2010/11 Annual Report July 2011 CSU The California State University PROGRAM FOR EDUCATION AND RESEARCH IN BIOTECHNOLOGY (CSUPERB)

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

CSUPERB is committed to supporting student research experiences because we know they are transformative and provide great benefit to students interested in biotechnology careers. In addition to research grants, CSUPERB makes travel grants to students and partners with other organizations, like the Doris A. Howell Foundation for Women's Health Research, to provide research scholarships. We want to share the stories and voices of a



Above: **Ashley Bonneau** (CSU Channel Islands) discusses research results based on RNA silencing at her poster during the 2011 CSU Biotechnology Symposium.

couple CSUPERB-supported undergraduate researchers in this annual report.

Ashley Bonneau (CSU Channel Islands) spent two years researching mechanisms of gene silencing with Dr. Nitika Parmar, funded in part by a 2010 Howell-CSUPERB Research Scholar Award. In her final report to CSUPERB, she wrote that the award "enabled me to spend more time in the lab and to study for my classes as I was not required to work part-time during the semester. I am extremely grateful and appreciative...and plan to focus on research during the summer break and hope to have enough data for a potential publication." The following academic year, Ms. Bonneau was named a Goldwater Scholar. In April 2011 she presented a poster at the American Society for Biochemistry and Molecular Biology annual meeting in Washington, D.C. Ashley won the national award for the best RNA-themed research poster. After graduating this spring, she's headed to Yale

to pursue a doctoral degree in molecular biology. Ashley characterized her research experience as having "monumental impact on my future career goals."

Sonoma State University undergrad, Frankie Gonzales, and his faculty mentor, Jennifer Whiles-Lillig, won a CSUPERB travel grant to collect isothermal titration calorimetry data in Daryl Egger's San Jose State University laboratory. They aimed to characterize antibacterial peptide-membrane interactions for a paper they plan to submit this summer. Frankie explains, "even though the hours were long and balancing difficult classwork with

lab time and trips to San Jose was challenging, I wouldn't have changed a thing. That's when I decided to pursue a career in the natural sciences." He elaborates, "my research ...allowed me to get more familiar with natural sciences in an applied manner; whereas before, the concepts were just sentences in a book. Since the type of research I will be doing in graduate school will most likely involve surface membrane proteins and binding, I have made myself an instant asset to whichever lab I go to work for." In August Mr. Gonzales moves to San Diego to begin doctoral studies in systems biochemistry at the University of California, San Diego.



Frankie Gonzales (Sonoma State, left) with his faculty advisor, Jennifer Whiles-Lillig, at the CSU Biotechnology Symposium in January 2011.

2010/11 Program Highlights

- Life Science Workforce Summit brought together 120 educators, workforce and economic development experts, industry professionals and government officials to CSU Los Angeles in October
- Presidents Karen Haynes (CSU San Marcos) and Richard Rush (CSU Channel Islands) joined the CSUPERB Presidents' Commission
- The 2011 CSU Biotechnology Symposium in Orange County drew 580 participants and featured 236 posters from student-faculty research teams
- CSUPERB made 90 grants and awards (totaling \$616,183) to 51 faculty and 21 students at 18 CSU campuses
- CSU Fullerton, Cal Poly Pomona, CSU Los Angeles and San Diego State University launched an online certificate for clinical trials project management – work funded by the SBA grant to CSUPERB

CSUPERB 10/11 Operating Budget

Total	\$1,752,511		
Salaries & Office Operations	\$506,126		
Program & Grants Administration	\$162,070		
SBA-funded Workforce Development Project	\$292,304		
Symposium	\$220,000		
Grants & Awards	\$572,011		



Above (left to right): Adam Worsham, Christopher Nourse and **Winncy Du** with their robot for assembling catheter devices at San Jose State University. Mr. Worsham is now working at Anritsu Corporation in Morgan Hill; Mr. Nourse is employed at Adept Technology in Pleasanton.

CSUPERB is: CSU Faculty Researchers

Dr. Winncy Du, a professor of Mechanical & Aerospace Engineering at San Jose State University, is an expert in robotic and sensor technologies. But back in 2006 Dr. Du had yet to work on biotechnology applications. That spring she won a CSUPERB Joint Venture grant to work with an early stage medical device company. Heart surgeons had access to medical devices capable of opening blocked arteries in patients with coronary disease. However, imaging technologies able to detect arterial lesions were limited. By the end of the CSUPERB grant, Dr. Du and her collaborators figured out how to integrate imaging capability with a surgical catheter device. The early stage company evolved and was eventually sold, but the San Jose State team continued their work. Dr. Du and her student, Winston Jose, published a paper in Sensor & Transducers Journal. As a result Dr. Du and her current SJSU students are working with Boston Scientific on the automated assembly of an imaging catheter, now under review as a new product at the US Food and Drug Administration (FDA). Dr. Du's students are now finding jobs with medical device companies or continuing on to graduate school with concentrations in medical device design. CSUPERB Pls are not only transforming students' lives, but also contributing solutions to improve patients' lives.

Letter from the Executive Director

Dear Colleagues and Friends:

In 2008 as part of the CSUPERB strategic planning process, CSU faculty, deans and presidents agreed that the "best way to engage, recruit and retain students in life sciences careers is to provide access to and opportunities in real world biotechnology research settings." Our life science industry partners also point out a real workforce need for graduates who have hands-on, team-based research experiences. Students report back excitement, inspiration and motivation based on their research experiences. This is one thing that CSUPERB's stakeholders all agree upon.

Despite this agreement, a growing number of policy articles, opinion pieces, and books are recommending instead that universities separate teaching and research. Some argue that research at comprehensive universities, like the California State University, is too costly and jeopardizes the campus's teaching objective. Even before this recent spate of publications, CSUPERB began tracking the graduation rates and post-graduation plans of the students supported by our research grant and award programs. Between 2006 and 2010 88% of CSUPERB-funded undergraduate researchers graduated and continued on in life science academic and career pathways! For comparison, only 28% of freshman entering CSU science, technology, engineering and math (STEM) programs in 2002 graduated.

This year CSUPERB analyzed San Francisco State University and CSU Fullerton data relating to undergraduate research experiences. We found that these experiences correlated with improved problem-solving, communication skills, academic performance in key intermediate courses, retention in biotechnology-related majors, graduation rates, and success in pursuing graduate degrees or landing life science industry jobs. Of note, one or more research experiences correlated with a 75% 5-year graduation rate for CSU Fullerton's Hispanic students entering STEM programs as freshmen in 2002. In contrast, without research experience, only 10% of that same group graduated in five years.

Michael Goldman (SFSU), Robert Koch (Fullerton) and I presented our results at the AAC&U's "Engaged STEM Learning" conference this spring in Miami. We have more analysis to do about the impact of research experiences on undergraduate education. What is the secret sauce? Is it the example of other students in lab? Is it the access to faculty scholars? Is it a perception of real-world applicability?

We discovered that research experiences were often available only to students maintaining a certain GPA, to students in grant-funded training programs, or to students who complete particular prerequisite courses. We recognize the CSU campuses probably do not have research capacity to accommodate all interested students. In addition to planning new programs to engage our students in research laboratories, field stations, business incubators and clinics statewide, we are recruiting external partners at biotech companies, national labs and research institutes to expand opportunities.

CSUPERB will be drafting a new strategic plan this fall. Three years ago the CSU community invested itself in the idea that high-quality biotechnology education requires the integration of coursework, hands-on practice and participation in multi-disciplinary, team-based research projects. The outcomes indicate we're on to something.

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CSUPERB is: Industry Partners

CSUPERB organized a Career Networking Session at the annual Symposium to expose CSU students to career paths in the life science industry. Professionals shared personal glimpses of work in the industry, along with their educational and career paths. Michael Onuscheck, President of the Neuromodulation Division at Boston Scientific, spent the Friday afternoon in January leading a roundtable discussion about Biomedical Product Development. Michael's division, based in Valencia, actively searches for new employees at nearby Cal Poly San Luis Obispo and CSU Northridge. Boston Scientific also recruits engineers, mathematicians, scientists and clinical researchers for paid internships during the academic year and summers. He got the word out to CSU students about these internship opportunities and spent time coaching them on how to apply. Michael explained, "it is often very difficult to discern talent from a good transcript." The company uses internships to "assess top academic talent" and gain "a sense of confidence in the applicant because they have stretched themselves and gained real world, relevant work experience." When asked why he put so much energy and enthusiasm into reaching out to and working with the CSU, he replied, "In order for companies to thrive we need hungry minds to



Above: **Michael Onuscheck** talking with students about biomedical product development at the 2011 CSU Biotechnology Symposium in Orange County.

fill our organizations and without the foundation of education the medical device, biotech, and pharmaceutical companies would ultimately fail... The CSU system has played a significant role in my company's success. From my VP of Operations to the engineers solving technical challenges to basic science and clinical research, we need this strategic alignment. Together we will build a better healthcare system and a better future for our state."

23rd Annual CSU Biotechnology Symposium: Highlights

The 23rd Annual CSU Biotechnology Symposium was held at the Hyatt Regency Orange County January 8-9, 2011. 580 participants were in attendance, including 45 invited speakers, career mentors and panelists from the life sciences industry. Students and faculty presented 236 research posters – the largest number yet – representing the work of 349 students and 115 faculty from 21 CSU universities. Chancellor Charles Reed, CSU Los Angeles President James Rosser, San Diego State professor Kelly Doran, Howell-CSUPERB Scholar Alyssa Jimenez, and CSUPERB Executive Director Susan Baxter kicked off the symposium by thanking outgoing (and retiring) Presidents' Commission Chair and San Diego State President **Stephen Weber** for his years of service and support to the CSU's biotechnology community. Sessions featured Healthcare Solutions for the Developing World, Science Communications, and Life Science Innovation. Many thanks to our sponsors: Life Technologies Foundation, the Pasadena Bioscience Collaborative, Economic Workforce & Development (California Community Colleges), Abbott Vascular, and Gilead Sciences, Inc.



CSUPERB is: New CSU Faculty

CSUPERB's research grant programs award between \$15,000-\$25,000 to CSU faculty. No matter your perspective this is not a lot of money with which to support a biotechnology project. Instead the strategic aim of these programs is to "seed" projects across the CSU, hoping that CSUPERB Pls win follow-on funding to support their scholarship and additional student researchers in their laboratories, field stations and clinics. In fall 2008 Henk Postma won a CSUPERB Seed grant to help start up his laboratory in the department of Physics and Astronomy at CSU Northridge. The peer review committee was intrigued by his proposal to use graphene nanogaps to rapidly sequence DNA. One reviewer wrote, "...it is a strong candidate for funding...[but] this proposal carries with it much more risk of failure than the other proposals I have been asked to review." In fact Postma and his group of students soon found they couldn't make nanometer-sized nanogaps in graphene with available techniques, so they had to step back and develop alternate theories and methods for sensing and nanogap creation. They published their ideas in Nano Letters and the paper ended up being one of the top 20 most accessed for 2010. By the time the CSUPERB grant ended, Postma secured funding from Research Corporation, followed in 2010 by awards from both NIH and NSF (he had to decline the NIH funding!). The Postma group's work has been featured in PloS One (6: e18442) GenomeWeb, Nature Research Highlights, an American Chemical Society video and on a BBC radio show. Henk's story is a great example of the ability of reviewers to recognize promising research ideas, along with the ingenuity and persistence of CSU faculty-student research teams.

Left: Henk Postma with the scanning electron microscope at CSU Northridge.

2010-2011 CSUPERB Grants & Awards Program Summary

Participation	
Total Proposals, Applications, and Nominations Received	
(including all competitive grants and awards programs)	265
Number of CSU Campuses Applying	22
Grants & Awards	# Awards / Total Award Dollars
Faculty-Student Collaborative Research Grants	26 / \$386,236
Entrepreneurial Joint Venture Matching Grants	5 / \$106,200
Programmatic Grants	3 / \$45,000
Travel Grants (Faculty and Student)	40 / \$40,497
Howell Foundation-CSUPERB Research Scholar Awards	11 / \$33,000
Symposium Awards	5 / \$6250
Total # CSUPERB Awards / Grant & Award Dollars:	90 / \$617,183
Number of CSU Campuses Receiving Grants & Awards:	18

CSUPERB Grants Program Impact

(Based on final and long-term reports from faculty funded by Research, Joint Venture and Programmatic grants only*)

	AY 06/07	AY 07/08	AY 08/09
CSUPERB Total Awards	\$492,068	\$430,764	\$673,467
CSU Faculty Involved	94	75	72
Students Involved in Research Projects	146	51	126
Students Impacted**	1205	571	1442
Peer Reviewed Publications	63	15	10
Total Follow-on Funding Received by Pls As of 7/13/11 (based on final and long-term	\$8,537,215	\$6,11,920	\$6,782,760
reports)			
Percentage Return-on-Investment Total follow-on funding \$ / CSUPERB total award \$	1735%	1420%	1007%

* Impact reporting is based on final and long-term reports received from CSUPERB PIs as of 7/12/11. Average final reporting rates were >95%; long-term reporting rates are 52-100%. Changes in follow-on funding totals reported relative to previous annual reports are expected since the totals are aggregates of multiple reporting cycles, received over 3 years after grant end date.

** Students Impacted figures reflect number of students enrolled in new courses or listed as users of new equipment funded by CSUPERB within 3 years of grant end date



2010-2011 CSUPERB Funding By Campus

The figure to the left illustrates CSU system-wide award data and interest in CSUPERB programs and activities. The data summarized includes grants, awards, and symposium participation funded by CSUPERB at each university. Proposals not funded are indicative of campus interest in CSUPERB programs and reflect faculty-driven biotechnology projects system-wide.

2010-2011 CSUPERB Leadership

Presidents' Commission

Stephen L. Weber, Chair San Diego State University

Karen S. Haynes CSU San Marcos

Mohammad H. Qayoumi CSU East Bay

Benjamin F. Quillian CSU Executive Vice Chancellor

Rollin C. Richmond Humboldt State University

James M. Rosser CSU Los Angeles

Richard Rush CSU Channel Islands

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Daryl Eggers San Jose State University

James Henderson, Dean CSU Los Angeles

Laura Kingsford, Dean CSU Long Beach

Robert Koch, Interim Dean CSU Fullerton

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Katherine McReynolds CSU Sacramento

Bianca Mothe CSU San Marcos

James Prince, Deputy Chair CSU Fresno

S. K. Ramesh, Dean CSU Northridge

Terri Swartz CSU East Bay

Sandra Sharp CSU Los Angeles

Koni Stone CSU Stanislaus

Jacob Varkey Humboldt State University

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Susan Baxter (Executive Director)

Total Funding (Dollars to Campus) Additional Dollars Requested, but Unfunded