

# From Vision to Change: Transforming How Life Science is Taught

---



# FROM VISION TO CHANGE: TRANSFORMING HOW LIFE SCIENCE IS TAUGHT

Science education is critical to prepare students for the world and jobs of the future, yet many institutions in the United States are using outdated educational models to teach science. The PULSE working group is a team of educators and administrators working to shift the culture of biology departments for stronger student outcomes in the life sciences.

---

## Rethinking Approaches to Educational Reform

Science and technology stand at the forefront of modern industry and many of the world's major challenges, such as climate change and feeding the global population, can only be solved through scientific innovation.

Despite the need for quality science, engineering, technology and mathematics (STEM) education, many colleges in the United States are not prepared to offer undergraduate students comprehensive and modern curriculum in the sciences. Across the US, many undergraduate institutions are utilising outdated pedagogical frameworks for teaching the life sciences, leaving students ill-prepared for high level coursework or career development related to biology. These schools are in dire need of curriculum updates to bring them up to speed with current best practices in biology instruction.

In an effort to solve this problem, the Partnership for Undergraduate Life Sciences Education (PULSE) was formed in 2012 as part of a collaboration between the National Science

Foundation (NSF), the Howard Hughes Medical Institute (HHMI), and the National Institute for General Medical Sciences (NIGMS). Program officers from these prestigious institutions selected 40 PULSE Fellows, each with a history of administrative success shaping undergraduate curriculums. Working together, these Fellows have developed a framework and tools to help institutions shift their biology teaching practices.

PULSE is unique because it pulls from the expertise of educators at all types of undergraduate institutions, from community colleges to universities with biology PhD programs, providing perspectives that shape a multifaceted view of how a biology curriculum can operate. Further, PULSE focuses on instituting department level changes rather than shifting the practices of any individual professor. This helps to ensure that changes will be long lasting and consistent across a program.

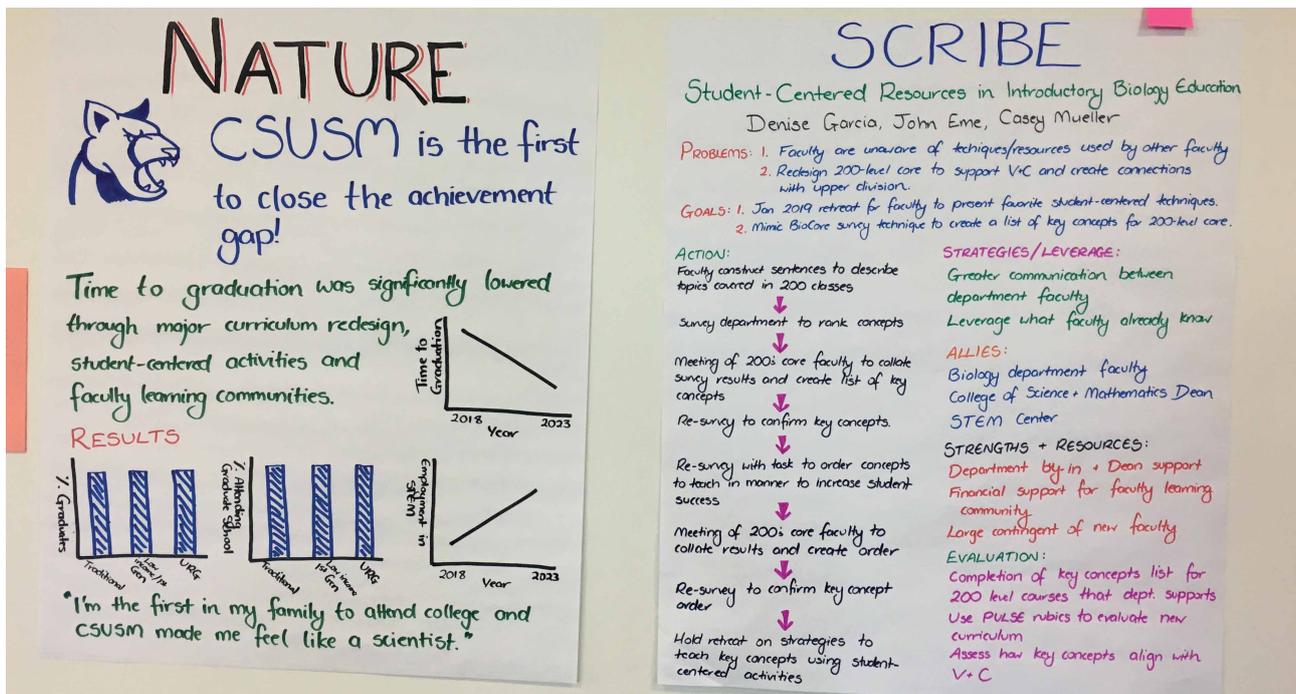
## Getting Local

A key component of the PULSE mission is engaging educators in workshops and conferences. The PULSE Fellows team recognised that in order to do this



effectively, it was necessary to develop regional teams that could provide locally relevant content and reduce travel costs for live trainings. PULSE Regional Networks include those from the Northeast, Southeast, Midwest/ Great Plains, Northwest, and Southwest.

The Southwest PULSE Network is composed of PULSE Fellows and educators across the southwestern US who meet in regular videoconferences designed to stimulate departmental reform. Through these virtual meetings, the idea of forming sub-regional networks for live workshops was born. The Southern California PULSE Institute (SCPI), a 2½-day event first run in June



Teams work to create Action Plans

2018, brought local undergraduate biology educators together for a series of activities designed to foster leadership skills, shift departmental strategies, and develop networks of engaged biology departments across Southern California.

While SCPI was based on similar PULSE events run in other regions, it leveraged novel aspects of the region to develop a program with unique features. First, as part of an effort to increase diversity in STEM, the PULSE Fellows chose to focus on Hispanic serving institutions for seven of the eight team slots, with the ultimate goal of increasing the number of Hispanic and Latino students in biology. Second, Southern California was chosen as the inaugural sub-region in the Southwest due to its dense population and close geographic proximity of schools. This allows SCPI to aid in the formation of a network of life science faculty and administrators that can easily visit one another and exchange ideas and social support. Third, the program included an inclusivity module designed to raise awareness of challenges facing students from populations underrepresented in STEM fields.

### Planning the Perfect Workshop

Prior to the event leaders from the Southwest PULSE Network, two PULSE Fellows from other regions that had already hosted a similar workshop, and two outside consultants met to plan the workshop. Using data collected from workshops in other regions, they were able to target key topics and areas for improvement to craft an effective 2½-day plan for SCPI. For the workshop to be successful, it was critical that the biology departments of participant institutions were assessed before and after to determine how effective the delivery was. Additionally, criteria for participant selection had to be outlined and a framework for selecting PULSE Catalysts established.

Describing the SCPI's goals PULSE member Dr David Marcey explains, 'We wished to provide opportunities for faculty and administrators to increase their awareness and understanding of the recommendations in *Vision & Change in Undergraduate Biology Education: A Call to Action*, identify specific elements to implement within their own departments, increase their understanding and awareness about systemic approaches and challenges

to achieving inclusive excellence in undergraduate science education, and as a team, develop a shared vision of the outcomes they would like to see in their undergraduate curriculum, and develop an action plan to help them reach that vision.'

### Bringing Diversity to the Table

Life science departments from the Southern California region were invited to apply to SCPI through an online survey, designed to determine their overall awareness of current biology teaching guidelines, their level of commitment to change, what obstacles they might be facing, the composition of their team, and unique features of their department.

To ensure that all levels of influence were represented at the workshop, teams of faculty, and in a few cases administrators, from schools that included 2-year colleges as well as universities ranging from liberal arts to research institutions, were selected. PULSE required a statement from an administrator of each institution that reform efforts would be supported and that improvement of life science departments was a priority.



*Teams work to create Action Plans*

Once teams were selected, they were asked to complete a number of PULSE Vision & Change Rubrics assessments to help score where their departments fell in relation to current best practices, the department's focus on student outcomes, availability of faculty support for life sciences, ability of the department to accommodate new curriculums, and how well the department as a whole was supported by their institution. These rubrics help PULSE Fellows determine what resources a participating team will need to succeed and what obstacles they might face that PULSE could help them to overcome. Further, they help identify how the workshop impacts a department by offering a prior baseline.

### **Three Days of Transformation**

In the first day of the workshop, teams worked together to review their PULSE Vision & Change Rubrics and evaluate their departments alignment to best practices. They worked to find ways that their department functions as a cohesive system and to identify places where the system is impeded. Finally, they built out a vision for the future of their department and considered potential barriers to that vision.

The second day of the workshop began with teams learning about research demonstrating how students best engage with science to through active learning and high order thinking. They learned about PULSE resources designed to help them achieve the vision they developed on day 1 of the workshop and began formulating a strategy to get there. To conclude, a speaker with expertise in Hispanic STEM education presented issues relevant to the student demographics of the teams.

On the final day of the workshop, the teams worked to solidify their plans for success. They presented their strategies to other teams and received feedback and other ideas. They identified resources needed to achieve their goals and networked to find other PULSE participants who could serve as mentors and support across institutions. Finally, PULSE Catalysts were selected and prepped for their exciting new role in the Southern California life science education community.

### **Moving Forward**

An assessment of the effectiveness of SCPI and PULSE initiatives will be conducted through a rigorous research follow up. Participating teams take part in quarterly video interviews and progress meetings to share how their strategy is progressing and will complete yearly rubrics to evaluate how their departments are changing. These data will not only help PULSE develop even more effective programs in the future, but will also help to keep participants on track with their visions for their departments.

Dr Marcey and his PULSE collaborators' next steps are to take the learnings from SCPI and use them to begin transforming schools in other sub-regions of the Southwest. 'We are evaluating the effectiveness of the institute and intend to incorporate participant feedback in order to deliver institutes similar to SCPI in targeted areas with high densities of undergraduate institutions,' he says. The PULSE program's dedication to biology education is set to shape life science departments across the US, creating a better future for all.

# Meet the Team

**David Marcey**

Fletcher Jones Professor of Developmental Biology  
Biology Department  
California Lutheran University  
E: marcey@callutheran.edu

**Richard Cardullo**

Howard H. Hays Jr. Professor  
Biology Department  
University of California, Riverside

**Akif Uzman**

Dean, College of Sciences & Technology  
University of Houston-Downtown

**Edwin Barea Rodriguez**

Associate Dean for Student Success and Instructional  
Innovation  
University of Texas, San Antonio

**Alan Savitsky**

Professor, Biology  
Utah State University

**Lisa Elfring**

Assistant Vice Provost, Office of instruction & Assessment  
University of Arizona

**Christine Goedhart**

Biology Instructor/Science Education Specialist  
University of British Columbia

**Betsy Desy**

Professor Emerita, Biology Department  
Southwest State University

**Nalani Linder**

Ready to Rise National Director  
Degrees of Change

**Steven Byers**

Owner  
Helping Human Systems

**Kimberly Tanner**

Professor, Biology Department  
San Francisco State University

**CONTACT**

W: <http://www.pulsecommunity.org/group/southwest-pulsers>  
E: marcey@callutheran.edu

**FUNDING**

US National Science Foundation

