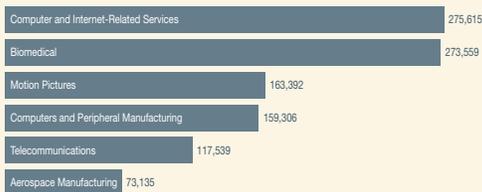


Life Sciences: Putting California to Work

California Biomedical Industry 2010 Report

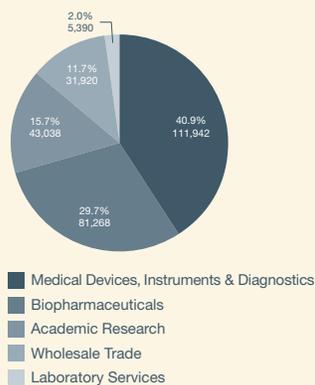
Employment in California's Life Sciences Industry

Figure 1: California Biomedical vs. Other High-Tech Employment (2008)



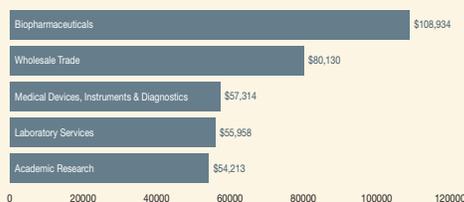
Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages and Company Specific SEC filings.

Figure 2: California Biomedical Employment by Sector (2008)



Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages and Company Specific SEC filings.

Figure 3: California Biomedical Average Wages by Sector (2008)



Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages and Company Specific SEC filings.

California's biomedical industry has been a powerful engine of economic growth for the Golden State for nearly 30 years. As the following data show, California has built a workforce and industry that is vital to the state's economy—and to the country's continued leadership in scientific, engineering and medical innovation. Moreover, the partnerships and technology transfer agreements among California's biomedical companies and academic centers continue to nurture excellence in education here and innovations that are improving health, healthcare and quality of life the world over.

Taking the Industry's Measure

Jobs California is known for its high-tech industries. Two of these, biomedical and computer programming, employ the most people. Each industry employed roughly 274,000 people in the Golden State in 2008 (Figure 1)—the most recent year for which complete data are available.

Of those employed in the biomedical industry (Figure 2), the medical devices, instruments and diagnostics sectors accounted for approximately 112,000, or about 41 percent of the overall total. Biopharmaceutical companies employed the next-largest segment with nearly 81,000 or about 30 percent. The state's academic research centers employed about 43,000 people in life sciences positions for approximately 16 percent of the total. Wholesale trade accounted for over 32,000 personnel or about 12 percent of the state's biomedical employees. The laboratory services sector rounded out the overall industry with approximately 5,400 employees or about 2 percent.

The biomedical industry in California also has been a steadily growing segment of the employment picture. Between 2004 and 2008, the industry added approximately 24,000 jobs. Over the same time period, every biomedical segment except laboratory services increased its overall employment levels. Growth rates varied among the biomedical industry sectors, however. Biopharmaceutical employment expanded at an average annual rate of 3.14 percent, while laboratory services grew at a slower pace of less than 1 percent.

Wages In 2008, California biomedical industry employees earned a total of \$20.5 billion. For the year, the average annual wage for the industry across the state was nearly \$75,000.

The averages continue to vary among the industry's sectors (Figure 3). Biopharmaceutical companies pay the highest average annual wages, with 2008's mark reaching approximately \$109,000. Wholesale trade came in second with average annual wages of about \$80,000. Academic research, laboratory services and medical device organizations paid salaries in the mid-\$50,000 range. The variances in compensation are attributable in part to differences in required education and training and in the commercial success of the various sectors.

Figure 4. CHI-PwC Survey: Rate the following areas of the adequacy of California's emerging workforce:

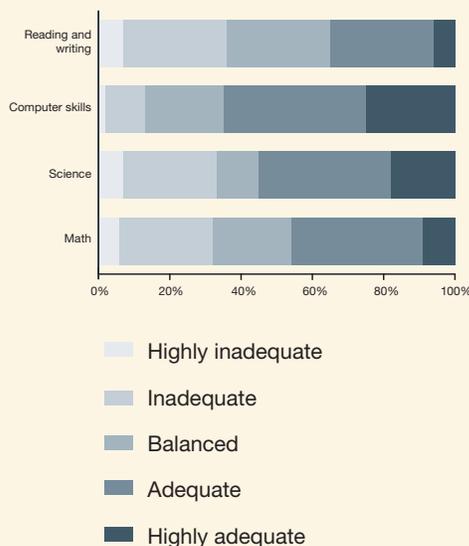
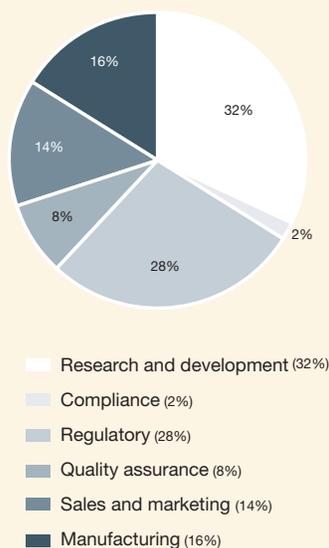


Figure 5. CHI-PwC Survey: The workforce in California is least prepared to work in these capacities:



PERSPECTIVES



Gail Naughton, Ph.D.
Dean of the College of Business Administration,
San Diego State University

and universities. We also need programs that get teachers involved in cutting-edge science so that it becomes more exciting and less daunting.

On California's educational system and its ability to produce the biomedical workforce of tomorrow:

For K through 12, it's critical that we do more to excite students about math and science at a very early age. Project Lead the Way is a national, nonprofit organization that offers middle and high school students the knowledge they need to succeed in high-tech fields. Student participants and their teachers spend a summer at university campuses learning fun things about engineering. They create projects, conduct experiments and learn engineering basics to ignite their interest in science and engineering careers. The program also offers teachers a greater practical knowledge of science, which they can then take to their classrooms. California needs additional general sciences programs to offer hands-on experience, to inspire middle and high school students to participate in junior internships, and to encourage them to explore science programs at colleges

On gaps in the educational system and how to improve the system:

Administrators of California's public school system should examine the entire curriculum at the school level, which offers very few mandatory programs in math and science. When California's public school system is compared with those in Massachusetts and North Carolina—systems that have become truly cutting edge—I believe they are better at cultivating their own talent. I also believe lab time for students is insufficient. We should truly engage students in what can be an exciting career for them—one with solid salaries, upward mobility and the opportunity to make a significant impact in people's everyday lives.

Even elementary students should learn very basic science so that they can embrace new technologies as they become adults. Also, I'm not aware of any current funding that supports mentoring programs for middle and high schools to bring in scientists and engineers—representing diverse cultures and backgrounds—to talk about their careers. We also need to make a concerted effort to allow students to meet with mentors who look like them. Whether they're women or Hispanics or African Americans, it makes such a difference for a 10-year-old child to say, "Wow, this person looks like me." It is a relatively low-cost alternative that would have a tremendous impact.

On California State University (CSU) programs that help train a workforce to meet industry demands:

At CSU, we developed four professional science master's (PSM) degree programs. These programs concentrate on biotechnology, bioinformatics and biostatistics. The impetus to create the programs was in response to industry's resounding cry that academia does not provide enough graduates who can hit the ground running and bring immediate value. An online Master's of Science program in regulatory affairs is taught by regulatory professionals and teaches students to take a product from concept to FDA approval, including foreign regulatory approval. Industry professionals also teach our quality control program, which focuses on the processes involved in developing a company's standard operating procedures, such as bringing a product from early-stage clinical trials to product approval, and all of the extensive training and statistical analysis that must take place for successful results.

Faces of California Biomed



MARTHA A. ORNELAS
B.S., Biopharmaceutical Chemistry,
M.S., Synthetic Chemistry,
Autonomous University of Baja California
Chemist for Pfizer Inc., La Jolla, CA

Ornelas joined Pfizer as a temporary employee eight years ago...and knew within six months that it was the perfect job for her. "The everyday challenges were and still are a constant stimulation for continuous learning and improvement," she said. "What I like most about Pfizer is that I continue to learn a great deal from my co-workers...Here, teamwork is taken seriously."



SHIVA MALEK, Ph.D.
B.S., Biochemistry, University of California, Los Angeles
M.S., Chemistry, University of California, Irvine
Ph.D., Biochemistry, University of California, San Diego
Scientist at Genentech, South San Francisco, CA

Malek focuses on small-molecule oncology products and says she finds great personal satisfaction in working to advance therapies in areas like cancer where present treatments are inadequate. "Most of us who work in biotech really take our work personally," she said. "Helping patients and expanding science and medical knowledge are big components of why people pursue careers in the biomedical industry."



ANGUS SINCLAIR, Ph.D.
B.S., Molecular Biology,
The University of Edinburgh
Ph.D., Hematology, National
Institute for Medical Research/
University College London
Principal Scientist for Amgen, Thousand Oaks, CA

Sinclair joined Amgen after working eight years in academic research and said that he especially enjoys the multifunctional teams of highly motivated and qualified people with whom he now works. "In conducting basic research in academia," he said, "you're often working as a sole scientist on projects that you hope would one day benefit patients and would help others better understand disease...Here, we are doing groundbreaking research that leads to products that are helping real people in real time."

PERSPECTIVES



Regis B. Kelly, Ph.D.
Director of the California
Institute for Quantitative
Biosciences (QB3)

On problems science and engineering students confront in pursuing biotechnology careers:

Our major problem is that many young people work toward careers in the biological sciences, but very few are entering the physical sciences. It is difficult for them to decide to work in biomedical research because many view it as a risky career—one that is not well defined.

To solve this conundrum, the California Institute for Quantitative Biosciences (QB3), a cooperative among three UC campuses and private industry, tries to move us away from “reverse engineering.” Our mantra is to make biology an engineering science so that it is predictable, exact and scientists can engineer life-forms that actually do what they intend them to do. Relatively few scientists are familiar with or have expertise in the engineering field, so it is difficult to attract engineers to quantitative biology.

On whether California’s educational system offers students the resources necessary to produce the biomedical workforce of tomorrow:

Currently, science in K through 12 is taught like history—out of books—when it should be taught more like carpentry, as an apprenticeship. Students who never have the opportunity to perform hands-on experiments fail to truly learn and get excited about science. People who are interested in science should have access to advanced scientific equipment. That is missing right now—the opportunity to experience the thrill of conducting an experiment and seeing a result. Of course, we also need to better compensate and train mathematics and science teachers, but insufficient hands-on scientific education is the primary problem. Like K through 12, California’s university students would also benefit from increased hands-on training, particularly with state-of-the-art scientific equipment. Such training would provide greater real-world experience and create a better-trained workforce for a career path in biotechnology. Additionally, the state’s higher education system needs improved video-conferencing facilities, which, in QB3’s case, would facilitate the combined strengths of all three campuses and improve the quality of the learning experience. Making lectures available online is also essential; a revolution in the way lectures are taught is coming, and we want to stay ahead of the game.

Industry-Supported Programs to Improve STEM Education and Diversity

A number of organizations throughout the United States are working together to excite young people about science, technology, engineering and mathematics (STEM) education opportunities—and the careers for which that training could prepare them. Recognizing that future growth, success and products depend on STEM programs today, California’s biomedical companies are committed to supporting and developing learning opportunities for the Golden State’s students. Among such programs are:

- Alliance/Merck Ciencia Hispanic Scholars Program
- Amgen American Society of Hematology Annual High School Symposium
- Amgen Award for Science Teaching Excellence
- Amgen Bruce Wallace Biotechnology Laboratory Program
- Amgen Scholars
- Bay Area Biotechnology Education Consortium
- Bayer’s Making Science Make Sense
- Biogen Idec Community Lab
- Biological Sciences Curriculum Study
- Biotech Partners
- California Academy of Math & Science
- California State University, East Bay MESA Center
- Cedars-Sinai Youth Employment and Development Program
- Chabot Space & Science Center
- Citizen Schools
- Discovery Science Center
- Edwards Lifesciences Fund
- Elementary Institute of Science
- Eugene and Ruth Roberts Summer Student Academy
- Genentech Foundation
- Genentech Scholars
- Girls Incorporated Operation SMART
- High Tech High
- Human BioMolecular Research Institute
- Inner World Discovery
- Johnson & Johnson RxSEARCH
- Life Sciences Summer Institute
- Medtronic Community Link
- Mentor LA
- Merck Index Women in Chemistry Scholarships
- National Society of Black Engineers (NSBE) Saturday Science, Technology, Engineering, Math and Robotics Program
- New Science Teacher Academy (NSTA) (Supported by Amgen)
- Pfizer Education Initiative
- Pfizer Solutions in Green Chemistry
- Preuss School
- Project SEED
- San Francisco Education Fund
- San Mateo Biotechnology Career Pathway
- Science Buddies
- Science Matters
- Skyline College Biomanufacturing Training Partnership
- Teach For America Amgen Fellows Program
- The Salk Institute High School Summer Enrichment Program
- The Scripps Research Institute High School Student Research Education Program
- United Negro College Fund/Merck Science Initiative



TAIYIN YANG, Ph.D.
B.S., Chemistry, National
Taiwan University
Ph.D., Organic Chemistry, University of
Southern California

Senior Vice President, Pharmaceutical
Development and Manufacturing at
Gilead Sciences in Foster City, CA

When Yang decided to join Gilead Sciences in 1993, “I saw it as an opportunity to make a difference at a company whose values very much mirrored mine. I saw the chance to help discover, develop and commercialize therapies for life-threatening conditions.” Fifteen years later, she says Gilead’s mission continues to motivate her and is one reason that she fully recommends a career in the biomedical industry to young people.



LARRY L. WOOD, MBA
MBA, Pepperdine University
Corporate Vice President of
Transcatheter Valve Replacement at
Edwards Lifesciences in Irvine, CA

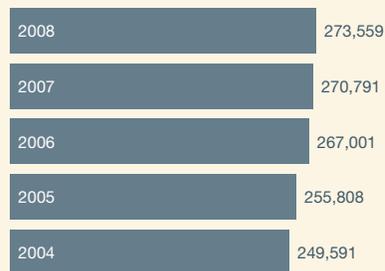
Wood joined American Hospital Supply Corporation, a predecessor to Edwards Lifesciences, in 1985 with a high school diploma and a drive to learn and grow through his job. He enthusiastically recommends the biomedical industry to anyone who is passionate about helping patients. “There will always be unmet patient needs,” he said, “especially in cardiovascular medicine...I feel very blessed and very fortunate in that I get to do work that motivates and excites me every day.”

Figure 6: Total Biomedical Employment by Cluster (2008)



Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages and Company Specific SEC filings.

Figure 7: California Biomedical Employment by Year



Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages and Company Specific SEC filings.

Reach Geographically speaking, biomedical industry jobs support workers all over California (Figure 6). The largest concentration of industry-related jobs is centered in the San Francisco Bay Area. Companies and academia there employ more than 53,000 people or 19.5 percent of the state’s total. Los Angeles County companies and institutions employed more than 44,000 people, while Orange County recorded more than 30,000 biomedical industry jobs. San Diego rounded out the top four clusters with more than 23,000 positions.

Many of the jobs within the biomedical industry require high levels of specialized training, and the industry employs a substantial number of scientists, researchers and clinicians with doctorate degrees, both Ph.D.s and M.D.s. At the same time, opportunities exist within academia and companies for individuals with high school diplomas and undergraduate degrees. The industry also employs professionals with business, information technology, human resources and other areas of expertise.

In the big picture, the industry’s full contribution to employment reaches well beyond workers whose salaries are paid directly by biomedical organizations. It is estimated that approximately 783,000 Californians are employed either part- or full-time because of the life sciences industry. This figure includes those who are employed directly, those hired by companies in the biomedical industry’s supply chain, and those whose jobs rely on spending by biomedical or supply chain employees. Construction, financial and legal professionals—indeed all the jobs associated with providing goods and services to life sciences employees—weigh into the multiplier effect. Combined, biomedical industry-related jobs make up 3.8 percent of the state’s total employment numbers.

“The problem lies in the lack of students interested in math and science education. As an industry, we should look for ways to help our schools—K through 12 and at the college level—better prepare students and fuel their passion for science.”

— Todd Kaufman, director of state government affairs at Genentech

Developing the Workforce

To continue to drive innovation in medicinal compounds and medical devices, researchers must be well-versed in math and science and insatiably curious about human conditions and diseases. Recruiting, managing and retaining today’s brightest is a challenge that companies and universities spend significant resources addressing.

Yet the biomedical industry must and does take the long view on workforce development. Through a number of programs (see sidebar on page 3), California companies are working to develop elementary and high school students’ interest in math, science and engineering. Some programs are directed at the students themselves, while others are designed to give their teachers the tools and insights they need to make the sciences more compelling and relevant to young people.

California’s commercial and academic organizations also have collaborated in a number of ways to draw college students and working adults to life sciences careers. From biotechnology curricula at community colleges to business-focused skills training in post graduate programs, universities and industry are working together to ensure that prospective employees are equipped to succeed.



CHI—California Healthcare Institute

CHI represents more than 250 leading biotechnology, medical device, diagnostics, and pharmaceutical companies, and public and private academic biomedical research organizations. CHI’s mission is to advance responsible public policies that foster medical innovation and promote scientific discovery.

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