Promoting an Inclusive Faculty Search Process

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MIT School of Science

Promoting an Inclusive Faculty Search Process

Executive Summary

At the School of Science, we believe that talented people come from all backgrounds, and that in order to continue to do the best science in the world, we must recruit the best talent. This handbook provides guidelines and information on promoting inclusive and equitable searches at the School of Science in order to recruit the best talent.

Research shows that diverse and inclusive workplaces not only lead to better work outcomes but foster healthy work environments (Page, 2007). Inclusion and a sense of belonging are key to promoting excellence and diversity in the workplace (Huntoon et al, 2015), and an absence of role models and representation causes underrepresented groups (gender, race/ethnicity, gender/sexual identity) to leave STEM fields at higher rates than majority groups (Riegle-Crumb et al, 2019). It is therefore important to carefully structure our search and hiring processes to ensure equity and inclusion, to screen for any potential biases, and to promote transparency.

This document is comprised of five sections, each addressing key components of the faculty search and hiring process. Section I, Initiating A Search looks at composition of the search committee; developing a job description; identifying the selection criteria; components of the job advertisement; identifying advertising venues; using social media to spread word about the search; and the process of initiating a search within the School of Science.

Section II, Preliminary Discussions and Outreach focuses on the importance of active outreach to solicit a broad applicant pool. This includes possible activities such as reaching out to departmental alumni; as well as targeted outreach to award recipients of professional societies, Minority Serving Institutions (MSIs), and recipients of prestigious fellowships relevant to the field of the search.

Section III, Conducting the Search contains information on conducting search committee briefings and effectively managing applications. Section IV, Creating a Shortlist and Interviewing Candidates continues this process, outlining effective practices as well as the logistical steps needed to seek approval from the Dean's Office. Section V, Final Selection and Offers outlines the steps around making an offer to a candidate. The DLCI Head can inform the candidate that they are the selected candidate but under no circumstances can a DLCI Head provide the candidate with any details of the offer, without the prior permission of the Dean.

Following Sections I – V is information on relevant policies and procedures at MIT and relevant forms for the faculty search process, including on our School of Science Canvas website (requires login). In addition to all this, this document has 8 appendices, each with resources and information relevant to the faculty search process. Appendix 1 provides a list of advertising

venues and resources that can promote a broad applicant pool. Appendix 2 provides a list of professional societies relevant to science and engineering. Appendix 3 provides an example of a candidate evaluation tool (this is merely an example – search committees should feel free to develop their own as needed). Appendix 4 provides the School of Science faculty demographics, including how this has evolved in recent years. Appendix 5 provides guidance for student participation in the faculty search process. Appendix 6 provides the updated template for faculty hiring, provided by the Office of the Provost. Appendices 7 and 8 provide information on social science research on bias. Appendix 7 provides guidance on avoiding gender bias in recommendation letters, while Appendix 8 provides convenient summaries of a wide range of studies. Appendix 9 provides a detailed bibliography for the convenience of anyone who would like to look up the full studies.

All search committee members should be provided a copy of this handbook.

Note that the Assistant Deans for DEI and HR and the Associate Deans remain a resource for any search committee or department at any stage of the faculty search process.

Special note: Guidelines on inclusive faculty searches are especially relevant since data show that as MIT has become more diverse and inclusive over the years, our scientific rankings have soared. Recent data places MIT as the top scientific and technological institution in the world. This reinforces our core belief that talented people come from all backgrounds, and that to continue to do the best science in the world we must recruit the very best talent in the world.

Section I: Initiating an Inclusive Search

When initiating an inclusive search, some key considerations are:

Composition of the search committee: Appointing a committee with various perspectives, backgrounds, experiences, and identities will help promote an inclusive search. The Head of each Department, Lab, Center or Institute (hereafter referred to as "DLCI Head") determines the search committee Chair and number of committee members. DLCI Heads should ensure student representation on the committee as outlined in Appendix 5.

Developing an inclusive job description: The language used in job descriptions can signal an inclusive search, and search committees are encouraged to include language on promoting inclusion. We recommend avoiding narrowly defined searches because this can discourage applications from individuals who could expand the talent pool in that broader field. While MIT does have standard language that is used at the end of each advertisement, search committees could use inclusive language in the body of the advertisement. Examples include but are not limited to: "*We are looking for candidates who embody our core values of inclusion and belonging;*" and "*In their research and teaching statements, candidates should also describe any activities that they have engaged in to promote equity and inclusion;*" and "*We are especially interested in candidates whose record of achievements includes leadership in inclusion and belonging.*" See Appendix 6 for an updated template provided by the Provost's Office.

Identifying selection criteria: Selection criteria are original groundbreaking research accomplishment, and an exciting plan for independent future research. In addition, consideration should also be given to activities that promote inclusion – such as outreach to and mentoring of (formal and informal) underrepresented students and postdocs.

Components of the job advertisement: Advertisements must include the following:
- A request for a curriculum vitae
- Research statement
- Teaching and mentoring plan
- Broader impacts statement
- A request for information on any mentoring and outreach that describes the candidate's experience in these areas
- The number of recommendations required of candidates (minimum of 3 outside letters are required for junior faculty appointments)
- Deadline for applications
- Name and address of the MIT contact
- The MIT affirmative action statement, "*MIT is an equal employment opportunity employer. All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of race, color, sex, sexual orientation, gender identity, religion, disability, age, genetic information, veteran status, ancestry, or national or ethnic origin.*" View MIT Policy on Non Discrimination.

Identifying advertising venues: While standard venues are HERC and IM Diversity, which are posted by the DLCI, DLCIs/search committees must also identify additional venues aimed at broadening participation. A list of diverse venues can be found in [Appendix 1](#) and we encourage search committees to use them. If the search committee knows any additional venues that are not included in Appendix 1, they should reach out to the Dean's Office so we can update the list.

Using social media: In addition to the above, search committees and departmental communications teams could use social media to advertise the search. This includes, but is not limited to, posting the advertisement on Facebook, X (formerly Twitter), LinkedIn, and following the pages of diverse organizations. Some examples are provided in [Appendix 1](#).

Process of initiating a search: Faculty searches require prior approval from the Dean of Science; no search can be posted or advertised before obtaining this approval. This process should be done prior to September 1 each year, and is outlined below:

- The search committee creates a job description, and then sends it to the DLCI Head for review and approval.

- With the help of the department administrator, a Faculty Search Request is submitted to the Dean's Office via the SoS Faculty Search Request app. Search Requests undergo review by the faculty affairs and DEI teams in the Dean's Office.

Note that faculty search approvals expire after 12 months from the date of approval.

Section II: Preliminary Discussions and Outreach

Once the search has been approved and posted, the search committee is expected to read this handbook. The committee is also encouraged to promote *active outreach to solicit a broad applicant pool*. This should include some or all of the following activities:

Meeting presentations: DLCIs should request faculty to include a slide about ongoing searches when they give talks at scientific meetings or visits to other institutions.

Department alumni: DLCIs should reach out to departmental alumni requesting the names of potential candidates. The search committee can then invite those candidates to apply. These could include a list of fellowship recipients, and/or other awardees and honorees.

Award Recipients of Professional Societies: Professional societies typically announce a list of honorees and awardees annually. The search committee could invite such individuals to apply. Examples of professional societies are included in Appendix 2. If the search committee know of professional societies that could be added to this list, please let the Dean's Office know.

Minority Serving Institutions (MSIs): DLCIs and search committees are encouraged to check out the NASA List of Minority Serving Institutions and the NASA MSI Exchange, a searchable list of MSIs offering specific scientific fields. The search committee should reach out to MSIs that have relevant programs/departments to spread word of the search and invite potential candidates to apply.

Fellows: Search committees could also reach out to recipients of prestigious fellowships, including those by federal funding agencies (e.g., NSF, NASA) and other organizations, to invite them to apply to the search.

Section III: Conducting the Search

Following the above, the search committee should do the following:

Search committee briefing: Wherever possible, the search committee should attend a briefing on *guidelines and best practices for promoting inclusive searches*. These could be conducted by the department's Diversity, Equity, Inclusion Officer (DEIO) where applicable, or a faculty member who serves on the departmental DEI committee or related body. Additional resources on Hiring at MIT are available through MIT Human Resources.

Managing applications: Application materials should be managed in the method that best suits DLCI needs and MIT's reporting requirements. The School of Science encourages committees to use Academic Jobs online, a flexible web-based application management system.

Demographic data: The departmental administrator supporting the search has access to the aggregated demographic data (specifically gender and race) of the applicant pool. This could be compared to the national level data for that field, using NSF data on who earns a doctorate in US universities.

Candidate evaluation tool: An example of a tool that can help promote consistency and equity in the process of evaluating candidates is using a form that solicits evaluation on a range of core criteria (See Appendix 3). Note that this is just an example and that search committees should feel free to develop their own tool/evaluation form as appropriate.

Reading applications thoroughly: Some strategies to promote an inclusive evaluation of applications include but are not limited to:

- o Discussion of implicit/unconscious biases and strategies to address biases in the selection process. For example, research shows that male applicants are more likely to be described in terms such as "star" and "brilliant" whereas female applicants are more likely to be described in terms such as "team player" and "nurturing".

- o Reading letters of recommendation with the understanding that letters may contain implicit/unconscious associations. See guidelines on avoiding bias in recommendation letters outlined in Appendix 7.

- o Acknowledging that a publication record may have gaps because a candidate took time for familial responsibilities, and/or were significantly impacted by the pandemic. The data reveal that these have disproportionately impacted women and people of color.

- o Considering all aspects of the application, including whether they have a track record of engaging in formal and/or informal mentoring of underrepresented groups, and/or activities promoting an inclusive work environment and demonstrating community citizenship.

- o Evaluating a candidate on their entire portfolio rather than just one metric such as publications.

Section IV: Creating a Shortlist and Interviewing Candidates

Once the above steps have been completed, the search committee will create an initial shortlist, and then following community feedback, will create a final shortlist and interview schedule.

Creating an initial shortlist: The search committee should create an initial shortlist of approximately 15-20% of the candidates. As per MIT policy, search committees have access to only broad aggregated demographic data for the applicant pool.

Soliciting feedback from students: The search committee should solicit feedback from graduate students. One way to achieve this is to include graduate students on the search committee. This is already the norm in some departments and offers a high level of transparency and inclusion. Another mechanism is to reach out to the departmental graduate student committee for feedback on the shortlisted candidates. Details on how to do this are outlined in Appendix 5. Soliciting feedback from students should be done with the same expectation of confidentiality as would be expected when soliciting feedback from faculty.

Creation and approval of a shortlist: Search committees should conduct initial interviews online (e.g., via Zoom) to allow for a larger number of interviewees than would otherwise be feasible in-person. To ensure consistency and fairness, the questions should be the same for all candidates – ***see MIT interviewing guidelines outlined at the end of this section***. The committee will then arrive at a final shortlist. Wherever relevant and possible, search committee members should solicit input on candidates' mentoring skills in addition to other information the committee considers relevant. The committee chair prepares a detailed search report including the list of Zoom interviews conducted and a list of candidates the department would like to invite for in-person interviews. A final search report must be approved by the Dean's Office before any offers can be made.

Scheduling interviews: Once the final shortlist is approved, the search committee can begin scheduling interviews. To ensure consistency and fairness, the process should be the same for all candidates – ***see MIT interviewing guidelines*** outlined in *Relevant MIT Policies and Resources*. Please arrange meetings with the Dean or Associate Deans with any candidates whom the search committee feels will be positively influenced by such a meeting.

Interview structure: While each search committee will likely have its own preferred structure for interviewing candidates, ***the same interviewing structure and process must be used for all candidates, including any internal MIT candidates***. Typically, these include having a candidate give one or more talks, as well as interviews with faculty members, including junior faculty. Committees should also organize meetings with students, postdocs, and others as appropriate, who should have the opportunity to provide feedback to the committee. All interviewers are also encouraged to review MIT's Guidelines for Interviewing and the MIT Human Resources Interviewing Guide. Note: In order to maximize participation by the community, it would be useful to record the candidate talks, with the permission of the candidate.

Section V: Final Selection and Offers

Once in-person interviews are complete, the search committee presents their results to the department at a faculty meeting. Faculty meetings where cases are considered should be scheduled to allow as many faculty members to participate as possible, with adequate advance notice of the meeting's occurrence (approximately 1-2 weeks). Zoom or a hybrid format should be considered to enable maximum participation. The case should be made available for faculty review at least 5 business days prior to the meeting to allow comments to be submitted ahead of the meeting.

As a reminder, a final search report must be approved by the Dean's Office before an offer can be made. Once the department decides to make an offer, the DLCI Head or their representative contacts the candidate to discuss space, start-up requirements, and other negotiable items required for the offer to be considered and funded by the Dean. Between the final selection of the candidate and the creation of the offer letter, there are various logistical, HR, and financial components to the search process. For details on these, search committees should reach out to their HR units, and contact the Dean's Office Faculty Affairs team if needed.

Once the case is approved by the Dean and financial support is secured from the Provost, the Dean's Office notifies the Department Head that the case is approved and confirms any modifications to the start-up package. The offer letter is prepared by the Department Head and sent to the candidate with a cc: to the Dean and the Dean's Office faculty affairs team. Once the candidate notifies the Department of their decision, the Department Head notifies the Dean.

Important! Communications with Faculty Candidates: A DLCI Head may convey to a candidate that a *recommendation* of an offer has been made to the department. The DLCI Head may ask the candidate about his or her start-up needs but may *not* tell the candidate that an offer will be forthcoming without the written permission of the Department Head, with a copy to the Dean. The Department Head should only provide this permission after the standard procedures of the department have been followed. The DLCI Head should not provide details of what the offer will be, even informally, without the prior permission of the Dean. The Dean must see the case and approve it before this permission is granted. There must also be agreement between the Dean and DLCI Head about the size of the startup package and contributions from the department, affiliated units, Dean, and Provost before an offer can be made.

Relevant MIT Policies and Resources

Search committees and DLCs should familiarize themselves with the following MIT policies and procedures:

- MIT Search, Appointment, and Promotion Process for Faculty
- MIT Conflict of Interest Policy
- MIT Non Discrimination and EOAA Policies
- MIT's Guidelines for Interviewing and the MIT Human Resources Interviewing Guide

Relevant MIT Forms

Forms related to the faculty search process are available to administrators on the School of Science Canvas site.

- Start-up Request Form
- Space and renovation requirements and costs
- NIFAL Approval Form

Other Search Guidelines

The following detailed guidelines are also available:

- A Guide for Search Committees: University of Wisconsin-Madison

- Handbook for Faculty Searches and Hiring: University of Michigan

Appendix 1: Advertising Venues and Resources to Broaden Applicant Pool

- American Indian Science and Engineering Society: Opportunities Board
- American Physical Society: Minorities in Physics
- American Psychological Association: Ethnicity, Race, and Cultural Affairs
- American Psychological Association: Women's Programs Office
- Association for Women in Science (AWIS): Career Center
- Black Chemist: Jobs
- Black in Neuro: Jobs
- Diverse Issues in Higher Education: Jobs
- GeoLatinas: Latinas in Earth and Planetary Science: Outreach
- HBCU Connect: Career Center
- Higher Ed Jobs: Jobs
- Hispanic Outlook in Higher Education: Job Board
- IM Diversity: Jobs
- Insight into Diversity: Jobs
- Institute for Broadening Participation: Pathways to Science
- Journal of Blacks in Higher Education: Jobs and Opportunities
- LGBT in Higher Ed: Jobs
- National Association of Black Geoscientists (NABG): Job Postings
- National Society of Black Physicists: Jobs
- Out to Innovate, formerly known as National Organization of Gay and Lesbian Scientists and Technical Professionals (NOGLSTP): Career Resources
- Society for the Advancement of Hispanics/Chicanos and Native Americans in Science: Job Opportunities
- Tribal College: Journal of American Indian Higher Education: Job Board
- Women in Higher Education: Jobs

Other Recruiting Resources:

Availability Pool:

- National Science Foundation (NSF): Survey of Earned Doctorates

Databases:

- National Aeronautics and Space Administration (NASA): [List of Minority Serving Institutions](#) and the [NASA MSI Exchange](#), a searchable list of MSIs
- Texas Tech University (TTU): [National Registry of Diverse and Strategic Faculty](#)

Social Media:

In addition to the above, search committees should work with their department communications professionals to post the open positions on their departmental websites and link to these via posts on social media as appropriate.

Search committees are encouraged to follow the social media accounts of professional societies to learn about upcoming conferences and events and to follow conversations to better understand concerns and experiences of underrepresented and marginalized groups in STEM.

Appendix 2: List of Professional Societies

Professional societies typically offer annual honors and awards to outstanding scientists and researchers. Search committees should reach out to relevant recipients and invite them to apply for the search. Here are some professional societies relevant to science.

- American Association for the Advancement of Science
- American Astronomical Society
- American Chemical Society
- American Geophysical Union
- American Institute of Biological Sciences
- American Institute of Physics
- American Mathematical Society
- American Nuclear Society
- American Physical Society
- American Society for Cell Biology
- American Society for Biochemistry and Molecular Biology
- Geochemical Society
- Geological Society of America
- Materials Research Society
- Mathematical Association of America
- National Association of Geoscience Teachers
- Optical Society of America
- Society for Industrial and Applied Mathematics
- Society for Integrative and Comparative Biology

The following offers a method for department faculty to provide evaluations of job candidates. This is a template that departments can modify as necessary for their own uses. The proposed questions are designed for junior faculty candidates; however, alternate language is suggested in parenthesis for senior faculty candidates.

Candidate's name:

Please indicate which of the following are true for you (check all that apply):
- ☐ Read candidate's CV
- ☐ Read candidate's scholarship
- ☐ Read candidate's letters of recommendation
- ☐ Read candidate's statements (e.g., research, teaching, diversity)
- ☐ Attended candidate's job talk
- ☐ Attended lunch or dinner with candidate
- ☐ Met with candidate
- ☐ Other (please explain):

Please rate the candidate on each of the following:	excellent	good	neutral	fair	poor	unable to judge
Potential for (Evidence of) scholarly impact						
Potential for (Evidence of) research productivity						
Potential for (Evidence of) research funding						
Potential for (Evidence of) collaboration						
Potential for (Evidence of) promoting diversity, equity, and inclusion						
Fit with department's priorities						
Ability to make positive contribution to department's climate						
Potential (Demonstrated ability) to attract and mentor graduate students						
Potential (Demonstrated ability) to teach and mentor undergraduates						
Potential (Demonstrated ability) to mentor diverse students						
Potential (Demonstrated ability) to be a conscientious community member						

Other comments?

For more information about this form, visit: https://advance.umich.edu/resources/

The following show some faculty demographics at the School of Science.

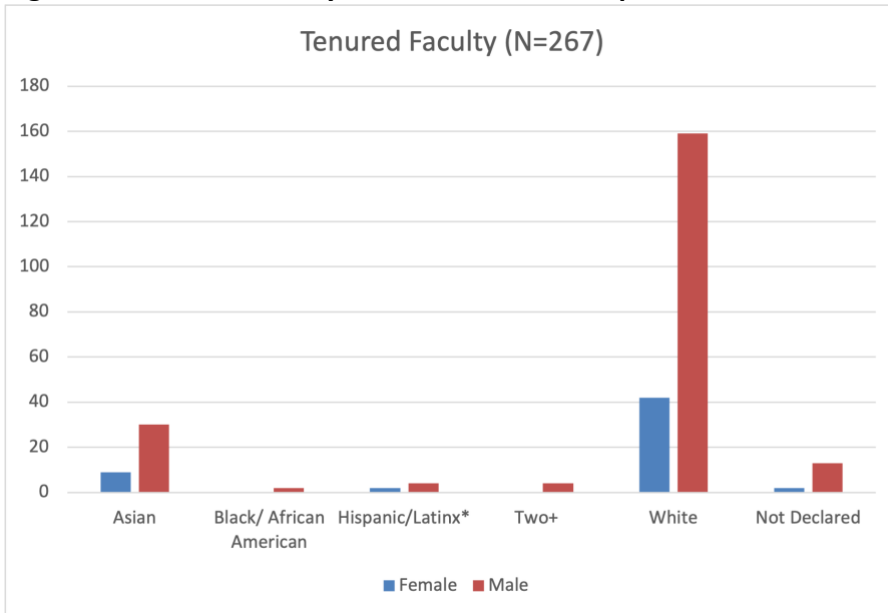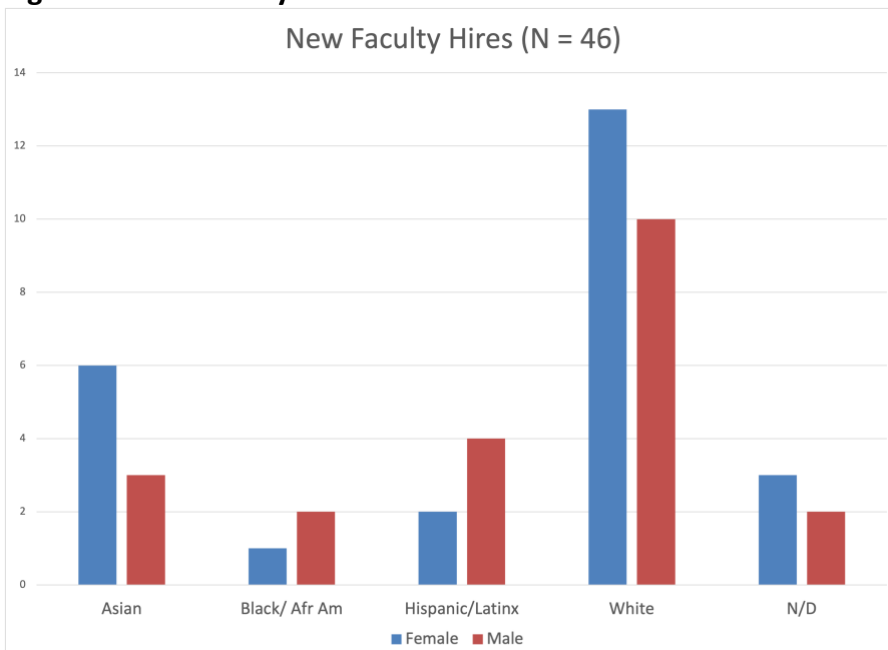**Figure 1: Tenured Faculty, School of Science, April 2023**

Figure 2: New Faculty Hires Jan 2021 – Jan 2024

Appendix 5: Guidance on Student Participation in the Faculty Search Process

Students are an integral part of MIT, and they are taught and mentored by MIT faculty. Accordingly, feedback from graduate students and several faculty across the School of Science indicate that they view student participation as an essential part of the faculty search process. Some departments have expressed concerns around confidentiality, especially for letters of recommendation and research statements. This appendix outlines a process by which students can participate in faculty searches, while acknowledging and honoring departmental concerns around maintaining confidentiality.

Currently, practices on involving students in faculty searches vary across departments. Some searches have students serving as full members of the search committee; some searches have little to no student involvement; and some searches have some student involvement such as meeting candidates for lunch. The process outlined in this appendix should be considered the minimum level at which students should be involved; departments and/or search committees can choose to involve students more deeply if they wish. Some departments within the School of Science involve students significantly more than what is outlined below.

Students can participate in the faculty search process in the following ways:

- Having a graduate student representative on the search committee;
- The departmental graduate student committee (or a group of graduate students as considered appropriate by the search committee) has access to the shortlisted candidates' CVs and Teaching/Mentoring Statements;
- The students have an interview style lunch with the candidate, with questions developed in advance, using the same questions for each candidate;
- The students attend each candidate's job talk;
- The student provide feedback to the search committee chair – this feedback is advisory.

Student feedback could include:

- Candidate's potential for teaching;
- Candidate's communication skill/ability;
- Candidate's collegiality and potential to be an engaging colleague;
- Candidate's potential to be an excellent mentor;
- Whether students are excited about the candidate's area of research;
- Anything else that the search committee would like feedback on

Documentation within Dean's Office

Starting from the faculty search cycle in the Fall of 2024, faculty search requests to the Dean's Office must include a Student Engagement Plan. This section should be brief, no more than one

or two paragraphs, and should explain how student participation and feedback will occur in that faculty search.

Involvement of Postdoctoral Scientists

Given the huge variation in the roles and responsibilities of postdoctoral researchers, and the fact that they might also be applying for these faculty positions, it is up to the discretion of the department and/or search committee on whether to include postdoctoral researchers in the faculty search process.

The following has been provided by the MIT Office of the Provost as a template for faculty hiring:

The [insert Department name] of the Massachusetts Institute of Technology, located in Cambridge, Massachusetts, invites applications for the faculty position[s] described below. The Department offers supportive mentorship to junior faculty and instructors, an exceptional environment for [insert] inquiry, and a strong commitment to an inclusive, welcoming culture.

We request that applications and other materials, including (a) curriculum vitae, (b) research statement, (c) {a teaching and mentoring plan}, d)*(optional or not based on dept preference)* broader impact statement, and (e) [x] letters of recommendation be submitted online at [insert].[1] The broader impact statement can cover topics including but not limited to service, contributions to the university community, or other means of supporting the educational environment. To receive full consideration, applications must be completed by [insert date].

MIT is an equal opportunity employer. We value diversity and strongly encourage applications from individuals from all identities and backgrounds. All qualified applicants will receive equitable consideration for employment based on their experience and qualifications and will not be discriminated against on the basis of race, color, sex, sexual orientation, gender identity, pregnancy, religion, disability, age, genetic information, veteran status, or national or ethnic origin. See MIT's full policy on nondiscrimination. Know your rights.

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[1] *Where item (c) might be removed for departments that prefer not to use a teaching plan or statement; item (d) might be made optional for the candidate, and some departments may opt out of using a broader impact statement (item d).*

Appendix 7: Guidelines on Avoiding Bias in Letters of Recommendation

Social science research shows that male applicants usually receive stronger letters than female applicants,[*] and that both male and female letter-writers exhibit similar biases. While research on recommendation letters often focuses on gender bias, there are other types of bias as well. Research also shows that there is often bias in how some people's contributions are perceived, and this can impact how they are described in letters of recommendation. Given the significant role that recommendation letters play in hiring decisions, reducing bias in these letters will help promote equitable and inclusive searches in STEM fields.

Communal vs. agentic: Women tend to be described in communal terms ("reliable"; "caring") and men in agentic terms ("confident"; "assertive"), and these communal terms tend to have a negative impact on hiring decisions (Madera et al., 2009). Try to counteract this tendency by mentioning other character traits, e.g., "highly motivated", "dynamic", "passionate".

Accomplishments: Take care to mention accomplishments, including publications, as research suggests that men are more likely to cite themselves compared to women (King et al., 2017). Also mention any DEI-related contributions and accomplishments, as underrepresented groups play a disproportionate role in advancing diversity and inclusion (Jimenez et al., 2019).

Skills: Before writing a letter look at the job description and identify the necessary skills. Examples could include "creativity", "problem-solving skills", "analytical skills". This will help avoid reliance on gendered language.

Assigning credit: Be mindful when assigning credit – research shows that men are more likely to be credited with the big picture (e.g., vision, ideas) whereas women are more likely to be credited with supporting roles and providing the labor of science (Macaluso et al., 2016).

Letter tone: Research shows that the tone and language of letters written for male applicants are stronger than those written for women (Dutt et al., 2016) and that women are more likely to be described with doubt raisers (Trix and Psenke, 2003).

"Hardworking" and "intelligent" – to use or not to use: Previous research (Trix and Psenke, 2003) suggests that words like "hardworking" and "intelligent" – labeled "grindstone" adjectives – might be deterrents for women. However, the overwhelming majority of the letters examined in Dutt et al. (2016) described candidates as hardworking and intelligent. The main difference was that some letters went significantly beyond that to describe the candidate in outstanding terms, while others did not. So, the key question is not whether to use words like "hardworking" and "intelligent", but more importantly, what is the best thing that is being said about the candidate?

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[*] The studies on gender differences mentioned in this document use binary identifiers – male or female.

Avoid rushing: Evaluate materials without rushing as we are more likely to make snap judgments when rushing or under stress, causing us to rely on stereotypes and implicit bias.

Avoid qualifiers and stereotypes: Avoid qualifiers wherever possible, e.g., "For someone with two small children, she is a very productive scientist". Similarly, avoid comments that reinforce stereotypes, e.g., "As a Black scientist, she is a credit to her race" and "For an Asian his English is very good."

John or Jennifer: A study found that male applicants for a lab manager position were ranked more highly than female applicants with identical qualifications (Moss-Racusin et al., 2012).

Innate brilliance: A study found that women and people of color (especially African Americans) were stereotyped as not possessing the raw talent and innate brilliance perceived as a requirement for certain fields such as STEM (Leslie et al. 2015). In a similar vein, another study found that words like "brilliant" and "genius" in online teaching evaluations were significantly lower for women and African Americans (Storage et al., 2016)

Racial/ethnic bias: A study found that CVs with western names like Emily and Greg were 50% more likely to receive interview callbacks than identical CVs with ethnic names like Lakisha and Jamal (Bertrand and Mullainathan, 2003)

Intersectionality: Women of color tend to have worse experiences in STEM (Clancy et al., 2017) including the highest levels of harassment. They are also less likely to be invited to give talks (Ford et al., 2019). Additionally, studies showed that women and people of color (especially Black scientists) received less NIH grant funding than similarly qualified men and/or White scientists (Oliveira et al., 2019, Ginther et al., 2011).

Role of recommendation letters: Letters of recommendation play a significant role in STEM hiring decisions (Potvin et al., 2017, Madera et al., 2009), so taking steps to reduce bias in these letters will help promote equitable and inclusive searches in STEM fields.

Concluding note: The overarching goal is not to simply start writing stronger letters for everyone; rather, it is to ensure that similarly qualified applicants are described in similar language, thereby avoiding unconscious biases in the STEM hiring process.

Appendix 8: Summary of Social Science Research on Implicit Bias

This section provides a summary of the social science research documenting implicit bias. This summary, along with a complete bibliography, will be provided to search committees at the time of the briefing on best practices for inclusive searches. Research shows that we all tend to hold unconscious/implicit biases, whatever our identity. These begin in early childhood and continue in adulthood. Unless checked, these biases disproportionately affect underrepresented and marginalized groups. These are apparent in the following:

Gender Bias[*]:

- **Hiring**: In one study, application materials for a lab manager position were randomly assigned a male or female name, and science faculty were asked to rate the application materials. Faculty rated the male applicant as significantly more competent and hirable than the (identical) female applicant, and offered a higher starting salary. Both male and female faculty were equally likely to exhibit bias against the female student. (Moss-Racusin et al, 2012). An older study found that both men and women were more likely to select a male applicant than a female applicant with an identical record, and credit the male applicant with more teaching, research and service experience compared to the female applicant with an identical record (Steinpres et al., 1999).

- **Nonbinary and Transgender**: Using data from the National Transgender Discrimination Survey, a study found that being out as a nonbinary transgender person has different effects on nonbinary transgender people based on sex assigned at birth, with those assigned male at birth (AMAB) tending to be discriminated against in hiring but those assigned female at birth (AFAB) more likely to experience differential treatment once hired. Transgender women tend to have worse employment experiences than nonbinary transgender people and transgender men, the latter two tending to have similar outcomes (Davidson, 2016).

- **Letters of Recommendation**: A study of recommendation letters in the geosciences found that regardless of the gender of the letter writer, male applicants were more likely to receive outstanding letters compared to female applicants (Dutt et al, 2016). Another study found that women were more likely to be described in communal terms (e.g., "reliable" or "caring") and men in more agentic terms (e.g., "confident" and "dynamic"), and that these communal characteristics were negatively related to hiring decisions based on letters of recommendation (Madera et al, 2009). A study in medicine found that men were more likely to be described as "brilliant" and "superb" while women were more likely to be described as "hardworking" and "intelligent" (Trix & Psenke, 2003).

- **Reviewing Journals**: A study in the geosciences found that women were used less as reviewers than expected (on the basis of their proportion of membership of the society and as published authors in journals). The bias was a result of authors and editors, especially male ones, suggesting women as reviewers less often, and a slightly higher

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[*] The studies on gender differences mentioned in this document use binary identifiers – male or female

decline rate among women in each age group when asked (Lerback and Hanson, 2017).

- **Salaries:** A report in Nature revealed that female scientists earn between 25% and 40% less than their male counterparts (Shen, 2013). Studies also show that salaries for women don't progress as quickly as salaries for men (Valian, 2005), and that women ask for less than their male colleagues (Babcock & Laschever, 2003).

- **Performance Evaluation:** Data from symphony orchestra auditions showed that with the introduction of blind auditions (i.e., the judges did not know the gender of the person auditioning), the number of women hired increased significantly. (Goldin and Rouse, 2000).

- **Teaching Evaluations**: A study found that a professor with a male name received higher teaching evaluations than an identical professor with a female name, and that this bias was not limited to subjective aspects such as how good the students believed the teacher was, but also for objective questions such as whether the teacher returned homework assignments on time (Boring et al, 2016).

- **Scientific Contribution:** A study found that women disproportionately perform the labor and experimental work of producing science – such as pipetting and centrifuging – while men are more likely to credited for the bigger picture such as conceiving ideas and analyzing data (Macaluso et al, 2016).

- **Entrepreneurial Ventures**: A study found that investors preferred entrepreneurial ventures pitched by a man over identical ventures pitched by a woman by a rate of 68% to 32%. Investors found the male pitches more "persuasive, logical, and fact- based" than the *identical* female pitches (Brooks et al., 2014).

- **Math Task:** A study found that without any information other than a candidate's appearance, both men and women were twice as likely to hire a man than a woman to do an arithmetic task that, on average, both genders perform equally well. This discrimination survived if performance was self-reported because men had a greater tendency to boast about their performance. This discrimination was reduced but not eliminated by providing full information about previous performance on the task (Reuben et al., 2014).

- **Publications:** A study of postdoctoral fellowships found that peer reviewers gave female applicants lower scores than male applicants who showed the same level of scientific productivity. The study also found that women needed 2.5 times more publications as men to achieve the same rating on scientific competence as men. The study also found a "friendship bonus" i.e., knowing someone on the review panel improved one's rating of scientific competence (Wenneras and Wold, 1997).

- **Citations:** A study found that men were more likely to praise their own research as "excellent" and "unique" and "novel" compared to women (Jagsi and Silver, 2019). An earlier study found that men cited their own papers 56% more than women on average, and that this gender gap in self-citation remained stable despite increased representation of women in academia in recent decades (King et al, 2017). A 2021 study found that articles in high-impact journals written by women primary or senior authors

had fewer citations than those written by men primary or senior authors. Articles written by women as both primary and senior authors had approximately half the number of citations as those authored by men as both primary and senior authors (Chatterjee et al, 2021).

- **Negotiations**: A study found that women who negotiated a higher salary were perceived as being more difficult and less nice to work with compared to men who negotiated a higher salary (Bowles et al., 2005). Another study found that due to the negative stereotype of aggressiveness associated with women leaders, women avoided leadership opportunities (Davies et al., 2005).

- **Attitude Towards Evidence of Gender Bias:** A study found that men evaluated gender bias research less favorably than women, and this was especially prominent among male faculty in STEM fields (Handley et al, 2015).

Race & Ethnicity Bias, and Intersectionality:

- **Speaking Opportunities:** A study found that female scientists were invited and assigned oral presentations less often than men at conferences, and that male primary conveners allocated invited abstracts and oral presentations to women less often and below the proportion of women authors (Ford et al, 2018). A related study found that women of color – in particular from underrepresented minorities – were least likely to be invited to speak at conferences (Ford et al, 2019).

- **Innate Talent**: A study found that women and minorities (particularly African Americans) were underrepresented in fields where raw innate talent and brilliance were considered a requirement for success in those fields, since they were stereotyped as not possessing such brilliance. This bias was reduced for Asians (Leslie et al, 2015). Another study found that words like "brilliant" and "genius" in online teaching evaluations were significantly lower for women and African Americans (Storage et al, 2016).

- **Workplace Experiences:** A study in astronomy and planetary science found that women of color experienced the highest rates of negative workplace experiences, including harassment and assault (Clancy et al. 2017).

- **Leaving STEM Fields at Higher Rates:**   A study found that while Black, White, and Hispanic/Latinx students were similarly likely to enroll in STEM fields, Black and Hispanic/Latinx students left STEM at higher rates, even for students with similar academic preparation (Reigle-Crumb et al, 2019)

- **"Where Are You Really From?"** A study found that Asian Americans commonly experience identity denial, and are perceived as less American than other groups (Cheryan and Monin, 2005)

- **NIH Grant Awards**: A study revealed that Black scientists were far less likely to receive NIH funding for a research idea than White scientists from a similar institutions and research records. A smaller gap was also found for Asians, though this gap disappeared when only US citizens were included. (Ginther et al., 2011). A more recent study showed that for early career scientists, women received approximately $41,000 less grant funding

on average than male scientists (Oliveira et al, 2019)

- **Foreign Accents:** Non-native accents make it difficult for native speakers to understand what is being said, and thereby reduces cognitive fluency, i.e., the ease with which the brain processes it. A study found that this caused people to doubt the veracity of what was being said. This credibility bias was somewhat reduced for milder accents compared to heavier accents (Lev-Ari and Keysar, 2010).

- **Interview Callback:** Using fictitious resumes a study found a significant racial gap in callbacks for interviews. Resumes with traditionally White names such as Emily and Greg elicited 50% more callbacks than similar resumes with Black/ethnic names such as Lakisha and Jamal. (Bertrand and Mullainathan, 2003).

- **Treatment of Ambiguity:** A study found that White participants did not discriminate against Black candidates relative to White candidates when the candidates' qualifications were clearly strong or weak, but they discriminated against Black candidates when the decision was more ambiguous. That is, when a candidate's qualifications for a position were ambiguous, bias against Black people was stronger than bias against equally qualified White people (Dovidio and Gaertner, 2000).

LGBTQ+ Bias:

- **Leaving STEM at Higher Rates:** A study found that LGBTQ students were more likely to leave STEM majors than their straight counterparts (Hughes, 2018)

- **Workplace Experiences:** A study found that after controlling for variation by demographic, discipline, and job factors, LGBTQ STEM professionals were more likely to experience career limitations, harassment, and professional devaluation than their non-LGBTQ peers. They also reported more frequent health difficulties and were more likely to intend to leave STEM (Cech and Waidzunas, 2021).

- **Harassment:** While women commonly experience more harassment than men, a study found that LGBTQ+ women and gender minorities in particular were more likely to be harassed than cisgender, heterosexual women (Richey et al, 2019).

- See also **Nonbinary and Transgender** section under **Gender Bias** section.

Appendix 9: Bibliography

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