216	216	0%	6
11-9121	Natural Sciences Managers	192	201	5%	6
19-1099	Life Scientists, All Other	22	25	14%	-
Total, All 14 Occupations		9,040	9,664	7%	360

*Growth refers to net change over the period, i.e. new job creation or job decline, and does not factor in replacement jobs.

**Annual openings represents the annual average number of new jobs plus replacement jobs projected for the five-year period.

Wages

In the South Central Valley’s five counties, the average living wage for one adult is \$10.53 per hour. Exhibit 4 displays the living wage for one adult for each county in the region.

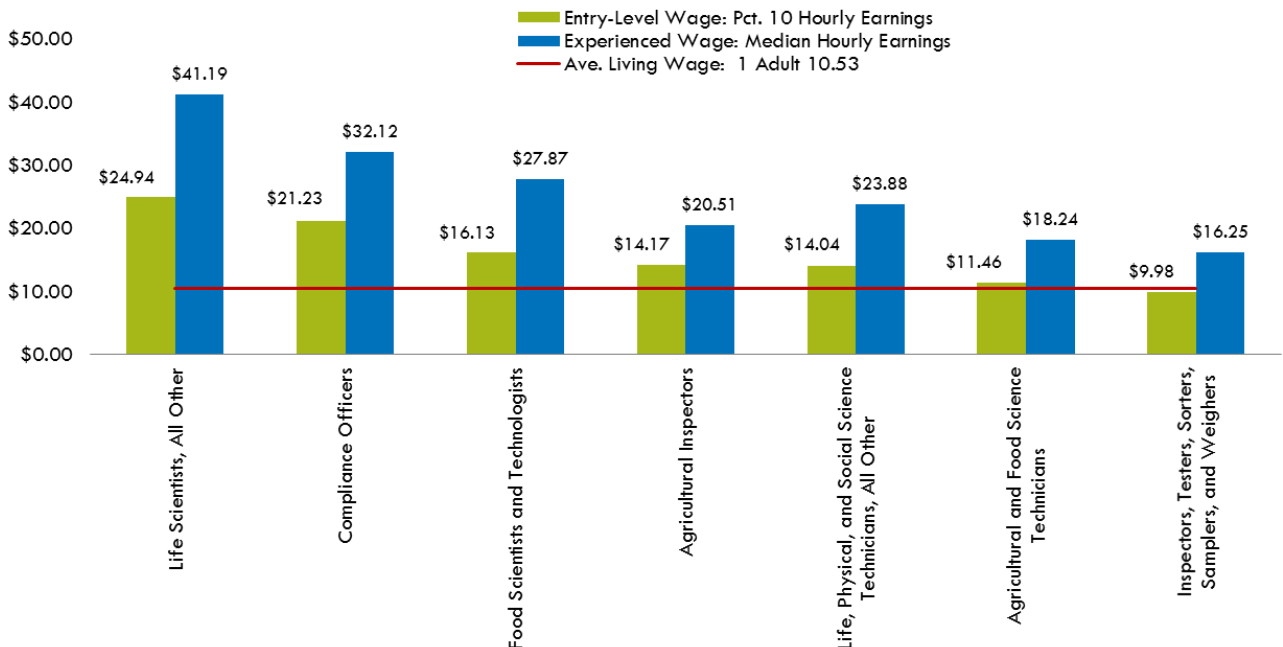
Exhibit 4 – Living wages for one adult by county

County	Living Wage
Fresno	\$10.84
Kern	\$10.72
Kings	\$9.89
Madera	\$10.83
Tulare	\$10.37
Average	\$10.53

Exhibits 5a and 5b compare the entry-level and experienced wages of the 14 occupations to the region’s average living wage. Exhibit 5a displays food safety occupational wages, while Exhibit 5b shows biotechnology occupational wages. The entry-level wage for all but one of the 14 occupations exceeds the living wage for one adult.

Among the food safety occupations, the entry-level wage for inspectors, testers, sorters, samplers and weighers is the only wage that falls below the average living wage for a single adult. Food safety occupations offering the highest wages include life sciences (all other), compliance officers, and scientists and technologists.

Exhibit 5a – Food safety entry-level and experienced wages



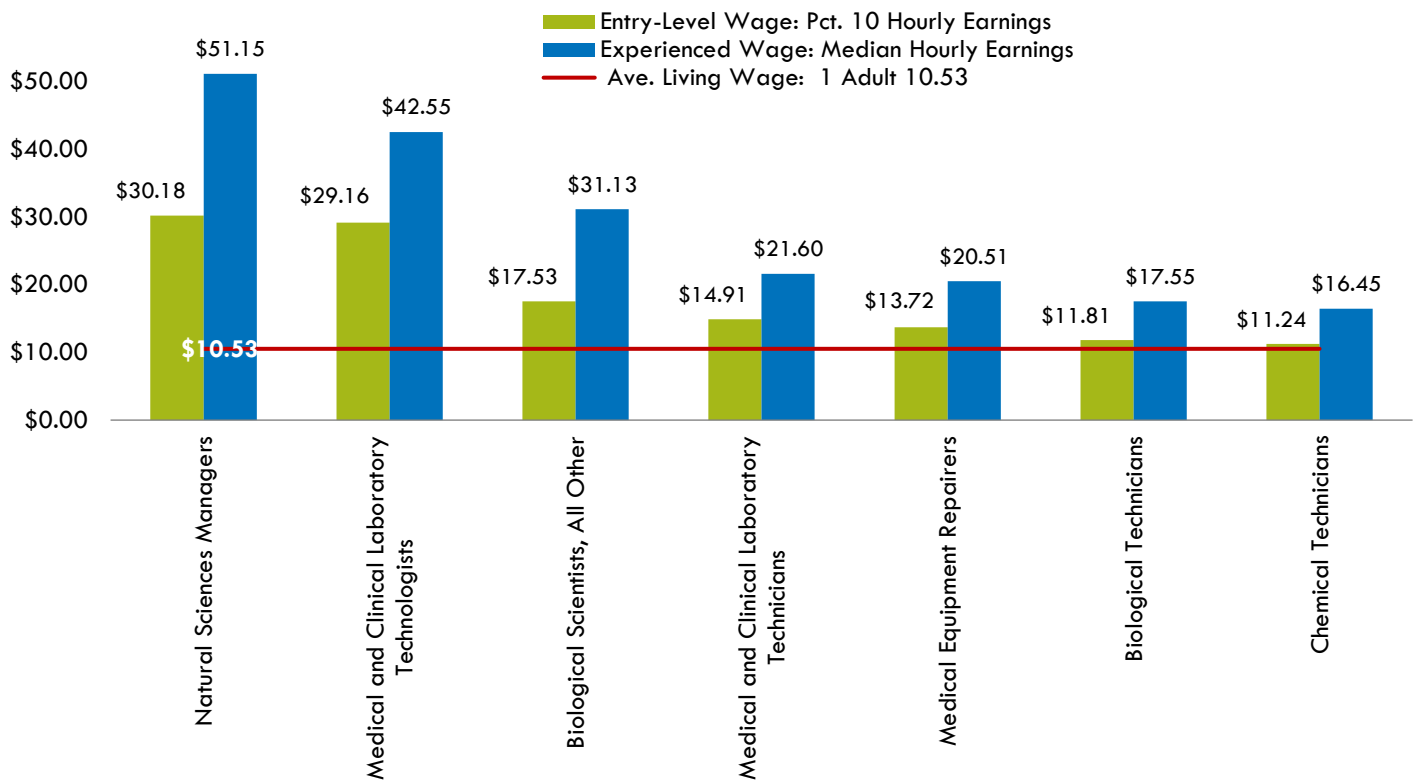
Among the biotechnology occupations analyzed, the occupation offering the highest wages is natural sciences managers, with an \$30.18/hour entry-level wage and an experienced wage that exceeds \$50/hour.

Other occupations offering high wages include natural sciences managers, medical and clinical laboratory technologists and biological scientists (all other).

Medical and clinical laboratory technicians offer mid-range wages, \$14.91/hour for entry-level workers and \$21.60/hour for experienced workers. Similarly, the occupation of medical equipment repairers pays \$13.72/hour for entry-level workers and \$20.51/hour for experienced workers.

Biological technicians and chemical technicians have the lowest wages in the group, but at \$11.81/hour and \$11.24/hour respectively, their entry-level wages still exceed the region's average living wage.

Exhibit 5b – Biotechnology entry-level and experienced wages



Typical Education Level

Education and training requirements for entry-level work will vary by occupation and employer preference. Exhibit 6 shows the typical required entry-level education as identified by the Bureau of Labor Statistics as well as the percentage of workers who have at least some college or an associate degree. This latter data was derived from the Census Bureau's Current Population Survey.

According to the education and training requirements listed by the Bureau of Labor Statistics, eight of the 14 food safety and biotechnology occupations require a bachelor's degree, and five occupations require an associate degree. Of the jobs requiring an associate degree, four are technician occupations: agriculture and food science technicians; chemical technicians; life, physical and social sciences technicians (other); and medical and clinical laboratory technicians.

The fifth occupation requiring an associate degree is medical equipment repairers, in which more than half of workers have an associate degree or some college.

The occupation of inspectors, testers, sorters, samplers and weighers has a typical entry-level education of a high school diploma or equivalent, but 38% of these workers possess an associate degree or some college as their highest level of education.

Exhibit 6 – Education requirements for food safety and biotechnology occupations

Occupation	Typical Entry-level Education	% of Current Workers with Associates Degree or Some College (CPS)
Agricultural and Food Science Technicians	Associate degree	36%
Agricultural Inspectors	Bachelor's degree	29%
Biological Scientists, All Other	Bachelor's degree	4%
Biological Technicians	Bachelor's degree	30%
Chemical Technicians	Associate degree	36%
Compliance Officers	Bachelor's degree	28%
Food Scientists and Technologists	Bachelor's degree	19%
Inspectors, Testers, Sorters, Samplers and Weighers	High school diploma or equivalent	38%
Life Scientists, All Other	Bachelor's degree	1%
Life, Physical and Social Science Technicians, All Other	Associate degree	34%
Medical and Clinical Laboratory Technicians	Associate degree	36%
Medical and Clinical Laboratory Technologists	Bachelor's degree	36%
Medical Equipment Repairers	Associate degree	54%
Natural Sciences Managers	Bachelor's degree	6%

Occupational Trends

With the rise of global food systems, the risk of food contamination and the spread of food-borne disease have increased. As a result, more attention is being given to food safety and the role of biotechnology in food production and screening. In addition, cellular agriculture is an emerging field and “uses biotechnology instead of animals to make products such as meat, milk, and egg whites.”¹⁰ As the synthetic foods produced by cellular agriculture get closer to being marketed to consumers, additional scrutiny regarding food safety and the need for government regulations is expected.

Overall, biotechnology’s role in industries related to agriculture and food has been growing, as it is applied to improving crop yields; increasing the resistance of plants to disease, insects and drought; increasing milk production; treating and preventing animal diseases; and developing better ways of processing foods.¹¹ According to the website Biotech Careers, advances in biotechnology are also being applied to determine the source of contamination:

“Biotechnology methods can be applied to identifying pathogens and harmful chemical additives and locating their source. ... Techniques like DNA barcoding, where DNA is isolated from the substance and sequenced, help investigators determine if the samples are correctly identified and if they were obtained illegally or poached.”¹²

Biotech Careers identifies three occupations that are particularly relevant to the convergence of biotechnology and food safety: agricultural and food science technician, chemistry quality control technician and food sample inspector.

According to a press release issued by the Market Research Reports Search Engine, the food types receiving the most food testing in 2011 were processed foods (approximately 36% of the overall tests conducted), followed by dairy, with meat and poultry products expected to increase their percentage of testing.¹³ The majority of food testing is for pathogens (largely salmonella), followed by GMOs, toxins and pesticides, according to the market research group.

Of the more than 1,000 biotech firms in the United States, more than half are located in California. There are three biotech hubs in the state—the San Francisco Bay Area, San Diego metro area and the Los Angeles-Orange County region. In addition, the Sacramento area has been experiencing biotech growth in recent years.¹⁴

According to the report “Careers in Biotech,” which was sponsored by the California Community Colleges Economic Development Program, the fastest growing biotechnology occupations include animal technicians, computer engineers and database administrators, environmental science and protection technicians, laboratory technicians and scientists.¹⁵ The report notes the occupations with the largest number of entry-level jobs are:

- laboratory support workers
- laboratory technicians
- laboratory assistants
- manufacturing technicians
- manufacturing assistants
- research assistants

¹⁰ Devitt, Elizabeth. “As lab-grown meat and dairy inch closer to U.S. market, industry wonders who will regulate?” August 23, 2016. Science Magazine. <http://www.sciencemag.org/news/2016/08/lab-grown-meat-inches-closer-us-market-industry-wonders-who-will-regulate>

¹¹ Frierman-Hunt, Gina and Julie Solberg. “Careers in biotechnology: A counselor’s guide to the best jobs in the United States.” Third edition. Sponsored by California Community Colleges Economic Development Program and Bio-Link, a National Science Foundation Advanced Technology Education Center. <http://www.ohlone.edu/instr/biotech/biotechcenter/docs/careersinbiotechnology-counselorsguidetobestjobsinus.pdf>

¹² “Food safety.” Biotech Careers. Accessed November 27, 2016. <http://www.biotech-careers.org/job-areas/food-safety>

¹³ “Rise in consumer awareness fuel the food safety testing market growth.” Press release issued February 18, 2016. Market Research Reports Search Engine. <http://www.sbwire.com/press-releases/food-safety-testing-market/release-666027.htm>

¹⁴ Frierman-Hunt, Gina and Julie Solberg. “Careers in biotechnology: A counselor’s guide to the best jobs in the United States.” Third edition. Sponsored by California Community Colleges Economic Development Program and Bio-Link, a National Science Foundation Advanced Technology Education Center. <http://www.ohlone.edu/instr/biotech/biotechcenter/docs/careersinbiotechnology-counselorsguidetobestjobsinus.pdf>

¹⁵ Ibid.

Regional Programs

The study identified 29 TOP codes related to food safety and biotechnology, which were translated into 13 Classification of Instructional Program (CIP) codes. The data by CIP code results are shown below. Awards include degrees and certificates.

Focusing strictly on food processing/science and biology/biotechnology programs, only one related program—Agricultural and Food Products Processing—was available to students. Offered by Bakersfield College, there were no completers. By comparison, Biology/Biological Sciences (General) was offered by seven community colleges with a total of 275 completers.

The analysis shows that nine South Central Valley community colleges offered programs related to food safety and biotechnology in 2014. Community colleges with the most awards conferred in related programs include: Reedley College, College of the Sequoias, Bakersfield College, Porterville College and Taft College. Appendix C contains a detailed list of all community college programs related to food safety and biotechnology offered in the South Central Valley, as well as the colleges offering the programs and the number of completions by college.

Exhibit 7a shows the identified programs and the total awards conferred for each program in the South Central Valley in 2014. No awards were conferred in agricultural and food products processing or chemical technology/technician—two programs closely related to food safety and biotechnology occupations. There were 33 awards conferred in agriculture (general), 37 awards in crop production and 21 in animal/livestock husbandry and production.

Exhibit 7a – Community college awards related to food safety and biotechnology

Educational Program	2014 Awards
Agricultural and Food Products Processing	0
Agriculture, General	33
Animal/Livestock Husbandry and Production	21
Biological and Physical Sciences	192
Biology/Biological Sciences, General	275
Chemical Technology/Technician	0
Chemistry, General	7
Crop Production	37
Geology/Earth Science, General	0
Health Services/Allied Health/Health Sciences, General	36
Mathematics, General	89
Physical Sciences	7
Physics, General	16
TOTAL	713

In order to gain a clear understanding of how the CIP coding in the above data correlates to community college TOP coding, completion data shown in Exhibit 7b were assembled and analyzed. After review of the Bakersfield College catalog, it appears that the college is using a dietetic services and management TOP code and title for its food safety program, which is not cross walked to any of the standard food safety occupations as outlined in Exhibit 2. This is a correct assertion based on the Taxonomy of Programs definition, which is as follows:

“* 1306.20 – Dietetic Services and Management Programs providing training in institutional food services and the management and supervision of such services, as Dietary Managers, Dietary Service Supervisors, and similar positions. Includes food services in schools, hospitals, nursing facilities, and other **noncommercial settings.”**

The Bakersfield College catalog also indicates that the college’s manufacturing program does not contain any food safety coursework. As a result, the study’s authors determined that the Bakersfield College numbers for these two programs would not typically be counted as contributing to food safety (manufacturing or production) occupations. Therefore, the numbers contained in this report as reflected from the propriety provider of the above data (EMSI) from Bakersfield college need to be subtracted from the supply total. This is also the case with Fresno City College and College of the Sequoias completions with the same TOP code and title as well those under TOP code 130600.

Exhibit 7b – Awards related to food safety and biotechnology by community college

TOP Code	TOP Title	College	Academic Year			3-Year Average
			2013-14	2014-15	2015-16	
010100	Agriculture Technology and Sciences, General	Porterville	5	5	8	6
		Reedley	13	10	3	9
		Sequoias	2	1		1
		West Hills Coalinga	13	19	4	12
		Subtotal	33	35	15	28
040100	Biology, General	Bakersfield	67	65	69	67
		Clovis			44	15
		Fresno City	30	35	60	42
		Reedley	149	143	124	139
		Sequoias	6	13	13	11
		Taft	23	24	17	21
		West Hills Lemoore	2	1	3	2
Subtotal	277	281	330	296		
130600	Nutrition, Foods, and Culinary Arts	Fresno City	1	3	1	2
		Subtotal	1	3	1	2
095600	Manufacturing and Industrial Technology	Bakersfield	2	1	2	2
		Cerro Coso	1			0
		Fresno City	28	41	23	31
		Porterville		25	1	9
		Subtotal	31	67	26	41
130620	Dietetic Services and Management	Bakersfield	2	6	7	5
		Fresno City	3	7	2	4
		Sequoias	1	2	1	1
		Subtotal	6	15	10	10
Total			348	401	382	377

A review of educational institutions in the South Central Valley revealed that the following four-year universities offer programs related to food safety and biotechnology: California State University, Fresno; California State University, Bakersfield; and one private university, Fresno Pacific University. Exhibit 7c provides 2014 data for these institutions, which altogether conferred 835 awards related to food safety and biotechnology. Focusing strictly on food processing/science and biology/biotechnology there were:

- 151 completions in three biology/biological sciences programs
- 11 completions in one food science program
- 8 completions in one biotechnology program

Exhibit 7c – Bachelor’s degrees related to food safety and biotechnology

Program	Academic Institutions	Awards 2014
Agriculture, General	CSU-Fresno	161
Animal Sciences, General	CSU-Fresno	5
Applied Mathematics, General	Fresno Pacific University	0
Applied Mathematics, Other	Fresno Pacific University	4
Biochemistry	CSU-Bakersfield	3
	CSU-Fresno	0
Biological and Biomedical Sciences, Other	CSU-Bakersfield	27
	CSU-Fresno	4
	Fresno Pacific University	6
Biological and Physical Sciences	CSU-Bakersfield	0
Biology/Biological Sciences, General	CSU-Bakersfield	50
	CSU-Fresno	98
	Fresno Pacific University	3
Biotechnology	CSU-Fresno	8
Chemistry, General	CSU-Bakersfield	39
	CSU-Fresno	63
	Fresno Pacific University	2
Environmental Biology	Fresno Pacific University	0
Food Science	CSU-Fresno	11
Geology/Earth Science, General	CSU-Bakersfield	16
	CSU-Fresno	11
Health Services/Allied Health/Health Sciences, General	CSU-Fresno	213
Mathematics, General	CSU-Bakersfield	24
	CSU-Fresno	52
Natural Sciences	CSU-Bakersfield	4
Physical Sciences	CSU-Fresno	11
Physics, General	CSU-Bakersfield	2
	CSU-Fresno	8
Viticulture and Enology	CSU-Fresno	4

Conclusion & Recommendations

Based on this study's occupational and program findings, it is suggested that colleges in the South Central Valley consider taking the following steps:

- Review the TOP codes and occupational titles included in this assessment to ensure that only those occupations with the most direct employment relevance to the curricula have been included.
- Based on the review of employer educational preferences and employment projections, food safety associate degree programs should focus on preparing students for agricultural food and science technicians and food scientists and technologists occupations.
- Biotechnology associate degree programs should focus on preparing students for medical and clinical laboratory technicians and technologists occupations.
- Although the occupation of inspectors, testers, sorters, samplers and weighers has the greatest job openings projections, this job offers an entry-level wage that falls below the region's living wage. In addition, this occupation only requires a high school diploma although 38% of these workers possess an associate degree or some college as their highest level of education. Colleges may want to work with employers to determine community college program relevance for this occupation.
- Community colleges may want to focus on developing programs and pathways that prepare students to enter technician occupations related to food safety and biotechnology. The entry-level wages for the four technician occupations identified by the study that require an associate degree exceed the region's living wage for one adult. These occupations are: agricultural and food science technicians; chemical technicians; life, physical and social science technicians; and medical and clinical laboratory technicians. (The occupation of inspectors, testers, sorters, samplers and weighers is the only occupation that falls below the average living wage for a single adult.)
- As curriculum is reviewed and updated or as new curriculum is developed, evaluate and consider the industry trends identified by the study, such as the inability of traditional methods to give instantaneous results for food safety and the expectation that rapid tests will take over the traditional methods by 2018.

Appendix A: Methodology, Data Sources, Key Terms and Concepts, and Implications for Analysis

Methodology

This report identifies occupations that are relevant to the California Community Colleges. Occupations can be identified using the federal Standard Occupational Classification (SOC) system, while related educational programs can be found using Taxonomy of Programs (TOP) codes. A TOP-SOC crosswalk can be used to identify education programs that are directly related to specific occupations.

Data Sources

Labor market and educational supply data compiled in this report derive from a variety of sources. Data were drawn from external sources, including the Economic Modeling Specialists, Inc., the California Community Colleges Chancellor’s Office Management Information Systems Data Mart and the National Center for Educational Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS). Below is the summary of the data sources found in this study.

Data Type	Source
Community College Awards	California Community College Chancellor’s Office Data Mart. The program awards module provides all credit degrees and certificates (from 6 to 60 semester units) that have been reported to the Chancellor’s Office: datamart.cccco.edu .
Labor Market Information	Economic Modeling Specialists, Intl. (EMSI). EMSI occupational employment data are based on final EMSI industry data and final EMSI staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level EMSI earnings by industry: economicmodeling.com .
Living Wage	A living wage calculator that estimates the cost of living in a specific community or region: livingwage.mit.edu .
Private Education Awards	National Center for Educational Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS). It includes all credit degrees and certificates (from less than one year to four years) that have been reported to IPEDS. Higher education institutions are required to report completion data to NCES if they participate in any federal financial assistance program authorized by Title IV of the Higher Education Act: nces.ed.gov/ipeds .
Typical Education Level and On-the-job Training	Bureau of Labor Statistics (BLS) uses a system to assign categories for entry-level education and typical on-the-job training to each occupation for which BLS publishes projections data: www.bls.gov/emp/ep_education_tech.htm .
Additional Education Requirements/ Employer Preferences	The O*NET Job Zone database includes over 900 occupations as well as information on skills, abilities, knowledges, work activities and interests associated with specific occupations: www.onetonline.org

Key Terms and Concepts

Annual Job Openings: Annual openings are calculated by dividing the number of years in the projection period by total job openings.

Education Attainment Level: The highest education attainment level of workers age 25 years or older.

Employment Estimate: The total number of workers currently employed.

Employment Projections: Projections of employment are calculated by a proprietary Economic Modeling Specialists, Intl. (EMSI) formula that includes historical employment and economic indicators along with national, state and local trends.

Living Wage: The cost of living in a specific community or region for one adult and no children. The cost increases with the addition of children.

Occupation: An occupation is a grouping of job titles that have a similar set of activities or tasks that employees perform.

Percent Change: Rate of growth or decline in the occupation for the projected period; this does not factor in replacement openings.

Replacements: Estimate of job openings resulting from workers retiring or otherwise permanently leaving an occupation. Workers entering an occupation often need training. These replacement needs, added to job openings due to growth, may be used to assess the minimum number of workers who will need to be trained for an occupation.

Total Job Openings (New + Replacements): Sum of projected growth (new jobs) and replacement needs. When an occupation is expected to lose jobs or retain the current employment level, number of openings will equal replacements.

Typical Education Requirement: represents the typical education level most workers need to enter an occupation.

Typical On-The-Job Training: indicates the typical on-the-job training needed to attain competency in the skills needed in the occupation.

Appendix B: Bureau of Labor Statistics Occupation Definitions and SOC Codes

Agricultural and Food Science Technicians (SOC:19-4011)

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

Chemical Technicians (SOC:19-4031)

Conduct chemical and physical laboratory tests to assist scientists in making qualitative and quantitative analyses of solids, liquids, and gaseous materials for research and development of new products or processes, quality control, maintenance of environmental standards, and other work involving experimental, theoretical, or practical application of chemistry and related sciences.

Life, Physical, and Social Science Technicians, All Other (SOC:19-4099)*

All life, physical, and social science technicians not listed separately.

*For further detail on all other occupations please visit www.onetonline.org/

Medical and Clinical Laboratory Technologists (SOC:29-2011)

Perform complex medical laboratory tests for diagnosis, treatment, and prevention of disease. May train or supervise staff.

Medical and Clinical Laboratory Technicians (SOC:29-2012)

Perform routine medical laboratory tests for the diagnosis, treatment, and prevention of disease. May work under the supervision of a medical technologist.

Medical Equipment Repairers (SOC:49-9062)

Test, adjust, or repair biomedical or electromedical equipment.

Inspectors, Testers, Sorters, Samplers, and Weighers (SOC:51-9061)

Inspect, test, sort, sample, or weigh nonagricultural raw materials or processed, machined, fabricated, or assembled parts or products for defects, wear, and deviations from specifications. May use precision measuring instruments and complex test equipment.

Agricultural Inspectors (SOC:45-2011)

Inspect agricultural commodities, processing equipment, and facilities, and fish and logging operations, to ensure compliance with regulations and laws governing health, quality, and safety.

Compliance Officers (SOC:13-1041)*

Examine, evaluate, and investigate eligibility for or conformity with laws and regulations governing contract compliance of licenses and permits, and perform other compliance and enforcement inspection and analysis activities not classified elsewhere.

*For further detail on all other occupations please visit www.onetonline.org/

Biological Technicians (SOC:19-4021)

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

Biological Scientists, All Other (SOC:19-1029)

All biological scientists not listed separately.

Natural Science Managers (SOC:11-9121)

Plan, direct, or coordinate activities in such fields as life sciences, physical sciences, mathematics, statistics, and research and development in these fields.

Life Scientists, All Other (SOC:19-1099)

All life scientists not listed separately

Appendix C: Award Completions by Community College and Program

Program	Community College	Awards 2014
Agricultural and Food Products Processing	Bakersfield College	0
	College of the Sequoias	2
Agriculture, General	Porterville College	5
	Reedley College	13
	West Hills College-Coalinga	13
	Bakersfield College	12
Animal/Livestock Husbandry and Production	College of the Sequoias	7
	Reedley College	2
	West Hills College-Coalinga	0
	Cerro Coso Community College	12
Biological and Physical Sciences	College of the Sequoias	30
	Fresno City College	31
	Porterville College	54
	Taft College	25
	West Hills College-Coalinga	15
	West Hills College-Lemoore	25
	Bakersfield College	67
Biology/Biological Sciences, General	College of the Sequoias	6
	Fresno City College	30
	Reedley College	147
	Taft College	23
	West Hills College-Coalinga	0
	West Hills College-Lemoore	2
	Cerro Coso Community College	0
Chemical Technology/Technician	Bakersfield College	2
	College of the Sequoias	5
	West Hills College-Lemoore	0
Chemistry, General	Bakersfield College	8
	College of the Sequoias	3
	Reedley College	26
Geology/Earth Science, General	West Hills College-Lemoore	0
Health Services/Allied Health/Health Sciences, General	Fresno City College	0
	Taft College	36
Mathematics, General	Bakersfield College	9
	Cerro Coso Community College	2
	College of the Sequoias	11
	Fresno City College	11
	Porterville College	4
	Reedley College	46
	Taft College	4
	West Hills College-Coalinga	0
West Hills College-Lemoore	2	

Program	Community College	Awards 2014
Physical Sciences	College of the Sequoias	0
	Fresno City College	1
	Reedley College	2
	Taft College	4
Physics, General	Bakersfield College	1
	College of the Sequoias	9
	Reedley College	5
	West Hills College-Lemoore	1