

1    **Catalyst for Change: Future of DEI in STEMM**

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41    **Key Words:** DEI, ally, mentor, microaggressions, intentionality

42  
43    **Abstract**

44    In this paper, we propose ways to address diversity, equity, and inclusion (DEI) challenges and  
45    outline steps and methodologies for creating allies and empowering leaders to support DEI efforts

46 in science, technology, engineering, mathematics, and medicine (STEMM) for underrepresented  
47 minorities (URMs).

51 **Introduction:**

53 Academia has started to evolve in landscape, as have the requirements needed to develop postdocs  
54 and students for careers in science, technology, engineering, mathematics, and medicine  
55 (STEMM). The STEMM academic world must diversify in all aspects if innovation is to be  
56 increased and discovery is to be strengthened [1]. Although some higher education leaders might  
57 desire to make diversity, equity, and inclusion (DEI) a priority for their learning environments,  
58 they may have difficulty cultivating it effectively since it takes more than simply pontification and  
59 demands making administrative changes. Change agents, diversity senior associate deans (SADs)  
60 and chief diversity officers, who create DEI strategies from the ground up, and institutional support  
61 is needed to catalyze transformations need to shape the future of DEI in STEMM.

64 **Non-traditional dean positions as Change Agents of DEI**

66 Currently, it is clear that many institutions have goals intended to increase DEI, mentoring,  
67 and career and professional development (CPD). However, these goals may be difficult to  
68 achieve due to the expansion of these areas, which undergo continual evolution. One solution to  
69 reaching the DEI, mentoring, and CPD goals is to expand current structures to include senior  
70 associate deans (SAD) to coordinate and accommodate the load required for students to be  
71 multifaceted scholars. A mentoring SAD, for example, would allow for high-power faculty to  
72 still pursue their academic goals while learning and using skills, regardless of position, to  
73 promote professional growth. Creating such a deanship position would allow undergraduates,  
74 postdocs, and faculty in STEMM to develop holistic mentorship, DEI, and CPD practices for  
75 themselves, as well as authentic relationships with senior faculty. Importantly, establishing  
76 offices for mentorship, DEI, and CPD would formalize the significance of these issues. Beyond  
77 this, it ensures faculty are getting needed resources while establishing positions to monitor  
78 evolving techniques and scholarship and creating a direct line of contact with the college's dean  
79 (Figure 1). *Longitudinal tracking, one of the SAD responsibilities, would allow the institution, its*  
80 *administrators, and faculty to evaluate and improve the broader impact of their programs.*

83 Mentoring Office

85 Mentoring has progressed beyond an afterthought to being a field based on methodical  
86 practices [2–5]. Currently, in many cases, the responsibility of mentoring disproportionately rests  
87 on minority faculty [6]. There is a need to alleviate the burden of mentoring on minority faculty  
88 and thus in the future, a SAD position should focus on training mentors to provide culturally-  
89 sensitive mentoring. Given the importance of mentoring in STEMM, and the breadth of skills  
90 required for executing this transformative change, an associate dean position is critical. The SAD  
91 of mentoring would cover training including, intentional mentoring [7], shadow mentoring [8],

92 cultural humility [9], and casual mentoring [6], as well as other topics (Table 1). Importantly, the  
93 SAD of mentoring would be able to reduce and balance the workload of faculty [10], particularly  
94 URM who are so often called upon to do more.

95 This office would also be responsible for recognizing individuals for excellent mentoring  
96 and for rewarding those who participate in mentoring training. . Beyond this, their diverse team  
97 would include coordinators and mentoring coaches to help with facilitation of these large-scale  
98 initiatives, while an assistant dean is able to oversee day-to-day operations to accommodate team  
99 members. The SAD could then focus on training professors across career levels to aid in professors  
100 understanding the responsibilities of associate professorship; the SAD could also carry out 3-4  
101 yearly trainings, provide onboarding training for new and existing faculty, and provide  
102 certifications based upon timely completion of mentoring trainings. In these updated yearly  
103 trainings, mentors can understand different mentoring styles as responses to certain wider-trends;  
104 for instance, during the Covid-19 pandemic, virtual mentoring created new challenges that  
105 necessitated different mentoring styles [11]. Other certifications such as culturally-aware  
106 mentoring and National Research Mentoring Network Master Mentor may be taught in unison and  
107 organized by this office. However, internal content around mentoring interventions to develop a  
108 positive university culture can further be facilitated by the SAD's office [12]. Finally, this office  
109 would work with new faculty to provide them with information and resources to become  
110 independent academicians. This office would be an ideal setting to collect necessary metrics of  
111 mentoring encompassing the mentoring of all students and faculty.

112

### 113 *Diversity, Equity, And Inclusion Office*

114 While most existing diversity offices have a diversity calendar of celebratory events, we  
115 believe this role must be expanded. The DEI office can send out weekly reminders to not only  
116 remind individuals of cultural holidays but explain the meaning of these holidays and their  
117 traditions. This removes the burden on trainees to explain potential absences from laboratories due  
118 to practicing a cultural-specific holiday. This will also demonstrate the institution's commitment  
119 to DEI and help everyone understand the significance of these events and the cultural adherences  
120 that URMs follow. Offering events that honor national and cultural holidays, including those often  
121 neglected, across the year is important for institutions and examples of such events are in Table 1.  
122 Further, common practices that can be adopted include hosting an annual diversity month where  
123 all types of diversity are represented and discussed with the wider institutional audience. Together,  
124 these events can aid in reducing racial or cultural microaggressions and help individuals  
125 understand how to navigate microaggressions [13].

126

127 Critically, this office needs an adequate budget to support events, recruitment, and  
128 retention efforts that are dedicated to minoritized groups across many populations. It is well  
129 understood that it is important for URMs to see and be reminded of individuals who look like  
130 them, so they can advance and inspire the next generation of minority candidates. Being able to  
131 highlight diverse individuals can importantly aid in stopping tokenism, a form of implicit bias  
132 that results in limited numbers of minorities at each career level. A call to action has been  
133 inspired by multiple lists that highlight some of the URM trailblazers in STEMM fields [14]. The  
134 DEI office can follow up on this call to action by inviting URM speakers and providing  
135 opportunities for recognition or URMs. Importantly, we foresee a future moving away from only  
136 lists such as the 1000 Black Scientist List [14], to wider recognition of minority scientists.

137 Importantly, many DEI offices may coordinate with societies across the STEMM field to create a  
138 national database for URM speakers and longitudinal DEI studies.

139

140

141 **Career And Professional Development Office (CAD) Accepted changes to give to Elsie**

142 There are many challenges to getting academic jobs, and individuals entering into STEMM  
143 may be interested in non-academic careers. Without a career coaching team, such as a CPD Office,  
144 trainees may not know meaningful ways to explore other opportunities. The career center may  
145 consider providing professional assistance and activities for students through specialized career  
146 coaching, resources, connections with future employers, and planning one's graduate experience  
147 to glean the adequate skills to be successful and supported. The career centers should make sure  
148 to have resources for a variety of professional careers as well as offer time to aid individuals in  
149 understanding their desired sense of direction, whether academia or not. The academic career  
150 coach may consider setting up meetings and professional activities throughout the year, with  
151 individual weekly events related to this overarching goal (Table 1). Beyond this, across the year  
152 this office can aid in having examples of resumes, CVs, and cover letters for each field (academic  
153 and non-academic research, industry, medical, etc.). Additionally, they can have writing  
154 workshops to aid in applying for grants and other mechanisms of funding. For departments that  
155 already have these activities, they can work with the CPD office to house these efforts and broaden  
156 their impact. Finally, they can also host a department of scientific editors along with several  
157 individuals working with them for the final preparation of manuscripts. This office allows for  
158 individuals to augment their careers without burning out or giving up due to toxic stress [15].

159 The CPD office can aid faculty networking and increase their visibility by promoting them  
160 on social media. The CPD offices could offer training opportunities on the effective use social  
161 media. Moreover, in addition to social media training programs, platforms such as LinkedIn  
162 could be leveraged to conduct longitudinal tracking of URM trainees to help identify career  
163 options.

164

165 **Conclusion:**

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167 It is time to truly think about innovative ways to diversify STEMM. Change sometimes calls for  
168 periods of uncomfortableness that are necessary to ultimately create a more inclusive roundtable  
169 of scientists. Reorganization and additions to administrative offices will take the burden off of  
170 individual faculty members. In many cases, one DEI office cannot do all of the needed functions  
171 of mentoring, DEI and career development (Table 1). The reorganization and addition of offices  
172 to form SAD would make a significant impact on mentoring, DEI and career development without  
173 neglecting many often-forgotten areas and diverse groups. Additionally, institutions must provide  
174 the funds and adequate personnel to allow programmatic events and opportunities to be offered to  
175 engage URMs in STEMM. Beyond this, if all institutions implementing these offices held  
176 conferences, it would be possible to meet, evaluate and compare the most effective strategies.  
177 Together, quantifiable change could be created, and the best practices across each institution could  
178 more easily be diffused across academia and create a straighter pathway for the future of DEI.

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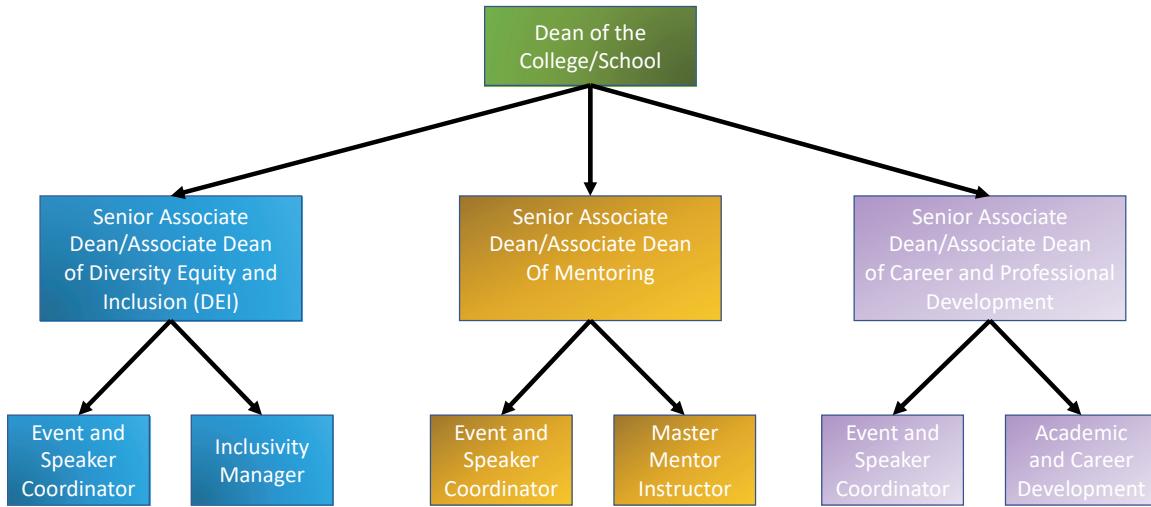
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194 **Figures:**



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196 **Figure 1: Example chain of command for newly established “Change Agents” offices**

197 Each of these offices should fall within one branch of the overall Dean’s office, with space within  
198 the dean’s office, and all offices reporting to the Dean. Each DEI, Mentoring, or CPD Dean has  
199 instructional or management staff (e.g., Academic and Career Development Instructor, Training  
200 Development and Mentoring Instructor, and Inclusivity Manager) to manage day-to-day of the  
201 deans. Smaller institutions can work across different colleges to have the required funding for these  
202 individuals to operate across the college. Furthermore, for small institutions, there may be these  
203 offices which work across all campuses or colleges, with interns that are able to help deliver this  
204 message on the micro-scale, before scaling up, to ultimately a chain of command similar to that  
205 highlighted here.

206

207 **Table 1: An example of programming and scheduling that the mentoring, diversity, equity,  
208 and inclusion (DEI), and career and professional development (CPD) offices may host  
209 throughout the year.**

210 While across the offices there may be some overlap in events or topics, the division of these offices  
211 is important to ensure that each office gets an appropriate budget. During overlap in general topics,  
212 the actual trainings will be distinct and from different perspectives (e.g., in the context of mentoring  
213 versus DEI). Furthermore, the offices will be encouraged to work together to divide these sessions  
214 between several of the offices to highlight their unique angles. Ultimately, these offices may  
215 remain collaborative in nature, while also hosting individual events. In general, for the focus of all  
216 the offices, we envision events or trainings will be twice a month and faculty may either attend in  
217 person, or via virtual platforms. The two trainings a month will be offered weekly, to allow faculty  
218 to choose either week, as dependent on their schedules. If faculty elect to do it virtually, this will  
219 require a reflection sheet to ensure faculty internalize the key points of the events. While the  
220 example events highlighted here would be the main focus for the month, this office may also offer  
221 other events depending on their budget and opportunities.

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226 **References**

- 227 1. Hofstra, B. *et al.* (2020) The diversity–innovation paradox in science. *Proceedings of the*  
228 *National Academy of Sciences* 117, 9284–9291
- 229 2. Montgomery, B. (2020) The “radical” thing I did in higher education. *Mentoring*.
- 230 3. Montgomery, B. (2020) Academic Leadership: Gatekeeping or Groundskeeping? *JVBL* 13
- 231 4. Whittaker, J.A. and Montgomery, B.L. (2022) Advancing a cultural change agenda in higher  
232 education: issues and values related to reimagining academic leadership. *Discov Sustain* 3,  
233 10
- 234 5. National Academies of Sciences, E., and Medicine (2020) *The science of effective*  
235 *mentorship in STEMM*, National Academies Press
- 236 6. Uddin, L.Q. and De Los Reyes, A. (2021) Cultivating allyship through casual mentoring to  
237 promote diversity. *Trends in Cognitive Sciences*
- 238 7. Shuler, H. *et al.* (2021) Intentional mentoring: maximizing the impact of underrepresented  
239 future scientists in the 21st century. *Pathogens and Disease* 79, ftab038
- 240 8. Davis-Reyes, B. *et al.* (2022) Shadow mentoring: a cost–benefit review for reform. *Trends in*  
241 *Cancer* DOI: 10.1016/j.trecan.2022.05.001
- 242 9. Murray, S.A. *et al.* (2022) Developing cultural humility in immunology and STEMM  
243 mentoring. *Trends in Immunology* 43, 259–261
- 244 10. Montgomery, B.L. *et al.* (2014) Guiding the Way: Mentoring Graduate Students and Junior  
245 Faculty for Sustainable Academic Careers. *SAGE Open* 4, 2158244014558043
- 246 11. Hinton Jr, A.O. *et al.* (2020) Mentoring minority trainees: minorities in academia face  
247 specific challenges that mentors should address to instill confidence. *EMBO reports* 21,  
248 e51269
- 249 12. Black, S.J. *et al.* (2022) Enhancing Research Mentors’ Cultural Awareness in STEM: A  
250 Mentor Training Intervention. *Understanding Interventions* 13
- 251 13. Marshall, A. *et al.* (2021) Responding and navigating racialized microaggressions in STEM.  
252 *Pathogens and Disease* 79, ftab027
- 253 14. 1,000 inspiring Black scientists in America[Online]. Available:  
254 <https://crosstalk.cell.com/blog/1000-inspiring-black-scientists-in-america>. [Accessed: 31-  
255 Jan-2023]
- 256 15. Rolle, T. *et al.* (2021) Toxic stress and burnout: John henryism and social dominance in the  
257 laboratory and STEM workforce. *Pathogens and Disease* 79, ftab041

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260 **Abbreviations:**

261

262 CV: Curriculum Vitae

263 CPD: Career and Professional Development

264 DEI: Diversity, Equity, and Inclusion

265 NIH: National Institutes of Health

266 STEMM: Science, Technology, Engineering, Mathematics, and Medicine

267 URM: Underrepresented Minority

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