April 2022

The Periodic Table of Women of Color in STEM

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Reflective Essay

In Fall Semester 2021, I took Core 3: Resistance and Resilience with Professor Gabriela Bacsan. This course centered on the experiences of women of color (WOC) in the United States as they challenged various oppressive systems and redefined heteronormative notions of womanhood and race. For our final project, we had to produce a research project in any form on a topic of our choosing that pertained to the resistance and resilience of WOC. As a biology major on the pre-med track, I was interested in analyzing the experiences of WOC in STEM. I was inspired by a moment from the year prior when, in Biology Lab, we were given a survey asking questions like: do you feel part of a community of scientists? and Do you consider yourself a scientist? I remember feeling disconnected from this apparent "community" and hesitated to identify as a scientist, despite my interest and my academic experiences. Motivated by this dilemma, I decided to research the resistance and resilience of Women of Color in academic and professional fields of STEM.

Before starting research for this project, Professor Bacsan invited librarian Nazia Islam to our class to inform us on effective ways to conduct research, navigate databases and choose good sources. First, Nazia highlighted the importance of posing good research questions to focus our investigation. Given that my research topic was really broad, I needed to ensure my project remained focused and coherent. Thus, I decided to structure my project in three central themes: 1) identifying the historical and ongoing barriers facing WOC in STEM, 2) highlighting the erasure and exploitation of WOC, and 3) exploring possible solutions to increase the accessibility and inclusivity of STEM. Regarding the first theme, some major questions I wanted to answer were: What are significant barriers women of color face when working in fields of STEM? How does the intersection of race and gender influence what these barriers are? Regarding the second

theme, the major questions I posed were: Who are notable figures in scientific history and in modern science whose contributions have been ignored? How are women of color exploited? Regarding the third theme, the major questions were: How can we increase gender and racial inclusion in fields of STEM? What are the major causes of exclusivity and inaccessibility in STEM? What informs our image of what a scientist looks like? How can we expand and re-invent our notions of who and what a scientist is?

Although my project had more focus now, the questions I was investigating were still quite broad. While Nazia Islam had provided pointers on effective database searching during the class workshop, I was struggling to use successful keywords, either producing searches that were too vague or too specific. Thus, I scheduled a one-on-one meeting with Nazia. She was extremely helpful in forming productive searches by showing me how to choose good keywords. We both agreed that GenderWatch would be the best database for my topic. Through trial and error, we found the best keyword choices and filters — for example, (women of color) AND STEM AND Barriers — and were able to find a good selection of articles, leaving me well-prepared to complete the rest of the research. One skill I found incredibly useful in finding relevant research papers was looking through a paper's citations. This allowed me to find articles that had similar themes but still analyzed a wide variety of experiences and issues. Another invaluable resource I employed was Zotero. This site was extremely helpful in allowing me to organize my various resources and quickly refer to them when needed.

For this project, we were also allowed to integrate non-academic sources. Going into this topic, I knew I wanted to center the voices/experiences of WOC in STEM. Therefore, I wanted to integrate a variety of sources to obtain a wide array of perspectives and showcase the testimonies of WOC. I chose a few academic papers because they directly interviewed or

surveyed various women and provided their quotes, allowing me access to these women's experiences. However, I also wanted to incorporate different sources, such as documentaries, to more directly observe these women's testimonies. Especially since my positionality as an Asian-American woman meant I would be sharing on behalf of other women of color, I wanted to ensure the sources I used were accurate and that I was not paraphrasing or approximating these women's lives. Integrating a wide variety of sources (academic papers, documentaries, nonfiction novels, and biographical movies) enabled me to develop my own thoughts on the themes I was investigating while also highlighting different POVs, issues, and solutions to consider. Furthermore, it allowed me to highlight multiple topics throughout my project in a thorough yet cohesive manner, even if I was only briefly touching upon them.

This project was the biggest research endeavor I have ever undertaken. Initially, I was anxious at the idea of navigating immense databases and I doubted my ability to pose relevant research questions to guide a cohesive project. I also wanted my project to be informative and challenge heteronormative spaces, allowing readers to rethink notions of who and what a scientist is. Working through this project and obtaining help from librarians like Nazia has taught me invaluable research skills. I now feel more comfortable conducting independent research, especially having improved my ability to navigate a database. I have already used these skills, along with my newfound mastery of Zotero, to be more methodical and efficient when I conduct research. This project further taught me how to effectively integrate a wide variety of topics, media, and themes into a cohesive final product. Lastly, I have grown more confident in my ability to pose relevant research questions that guide my thinking process and enable me to create a compelling product.

Research Project and Bibliography

The Periodic Table of Women of Color in S.T.E.M.

By Ella Wasson
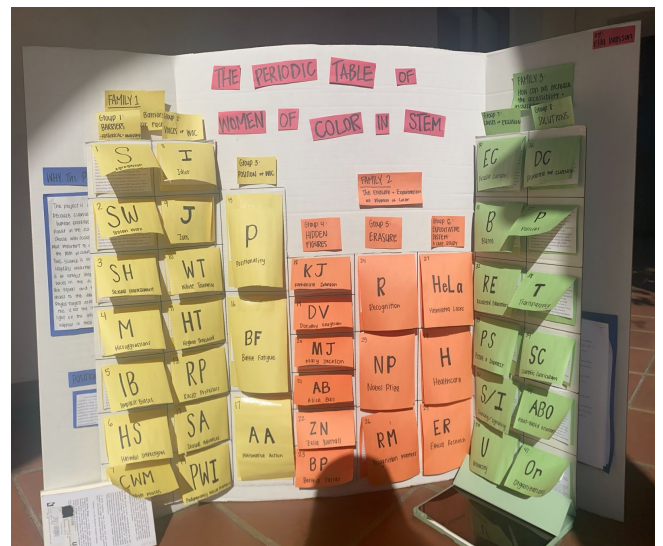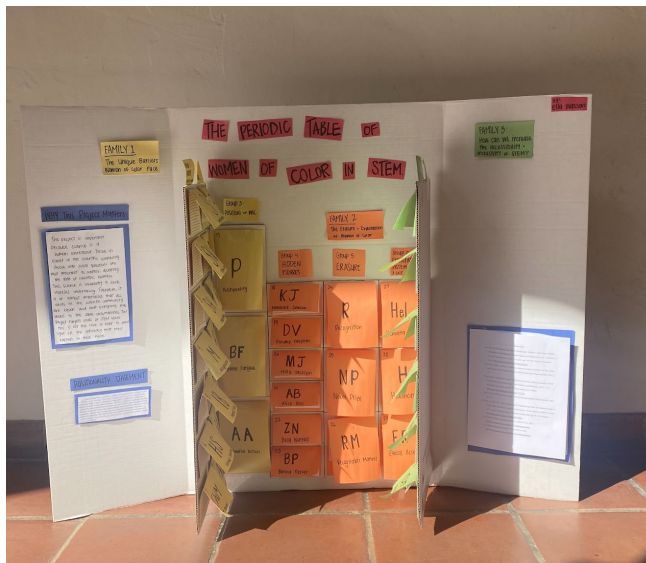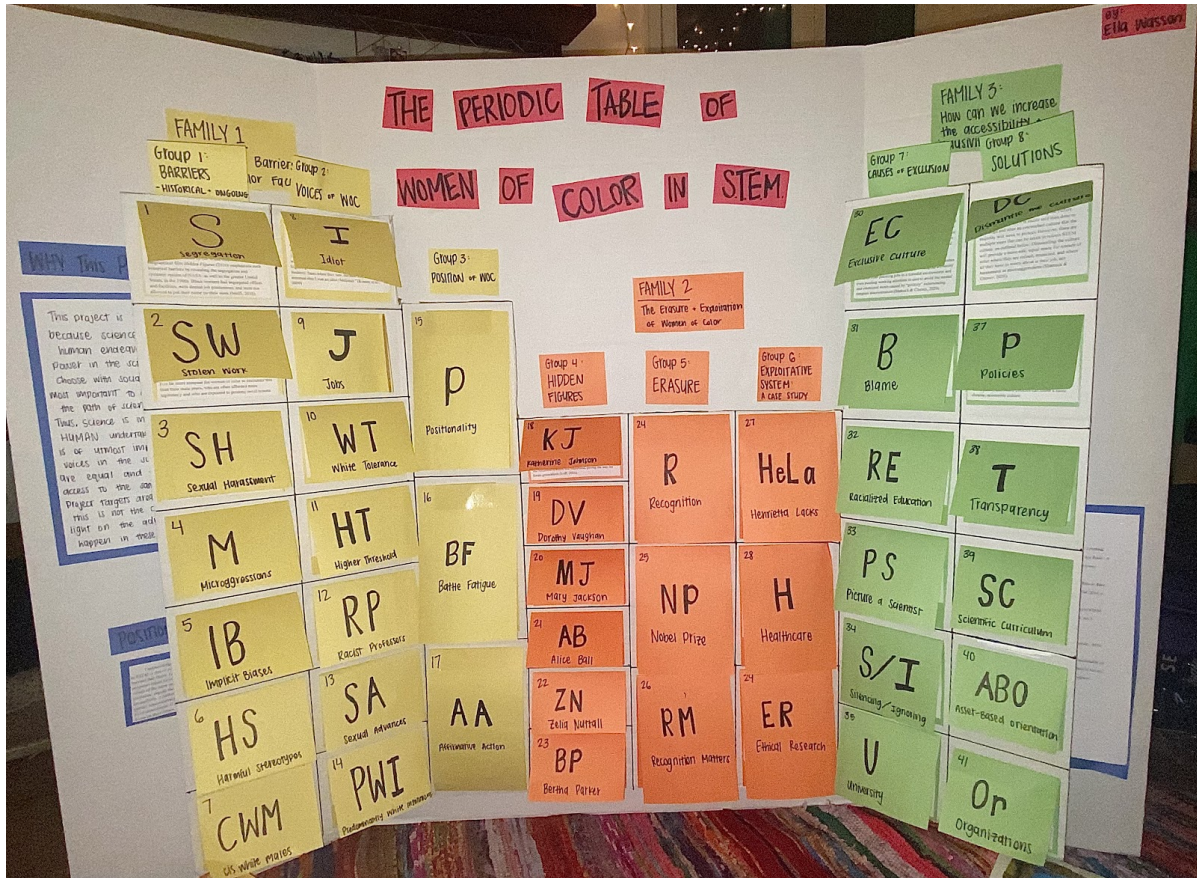
^ The Periodic Table portion extends off the board and is an interactive element!

I acknowledge that my position relative to the barriers facing women of color in STEM is one of privilege. As an Asian-American in STEM, I do not face the same barriers that Black, Latinx, or Indigenous women face. I benefit from a system that promotes ideals favoring Asian-Americans. Therefore, I worked to center the issues and voices of the underrepresented women of color in order to highlight their immense resilience, expose the enormous barriers they must overcome, and promote increased exclusion and accessibility. I further acknowledge that this project fails to encompass the issues of gender-nonconforming folks and feel that more light and focus must be shed on their lived experiences. If given the chance, further points of departure on this project should center on their issues.

Why This Project Matters:

This project is important because science is a human endeavor. Those in power in the scientific community choose which socially relevant scientific questions are most important to address, dictating the path of scientific research. Thus, Science is inherently a social, human undertaking. Therefore, it is of utmost importance that all voices in the scientific community are equal and that everyone has access to the same opportunities. This project targets areas of STEM where this is not the case in order to shed light on the advocacy that must be done in these fields

FAMILY 1 - The Unique Barriers Women of Color Face

FAMILY 1

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Group 2:
VOICES OF WOC

WOMEN

Group 3:
POSITION OF WOC

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segregation

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d facilities, were denied job promotions, and were not
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Positionality

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SH

Sexual Harassment

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WT

White Tolerance

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Microaggressions

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Higher Threshold

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BF

Battle Fatigue

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IB

Implicit Biases

12

RP

Racist Professors

6

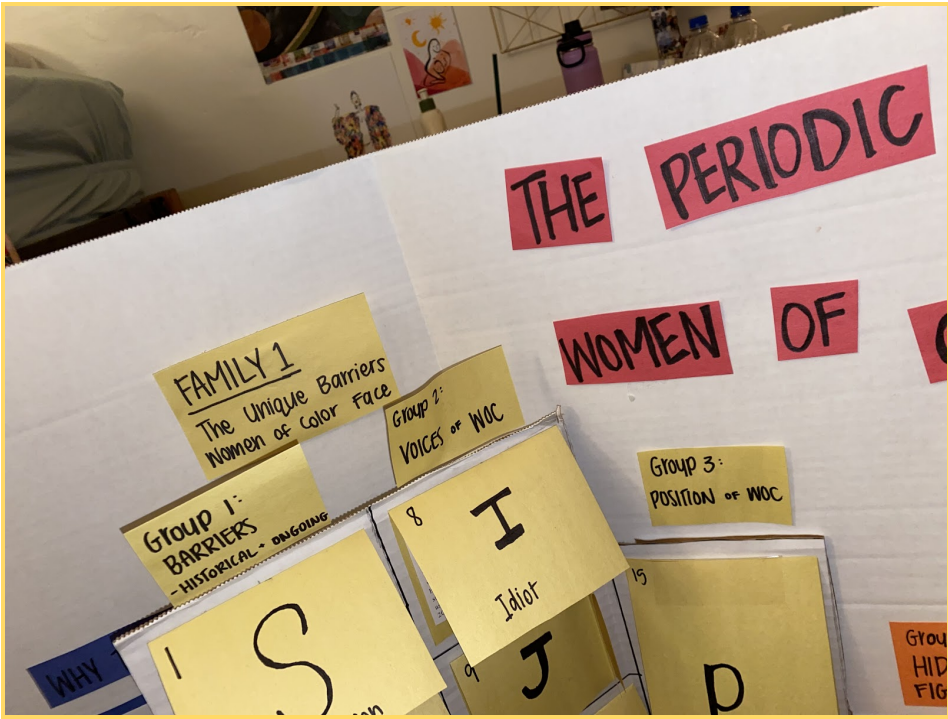**HS**

Harmful Stereotypes

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SA

Sexual Advances

17

CWM

Cis White Males

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PWI

Predominantly White Institutions

AA

Affirmative Action

THE PERIODIC WOMEN OF C...

FAMILY 1
The Unique Barriers Women of Color Face

Group 2: VOICES of WOC

Group 3: POSITION of WOC
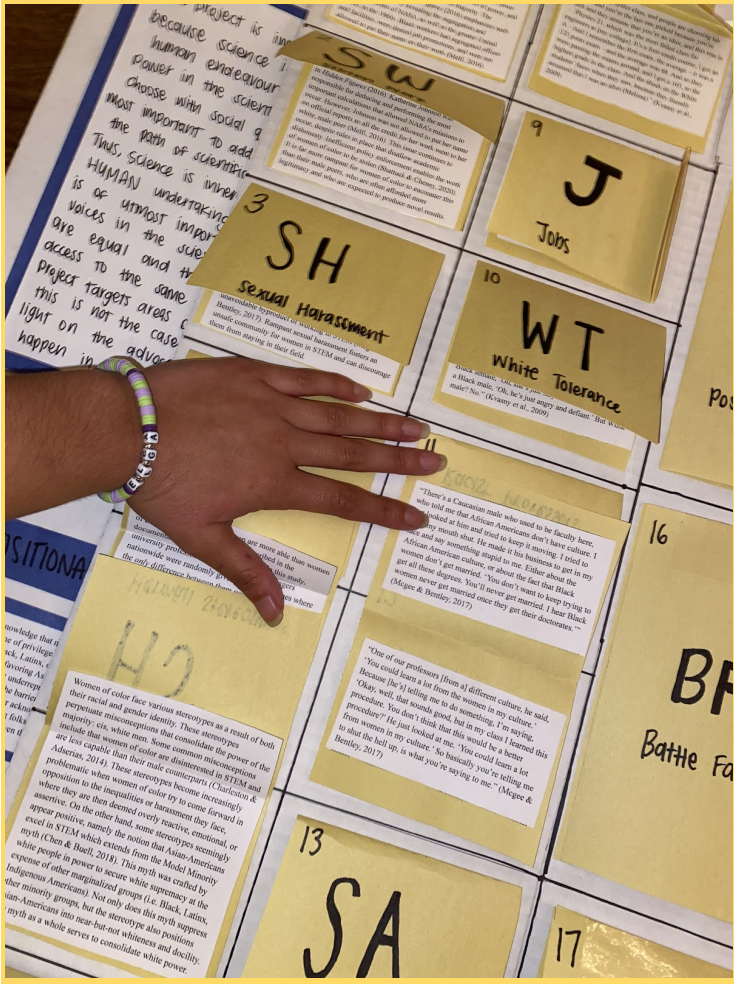
GROUP 1: BARRIERS
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Women of color face various stereotypes as a result of both their racial and gender identity. These stereotypes perpetuate misconceptions that consolidate the power of the majority: cis, white men. Some common misconceptions include that women of color are disinterested in STEM and are less capable than their male counterparts (Charleston & Adserias, 2014). These stereotypes become increasingly problematic when women of color try to come forward in opposition to the inequalities or harassment they face where they are then deemed overly reactive, emotional, or assertive. On the other hand, some stereotypes seemingly appear positive, namely the notion that Asian-Americans excel in STEM which extends from the Model Minority myth (Chen & Buell, 2018). This myth was crafted by white people in power to secure white supremacy at the expense of other marginalized groups (i.e. Black, Latinx, Indigenous Americans) Not only does this myth suppress other minority groups, but the stereotype also positions Asian-Americans into near-but-not whiteness and docility. This myth as a whole serves to consolidate white power.

13 SA

BR
Battle Fa...

1. S - Segregation

Historically, women of color have faced immense barriers and inequalities in STEM. A major barrier that women of color faced was racial segregation. Women of color, especially Black, Indigenous, and Latinx women, were not, often legally, allowed the same educational and work opportunities as their white counterparts. Women of color were segregated from their white peers, were given fewer resources, were not allowed to hold positions of power, and were viewed as inferior by the White majority. The biographical film *Hidden Figures* (2016) emphasizes such historical barriers by revealing the segregation and systemic racism of NASA, as well as the greater United States, in the 1960s. Black workers had segregated offices and facilities, were denied job promotions, and were not allowed to put their name on their work (Melfi, 2016).

2. SW - Stolen Work

Throughout time, women of color have struggled with their academic work being stolen, with the credit often going to a cis, white man. One historical example of this can be seen in *Hidden Figures* (2016). Katherine Johnson was responsible for deducing and performing the most important calculations that allowed NASA's missions to occur. However, Johnson was not allowed to put her name on official reports so all the credit for her work went to her white, male peer (Melfi, 2016). This issue continues to occur, despite rules in place that disallow academic dishonesty. Inefficient policy enforcement enables the work of women of color to be stolen (Shattuck & Cheney, 2020). It is far more rampant for women of color to encounter this than their male peers, who are often afforded more legitimacy and who are expected to produce novel results.

3. SH - Sexual Harassment

One common barrier women of color face in all areas of STEM is sexual harassment and coercion (Shattuck & Cheney, 2020). The power imbalance between advisors, professors, bosses, etc. often leaves women of color in the unfortunate, harmful position of being coerced and harassed. Furthermore, there is increased difficulty for these women to come forward against their harassers as the assailants often hold respected positions in the scientific community or the women face losing their own legitimacy as a scientist (Shattuck & Cheney, 2020). Thus, many women of color have accepted sexual harassment as an unavoidable byproduct of working in STEM (Mcgee & Bentley, 2017). Rampant sexual harassment fosters an unsafe community for women in STEM and can discourage them from staying in their field.

4. M - Microaggressions

Sexual harassment is just the tip of the iceberg of barriers women of color face. They also suffer from rampant microaggressions inflicted by their cis, white, and/or male peers. Some examples include not being invited to collaborate with male peers, being ignored in meetings, being doubted on their abilities, and being sent inappropriate emails from male colleagues

(Shattuck & Cheney, 2020). One notable microaggression women of color faced was highlighted in the documentary *Picture A Scientist* (2020). Dr. Raychelle Burks, a Black chemist at American University, was sitting at her desk with work in front of her yet was still mistaken for the janitor. In facing such microaggressions, women of color are expected to maintain "professionalism," grinning and bearing the continual racism and sexism they experience.

5. IB - Implicit Biases

The implicit bias that white men are more able than women of color is highlighted in a study described in the documentary *Picture A Scientist* (2020). In this study, university professors and other scientific managers nationwide were randomly given identical resumes where the *only* difference between them was that one was a male and the other female. Despite identical qualifications, the male applicant was chosen significantly more than the female. This same study was replicated where the only difference was racial identity, where one applicant was White and the other was Black. The White applicant was chosen more often (Shattuck & Cheney, 2020). These studies reveal that women of color, who inhabit both undervalued identities, are placed in the delegitimized margins of STEM for no reason other than their gender and racial identity. The studies reveal that people are implicitly biased to believe that white men are most capable in fields of STEM.

6. CWM - cis white males

The issues outlined above are a result of the overwhelming majority group in STEM spaces: cis white males. They do not have to deal with nor do they understand the immense barriers and added pressures that women of color face in STEM (Mcgee & Bentley, 2017). Furthermore, cis white men are often afforded more room for error whereas women of color are highly scrutinized if a mistake is made (Kvasny et al., 2009). This increased tolerance for white men and the widespread dominance of their ideology in STEM produces an environment that places women of color lower on the totem pole purely based on their racial and gender identity. Cis white males are immediately supported and valued, regardless of qualifications or actual ability (Shattuck & Cheney, 2020).

7. HS - Harmful Stereotypes

Women of color face various stereotypes as a result of both their racial and gender identities. These stereotypes perpetuate misconceptions that consolidate the power of the majority: cis, white men. Some common misconceptions include that women of color are disinterested in STEM and are less capable than their male counterparts (Charleston & Adserias, 2014). These stereotypes become increasingly problematic when women of color try to come forward in opposition to the inequalities or harassment they face, where they are then deemed overly reactive, emotional, or assertive. On the other hand, some stereotypes seemingly appear positive, namely the notion that Asian-Americans excel in STEM which extends from the Model Minority myth (Chen & Buell, 2018). This myth was crafted by white people in power to secure

white supremacy at the expense of other marginalized groups (i.e. Black, Latinx, Indigenous Americans). Not only does this myth suppress other minority groups, but the stereotype also positions Asian-Americans into near-but-not whiteness and docility. The myth as a whole serves to consolidate white power.

8. I - Idiot
 "So you're in physics class, and people are choosing lab partners and you're the last one picked because you're Black and they assume that you're an idiot, and this was in … Physics 21, which was the most failed class for engineers at [my college]. It's a four-credit course, I got an A – And I remember the first exam, the average – it was a 125 point exam – and the average was 68. And so they were passing the exams around, and I got a 103, so the highest grade in the class. And the shock on the White students' faces when they saw, because they literally assumed that I was an idiot (Melissa)." (Kvasny et al., 2009)

9. J - Jobs
 In relation to job interviews/hiring process:
"... part of the perception is that they automatically assume that Black women are probably single with kids. So that's another problem as far as the different things you have to go through. You're not considered to be stable because you don't have a man at home… And those types of things are not really said, they're kind of implied… I don't get into what kinds of benefits I'm looking for, insurance for the entire family. None of those discussions come up until after the job interview is posted and been accepted and then I will say, 'Well what kinds of medical insurance?' things like that (Joanne)." (Kvasny et al., 2009)

10. WT - White Tolerance
 Megan: "[R]ecently on another team I was on, we hired two new people, one was a young African American female and one was a White male. And the Black female was much sharper and dependable, and this White male was kind of lackadaisical. But I think they tolerated that laziness a lot more with him, because he was a young White male versus how long they would have tolerated that with anyone else. Whether it be a White female, a Black female, or a Black male, they tolerated it a lot more with him."

Interviewer: "So how does it make you feel?"

Megan: "It makes you feel angry. You get angry, because, I'm like, 'They babied him a little bit more, and hoping he would come around.' and I think if it had been anyone else, you know, if it were a White female, 'She's just so emotional and weak.' And then if it would have been a Black female, 'Oh, she's just lazy.' Or if it would have been a Black male, 'Oh, he's just angry and defiant.' But White male? No." (Kvasny et al., 2009)

11. HT- Higher Threshold

"STEM majors, I think just in general, are very, very rigorous, but… if you took away the factors of being a woman of color, it's almost to the point where it's so strenuous to get things done and you feel like even when you do, it's not enough. As a Black woman, I can't fail because if you fail, then you have like the weight of the world on your shoulders and it almost has this front of that everybody's succeeding and everybody's doing great, but if you're not doing great, what's wrong with Black people? So it's this constant thing hanging over you: I have to always do great. My test scores have always got to be great; every time I present, I always have to be great; or, when I, youknow, come up with a research idea or whatever, it has to be the top of the top … because if I don't, then I'm gonna get kicked out or I don't belong to, I don't deserve to be here. So, it can be very taxing." (Mcgee & Bentley, 2017)

12. RP- Racist Professors

"One of our professors [from a] different culture, he said, 'You could learn a lot from the women in my culture.' Because [he's] telling me to do something, I'm saying, 'Okay, well, that sounds good, but in my class I learned this procedure. You don't think that this would be a better procedure?' He just looked at me. 'You could learn a lot from women in my culture.' So basically you're telling me to shut the hell up, is what you're saying to me." (Mcgee & Bentley, 2017)

"There's a Caucasian male who used to be faculty here, who told me that African Americans don't have culture. I just looked at him and tried to keep it moving. I tried to keep my mouth shut. He made it his business to get in my face and say something stupid to me. Either about the African American culture, or about the fact that Black women don't get married. 'You don't want to keep trying to get all these degrees. You'll never get married. I hear Black women never get married once they get their doctorates.'" (Mcgee & Bentley, 2017)

13. SA- Sexual Advances

"You need to become comfortable with sexual advances, which is cumbersome. Um, it really is. Because how do you prove it? You know, who do you … who do you confide in, how do you combat it? You just don't. You just suck it up and say, 'I've got 1, 2 more years left. I can't wait to get the hell out of here,' you know. And it's not just here, because it is here, make no mistake. Um, but even when I go to conferences, ... I've had a number of men ask to be on my committee, and then solicit me for sex. And so, uh, it sucks. ... Some days I feel very powerless. Um, I feel like they make me their work wife. So, any time someone needs to take notes or run and get an errand and grab something to eat—flunky stuff—it's typically me who gets those directives." (Mcgee & Bentley, 2017)

14. PWI- predominantly white institutions

"So people assume that we're somehow below them, like, even though we… have degrees in math and science, ... our HBCU degree can't hold up to their degree from a White school. Like it's below because we go to the school that is the reject school in their eyes." (Mcgee & Bentley, 2017)

15. P - Positionality

The position women of color inhibit influences the immense barriers they face in STEM (Collins & Bilge, 2016). All the barriers outlined in this section are a result of the intersecting identities of women of color. These barriers stem from being both a racial minority *and* a female. Thus, the inequalities women of color face have roots in both racism and sexism. Women of color face far more immense barriers than their non-POC female or men of color counterparts. Furthermore, their significant underrepresentation often leads to their issues being overlooked and their voices being silenced (Shattuck & Cheney, 2020). When enacting solutions that target the issues of women of color, it is important to use an intersectional lens that encompasses their unique position at the crossroads of many identities.

16. BF - Battle Fatigue

In navigating the harmful barriers rampant in STEM workplaces and academic spaces, women of color show an immense amount of resilience. However, resilience can be a double-edged sword (Mcgee & Bentley, 2017). While women of color are able to persevere in the face of discrimination, they are then plagued with diminished mental and emotional health, anxiety, and feelings of isolation. Frequently, women of color face racism and sexism while they are expected to maintain professionalism. This "battle fatigue" against such inequalities, microaggressions, and discrimination is something only women of color experience and it is a burden they have to carry on top of work-related stresses. Meanwhile, their cis male and white counterparts do not have to carry this same mental and emotional weight (Shattuck & Cheney, 2020).

17. AA - Affirmative Action

On the face of it, Affirmative Action policies appear to be a successful solution to increasing the inclusion of women of color in STEM. However, seemingly positive policies like Affirmative Action are a double-edged sword (Kvasny et al., 2009). For some women of color, their achievements are undermined by peers who feel they are only there in the name of increased diversity. Thus, Affirmative Action actually delegitimizes the abilities and success of underrepresented women. That being said, such policies still serve a vital purpose: fostering inclusion and promoting diversity. The delegitimizing aspect of this policy lies in the racist implicit biases perpetuated by the cis, white male majority (Kvasny et al., 2009).

FAMILY 2- The Erasure and Exploitation of Women of Color

FAMILY 2

The Erasure + Exploitation of Women of Color

Group 4: HIDDEN FIGURES

Group 5: ERASURE

Group 6: EXPLOITATIVE SYSTEM: A CASE STUDY

18 **KJ** Katherine Johnson	24 **R** Recognition	27 **HeLa** Henrietta Lacks
19 **DV** Dorothy Vaughan		
20 **MJ** Mary Jackson	25 **NP** Nobel Prize	28 **H** Healthcare
21 **AB** Alice Ball		
22 **ZN** Zelia Nuttall	26 **RM** Recognition Matters	2? **ER** Ethical Research
23 **BP** Bertha Parker		

to walk over a mile to the designated "colored" restroom, she remained resilient and successful, paving the way for future generations (Loff, 2016).

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18. KJ - Katherine Johnson

      Katherine Johnson accomplished many feats throughout her extraordinary life. After graduating from West Virginia State College, she was chosen as one of three black students (the only woman) to integrate the university's graduate schools. She is most prominently known for her work with NASA, where she was responsible for producing countless vital and novel calculations that allowed for the success of multiple missions. While she faced rampant racial and gender discrimination while working at NASA, namely being unable to take credit for her work and having to walk over a mile to the designated "colored" restroom, she remained resilient and successful, paving the way for future generations (Loff, 2016).

19. DV - Dorothy Vaughan

      Dorothy Vaughan is most prominently known for being NASA's first African-American manager, paving the way for future generations of diverse leaders. She initially began work as the manager for the segregated West Area Computing Unit, overseeing a large group of Black female mathematicians who collectively contributed to almost every area of research at NASA (Loff, 2016).

20. MJ - Mary Jackson

      Mary Jackson is prominently known for being NASA's first Black aeronautical engineer. In order to take the classes needed to become an engineer, Jackson had to go to court as the courses she needed were only available at a white-only school. Jackson obtained the city's permission and completed the courses to become an engineer. She was one of the only, if not THE only, black female aeronautical engineer at the time. Later in her career, she focused on

hiring and supporting the next generation of NASA's female workers as the Women's Program Manager. She always focused on supporting new recruits in their budding careers, highlighting that to her, science and service were of utmost importance (Loff, 2016).

21. AB - Alice Ball

Alice Ball was the first woman AND Black American to obtain both a Master's Degree and professorship position at the University of Hawaii's chemistry department. At the University of Hawaii, Ball conducted research on chaulmoogra oil, whose chemical properties seemed to reveal potential treatment for leprosy. The oil's properties were extremely difficult to use due to their structure/composition. However, Ball was able to develop an injectable form that isolated the relevant active ingredients, producing a far more effective treatment. Unfortunately, Ball died before she could publish her findings and another scientist took credit for her work without acknowledging her contributions (Pak).

22. ZN - Zelia Nuttall

Zelia Nuttall was a self-trained Mexican-American archaeologist and anthropologist. Nuttall sought to preserve the history and revive the rituals of the ancient indigenous peoples who had been eradicated by Spanish colonialism. Nuttall worked outside the norms of colonial science while still using the tools of the field to challenge the narratives colonial science perpetuated. She was able to recover Aztec artifacts from European libraries, advocated for Aztec visibility, and challenged the scientific community on the notion that Indigenous communities were, "bloodthirsty savages, having nothing in common with civilized humanity" (McNeill & Reser).

23. BP - Bertha Parker

Bertha Parker was another self-trained archaeologist and anthropologist of Abenaki and Seneca descent. Parker was motivated to pursue the preservation of Native American culture during the racialization of American school curriculums in Native American communities through sterilization programs. These programs sought to suppress the Indigenous Americans' life and culture. Similar to Nuttall, Parker both challenged and utilized the tools of Western science to publish research and increase visibility for Native Americans. Parker and Nuttall highlight that a university education is not a prerequisite to being an effective scientist and that it is important to have indigenous voices control their own histories/narratives in order to achieve more complete truths, which is a central purpose of science (McNeill & Reser).

Group 5: Erasure
24. R - Recognition

The erasure of women of color, specifically in how their work is overlooked and/or stolen, is hard to quantify. A suitable proxy measurement for the recognition of women of color in STEM is the number of prestigious scientific awards they receive. The paper, "The Gender

Gap in Highly Prestigious International Research Awards, 2001–2020" (2021) reveals the large inequalities in the recognition of women. Of the awards this paper analyzed, many did not honor a single woman. The article does not center women of color in their analysis, but presumably, they are far more overlooked. This lack of recognition by their peers highlights that the contributions of women of color are ignored and valued less than the contributions of their cis, white male peers (Meho, 2021).

25. NP - Nobel Prize

It is further important to highlight the gender and racial gap in the Nobel Prize, a highly regarded and widely publicized award. The prize has been awarded for over a hundred years, yet in science-based categories only 3% of the winners are women, and almost all of them were awarded alongside male peers. Never has a Black person won a science-based Nobel prize. These dismal statistics highlight the entrenched systemic sexism and racism in the scientific community that causes the contributions of women of color to be overlooked and undervalued (Wetzyl, 2021).

26. RM - Recognition Matters

While winning awards may seem somewhat trivial relative to combatting workplace discrimination and day-to-day inequalities, recognition by prestigious committees is extremely important in scientific communities. Scientific awards not only acknowledge the contributions of scientists which legitimizes their abilities, but they also increase the visibility of winning scientists, improve their chances of receiving future funding and tenure, and help influence future research and policies (Meho, 2021). These are integral aspects of succeeding in academia. Furthermore, high-profile awards like the Nobel Prize perpetuate the societal image of a scientist. The exclusion of women of color from Nobel Prize honorees maintains the image of a scientist as a cis, white man (Wetzyl, 2021).

Group 6: Exploitative system: A Case Study

27. HeLa - Henrietta Lacks

Henrietta Lacks was born in 1920 in Virginia and died of cervical cancer in 1951. Prior to her death, Lacks went to Johns Hopkins Hospital to get a diagnosis for the pain she was feeling. There she was diagnosed with cervical cancer and was treated. During treatment, cancerous cells were taken from her body without her knowledge or consent. These cells were used to form the HeLa cell line, and have since been used extensively in medical research to study disease and to test drugs. For example, the cells were used to develop the polio vaccine. Lacks' case brings up legal and ethical debates over the rights of an individual to their genetic material as well as proper practices regarding human research and informed consent (Skloot, 2010).

28. H - Healthcare

The story of Henrietta Lacks becomes increasingly ethically questionable when analyzing the treatment of her descendants, especially her children. Henrietta's family was neither compensated for the profits made off their mother's cells nor even informed her cells were taken and still alive. Furthermore, many of her descendants experience various health problems that, while simple to treat, are too expensive without insurance. Thus, the Lacks family remains low-income and unable to receive needed health care despite the fact the system continually profits off their own mother's cells. This case study emphasizes the systemic shortcomings of the healthcare system (Skloot, 2010).

29. ER - Ethical Research

This case study highlights an important aspect of the interactions between marginalized individuals and the STEM system as a whole. Historically, people of color have been unethically exploited in the name of scientific research and progress (Skloot, 2010). A lack of transparency and informed consent enabled hundreds of marginalized men and women to be exploited by a systemically racist system. Ultimately, science is a human endeavor. When those in power are a dominant white majority group, they will always choose marginalized groups to exploit, preying on gender, race, and class differences. This begs the question of whether human research can be ethical, even with informed consent, and especially when race, class, and gender are involved.

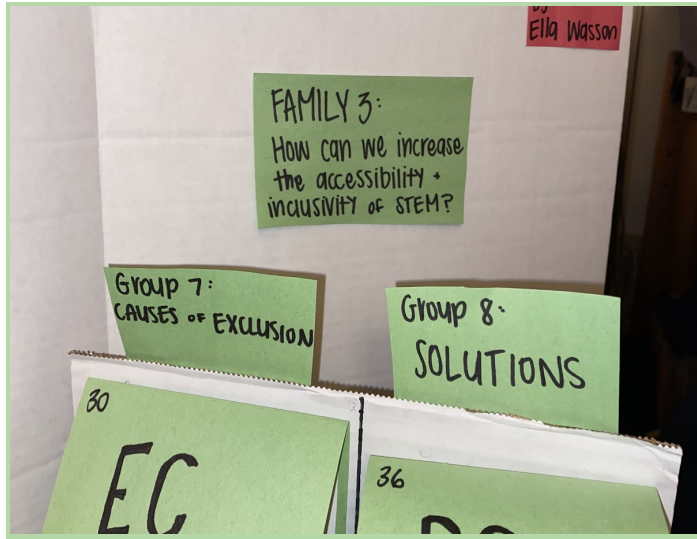# FAMILY 3- How can we increase the accessibility and inclusivity of STEM?

30. EC - Exclusive Culture

While a major cause of STEM's inaccessibility is a lack of resources and support to underrepresented communities in early education, a primary source of exclusivity against women of color derives from the harmful culture that favors and sustains the cis, white male majority (Charleston & Adserias, 2014). This culture protects the white males in power, inhibiting the upward movement of women of color and delegitimizing their contributions. This culture fosters the misconceptions that women of color are less qualified and less able than their white and/or male peers while undermining the validity of their complaints against the oppressive system. This inherently exclusive culture pushes women of color away from STEM, discouraging university students from pursuing jobs in a harmful environment and even pushing working scientists to quit to avoid the mental and emotional strain caused by "politely" experiencing rampant discrimination (Shattuck & Cheney, 2020).

31. B - Blame

The culture of STEM is a high-stress environment where, often, people's failures are attributed to their personal characteristics (Mcgee & Bentley, 2017). Thus, along with the field being primarily male and white, the underrepresentation of a minority group becomes that minority's fault, not the fault of the system. This provides a barrier to reform since the notion that science is fair and purely based on one's ability gets perpetuated, masking the rampant systemic sexism and racism. Further, it forces marginalized groups to work much harder to a consistently high level of quality with little room for error, since the legitimacy of their place in STEM communities is constantly under question (Charleston & Adserias, 2014).

32. RE - Racialized Education

The racialization of STEM in both its culture and content breeds the inherent exclusion of marginalized groups. Women of color especially feel unseen in a scientific curriculum that centers cis, white men. The lack of diversity and visibility in STEM curricula promotes the notion that white men are more capable of jobs in STEM and that the various fields are primarily for them. This causes women of color to feel alienated by STEM and unwelcome, as they do not feel as connected to the STEM community as cis, white men do (Charleston & Adserias, 2014).

33. PS - Picture a Scientist

What image comes to mind when you are told to picture a scientist? For most, the answer is a cis, white man (Wetzyl, 2021). This image exemplifies the existence of the immense barriers that women of color face which prevent them from inhabiting major roles in the scientific community. If they were provided increased recognition and visibility, there would not be such a dominant image of a white, male scientist. Furthermore, this image reveals the immediate importance of diversifying STEM fields.

34. S/I - Silencing/Ignoring

Because of the overwhelming dominance of the cis, white male majority, the voices and complaints of women of color are often ignored and silenced. For example, when women of color try to come forward as victims of sexual assault, their assailants are often protected by the system. Their assailants often hold power in the scientific community, such as bringing their university prestige or money in the form of grants (Shattuck & Cheney, 2020). Thus, when women of color try to obtain justice for the inequalities they face, they are often ignored. Furthermore, the lack of power women of color have often causes them to feel they cannot speak up for fear of repercussions, namely losing their job or delegitimizing their perceived ability as a scientist by being deemed overly emotional or reactive. This can often turn women of color away from working in STEM since it is more important for their mental, physical, and emotional health to avoid putting themselves in harmful situations where they have no protection from the system (Mcgee & Bentley, 2017).

35. U - University

Upon researching the barriers women of color face in STEM, it became apparent that a university education was seemingly a prerequisite to being successful in the field. Furthermore, in reflecting on science education, popular narratives focus on university-trained scientists or those glorified as famous figures. Such narratives produce incomplete images of what a scientist should be and look like: university-trained and white, and for women, famous and almost mythologized (think Florence Nightingale or Marie Curie). This focus on university education or widespread recognition ignores the women working on the margins of institutions who have pushed the bounds of scientific inquiry without access to higher education. In ignoring the scientists who are self-trained yet still produce novel discoveries, a narrow, incomplete, and

exclusive definition of who can be a scientist and what science is gets perpetuated (McNeill & Reser).

36. DC - Dismantle the Culture

Since the harmful culture is one of the most pressing influences in driving women of color away from careers in STEM, dismantling the culture should be a priority. It is easier said than done to challenge and alter an entrenched culture that the majority will work to protect. However, there are multiple steps that can be taken to reform STEM culture, as outlined below. Dismantling the culture will provide a more safe, equal space for women of color where they are valued, respected, and where all they have to worry about is their job, not harassment or microaggressions (Shattuck & Cheney, 2020).

37. P - Policies

Implementing policy changes and *enforcing* policies that protect marginalized groups is of key importance (Carter-Sowell & Zimmerman, 2015). One major issue in STEM is the lack of justice for women of color against assailants and oppressors (Shattuck & Cheney, 2020). The culture of STEM is organized to protect the notorious sentences who bring prestige and money, regardless of the harassment they inflict on their women of color peers. In enforcing that these men face real consequences, that is one step forward to creating a safe, more equal space for women of color. Furthermore, policy changes can be implemented that increase inclusivity and accessibility. Such changes can occur at multiple levels, for example, in university admissions offices, labs, office workspaces, etc. These policies can foster a more diverse, accessible culture.

38. T - Transparency

One effective way to verify that those in power are abiding by policies or fairly choosing college/job applicants, convention speakers, and award winners is to increase the transparency of such processes (Wetzyl, 2021). Knowing exactly how applicants or winners are chosen, why certain policies get enacted, or why particular decisions get made allows the community to ensure that there is equality regarding inclusion and judgment. If there appear to be unfair practices, then whoever employed those practices can be held accountable.

39. SC - Scientific Curriculum

Another way to increase the inclusivity of STEM would be to change the science curriculum. More specifically, centering the contributions of women of color and removing gendered ideas and notions from education (Charleston & Adserias, 2014). A de-racialized education would show young girls of color that STEM can be a space for them also and would encourage them to try for STEM opportunities. It would further highlight to their white and/or male peers that science is for everyone, eliminating implicit biases that cis, white males are more capable.

40. ABO - Asset-based Orientation

As outlined in the paper "Hidden in Plain Sight: Locating, Validating, and Advocating the Stigma Experiences of Women of Color" (2015), an asset-based orientation framework is a useful tool to identify the most relevant issues women of color face. Women of color in STEM lack visibility, which thus means there is a lack of advocacy for their issues. An asset-based orientation integrates the strengths of the individual, association, and institution. This allows advocacy to be aimed towards relevant issues and allows solutions to be effective for as many individuals as possible. This orientation centers the unique issues women of color face, allowing for the implementation of competent solutions (Carter-Sowell & Zimmerman, 2015).

41. Or - Organizations to support

- **Girlstart**
  - This organization's goal is to foster interest in STEM and increase accessibility for girls from kindergarten to twelfth grade by organizing nationwide education programs in various areas of STEM. Girlstart especially works to support economically disadvantaged students (Mizzi, 2020).
- **IGNITE Worldwide**
  - IGNITE Worldwide provides opportunities to girls and non-binary students to participate in STEM fields. This organization centers on changing education by directly connecting with teachers and training them to be effective leaders (Mizzi, 2020).
- **Latinas in STEM**
  - This organization seeks to help Latina women overcome the large barriers they face when entering and navigating STEM fields. This organization focuses on mentorship, networking, and recognition to foster Latina success in STEM (Mizzi, 2020).
- **Black Girls Do STEM (BGDSTEM)**
  - The primary goal of BGDSTEM is to increase the engagement of black girls in STEM via inclusive education and accessible opportunities. This organization provides young black girls with mentorships and research opportunities, revealing to them available opportunities within STEM (Mizzi, 2020).

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