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Women in STEM

Female Faculty: Why So Few and Why Care?

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Abstract: Despite slow ongoing progress in increasing the representation of women in academia, women remain significantly under-represented at senior levels, in particular in the natural sciences and engineering. Not infrequently, this is downplayed by bringing forth arguments such as inherent biological differences between genders, that current policies are adequate to address the issue, or by deflecting this as being "not my problem" among other examples. In this piece we present scientific evidence that counters these claims, as well as a best-practice example, Genie, from Chalmers University of Technology, where one of the authors is currently employed. We also highlight particular challenges caused by the current COVID-19 pandemic. Finally, we conclude by proposing some possible solutions to the situation and emphasize that we need to all do our part, to ensure that the next generation of academics experience a more diverse, inclusive, and equitable working environment.

As chemistry professors, we grew up, academically, in a world full of men, and as students and early career researchers, we were so used to this situation we did not seek to question it as being anything but the norm. As we grow academically older, however, we began to 'see' more and realize the underlying reasons for why the gender balance is so skewed. Historically, academia was a career path for men, and even today, the number of female faculty is low and gender biases flourish. This is true, also in Sweden where we both work now, a country frequently and rightly praised for gender equality. Even though Sweden is a very progressive country in terms of childcare options, parental leave, etc., women make up only 16% of Grade A staff (equivalent to full professor, EU-28 18%, Figure 1A) in natural sciences.[1] The challenges to reach a Grade A position can also be measured in the "Glass Ceiling Index" (GCI), which compares the proportions of women in academia at Grades A, B and C positions (with Grade C defined as either postdoctoral scholar or assistant professor depending on country, Grade B being an intermediary faculty position, and Grade A being equivalent to a full professorship), with the proportion of women in Grade A positions, in a given year. As described in Ref. [1], the GCI can range from 0 to infinity: a GCI score of <1 indicates that women are more represented at the Grade A level than in academia generally (defined as Grade C or higher), and a GCI score of >1 indicates that women are less represented in Grade A positions than in academia generally, that is, that there is a glass ceiling effect making it more difficult for women to reach a position of top seniority than to enter academia generally, and the larger the GCI score, the stronger this glass ceiling effect. Here, again, despite ranking first in the EU on the Gender Equality Index[2] Sweden, nevertheless, scored 1.59 on the GCI in 2016 (Figure 1B, slightly improved from 1.63 in 2013), compared to an EU-28 average of 1.64.[1] But why are there so few women faculty, and why should we care about it?

We are now in senior faculty positions where we can and do dare to speak up; and we must do so both in order to help younger female colleagues, as well as to create a better future for all young people. In addition, an inclusive workplace climate that takes into account all aspects of diversity leads to great productivity and collegiality,[3] with a diversity of perspectives and viewpoints represented, and therefore benefits us all. Most female scientists have personal stories of things that have happened to them, and while anecdotal evidence is important, it is also significant to emphasize that there now exists a wealth of scientific data on gender inequality in academia. Below, we will highlight the most common responses (truly, resistance) one may get when bringing up gender in discussions and counteract each of them with scientific evidence. We will then present an example of a promising gender equality initiative in academia (currently taking place at one of the authors' universities), concerns that arise due to the current coronavirus crisis, and conclude with our views of possible solutions.

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Common Resistance to Gender Equality

There is no problem

Despite denial by many, there is a problem. Analyses of universities in most countries reveal that the fraction of female faculty, and specifically, female professors, is low. In Sweden, 2018, 29% of all professors across all disciplines were female[4] (16% in natural sciences;[1] note that the Swedish numbers are very similar to the EU-28 average[1], for example in 2016, the proportion of female professors (all disciplines) in Sweden was 25% compared to an EU-28 average of 24%).[5] It is important to note that this is not due to few women pursuing tertiary and quaternary education. For decades, the relative gender proportion between undergraduate[6] and graduate[7] students, across all disciplines, has been around fifty–fifty. Despite this, the relative proportion of men keeps increasing as one moves up the academic career ladder, and we often depict this as the 'leaky pipeline' or the 'glass ceiling'. In addition, it is important to note that there is a gender pay gap against women in all countries[8] (men earn more on average) and women do more household work than men on average.[9] Recent studies also suggest that women do more so-called 'academic household' work, that is, things helpful to the community but not counting as merits when competing for elite grants and highly competitive senior leadership positions.[10] During the last decade or so, the percentage female professors in Swedish academia has increased by about 1% per year.[4] But we cannot simply wait until 50 percent is reached, as studies show that progression towards gender equality stops when approximately 25–30% of females at the top in a profession is reached.[11]

It is all about biology

Some people claim that women are not as good as men in certain scientific topics, and women do not have the skills, or do not want, to become leaders. Thus, there is nothing one can do about the situation—but this is totally wrong. If one looks at traits such as ambition, analytical ability, intelligence, physiological well-being, personality, cognitive performance and problem solving, there are no differences between men and women.[12] If anything, girls perform better in school than boys.[13] Instead, the explanation includes historical norms, culture, and unconscious bias.[14] We all have built-in norms that are hard to change, and even hard to detect as they are so natural. For example, the Harvard Implicit Association Test shows that most people associated science with men.[15]

There are policies in place so today we are fair

We think we follow appropriate rules and we are fair, but we are not. For example, the wording used in recommendation letters differs dramatically between letters written for men and for women.[16] Teaching evaluations (such as those found on the Rate My Professor website, https://www.ratemyprofessors.com) show lower ratings for female teachers compared to men, for the same performance, as well as gender bias in general.[17] Several studies show it is harder for women to publish, women are less likely to be in senior authorship positions, and papers authored by women get less citations than papers by male authors.[18] Success rates for grant proposals from women are lower than for men.[19] A striking study is the John/Jennifer test, where it was clearly shown how unconscious bias is at play.[20] Despite distributing identical CVs for hypothetical applicants for a laboratory manager position to participants (with only the gender of the candidate changed), when the applicant name was "male", he got better evaluations and was offered a higher salary than "female" candidates. It is important to note here that both men and women in academia show unconscious bias against women. Each difference between men and women may be small in isolation, but when these small differences are accumulated, this leads to a "mountain of feathers" effect that contributes to excluding women from full participation in academia, independently of their objective merits as an academic.

It is not my problem

Many people say they are in favor of gender equality, but they do not want to get involved in equality and diversity issues directly, as they believe such issues do not affect them. But, by being quiet, one supports the current system (a phenomenon sometimes called complicit masculinity). Homophily means men supporting men; in academia, there are many 'old boys' networks' that set unwritten rules. Women, on the other hand, being in the minority, may become hostile to each other

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Pernilla Wittung-Stafshede *obtained a PhD at Chalmers in 1996, followed by a postdoc at California Institute of Technology. In 1999, she started as an assistant professor in Chemistry at Tulane University, New Orleans, where she received tenure in 2002. In 2004 she moved to Rice University, Houston and, in 2008, she returned to Sweden and became a professor at Umeå University, followed by, in 2015, a move to Chalmers. Her research centres around protein biophysics, with focus on copper transport and amyloid formation. She is a Wallenberg Scholar, member of the Royal Swedish Academy of the Sciences, and the Nobel Committee for Chemistry. She heads the Genie initiative at Chalmers.*

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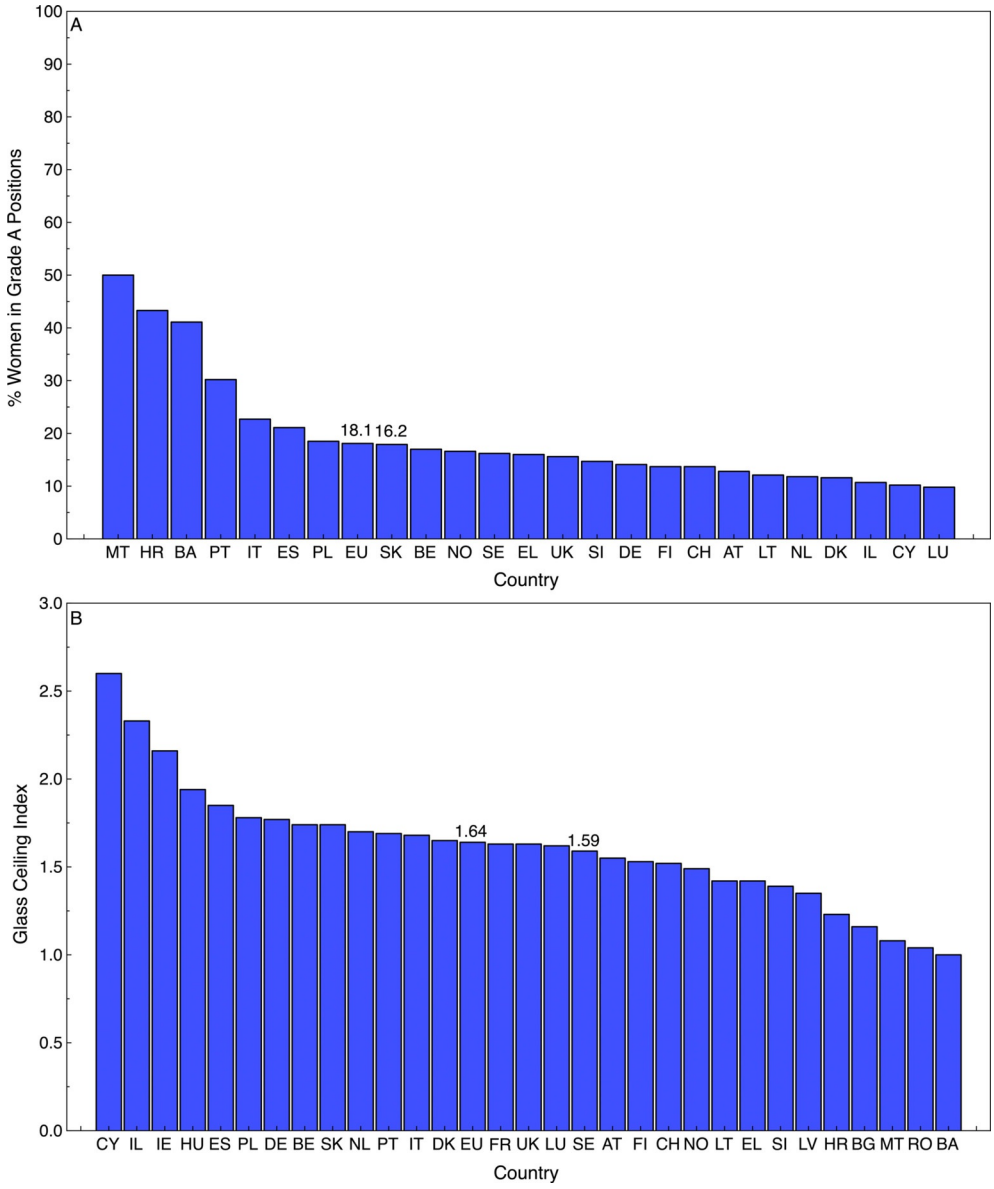

Figure 1. (**A**) Proportion (%) of women among Grade A staff in natural sciences (full professor equivalent). (**B**) Glass Ceiling Index. The majority of this data is from 2016, although there are exceptions to the reference year in both panels, and data is not available for all countries. Here, "EU" denotes the EU-28 average. Based on raw data presented in Ref. [1]. For methodological details and exceptions, as well as country codes, see Ref. [1].

simply to survive, rather than building on similar network strategies and supporting each other. In addition, evaluation of women's performance becomes subjective rather than objective when gendered (masculine) definitions of excellence are used.[21] In this context, it is important to point out that several studies in recent years have shown mixed groups, or diversity, to result in more successful research and publications with higher impact.[22] Since the goal of universities is to be successful, promoting gender equality becomes everybody's problem and a real strategy to increase university quality and reputation.

There is too much already (gender fatigue)

There are some people who are now arguing that gender equality has gone too far, and today men are discriminated against instead.[23] This is not true, as if this were the case, the percentages mentioned in the beginning of the text should have been different. Although gender equality has been a topic of discussion, research and policy planning for decades, there have been few concrete actions that have truly transformed society. Female scientists and students are still the targets of stereotyped comments and microaggressions on an everyday basis. Even if each individual comment may in itself be unharmful, they build up and affect women's confidence. Studies show that women underestimate their self-confidence (and

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attribute success to others) whereas men overestimate their self-confidence (and happily attribute others' success to themselves), see for example, Ref. [24]. This is important as confidence is easier to spot than competence, which in turn has been shown to give men benefits.[24b,25] The confidence gap will lead to differences in how men and women decide on applying for example, for promotion and grants, with men often pushing through with less merits.

Current Initiatives and Perspectives for the Future

What is Genie?

One promising initiative to target gender inequality in academia that started in January 2019 at Chalmers University of Technology (Gothenburg, Sweden) is called "Genie" (Gender Initiative for Excellence) (https://www.chalmers.se/genie). Genie is a university-wide effort to increase excellence at the university through gender equality efforts. Genie aims to increase the representation of female faculty and promote gender equal systems and processes as well as to create an inclusive work environment and campus culture. Initiatives such as this are important at all institutions irrespective of discipline, but particularly important at institutions such as Chalmers, as the representation of women at technical universities has been historically low.[26] For example, at Chalmers, women comprise 17% of all professors (2018, based on employment data). What gives Genie higher potential for success than many other initiatives are at least three features. First, it is a bottom-up initiative, led by members of the faculty, with two professors driving this initiative (which is in contrast to many other such initiatives which are instead led by administrators). This is important because it means that the Genie leaders will understand other faculty and they will more easily get respect in the organization. Second, Genie has lots of money, in fact the funding to Genie (€30 million) is the largest ever given to a gender initiative in academia.[27] Third, the Genie initiative has a long lifespan, 10 years, so the hope is that changes introduced through this initiative can become permanent. The key mission of Genie is to stimulate and help each department to take ownership of and responsibility for gender-equality work. Genie will provide the tools, feedback and money to facilitate this. Each department is different, thus tailored work is needed to address the individual needs of the different departments. Genie will also finance hires of female faculty, support female scientists in the system, measure gender-divided data (such as flow of money, sick leave, hires, faculty positions; all as a function of time), look over policies and in general try to increase awareness. The concept builds on making the university staff wanting to change, not forcing them. After one year, based on feedback from Department Heads and faculty at Chalmers, it is clear that Genie has built trust in the system and increased the awareness of diversity and equity issues.

Consequences of the COVID-19 pandemic?

There is a risk that gender equality and diversity work may be forgotten at universities due to the multiple pressures caused by the ongoing COVID-19 pandemic. Historically, crises affect gender equality negatively.[28] Today, universities around the world have shut down campuses, undergraduate teaching is done online and Zoom has become the new tool for faculty meetings. Most faculty work from home, often surrounded by family. It has already been reported that in the last few months, women are submitting dramatically fewer manuscripts for publication than men.[29] To the best of our knowledge, there is no research yet on how online meetings affect gendered power structures. In the long term, we worry that a virtual academic life will hamper research creativity, for both men and women, as interactions with peers often underlie new ideas and inspiration. However, if the proportion of female professors continues to increase at a rate of only 1% a year[4] (Swedish numbers), the pandemic will be long under control before we reach gender equality in academia. Thus, we should not let the current crisis result in a setback in gender equality work.

Possible solutions?

There is no magic bullet to solve gender inequity in academia, but rather, this is an issue one must work to tackle on many levels in many ways, and each and every one of us, irrespective of seniority, play a role in creating a more equitable and inclusive working environment for women and other minority groups. To truly change academic culture, most scientists must get onboard and realize such a change is good for all. Both formal and informal leaders in the departments must engage in gender issues and become aware of the current situation. Gender equality must be put on top of universities' strategic agendas, there must be strong leadership caring for the topic at every level, and awareness/education of all university staff must be increased. Before bias in academic evaluations are removed, women need to be prioritized. Scientific excellence (meritocracy) must be guiding all work, although quality must be valued higher than quantity of merits. It is important to note that a lot of university efforts were put into dealing with sexual harassment after #MeToo. But sexual harassment is only the tip of the iceberg; we also need to address all smaller issues found in the big chunk of ice under the waterline. Those issues are much more common and make up the academic culture we have today. We can all help: by speaking up when things are wrong, pushing on our leaders to make decisions that favor equity, collecting data and statistics on gender in different academic contexts, raising our voices to increase awareness, and supporting the women (and other minorities) around us irrespective of their career stages. In fact, we all have a responsibility to get engaged—all of us together form the academic culture.

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Conflict of interest

The authors declare no conflict of interest.

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