

## COMMENTARY

# The Fermi Paradox in STEM—Where Are the Women Leaders?

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### Abstract

This commentary summarizes insights and discussions about the status of women leaders in STEM (science, technology, engineering, and medicine). While many academic institutions now train close to 50 % female students in STEM disciplines, there is a major underrepresentation of qualified women in leadership roles. Women are admitted to the basements of STEM institutions, but only few make it to the top floor. We see male superstars receiving well-deserved recognitions and advancements. Unfortunately, their female counterparts are often held back or cut down by both male and female colleagues. Increasing reports of acts of discrimination reported by women in STEM fields are a symptom. Unilateral hierarchy is the root cause. Just increasing the quote/proportion of women and underrepresented minorities at an institution is therefore not enough to address the underlying problem. At Stanford Radiology, we started a major initiative to increase the representation of qualified women and other underrepresented minorities in our leadership teams in order to ensure that every member of the Department has an advocate at the leadership table, when decisions are being made. Diverse leadership teams are vital to creating a culture of respect and inclusion for everyone.

**Key words:** Diversity, Women in STEM, Equality, Leadership, WIMIN (Women in Molecular Imaging Network)

The Women in Molecular Imaging Network (WIMIN) is convening a meeting at the World Molecular Imaging Congress to discuss the status of women leaders in STEM (science, technology, engineering, and medicine). As one of the panelists, I was asked to reflect on my experiences as a female physician-scientist and provide insights on a perceived scarcity of female leaders in STEM fields.

I am a Professor of Radiology, Director of Pediatric Molecular Imaging, and Associate Chair for Diversity in the Department of Radiology at Stanford University. I am also an immigrant and the first doctor in my family. I grew up in a small town with a population of about 6000 people. My mother was a teacher and my father an administrative

manager at the nearby University. I was a quick learner and made my way from the best local schools in my area to some of the best universities in the world. That path was not easy. I had to overcome many financial, geographical, and political barriers until finally joining Stanford. This would be difficult for anyone, but especially for someone who comes from the other end of the world, speaks a different language, has few resources, and is a woman. I consider myself fortunate to have made it thus far. And I want to represent a role model for any immigrant, anyone who is the first professor in their family, and any woman - that if we work hard with dedication and integrity, we can realize our full potential.

Unfortunately, I saw many of my female colleagues giving up along the way. While new space programs are becoming successful in sending rockets to new planets and

landing them safely, we cannot yet report the same success for women who embark into the STEM universe. Many of us seem to disappear in black holes. When we look at many STEM leadership rounds, we wonder: Where are the women leaders? It reminds me of the Fermi paradox: The contradiction between a high probability of extraterrestrial life and humanity's lack of contact with it. Eduardo Fermi, a physicist in the 1900s, explained at least three possible reasons for our lack of contact with alien life: (1) they might not exist, (2) we might see but not recognize them, and (3) they might be too different from us to engage with them. I propose that female physicians and scientists face a Fermi paradox and that we need to come together to solve it:

### *They Do Not Exist*

If you try to find a galaxy of female leaders in STEM to date, there is evidence to support the notion that our male leaders are officially alone—or nearly so. While many academic institutions now train close to 50 % female students, there is a major underrepresentation of qualified females in leadership roles. According to reports by the American Medical Association [1], women comprise only 21 % of full professors and 13 % of Department Chairs at US Medical Schools. If you look at the beginning of plotted career paths for male and female physicians and scientists, you see that they start out with nearly equal gender distributions. But as their careers go on from junior positions to mid and senior careers, the gender gap increases more and more, leading to male superstars and female supernovas.

What causes this diversion? The answer is we are all responsible. As a society, we create black holes for our female stars. Science, technology, engineering, and medicine are still pretty much male domains. When women enter this male-dominated sphere like an alien space ship, the environment often bombards us with meteoroids of criticism and disapproval. I personally was told repeatedly that I was not leadership material: I was “too outspoken,” “too soft,” “too calm,” “too casual,” “too rebellious,” “intimidating,” “not ready,” and “would never be suited for a leadership position”. Comments such as these may seem contradictory and perhaps ridiculous. But they do have profound impact on the perception, confidence, and development of women in STEM disciplines. Many rising female stars at our universities internalize prevailing stereotypes and discount their own leadership potential, leaving the academic environment or science/medicine all together. Others disengage and become bitter and resentful, thereby reinforcing negative stereotypes and making it harder for newcomers to break through the glass ceiling. This is an incredible loss for our universities and our society. We must create a culture where our talent does not drop out, physically or mentally. We have invested in decades of their education and cannot afford to miss their potentially groundbreaking discoveries.

### *They Are Among Us, but We Do Not Recognize Them*

Those female stars who persist despite the obstacles are often not recognized. While there is increased awareness that we need to support junior scientists, there is continued underrepresentation of female faculty in departmental leadership positions, Grand Round Lectures, society boards, editorial boards, and Senior Scientist Award Recipients. Women are admitted to the basements of STEM institutions, but only few make it to the top floor. We see male superstars receiving well-deserved praise and recognition for their work. Unfortunately, their female counterparts are often held back and cut down by both male and female colleagues. Before we train more female students in medicine and science, we have to redesign their career prospects.

Surprisingly, there are no uniform standards for professional career development at our universities. Female scientists who meet and exceed objective qualifications are often over-scrutinized. Many of us have seen male faculty being appointed or promoted to specific ranks or roles with fewer publications and grants than their female peers. Women reported that they needed to work twice as hard to be viewed as equal to men [2]. Some European universities have solved this problem by requiring a specific publication metric for specific ranks. While the type of metric might be debatable, it should be possible to set equal and objective criteria for all.

In addition, it has been noted that ambitious and powerful women tend to receive over-reactive and inappropriately personal criticism [3]. It is very hard to check the validity and motivations behind these subjective judgments. The new era of ubiquitous ratings has created a new platform for bullies and haters: promotion troll. They blindfold our ability to recognize the abilities and achievements of our valuable workforce. As a community, we need to address this problem. We need to acknowledge that all substantive work will bring both praise and criticism and protect our rising stars from trolls. We need to provide objective criteria for advancements and rate scientific ideas and contributions, not people.

### *They Are Too Alien*

Our imagination is limited by beliefs that our culture has imprinted in our minds. If we believe that aliens are too different for meaningful interactions, we will not seriously try to overcome space and time to find them. Before John F Kennedy, nobody believed that we could put people into a rocket, shoot them on the moon, and return them safely. The Apollo 11 mission showed us how a great vision can fundamentally change our reality. If we want to integrate women in STEM leadership teams, we have to believe in them first. As a community, we need to eliminate marginalizing stereotypes and create a more supportive environment. Women in leadership teams can provide new

perspectives and important contributions that will benefit us all. Women in leadership teams alleviate unilateral hierarchies, introduce powerful advocates for women at the workplace, and thereby, reduce the risk of discrimination and harassment at the workplace. Women leaders are vital to providing our students and junior faculty with a diverse set of role models [4].

There have been always Jedis who supported female pioneers in medicine and science. For example, the pathologist Frieda Robscheit-Robbins was not recognized when her research partner George Whipple received the Nobel Prize. But in the year 1934, when women were still fighting for access to our universities, George shared the prize money with Frieda. A male-dominated culture was not ready for her yet, but George did what he felt was right. That is what I call progressive! As a female physician-scientist in the twenty-first century, I encountered hate and discrimination by some people, but I also received overwhelming support from many colleagues, friends, and family members, both male and female, who stood up for me. And that made all the difference. I am eternally grateful to them: Thank you for cheering me on! Thank you for holding my hand and wiping away my tears in times of setbacks and political charades. Thank you for making me laugh about small mindedness. Thank you for celebrating with me! You are the people worth fighting for!

I do not write this to cast judgment. I share this because you most likely know a woman in the same shoes. If you do, please support her. Even the strongest woman will struggle sometimes. Do not look away. Give her a hand. Speak up for

her. You can help her succeed. Whether we create new ideas, develop solutions to fundamental problems, or bring new concepts to our patient's bedside, we need your help to face our daily Darth Vaders. As a community, we must come together to spot, support and nurture our female superstars in science and medicine. We need to seize the full breadth of our nation's scientific and economic potential. Women in STEM have not made it through the glass ceiling yet [4]. We all need to try a little harder. Together, we can ignite that magical collective force that will create a better future for all of us.

#### **Compliance with Ethical Standards**

#### **Conflict of Interest**

The author declares that she has no conflict of interest.

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