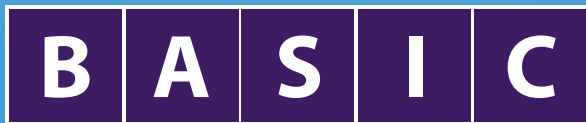
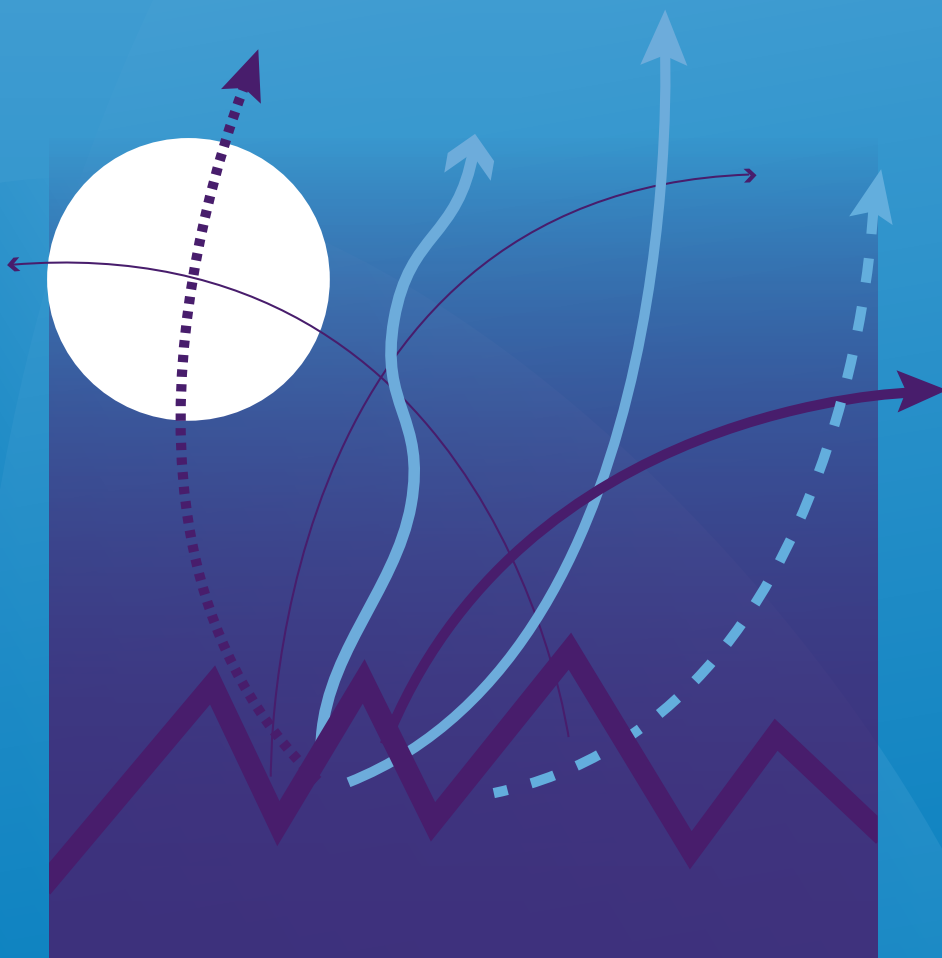




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BAY AREA SCIENCE AND INNOVATION CONSORTIUM



Workforce Shortfalls Cloud the Future for California's Life Sciences Industries

BASIC Study Finds Challenges and Opportunities

This report is a product of BASIC through a grant from the California Space Authority under the U.S. Department of Labor WIRED initiative.

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This report was produced through the Bay Area Science and Innovation Consortium (BASIC), an action-oriented collaboration of the region's major research universities, national laboratories, independent research institutions and research-and-development-driven businesses and organizations. BASIC is a program of the Bay Area Council Economic Institute.



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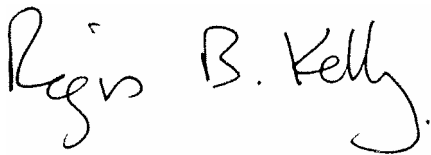
Message from the BASIC Chairman

In early April 2007, BASIC convened a roundtable forum of Bay Area visionaries to discuss the “drivers” of innovation and the exciting potential that could be realized by innovators. They also laid down a challenge: for the region to remain a leader in today’s competitive innovative global environment, we must change the way we think; then we must act and work together.

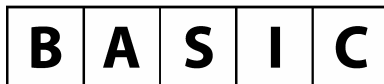
The roundtable forum and resulting initial report helped define innovation. This new report, *Workforce Shortfalls Cloud the Future for California’s Life Sciences Industries*, is a first step in responding to one of the challenges laid down at the roundtable—the need to strengthen the Bay Area’s highly talented science and technology workforce. This second report highlights the expanded skills required of 21st century science and technology professionals and sets out some of the existing disconnects in industry-university-student linkages. It also recommends four cross-cutting action items to address obstacles and prevent anticipated shortfalls—actions which can be achieved only through a collaborative effort by the public, private and academic sectors.

BASIC is in a unique position to assist in that collaborative approach. Building on the foundation established by the innovation and workforce reports, BASIC could bring together visionary leaders from the research and development industry, research universities and the national laboratories to meet with decision-makers at the state and federal levels. Such meetings would set the stage for developing a unified strategy to implement the critical changes needed to ensure our continued state and national global leadership in science and technology.

BASIC is committed to maintaining the talented science and technology workforce for which this region is noted.

A handwritten signature in black ink that reads "Regis B. Kelly". The signature is written in a cursive, flowing style.

Regis B. Kelly
Chairman, BASIC
Director, QB3



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Workforce Shortfalls Cloud the Future for California’s Life Sciences Industries

BASIC Study Finds Challenges and Opportunities

The term “life sciences” was once a synonym for biosciences or biotechnology, but no longer. In recent years, it has been expanded to encompass a broad range of research and development efforts that connect to health, agriculture, energy, the environment and even homeland security. The list of academic disciplines covering life sciences has also broadened to include not only biology, but physics, chemistry and engineering as well. One attribute that all of the industries and research and development efforts under the life sciences umbrella share is that they involve work with living organisms.

Life sciences R&D and industries have become a gold mine for the California economy, generating thousands of jobs and billions of dollars in revenue. The potential is there for them to continue to gild the state’s coffers for many years to come, but a huge challenge on the horizon is clouding the future. At a time when dramatic and fast-paced technological changes in the life sciences are demanding increasingly more sophisticated and varied workforce skill sets, there is a rising shortfall in the ability of the state to provide—through education or recruitment—a sufficient number of individuals who possess the necessary skills.

That is the conclusion of an investigative report conducted by the Bay Area Science and Innovation Consortium (BASIC), a regional entity dedicated to advancing the San Francisco Bay Area’s leadership in science, technology and innovation in the increasingly competitive national and international R&D environment. If the shortfalls identified in the BASIC report are not addressed, California could see a severe

reduction of its global competitiveness in the life sciences. Furthermore, this state, which enjoys a substantial lead over all others in life sciences R&D and life sciences-generated revenues, might lose its national dominance.

The findings of the BASIC report, which was carried out on behalf of the U.S. Department of Labor's WIRED Initiative (Workforce Innovation in Regional Economic Development), are based on a review of national trends, personal interviews with 17 senior executives and 10 new doctoral graduates in the life sciences, input from stakeholders at national laboratories and research universities, and a BASIC-sponsored roundtable discussion that featured a premier panel of life sciences leaders. This roundtable panel, the culmination of the BASIC investigation, produced recommendations for four cross-cutting action items that could help forestall or prevent the anticipated shortfalls. These action items called upon life sciences stakeholders to:

- acquire a better understanding of pain points;
- address acute areas of need;
- address longer-term areas of need;
- and address fundamental interest in and support for science and science education.

The full report is entitled *21st Century Workforce Preparedness in the Life Sciences: Summary of Findings*, and is available in electronic (PDF) format from the BASIC website (www.bayareabasic.org).

The BASIC review of national trends uncovered one other factor that is especially relevant to the life sciences: the often very long lab-to-market cycle for life sciences industries can severely impact hiring cycles. Doctoral students need to be more swiftly graduated and placed to reduce the problem of doctoral supply being out of phase with hiring demand. Consideration also needs to be given to the career placement of individuals who are entering the life sciences job market during a hiring downswing.

When asked about specific workforce shortages facing the life sciences in California, the executives described across-the-board shortcomings at a range of levels from technician to professional, and from middle-management to leadership levels of executives. These shortcomings will arise from a lack of solid backgrounds in science, clinical development and business, including business development, finance, regulatory affairs and quality management. More specifically, there are shortages in the next generation of CEOs; doctoral-level scientists and lawyers who possess intellectual property management expertise; and both managerial and technical-level specialists in pre-clinical, clinical and regulatory affairs. The executives also cited niche shortages, such as a lack of qualified chemists.

While the executives agreed that the research universities have done a good job with producing top-level scientists and innovation, they feel that there are problems at the lower academic levels. In addition, they were concerned about an imbalance between advanced degree scientists pursuing academia and industry careers, that affects attrition, turnover and workforce quality. At the same time, workforce turnover and fluctuations in company sizes make in-house training difficult or impossible. The net results for the life sciences industries are high turnover rates, cannibalization into stretch positions, theft of employees between competing companies, and less experienced people assuming senior positions.

In response, the executives discussed plans by California companies to import talent from outside the state or even outside the U.S. However, searching the world for talent is very expensive for small and mid-sized companies, and some of the interviewed executives noted that it would be easier to retain people from outside the country who have been trained here. However, the cost of living, cultural differences and U.S. green card policies can present stiff barriers to this strategy.

In the worst case scenario, California life sciences companies could hire and expand outside the state and nation through relocation, outsourcing or offshoring. The executives noted that location does matter: there is value in proximity, in the ability for immediate contact and communication, in a stable information technologies (IT) environment, and in the desired ability to tightly control relationships, assets and infrastructure. The executives did underscore that relocation is a

greater concern than outsourcing. Outsourcing can stay local and even offshoring can at least keep core employment here. Relocation is a complete loss to the state. A substantial number of the executives warned that the rest of the nation and the world are trying to take California's place as the leader in the life sciences, and the state needs to take action.

One of the major recommendations by the executives was a call for more excellent, committed and motivated math and science teachers, and a complete overhaul of the K–12 public education system, which many feel has already reached a crisis stage. There are far too many drop-outs due to popular ignorance of the importance and excitement of science, technology, engineering and math. The executives also called on universities to adapt more rapidly to changing workforce needs, to provide more information technology and computational training, and to accelerate advanced scientific and business training. Education in the life sciences needs to inform and be informed by macro trends in the life sciences industries.

The university input underscored that there has been a great deal of attention to developing curricula and supporting programs to expand California's talent base in the life sciences. For example, three of the UC campuses—San Francisco, Berkeley and Santa Cruz—have collaborated with representatives from private industry to form the California Institute for Quantitative Biosciences (also known as QB3, a moniker derived from the venture's original name: the Center for Quantitative Biology, Biochemistry and Bioengineering). This effort intends to harness the quantitative sciences—math, physics, chemistry and engineering—to integrate the understanding of biological systems at all levels of complexity for the benefit of human health. In addition to the creation of fundamental new knowledge and potent new technologies, a major goal of QB3 is to train a new generation of students able to fully integrate the quantitative sciences with biomedical research. Stanford and UC Davis have intensive life sciences programs of their own, as do the individual member institutes of QB3.

Despite the academic and research richness available to drive innovation and competitiveness in the California life sciences workforce, the university respondents stressed the essential need for California and the rest of the nation to get organized and better compete with models in other countries. The German model for technology education, career placement and commercialization was specifically mentioned. There were also criticisms about the life sciences lacking the systematic planning that exists in other domains. A major challenge will be defining the workforce problem and need so as to develop a master plan and model to update academic programs and systematically link them to industry needs.

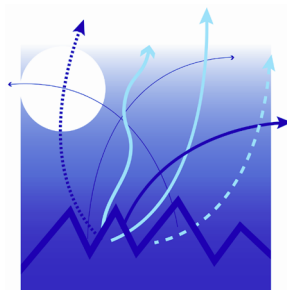
With regard to specialized applied training, there were arguments made that universities should be able to train excellent, well-rounded talent in fundamentals, and that such training should be able to meet employer needs without training for very specific, narrowly defined jobs. There was also concern about the challenge of meeting smaller company needs for specifically trained people. Part of these concerns evolved from the intellectual argument in favor of broader education, and part from industry's acknowledged uncertainty and short time-frames with regard to projecting hiring needs.

In commenting on the importance of undergraduate talent for meeting industry needs, university respondents spoke of a need for more dual-degree programs to enable a Bachelor of Science graduate to get a relevant job immediately out of a four-year program and subsequently consider postgraduate study after gaining work experience. The comparison was made with the financial industry in which students move immediately into a job upon graduation. On this basis, the job potential for an academic program could be a key criterion regarding its design.

sciences students, counselors, teachers and professors; and a coordinated effort with local policy organizations to lobby for a green card fast track program in the life sciences.

Under actions to address longer-term needs, the roundtable called for a gathering of the complete set of educational institutions—including representatives from secondary schools, technical training institutions, community colleges, undergraduate institutions, postgraduate universities and research institutions—to become involved in addressing industry-education-government coordination. There should also be an ongoing analysis of government spending, macro trends and other indicators to assess medium-term needs and develop a strategic plan to meet industry workforce and other needs.

Finally, under actions to increase interest in and support for science and science teaching, the roundtable group called for a coordinated public relations campaign—a collaborative effort by all sectors concerned about our nation’s science future. This concept is exemplified by the Coalition on the Public Understanding of Science (COPUS), a grassroots national network of public and private organizations committed to increasing public understanding and appreciation of the critical contribution science makes to the world’s quality of life. COPUS has declared 2009 as the Year of Science. It was the roundtable group’s consensus that if the objectives of COPUS and similar science educational organizations were supported by all sectors, 2009 could signal the start of a new era for science in this country. BASIC is in a unique position to convene meetings of visionaries from the Bay Area’s R&D industry, research universities and national laboratories with decision-makers at state and federal levels to develop a unified strategy for responding to the critical changes that are needed to ensure the future of the state and the nation’s leadership in science and technology.



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