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# Demystifying the Academic Research Enterprise

## Becoming a Successful Scholar in a Complex and Competitive Environment

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# 8

## We See the World Differently: Bias and Differing Views

### Chapter Overview and Learning Objectives

Whether we realize it or not, everyone has biases. In many cases, they are manifested as behavior impacting our decisions or recommendations, often leading to undesirable outcomes. Although bias is not inherently negative, it can have a profound effect on society, including the research enterprise. Indeed, bias appears in a variety of forms in research and creative activity, ranging from how reviewers are influenced by the names, institutions, races, and quality of writing in grant proposals, books, and journal manuscripts, to how researchers gather and interpret content from interviews or performances. Education regarding the nature and forms of bias, and the ability to identify and mitigate it, are critically important for research and creative activity to operate with integrity and flourish.

This chapter describes the fundamental concept of bias, the types of bias present in the research enterprise and their associated impacts, and strategies for mitigating bias in various forms. It also provides perspectives regarding bias in peer review across a wide range of stakeholders. After reading this chapter, you should

- Understand the concepts of bias and discrimination;
- Understand the differences between conscious and unconscious bias;
- Be able to describe the types of bias occurring in research and creative activity and understand their associated impacts;
- Understand and be able to apply actions for mitigating bias, and know how to access associated resources for doing so; and
- Understand the differing views of bias among key stakeholders and the factors giving rise to them.

## 8.1 Defining and Understanding Bias

What comes to mind when you hear the word “bias”? Most likely, something negative, such as bias against a particular race, political party, or media outlet. On the heels of that thought, you may reflect that you hold no such biases but know individuals who do. Take a moment to think about biases in your life and the extent to which they are either positive or negative. Also, consider whether such biases impact your behavior, or simply are beliefs upon which you never act.

A word closely related to bias is discrimination, which today has an almost purely negative connotation. Yet, bias and discrimination are not always pejorative. You can, for example, have discriminating taste in food or clothing, the type of car you choose to drive, or in art and music. Funding agency program officers must discriminate among a wide range of comments in selecting which proposal is worthy of support. They also sometimes have to apply measures to ensure geographic, disciplinary, or other types of balance in their funding portfolios. If done ethically, none of these actions or their outcomes is improper.

An interesting fact about discrimination and bias is that they are related, and both can occur quite intentionally or completely subconsciously. In this book, we are concerned with the intentional and unintentional application of bias, with the former being addressed largely by oversight and peer assessment mechanisms described previously (chapters 6 and 7) and in chapter 10. It is the latter—unconscious, negative, and potentially harmful bias—that is more challenging to understand and address and is the subject of the current chapter.

At its very core, bias is the tendency to *think or reason* in a particular way and is a shortcut of sorts for how we process and retain information. Bias is not behavior per se, but it is a partial determinant of behavior. According to the *Oxford English Dictionary*, bias is a “Tendency to favour or dislike a person or thing, especially as a result of a preconceived opinion; partiality, prejudice” (Bias n.d.-b). The *Cambridge English Dictionary* defines bias as “The action of supporting or opposing a particular person or thing in an unfair way, because of allowing personal opinions to influence your judgment” (Bias n.d.-a). Note that both definitions portray bias in a negative light which, as I just explained, is not always the case. Note also how the latter definition involves action, not simply a point of view.

With regard to our focus on scrutinizing research and creative activity, say using peer review, bias generally is viewed as violating the principle of impartiality (chapter 7). What is impartiality? Quoting from Lee et al. (2013, 4), it is “the ability for any reviewer to interpret and apply evaluative criteria in the same way in the assessment of a submission.” In other words, ideally—and

that is an important word—any reviewer who holds no bias would apply the criteria in exactly the same manner and arrive at the same result, completely independent from “the author’s and reviewer’s social identities and also the reviewer’s theoretical biases and tolerance for risk.” The identities being spoken of include but are not limited to one’s sex, race, ethnicity, institutional affiliation, current and/or previous positions or titles, professional expertise, publication record, awards received, and so on. In today’s social media culture, identity also can be a function of what one posts or tweets, including comments made on items posted by others.

Bias comes to our attention, and to the attention of others, when it actively, even unconsciously, influences our behavior. As a result, we make decisions that end up being flawed or narrow. When a given bias is established based upon information not grounded in fact or agreed-upon truth—for example, all people with blue eyes are smarter than people with brown eyes—its influence may result in decisions and behaviors that are in opposition to fact and truth. By this description, bias has influenced behavior. However, without the behavior, the bias may or may not be known to self or others.

We use observations of behavior to gain insight into our own or another person’s thinking. When behavior suggests thinking is biased in opposition to fact or truth, what should we attempt to do? Change the behavior, change the thinking, or both?

Training on conscious and unconscious bias, described below, addresses both types of potential change but also the impacts upon patterns of thought. And, if the influences on thinking are unconscious—that is, the thinker is unaware of the influence—then it becomes difficult to address changes in thinking. One first has to assist the thinker in becoming aware of these influences, followed by them understanding and accepting that bias indeed influenced their behavior.

Bias has been and continues to be studied extensively. As you might imagine, a wide range of views exists regarding the extent to which bias present in our subconscious mind actually influences our behavior. What is not questioned is the fundamental existence of unconscious bias, and the fact that bias clearly is present in research and creative activity.

## 8.2 Types of Bias and Their Impacts: The Research Process

Before examining various classifications and types of bias, it is useful to formally define it in the context of research and creative activity. Definitions, and their interpretation and application, depend somewhat upon the nature of the research being performed (e.g., qualitative, quantitative, clinical). In general,

however, bias in research and creative activity occurs when prejudiced, unfair, or tainted practices intentionally or unintentionally affect the planning, structure, execution, and outcomes of the work. Because bias ultimately leads to conclusions that deviate from the actual outcomes, it violates the fundamental tenets of scholarly conduct (section 9.2 and chapter 10).

The broad universe of research bias can be placed within two buckets: implicit, unintentional, or unconscious bias, and explicit, intentional, and conscious bias. Although the terminology largely is self-explanatory, a closer look is valuable.

Implicit bias occurs when we act out our views and beliefs—including prejudices, stereotypes, and attitudes—without awareness or intent. Common examples include giving higher scores to job applicants if their names sound Caucasian or European or providing greater weight to advice given by a male colleague—in both cases “without even thinking.” Explicit bias is just the opposite; namely, when actions are intentional and based upon biased views inconsistent with known facts.

Within these two broad categories, bias can occur within the research process itself (i.e., as part of project planning, design, data collection, execution, analysis, and presentation of results), and within peer/merit review (e.g., of grant proposals, journal manuscripts, performances, and exhibitions). Because research can, in general, be classified as qualitative, quantitative, or mixed (section 4.1), various types of bias sometimes exist within all three categories, with bias in clinical trials often classified separately. To avoid confusion, given that some types of bias are common to multiple research frameworks, I simply describe the more common biases in both the research process as well as peer review, providing examples of their occurrence and impact. Numerous references are provided if you wish to explore bias in greater depth (e.g., Pannucci and Wilkins 2010; Lee et al. 2013; Ioannidis et al. 2014; Sarniak 2015; Batterbee 2017; Tricco et al. 2017; Nosek et al. 2018; Mehta 2019; Roper 2019; Bradley et al. 2020).

Beginning with the first steps of the research process, *design bias* occurs when the structure, methodologies, and processes used to conduct research are based not upon objectively determined or previously successful approaches, but rather upon your own preferences or other subjective determinations. You may, for example, be attracted by the simplicity of a particular method, its shallow learning curve, or the ready availability or low cost of needed software. As described in section 4.7, poor experiment design, whether done intentionally or unintentionally, is one of the leading causes of irreproducible or flawed results. If you believe your research methodologies are not firmly grounded,

seek guidance from others, especially if you are employing methods, such as certain statistics, with which you are not completely familiar.

As described in chapter 5, the collection of data for research—in the form of observations, measurements, population samples, documents, recordings, or videos—is foundational to the research process. Not surprisingly, bias can occur during these activities and is known as *data collection/sampling/measurement bias*. In the case of physical instruments, bias can occur as a result of improper calibration or use. Observations can be biased if not collected in ways that account for outliers, bad data points, or are taken during times and in locations that fail to accurately portray reality (e.g., a video showing a small protest being portrayed as if it is taking place over a huge area). Bias in population samples—such as surveys of public opinion—can occur if the samples do not reflect the make-up of the population, if only certain dimensions of sampling are considered (e.g., sampling from users of a particular social media platform as a proxy for all of society), or if a particular part of the population is systematically excluded. The latter example is illustrative of *selection/participant bias*. Fortunately, sampling bias is well understood, and consequently a variety of approaches exist to address it.

*Historical bias* is an issue in social and behavioral science research and can be manifest in surveys as changes in participant responses owing to the occurrence of a particular event. For example, scholars conduct surveys nationally to determine the extent to which the general population is aware of certain weather patterns, events, and climate change. A response can be skewed if, for example, someone was impacted personally by a recent storm or wildfire. Similarly, statistics of particular events, such as tornadoes, protests, and homelessness, have been greatly impacted by the proliferation of mobile phones and social media. Is the number of tornadoes really increasing, or are more simply being reported and documented as a result of technology? In this case, historical and observation bias converge!

In section 4.4, we examined Indigenous research methods and described the importance of culture not only as a research topic, but also as part of the research process itself. Challenges exist when conducting research through a particular cultural lens, which can lead to *cultural bias*. More specifically, cultural bias occurs when researchers employ their own cultural norms, values, and standards to the study of other people, groups, or communities that do not subscribe to them. The evaluation of island tribal families from the viewpoint of Western familial structures is an example. This type of bias can result in misleading or incorrect conclusions, and even harm the community being studied (section 4.4).

*Procedural bias*, as the name implies, takes place when procedures used in research are constrained artificially and thus negatively affect the outcome. In the context of social and behavioral sciences research, this type of bias occurs if survey technology requires the interpretation of color and thus creates different responses for those who are colorblind (assuming color differentiation is not the topic of the study), if insufficient time is allocated for survey completion, or if the survey is conducted at times and locations that preclude certain individuals from participating.

The analysis of data is a key component of the research process (chapters 4 and 5), and thus awareness of *analysis bias* is critical for obtaining unbiased outcomes. This type of bias occurs when a researcher is influenced by his or her own desired outcomes, and then takes steps in the analysis process to steer the results toward them. Two of the “big three” forms of research misconduct (chapter 9) rear their heads at this point. That is, researchers can fabricate data by simply creating information that was not collected, and they can falsify data by excluding or modifying certain values to improve the results. Fortunately, efforts to ensure reproducibility (section 4.7) are aiding in the identification of this nefarious bias.

Closely related to analysis bias is *confirmation bias*, which involves seeking evidence, interpreting data or other information, and storing and recalling facts in a way that confirms existing beliefs or expected outcomes. This well-known bias manifests in everyday life when, for example, we read news articles, or watch news programs, that align with and thus reinforce our political or cultural worldviews. In the context of research, confirmation bias is a “tunnel vision” of sorts that can greatly limit one’s ability to explore new avenues or utilize the work of others. In extreme cases, it can lead to analysis and interpretation bias. As noted in the next section, confirmation bias is particularly problematic in peer/merit review, where the reviewer assesses a proposal, manuscript, or performance through their own perspectives or work rather than a broad context of previous work.

*Anchoring bias* occurs when a researcher is overly influenced by one theory or study (the anchor, which sometimes is their own work), or by the first impression they had on a given topic, thus leading them to ignore other sources. Strongly held views often are difficult to overcome and can lead to “blind spots” that hinder consideration of other perspectives. In a similar vein, the *halo effect* occurs when our overall impression of an individual influences our views toward other dimensions of their personality or character, even if we do not know them personally. For example, a researcher may seek to collaborate with a world-renowned scholar, presuming that because they are brilliant and successful, they also will be an effective collaborator (chapter 13).

Another important bias is *publication bias*, which concerns the tendency for journals to avoid publishing negative results; that is, research in which results opposite those expected were obtained despite sound experiment design and data analysis. One such example concerns a study (Mehta 2019) in which a gene-editing tool was used in an attempt to render a particular tropical plant—one that is a staple of the diets of a billion people—resistant to a viral disease. The results obtained showed that the genetic intervention not only failed to create immunity, as originally envisioned based upon previous work, but actually led to greater vulnerability to disease. Although the paper describing these results was in fact published, many researchers do not even bother submitting papers regarding negative results, thereby influencing statistics regarding trends in scholarly topics and outcomes and depriving other researchers of knowing the negative outcomes.

Although some consider publication bias synonymous with *citation bias*, I prefer to view citation bias as including the tendency for researchers to cite their own prior work over the work of others. This type of bias gives readers an inappropriately narrow impression and can be especially harmful to early-career scholars. The correct approach is of course to cite all relevant literature even if the outcomes of other studies, or the views of other scholars, are inconsistent with your own.

### 8.3 Types of Bias and Their Impacts: Peer/Merit Review

Bias in peer/merit review—irrespective of the discipline and form in which such review occurs—is an exceptionally important issue. Why? Because subjecting scholarly work to scrutiny (chapters 6 and 7) helps ensure its outcomes are consistent with scholarly values (chapter 9).

In virtually all situations, peer review involves three participants: the scholar(s) and their work, the reviewer(s), and the sponsor or publisher. Here, I presume the sponsor or publisher is operating with integrity, is broadly inclusive in selecting reviewers, addresses conflicts of interest, and only applies bias in an appropriate manner. Likewise, I assume the scholar(s) evidence little or no bias of the types described in the previous section, leaving us to focus on bias associated with the reviewer(s) and review process.

The first type of bias concerns how reviewers interpret scholar characteristics. Reviewers may be biased, in a positive or negative manner, by the *institutional affiliation* of the scholar. For example, if the scholar is employed by a highly prestigious institution, the reviewer might not conduct as thorough a review, presuming the work to be solid (this is an example of *prestige bias*—see below). Or, the reviewer might not be favorably inclined toward the work,



irrespective of its quality, if they applied for but were not selected for a position at the same institution (“sour grapes”). *Affiliation bias* also can occur if the scholar and reviewer are personal friends. Although professional interactions of scholars are now required to be disclosed by virtually every funding organization, the review process usually does not address personal scholar-reviewer interactions.

Another example of prestige bias is reflected in the familiar saying, “the rich get richer.” That is, scholars from prestigious institutions may tend to be funded more frequently, and receive more funding, than those at other institutions. Data show that roughly half of NSF funding for research goes to fifty universities in the US (National Science Board 2021a). However, one also must recognize that such institutions tend to have outstanding facilities, highly accomplished faculty, vast research administrative support structures, and funding to incentivize and support research and creative activity. Additionally, as noted in section 7.3, major federal funding organizations, such as NSF, undergo periodic review of the review process itself to help ensure it is unbiased. Consequently, I would characterize the “rich get richer” bias as equity bias, not prestige bias.

*Race, gender, and nationality bias* occur when reviewers presume these characteristics based upon the scholar’s name. Numerous studies have been conducted on these topics, and the results are not entirely clear (e.g., Ginther et al. 2011; Kaiser 2018; National Institutes of Health n.d.-d). In general, owing to research comparing double-blind and single-blind reviews (chapter 7), gender bias appears to be less an issue than originally thought. Racial and nationality bias, with the latter often manifest as publications favoring authors located in the same country, does appear to occur more readily, and of course, world events sometimes impact these issues (e.g., relations between the US and China).

Finally, *language bias* occurs when the scholar’s native language is not the same as that of the reviewer. This can make difficult the reviewer’s ability to understand and assess the content of the proposal or article, leading to frustration on the part of the reviewer and thus a negative evaluation. Many years ago, a reviewer usually could decline to review a submission if the writing was deemed substandard or a barrier to assessment. However, more recently, funding organizations have attempted to address language bias by urging reviewers to proceed even if they find a language barrier to be problematic.

Turning now to reviewer assessment of submission content, *content bias* can occur regarding anything associated with the work (goals, structure, execution, analysis, etc.). Confirmation bias, described in the preceding section, is an important consideration for peer review, as is *bias against interdisciplinary work*.

With regard to the latter, historically, the single-authored publication and single-investigator grant proposal (section 1.4) were viewed as most prestigious, especially prior to the establishment of integrative disciplines such as biomedical engineering and entrepreneurship. Indeed, some scholars prefer deep dives in a single discipline while others lean more toward boundary-spanning activities. This can lead to biases in reviews, though of course one also has to consider possible impacts of the ability of funding organizations and publishers to facilitate review of submissions involving multiple disciplines.

One of the topics I worked on as a member of NSB (National Science Board 2007) was the inherently conservative nature of peer review (especially when conducted in panel form) and the tendency for reviewers to dismiss or overlook potentially transformative research that might overturn established paradigms (section 7.4). This characteristic is known as *conservatism bias* and is something I addressed while serving at the White House. Specifically, I argued to Congress that failure to consistently fund potentially transformative research would impact America's competitiveness, and that eventually, scholars would stop submitting such proposals and ultimately even stop having big ideas!

All peer/merit reviews are conducted using evaluation criteria supplied by the sponsor or publisher (chapter 7). They vary from methodological and technical issues—such as goals, design, approaches used, data, quality of analyses, and logic of conclusions—to project justification, effectiveness of presentation, and potential impact on the scholarly record. Such criteria usually are well explained and, in some cases, involve numerical ratings. However, they differ considerably in their nature, and possibly in their relative importance in the eyes of the reviewer. Ultimately, reviewers must synthesize assessments across this broad space and arrive at a single numerical rating or conclusion: accept, reject, fund, decline, and so on. *Commensuration bias* is a term used to describe how some criteria are prioritized by reviewers over others, which can lead to problematic decisions that are inconsistent with the intent of the sponsor or publisher.

#### 8.4 Approaches for Mitigating Bias

It is unrealistic to believe bias can be eliminated completely in the manner conflicts of interest can be eliminated or managed (chapters 9 and 10). Rather, the goal for you, as a next-generation scholar, is to understand various types of bias and how it is manifested, and to use this understanding to reduce your own biases and their impact on the research enterprise.

Consequently, the first and most important step to bias mitigation in research and creative activity is education and training. Numerous resources exist,

ranging from those offered at academic institutions—often as part of compliance training regarding bias and discrimination in the workplace—or as formal courses on research methods. Additional training is available via in-person and online courses, seminars offered by professional societies, and guidance provided by federal agencies and publishers. If your institution does not provide training in research compliance that includes the topic of bias, consult your advisor or senior research officer to learn about options available to you.

A variety of specific actions exist for reducing bias in both research and peer/merit review. Those that span multiple types of bias include registering experiments and reports in advance (section 4.7), attempting to replicate research results (section 4.7)—a process facilitated by open access to data (section 11.2)—use of double-blind or open peer review (section 7.5), rigorous management of conflicts of interest (sections 10.2 and 10.3), and improving diversity among reviewers.

Confirmation bias, the halo effect, and cultural bias all can be reduced by challenging your own thinking and presumptions regarding the work of others, the characteristics and culture of the people you study, and the viewpoints you hold. Try to formulate alternative views and seek peers or those senior to you to discuss your thoughts and approaches. You might be surprised at how quickly such discussions expose biases of which you were unaware, and lead to specific steps you can take to address them. Strategies for mitigating other types of bias can be found in the literature, including the references noted previously.

Although the existence of bias in the research enterprise is well established, additional research is needed to fully understand its manifestation, frequency of occurrence, the nature and depth of its impacts both short and long term, and the effectiveness of mitigation measures.

The bottom line with regard to bias—and something I hope you internalize from this chapter—is that in the research enterprise, bias exists, its influence can be positive but usually is quite negative and limiting, it is a very complex topic that needs more attention, and mechanisms exist to reduce its influence even as we continue to learn more about it.

## **8.5 Differing Points of View: Agencies, Publishers, the Research Community, the Public, and Law/Policy Makers**

In chapter 7, we examined the role, process, and value of peer/merit review in research and creative activity. We also noted that, although peer review is not perfect, with variations always being explored, the foundational concepts of peer review continue to serve well the research enterprise and society more

broadly. Indeed, no radically new approach has arisen to replace it on a large scale. Despite these facts, and in some sense because of them, multiple perspectives exist regarding peer review among audiences such as the general public, law and policy makers, and private corporations.

Considering first the general public, their trust in the research enterprise is quite high, second only to the military (chapter 3). It therefore is not surprising that, in the eyes of the public, the rigorous processes associated with peer review lead to trust and the assurance of quality. The public is not aware, nor should we expect it be, of realities such as differences in quality and rigor among journals, inherent limitations of the peer review process (including its inability to identify all fraud or other misconduct), and of course, bias.

However, public awareness regarding research is probably higher now than at any previous time owing in no small part to the COVID-19 pandemic. This is a very positive development. Consequently, now is a good time for researchers to dialogue with the public about the scrutiny of research outcomes, and how our understanding based upon research evolves over time mostly via incremental advances and rigorous debate and disagreement. Researchers also need to make clear their recognition of, and desire to continue addressing, important issues such as bias, the protection of research assets from malign foreign government interference (section 10.3), and research misconduct (chapter 9). It is not up to the public to seek us out! The greater the transparency, accountability, and trust between researchers and taxpayers, the more effective the research enterprise.

Turning to private companies, especially those in the pharmaceutical arena, they understandably are cautious about subjecting their internal research to broad scrutiny as their competitive edge depends upon maintaining confidentiality, and because of the high monetary stakes involved. Yet, such lack of transparency and accountability naturally leads to suspicions that unfavorable findings may be suppressed or that rigorous methods are not being employed. And some reason exists for these fears based upon past revelations, including most recently in the automobile industry (e.g., Mehrotra and Welch 2017), where test results regarding emissions were modified and later uncovered. Of course, we must avoid painting the entire private sector with a broad brush because the majority of companies most likely operate with integrity and are subject to other forms of evaluation and compliance.

Finally, policy and law makers have widely differing views of the peer review process and, in some cases, about the integrity of the research enterprise as a whole. Perhaps most prominent among the skeptics was US senator William Proxmire, who in the mid-1970s established the Golden Fleece Award to highlight examples of what he considered wasteful federal spending on

procurements, research, and programs (Wisconsin Historical Society n.d.). As you might imagine, not everyone agreed with the senator's assessments. And indeed, a counterpart award, known as the Golden Goose Award (<http://goldengooseaward.org>), was established in 2012 to recognize scientists whose federally funded basic research has substantially impacted society in notably positive ways.

Yet, the Golden Fleece theme survives. Senators now publish a yearly *Waste-book* and *Federal Fumbles* (Flake 2015, 2017; Lankford 2017) to highlight what they consider wasteful and unnecessary activities, including specific research projects funded with taxpayer dollars. And indeed, I do myself wonder how a small number of projects get funded. Additionally, some politicians have questioned peer review at federal agencies and especially the criteria by which decisions are made.

Although it may be easy, as current- and next-generation scholars, to become frustrated with viewpoints and strategies that do not align with our own, we must never forget—as described in the next section—that the opinions of others are useful if we choose to respect, understand, and as appropriate take time to act upon them.

For example, NSF now formally responds to the *Federal Fumbles* publication (National Science Foundation n.d.-c, n.d.-d). In so doing, NSF provides itself an opportunity to reflect more deeply upon the work it funds and perhaps modify the manner in which descriptions of it are conveyed to general audiences. The originator of *Federal Fumbles* has an opportunity to better understand the true value of research that was criticized and perhaps not effectively portrayed by NSF, and the overall exchange helps the general public continue knowing that open, thoughtful, and well-intentioned debate still occurs, thus leading to an even more robust and trustworthy research enterprise.

### Assess Your Comprehension

1. Define bias in the context of research and creative activity and compare and contrast it with discrimination.
2. Do bias and discrimination always constitute negative behaviors?
3. Does bias always determine behavior?
4. What are the principal differences between conscious and unconscious bias?
5. Compare and contrast the key types of bias that occur in the research enterprise.

6. In what ways is bias manifested differently in publications, peer review, and various stages of the research process?
7. What types of bias do you believe are potentially most damaging to research?
8. What mechanisms exist to address bias?
9. Compare and contrast the views toward peer review by the public and private sectors.
10. What is the Golden Fleece Award?
11. What can federal agencies and the research enterprise more broadly learn by carefully considering the Golden Fleece Award, *Federal Fumbles*, and similar assessments?
12. In what ways can bias impact potentially transformative ideas and proposals to pursue them?
13. Why should researchers not dismiss public opinion about their work?
14. What resources exist for you to learn more about bias?
15. Without painting groups with a broad brush, compare and contrast the views toward bias generally held by researchers, publishers, law and policy makers, funding organizations, and the general public. Discuss the reasons for any differences that exist.

### Exercises to Deepen Your Understanding

**Exercise 1:** Whether we realize it or not, all of us have inherent biases on a wide range of topics or issues, and in many cases these biases impact decisions we make or actions we recommend. In fact, researchers from Harvard University, the University of Virginia, and the University of Washington have created “Project Implicit,” which includes tests to measure our unconscious biases. For this exercise, utilize the Project Implicit evaluation framework (<https://implicit.harvard.edu/implicit/>) to learn about your own biases. After completing the tests, reflect on the results and summarize them. Were you surprised? Do you think the results will impact your behavior or views in the future?

**Exercise 2:** As noted in this chapter, a wide array of bias types exists in the context of scholarly activity. Select a half dozen or so biases and compare and contrast them (a comprehensive list of biases, with examples and impacts, can be found at <https://catalogofbias.org/biases/>). What common features do you find among them, and how specifically do they differ? Place them in the context of your own research or creative activity and describe how such biases might be manifest, as well as their possible impacts.

**Exercise 3:** Bias is an issue principally when manifest as behavior, and in the world today, bias is a popular topic of discussion from politics to science, from race to immigration. Select two to three such topics and expound upon them in light of the biases you perceive to exist, using information from this chapter, and supplementary resources, to guide your analysis. Do you find yourself frequently noticing bias in society? If so, in what ways do you believe it is harmful in the context in which it occurs? How might it be reduced?

**Exercise 4:** A recent study (cited at <https://psyarxiv.com/r2xvb/>) finds no race or gender bias in the peer review of US National Institutes of Health (NIH) grant proposals, which contradicts earlier published findings cited at <https://www.nature.com/articles/news.2008.988>. Yet many are convinced bias in peer review is pervasive and serious. Considering this issue, study the two articles provided and use the Internet to identify other sources. How would you frame the argument of bias in peer review and explain the situation to a member of Congress?

**Exercise 5:** Contact the office of sponsored programs at your institution (typically housed within the office of the vice president or vice chancellor for research) to determine what types of bias training are available to faculty, staff researchers, and graduate and undergraduate students (if your institution has no such office, contact your advisor, department chair, or dean to determine how you can complete training in bias related to research). If you have never completed such training, do so now and comment on its breadth and depth. How do the issues raised apply to your own research or creative activity, and do you feel you have exhibited bias in your scholarly work, either consciously or unconsciously? If so, elaborate.

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