Understanding the Network of Interventions Shaping Successful Scientists Through to the Doctorate in Biology Before and After the REU. *Understanding Interventions Conference, Baltimore, March 2018*

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Significance to the UI community: This paper examines the network of "interventions" facilitating underrepresented success in Biology/STEM. It is based on a longitudinal outcomes study of the trajectory of 125 participants over 12 years of a NSF Research Experience for Undergraduates Program in Biology 2006-2017 at UC Berkeley. The program itself is an intervention, but students benefit from a network of interventions before and after participation. Conventionally evaluation of the program focuses on the immediate impact of it in terms of student perception such as increased knowledge of science, or self-confidence, toleration of failure and especially increased commitment to entering a Ph.D. program. Without tracking, however, post-BS activity and whether a student earns a Ph.D. and enters the research workforce cannot be known. Documenting outcomes provides this information. Without detracting from the value added of REU participation, every student is exposed to other influences and interventions before and after the REU contributing to post-BS choices. The paper examines this network, its complexity and the multiple sources of success. **Study Population:** The highly diverse undergraduate participants in this REU Program tracked through the present. All but one earned a Bachelor's degree, a majority of earlier cohorts have entered and/or completed doctoral and M.D. programs.

Context: Underrepresented populations are neither significantly expanding their Ph.D. acquisition or scientific careers, proportionate to population growth; URM advancement has stagnated. The issue is ongoing despite decades of programs/interventions and many calls for different kinds of programs targeting the diversity of student backgrounds, values and ambitions (Campbell, et al. 2014, Fagan & Labov, 2007). Studies of successful programs such as the the Biology Scholars Program at UCB or the Meyerhoff Program at UMBC are demonstrably successful because they address the complexities of an undergraduate student's life and last for several years. This paper examines the events of a student life to identify influences which affect student academic success and persistence. It weighs those by what participants themselves emphasize and compares these to the existing literature. The outcome contextualizes the impact of any specific program in relation to "soft" influences such as parents' belief in education, teacher mentoring in K-12, students' own ambition. The analysis provides an understanding of the multiple factors influencing a student before and after a REU "intervention" which contributes to student success drawing on a network of support. It integrates what is already known about specific factors and highlights areas for policy and program design and their timing.

Methodology: This is a case study using a mixed methods longitudinal approach combining analysis of primary data (REU applications), surveys (annual evaluation), interviews (entering and exiting program), and follow-up survey/interviews about life course after REU participation. This methodology draws on theories of integration beyond self-efficacy to broader social influences to shape scientific identity development—a network supporting scientific success. There is no control group per se, but a direct comparison group is from a study of success factors of URM STEM doctoral recipients from University of California earned 1980-1990 (n=158) when more students of color earned Ph.D.s proportionally than in any other decade (MacLachlan, 2006). Contextual data comes from related secondary literature, databases and this study.

Contribution of Paper: This is one of the few outcomes/longitudinal studies of any undergraduate federal intervention and among the first in biology (McDevitt, 2017). It uses many sources, presenting a deeper and differentiated understanding of what makes students successful through the impact of multiple factors shaping a student life up to the present in a comparative context. The results lend themselves to

shaping interventions at the undergraduate level by providing a guide to the impact of a particular program and its potential to intensify the positive impact of a host of factors before and after.

References:

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