

Suggestions for Improving Invited Speaker Diversity To Reflect Trainee Diversity

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Within the field of biomedical research in the United States, the proportion of underrepresented minorities at the Full Professor level has remained consistently low, even though trainee demographics are becoming more diverse. Underrepresented groups face a complex set of barriers to achieving faculty status, including imposter syndrome, increased performance expectations, and patterns of exclusion. Institutionalized racism and sexism have contributed to these barriers and perpetuated policy that excludes underrepresented minorities. These barriers can contribute to decreased feelings of belonging, which may result in decreased retention of underrepresented minorities. Though some universities have altered their hiring practices to increase the number of underrepresented minorities in the applicant pool, these changes have not been sufficient. Here we argue that departmental invited seminar series can be used to provide trainees with scientific role models and increase their sense of belonging while institutions work towards more inclusive policy. In this study, we investigated the demographics (gender and race) of invited seminar speakers over 5 years to the Department of Microbiology and Immunology at the University of Michigan. We also investigated current trainee demographics and compared them to invited speaker demographics to gauge if our trainees were being provided with representation of themselves. We found that invited speaker demographics were skewed towards Caucasian men, and our trainee demographics were not being represented. From these findings, we proposed policy change within the department to address how speakers are being invited with the goal of increasing speaker diversity to better reflect trainee diversity. To facilitate this process, we developed a set of suggestions and a web-based resource that allows scientists, committees, and moderators to identify members of underserved groups. These resources can be easily adapted by other fields or subfields to promote inclusion and diversity at seminar series, conferences, and colloquia.

INTRODUCTION

Long-standing systemic bias, sexism, and racism have contributed to the underrepresentation of many racial and ethnic groups, as well as of women, in science, technology, engineering, and math (STEM) fields (1–4). Specifically, within the field of biomedical research in the United States, the proportion of underrepresented minorities at the Full Professor level has remained consistently low at 4% (survey data taken from the NIH from 2001 to 2013) (5, 6). Similar discrepancies exist for women in biomedical sciences, as Full professorships are currently held mostly by men (7, 8). As demographics of faculty within the biomedical sciences remain skewed towards Caucasian men, the demographics

of trainees (graduate students and postdocs) are becoming more diverse (5).

Policy changes are needed to support inclusion of all individuals, particularly in the biomedical sciences, since underrepresented groups face a complex set of barriers to achieving faculty status (9). For example, the dedication of women—who have children—to their work is perceived to be less than that of their colleagues, including men who also have children (10–12). Historically underrepresented minorities (HURM) in the United States, Asian/Asian-Americans, and women are all held to stricter competency standards and report having to work harder than Caucasian men to be perceived as legitimate scholars (13, 14). Asian/Asian-Americans suffer from imposter syndrome at greater rates than other marginalized groups, and Asian women report a lack of sponsors (15, 16). Increased performance expectations and patterns of exclusions are consistent themes in studies characterizing the HURM faculty experience (17, 18). While HURM and other marginalized groups share some experiences, differences including varying rates of hiring and tenure promotion mean that unique considerations are important for inclusion of each group (3).

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Here, we argue that to support the retention of faculty from marginalized groups at the professor level, universities should provide trainees with a visual representation of themselves as successful scientists. Recent studies have shown that women in STEM benefit from women role models through improved belonging and self-efficacy (19, 20). Predictably, a lack of active inclusion also decreases self-efficacy in URM, which can result in decreased feelings of belonging (21). However, as the demographics of trainees have become more diverse, those who are not Caucasian men are lacking role models. Institutionalized racism and sexism (22), defined as policies, societal norms, and ideologies that reinforce inequities, have played a large role in access to, inclusion in, and hiring policies at U.S. universities (23, 24). Accordingly, faculty from marginalized groups are eliminated from the applicant pool and subsequent hires, leaving university policies and practices to be predominantly created by Caucasian men. Thus, institutionalized racism and sexism are perpetuated (25, 26). Universities have begun adjusting hiring practices and creating initiatives to address inequitable hiring practices, but they have had limited results (27). Considering that most faculties within the United States are still skewed towards Caucasian men, invited seminar series are a possible tool to provide marginalized trainees with representations of themselves as successful scientists.

Invited seminar series are common within biomedical departments across the United States (28). Usually, seminar series consist of faculty members selecting a scientist from another institution to visit their university and present their research, as well as meet with other faculty members and trainees. Named lectureships follow the same format but are decided by committee and are considered more prestigious because they are named in honor of prominent local scientists. These seminar series and lectureships provide an opportunity for trainees to be exposed to research outside of their department. Additionally, being an invited speaker provides the scientist with an opportunity to make future collaborations and build their own curriculum vitae (CV). Scientists invited to give seminars are widely regarded as successful and the top in their field, providing an opportunity for trainees to be exposed to successful scientists in that field. Some studies have examined the addition of more women speakers at conferences to promote inclusion (29–31); however, we have only identified one other study that has focused on invited speakers at universities (28). In that study, Nittrouer *et al.* examined 3,652 talks at 50 U.S. institutions in 2013 to 2014 and found that women faculty were less likely to be invited speakers (28). We have not been able to identify any publications examining scientific speaker diversity beyond gender or how department speaker series compare to trainee diversity in that department.

In this study, we examined and compared the demographics of invited speakers to Caucasian men in the Department of Microbiology and Immunology at the University of Michigan. Additionally, we compared invited speaker demographics to the current trainee demographics to gauge

if trainee demographics were being represented throughout the seminar series. Following our investigation, we proposed a policy change to the Department of Microbiology and Immunology in how invited speakers are selected to promote inclusion in our department and reduce unconscious bias. In order to facilitate inviting a more diverse group of scientists, we developed a set of resources that allow scientists, within the fields of microbiology and immunology, to self-identify any underrepresented or underserved identity including HURM, non-Caucasian/non-HURM (NCNH), or a Caucasian woman. These resources will promote inclusion and diversity by providing greater representation of all scientists and will provide hosts an opportunity to invite a more diverse group of scientists.

METHODS

Each academic year, each faculty member in the Department of Microbiology and Immunology at the University of Michigan has the opportunity to invite one speaker per year for a weekly seminar series. Some of these seminar slots are dedicated to named lectureships, which are decided by committee, and there are three trainee-invited speakers. We analyzed the demographics of invited speakers and faculty hosts for five academic years (fall 2014 to spring 2019) and compared them to the current trainees when the data were analyzed (spring 2019). Each speaker was only counted once, and those listed as departmental faculty members or as a “host” at any point could not also be considered “invited speakers.” The list of faculty hosts was used as a proxy for faculty demographics, because as hosts, these faculty members are visible representatives of the department. There were a total of 142 invited speakers and paired hosts. The trainees were identified using departmental e-mail lists that included master’s students, doctoral students, and postdoctoral fellows. There were 44 students and 45 postdoctoral fellows.

This was a retrospective study; thus, speakers were not asked for their identities at the time of visit. Instead, we hand-coded proxy demographics of the speakers, faculty hosts, and trainees, using first names, publicly available photos, and CVs (32–36). Information from CVs, such as undergraduate institutions and activity in HURM groups, helped inform our demographics by indicating identities that might be held by that individual. For instance, an undergraduate at a Puerto Rican university and activity in the nonprofit Ciencia Puerto Rico suggested that even if the individual appears Caucasian, they probably identify as Puerto Rican and qualify as a HURM. Because these data were collected from publicly available sources, this study was not submitted to an IRB for consideration. The presenting gender of each individual was inferred using a binary system (man/woman). Due to the low number of individuals in the study, race/ethnicity demographics were only split into three groups: Caucasian, HURM, and NCNH, each with a binary (yes/no)

possibility. Caucasian was inferred using the current U.S. Census definition, where those of Middle Eastern, European, and Russian descent are included. URM individuals include those of African-American, Indigenous American, Alaskan/Hawaiian Native, and Latinx and/or Hispanic heritage (20 USC §1067k); we use the HURM designation to recognize the history of enslavement and active oppression in the United States for these populations. The NCNH group predominantly included Asian/Asian-Americans, but also African immigrants (37).

Data were compiled and figures generated in R statistical software, using relevant packages (38–50).

Code and data availability

The anonymized data, code for all analysis steps, and an Rmarkdown version of this manuscript is available at https://github.com/akhagan/Hagan_SpeakerDiversity_JMBE_2019. Template and complete instructions for generating a field-specific diversity website are available at <https://github.com/diversifymicrobiology/DiversifyMicrobiology.github.io/>.

RESULTS

To understand the representation of women, we compared the proportion of women in each academic role. At the trainee level, more than half of students and postdoctoral fellows were women. That dropped to 46.77% of faculty hosts and 38.73% of the invited speakers (Fig. 1A). Of 27 lectureships over the 5-year period, 37.04% were awarded to women.

Our analysis identified an overrepresentation of Caucasian individuals as hosting faculty and invited speakers (80% each), relative to the proportion of Caucasian trainees, which was 55% (Fig. 1B). We also observed declines in the representation of HURM and NCNH faculty and speakers relative to the trainees (Fig. 1B). HURM trainees made up 11% of the department, on track with the 11% of U.S. microbiology and immunology doctorates awarded in 2017 (51). However, only 8.5% of invited speakers, and none of the hosting faculty, were HURM scientists. NCNH trainees were 34% of department students and postdocs (versus 22% of U.S. microbiology and immunology doctorates in 2017), but only 19% of hosting faculty and 10.5% of invited speakers (51).

The more prestigious invited speaker lectureships were also dominated by Caucasian scientists, who comprised 81.48% of those awarded (Fig. 1C). HURM and NCNH scientists were awarded three and two lectureships, respectively. Because the intersection of identities can compound biases and outcomes, we further examined the lectureships by gender and race/ethnicity status (52). Caucasian men and women accounted for 44.44% and 37.04% of the lectureships, respectively. Just 18.52% of lectureships were held by

non-Caucasian men, while none was held by non-Caucasian women (Fig. 1D).

DISCUSSION

This study found that the proportion of HURM and NCNH invited speakers were underrepresentative of the trainee populations for each group. Additionally, within the last 5 years, no HURM or NCNH woman was awarded a lectureship, despite that in 2017 non-Caucasians were 30% of the professoriate (53). This means that the department is not providing non-Caucasian trainees with adequate representation of successful scientists and failing to support an inclusive environment in terms of visual faculty representation. We also found that the proportion of women as faculty hosts and speakers in our study population is equivalent to global estimates that 40% of microbiologists are women, though women only represent about 30% of academic biomedical faculty (7, 54). Women are also overrepresented as graduate students and postdoctoral fellows in this department. Overall, Caucasian scientists are overrepresented as host faculty and invited speakers, compared to their presence as trainees, particularly when lectureships are considered.

We have not been able to identify any publications examining scientific speaker diversity beyond gender (28). This report seems to be the first, which is concerning since conclusions drawn from gender-based studies are often framed, and considered, to be applicable to other marginalized groups (e.g., HURM), for instance, the assumption that African-American and Caucasian women benefit equally from the same policy change. This is a flawed assumption (55). While there is no doubt some overlap, each group remains marginalized due to a unique complex set of factors that cannot always be solved by gender-based solutions. The historical exclusion of HURMs by U.S. institutions means that these institutions have a particular responsibility to improving the academic experience for these populations (23). We therefore call on U.S. institutions to apply intersectional framing to their discussions and research.

Departments have different processes and criteria for selecting invited speakers, but it is a matter of pride to bring the best scientists possible. The barriers to achieving faculty status for HURMs, Caucasian women, and NCNH may also impact their speaking invitations. For instance, the perceived prioritization and commitments of women to family over work may cause faculty to doubt their acceptance of a speaking invitation, despite the prestigious nature of these invitations and evidence that men and women accept at similar rates (28, 56). As a result, the faculty member may invite a different colleague who they feel is more likely to agree (and is a man). It may also be that the definition of “best” poses a problem to underrepresented and underserved groups (e.g., women, HURM, and Asian) who are held to stricter competency standards (13, 14). Some departments may only invite tenured faculty, which severely limits the

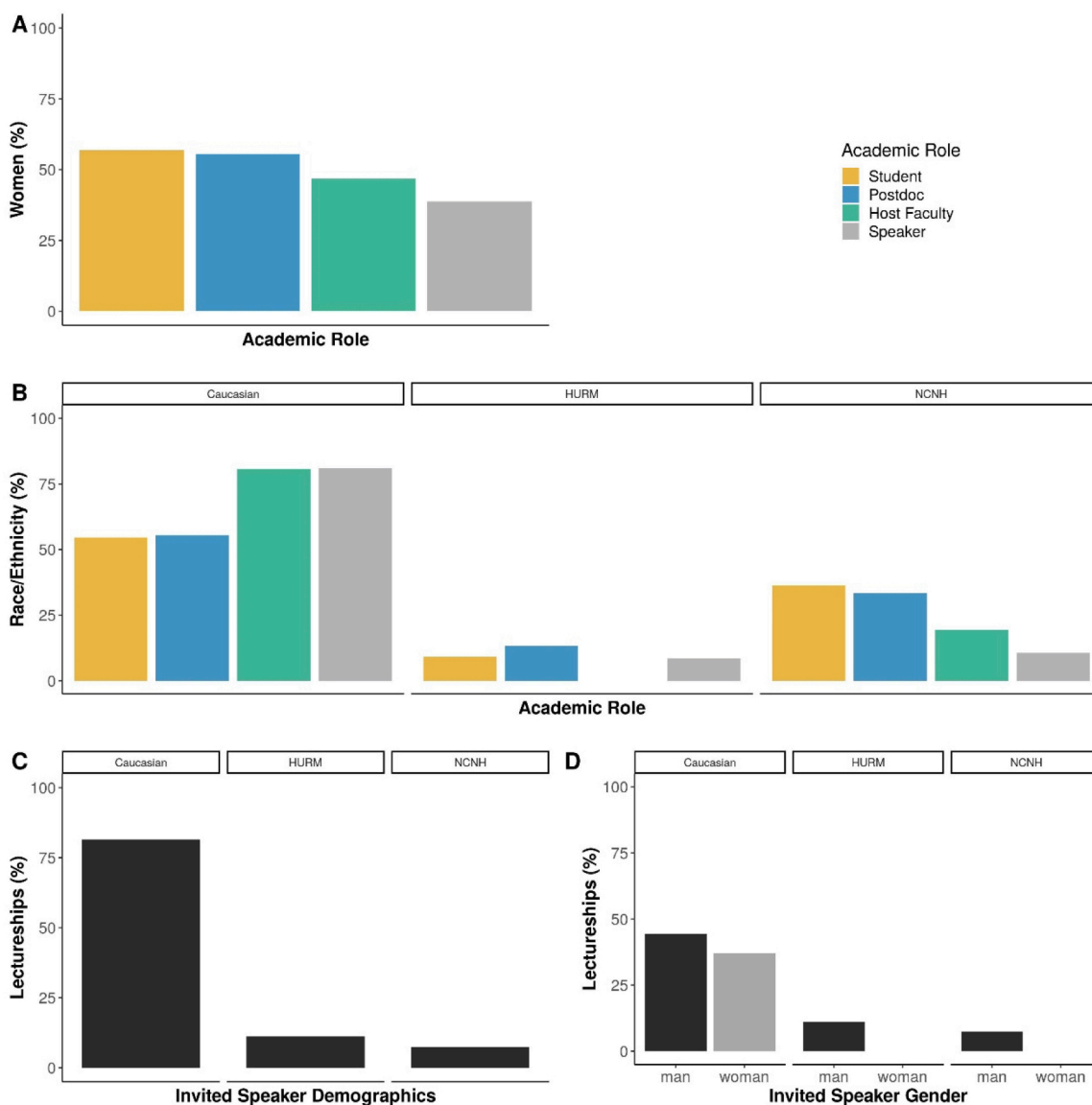


FIGURE 1. The demographics of invited speakers, hosting faculty, and trainees. A) The proportion of women in each academic role. B) The proportion of each academic role represented by individuals that are Caucasian (left), HURM (center), or NCNH (right). C, D) The percentages of lectureships awarded to individuals who are C) Caucasian, HURM, or NCNH and D) Caucasian, HURM, or NCNH by gender.

number of potential speakers who are Caucasian women or non-Caucasian. Yet, another scenario is that pre-tenure faculty members invite prestigious, tenured faculty in their field to network and secure letters for their own tenure package. The increased burden of women and non-Caucasian scientists to prove competency decreases their likelihood to be considered for either tenure or as a possible source of tenure letters. In particular, the proportion of HURM faculty at the Assistant and Associate Professor level is currently higher than at the Full Professor level, so it would be difficult to increase speaker diversity if early-career researchers are not being considered (57). Even when HURM speaker rates match the proportion of HURM faculty employment, HURM trainees will be represented at a significantly higher proportion. We argue that inclusion of marginalized faculty

in seminar series is an important factor to increasing their representation among Associate and Full Professors. It is just one aspect of larger institutional change that is needed, but one that will benefit trainee experiences and the CVs of faculty from marginalized groups (58).

We recognize that our proxy demographics are a limitation of the analysis and want to acknowledge that biological sex (male/female) is not always equivalent to the gender that an individual presents as (man/woman), which is also distinct from the gender(s) that an individual self-identifies as. We also want to acknowledge that there are many other identities that are not captured in this limited analysis and that our personal implicit biases may have impacted our assignment of demographics. While our pilot study combined 5 years' worth of seminars, our *n* is still quite low, and we did not

have other departments for comparison. Consequently, our results cannot be generalized to other departments, fields, or universities. Another limitation to looking at a single department is that trainees may interact with faculty from many other departments, depending on their research and interests. Therefore, the individual experience of representation would vary by trainee. Future research needs to consider multiple departments, universities, and/or fields to bolster generalizability. There is a paucity of research on speaker identities other than their gender, so this also needs to be addressed in future studies. However, we caution that representation is a shallow metric on which a single-minded focus can cause more harm than help (25). We recommend that future research also survey trainee and speaker experiences and trainee participation in seminar series to better understand the dynamics at play.

Instituting policy change

In an attempt to promote inclusion within the Department of Microbiology and Immunology at the University of Michigan, these data were presented to faculty members and the department chair. Since trainee demographics were not

represented by the seminar speaker demographics over the past 5 years, we proposed a policy change as to how seminar speakers were being invited (Table 1). One suggestion was to switch from faculty-invited to lab-invited speakers to allow trainees to choose a speaker that best represented themselves. This is easy to implement as it does not change the overall structure of the department’s seminar series; however, for this same reason it may not have a significant impact on the diversity of invited speakers. Trainees may be pressured to invite the top individuals in their subfield or may be influenced by the same unconscious biases as faculty members. This idea can be expanded by increasing the number of trainee-invited speakers and varying the trainee group that extend invitations, for instance, by training program, career interest, and/or trainees and faculty in an identity-affinity group. Invitations from trainees are often seen as an honor by potential seminar speakers and nominating as a group may decrease the pressure to invite particular subfields or ranks.

We also used this opportunity to begin a conversation about the purpose of seminar speakers. Seminar speakers are sometimes invited to highlight their latest high-impact paper or to share the arc of discoveries they have made

TABLE 1.
Suggestions and resources to increase invited speaker diversity.

Suggestion	Description	Resource
Trainee-invited speakers	Request suggestions from trainees, increase number of trainee-group-invited speakers	
Use a list	Lists of scientists from under-represented and under-served groups are available in several fields	https://DiversifyMicrobiology.github.io/resources
Create a list	Use the GitHub template to create a self-nomination list and resource for your field	Template can be found at https://github.com/diversifymicrobiology/DiversifyMicrobiology.github.io
Use resources from professional societies	Many scientific societies have a committee focused on serving individuals from under-represented and underserved backgrounds. Other societies (e.g., SACNAS) are dedicated to these issues.	SACNAS, ABRCMS, AISES, ASM Subcommittee on Minority Education
Think outside your sub-discipline	Speakers may introduce you to a technique that is not used in your sub-discipline	
Consider scientists outside research-focused universities	Scientists from industry, teaching-focused institutions, and non-profit orgs have different approaches to their research	
Communicate invitation expectations	Unit leadership should explicitly communicate expectations about who is invited to speak and the desired atmosphere	
Encourage trainees to engage	When a talk is over, ensure that trainees are the first to ask questions	
Foster an inclusive atmosphere	Consider the identities of individuals the speaker is meeting with. Ask if the speaker would like to meet a particular student group	
Highlight the journey	Invite speakers to spend a few moments describing their personal science journey	

ABRCMS, Annual Biomedical Research Conference for Minority Students; AISES, American Indian Science and Engineering Society.

over several years of their career. While both are certainly worthwhile, there are other benefits to be gained from interacting with seminar speakers, such as how to apply new techniques and how research is framed outside research-focused universities (Table 1). Thinking more broadly about what material is valuable during a seminar series may lead to more speakers from underrepresented and underserved backgrounds, as well as more diversity of career paths. For some institutions, these suggestions represent more of a structural change to the departmental seminar series as speakers focusing on techniques or from non-research-intensive universities are usually invited as part of a professional development series. If these changes are to be implemented, many members of the department must agree to the value of including these seminars in the main departmental seminar series, and these expectations must be clearly communicated by the leadership (Table 1). Departmental leadership can also ask individuals and groups to consider the unconscious biases that may be impacting their own speaker nominee lists to combat some of the barriers to inviting diverse speakers.

Presented with these ideas, several members of the Department of Microbiology and Immunology at the University of Michigan expressed interest in specific resources they might use to identify individuals from diverse identities, careers, and institutions. One suggestion is to use resources organized by professional societies such as the American Society for Microbiology (ASM) and the Society for Advancing Chicanos/Hispanics & Native Americans in Science (SACNAS) (Table 1). We also chose to develop “Diversify” resources for the microbiology and immunology fields that provide a list of scientists from underrepresented and underserved groups; these resources are not associated with a specific professional society. More information on the type of resources and how to establish a Diversify list is presented below. Using list resources like those available from professional societies as well as our Diversify resources are particularly useful, as social science research has shown that the human brain is much better at recognizing and using information (such as a strong scientific speaker) from a list than it is at recalling the same information from memory (59, 60).

We caution, however, that it is not enough to invite speakers from diverse identities. An inclusive environment must be built within the department. Start by inviting all speakers to spend a few minutes describing their personal science journey and by providing time for trainees to engage with the speaker. Trainee-speaker interactions can be encouraged by ensuring that trainees are the first to ask questions at the seminar’s conclusion and by scheduling a dedicated meeting time for trainees. As speaker schedules are being designed, departments should consider how they can foster an inclusive atmosphere during the speaker visits. Speakers should be asked prior to their visit if they have any dietary, movement, or other restrictions that should be accommodated during the visit. The identities of indi-

viduals the speaker is meeting with during their visit may also need to be considered; this is not to say that all identities of a speaker should be matched on their schedule or that a HURM speaker must have a meeting a HURM faculty member, but take care to ensure that speakers are meeting with faculty that reflect the diversity of thought and identity in the department. If a portion of the department is consistently not represented on speakers’ schedules (or extending invitations), this may reflect an opportunity for increased inclusivity in the department. Finally, speakers should be provided with ample opportunity to request meetings, not only with faculty but also with student groups or campus administrators who share similar interests. Through these steps, departments can increase the diversity of speakers invited to their seminars while also increasing the impact of the seminar speakers.

Building the Diversify resource

Motivated by a lack of resources to identify scientists who are members of marginalized and/or historically underserved groups and also inspired by resources in other fields—DiversifyEEB and DiversifyChemistry—we created DiversifyMicrobiology and DiversifyImmunology (61–64). These resources are a tool for symposium organizers, award committees, search committees, and other scientists to identify individuals to diversify their pools. Additionally, we have built these as a template to be used by other fields and organizations that wish to create their own lists. Since these lists are compiled by self-nomination, we can ensure that only scientists comfortable revealing their marginalized identities are included.

The self-nomination form is a Google form with entries logged in a private Google sheet. This form is embedded within the website and can be linked to directly. The use of a Google form allows us to maintain this database at no cost and gives us the flexibility to add questions or change response options without disrupting previous responses. Entries are logged in a private spreadsheet so that entries can be screened before being added to the public database. This screening includes two steps: confirming that each person is listed in the database only once and that any submitted website is a personal, professional website. If both criteria are met, a new entry is added to the public database spreadsheet. If a person is already listed in the database, their information is updated to the most recent submission.

This public spreadsheet is embedded in the website and can be opened separately as a locked (uneditable) Google sheet, allowing the list to be easily searched. We have chosen to list individuals’ academic information first in the spreadsheet to encourage a focus on academic achievement rather than tokenization of marginalized identities. Currently, the database lists individuals in order of self-nomination, but future versions will be re-sorted based on name and/or academic field to vary the individuals who might receive more attention for simply being at the top of the list.

The website provides an interface to the Google forms and spreadsheets with template pages for viewing the list, adding a name to the list, and finding additional resources. Importantly, our website creation tool is hosted for free by GitHub, which provides a free website for each GitHub organization. Basic tools and skills required to set up a Diversify site include knowledge of, or experience with, the version control tool git, the web tool GitHub, and a text editor. A tutorial in the DiversifyMicrobiology repository on GitHub provides links to these resources and instructions for adapting the tool to your own field (Table 1) (63). We caution creators of Diversify lists that the data voluntarily submitted to these lists are not eligible for study. IRB approval must be obtained prior to launching the list if that is a goal.

CONCLUSION

To increase the retention of Caucasian women, HURM, and NCNH trainees in the biomedical sciences, they must also be represented as experts. However, the invited speaker diversity at one department does not represent the diversity of trainees. To facilitate the identification and recruitment of individuals in these, and other, underserved groups, we have built a tool to create self-nominated, field-specific lists.

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