# *Part II:*
## Gender Bias: Myth or Fact?

Career Support Group
Women in Science

CSG-WiS Survey 2018-19

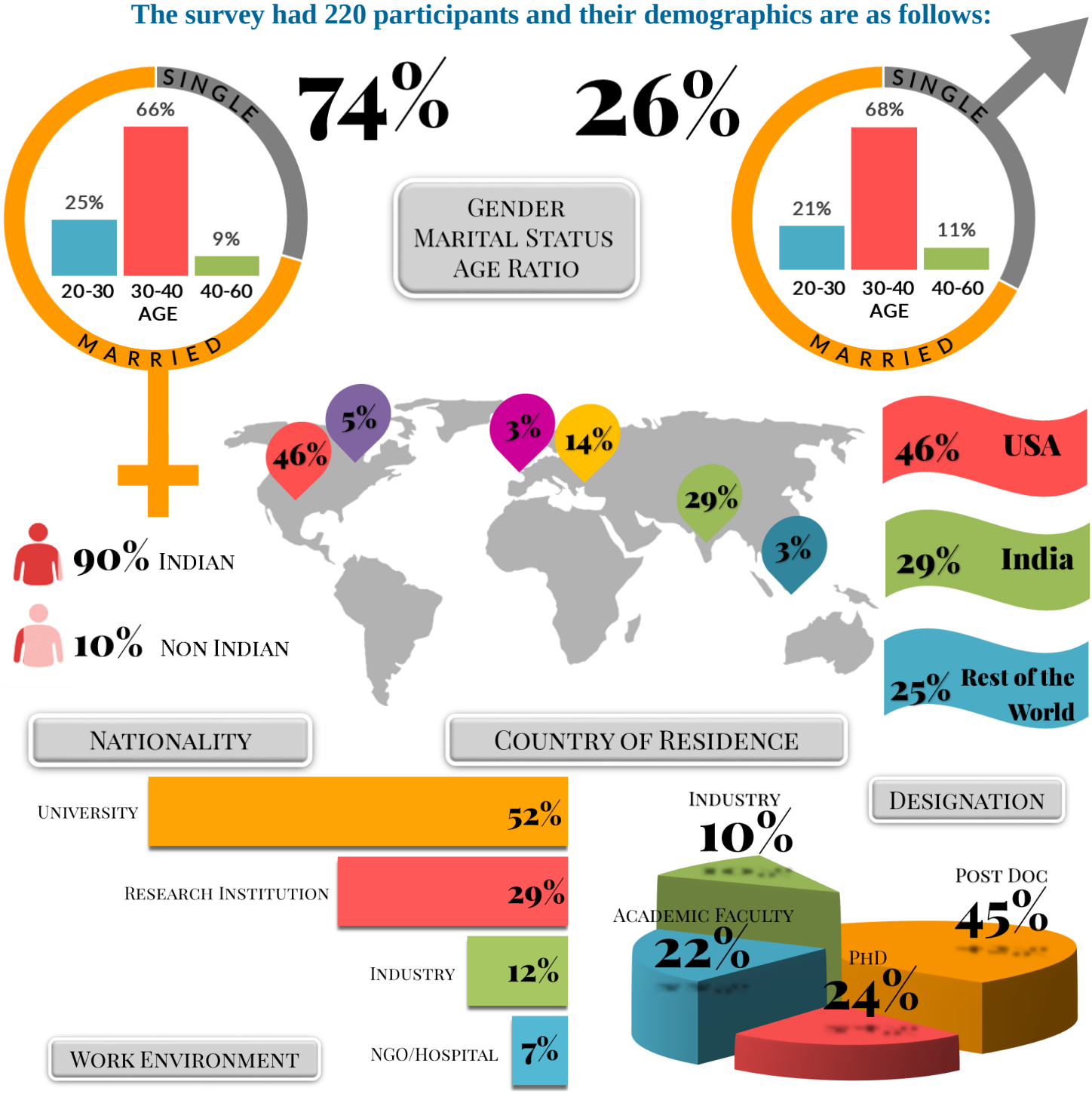
# CSG-WiS Survey : Part II

**2018-19**

Career Support Group
Women in Science

In early 2018, a post on Career Support Group (CSG) asking about the challenges faced by women in their work place/graduate school, got an overwhelming response. There were stories and struggles shared, but also support and willingness to take action. This led to the inception of Women in Science (WiS) sub-group of the PhD Career Support Group (CSG), a group of volunteers both women and men who care about the challenges faced by women in their lives. This survey is a part of an initiative to identify and address gaps in the support received by women researchers in a professional STEM environment and will be published as a 5-part series on ClubSciWri.

## The survey had 220 participants and their demographics are as follows:

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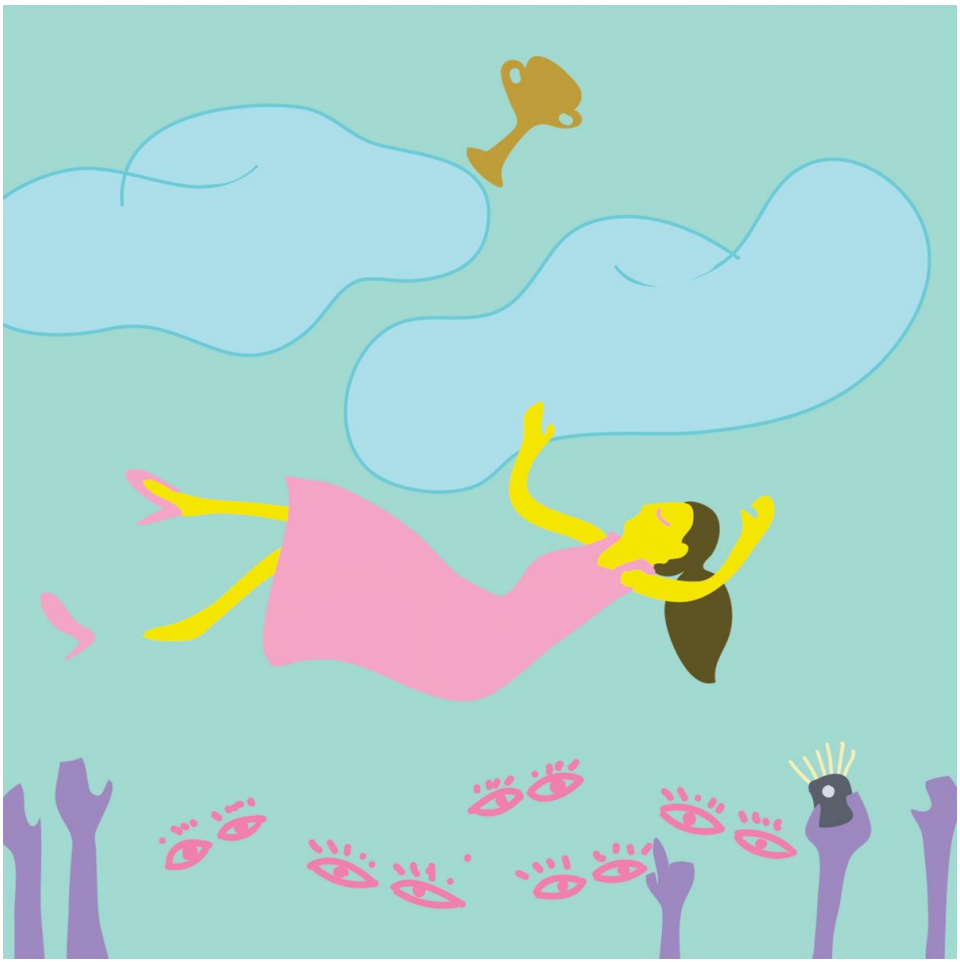
# Gender Bias - Myth or Fact?

*Ashwani Kumar [PhD student] and Shivasankari Gomathinayagam, PhD*

*Dr. Janaki* (name changed), a passionate researcher was judged for being married and wanting to "continue" her research post marriage. She was constantly judged as someone who might not be serious with her research career post marriage, would not be open to relocation or wouldn't make a good researcher since she would eventually have kids and hence was denied opportunities in spite of her accomplishments. Even the break she took owing to her cancer treatment and the eventual "career gap" in her CV was considered as inefficiency on her part. Her spousal status/commitment was questioned when she tried to immerse herself in her research to make up for the "lost time". In short, irrespective of her qualifications and dedication she was questioned just because she was a female and married.*

## The Trust Fall



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## Introduction

The above personal story is a striking example of gender bias where women are constantly judged, denied opportunities and harassed for no fault of them. In fact, trying hard or otherwise, they are being judged either way. Here in this survey, we tried to analyze the conscious or unconscious gender-bias and/or harassment of women in a professional environment. To this end, we conducted a survey in the CSG group (Career Support Group: Create Share and Grow) and analyzed the results from the responses. This article is Part II of the 5-article series. You can find the Part I here.

Gender bias is discrimination of an individual based on their gender. It can be (i) conscious or unconscious (CSG-WiS Survey: Bias I) and (ii) subtle or obvious. Harassment is unwelcome conduct that is based on sex, race, color, religion, age, etc. According to U.S. Equal Employment Opportunity Commission (EEOC), gender bias and harassment based on sex become deleterious and/or unlawful where 1) enduring the offensive conduct becomes a condition of continued employment or 2) the conduct is severe or pervasive enough to create a work environment that a reasonable person would consider intimidating, hostile, or abusive (1).

Gender bias against women exists at various levels starting from early childhood where girls believe men to be smarter than women (2) and continues through school where male students ranked themselves more knowledgeable than even over-performing female classmates (3). When it comes to higher education/employment, male students rated female instructors less efficient than male instructors (4), women researchers are paid less salary than their male counterparts (5), male students' applications were preferred over identical female applications by both male and female faculty (6), male candidates were given "solid" recommendation letters portraying them as professionals and researchers while female candidates were given "minimal assurance" portraying them as students and teachers (7). Ironically, men evaluate gender-bias research less favorably than women and show reluctance in accepting the presence of gender-bias in STEM (8). Women on the other hand show inherent bias as in (2), (6) and consider them less smart among their class while men with the same GPA considered themselves better than their class (9). On the other hand, these studies (10, 11, 12) show that underrepresentation of women is not because of gender-bias in hiring, grant funding or peer review of publications but because of fertility decisions, gendered responsibilities, incompatibility with raising a family, etc.

## Methods

Our focus was on Bias-I subsection of the CGS-WiS survey - conscious or unconscious gender-bias and/or harassment at the workplace. The survey had two questions - whether the person has faced gender-bias or discrimination from male (Q26) and/or female (Q27) colleagues. There were five options to pick from: 1) Yes, 2) No, 3) Not sure, 4) Not available, and 5) Do not wish to answer. 85.4% and 82.6% of the participants answered either 'Yes' or 'No' respectively, and therefore, we primarily compared these two responses with each other. We shortlisted 17 questions and then explored how they were associated with participants who experienced bias from those who did not. For each of these 17 questions, we further split them according to "Yes" or "No" or "Not sure" responses from Bias 1. For each observation, Fisher's exact test was applied to calculate a statistical significance and only significant results have been discussed in this article. Heatmap tiles are labeled with the percentages of Y-axis options. A scale is provided for each heatmap as a gradient [high–green; low–yellow]. The values used to calculate statistical significance are formatted as "bold" and enclosed in a dark border in the heatmap.

## Results

**Bias Parameter : Experience**

| Discriminator | Yes | No | |
|---|---|---|---|
| ♂ | 101 | 86 | *p=0.0008* |
| ♀ | 66 | 115 | |

*Figure 1: Results (in numbers) from the survey question asking participants if they faced bias in a workplace situation. p-value was calculated between Yes and No responses.*

We wanted to examine whether demography adds to bias at workplaces. Males were found to be more likely to be biased (or discriminating) than female (Fig.1). Corroborating the general perception (3, 4, 5, 6, 7, 8), women are more likely to face bias from men ($p<0.05$) (Fig.2). Bias from females toward one gender in comparison to another was inconclusive. Unconscious bias by women against other women has also been

reported (6) and this, emerging in the early stages of life (2) is quite worrisome. Hence, it is important to understand this unconscious bias if we want to properly address the gender bias in research.

**Bias Parameter : Gender**

| | Participant | Yes | No | Not sure | |
|---|---|---|---|---|---|
| Biased ♀ | ♀ | 84.0 | 58.8 | 79.0 | *p<0.05* |
| | ♂ | 16.0 | 41.2 | 21.0 | |
| Biased ♂ | ♀ | 78.5 | 68.7 | 71.4 | *p=0.17* |
| | ♂ | 21.5 | 31.3 | 28.6 | |

*Figure 2: Results (in percentage) from the survey question asking participants to rate their experience with bias in a workplace situation grouped based on the gender of the participant and their colleague. p-value was calculated between Yes and No responses.*

First, the age group of participants was considered to determine if age is a contributing factor to gender bias. The majority (67.1%) of participants were in 30-40 years age range. Participants in 20-30 years age range were less likely to face bias from their male (p=0.08) and female (p=0.01) (Fig.3) colleagues. To conclude, age is not a significant factor that contributes to the bias.

**Bias Parameter : Age**

| Participant | Age | Yes | No | Not sure | |
|---|---|---|---|---|---|
| ♂ | 20-30 | 17.8 | 29.1 | 31.0 | *p=0.08* |
| | 30-40 | 71.3 | 64.0 | 62.1 | |
| | 40-50 | 9.9 | 5.8 | 6.9 | |
| | 50-60 | 1.0 | 1.2 | 0.0 | |
| ♀ | 20-30 | 12.1 | 29.6 | 28.6 | *p=0.01* |
| | 30-40 | 74.2 | 61.7 | 67.9 | |
| | 40-50 | 12.1 | 7.8 | 3.6 | |
| | 50-60 | 1.5 | 0.9 | 0.0 | |

*Figure 3: Results (in percentage) from the survey question asking participants to rate their experience with bias in a workplace situation grouped according to the age of the participants. p-value was calculated between Yes and No responses.*

This could be because of the following reasons:

a) Younger people (20-30) who are new in the field take time to understand their situation and may not be able to conclude if they are facing bias or not.
b) People who are in 30-40 years range might be looking to move to the next level and hence would need more support than those in the other age category.
c) Relationship status of the participants in the 30-40 year age category might require them to divert time to other activities like parenting/marital responsibilities, etc. However as per our survey, marital status doesn't seem to have a significant effect on gender bias.

Primarily participants were either married (64.3%) or single (29.7%). Marital status (married or single) was found to have no significant effect.

Does the likelihood of encountering unfairness increase with the increase in number of bosses of a specific gender? We asked our participants how many male and female supervisors they have worked with. Not to our surprise, 52.2% of the total participants have worked with 3 or more male bosses whereas only 17.8% in case of female bosses. It shows a vast inequality in the leaders' selection process and also supports inequality of sexes in higher-level jobs (p<0.00001). Moreover, the chances of discrimination increased while working with 3 or more male supervisors (p<0.01; Fig.4). A higher frequency of male (or female) supervisors did not contribute to the bias coming from female colleagues (p=0.76; Fig.4).

**Bias Parameter : Numerosity - Male Boss**

| Participant | n(Male boss) | Yes | No | Not sure | |
|---|---|---|---|---|---|
| ♂ | <3 | 33.7 | 58.1 | 34.5 | |
| | ≥3 | 66.3 | 41.9 | 65.5 | *p=0.01* |
| ♀ | <3 | 40.9 | 43.5 | 42.9 | |
| | ≥3 | 59.1 | 56.5 | 57.1 | *p=0.76* |

*Figure 4: Results (in percentage) from the survey question asking participants to rate their experience with bias in a workplace situation grouped according to the number of male bosses the participants have worked with. p-value was calculated between Yes and No responses.*

Next, we evaluated the support participants received from their supervisors and colleagues. We compared positive (always or mostly supported) feedback with negative (rarely or never supported) feedback. Overall, the support from supervisors, irrespective of their gender, was positive. Those who faced discrimination from male colleagues also felt a lack of support by them (Fig.5). Similarly, respondents discriminated by female colleagues also lacked support from them (Fig.5).

**Bias & Support Received**

| | Male Colleague | Yes | No | Not sure | |
|---|---|---|---|---|---|
| Biased ♂ | Always or mostly | 52.5 | 79.8 | 79.3 | |
| | Rarely or never | **14.9** | **1.2** | 6.9 | *p=0.0002* |
| Biased ♀ | Always or mostly | 63.1 | 69.3 | 67.9 | |
| | Rarely or never | **7.7** | **7.0** | 17.9 | *p=0.77* |
| | **Female Colleague** | **Yes** | **No** | **Not sure** | |
| Biased ♂ | Always or mostly | 56.6 | 75.3 | 58.6 | |
| | Rarely or never | **7.1** | **4.7** | 10.3 | *p=0.35* |
| Biased ♀ | Always or mostly | 51.5 | 77.4 | 41.4 | |
| | Rarely or never | **16.7** | **0.9** | 6.9 | *p<0.00001* |

*Figure 5: Results (in percentage) from the survey question asking participants to rate support received from Male colleagues in their workplace. p-value was calculated between Yes and No responses.*

We also asked if the participants witnessed any gender bias and/or discrimination faced by their colleagues. Those who faced discrimination were also more likely to witness it against others than those who did not face it (Fig.6). It indicates that the untoward experience of bias makes people notice them better when it happens to others. Therefore, it's important to know how to spot gender bias and/or discrimination in order to act upon it.

**Witnessed Bias**

| | Male Colleague | Yes | No | Not sure | |
|---|---|---|---|---|---|
| Biased ♂ | Yes | **55.6** | **27.1** | 37.9 | *p<0.00001* |
| | No | 27.3 | 67.1 | 20.7 | |
| | Not sure | 17.2 | 5.9 | 41.4 | |
| Biased ♀ | Yes | **65.6** | **33.0** | 37.0 | *p<0.00001* |
| | No | 23.4 | 60.6 | 18.5 | |
| | Not sure | 10.9 | 6.4 | 44.4 | |
| | **Female Colleague** | **Yes** | **No** | **Not sure** | |
| Biased ♂ | Yes | **63.6** | **39.0** | 31.0 | *p<0.0001* |
| | No | 22.2 | 51.2 | 24.1 | |
| | Not sure | 14.1 | 9.8 | 44.8 | |
| Biased ♀ | Yes | **75.4** | **45.6** | 25.9 | *p<0.00001* |
| | No | 15.4 | 54.4 | 18.5 | |
| | Not sure | 9.2 | 0.0 | 55.6 | |

*Figure 6: Results (in percentage) from the survey question asking Male and Female participants if they have witnessed bias faced by their Female colleagues from other male and female colleagues in their workplace. p-value was calculated between Yes and No responses.*

Gender-based disparity among leadership roles such as supervisors is a well-identified predicament. However, how prevalent it is among Gender-based disparity among leadership roles such as supervisors is a well-identified predicament. However, how prevalent it is among peers is not very visible. We observed that leadership responsibilities delegated to male colleagues (mostly or always: 62.1%) were 14.5% more than female peers (mostly or always: 46.6%).

**Lab maintenance responsibilities**

| | ♂ | ♀ | |
|---|---|---|---|
| Mostly or always | **32.9** | **66.7** | *p<0.00001* |
| Rarely or never | **18.3** | **4.1** | |

**Other volunteer responsibilities**

| | ♂ | ♀ | |
|---|---|---|---|
| Mostly or always | **35.1** | **65.7** | *p<0.00001* |
| Rarely or never | **18.7** | **6.8** | |

*Figure 7: Results (in percentage) from the survey questions targeting gender-based distribution of lab maintenance and other volunteer responsibilities. p-value was calculated between the perceived gender-based distribution of volunteer responsibilities.*

On the contrary, women were more likely to be assigned with lab maintenance related responsibilities like lab cleaning and organization (Fig.7). Further, volunteer contribution from women was overwhelmingly higher than men (Fig.7). The fact that, even among peers, men are given decision-making responsibilities and women are expected to be more task-oriented leads to the existing gender-based disproportion in leadership roles, such as principal investigator. The more important question is, why do women volunteer more than men for tasks that do not lead to professional growth? A study addressed this question where they found that, when volunteers requested from a mixed-sex group, it was a shared understanding between men and women that women are expected to volunteer more (15). When they requested volunteers from the same sex group, tasks were still completed by both men and women suggesting that men do step up when there are no women to volunteer. They also found that women received 44% more volunteer request than men. Even women managers requested more women to volunteer than men. These analyses highlight the inherent social bias against women which is deep-rooted in all aspects of life, be it personal and professional.

## Discussion

From this survey, we understand that gender bias and discrimination exists in STEM research environment and that there are various factors contributing to it, whereas, some don't show a significant contribution towards it. This survey is part of the CSG-Women in Science (CSG-WiS) team effort to identify and address gender inequality in the scientific workplace. We have identified certain factors that contribute or exacerbate gender bias while certain factors don't play a role (according to our survey). Other than the fact that gender bias and/or discrimination affects productivity and creates an unhealthy work atmosphere, there is other profound yet not so discussed effects of gender bias in science. For example:

1. Research funding for coronary artery disease is greater for men than women even though the at-risk population of older women suffers greater morbidity and mortality (13).

2. Gender bias can be seen during patient recruitment for clinical trials, for a variety of reasons as discussed in (14). As a result, there is a huge gap in analysis of the drug efficacy and/or its side effects in women. Also, the effect of drugs due to contraceptive usage, hormonal status, and pregnancy of women has been overlooked as a result of not including enough women in the clinical trials.

So what can be done to eliminate gender bias from the workplace? There are articles dealing with how to eliminate gender bias from the employer's point of view, so we would like to discuss what the employee in such cases could do. This is usually the first line of defense before taking it to the employers.

1. Assess and realign your thoughts on how you treat the opposite gender but also people from your own gender. Unconscious bias easily goes unnoticed than conscious bias.

2. Form a support group and be there for one another. It makes it easier to identify and deal with bias when you have someone to support you.

3. Speak out when you see someone being harassed or when you see there is gender-bias. If you cannot always voice it out on the spot, try to look at alternative ways that can be used.

4. Speak up and confront the perpetrator(s) when you find something unacceptable. It is better to address the concern right away.

5. Educate yourself about your rights, your workplace policies, and contact person in case of needing help. Being aware of your rights puts you in a better place to act against harassment and/or gender bias.

6. In case of doubt, seek help. Many of us have migrated from different countries and cultures. Sometimes it might be difficult to understand, if what we are experiencing is because of a cultural difference or not. In any case, if you feel different you always have the right to tell the other person how you feel and not encourage them to do it. It is okay, if someone does not find something offensive but you do.

7. When you are being discriminated it reflects poorly on the person perpetuating this. Reassure yourself that it is not your fault and you do not deserve to be treated that way.

The results from our survey point towards the fact that gender-bias is still present in the research environment globally. We all need to collectively work to identify it, remove it and strengthen objectivity in our workplace. One step for a researcher will be a huge leap for the scientific community.

*Let's remember that any significant change starts with AWARENESS.*

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## References

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https://www.eeoc.gov/laws/types/harassment.cfm

2. Gender stereotypes about intellectual ability emerge early and influence children's interests. Girls as young as 6 years seem to endorse and believe the common stereotype that men are smarter than women. The findings suggest that gender stereotypes and gender bias emerges early in girl children and have an immediate effect on the interests of these girls.
http://science.sciencemag.org/content/355/6323/389

3. Males under-estimate academic performance of their female peers in undergraduate classrooms. Males are more likely to be considered to be knowledgeable than females by their peers. Males over-nominated other males relative to their performance, whereas females nominated equitably based on performance rather than gender.
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4. Gender bias in teaching evaluations. In this study, students were randomly assigned male or female instructors and were asked for evaluations at the end of term. Male students consistently rated their female instructors lesser than that of the male instructors and it was particularly pronounced in mathematical courses and with junior faculty.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3037907

5. The National Science Foundations' (NSF) documentation of median annual salary of male and female doctorates in different fields of study in the US. The numbers clearly show that the average median salary of female doctorates is consistently lower than that of their male counterparts.
https://www.nsf.gov/statistics/2018/nsf18304/data/tab48.pdf

6. Science faculty's subtle gender biases favor male students. In this double-blind study faculty members rated an application, which was randomly assigned male or female name for a laboratory manager position. Both male and female faculty members rated applications with male names as competent and hireable than the same applications with female names. Similarly, both male and female faculty members selected a higher stating salary and offered more career guidance to male students than female students.
https://www.pnas.org/content/109/41/16474

7. Male students were provided "better" recommendation letters than female students. Recommendation letters given to female students consistently differed in length, lacked basic features and had high doubt raisers (negative commendation) and differed in the frequency of mention of status terms than male students.
https://diversity.berkeley.edu/sites/default/files/exploring-the-color-of-glass.pdf.

8. This study examined how receptive the public and scientific faculty to studies showing gender-bias in STEM. It shows that both the public and the scientific faculty evaluate the quality of research on gender bias less meritorious than the women. Among the two (public and scientific faculty) gender difference was more pronounced in science faculty.
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9. Women perceive them to be less smart among the class. In this study, male students (with 3.3 GPA considered him to be smarter than 66% of students in his class) were significantly more likely than female students (with the same GPA considered her to be smarter than only 54% of the class) to have higher academic self-concept in physiology relative to the whole class.
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https://www.nsf.gov/statistics/2017/nsf17310/data.cfm

*Footnote:*

**The personal story is based on real life incidents. Name has been changed upon request. However, we have tried to use name/position as close to the real life character as possible to convey the essence of the situation.*



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# ACKNOWLEDGEMENTS

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