CSUPERB Faculty Consensus Group (FCG) Summer Meeting
Dumke Auditorium, Office of the Chancellor, Long Beach, CA
Monday, August 6, 2018

7:15 am  Breakfast and Informal Networking

8:00 am  **A. Call to Order** (Kathie McReynolds, CSU Sacramento & FCG Chair)
- Welcome & Introductions: FCG Representatives and Guests
- New Chair Comments (McReynolds)
- Discussion of FCG Representatives’ Duties (Paula Fischhaber, CSU Northridge & FCG Deputy Chair)

8:30 am  **B. State of CSUPERB Report** (Susan Baxter, Executive Director, CSUPERB)
- 2018-2021 Strategic Plan Approved by Chancellor White (appended)
- AY 18-19 Annual Plan and Budget

9:30 am  Break

9:45 am  **C. Community Canvas Activity**
“Community programs… are about carving out an identity for members within them and creating experiences that serve their needs” - Carrie Melissa Jones

11 am   **D. 2018 Talent Integration Report** (appended)
Liisa Bozinovic, Executive Director, Biocom Institute

12:00 noon  Lunch (continued discussion and networking)

1:00 PM  **E. AY 17-18 Annual Reporting**
- Grant Program Data (Schmitt)
- Long Term Student Outcomes (Baxter)

1:30 PM  **F. Decisions to Make** (FCG)
1) Should CSUPERB adopt a Code of Conduct to address bullying and harassment? If so, who should write it? (See background material appended)

2) Should CSUPERB invest in a Team Science Program, replacing the Joint Venture Program? (See background material appended)

3) Should the CSUPERB Travel Grant Program Cycles Change? (see background material appended)

4) Should Research Development Seed Grant Applicants be required to include reviews of failed grant applications? (see background material appended)
3:00 PM  **G. 2019 Symposium Planning** (McReynolds)
   - Preliminary Symposium Budget Report & Implications for 2019 (Schmitt)

4:00 PM  Adjourn
CSUPERB believes that the best way to engage and help students embark on life sciences careers is to invest in and provide access to experiential learning opportunities in biotechnology research and entrepreneurship. CSUPERB recognizes that biotechnology preparation requires integration of disciplinary knowledge, hands-on practice, and collaborative, team-based projects. We know that these experiences are particularly effective at engaging and retaining students who are the first in their families to attend college or are from communities underrepresented in the life sciences. By working on solutions for real-world problems with CSU faculty teacher-scholars in the classroom and on research teams, all students can build a solid foundation for successful biotechnology careers. CSUPERB partners with industry professionals, alumni, and organizations to support the always-evolving life sciences industry and California’s regional economies. The California State University plays a critical role in California’s biotechnology ecosystem by providing not only a professional workforce but also innovative ideas that drive the growth and evolution of the entire industry.
Executive Summary

Since 2009 CSUPERB has developed three-year strategic plans to articulate the CSU’s biotechnology community’s purpose, values and goals, to prioritize investments, to develop programming, and to frame annual operational plans. In Spring 2017 the CSUPERB Presidents’ Commission decided to continue the practice, which was also adopted by Executive Order (EO) 1103, the CSU’s new policy governing system-wide affinity groups.

During the Fall 2017 and Winter 2018, members of the CSUPERB Faculty Consensus Group (FCG), the Strategic Planning Council (SPC), and the Presidents’ Commission (PC) collaborated on a strategic planning process that involved:

- Surveys (September - October 2017), to gather detailed feedback from 162 individuals, including FCG members, campus administrators, grantees, program participants, external partners, and biotechnology industry leaders;
- A one-day retreat (November 2017), involving SPC members, students, faculty, and administrators, to synthesize the stakeholder feedback and industry trends; and
- PC (November 2017 and April 2018) and SPC (April 2018) meetings to review and respond to ideas and strategic plan drafts.

The CSUPERB community overwhelmingly decided the program should continue to operate with three broad strategies: Expand Experiential Biotechnology Learning Opportunities, Innovate Biotechnology Education, and Partner with Industry. Priorities and cross-cutting themes for 2018-2021 are: 1) raising the visibility of the CSU’s impactful biotechnology community, 2) deepening efforts to improve undergraduate biotechnology-related education, and 3) providing biotechnology career resources to faculty mentors and students. The Presidents’ Commission especially encouraged CSUPERB to 4) lead boldly in advancing integrative, inter-disciplinary education, and team research.

CSUPERB remains focused on improving student success in biotechnology. We define student success not only as the completion of a biotechnology-relevant degree, but also the acquisition of abilities needed to chart a successful life science career. The latter is increasingly tied to the need to integrate, “make sense,” and make decisions based on disparate sources of knowledge, data, or content. As a result, partnerships with the individuals and organizations that make up the life science industry – companies, universities, non-profit research institutions, industry associations, business incubators, and government laboratories – are key not only to our success as a community, but also our graduates’ successes.

A community like CSUPERB needs to remain vibrant, maintain its intellectual focus and energy, and have access to and remain aligned with system-wide CSU decision-making. CSUPERB’s impact will depend on collaborative partnerships, alumni networks, faculty volunteerism, administrative support, and campus engagement. Over the next three years, CSUPERB will continue to champion experiential education, make seed investments in faculty-driven academic programs and research projects, and remain open to new ways of thinking within the university and the surrounding life sciences ecosystem.
CSUPERB was organized between 1985 and 1987 by faculty across the CSU and led by Joe Bragin (CSU Los Angeles, Chair, Governing Board and Executive Committee), Steve Dahms (SDSU, Co-Director), and Crellin Pauling (SFSU, Co-Director). President Thomas B. Day (San Diego State University) championed the organization and in 1987 CSU Chancellor W. Ann Reynolds approved and chartered CSUPERB. During this time, CSUPERB focused on acquiring resources and equipment necessary to incorporate molecular biology and genetic engineering techniques and concepts into the CSU curriculum, core facilities, and research laboratories. In 1988 a travel grant program was established and CSUPERB began hosting annual CSU Biotechnology Symposia.

Because more than 80% of the >280,000 professionals working in the California life sciences industry have an education at or below the master’s degree level, a special legislative line item (AB 968, Ducheny, 1999) provides ongoing support for CSUPERB to “maintain and enhance its role in the preparation of the biotechnology workforce.” The increased financial support allowed CSUPERB to broaden its focus and create additional grant programs. At the same time a shared leadership structure was organized to include a Presidents’ Commission (PC), a Strategic Planning Council (SPC), and a Faculty Consensus Group (FCG). A CSUPERB Operations Committee, including the Executive Director, program staff, SPC Chairs, and taskforce chairs, manages and administers program operations.

In 2008 CSUPERB developed its first three-year strategic plan, approved by the CSU Chancellor. This effort matured the system-wide program and it began operating intentionally as a community of practice to “create, expand, exchange knowledge and to develop individual capabilities.” CSUPERB uses strategic plans to articulate the community’s purpose, values, and goals, while also framing annual operations. In March 2016 CSUPERB was authorized by Executive Vice Chancellor Loren J. Blanchard to continue operations as a system-wide affinity group under EO 1103.

CSUPERB strategically partners with biotechnology employers and industry associations1 on curriculum and workforce development initiatives. In 2008 CSUPERB (continued)
provided initial support, bolstered by funding from the Alfred P. Sloan Foundation, for the development of biotechnology-related Professional Science Master’s degree programs. CSUPERB served as a catalyst to make California Institute for Regenerative Medicine (CIRM) funding available to CSU students interested in stem cell research. Fourteen CSU campuses now have Bridges to Stem Cell Research programs that, as of 2018, have received over $82 million in CIRM funding. CSUPERB built public-private partnerships to increase the number of clinical laboratory scientists and other skilled professionals in California; as a result, in 2010 two CSU-led teams won $10 million in Department of Labor funding. In 2014 CSUPERB seeded partnerships and the community contributed data that led to major funding to the CSU from The Leona M. and Harry B. Helmsley Trust for the STEM Collaboratives project and the National Institutes of Health to fund BUILD programs. The CSUPERB community’s efforts to adopt Vision and Change principles in biology courses system-wide were featured in a 2015 AAAS report. In 2014 CSUPERB won a National Science Foundation (NSF) grant to establish CSU Innovation Corps (I-Corps™) and offer experiential entrepreneurship education to faculty and student researchers system-wide. NSF renewed the CSU I-Corps grant in 2018, based in part on our success including a discipline-, gender- and ethnically-diverse set of researchers from campuses system-wide. Final reports from undergraduates supported by CSUPERB seed grants (2007-2017, n = 583) highlight even greater, transformative impacts. The graduation rate of CSUPERB-supported students is greater than 90%, roughly double the averaged CSU STEM six-year graduation rates. We know the same percentage of CSUPERB-supported students (~90%) continue on in life sciences career paths, whether accepting jobs in the life science industry or entering professional, graduate or medical school programs.

Self-reported ethnicity of research-active students supported by CSUPERB (Fall 2017), compared to overall CSU student demographics. Responses came from the 397 CSU students who attended the 30th Annual CSU Biotechnology to present research posters in Santa Clara, California. The biotechnology industry overall does not reflect California’s demographics; many of our communities remain underrepresented in biotechnology-related degree programs and career paths.
reminding us that more work is needed to include students underrepresented in the biotechnology ecosystem. Over 90% of the undergraduate and master’s students participating in CSUPERB programs and symposia report they do not have family or friends working as researchers, clinicians or professionals in the life sciences industry. However - against this backdrop - we know that 90% of CSUPERB-supported students continue in life sciences career paths, whether accepting jobs in the life sciences industry or entering graduate or medical school programs.

Importantly, these student outcomes hold across all CSUPERB programs – amongst Howell Scholars, who are academically accomplished juniors and seniors, or Presidents’ Commission Scholars, who are lower-division students recruited into faculty-led research groups. As many other education researchers nationwide have found, discovery-based STEM learning coupled with teamwork is a high-impact practice.8 While many of these “signature” experiences may not yet show up on transcripts, they are the number one workforce need articulated by alumni and employers in the biotechnology industry.3

Programs and activities inspired by previous CSUPERB strategic plans are bolstered and amplified by other system-wide and campus-driven projects and strategies. In Fall 2017 we attempted to assess not only the “aliveness”1 and culture of the CSUPERB community, but also its impact on campuses, the faculty, and the student experience.

The majority of faculty members, CSUPERB PIs, and administrators surveyed during the Fall of 2017 observed that greater numbers of CSU faculty and students were involved in biotechnology research, partnerships and collaborations compared to three years ago. The majority of students and faculty surveyed reported increased opportunities within the CSU to learn about entrepreneurship and biotechnology commercialization. Faculty reported that campuses now place increased value on course-based active learning and innovative educational experiences for CSU students, building on positive outcomes reported by STEM Collaboratives projects.9 The majority also reported unmet student needs for interdisciplinary, biotechnology-related courses and course-based research opportunities. Concomitantly, they see unmet faculty professional development needs in curriculum redesign. Students, in particular, asked for more networking and connections with alumni and biotechnology professionals. The majority of respondents viewed CSUPERB as a supporter, investor, and convener around these system-wide issues.

Survey respondents and stakeholders agreed that CSUPERB’s culture fosters communication, collaboration and trust, while also welcoming a variety of participation levels and fostering a collective sense of purpose, professionalism, or intentionality. All groups surveyed and stakeholders alike agreed that CSUPERB doesn’t need better communication within the community. Instead, it should raise the visibility of the CSU’s biotechnology community, its workforce development work, and accomplishments of faculty, students and alumni within and beyond the CSU’s campuses.

CSUPERB continues to mature and evolve with the dynamic, cutting-edge ecosystem it inhabits. The CSUPERB community and its network of external partners change as new biotechnologies evolve to solve problems in our communities and regions. The SPC and the Presidents’ Commission recognize the strategic value of system-wide, disciplinary-diverse faculty participation in CSUPERB.

Looking forward we see an increased need for inter-disciplinary partnerships to tackle complex problems from sustainable crop production to human diseases. Indeed, employers and graduate school admissions committees seek scientists and engineers capable of integrating knowledge from disparate sources.3 The 2018-2021 strategic plan is crafted to steward an adaptive, responsive community supporting excellence in biotechnology education and research across the CSU system.

“I learned and GREW so much by attending CSUPERB for the first time...[I] was INSPIRED by professionals and realizing that I can make a difference in the world by pursuing research. I’ll also remember the people I met and how amazing everyone’s research work was (and how incredibly knowledgeable the students are!) I’ll remember this was the weekend I began to fall in love with research and truly be exposed to this world with opened eyes.”

– Student who attended the 30th Annual CSU Biotechnology Symposium
This 2018-2021 CSUPERB strategic plan identifies three priorities for the program: 1) expand experiential biotechnology learning opportunities across the CSU; 2) innovate biotechnology education; and 3) partner with the life science industry. To address these priorities simultaneously over the next three years, CSUPERB will need support, advocacy and resources from the CSU, external partners, and policy makers.

The four cross-cutting programmatic themes for 2018-2021 are Career/Professional Development for Students and Faculty, Communication Efforts, Inter-Disciplinary Education and Team Science, and Operational Capacity and Effectiveness. Program priorities include efforts to 1) raise the visibility of the CSU biotechnology community’s impact, 2) deepen efforts to improve undergraduate biotechnology-related education to engage students and close opportunity gaps, and 3) provide trusted biotechnology career resources to faculty mentors and students. The Presidents’ Commission especially encouraged CSUPERB 4) to lead boldly to advance integrative, inter-disciplinary education and team science, a theme ratified by the Faculty Consensus Group in January 2018.

At this stage in CSUPERB’s evolution, we think capacity-building activities should include expanded efforts to track student career trajectories, to support faculty leadership development, to champion quality, high-impact practices for student learning and success, and to measure CSUPERB programs’ impact on student success and their value to the CSU system. CSUPERB must pay continued attention to collaborations, communications, and outreach to CSU administrators, faculty, students and alumni to align our efforts with the overall strategic directions of this great public higher education system.

**Strategic Goal #1: Expand Experiential Biotechnology Learning Opportunities**

Based on feedback from life science industry employers and graduate school admissions advisors, CSUPERB will invest in disciplinary-diverse, team-based experiential learning opportunities. Well-implemented research opportunities, project-based internships, and evidence-based entrepreneurship programs allow students access to cutting-edge science and technology and opportunities to think like scientists, engineers, and entrepreneurs. These student research experiences – whether in campus laboratories, companies, innovation centers, or classroom settings – empower students to pursue impactful careers.

“I learned about what a research career is really like from people who are passionate about it and do it everyday. I was also exposed to so many new ideas from fellow undergraduate students whose research opened my eyes to broaden my horizon and not to limit myself to just conquer the ‘easy’ things but to shoot for the stars.”

– Student who attended the 30th Annual CSU Biotechnology Symposium
classrooms – create opportunities to explore and discover, knit together multi-disciplinary concepts, collect disparate data for evidence-based investigation, and synthesize and communicate findings. These are critically important modes of learning required to prepare graduates for biotechnology industry careers.³

Financial support for experiential learning experiences is particularly impactful for students not supported by other training or scholarship programs. CSUPERB seed grants provide faculty with the resources to successfully compete for follow-on, externally funded grants. External grant support for CSU biotechnology faculty increases the number of students involved in faculty-led scholarship, creative activities, and research programs in classrooms, laboratories, and the field. During these next three years, CSUPERB will invest in and nurture partnerships (intra-campus, cross-divisional, and inter-campus) aimed at expanding experiential learning opportunities for all CSU biotechnology students. Complex biotechnology-related problems require diverse perspectives and techniques, bringing together life, physical, clinical, computer sciences, business, engineering, public health and mathematics expertise. Professional development workshops, incorporating design thinking, team-building, and project management, for both students and faculty will cultivate diverse teams capable of identifying and addressing problems worth solving. CSUPERB leadership will advocate within the CSU and in Sacramento for infrastructure, building maintenance, and architectural designs needed to unlock creativity and support experiential learning.

Strategic Goal #2: Innovate Biotechnology Education

The CSU has a strong record of preparing and graduating students into jobs, graduate and medical school programs. Our alumni provide the high-level talent for basic discovery programs and clinical research in the biotechnology industry. However, the

More than 80% of the professionals working in the life science industry have an education at or below the master’s degree level

“The first student who worked on the project is in the PhD program at UC Riverside. The second student who worked on the project just started a research associate job at Medtronic in Irvine, CA… The CSUPERB research development grant allowed gap money to produce preliminary data that was used in my funded SC3 [NIH] grant.”

– Judy Brusslan (CSU Long Beach, 2014 Research Development grant recipient)

“It was so great to see all the amazing and diverse research that is going on in the CSU system. Going through the posters I got to see a lot of interesting research, and compared to other conferences that are solely student focused (like SACNAS) people were genuinely interested in MY RESEARCH and that was really great.”

– Student who attended the 30th Annual CSU Biotechnology Symposium
biotechnology industry overall does not reflect California’s demographics; many of our communities remain underrepresented in biotechnology-related degree programs and career paths.

CSUPERB knows that intentionally designed and well-implemented experiential learning opportunities engage all students. Students learn knowledge needed to persist toward STEM degrees and skills to navigate degree-relevant careers post-graduation. CSUPERB will work to increase adoption of well-designed, high-impact practices, collaborative projects, experiential learning, and course-based research at all levels of biotechnology-related curricula. We know there is more to meeting the needs of students than merely offering experiential learning opportunities. Lessons learned from the STEM Collaboratives projects raised the importance of effective early interventions, faculty and peer mentoring, and the unified campus community of support needed to ensure success across all student demographics.

**Strategic Goal #3: Partner with the Life Science Industry**

The Life Sciences Industry is an ecosystem – defined as networked organizations including companies, universities, non-profit research institutions, industry associations, business incubators, hospitals, and government laboratories. CSU biotechnology faculty and students report increased interest in learning from and working with entrepreneurs, community partners, small business development centers, regional innovation hubs, and companies. They want to learn how to translate science into something tangible or impactful. On the academic side, we need to find ways to make campuses more porous and open to external partnerships with other universities, companies, and communities. To this end there is keen interest in recruiting CSU alumni to serve as mentors, advisors and partners in career mentoring, entrepreneurship education, and interdisciplinary research efforts. Our stakeholders recognize that alumni and industry professionals can be particularly effective partners in aligning educational programs with workforce realities, as well as building student awareness of career options, biotechnology-relevant product development, and skills needed beyond the university.

**Success Indicators**

- Renewing numbers of CSU students and faculty involved in biotechnology research, discovery, and evidence-based entrepreneurship
- Evidence of effective and engaging biotechnology-related courses across the CSU, especially those that integrate course-based research
- Seminars and workshops successful at building integrated, inter-disciplinary partnerships, with a special emphasis on identifying problems worth solving and knowledge translation
- Industry and alumni participation in CSUPERB programs, especially the Annual Biotechnology Symposium, career mentoring programs, entrepreneurship programs, and collaborative projects

“This CSUPERB grant program is invaluable to the success in redesigning and implementing our new BIO 2 (Cells, Molecules, and Genes) laboratory course. The course redesign would not have been possible without the funding for new equipment and supplies. The course implementation would not have been possible without the help of our two Graduate Teaching Assistants, whose salaries were provided by this grant.”

– Hao Nguyen (CSU Sacramento, 2014 Curriculum Development grant recipient)
• Continued compliance with EO 1103, including timely annual reports, impact reporting (student outcomes, follow-on funding, etc.), and workforce demand data

• Internal and external awareness of the CSUPERB community’s excellence, its collective impact on the CSU’s biotechnology-related research enterprise, effective educational practices, and CSUPERB-supported students’ success on campus and beyond the university

• Board level involvement of CSUPERB leadership with biotechnology industry associations and in higher education-related policy discussions

References


(7) CSU Student Success Dashboard, STEM Majors Home. www.calstate.edu/dashboard (access within CSU only).


Photos

Page 1: Student researchers from San Diego State University at the 30th Annual Biotechnology Symposium. Left to right: Paul Smith (MS student), Kevin Walsworth (PhD student), Amy Jackson (undergrad), Sean Maddox (PhD student), Andrew Dinh (PhD student), Greg Dawson (undergrad) & Susan Andersen (undergrad).

Page 2: Members of the CSUPERB Faculty Consensus Group (FCG) at the end of the 30th Annual Biotechnology Symposium. FCG members design, organize, and manage the symposium program each year.

Page 3: Don Eden Graduate Student Research Award Finalists at the 30th Annual CSU Symposium. Left to Right: Rafael Sandoval (CSU Los Angeles), Roger Berton (CSU Los Angeles), Hansini Vitharanage (Cal Poly Pomona), Anastasia Martinez (CSU Fullerton), Clariss Limso (CSU Long Beach; 2018 Awardee) and Matt Escobar (CSU San Marcos, 2018 Eden Award Selection Committee Chair).

Page 4: Audience at the 30th Annual CSU Biotechnology Symposium, Santa Clara, CA.

Page 5: CSU Alumni Speakers at the 30th Annual CSU Biotechnology Symposium. Left to right: Mitch Lucas (Breeding Project Lead, Syngenta & CSU Fresno alum), Stacy Markison (Senior Director of Pharmacology and Toxicology, Cinetics Pharmaceuticals & San Diego State University alum), and Avery August (Professor of Immunology, Chair of the Department of Microbiology and Immunology in the College of Veterinary Medicine & Vice Provost for Academic Affairs, Cornell University & CSU Los Angeles alum).

Page 6: Chemistry researchers from CSU Fresno at the 30th Annual CSU Biotechnology Symposium. Left to right: Undergraduates Maizie Lee, Pravien Rajaram, Ziran Jiang & Graduate Student Kevin Muthima.

Page 7: Maricruz Macz De La Torre (CSU Dominguez Hills) accepts the 2018 Crellin Pauling Student Teaching Award during the 30th Annual CSU Biotechnology Symposium. Also pictured, left to right, Undergraduates Maizie Lee, Pravien Rajaram, Ziran Jiang & Graduate Student Kevin Muthima.

Page 8: Maricruz Macz De La Torre (CSU Dominguez Hills) accepts the 2018 Crellin Pauling Student Teaching Award during the 30th Annual CSU Biotechnology Symposium. Also pictured, left to right, Undergraduates Maizie Lee, Pravien Rajaram, Ziran Jiang & Graduate Student Kevin Muthima.

Page 9: Students and faculty from Cal Poly San Luis Obispo at the 30th Annual CSU Biotechnology Symposium.

Page 10: Students and faculty from Stanislaus State University at the 30th Annual CSU Biotechnology Symposium.

“...He gave us the picture - the way vital signs are measured in hospitals or health care facilities. It totally changed the way we think and it gave us the idea and potential scope of our work. And because of that interview we have a potential partner to help conduct the validation test of our technology.”

- 2017 CSU I-Corps Participant
What capabilities will we need?

Biotechnology student success depends on a faculty and administrator community well-versed in discipline-based education research and familiar with the literature on undergraduate STEM learning. We need committed partners and alumni from the life sciences industry to ground our work in relevant workforce needs.

Where will we work?

Our strategic roles are catalyst, persuader, investor, and convener. We will seed faculty-driven projects, support preliminary data collection, provide a competitive peer review framework, and offer faculty and student professional development opportunities. As a result, we can scale up faculty success in winning external grants, follow-on funding, and institutional support. In turn greater numbers of CSU students are impacted and continue in biotechnology careers. CSUPERB-supported students will have experiences and skills of interest to employers and graduate schools.

How will we succeed?

The rate and scale at which we work depends on our budget, the size and vibrancy of our community, and the quality of the collaborations we catalyze. We hope to see CSU faculty, administrators, departments, and campuses design effective ways to incorporate experiential learning for all STEM students across the curriculum. This will require learning by discovery, scientific teaching practices, and collaboration with intra-campus, inter-campus, and industry partners.

Program Home Page:
www.calstate.edu/csuperb

CSUPERB Grants and Awards Database (1999- present):
csuperb.org/grants/database/

CSUPERB Events:
www.csuperb.org/symposium

CSUPERB Entrepreneurship (@csu_icorps)
www.csuperb.org/csui-corps

CSUPERB Student and Alumni Outreach:
www.facebook.com/csuperb
California’s life science industry is a major driver of innovation, economic development and job creation, employing more than 360,000 individuals in the state in 2016\(^1\). As part of a dynamic industry characterized by disruptive discoveries, an ever-complex regulatory environment, and the globalization of health care, life science employers must secure the right talent for their organizations to survive and thrive. In this third report since 2014\(^2\), the Biocom Institute and the California Life Sciences Institute have collaborated to assess and forecast the most pressing talent needs of the state’s life science industry. This report provides a snapshot of workforce trends, including some of the key job opportunities and corresponding educational backgrounds and skills that employers seek\(^3\). It also provides a unique statewide perspective into the workforce challenges and opportunities industry executives face in driving the industry into the next decade.

**BENEFICIARIES OF THE 2018 CALIFORNIA WORKFORCE TRENDS REPORT INCLUDE:**

- **Company executives**
  - who must build organizations, develop talent and allocate resources to address unmet medical and societal needs

- **Legislators**
  - who must set policy and allocate resources based on industry and community needs

- **Recruiters**
  - who must match available talent with evolving company needs

- **HR professionals**
  - who must develop, engage and motivate staff

- **Educators and trainers**
  - who must prepare the next generation of industry professionals
ABOUT THE STUDY

This report highlights current and anticipated skills needed for life science industry positions in California. The analysis is drawn from three sets of quantitative and/or qualitative data:

- **Job Postings**: Quantitative data from ~9,900 job postings for California life science technical jobs from representative industry NAICS codes, utilizing Burning Glass Technologies (Jan-Dec 2017). Non-technical positions in the industry, such as those in sales, accounting, purchasing, etc. are not included in this sample. Specifics on the filters applied can be found at califescienceworkforcetrends.org.

- **Survey Responses**: Survey responses from human resource representatives and hiring managers in 117 California life science companies on recent hiring, workforce composition and hiring challenges. Participating companies span industry sectors and sizes, although representation is skewed more toward drugs and pharmaceutical companies (36%). Participants also include medical device and equipment (21%) and research testing and medical lab (21%) companies. 67% of respondents were from small to mid-size companies (11-150 employees) followed by 31% of companies with 11-50 employees. Companies with fewer than 11 employees constitute 2% of respondents.

- **Interviews**: To understand the drivers of the life science industry’s hiring decisions and its future talent pipeline in more depth, 41 California life science executives were interviewed in early 2018. Their companies range from startups to emerging and multinational companies, and encompass the range of industry sectors, including drugs & pharmaceuticals, medical device & equipment, research testing & medical laboratories, industrial biotech and bioscience-related distribution. Leaders shared their views on hiring talent, how externalities are shaping their needs for talent, their experiences with academic partnerships and the role of diversity in the workplace. These rich discussions were distilled into 5 key workforce trends that are shaping the talent demands of California’s life science industry.

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**Figure 1** - Sector distribution of companies interviewed and surveyed in this study. Elsewhere in this report, the small number of companies that described their company focus as spanning more than one sector or “other” are treated as “other” for industry segmentation analysis. For a breakdown of the overall life science company sector distribution in the state of California, see the expanded methodology for this report at califescienceworkforcetrendsreport.org.
WHAT ARE COMPANIES LOOKING FOR?

Job and Functional Demand: An analysis of the approximately 9,900 statewide life science job postings for technical occupations from 2017 (Burning Glass Technologies) shows the highest demand for medical scientists - followed by chemists, biologists and clinical research coordinators. Regulatory and quality occupations, when taken together, constitute the highest area of job demand. Similarly, when looking at top specialized skill sets, regulatory and quality together constitute the highest demand (Figures 2A and 2B).

The Bureau of Labor Statistics (BLS) defines life science industry “medical scientist” as an individual with a PhD, usually in biology or a related life science, or an MD degree and conducting research aimed at understanding human diseases and improving overall human health. Burning Glass Technologies (Burning Glass) employs an expanded definition of medical scientist that includes individuals with bachelor’s degrees and a variety of additional job titles such as Clinical Research Associates and Clinical Laboratory Scientists. It is this expanded definition of “medical scientist” presented in Figures 2A and 2B.

Figure 2A – Top 14 occupations in California based on approximately 9,900 online job posting in 2017 (Burning Glass Technologies)

Figure 2B – California life science in-demand skills based on approximately 9,900 online job postings in 2017 (Burning Glass Technologies)
As California’s life science industry continues to evolve and adapt to new technologies, increasing globalization, an ever-changing regulatory landscape, increasing marketplace demands for demonstrable pharmacoeconomic or other value, and competition with other industries. To remain competitive and relevant, the life science companies we interviewed described a landscape in which their organizations and their workforce must continually evolve, learn and respond to new opportunities.

It typically takes years for a life science company to move from concept to commercial product. A company may begin as a research-only organization. As it develops a product or service, it may grow in size and development and operational capabilities. Eventually it may grow into a commercial organization, adding more business and operational capabilities along the way, by hiring talent or engaging contract workers or outsourcing.

As a company matures through these stages, its talent needs shift and the complex interplay between functions grow. A more mature organization may have many more specialists, but it also needs employees that can communicate across functional areas and drive informed decision-making while maintaining awareness of changes in the global, environmental and competitive landscape. Companies want employees who can help them innovate the ways they develop new products and services - shortening development cycles and reducing development risks.

Industry executives are seeking employees who come to their organizations with an understanding of how the industry works: how to develop technology into innovative products/services, how the functional pieces fit together and how the external environment impacts internal decisions. Many employees thrive in such a dynamic environment, finding opportunities for learning, growth, creativity and advancement. These complex dynamics however can limit the opportunities for individual contributors who cannot think beyond their functional area, who lack strong communication and interpersonal skills and who are not adaptable.

Trends Impacting Talent Needs

As California’s life science industry evolves, and new industry sectors appear and expand while previous distinct industries collide, companies need to stay nimble as they innovate in increasingly interconnected marketplaces and ecosystems. This creates complex workforce talent requirements. To complement the quantitative data, we interviewed 41 California life science industry executives, asking each a set of open-ended questions about key developments that are impacting their current and pipeline talent needs. Five key trends emerged from the interviews and are highlighted throughout the report.

**Five Key Trends**

1. New technologies and rapid change fuel emerging talent needs
2. Demand for soft skills rises to the top
3. Life sciences and tech converge and compete for talent
4. Diversity of thinking / experiences drives innovation
5. Industry reaps the rewards of academic partnerships

“In this competitive space, companies are bringing products to market much more quickly and we expect that to accelerate. It’s critical to improve time from product ideation to market.”
TREND 1 - NEW TECHNOLOGIES AND RAPID CHANGE FUEL EMERGING TALENT NEEDS

“Changes will require dramatically different skill sets over time... In 10 - 15 years we will see a lot less wet lab research and see it replaced by much more computer modeling and in silico chemical design for drug research.”

California’s life science companies continue to operate in a dynamic and often unpredictable environment. Technological innovations, globalization and shifts in the competitive landscape and regulatory environment require companies to remain vigilant and adaptable to the changing landscape while continuing to innovate.

New technologies are emerging and shifting the ways we think about products, product development and markets. CRISPR/gene editing technology profoundly shifts our thinking and our ability to ask questions about biological systems. Computing technologies continue to impact how the industry works and drives value. New e-technologies can help make clinical trials more efficient than ever before. Products and services are becoming more interlinked and more complex. We now have medical devices, for example, that incorporate hardware, software, connectivity and monitoring capabilities.

Changing external factors are also creating hurdles and challenges for life science companies. Changes in healthcare and reimbursement increasingly demand that life science companies demonstrate the economic benefits of their products and services. Scientific challenges, regulatory hurdles and investor expectations all demand that companies remain focused and adaptable.

Combined, these forces impact the ways companies recruit and think about their workforce. Companies seek employees who are experts in the latest technologies, including proteomics, immune-oncology, epigenetics, regenerative medicine, biomarkers, robotics, AI and 3D printing. There is growing demand for people who can work in environments where large amounts of data, artificial intelligence, massive computing power and processing speeds are key in product development, decision-making and business operations. Much of this expertise for the most advanced technologies comes from academic labs.

Companies also understand that today’s hot technology may quickly be superseded by the next wave of innovation. They thus seek people who have a passion for developing, learning, and combining technologies to solve new problems.

“As our product/service offerings become more complex and incorporate more technology hardware, software and connectivity capabilities, we need to bring in more people who understand how product development works and who understand these kinds of integrated offerings. This creates demand for more expertise in project management, connectivity, systems integration, analytics, Agile and Lean processes.”

“Job responsibilities are shifting throughout the organization. Even lab jobs are requiring new skills... jobs in the past that were predominantly hands-on now require more and more planning, processing and analysis.”

“We see the arrival of new technologies that profoundly impact our industry, including CRISPR/gene editing technology, greater access to human cells, including pluripotent stem cells and novel ways of combining these technologies.... We need people who can think outside their core or historic area of expertise to take advantage of the newly available technologies.”
As in 2016, a number of executives pointed to the impacts of continued rapid changes in the US healthcare industry on their talent needs. The US spends an unsustainably large amount of its GDP on healthcare, and while patients, hospitals and doctors still demand innovative products, payers are less willing to pay for them. Payers are looking to commoditize solutions and pay the lowest cost for a set minimum standard of care. Many companies are responding by shifting from a fee-for-service model to a model more based on economic value and risk sharing.

“The whole industry is suffering from reimbursement and high health care cost issues. Consolidation of the pharmacy benefit management and reimbursement sectors is putting more pressure on controlling healthcare costs at large and on drug prices in particular.”

Employers still look for individuals who can navigate the complex health care system, have regulatory expertise, understand reimbursement, and who are adept at managing relationships and business partnerships. They also continue to express concern that the national discourse on drug pricing adds to their recruitment challenges.
While new discoveries and the rapidly changing life science environment create demand for new technical skills, executives continue to highlight their overarching need for more employees with strong soft skills throughout their organizations. As companies’ needs evolve and change, so does the desire for nimble, adaptive employees who are willing to continue to learn and grow. Flexibility, creativity, strong verbal and written communication skills, the ability to work well with others, comfort working with ambiguity, and the ability to work in matrix or virtual work environments are frequently cited as necessary and valued skill sets. To thrive in this dynamic and competitive environment, executives seek employees who have “fire in their bellies,” energy, passion, integrity, resilience, interest in taking on more responsibility, and commitment to the company’s success.

As multiple internal and external groups and organizations collaborate for successful product development, companies value employees who appreciate the “big picture”. Such employees take initiative to drive alignment across functional and organizational boundaries to anticipate and solve problems, and proactively identify new opportunities aligned with company goals. They possess the ability to think creatively, and to develop and implement thoughtful, team-driven solutions. Individuals who understand how to lead, persuade and make decisions, and how to energize teams are highly valued. They may need to synthesize solutions with incomplete information, and - in matrix organizations - to influence rather than manage a team of disparate stakeholders. In this environment, collaborators and team players are valued over individual contributors.

People with hybrid backgrounds and strong soft skills can be highly effective, but not easy to find. The hybrid scientist-business professional, for example, may be uniquely qualified to negotiate and sell technical products and services. An engineer with IT expertise might be ideally suited for the medical device team that is building new automation and robotics capabilities into its product line. Technology experts with holistic views of problems or systems who effectively engage with people in other functional areas to solve complex problems are increasingly valued by employers.

**Figure 5** - Communication and Research Skills are the top two soft skills reported in the online job postings. Combined, problem solving and troubleshooting are a high third on the list. (Burning Glass Technologies)
FINDING THE RIGHT TALENT

Of the 117 companies surveyed:

- 97% of responding companies report that they have hired employees within the past 12 months. This recent hiring spans the industry with respect both to industry sectors (Figure 3) and company sizes (data not shown).
- 88% of respondents were able to fill positions within 4 months; half of those within 9 weeks or less (data not shown). Regulatory Affairs/Compliance positions continue to stand out as some of the most challenging to fill. 39% of respondents described those positions as “more difficult” or “much more difficult” than average to fill. Quality, Data Analytics and R&D positions were the next most difficult positions to fill (Figure 4).
- Multiple companies also cited significant individual challenges in finding the right candidates for executive and C-suite positions and in multiple functional areas, including analytics, bioinformatics, biostatistics, clinical development, clinical operations, IT and manufacturing.

Figure 3 - Companies in the “Other” category include organizations such as integrated research/manufacturing companies, research firms, university hospital, CRO, search firm, venture capital firm, etc. (HR Survey, n=117)

Figure 4 - Source HR Survey, n=117
TREND

3 LIFE SCIENCES AND TECH CONVERGE AND COMPETE FOR TALENT

“Innovation in computing and technology and its increasingly frequent application in the life sciences is creating more overlap and convergence between the tech and life science industries. This convergence opens new opportunities for value creation, changes the customer experience, creates new career pathways, and impacts the marketplace for talent.

Convergence with tech opens new vertical markets and opportunities for life science companies to develop connected devices, systems and networking solutions to improve clinical outcomes. Increased adoption of technology into life science products, services and operations also creates new cyber security and hacking risks where the impact of a data breach can mean life or death.

This convergence of industries creates demand for people who can work at the interface of previously non-overlapping industries, think in new ways about global markets and sectors and about customer experiences, and create entirely new roles. Life science companies often find that much tech talent is not comfortable working in the regulated sectors of the life science industry, where product development cycles are long and the tolerance for error and risk is very different than in the tech industry. This limits the mobility of talent from tech to life sciences.

At the same time life science companies increasingly are competing with tech companies for talent, particularly in the San Francisco Bay Area. Marquee tech companies such as Amazon, Google and Apple are entering the field, offering rich benefit packages and rapid product development cycles with attractive resume-building opportunities. Life science companies, however, have the advantage of offering mission-inspired talent the opportunity to have high impact “working toward the greater good” while earning good salaries and enjoying careers of lifelong learning. As an industry, we need to do more to get that message out.

—

“As the regulated life science industry collides with tech, finding the right talent can be a challenge... When I talk with young people about their careers they are more excited about Google, Facebook and other tech companies and attracted to the ‘cool factor’ of technology and the rapid development cycle of tech.”

“Medical devices are more integrated with smart phones and there is increasing pressure to make [them] more like consumer electronics - things people wouldn’t be ashamed to pull out and use in public.”
A LONG-TERM INDUSTRY SUSTAINABILITY THREAT

Long-term industry sustainability is a looming concern for California’s life science industry leaders. California used to be such a desirable destination that life science companies had their pick of talent from anywhere in the world.

Ever-increasing infrastructure challenges and affordability have made it difficult for young people to stay in the area. Employees are spending more time in long commutes and more money on housing. This makes it challenging to retain talent, let alone recruit new talent, impacting the industry’s ability to compete. Some suggest that legislators need to do more to make California an affordable place for new talent to stay and live.

Nevertheless, a steady stream of companies continue to set up shop in California in order to be on the forefront of innovation and among the preeminent research and talent coalescing around the state’s stellar research and academic institutions. While California pioneered the modern life science industry, past performance is no guarantee of future success. We must never forget that this is an incredibly competitive sector, and that policymakers play a critical role in nurturing the biomedical innovation that has made the Golden State a life science powerhouse.

While California is unlikely to lose its leadership in this space, many business, patient, community and industry groups are working closely with local, state and national policymakers to address this issue head on, to ensure that California remains competitive and the world leader in life science innovation.

“The economy and cost of real estate in California are becoming huge challenges for the sustainability of the state’s life science industry. Employees can be attracted to low-cost regions such as Texas and the Midwest.”

“The Bay Area is a challenging environment in which to operate due to the exceptionally high cost of living and lack of affordable housing...California or the region need to address this if the life science industry in the Bay Area is to remain competitive.”

“[The upcoming gubernatorial race] is a great opportunity to highlight the importance of this industry and the challenges of retaining talent in the state.”

The top 20 life science employers in California, in 2017, as measured by number of job postings accounted for approximately 38% (3,730 of the 9,900) total life science job postings in the state.

Top Employers: California Life Science Job Postings

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Job Postings</th>
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<td>1</td>
<td>Amgen</td>
<td>415</td>
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<td>2</td>
<td>Pfizer</td>
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<td>3</td>
<td>Genentech</td>
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<td>4</td>
<td>Thermo Fisher Scientific Inc</td>
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<td>5</td>
<td>Johnson &amp; Johnson</td>
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<td>6</td>
<td>Abbott Laboratories</td>
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<td>7</td>
<td>Gilead Sciences</td>
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<td>8</td>
<td>Merck &amp; Company</td>
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<td>9</td>
<td>General Atomics</td>
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<td>10</td>
<td>Biomarin Pharmaceutical Incorporated</td>
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<td>Quest Diagnostics Incorporated</td>
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<td>Danaher Corporation</td>
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<td>13</td>
<td>AbbVie</td>
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<td>14</td>
<td>Celgene Corporation</td>
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<td>15</td>
<td>Illumina Incorporated</td>
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<td>16</td>
<td>Lawrence Livermore National Laboratory</td>
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<td>17</td>
<td>Becton Dickinson</td>
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<td>Allergan PLC</td>
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<td>19</td>
<td>Novartis</td>
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<td>20</td>
<td>Edwards Lifesciences Corporation</td>
<td>90</td>
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Figure 6 - Source Burning Glass Technologies
California life science industry leaders are committed to diversity and understand its importance in driving innovation. Company leaders frequently describe diversity as “diversity of thinking” or “diversity of experience” and recognize its importance across their organizations and in the way they work: from entry-level employees to the board of directors; from advisory boards, and patient advocacy groups to the experiences of customers, partners, and clinical trial subjects. Most company leaders are highly attuned to diversity and inclusion within their organizations and can point to specific examples of why diversity matters. Many readily point to examples of existing diversity within their own companies, whether or not they have formal diversity initiatives or metrics.

While many life science companies have highly diverse teams, they acknowledge that they still have work to do to reach internal diversity goals. Where diversity gaps exist, they generally are at the very tops of organizations – company leadership teams and boards.

Several companies described specific goals and plans to increase the gender diversity among their senior management ranks and boards. One company described grooming women for advancement by giving them stretch assignments earlier than they would otherwise. Another set up a training program to groom women leaders to be future industry board members. Because so many organizations are seeking to do the same thing, they are finding it very competitive to find senior women board candidates.

Executives described a wide array of programs and initiatives to build and retain diverse employees throughout their workforce ranks. One executive has a world map in his office with a pin marking the birth location for each company employee to help him monitor diversity. Other companies do not proceed with hiring decisions until their candidate pool meets their candidate diversity targets. Others have taskforces that monitor internal hiring and promotion decisions to flag potential biases. One company has tapped diversity mentors to build and maintain inclusive work environments for their diverse workforce.

**HIRING MANAGERS REPORT ON “FORMAL” DIVERSITY INITIATIVES**

Only 13-15% of the 117 companies surveyed have indicated they have “formal” diversity initiatives for gender or race for non-management hires; 10%-12% for management hires, and 3%-5% at the board level. Those companies with diversity training typically offer it for management and non-management. (HR Survey, n=117)
88% of respondents anticipate expanding their employee headcount across major functional areas during the next 12 months, particularly in Research & Development, Quality, and Regulatory Affairs/Compliance (Figure 8).

Respondents rely on a variety of sources to identify and recruit talent (Figure 9). In recruiting experienced talent, most companies use a combined approach of engaging recruiters, posting on job boards and tapping internal networks.
Life science companies have a rich history of partnering with academic institutions for discovery research, technology licensing, drug candidate evaluation in disease models, clinical development and advisory board service. Many life science companies are exploring new approaches to partnering with academic institutions, many noting the misalignment of industry and academic incentives that have traditionally limited partnerships.

Companies continue to deliberately locate R&D operations near academic partners. They invest significant time in building deeper relationships with academic departments more so than in the past when relationships were more focused on individual professors or key opinion leaders at educational institutions. They are also sending their employees to partner campuses to participate in training, workshops or other events to learn side-by-side with their academic colleagues in order to establish stronger relationships and build trust.

Companies and educational institutions have also developed a number of innovative programs with academic partners at all levels to provide young people with industry exposure and experience. In one example, industry and academic partners collaborate in a co-op program in which graduate students spend six months in an academic lab followed by six months in an industry lab. Another company is investing in a large university lab and co-manages the hybrid academic-industry lab with its academic partner, providing multiple benefits for both organizations and unique learning opportunities for the lab’s students and post-doctoral fellows.

Recognizing the importance of reaching students early, several companies are working with local schools to develop or customize curriculum that educates students on how the industry works and the skills it needs. They offer company tours and job shadows, give informational interviews and career talks, serve as mentors on research projects, and help teachers develop and deliver hands-on science modules with real-world applications. These companies and individuals recognize the need to inspire and develop an affinity for science early in order to attract more students - particularly underrepresented students - into STEM careers.
We asked companies what percentage of H1B visa holders and contract workers make up their workforce:

**H1B visa holders**: Hiring of H1B visa holders is common across the industry, with greater participation by larger companies. 89% of the very large (>500 employees) companies have H1B visa employees representing, on average, 7.5% of their total workforce. 52% of the smaller companies (<500 employees) have on average 5% of the workforce staffed by H1B visa holders (data not shown)

**Contract workers**: Across industry sectors, 14% - 33% of companies rely on contract workers, with very small and very large companies reporting greater numbers of contact workers (Figure 10).
TO PROVIDE INTERNSHIPS OR NOT

Internship programs with local educational institutions continue to be a coveted way for students to gain the industry experience and hands-on learning that companies continually state they want. Not only do internships provide invaluable industry experience for (community) college and graduate students in technical fields, but increasingly for students in business and non-technical fields as well. Industry internships can make candidate employees much more attractive to employers for entry-level positions, and several companies cite internships as a valuable source of pipeline talent, hiring students when they complete their programs.

Many companies have also developed internships to inspire an early appreciation for careers in the industry. Most internship programs, however, focus on college students, graduate students and post-doctoral fellows helping them to supplement pre-existing technical training with critical hands-on work experience. High school internship programs are rare, which suggests that companies need to find other ways to engage with students to help nurture and develop their interest in the life sciences.

While there is no question that internships can play an important role in new talent development, many companies are reluctant to develop such programs out of concerns for time investment, capacity, liability issues, and more. This is particularly true of smaller companies, who point to the HR and other resources available to large pharmaceutical company internship programs.

Life science startups, however, are often a great source of internships for (community) college and graduate students. Staff-starved startups have figured out a way to augment their own capacity, while providing students with valuable exposure to life science techniques and startup culture. In best case scenarios, these young companies “grow their own” and bring on students as employees as their companies grow.

Several school programs that seek to provide industry-relevant experience for their students lament the lack of internship opportunities available in life science companies and organizations. Some suggestions for expanding internship programs include:

- Share internship program best practices to help peer companies understand how to develop successful, rewarding, and cost-effective programs.
- Create win-wins for startups and students by making lab space available to entrepreneurs who take on interns.
- Develop “reverse internship” programs where industry professionals supervise student research at their schools, with regular company site visits to present their findings.
- Build more deliberate training into internships, allowing students to explore career options, functions and skills beyond their assigned internship project scope.
RECOMMENDATIONS

GROOMING THE NEXT GENERATION OF TALENT: MORE WORK NEEDED

As in prior years of this report, executives continue to lament the lack of preparedness of students coming out of university programs. Some criticize institutions for focusing on developing talent for an increasingly small number of academic positions rather than for high-demand careers in the industry. This leaves numerous graduate and post-doc job seekers ill-prepared for jobs in the corporate sector. The charge is similar for recent 4-year graduates who many executives feel are not well-prepared for entry-level positions. Fresh college graduates typically don’t understand how industry works, its culture, the importance of soft skills and teamwork over individual contributions, the basics of product development or the fundamentals of business. As a consequence, some companies exclusively or predominantly hire people with prior industry experience.

EARLY CAREER EXPOSURE NEEDED

Too many young people are still unaware of the vast and exciting careers available in the life science industry, and the opportunities to move into well-paying, interesting, mission-driven jobs that provide lifelong learning opportunities. Many students thus don’t understand the importance of early STEM education in providing access to this career pathway.

This lack of awareness is especially acute among populations most underrepresented in STEM careers (i.e., women, people of color, economically disadvantaged) who often do not have industry role models and who thus opt out of STEM pathways altogether as early as middle school. This lack of pipeline diversity makes it more difficult for industry leaders to build the diverse teams that they tell us drive innovation. Most executives agree that we cannot wait until students reach college or graduate school to get students excited about careers in the life sciences.

Industry-academic partnerships that expose young talent to the industry, its culture and the drivers of life science innovation, can better prepare students for academic and career success. Many of those interviewed agreed that more should be done to foster academic partnerships to help develop the next generation of talent. Some ideas include:

- Address the foundational factors that misalign incentives between companies and academic institutions.
- Collaborate more on designing curriculum in areas that are meaningful and that drive innovation for industry.
- Create more opportunities for industry and academic professionals to collaborate on advisory boards and roundtables, and engage in greater dialog about talent development, education and innovation.
- Increase focus of partnership programs on technical schools and community colleges where hands-on learning is emphasized.
There are numerous pilot programs and initiatives underway to better prepare talent for future life science industry jobs. Companies are aware of some of these, but the means for sharing impact metrics and disseminating best practices are less clear. Some programs and approaches that might be helpful in grooming the next generation of life science industry talent include:

- Creating regional industry-academic advisory teams to develop strategic roadmaps that identify drivers of life science innovation and the skills and training needed to realize those roadmap destinations.
- Working with industry partners to design research projects that require critical thinking and the application of academic knowledge to real-world industry workplace challenges for students in STEM academic programs.
- Designing industry-academic partnerships in ways that allow students and post-docs to participate and gain working exposure to industry partners and culture.
- Expanding mentoring programs, particularly for populations that are underrepresented in STEM fields.
- Encouraging student participation in professional industry association networking and educational events
- Training students on soft skills (e.g., communication, working on teams, persuasion, leading by influencing, critical thinking, problem solving, getting along with others, dealing with ambiguity) and industry job readiness skills (e.g., understanding industry culture, decision-making, value drivers and economics)

Small companies often lack the resources to develop partnerships with academic institutions. Many of them expressed interest in doing more with academic partners - from participating more extensively in internship programs to establishing more R&D collaborations.

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1 2017 Biocom California Economic Impact Report, note that the 2018 California Life Sciences Association Life Sciences Industry Report, using a different methodology, indicates nearly 300,000 employees.
3 Interviews and job postings data for the 2018 California report are also included in a national report of the Coalition of State Bioscience Institutes (2018 CSBI National Workforce Trends Report), to which the Biocom Institute and the California Life Sciences Institute belong. As appropriate, some of the analyses, recommendations and quotes can be found in both reports.
THANK YOU

TO ALL THE LIFE SCIENCE COMPANIES AND ORGANIZATIONS THAT PARTICIPATED IN THE ANALYSIS, INCLUDING THE FOLLOWING THAT PROVIDED IN-DEPTH INTERVIEWS:

Abbott Laboratories
Amyris
Antiva Biosciences
Apricus Biosciences
Arcus Biosciences
Ardelyx, Inc.
Bayer
Becton, Dickinson & Company
Bell Biosystems, Inc.
BioAtla LLC
BioClarity
Boehringer Ingelheim
Caribou Biosciences, Inc.
Centaur Clinical CRO
Codexis, Inc.
Conatus Pharmaceuticals Inc.
CytomX Therapeutics
Dermata Therapeutics, LLC
Dupont Biosciences
Edwards Lifesciences, Inc.
Global Blood Therapeutics
Hologic Inc.
Immix Biopharma, Inc.
Janus-I Science Inc.
Meditope BioSciences
Medtronic
Merck
Neuroservice
Notogen, Inc.
Novvi LLC
Nucleus Biologics
Organovo
REVA Medical, Inc.
Ritter Pharmaceuticals, Inc.
Sutro Biopharma, Inc.
Theravance Biopharma, Inc.
Viscient Biosciences
Whole Biome, Inc.
Xencor, Inc.

Some organizations requested to remain anonymous.
Biocom Institute provides a rich array of programs to accelerate the growth of the life sciences ecosystem through workforce development and STEM education programs. Our industry-leading initiatives drive success for professionals eager to expand and enrich their skill set. Our world-class Science and Engineering Festival inspires today’s students to become future leaders. With a goal to invigorate the student community of California to embrace a career in STEM, and attract the best and brightest talent for long-term careers in life science, the Biocom Institute is a driving force in shaping the Science of Life. The Biocom Institute is an affiliate of Biocom, the largest and most experienced advocate for California’s life science sector. www.biocominstitute.org and @BiocomInstitute

California Life Sciences Institute (CLSI) supports the foundations of innovation that have made California home to the world’s most prominent life sciences ecosystem. Our mission is to maintain California’s leadership in life sciences innovation through support of entrepreneurship, education and career development. CLSI also serves as an accelerator for CARB-X, the world’s largest public-private partnership devoted to early stage antibacterial R&D. CLSI is an affiliate of the California Life Sciences Association (CLSA), the state’s largest and most influential life sciences advocacy and business leadership organization. The California Life Sciences Institute is a non-profit 501(c)(3), and was established in 1990 as the BayBio Institute. www.califesciencesinstitute.org and @CLSIStartups

The Centers of Excellence for Labor Market Research (COE) strive to be the number one source of labor market information for the California Community Colleges. The COE are strategically located across the state to study the regional economies of California. The colleges use COE’s data and research to better understand the workforce needs of employers and make data-driven decisions in program development. More information about the Centers of Excellence is available at coeccc.net.

Ron Susek, PhD MBA

At Anthem Blue Cross we understand our health connects us to each other. What we all do impacts those around us. Anthem is dedicated to delivering better care to our members, providing greater value to our customers and helping improve the health of our communities. Anthem offers a wide range of flexible, affordable benefits, health and wellness programs, innovative solutions and simplified administration services that make health care easier than ever to use. With local service and the value of the Blue Cross brand, we deliver measurable results and real value — now and for the long term. Anthem Blue Cross has been serving Californians for nearly 80 years and we’re committed to providing the best value in health care benefits.
FCG Agenda Item F 1
Should CSUPERB adopt a Code of Conduct to address bullying and harassment?

Background Material

Included in the recommendations from the recent NASED Report, “Sexual Harassment of Women Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine,” were suggestions about ‘The Role of Professional Societies and Organizations that Facilitate Research and Training:’

“Although each society has taken a slightly different approach to addressing sexual harassment, there are some shared approaches, including the following:

- Enacting new rules related to conference attendance and codes of conduct…
- Requiring members to acknowledge, in writing, the professional society’s rules and codes of conduct relating to sexual harassment during conference registration and annual membership sign-up and renewal.
- Supporting and designing programs that prevent harassment and provide skills to intervene when someone is being harassed (e.g., Astronomy Allies and the American Geophysical Union’s (AGU) Safe program).
- Strengthening statements on sexual harassment, bullying, and discrimination in professional societies’ codes of conduct, with a few defining it as research misconduct.”

Online Link to NASED Report (PDF free for download):
**FCG Agenda Item F 2**
Should CSUPERB invest in a Team Science Program, replacing the Joint Venture Program?

**Background Material**

The 2018-2021 CSUPERB Strategic Plan states that CSUPERB should “lead boldly in advancing integrative, inter-disciplinary education and team research.” This is a policy position ratified by all levels of program governance: requested by CSUPERB PIs surveyed during Fall 2017, the Faculty Consensus Group in January 2018, the Strategic Planning Council in April 2018, and the Presidents’ Commission in April 2018.

Framing the issue, we wrote in the strategic plan, “Complex biotechnology-related problems require diverse perspectives and techniques, bringing together life, physical, clinical, computer sciences, business, engineering, public health and mathematics expertise. Professional development workshops, incorporating…team-building and project management skill-building, for both students and faculty will cultivate diverse teams capable of identifying and addressing problems worth solving.”

The CSUPERB Strategic Planning Council and Presidents’ Commission asked the program office to draft a Team Science pilot program proposal for consideration at the August 2018 FCG and SPC meetings. Susan Baxter (CSUPERB) consulted with experts nationwide, including faculty and administrators affiliated with the National Science Foundation-funded CREDITS project (grant # 1464064). CREDITS is an “integrated research and training program aimed at increasing and enhancing the capacity, effectiveness and excellence of team science efforts in California.” As a result, this a draft Team Science Pilot Proposal for consideration.

**Problem:**

During the last decade, national reports and federal agencies\(^1\) have put greater emphasis on collaborative research in an effort to solve societal problems. Experts have shown that “integrative capacity”\(^2\) can better advance research endeavors and incubate novel ideas. Students, especially, find collaborative, real-world research to be engaging and impactful. In answer, faculty PIs affiliated with CSUPERB have asked for help building interdisciplinary partnerships across divisions on campus, between campuses, or with external organizations. Most biotech-related researchers are comfortable working in multidisciplinary teams (“researchers from different disciplines working sequentially, each from their own discipline-specific perspective, with a goal of eventually combining results to address a common problem”\(^3\)). But the move to interdisciplinary teams (“researchers from different disciplines working jointly to address a common problem”\(^3\))
is more difficult. As many have discovered, “Collaborations among multiple organizations are simple in theory, but difficult in practice. Making them work requires a backbone organization that pays close attention to the needs of all participants.”

While there is much organizational research into the Science of Team Science, we are not aware of existing Team Science Initiatives that we can re-purpose or adopt that provide team science training and team support services. Most existing programs provide networking platforms (see for example UCSF Team Science Services: https://rdo.ucsf.edu/team-science-program). However, most of these programs are offered at and tailored to human disease-focused researchers and clinicians at research-intensive universities and medical centers.

The CSU’s faculty is more diverse, dispersed (across the state), and involves collaborative faculty-student teams. CSUPERB faculty researchers are open to collaborating with colleagues in other departments, divisions, and on other CSU campuses, but need a supportive infrastructure and training on how to build and sustain dispersed teams on small liberal arts campuses, regional comprehensive universities, and small research universities. CSUPERB faculty PIs think that Team Science projects offer a way to build research capacity at CSU campuses, involve students in high-impact and real-world projects, connect with needs of regional communities, and enhance the careers of our diverse faculty members. CSUPERB leadership is familiar with and expert in using faculty learning communities (FLCs) to support professional development. Our concept for a pilot Team Science Program would incorporate the peer-learning and leadership development gains seen in effective FLCs. A successful Team Science Program will, over time, build the “capacity, effectiveness, and excellence” of CSU faculty-led biotechnology education and research. For instance, participants in early cohorts could serve as facilitators in later cohorts.

1) NIH Team Science Net, https://www.training.nih.gov/team_science (see https://loop.nigms.nih.gov/tag/team-science/)
2) Facilitating innovation in diverse science teams through integrative capacity, MR Salazar, TK Lant, SM Fiore, E Salas - Small Group Research, 2012
3) CREDITS Retreat 2018 (https://oru.research.ucsb.edu/teamscience/about/)

Strategy: CSUPERB thinks an integrated Team Science program should incorporate: 1) a curriculum focused on team science concepts, functions and operations, as well as 2) coaching and project management assistance. A grant program would not be sufficient, based on our experience with the CSUPERB Joint Venture program. Instead, a multi-faceted program to build teams capable of solving complex biotechnology problems and involving CSU students in their work / scholarship is suggested.
**Pilot Goals:** (1) The goal for each team would be to work together over the course of ~year to submit a collaborative, interdisciplinary grant proposal to an external agency/organization or gain institutional/campus support for an ongoing, interdisciplinary program. Multiple, parallel, but coordinated, proposal submissions would be considered a success in the pilot phase. (2) Individual participant goals would be related to professional development and learning team science concepts and skills. (3) The pilot program will inform a program model to build institutional capacity for team science within the CSU system. For instance, it is anticipated that a subset of program participants will become team coaches for subsequent team cohorts. By placing the proposed activities with the context of building capacity, the model and the lessons learned from the pilot can be viewed within the context of a comprehensive plan to develop, support, and sustain impactful biotechnology research and education teams in the future.

**Team Eligibility:** Mission-driven teams would consist of 6-8 CSU faculty, staff or administrators. Up to 2 team members can be external partners. Team members must be discipline-diverse, but the project or program proposed must be biotechnology-relevant. Team members can be drawn from multiple CSU campuses, but it is not required. For the pilot, existing teams will be considered if they can demonstrate a need to improve the quality of the team’s interactions and productivity.

It is important to understand that individual team members may be externally-funded, but the team project should not yet have external or internal funding support. As a result, ideas and preliminary data to inform team planning, activities, and follow-on proposals will already exist (or will be under development). The “Team Science” challenge is pulling together experts and already existing, separate research strands to build effective interdisciplinary teams and programs to solve “problems worth solving.”

**2018-2019 Pilot Program Description:**

- A 9-12 month program for four mission-driven teams (defined above)
- Provide team-building workshop at 2019 CSU Biotechnology Symposium to recruit applicants
- Provide team science training up front at a 2-day kick-off meeting once teams are selected
- Provide year-long support (= a team coach/project manager/facilitator who will organize monthly calls and virtual team meetings, help with milestone-setting, offer conflict resolution, etc.)
- Provide 2-3 external-to-the-CSU subject matter experts (SMEs) to consult with teams on grant or campus proposals. SMEs will be required to sign confidentiality agreements. Conflicts of interest will be managed.
Hold 3 in-person convenings throughout the year: kickoff, mid-year check-in, and final, public lessons-learned presentations at 2020 CSU Biotechnology Symposium. In-person meetings will include team progress assessment, problem solving, and process evaluation.

An external-to-the-CSU assessment team will help CSUPERB determine whether the pilot meets the goals of the project.

An external-to-the-CSU project management team will oversee pilot activities and prepare/review monthly, quarterly and final evaluation reports in collaboration with CSUPERB. CSUPERB will issue a call for proposals to solicit contractors.

**Pilot Program Budget: $130,000 (or $65,000/year over 2 years)**

- Includes external contractor costs and
- Includes travel and all in-person meeting costs
- Does **not** include a “grant” to teams for preliminary data collection (can be revisited if pilot successful)
- Does **not** include a release time “grant” (can be revisited if pilot successful)
- Does **not** include a “prize” for submitting a team science proposal at the end of the year (can be revisited if pilot successful)
- Instead of a Grant Program, the Team Science Pilot program design is analogous to CREDITS programming ([https://oru.research.ucsb.edu/teamscience/about/](https://oru.research.ucsb.edu/teamscience/about/)), Middle Leadership Academies ([http://csunetwork.edinsightscenter.org/Activities/Middle-Leadership-Academy](http://csunetwork.edinsightscenter.org/Activities/Middle-Leadership-Academy)), or Faculty Learning Community models ([https://www.aacu.org/summerinstitutes/ilsw/2018](https://www.aacu.org/summerinstitutes/ilsw/2018)) – all involve motivated, mission-driven teams.
FCG Agenda Item F 3
Should the CSUPERB Travel Grant Program Cycles Change?

Background Material

Based on complaints, suggestions and questions from grantees the last couple of years, is the FCG open to altering the Travel Grant Program cycles?

**Current travel grant cycles are based on a “past/future” design.** That is, applicants can apply for grants to reimburse expenses for travel already completed OR to reimburse future travel. For example, as currently offered, the Fall Travel Grants would fund travel from July 1, 2018 through June 30, 2019. The program is open for proposals twice a year, with a six-month overlap.

**Would the FCG consider a “future” designed program instead?** This means that the Fall Round of Travel Grants would reimburse (future) travel from January through December of the following year. The Spring Round would fund travel from July of the application year through June of the following year (maintaining the six-month overlap of the current program design). Nonetheless, this means applicants would need to plan ahead and identify meetings in advance of travel grant proposal submissions.

To mitigate the disruption of altering the schedule, the Fall 2018 round could have its funding window extended by 6 months so that travel grants could be used to reimburse travel from July 1, 2018 (the traditional start) through December 31, 2019. Then the Spring 2019 grant cycle would fall back to a 12-month window to reimburse travel between July 1, 2019 through June 30, 2020.

**Feedback from Applicants:**

- Travel Grant funding decisions are currently not made until halfway through the eligible travel “window” to utilize the funds. As a result, some applicants don’t win grants until 5-6 months after their actual trip. Applicants have to risk the use of their own funds in the hopes of winning a grant to be reimbursed. With the recent success rates so low (<25%), this seems to be an increasingly unfair expectation.

- Thinking a CSUPERB grant award is a long shot, awardees who travel months prior to winning travel grants tend to skip appropriate campus travel approvals, for instance the foreign travel insurance program. This often makes reimbursement through campus mechanisms impossible (= negative impact of current program design).

- Thinking a CSUPERB grant award is a long shot, awardees traveling months prior to winning travel grants often obtain reimbursement from other funding sources (sometimes inappropriate) so they don’t have to carry the expense themselves. This often makes reimbursement through campus mechanisms impossible (= negative impact of current program design).
**FCG Agenda Item F 4**  
**Should Research Development Seed Grant Applicants be required to include reviews of failed grant applications?**

**Background Material**

Based on suggestions from the Research Development (RD) proposal review committee this past year, is the FCG open to altering the eligibility criteria for that program?

Recall, the RD program is our gap or bridge grant program. The T-shirt slogan is “Don’t apply to CSUPERB first,” - that is - you must have applied to an external funding organization unsuccessfully before applying to the RD program.

The Spring 2018 reviewers felt it would be helpful to the review to **REQUIRE** that RD applicants attach the reviews of their failed grant application (if possible). If no reviews were returned, at the least, the review committee would like applicants to make clear the specifics of that failed application and the feedback so as to make it easier for a review committee to assess how well the proposed project would address the deficiencies cited.

Currently, the RD Request for Proposals suggests this information should be included in the proposals, but does not require them. As a result, there is a “bell curve” of responses to this review criteria. The review committees increasingly think it’s a waste of their time to “guess” what the review feedback was when proposal writers obfuscate the specifics.

The committee writes: As usual there was quite a range among the applications as to how thoroughly they had addressed the description of the prior attempts to secure grant funding from an external source. Could we include a section that either requires them to upload the summary pages or else/additionally, require the applicants to upload a form containing the following:

- Name of grant agency
- Name of Grant mechanism, and possibly budget dollar amount
- Date of submission
- Text of feedback from review committee (or statement that such feedback is not provided by that grant mechanism)
- Projected plan for resubmission/submission to a new agency if CSUPERB RD grant is funded.”