A Guide for Broadening Faculty Searches at Montana State University

Transforming the Search Process to Enhance Excellence and Diversity

Fifth Edition
Dear MSU Community

We thank you for giving your time, effort and talents to serve on a search committee, which is an important responsibility. We also thank you for taking an additional few minutes to read the Montana State University Search Toolkit, which has been developed with the goal of building a strong, diverse workforce at MSU.

Our campus is determined to enhance the diversity of perspectives and the number of diverse role models to guide students as they prepare for citizenship and employment in an increasingly global society. This toolkit is chock full of hints and tips to optimize and expand search pools. More choices means better access to highly qualified applicants and a greater likelihood that the best candidate for the position applies. The concepts included in the toolkit have proven to be effective, as demonstrated in controlled scientific studies. The toolkit is a fundamental part of the strategy to transform the campus climate to allow a diverse faculty, staff and student body to thrive.

Warmly,

Waded Cruzado, President

Martha Potvin, Former Provost

Co-PIs of ADVANCE Project TRACS (2012-2017)
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About This Search Toolkit

Many institutions have made great strides in combatting unintentional hiring discrimination against women and minorities in recent years and have now moved on to addressing other causes of underrepresentation, especially differences in family life expectations between the sexes (Ceci and Williams, 2011; Williams and Ceci, 2012). Unfortunately, MSU has lagged behind these institutions and must confront both problems simultaneously.

This toolkit provides step-by-step procedures and tips that your search committee and department can use to increase and retain diverse faculty, depending on the specific diversity needs of your department. We have also developed a webinar that, with a facilitator, will help educate your search committee on key issues and guide you through this toolkit (see: http://www.montana.edu/nsfadvance/videos/SearchTrainingWebinar-Mar2016.ppsx). Although some information in this toolkit is MSU-specific and written by members of our ADVANCE Project TRACS team, much of it was borrowed directly from other sources, including the University of California Affirmative Action Guidelines for Recruitment and Retention of Faculty, Northwestern University’s Recruiting and Retaining Minority and Female Faculty: Some Suggested Best Practices, the University of Michigan ADVANCE Faculty Recruitment Handbook (Hopkins, 2006), and especially Searching for Excellence and Diversity: A Guide for Search Committee Chairs, which was published by the Women in Science and Engineering Leadership Institute at the University of Wisconsin-Madison.

This toolkit is intended to supplement Searching for Excellence & Diversity: A Guide for Search Committees authored by Fine and Handelsman (2012). We provide an introduction to concepts addressed at length therein. We recommend that all search committee chairs peruse Fine and Handelsman (2012) and that other search committee members read this guide.

Enhanced search procedures increase both the quality and diversity of the applicant pool!

The two most important actions to increase diversity in a search are to:

1. Expand recruitment strategies and tactics to increase the size and depth of the applicant pool; and
2. Recognize that we all (yes, you too) hold unintentional biases and assumptions that influence our evaluation of applicants. We must actively work to counteract these biases and assumptions to recruit the finest faculty possible.
Infusing Psychological Need Support into Faculty Search Processes: An Intervention to help Broaden the Participation of Women Faculty

Background: A diverse university faculty stimulates student and faculty creativity, discovery, and satisfaction. At Montana State University, the Science, Technology, Engineering, and Mathematics faculty are largely homogenous (81% men). Intervening in the search process is one potential way to enhance faculty gender diversity. But how to do this? According to Self-Determination Theory (Deci & Ryan, 2000), effective functioning and personal growth emerge when autonomy, competence, and relatedness needs are supported. Informed by this theory, a faculty search intervention was designed by ADVANCE Project TRACS to:

- Enhance competence of the search committee by delivering concrete strategies for conducting a broad search
- Enhance autonomy of the search committee by illustrating how unconscious bias can undermine decision making and
- Enhance relatedness of the committee by offering personal assistance throughout the process and enhance relatedness of job finalists by connecting them with a faculty Family Advocate to discuss work-life integration.

Methods: A randomized field experiment, blocked by college, was conducted with all 23 STEM searches in one academic year (intervention n=14). A Broadening the Search Record Survey was sent out and completed by Deans, Search Chairs, or Department Heads. Semi-structured phone interviews with 7 job candidates were conducted to assess how candidates’ view meeting with the Family Advocate.

Results: t-test analyses and odds ratio analyses found that compared to searches in the no-intervention condition, searches in the intervention condition:

- Phone interviewed significantly more women ($p< .02$)
- On-campus interviewed a significantly greater proportion of women ($p< .05$).
- Were 6.3 times more likely to make an offer to a woman candidate, and these women candidates were 5.8 times more likely to accept the offer.
- Further, qualitative evidence showed candidates view the meeting with the Family Advocate as a positive experience.

Summary: Results suggest that the intervention was effective in broadening the participation of women faculty.

Diversity is an issue that inevitably surfaces in every search. The diversity of a college’s or university’s faculty and staff influences its strength and intellectual personality (Fine and Handelsman, 2012). Homogeneity has a tangible downside; ask yourself, can we really grow and learn best from each other as a department if we all share the same general perspectives and experiences? Not really. For example, until 1990 medical research in the USA was conducted mostly by White male scientists on White male subjects, which very much limited the generalizability and scope of medical knowledge (Dresser, 1992).

Enhanced creativity, critical and divergent thinking, insight, productivity, job satisfaction and economic efficiency—these are the products of diversity within work environments (Herring, 2009; Smith et al., 1997; Temm, 2008).

Academic departments and universities with more diverse faculty instill better educational outcomes among diverse students (Carrell, Page & West, 2010).

**Did you know?** Diversity and inclusion messages aimed at one group (e.g., white women) can create “identity safety cue transfers” among other diverse people (men of color). (Chaney et al., 2016). The things we do to improve the search process can benefit everyone, across a spectrum of identities (Mitchneck, Smith & Latimer, 2016).

**Diversity Matters:**

- Because more diversity deepens the applicant pool, and increases the chances of finding excellent people to work at MSU.
- Because diversity can challenge assumptions about the status quo and thus enhance creative problem solving.
- Because real examples of people from different ethnicities, genders, religions and walks of life disrupt stereotypes (good or bad!) that we might carry around in our heads.
- Because equity, inclusion, and fairness are fundamental to higher education.
- Because diversity enhances the translation of research findings and teaching practices to programs and policies that serve more Montanans.
- Because the world is diverse and MSU students, staff, and faculty benefit from exposure to people from different corners of the earth with different life experiences and perspectives.
- Because diversity keeps things interesting!
Missed Opportunities
Montana State University has one of the least gender and ethnoracially diverse faculty among the top-rated High Research Activity academic research institutions, particularly in STEM and SBS departments, as shown in the graphs below of MSU tenure-tenure track faculty. The bottom line is clear; MSU faculty are very similar to one another demographically. Is this really best for our students, our creativity, and for discovery?

Look up your Department’s faculty data from the last several years with comparisons to national norms, land-grant university norms, and the number of new PhDs:
http://www.montana.edu/opa/facultystaff/index/diversity/index.html
...In administering a program the recipient [of federal funding] must take affirmative action to overcome the effects of prior discrimination Civil Rights Act (1964) (34 CFR § 100.3(b)(6)(i))

Affirmative Action is a program to which all recipients of federal funding must adhere. The purpose of Affirmative Action is to redress the pervasive historical discrimination against particular "discrete and insular" minorities and women in the United States. Sometimes avoiding discrimination requires not acting in certain ways.

But sometimes avoiding discrimination and cultivating diversity requires taking positive measures to recruit, retain, and advance employees or students who have traditionally been excluded from certain jobs or educational opportunities.

Given legacies of discrimination, sometimes doing nothing amounts to perpetuating exclusion – for example, a business does not have to hang a sign saying "disabled need not enter;" if there is no wheelchair accessible entry de facto exclusion is virtually ensured. Actively including wheelchair users thus requires taking positive action to build a ramp. One way to think about Affirmative Action in hiring and university admissions, then, is to think not about giving certain runners a head start, but rather about fixing the broken or obstructed lanes on a track that have traditionally set certain runners back.

“MSU BOZEMAN employs appropriate methods to attempt to improve recruitment and increase the flow of qualified minorities and women applicants in and through its recruiting process.”
(Emphasis added, MSU Affirmative Action Plan 2013)
Diversity versus Quality?

Search committee members are often concerned that considering diversity will prevent selection of the “best” candidate as judged by number of publications, creative works, grant dollars, or other objective, quantitative criteria.

Yet, the reality is that search committee members seldom select the “best” candidate using such criteria anyway—for example, if a candidate’s area of expertise overlaps broadly with that of an existing faculty member or if it does not “sufficiently” match the vacancy announcement. In a department that currently lacks diversity, a candidate that adds diversity but is overlooked due to some criteria may actually be the best candidate overall for the program because of the benefits that diversity affords. To continue the example, a candidate that adds diversity can also add diversity to research perspectives, methods, etc., that can enhance the science or creative outputs of faculty with similar research interests, and may attract more diverse students and collaborators.

“Reverse Discrimination?”

Some search committee members may also be concerned about “reverse discrimination” against White men. Importantly, no evidence for “reverse discrimination” exists in academia (Chapter II in Fine and Handelsman 2012). White men are well-represented in academia; 78% of full-time tenured or tenure-track faculty in the U.S. are White and 62% are male.

All people are covered under civil rights laws, so if someone was not hired because of being white, or Christian, or male, for example, that would be discrimination just like if they were not hired because they were Somali, or Hindu, or a woman. Affirmative Action and intentionality around developing diverse pools of applicants doesn’t negate everyone’s rights under civil rights laws.

Keep in mind, we aim to overcome a history of underutilization, and the gains of women and minorities does not mean white men are now victimized. In fact, White men with some expertise related to diversity had a significant advantage in the job market (Smith et al., 1996). Further, we simply recommend that search committees consider diversity as an asset and use it as one criterion of evaluation, recognizing that the benefits in diversity might outweigh or balance out some shortcomings on other criteria, such as research overlap with other faculty.

Remind yourself and others that:

1) Reaching and attracting a more diverse applicant pool increases search committees’ chances of attracting more (i.e., otherwise missed) highly qualified individuals.

2) Diversity itself is a valuable asset candidates can bring to a department, in regards to teaching, research, service, and outreach.

3) ANYONE can demonstrate a commitment to creating an inclusive workplace. Infusing diversity into the search process can help you find a colleague who values and respects difference—no matter his or her identity.
The Self-Fulfilling Prophecy of Homogeneity

**But this is Montana!** Search committee members sometimes use Bozeman’s location and culture as a justification for searches that yield non-diverse pools. Search committee members often infer that a lack of women or minorities in the pool is a result of decisions by potential applicants to not apply because of our location or culture. It is possible that our fairly homogeneous applicant pools result instead from the wording of our job announcements, where we advertise, and us assuming that there will be a high-demand and competition for the diverse applicants.

Sure, there might be high-demand, but you simply don’t know their motivation for applying – they might really want to come here for any number of reasons! Committee members sometimes exclude applicants from consideration because of assumptions about how well they would fit in here or their perceived reasons for applying or assuming the person wouldn’t accept an offer. Some of these assumptions include:

“She will have so many other offers and won’t come to MSU with our low salaries”

“She is young and single and would never stay.”

“He is just using this search to get a raise at his current institution.”

Let applicants decide if MSU is a good match for them. Get them into the pool so that they have the opportunity to make that choice. Do not make the decision for them by not actively recruiting or considering them.

The preceding section was adapted from Chapter II of Fine and Handelsman, 2012.

**Reactance**

**My Search Committee does not see the need for this!** If you do not want someone to do something, tell them they have to do it. People greatly dislike having their freedom restricted, and will generally react against the statement or implication that they have no choice on a particular matter (Brehm, 1966). Thus, if search committee members feel they “must” consider diversity in their faculty searches, they may do so half-heartedly just to oppose, or react against, the seeming demand. So, it is important for the reader to understand that this toolkit was designed to optimize our faculty application pools in the hopes of recruiting the best faculty possible. This toolkit was designed as a way to enhance the diversity of the applicant pools with this goal in mind. Certainly, departments and search committees are not required to hire under-qualified candidates simply because they are from diverse backgrounds.
Won’t this lead to “reverse discrimination?”

No.

Federal contractors uphold EEO laws. What you are trying to reverse is years of past discrimination. As important, you are seeking to raise the diversity and excellence of our MSU faculty.

What about other kinds of diversity?

Of Course!

But don’t let what “counts” as diversity get out of hand. Yes, it is good to have people from various political backgrounds or from urban vs. rural locations, but keep in mind we are talking about underutilized and historically marginalized groups. Diversity does not mean a mix of snowboarders and skiers. Consider the value added of people with different physical ability, sexual orientation, religion, gender identity, race/ethnicity and other such lived experience. Such diversity adds richness to the campus environment for teaching, research, and collaboration.

Isn’t it illegal to consider gender and/or race and/or another diversity characteristic?

No.

As a federal contractor, MSU follows equal opportunity and affirmative action law - Executive Order 11246. What is illegal is discrimination. Given that often times people can tell if the applicant is male or female (for example, by the first name or the pronoun in a letter of reference) we already know – or think we know – the gender of the applicant. Instead of trying to pretend we “don’t consider gender” and aren’t influenced by the information (and we are, see the unintended bias section in this and the main handbook; Moss-Racusin et al., 2013), it is important to take a step back, see the whole picture, and know the proportion of men and women in your pool so that you can ask if a historically underrepresented person might deserve a second look.

Isn’t it better to ignore demographics and focus just on the quality?

Only in a perfect world.

Although well-meaning, the sentiment that one “doesn’t see gender” or is “color blind” can lead to overlooking systematic bias and make it difficult to see discrimination when it happens, (e.g., Apfelbaum et al., 2012). Because really, we already know the gender of a candidate (or think we know) and, without taking very extreme measures, we are likely unintentionally using that frame of reference to interpret the candidate’s qualifications (Jones & Urban, 2013). Embrace difference and talk openly about diversity and gender on your search committee and realize the value added that comes from a different life experience. Consider “adds depth and intellectual diversity and can mentor diverse students” as a unique qualification that the candidate brings to your department.
Steps to Enhancing Diversity at MSU

Step 1: Create a search committee environment that focuses on building a diverse applicant pool
(adapted from Fine and Handelsman, 2012, pages 6, 16, and 18)

A more diverse search committee will provide a greater variety of perspectives and new ideas that will help you attain a larger, deeper, applicant pool. We highly recommend including women (25% required) and minorities on search committees, but you can also increase diversity by including graduate students, research staff, faculty from other departments, and professionals from industry, non-governmental organizations (NGOs), or agencies.

Because we naturally prefer (and therefore hire) people similar to us, increased diversity on the search committee can increase the chances of seeking out, attracting, and recruiting diverse faculty. Equity Advocates are available to help form and advise diverse search committees that can recruit more diverse applicant pools.

Search committees should not assume that simply having women or minority committee members assures advocacy and consideration of diversity issues. Unwittingly, everyone—women and minorities and men alike—can succumb to unconscious biases while evaluating women and minority candidates. Therefore, every member must take personal responsibility for recruiting diverse and excellent applicants and evaluating them fairly and equitably. It is the committee’s responsibility to ensure that
1) the best candidates are in the pool, and
2) the best candidates receive top consideration and job offers.

Search-committee chairs need to stress that failure to recruit and fairly evaluate a diverse pool can jeopardize a search; lack of diverse finalists is often indicative of an inadequate search and will raise red flags among administrators. A search-committee chair does not want to grapple with the question “Why are there no women or minorities on your finalist list?” because they exist in every discipline. Resist the urge to blame the “pipeline” for yielding low numbers of available diversity applicants. The pipeline does not fully account for differences in hiring outcomes (e.g., Shaw & Stanton, 2012). Applicant pools lacking diversity might be the result of uninspired and halfhearted recruitment efforts.
The Vacancy Announcement

How to recruit an excellent and diverse pool of applicants?

Generating a large, diverse pool of applicants ensures that the best candidates are in the pool and increases the chances that, more often than in the past, the best candidate will enhance MSU’s diversity (Fine and Handelsman, 2012, page 17).

Use a broad vacancy announcement (position description) to allow people into the applicant pool that may not meet your qualifications perfectly, but that would enhance diversity and could therefore be preferred candidates when all things are considered. Vacancy announcements can exclude women and minority candidates by focusing too narrowly on subfields in which few women and minorities specialize. Similarly, do not list specific courses that the successful candidate will be expected to teach.

On average, men apply for a job when they meet only 60% of the qualifications. Women apply only when they meet 90% of them. (Mohr, 2014)

Thus, women are less likely to apply if they do not perceive that they are a perfect match for every preferred qualification. For example, if a commitment to summer field research is a preference in the job advertisement, a woman might assume this is “normative” information about expectations and perceive no flexibility in how she manages her field work schedule, so she decides not to apply (e.g., Van Hooft et al., 2006). Therefore, be very clear about preferred versus required qualifications. Pay close attention to language; research shows that women are less interested in applying for positions described with stereotypically masculine attributes such as “competitive,” “aggressive,” and “forceful” than those with more gender-neutral terminology such as “accomplished,” “successful,” and “committed” (Gaucher et al., 2011).

Include Multicultural Wording

Minority job applicants who read valuing diversity statements (vs. colorblind) infer an organization is more trustworthy and more accepting (Purdie-Vaughns et al., 2008). When a job advertisement or promotional materials, for example, convey a colorblind philosophy or ignore diversity all together, people anticipate more bias to occur in that setting (Wilton et al., 2014). So don’t be shy - know that people pay positive attention to strongly worded EEO statements (Barber & Roehling, 1993)

A broad vacancy announcement may produce an applicant pool that includes candidates that can improve diversity but in subfields or with expertise that you may not have considered or that are not exactly what you were looking for originally.

Perhaps such deviations from original preferences may be acceptable when considered in a larger sense, especially if existing faculty can be encouraged to shift course assignments or other responsibilities.

More flexibility will help achieve diversity in the applicant pool.
Vacancy Announcement Wording: Infusing Diversity as a Value Added

Overview section:
Montana State University values diverse perspectives and is committed to continually supporting, promoting, and building an inclusive and culturally diverse campus environment. MSU recognizes the importance of work-life integration and strives to be responsive to the needs of dual career couples.

Duties and Responsibilities section:
We hope to attract applicants who are committed to helping students from diverse backgrounds succeed.

Preferred Qualifications (select one to include):
- Ability to promote the advancement of an inclusive and equitable working environment.
- Potential to foster and support student and faculty diversity.
- Demonstrated commitment to working with and engaging diverse students and colleagues within and outside the department.

Phone Interview Question for Prospects (and/or for Telephone Reference Checks):
- Please give examples of your involvement in any diversity initiatives and subsequent outcomes.

On-Campus Interview Question:
- How will you go about promoting diversity and inclusion within the department and MSU?

NOT IN THE AD? YOU CAN’T SCORE IT!
Did you know: If you don’t include the value of diversity in the preferred qualifications, you will not be able to screen/score on this factor! Including it here ensures all candidates address this dimension in their cover letter. Requiring all candidates to showcase this strength is key to selecting a candidate who will contribute to an inclusive department.
Overview
The Department of XXX invites applications for a tenure-track faculty position at the level of Assistant Professor. XX degree offerings include BS, MS, and PhD degrees. About XX BS students, XX MS students, and XX0 PhD students are enrolled. These students are supported by XX full time faculty. The department’s research collaborators include faculty within other academic departments, campus research centers, and industry.

The faculty position to be filled is a full-time tenure track appointment with primary responsibilities in teaching, research, and service/outreach. The successful candidate will become an integral part of the XX program, with duties to include teaching courses in the department curriculum consistent with his or her background, working on program/curriculum development, developing a nationally recognized research program with extramural funding, and participating in professional and university outreach and service activities. Montana State University and the College of XX value diverse perspectives and hope to attract applicants who are committed to helping students from underrepresented backgrounds succeed.

Duties and Responsibilities
The faculty member will be responsible for developing and maintaining an extramurally funded, nationally recognized research program and teach in his or her area of expertise within the broad field of SUBFIELD HERE. Applicants with interests in XXX, XXX, or XXX are especially encouraged to apply, although all specialties will be considered. The faculty member will participate in teaching undergraduate and graduate courses in his or her area of specialization and mentoring graduate and undergraduate students. The faculty member will also be responsible for providing service to the university and the XXX professional community.

Required Qualifications
1. PhD in XXX or related field;

Preferred Qualifications
1. Potential to conduct and publish high-quality and original research, as indicated by publication in peer-reviewed journals
2. Demonstrated or potential ability to secure external funding
3. Research program that complements and expands the department’s current strengths; and
4. Demonstrated ability to work with and engage diverse students and colleagues within and outside the XX program;
5. Evidence of or potential for excellence in undergraduate and graduate teaching and mentoring

The Successful Candidate Will
be a dynamic researcher and communicator who has excellent written and oral communication skills namely the ability to teach, inspire and mentor students; the ability to establish a XXX research program; an appreciation for diverse constituencies; and effective interpersonal skills including the ability to collaborate successfully with faculty, staff, and students.

Additional Requirements
In accordance with MSU policy, hiring will be conditional upon successful completion of a pre-employment background check.

Application Deadline
Screening of applications will begin on XXX and will continue to be accepted until the position is filled.

Application Procedure
To apply, submit the following:
• (1) a letter of application addressing all of the above required and preferred qualifications. and
• (2) a current curriculum vitae, and
• (3) the names, addresses, telephone numbers and email addresses of three current references.

Comment [1]: It is a good idea to inform candidates of the various opportunities on campus.
Comment [2]: Notice no precise mention of a specific subfield is mentioned nor is any specific class for teaching. This will yield the greatest number of candidates. If a specific field is important, see duties below.
Comment [3]: This is one way to illustrate to candidates that we want someone attuned to inclusion and equity.
Comment [4]: “Potential” is a key word to include for assistant level positions. “Demonstrated” is for use in open-rank searches.
Comment [5]: Including this in the preferred guarantees that the candidates will discuss this topic in their cover letter and that the committee can score on this factor.
Comment [6]: This is a “soft skill” that will be assessed at the time of the phone or campus interview.
Comment [7]: If appropriate to your field, asking for names instead of letters can yield more applicants and better information on the reference checks.
All MSU searches are handled via an online Applicant Tracking System (ATS) developed and produced by PeopleAdmin. The search committee creates a vacancy announcement that is then posted online. Applicants will apply directly to the vacancy announcement on MSU’s website and all search committee members will see the real time updates of each applicant.

Members of the committee and the search support team will see a screen similar to the one captured above as they work on the vacancy ad.
Resist the “Post and Pray” Technique: Placing an advertisement in the back of Science and posting the vacancy announcement on your professional society’s website is insufficient to get a diverse pool. Some of the best candidates may not see your advertisement, may not see themselves as a good fit, or may not be actively looking for a position at present. You need to find them and encourage them to apply!

What do do? Advertise in publications and websites that target women and underrepresented minority scholars. Look for potential applicants among directories of women and minority doctoral recipients and candidates. You can also send the vacancy announcement to officers of your professional society’s diversity section or committee and ask that it be distributed to its membership by e-mail. Seeing that MSU has made an effort to target these outlets will help convince potential applicants that we are serious about increasing diversity at our university. Want a list of ideas to get you started on outlets to advertise? Resources are listed in the last tab.

Make calls and send emails: The most effective way to find candidates is to call or e-mail colleagues and department heads at other institutions, agencies, NGOs, and corporations and ask them if they can recommend any outstanding candidates. Be aware: because of their own unintended biases, they might not mention women and minorities. If this happens, follow up with “Great! Can you suggest some outstanding women and minority students and post-docs too?”

A personal invitation greatly increases the probability of eliciting an application. This strategy has been very effective at MSU in recent years. The previous ideology at MSU was “We shouldn’t have to convince a person to be a candidate,” but in fact, many of the finalists in searches at MSU needed to be convinced to apply by mentors, collaborators, colleagues, or search committee members.

Granted, making these calls (to both colleagues and potential applicants) is time consuming. Divide the work up among the search committee and solicit help from other department members. Search committee members are the best resource to obtain a large applicant pool.

What to say when you call? Use language like “We would love to review your application” or “The hiring committee looks forward to reviewing your application materials” as opposed to “You’d be perfect and you should apply” in order to keep the search committee in line the rules laid out by MSU Human Resources.

Challenge:
Each committee member personally find and contact 10 people to invite to apply
Step 2. Raise awareness of unintentional biases and their effects on evaluating applicants and enhancing diversity.

A demonstration.

Name the color of the words below. Be as quick and accurate as possible

RED
GREEN
BLUE
BLACK

Again, name the color of the words below. Be as quick and accurate as possible

RED
GREEN
BLUE
BLACK

Most people find the second set of colors harder to name because of our habit of reading. Called the Stroop Effect (1935), this illustrates that even when trying to follow directions, habits are difficult to break. Overcoming stereotypes is a lot like trying to break a habit.
Although academics believe that they select the best candidates based on objective criteria, their decisions are in reality subtly biased by knowledge about the candidates’ race, ethnicity, sex, sexual orientation, physical ability, religion, experience, education, and age. Simply through our exposure to media, other people, and our personal experience, we form “schemas,” or knowledge structures, of many social groups. These schemas are necessarily overgeneralizations, and we form biased impressions of an individual using these schemas.

We all know, for example, what the stereotypes are for women, men, Whites, African-Americans, Asians, Muslims, etc., even if we do not personally endorse those stereotypes (e.g., Devine, 1989).

Decades of psychological research demonstrate time and again that simply having the stereotypes represented in our minds can lead to implicit, subtle, and—this is important—unintentional bias when we evaluate others. Even the most well-intentioned, egalitarian, individual out there has stereotypes represented in his or her mind. And given this, those stereotypes can at times influence judgments and behavior even without the individual realizing it. This does not mean that we are all racists or misogynists, etc.

This is just the way our minds work; activated concepts (such as stereotypes) influence our attention, interpretation of information, and actions, generally without our awareness. Unfortunately, stereotypes are very easily activated concepts—if you are reading Karen or Jamal’s CV, the names alone will activate your stereotype of “women” or “African-American” automatically, intentional or not.

A good starting point is to take the (fun!) Harvard Implicit Association Test at [https://implicit.harvard.edu](https://implicit.harvard.edu).

Even with the best of intentions, we prefer those who feel familiar to us—those who look and think like us—and therefore, we tend to hire them to be our colleagues (Rivera, 2012). We might just “feel” that these candidates are a better “fit” without thinking through why we feel that way. It is critical to personally acknowledge that we all have implicit associations regarding various social categories and to challenge ourselves and our colleagues to speak openly about them. Failure to acknowledge and actively combat unintentional biases can perpetuate MSU’s low diversity and result in unequal access to the professoriate. Moreover, enhancing awareness of this issue, a task that often falls to the search committee chair or female or minority search committee member, is difficult, time consuming, and thankless. The critical self-examination needed to accept that we make assumptions, albeit unintentionally, does not come naturally to ambitious, highly competitive, successful non-minority men in our culture. Acknowledging this phenomenon takes time and copious evidence. We offer some of that evidence on subsequent pages. More can be found in Chapter III of Fine and Handelsman (2012) and in the primary literature cited.
**Gender Bias:** In an experiment recently reported in the *Proceedings of the National Academy of Science*, chemistry, biology, and physics professors received a resume for a lab manager position. All professors received an identical resume, but depending on random assignment, the resumes began with either a male or female name. Of concern, these *science professors* rated applicants more competent, more worthy of mentorship, and offered on average $4,000 more in starting salary if they had male relative to female names. Importantly, demonstrating how subtle and unintentional this bias is, both men and women science faculty equally showed the gender bias (*Moss-Racusin et al., 2012*).

In a similar vein, both male and female academic psychologists given identical curricula vitae (CVs) gave better evaluations of a tenure-track applicant for teaching, research, and service if the CV was associated with a male name than a female name; they were also more likely to recommend hiring the candidate if they thought the candidate was male than female, despite the CVs being identical in every other aspect (*Steinpreis et al., 1999*).

**Ethnoracial Bias:** Résumé submissions of applicants with “Whitesounding” names received 50% more callbacks than did equally qualified applicants with “African American-sounding” names from companies advertising job openings in Boston and Chicago newspapers (*Bertrand & Mullainathan, 2004*). Results are replicated even when candidates apply to pro-diversity organizations (*Kang et al., 2016*).

**Motherhood Bias:** Evaluators of an application packet judged mothers to be less committed to their careers and less competent than non-mothers and recommended more non-mothers (84%) than mothers (47%) for hire; when mothers were recommended for hire, their recommended starting salaries were $11,000 lower than for non-mothers (*Correll et al., 2007*). Fathers and non-fathers were judged equally competent, but fathers were deemed more committed to their careers than non-fathers, were more likely to be recommended for hire, and were recommended for higher starting salaries (see also *Biernat & Fuegen, 2001*).

**Disability Bias:** Highly qualified disabled applicants receive significantly less employer interest than the same applicant without a disclosed disability (*Ameri et al., 2015*).

**Sexuality Bias:** A seven-state study showed that when a resume conveys information that the applicant is gay (leader in a gay-friendly organization), that applicant received 40% fewer callbacks for the job compared to the same resume that did not convey this information (*Tilcsik, 2011*).

**Elitism Bias:** Highly qualified applicants to law firms are evaluated better when the application has a male name and the application conveys signs of higher social class. These male higher-class candidates are seen as “better fits with the elite culture and clientele” compared to the identical applicant who has a female sounding name or is from a lower-class background (*Rivera & Tilcsik, 2016*).
Journal Articles: A before-and-after study of articles published in Behavioral Ecology found a significant increase in the publication of articles with a woman as first author after implementation of a double-blind review process (Budden et al., 2008).

Grants/Fellowships: In a study of postdoctoral fellowships awarded by the Swedish Medical Research Council, researchers compared publication records of applicants to reviewer assessments of competency; women needed to be twice as productive as men to receive the same competency rating (Wennerås & Wold, 1997). Research on NIH grant reviews/awards also shows evidence of gender bias (Kaatz et al., 2016) and racial bias (Hayden, 2015).

Conference Abstracts submitted to an international social science conference were stripped of real author identities and instead were randomly provided a fake male or female name. Abstracts with a male author were given higher “scientific quality” ratings than those with a female author. What is more, more “masculine” topics of study (e.g., computer technology) were rated higher quality than “feminine” topics of study (e.g., parenting; Knobloch-Westerwick et al., 2013).

Conference Speakers: A review of two major biology conference programs from 2001-2011 showed women are less likely to be invited to give talks. The number of invitations extended to women was greater if women were also on the conference organizing committee (see Schroeder et al., 2013 and Casadevall & Handelsman, 2014).

Creative Talent: The proportion of women hired by symphony orchestras increased substantially in the 1970s and 1980s after screens to conceal candidate identities from audition committees came into use (Goldin and Rouse, 2000).

Citations: Examination of all publications between 1980 and 2006, show women are systematically cited less than men. Even after controlling for a large number of variables, such as journal outlet, publication year and tenure status (Maliniak et al., 2013). Men are also more likely to self-cite (Lariviére et al., 2013) and scholars tend to cite other scholars of the same gender (Maliniak et al., 2013). This means when a field is male-dominated this pattern will lead to significantly fewer citations for women and significantly less exposure for their scholarship.
Step 3: Strategies for Reviewing Applicants that Enhance Equity and Inclusion  
(adapted from Fine and Handelsman, 2012, Chapter IV)

The good news is that enhanced awareness of unconscious bias(es) has led to successful efforts to combat such biases about women in science (Ceci and Williams, 2011). Awareness of unconscious biases, combined with a desire to avoid them, reduces unintended prejudicial behavior (Devine et al., 2002). Thus, search committee chairs are challenged to raise awareness about unconscious biases and to deliberately work to counter their effects during the search process.

Periodically remind all search-committee members that they are prone to such biases—indeed, of their actual beliefs regarding various social groups—and must actively counter them and ask themselves: “Is it plausible that I evaluated this individual less favorably than I should have based on an unintended and unconscious bias?”

Surprisingly, trying to suppress stereotypes can actually result in greater bias, so committee members should simply try their best to rate candidates objectively rather than trying to avoid using their stereotypes. Even still, unconscious bias can creep into seemingly objective evaluations (Chapter IV of Fine and Handelsman, 2012).

_Fortunately, the following methods, which involve accepting that bias and assumptions exist and working to overcome or minimize them, are more successful._

**Recognize and accept that you are prone to bias and assumptions.** People who believe that they are objective (and 88% believe themselves to be above average in objectivity) do not consider the possibility that they are influenced by unconscious assumptions and biases (Uhlmann and Cohen, 2007).

**Consciously think about the accomplishments, research, teaching, and contributions of successful, highly competent, well-regarded women and minority members** of your department, university, or discipline. These conscious thoughts can temporarily overshadow unconscious assumptions, thereby minimizing their influence (Blair et al., 2001).

**Increase the representation of women and minority scholars in your applicant pool.** Evaluators are less influenced by gender stereotypes and focus more on individual merits when women are well represented in the applicant pool (>25%; Heilman, 1980). For the same reason, force yourself to _ask if the best woman or minority candidate among the runner-ups has been unintentionally downgraded and should be lifted up into the list of finalists._ When only one woman or minority candidate is in the finalist pool, committee members tend to perceive that candidate as the token minority; having two or more minority members removes the token status from the process.
Develop well-defined evaluation criteria to provide guidance for evaluating applicants. Vague and ambiguous criteria (e.g., “excellence in research and/or teaching”) allow us to ascribe excellence to those who look and act like the majority of us and hinder us from seeing excellence in those who differ (Heilman, 2001).

Prioritize evaluation criteria before evaluating applicants; failure to do so allows evaluators to adjust the importance of criteria to justify their potentially biased choices (Uhlmann and Cohen, 2005).

Spend at least 15 to 20 undistracted minutes evaluating each applicant. We apply stereotypes as mental shortcuts to save time, so quickly made evaluations are particularly prone to unconscious biases (Moody, 2010). If you have a large pool, and hopefully you do, divide the applicants among committee members for initial evaluation to reduce your individual workloads and time pressure.

Evaluate each application in its entirety; do not depend too heavily on any one element. Incorporating more information about an individual’s qualifications lessens the effects of assumptions and biases (Tosi and Einbender, 1985).

Focus on inclusion rather than exclusion when making selection decisions. Evaluators make more careful and deliberate choices when deciding whom to include than exclude (Hugenberg et al., 2006). Require that each search committee member is prepared to defend every decision for eliminating or advancing a candidate. Holding evaluators to high standards of accountability for the fairness of their evaluation reduces the influence of bias and assumptions (Foschi, 1996).
Identify Diamonds in the Rough

This is a strategy, successfully applied elsewhere, to identify and recruit women and minority candidates that show great promise but that may not yet appear to be competitive with the more advanced non-minority men that typically populate our finalist lists. This is also a useful tool to employ when you have an “open rank” search and are trying to compare recent post-docs to more senior candidates.

*Look at productivity rate instead of career productivity, such as publications per year since receipt of PhD instead of total number of career publications.* It is likely that this strategy helps level the playing field and thereby increases competitiveness of more recent graduates.
Reviewing References and Cover Letters

When possible, ask for names and contact information of references instead of letters of recommendation. Or, wait to collect letters until after the committee has narrowed down the list of finalists.

Medical school application letters of reference for women were significantly shorter than for men and overemphasized personality versus professional experience (Trix and Psenka 2003).

Even after taking into account qualifications (e.g., grants and publications), letters written for men applying to a faculty chemistry position contained significantly more “standout” adjectives (e.g., outstanding, unique, and exceptional) than letters written for comparably qualified women (Schmader et al., 2007).

Think about what is not said in the cover letter.

Women are often less likely than men to “self-promote” and boast about accomplishments (e.g., Moss-Racusin & Rudman, 2010; Smith & Huntoon 2014). Thus, relying just on the cover letter or research/teaching statements might also underestimate the qualifications of a woman candidate.

So what to do?

To avoid this unintentional bias by letter writers but ensure that you get as much information as possible about a candidate’s potential for success, develop a very specific list of questions to ask each reference of the short-list applicants on the phone.

Ask Phone References:

• How has the candidate supported efforts to diversify your department?
• Tell me about the potential for success of the candidate.
Red Flags to Watch Out For

Members of search committees that failed to hire women or diverse faculty at MSU often cited rather vague and ambiguous (or irrelevant) reasons for their low ranking of finalists. Words such as “seemed” and “appeared” often cropped up; these are signs of unconscious biases creeping in.

Vague Red Flag Examples include:

“Her priorities didn’t seem to match up with ours very well.”

“He wasn’t as mature as the other candidates.”

“His personality didn’t seem like a good match for us.”

“She didn’t seem to be as serious about this position as John was.”

“I didn’t think she would like living here in Bozeman.”

“I don’t know that he’d find many friends here.”

“She hadn’t worked with any of the real leaders in the field.”

“I’ve just never been all that impressed with graduates of Southeastern Montana University,” or the related “He was lucky that he got his degree under Professor Tweed at Ivy University,” which suggests that luck rather than skill got her to where she is.

“Her comment about astrophysical assimilation in her seminar made her totally unsuitable for the position.”

These are the kinds of rationales and comments that can be red flags of unconscious biases and assumptions in search committee discussions. Because all of us, including women and minorities, hold unintentional biases, we must force ourselves and our colleagues to view all candidates objectively to avoid prejudice, and speak up when we observe unconscious (and likely unintentional) biases expressed by others. **Challenge committee members and other faculty to back-up such statements with objective information.**
Step 4. Conduct on-campus visits and interviews fairly and in such a manner that they put MSU in a good light.

Remember, search committees cannot probe into candidates’ potential minority status or personal life. We cannot ask people if they are gay/lesbian/bisexual/transgendered, Episcopalian, Jewish, Muslim, or Republican; all of this is irrelevant to their ability to do the job.

For too long, however, we have been taught to adopt a “colorblind” or “gender blind” perspective with the idea that if we ignore such group characteristics, then the process is fair. The “neutral” response is frequently laden with unintended bias. Identical treatment is not the goal. Treating people as equals is the goal. Decades of research shows that a color blind perspective perpetuates discrimination (e.g., Apfelbaum et al., 2010 as just one example). Instead, realize there is value added when someone brings diversity to your department; their unique life experience might be just the creative spark your faculty need or the role model your students desire. Thus, we must communicate that MSU values and supports diversity.

We must also be sensitive to the ever-changing concept of family and family roles and obligations. It is illegal to ask a candidate if they are married or have children or have an elderly parent to tend to. But we also do want candidates to know that MSU values work-life integration, and recognizes how important work-life integration support is for recruiting diverse faculty in science in particular (e.g., Hewlett et al., 2008). Many of us come and stay at MSU for the “quality of life,” after all. But some people might avoid MSU because of the perception that it is not family friendly. For example, women scientists, more than men, face the “two-body problem” (both spouses obtaining jobs; McNeil & Sher, 1999). What to do?

Provide all candidates access to information they might explore per their personal interests, situations, and background. For instance, your search can schedule brief meetings with the MSU Family Advocate to discuss career/life balance from a faculty perspective. Remember that family does not only mean having children, candidates can have siblings, parents, spouses, etc., who at one point or another might need care or assistance, and everyone has a life to balance outside of work. If a meeting isn’t possible, provide all candidates with a brochure on work-life policies and practices at MSU. Put all your candidates in touch with the MSU Dual Career Community Liaison from HR. Need help doing this? Email familyadvocate@montana.edu
Hosting Your Candidate: Setting the Agenda

All candidates will benefit from learning about work-life integration practices and policies at MSU. Provide all of them with the Family Advocate Brochure or set up a 20 minute in-person meeting with the Family Advocate for all your candidates.

The MSU Family Advocate is available to meet with your job candidates when they visit campus!

These 20 minute (or so) meetings are aimed at informing candidates about what MSU does to help faculty achieve healthy work-life integration. Preferably candidates come to the office of one of the Family Advocates, where they can be assured of a confidential discussion about everything from support for family caregiving leave (parental leave, but also eldercare and partner care), MSU’s tenure clock extension policy, childcare options in Bozeman, dual career employment support, the culture of work-life balance at MSU (including support for recreation and pets), and even the opportunity to purchase discounted ski tickets.

During our explosive 2012-2013 hiring season, ADVANCE collected data from a cross-section of candidates after these meetings, to assess whether they were considered useful. Candidates described these meetings as a unique opportunity that MSU offered compared to other institutions they visited and an important expression of the culture of support at MSU. Contact familyadvocate@montana.edu to schedule your candidate and/or click here for a brochure to include during their visit.

Remember: It is never appropriate to seek information from the candidate regarding their personal or family life. If they volunteer the information, acknowledge it and move the conversation to other areas. Let them explore those questions in confidence with the MSU Family Advocate.
Advance interviewed several job candidates in 2012-2013 to get feedback on what was valued, and what could be improved, for on-campus interviews. Several themes emerged, leading to several recommendations for the campus interview process:

**First, avoid being defensive about the salaries and start-ups MSU offers.** Candidates are typically enthusiastic about Bozeman and the fit between themselves and the position, and weigh that very heavily. Salary surely will be a factor when candidates receive an offer and make their decision; but up front, make sure the candidates are impressed with their visit and not weary before an offer even comes.

**Second, give candidates some degree of input, or control, over their visit.** Besides the usual routine, consider asking candidates well in advance if they would like to observe a classroom, see the library, meet with a realtor, stay in a hotel or bed and breakfast, learn about the school districts or specialized groups, etc. Also, if possible, let candidates express preferences for the time of their job talk and with what groups on campus they might like to visit. Giving candidates input and control makes them feel comfortable and respected, leaving them with a positive experience and impression of MSU.

Remember—your candidates are seeing Bozeman and MSU for the first time. Give them the opportunity to see the many positive things the area and the university have to offer.
Showcase MSU’s Diversity to ALL Candidates! Help make candidates aware of diversity groups and events on campus (e.g., Women’s Faculty Caucus, GLBT groups, the Pow Wow, international food day in the SUB) and off campus (e.g., various religious organizations, recreational organizations and clubs, etc.). We can provide such information in a broad context to convey the overall lifestyle that MSU/Bozeman/Montana has to offer. In explaining the uniqueness and charm of the area (outdoor recreation, The Sweet Pea Festival, Music on Main, Yellowstone, skiing, and the like), we can also communicate diversity so that job candidates fully appreciate the spectrum of opportunities available in our community.

Ask candidates during their interview:
What ideas do you have for increasing and promoting diversity within the department/college?

All candidates benefit from the opportunity to meet people who are like them even if those they meet are playing non-evaluative roles (e.g. faculty from other departments and/or graduate students who are not serving any formal role in the search). Of course, due to demographics in some departments, this is easy to uphold for Caucasian Male candidates and harder to uphold for both female and/or other underrepresented minority candidates. Aspire to provide the same opportunity for all candidates and know that doing so for women and/or underrepresented minority candidates requires conscious attention and planning.
Adopt an on-campus evaluation tool that requires observers/judges to declare the level of scrutiny they have given the candidate. Did they read the vita? Meet with the candidate? Go to lunch? Is their review based only on the job talk? Here is a sample adopted from STRIDE. Want a Word.doc version of this to modify for your search? Go to [http://www.montana.edu/nsfadvance/resources.html](http://www.montana.edu/nsfadvance/resources.html).
"Partner accommodation may be particularly important in attracting more women to underrepresented fields."
—Ann Higginbotham, American Association of University Professors

Assume every candidate has a partner - statistically speaking, this is likely, regardless of gender or discipline. And our own MSU data shows that a major factor in accepting or declining an offer is partner accommodations. Be ready to embrace the Two-Body Opportunity!

Some Common Questions:
Do we have to do a national search and hope the academic partner comes out on top? No. Complete the partner accommodation request form. Montana policy provides exceptions for partner hires. Consider asking the partner to submit materials and come for an interview. And if you know someone is a partner who has risen to the top of your search, consider this an advantage over otherwise equally qualified applicants. We must prioritize partner hires if we are to recruit and retain the most outstanding faculty.

But the partner isn’t a perfect fit and might dilute the quality of our faculty: Partner hires are on average more productive than typical hires! A 10 year study at WSU showed partner hires (compared to non-partner faculty hires) published more and secured more grant funding (see http://dualhire.org).

What are the options? Tenure track lines are certainly hard to come by. But if the partner’s department has a vacancy or is willing to leverage a future vacancy, it is worth pursuing. NTT multi-year contracts are also an option. And, if the partner is not an academic, refer them to the dual career liaison. Be realistic but optimistic about possible partner-accommodations. It is a show of good faith if you offer some departmental resources to assist the partner’s department in start-up, space, or other support.

What to do? Regardless of whether a candidate asks, we recommend giving them the opportunity to talk confidentially with the Family Advocate to learn about dual career and work-life integration policies and practices on campus. Candidates will be more inclined to join our community if they understand what institutional supports exist to support recruiting families, and not just individuals. In this vein, consider that candidates may want to bring their partner with them during their initial visit, or they may want to visit again after obtaining an offer.

Over a third of academics have a partner in academia. Rate is highest among scientists:
54% of male/83% of female scientists have a partner in academic science
(L. Schiebinger et al., 2008)
After you have made your decision, make MSU’s offer of employment appealing

Compared to some other universities, MSU can come up short on some dimensions such as faculty salary, start-up packages, pension and retirement plans, and geographical isolation. But on the whole, the positive outweighs the negative, and most faculty would agree that MSU is a wonderful place to work and live (after all, we are here).

So, tout the university and lifestyle. MSU is an R1 research university that is growing. MSU supports diversity and inclusiveness and work-life integration. Bozeman is a great community nestled in a beautiful location. Mention the fun, mention the opportunities in the community, mention the schools and diversity in the area, and showcase the lifestyle as best you can.

Of course, our job candidates are not fools. They will notice that on some dimensions MSU is not competitive with other universities. Acknowledge that (if true for your college/department), but tout the advantages, the lifestyle, the promise, and the excitement of being at MSU and Bozeman right now. This is a great place to live and work, and we are here for many reasons; share those reasons.


Science faculty’s subtle gender biases favor male students

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Despite efforts to recruit and retain more women, a stark gender disparity persists within academic science. Abundant research has demonstrated gender bias in many demographic groups, but has yet to experimentally investigate whether science faculty exhibit a bias against female students that could contribute to the gender disparity in academic science. In a randomized double-blind study (n = 127), science faculty from research-intensive universities rated the application materials of a student—who was randomly assigned either a male or female name—for a laboratory manager position. Faculty participants rated the male applicant as significantly more competent and hireable than the (identical) female applicant. These participants also selected a higher starting salary and offered more career mentoring to the male applicant. The gender of the faculty participants did not affect responses, such that female and male faculty were equally likely to exhibit bias against the female student. Mediation analyses indicated that the female student was less likely to be hired because she was viewed as less competent. We also assessed faculty participants’ preexisting subtle bias against women using a standard instrument and found that preexisting subtle bias against women played a moderating role, such that subtle bias against women was associated with less support for the female student, but was unrelated to reactions to the male student. These results suggest that interventions addressing faculty gender bias might advance the goal of increasing the participation of women in science.

diversity | lifestyle choices | science education | science workforce

A 2012 report from the President’s Council of Advisors on Science and Technology indicates that training scientists and engineers at current rates will result in a deficit of 1,000,000 workers to meet United States workforce demands over the next decade (1). To help close this formidable gap, the report calls for the increased training and retention of women, who are starkly underrepresented within many fields of science, especially among the professoriate (2–4). Although the proportion of science degrees granted to women has increased (5), there is a persistent disparity between the number of women receiving PhDs and those hired as junior faculty (1–4). This gap suggests that the problem will not resolve itself solely by more generations of women moving through the academic pipeline but that instead, women’s advancement within academic science may be actively impeded.

With evidence suggesting that biological sex differences in inherent aptitude for math and science are small or nonexistent (6–8), the efforts of many researchers and academic leaders to identify causes of the science gender disparity have focused instead on the life choices that may compete with women’s pursuit of the most demanding positions. Some research suggests that these lifestyle choices (whether free or constrained) likely contribute to the gender imbalance (9–11), but because the majority of these studies are correlational, whether lifestyle factors are solely or primarily responsible remains unclear. Still, some researchers have argued that women’s preference for nonscience disciplines and their tendency to take on a disproportionate amount of child- and family-care are the primary causes of the gender disparity in science (9–11), and that it “is not caused by discrimination in these domains” (10). This assertion has received substantial attention and generated significant debate among the scientific community, leading some to conclude that gender discrimination indeed does not exist nor contribute to the gender disparity within academic science (e.g., refs. 12 and 13).

Despite this controversy, experimental research testing for the presence and magnitude of gender discrimination in the biological and physical sciences has yet to be conducted. Although acknowledging that various lifestyle choices likely contribute to the gender imbalance in science (9–11), the present research is unique in investigating whether faculty gender bias exists within academic biological and physical sciences, and whether it might exert an independent effect on the gender disparity as students progress through the pipeline to careers in science. Specifically, the present experiment examined whether, given an equally qualified male and female student, science faculty members would show preferential evaluation and treatment of the male student to work in their laboratory. Although the correlational and related laboratory studies discussed below suggest that such bias is likely (contrary to previous arguments) (9–11), we know of no previous experiments that have tested for faculty bias against female students within academic science.

If faculty express gender biases, we are not suggesting that these biases are intentional or stem from a conscious desire to impede the progress of women in science. Past studies indicate that people’s behavior is shaped by implicit or unintended biases, stemming from repeated exposure to pervasive cultural stereotypes (14) that portray women as less competent but simultaneously emphasize their warmth and likeability compared with men (15). Despite significant decreases in overt sexism over the last few decades (particularly among highly educated people) (16), these subtle gender biases are often still held by even the most egalitarian individuals (17), and are exhibited by both men and women (18). Given this body of work, we expected that female faculty would be just as likely as male faculty to express an unintended bias against female undergraduate science students. The fact that these prevalent biases often remain undetected highlights the need for an experimental investigation to determine whether they may be present within academic science and, if so, raise awareness of their potential impact.

Whether these gender biases operate in academic sciences remains an open question. On the one hand, although considerable research demonstrates gender bias in a variety of other domains (19–23), science faculty members may not exhibit this...
bias because they have been rigorously trained to be objective. On the other hand, research demonstrates that people who value their objectivity and fairness are paradoxically particularly likely to fall prey to biases, in part because they are not on guard against subtle bias (24, 25). Thus, by investigating whether science faculty exhibit a bias that could contribute to the gender disparity within the fields of science, technology, engineering, and mathematics (in which objectivity is emphasized), the current study addressed critical theoretical and practical gaps in that it provided an experimental test of faculty discrimination against female students within academic science.

A number of lines of research suggest that such discrimination is likely. Science is robustly male gender-typed (26, 27), resources are inequitably distributed among men and women in many academic science settings (28), some undergraduate women perceive unequal treatment of the genders within science fields (29), and nonexperimental evidence suggests that gender bias is present in other fields (19). Some experimental evidence suggests that even though evaluators report liking women more than men (15), they judge women as less competent than men even when they have identical backgrounds (20). However, these studies used undergraduate students as participants (rather than experienced faculty members), and focused on performance domains outside of academic science, such as completing perceptual tasks (21), writing nonscience articles (22), and being evaluated for a corporate managerial position (23).

Thus, whether aspiring women scientists encounter discrimination from faculty members remains unknown. The formative predoctoral years are a critical window, because students’ experiences at this juncture shape both their beliefs about their own abilities and subsequent persistence in science (30, 31). Therefore, we selected this career stage as the focus of the present study because it represents an opportunity to address issues that manifest immediately and also resurface much later, potentially contributing to the persistent faculty gender disparity (32, 33).

Current Study

In addition to determining whether faculty expressed a bias against female students, we also sought to identify the processes contributing to this bias. To do so, we investigated whether faculty members’ perceptions of student competence would help to explain why they would be less likely to hire a female (relative to an identical male) student for a laboratory manager position. Additionally, we examined the role of faculty members’ preexisting subtle bias against women. We reasoned that pervasive cultural messages regarding women’s lack of competence in science could lead faculty members to hold gender-biased attitudes that might subtly affect their support for female (but not male) science students. These generalized, subtly biased attitudes toward women could impel faculty to judge equivalent students differently as a function of their gender.

The present study sought to test for differences in faculty perceptions and treatment of equally qualified men and women pursuing careers in science and, if such a bias were discovered, reveal its mechanisms and consequences within academic science. We focused on hiring for a laboratory manager position as the primary dependent variable of interest because it functions as a professional launching pad for subsequent opportunities. As secondary measures, which are related to hiring, we assessed: (i) perceived student competence; (ii) salary offers, which reflect the extent to which a student is valued for these competitive positions; and (iii) the extent to which the student was viewed as deserving of faculty mentoring.

Our hypotheses were that: Science faculty’s perceptions and treatment of students would reveal a gender bias favoring male students in perceptions of competence and hireability, salary conferred, and willingness to mentor (hypothesis A); Faculty gender would not influence this gender bias (hypothesis B); Hiring discrimination against the female student would be mediated (i.e., explained) by faculty perceptions that a female student is less competent than an identical male student (hypothesis C); and Participants’ preexisting subtle bias against women would moderate (i.e., impact) results, such that subtle bias against women would be negatively related to evaluations of the female student, but unrelated to evaluations of the male student (hypothesis D).

Results

A broad, nationwide sample of biology, chemistry, and physics professors (n = 127) evaluated the application materials of an undergraduate science student who had ostensibly applied for a science laboratory manager position. All participants received the same materials, which were randomly assigned either the name of a male (n = 63) or a female (n = 64) student; student gender was thus the only variable that differed between conditions. Using previously validated scales, participants rated the student’s competence and hireability, as well as the amount of salary and amount of mentoring they would offer the student. Faculty participants believed that their feedback would be shared with the student they had rated (see Materials and Methods for details).

Student Gender Differences. The competence, hireability, salary conferral, and mentoring scales were each submitted to a two (student gender: male, female) × two (faculty gender: male, female) between-subjects ANOVA. In each case, the effect of student gender was significant (all P < 0.01), whereas the effect of faculty participant gender and their interaction was not (all P > 0.19). Tests of simple effects (all d > 0.60) indicated that faculty participants viewed the female student as less competent [t(125) = 3.89, P < 0.001] and less hireable [t(125) = 4.22, P < 0.001] than the identical male student (Fig. 1 and Table 1). Faculty participants also offered less career mentoring to the female student than to the male student [t(125) = 3.77, P < 0.001]. The mean starting salary offered the female student, $26,507.94, was significantly lower than that of $30,238.10 to the male student [t(124) = 3.42, P < 0.01] (Fig. 2). These results support hypothesis A.

In support of hypothesis B, faculty gender did not affect bias (Table 1). Tests of simple effects (all d < 0.33) indicated that female faculty participants did not rate the female student as more competent [t(62) = 0.06, P = 0.95] or hireable [t(62) = 0.41, P = 0.69] than did male faculty. Female faculty also did not offer more mentoring [t(62) = 0.29, P = 0.77] or a higher salary [t(61) = 1.14, P = 0.26] to the female student than did their male

![Fig. 1. Competence, hireability, and mentoring by student gender condition](image-url)
colleagues. In addition, faculty participants’ scientific field, age, and tenure status had no effect (all \( P > 0.53 \)). Thus, the bias appears pervasive among faculty and is not limited to a certain demographic subgroup.

**Mediation and Moderation Analyses.** Thus far, we have considered the results for competence, hireability, salary conferral, and mentoring separately to demonstrate the converging results across these individual measures. However, composite indices of measures that converge on an underlying construct are more statistically reliable, stable, and resistant to error than are each of the individual items (e.g., refs. 34 and 35). Consistent with this logic, the established approach to measuring the broad concept of target competence typically used in this type of gender bias research is to standardize and average the competence scale items and the salary conferral variable to create one composite competence index, and to use this stable convergent measure for examination of target competence typically used in this type of gender bias research is to standardize and average the competence scale items to create a robust composite competence variable (\( \alpha = 0.86 \)). This composite competence variable was used in all subsequent mediation and moderation analyses.

Evidence emerged for hypothesis C, the predicted mediation (i.e., causal path; see SI Materials and Methods: Additional Analyses for more information on mediation and the results of additional mediation analyses). The initially significant impact of student gender on hireability (\( \beta = -0.35, P < 0.001 \)) was reduced in magnitude and dropped to nonsignificance (\( \beta = -0.10, P = 0.13 \)) after accounting for the impact of student composite competence (which was a strong predictor, \( \beta = 0.69, P < 0.001 \)), Sobel’s \( Z = 3.94, P < 0.001 \) (Fig. 3). This pattern of results provides evidence for full mediation, indicating that the female student was less likely to be hired than the identical male because she was viewed as less competent overall.

We also conducted moderation analysis (i.e., testing for factors that could amplify or attenuate the demonstrated effect) to determine the impact of faculty participants’ preexisting subtle bias against women on faculty participants’ perceptions and treatment of male and female science students (see SI Materials and Methods: Additional Analyses for more information on and the results of additional moderation analyses). For this purpose, we administered the Modern Sexism Scale (38), a well-validated instrument frequently used for this purpose (SI Materials and Methods). Consistent with our intentions, this scale measures unintentional negativity toward women, as contrasted with a more blatant form of conscious hostility toward women.

Results of multiple regression analyses indicated that participants’ preexisting subtle bias against women significantly interacted with student gender to predict perceptions of student composite competence (\( \beta = -0.39, P < 0.001 \)) and hireability (\( \beta = -0.31, P < 0.05 \)), and mentoring (\( \beta = -0.55, P < 0.001 \)). To interpret these significant interactions, we examined the simple effects separately by student gender. Results revealed that the more preexisting subtle bias participants exhibited against women, the less composite competence (\( \beta = -0.36, P < 0.01 \)) and hireability (\( \beta = -0.39, P < 0.01 \)) they perceived in the female student, and the less mentoring (\( \beta = -0.53, P < 0.001 \)) they were willing to offer her. In contrast, faculty participants levels of preexisting subtle bias against women were unrelated to the perceptions of the male student’s composite competence (\( \beta = 0.16, P = 0.22 \)) and hireability (\( \beta = 0.07, P = 0.59 \)), and the amount of mentoring (\( \beta = 0.22, P = 0.09 \)) they were willing to offer him. [Although this effect is marginally significant, its direction suggests that faculty participants’ preexisting subtle bias against women may actually have made them more inclined to mentor the male student relative to the female student (although this effect should be interpreted with caution because of its marginal significance).] Thus, it appears that faculty participants’ preexisting subtle gender bias undermined support for the female student but was unrelated to perceptions and treatment of the male student. These findings support hypothesis D.

### Table 1. Means for student competence, hireability, mentoring and salary conferral by student gender condition and faculty gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>4.01±0.92</td>
<td>4.1±1.19</td>
<td>3.33±1.07</td>
<td>3.32±1.10</td>
<td>2.96±1.13</td>
<td>2.84±0.84</td>
</tr>
<tr>
<td>Hireability</td>
<td>3.74±1.24</td>
<td>3.92±1.27</td>
<td>4.00±1.21</td>
<td>3.91±0.91</td>
<td>4.37±1.31</td>
<td>3.91±0.91</td>
</tr>
<tr>
<td>Mentoring</td>
<td>4.74±1.11</td>
<td>4.73±1.31</td>
<td>4.74±1.31</td>
<td>4.73±1.31</td>
<td>4.74±1.31</td>
<td>4.73±1.31</td>
</tr>
<tr>
<td>Salary</td>
<td>30,520.83±5,764.86</td>
<td>29,333.33±4,952.15</td>
<td>27,111.11±6,948.58</td>
<td>25,000.00±7,965.56</td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

Note: The results for competence, hireability, salary conferral, and mentoring ranges from $15,000 to $50,000. Means with different subscripts within each row differ significantly (\( P < 0.05 \)). Effect sizes (Cohen’s \( d \)) represent target student gender differences (no faculty gender differences were significant, all \( P > 0.14 \)). Positive effect sizes favor male students. Conventionsmall, medium, and large effect sizes for \( d \) are 0.20, 0.50, and 0.80, respectively (SI 1). \( n_{\text{male student condition}} = 63, n_{\text{female student condition}} = 64. **P < 0.001.**
Finally, using a previously validated scale, we also measured how much faculty participants liked the student (see SI Materials and Methods). In keeping with a large body of literature (15), faculty participants reported liking the female (mean = 4.35, SD = 0.93) more than the male student [mean = 3.91, SD = 1.08], t(125) = −2.44, P < 0.05]. However, consistent with this previous literature, liking the female student more than the male student did not translate into positive perceptions of her composite competence or material outcomes in the form of a job offer, an equitable salary, or valuable career mentoring. Moreover, only composite competence (and not likeability) helped to explain why the female student was less likely to be hired; in mediation analyses, student gender condition (β = −0.48, P < 0.001) remained a strong predictor of hireability along with likeability (β = 0.60, P < 0.001). These findings underscore the point that faculty participants did not exhibit outright hostility or dislike toward female students, but were instead affected by pervasive gender stereotypes, unintentionally downgrading the competence, hireability, salary, and mentoring of a female student compared with an identical male.

**Discussion**

The present study is unique in investigating subtle gender bias on the part of faculty in the biological and physical sciences. It therefore informs the debate on possible causes of the gender disparity in academic science by providing unique experimental evidence that science faculty of both genders exhibit bias against female undergraduates. As a controlled experiment, it fills a critical gap in the existing literature, which consisted only of experiments in other domains (with undergraduate students as participants) and correlational data that could not conclusively rule out the influence of other variables.

Our results revealed that both male and female faculty judged a female student to be less competent and less worthy of being hired than an identical male student, and also offered her a smaller starting salary and less career mentoring. Although the differences in ratings may be perceived as modest, the effect sizes were all moderate to large (d = 0.60–0.75). Thus, the current results suggest that subtle gender bias is important to address because it could translate into large real-world disadvantages in the judgment and treatment of female science students (39). Moreover, our mediation findings shed light on the processes responsible for this bias, suggesting that the female student was less likely to be hired than the male student because she was perceived as less competent. Additionally, moderation results indicated that faculty participants’ preexisting subtle bias against women undermined their perceptions and treatment of the female (but not the male) student, further suggesting that chronic subtle biases may harm women within academic science. Use of a randomized controlled design and established practices from audit study methodology support the ecological validity and educational implications of our findings (SI Materials and Methods).

It is noteworthy that female faculty members were just as likely as their male colleagues to favor the male student. The fact that faculty members’ bias was independent of their gender, scientific discipline, age, and tenure status suggests that it is likely unintentional, generated from widespread cultural stereotypes rather than a conscious intention to harm women (17). Additionally, the fact that faculty participants reported liking the female student more than the male student further underscores the point that our results likely do not reflect faculty members’ overt hostility toward women. Instead, despite expressing warmth toward emerging female scientists, faculty members of both genders appear to be affected by enduring cultural stereotypes about women’s lack of science competence that translate into biases in student evaluation and mentoring.

Our careful selection of expert participants revealed gender discrimination among existing science faculty members who interact with students on a regular basis (SI Materials and Methods: Subjects and Recruitment Strategy). This study also allowed for a high degree of ecological validity and generalizability relative to an approach using nonexpert participants, such as other undergraduates or lay people unfamiliar with laboratory manager job requirements and academic science mentoring (i.e., the participants in much psychological research on gender discrimination). The results presented here reinforce those of Stenpries, Anders, and Ritze (40), the only other experiment we know of that recruited faculty participants. Because this previous experiment also indicated bias within academic science, its results raised serious concerns about the potential for bias within the biological and physical sciences, casting further doubt on assertions (based on correlational data) that such biases do not exist (9–11). In the Steinpreis et al. experiment, psychologists were more likely to hire a psychology faculty job applicant when the applicant’s curriculum vitae was assigned a male (rather than female) name (40). This previous work invited a study that would extend the finding to faculty in the biological and physical sciences and to reactions to undergraduates, whose competence was not already fairly established by accomplishments associated with the advanced career status of the faculty target group of the previous study. By providing this unique investigation of faculty bias against female students in biological and physical sciences, the present study extends past work to a critical early career stage, and to fields where women’s underrepresentation remains stark (2–4).

Indeed, our findings raise concerns about the extent to which negative predoctoral experiences may shape women’s subsequent decisions about persistence and career specialization. Following conventions established in classic experimental studies to create enough ambiguity to leave room for potentially biased responses (20, 23), the student applicants in the present research were described as qualified to succeed in academic science (i.e., having coauthored a publication after obtaining 2 y of research experience), but not irrefutably excellent. As such, they represented a majority of aspiring scientists, and were precisely the type of students most affected by faculty judgments and mentoring (see SI Materials and Methods for more discussion). Our results raise the possibility that not only do such women encounter biased judgments of their competence and hireability, but also receive less faculty encouragement and financial rewards than identical male counterparts. Because most students depend on feedback from their environments to calibrate their own worth (41), faculty’s assessments of students’ competence likely contribute to students’ self-efficacy and goal setting as scientists.
which may influence decisions much later in their careers. Likewise, inasmuch as the advice and mentoring that students receive affect their ambitions and choices, it is significant that the faculty in this study were less inclined to mentor women than men. This finding raises the possibility that women may opt out of academic science careers in part because of diminished competence judgments, rewards, and mentoring received in the early years of the careers. In sum, the predoctoral years represent a window during which students’ experiences of faculty bias or encouragement are particularly likely to shape their persistence in academic science (30–33). Thus, the present study not only fills an important gap in the research literature, but also has critical implications for pressing social and educational issues associated with the gender disparity in science.

If women’s decisions to leave science fields when or before they reach the faculty level are influenced by unequal treatment by undergraduate advisors, then existing efforts to create more flexible work settings (42) or increase women’s identification with science (27) may not fully alleviate a critical underlying problem. Our results suggest that academic policies and mentoring interventions targeting undergraduate advisors could contribute to reducing the gender disparity. Future research should evaluate the efficacy of educating faculty and students about the existence and impact of bias within academia, an approach that has reduced racial bias among students (43). Educational efforts might address research on factors that attenuate gender bias in real-world settings, such as increasing women’s self-monitoring (44). Our results also point to the importance of establishing objective, transparent student evaluation and admissions criteria to guard against observers’ tendency to unintentionally use different standards when assessing women relative to men (45, 46). Without such actions, faculty bias against female undergraduates may continue to undermine meritocratic advancement, to the detriment of research and education.

Conclusions

The dearth of women within academic science reflects a significant wasted opportunity to benefit from the capabilities of our best potential scientists, whether male or female. Although women have begun to enter some science fields in greater numbers (5), their mere increased presence is not evidence of their full equality of capability. Rather, some women may persist in academic science despite the damaging effects of unintended gender bias on the part of faculty. Similarly, it is not yet possible to conclude that the preferences for other fields and lifestyle choices (9–11) that lead many women to leave academic science (even after obtaining advanced degrees) are not themselves influenced by experiences of bias, at least to some degree. To the extent that faculty gender bias impedes women’s full participation in science, it may undercut not only academic meritocracy, but also the expansion of the scientific workforce needed for the next decade’s advancement of national competitiveness (1).

Materials and Methods

Participants. We recruited faculty participants from Biology, Chemistry, and Physics departments at three public and three private large, geographically diverse research-intensive universities in the United States, strategically selected for their representative characteristics (see SI Materials and Methods for more information on department selection). The demographics of the 127 respondents corresponded to both the averages for the selected departments and faculty at all United States research-intensive institutions, meeting the criteria for generalizability even from nonrandom samples (see SI Materials and Methods for more information on recruitment strategy and participant characteristics). Indeed, we were particularly careful to obtain a sample representative of the underlying population, because many past studies have demonstrated that when this is the case, respondents and nonrespondents typically do not differ on demographic characteristics and responses to focal variables (47).

Additionally, in keeping with recommended practices, we conducted an a priori power analysis before beginning data collection to determine the optimal sample size needed to detect effects without biasing results toward obtaining significance (SI Materials and Methods: Subjects and Recruitment Strategy) (48). Thus, although our sample size may appear small to some readers, it is important to note that we obtained the necessary power and representativeness to generalize from our results while purposefully avoiding an unnecessarily large sample that could have biased our results toward a false-positive type I error (48).

Procedure. Participants were asked to provide feedback on the materials of an undergraduate science student who stated their intention to go on to graduate school, and who was applying for the position of laboratory manager. Of importance, participants believed they were evaluating a real student who would subsequently receive the faculty participants’ ratings as feedback to help their career development (see SI Materials and Methods for more information, and Fig. S1 for the full text of the cover story). Thus, the faculty participants’ ratings were associated with definite consequences.

Following established practices, the laboratory manager application was designed to reflect high but slightly ambiguous competence, allowing for variability in participant responses (20, 23). In addition, a promising but stillnascent applicant is precisely the type of student whose persistence in academic science is most likely to be affected by faculty support or discouragement (30–33), rendering faculty reactions to such a student of particular interest for the present purposes. The materials were developed in consultation with a panel of academic science researchers (who had extensive experience hiring and supervising student research assistants) to ensure that they would be perceived as realistic (SI Materials and Methods). Results of a funneled debriefing (49) indicated that this was successful; no participant reported suspicions that the target was not an actual student who would receive their evaluation.

Participants were randomly assigned to one of two student gender conditions: application materials were attributed to either a male student (John, n = 63), or a female student (Jennifer, n = 64), two names that have been pretested as equivalent in likability and recognizability (50). Thus, each participant saw only one set of materials, from either the male or female applicant (see Fig. S2 for the full text of the laboratory manager application and SI Method and Materials for more information on all materials). Because all other information was held constant between conditions, any differences in participants’ responses are attributable to the gender of the student.

Using validated scales, participants rated student competence, their own likelihood of hiring the student, selected an annual starting salary for the student, indicated how much career mentoring they would provide to such a student, and completed the Modern Sexism Scale.

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Now Hiring! Empirically Testing a Three-Step Intervention to Increase Faculty Gender Diversity in STEM

JESSI L. SMITH, IAN M. HANDLEY, ALEXANDER V. ZALE, SARA RUSHING, AND MARTHA A. POTVIN

Workforce homogeneity limits creativity, discovery, and job satisfaction; nonetheless, the vast majority of university faculty in science, technology, engineering, and mathematics (STEM) fields are men. We conducted a randomized and controlled three-step faculty search intervention based in self-determination theory aimed at increasing the number of women faculty in STEM at one US university where increasing diversity had historically proved elusive. Results show that the numbers of women candidates considered for and offered tenure-track positions were significantly higher in the intervention groups compared with those in controls. Searches in the intervention were 6.3 times more likely to make an offer to a woman candidate, and women who were made an offer were 5.8 times more likely to accept the offer from an intervention search. Although the focus was on increasing women faculty within STEM, the intervention can be adapted to other scientific and academic communities to advance diversity along any dimension.

Keywords: diversity, women in science, science education and policy, behavioral science

A homogenous university faculty limits student and faculty creativity, discovery, and satisfaction (Page 2007, Apfelbaum et al. 2014), whereas diversity in science furthers social justice, expands workforce talent, and increases objectivity (Intemann 2009). However, university faculty are largely homogenous on the salient dimension of gender, because the majority of faculty at all ranks worldwide are men, especially within science, technology, engineering, and mathematics (STEM) fields (NSB 2012, European Commission 2013). For example, 68% to 89% of all academic grade C to grade A STEM personnel in the EU are men, and 81% of tenure-track STEM faculty at US public and land grant universities are men (European Commission 2013, Oklahoma State University 2013). Therefore, increasing gender diversity among STEM faculty is one straightforward way to enhance science education and scientific research innovation.

What is less straightforward are the reasons why STEM fields are male dominated and what can be done to enhance diversity. There is a tendency to blame “the pipeline” because few women candidates populate STEM-faculty search pools. It is true that fewer and fewer women advance at every transition point from secondary school to college to graduate study such that proportionally fewer women are qualified for STEM faculty positions than men (McCook 2011, NSB 2012). However, social psychological factors, such as implicit gender biases among university faculty and administrators that favor men in STEM, may inadvertently perpetuate homogeneity (Moss-Racusin et al. 2012, Shen 2013). Fortunately, educational programs could potentially actively counter this bias. What is more, search committees typically do not understand how to recruit and attract diverse candidates. For example, many assume that the competition for diverse candidates is fierce among institutions and therefore do not undertake efforts to broaden the pool of applicants. This scenario is consistent with social-judgment biases such as the false-consensus effect (Ross 1977), which occurs when people overestimate the extent to which others believe as they do. As a case in point, only 29% of white women who had won prestigious fellowships in the United States (Ford, Mellon, or Spencer fellows) received multiple tenure-track job offers for positions they desired; the majority of these women (71%) did not receive multiple offers or had limited choices among less than ideal offers (Smith DG et al. 1996).

Acquiescence that universities cannot diversify their faculty is a form of system justification that ultimately maintains the homogenous status quo (Jost et al. 2004). Offering search committees concrete best-practice techniques to address these psychological considerations could potentially enhance diversity. Finally, search committees must understand that partner accommodations and other work–life integration
issues are central to recruiting women, because 83% of women scientists in academia have partners also in academic science (Schiebinger et al. 2008, Moors et al. 2014).

We designed an intervention to overcome these challenges. As Timothy Wilson noted in his 2006 Science article on the power of social psychological interventions, “Brief theory-based interventions that focus on people’s construals can reap large benefits” (Wilson 2006). Intervening in the faculty search process is therefore one potential way to enhance the representation of women STEM faculty at an institution. Past intervention efforts to enhance gender diversity in academia focused mostly on the pipeline issue by supporting women students to perform well in, pursue, and persist in STEM (Huberman and Harackiewicz 2009, Miyake et al. 2010, Moss-Racusin et al. 2012, Smith JL et al. 2013). One notable exception was a detailed case study of an ecology faculty search employing intuitive (albeit effort-intensive) gender-blind applicant tracking that achieved partial success (Jones and Urban 2013). Theory-driven, randomized control trials aimed at enhancing diversity are relatively rare in intervention research (Moss-Racusin et al. 2014), and few studies on the search process include faculty as participants (e.g., Stewart et al. 2004, Carnes et al. 2012, Fine et al. 2014). We designed and empirically tested an intervention guided by the tenets of self-determination theory (Deci and Ryan 2000) aimed at enhancing the recruitment processes for multiple and varied STEM-faculty search committees.

Self-determination theory (Deci and Ryan 1985, 2000) proposes that creativity, motivation, and performance thrive when three particular psychological needs are satisfied: to engage in opportunities for learning and mastery (competence), to have flexibility and control over processes and outcomes (autonomy), and to make meaningful connections with others (relatedness). Informed by this theory, we designed a three-step faculty search intervention to supplement the mandatory human resources (HR) training that would (1) enhance the competence of the search committee by delivering concrete strategies for conducting a broad applicant search in the form of a printed “faculty search toolkit,” (2) enhance the autonomy of the search committee by showing them how to gain better control over possible unintentional biases in their decisionmaking through a 30-minute oral presentation by a faculty member on the role of implicit gender bias in skewed the candidate-screening and interview processes, and (3) enhance the relatedness of the search process more generally by both connecting the search committee with a peer faculty member who was supportive during the entire search process and by specifically connecting job finalists with a faculty “family advocate” totally independent from the search for a confidential 15-minute conversation. The faculty family advocate meetings were designed to meet all Equal Employment Opportunity rules by including all finalists, providing an overview of policies and practices without inquiring directly about a candidate’s marital or family status, and maintaining the confidentiality of any information shared through the discussion of work–life related questions. Family-advocate conversations were in no way communicated to the search committee nor had any bearing on the hiring decision.

The search committees in the no-intervention (status-quo) condition received only the mandatory HR training. This brief in-person training was conducted by an assigned staff member from HR. The HR staff person provided a packet of handouts that outlined compliance issues (e.g., must have at least two people on every phone reference check) and procedure issues (e.g., how to submit paperwork for the web-posting of the vacancy advertisement). The HR training did include a brief overview of antidiscrimination law, including a handout with a list of protected classes and a list of questions committees were not allowed to ask. The emphasis on this part of the HR training was on avoiding discrimination lawsuits by treating everyone equally, akin to the colorblind or gender-blind notion that gender or race “should not and does not matter” (Neville et al. 2000, p. 60), which is limited (Bagenstos 2006) and may lead, however inadvertently, to greater bias (Richeson and Nussbaum 2004). More details on the intervention and no-intervention conditions, including the family advocate, are outlined in the supplemental method S1 section; materials and facilitator guides are also freely available at www.montana.edu/nsfadvance/resources.html.

Our hypothesis was that search committees randomly assigned to the intervention, compared with the no-intervention, as-usual search procedures, would have an increased number of women candidates considered for and offered tenure-track positions in STEM.

Methodology
Our experiment took place across a broad discipline of 23 STEM-faculty searches during one academic year at Montana State University (MSU), a Carnegie Foundation–ranked Very High Research Activity (VHR) university in the United States (see methods S1 for more details). At the time, the 235 STEM faculty at MSU were largely homogenous (81% men), making this a representative context that mirrored national faculty gender statistics (Oklahoma State University 2013) in which to test our intervention. Moreover, the rural setting of the university, its low salaries (lowest among the 102 VHR ranked universities; Curtis and Thornton 2014), and the lack of a medical school also posed recruitment challenges, allowing for a strong test of the intervention. Our research is the first to use STEM faculty as participants in a hypothesis-testing study on diversity faculty hiring.

Search committee chairs were identified and invited via email by a faculty peer to voluntarily participate in a supplemental training to coincide, if possible, with the mandatory human resources–search committee training, which all committees received (see supplemental methods and discussion S1). None refused to participate. The selection of a faculty peer to contact search committee chairs and to present the intervention material were intentional to increase participation (see discussion S1). Presenting material to each search committee separately ensured a small group setting meant to enhance engagement with the presentation.
Results

The three-step intervention was successful. Among searches in the intervention condition, more applicants overall were short-listed and phone-interviewed (mean \( M = 9.5 \), standard error \( SE = 1.5 \)) compared with those in the no-intervention condition (\( M = 4.7 \), SE = 1.3; Cohen’s \( d = 0.99 \), \( t(21) = 2.26, p < .05 \)). Importantly, searches in the intervention condition phone-interviewed a significantly greater percentage of women applicants (\( M_{\text{women}} = 40.5\% \), SE = 7.4\%) compared with searches in the no-intervention condition (\( M_{\text{women}} = 14.2\% \), SE = 5.4\%; \( d = 1.16 \), \( t(21) = 2.57, p < .02 \); figure 1), illustrating a large improvement in the representation of women on the short lists. Given that travel funding limits the number of finalists brought to campus for interviews in each search, no difference existed in the mean numbers of finalists brought to campus for interviews between searches in the intervention (\( M = 6.1 \), SE = 1.4) and no-intervention (\( M = 3.6 \), SE = 0.5; \( p > .05 \)) groups. However, women made up a significantly greater percentage of on-campus interviewees for searches in the intervention group (\( M_{\text{women}} = 40.3\% \), SE = 6.9\%) than in the no-intervention group (\( M_{\text{women}} = 18.2\% \), SE = 7.3\%; \( d = 0.92 \), \( t(21) = 2.12, p < .05 \)), illustrating a large difference in the inclusion of women as finalists. Importantly, we ruled out alternative explanations and confirmed the effectiveness of our random assignment (see supplemental results and table S1).

Furthermore, 11 women were extended offers for tenure-track faculty positions—nine in the intervention condition and two in the no-intervention condition. Odds ratio statistics showed that a search in the intervention condition was 6.3 times more likely to make an offer to a woman candidate than a search in the no-intervention condition (\( d = 0.93 \); see figure 1). Moreover, women offered jobs were 5.8 times more likely to accept the offer from an intervention search (\( n = 7 \) accepted) than from a no-intervention search (\( n = 1 \) accepted; \( d = 0.80 \)). The three-step intervention effectively increased the number of women hired as incoming STEM faculty at MSU. Subsequent application of our intervention to all STEM faculty searches has continued this trend, with women representing precisely 50\% of all STEM faculty hires with start dates in 2013–2014 academic year (\( n = 10 \) men and 10 women) and start dates in 2014–2015 academic year (\( n = 9 \) men and 9 women hired).

Conclusions

We tested a theory-derived three-step intervention that involved (1) a short presentation to search committees about overcoming the influence of unintentional (i.e., implicit) bias during the review process, (2) arming search committees with a guidebook on tactics for recruiting diverse candidates, and (3) providing access to a faculty family advocate who was unaffiliated with the search to confidentially discuss any work–life integration issues deemed appropriate by the candidates. The intervention measurably increased gender diversity among STEM faculty. Although the focus here was on increasing women faculty within STEM, the intervention can be adapted to other scientific and academic communities to advance diversity along any dimension.

Some pushback was experienced, as we expected, and a small number of male and female faculty expressed concerns that paying attention to gender diversity in STEM while conducting a faculty search was “lowering standards to fulfill a quota” (a sentiment that perfectly exemplifies gender bias). Indeed, a good next step would be to examine how faculty experience the intervention process itself (Moss-Racusin et al. 2014) versus the outcomes of the intervention as we reported here. For example, some faculty may believe that a focus on gender diversity is a form of reverse discrimination or that such a focus implies women are less competent and unable to make it on their own merits (Etzkowitz et al. 1994, Norton and Sommers 2011). Such mental frameworks probably have important ramifications for how people experience self-determination within what is perceived as a potentially threatening, high-stakes situation. Pushback notwithstanding, our brief three-step faculty search intervention was successful. We show that organizations can benefit from using psychological science to inform precise interventions. Although our data does not build on self-determination theory, it was inspired by and supports self-determination theory. Systematically testing theory through application can potentially contribute to theory-building in the future (e.g., Wilson 2006, Walton 2014). For example, future research could test which psychological need (competence, autonomy, or relatedness) was most essential to the success of the intervention and/or reveal the level at which it is important to foster psychological-need support, whether to the entire group (i.e., the search committee) or to an influential leader of the group (i.e., the search chair).

Figure 1. Mean percentages of women interviewed at two points in the science, technology, engineering, and mathematics (STEM) faculty search process and simple percentages of tenure-track job offers extended to and accepted by women, by intervention group. The error bars represent the standard error.
Worldwide, STEM funding agencies are investing heavily in diversifying the scientific workforce. As just two examples, the US National Science Foundation NSF ADVANCE-Institutional Transformation program and the European Commission genSET project have spent millions to bring about equality for women working in STEM. Our findings contribute to these important efforts. After all, a diverse faculty engenders social justice and betters the condition of underrepresented people working within STEM (Etzkowitz et al. 1994, Sekaquaptewa 2002). Diversity within STEM is essential for creating a thriving workplace and a learning environment replete with role models, diverse ways of thinking, and enhanced learning that elevates excellence and benefits scientific innovation, public health, and economic growth.

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Supplemental material
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Quality of evidence revealing subtle gender biases in science is in the eye of the beholder

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Scientists are trained to evaluate and interpret evidence without bias or subjectivity. Thus, growing evidence revealing a gender bias against women—or favoring men—within science, technology, engineering, and mathematics (STEM) settings is provocative and raises questions about the extent to which gender bias may contribute to women’s underrepresentation within STEM fields. To the extent that research illustrating gender bias in STEM is viewed as convincing, the culture of science can begin to address the bias. However, are men and women equally receptive to this type of experimental evidence? This question was tested with three randomized, double-blind experiments—two involving samples from the general public (n = 205 and 303, respectively) and one involving a sample of university STEM and non-STEM faculty (n = 205). In all experiments, participants read an actual journal abstract reporting gender bias in a STEM context (or an altered abstract reporting no gender bias in experiment 3) and evaluated the overall quality of the research. Results across experiments showed that men evaluate the gender-bias research less favorably than women, and, of concern, this gender difference was especially prominent among STEM faculty (experiment 2). These results suggest a relative reluctance among men, especially faculty men within STEM, to accept evidence of gender biases in STEM. This finding is problematic because broadening the participation of underrepresented people in STEM, including women, necessarily requires a widespread willingness (particularly by those in the majority) to acknowledge that bias exists before transformation is possible.

gender bias | science workforce | diversity | science education | sexism

Objectivity is a fundamental value in the practice of science and is required to optimally assess one’s own research findings, others’ findings, and the merits of others’ abilities and ideas (1). For example, when scientists evaluate data collected on a potentially controversial topic (such as climate change), they strive to set aside their own belief systems and instead focus solely on the strength of the data and conclusions warranted. Similarly, when scientists evaluate a resume for a laboratory-manager position or assess the importance of a conference submission, the gender of the applicant or author should be immaterial. If they are truly objective, scientists should focus only on the relevant criteria of applicant qualifications or research merit.

However, despite rigorous training in the objective evaluation of information and resultant values (2), people working and learning within the science, technology, engineering, and mathematics (STEM) community are still prone to the same subtle biases that contribute to women’s underrepresentation in STEM fields (8, 9) and the undervaluation of these women and their work. Specifically, many scientists have systemically documented and reported (including in PNAS) a gender bias against women—or favoring men—in STEM contexts (10–17), including hiring decisions for a laboratory-manager position (10) and selection for a mathematical task (11), evaluations of conference abstracts (12), research citations (13), symposia-speaker invitations (14), postdoctoral employment (15), and tenure decisions (16). For example, Moss-Racusin et al. (10) conducted an experiment in which university science professors received the same application for a laboratory-manager position, either associated with a male or female name through random assignment. The results demonstrated that the science professors—regardless of their gender—evaluated the applicant more favorably if the applicant had a man’s name compared to a woman’s name. These findings mirror past results in which men and women psychology faculty participants evaluated an application from a faculty candidate with a woman’s name less favorably than the identical application with a man’s name (17). As another example, Knobloch-Westerwick et al. (12) found that graduate students evaluate science-related conference abstracts more positively when attributed to a male relative to a female author, particularly in male-gender-typed science fields. These biases are frequently unintentional (18–20), exhibited even by individuals who greatly value fairness and view themselves as objective (21). Indeed, gender biases often result from unconscious processes (22, 23) or manifest so subtly that they escape notice (24).

However unintentional or subtle, systematic gender bias favoring male scientists and their work could significantly hinder scientific progress and communication (12). In fact, the evidence for a gender bias in STEM suggests that our scientific community is not living up to its potential, because homogeneous workforces (including the academic workplace) can deplete the creativity, discovery, and satisfaction of workers, faculty, and students (25–27). STEM fields are fairly homogeneously male; at 4-y US colleges, for example, an average of 71% of STEM faculty are men.

Significance

Ever-growing empirical evidence documents a gender bias against women and their research—and favoring men—in science, technology, engineering, and mathematics (STEM) fields. Our research examined how receptive the scientific and public communities are to experimental evidence demonstrating this gender bias, which may contribute to women’s underrepresentation within STEM. Results from our three experiments, using general-public and university faculty samples, demonstrated that men evaluate the quality of research unveiling this bias as less meritorious than do women. These findings may inform and fuel self-correction efforts within STEM to reduce gender bias, bolster objectivity and diversity in STEM workforces, and enhance discovery, education, and achievement.


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promoted inclusiveness as a core value in its 2014 STEM fields. For instance, the National Science Foundation (NSF) participation of women (and other underrepresented groups) in (28). For these reasons, there is a growing call for broadening the participation within STEM to create a thriving, diverse, and equitable scientific community (31–34). However, are people generally (e.g., taxpayers, voters, government officials, etc.) and STEM practitioners in particular “buying” the mounting evidence of these gender biases within the STEM community? Currently, to our knowledge, there is no experimental research examining how receptive or biased various individuals within the STEM and public communities are to research demonstrating gender bias that undermines women’s participation within STEM. Thus, to address this question, our experimental research investigates potentially biased evaluations among the general public and STEM practitioners, with evidence demonstrating gender biases against women favoring men within STEM fields.

Of course, to ameliorate gender bias within STEM fields, it is not sufficient to simply herald findings demonstrating that STEM practitioners exhibit these biases. Indeed, there may well be another layer of bias such that men evaluate findings such as those reported by Moss-Racusin et al. (10) and Knobloch-Westerwick et al. (12) less favorably than women. In fact, a recent (nonexperimental) analysis of naturally occurring online comments written by readers of popular press articles covering the research of Moss-Racusin et al. (10) suggests that men were more likely than women to demonstrate negative reactions to experimental evidence of gender bias (35). Further, several lines of theorizing suggest that men may evaluate such research as less meritorious than would women (24, 36–42). Among these theories, Social Identity Theory (36–38) and related perspectives (39) posit that men are motivated to prefer male over female status and to favorably and defend that perception against threat, and that people within privileged groups often seek to retain and justify their privileged status (39). Men clearly hold an advantageous position within the sciences, because they represent the vast majority of STEM university faculty at all ranks, earn higher salaries controlling for rank and related factors (43), and on average receive more federal grant funding to support their research than their comparable women colleagues (44, 45). Indeed, growing evidence reveals an often invisible advantage for men, stemming in part from inequities against women in STEM, which can threaten that advantage (10, 12, 46, 47). That is, men might find the results reported by Moss-Racusin et al. (10) threatening, because remedying the gender bias in STEM fields could translate into favoring women over men, especially if one takes a zero-sum-gain perspective (47). Therefore, relative to women, men may devalue such evidence in an unintentional implicit effort (18–20) to retain their status as the majority group in STEM fields. However, some men might perceive research that exposes gender bias in STEM as more threatening than other men. According to Social identity Theory, individuals perceive greater threat toward their group (and defend against it) when they are highly committed to that group (37, 38). Thus, men within STEM fields (e.g., physics professors) may feel more threatened by the research of Moss-Racusin et al. (10) than men within non-STEM fields (e.g., English professors), assuming they are more committed to STEM fields and men’s status therein.

Thus, men overall relative to women are likely to devalue research demonstrating bias against women in STEM, but this difference may be prominent among individuals within (and committed to) STEM fields, and weaker to nonexistent among individuals within non-STEM fields.

Beyond Social Identity Theory, other frameworks could predict a difference between men’s and women’s evaluation of research demonstrating bias against women in STEM, and, in fact, this difference might result from multiple factors. For instance, the predicted gender difference may also result from a confirmation bias such that people favorably evaluate information that is consistent with their beliefs, but unfavorably evaluate information that is inconsistent with their beliefs (48). A classic empirical example of confirmation bias showed that peer-reviewers were less favorable toward an essentially identical research manuscript when it was doctorated to report results inconsistent with the reviewers’ preferred theoretical viewpoint, but more favorable when it was doctorated to report results consistent with the reviewers’ preferred theoretical viewpoint (49). Add to this finding that there is compelling evidence that women faculty are more likely to view gender bias as a problem within their current working academic context (40), and it is possible that women may evaluate research demonstrating a gender bias (belief consistent) more favorably than men, but evaluate research demonstrating no gender bias (belief inconsistent) less favorably than men.

**Current Research**

We report three experiments designed to provide, to our knowledge, the first test for gender differences in the evaluation of scientific evidence demonstrating that individuals are biased against women within STEM contexts. In each experiment, men and women participants read via an online survey instrument an actual article abstract from a peer-reviewed scientific journal, accompanied by the date and title of the publication (see Materials and Methods for more details). Participants then evaluated their agreement with the authors’ interpretation of the results, the importance of the research, and how well-written and favorable they found the quality of the abstract. These ratings were highly associated with one another and were averaged to create a measure of participants’ overall evaluation of the abstract (for further details, see SI Materials and Methods, Dependent Variables). Globally, we predicted that male relative to female participants would evaluate the abstract less favorably when the abstract reported a gender bias against women in STEM (hypothesis A; experiments 1–3), and that this difference would be more prominent among participants in STEM (vs. non-STEM) fields, to whom a gender bias in STEM is most germane (hypothesis B; experiment 2). Further, we predicted that this gender difference would manifest for abstracts that reported a gender bias in STEM, but would reverse for abstracts that reported no gender bias in STEM (hypothesis C; experiment 3).

All experiments included 2 or more factors (some for exploratory purposes in Experiments 1 and 2; see SI Materials and Methods for more details), and thus we tested all hypotheses using between-groups factorial analyses of variance. Further, we calculated Cohen’s d for each experiment to provide an index of strength for the predicted difference between men and women participants and to account for the unequal sample sizes between the genders. As per convention (50), effect sizes can range from small (d = 0.20), to medium (d = 0.50), to large (d = 0.80).

The first two experiments tested for participant-gender differences in the evaluation of the actual abstract written by Moss-Racusin et al. (10). As discussed above, Moss-Racusin et al. (10) produced experimental evidence that STEM faculty of both genders demonstrate a significant bias against an identical applicant with a female vs. male name. Although this gender bias was empirically demonstrated with a national sample, we predicted that men would be less receptive to these (and related) findings, and
women more receptive. Our first experiment involved a general sample of US adults (*n* = 205) recruited online through Amazon’s Mechanical Turk. Our second experiment involved a sample of professors (*n* = 205) from all STEM and non-STEM departments at a research-intensive university, allowing us to test whether the predicted gender difference in abstract evaluations is larger among individuals within STEM fields of study. A third experiment replicated the first two with a different abstract and is discussed in more detail below.

**Results**

**Experiments 1 and 2.** Results from our experiment 1 supported hypothesis A, revealing a main effect of participant gender [*F*(1, 197) = 9.85, *P* = 0.002, η<sup>2</sup> *partial* = 0.048], such that men (*M* = 4.25, *SD* = 0.91, *n* = 146) evaluated the research less favorably than women (*M* = 4.66, *SD* = 0.93, *n* = 59) in a general sample. Further, this effect was of moderate size (*d* = 0.45).

Results from our experiment 2 also supported hypothesis A, revealing a main effect of participant gender [*F*(1, 174) = 6.08, *P* = 0.015, η<sup>2</sup> *partial* = 0.034], such that male faculty evaluated the research less favorably (*M* = 4.21, *SD* = 1.05) than female faculty (*M* = 4.65, *SD* = 1.19, *d* = 0.397) [similar to experiment 1]. Thus, overall, experiments 1 and 2 provide converging evidence from multiple participant populations that men are less receptive than women—and by the same token, that women are more receptive than men—to experimental evidence of gender bias in STEM. Importantly, results from experiment 2 further reveal that this effect was qualified by a significant interaction between participant gender and field of study [*F*(1, 174) = 5.19, *P* = 0.024, η<sup>2</sup> *partial* = 0.03]. This interaction supported hypothesis B, because simple-effect tests confirmed that male faculty evaluated the research less favorably (*M* = 4.02, *SD* = 0.988, *n* = 66) than female faculty (*M* = 4.80, *SD* = 1.14, *n* = 38) in STEM fields [*F*(1, 174) = 11.94, *P* < 0.001], whereas male (*M* = 4.55, *SD* = 1.09, *n* = 37) and female (*M* = 4.54, *SD* = 1.23, *n* = 49) faculty reported comparable evaluations in non-STEM fields (*F* < 1).

Further, the effect size for the observed gender difference was large within STEM departments (*d* = 0.74). Looking at this interaction another way, simple-effect tests demonstrated that men evaluated the research more negatively if they were in STEM than non-STEM departments [*F*(1, 174) = 4.19, *P* = 0.042], whereas the opposite trend was not statistically significant among female faculty [*F*(1, 174) = 1.45, *P* = 0.23]. Thus, it seems that men in STEM displayed harsher judgments of Moss-Racusin et al.’s (10) research, not that women in STEM exhibited more positive evaluations of it. The analysis revealed one other significant interaction that did not involve faculty gender (for further details, see SI Additional Analyses, Experiment 2). No other main effects or interactions reached significance (all other *F* < 2.07; *P* > 0.15). Finally, additional measures collected within a faculty survey (SI Materials and Methods, Dependent Variables) and analyses thereof provide suggestive evidence for a threat mechanism behind the effects (for the analyses and discussion, see SI Additional Analyses, Experiment 2).

**Experiment 3.** We predicted that, compared with women, men would be prone to more negative evaluations of research that demonstrates a gender bias against women (and favors men) in STEM, not just the specific research reported by Moss-Racusin et al. (10). Further, we predicted that, compared with men, women would be prone to more negative evaluations of research that demonstrates no gender bias against women in STEM. Thus, the gender effect seen in experiments 1 and 2 should replicate for a different abstract that also reports a gender bias, but reverse for an abstract that demonstrates no gender bias. Testing these predictions, we randomly assigned new participants to read either the original abstract published by Knobloch-Westerwick et al. (12) which reported a gender bias against women’s (relative to men’s) scientific conference submissions, or a version slightly altered to report no gender bias. These participants were recruited online through Amazon’s Mechanical Turk (*n* = 303). Results indicated only a significant interaction between participant gender and abstract version [*F*(1, 299) = 4.00, *P* = 0.046, η<sup>2</sup> *partial* = 0.013] (all other *F* < 1). Although no simple-effect tests were significant (all *F* < 2.69, *P* > 0.10), together, these results support the overall pattern predicted by hypothesis C, such that that men evaluated the original (gender-bias exists) abstract less favorably (*M* = 3.65, *SD* = 1.03, *n* = 78) than did women (*M* = 3.86, *SD* = 1.05, *n* = 74; *d* = 0.20), whereas men evaluated the modified (no gender-bias exists) abstract more favorably (*M* = 3.83, *SD* = 0.92, *n* = 84) than did women (*M* = 3.59, *SD* = 0.86, *n* = 67; *d* = 0.27).

**Discussion**

There is now copious evidence that women are disadvantaged in STEM fields (51–53) and that this disadvantage may relate to gender stereotypes (11) and consequent biases against women (or favoring men) traversing the STEM pipeline (10–17). Of course, people should not passively accept such evidence, even if it appears in preeminent peer-reviewed journals (e.g., *Science, PNAS*, or *Nature*)—suggesting the quality of the research was sound. Ideally, especially within the STEM community, people should evaluate as objectively as possible the research producing such evidence, the resulting quality of the evidence, and the interpretation of that evidence.

However, the evidence from our three straightforward experiments indicates that men evaluate research that demonstrates bias against women in STEM less favorably than do women—or, that women evaluate it more favorably. Specifically, male relative to female participants (including university faculty) in experiments 1 and 2 assessed the quality of the research by Moss-Racusin et al. (10)—as presented simply through their actual abstract—as being lower. In addition, perhaps of greatest concern, this gender difference and accompanying effect size was large among faculty working within STEM fields (50) and nonexistent among faculty from non-STEM fields (experiment 2). Further, the overall gender difference observed in the first two experiments was replicated among participants in experiment 3 who read the true abstract of Knobloch-Westerwick et al. (12), who also reported a gender bias in STEM. However, this gender difference was reversed among participants who read an altered version purporting no gender bias in STEM.

The results from this third experiment are important for at least three reasons. First, they indicate that men relative to women do not uniquely disfavor the research of Moss-Racusin et al. (10), but research that reports a gender bias hindering women in STEM. Second, these results suggest that men do not generally evaluate research more harshly than women, as it might seem from the first two experiments (but see the results from non-STEM faculty in experiment 2). Rather, relative to women, men actually favor research suggesting there is no gender bias in STEM. Finally, the results indicate that individuals are likely to demonstrate a gender bias toward research pertaining to the mere topic of gender bias in STEM; men seem to disfavor (and women favor) research demonstrating a gender bias, but women seem to disfavor (and men favor) research demonstrating no gender bias. Of course, given that we cannot have a gender-free control condition, it is important to note that these biases are relative to the other gender; we cannot conclude that one gender is more biased than the other, just that individuals’ judgments of research regarding gender bias in STEM is biased by their gender.

Critically, across three experiments, we uncovered a gender difference in the way people from the general public and STEM faculty evaluate the quality of research that demonstrates women’s documented disadvantage in STEM fields: Men think the research is of lower quality, whereas women think the research is of higher
quality. Why does this gender difference matter? For one, there are significant implications for the dissemination and impact of meritorious previous, current, and future research on gender bias in STEM fields. Foremost, our research suggests that men will relatively disfavor—and women will relatively favor—research demonstrating this bias. Given that men dominate STEM fields throughout industry and academia, scholars whose program of research focuses on demonstrating gender bias in STEM settings might experience undue challenges for publication, have lower chances of publication in top-tier outlets, experience greater challenges in receiving tenure, and overall have lower-than-warranted impact on the thinking, research, and practice of those in STEM fields. Such possibilities are highly problematic and call for additional research evaluating biased reactions to scientific evidence demonstrating gender and/or racial biases within STEM.

Second, because men represent the majority of individuals in STEM fields and yet are less likely than women to acknowledge biases against women in STEM, it may be challenging to fully embrace the numerous calls to broaden the participation of women and minorities in STEM. How can we successfully broaden the participation of women in STEM when the very research underscoring the need for this initiative is less valued by the majority group who dominate and maintain the culture of STEM? Intensifying the challenge, men hold an advantageous position in majority group who dominate and maintain the culture of STEM? Why does this gender difference matter? For one, there are significant implications for the dissemination and impact of meritorious previous, current, and future research on gender bias in STEM fields. Foremost, our research suggests that men will relatively disfavor—and women will relatively favor—research demonstrating this bias. Given that men dominate STEM fields throughout industry and academia, scholars whose program of research focuses on demonstrating gender bias in STEM settings might experience undue challenges for publication, have lower chances of publication in top-tier outlets, experience greater challenges in receiving tenure, and overall have lower-than-warranted impact on the thinking, research, and practice of those in STEM fields. Such possibilities are highly problematic and call for additional research evaluating biased reactions to scientific evidence demonstrating gender and/or racial biases within STEM.

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Limitations and Future Directions

As with any research, ours is met with limitations. First, we did not directly test the potential mechanisms behind the reported gender effect. However, even before we understand exactly why men are less favorable than women toward research demonstrating a gender bias in STEM, we suggest that is important for the STEM community to know that this phenomenon exists. However, we uncovered evidence in experiment 2 suggesting that men in STEM found the abstract of Moss-Racusin et al. (10) threatening (SI Additional Analyses, Experiment 2), which may be one possible explanation for the results (37). In the future, researchers could test this possibility by including a direct measure of how threatening people find the implications of various research results and multiple measures of social identity. It is also worth investigating in future research whether the confirmation bias (48, 49) contributes to the reported gender effect by measuring people’s beliefs about gender bias in STEM before reading research demonstrating that bias. We hope our findings will spark future research thoroughly investigating the mechanisms underscoring this effect. Second, we investigated individuals’ evaluations of two abstracts reporting gender bias in STEM, specifically within the contexts of evaluating a laboratory-manager application and conference abstracts. It is worthwhile to investigate whether this bias furthermore generalizes to evaluations of research that demonstrates gender bias in other STEM contexts, such as disparities in funding, publication rates, faculty and post-doctoral applicants, talk invitations, tenure decisions, and so forth. Theoretically, however, there is reason to predict that gender biases toward such research would replicate our current findings. In fact, because these contexts suggest a bias against (or in favor of) one’s direct peers and colleagues, it seems likely that gender-biased evaluations of this research would be even more prominent. For instance, STEM faculty might find threatening the possibility that they are biased regarding the quality of research from their female colleagues and prefer (likely implicitly) to find fault with the research rather than face that possibility.

Third, we investigated individuals’ assessment of research quality after they read only an abstract. We chose an abstract as a reasonable basis for assessment because abstracts present key methods and findings, are indexed and available for free, and are often what people read to determine whether or not they will read the full article. Nonetheless, it is conceivable that the gender bias we uncovered is a short-lived reaction. Perhaps the bias would shrink or disappear after reading the full article or a longer synopsis of the research. However, there is ample reason to predict that the bias will actually strengthen as people receive greater amounts of information, because they will (unintentionally) process that information based on initial impressions and per their motivation to arrive at a particular conclusion (42, 48, 49). However, we encourage future research into this issue.

As a final point on limitations, our experiments took place on an Internet platform, either at the end of a faculty survey that offered US$5 or as a short 10-min experiment paying $0.25. Thus, it is possible that our participants were not highly motivated to think about the abstract and thus simply based their quality assessments on “gut reactions” resulting in part from unconscious biases. Perhaps our findings would not hold among highly motivated participants whose assessments might have actual bearing on the publication of the research described in the abstract (e.g., peer reviewers). This hypothesis is certainly a possibility that warrants future exploration. However, we note that greater motivation does not always result in greater objectivity. In fact, biases can influence people’s judgments even more so when they are motivated to be accurate, particularly if they do not notice that their thought process is biased (21, 42).

Further research might also explore why our first two experiments did not replicate previous research demonstrating an overall bias favoring the research of men above women in STEM (SI Additional Analyses). In particular, Knobloch-Westerwick et al. (12) found that graduate students evaluate science-related conference abstracts more positively when attributed to a male (relative to female) author, particularly in male-gender-typed fields. However, we did not find that participants in experiment 1 and 2 favored the abstract written by Moss-Racusin et al. (10) more if they thought it was written by a man vs. a woman. It is possible that participants in our first two experiments found the topic of gender bias within STEM “feminine,” or perhaps only somewhat “scientific,” thus decreasing the bias toward the author’s gender. Future research might reveal that participants’ perception of gender-bias research plays an important role in producing biases against women—and favoring men—who conduct such research.

Conclusion

Failures in objectivity are problematic to specific research projects, science generally, and receptivity to discovery. However, objectivity
is threatened by a multitude of cognitive biases, including gender bias in STEM fields. Numerous experimental findings confirm the existence of this bias, and the research we present here peels back yet another level of bias: Men evaluate the research that confirms gender bias within STEM contexts as less meritorious than do women. We hope that our findings help inform and fuel self-correction efforts within STEM to reduce this bias, bolster objectivity, and diversify STEM workforces. After all, the success of these efforts can translate into greater STEM discovery, education, and achievement (57).

Materials and Methods

Participants. In experiments 1 and 3, participation was solicited from workers on Amazon’s Mechanical Turk online job site, who could view our employment opportunity list alongside other opportunities. In experiment 1, a total of 205 individuals (146 men and 59 women) from the United States who were 18 y of age or older (M = 30.13; range = 18–66) opted to participate in the experiment and provided usable data (for more details, see SI Materials and Methods, Participants and Recruitment for Experiments 1 and 3). In experiment 3, a total of 303 individuals (162 men and 141 women) from the United States who were 18 y of age or older (M = 34.22; range = 18–79) opted to participate in the experiment and provided usable data. All participants engaged in the ~10-min experiment in exchange for $0.25.

In the United States, selection was achieved through a random sample of all tenure-track faculty at a research-intensive American university via an email from their university provost encouraging participation in a larger baseline faculty climate survey. The survey and experiment were conducted on an internet platform, during which time 506 tenure-track faculty from this university received the email invitation to participate. A total of 268 of these faculty participated in the experiment at the end of the survey. The resulting sample included faculty from all departments at the university, from STEM departments (n = 116) and non-STEM departments (n = 89; for more details, see SI Materials and Methods, Participants and Recruitment for Experiment 2). All participants received a $5 coupon for a local coffee shop and, if they elected, were entered into a raffle for 1 of 50 possible $500 US gift certificates for the campus bookstore.

Procedure. All procedures were approved by the Montana State University institutional review board. The three experiments were approximately identical, although the experiment stood alone in experiments 1 and 3 and followed a faculty climate survey in experiment 2. All participants completed the experiment using a personal or work computer and received experiment materials, provided informed consent, and provided responses through www.surveysmonkey.com.

Participants in experiments 1 and 2 were first instructed to read the actual abstract from the Moss-Racusin et al. (10) paper, which was provided in full on a single screen. The abstract was accompanied by that paper’s actual title, publication date, volume and issue number, first author’s full name, keywords, and a fictitious DOI. Further, participants were randomly assigned to receive a version of the abstract that either identified the first authors’ first name as “Karen” or “Brian,” which previous research indicates are equally likable and common names in the United States (58). Independent from this manipulation, participants received a version of the abstract that identified the author as affiliated with either Yale University (Moss-Racusin’s true affiliation at the time of the publication) or Iowa State University. After reading the abstract and affiliated information, participants were asked to provide ratings on several scales (adapted from scales commonly used to gauge attitude change and evaluations of persuasive materials) assessing the quality of the abstract and the research provided therein (for details, see SI Materials and Methods, Dependent Variables). Participants also provided demographic information, including their gender. Participants’ responses were anonymous, but in experiment 2 their status as a STEM or non-STEM faculty member was identifiable using specialized codes. Overall, the research design allowed us to analyze participants’ quality assessments of the Moss-Racusin et al. (10) research as a function of participant gender, author gender, author affiliation, and participants’ STEM self-identification. First, participants engaged in the experiment using a personal or work computer and received experiment materials, provided informed consent, and provided responses through www.surveysmonkey.com.

Participants in experiment 3 completed a similar procedure, with some key differences. First, participants were randomly assigned to read either the original version of the abstract by Knobloch-Westercik et al. (12), which reported a gender bias, or a version slightly altered to report no gender differences. Second, the abstract was not accompanied by the author’s name or affiliation (as was done in experiments 1 and 2). Otherwise, the procedures and dependent measures for this experiment are identical to those used in the previous experiments. This research design allowed us to analyze participants’ quality assessments of the research by Knobloch-Westercik et al. (10) as a function of participant gender and abstract version (reporting gender bias or no gender bias).

ACKNOWLEDGMENTS. We thank the social science research team (especially Rebecca Belou) and project management staff of ADVANCE Project TRACS (Transformation through Relatedness, Autonomy, and Competence Support) for their efforts. This work was supported in part by the National Science Foundation Grant 1208831 (to J.L.S.).

Supporting Information

Handley et al. 10.1073/pnas.1510649112

SI Materials and Methods

Participants and Recruitment for Experiments 1 and 3. Participation was elicited from workers on Amazon’s Mechanical Turk online job site, who could view our employment opportunity (titled “What do REAL people think about science research results?”) listed alongside other opportunities.

A total of 205 individuals opted to participate in experiment 1 and provided usable data, which was active in March 2014. Originally, 218 individuals participated in the experiment, but 9 were excluded from data analysis because they failed one or more attention-check items (e.g., “If you are reading, respond ‘very much’ to this question;” “If you are reading, respond ‘not at all’ to this question”), 2 because they reported being under 18 y of age, and 2 because they did not specify their gender. Ultimately, 146 men and 59 women from the United States who were 18 y of age or older (M = 30.13; range = 18–66) were retained for analysis. Of this general sample, 68.12% reported their race as “white,” and 51 individuals reported they were currently college students.

A total of 303 individuals opted to participate in experiment 3 and provided usable data, which was active in November 2014. Originally, 321 individuals participated in the experiment, but 12 were excluded from data analysis because they failed one or more attention-check items, 2 because they reported being under 18 y of age or did not specify an age, 1 because they did not specify their gender, and 7 because they reported they had read the abstract before (some participants met multiple exclusion criteria). Ultimately, 162 men and 141 women from the United States who were 18 y of age or older (M = 34.22; range = 18–79), were retained for analysis. Of this general sample, 73.93% reported their race as “white,” and 55 individuals reported they were currently college students.

Participants and Recruitment for Experiment 2. Participation was initially elicited on November 4, 2013, from all 506 tenure-track faculty at a research-intensive university via an email from their university provost encouraging participation in a larger faculty climate survey. That same day, our research team emailed all tenure-track faculty a message that explained the nature and importance of the survey, contained an informed consent form for faculty to read, explained the compensation faculty would receive for their participation, and contained a link to the survey and experiment, which was hosted on surveymonkey.com. This email included a unique identification code for each person, which preserved respondents’ anonymity and confidentiality, but allowed us to trace the faculty’s home department. In this way, we could determine whether faculty resided in STEM, including Social and Behavioral Sciences, departments (i.e., Agricultural Economics and Economics, Animal and Range Sciences, Cell Biology and Neuroscience, Center for Biofilm Engineering, Chemical and Biological Engineering, Chemistry, Civil Engineering, Computer Science, Earth Science, Ecology, Electrical Engineering, Industrial and Management Engineering, Institute on Ecosystems, Immunology and Infectious Diseases, Land Resources and Environmental Science, Mathematical Sciences, Mechanical and Industrial Engineering, Microbiology, Native American Studies, Physics, Plant Sciences, Political Science, Psychology, and Sociology and Anthropology) or non-STEM departments (i.e., Agricultural Education, Art, Nursing, Education, English, Film and Photography, Health and Human Development, History and Philosophy, Honor’s Program, Liberal Studies, Modern Languages and Literature, Science Education, Music, and University Studies). All faculty who did not participate as of November 18 received a reminder email, which also contained a link to the survey and experiment and their unique identification code. The survey was closed on the evening of November 22.

Ultimately, 286 faculty participated in the unrelated survey, and 205 (40.5% of faculty) further elected to participate in our experiment at the end of the survey. Of these, 111 (54%) were men and 94 were women. Further, as specified above, 116 faculty were categorized as residing in STEM departments and 89 as residing in non-STEM departments. A comparable ratio of faculty from STEM (116/289 or 40.1%) and non-STEM (89/217 or 41.0%) departments completed the experiment. Participants indicated their race as white/Caucasian (86.3%), Asian (2%), Hispanic/Latino (1%), Native American (0.5%), or mixed (0.5%), or they opted not to report these data (9.8%). Further, participants reported their faculty rank as assistant (43.9%), associate (27.8%), or full (26.3%), or they did not specify (2%). Participants’ ages ranged from 27 to 73 y (M = 47.35), and they had worked in their current position between 0 and 35 y (M = 10.51). The demographics of our sample closely match the population of professors from this university (which is 64% male and 90.9% white/Caucasian), although assistant professors were somewhat overrepresented in our sample relative to the university population (assistant, associate, and full ranks comprise 29.3%, 32.1%, and 38.6% of professors, respectively). Aside from rank, however, we can reasonably infer that there were no systematic biases influencing individuals’ decisions to participate in the experiment. That is, the results from this sample likely generalize to the population of faculty under investigation.

Procedure for Experiment 1. For experiment 1, once participants clicked on the title for our experiment on Amazon’s Mechanical Turk, they encountered the following short paragraph: “In the scientific world, peer experts judge the quality of research and decide whether or not to publish it, fund it, or discard it. But what do everyday people think about these articles that get published? We are conducting an academic survey about people’s opinions about different types of research that was published back in the last few years. You will be asked to read a very brief research summary and then answer a few questions about your judgments as non-experts about this research. There is no right or wrong answer and we realize you don’t have all the information or background. But just like in the scientific world, many judgments are made on whether something is quality science or not after just reading a short abstract summary. So to create that experience for you, we ask that you just provide your overall reaction as best you can even with the limited information. You will also be asked to provide demographic information about yourself. Select the link below to complete the survey.” Participants were also reminded that they would receive $0.25 in exchange for submitting the job “hit.” Participants then accepted the hit and opened up the survey in a separate tab or window. After consenting to participate, participants were given a summary of the experiment that they read before accepting the hit and then were asked, “Please read the following abstract from a 2012 published research study then provide your opinion with the items below.” Next, participants viewed the abstract written by Moss-Racusin et al. (10), the first author’s name and affiliation, and keywords, as described in the main text, and participants then provided their opinions about the abstract using scale ratings (SI Materials and Methods, Dependent Variables). Once they began the survey, participants learned that they could skip over any questions or task that they wished, ensuring that our procedures were not coercive. Participants then completed demographic information, were debriefed regarding
the purpose of the experiment, and were compensated $0.25 for their time.

Procedure for Experiment 2. For experiment 2, once participants followed the link to the survey website, they first read information about the faculty climate survey and the types of tasks and questions they would encounter. Participants were also reminded that they would receive a $5 coupon from a local coffee shop for completing the survey and would be entered into a raffle to win 1 of 50 gift certificates form the campus bookstore (worth $50). Once they advanced to the survey, participants further learned that they could skip over any question or task they wished. This option resulted in several participants providing only partial data for the experiment (addressed in SI Additional Analyses, Experiment 2). The faculty climate survey took ~15 min to complete and primarily contained questions about the university work environment, which were independent from the reported experiment.

Just after the survey, participants were asked “Please read the following abstract from a 2012 published research study then provide your opinion with the items below.” They then viewed the same abstract and associated information as in experiment 1 and evaluated that abstract using the same scale ratings. Finally, participants entered their unique code and could print off a coupon in compensation for their participation.

Procedure for Experiment 3. The procedures for experiment 3 were identical to experiment 1, with a few minor, but important, differences. First, participants were randomly assigned to read either the original version of the Knobloch-Westervick et al. (12) abstract, which reported a gender bias (e.g., “Publications from male authors were associated with greater scientific quality, in particular if the topic was male-typed”) or a version slightly altered to report no gender differences (e.g., “Publications from male and female authors were associated with comparable scientific quality, even if the topic was male-typed”). Second, unlike in experiments 1 and 2, the abstract was not accompanied by the author’s name or affiliation. Otherwise, the procedures and dependent measures for this experiment were identical to those used in the previous experiments. At the end of the experiment, participants completed demographic information, were debriefed regarding the purpose of the experiment, and were compensated $0.25 for their time.

Dependent Variables. After reading the abstract, participants in all experiments reported their evaluation of the abstract and research using measures adapted from those commonly used to gauge attitude change and evaluations of persuasive materials (59, 60). Specifically, on scales from 1 (not at all) to 6 (very much), participants responded to the following four questions or statements: “To what extent do you agree with the interpretation of the research results?” “To what extent are the findings of this research important?” “To what extent was the abstract well written?” and “Overall, my evaluation of this abstract is favorable.” These four responses demonstrated high internal consistency in all experiments (Cronbach’s α = 0.84, 0.89, and 0.78 in experiments 1, 2, and 3, respectively) and were therefore averaged to measure participants’ personal experience of gender discrimination.

SI Additional Analyses

Experiment 1. For the primary measure, author gender and affiliation alone did not influence evaluations, and neither did any two-way interactions among factors (all $P > 0.3$). However, the analysis revealed a nonpredicted and significant interaction among participant gender, author gender, and author affiliation [$F(1, 197) = 18.13; P < 0.001$]. Consistent with the theme of this work, we describe this interaction in terms of gender differences at each combination of author gender and affiliation. When the abstract author was supposedly a man from Iowa State University, male participants rated the abstract as being of higher quality ($M = 4.57, SD = 0.787$) than did women ($M = 4.26, SD = 0.893$), whereas when the abstract author was supposedly a woman from Iowa State University, female participants rated the abstract as being of higher quality ($M = 5.03, SD = 0.713$) than did men ($M = 3.89, SD = 1.13$). Thus, when the author was supposedly affiliated with Iowa State University, all participants seemed to demonstrate a gender bias in favor of their own gender; women had higher ratings for a female author, and men gave higher ratings for a male author. However, when the abstract author was supposedly a man from Yale University, female participants instead rated the abstract as being of higher quality ($M = 5.02, SD = 0.874$) than did men ($M = 4.13, SD = 0.977$), whereas when the abstract author was supposedly a woman from Yale University, female participants reported ratings of the abstract ($M = 4.38, SD = 1.031$) that were equivalent to those of men ($M = 4.38, SD = 0.697$).

Interestingly, when evaluating research from Yale that reveals gender bias, it seems that women demonstrated the greatest bias against women (or favoring men) authors.

There are at least two important notes regarding this interaction between participant gender, author gender, and author affiliation. First, this interaction was not observed in the second experiment among university faculty. Thus, although this interaction is certainly interesting, we withhold focusing too much on this result until it is replicated in future research. This result was not predicted or replicated and may be spurious. Second, if this interaction pattern does replicate in future research, this finding may indicate that the lay public and scientific community manifest bias toward research uncovering gender bias differently under different conditions. Within scientific communities, perhaps the gender bias against such research is unaffected by author gender or affiliation. However, in the lay public, the gender bias is more complex and context-dependent. Ultimately, it is important to understand failures in objectivity among the scientific community, as well as the public, regarding research demonstrating gender bias in STEM. After all, it is often the nonscientists (the public, government officials, bureaucrats, nonprofit organizations, special-interest groups, etc.) that drive the funding opportunities so critical to scientific progress and discovery.

Experiment 2. In addition to the predicted effects reported in the paper, the primary analysis also revealed a significant interaction among field of study, author gender, and author affiliation [$F(1, 174) = 8.07; P < 0.01$]. The interaction pattern indicated that faculty in STEM evaluated the abstract written by a man more favorably if the author was from Yale (vs. Iowa State), but the abstract written by a woman more favorably if the author was from Iowa State (vs. Yale), whereas the opposite pattern manifested among non-STEM faculty.

Additionally, we conducted the analysis again, removing fields of study associated with the social and behavioral sciences (i.e., Agricultural Economics and Economics, Native American Studies, Political Science, Psychology, and Sociology and Anthropology) from the analysis entirely. Given that the classification of some of these fields as STEM might vary depending on
who one consults, we wanted to confirm that the key results held comparing STEM to non-STEM fields, even excluding the social and behavioral sciences. Indeed, this analysis, too, revealed the predicted significant main effect of gender \( F(1, 156) = 8.30; P = 0.005 \) and the predicted significant interaction between gender and field of study \( F(1, 156) = 7.31; P = 0.008 \).

Further, given that there was a somewhat disproportionate representation of assistant professors in our sample, we investigated whether our results held accounting for faculty rank. To do this analysis, we collapsed across the author’s gender and affiliation (including all factors created several conditions with only one participant’s response) and conducted an analysis with faculty gender, field of study, and faculty rank as factors (four participants did not report their rank and were therefore not included in this analysis). Like the primary analysis, this analysis revealed a significant main effect of gender \( F(1, 174) = 6.04; P = 0.015 \) and a significant interaction between gender and field of study \( F(1, 174) = 5.27; P = 0.023 \). Therefore, the original results hold while controlling for faculty rank. No other main effects or interactions reached significance (all other \( F < 2.43; P > 0.09 \)).

Of note, several participants in experiment 2 elected to skip some of our four measures. Of the full 205 participants, 190 completed all four measures—which were averaged for the primary analyses. Thus, we examined how well our predicted findings held examining each measure independently. Critically, there was a significant main effect of participant gender for three of the four measures. Relative to female faculty, male faculty agreed less with the interpretations of the research \[ n = 190, F(1, 183) = 6.66; P = 0.011 \], evaluated the research findings as less important \[ n = 202, F(1, 186) = 7.00, P = 0.009 \], evaluated the abstract as less well written \[ n = 196, F(1, 181) = 4.67; P = 0.032 \], and overall evaluated the abstract less favorably \[ n = 201, F(1, 185) = 3.45; P = 0.065 \].

Additionally, the pattern of means for the interaction between participant gender and their STEM status for each of these measures was identical to that observed for the primary analysis. However, the omnibus test of this interaction was significant for participants’ ratings of how important they evaluated the research findings \[ F(1, 186) = 5.31; P = 0.004 \], how well written they found the abstract \[ F(1, 181) = 4.22; P = 0.041 \], and their overall favorability toward the abstract \[ F(1, 185) = 9.80; P = 0.002 \], but not for their assessment of how much they agreed with the interpretations of the research \[ F(1, 183) = 1.55; P = 0.21 \]. Nonetheless, as in the primary analysis, simple-effect tests for all measures revealed that male faculty reported less favorable evaluations than female faculty in STEM departments (all \( F > 7.91 \) and \( < 17.14 \); all \( P < 0.005 \)), but comparable evaluations within non-STEM departments (all \( F < 1 \)). Overall, then, the critical findings for the primary measure hold well when looking at each individual measure.

Finally, although we did not design experiment 2 to specifically investigate potential mechanisms behind these effects, especially regarding the interaction, some data within a faculty survey (completed just before our experiment) allowed us to explore the possibility that these effects were related to perceptions of threat. Specifically, faculty rated the extent to which they felt they had been personally discriminated against due to their gender (SI Materials and Methods, Dependent Variables). We reasoned that the greater men’s experience of gender discrimination (the more they feel women have had an unjust advantage at men’s expense), the more threatening they should find research demonstrating an actual bias against women in STEM. After all, men who have experienced gender discrimination may harbor concern that such research could promote future “reverse” discrimination against men in STEM. Further, assuming men in STEM are more committed to (or identify with) STEM than men in non-STEM fields, Social Identity Theory (36, 37) predicts that the experience of threat should predominantly manifest among men in STEM. Indeed, there was a negative correlation between the personal experience of gender discrimination and evaluations of the abstract only among men in STEM. The more male faculty in STEM felt they experienced gender discrimination, the less favorably they evaluated the abstract \( r(63) = −0.404; P = 0.001 \). This same correlation among non-STEM men was positive but nonsignificant, \( r(34) = 0.157; P = 0.367 \). Among women, results yielded a significant correlation within non-STEM fields \( r(48) = 0.35; P = 0.014 \), but no correlation within STEM fields \( r(36) = 0.262; P = 0.118 \). However, these correlations would not indicate anything about threat because the results of Moss-Racusin et al. (10) affirm women’s experience with gender discrimination.

Together, these two correlations among men in STEM and non-STEM are consistent with Social Identity Theory and our assumption that men in STEM identify more with STEM than do non-STEM men and likely perceived the abstract as more threatening. However, the gender-discrimination measure did not mediate the effects found for the abstract evaluation. To test for possible effects, we subjected the gender-discrimination measure to an analysis of variance with gender and field of study as factors (participants completed this measure before reading the abstract, making the factors associated with the abstract inconsequential). Importantly, this analysis revealed a significant main effect of gender such that women experienced greater gender discrimination than men \[ F(1, 194) = 16.87; P < 0.001 \], indicating that the construct was valid. However, this analysis revealed no interaction \[ F(1, 194) = 1.77; P > 0.18 \], meaning this construct did not mediate our primary results. This finding is not necessarily surprising, however, given that the gender-discrimination measure was not designed to directly measure the extent to which participants find the results of Moss-Racusin et al. (10) to be threatening. Overall, then, the correlation evidence is only suggestive, and we encourage future research to explore this and other possible mechanisms behind our effect.
Directories of Women and Minority Faculty and PhD Candidates and Recipients

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General Recruitment Outlets

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## Discipline-Specific Recruitment Outlets

### AGRICULTURAL ECONOMICS

- Committee on the Opportunities and Status of Blacks in Agricultural Economics  
  [http://www.aaea.org/membership/sections/cosbae](http://www.aaea.org/membership/sections/cosbae)
- Committee on Women in Agricultural Economics  
  [http://www.aaea.org/membership/sections/cwae](http://www.aaea.org/membership/sections/cwae)

### AGRICULTURAL SCIENCES

- Minorities in Agriculture, Natural Resources, and Related Sciences  
  [http://manrrs.org/](http://manrrs.org/)

### AGRONOMY, CROPS, SOILS, AND ENVIRONMENTAL SCIENCES

- Diversity in Agronomy, Crops, Soils, and Environmental Sciences Committee  
  [https://www.agronomy.org/about-society/committees/ACSS28](https://www.agronomy.org/about-society/committees/ACSS28)
- Women in Agronomy, Crops, Soils, & Environmental Sciences Committee  
  [https://www.agronomy.org/about-society/committees/ACSS26](https://www.agronomy.org/about-society/committees/ACSS26)

### AMERICAN STUDIES

- American Studies Association — Minority Scholars’ Committee; Women’s Committee  
  [http://www.theasa.net/about/page/officers_and_committees/](http://www.theasa.net/about/page/officers_and_committees/)

### ANTHROPOLOGY

- American Anthropological Association – Association of Black Anthropologists  
  [http://www.aaanet.org/sections/aba/](http://www.aaanet.org/sections/aba/)
- American Anthropological Association – Association for Feminist Anthropology  
- American Anthropological Association – Association for Queer Anthropology  

### ARCHITECTURE

- Asian American Architects and Engineers Association  
- National Organization of Minority Architects  
  [http://www.noma.net/](http://www.noma.net/)
- Association of Collegiate Schools of Planning — Faculty Women’s Interest Group  
- Association of Collegiate Schools of Planning — Planners of Color Interest Group  
- American Planning Association — Gays and Lesbians in Planning Division  
  [http://www.planning.org/divisions/galip/](http://www.planning.org/divisions/galip/)
- American Planning Association — Latinos & Planning Division  
- American Planning Association — Planning and the Black Community Division  
- American Planning Association — Planning & Women Division  
### ART

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### CHEMISTRY

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### CHEMISTRY

- American Chemical Society Women Chemists Committee [http://womenchemists.sites.acs.org/](http://womenchemists.sites.acs.org/)
- Committee on the Advancement of Women Chemists [http://coach.uoregon.edu/about/](http://coach.uoregon.edu/about/)
- National Organization for the Professional Advancement of Black Chemists & Chemical Engineers [https://www.nobcche.org/](https://www.nobcche.org/)

### CIVIL ENGINEERING


### COMPUTER SCIENCE


### ECONOMICS


### EDUCATION

- American Educational Research Association — Social Justice Program [http://www.aera.net/About-AERA/Key-Programs/Social-Justice](http://www.aera.net/About-AERA/Key-Programs/Social-Justice)

### ENGINEERING

- Society of Hispanic Professional Engineers [http://www.shpe.org/](http://www.shpe.org/)

### ENGLISH


### ENTOMOLOGY

- Entomological Society of America — Black Entomologists [http://esanetworks.org](http://esanetworks.org)
- Entomological Society of America — LGBT and Ally Network [http://esanetworks.org](http://esanetworks.org)
- Women in Entomology Network [http://esanetworks.org](http://esanetworks.org)

### FILM AND PHOTOGRAPHY
## Discipline-Specific Recruitment Outlets (continued)

**FISHERIES**

| American Fisheries Society Equal Opportunity Section | http://equalopportunity.fisheries.org |

**GEOLOGY**


**HISTORY**

| American Historical Association — Committee on Minority Historians | http://www.historians.org/governance/cmhm/index.cfm |

**IMMUNOLOGY**

| American Association of Immunologists: Minority Affairs Committee | http://www.aai.org/about/Leadership/Committees/MAC |

**LIBRARY SCIENCE**

| Association of Research Libraries Diversity Recruitment | http://www.arl.org/leadership-recruitment/diversity-recruitment |

**MATHEMATICS**

| Association for Women in Mathematics | https://sites.google.com/site/awmmath/home |
| Mathematicians of the African Diaspora | http://www.math.buffalo.edu/mad/00.INDEXmad.html |
| Black Women in Mathematics | http://www.math.buffalo.edu/mad/wmad0.html |

**MICROBIOLOGY**

| American Society for Microbiology Committee in Diversity | http://www.asm.org/index.php/underrepresented-members2/minority-committees/ |

**MODERN LANGUAGES**

| Modern Language Association — Committee on Disability Issues in the Profession | http://www.mla.org/comm_disability |
| Modern Language Association — Committee on the Status of Women in the Profession | http://www.mla.org/comm_women |

**NATIVE AMERICAN STUDIES**

| Native American and Indigenous Studies Association | http://www.naisa.org/ |

**NEUROSCIENCE**

| Society for Neuroscience Diversity Programs | http://www.sfn.org/careers-and-training/diversity-programs |

**NURSING AND HEALTH**

| Association of Colleges of Nursing — Diversity in Nursing | http://www.aacn.nche.edu/diversity-in-nursing |
| Association of Colleges of Nursing — Minority Nurse Faculty Scholarship Winners | http://www.aacn.nche.edu/students/scholarships/minority |
### NURSING AND HEALTH continued

<table>
<thead>
<tr>
<th>Organization</th>
<th>Website</th>
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<tbody>
<tr>
<td>Association of Black Nursing Faculty, Inc.</td>
<td><a href="http://www.abnf.net/">http://www.abnf.net/</a></td>
</tr>
<tr>
<td>American Public Health Association Committee on Women’s Rights</td>
<td><a href="http://www.apha.org/about-apha/governance/apha-committees/committee-on-womens-rights">http://www.apha.org/about-apha/governance/apha-committees/committee-on-womens-rights</a></td>
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<tr>
<td>American Public Health Association Equal Health Opportunity Committee</td>
<td><a href="http://www.apha.org/about-apha/governance/apha-committees/equal-health-opportunity-committee">http://www.apha.org/about-apha/governance/apha-committees/equal-health-opportunity-committee</a></td>
</tr>
<tr>
<td>Institute for Diversity in Health Management</td>
<td><a href="http://www.diversityconnection.org/">http://www.diversityconnection.org/</a></td>
</tr>
<tr>
<td>Association for Multicultural Counseling &amp; Development</td>
<td><a href="http://www.multiculturalcounseling.org/">http://www.multiculturalcounseling.org/</a></td>
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</tbody>
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#### NUTRITION

<table>
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<tbody>
<tr>
<td>American Society for Nutrition Minority Affairs Committee</td>
<td><a href="http://www.nutrition.org/our-members/minority-affairs/">http://www.nutrition.org/our-members/minority-affairs/</a></td>
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#### PHILOSOPHY

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<tr>
<td>American Philosophical Association — Inclusiveness in the Profession Committee</td>
<td><a href="http://www.apaonline.org/members/group.aspx?id=110430">http://www.apaonline.org/members/group.aspx?id=110430</a></td>
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#### PHYSICS

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<td>National Society of Black Physicists</td>
<td><a href="http://www.nsbp.org/">http://www.nsbp.org/</a></td>
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<tr>
<td>National Society of Hispanic Physicists</td>
<td><a href="http://www.hispanicphysicists.org/">http://www.hispanicphysicists.org/</a></td>
</tr>
<tr>
<td>Physicists of the African Diaspora</td>
<td><a href="http://www.math.buffalo.edu/mad/physics/physics-peeps.html">http://www.math.buffalo.edu/mad/physics/physics-peeps.html</a></td>
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#### PHYSIOLOGY

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<tbody>
<tr>
<td>American Physiological Society: Porter Physiology Development and Minority Affairs Committee</td>
<td><a href="http://www.the-aps.org/mm/hp/Audiences/APS-Committees/porter">http://www.the-aps.org/mm/hp/Audiences/APS-Committees/porter</a></td>
</tr>
<tr>
<td>American Physiological Society: Women in Physiology Committee</td>
<td><a href="http://www.the-aps.org/mm/hp/Audiences/APS-Committees/wic">http://www.the-aps.org/mm/hp/Audiences/APS-Committees/wic</a></td>
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#### POLITICAL SCIENCE

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<tr>
<td>American Political Science Association — Diversity Programs</td>
<td><a href="http://www.apsanet.org/diversityprograms">http://www.apsanet.org/diversityprograms</a></td>
</tr>
<tr>
<td>American Political Science Association — Status of Asian-Pacific Americans in the Profession Committee</td>
<td><a href="http://www.apsanet.org/statuscommitteeapa">http://www.apsanet.org/statuscommitteeapa</a></td>
</tr>
<tr>
<td>American Political Science Association — Status of Blacks in the Profession Committee</td>
<td><a href="http://www.apsanet.org/statuscommitteeblacks">http://www.apsanet.org/statuscommitteeblacks</a></td>
</tr>
<tr>
<td>American Political Science Association — Status of Latinos y Latinas in the Profession Committee</td>
<td><a href="http://www.apsanet.org/statuscommitteeLatinos">http://www.apsanet.org/statuscommitteeLatinos</a></td>
</tr>
<tr>
<td>American Political Science Association — Status of Lesbians, Gays, Bisexuals, and Transgendered in the Profession Committee</td>
<td><a href="http://www.apsanet.org/statuscommitteeLGBT">http://www.apsanet.org/statuscommitteeLGBT</a></td>
</tr>
<tr>
<td>American Political Science Association — Status of Women in the Profession Committee</td>
<td><a href="http://www.apsanet.org/statuscommitteeWomen">http://www.apsanet.org/statuscommitteeWomen</a></td>
</tr>
</tbody>
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## Discipline-Specific Recruitment Outlets (continued)

### PSYCHOLOGY

### PLANT BIOLOGY
- American Society of Plant Biologists: Women in Plant Biology Committee [http://my.aspb.org/?G_Leadership#WIPB](http://my.aspb.org/?G_Leadership#WIPB)
- American Society of Plant Biologists: Committee on Minority Affairs [http://my.aspb.org/?G_Leadership#minority](http://my.aspb.org/?G_Leadership#minority)

### PUBLIC ADMINISTRATION

### SOCIOLOGY
- American Sociological Association – Committee on Status of Women in Sociology [http://www.asanet.org/committee-status-women-sociology](http://www.asanet.org/committee-status-women-sociology)
- The Rural Sociology Society Diversity Committee [http://www.ruralsociology.org/?page_id=3209](http://www.ruralsociology.org/?page_id=3209)

### STATISTICS
- American Statistical Society Committee on Women in Statistics [http://amstat.org/committees/cowis](http://amstat.org/committees/cowis)
- American Statistical Society Committee on Minorities in Statistics [http://community.amstat.org/cmis/home](http://community.amstat.org/cmis/home)

### WILDLIFE

Updated 7/25/2016

For an up to date list of resources or to contribute to this list, please contact [ADVANCE@montana.edu](mailto:ADVANCE@montana.edu)
Faculty Search Toolkit Disclaimer


Research showing the effectiveness of a two page summary coupled with other intervention materials, is reported in Smith et al., 2015 at http://bioscience.oxfordjournals.org/content/65/11/1084.

See also Fine et al., (2014) at http://dx.doi.org/10.1108/S1529-21262014000019012.

Should you choose to reproduce and/or adapt any information in this toolkit and/or to create documents of your own, permission must be requested and received from the Women in Science and Engineering Leadership Institute (WISELI) for material attributed to Fine and Handelsman, 2012. To request such permission from WISELI, please complete the request form at: http://wiseli.engr.wisc.edu/copyright.php#form, and then email it to wiseli@engr.wisc.edu.

For other university faculty search toolkits and research papers on this topic see: http://www.montana.edu/nsfadvance/resources.html

For complete information on the university faculty family advocate program, see http://www.montana.edu/provost/family-advocates.html
Invoking the metaphor of a “runner’s track” suggests women faculty frequently find themselves on an “outside” track with hurdles to overcome and a longer distance to run than their male counterparts.

We aim to transform MSU by removing those hurdles and advancing women to an equal starting point.

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