

Women in Science, Technology, Engineering and Mathematics (STEM): A Personal Perspective

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I thought about showing you many pretty pictures of animals and places that I have seen in my career, but then I figured I would make it more personal and explain how I entered the field of Wildlife Biology and some of the challenging issues that I have had along the way. At the end, I will consider the roles of, and challenges for, women in the STEM (science, technology, engineering and mathematics) professions.

MY PERSONAL STORY

I grew up in India, which should be pretty obvious from my name, and in a big city, Bangalore. My dad was an academic and my mother was a housewife. I have two older brothers. Although Indian society was male-centric while I was growing up, I did not really face gender discrimination at home. My parents had the same set of expectations for me as they had for my brothers. I went to an all-girls Catholic school. I am neither Catholic nor Christian, but it was not necessary to be either to attend a Catholic school, at least at that time. Parents typically sent their children to the best school they could afford that was in their neighborhood. I believe going to this school played an important role in how I ended up with a career in the sciences. I never heard the statement “Girls are just as good as boys.” To me that statement sounds like a justification—like we needed to say it out loud to believe it. Going to an all-girls school, I knew girls were as capable as boys and I saw it every day. I was an average student in a school that was very competitive academically. Grades were posted for the results of national exams. There was no such thing as Family Educational Rights and Privacy Act violations. We knew that girls were incredibly competitive and girls usually held the top ranks nationwide.

Another advantage of going to Catholic school is that we had very strict dress regulations; we had to wear uniforms. These were not just any uniforms. They had to be stitched by the school tailor. Looking back, the tailor must have been close to ninety, and I am sure he was blind. He took several measurements but would end up making uniforms of the same size for each grade. If you were a bigger kid, the uniform was too small, and if you are a smaller kid, which I was, it was like a sack. The nice part was that every student looked ugly. We wore neckties, our hair was pulled back and braided, and we were not allowed to

wear makeup or accessories. This standardized dress code made everyone equivalent, and upon reflection, it really was quite liberating. I do not have any daughters, but I have stayed with my nieces and have witnessed huge arguments between my brothers and their daughters about what was appropriate to wear to school. My parents did not have these concerns, thus saving them from spending money on expensive name-brand clothes and shoes. This “uniformity” played an important role in building my confidence and that of most of my classmates. Any competition between students was about academics, sports, music, art, etc., and not about clothes or looks. One hundred percent of my graduating class, all sixty-four students, attended college, and about half obtained graduate school degrees. Many of them ended up in Silicon Valley and other parts of the world. The lesson from this is that uniforms are not a problem; you can express your individuality in many other ways.

I started college at fifteen, not because I was smart but because that was the system. I think it is the equivalent of eleventh and twelfth grades here in the United States, except I did them in college. However, at this time you had to select a study track. I picked PCMB, which is Physics, Chemistry, Math and Biology. Unlike the American system, all of my course work during the next two years was PCMB, English, and Hindi (a required second language). One of the reasons why I chose the PCMB track is that it gave you more academic options than other tracks. You could decide to study medicine, engineering, or switch to the Arts (Humanities and Social Sciences) or Business. As a side note, in India and most countries in the world, you can attend medical school right after twelfth grade. This is common practice throughout most of the world, which is one of the reasons why outside the United States medical care is cheaper and doctors have less student debt after they graduate.

I knew I did not want a career in medicine or engineering. When I graduated from twelfth grade, I still had not identified a field of study that interested me. So I decided to get a degree in Chemistry. For the life of me, I do not know why I picked Chemistry. I did not like Chemistry. I drifted along in the program, but then I picked up a minor in Zoology and Environmental Science simply because I also wanted to do something other than Chemistry. While at college, I spent more time outdoors in natural areas than I was able to do growing up in a big city. During my childhood, Bangalore still had many green spaces, so I did go out with friends for bird watching, hiking, etc. When I was a graduating senior, one of my friends told me about a new Master’s degree program that she was attending. She invited me to visit her, which I did, and I loved it. She was doing her Master’s degree in Ecology at Pondicherry University, which involved considerable hands-on outdoor fieldwork. During this visit, I finally realized what I wanted to do with my life.

I started my Master’s degree in Ecology in Pondicherry and loved every minute of it. I used every opportunity I had to explore different ecosystems. I worked in a desert habitat and realized I did not really like spending time in deserts. I also worked in rainforests and realized that the damp, dark setting was not

my cup of tea. Fortunately, I discovered many other habitats that I liked, and I knew I wanted to be a field biologist. My thesis focused on the Malabar Giant Squirrel (*Ratufa indica*), a beautiful animal found in high-elevation forests in the Western Ghats. It is large, approximately the size of a red fox, with a brilliant red and orange pelage.

I remember one of my brothers came to visit and later told my parents, “Trust Uma to find a job that most of us pay to do on vacation.” It was nice to be able to find what I really liked doing, but now I needed to find a job. The educational system I was a part of did not really provide us with information on how to find jobs, writing résumés, etc. The focus of college and graduate school was to provide students with a solid background in a specific discipline. Job searches were our own business.

Near the end of my Master’s degree program, I went to an Ecology conference in another city with some of my friends. I attended a talk on elephants. The researcher giving the presentation was from my hometown. When we had a chance, my friend and I talked to the speaker. The field of elephant research was still relatively small, with very few people in the discipline. Most professionals wanted to speak and interact with students, encouraging them to stay in Field Biology and Wildlife Conservation. We asked the elephant researcher whether he was hiring technicians. We were in luck, for he said he was looking to hire two researchers. We were excited, and we told him that we would like to be considered for the position. He asked us if we had résumés, and I said, “Sure, we will give it to you tomorrow.” My friend was very upset with me because he pointed out that we did not have résumés. I responded by saying “What’s a résumé?” I had no clue. I had never heard that term before. At that time, laptop computers did not yet exist. As a result, nobody at the conference brought a computer. So it appeared that we were stuck. My friend was upset because I had just promised to submit a résumé the following day, but we appeared unable to do so.

As we walked back from the conference we passed a big pharmaceutical company. I walked in and asked if we could use their computer. The company secretary said that we could not use her computer. She offered us a typewriter, which we did not know how to use. While we were trying to convince her to help us out, someone came out of a room and asked us what we wanted. It turned out that this person was the vice president of that company. He spent a good two hours helping us draft a résumé, starting with explaining what it was and what was included on one. At the end of the meeting, we had two fancy résumés, which we gave to the elephant biologist. Amazingly, before we graduated, we were both offered jobs. Life was good.

I want to switch gears a little bit and describe a somewhat unpleasant but worthwhile topic. On the first day of my new job, my boss told us that there was a training workshop in Indonesia, and he said only one of us could participate. We were learning how to use a new software program for habitat analysis of elephants, and he said that any country that has Asian elephants can send only one person. We

went back to our offices, flipped a coin (yes, very scientific, but that is how we decided) and I got to go to Indonesia. So here I was, twenty-one years old, my first job ever, working for the International Union of Conservation. Unfortunately, I faced fairly severe sexual harassment while in Indonesia. This was the first, last, and only time I have ever cried at work. This incident definitely had a negative impact on my life. It made me feel ashamed. I needed people to help me, and that sucked. When I returned to India, I told some people about my experience. They knew the person who had harassed me. They found the whole incident amusing; they started laughing and said that everybody knew that person was a lecher. Their thinking was that because I was never in any physical danger, the harassment was not really a problem. The humiliation that I felt was an accepted part of what women had to face in the professional world. I was determined that that would never happen to me again.

I do not want this example to jade you. You can set up reasonable boundaries, and most people will respect them. I want to remind you that 99% (or more) of the people you work with are decent, but sometimes there are unpleasant people who think harassment is okay. This incident made me more careful and aware of the people with whom I worked. My experience is not limited to male-dominated fields; this can happen in any profession. I do not know a single professional woman of my generation who has not faced sexual harassment at work. I am sure that things are going to be better for all of you. Situations I experienced are now considered unacceptable, at the very least. For a long time I was angry with myself for not dealing with the incident differently.

Unfortunately, my field of Field Biology and Wildlife Conservation continues to be very male-dominated. I spoke to three Juniata College alumni working for the federal government. They were 2014, 2015, and 2016 graduates, all females. I asked each of them how many females they had in their work place. The first one said, "Oh, the entire administrative staff is female." I asked how many field biologists were female, and she said "none." Similarly, the second alumna said there were no female biologists at her work place. The third student said there were three female biologists at her office and fourteen males.

I have been trying to figure out why field biology is still a male-biased discipline. I think one of the reasons is that women are typically smaller than males. I remember when I was working on elephants I had several people say, "Oh, you are so small and you work on elephants." My response was that my size was not a limitation when working on elephants because there really is no disadvantage in being small. When working with deer, however, there is a disadvantage to being small because the average doe is 100-120 pounds and the average buck is 140-200 pounds. I weigh about a hundred pounds. While no individual person can restrain an elephant, individuals can restrain white-tailed deer. One time when I was working as a deer biologist in Connecticut, I was trying to restrain a tranquilized doe and my hand was just a little too small to hold the front two hooves together. One of the hooves escaped my grip and she

kicked me, breaking bones in my hand. So, when working on some species, the size of the researcher may make a difference.

Some people may also view women as a liability in the field. This is definitely a misconception, but some people can be a liability. I remember when I was leading a workshop on population monitoring, I had taken a team of people out to survey habitat. When we were several miles from the closest road, one of the participants said he was not feeling well and asked if I could help him. I looked up and saw a big man who looked pale and was wheezing. I realized he was going to faint, and we were standing on a slope. If he fell on me, I would have been seriously injured. I got out of the way just in time, and he fell flat on the ground. I was wondering what to do about him. The other participants in my group were Burmese. They did not know the language and were not familiar with the area. So I had to find a way to get him out of there. He was conscious briefly, and told me he was a diabetic. Unfortunately, I did not have anything for him to eat. So I had to walk several miles up the mountain and back to the road, find help, and then walk back to lead people to where the participant had fallen. Understand that not only was that an incredible amount of work for me, it was also a huge responsibility. I had to leave him on the forest floor for hours to go back and get help. I am giving you this example to illustrate how dangerous it can be in the field if someone is injured. I am now always careful to look out responsibly for the people who are with me.

Let me describe an example of how I used this experience to influence my actions. I carried out my Ph.D. research in Ecology at the University of California at Davis. I decided to go back to India for my field research and my Ph.D. advisor from Davis came to visit me. During his visit, an official from the Forest Department asked if we would take him out to the field with us, and we agreed. When we were out, I stopped to rest every half hour or so, saying I was tired. My supervisor was surprised because I had already been in the field for several months. After we returned to camp, he asked me why I kept stopping along the way. I explained that I was doing that for the forest department official who was with us that day. It was a cultural thing—he was not going to say he was tired while I, a female, was not, because it would embarrass him. So I stopped occasionally because I wanted to make sure he was okay. Both my advisor and his wife (who was also visiting) were surprised. They asked me why I would want to perpetuate that stereotype. I asked them to think about the potential consequences if our visitor did in fact collapse. Option number one would be that we could leave him there to die. I think that would have been frowned upon [said in jest]. So the other option would have been to get help. The problem with that was that I was the only person in the group who knew the area and the language, so I would have been the person who would have had to walk down to the road, take the bus to the closest town, and find medical help. I was willing to admit that I was not that proud. If it meant that I needed to pretend that I needed rest, so be it. The reality was that I had nothing to prove. Everyone in the group knew I was fit. I am also

quite sure that the forest department official knew that I was doing this for him. Showing him this consideration could have also helped me in the future if I needed to get permits, for example. This example again illustrates the importance of being fit when working as a field biologist. Some people have the misconception that women are not as fit as men. It is unfortunately our job to dispel that myth. All of the other field biologists at Juniata College are male, including Doug Glazier, John Matter, Chris Grant, George Merovich, and Chuck Yohn. They are all extremely fit. I have seen Doug play a couple of hours of tennis on a ninety-degree day and then teach a class!

A third factor may also affect the number of female field biologists. Many wildlife programs in the United States are referred to as “hook and bullet” because most of their faculty fish and hunt. Since most of the students in the audience are in the field of wildlife conservation, they know that hunters played a major role in the start of the conservation movement in the United States. As a result, many conservation programs are built around the needs of recreational hunting and fishing. Wildlife programs prefer hunters over non-hunters, and since there are more male hunters than female, this might help explain why there are many more males than females in the discipline.

WOMEN IN THE STEM PROFESSIONS

Now let us consider some challenges that women have faced in the STEM professions. Most Americans view STEM jobs as higher paying and more well-respected than other jobs, thus attracting brighter, more qualified people (Figure 1). There are also notably fewer women in STEM fields (Figure 2). Women form about 47% of the work force in non-STEM jobs. The comparison with STEM jobs is striking; females are under-represented greatly in STEM professions, comprising only 24% of the workforce.

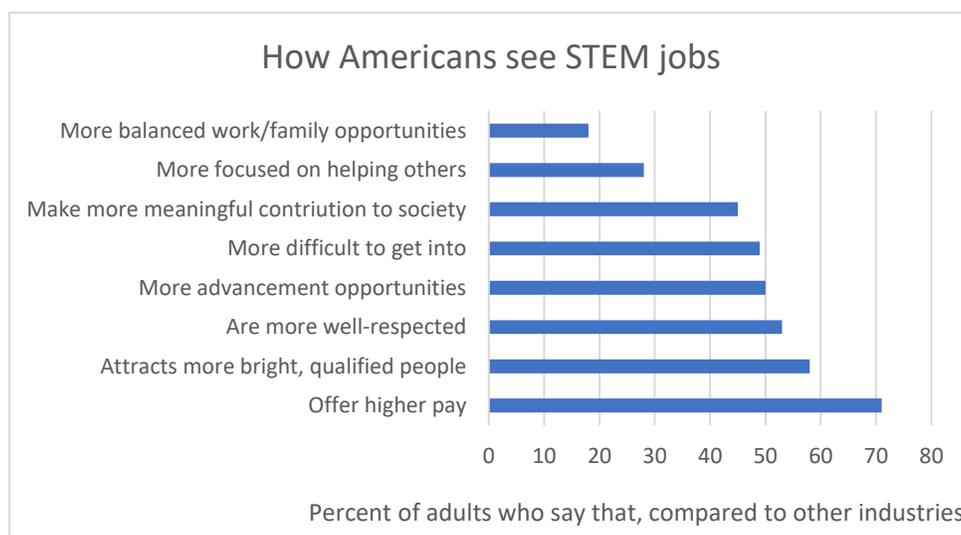


Figure 1. American perceptions of jobs in science, technology, engineering and mathematics.¹

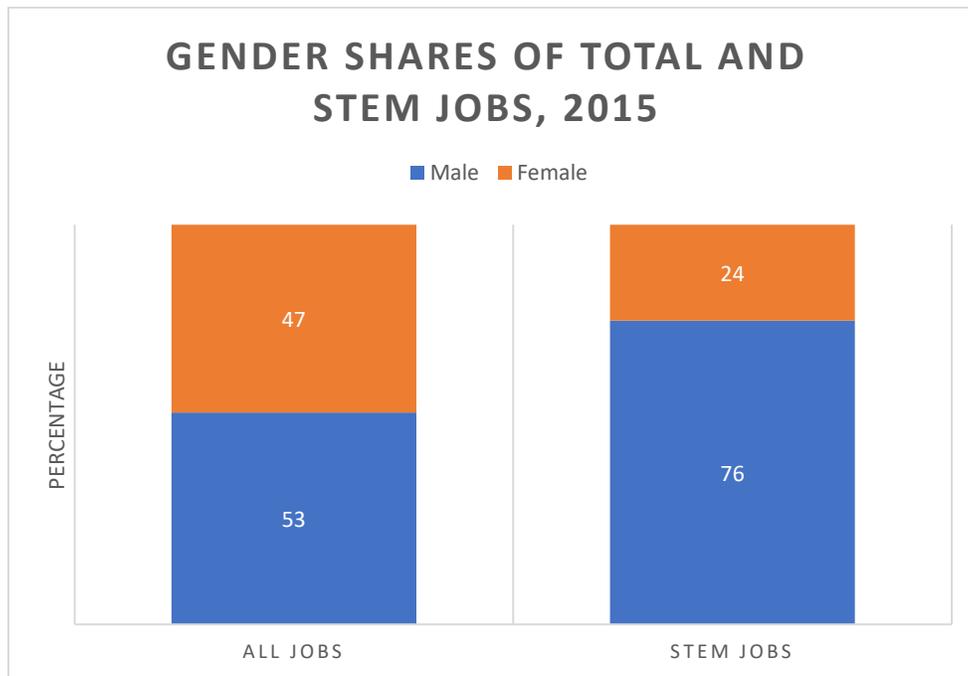
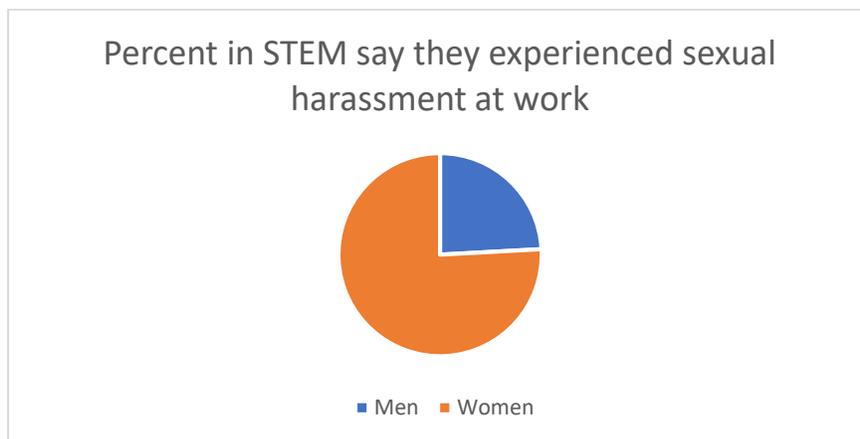


Figure 2. Proportion of women in STEM and non-STEM jobs in the U.S.²

Sexual harassment is another issue that professionals face in the workplace. Overall, women report experiencing higher levels of sexual harassment than men (Figure 3). This experience does not differ significantly between STEM and non-STEM fields. Recent news stories report that women face high levels of sexual harassment in male-dominated technology fields in Silicon Valley.



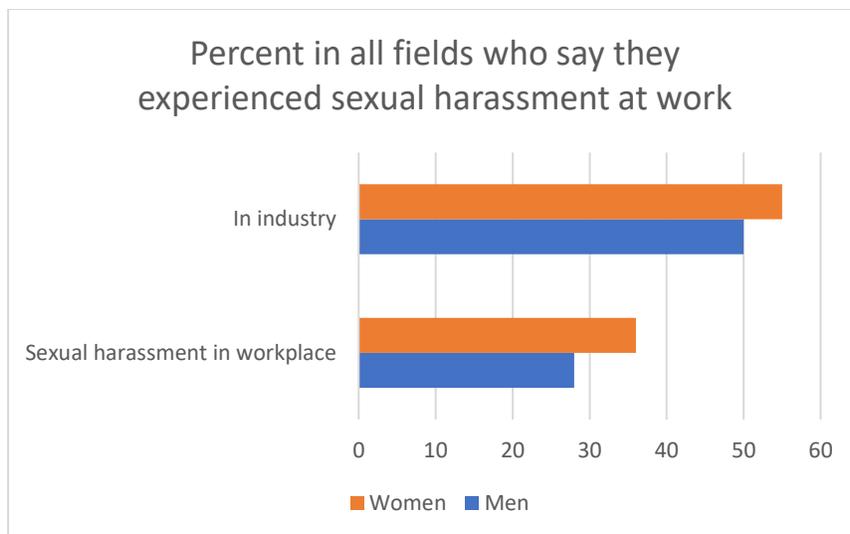


Figure 3. Proportion of women reported experiencing sexual harassment in the workplace.³

The proportion of women faculty in STEM fields is still significantly lower than that of men (Figure 4). The proportion of women faculty in Earth and Environmental Science is a little under 20%, and in Ecology and Evolutionary Biology is a little over 30%. By the way, while Mathematics departments typically have very few females, Juniata has about 70% female faculty. This is highly unusual. In Figure 4, you can see that, with the exception of Behavioral and Social Sciences, all other STEM fields are dominated by males.

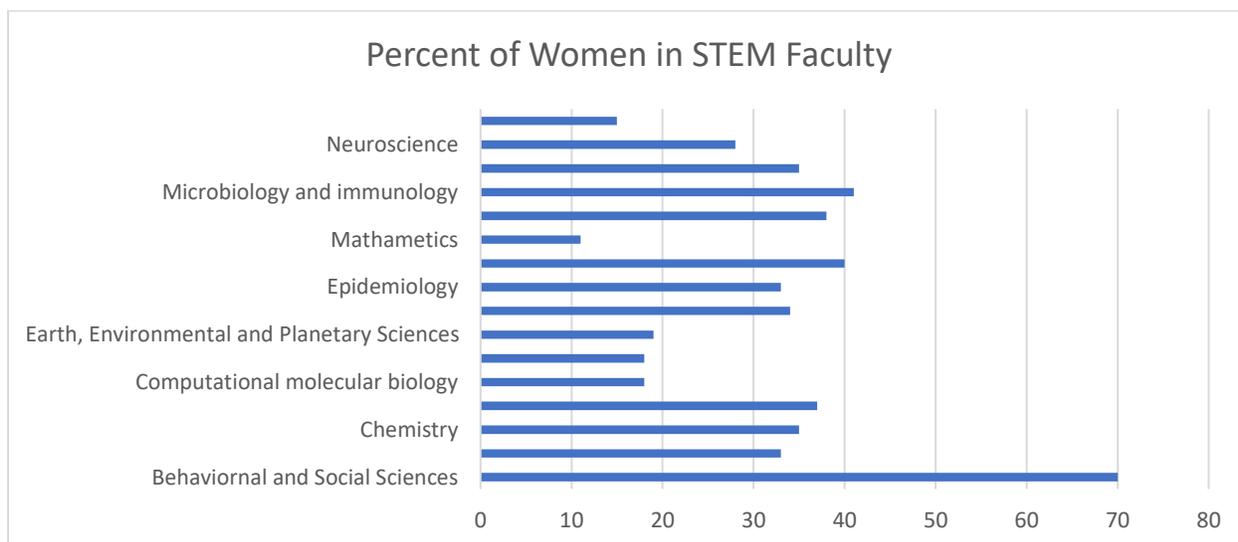


Figure 4. Proportion of women faculty in STEM fields.⁴

Women also face issues of stereotyping. Figure 5 illustrates the experience of women in the STEM fields. They have to prove themselves a little bit more than their male counterparts. They talk about being mistaken for either administrative or custodial staff. I was mistaken for administrative staff several times when I worked as a deer biologist in Connecticut. I also looked a bit younger than I was then. This does seem to be a disadvantage for women. In their twenties and thirties, women look younger than men of the same age. This makes evolutionary sense. Since people often equate youth with inexperience, men have an advantage early in their career. Employers are also concerned that women will take time off once they have children, which is another reason men are more likely than women to get professional positions.

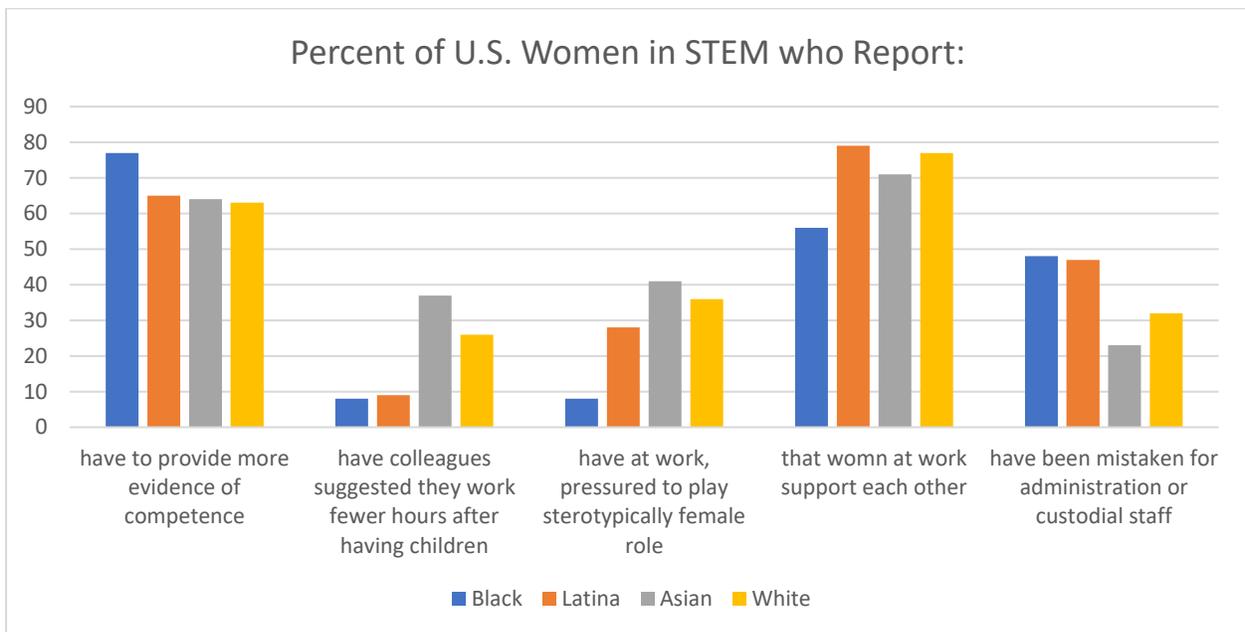


Figure 5. Stereotyping that women face in STEM jobs.⁵

Considering children, I do not have enough time to discuss fully the additional difficulties that they entail for professional women. I was married when I was twenty-four years old and I had decided that I did not want to have children for a while. There were several reasons, but given their personal nature, one would think people would mind their own business about this. But, no, people would ask, “How long have you been married?” and after answering that, the next question was “Why no children?” It was much harder when I went to India. I dreaded going back because it added so much pressure to my already-stressful experience of graduate school. Once you have reached the age of thirty, everybody thinks it is their responsibility to tell you that your biological clock is ticking. Really? I do not I know how old I am? Furthermore, the questioning does not stop once you have a child. People take it upon

themselves to give you unsolicited advice. For example, I have been told that my son is involved in too many sports. I have had people hint that he is not active enough, or that he should spend less time outdoors, or more time outdoors. Probably one of the hardest decisions a professional woman has to make is when to go back to work once they have a child. I always knew that I did not want to be a stay-at-home mom. Over the years, several women, and unfortunately only women, have commented on my decision. Women have even told me that they chose to stay at home and raise their kids because, to them, their children were more important than a career. I was brought up by a stay-at-home mom, and I have to admit that I attribute my success and that of my brothers, at least in part, to the fact that my mom was always available. However, I am not my mother and I have had opportunities she never had. I am not the only woman who has faced such pressures. Apparently, this type of criticism is common for professional women, so it is to be expected. My advice to young professional women is that if you want to have children early in life, do so, and if you want to have children late in life, do that too. The decision is up to you and your partner.

On a positive note, the proportion of women with STEM degrees is increasing. Information from the Integrated Postsecondary Education Data System database indicates an increasing trend in all disciplines, including Biology, where the proportion of women in the field has increased from 30% in 1965 to over 60% in 2015.⁶ Things are changing for the better for women in all STEM professions. State and federal wildlife and conservation agencies are making an effort to hire more women, and there are more opportunities than ever before.

I would like to end by saying that I consider myself very lucky. I have loved every minute of my professional journey. I have traveled all over the world, seen exotic places, been chased by elephants in Vietnam, swum with sea lions in the coastal waters of the Galapagos Islands, and tracked chimpanzees in Rwanda. If I were to single out the most important reason to go to college, it is that ten to twenty years into your professional career you should still be excited to wake up and go to work. Do not misunderstand me—there are going to be some hard days. For example, I do not like meetings and I do not like grading papers. Overall, however, being a faculty member in the Department of Environmental Science and Studies is really exciting, and I love working with students. I get to spend my summers stomping around in streams and forests in the name of research. If you choose a career in Environmental Science or Field Biology, you will find it to be a really rewarding career. You get to work with fun people, those who like the outdoors and who are excited about their discipline.

NOTES

1. Cary Funk and Kim Parker, “Women and Men in STEM Often at Odds over Workplace Equity,” *Pew Research Center’s Social & Demographic Trends Project*, January 9, 2018,

<http://www.pewsocialtrends.org/2018/01/09/women-and-men-in-stem-often-at-odds-over-workplace-equity/>.

2. Ryan Noonan, “Women in STEM: 2017 Update” *U.S. Department of Commerce Economics and Statistics Administration Office of the Chief Economist*, 2017, <http://www.esa.doc.gov/reports/women-stem-2017-update>.
3. Funk and Parker, “Women and Men in STEM Often at Odds over Workplace Equity.”
4. Elena Renken, “Women in Science Tend to Gravitate toward Biology, Cognitive Sciences.” *Brown Daily Herald* (Providence, RI) March 16, 2016. <http://www.browndailyherald.com/2016/03/16/women-in-science-tend-to-gravitate-toward-biology-cognitive-sciences/>.
5. Joan Williams, “The 5 Biases Pushing Women Out of STEM.” *Harvard Business Review*, 2015, <https://hbr.org/2015/03/the-5-biases-pushing-women-out-of-stem>.
6. “The Integrated Postsecondary Education Data System 2018”, <https://nces.ed.gov/ipeds/>.