Mentoring Future Scientists

Inspiring and Ethical Mentoring in STEM

Future of
Research

Future of Research is a 501(c)(3) nonprofit organization created for and by early career researchers (ECRs). We champion, engage and empower ECRs to improve the research enterprise.

The Problem

Academic research institutes have a fundamental responsibility to ensure the early career researchers (ECRs) they are training are set up for success. This must include both teaching technical proficiency in research and providing career development opportunities in a safe and inclusive environment. It is critical to the development of a productive environment for training, particularly in an apprentice-like model such as employed in academe, that those given training responsibilities are providing competent and appropriate mentoring to allow the next generation to realize their potential.

However, too often there are incidences of "mentors" acting as "*de*mentors" or "*tor*mentors". This scenario occurs due to a lack of institutional evaluation of current mentoring practices and few systemic incentives to mentor ECRs well (compared to publishing papers and successfully applying for grant awards). It is therefore no coincidence that there is a high prevalence of sexual harassment and bullying of scientists in academia, and offenders are rarely held accountable by institutions. In the recent National Academies of Science, Engineering and Medicine report "Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine"[1] it was found that sexual harassment in academe in the U.S. is at levels second only to the military. In these cases, mentors and working conditions in institutions are not just passively failing to provide trainees with adequate support, but are actively contributing to a problem which widely affects their feelings of safety, mental health, and productivity. Mentorship style and workplace environment were among the highest predictors of risk for depression in a recent study on the high rate of mental health problems in PhD students[2]. These issues affect the diversity of the research enterprise, as women[3] and underrepresented minorities[4] are at higher risks for receiving less mentoring, as well as experiencing harassment.

Efforts to overturn this mentoring landscape, however, have struggled to succeed because the current incentives and rewards in academe are placed elsewhere (mostly on publications and grants) in the current hyper-competitive funding environment. Measures have not been adopted to improve mentoring in a way that shifts current paradigms in order to significantly improve the mentoring climate, due to lack of motivation and expectation to do so.

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[1] https://www.nap.edu/catalog/24994/sexual-harassment-of-women-climate-culture-and-consequences-in-academic
[2] https://www.sciencedirect.com/science/article/pii/S0048733317300422
[3] https://www.ncbi.nlm.nih.gov/pubmed/15671328
[4] https://insights.ovid.com/crossref?an=00001888-201304000-00028

The Vision

Studies on the effects of positive mentorship relationships on science trainees have linked strong mentorship to "enhanced mentee productivity, self-efficacy, and career satisfaction [and is] an important predictor of the success of researchers in training"[5]. There is a clear need to ensure not only that mentoring takes place in institutions, but also to evaluate and ensure that this mentoring is both effective and appropriate.

What effective mentoring looks like, and whether positive mentoring is being practiced in research training environments, is an area of active discussion, not least among the community of ECRs. We intend to take advantage of the insights, energy, and vision of various stakeholders (from ECRs to institutes and funding agencies) already partaking in mentoring research and discussions on improving mentoring practices to bring about both bottom-up and top-down changes to the mentoring climate.

Our ultimate goal is to create widespread acceptance of mentoring excellence as a central priority of training institutions, ultimately improving the quality of science produced by these centers. Greater mentoring competence will also create a research enterprise more supportive of the needs of ECRs and ensure the retention of diverse talent, reversing current trends of ECRs from underrepresented populations leaving academe[6].

Timeline

Aim	2019-20	2020-21	2021-22
1	Aim 1: consortium meeting		
2		Aim 2.1: monitor policies	
3			Aim 2.2: third party system

The Solution

In order to evaluate the efficacy of mentoring practices, appropriate metrics must be determined, and relevant data collected. While current metrics for evaluating mentoring efficacy between undergraduate STEM mentor/mentee dyads have been previously published and validated, no such metrics exist for evaluating mentoring practices and cultures at the institute level for graduate students and postdocs, and we propose to collect and assess data and metrics for these populations. Already entities studying mentoring such as the National Academies (NASEM) and the National Research Mentoring Network (NRMN) are holding meetings, calling for information, and doing research on evaluation of mentoring best practices and interventions to improve the mentoring quality ECRs receive.

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[5] https://www.ncbi.nlm.nih.gov/pubmed/27062425; https://insights.ovid.com/crossref?an=00001888-201304000-00028
[6] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114736

The **Mentoring Future Scientists** project will take this discussion one step further, and determine how to effectively enact these recommendations across institutes, bringing in other stakeholders to facilitate their implementation. Therefore best practices for implementation are another novel aspect of this project. To determine both needed metrics and steps for implementation of effective mentoring practices, this project will recruit stakeholders as collaborators in creating a centralized, data-driven, third-party method for evaluating and rating research institutes on their mentoring cultures and practices. Involving stakeholders such as institutional leaders, research faculty, mentoring researchers and ECRs themselves in discussions around the following topics is critical to the success of this project:

1. Which mentoring metrics should be considered and included?
2. How will data gathered from ECRs be anonymized, protected, reported, and disseminated?
3. What reporting model should be implemented to best serve and empower ECRs to speak up for practices that aren't serving them?
4. How do we enable ECRs to safely report and transparently deal with egregious behavior, including sexual harassment?

To facilitate enacting these changes, we will organize a Mentoring Consortium, whose goal is to bring together experts in the fields of mentoring and STEM education, funding agencies to support the project, and university leadership from "early adopter" universities participating in pilot studies to identify best practices and increase participation from other institutions. In order to successfully bring together these stakeholders for discussions with the potential to effect change, we will organize a consortium meeting on the topics discussed above (Year 1), and continue to oversee and evaluate the implementation of mentoring recommendations resulting from this meeting in consecutive years of the project (Years 2-3).

We envision one of the major outcomes of this project to be the implementation of an Athena SWAN-like model [7] for badging and transparency in mentoring, where a third party organization creates a positive incentive and competition model for universities to earn mentoring badges and ratings. The transparency of displaying badges awarded by a trusted, third-party source (with proven success in other areas) will empower ECRs when selecting their future training and work environments based on which institutions offer the best opportunities. This system will therefore create strong incentives for institutes to seek buy-in for positive mentoring practices. We are thus also aiming for funding agencies to adopt these badges as criteria for evaluating whether to fund particular institutions, similarly to UK funding agencies using the Athena SWAN charter. However, this model is neither prescriptive nor restrictive, but provided as a "strawman" argument for Mentoring Consortium discussions around this and other models (if more appropriate) that can provide mentoring metrics, and the best ways to improve mentoring practices and their implementation.

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[7] https://www.ecu.ac.uk/equality-charters/athena-swan/

Our Strategy

To draw attention to the importance of mentoring in institutions, Future of Research organized a meeting in College Park in September 2017[8], in which the need for the **Mentoring Future Scientists** project was made clear. The goals of the meeting were to: recognize and discuss the issues surrounding mentoring in STEM fields; discuss effective mentorship and advocacy techniques at all levels (graduate student, postdoc, faculty); provide a platform to connect like-minded young scientists who wish to effect change at their own institutions at the grassroots level; and, inspire participants to practice effective mentorship practices and promote these skill sets to their peers and colleagues at their own institutions. As a result of this meeting, key roadblocks to inspiring and ethical mentoring were identified, which we seek to overcome with this project:

- **Awareness of mentoring best practices -** Alongside a centralized, widely adopted system of evaluation, the Mentoring Consortium will develop a theoretical model of best practices by which to compare institutions, providing a model for others to follow locally.
- **Incentives for positive mentoring -** Evaluation and rating of mentoring will create a system of positive reinforcement and competition among institutes to provide the best mentoring. Implementation of mentoring evaluation by "early adopter" institutes will create social pressure for others to join.
- **Accountability for egregious behavior -** Evaluation of mentoring practices will include protection of ECRs and transparency during known cases of abuse and harassment in institutions. We aim to indirectly evaluate how institutes deal with egregious behavior to incentivize them into holding abusing parties more justly accountable.

For the project and consortium, we propose the following aims to be fulfilled in Year 1:

Aim 1 (Year 1): Mentoring Consortium Meeting

Our goal is to organize a Mentoring Consortium which will meet to discuss said evaluation. To do this, we will:
- Disseminate findings from the 2017 meeting and create a web portal in which the goals and discussion topics of the Consortium meeting will be clearly outlined.
- Invite prospective Consortium members from (among others): funding agencies; academic institutions; professional societies; the biotech industry; and ECRs organizations committed to collaborating on this project.
- Organize and hold the Consortium meeting, which will catalyze discussion around the topics of the project, particularly the appropriate model for evaluation, and lead to strategies for best implementation within institutions.

We will then utilize the results from this meeting to both implement a pilot project in "early adopter" institutions (Year 2) and evaluate mentoring quality using a third-party system (Year 3), both of which are in the exploration phase:

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[8] http://futureofresearch.net/college-park-2017/

Aim 2 (Years 2-3): Implementation of a pilot project in mentorship evaluation:

2.1 Monitoring university policies and practices on mentoring

University hiring, promotion, and tenure evaluation criteria are powerful drivers of faculty behavior, but these policies are not publicly available, hindering their comparison and critique. **We will promote the inclusion of mentoring criteria in the faculty evaluation processes and the development of programs that promote and reward high-quality mentoring.** To do this, we will:

- Complement efforts by the nonprofit Rescuing Biomedical Research to collect data on university tenure and promotion policies, advocate for public disclosure of these policies using a pre-assembled consortium of stakeholders
- Develop a taxonomy of mentoring criteria in tenure & promotion, as well as institutional training and support programs related to mentoring
- Publicly track the status of universities' implementation of these policies and celebrate mentoring excellence

2.2 A trusted, third-party reporting system for mentoring quality

The quality of mentoring provided by individual PIs is relatively opaque to both potential mentees and the institutions that employ them. As a result, mentoring quality does not figure meaningfully into the incentive system for mentors. At the same time, efforts to establish a public "rate my professor"-like system for reviewing mentors have fallen short due to the highly sensitive and personal nature of the information. To address this problem, **we propose to utilize a trusted, third-party system that would enable trainees to securely and privately describe their mentoring experience.** This information will then be aggregated together to inform institutions and other audiences. To do this, we will:

- Maintain a secure, private, third-party database of trainee feedback on mentors, using established instruments (i.e. developed by NRMN)
- Where data is relatively complete, announce Athena SWAN[9]-like awards for universities or departments that provide good mentoring experiences or are improving
- Offer partnering universities anonymized notifications of concerning mentoring *patterns*, either longitudinal (by a PI over time) or lateral (in a department or among a population of students). This approach of aggregating multiple independent warnings is used by Callisto[10] to derisk the reporting process for individuals.

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[9] https://www.ecu.ac.uk/equality-charters/athena-swan/
[10] https://www.projectcallisto.org/