

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



Congressional representative Zoe Lofgren visited the Wilkinson lab at San Jose State University in August 2017 to learn about research training and biotechnology education. (Left to right): Michael Kaufman (Interim Dean, College of Sciences), Katie Wilkinson, Cebrina Bustos, Natanya Villegas, Sarah Chu, Rep. Zoe Lofgren, Kimberly Than, Tarianna Perez, Camila Espindola Villarino, and Marc d'Alarcao (Associate Dean for Research, College of Science).

CSUPERB-supported students and faculty grapple with the scientific method, teach in labs, clinics and classrooms, experience the joy and heartbreak of discovery, and build engaged, off-campus communities and partnerships.

Katie Wilkinson (*San José State University; 2014 New Investigator, 2017 Research Development, and 2015 Curriculum Development grant recipient*) was frustrated by 2013 budget cuts to the campus Maximizing Access to Research Careers (MARC) program. She contacted Rep. Mike Honda's office to share her concerns and invite him to visit and learn about the discoveries MARC student researchers were making in her neurophysiology laboratory. During his visit, Katie discovered that science advocacy required a big picture perspective and tactical knowledge she didn't yet have. She applied for and received a 2014 Society for Neuroscience Early Career Advocacy Fellowship to learn better how to build relationships with legislators. She learned it's "surprisingly easy." Today she serves on the American Physiological Society's Science Policy Committee, writes a [Science Policy blog](#), and helps CSU researchers make policy connections. She comments, "my chair, dean, and our AVP for research have been very supportive of these activities...The science policy committee helps me keep up to date on changes to NIH grant policies and other things that do impact my research." In August Katie shared her experience at CSUPERB's Summer Meeting, teaching faculty how to make the best case for STEM education and research to the public, news media, and government officials.

Four Wilkinson lab group members have gone on to doctoral programs; two of them won prestigious NSF Graduate Research Fellowships to do so. With CSUPERB funding, Katie is working with colleagues to revise introductory biology courses to better engage and teach the 900 SJSU students who take them. Early results indicate the redesigned courses completely eliminate the achievement gap for first-generation college students. Dr. Wilkinson explains, "I like the balance of being able to work closely with students in both the classroom and the lab... one of the most rewarding parts of the job is to see students become independent researchers."

2016/17 Program Highlights

- Academic Year (AY) 17-18 marks CSUPERB's 30th year as a system-wide program. In aggregate, CSUPERB made grants, awards and scholarships to CSU faculty and students 1999-2017 totaling \$12,680,705.
- The 29th Annual CSU Biotechnology Symposium at the Santa Clara Marriott drew 693 participants and featured 290 posters from 22 CSU universities – representing work from 168 CSU labs.
- During AY 16-17 CSUPERB made 110 individual grants and awards (totaling \$749,096) to 50 faculty and 60 students at 21 CSU campuses.
- In total 348 individuals from 21 CSU campuses and 109 external organizations have participated in CSU Innovation Corps (I-Corps™) courses and workshops. This summer the National Science Foundation granted a competitive renewal to support CSU I-Corps programming through January 2021.

2016 - 2017 CSUPERB Leadership

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Letter from the Executive Director

"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."

– 2015-2018 CSUPERB Strategic Plan

Dear Colleagues and Friends:

As we enter our 30th year as a system-wide affinity group, we also begin our next three-year strategic planning process. The CSUPERB Strategic Planning Council meets at Cal Poly Pomona for a retreat in early October to review operational efficiency, program impact, and the "ecosystem happiness"¹ of the CSU's biotechnology community. We'll study feedback from students, faculty members, and administrators system-wide, as well as opinions of our external partners (some of which is contained in this annual report). During the retreat, we'll try to make sense of it all and chart a path for CSUPERB into 2021.

According to the literature, thirty years is a remarkable run for a community of interest, learning and practice. In my opinion Wenger, McDermott & Snyder² wrote the definitive text on communities like CSUPERB. In that book they state, "If it is not clear how members benefit directly from participation, the community will not thrive because the individuals will not invest themselves in it."

We were happy to see that 28% of the faculty members at the annual symposium were attending for the first time. This year 46% of the proposals CSUPERB received were from first-time applicants. Because we're seeing renewing participation patterns, we can conclude CSUPERB programs offer benefits to new faculty, but also impact established researchers and students (read student comments on page 4). We also know CSUPERB seed grants are an important boost to start-up packages for biotechnology researchers system-wide; the stories in this report reiterate that point again and again.

But grant funding really can't explain the longevity of CSUPERB. Paraphrasing Wenger, McDermott & Snyder here somewhat, they wrote that successful communities:

- Let the community evolve naturally,
- Foster a collective sense of purpose, professionalism or intentionality,
- Welcome a variety of participation levels,
- Support the community with a 'regular rhythm' of activities, convenings, media posts, open reporting,
- Sustained interactions over time lead to sharing of tacit knowledge and promising practices, and
- Allow sense-making of complex issues - regularly meet, reflect, and...evolve.

I hope CSUPERB participants recognize these features in our community. In my opinion, the mentoring, information-sharing, and professionalism that CSUPERB faculty contribute is the key to this community's success and longevity. Functioning both as institutional memory and a smoothing function, CSUPERB acts as a buffer against budget cuts and leadership change. But the community also challenges and raises up participants so they can keep up with changes in biotechnology and higher education. Recently Hunter Walk³ wrote, "The right norms...could raise a group's collective intelligence, whereas the wrong norms could hobble a team." Over 30 years CSUPERB has articulated innovative thinking and pragmatic approaches to biotechnology education and research. Here's to 30 more years!



1. Lindegaard (2016) Metrics and Measurements for Open Innovation and Ecosystems: A Collection of Inspiration and Insights. Available online: <https://www.linkedin.com/pulse/metrics-measurements-open-innovation-ecosystems-stefan-lindegaard>

2. Wenger, McDermott & Snyder (2002) Cultivating Communities of Practice, A Guide to Managing Knowledge. Harvard Business School Press.

3. Walk (2016) Google Finds That Successful Teams Are About Norms Not Just Smarts. Available online: <https://medium.com/startup-grind/google-finds-that-successful-teams-are-about-norms-not-just-smarts-955fc8df60d0>

CSUPERB is: Entrepreneurs, Innovators & Collaborators

In 2014 CSUPERB made the case to the National Science Foundation (NSF) for a specialized, multi-campus Biological Sciences Innovation Corps (I-Corps™) Site. [CSU I-Corps](#) program offers courses and activities tailored to help academic research teams explore commercialization. This year the CSU I-Corps teaching team worked with six cohorts of teams, including one national cohort co-sponsored by NSF and the Biotechnology Innovation Organization. Overall, 176 students, 54 faculty and 4 staff members from 21 CSU campuses participated in CSU I-Corps courses, design thinking workshops, and meetings. I-Corps encourages academic researchers to break their routines, look off-campus for partners, and become active members of regional life sciences innovation ecosystems.

New this year was [Ignite22](#), a one-day “first-of-its-kind Tech Innovation throw-down designed to bring together folks from tech start-ups, academia, and the finance/venture capital worlds,” as described by Sean Anderson from CSU Channel Islands. The meeting was organized by Braid Theory and involved 17 research groups led by CSUPERB, [COAST](#) and [ARI](#) investigators who presented posters and lightning talks.

Participants report large learning gains in entrepreneurship and Lean Startup concepts, but it is the professional growth that is most impactful for both student and faculty. 90% report they grew their professional networks into the private sector *for the first time*. A faculty PI wrote:

“Overall, the experience has been great and allowed me to discover the language and mindset of the industry, which is so different than the academic world.” A student reflected, “I always thought of starting a company as a distant dream...But this workshop changed that outlook for me, I think starting a company is possible whenever you are ready to actually put in the effort to do it and follow through with your plans.”



Clockwise from top right: 1. Xiaorong Zhang (Assistant Professor of Computer Engineering, SFSU) gives a lightning talk at Ignite22 (April 6, 2017, San Pedro). Jonathan Kelber (Northridge), Nathaniel Martinez (Cal Poly) and Howard Xu (Los Angeles) also presented in the biotech session. 2. Participants and teaching team members gather at the end of at the BIO 2017 I-Corps workshop at San Diego State University (June 21, 2017). 3. CSU I-Corps Summer Sprint participants and teaching team members visited JLABS, a biotech incubator hosted at Janssen Pharmaceutical, to interview resident biotech entrepreneurs (San Diego, July 29, 2017). 4. CSU I-Corps student teams, teaching team members and evaluators gather during the final immersion weekend for the Fall 2016 short course at the 29th Annual CSU Biotechnology Symposium (January 5, 2017, Santa Clara).

“Shortly after publication of our initial results we were contacted by Kent Thurber at the National Institutes of Health regarding the possibility of collaborative study of verdazyls as biological probes. A sample was sent to Dr. Thurber’s research group; initial studies with high field electron spin resonance indicate that our free radicals have potential as agents for dynamic nuclear polarization and are being written up as a publication. These studies have also provided insight into the design of future verdazyl probes. We are currently working on probes based on diradical systems and verdazyl amino acid analogs. – [David Brook](#) (San José State University; 2013 New Investigator)

Anonymous Student Voices from the Post-Symposium Survey

"The opportunity to give a lightning talk, it was a very fun experience. I also enjoyed the poster session and the people that stopped by to talk to me were from many different fields."

"The career networking tables were far and away the most useful and practical part of the entire symposium."

"It was my first time presenting my research, and so I am very glad to have been in such a welcoming, open environment with plenty of other students and professors all attending to learn and explore a bit."

"I liked that the research people have done for many years in school and used their knowledge and skills built up companies off campus. It made me feel that even though you are a little fish in a big ocean, anything is possible if you put your mind to it."

"This Symposium opened my eyes to other opportunities. I was thinking that academia was the only way to go. I feel excited about the possibility of working on my own and conducting my own research outside academia."

"The symposium overall was decent. I learned quite a bit about potential careers in the networking session...The poster sessions were more enjoyable than I expected."

"I enjoyed that this symposium discussed career opportunities along with graduate school. The conferences I've been to only mention graduate school and ignore industry options. Lighting talks were fun too. It broke me out of my shell."

[I learned]"That there's opportunity everywhere."

"I learned about fetal alcohol syndrome, gene therapy, the process to establish a start-up company, and the possibility of life outside of earth and what kind of environment they have to survive."

"I truly learned how to think like a scientist and question everything after the conference. It really opened my mind and gave me a lot of ideas."

"My favorite thing learned was a poster on ant memory. I'm amazed that that is even knowable."

"The idea that my research could be (and should be) applicable to something in the biotech industry instead of just being a research project. I think this is very important because most people think that the research that we do [produces a] "useless" piece of information that no one from the outside cares about. But the symposium showed that with a little creativity, we can make other people care about our research too."

"I learned about FDA and a company that works on the side effects of drugs...how excited I am that there are so many opportunities for me after graduation."

29th Annual CSU Biotechnology Symposium Summary

A recent National Academies Press (NAP) report* encouraged universities to provide students opportunities to "interact with STEM professionals and learn about employers and career opportunities" and "meet role models and mentors who look like the students." The [annual CSU Biotechnology Symposium](#) is a working example of a "larger-scale, convening event" called for in the NAP report.

CSUPERB designs the event each January to broaden exposure to cutting-edge biotechnologies, product-focused innovation, and the spectrum of career paths available in the life sciences. Faculty and administrators system-wide use the event to catch up, initiate collaborations, share ideas, and swap lessons learned. The 29th annual CSU Biotechnology symposium (January 5-7, 2017) brought together 693 students, faculty members, administrators, industry professionals, alumni and government officials. The symposium is open to CSU students and faculty, whether they are funded by CSUPERB or not.

The symposium program showcases the high level of hands-on, project-based research and entrepreneurial projects the CSU's students take on. The 290 posters and 8 CSU I-Corps team presentations at the event featured collaborative faculty-student research projects from 168 labs across the CSU, >60% of which are supported by the National Institutes of Health, National Science Foundation, Howard Hughes Medical Institute, and other external funding organizations.



Invited symposium speakers told stories about moving research ideas off campus through collaboration and commercialization. (Left to right): Michael Goldman (SFSU & Chair, Strategic Planning Council, SPC), Stanley Maloy (SDSU & SPC member), [Margaret Black](#) (Washington State University), Diego Rey ([GeneWEAVE](#)), Sebastian Kraves ([miniPCR](#)), and Susan Baxter (CSUPERB).

*<https://www.nap.edu/catalog/21894/promising-practices-for-strengthening-the-regional-stem-workforce-development-ecosystem>

Find photos from the 29th Annual CSU Biotechnology Symposium at our Facebook page: https://www.facebook.com/pg/csUPERB/photos/?tab=album&album_id=10154530976732100

The detailed 29th Annual CSU Biotechnology Symposium program can be read here: <http://www.csUPERB.org/symposium/2017-detailed-program/>; 2017 poster abstracts are here: <http://www.csUPERB.org/symposium/poster-info/2017-poster-list/>

2017 CSU Biotechnology Symposium Awards

2017 ANDREOLI FACULTY SERVICE AWARD: **Dr. Warren D. Smith**, Professor of Electric and Electronic Engineering, College of Engineering and Computer Science, CSU Sacramento. The selection committee called out Dr. Smith's research accomplishments, important regional public-private partnerships, and ability to inspire bioengineering students. Within the CSUPERB community, Dr. Smith helped develop our entrepreneurship education programs (I2P®, now CSU I-Corps™). *Pictured (left to right):* Lorenzo Smith (Dean, College of Engineering & Computer Science, CSU Sacramento), Dr. Smith, and Guna Selvaduray (Professor & Chair, Department of Biomedical, Chemical and Materials Engineering, San José State University & Chair, 2017 Andreoli Award Selection Committee).



2017 CSUPERB FACULTY RESEARCH AWARD: **Dr. Joseph Pesek**, Professor of Chemistry, San José State University. Dr. Pesek was recognized not only for his outstanding research productivity and his dedication to students, but also his persistence in commercializing high-performance liquid chromatography (HPLC) products. His group has published over 230 peer-reviewed papers and garnered \$6.95 million in research grants. *Pictured (left to right):* Daryl Eggers (Department of Chemistry, San José State University), Sep Eskandari (Biological Sciences, Cal Poly Pomona & Chair, 2017 Faculty Research Award Selection Committee), Dr. Pesek, and Pam Stacks (Associate Vice President, Office of Research, San José State University).



2017 CRELLIN PAULING STUDENT TEACHING AWARDS: **Mr. David Hsu**, (Master's degree candidate, Department of Biological Science, CSU Fullerton) added peer discussions to his courses and encouraged biology students to learn from failures in lab. CSUPERB applauds his "his gift for teaching." **Mr. Aaron Miller** (Master's degree candidate, Chemistry and Biochemistry, CSU Northridge) wrote, "effective teaching [is] a delicate balance between nurturing students through directed guidance, while promoting...self-reliability and accountability." *Pictured (left to right):* Mr. David Pauling, Dr. Kay Pauling, Mr. Miller, Mr. Hsu, and Jeremy Dodsworth (CSU San Bernardino & Chair, 2017 Pauling Award Selection Committee).



2017 GLENN NAGEL UNDERGRADUATE STUDENT RESEARCH AWARD: **Carina Sandoval** (CSU Fullerton). Research Mentor: Melanie Sacco, Department of Biological Science, CSU Fullerton. Ms. Sandoval studies tomato receptor and signaling proteins involved in disease resistance. She is an HHMI and McNair undergraduate research scholar. *Pictured (left to right):* Dr. Kathleen Szick-Miranda (Associate Professor, Department of Biology, CSU Bakersfield & Chair, 2017 Nagel Award Selection Committee), Ms. Sandoval and Ms. Lisba Fowler (Eden Family Representative).



2017 DON EDEN GRADUATE STUDENT RESEARCH AWARD: **Noopur Dave** (CSU Fullerton). Research Mentor – Veronica Jimenez Ortiz, Department of Biological Science, CSU Fullerton. Ms. Dave studies mechanosensitive channels in the parasite that causes Chagas disease. Ms. Davis is an HHMI graduate student scholar at CSU Fullerton and has presented her work at multiple local and international conferences. *Pictured (left to right):* Lisba Fowler (Eden Family representative), Noopur Dave (CSU Fullerton) & Michael Cohen (Professor, Department of Biology, Sonoma State University & Chair, 2017 Eden Award Selection Committee).



CSUPERB is: Alumni & Mentors



Left: Dr. Christina Waters with CSU I-Corps team members at the conclusion of the Fall 2016 student challenge. Right: Dr. Waters was a featured speaker at the 28th Annual CSU Biotechnology Symposium in January 2017.

CSUPERB aims to close the gap between CSU-based learning and biotechnology industry practice. To do this, we partner with external advisors, industry experts and biotechnology industry organizations. It is no great surprise to find that some of our most effective partners are also CSU alums! [Christina Waters](#) is CEO and Founder of [RARE Science](#), a non-profit research organization focused on accelerating cures for children with rare disease. Dr. Waters also works with The Innovation Institute, where she leads efforts to link patients' genetics and medical information to create individualized treatment plans. We asked Chris a few questions to uncover her vision and motivation.

How has your career mapped to or diverged from your expectations when you graduated from SDSU?

"I grew up on a farm, showed sheep at the Del Mar Fair, and I always thought I would work with animals. At SDSU, I even worked on a project with Dr. McClenahan to determine the genetic diversity of the Badland Buffalo. After graduation, I was accepted in the UC Davis genetics PhD program and thought I was on my way to a career in conservation genetics. [But] I took a slight turn to use my genetics training to pursue the understanding of human disease."

Why have you been so willing to help out with CSU I-Corps programs?

"I enjoy participating and helping students from different areas of study learn in real time how to work together and to take an idea to a successful venture. This program helps them build their toolbox of real life skills on the way to becoming successful entrepreneurs. I had a similar experience as a student...my hope is to give them what I found valuable to me when I was in their shoes."

After speaking at the 2016 CSU Biotechnology Symposium, you began working with faculty on new programs at CSU San Marcos and Humboldt State. Can you describe those projects?

"Through the California Institute of Regenerative Medicine ([CIRM](#)), RARE Science has the great opportunity to partner with faculty and students participating in the CIRM Bridges program. Through the program, RARE Science has changed the conversation of teaching and research by introducing students directly to patient families. At the beginning of their research careers, students learn the urgency of what patient families face and in turn learn, in real-time, the potential value and application of their research. Some of the students are working on stem cells or techniques that are directly integrated into RARE Science research programs. So these students are actual contributors to research that can potentially change the life of a child."

What preparation or skills do you think students need to enter and advance in the biotech industry?

"Programs like CSUPERB, [Zahn Innovation Platform](#) (SDSU), and CIRM Bridges share the same philosophy of giving real-life experience to learn applied skills with coaching and guidance. This experience is not only valuable but can set students apart when looking for that first job. I find it is so important to have a mentor or a few advisors who have different views, perspectives, expertise - from different industries - to serve as a sounding board along the journey. Lastly, students can build a network of people to support each other as they grow professionally in the life sciences community. Not only does this serve to help individual goals, but I think collective success across a network can drive transformative advancement in the health and wellness of our global community."

CSUPERB is: Researchers, Educators & Mentors

Jonathan Kelber (CSU Northridge; 2014 New Investigator & 2015 Joint Venture grant recipient) runs a research program aimed at discovering molecular mechanisms that drive cancer initiation and progression, as well as normal cellular regeneration. Two of the three undergraduates who helped start-up the Kelber lab were supported by CSUPERB grants. Malachia Hoover is now enrolled at Stanford's stem cell doctoral program and Yvess Adamian is now a research assistant in the genomics core at Children's Hospital in Los Angeles. With CSUPERB support, the small team published three key papers and solidified partnerships with researchers at Claremont BioSolutions and UC San Diego (UCSD).

In January Dr. Kelber learned his National Institutes of Health (NIH) SC1 grant application was funded to support ongoing mechanistic and cancer therapeutic studies in the lab. The Kelber lab has now grown to a team of 11. To keep the

science moving forward, Dr. Kelber spent this summer at Harvard, supported by an American Society of Cell Biology professional development program for tenure-track faculty at minority-serving institutions. He worked in Joan Brugge's lab at the Ludwig Center for Cancer Research to establish new *in vitro* methods for studying therapy-induced cell states. He explains, "In addition to making connections with faculty at Harvard, I've also been able to connect with senior postdocs who are in transition toward beginning their own labs at other leading academic institutions, and I'd like to think that my own experience has been helpful to them as they navigate these next steps in their careers." When asked what makes him happy about working at CSU Northridge, he answers, "I was an undergraduate and MS student at Cal Poly Pomona. My research training there with Patrick Mobley in the Chemistry and Biochemistry Department seeded my fascination with research and provided me with a foundation to continue my education/training at leading R1 institutions...I visited with Patrick and discussed his decision to take a faculty position at Cal Poly. I asked him, 'would you take this same path again?' and his answer was emphatically 'yes.'" As a UCSD postdoc, Kelber had funding from a NIH Institutional Research and Career Development Award (IRACDA), aimed at increasing diversity in science. He says that, "training, combined with my love of the CSU system, made the opportunity to teach and run a research lab at Cal State Northridge an ideal fit for me. I get to work alongside wonderful colleagues, I'm supported by fantastic administrators, and I am very satisfied when members from our diverse student body commit to the study of biomedical problems and diseases that impact human lives."



The Kelber Lab gathered together at the end of summer 2017. (left to right) Analine Aguayo (RISE undergraduate), Lindsay Kutscher (BUILD PODER undergraduate), Sa La Kim (graduate student), Robert Guth (postdoc), Preston Shisgal (graduate student), Kayla Meade (graduate student), Cameron Geller (lab tech/manager), Andrea Canahui (BUILD PODER undergraduate), Erika Duell (BUILD PODER undergraduate), Sarkis Hamalian (graduate student) & Jonathan Kelber.

CSUPERB funding "catalyzed a number of collaborations with faculty within my college. This is a direct consequence of having a confocal microscope available for ultrasensitive high-resolution imaging...These funds also made it possible for undergraduate students that would not have otherwise had the financial means necessary to participate in undergraduate research to be able to do so. These undergraduate student researchers have presented their thesis research projects at various local conferences and meetings. These experiences are invaluable to their progress towards more advanced degrees and/or future careers. In addition, many of my students have received awards recognizing their achievements. Examples include national awards such as the NSF Graduate Research Fellowship award (\$135,000 over 5 years to Judith Flores), departmental awards recognizing research achievements (Lizbeth Reyes and Jesse Howe), college-level awards recognizing research productivity (Jesse Howe), and university-level awards recognizing creative activities (Will Parker, Jesse Howe, and Greg Walters)." – **Kambiz Hamadani** (CSU San Marcos, 2014 New Investigator grant recipient)



Dr. Kambiz Hamadani (Assistant Professor, Biochemistry, CSU San Marcos) works with a student-faculty team at the Design+Biotech Hackathon during the 29th Annual CSU Biotechnology Symposium.

CSUPERB is: Researchers, Educators & Mentors



(Left) Dr. Carolynn Arpin advises undergraduate chemistry student, Daniela Melchor, on the flash column purification of a new compound. (Right) Kelsey Hanson (front) and Daniela Melchor (back) work in hoods performing synthetic chemistry in attempts to prepare anti-cancer drug leads.

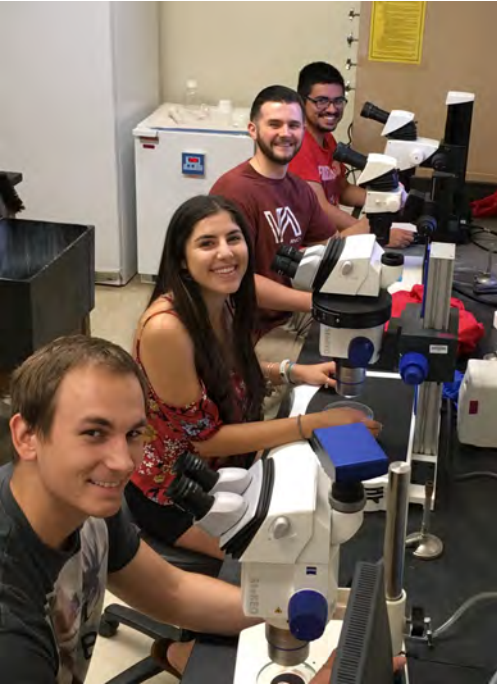
Carolynn Arpin (CSU Chico; 2015 New Investigator grant recipient) used CSUPERB funding to start-up a medicinal chemistry group at CSU Chico. Dr. Arpin explains, "disrupting protein-protein interactions requires molecules that are much larger and more hydrophobic than common drugs, and they don't fit the same 'formula' that most other drugs do. This means that pursuing these targets is too risky for most of the pharmaceutical industry, leaving an open door for academia to enter..." The Arpin lab collaborates with Dr. [David Stachura](#)'s NIH-funded lab at CSU Chico, a partnership that led to a series of grant proposals based on a multi-disciplinary approach to developmental biology research questions. Carolynn says, "While my background involves targeting cancer-relevant proteins, Dave's focus is more on developmental pathways that can be studied in zebrafish...His lab is performing unanticipated assays, and my lab is designing drugs for signaling pathways that we have not explored previously." Together they made a persuasive case and, as a result, won an NSF Major Research Instrumentation grant to purchase a Fluorescence-Activated Cell Sorter (FACS). "FACS machines are extremely useful in providing fast, objective, and quantitative recording of signals from individual cells...We proposed to isolate a unique subset of progenitor cells, treat them with our [novel compounds], culture *in vitro*, and analyze to determine mature cell differentiation. Thus, the compounds developed through my CSUPERB-funded work will allow us to investigate the signaling pathways of our specifically isolated cells via FACS." When asked about her role as a CSU faculty member, Dr. Arpin says, "Having attended a primarily undergraduate institution for my own undergraduate education, I knew that faculty at similar institutions have the ability to affect change through the education of students both in the classroom and in the lab. I'm extremely lucky to admit that what was once my dream job is literally my current job... Working with undergraduate researchers, I have sincerely gained a new appreciation for lab work. Not only does our work bring us closer to new grants, publications, and potential drugs; but it also serves as a significant experience for students to find out what it means to push the limits of our current understanding. Seeing how much the students grow in not only their techniques and skills, but more importantly their maturity in dealing with failure, and their confidence in themselves is extremely rewarding."

"This project has had a significant impact on my research career. The initial results on the co-feeding paved the way for a collaborator's work on the vervet trials and also on a Phase I human clinical trial for safety of L-serine. These results produced a press release that then allowed me to give public talks at venues open to the public and community (e.g. Osher Lifelong Institute, Fresno State Discovery Talks, Young Executives local businessmen's luncheon talk, etc.)." – [Joy Goto](#) (CSU Fresno, 2012 New Investigator Award)

"This is a very valuable program that allows progress to be made on research projects while external funding is obtained. This is extremely important at the CSU campuses as research funding is difficult to obtain on a consistent basis. This allows us to be competitive and to continue to train students while in between large grants. The program is especially important in biotechnology research, which is relatively costly." – [Brian Livingston](#) (CSU Long Beach, 2014 Research Development Award)

CSUPERB is: Researchers, Educators & Mentors

Joseph Ross (CSU Fresno; 2012 New Investigator and 2016 Research Development grant recipient) runs a molecular genetics research group. The lab aims to identify mutations that can initiate the process of species formation and understand how that genetic trajectory might influence the health of offspring. Dr. Ross says, "Our research projects became more relevant to human health when we identified that genetic changes in the mitochondrial genome are relevant to this process." The lab uses nematode genetic model systems. "Critically, they're easy to grow in large numbers (and hard to kill) and cost little money to maintain. They're perfect for involving lots of students in research," Ross explains.



Members of the Ross Lab get ready for regular maintenance of the nematode cultures central to their research program.

(left to right) Chris Jorgensen (lab technician), Lesly Fita (undergraduate student), Kevin Helwick (undergraduate student), and Enrique Cazares (undergraduate student).

CSUPERB grant funding supported two of Dr. Ross' first students. "They were particularly effective, even beyond the project period, in helping train additional students...Ultimately, their expertise was critical in the development of a now-published manuscript from my lab and generation of pilot data used in federal grant submissions [which were] invaluable in securing an NIH grant." Ross also works to redesign biology courses at Fresno and was selected as an Apple Distinguished Educator in 2017 and a Faculty Cohort Lead in the CSU Course Redesign with Technology (CRT) program. He comments, "...my outcomes for students have shifted from memorization/retention-based goals to promoting outcomes that require students to use online resources and tools to perform authentic practices in biology. The effects in class have been remarkable: I've seen improved student grades, enhanced attendance, and an increase in the willingness of students to ask questions during class!"

Obviously comfortable with technology, Dr. Ross engages with the public and has a significant presence online - blogging, vlogging and tweeting ([@rossbiology](#)). He explains, "I get a lot of personal satisfaction providing resources that might help others become better teachers and better-informed citizens themselves, so I invest time promoting both research and teaching ...As an example, I was approached by a local TV station to be interviewed for a story on genetic testing and ancestry. [It] benefitted me in at least two ways. First, [I got] my own ancestry tests - so now I have real data to use, and an engaging story to tell, in all of my future genetics courses... Second, it prompted me to learn more about how companies are performing ancestry tests, so now I'm a better-informed instructor."

When asked what it means to be a CSU faculty member, Dr. Ross answers, "I always knew I wanted to be at a university that not only values, but also invests in, both teaching and research...I have not had a single day, in my four years and counting at Fresno State, when I woke up and was not motivated (and excited) to get to campus! I think I've settled on a useful approach to dividing a big project into student-centered projects, where both undergraduate and Masters students work together to achieve great things. Most importantly, to me, they're not just making new discoveries in biology, but they're also honing skills that will be critical in their next step beyond campus, whether that be more school or a career in biotechnology. They're learning how to be critical thinkers, to make data-driven decisions, to work in teams, and to communicate effectively."

"The first student who worked on the project, Alex Plong, is in the PhD program at UC Riverside. The second student who worked on the project, Soumi Barman, just started a research associate job at Medtronics 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)

"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)

CSUPERB is: Researchers, Educators & Mentors

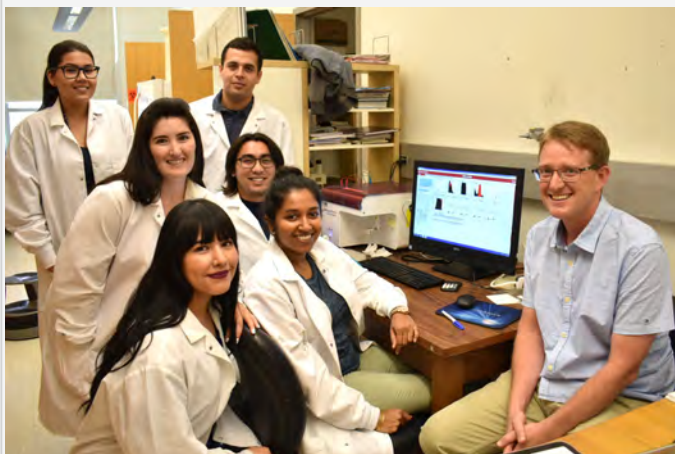
When he submitted his CSUPERB grant proposal, [Joseph Chen](#) (*San Francisco State University; 2014 Joint Venture grant recipient*) planned to work with synthetic biology researchers at the Joint BioEnergy Institute ([JBEI](#)) and develop more efficient methods to construct engineered microbial strains. By the time the grant was awarded, the newly developed CRISPR/Cas9 DNA modification system seemed to promise a better technical path forward. Dr. Chen explained, "Initially I started to test the use of CRISPR/Cas9 system...but the technology did not seem as practical...So I began to work with Dr. Michael Thelen at JBEI and specifically his Ph.D. student at the time, Thomas Ruegg. I generated numerous constructs and tested the utility of a new gene expression system that they developed. Results from that collaboration were incorporated into a manuscript that was submitted for publication recently... the JV grant contributed to the successful competitive renewal of my previous SC3 [NIH] grant. The JV grant gave me the opportunity to use the tools and the pipeline at JBEI."

Further, "The JV grant allowed me to establish contact with scientists so that I can help students gain access to research experiences and technical skills that I may not necessarily be able to provide. In the past 10 years, I have trained over 20 Master's students and over 25 undergraduate students. This fall I expect to have 4 Master's student, 8 undergraduates, and 2 volunteers (SFSU alumni) working in my group. Funding from NIH has allowed me to maintain a part-time research assistant who helps me manage the lab and train students." When asked about his role at SFSU, Dr. Chen replied, "I would like to think that I help provide growth opportunities for those who may not necessarily had the best advantages prior to coming to our university. I have learned to be more patient with undergraduate and masters' level researchers, particularly in terms of research progress...I hope that they learn to be rigorous and meticulous and improve their proficiency in critical thinking, quantitative analysis, communication, and reading...the scientific literature."



The Chen Group at San Francisco State University, August 2017. (front row, from left) Ivan Gao, Bethany Kristi Morin, Eva Guan, Donna Karp; (back row, from left) Milo Aviles and Joseph Chen (PI). All are undergraduates except for Mr. Gao, who received his Master's degree during the summer of 2017.

[Douglas Pace](#) (*CSU Long Beach, 2015 New Investigator grant recipient*) is a cellular and ecological physiologist. Dr. Pace runs programs that "focus on how organisms interface with their respective environments to solve problems. What is so fascinating about this broad subject is that all solutions to life's problems come down to getting what you need from the surrounding environment while protecting yourself from its many dangerous attributes." Pace explains, "My follow-on funding [from NIH] is to study calcium-binding proteins and how they regulate virulence of *Toxoplasma gondii*, one of the world's most successful human parasites. The CSUPERB-NI grant also led to an unexpected result...the amino acid lysine may play an important regulatory role in ionic and acid-base regulation in the parasite during the lytic cycle when it is infecting human cells...[this work will be] submitted as its own NIH proposal."



The Pace Lab at CSU Long Beach, August 31, 2017. (left to right): Dalia Sandoval, Colleen Monahan, Viviana Valencia, Emmanuel Cuevas, Jason Chetsawang, Imara Meepe, and Douglas Pace.

The Pace Lab is up and running, but not without bumps along the way. "I did not get funded by CSUPERB the first time, but I was able to use reviewer comments to fashion a better proposal with more clearly defined specific aims. The entire submission and review process...gave me critical experience that helped me write a competitive NIH proposal...The CSUPERB funding got me through a very tricky time where the unexpected failure of lab equipment [an HPLC] could've jeopardized one of my major research goals." Dr. Pace continues, "I am very happy to be at CSULB. I find the balance of teaching and research very fulfilling and each makes the other better. It is gratifying to be at the "front line" of research education and play a role in training the next generation of biologists and ensuring that they are representative of the diversity of our communities. Science is a journey that a society undertakes and it should be reflective of all members of that group of people."

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

Annual Report
Academic Year
2016-2017

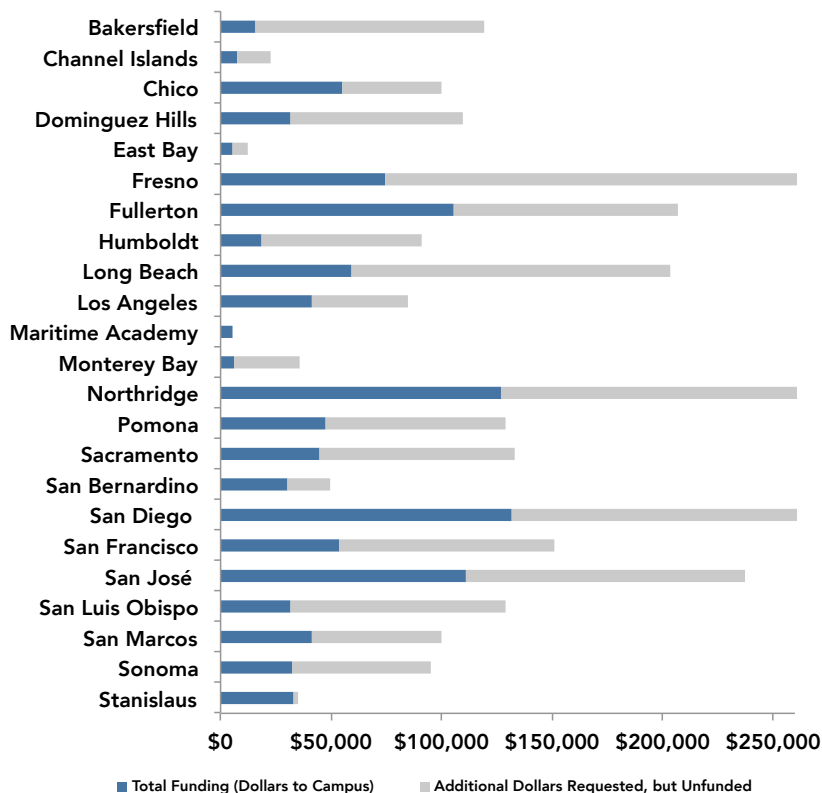
Annual Expenditures AY 16-17	Salaries & Office Operations	\$ 459,142
	Program Operations & Outreach	144,425
	Symposium (including Symposium Awards)	336,552
	Grants & Awards	714,222
	CSU I-Corps™ Grant (NSF)	60,122
Total Expenditures:	\$ 1,714,462	

This year CSUPERB filled a new position, student programs specialist, based on capacity building efforts spearheaded by two CSU STEM VISTA members (2014-2015).

Grants and Awards Issued by Program (Number of Awards & Total Award Dollars)	Faculty-Student Collaborative Research Grants	30 / \$ 449,864
	Entrepreneurial Joint Venture Matching Grant	3 / 55,421
	Curriculum Development Grants	2 / 30,000
	Travel Grants (Faculty & Student)	38 / 55,311
	Howell - CSUPERB & Presidents' Commission Research Scholar Awards	22 / 126,500
	Symposium Awards	6 / 9,500
	CSU I-Corps™ Microgrants	9 / 22,500
Total Number of Awards / Total Dollars:	110 / \$ 749,096	

CSUPERB received 390 proposals, applications and nominations from all 23 campuses this year; awards were made to 21. The CSU I-Corps™ program is made possible by a grant from the National Science Foundation, renewed this summer through January 2021.

Competitive CSUPERB Funding by CSU Campus AY 16-17

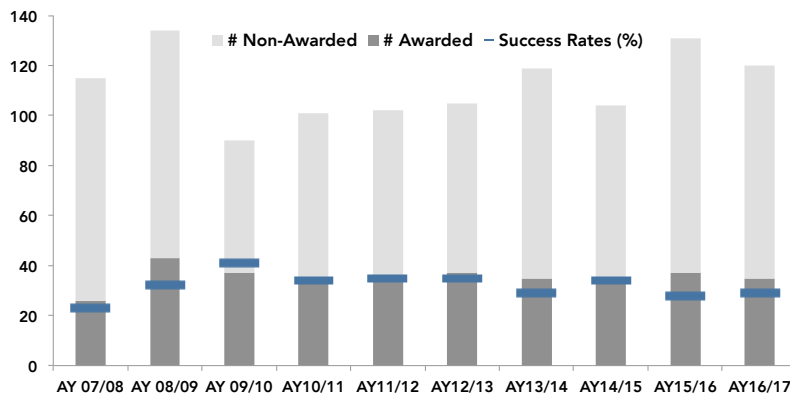


This chart summarizes CSUPERB financial support in the form of competitive grants, awards, and symposium expenses (in dollars, \$) by campus. 21 campuses won grants and awards this year; 21 campuses were represented at the 29th Annual CSU Biotechnology Symposium.

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.

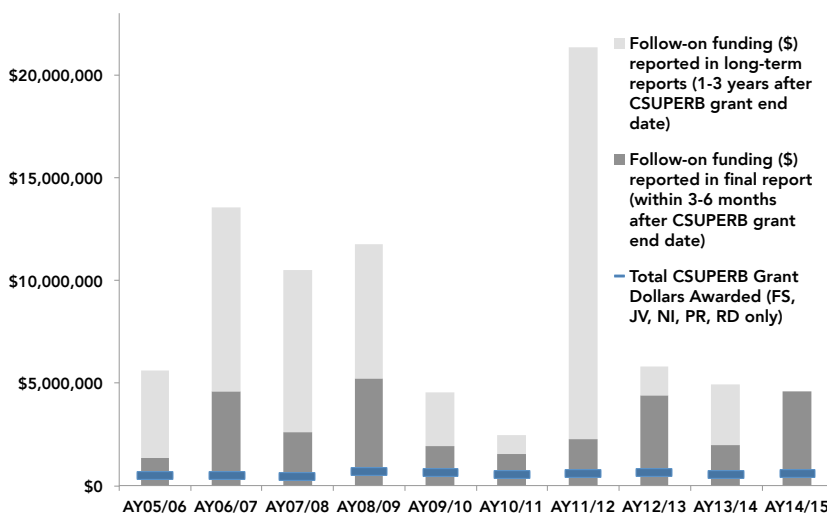
CSUPERB Program Trend Data - At a Glance

Competitive CSUPERB Grant Program Success Rates: Number (#) of proposals awarded, # of unfunded proposals and success rates (AY 07-08 through AY 16-17)



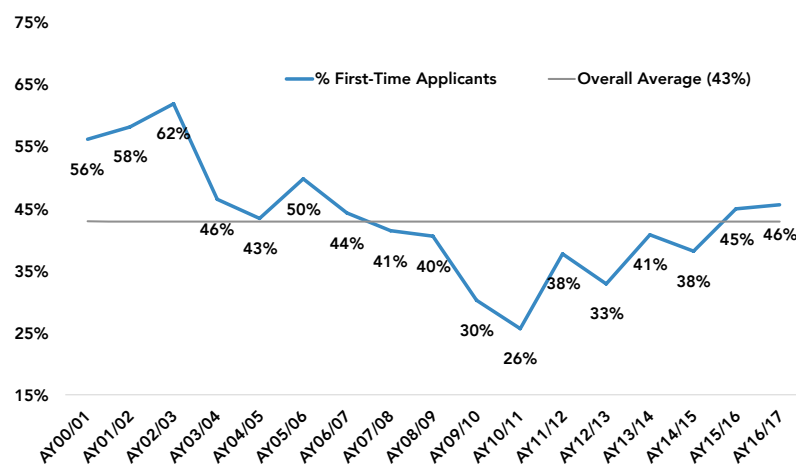
Overall success rates (number awards made ÷ number proposals received, reported as a percentage) are shown by academic year for the seed grant programs. For the last three years ~30% proposals were funded. New Investigator applications represent 56% of all seed grant proposals received, correlated perhaps to new faculty hiring system-wide.

External, follow-on funding received by CSU faculty supported by CSUPERB seed grants (AY 05-06 through AY 14-15)



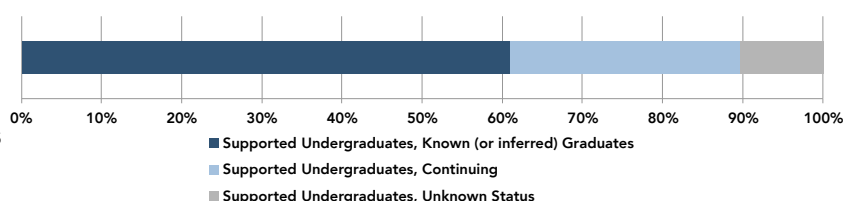
31% of CSUPERB seed-grant-funded faculty (2010-2015) won external, follow-on funding. The averaged financial return-on-investment in PIs funded 2005-2015 is 1451%, based on reports received as of July 1, 2017. Follow-on funding represents an expansion of student research and experiential learning opportunities.

Renewing community metric: First-time faculty applicants (AY 00/01 through AY 16/17)



As a proxy for the renewing quality of the CSUPERB community, we track the percentage of first-time applicants to our seed and faculty travel grant programs. Looking back to 2000 (the second year CSUPERB grants were made), on average, 43% of applicants apply to CSUPERB for the first time. 35% of grants (2000-2017) were made to first-time applicants.

Last Known Status, Supported Undergraduates (2007-2017)



At least 90% of CSUPERB-funded undergraduates (2007-2017, n=584) graduated or continued in CSU degree programs.