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## A How-To Guide for Promoting Diversity and Inclusion in Biomedical Engineering

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### Perspective

Biomedical engineering is well known to have more gender parity than almost any other engineering field [1]. Data from 2017 confirm that biomedical engineering is second only to environmental engineering in having the highest proportion of Bachelor's degrees awarded to women (44% vs. 50%; engineering average 21.3%), Doctoral degrees awarded to women (39.1% vs. 48.7%; engineering average 23.3%), and women faculty tenured or on the tenure track (22.7% vs. 26.9%; engineering average 16.9%) in the United States [2]. However, along other axes of diversity, such as race and ethnicity, biomedical engineers are a highly homogenous group. The percentages of Bachelor's degrees awarded to Blacks or African American, Hispanics and American Indians or Hawaiian/Pacific Islanders were 3.8%, 8.8%, and 0.3%, respectively, which are less than the engineering averages of 4.1%, 11.2%, and 3.8%, respectively [3]. Similarly, the percentages of Black or African American and Hispanic faculty members in biomedical engineering are substantially lower than the engineering averages -- 1.8% vs. 2.3% and 3.0% vs. 3.9%, respectively in 2017 [2]. Interestingly, whereas the percentage of Bachelor's degrees awarded to Asian Americans in biomedical engineering is higher than the engineering average (21.6% vs. 14.6%), the percentage of faculty is similar (25.7% in biomedical engineering vs. 27.9% in engineering) [2,3]. Understanding why biomedical engineering is especially appealing and/or hospitable to women and Asian Americans and unappealing and/or inhospitable to Blacks and Hispanics is critical to developing institutional strategies to diversify the profession.

As individuals, many faculty and industry leaders who want to increase the diversity of our discipline are uncertain about what to do and how. This is often true for me as a white, cisgender, straight (i.e., heterosexual) woman and may be even more true for white men. So, with strategies curated from the literature on diversity, conflict resolution, and transformational change, here I present a "How-To" Guide for leaders in biomedical

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<sup>1</sup>Data does not include foreign nationals. For clarity, I use the racial/ethnic categories from [3] verbatim.

engineering, especially members of the majority (i.e., white men and increasingly white women), to think about and work toward diversity and inclusion in biomedical engineering.

## **Accept complexity in understanding diversity and working across difference**

Just as “white” is a catch-all category that includes people of various background, experience, age, class, physical and mental ability and other dimensions, non-white individuals can have less in common with each other than with white individuals. What non-white individuals have most in common may be how they are treated by white society. That is, the wealthy person of color is just as likely to be followed in a clothing store, asked to leave a public pool, or challenged when entering his apartment building as the working-class person of color. People of color are judged by skin color first and other characteristics second. In contrast, the skin color of white people goes unnoticed and unremarked because it is assumed to be the norm. Accepting the complexity of diversity means understanding that neither you nor anyone else is only or even mostly defined by their skin color or any other characteristic. Each of us are members of groups as well as individuals; we are who we are because of our family background, talents, experiences in the world, age, class, and many other factors.

## **Seek to understand your own privilege in society and academia**

Our family background can provide educational and financial advantages early in life, or not. Over time, unearned advantages accumulate into privilege. Privilege is defined as: “a right or benefit that is given to some people and not to others; a special opportunity to do something that makes you proud; the advantage that wealthy and powerful people have over others in a society” [4]. Privilege has many dimensions. A useful way to think about privilege is in terms of what you don’t think about or are not expected to do (Table).

Acknowledging one’s privilege and affording others benefit of the doubt can mitigate others’ lack of privilege. For example, if the teaching evaluations of the white male faculty members are consistently the highest in the department, ask yourself if race and gender maybe playing a role (the literature says they do [6-8]). Or, if you find yourself wondering if a person of color hired into your group was given special consideration, ask yourself why you think so? Then, give them the benefit of the doubt that they earned that position by merit just as you did.

## **Speak out about diversity issues; use your privilege to advocate for change**

As eloquently stated by Nobel Laureate Elie Wiesel, “there may be times when we are powerless to prevent injustice, but there must never be a time when we fail to protest it.” Or, as Martin Luther King Jr. said “Our lives begin to end the day we become silent about things that matter.”

Historically, white women and people of color have been the most active campaigners for equality and equity and moreover have been responsible for educating white men on

diversity issues. Unlike in our own research, in which we relish the unknown and seek answers through independent investigation, when considering diversity and inclusion we look to members of unrepresented groups, including white women and men and women of color, to teach us. This “instructional” dynamic burdens white women and men and women of color, who already pay an “identity tax” in teaching evaluations, grant funding and development of effective collaborations [9-13]. While members of underrepresented and underprivileged groups are the ones who experience discrimination, it is everyone’s responsibility to recognize inequities, speak up, and develop solutions. Those in power – department chairs, deans, and industry leaders – have an even greater responsibility to use their privilege to advocate for equity and equality, diversity and inclusion.

That said, we must be careful not to speak over members of historically underrepresented and disadvantaged groups – to presume to know their experiences or to take credit for their work. By asking white women and men and women of color about their experiences and then having a dialogue, instead of asking them what you should do, you can begin to create an effective partnership. When you do successfully achieve change, however minor, be sure to acknowledge their contributions!

### **Accept that you will make mistakes; when you “know better, do better.”**

The discomfort many white men feel when discussing racism, sexism, and other “isms” can arise from the fear of making a mistake. That fear leads to silence and prevents action, which leaves the work to others already burdened by the “isms” themselves. According to Psychology Professor Carol Dweck, we should view each of our mistakes and failures as opportunities to learn [14]. That is, more important than the mistakes we make is how we respond to them. We can follow the lead of the writer, poet and civil rights activist Maya Angelou: “I did then what I knew how to do. Now that I know better, I do better.” Of course, learning how to do better is the hard part. For that, we need to listen to others’ perspectives, acknowledge their lived experiences, and change our behaviors.

### **Learn the difference between intent and impact.**

How many of us instinctively say “I didn’t mean to!” when our actions cause harm? The difference between intent and impact can be considerable, and when we do something hurtful or offensive to another person our impact is more important than our intent. In fact, it is an expression of power and privilege to redirect the conversation to our intentions, which were presumably harmless, rather than focus on the feelings of the person who we have hurt or offended (or both). Focusing on our intentions or saying “I’m sorry if I offended you,” which subtly redirects blame back to the offeree (note the “if”), are examples of microaggressions, which are best defined, I think, as insults that the giver doesn’t recognize as insults. Taking examples from my own lived experience, “you don’t look like an engineer!” and “we’re hoping to hire a senior woman for this position and you’ve been around for so long...” are microaggressions; they may not have been intended as insults but felt that way to me.

## LARA: Listen, Affirm, Respond, Add

Once we recognize that we've caused harm, a thoughtful response is in order. Saying "I'm sorry," or worse "I'm sorry if you were offended," is not enough. If it were, we wouldn't have the New York Times, Time Magazine and others publishing articles on how to apologize in 2018 [15, 16]. Moreover, if we apologize without understanding what we've done, we may do it again unwittingly or resent it later. What to do? One approach to engaging in conversations around difficult topics is LARA: Listen, affirm, respond, add [17]:

### Step 1: Listen

Ask your colleague about the impact and then listen. Asking takes courage; listening takes time, learning takes even longer! Learning often means understanding the consequences of your privilege and empathizing with others who have had different lived experiences than you. This is a critical step in building good working partnerships across difference.

### Step 2: Affirm

Confirm that you heard what was shared. You don't have to agree; you probably see the situation differently, but that is inherent in working across difference. Before you can move forward, you at least need to affirm that you heard another's perspective.

### Step 3: Respond

Don't pivot! Debaters may gain points for changing directions mid-argument, but they're trying to win rather than trying to meaningfully engage in conversation. Respond directly and ask clarifying questions if need be. Seek to understand another's perspective through dialogue.

### Step 4: Add (or Act)

Once you understand another's perspectives and concerns, add to the conversation. Perhaps add what you've learned, how you plan to act in the future, and appreciation for the open exchange of feelings and experiences.

## Conclusion

The above 6 suggestions – accept complexity, seek to understand your own privilege, speak out, accept your mistakes, learn the difference between intent and impact, and use LARA to engage in difficult conversations – can accelerate appreciation of diversity and the creation of an inclusive culture in biomedical engineering. In turn, we will be rewarded by the ideas, designs, devices and discoveries of a new generation of problem solvers and thought leaders who bring diverse experiences and perspectives. And, we will have learned about ourselves. And, maybe, we will become the change we wish to see in our discipline.

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**Table:**

Examples of worries, concerns and expectations that are absent for those with particular types of privilege (adapted from [5]).

<b>White Privilege</b>	<b>Male Privilege</b>
<ul style="list-style-type: none"> <li>* I don't have to think about or worry about whether I got a job or a promotion solely because of my race. Nor do I have to worry that my peers think this was the case.</li> <li>* I do not worry that I am putting my race on trial when I express my opinion in public.</li> <li>* My student evaluations of teaching are not affected by my race.</li> <li>* I am not expected to do outreach to kids of color in my community.</li> </ul>	<ul style="list-style-type: none"> <li>* I am not judged by students or peers on my attractiveness or appearance.</li> <li>* I seldom worry about my own safety when I travel internationally.</li> <li>* I am not expected to serve on more committees or advise more than my fair share of students.</li> <li>* My student evaluations are not affected by my gender.</li> <li>* I am not expected to do outreach to girls in my community.</li> </ul>
<b>Heterosexual Privilege</b>	<b>Domestic Privilege</b>
<ul style="list-style-type: none"> <li>* I can have pictures of my loved ones on my desk and not have to worry about what people will think.</li> <li>* I can talk about what I did last weekend without having to edit what I say.</li> <li>* I will not be denied access to my partner's hospital bedside if there is a life-threatening illness or accident.</li> </ul>	<ul style="list-style-type: none"> <li>* I don't have to adjust to a different culture and language in the workplace.</li> <li>* I am not separated from family by a vast distance and several time zones.</li> <li>* When I write papers and give presentations, they are in my native language.</li> <li>* I don't have to worry about getting a visa (or renewing a visa) to continue my research or move to a new institution.</li> </ul>