

## **REU: A Balancing Act**

### **Ms. Margo Cousins, University of Texas at Austin**

Ms. Cousins leads the academic advising team for Biomedical Engineering (BME) bachelor's, master's, and doctoral programs since 2011. She oversees programming and advising activities aimed at improving student success and professional development for all BME students. In addition to advising students individually, Ms. Cousins: teaches professional development workshops; facilitates first-year student interest groups; facilitates the department's National Science Foundation (NSF) Research Experience for Undergraduates (REU) Site BME CUREs Cancer weekly summer seminars; maps global exchange pathways to expand access to study abroad; partners with industry & clinical sponsors in the Capstone Design Program; and leads ABET engineering and SACSCOC regional accreditation activities for the BME department. Her academic interests include implementing and measuring psychosocial interventions that have been demonstrated to improve success for targeted at-risk populations, such as social-belongingness, growth mindset, and self-efficacy. Ms. Cousins holds a Master of Arts in Higher, Adult, and Lifelong Education (HALE) from Michigan State University, and a Bachelor of Science in Biology from Washington State University. She has worked in the Department of Biomedical Engineering at The University of Texas at Austin since 2005.

### **Dr. Laura Suggs, University of Texas at Austin**

### **Prof. Mia K. Markey, University of Texas at Austin**

Dr. Mia K. Markey is a Professor of Biomedical Engineering and Cullen Trust for Higher Education Endowed Professorship in Engineering #1 at The University of Texas at Austin as well as Adjunct Professor of Imaging Physics at The University of Texas MD Anderson Cancer Center. Dr. Markey is a 1994 graduate of the Illinois Mathematics and Science Academy. She has a B.S. in computational biology (Carnegie Mellon, 1998). Dr. Markey earned her Ph.D. in biomedical engineering (2002), along with a certificate in bioinformatics, from Duke University. Dr. Markey has been recognized for excellence in research and teaching with awards from organizations such as the American Medical Informatics Association, the American Society for Engineering Education, the American Cancer Society, and the Society for Women's Health Research. She is a Fellow of both the American Association for the Advancement of Science (AAAS) and American Institute for Medical and Biological Engineering (AIMBE), and is a Senior Member of both the IEEE and the SPIE.

## REU: A Balancing Act

Margo Cousins, Laura J. Suggs, Mia K. Markey  
Biomedical Engineering Department  
The University of Texas at Austin

### Extended Abstract

We share some of our experiences managing an Research Experiences for Undergraduates (REU) Site. Our Site was established in 2015 and has served 63 students to date by leveraging multiple support mechanisms<sup>1</sup>. We are grateful for the financial support of our Site, especially National Science Foundation (NSF) grants 1461192 and 1757885 and National Institutes of Health (NIH) grants RL5 GM118969 and RL5 GM118969, but we emphasize that the recommendations presented are our own opinions and we do not speak on behalf of the NSF or the NIH.

Faculty and staff leading Research Experiences for Undergraduates (REU) can perceive a conflict between the goals of their funding agency, which often wants to offer research opportunities to students who otherwise may not have them, and their institution, which wants to "preview" future graduate students to enhance recruitment. It seems there is the potential for conflict between these goals because students who do not have research experience as undergraduates typically do not submit competitive applications for graduate school.

Our approach to resolving this conflict in goals is to offer the REU experience to rising sophomores. Rising sophomores may otherwise not have had research opportunities or opportunities to receive mentoring early in their undergraduate studies. Participating in an REU program early in their college experience allows them more time to follow up and to prepare competitive applications for graduate school. This presentation will discuss our experiences in offering the REU experience to rising sophomores. Moreover, we will describe a webinar that we recently recorded on this topic and we will request that the ASEE GSW attendees participate in an evaluation of the webinar.

Offering the REU experience to rising sophomores requires careful consideration of the application process. Especially, how can one assess applicants' potential fit for the REU experience given the limited track record of rising sophomores? Our approach is to look for *characteristics and skills* needed to become a successful researcher rather than a history of prior success in research. In the essays and letters of reference we look for evidence of comfort with and skills for effective non-classroom learning; ability to stick with things that are hard and learn from failure; and enthusiasm for science.

We designed the application essay prompts to encourage students to directly address our criteria. The application essay prompts are (1) "Tell us about how you learned something outside of a formal classroom environment. What impact did this experience have on you?", (2) "Tell us about a challenge that you were faced with and how you were able to overcome this adversity. What was

your strategy to persevere and what did you learn?", and (3) "Tell us about a scientific topic or topics that you have been exposed to in your coursework that excite you. Why are they of particular interest to you?"

The letters of reference *should* provide more data to help us evaluate applicants based on our criteria. However, first-year undergraduate students often do not know how to choose letter-writers. To address this concern, we give guidance about more relevant references (e.g., University professor for STEM course) and less relevant references (e.g., high school English teacher) for this application.

Offering the REU experience to rising sophomores requires careful consideration of how the applications are reviewed. We have developed an application review process that explicitly considers the goals of funding agencies and institutions. Two reviewers read each application. One is tasked with focusing on the funding agency's goal, i.e., selecting students who otherwise may not have opportunities for research. The other is tasked with focusing on the institution's goal, i.e., selecting students who will be competitive applicants for graduate school. This explicit approach to considering both goals ensures that one set of priorities does not dominate the review process.

Considered individually, more students would meet the application review criteria outlined so far than we can support at our REU Site. Thus, our approach also emphasizes the characteristics of the cohort rather than just the those of the individual students. Our *cohort criteria* are (1) The students should come from different schools. We have learned that group dynamics can suffer if a subset of students is from a single school. (2) The students must plausibly fit within a range of possible research projects because we cannot place all the students in just one or two research labs. (3) The students should bring diversity of life experiences because the students will not learn as much from the REU experience if they only interact with people who are like themselves.

In practice, we implement these ideas in our application review by employing a modified draft pick process. After each of the reviewers has assessed each application based on their assigned goal (access to research experiences vs. competitiveness for graduate studies), they take turns choosing students for the cohort. By sequentially building the cohort together, the cohort criteria are combined with the individual criteria. For example, suppose that Reviewer A selects a student in round 1 who is from school X. Reviewer B had two comparable students in mind for round 1 selection, one of which was from school X and the other from school Y. Knowing Reviewer A's selection, Reviewer B will now choose the student from school Y.

Offering the REU experience to rising sophomores also has implications for Site activities. First, there is more need for mentor training since the less-experienced Scholars will need more support<sup>2</sup>. Our tip for this is, don't reinvent the wheel! For example, we leverage the established Entering Mentoring curriculum<sup>3</sup>. We also emphasize that the larger university community benefits from the mentor training component since mentors will likely work with students outside of the REU program. We have proudly provided mentor training to 46 graduate students through our REU Site.

Second, there is more need for a "Bootcamp" experience to quickly introduce research skills since these are less experienced Scholars. Again, we recommend that you don't start from scratch. Many

REU Sites and similar programs have created Bootcamp experiences that you can build on<sup>4</sup>. Also, look for on-campus resources that you may be able leverage. For example, is there a student organization that has developed a great outreach activity that could be modified for the REU students? On the other hand, other programs, such as outreach mechanisms, may benefit from new materials or approaches that you develop for your bootcamp.

Third, the evaluation needs to be designed to assess the intended program outcomes, which are of course dependent on the students selected. Less experienced Scholars may be hypothesized to experience different benefits than more experienced Scholars. The evaluation plan is another aspect that can benefit from on-campus partnerships outside of your research unit. For example, is there an education training program on campus through which you could recruit an evaluator? We have had positive experiences working with trainees in educational psychology, STEM education, etc. in support of our evaluation efforts, e.g.,<sup>5-7</sup>.

In conclusion, while balancing the goals of stakeholders can be challenging, ultimately one's program benefits from the required changes. We are confident that our REU Site is more impactful because of the design choices made to balance the goals of our stakeholders.

## References

1. M. Cousins, B. DeMont, L. Suggs, M.K. Markey, "Coordinated Summer Undergraduate Research Programs: Opportunities and Challenges," Proceedings of the 2018 American Society for Engineering Education Gulf-Southwest Conference (ASEE-GSW) (2018).
2. M. Cousins, L.J. Suggs, M.K. Markey, "Mentor training practices of NSF funded Research Experiences for Undergraduates (REU) Sites," American Society for Engineering Education Gulf-Southwest Conference (2016).
3. Entering Mentoring (Pfund, Branchaw, and Handelsman, 2014) developed with support from HHMI. <https://cimerproject.org/entering-mentoring/> (accessed 2020)
4. M. Cousins, S. Young, E. Dolan, L. Gonzales, B. DeMont, M.K. Markey, L.J. Suggs, "A "Boot Camp" as in-laboratory introduction to research methods for a Research Experiences for Undergraduates program," Biomedical Engineering Society (BMES) Annual Meeting (2016).
5. S.R. Young, M. Cousins, L.J. Suggs, M.K. Markey, B. DeMont, "Developing science communication skills as a part of a summer Research Experiences for Undergraduates (REU) program," Proceedings of the 2017 American Society for Engineering Education Annual Conference and Exposition (2017).
6. M. Cousins, C. Sviatko, S. Young, L.J. Suggs, M.K. Markey, B. DeMont, "Improvements on a communication intervention as a part of a summer Research Experiences for Undergraduates (REU) Program," Biomedical Engineering Society (BMES) Annual Meeting (2017).
7. C.O. Crosby, A. Patrick, M. Cousins, L.J. Suggs, M.K. Markey, "Scientific skill acquisition and research identity in a Research Experience for Undergraduates (REU) Site," Proceedings of the 2020 American Society for Engineering Education Gulf-Southwest Conference (ASEE-GSW) (2020).

### MARGO COUSINS

Ms. Cousins is the Assistant Director of the Biomedical Engineering Department at The University of Texas at Austin.

### LAURA J. SUGGS

Dr. Suggs is a Professor in the Biomedical Engineering Department at The University of Texas at Austin.

### MIA K. MARKEY

Dr. Markey is a Professor in the Biomedical Engineering Department at The University of Texas at Austin.