

CSUPERB's mission is to develop a professional biotechnology workforce by mobilizing and supporting collaborative CSU student and faculty research, innovating educational practices, and responding to and anticipating the needs of the life sciences industry.



Above: CSU I-Corps Cohort #1 (all student teams) gathers after presenting their Lessons Learned Presentations at the 27th Annual CSU Biotechnology Symposium in Santa Clara, California, on January 10th, 2015.

CSUPERB invests in the idea that a modern biotechnology education requires an integration of coursework, hands-on practice, and participation in team-based research and entrepreneurship projects.

But what happens next for research discoveries and inventions made in biotechnology laboratories? Traditionally academic researchers publish their work in journals or make conference presentations to get the word out. What is much more difficult to figure out is how to actively commercialize research ideas or make a product that solves societal problems. Further complicating matters, academic biotech research-based ideas are rarely ready for the market. The gap between academic research and biotechnology product development has time and cost dimensions, but also a knowledge deficit. The result, as Roman Lubynsky* points out, is that “Ventures based on university research still on a lab bench start off in a science phase to continue the research, and this phase can last a long time.”

Entrepreneurship education is one way to reduce the gap and improve commercialization efficiency. Steve Blank, architect of the National Science Foundation's Innovation Corps (I-Corps™), insists that meaningful solutions can result if researchers learn to talk to and learn from domain experts, industry mentors, external collaborators and downstream customers. CSU I-Corps is our mentored, experiential learning program for student and faculty biotechnology researchers interested in biotechnology commercialization.

Supported by an NSF grant to CSUPERB, we've led three cohorts of teams through the Lean Launchpad® curriculum, on which I-Corps is based. While current interest in entrepreneurship education is largely student-driven, faculty members are getting interested as well. Not all research-based ideas fit a definitive market need, but already faculty members see an important link to their teaching. A cohort #2 team lead writes, “...when we [mentor] student projects...commercialization may not be the first priority issue to be considered. However, as engineers, we must think about developing products so that those [ideas] will be eventually useful.”

*Lubynsky, R. (2013) From Lab Bench to Innovation: Critical Challenges to Nascent Academic Entrepreneurs.

2014/15 Program Highlights

- The 27th Annual CSU Biotechnology Symposium in Santa Clara drew 627 participants and featured 264 posters from 21 CSU universities – representing work from 142 CSU labs and 86 external partners.
- CSUPERB made 121 individual grants and awards (totaling \$790,311) to 55 faculty and 66 students at 21 CSU campuses.
- CSUPERB was featured in the new report, *Vision & Change in Undergraduate Biology Education; Chronicling Change, Inspiring the Future* (2015), for our strategy of supporting “high-impact practices” system-wide.
- The National Science Foundation-supported CSU Innovation Corps (I-Corps™) involved 116 students and 24 faculty members from 9 CSU campuses in experiential, “evidence-based” entrepreneurship to identify biotechnology research-based solutions for market needs or problems.

Student Researcher Voices

Christopher Ikeda (San Francisco State University & Spring 2014 CSUPERB Travel Grant recipient) is a masters' student in Marine Biology working in Dr. William Cochlan's lab at the Romburg Tiburon Center for Environmental Studies. Mr. Ikeda is part of a joint, collaborative research team involving researchers at SFSU, NOAA Seattle, Western University (Canada) and the University of Maine. Using cell culturing techniques and fluorescence microscopy, among other bio-techniques, Mr. Ikeda and coworkers demonstrated that Harmful Algae Blooms (HABs) in the Puget Sound have toxicities that vary as a function of growth phase and salinity. As a result of this work, Chris was allocated an oral presentation slot at the 2014 Ocean Sciences Meeting in Honolulu, Hawaii, a very rare opportunity for MS-level students. In his final report Mr. Ikeda explains, "...this was my first oral presentation at a professional conference, preparing for it was an important learning experience that required a different presentation style...[I had to] create a presentation that appealed to a wide range of disciplines, including researchers, educators and students."

Lauren (Paaske) Delhousay (CSU Long Beach & Fall 2013 Travel Grant recipient) was a masters' student in the Department of Biological Sciences, where she worked in Dr. Kevin Sinchak's NIH-funded neuroscience lab, investigating the role of neuroprogesterone in reproduction. She presented her work at the 43rd annual meeting of the Society of Neuroscience in San Diego. In her final report Ms. Delhousay explained, "After graduation I landed a job at the Experium Science Academy in Torrance. Because of the experiences like the one in San Diego... I am now the head of the High School Independent Research program, in which I mentor students in their research projects. Students make poster presentations that are comparable to those presented at international meetings...I believe that having the travel grant program in place for CSU students is an incredible motivator...and my current employer was very impressed that my research was eligible for such an award. Thank you for recognizing my work and allowing me to take my research and education to another level."

Letter from the Executive Director

Dear Colleagues and Friends:

We issued a new CSUPERB Strategic Plan this year, approved in April by Chancellor White. We placed a greater emphasis on entrepreneurship education. Our opening statement now says, "CSUPERB believes that the best way to recruit, engage, and help students persist in life science careers is to provide access to experiential learning opportunities in biotechnology research and entrepreneurship." Many of us already see CSU I-Corps as a "high-impact*" practice, comparable to undergraduate research or service learning. But I-Corps also forces student and faculty researchers to open up to external partners and collaborations to tackle difficult, societal problems. During the planning process we also heard that we should incentivize greater inter-disciplinarity. We wrote, "Student success is defined as persistence to a degree, but also the acquired abilities to build a life science career." The latter is increasingly tied to the need to integrate or "make sense" of disparate, multi-disciplinary sources of knowledge or content." Collectively the CSUPERB community thinks these are good ideas.

CSUPERB is used to its principal investigators making the news (see the feature in this report on Dr. Iñiguez), but we're not used to being in the spotlight ourselves. We were excited to find ourselves in the middle of the 2015 report, *Vision & Change in Undergraduate Biology Education; Chronicling Change, Inspiring the Future*, published jointly by the American Association for the Advancement of Science, the National Science Foundation (NSF), Howard Hughes Medical Institute and the US Department of Agriculture. The feature is based on a poster that Jim Henderson (formerly a dean at CSU Los Angeles and CSUPERB SPC member; now at University of Louisiana Lafayette) and I presented at a 2013 Vision and Change conference in D.C. We outlined our strategic plan to increase access to research experiences across the CSU and tied it to student success (see our definition above). The AAAS reporter I talked with said she was impressed with the scale of our ambition and effort.

I occasionally struggle to explain the reach, effectiveness and impact of CSUPERB. How can I explain to those not familiar with the research on learning organizations the power (and magic?) of a renewing, system-wide community created to support biotech education and research? How best can I describe the value of CSUPERB's savvy proposal peer reviewers or the scale of our collective experience "on the ground" in deans' offices, departmental units, classrooms, laboratories and regional communities? With a system-wide mission and perspective, CSUPERB has formidable institutional memory on lessons learned. The outcomes of our work together are made real in the stories and voices featured in these pages.

In short I think communities like CSUPERB provide an effective way to scale up evidence-based ideas, test out promising ones, or "bend" culture (or accelerate tipping points, as the NSF names it). When we learn together, we can make real and meaningful impact on student success, innovation ecosystems, and scientific and technical frontiers. This is deliberate, intentional, systematic work that plays out over time. Collectively the CSUPERB community thinks this is a very effective and strategic way of getting good things done.



*High Impact Educational Practices: https://www.aacu.org/sites/default/files/files/LEAP/HIP_tables.pdf

SAVE THE DATE! The 28th Annual CSU Biotechnology Symposium will be held January 7-9, 2016, at the Hyatt Regency Orange County!

CSUPERB is Industry Mentors

As part of our strategic plan, CSUPERB aims to close the gap between CSU-based learning and biotechnology industry practice. To do this, we recognize the ongoing need to partner with external advisors, industry experts and biotechnology industry organizations. It turns out some of our best partners are also CSU alums!

Willie Zuniga graduated with a bachelor's degree from California State University, Los Angeles in 1986; today he's the President of Grifols Biologicals, Inc., a manufacturer of biological products derived from human plasma that are used as lifesaving therapies for individuals worldwide. He explains how he got from CSULA to his position today, "Initially, I entered a private college with aspirations to become a physician. However, life happens and I found myself a young father with the need to discontinue college on a full-time basis and re-focus on working and bringing food to the table. I want to say that I chose the biopharmaceutical industry; however, the truth is I simply needed a job and an entry-level position was available to me. The difference is that I got lucky. I found an area that interested me; and what started as a job suddenly became a career. The beauty is that although I am not a physician, I work for a company that makes life-saving products. So, I can still proudly say that I 'save lives' every day."

Mr. Zuniga learned about CSUPERB in 2010 at a workforce development summit at CSULA; he says, "...I was hooked... CSUPERB's mission to 'develop a professional biotechnology workforce' with the collaborative efforts of the CSU community and its resources provides the proactive and progressive approach that we need as an industry." Since then he's attended the annual symposium and served as a mentor at the Career Networking Session for students. When asked what preparation undergraduates need to land jobs these days, Mr. Zuniga says, "There's a combination of academic, technical and soft skills that we look for at Grifols. For our entry-level positions, I continue to work with biotechnology, as well as chemical and process technology programs. I find that these students...'hit the ground running'...For our chemists, microbiologist and principal scientist positions, I look for [graduates] with degrees in specialized areas of science."

Mr. Zuniga and Grifols are deeply involved with the local community on a variety of workforce development partnerships. He explains, "Together with Cal State LA, we began specialized presentations in the classroom; became the first industry supporter of the GO East LA "cradle to career" program...partnered with El Nido Family Centers to share STEM curriculum ...connected Grifols employees/Cal State alumni to students...and joined the President's Advisory



Willie Zuniga (center) chats with fellow industry mentors, Gary Fujii (left) and Chris Chow (right; also Mr. Zuniga's wife) at the conclusion of the 2013 Career Networking Session in Anaheim, California.

Summary: 27th Annual CSU Biotechnology Symposium



Opening Session Speakers at the 2015 Symposium (left to right): David Martin (AvidBiotics), Rachel Haurwitz (Caribou Biosciences), Karen Burg (U. Kansas), President Leslie Wong (San Francisco State University & CSUPERB Presidents' Commission) & Susan Baxter (CSUPERB).

The annual symposium returned to Santa Clara, California, for the second year in a row. The lack of geographic variety didn't deter the CSU's biotechnology community; the post-symposium surveys from student and faculty participants suggest it was our best one ever. 100% of the faculty participants surveyed would recommend the event to their colleagues; 96% of students would recommend it to their peers!

Interestingly 33% of the 264 research posters presented involved external-to-the-CSU collaborators and partners – a 12% increase over last year. The post-symposium surveys highlighted two main "take-away" themes from this year's meeting. First, many survey respondents reflected on the Eden Graduate Student Research Award Finalists' talks. One wrote, "I realized the importance of the Eden award talks to the symposium...I think they inspire and encourage that audience in a profound way. We as faculty, and (even) 28-year-olds who have already founded 2 biotech companies, can't provide the same kind of model as successful peers do." Secondly, the participants were very impressed with the entrepreneurs who presented at this year's symposium. One wrote, "The most memorable moments from this year's symposium included stories told by the biotechnology entrepreneurs on Friday morning, as well as the paths and detours taken by the I-Corps teams." Another writes, "Their stories are amazing and I learned how entrepreneurs think differently than basic researchers. They are very honest with themselves about their technology's strengths and weaknesses..." CSUPERB thanks Gilead Sciences, Inc. and the National Science Foundation for their support.

CSUPERB is: Faculty Researchers, Teachers & Mentors

Deborah Fraser (CSU Long Beach; 2013 New Investigator Grant recipient). Dr. Fraser's research group investigates the molecular mechanisms of the human innate immune response and factors involved in inflammatory diseases like atherosclerosis. Using her CSUPERB grant, Dr. Fraser involved six undergraduate students in her lab where she trained them in the molecular and cellular biology techniques needed to do basic biomedical research. The preliminary data and results they generated led to a new National Institutes of Health grant (\$427,000) to the lab, supporting ongoing studies through 2018. Dr. Fraser writes, "This CSUPERB grant was instrumental in keeping my lab going after my start-up funds ended, it allowed me to focus on research during the summer, and not have to teach for income as well as providing me with the preliminary data I needed for a successful NIH SC3 application. The value of this program is immeasurable. Beyond the obvious monetary advantages, I have benefitted greatly from the practice of writing grants and grants management, budget and reporting."

Sergio Iñiguez (CSU San Bernardino; Spring 2013 New Investigator Grant recipient). Dr. Iñiguez's research group investigates the neurobiology of human mood-related illnesses, like depression, using preclinical mouse models and neurophysiological techniques. The group collaborates with researchers at Florida State University, Mount Sinai School of Medicine, University of Maryland and the Massachusetts Institute of Technology. Using his CSUPERB grant, Dr. Iñiguez involved six undergraduate and graduate students in his lab, generating results for two publications (*Journal of Neuroscience* and *Stress*) and an NIH grant proposal. In his final report Dr. Iñiguez explained what happened next: "The funding of this project has a significant positive effect to my research program, the university and my students...The results were well-received by the scientific community and, as a result, the project was published in a prestigious academic journal (*Journal of Neuroscience*). Shortly after its publication, the manuscript was featured in the *Los Angeles Times* newspaper, thus bringing national attention to the biotechnological research conducted at CSU San Bernardino." To top it all off, as this report went to press, Dr. Iñiguez found out his NIH proposal was funded, providing support (\$429,940) for the research group through 2018.



The Iñiguez Lab Group at CSU San Bernardino, Summer 2015. (left to right) Jason Alipio (undergrad student), Lace Riggs (grad student), Francisco Flores (grad student), David Sanchez (undergrad student), Sergio Iñiguez & Mirella Hernandez (undergrad student).

Student Researcher Voices

Phu Truong (San Francisco State University & Fall 2014 CSUPERB Travel Grant recipient) is an NIH-MARC-supported masters' student in Biology working in Dr. George Gassner's laboratory. Mr. Truong's enzyme engineering work is focused on understanding the key active site and specificity of variants of an enzyme called styrene monooxygenase. Mr. Truong demonstrated an engineering approach to develop new biocatalysts capable of either building novel compounds or breaking down toxins as part of bioremediation efforts. He presented his work at the April 2015 Annual meeting of the American Society of Biochemistry and Molecular Biology in Boston. In his final report Mr. Truong writes, "The grant has allowed me to experience the professionalism of being a scientist...The meeting in Boston definitely had more participants from the east coast so I got a glimpse of what it would be like doing research in a different culture, influencing me to apply to [doctoral programs] outside California."

Laura Walters (CSU San Marcos & Spring 2014 CSUPERB Travel Grant recipient) is a masters' student working in Dr. Matt Escobar's group in the Department of Biological Sciences. Ms. Walters began working in the Escobar lab as an undergraduate and decided to continue as a graduate researcher. In 2014 the lab published an influential paper in *Plant Physiology* suggesting that polyphenol oxidase (PPO) enzymes are involved in alkaloid biosynthesis in walnut trees. As a result Dr. Facchini, an alkaloid biochemist at the University of Calgary, agreed to train Laura in metabolite (alkaloid) profiling techniques, offering a unique opportunity for Laura who, at that time, had spent her entire academic career at CSUSM. In her final report Ms. Walters describes the impact of her research experience in Canada, "Not only did I learn new techniques, I had the chance to observe and interact with graduate students and post-doctorates...[they] were very inspirational to me...I was starting to feel that most women of science have to choose between either staying in research or having a family, but after seeing Jill [a postdoc] I see otherwise. [Another Facchini lab postdoc] taught me a valuable lesson about being flexible in any situation, finding your interests, putting them to good use, and not giving up on a project if it gets too hard."

Anonymous Student Voices from the Post-Symposium Survey

What will you remember?

"The speakers from Friday morning and their journey to being a biotechnological entrepreneur."

"The career networking speech given by Samantha Kubeck!" [a San Jose State University graduate, now working at Nodality, Inc.]

"...it was nice to talk to CSU alumni who are now in Ph.D programs and shared the similar stories that occur in the lab."

"I'll remember the array of projects spanning several areas of the sciences including organic chemistry, inorganic chemistry, biology, biochemistry, etc. The range of focus emphasizes the camaraderie inherent in the continued progression of research."

"Alicia Davis and her PI Dr. Newcomb of CSU San Bernardino were incredibly inspiring as both took the time to understand my lab's research, offer advice both for our experiments and for our personal futures..."

"I will remember the information I received during the career networking session. It was very useful and eye opening to me. I realized that there are more opportunities out there than I had thought."

"The I-Corps presentations were very interesting because it involved a lot more than just the research behind developing a product."

"I got to talk about my research in a new environment and in a slightly different context (i.e. with people who weren't at all familiar with protein NMR)."

"It was really great to see how big of an event this was. There were probably around 400+ people [at the Final Banquet] all from different CSUs all with a focus towards Biology. It was mind-blowing."

"Potential jobs in bioinformatics are almost a footnote to the actual biotech field."

"Truth be told, I had no idea such brilliant research existed throughout the CSU system and I am incredibly proud and impressed for the exposure."

"Basically, every poster represented a new discovery in its respective field. It was hard to find something that wasn't new, really."

CSUPERB is: Faculty Researchers, Educators & Mentors

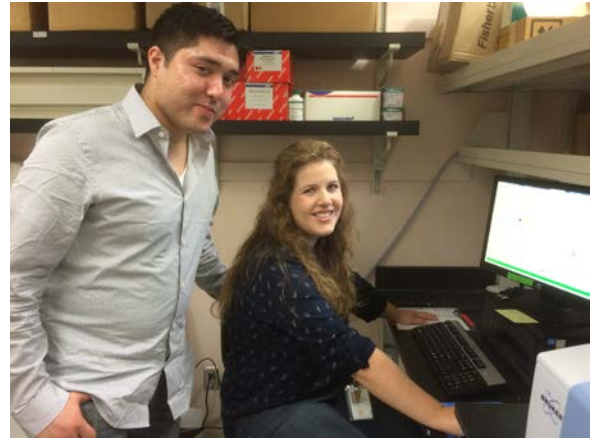
Rachel Mackelprang (CSU Northridge; 2013 New Investigator Award recipient). Dr. Mackelprang joined CSU Northridge as an Assistant Professor in the Department of Biological Sciences, after completing her doctoral studies at University of Washington and a postdoc at the Department of Energy's Joint Genome Institute and the Lawrence Berkeley National Laboratory. Dr. Mackelprang's research group uses "ultra high-throughput sequencing, bioinformatic analysis, and microbiology-based approaches to study microbial community response to human-caused environmental perturbations and determine the impact of microbes on biogeochemical cycles." Her CSUPERB grant allowed the lab to investigate microbial strategies for survival in permafrost over geologic timescales. Dr. Mackelprang writes, "Perhaps one of the most important things to come out of this project was strong support for our hypothesis that permafrost age rather than other soil physiochemical properties drives microbial community structure and function. These data are particularly relevant to NASA's exobiology program that seeks to investigate the boundaries at which life exists in order to inform the search for habitable environments outside Earth. Permafrost has been found on Mars, so Earth's permafrost may act as an analogue reflecting potential inhabitants on Mars or other extraterrestrial cryogenic bodies...We submitted a \$1.3M proposal to NASA...using CSUPERB-funded research as preliminary data. In April 2015 we found out the grant was funded..." Dr. Mackelprang's recent results led to invitations to present her lab's work at the Soil Biology and Biochemistry Symposium this fall and at the University of Helsinki in December. She's also published an invited review article on "Permafrost Metagenomics and Climate Change" in the most recent *Annual Review of Earth and Planetary Sciences*.

Elizabeth Skovran (San José State University; 2014 Travel Grant and New Investigator Grant recipient). Dr. Skovran joined SJSU as an Assistant Professor in the Department of Biological Sciences, after completing her doctoral studies at University of Wisconsin, Madison, and a postdoc in chemical engineering at the University of Washington. Dr. Skovran's research group uses systems biology approaches, along with classical genetic and biochemical techniques, to understand the metabolic properties of methylotrophic microbes and better engineer them to produce value-added chemicals like biofuels and bioplastics from methanol. Dr. Skovran won a travel grant to attend a Gordon Conference in Massachusetts. She planned on meeting with research collaborators from Michigan, Idaho and Switzerland during the meeting, but also "...to show that you can make important contributions and do great research with undergraduates." In her final report she writes, "This conference has had a tremendous impact on my career, more so than any other conference I have ever attended." With a collaborator I met at the conference, "we submitted one NSF grant and one NIH grant surrounding the work I presented. Additionally I was invited to speak at a second Gordon Conference on Biometals. A representative from *Science Magazine* asked me to write a perspective for *Science*...[it] contains a figure created by my General Microbiology class. I incorporated this project into my General Microbiology class, giving the 100+ students a chance to work on a real research project. This resulted in novel discoveries that we are following up on in several publications. [At the Gordon Conference] I met a representative from Intrexon (a biotech company) who has now hired a student from my research lab. It is because of CSUPERB that my career is off to a promising start..."

CSUPERB is: Collaborative Researchers

Carol Lauzon (CSU East Bay; 2013 Joint Venture Grant recipient). Dr. Lauzon won a Joint Venture (JV) grant to work with a collaborator at the U.S. Food & Drug Administration (FDA). They wanted to investigate the utility of FT-IR spectroscopy methods and a proprietary algorithm to rapidly and accurately detect and identify harmful bacteria in food samples. However, even the best planned-out external partnership plans sometimes unravel; her research partner left the FDA to take a job at a biotech company. Quickly pivoting Dr. Lauzon found another collaborator, Dr. Lisa Gorsky, at the US Department of Agriculture (USDA) lab in Albany, California, interested in developing the technology. The USDA matched CSUPERB's Joint Venture grant by purchasing a state-of-the-art FTIR machine for the research team. As a result a group led by Dr. Shunlin Wang from Bruker Optics, Inc. has been instrumental in the team's success. Dr. Lauzon writes, Dr. Wang "has been invaluable. [He] hosted us at Bruker for a personal workshop on the use and theory of FTIR for bacterial identification. We have an excellent relationship with the company as a result of this funding." CSU East Bay students,

Nicole Herbold, Kelly Romanolo and Bijan Kashmanian, involved in the project presented research results at the May 2014 American Society for Microbiology meetings and the group published a paper in *Current Microbiology*. Ms. Romanolo is now employed at the USDA lab and Ms. Herbold is working at the Joint Genome Institute. Dr. Lauzon concludes, "This grant program is extremely valuable, especially for our students and also to facilitate faculty engagement with outside agencies."



Bijan Kashanian (left) works with **Kelly Romanolo** (right) at the USDA ARS Laboratories in Albany, CA, to develop methods to rapidly identify and classify *Salmonella* spp. using FTIR. Mr. Kashanian is currently a graduate student working with Dr. Lauzon at CSU East Bay; just this week he got a job offer to work as a research associate at a biotech company. Ms. Romanolo recently completed her master's degree at CSU East Bay and is now employed at USDA, working with Dr. Gorsky.

Nathan Rank (Sonoma State University; 2013 Joint Venture Grant recipient). Dr. Rank used the JV grant to bring new genetic and genomic technologies into his research program investigating how montane leaf beetles in the eastern Sierra Nevada might cope with stressful temperatures and climate change. As he explained in his proposal, "...genomic innovations have enabled scientists to study non-model organisms in the wild, addressing physiological



Team Beetle at the Start of the field season, 2010. (Back row, left to right) Elizabeth Dahlhoff (Professor, Santa Clara University), Nathan Rank, Kevin Roberts (Sonoma State, now PhD student at UC Berkeley), Chris Macko (Santa Clara), Mike Carlson (SSU). (Front row, left to right) Malia Naomi Grobbel-Rank, Maggie Abercrombie (Santa Clara), Julie Lynn (SSU), Rae Heitcamp (Santa Clara), Nic Zavala (Santa Clara), Victoria Dahlhoff, Sarah Heidi (SSU).

and evolutionary questions that would have been unapproachable just a few years ago." To tackle the questions he had, Dr. Rank recruited a global network of evolutionary biologists from Sweden, Canada, Finland and Belgium; and used DNA sequencing centers in the United States. The JV grant specifically funded preliminary data collection and analysis with collaborators at Santa Clara University and Stockholm University. By May 2015 Dr. Rank's group received external funding (\$408,986) from the National Science Foundation, graduated the lead Sonoma State student researcher into an Integrative Biology doctoral program at UC Berkeley, enriched student learning at Sonoma State University with a workshop on cutting-edge PoolSeq methods, and deepened a partnership with researchers at the Stockholm University. Dr. Rank writes in his final report, "The CSUPERB grant program has had an amazingly positive impact on my research program...Without the CSUPERB award for the joint venture, I do not believe we would have put this work together or received the award."

2015 CSU Biotechnology Symposium Awards



2015 ANDREOLI FACULTY SERVICE AWARD: **Dr. Guna Selvaduray**, Professor & Director, Biomedical Engineering, Chemical and Materials Engineering Department, San José State University (SJSU). Dr. Selvaduray was recognized for his leadership and development of new bioengineering degree programs and the founding of a flourishing and award-winning Biomedical Engineering Society (BMES) chapter at SJSU. Pictured here (left to right): Sandra Sharp (CSU Los Angeles & Chair, 2014 Andreoli Award Selection Committee), Daniel Khuc (Graduate Student, Biomedical Engineering & 2013-2014 President, SJSU Biomedical Engineering Society), Dr. Selvaduray, and Andrew Hsu (Dean, Charles W. Davidson College of Engineering, SJSU).



2015 CSUPERB FACULTY RESEARCH AWARD: **Dr. Cynthia Crawford**, Professor, Department of Psychology, California State University, San Bernardino. Dr. Crawford was recognized for her outstanding research accomplishments and publication record in the biomedical neuroscience and psychopharmacology fields, her enviable federal funding track record, her national service record, her influential mentoring capabilities, and her support for student researchers throughout her career at CSU San Bernardino. Pictured here (left to right): Dr. Crawford, Sergio Iñiguez (CSU San Bernardino), Arturo Zavala (CSU Long Beach) & Michael Goldman (San Francisco State University & Chair, Faculty Research Award Selection Committee).



2015 CRELLIN PAULING STUDENT TEACHING AWARDS: **Mr. Peter Ewing**, Biological Sciences master's candidate, CSU Los Angeles, and **Ms. Danae Madrid**, master's candidate, Chemistry & Biochemistry, San Diego State University. The selection committee was impressed by Mr. Ewing's energy and recognition that mentoring and teaching makes "us better scientists through the very act of teaching. The selection committee was impressed by Ms. Madrid's student-centered focus and her recognition that her "contact with the students and the guidance I [provide] them in the lab could profoundly influence how they viewed chemistry and whether they would continue to pursue careers in science or engineering." Pictured here (left to right): Dr. Kay Pauling, Ms. Madrid, Mr. Ewing and David Pauling.



2015 GLENN NAGEL UNDERGRADUATE STUDENT RESEARCH AWARD: **Ashley Chui** (CSU Fullerton). Research Mentor: Michael Bridges. The Bridges lab investigates stathmin – a cytoskeletal protein involved in regulating the fundamental network that gives cells support and structure. Ms. Chui investigated different forms of stathmin to predict its normal structure as compared to dis-functional structures associated with neurodegenerative diseases. Ms. Chui was supported by the Howard Hughes Medical Institute and was an Amgen Scholar during summer 2014 at University of California San Francisco. Pictured here (left to right): Michael Bridges (CSU Fullerton), Greta Nagel, Ms. Chui, and Miri Van Hoven (San José State University & Chair, 2015 Nagel Award Selection Committee).



2015 DON EDEN GRADUATE STUDENT RESEARCH AWARD: **Alicia Davis**, CSU San Bernardino. Research mentor: Laura Newcomb. The Newcomb group studies an influenza virus, the negative sense RNA virus influenza A (Udorn). Ms. Davis worked to characterize a specific domain of the virus important for viral replication. In the course of her work, Ms. Davis coauthored a review published in *Virology Journal* (2014, 11:167). Their work is supported by the National Institutes of Health (NIH); Ms. Davis was an NIH Maximizing Access to Research Careers (MARC) Scholar. Pictured here (left to right): Lisba Fowler (Eden Family Representative), Laura Newcomb (CSU San Bernardino), Ms. Davis, and Mark Wilson (Humboldt State University & Chair, 2015 Eden Award Selection Committee).

CSUPERB is: Mentors

October 2014 brought huge news for undergraduate researchers and biotechnology faculty mentors at CSU Long Beach, CSU Northridge and San Francisco State University. The NIH announced that all three universities won large BUILD grants (\$17 million – \$22 million over 5 years). Each program aims to prepare greater numbers of undergraduate students for biomedical research careers, to help students work toward their individual goals, and to carry out studies to gauge the effectiveness of campus programming. Because the CSU's students as a whole reflect California's demographics, these grants are also designed to help improve the diversity of the biomedical research workforce. Each of the three CSU BUILD programs will be studying a different angle of the cultural and institutional changes needed so that more underrepresented students persist and succeed in biomedical research-based career paths.

CSUPERB has been talking as a community about mentoring diverse groups of student researchers for some time. This year the first (2012) cohort of Presidents' Commission Scholars began graduating. This is our summer research program targeting students in their first or second year of college. We encourage faculty to recruit beyond the usual suspects ("A" students, students who have completed organic chemistry, MARC students, etc.). So how is the first cohort of 24 students doing? Five are attending graduate school, ten are employed in corporate research settings, others are working as research technicians, high school teachers and clinical laboratory scientists. The rest are continuing their studies. This is the same profile of outcomes we see in the Howell and Travel student grant programs



SFSU-UCSF collaboration to build a more inclusive biomedical workforce. (left to right): Esteban Burchard (UCSF), Patricia Castruita (SFSU) and Leti Márquez-Magaña (SFSU). Ms. Castruita worked on Dr. Márquez-Magaña's CSUPERB-funded research project and she is now an SF BUILD scholar.

Leticia (Leti) Márquez-Magaña at San Francisco State University credited her CSUPERB Joint Venture grant for setting the campus up for success in the BUILD grant competition. As much as we'd love to take some credit for seeding that outcome, we were curious about the details. Dr. Márquez-Magaña explains, "the CSUPERB award...demonstrated ongoing collaborative work with UCSF who is our partner in the BUILD. Specifically, the joint venture grant allowed me to partner with researchers studying the genetic ancestry of breast cancer at UCSF (e.g., Laura Fejerman and Elad Ziv). This work is being expanded upon in SF BUILD and we are now collaborating with Esteban Burchard (who was named to an expert panel advising President Obama's Precision Medicine Initiative)...It provided an example of a project that links basic science to the health of communities of color. In particular, the project was to determine the genetic ancestry of triple-negative breast cancer patients. This type of cancer primarily affects African Americans and Latinas..."

This is exactly the type of compelling, real-world research problem that will engage, inspire and motivate BUILD scholars going forward. It's wonderful to see the NIH invest to build a more diverse and inclusive biomedical research workforce, but also their recognition that the CSU's undergraduate education and research community has a large and important role in reaching that goal.

that serve as capstone experiences. The things we worried about (*what if scholars are overwhelmed or under-prepared and feel out of their league in research laboratories?*) didn't happen. We credit the commitment of the Presidents' Commission Scholars themselves, the mentors involved, welcoming team (peer group) members, and engaging, real-world problems on which to work.

In her final report Dr.

2014-2015

CSUPERB Leadership

Presidents' Commission

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Dianne F. Harrison
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Forouzan Golshani, Dean
CSU Long Beach

Anne Houtman, Dean
CSU Bakersfield

Katherine Kantardjieff, Dean
CSU San Marcos

Richard Lapidus, Dean
Cal Poly Pomona

Jennifer Lillig
Sonoma State University

Stanley Maloy, Dean
San Diego State University

Bori Mazzag
Humboldt State University

Katherine McReynolds, Deputy Chair
CSU Sacramento

Bianca Mothé
CSU San Marcos

S. K. Ramesh, Dean
CSU Northridge

Sandra Sharp
CSU Los Angeles

Lorenzo Smith, Dean
CSU Sacramento

Lynn Stauffer, Dean
Sonoma State University

Koni Stone
CSU Stanislaus

California State University Program for Education and Research in Biotechnology (CSUPERB)

Annual Report
Academic Year
2014-2015

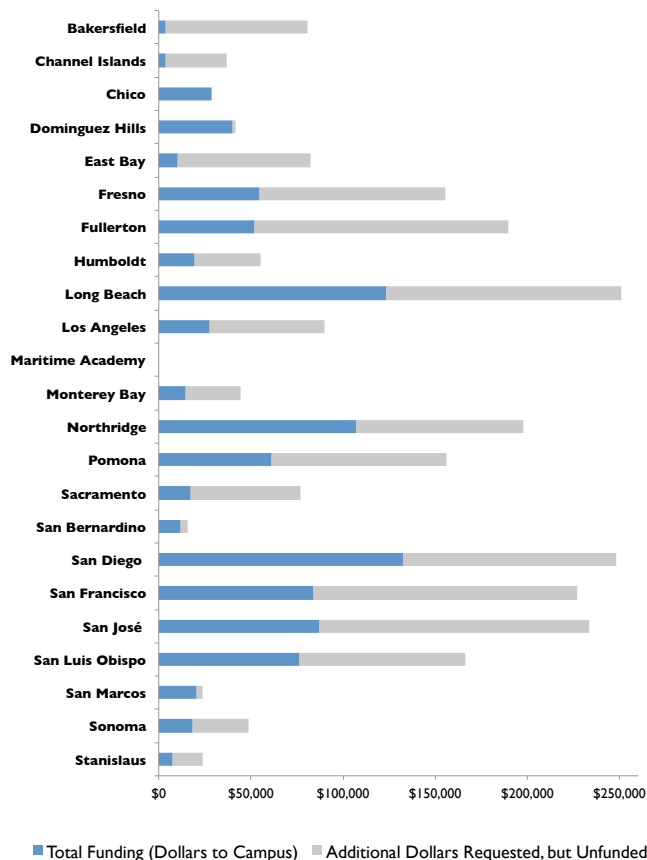
Annual Expenditures AY 14-15	Salaries & Office Operations	\$ 406,019
	Program Operations & Outreach	167,481
	Symposium (including Symposium Awards)	289,909
	Grants & Awards	739,345
	CSU I-Corps™ Grant (NSF)	39,477
Total Expenditures:		\$ 1,642,231

CSUPERB has been fortunate to have help from the CSU STEM VISTA program to ramp up CSU I-Corps programming. This summer (2015), two VISTA members joined the office for the year.

Grants and Awards Issued by Program (Number of Awards & Total Award Dollars)	Faculty-Student Collaborative Research Grants	31 / \$ 463,578
	Entrepreneurial Joint Venture Matching Grant	3 / 75,000
	Programmatic Grants	1 / 15,000
	Travel Grants (Faculty & Student)	40 / 54,733
	Howell - CSUPERB & Presidents' Commission Research Scholar Awards	23 / 130,000
	Symposium Awards	6 / 9,500
	CSU I-Corps™ Microgrants	17 / 42,500
Total Number of Awards / Total Dollars:		121 / \$ 790,311

CSUPERB received 374 proposals, applications and nominations from 22 campuses this year; awards were made to 21. This was the first year we made CSU I-Corps microgrant awards to research teams exploring biotech commercialization. The microgrant program was made possible by a grant from the National Science Foundation.

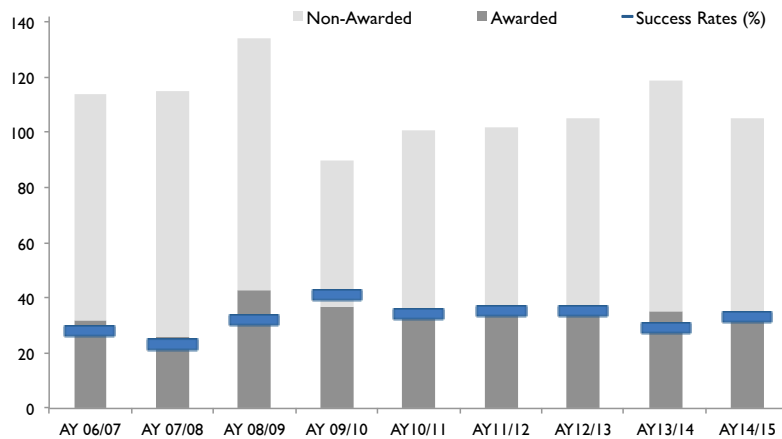
Competitive CSUPERB Funding by CSU Campus AY 14-15



This chart summarizes CSUPERB financial support in the form of competitive grants, awards, and symposium expenses (in dollars, \$) by campus. 21 campuses won grants and awards this year; 21 campuses were represented at the Annual Biotechnology Symposium.

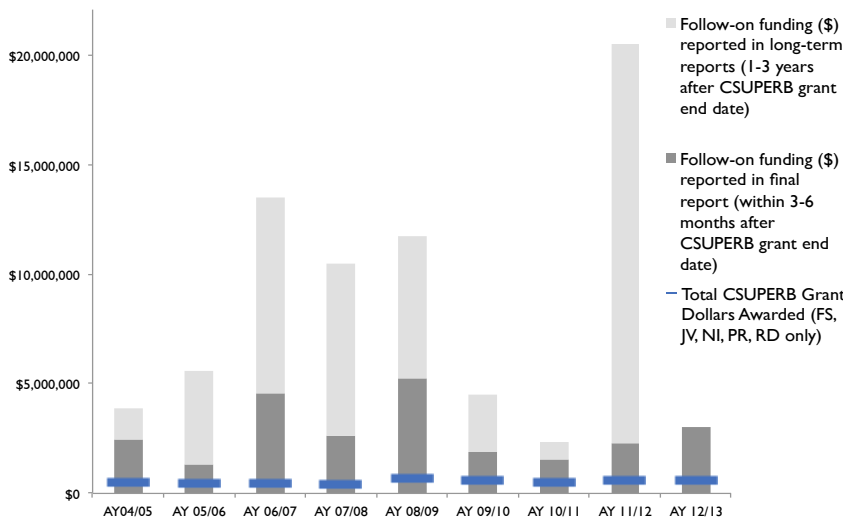
Additional dollars requested reflects campus applications and proposals that were not funded and symposium registrations that could not be accommodated. The grey bars indicate both campus and faculty interest in CSUPERB programs from biotechnology teams across the CSU system.

Competitive CSUPERB Grant Program Success Rates: # of proposals awarded, # of unfunded proposals and success rates (AY 06/07 through AY 14/15)



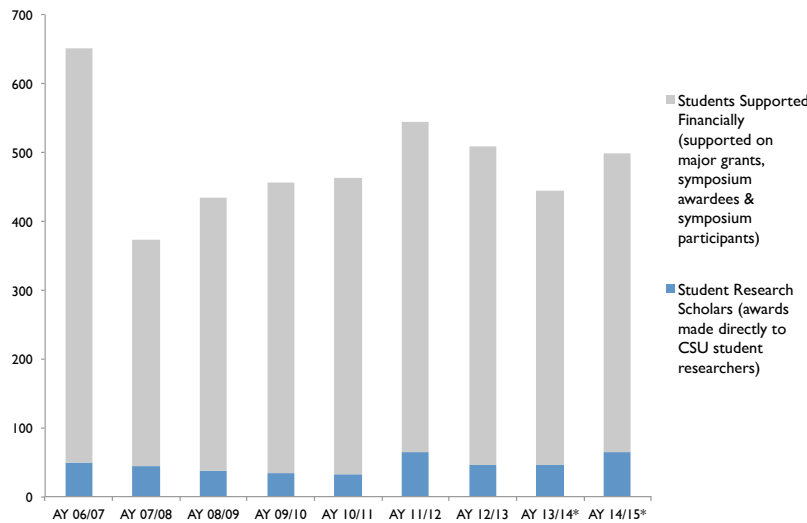
Overall success rates (number awards made ÷ number proposals received, reported as a percentage) are shown by academic year for faculty-student research grants, the New Investigator and Research Development programs. The CSUPERB FCG recommends success rates across all programs be similar; as a result ~33% proposals have been funded for the last three years.

External, follow-on funding received by CSU faculty supported by CSUPERB seed grants (AY 04/05 through AY 12/13)



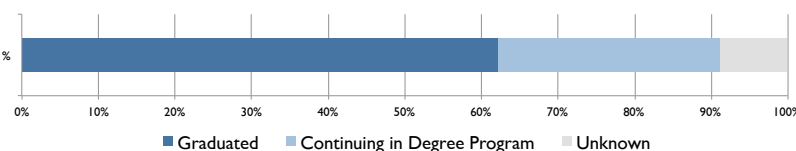
CSU faculty members funded by CSUPERB are successful at winning external, follow-on funding. The averaged financial return-on-investment in PI's funded 2004-2013 is a remarkable 1447%, based on final and long-term reports received as of August 1, 2015. One of CSUPERB's strategic aims is to increase the number of biotechnology researchers system-wide. Follow-on funding represents an expansion of student research opportunities.

Numbers of Students Impacted by CSUPERB Programs (AY 06/07 through AY 14/15)



Each year CSU students receive financial support from CSUPERB as direct scholarships, symposium participation and grant support. 245 research grants (2006-2013) resulted in 219 peer-reviewed publications; 88 of the authors were undergraduates, 89 were master's students. Impact data is reported by year of award. Recent years'* data includes some projections based on approved grant budgets.

Last Known Status of Supported Undergraduate Researchers



At least 91% of CSUPERB-funded undergraduates (2006-2014, n=401) graduated or continued in CSU life science or engineering degree programs.

California State University Program for Education and Research in Biotechnology (CSUPERB)

Susan Baxter, Executive Director

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