

THE 2014 COMMUNITY COLLEGE PROGRAM@BIO REPORT

SEPTEMBER 2014

BIOMANUFACTURING CAREER OPPORTUNITIES ABOUND

Biotechnician careers provide opportunities for individuals to do well financially and to do good by helping with the development of innovative products.

Biotechnology innovations consistently produce jobs and other economic activity in the regions where biomanufacturing, pharmaceutical, medical device, and ag-bioscience businesses are clustered, according to *Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014*.

Biotechnology uses organisms and biology-based processes to create products.

“These are really good paying jobs,” Peter M. Pellerito said at the Community College Program at BIO (CCP@BIO) in San Diego, California on June 23, 2014. Pellerito is the senior advisor for Economic Development and University/College Relations for the Biotechnology Industry Organization (BIO).

The average annual salary of bioscience workers was \$88,202 in 2012, according to the *Battelle/BIO State Bioscience Jobs, Investments and Innovation 2014* report released at the 2014 BIO International Convention.

Employment is growing in the industry that BIO divides into four sectors: agricultural feedstock and chemicals; drugs and pharmaceuticals; medical devices and equipment; and research, testing, and medical laboratories. Although bioscience experienced some employment cuts following the recession, Battelle researchers found that these were fewer than what other private sector industries endured.

Pellerito predicts that the further convergence of bioscience with digital health innovations and discoveries in other fields will provide new opportunities for graduates of community college biomanufacturing and biotechnology programs to make positive impacts through their work.

Aside from the opportunity to be involved in medical improvements, biotechnicians contribute to society by assisting with the development of green bioproducts, alternative fuels, and food cultivation innovations.

NBC2 BIOMANUFACTURING CURRICULUM LINES UP WITH INDUSTRY TRENDS

Demand remains strong for individuals with knowledge of science who possess a combination of multidisciplinary academic and training experiences, according to the Coalition of State Bioscience Institutes (CSBI).

Many of the top 10 skills listed in life sciences job postings nationally are emphasized in the biomanufacturing curricula from the Northeast Biomanufacturing Center and Collaborative (NBC2). This indicates that technicians who graduate from community colleges that use NBC2's curriculum have the skills that industry wants.

The 2014 *Life Sciences Workforce Trends Report* summarized at CCP@BIO by Lori Lindburg, CSBI chairman emeritus, is based on interviews with 100 bioscience employers and on an analysis of national job listings by Burning Glass Technologies.

CSBI's recommendations to meet future workforce demands are already in place in many NBC2-affiliated programs. These include utilization of

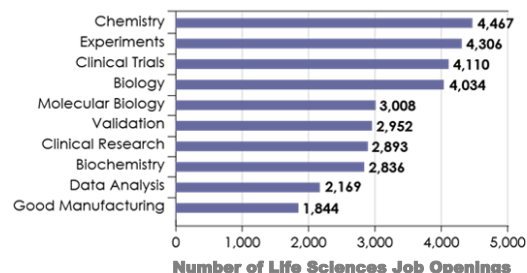
- innovative industry-academic partnerships;
- interdisciplinary approaches to learning;
- professional development that informs educators about industry needs;
- experiential learning opportunities that allow students to learn by doing; and
- courses that have students work in teams and across institutions and disciplines.

“The Biotechnology Industry Organization clearly understands the value of the higher education community to our future. Because you can have all the great equipment you want; you can have all the great legislation you want; you can have all that intellectual property you want, but if you don’t have the people to drive all of that forward, it’s a waste of resources. And you all are the ones—you are the gasoline for that. You make all that work. And the more you do to prepare minds, young and older minds, to be available in the workplace for our industry, we all share in that opportunity and we’re all partners.”

Peter M. Pellerito

senior advisor for Economic Development and University-College Relations
Biotechnology Industry Organization (BIO)

Academic Proficiencies and Skills Most Frequently Listed in Life Sciences Job Openings



These in-demand proficiencies and skills are among those emphasized in NBC2's biomanufacturing curriculum for technician education.

Source: Burning Glass Technologies

POTENTIAL OF BIOTECH CAREER HELPS WOMAN LIFT FAMILY OUT OF ABUSE



Knowing that she could support her children with a career in biotechnology helped Tracy Ludwick Naputi extricate herself from an abusive marriage.

"I used every negative aspect of my life as a thing to motivate me instead of to bring me down. I used it to be my drive to do better," she explained.

Naputi credits the resumé writing and interviewing skills she learned along with the top-notch biotech laboratory skills taught in the applied biotechnology certificate program at San Diego Miramar College in San Diego, California, and the biofuels certificate program at Mira Costa College in Oceanside, California, as the critical factors for being hired as a lab assistant at INOVA Diagnostics in 2012.

She earned two promotions in two years and by 2014 was a Chemist I, a post typically held by an experienced bachelor's degree holder.

A child immigrant from Micronesia, Naputi's plans to become a nurse were derailed by a youthful marriage to a drug dealer.

While her husband was incarcerated, Naputi started a biotech certificate at Miramar College. Upon his release, the family moved three hours from the college. Five years later, when her husband became physically abusive, she left him and took her five children back to San Diego.

Inspired by Miramar Professor Sandra Slivka's passion for biotechnology, Naputi re-enrolled. "She coached me to step out of my comfort zone, which I've had to [do] many times during the duration of the program," Naputi said.

After earning a biotech certificate at Miramar in 2010, Naputi enrolled in the EDGE Biomass Production Certificate program at Mira Costa College.

Thanks to the skills she learned in these two programs Naputi's search for full-time work was short. The second biotech company where she interviewed, INOVA Diagnostics, hired her.

VETERAN RECOMMENDS BIOTECH PROGRAM TO OTHERS WITH MILITARY EXPERIENCE



Daniel Pedry had already completed two tours in the U.S. Marine Corps when he enrolled at Mira Costa College in Oceanside, California. Initially a kinesiology major, he switched to the associate's degree program in biotechnology research and development after attending Mira Costa's Biotechnology Speaker Series.

Pedry excelled in the biotech program. In 2012 he got a three-month internship doing research on cellular metabolic pathways as part of the Research Experience for Undergraduates at University of California, San Diego. Later that same year, Pedry was selected

for a yearlong California Institute for Regenerative Medicine internship at the University of California, San Diego, where he contributed to research on hepatocyte differentiation.

He is now a contract employee at Genentech's Oceanside facility. He likes the hands-on activity of the downstream purification processes for manufacturing pharmaceuticals. He creates buffer preparations, does chromatography, executes formulations, and cleans lab equipment.

"I really enjoy what I'm doing here now, and I wouldn't be here if it wasn't for community college. It was kind of a long road. It's tough when you're not sure what you want to do... Fortunately community college gives you a lot of opportunities," Pedry said.

ENGLISH LIT MAJOR USES WRITING SKILLS IN BIOTECH CAREER



Cali Nguyen's meandering career path has combined her lifelong interests in science and writing.

In high school she participated in two science internships. While working on her bachelor's degree in English literature, she performed so well in the two biotechnology courses she took at Contra Costa College in San Pablo, Califor-

nia, that she landed a job as a part-time lab technician.

Because Nguyen enjoyed the work and wanted to advance, she enrolled in Pasadena City College (PCC) in Pasadena, California, and earned certificates in stem cell culture and computational biology.

The bench skills and record-keeping emphasized at PCC, along with her work experience, have helped her get job offers everywhere she has interviewed.

While employed at Oak Crest Institute of Science she melded her biotechnology training with her strong background in English literature to help write research reports. Seven of the articles she co-authored with colleagues have been published. She currently works as a cell culture technician at two companies: CohBar Inc. and BCN Biosciences.

"For me biotech is like art or the space program. It's the kind of work that moves society forward. In my work I'm making a difference by helping to slow the progress of and protect against cancer, Alzheimer's [Disease], and diabetes for our future," she said.

NON-TRADITIONAL STUDENT LANDS JOB IN REGENERATIVE MEDICINE LAB

Kristina Stumpf's stellar performance in the biotechnology program at Forsyth Technical Community College (Forsyth Tech) meant that by the time she completed her associate's degree she had a job in the lab at the Wake Forest Institute for Regenerative Medicine.

The fact that her two attempts at college had been separated by nearly two decades, several jobs, and parenthood, made her "a very proud graduate" in 2014.

Financial constraints interfered when she started college right out of high school in 1992.

In 2011 when she enrolled at Forsyth Tech, where the National Center for the Biotechnology Workforce is located in Winston-Salem, North Carolina, it was with the support and encourage-

ment of her husband. But this second enrollment was nearly thwarted by academic challenges. Her first course was organic chemistry and her initial grades were Fs.

Instead of giving up, Stumpf hired a tutor and went to Professor Deborah Pritchard's early morning office hours to go over material she did not understand. She finished the course with an A. Her diligence in other courses yielded Stumpf an internship in the Institute for Regenerative Medicine at Wake Forest University in Winston-Salem, North Carolina.

She performed so well during the internship, the university hired her in July 2013 even before she had her associate's degree.



WOMAN PURSUES INTEREST IN CANCER RESEARCH WITH BIOTECH CAREER

Maria E. Rodriguez-Aguirre's first career in nursing was motivated by her step-father's cancer diagnosis. When a back injury forced her to change careers, she went to Southwestern College in Chula Vista, California, to find out more about its then-new biotechnology program.

A three-hour conversation with Professor Nouna Bakhiet, the biotechnology program director, got her excited about becoming a technician at a laboratory doing cancer research. "It totally changed the way I looked at everything. Now I can understand cancer. Now I can go back and study it," she explained.

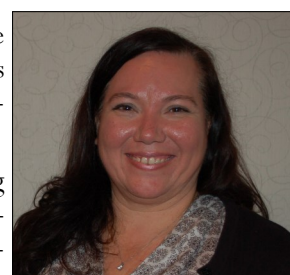
During an internship at the Salk Institute, she earned a place as the second author of an article published in *Science*.

Since completing her associate's degree in biotechnology from

Southwestern in 2001, two of the three biotechnology companies where she has worked have been involved in developing cancer treatments.

In the past five years, while working full time at Tocagen Inc., Rodriguez-Aguirre has received numerous academic awards on the way to earning her bachelor's and master's degrees from National University.

Now a Research Associate II-Cancer Biology at Tocagen, Rodriguez-Aguirre is working on a colorectal cancer project of her own design. "My education that started back at Southwestern has led me up to this opportunity," she said.



FRIENDS' SUGGESTION LEADS STUDENT TO BIOMANUFACTURING

Because he worked full time and was indecisive about his career goals, Paul Earnshaw had a winding path to biomanufacturing.

"I was definitely not the poster boy. I was in college for seven-and-a-half years. I worked full time through school, and it took me that long to decide what I wanted to do, let alone get into UC Davis [the University of California, Davis]," he explained.

Earnshaw spent more than three years in the mid-1990s at Solano Community College in Fairfield, California. At the time the college did not have a biotech program. "I kind of got there and I wasn't sure what I wanted to do," Earnshaw said. He eventually decided to major in exercise physiology and took numerous science courses.

Earnshaw was one course short of earning an associate's degree when he transferred to UC Davis, where he completed his bachelor's degree in 1999. He was planning to be a physical therapist, however, he found he disliked the work when he got a part-time job at a physical therapy clinic.

College friends who were working at Genentech suggested he

apply for a job at the biotech company's facility in Vacaville, California. At that time Earnshaw's science degree qualified him for a technician job.

Biomanufacturing clicked with Earnshaw; the work at the biotechnology manufacturing plant known for large-scale production of pharmaceutical proteins thoroughly engaged him.

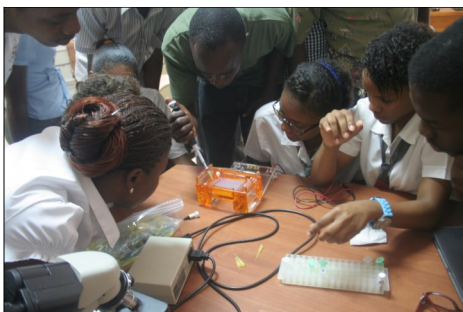
During his fifth year at the company, Earnshaw began to use Genentech's tuition reimbursement program to earn his master's degree in business administration at California State University-Sacramento.

With his MBA's focus on marketing, Earnshaw now works as a bioprocess specialist. Earnshaw likes this aspect of biotechnology, although it is not the science career he originally anticipated.

"I was very fortunate getting my science background at Solano," he said.



BIO-LINK FACILITATES HAITI BIOSCIENCE INITIATIVE



The Haitian Bioscience Initiative uses Bio-Link curricula and connections to teach basic laboratory skills to students in Haiti with food and water safety as the context for lessons.

Jim DeKloe, director of the industrial biotechnology program at Solano Community College in Fairfield, California, served as a curriculum advisor and instructor for the May 2014 pilot project.

DeKloe was connected to Ilio Durandi, his co-teacher for the pilot project and the founder of the Haiti 2015 community empowerment campaign, by Phil Gibson, director of Georgia Bioscience Training Center. Gibson and DeKloe met at a Bio-Link Summer Fellows Forum. Afterward Gibson asked DeKloe to assist with Haiti 2015's effort to use bioscience education for economic development.

The Haiti Bioscience Initiative curricula utilizes aspects of Bio-Link's Bridge to Biotech program to give recent high school graduates and post-baccalaureate adults experience using microscopes and molecular models. During his presentation at the 2014 CCP@BIO meeting, DeKloe reported that the shortage of wet chemistry lab facilities is one of the challenges the initiative hopes to overcome to help Haiti's bright and eager students sharpen their bioscience skills.

MEETINGS WITH EMPLOYERS SHAPE BIOMEDICAL TECHNICIAN PROGRAM

Giovanna Taylor quickly built industry support for a new biomedical engineering technician program at St. Petersburg College by meeting face-to-face with employers.

Just a few in-person meetings opened doors throughout Florida's medical device industry, which is the second largest medical device industry cluster in the U.S.



Taylor joined the St. Petersburg, Florida, college in 2013 to direct the development of the biomedical technology and medical device program. St. Petersburg College is part of the medical devices hub for the Community College Consortium for Bioscience Credentials (c3bc), a collaboration funded by a U.S. Department of Labor Trade Adjustment Assistance Community College and Career Training grant.

To figure out what the college's new curriculum should be, Taylor called and made appointments with several industry people suggested by faculty colleagues who are involved in the college's Medical Quality Systems certificate, which was developed with an National Science Foundation Advanced Technological Education grant.

In an interview after her CCP@BIO presentation, Taylor explained that during her initial meetings with manufacturing operations directors and the clinical engineering director of the local hospital system, she told them about the program's goals, toured their facilities, and gathered information on their unmet needs for biomedical technicians.

She then designed a Biomedical Engineering certificate to stack with other credits for an associate's degree, and she aligned the curriculum with three national industry certifications.

FORSYTH TECH PRESIDENT SEES MORE OPPORTUNITY FOR BIOTECH

"Future jobs are at the intersection of biotech and other fields," says Gary Green, president of Forsyth Technical Community College. He cites the growth of information technology in bio-informatics and personalized medicine as one example of this convergence.

His college is responding to this trend by developing programs that prepare technicians to work at the convergence of biotechnology and nanotechnology in fields ranging from industrial design to human tissue research.

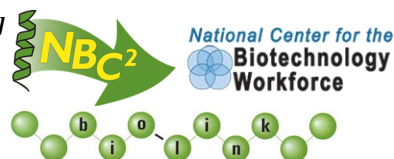
"There are more opportunities today than there have ever been. We have in the future opportunities to create products and, ultimately, to create jobs we haven't even envisioned yet," he said during a keynote address at CCP@BIO.

CCP@BIO is organized by three biotechnology workforce development groups: The Northeast Biomanufacturing Center and Collaborative (NBC2), Bio-Link, and the National Center for the Biotechnology Workforce. For more information, visit

www.biomanufacturing.org

www.bio-link.org

www.biotechworkforce.org



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Text by Madeline Patton

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