frontiers | Frontiers in Education

TYPE Brief Research Report
PUBLISHED 16 October 2024
DOI 10.3389/feduc.2024.1477538

OPEN ACCESS

EDITED BY
Adriana Bankston,
AAAS STPF/AGCT Congressional Policy Fellow, United States

REVIEWED BY
Christopher Thomas Smith,
Virginia Tech, United States
Brian J. Rybarczyk,
University of North Carolina at Chapel Hill, United States
Sarah Rovito,
National Academies of Sciences, Engineering, and Medicine, United States

*CORRESPONDENCE
Robin H. Cresiski
✉ rcresisk@umbc.edu

RECEIVED 08 August 2024
ACCEPTED 27 September 2024
PUBLISHED 16 October 2024

CITATION
Cresiski RH, Ugarte F, Harris L and Clark JK (2024) Exposing postdocs to multiple institutional types: a PROMISE-ing intervention to prepare biomedical faculty. *Front. Educ.* 9:1477538. doi: 10.3389/feduc.2024.1477538

Exposing postdocs to multiple institutional types: a PROMISE-ing intervention to prepare biomedical faculty

Robin H. Cresiski[1]*, Fadel Ugarte[1], LaKeisha Harris[2] and Jessica K. Clark[3]

[1]The Graduate School, University of Maryland Baltimore County, Baltimore, MD, United States, [2]School of Graduate Studies, University of Maryland Eastern Shore, Princess Anne, MD, United States, [3]Academic Affairs, Salisbury University, Salisbury, MD, United States

Biomedical faculty positions require experience as a postdoctoral scholar (or "postdoc"). However, there is a current misalignment with postdoctoral training and workforce needs within higher education. The majority of postdocs are trained to be research faculty while completing fellowships at research-intensive universities, despite the fact that the majority of US higher educational institutions (where these postdocs may be employed) focus on undergraduate education. This leads to postdoctoral scholars not having the opportunity to gain exposure to different institutional types where they could be employed. Importantly, they also lack the opportunity to build a network or receive mentorship from faculty at non-R1 institutions. This may be particularly true of underrepresented scholars. In this brief report, we describe the practice of the NSF-funded PROMISE Academy Alliance to bridge this training gap and support greater preparation for faculty careers at an array of institutional types by leveraging collaboration within a state university system. A survey of PROMISE Academy Fellows about their structured experiences engaging with other campuses (e.g., campus tours, workshops, speaking opportunities) reveals that visits to other campuses within the state system are informative and impactful, both on their research and their employment interests. The positive findings can hopefully inspire easy-to-implement changes in postdoctoral support across other university systems or regional consortia.

KEYWORDS

postdoctoral, faculty, diversity, AGEP, university system

1 Introduction

Biomedical faculty complete one if not more postdoctoral fellowships prior to their first tenure track appointment (Kahn and Ginther, 2017; Aikens et al., 2016). These fellowships are completed most commonly at research-intensive institutions in the Carnegie Classification "R1" which are doctoral institutions with "very high research activity." Postdoctoral fellowships are apprenticeships within the lab of a faculty investigator, and thus are frequently an intensive experience that trains the postdoctoral fellow (often called a "postdoc") toward a research-intensive career trajectory. However, there are not enough R1 faculty positions for the vast army of postdocs being trained (Blackford, 2018), and the majority (>96%) of hiring institutions in the US are not R1s, but instead focus on undergraduate education (National Center for Education Statistics, 2021). Recent data from IPEDs (AAUP Department of Research and Public Policy) on

FT Faculty New Hires in Fall 2022 provides a more nuanced picture of the academic job market. While R1 institutions account for a significant portion of new faculty hires (42.8% of all hires and 33.5% of tenure-track hires), the majority of hiring still occurs at non-R1 institutions. Specifically, non-R1 institutions, which include regional comprehensive institutions, liberal arts colleges, R2 ("high research activity") institutions, R3 ("moderate research activity") institutions, and community colleges, accounted for 57.2% of all new faculty hires and 66.5% of new tenure-track hires in Fall 2022. This distribution highlights a potential mismatch between the preparation of postdocs, who are primarily trained at R1 institutions, and the broader landscape of career opportunities. R1-trained postdocs may be under-aware of these diverse career opportunities or lack the specific skills and networks needed to succeed in applying, obtaining, and advancing at non-R1 campuses. As the faculty supervisors of postdoctoral scholars are disproportionately from a select set of top research universities (Clauset et al., 2015), they likely lack the knowledge or networks to help postdocs land a tenure-track position at a non-R1 institution (Hayter and Parker, 2019). Blackford argues that being forced to work within "quite narrow limits in terms of their specialist knowledge and community of colleagues" (2018) restricts postdoctoral opportunities to advance their careers.

Thus, biomedical postdocs need expanded networks and meaningful exposures to different campus environments and mentors to gain the information and skills they need to obtain and advance in non-R1 tenure-track faculty positions. Lave and Wenger (1991) postulate that individuals learn by participation when they have the opportunity to engage in "legitimate peripheral participation" with a community of interest or practice. If postdocs do not have opportunities to engage in such communities (such as with faculty at predominantly undergraduate institutions), they are likely to not see themselves as potential members of those communities (Yadav and Seals, 2019). Similarly, since life decisions are highly influenced by the communities in which individuals reside and operate (Bosley et al., 2009), expanding their academic community to other institutions could have a significant impact. Blackford argues networking activities are an important component of postdoctoral initiatives to expand the employment opportunities for early-career researchers beyond research-only positions (2018).

Providing opportunities for biomedical postdoctoral scholars to experience other campuses is therefore critical to their networks and preparedness for faculty positions across our academy. The ability to accumulate an expanded social capital and build a robust social network across institutions has two important implications: first, it will influence from whom the postdoctoral scholars get information on career opportunities, and second, it will determine the extent to which the scholar can harness that information to transform those opportunities into career outcomes (Blackford, 2018). Although focused on mathematical, physical, computer, and engineering sciences, Patt et al. (2022) found that inter-institutional visits (for example, in a university consortia) help postdocs increase their visibility, improve their training experience, and elevate their career aspirations. Visits to other campuses and in-person engagement with the academic community on these campuses could be considered "experiential learning" because they facilitate the immersion of postdocs in an authentic job environment, allowing the postdoc to acquire and practice the skills needed to obtain alternative (non-R1) position (Van Wart et al., 2020). Patt et al., argue that campus visits and other inter-institutional activities not only have positive benefits for the postdoctoral scholars, but promote greater faculty involvement and collaborative research thus helping to mitigate historical biases (2022). From another angle, Murphrey et al. (2022) investigated the successful paths of diverse STEM faculty, and noted that visits to campuses successfully expanded scholars' networks and had a positive impact on the successful trajectory of the interviewed scholars (2022).

State university systems offer an existing structure of collaborating campuses to leverage in improved training of postdoctoral scholars for careers outside of research-intensive institutions (Enekwe and Cresiski, 2023). In this report, we specifically examine an initiative in the University System of Maryland, the NSF-funded PROMISE Academy Alliance, which seeks to diversify faculty through providing inter-institutional development for minoritized scholars and facilitating pathways into tenure track positions within the system (Cresiski et al., 2022; Culpepper et al., 2021). The PROMISE Academy Alliance has seven participating campuses of varying types, including three R1 campuses (one a professional school), an R2, a research center, and two regional comprehensive institutions that focus on undergraduate education. The PROMISE Academy provides supports (but not salary) for minoritized postdocs ("Fellows") at any participating institution that aspire to tenure-track careers, and has employed numerous mechanisms to increase exposure to different institutional types including:

- Monthly meetings in a virtual setting, giving them the opportunity to talk to postdocs in different institutional settings;
- Professional development opportunities virtually or in person on other participating campuses, allowing them to improve skills and prepare for careers at other institutions;
- Visits to institutions within the PROMISE Academy Alliance, touring campuses, meeting with students and faculty, and presenting their work, allowing them to hear directly about faculty and student life;
- Providing the opportunity to be paired with an external mentor(s) from a different participating institution, providing them confidentiality and breadth of expertise in their mentor network.

In this brief research report, we provide evidence from a survey of participating Fellows to demonstrate the impact of structured in-person experiences on campuses outside of their fellowship institution, but within the Alliance (university system).

2 Methods

2.1 Context

The work reported in this paper was performed as part of grants funded by the National Science Foundation (NSF) under the Alliances for Graduate Education and the Professoriate (AGEP) Program and under the Eddie Bernice Johnson INCLUDES initiative. Our AGEP project has focused on building a state university system model (the PROMISE Academy Alliance) to diversify tenure-track biomedical faculty through creating a collaborative postdoctoral conversion program within the University System of Maryland (USM). The INCLUDES initiative (Re-Imagining STEM Equity Utilizing Postdoc Pathways, RISE UPP) focuses on scaling the model to additional

institutions within USM, to additional disciplines beyond biomedical sciences and to additional university systems. Fellows in the PROMISE Academy program were predominantly from biological sciences and from underrepresented racial groups as defined by AGEP (African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and Native Pacific Islanders).

2.2 Data collection

After obtaining IRB approval, we used an online survey to collect information on participation in-person campus activities across the USM from 18 postdoctoral fellows ("Fellows") that have participated in the PROMISE Academy program from 2019 to 2024. The survey was distributed using Qualtrics and consisted of 15 questions including multiple-choice, Likert scale, and open-ended questions. At the end of the data collection period, 12 of the 18 Fellows completed the survey. As all questions were optional and several questions had an "N/A" or a "Prefer not to respond" option, not every question was answered by every surveyed participant.

The purpose of the questionnaire was to gather information on the types of in-person experiences that Fellows participated in, particularly on a campus other than their fellowship institution, as a part of the PROMISE Academy program. The survey also assessed the effectiveness and impact of such activities in building professional relationships, skills, strengthening the sense of community, and expanding the scholar's network. In a few instances, we use data from national surveys or from an internal University System of Maryland report (which included a 2024 survey of postdocs across the university system, $n = 247$) for comparisons as we do not have a control group.

3 Results

The survey's response rate was 67% percent (12 of the 18 Fellows participated). When asked "Outside of the events you learned about/participated in through the PROMISE Academy, have you had/did you have other opportunities to visit and engage with other USM campuses during your postdoctoral fellowship?" a remarkable 42% of Fellows reported "No opportunities," while 17% reported "Few Opportunities, 1–2/year" and 41% reported "Some opportunities (3–4/year)" (see Figure 1). This clearly demonstrates that not all postdocs have the chance to engage with other campuses during their fellowships, and that the PROMISE Academy enables opportunities that a significant number of Fellows would not have. The limited opportunity the PROMISE Academy Fellows have had to engage with other campuses is also reflected in a survey of postdoctoral scholars across the USM ($N = 247$) in which 88% of respondents claimed that they had not attended any professional development at a campus besides their own and 91% of respondents indicated they would like they opportunity to attend professional development on other campuses within the university system (PROMISE Academy Alliance, 2024).

The type of in-person activity on a campus besides their fellowship institution with the most Fellows' participation was "Workshops" (83% of Fellows experienced this activity); followed by "Meeting with Faculty" (67%), "Touring Facilities" (58%), "Social Gathering of Fellows" (50%) and "Meeting with Leadership" (42%). Conversely, a smaller number of Fellows (33%) reported having had the opportunity to "Meet with Students," "See the Surrounding Area" (25%) or "Give a Research Talk" (17%).

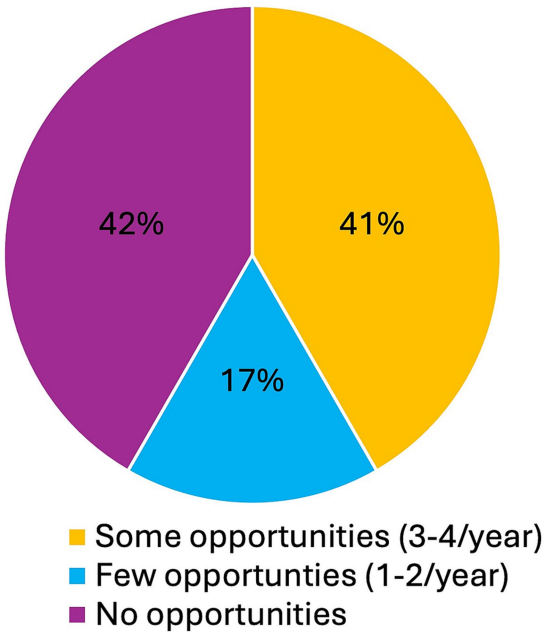

FIGURE 1
Opportunities to engage with other University System of Maryland campuses during your postdoctoral fellowship outside of PROMISE Academy events.

Figure 2 shows what the Fellows rated as the most impactful components of in-person campus visits in changing their interests in alternative institutional settings for employment. Fellows could rank each component on a five point scale of "extremely impactful," "very impactful," "moderately impactful," "slightly impactful," or "not impactful." Since Fellows could select "N/A" for components that they may not have experienced, the number of Fellows that ranked the impact of each component is reported individually. "Getting a Response to Your Research Talk" ($N = 3$) had the greatest impact, with 100% of Fellows saying this was very or extremely impactful. Of those Fellows that experienced "Meeting with Faculty" ($N = 8$), 86% found that component very or extremely impactful. Interestingly, Fellows rated "Seeing the Area Surrounding Campus" ($N = 5$), as more impactful than "Touring the Facilities/Seeing Campus" ($N = 8$) (83% found it very or extremely impactful compared to 75%). "Meeting with Students" ($N = 5$) and the "Content/Quality of the Workshop" ($N = 11$) also were of value, with 80 and 82%, respectively, finding these very or extremely impactful. "Meeting with Campus Leadership" ($N = 6$), was of value but less so than other components (only 67% of Fellows found it very or extremely impactful).

When evaluating how informative the PROMISE Academy in-person events on other campuses have been on a scale of 1 (not informative) to 5 (extremely informative), 100 percent of the respondents ($N = 12$) evaluated these as either Extremely Informative ($N = 6$) or Very Informative ($N = 6$). Ten of the 12 respondents provided qualitative responses to "What elements of your visit(s) to other campuses were particularly informative (made you particularly

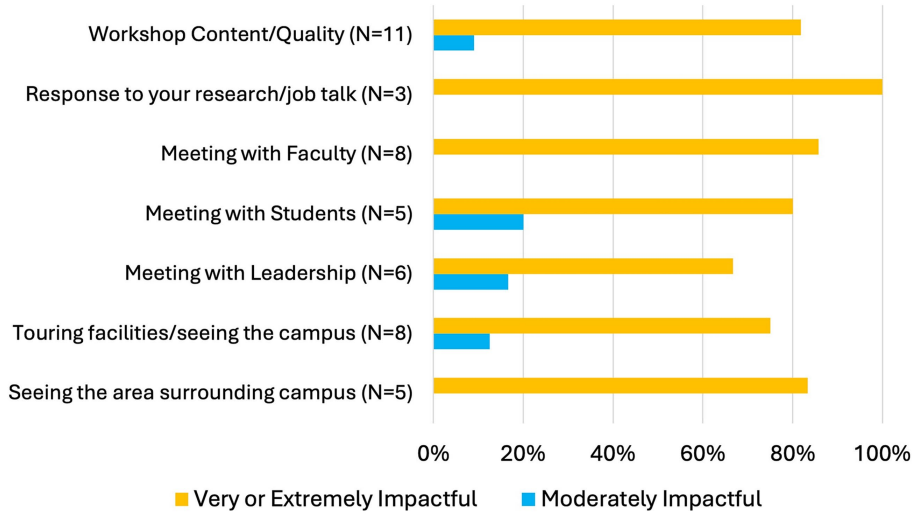

FIGURE 2
Proportion of respondents who reported an impact on their perception/interest in different institutional types as places of employment as a product of these components of in-person PROMISE Academy visits.

more interested or less interested in the institution/campus type as a potential employer)?" Some Fellow comments included:

> "Seeing the atmosphere, meeting with faculty and talking with students. Visiting during the school year and experiencing the other campuses, even if just for a few hours, made me appreciate them and understand them better. If I had the chance to work at Salisbury, UMES or UMBC, I would be able to make a more informed decision, and know more about the support systems, faculty environment, and student quality. So, that was very valuable to me!."
>
> "The ability to have access to other campuses and one-on-one conversations with people was particularly informative."
>
> "Learning more about what faculty life looks like at different types of institutions has been very helpful. At times, I have considered leaving academia because of various aspects of academic culture and values, so it has been refreshing and encouraging to find out that these often vary significantly between different types of institutions. It has helped me to be better able to gage which types of institutions would be a better fit for my values and my preferred institutional culture."
>
> "Hearing about the day-to-day logistics of what it would be like to set up a lab, teach classes and mentor students from current faculty. It is very illuminating to listen to how easy or difficult certain aspects can be at different institutions."
>
> "I liked hearing about other professors' experiences, their academic lives, and how they organized their time. All these insights helped me rethink my own goals."

Figure 3 reports the effectiveness of in-person events on other campuses on a set of outcome variables. Fellows were asked to rank their experiences as "extremely effective," "very effective," "moderately effective," "slightly effective" or "not effective." We then examined the % of respondents that reported the events as very or extremely effective: 83% of respondents ($N = 11$) found in person events were very or extremely effective at "Increasing your knowledge of different Institutional types," "Providing programming that was not being covered by your current institution" and "Building your sense of community within the PROMISE Academy." In addition, 75% of respondents found in person events were very or Extremely Effective at "Advancing your career or job prospects." Fifty-eight percent of Fellows found in person events were very or extremely effective at "Building your skill set" and "Building your sense of community within the University System of Maryland." In person events were less effective at "Facilitating any advancement in your research" (33% of Fellows found in person events very or extremely effective while another 33% found this moderately effective). Participants that rated either "Advancing your career or job prospects" or "Facilitating advancement in your research" as moderately effective or higher ($N = 11$) were asked a follow up question "How did the workshops facilitated the advancement in your research and/or career? (Select all that apply)." Most (8 of 11, or 73%) selected "By facilitating the exchange of ideas with other faculty," while 64% selected "By connecting you with potential collaborators" and 45% selected "By connecting you to potential funding opportunities."

Perhaps one of the most telling results is whether PROMISE Academy Fellows recommend we continue offering structured in-person campus opportunities. Participants were asked "On a scale of 1–5, with 1 being 'do not recommend' and 5 being 'highly recommend', how much would you recommend we continue to have in-person opportunities to visit other PROMISE Academy campuses as part of our program?" All selected either 4 or 5 with the vast majority (8 of 12, 75%) selected "5-highly recommend." The participants nevertheless provided a few recommendations on how to improve the in person programming such as: "A campus tour would be great, as well as being able to see a classroom in action," "perhaps having scheduled one-on-one meeting time with faculty," and "a more informal setting would be interesting (or a "ask me anything" type of meeting)." In addition, one Fellow made a suggestion about logistics: "The events that happen during work

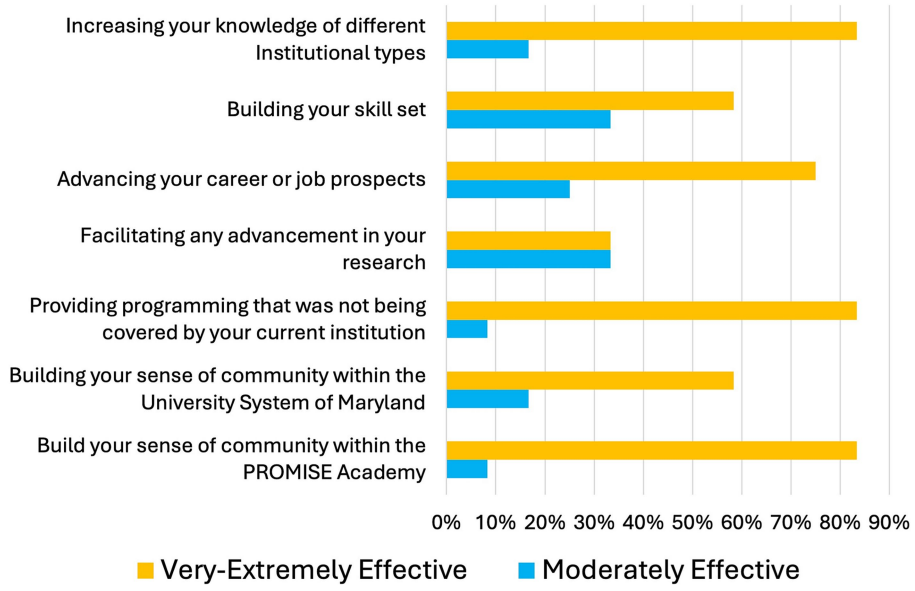

FIGURE 3
Participant's perception of effectiveness of in-person PROMISE Academy events on several outcomes.

hours were often hard for me to attend as some of the responsibilities I have in my postdoc require me to be in-person and are often hard to reschedule as they involve several other people. So I believe having more events on evenings or weekends may make it easier for some fellows to attend." While the PROMISE Academy Fellows are a small subset of the greater postdoctoral population within USM, their recommendation to continue the practice of in-person opportunities to learn about faculty careers at other regional institutions reflects a similar desire documented in a survey of postdoctoral scholars across the USM (N = 247), in which 79% of respondents reported they "would you like to have more opportunities to learn about faculty life/careers at different institutions within the USM" (PROMISE Academy Alliance, 2024).

Finally, the PROMISE Academy provides the opportunity for Fellows to be matched with "external mentors" from other institutions or departments within the PROMISE Academy Alliance, and 6 of the 12 respondents reported to have been assigned such mentors. This subgroup was asked to rate the effectiveness of their PROMISE Academy external mentors on a series of outcomes. 100% of respondents ranked their PROMISE Academy mentors as "extremely effective" at "Increasing your knowledge of different institutions/institutional types," "Building your skills," and importantly, "Providing you mentorship that was not being provided by your primary mentor." In other categories, the effectiveness of the external mentors were still ranked positively. Three of 5 responding Fellows found their external mentors were extremely effective at "Facilitating any advancement in your research" (1 rated their method very effective, another moderately effective). And 4 of 5 responding Fellows rated their external mentor as extremely effective at "Providing feedback on written materials (e.g., grants, manuscripts, job market materials)" and "Helping you navigate difficult decisions/circumstances." For each of these categories, the other respondent rated their mentor as very effective.

4 Discussion

While tenure-track faculty positions remain the top aspiration of most biomedical postdocs (Andalib et al., 2018; Woolston, 2020), there are a limited number of R1 positions for what some consider an oversupply of talent. Limited research has been conducted on interventions that expose biomedical postdoctoral scholars to faculty positions at different institutional types, despite there being significantly more faculty jobs at non-R1 institutions (AAUP Department of Research and Public Policy.). This survey of postdoctoral scholars in the PROMISE Academy program demonstrates that structured visits to other campuses within a state university system are valuable in informing their decisions about future employment. Fellows gained skills, built their networks, and learned about the lives of faculty in different institutional settings and contexts. Importantly, they perceived that visits were extremely effective at advancing their job prospects, and were extremely impactful on their perception/interest in different institutional types as places of employment. Having assigned mentors from other institutional types was also an effective way to inform postdoctoral scholars about different institutional environments and potential faculty positions. Future investigations will examine the outcomes of these visits and the extent to which PROMISE Academy Fellows obtain tenure-track positions at non-R1 institutions, or institutions that differ from their fellowship institution.

The PROMISE Academy programming to provide expanded networks for postdoctoral scholars went beyond being informative. The participating scholars were able to get meaningful feedback on their job talks, their job application materials, build collaborations and gain ideas about advancing their research. Importantly, it fostered a sense of belonging among postdocs across institutions and within the university system. Research has demonstrated

repeatedly that many postdocs, but particularly postdocs from underrepresented and minoritized populations, feel isolated (Yadav et al., 2020; Rybarczyk et al., 2016). Though this study is limited to capturing the impact of a single program with a small sample size, it provides an evidence-based intervention that can counter that sense of isolation, and provide personal as well as professional support to biomedical postdoctoral scholars that are longing for such community. As Blackford argues that expanded academic-related networks can help reduce the inequality in social capital accumulation caused by differences in personal networks (2018), providing postdocs (particularly those from historically excluded populations) expanded academic communities in institutions within a geographical region or university system is an equity-enhancing intervention. For this reason, the PROMISE Academy programming also serves as a potential mechanism for retaining talented postdocs who might otherwise leave the academy. Likewise, showcasing different institutional types addresses a significant gap in postdoctoral training; many R1-trained postdocs may have limited awareness of the distinct cultures, values, and opportunities present at non-R1 institutions. As one Fellow noted: "Learning more about what faculty life looks like at different types of institutions has been very helpful. At times, I have considered leaving academia because of various aspects of academic culture and values, so it has been refreshing and encouraging to find out that these often vary significantly between different types of institutions. It has helped me to be better able to gage which types of institutions would be a better fit for my values and my preferred institutional culture."

These opportunities may have the added benefit of being positive for the hosting institution as well, though this was not a focus of this study. Having regional scientific talent, particularly those from underrepresented groups, be visible on campus, sharing their research, can serve as a counter-stereotype to combat bias among faculty (Crisp and Turner, 2011) and positively impact student audience members' sense of belonging (Shin et al., 2016). As institutions and departments aim to hire new faculty, welcoming regional postdocs to their campus can help build inter-institutional collaborations and expanded applicant pools. Investigating the impact of in-person visits from regional postdoctoral fellows, such as those within the PROMISE Academy, on the hosting institution would be an interesting future direction.

Additional future directions for research include looking at the outcomes of the PROMISE Academy Fellows in terms of where they applied, where they plan to apply (what types of institutions), interviewed, and obtained employment. While this project focuses on the pathway to tenure-track faculty, institutions and postdoctoral development offices interested in providing broader opportunities for postdoctoral scholars could consider on-site visits that help introduce non-faculty career trajectories as well (such as visits to pharmaceutical research companies, educational sites/schools, or government labs).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by University of Maryland Baltimore County Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

RC: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. FU: Writing – review & editing, Visualization, Software, Methodology, Data curation. LH: Writing – review & editing, Project administration, Conceptualization. JC: Writing – review & editing, Project administration, Conceptualization.

Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. This research is supported by the National Science Foundation Eddie Bernice Johnson INCLUDES Initiative: Re-Imagining STEM Equity Utilizing Postdoctoral Pathways (RISE UPP), Division of Equity and Excellence in STEM (EES), NSF Award # 2217329 and the following Alliances for Graduate Education and the Professoriate (AGEP) NSF awards: #1820984 (University of Maryland Baltimore County), #1820974 (Towson University), #1820971 (Salisbury University), #1820983 (University of Maryland, Baltimore), #1820975 (University of Maryland, College Park).

Acknowledgments

We would like to thank the PROMISE Academy Alliance Leadership Team members for their continued work developing, implementing and scaling the model of faculty diversification in the biomedical sciences through postdoctoral pathways. In particular we would like to acknowledge our internal evaluator and IRB liaison, Dr. Wendy Carter-Veale, whose social science expertise has greatly benefited our project.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Aikens, M. L., Corwin, L. A., Andrews, T. C., Couch, B. A., Eddy, S. L., McDonnell, L., et al. (2016). A guide for graduate students interested in postdoctoral positions in biology education research. *CBE—Life Sci. Educ.* 15:es10. doi: 10.1187/cbe.16-03-0130

Andalib, M. A., Ghaffarzadegan, N., and Larson, R. C. (2018). The postdoc queue: A labour force in waiting. *Syst. Res. Behav. Sci.* 35, 675–686.

Blackford, S. (2018). Harnessing the power of communities: career networking strategies for bioscience PhD students and postdoctoral researchers. *FEMS Microbiol. Lett.* 365:fny033. doi: 10.1093/femsle/fny033

Bosley, S. L., Arnold, J., and Cohen, L. (2009). How other people shape our careers: A typology drawn from career narratives. *Hum. Relat.* 62, 1487–1520.

Clauset, A., Arbesman, S., and Larremore, D. B. (2015). Systematic inequality and hierarchy in faculty hiring networks. *Sci. Adv.* 1:e1400005. doi: 10.1126/sciadv.1400005

Cresiski, R. H., Ghent, C. A., Rutledge, J. C., Carter-Veale, W. Y., Aumiller, J., Bertot, J. C., et al. (2022). Developing a state university system model to diversify faculty in the biomedical sciences. *Front. Psychol.* 13:734145. doi: 10.3389/fpsyg.2022.734145

Crisp, R. J., and Turner, R. N. (2011). Cognitive adaptation to the experience of social and cultural diversity. *Psychol. Bull.* 137, 242–266. doi: 10.1037/a0021840

Culpepper, D., Reed, A. M., Enekwe, B., Carter-Veale, W., LaCourse, W. R., McDermott, P., et al. (2021). A new effort to diversify faculty: postdoc-to-tenure track conversion models. *Front. Psychol.* 12:733995. doi: 10.3389/fpsyg.2021.733995

Enekwe, B., and Cresiski, R. H. (2023). Leveraging state university systems for postdoctoral development. POSTDOCket 21. Available at:https://www.nationalpostdoc.org/page/POSTDOCket_2102#section4

Hayter, C. S., and Parker, M. A. (2019). Factors that influence the transition of university postdocs to non-academic scientific careers: an exploratory study. *Res. Policy* 48, 556–570. doi: 10.1016/j.respol.2018.09.009

Kahn, S., and Ginther, D. K. (2017). The impact of postdoctoral training on early careers in biomedicine. *Nat. Biotechnol.* 35, 90–94. doi: 10.1038/nbt.3766

Lave, J., and Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press.

Murphrey, T. P., Carter, C. R., Regisford, E. G. C., Carson, L. E., Butler-Purry, K., Carter-Sowell, A. R., et al. (2022). An examination of the paths of successful diverse stem faculty: insight for programming. *Front. Educ* 7:767476. doi: 10.3389/feduc.2022.767476

National Center for Education Statistics. (2021). *Digest of Education Statistics 2021. U.S. Department of Education, Institute of Education Sciences*. Available at: https://nces.ed.gov/programs/digest/d21/index.asp (Accessed September 2024).

Patt, C., Eppig, A., and Richards, M. A. (2022). Postdocs as key to faculty diversity: a structured and collaborative approach for research universities. *Front. Psychol.* 12:759263. doi: 10.3389/fpsyg.2021.759263

PROMISE Academy Alliance (2024). Career interests, skills and mentoring needs in USM postdoctoral scholars. Internal PROMISE Academy Alliance Report.

Rybarczyk, B. J., Lerea, L., Whittington, D., and Dykstra, L. (2016). Analysis of postdoctoral training outcomes that broaden participation in science careers. *CBE-Life Sci. Educ.* 15:1–11. doi: 10.1187/cbe.16-01-0032

Shin, J. E. L., Levy, S. R., and London, B. (2016). Effects of role model exposure on STEM and non-STEM student engagement. *J. Appl. Soc. Psychol.* 46, 410–427. doi: 10.1111/jasp.12371

van Wart, A., O'Brien, T. C., Varvayanis, S., Alder, J., Greenier, J., Layton, R. L., et al. (2020). Applying experiential learning to career development training for biomedical graduate students and postdocs: perspectives on program development and design. CBE—life sciences. *Education* 19:es7. doi: 10.1187/cbe.19-12-0270

Woolston, C. (2020). Postdoc survey reveals disenchantment with working life. *Nat.* 587, 505–509.

Yadav, A., and Seals, C. (2019). Taking the next step: supporting postdocs to develop an independent path in academia. *Int. J. STEM Educ.* 6, 1–11. doi: 10.1186/s40594-019-0168-1

Yadav, A., Seals, C. D., Sullivan, C. M. S., Lachney, M., Clark, Q., Dixon, K. G., et al. (2020). The forgotten scholar: underrepresented minority postdoc experiences in STEM fields. *Educ. Stud.* 56, 160–185. doi: 10.1080/00131946.2019.1702552