

CTE: THE KEY TO ECONOMIC DEVELOPMENT

Biosciences:



Focus on the study of living organisms and developing related processes, products and services that improve lives

Pay **more than twice** the average U.S. wage¹

Generated national revenues of **\$100 billion** in 2010, from industrial biotechnology²

What is the pathway to these fulfilling and essential careers?

Career and Technical Education!



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Biosciences

Advancing innovation, the bioscience sector:

- includes agricultural chemicals and feedstock; drugs and pharmaceuticals; medical devices and equipment; research, testing and medical laboratories; and bioscience-related distribution³
- is considered an emerging industry in many states
- needs highly skilled employees

What jobs are available in biosciences?

In recent years, workers in the biosciences have been needed to develop vaccines, increase crop yields and make advances in biofuels, among other innovations. Over the past decade, the bioscience industry in the U.S. grew by about 110,000 jobs, or more than 7.4 percent, in comparison to a 1-percent increase in employment in all private sector industries.⁴ Jobs for biochemists and biophysicists are expected to grow by 19 percent through 2022, faster than the U.S. average of 11 percent, while pharmaceutical and medical manufacturing is driving demand for biological technicians.⁵ The demand for forensic science technicians will grow by 20 percent through 2018, and there will be greater opportunities for food scientists and technologists owing to efforts to improve the food supply and food safety.⁶

Annual earnings for those employed in the biosciences averaged more than \$88,000 in 2012, well above the national average.⁷ Those employed working with agricultural feedstock and chemicals or medical devices and equipment made more than \$75,000, while earnings were more than \$100,000 in the drugs and pharmaceuticals sub-sector.⁸

Most jobs in the biosciences require some postsecondary education. Occupations in this sector require academic, technical and employability skills, not only for research, development and manufacturing but also in bioinformatics; law and regulatory affairs; quality control and sales; marketing and business management; and more. In addition, a number of jobs in other industries make use of bioscience products and processes. Here is just a small sampling of bioscience occupations:

- pharmaceutical sales representatives
- agricultural and food science technicians
- market research analysts
- biomedical engineers
- forensic science technicians
- medical equipment wholesalers
- first-line supervisors for medical instrument manufacturing
- bioinformatic scientists

How does CTE prepare the bioscience workforce?

Career and technical education prepares high school, postsecondary and adult students for careers in the biosciences through:



Endnotes

1. Battelle and BIO—Biotechnology Industry Organization. (2014). *Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014*. Columbus, OH: Battelle.
2. The White House. (2012). *National Bioeconomy Blueprint*. Washington, DC: The White House.
3. Battelle and BIO—Biotechnology Industry Organization. (2014). *Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014*. Columbus, OH: Battelle.
4. Ibid.
5. U.S. Bureau of Labor Statistics. (2014). *Occupational Outlook Handbook, 2014-15 Education*. Retrieved from <http://www.bls.gov/ooh/life-physical-and-social-science/biochemists-and-biophysicists.htm>; Carnevale, A. P., Smith, N., Stone III, J. R., Kotamraju, P., Steuernagel, B., & Green, K. A. (2011). *Career Clusters: Forecasting Demand for High School Through College Jobs*. Washington, DC: Georgetown University Center on Education and the Workforce.
6. Carnevale, A. P., Smith, N., Stone III, J. R., Kotamraju, P., Steuernagel, B., & Green, K. A. (2011). *Career Clusters: Forecasting Demand for High School Through College Jobs*. Washington, DC: Georgetown University Center on Education and the Workforce.
7. Battelle and BIO—Biotechnology Industry Organization. (2014). *Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014*. Columbus, OH: Battelle.
8. Ibid.
9. DuPont Industrial Biosciences. (n.d.). *Internships at DuPont Industrial Biosciences*. Retrieved from <http://biosciences.dupont.com/careers/internships>; DuPont Pioneer. (n.d.). *Internships*. Retrieved from <https://www.pioneer.com/home/site/about/careers/student-center/internships>.
10. HOSA—Future Health Professionals. (n.d.). *HOSA Handbook Section B*. Retrieved from <http://hosa.org/node/117>.
11. Gwinnett Technical College. (2013). *Gwinnett Tech & Southern Polytechnic State University Partner on Bioscience Education: GTC Graduates Now Have 'Seamless Transition' to SPSU*. Retrieved from <http://www.gwinnettech.edu/content.cfm?PageCode=news&PressReleaseID=585>.
12. Powers, C. (2013). "A Vision of the Future." *Legacy*, Winter 2013. Ardmore, OK: The Samuel Roberts Noble Foundation; additional information provided by SOTC faculty.
13. MassBay Community College. (n.d.). *Biotechnology Department at MassBay*. Retrieved from <http://www.massbay.edu/Academics/Science,-Technology,-Mathematics-and-Engineering/Biotechnology-Program/Biotech-Programs.aspx>; O'Connell, S. (2013). "MassBay Biotech student wins Goldwater Scholarship." *MetroWest Daily News*, April 17, 2013; additional information provided by MassBay faculty.

- the national Career Clusters Framework—including Career Clusters and pathways in STEM; health science; agriculture, food and natural resources; manufacturing; and business management and administration—which outlines course progressions that help students explore career options and prepare for college and career success
- CTE courses in biotechnology, pharmacology, biomedical innovation, agricultural biotechnology and biotechnical engineering, as well as Project Lead the Way's biomedical science curriculum, integrated with rigorous academics
- work-based learning experiences, such as opportunities for interns at DuPont Industrial Biosciences and DuPont Pioneer, a developer and supplier of advanced plant genetics⁹
- career and technical student organization enrichment experiences, such as HOSA—Future Health Professionals industry-based competitions in biotechnology and other health, medical and emergency preparedness topics¹⁰
- opportunities to earn stackable industry-recognized certifications, postsecondary certificates and degrees, such as Gwinnett Technical College's associate degree in bioscience technology, which seamlessly transfers to a Bachelor of Applied Science in biotechnology at Southern Polytechnic State University¹¹

What are promising programs in biosciences?

The award-winning **Biotechnology Academy at Southern Oklahoma Technology Center** in Ardmore offers a rigorous and relevant curriculum for juniors and seniors in high school. Focusing on medical, agricultural, industrial and environmental disciplines, the academy teaches theory and brings it to life in its 4,000-square-foot laboratory and classroom space, preparing students for bioscience degree programs or for the biotechnology workforce. First-year students study the fundamentals, learn technical laboratory skills and regularly visit the nearby campus of the Noble Foundation, which conducts plant science research, for tours and hands-on workshops. Second-year students participate in capstone internships, working on projects with researchers at the Noble Foundation and the Oklahoma State University Institute for Agricultural Biosciences. Students have the opportunity to extend these projects into summer internships and earn college credit. ACT composite and science scores have increased since the academy was founded, and the vast majority of students go on to postsecondary education in STEM-related majors.¹²

Massachusetts Bay Community College is home to one of the nation's most celebrated undergraduate science programs, combining relevant, hands-on instruction with internship experiences, leading to associate degrees in biotechnology, forensic DNA and marine biotechnology. The MassBay Biotechnology Department provides students with opportunities to participate in real-world research projects such as exploring the genetic basis of prostate and breast cancer, investigating actual criminal and anthropological forensic DNA cases and studying the ecological impact of an active volcano. Designed specifically for nontraditional students, the program has produced 20 recipients of the Barry M. Goldwater Scholarship, the nation's highest undergraduate science award, including a number of Goldwater Scholars who were single mothers or had dropped out of high school. Students intern at prestigious research institutions, including Boston University, Genocera Biosciences, XTAL BioStructures, MIT and Brandeis University. The program enjoys a 100 percent job placement rate with employers such as Genzyme, Abbott, Organogenesis, SBH Sciences, Shire Pharmaceutical and Biogen Idec, while about 50 percent of students pursue advanced science degrees through articulated partnerships and bridge programs with institutions worldwide.¹³



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