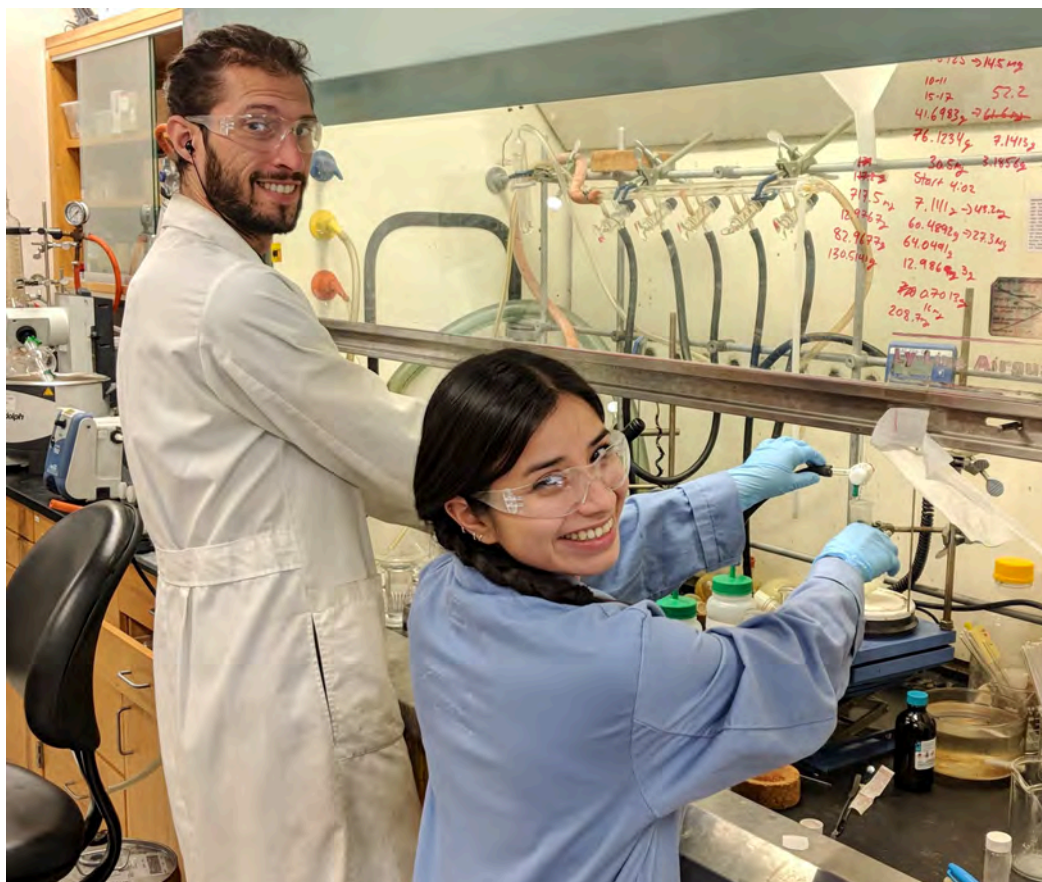


CSUPERB's mission is to develop a professional biotechnology workforce by mobilizing and supporting collaborative CSU student and faculty research, innovating educational practices, and partnering with the life sciences industry.



Doctoral student Michael Coste and master's student Sharai Mendez work on the synthesis of novel inhibitors of the Zika virus in Dr. Byron Purse's laboratory at San Diego State University.

Byron Purse's (*San Diego State University, 2015 & 2016 New Investigator, CSU I-Corps 2017 Summer Sprint*) team designs fluorescent molecular probes for the study of nucleic acids and their interactions with other biological molecules. To get his lab up and running, Purse turned to the CSUPERB New Investigator Grant program. "My best advice to other New Investigators is to focus constantly on refining your research plans, your message, and to critically assess the focus of your research. We made a number of pivots. But...keep in mind that you can't expect to have a big impact if you aren't working on an important problem." Purse's efforts paid off with the receipt of two NSF grants. He led a team through CSU I-Corps last summer. The I-Corps experience "helped my students to be more confident with the networking that's essential for success...We also made a number of new connections because of I-Corps and are following up on several prospective applications for our fluorescent molecular probes that could have real commercial potential."

[Read the full Purse PI profile at the CSUPERB webpage.](#)

2017/18 Program Highlights

- 1999-2018 CSUPERB made grants, awards and scholarships to CSU faculty and students totaling \$13,369,622.
- The 30th Annual CSU Biotechnology Symposium at the Santa Clara Marriott drew 670 participants and featured 287 posters from 23 CSU universities – presenting discoveries from 170 CSU faculty-led research teams.
- During AY 17-18 CSUPERB made 112 individual grants and awards (totaling \$720,578) to 56 faculty members and 56 students at 19 CSU campuses.
- In total 383 individuals from 21 CSU campuses and 114 external organizations have participated in CSU Innovation Corps (I-Corps™) courses and workshops. The entrepreneurship education program is funded by the National Science Foundation through January 2021.

2017 - 2018 CSUPERB Leadership

Presidents' Commission

Karen S. Haynes, Chair
CSU San Marcos

Soraya M. Coley
California State Polytechnic
University, Pomona

Dianne F. Harrison
CSU Northridge

Gayle E. Hutchinson
CSU Chico

Leroy M. Morishita
CSU East Bay

Leslie E. Wong
San Francisco State University

Strategic Planning Council

Michael Goldman, Chair
San Francisco State University

William Cordeiro
CSU Channel Islands

Math Cuajungco
CSU Fullerton

Daryl Eggers
San José State University

Matthew Escobar
CSU San Marcos

Paula Fischhaber
CSU Northridge

Fourouzan Golshani
CSU Long Beach

Katherine Kantardjieff, Dean
CSU San Marcos

Jennifer Lillig
Sonoma State University

**Stanley Maloy, AVP Research &
Innovation**
San Diego State University

Bori Mazzag
Humboldt State University

**Katherine McReynolds, Deputy
Chair**
CSU Sacramento

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)
www.calstate.edu/csUPERB
Susan M. Baxter (Executive Director)

Letter from the Executive Director

"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."

- 2018 – 2021 CSUPERB Strategic Plan

Dear Colleagues and Friends:

This summer we gathered stories, updates and memories from students and faculty supported by CSUPERB this decade. It's no surprise that we have nearly 1000 CSU student names on our email list now! They check back in with us from lives beyond the university - working in biotechnology-related jobs, making clinical rounds, and attending graduate schools all over the world. We rolled their individual stories up into a new CSUPERB Data Dashboard (<https://csuperb.org/grants/csUPERB-data-dashboard/>) that we'll continue to update going forward. You'll see that nearly a third of our graduates are working at biotechnology companies. 76% of our graduates live and work in California, the nation's leading state for biotech research and development (R&D) jobs at hospitals, universities, startups, national laboratories, and companies.*

This annual report features profiles of CSUPERB-funded groups and projects from across California. I think the stories here capture the diverse talent, innovative spirit, and top-rated, nationally-competitive research found on Cal State campuses. The education and soft skill-building** that students gain at the CSU sets them up for an abundance of career opportunities and success within the biotech ecosystem. The faculty mentors profiled here are shining representatives of the CSU's biotechnology community, proudly developing talented students and graduating the next generation of scientists, engineers and entrepreneurs.

Chancellor White approved a new three-year CSUPERB strategic plan in July. We're going to continue to invest in experiential learning, but also begin the work of building infrastructure for multi-campus, collaborative research teams and partnerships. It's a year of leadership transition, as well. President Coley (Cal Poly Pomona) is the new Chair of the Presidents' Commission and Dr. Katherine McReynolds (CSU Sacramento) was elected as the new Chair of the Faculty Consensus Group. I can't thank the outgoing Chairs, President Haynes (CSU San Marcos) and Dr. Michael Goldman (San Francisco State University), enough for their dedicated service to and fierce advocacy for CSUPERB's students and faculty.



*San Francisco Business Times (August 2018). Available online at:

<https://www.bizjournals.com/sanfrancisco/news/2018/08/30/biotech-jobs-california-massachusetts-massbio-clsa.html>

**2018 Talent Integration Report (June 2018). Available online at: <http://www.califescienceworkforcetrends.org/>

30th Annual CSU Biotechnology Symposium Summary

CSUPERB celebrated its 30th Annual CSU Biotechnology Symposium January 11-13, 2018, at the Santa Clara Marriott. This year eighteen inspiring alums returned as speakers, mentors, and evaluators, including Avery August (now Professor of Immunology at Cornell University), Katherina Chua (now a graduate student at UCSF), Terri Quenzer (now biotechnology sector lead for the California Community Colleges), Cody Fullenwider (now a scientist at Pharmacyclics), Austin Jelnick (now Director of Business Strategy and Marketing for Cyagen Biosciences), and Christopher Yee (now a Captain on the U.S. FDA's Emergency Response team). Their current positions reflect the breadth of career path options for biotechnology researchers beyond the university, echoed in the [Student Outcomes data](#) we updated this year.

The symposium brought together 592 Cal State students, faculty members, and administrators. In addition to the alumni talks Friday morning, plenary sessions featured Data Science, CSU I-Corps team presentations, as well as CSU student and faculty short talks. The program included three professional development workshops for faculty: one on scientific communication, another on academic project management, and a CSUPERB proposal writing workshop. Students attended GRFP writing, career networking, and graduate school information sessions. The two poster sessions featured 287 collaborative research from 170 groups from all 23 CSU campuses and 61 external partners. Visit the symposium [photo gallery](#) to look back on all sessions, activities, and participants.

We thank Gilead, the National Science Foundation, and Arcus Biosciences for their support of this year's symposium.

CSU Alumni gave talks during the opening plenary session of the 30th Annual CSU

Biotechnology Symposium. (Left to right) Mitch Lucas (Syngenta & CSU Fresno alum), Stacy Markison (Crinetics Pharmaceuticals & San Diego State University alum), and Avery August (Cornell University & CSU Los Angeles alum). Bios for all the speakers, mentors and evaluators can be found here: <https://www.csuperb.org/symposium/2018speakerbios/>



Anonymous Student Voices from the Post-Symposium Survey

"I will remember the various talks and sessions. I loved that there were some who spoke more about their journey to where they are today and that others spoke more about their research. It was refreshing to never know quite what type of talk it would be."

"I heard more details about transitioning from CSU to PhD to industry; I had heard about it before but I was moved by individual presentations on Friday morning."

"I learned that it is possible to talk to people already in the field and that people are often a lot friendlier than imagined regardless of position."

"I loved the Friday Morning talks from alumni and the networking session. Learned a lot about fields I previously had no knowledge in. They gave great advice and it made me feel better knowing they didn't follow their set plans and things still worked out well for them."

"For the first time I got to hear a professional map out the road to drug engineering. I was not aware of the steps and methods that were used for quality assurance."

"I will remember the opportunity to share my research with professors that were familiar with the research I'm doing. Additionally, as a Nagel finalist, I will remember presenting my poster during the judged time period. I will also remember the conversations that I had with people I had never met before and the experience of listening to the graduate student talks..."

"As an undergrad senior, my biggest concern is not knowing where I will ultimately end up. Upon talking and listening to many professionals share their career paths, I felt a sense of relief and assurance that as long as I continue working hard and growing as a scientist, I will find and succeed in my career."

"The symposium really brought home to me that bioinformatics is a tool and without my biology background I am just playing with data and not making any meaningful conclusions. I have been wrapped up in getting the coding down that I have lost sight of what my data means biologically."

"Everything about this symposium will be memorable to me. It was much more than I expected and I was able to gain a lot of knowledge about multiple aspects of my academic and professional careers."

"For the first time I was exposed to many of the biotechnology companies that exist and also how to get into PhD programs."

"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...compared to other conferences that are solely student focused (like SACNAS) people were genuinely interested in my research and that was really great."



2018 CSU Biotechnology Symposium Awards

CSUPERB FACULTY RESEARCH AWARD: Dr. [Howard Xu](#), Professor of Biological Sciences, CSU Los Angeles. Since joining the CSU in 2004 after working in San Diego's biotechnology companies, Dr. Xu has received over \$2 million in funding for his research program studying mechanisms of antibiotic resistance and virulence and over \$11 million in grants that support research and biotechnology initiatives at CSU Los Angeles. Recently appointed as Director of the LA BioStart Project, Dr. Xu and campus colleagues are nurturing biotechnology entrepreneurship on campus.



ANDREOLI FACULTY SERVICE AWARD: Dr. [Marcelo Tolmasky](#), Professor of Biological Science, CSU Fullerton. Dr. Tolmasky was honored for his great dedication in mentoring students in his molecular microbiology lab, but also creating opportunities for students nationwide in the biotechnology field. He leads the NIH-supported Los Angeles Basin Minority Health and Health Disparities International Research Training (MHIRT) program. Since 2004 MHIRT has supported over 150 students who travel to another country to conduct biomedical research.



DON EDEN GRADUATE STUDENT RESEARCH AWARD: [Clariss Limso](#), CSU Long Beach. Ms. Limso is a researcher in Deepali Bhandari's group. Ms. Limso identified a way to diagnose cell stress using a molecular pattern that, in turn, may be a promising target for future cancer therapies.



GLENN NAGEL UNDERGRADUATE STUDENT RESEARCH AWARD: [Stacy Guzman](#), CSU Fullerton. Ms. Guzman is a researcher in Peter de Lijser's group, where she synthesized a series of small molecules capable of blocking protein-protein interactions.

CRELLING PAULING STUDENT TEACHING AWARDS: **Maricruz Macz De La Torre** (CSU Dominguez Hills) and **Justin Minck** (CSU San Bernardino). Ms. De La Torre served as a Supplemental Instructor for molecular biology courses. Mr. Minck served as an instructor in biology and genetics labs.



From Top (1): Dr. Xu and Dr. William Tong, SDSU & 2018 Chair, Andreoli Award Selection Committee. (2) Dr. Stanley Maloy (SDSU), Dr. Amybeth Cohen (CSU Fullerton & 2016 Andreoli Awardee) and Dr. Tolmasky. (3) Ms. Lisba Fowler (Eden Family), Ms. Limso, and Dr. Matt Escobar, (CSU San Marcos & Chair, 2018 Eden Selection Committee). (4) Ms. Guzman and Dr. Kasuen Mauldin (SFSU & Chair 2018 Nagel Selection Committee). (5) Mr. Minck, Dr. Kay Pauling, Ms. De La Torre, Mr. David Pauling, and Dr. Aparna Sreenivasan (CSU Monterey Bay & Chair, Pauling Selection committee).

CSUPERB PI Profile



The Stachura Group in the zebrafish aquarium room at CSU Chico. Left to right: Kallie Griffin, Skylar Tomasetti, Peter Kure, Rebecca Belmonte, Illiana Cajias, Payton Laurie, Sarah Maciel, Stephanie Aguiar, and David Stachura.

David Stachura (CSU Chico, 2016 New Investigator) is a cell biologist leading a research group investigating the genes important in the formation of hematopoietic stem and progenitor cells, "which are responsible for making blood over an organism's lifespan." He explains, "Ever since I was a graduate student, I was fascinated with how the body generates and maintains the correct number of blood cells – we need to generate billions of these cells every day to circulate oxygen, fight infections, and stop blood loss during injury. The signals that control this are not entirely known."

The CSUPERB New Investigator grant funding "allowed us to explore the function of a number of genes that are important in blood formation...Luckily, CSUPERB believed in our plan...which allowed us to apply for (and obtain) further funding from the NIH to continue these studies." The student-faculty team also published two papers based on work funded by the CSUPERB grant.* The new NIH funds supporting the Stachura group's hard-working student researchers allows them "to travel and talk about all the research that we are doing to a national and international audience."

"I think the best part [of his position at CSU Chico] is that students constantly surprise you - they'll think about a research problem from a different angle...I love the constant questions about subjects that I either haven't thought about for a while or that are really confusing and need to be more deeply explored. It keeps me constantly thinking and exploring, which is why I became a scientist in the first place."

*Berrun AC, Harris E, Stachura DL. (2018) *isthmin 1 (ism1)* is required for normal hematopoiesis in developing zebrafish. *PLoS One*. 13(5):e0196872.

Berrun AC, Stachura DL. (2017) Development of an In Vitro Assay to Quantitate Hematopoietic Stem and Progenitor Cells (HSPCs) in Developing Zebrafish Embryos. *J Vis Exp*. 129. doi: 10.3791/56836

CSUPERB Mentor Profile



Ken Hitchner (center) talks with students at the Career Networking Session during the 30th Annual CSU Biotechnology Symposium in January 2018.

Ken Hitchner is Vice President, Development Sciences Quality, at BioMarin Pharmaceutical Inc. Mr. Hitchner has 30+ years of biotech experience in project management, pharmaceutical collaborations, and product development in numerous leadership and management roles at BioMarin, Monogram Biosciences, Gilead Sciences and Genentech. As a result, he has a wealth of wisdom and advice about careers in biotechnology that he's shared with CSU students and faculty over the last decade.

When the annual CSU Biotechnology Symposium is held in northern California, Ken is a regular participant at and supporter of the the Career Networking Session for students. He says, "I love interacting with the students because there were many people who helped me out along the way and I get a lot of satisfaction from returning the favor. I am always impressed by the enthusiasm and the student experience reminds me how important it is to stay on a steep learning curve; I am blown away by the caliber of work they do. [But] many students seem to think that their specific course work or training defines or limits their career path. The reality is that most people don't end up in the area of focus they start with."

He uses his path as an example, "My master's degree was inherently divergent in that I started in Marine Biology [at San Francisco State University] with Tom Niesen and finished off with Sarane Bowen in Ecology & Systematics. Both Tom and Sarane helped me to discover my strengths (and areas for development) which led me to my career in biotech. Like many others, my career evolved from a scientific/laboratory path to a business/management path, but I've always maintained an appreciation and passion for the science."

The blending of disciplines and inevitable evolution of job roles are unfamiliar concepts for university-based researchers, so Mr. Hitchner explains the world of work in biotechnology companies. "We talk about working in a matrix fashion. A strong matrix is when the majority of planning and decision-making is conducted by interdisciplinary/cross-functional teams...whereas a weak matrix means that the functional areas (and their leaders) drive the planning and decision-making more independently of one another. Most companies, especially biotech start-ups, begin in the weak matrix fashion and evolve over years to a stronger matrix mode...A typical cross-functional team in R&D might include Clinical Sciences, Clinical Operations, Regulatory Affairs, Pharmacological Sciences, Bioanalytical Sciences, Biostatistics/Data Management, Manufacturing, Quality, Project Management and a Team Leader. It is critical to have a sense for teamwork and a willingness to contribute to the overall cause." Thanks to Mr. Hitchner and other generous alumni working in the biotechnology industry, CSUPERB-supported students have the opportunity to learn these concepts before leaving the university.

CSUPERB PI Profile

Kimberly Mulligan (CSU Sacramento, 2015 & 2016 New Investigator) is a developmental biologist working to identify environmental factors that may increase the risk of onset or increase the severity of neurodevelopmental disorders, like autism and Fragile X syndrome. “The complexity of neurodevelopmental and neuropsychiatric disorders is stunning, and we are just hitting the tip of the iceberg in terms of understanding their molecular underpinnings. That is why there is such a deficit of effective treatments,” she explains.

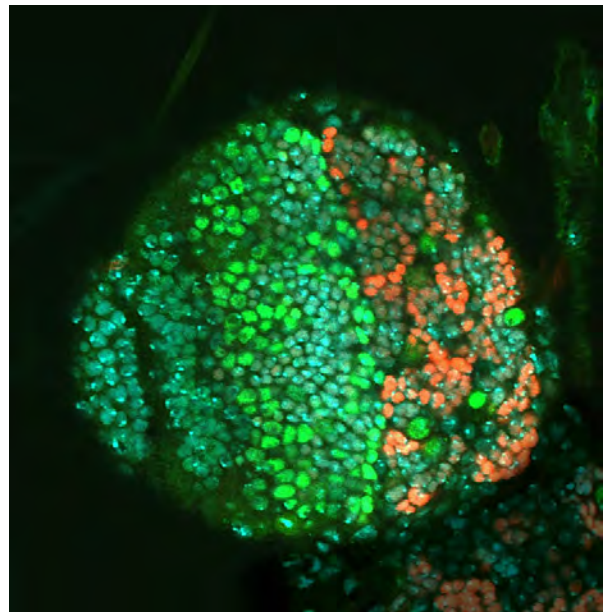
Dr. Mulligan says the “CSUPERB New Investigator Award I received in 2016 was critical for launching my research program. It allowed me to pay a number of undergrads for their research efforts over the summer. [It] was also my first experience with ‘grant management,’ so there were certainly bumps along the way! I now have an appreciation for the pace of research at teaching universities...I have come to view my research as an extension of my teaching—it is providing students with experiential learning opportunities at the bench. Whether data generation is slow or fast, my students are gaining a fabulous skill set. That is the win for me.”

In fact, Dr. Mulligan has trained a remarkable number of undergraduates in her lab already. She says, “Managing a lab of 20-25 students [primarily undergraduates] has certainly provided a steep learning curve! I think the most valuable lesson I’ve learned is the importance of letting students fail and encouraging them to do their own troubleshooting...students more effectively learn how to think critically and have a greater sense of scientific ownership over their projects.” She concludes, “the impact factor of teaching—the sheer number of lives that you can potentially affect—is incredible to me. Being in my hometown, teaching at Sac State, getting to contribute to the community in which I was raised feels like a dream. I am a fierce advocate for diversity in science—and being at Sac State puts me in the wonderful position of training diverse students and helping to launch them into careers in the biomedical workforce.”

[Read the full Mulligan PI profile at the CSUPERB webpage.](#)

Left - Summer 2018 Mulligan Lab Photo (CSU Sacramento). (Top Row, Left to Right): Alex Ceballos, Brendan Tinsley, Alain Hu, Aliyah Penn, Kirill Iakounitchev. (Middle Row, Left to Right): Chloe Welch, Yomira Polacios, Raina Brown, Any Ardon-Castro, Angelina Tupikova, Lillian Murphy, Kristina Ghenta. (Bottom Row, Left to Right): Daniel Chu, KC Leodones, Kimberly Mulligan, Uyen Nguyen, Kimberly Nguyen. (In the tree: Mulligan’s children).

Right - The Mulligan lab examines how the combination of genes and environment converge to affect neural stem cell proliferation. Type I and II neuroblasts (Drosophila neural stem cells) are distinguished using anti-Prospero (red), anti-Deadpan (green), and DAPI (blue). Photo credit: Chloe Welch, Jacqueline Stein and Lillian Murphy.



CSUPERB PI Profile

Sami Khuri (*San José State University, 2016 Curriculum Development*) is a computer scientist who won a CSUPERB grant to partially support a collaboration involving faculty from Biological Sciences, Mathematics and Statistics, Computer Science and Chemical Engineering. The team's overall goal was to develop new interdisciplinary degree programs in Bioinformatics: a six-course Minor in Bioinformatics and a two-year [Master's in Bioinformatics](#).

Dr. Khuri explains their motivation, "...programming courses were designed and developed with CS majors in mind and often leave non-CS majors disappointed or discouraged...We believe that Minor degrees are a perfect option...We should not forget that interdisciplinary Minor degrees are open to CS students too...These CS majors will see new career and research opportunities."

The Minor in Bioinformatics program was designed and developed in close collaboration with Miri VanHoven (Biological Sciences). Virginia Lehmkuhl-Dakhwe (SJSU STEM Education Officer) and Sami jointly developed the two CSUPERB-supported "Python Programming for Non-Majors" lower division courses. Dr. Khuri says, "We offered the first course for the first time in Fall 2017...and all Python examples, assignments, and computer programs are motivated by real problems drawn from life sciences." In Fall 2017, 30 students enrolled in the active-learning-based, in-person courses. The enrollment doubled this fall, suggesting significant student interest in the option.

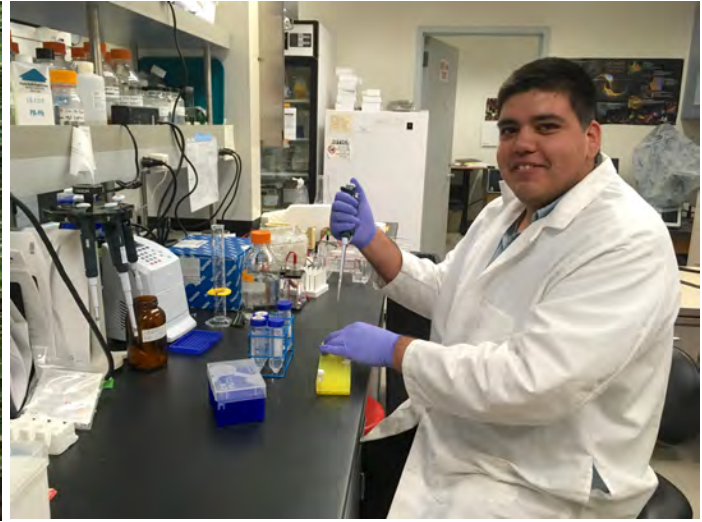
Khuri and VanHoven recruited multi-disciplinary

team members to design the Bioinformatics master's program, including Leonard Wesley (Computer Science), Phil Heller and Rula Khayrallah (Computer Science), Rachael French and Cleber Ouverney (Biological Sciences), Martina Bremer (Mathematics and Statistics), and Brooke Lustig (Chemical Engineering). The group won additional grant support from the Technology Pathway Initiative (TPI) at the Center for Advancing Women in Technology.

The effort to develop new interdisciplinary courses and programs is often perceived as difficult and frustrating. Dr. Khuri advises, "There are three components for successfully creating any interdisciplinary course/program. All three components should be in place before starting...First: It is important to assemble a group of core faculty representing different disciplines who understand the purpose of the new program and who are convinced of its benefits. They should be able and willing to communicate with each other. Second... It is important to secure a buy-in from administration early on by making sure that they understand the value of the proposed program and are willing to support it by providing resources and acknowledging the work of the faculty. Third... since all programs need to go through curricular review and approvals, it is vital to understand the processes, procedures and deadlines. It helps to meet with some of the committee chairs informally and explain to them the initiative and get advice."

The SJSU Bioinformatics Educational Team, Summer 2018 (Left to right): Shantanu Deshmukh (Master's student and website designer), Len Wesley (Bioinformatics Professor & Co-Coordinator of MS in Bioinformatics), Wendy Lee (Bioinformatics Lecturer), Phil Heller (Bioinformatics Professor), Miri VanHoven (Genetics Professor & Co-Coordinator, MS and Minor in Bioinformatics), Neha Bhagwat (Instructional Student Assistant), and Sami Khuri (CS Chair and Co-Coordinator, Minor in Bioinformatics). Not present: Sebrianne Ferguson (Instructional Student Assistant).





The Brennan Lab at CSU Fullerton: Left (left to right): Caitlin Harris, Dr. Catherine Brennan, Amber Myers, and Martin Arreola (Summer 2018). Right: Undergraduate Martin Arreola prepares samples for PCR in the Brennan lab.

CSUPERB PI Profile

Catherine (Katie) Brennan (CSU Fullerton, 2014 & 2016 New Investigator, 2016 & 2018 Travel Grant) is an immunologist interested in the fundamental processes used by blood cells to protect themselves, as well as the entire organism, from infection. Her lab uses *Drosophila* (fruit fly) as a model organism “to discover and analyze these really fundamental cell biological questions, using the arsenal of genetic approaches that generations of scientists have developed... Inflammation is a double-edged sword, essential during infection, but harmful if it becomes a chronic state, such as in cancer, diabetes, and atherosclerosis.”

When Dr. Brennan joined the faculty at CSU Fullerton she “was making a big change in research field. I had studied the genetics of fly immunity in the early 2000’s, but then had a long hiatus, during which time I conducted HIV research and also taught high school. It took me a little while to find my feet in this new field of macrophage cell biology, and the research support and teaching release from the two CSUPERB NI grants helped enormously.”

All the preliminary work and learning paid off; Dr. Brennan’s lab received NIH funding in 2017. When asked how the funding will change her group, she explains, it “can really accelerate the pace of discovery. I also have much more time to meet with my research students to analyze their data, and bring a second pair of eyes towards thinking about significance and troubleshooting. Also, it has given me more time to write manuscripts [and] I’ve been able to afford some invaluable reagents that would have been out of reach, financially, before.”

After her training in research-intensive settings at Sloan-Kettering Institute, Stanford and UCLA, Dr. Brennan says there are many things to love about her position at CSU Fullerton. “I love the breadth among my colleagues, from marine biology to ornithology to computational biology – you just don’t get that breadth in a medical research institute. I really appreciate the emphasis on teaching quality – it is something I put a lot of time and effort into, and it’s really nice to have that valued by my department. Also, having the teaching be a big part of the job means that my salary is not dependent on grants, which can be a very stressful way to live. I like being part of an institution where we want our students to succeed; in other places, introductory science courses are explicitly set up to weed out students, which I would find very discouraging. Finally – the students! Overall, most of them are here to learn, and are curious and motivated, and a lot of fun to teach.”

[Read the full Brennan PI profile at the CSUPERB webpage.](#)

CSUPERB PI Profile

[Christal Sohl](#) (*San Diego State University, 2016 New Investigator, 2017 Travel Grant*) leads a research group that uses "kinetic, structural, and cellular tools to address how altered enzyme activity impacts human health, especially in diseases like cancer." She says, "Right now a major focus of the lab is understanding how metabolic enzyme activity is altered by mutation or environmental stress in the context of cancer."

CSUPERB "funds allowed us to pursue an interesting problem in genome infidelity that would not have been funded by traditional grant mechanisms. This project was in its infancy, and the CSUPERB New Investigator funds allowed us to generate preliminary data... The feedback received from the study sections is also enormously helpful. Even if one doesn't get funded, I advise other CSUPERB PIs to think of this as an



Christal Sohl (San Diego State University) trains graduate student Anna Uvarova (now employed at Novartis in Boston) to use a rapid quench to measure how quickly polymerases replicate DNA.

opportunity for a room full of intelligent scientists to critically assess your ideas...A reviewer on an NIH study section was pleased to see that we were successfully competing for grant opportunities at the university, local, and state levels."

Dr. Sohl trained at Vanderbilt University and Yale University, but says "SDSU is a special place for a variety of reasons...Our student population is rich in traditionally underrepresented groups in STEM, perhaps

most obviously through our Hispanic-serving institution designation, but we are also recognized for supporting first-in-family students and LGBTQ students. We have a real opportunity to diversity the local workforce by training and mentoring these students in STEM fields. I've launched a new cross-university mentoring program, MINDSET (Maximizing INclusion and Diversity in Science, Engineering, and Technology) that has at its heart this very goal. And I'd like to add that the students in my lab are just as talented and just as hardworking as any as I've seen at my previous institutions."

Research pulls open-minded investigators in unforeseen directions, leading to unexpected collaborations and impactful outcomes. Dr. Sohl explains, "Our CSUPERB funding was focused on the kinetic features of human polymerases, but partway through the project, a really exciting collaborative opportunity emerged. We were fortunate that CSUPERB funding allowed us to switch gears a little bit to study the catalytic features of the viral polymerase found in Zika." Dr. Sohl says, "This is directly preparing our students for the types of challenges and opportunities they may face in future industry careers."

[Read the full Sohl PI profile at the CSUPERB webpage.](#)

CSUPERB PI Profile

[Nathan Lanning](#) (CSU Los Angeles, 2016 New Investigator) is a cell biologist leading a group aiming to develop cell models of mitochondrial diseases, including the rare childhood genetic disease Leigh Syndrome. Dr. Lanning explains, "We have multiple motivations. First - rare diseases, including mitochondrial diseases, are underfunded at both the basic and translational levels so a pressing need exists for more research. These diseases are severe, often resulting in children's death, adding urgency to the problem. Another motivation is that up to a third of mitochondrial proteins remain uncharacterized, lending real excitement to our field as we seek to identify these proteins' functions."

While getting his lab up and running, Lanning tells this story: "It took me two tries to obtain CSUPERB funding, and I heavily relied on the comments from my first unfunded proposal to write the second, funded proposal. I really took the time to carefully map out realistic student involvement in the successful submission." The exercise was worthwhile, Dr. Lanning recently won NIH funding to support the lab's research year-round. "The CSUPERB funding was fundamental in providing students the opportunity do real research and to purchasing essential reagents," Lanning says, "We were also very fortunate that the results of this research yielded data that was directly included in our NIH proposal and paved the way for major sections of two aims."

Like all assistant professors in the CSU, Lanning has learned how to succeed by working with undergraduate and masters' level researchers. He says, "I've learned that they have an almost unbounded enthusiasm for research if they are provided the proper environment to pursue their interests. Their desire to engage with contemporary research questions is an inspiration to me."

Concurrently, I've learned that research in an undergraduate context sometimes requires intensive mentoring on my part, and I am still learning how to become a better mentor in this respect...I'm biased, but our group is a particularly great group of students. They are constantly in the lab helping each with their research projects as well as their academic work and have made our lab a wonderful environment where they are really blossoming as future scientists, educators, and medical professionals."



Lanning Lab @ CSU LA, Summer 2018. Front (left to right): Carlos Gonzalez, Ernesto Castellanos, Joshua Alverado, Sarah Madira, Jocelyn Rodriguez, Nathan Lanning, and Bea Parcutela. Back (left to right): Jessica Hsueh, Anh Phuong Nguyen, Ryan Meraz, and Benjamin Nittayou.

CSUPERB PI Profile

[Qiao-Hong Chen](#) (CSU Fresno, 2013 New Investigator, 2015 Research Development) is a synthetic organic chemist leading a group expert in generating small molecules with potential use as molecular probes or drugs to treat aggressive cancers, including prostate cancer.

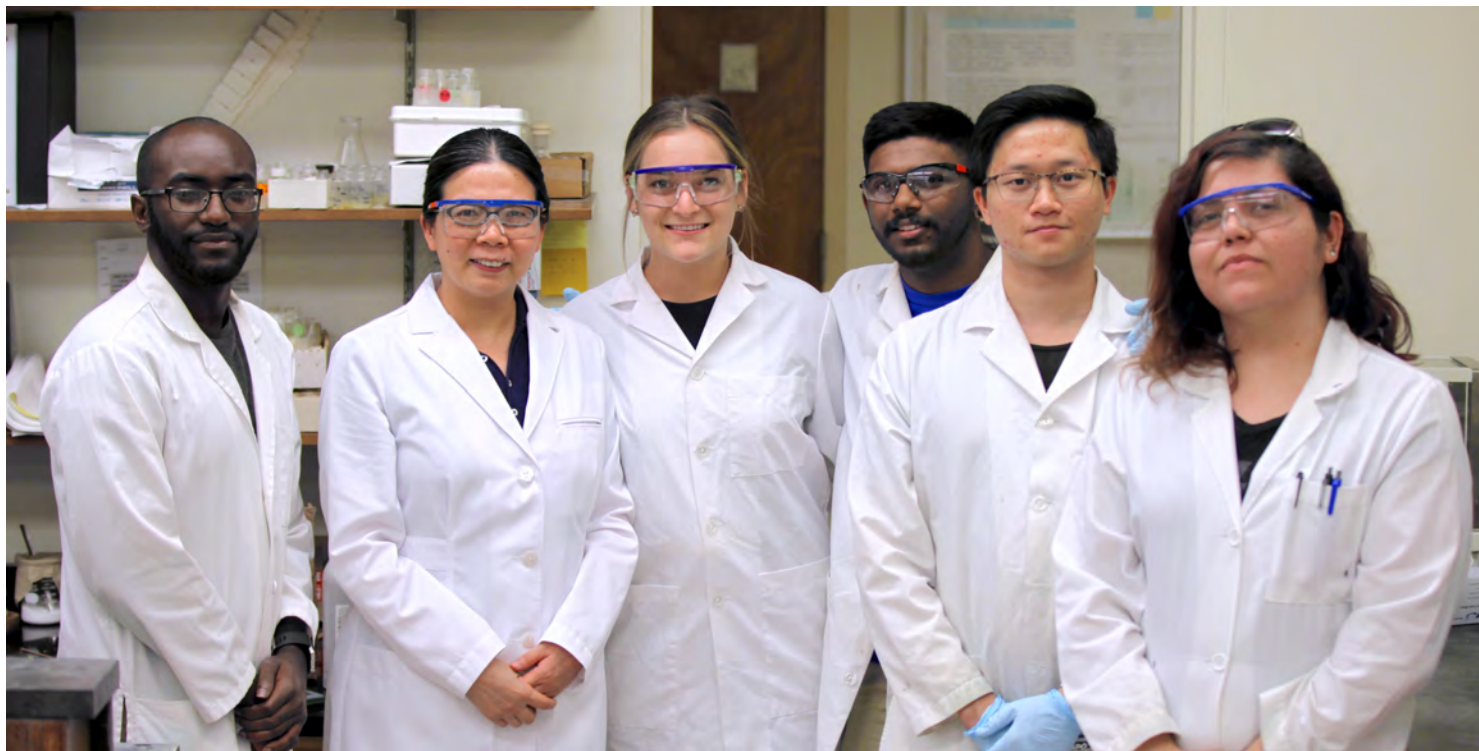
Dr. Chen reached out to CSUPERB as soon as she joined the Fresno State faculty in 2012. She explains, "CSUPERB provides me an excellent platform to learn how to write grant proposals and to communicate with colleagues from other campuses. The constructive review comments are extremely helpful for me to craft a competitive NIH proposal. The CSUPERB funds helped my research group to build our research capability and our good record of publications, which set up the stage for our successful NIH SC2 grant."

That research record is remarkable. Since 2012, the Chen group has published 32 peer-reviewed papers (with 54 Fresno State student co-authors and 2 high school student co-authors), 81 research presentations (67 student presenters), 3 provisional patent applications, and 1 issued US patent. Student researchers in the Chen group have been successful winning CSUPERB scholarships, CSU I-

Corps microgrants, and travel awards as well. "First, I try hard to help my students to love and own their research projects. I then encouraged them to get familiar with various CSUPERB student awards by reading the respective Request for Proposal," she explains "Then I guide them to find the best references and their research data to build up their proposals. I also encourage them to have other lab-mates and friends proofread their grant applications...I am so excited to witness my students to grow up as young scientists from these research projects."

She concludes, "I always believe that just like natural products are a robust source for new drugs, research is an endless supply for the enhancement of teaching, especially at primarily undergraduate institutions. Consequently, I really want to commit my expertise in both research and teaching, especially to first generation students, like me...For example, nothing can make me more satisfied and excited than the fact that four of my research group members were accepted into four well-known Ph.D. programs this year."

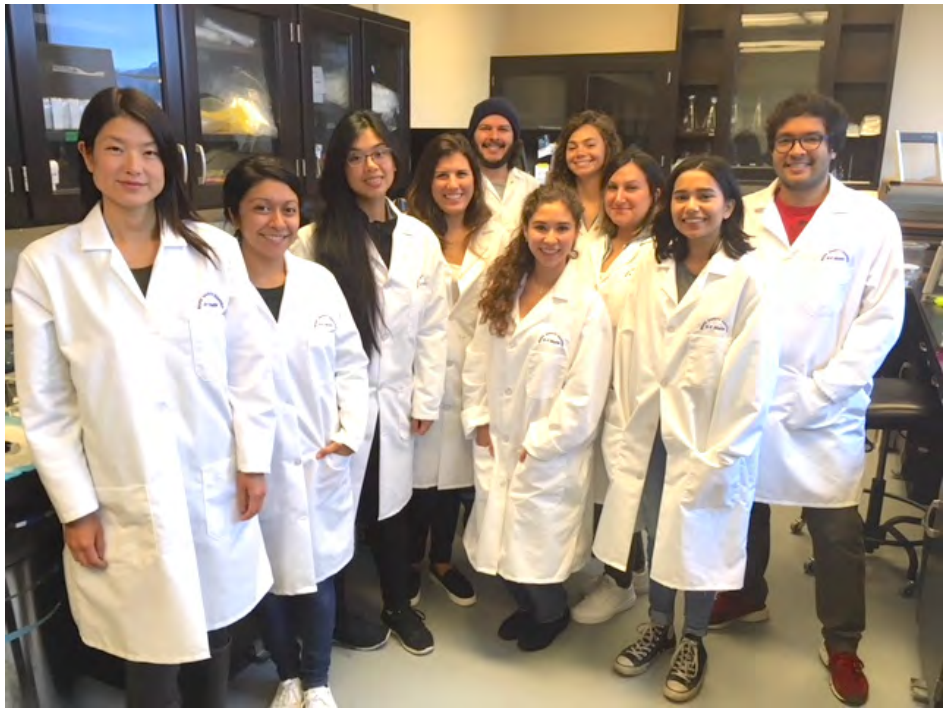
The Chen Lab at Fresno State (Summer 2018). Left to right: Kevin Muthima (graduate student), Dr. Chen, Maizie Lee (undergraduate & Howell-CSUPERB Scholar), Pravien Rajaram (graduate student & travel grant awardee), Ziran Jiang (graduate student), and Maricarmen Gonzalez (graduate student).



CSUPERB PI Profile

Andrea Swei (San Francisco State University, 2015 New Investigator) is a disease ecologist leading a research group studying the intersection of host and pathogen diversity in tick-borne and non-tick disease systems. She explains, "My research is motivated in my interest in understanding how environmental factors like habitat fragmentation and land use patterns can influence the spread and transmission of human-relevant diseases."

To start up her lab, she says, "The CSUPERB grant allowed me to hire students like Alexandra [Lawrence] and Liliana [Cerna] to really push my research goals forward. Students really drive the research at all universities, but especially at CSUs where faculty teaching and service responsibilities are so high. The CSUPERB grant allowed me to really invest in excellent students to produce data and write up high impact publications. That really helped me prepare strong NSF grant proposals that resulted in two successful grants, an NSF EAGER and a CAREER award."



The Swei Lab Group at San Francisco State University, Summer 2018. Left to right: Dr. Andrea Swei, Liliana Cerna, Adrienne Almarinez, Samantha Sambado, Thor Olsen, Arielle Crews (front), Jordan Salomon, Rachel Grgich, Sukhman Sidhu, and Adrian Barrera-Velasquez.

Ms. Lawrence is now pursuing a PhD in Germany at the University of Bayreuth. Ms. Cerna was an NIH MARC fellow last year and graduated from SFSU with a BS in Biology. She is now a research associate in the Swei lab and plans to apply to graduate programs soon. Dr. Swei says, "I love working with the students here. They are highly motivated, smart, and do not take their educational opportunities for granted. I am happy to contribute to their training and provide them with an opportunity to see what they can achieve as scientists. I also feel like being at SFSU does not mean I have to sacrifice my research program. I can work with students to conduct really important disease ecology research that can actually improve our understanding of where and how human-relevant diseases affect us."

The NSF CAREER Award Program funds faculty researchers who not only work to integrate research and education, but also effectively communicate with a larger audience. Dr. Swei embraces these concepts as well. She explains, "Disease ecology is a topic that is inherently easy to connect to because it affects us all...I am using this inherent interest to reach undergraduate students in their courses by developing field and lab exercises that allow them to test hypotheses, learn concepts, and actually do science. This is how I was trained many years ago and I believe it's the best way to show students how exciting and accessible science can be."

Dr. Swei is also comfortable communicating with the public [via podcasts](#) and newspaper articles. She says, "I am very much intentionally engaging with the public to increase public awareness of diseases but also to use it as a platform to show that ecological research of all types is so important to understand our changing world...Sometimes it seems like the take away from my research on the risk of vector-borne diseases is that nature and the outdoors are dangerous things. But I hope that people will go outside and also teach their kids how to enjoy natural areas. As long as people are aware that there are some risks and learn how to identify them, they will be happier, healthier, and safer in the long run."

CSUPERB PI Profile

Jeffrey Gustafson's (San Diego State University, 2015 & 2017 New Investigator, 2018 CSU I-Corps Summer Sprint) medicinal chemistry group synthesizes atropisomers, or small molecules that have locked or hindered rotation around a single bond. He explains, "I am fascinated by this problem because there are many angles to it that span chemistry, biochemistry and cell biology..."

Gustafson brought his interdisciplinary perspective to SDSU and in 2015 published paper on atropisomeric kinase inhibitors in *Angewandte Chemie*. Their work pointed the way to a surprisingly simple strategy to increase the target selectivity of kinase inhibitors. "The Medicinal Chemistry division of ACS asked me to speak in a session on atropisomerism in drug discovery during the spring 2018 National Meeting. This allowed our work to be introduced to a large audience (mostly industrial medicinal chemists), and eventually led to a [nice article in C&E News](#)."

At first Gustafson was unsuccessful winning grant funding from the NSF and NIH. He explains, "The support from CSUPERB has been critical to my lab's success...During my fourth year at SDSU, I kept my lab running and obtained key preliminary results thanks to gritty students and funding from CSUPERB's New Investigator grant. Notably, we were able to get several in-house kinase inhibitor assays up and running, which allowed us to get exciting preliminary results for a NIH proposal that was funded."

Now the group has funding from both NIH and NSF. With the extra bandwidth, the Gustafson lab decided to try out CSU I-Corps this summer. As a result, his "students caught the start-up bug, and they are actively (with my blessing) planning to start a company based on our research. For me, the most striking part was growing my professional network in San Diego. I've spoken with so many people throughout the biotech and medicinal chemistry communities, and these conversations really put things in perspective. I-Corps also taught me how to be a better listener and to better assess the problems of others."

Gustafson came to SDSU from Yale University. He says, "SDSU operates by a teacher-scholar model. I find the teaching part makes me a better scientist and communicator and can be a lot of fun. I also appreciate the commitment to undergraduate research at SDSU (and the CSU system, in general). I feel I am making a huge

difference in the lives of undergraduates who do research in my lab, and I get very excited when they have a major triumph."

[Read the full Gustafson PI profile at the CSUPERB webpage.](#)

The Gustafson group striving to reach greater heights at SDSU. Left to right: Dr. Sagar Vaidya, Dr. Jeffrey Gustafson, Sean Toenjes, Mariel Cardenas, Valeria Garcia, Andrew Dinh, Samuel Albright, Zachary Brown, Dr. Mirza Saputra and Lalena Janke.



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

Annual Report
Academic Year
2017-2018

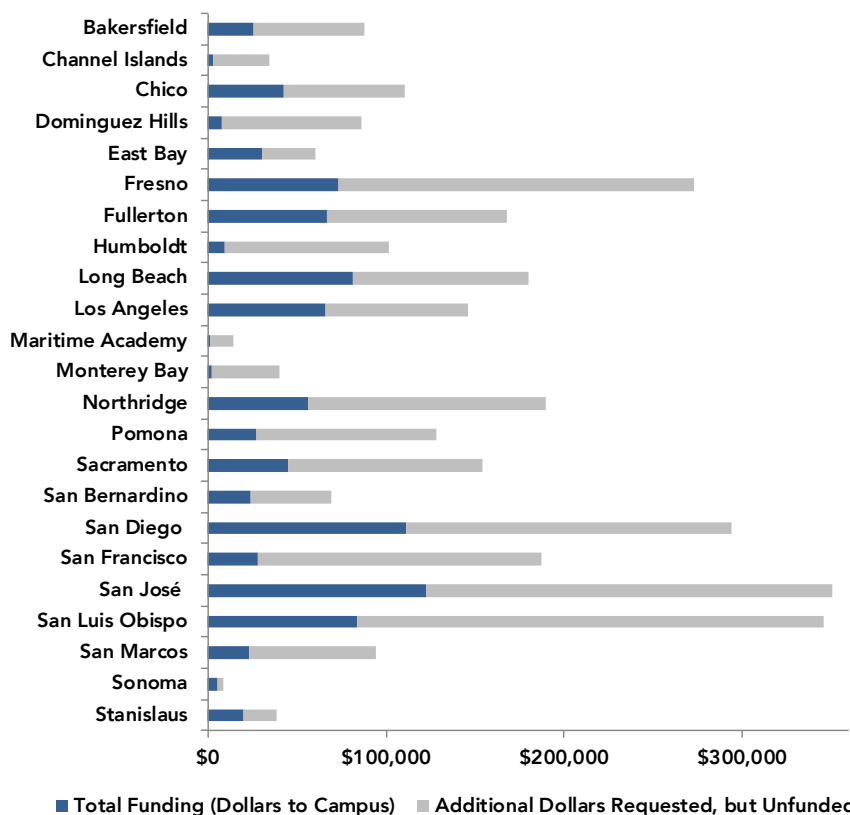
Annual Expenditures AY 17-18	Salaries & Office Operations	\$ 482,471
	Program Operations & Outreach	189,518
	Symposium (including Symposium Awards)	342,725
	Grants & Awards	667,946
	CSU I-Corps™ Grant (NSF)	73,229
Total Expenditures:		\$ 1,755,889

This year's expenditures included overlapping grants from NSF: the final year of the original I-Corps Site grant and a Type II I-Corps Site grant at \$100,000 per year that began February 1, 2018.

Grants and Awards Issued by Program (Number of Awards & Total Award Dollars)	Faculty-Student Collaborative Research Grants	29 / \$ 432,574
	Entrepreneurial Joint Venture Matching Grant	3 / 44,996
	Curriculum Development Grants	2 / 30,000
	Travel Grants (Faculty & Student)	39 / 56,008
	Howell - CSUPERB & Presidents' Commission Research Scholar Awards	23 / 130,000
	Symposium Awards	6 / 9,500
	CSU I-Corps™ Microgrants	10 / 17,500
Total Number of Awards / Total Dollars:		112 / \$ 720,578

CSUPERB received 449 proposals, applications and nominations from all 23 campuses this year; awards were made to 20. The CSU I-Corps™ program is made possible by an NSF grant active through January 2021.

Competitive CSUPERB Funding by CSU Campus AY 17-18

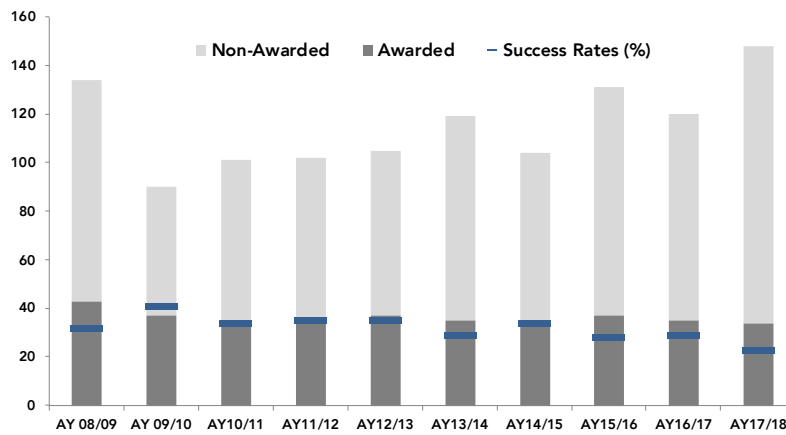


This chart summarizes CSUPERB financial support in the form of competitive grants, awards, and symposium expenses (in dollars, \$) by campus. 20 campuses won grants and awards this year; 23 campuses were represented at the 30th Annual CSU Biotechnology Symposium.

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

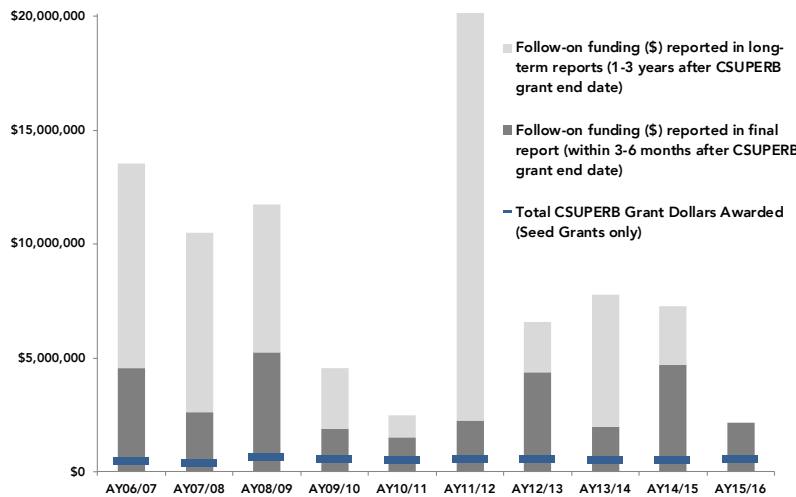
CSUPERB Program Trend Data - At a Glance

Competitive CSUPERB Grant Program Success Rates: Number (#) of proposals awarded, # of unfunded proposals and success rates (AY 08-09 through AY 17-18)



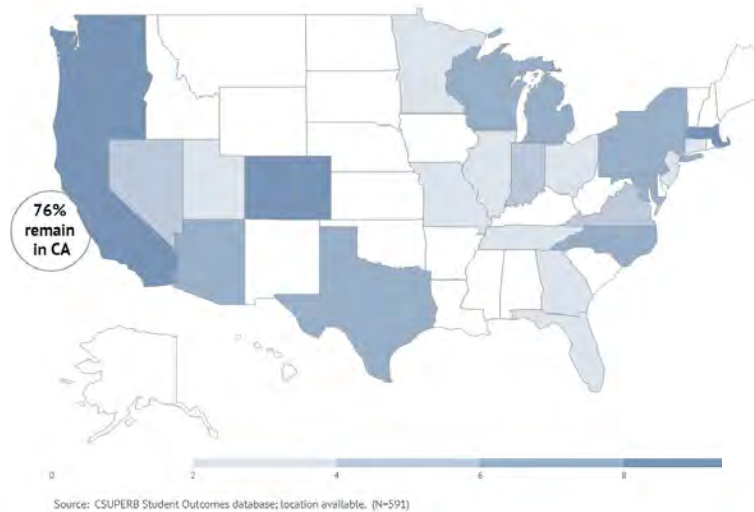
Overall success rates (number awards made ÷ number proposals received, reported as a percentage) are shown by academic year for the seed grant programs. For the last three years 27% proposals were funded. New Investigator applications represent 57% of all seed grant proposals received, correlated perhaps to new faculty hiring system-wide.

External, follow-on funding received by CSU faculty supported by CSUPERB seed grants (AY 06-07 through AY 15-16)



31% of CSUPERB seed-grant-funded faculty (2010-2015) won external, follow-on funding. The averaged financial return-on-investment in PIs funded 2006-2016 is 1472%, based on reports received as of July 1, 2018. Follow-on funding represents an expansion of student research and experiential learning opportunities.

CSUPERB-Supported Students: Where are they now?

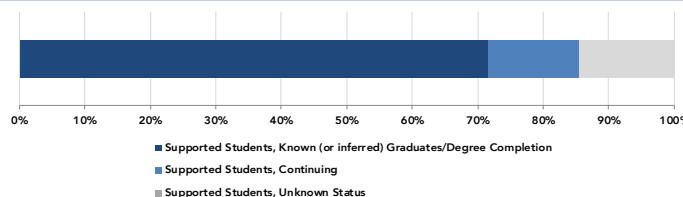


Every three years CSUPERB surveys the students and alumni we've supported. CSUPERB supported 983 students (2000-2018) with scholarships, travel grants, and faculty-mentored seed grant-funded projects.

Explore the data at: <https://csuperb.org/grants/csUPERB-data-dashboard/>

This year we developed a new, online CSUPERB Data Dashboard where you can explore CSUPERB Supported Student Outcomes, including career paths.

Last Known Status, Supported Undergraduates



At least 86% of CSUPERB-funded undergraduates (2000-2017, n=691) graduated or continued in CSU degree programs.