"In the back of my mind": A Longitudinal Multiple Case Study Analysis of Successful Black Women Biomedical Graduate Students Navigating Gendered Racism

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ABSTRACT

Black women in graduate school can experience stress due to blatant and subtle acts of gendered racism. However, we do not know how such stressors are navigated over time among those who successfully complete their PhDs. The current study used a Black feminist thought framework and narrative analysis to conduct a longitudinal exploration of how three successful Black women biomedical graduate students make sense of and respond to gendered racism they experienced and the coping strategies they employ as they persist. When interacting with others, the women experienced low expectations and doubts about being legitimate scientists. These experiences contributed to feelings of isolation, impacted their networking opportunities, and dampened their view of the desirability of an academic career postgraduation. Over time, their coping strategies for dealing with negative racial and gendered racial stereotypes and biases shifted from opting to "prove others wrong" or working harder, to leaning on their social networks for camaraderie and advice as well as choosing to not exert energy to form a response. Implications for mentoring and mentoring programs at the graduate level and science, technology, engineering, and mathematics programming are discussed.

INTRODUCTION

Black women have successfully obtained doctoral degrees despite experiencing stress due to blatant and subtle acts of gendered racism in college (Shavers and Moore, 2014; McGee and Bentley, 2017; U.S. Department of Education, 2019). We understand what gendered racism–based experiences look like as an individual event (Shavers and Moore, 2014; McGee and Bentley, 2017), and some of the coping responses to these encounters (Lewis *et al.*, 2013; Szymanski and Lewis, 2016; Thomas *et al.*, 2008). However, we are rarely afforded insight into the individual experience over the course of one's entire graduate career. We also do not know how these experiences, over time, inform Black women's motivations to stay within academia after attaining their PhDs, particularly in the field of biomedical science. In this paper, we employ narrative analysis to conduct a longitudinal exploration of how Black women biomedical graduate students make sense of and respond to gendered racism in their doctoral programs and the coping strategies they employ as they persist.

Conditions That Undermine Sense of Belonging among College Students

Studies have shown that hostile racial climates (Hurtado and Carter, 1997; Nunez, 2009; Jones *et al.*, 2021a) and experiences with subtle forms of racial-ethnic discrimination and bias (Hussain and Jones, 2021) are negatively related to a sense of belonging

among college students, where sense of belonging refers to students' psychological sense of connection to their communities (Hurtado and Carter, 1997). Additionally, low sense of belonging has been found to predict low academic persistence (Hausmann *et al.*, 2007), low academic self-efficacy (Zumbrunn *et al.*, 2014), and increased depressive symptoms (Choi *et al.*, 2021). Gendered racism, a stressor that exemplifies experiences (i.e., discrimination, biases, stereotypical expectations, microaggressions) at the intersections of racism and sexism also predicts psychological distress and depressive symptoms, (Essed, 1991; Thomas *et al.*, 2008; Szymanski and Lewis, 2016; Williams and Lewis, 2019) and may undermine a Black woman's sense of belonging during her tenure in a biomedical graduate program within a predominantly White institution (PWI).

Black Women Graduate Students and Coping with Gendered Racism

The intersectionality theory (Crenshaw, 1991) acknowledges that racism intersects with other forms of oppression and puts women of color in science, technology, engineering, and mathematics (STEM) in a position of exaggerated social isolation (McGee, 2021; Ong *et al.*, 2018). Walkington's (2017) critical overview of the sociological research on Black women's experiences as graduates from 1995 to 2015 revealed that Black women graduate students: face isolation and marginalization, racism and eroticization, microaggressions; have fewer funding, research, and network opportunities than their White and male counterparts; and have a higher risk of dropping out of graduate programs. Additionally, the participants in McGee and Bentley's (2017) case study analysis on high-achieving Black undergraduate and graduate women in STEM encountered stereotyped expectations based on their social identities as Black women. All respondents in this study discussed or alluded to feeling the pressure to conform (or at times defy) the strong Black woman stereotype and discussed the need to prove themselves as intellectually capable and to counter stereotypes of Black women (e.g., loud, aggressive, unintelligent).

Previous research has shown that Black women graduate students use a variety of coping strategies in response to racial, gendered, and racial-gendered experiences at PWI. Shavers and Moore (2014) interviewed 15 Black women doctoral students at a PWI to explore the strategies they used to persist academically and cope in their programs. They used Black feminist theory as both a theoretical foundation and an interpretive lens. The researchers found that the women's sense of responsibility to their communities fueled their motivation to activate strategies in which they: 1) "proved others wrong" regarding negative racial stereotypes; and 2) perceived their pursuit of a doctoral degree as something greater than themselves or as a way to give back to their communities. The authors referred to these strategies as "prove them wrong" syndrome and "part-of-a-bigger whole" syndrome. McGee and Bentley (2017) used a phenomenological approach to analyze case study data on whether and how Black women STEM students experienced structural racism in daily schooling. Their participants reported that they coped with racial and gender stereotypes in their STEM programs by focusing on work and proving themselves, avoiding people around whom and spaces where they felt unsafe, and drawing on close Black colleagues and friends for support. It is important to note that in this and other studies, students did

not cite institutional support to help them cope with these biases. Notably, the authors of these studies recognized that, while selecting the "prove others wrong" coping strategy may lead to resilience as demonstrated by academic persistence, the internal pressure of such an approach could simultaneously have a negative impact on one's overall well-being (Shavers and Moore, 2014; McGee and Bentley, 2017).

Black Feminist Thought Framework

Black feminist thought (Collins, 2002) is a methodological tool and framework for analyzing data (Clemons, 2019). It is a way of knowing that is grounded in the belief that Black women have developed a distinctive standpoint and are producers of knowledge. When researchers utilize Black feminist thought, they recognize lived experiences as criteria of meaning are self-reflexive, and they integrate ethics of caring and personal accountability in the entire research process (Clemons, 2019). Two important components of the Black feminist thought framework are that: 1) Black women are agents of change personally, interpersonally, and politically; and 2) the interconnected nature of social identifiers shapes the social realities of Black American women (Collins, 2002; Few, Stephens, and Rouse-Arnett, 2003). The themes of Black feminism (Collins, 2002) provide a useful lens to interpret the experiences of graduate students, because Black feminism recognizes that Black women have unique, shared experiences as members of a group characterized by their gender and race.

Objective

The experiences and coping strategies of Black women in graduate school have been investigated through a Black feminist thought lens (Shavers and Moore, 2014) and through a multiple case study approach (McGee and Bentley, 2017). However, these qualitative studies were cross-sectional and did not explore how their experiences and strategies to combat gendered racial oppression changed over time and toward the completion of their graduate programs. A longitudinal approach would enable deeper exploration of the impacts of long-term use of specific coping strategies on emotional well-being, academic persistence, and preferred sources of support. This study employs a Black feminist theory framework and narrative analysis in a longitudinal exploration of how Black women biomedical graduate students make sense of and respond to gendered racism in their doctoral programs.

METHODS

This study was reviewed and approved by Northwestern University's Institutional Review Board, Project STU00035424. Participants provided informed consent.

Context of the Larger Study from which the Interviews for This Report Are Drawn

This study draws from the Academy for Future Science Faculty (hereafter, "the Academy") a coaching intervention and longitudinal randomized controlled trial, with two cohorts of biomedical PhD students from across the United States. One cohort was recruited at the start of their PhDs and the other when they were nearing completion (Thakore *et al.*, , 2014).To recruit the students, we sent an email describing the Academy to biomedical graduate school leaders who were members of the Group on

Research, Education, and Training (GREAT), graduate directors at other nonmedical major research training universities, and leaders of undergraduate diversity STEM programs throughout the United States (Thakore *et al.*, 2014) The leaders were asked to forward these emails to incoming PhD students or undergraduates they had advised who were starting a PhD program in Fall 2011 (Thakore *et al.*, 2014).

Annual interviews provided a window into the PhD experience in a longitudinal manner. Interview topics included experiences in graduate school, experiences with mentors and principal investigators (PIs), issues of work–life balance and identity, and future career plans. The current report focuses on three Black women who were participants in the study and were first interviewed just before the start of their PhD programs. Thus, the interviews capture students' experiences from day 1 of their PhD programs. This study incorporates interview data over six time points: immediately before the start of the PhD and after 1, 2, 3, 4, and 5 years of the PhD program. Interviews were conducted during the Summers of 2011 to 2016. The three students in this study were interviewed by a White woman for the first 3 years and a Black woman (V.Y.W.) for the last 3 years.

Study Participants

Study participants were selected from the 200 students who were part of the Academy from the start of their PhD training. To be part of the Academy required that they expressed an interest in an academic career in science and were U.S. citizens or permanent residents. From among those 200 students, seven met the following eligibility requirements for the current multiple case study analysis: 1) identified as a Black woman; 2) in the interview following the first year of graduate school, they articulated that they experienced a race, gender, or gendered racial experience associated with belonging in science; and 3) attained their PhD by the end of the 6 year period. Using a random number generator, three students were selected to be the focus of the study. We chose three cases because we predicted a literal replication, or similar results, across their cases (Yin, 2014).

Positionality

Two Black women, one White woman (P.B.C.), and one White man (R.M.) form our team of authors and qualitative researchers. Our backgrounds and perspectives are diverse, and include being a social psychologist, global equity researcher, educational researcher and evaluator, and biomedical scientist turned research training leader and qualitative researcher. We come to this work with a mutual understanding that Black women have been marginalized and stereotyped within multiple American contexts, including STEM graduate programs at PWIs. Our lead author has written about gendered racism and mental health among young U.S. Black women (Jones *et al.*, 2021b), two team members have published research on a culturally aware mentoring training that they cocreated and facilitated for biomedical graduate instructors and administrators, and one team member published a book on evaluation from a racialized and social justice perspective (Thomas and Campbell, 2021).

The two Black women authors (V.Y.W. and L.O.) conceived this research question, after interviewing and coding the transcripts of numerous Black women for the larger project and noting that their experiences in graduate school seemed to be unique and somewhat troubling in comparison to the other gendered racial groups in the study. These authors were interested in understanding these observations, particularly as members of groups historically underrepresented in the academy. However, their career stage and professional roles in academia differed from those of the study participants. Therefore, they remained attentive to the participants' narratives and attempted to minimize their subjectivity by iteratively discussing and reaching a consensus on how quotes were coded as well as the interpretation of participant narratives. Recognizing the tenets of Black feminist thought and valuing lived experiences, the group's final consensus privileged the interpretations of the two Black women on the research team.

Data Analysis

Interviews were professionally transcribed and were checked and edited by members of the research team to ensure accuracy. Preliminary qualitative data were analyzed using NVivo qualitative software (Doncaster, Victoria, Australia) and used a coding architecture developed by the larger research team involved with the study in its early years. These codes were initially developed through a content analysis approach, which allowed us to start with larger, "open" codes reflecting the Academy's larger objectives. The open code used for the preliminary analysis in this report was "racial/ethnic background," which captured the experiences that the coders attributed to this identity. We read the year 2 (summer after the first year of graduate school) data in this code for participants who identified as Black women and attained their PhD by the end of the 6 year period ($n = 14$). Of this sample, seven reported a racial, gendered, or gendered racial experience associated with belonging in science during the first year of their PhD programs. Then, three participants were selected using a random number generator (www.random.org) for a longitudinal case study analysis. The final selection consisted of Monica, Yvonne, and Clarissa. These names are pseudonyms to protect the privacy of the participants.

All authors were familiar with the interview data, each having conducted a portion of interviews related to this study and the wider research project and having contributed to discussions and preliminary data-reduction and data-tagging exercises. Although NVIVO-coded data existed for the three students, the data for the case study analysis were based on two of the authors (V.Y.W. and L.O.) rereading of the full transcripts. This was done because the initial coding architecture was not designed for in-depth analysis of the research questions of this study. Both of these authors engaged in memoing, capturing the themes and ideas of the narratives, while reading the transcripts. They longitudinally organized the memos in a spreadsheet, dedicating one column to a theme of interest, including barriers, stressors, supports, gendered racial experiences, long-term goals, and short-term goals. We selected these themes because we thought they would capture the participants' perceptions, aspirations, and coping responses, further allowing us to see patterns and changes over the course of their time in graduate school.

The structural narrative analysis approach (Riessman, 2005), which emphasizes the *way* a story is told, was used to organize and write the focal stories of microaggressive

experiences present in each of the case studies. This approach is useful when examining a small number of detailed case studies and comparison of several narrative accounts and requires that the syntactic and prosodic features of talk are captured (Riessman, 2005). For this reason, the direct quotes were minimally truncated and the rhythm and pauses of the speaker were captured. Labov's (1982) structural narrative components were highlighted in each of the stories about gendered racial, gendered, and racialized experiences. These components included: orientation (to time, place, characters, and situation), complicating action (the event sequence), evaluation (where the narrator comments on meaning and communicates emotion), and resolution (outcome of the event).

We used the personal narrative approach (Nadar, 2014) to ensure that the participant voices, and the "lived experiences were the criterion of meaning", informed our interpretations of their actions (Collins, 2002). By listening to the content of their speech, specifically the "why" and "how" of their stories, this approach, rooted in Black feminist epistemology, uses the counternarratives of members of a marginalized group to pose suspicion on the master narratives of knowledge created by dominant groups (Hooks, 1989; Nadar, 2014). The personal narrative approach also informed our decision to be reflexive of our positioning as researchers, bringing awareness of our emotions and our ethics to the research process. This reflexivity, as Black women in academia, was demonstrated in our decision to debrief after reading and writing each longitudinal narrative and allocating time to share our similarities and differences with their stories, along with any accompanying emotions. This time also gave us an opportunity to see whether our interpretations were in fact projections, as we did not want to unknowingly insert our experiences into their narratives. Black feminist epistemology was also evident in our process of routinely discussing our responsibility to contextualize their stories and center their voices, as demonstrated by capturing their observations and approach to meaning making.

Finally, our use of the Black feminist theory framework (Collins, 2002) is demonstrated in our interpretive summary of each case study, which highlights the students' agency and decisions throughout graduate school and how the interconnected nature of race and gender informed their experiences.

RESULTS
Case 1: Monica
Expectations at the Start of the PhD. Monica is a first-generation African-American woman whose parents were born in Ghana. She attended a PWI graduate school in the southeastern region of the country. Monica entered graduate school with a strong anticipation that, as a Black woman, she would have to navigate negative stereotypes and low expectations. Throughout her program, she employed a variety of coping strategies to combat negative stereotypes and manage stress.

In the interview before graduate school, she noted her plans to get to know the people in her lab in a social environment so that she would not be intimidated when she first went in. She also planned on entering the lab with a "willing to learn" attitude. This attitude was characterized by asking questions and working with senior lab members, like postdocs, from whom she can learn. She stated, "It's gonna be difficult. I think if I make myself more available, it should help me do a better job."

When asked to what degree being a scientist is part of her identity, she explained that she has always wanted to be a scientist, that she understood it, and that it was relevant to her. She wanted to enter a lab that studied viruses, noting, "If I can help do anything about it [HIV], it would just make me so happy." She also wanted to prove others wrong, particularly those who thought it is enough for Black women to finish college. "As a girl, I just wanna prove that we can do more."

Years 1 and 2: Identifying New Stressors and Defying Expectations. In her first year of graduate school, Monica noted that balancing classes and lab rotations and not being able to see her family were stressful. To reduce stress, she talked to her family every weekend and spent time with others who were going through similar challenges. A study group that she and her peers created was helpful as well.

It was also during her first year of graduate school that she experienced one of several encounters with gendered racism. In this incident, she told a White male colleague that she was going to apply for a fellowship, and he responded, stating, "Oh, feel bad for me because I'm a White male. I'm gonna have a harder time getting it." This reaction prompted her to wonder if people think of her as "a joke" due to her minoritized status. She explained,

> I wonder if other people think, oh, we're just here because, you know, minorities are gonna get, you know, we get, like, a special opportunity. I wonder if they think we're incapable. You know, it's been years, they know that we're on the same level, minorities. That's why I got into a program. I got into the program because I'm as good as you. So I do wonder if—nobody— I—I never felt like anybody was judging me based on my race, but I do wonder if they think that, you know, see me—like, I wonder how people, you know, kind of, you know, a joke, I guess. (Year 1)

She continued, "I think they feel like we get it easier because they feel sorry for us." In response to moments of others doubting her capabilities because of her identities, she worked harder.

> I like to prove people wrong, you know, and I feel like if I work—I guess it's all motivating for me to work hard … It just motivates me. I just wanna prove you wrong and show that I do belong here, and I do deserve to be here no matter, you know, whether I'm a woman or Black or whatever. It just makes me wanna prove the people wrong …. I'm motivated to do it, not necessarily because of my external qualities of, you know, who I am as a woman or as Black woman. (Year 1)

We see that Monica wants to demonstrate that she is not in the graduate program due to the "external qualities" that she holds but due to her intrinsic motivation. This stance reflects that she is aware of how her social identities are shaping her interactions as a Black woman (Collins, 2002). She seems to adopt a problem-focused coping strategy (Lazarus and Folkman, 1984) to address this stressor, incorporating actions and behaviors that may counter the low academic expectations that others have of her due to her race and gender.

At the end of her second year of graduate school, Monica noted that she was slowly becoming a better scientist and

critic of her data. She talked to other people who let her know that it is normal to have delayed results, and therefore her findings were not surprising. She viewed disappointing aspects of her project as preparation for the real world and a learning opportunity, even though it was frustrating. She would cope with various stressors by focusing on proving others wrong, venting to her friends, and recognizing that challenges pose opportunities. Monica felt like she had to prove herself as a Black person.

> We [Black students] have to think, "people are going to look down on us." We don't want to, you know, we don't wanna make them feel like they're right. So, we have the added pressure of trying to do better. I feel like they [non-Black students] don't have to worry about that because they're already where they're supposed to be. (Year 2)

In alignment with John Henryism, a synonym for prolonged, high effort coping with difficult psychosocial environmental stressors (James, 1994), Monica also focused on "working harder" in her program during her second year to distinguish herself from the other Black women in her program. When asked if skin color played a role in how she was viewed as a scientist, she responded,

> Not that I can think—nothing that happened recently in a year, I don't think so. I guess the only thing is they probably think we're all the same people. Like we [Black women] don't stand out enough for them unless we make ourselves try more. So, I feel like when I present, I try to outshine so I can stand out so I'm not just another Black girl in the program. (Year 2)

When asked what she does to "shine a little bit more" as to not be perceived as solely a member of her gendered racial group but as an individual, she noted,

> Just working hard on everything I do. I guess working the weekend, bringing in data, yes, just working harder. When I do my oral—when I do my qualifying I try to do it as good as I can. When I present, I practice a lot to get it right. (Year 2)

Reflecting the Black feminist thought framework, we see that Monica is cognizant of how the interconnectedness of her gender and race informs her social reality, which in this case was not being seen as distinct from other Black women in her program. Subsequently, this awareness influenced her decision to cope with this mistreatment by "working harder." Although Monica mentioned this strategy during her first year of graduate school, she now specifies that she worked harder in response to gendered racial encounters.

Years 3 and 4: Navigating Depression and Shifting Coping Strategies. Monica continued to work in her lab and noted that trying to meet her PI's high expectations "stresses me out a lot." However, she acknowledged that she was becoming a better graduate student and a "better criticizer" of her data. The following year, she recognized that her PI had given her more control and that she was "90% independent." She became more confident in herself as a scientist, because she was reading more and getting more ideas. She also admitted that she became depressed after working on her project for so long and not having it work out. She characterized depression as having bad days and wanting to go home, go to sleep and just give up. She would receive pep talks from others to keep going and that it would soon be over. To reduce stress, Monica would go out with friends, watch TV, do something outside her house, or sleep.

During this same year, her fourth year in graduate school, she recalled another gendered racial experience. She noted that her PI did not expect as much out of a woman scientist as he would out of a male scientist. He once made a comment suggesting that when Black women graduate students get married and get pregnant, they do not go back into academia. She thinks that he has a stereotype about women scientists. Her reaction to such beliefs was to laugh. She explained,

> He's one of those people you cannot change his opinion when he says things, so I just laugh it off but, I mean of course I talk through it with my friends and that's when we discuss it. (Year 4)

Monica appears to have adopted an emotion-based coping strategy (Lazarus and Folkman, 1984) to deal with the stereotypical expectations that her supervisor has regarding Black women in science. She found humor in the situation and sought out support and camaraderie from her friends. This is a distinctly different reaction to gendered racism compared with the first one by her White male colleague who assumed she would not have to work as hard as he would to secure a fellowship. She was focusing less on proving others wrong through her achievements, instead recognizing the extent to which she could change others' opinions about her and opting for behaviors that are more internally focused. This shift in coping strategies also showcased that Monica was an agent for change in her personal life. She assessed how she dealt with gender racial encounters and chose to handle them differently, a demonstration of empowerment.

Year 5: Postgraduate Career Goals. After graduating with her doctorate, Monica became a postdoc at an agency of the Department of Health and Human Services. As a scientist outside academia, Monica can build upon her strengths, which include persistence, taking initiative, and the desire to keep learning new things and develop ideas. Although she found the position through her own connections, she did seek advice from her PI and lab members when seeking guidance around selecting her next position. They reiterated that she should choose a position where she could see herself getting a career out of it, one where other opportunities would be presented to her. She felt comfortable asking her PI for a recommendation, because she knew he would be willing to and capable of giving her a good one. This was a reflection of how much their relationship had grown. She stated,

> You know at the end he was like—was proud of me so that's you know overall it's what I could have asked for. Somebody who wasn't, you know the easiest PI to work with in the beginning, but now I can say I'm like okay, okay. I actually did grow as a person and as a student, as everything all around. (Year 5)

Monica's PI also supported her future goals, even though she chose not to go straight into academia. Her goal is to become a staff scientist within 10 years. She wants to do collaborative research in a lab where she does not have to worry about funding or writing grants. Monica would also like to be married with children and start mentoring Black women students. She explains:

> Well, I mean I feel like we have it as a double whammy, you know, you have to deal with being a woman, you have to deal with being Black and it's really hard. I mean I just want to let people know that you can do it. I've done it. It wasn't, it wasn't easy, but I feel like when people see you in positions that they didn't think were possible, it gives them motivation … There's no reason why there's not more women scientists. (Year 5)

When reflecting on her desire to be a mentor, she spoke about how her career trajectory was heavily influenced by the experiences and advice of a Black woman scientist in her department who did not get tenure and left. Although the scientist now has her own lab at another university, seeing the only Black woman in a department of 100 not get tenure was "discouraging." She continues,

> That impacted me a lot. It scared me a lot because I felt like she basically implied it was because of race, gender thing, that's why she didn't get tenure … She kind of discouraged me, not intentionally, not to go into academia because she said the road there is not easy at all, you know. (Year 5)

Monica's observation served as another example of her awareness of how the interconnected nature of race and gender shaped the social realities for Black women. It was if the scientist served as an example for how she might be treated as a Black woman in academia. It is impossible to know whether this particular Black woman getting tenure would have changed Monica's desire for or success in an academic career. But it is a clear example of how not seeing the success of other Black women in academia contributes to Black women's concerns over bias in academia.

Summary of Monica's Journey to the PhD. Throughout her PhD, Monica was keenly aware of her gendered racial identity and how it could negatively shape her scientist identity and her graduate experience if she was not confident and strategic. She expressed that others had lower expectations or would confuse her with other students because she was a Black woman. Her strategies for navigating gendered racism evolved over time, from striving to prove others wrong and distinguishing herself from other Black women to laughing and opting to not try to convince people to change their opinions about people from her social group. In addition to closely watching her Black women peers, she also noticed a Black woman scientist in her department, recalling that the woman did not get tenure, likely due to gendered racism, contributed to her decision to not work in academia and instead have a career where she would have more opportunities.

Case 2: Yvonne
Expectations at the Start of the PhD. Yvonne is a Black woman whose parents were born in the United States. She attended graduate school in the southeastern region of the country. Yvonne also entered grad school with an awareness of how her identity as a Black woman likely would impact her experiences. Throughout her program, Yvonne navigated a variety of stressors due to isolation, gendered racism, and lack of support.

Before her first year, Yvonne highlighted how her passion for science was sparked in high school, beginning her eventual journey to graduate school. She always had a passion for problem solving as well. During her undergraduate career, her goal was to go to medical school instead of graduate school. In discussing her choice to pursue research, she recalls the moment of realization that research would enable her to engage in problem solving while helping people manage health issues.

When asked about which of her identities she expected to impact her progression in grad school the most, Yvonne expressed that race and gender would likely have the most impact on her goals, as they have in the past. In discussing barriers related to gender, she felt pressure to focus on settling down and starting a family, instead of advancing in her career. She revealed that when she discussed her ambitions with others, she was often asked "Don't you want to have kids?" Yvonne also recalled having received multiple negative messages about her abilities as a minoritized student in science. These messages were compounded by her observations of the experiences of other Black scientists, who were passed up for several opportunities despite being equally qualified.

> I guess when you actually see that people, minorities, are being treated differently. Um, some people who are not minorities, um, where maybe minorities, they work just as hard or they have the same capabilities as the other person, and they're sort of passed off or not given, um, the opportunity to achieve more or maybe roadblocks are being put in place. They could be just like, having, uh, uh, a training opportunity to go overseas to do research, where the minority students wouldn't be allowed to go, but the other students would. Uh, I've seen things like that. (Year 0).

She expected to confront similar barriers in graduate school and acknowledged that, while hearing these messages and witnessing her peers being treated differently was hurtful, her approach was to ignore them, and keep going "no matter what." She optimistically added:

> Everybody on this earth, they have a purpose for life, and, um, I think we are able to have so much in the world that you can do what you wanna do in your life. And it shouldn't be based on where you're from, no geographical area or your culture or the color of your skin or how you look on the outside. It's really about your character and your ability to do something and do it well. (Year 0)

At this stage, she also felt confident in her ability to reach her goals, as she was a strong scientist in a top graduate program in her field. In the long term, she aspired to be a physician scientist, running clinical trials and community interventions and in a tenure-track position.

Years 1 and 2: Being the Only. During her first year of graduate school, Yvonne remained committed to doing whatever it

took to achieve her long-term goals. Yvonne reflected on an instance of racism in which she received written feedback from her professor, calling her "slow." While processing her reaction to this feedback, she revealed that it felt like an accusation based on a racist stereotype. This experience heightened her awareness of the stereotypes many of her peers and professors had about Black students and created significant anxiety during class.

> In one of my classes, I was told that I was slow, and I think, at the beginning, it wasn't vicious, but when I really thought about it, it became offensive. Because I don't think I was slow. I think, um, I just wasn't good at answering questions. Some of it came to me, but [I have] anxiety, because I, um, have an issue where, sometimes, if somebody calls on me, I'll freak out. (Year 1)

Yvonne's anxiety was heightened by the stiff competition she observed within her program. Within classes and lab rotations, she often found herself the only woman or the only Black person. She often felt overlooked, especially when she would speak up and be ignored, while her male colleagues would be revered for repeating the very same thing. As the only Black person, she felt like she was combating stereotypes about Black people being lazy. While those stereotypes were not affecting her at this stage, they remained in the back of her mind. Her approach was to try and ignore those messages and do her best so that she might be able to prove people wrong.

> So, I think, sometimes, it's [in] the back of my mind. Um, I wonder what people think of me because I'm not rich and, um, and I'm African American…. So, I think it's [in] the back of my mind, but I try not to focus on it a lot. I don't think it's a big issue at this stage. It isn't too much of an issue. Um, I think the other thing, the way to get around it, is sort of proving yourself to people. Sometimes you might not be able to change their stereotypes about you… [They] see that by how hard I worked. I'm not lazy, you know. I do know my stuff, like, you know, when it comes to research or science. So, I think if you show who you are, and they see that in some people, that will change their perspective, but others will maybe hold onto it. Um, so right now, it isn't too much of a problem. (Year 1)

Here, we see that Yvonne recognized that the interconnected nature of socioeconomic status and race have shaped her social reality, particularly concerns about being perceived as a stereotype. In her second year of graduate school, Yvonne felt isolated as she experienced frequent and overt acts of racist hostility. She constantly felt underestimated as members of her lab and institution let her know that she did not fit their image of a scientist. Yvonne reflected on when her peers saw her image on a promotional poster for a prestigious national training program. A White professor who saw this poster told a student in her program that there was "no way" Yvonne could have taken part in such a program. She felt insulted and frustrated that this professor did not think she was good enough to participate in such a program.

Yvonne's classroom and lab experiences were also marked with overt race-based hostility from other students. In class, she recalled, "Sometimes they're just very nasty with me." Students talked over her and cut her off to the point where a teacher had

to intervene. In her lab environment, she felt isolated due to the competition and her lab members' dismissal of her presence. She recalls multiple instances in which lab members undermined her accomplishments and attempted to sabotage her progress. For example, during presentations, the tone of voice, facial expressions, and body language of her lab members was "aggressive and not friendly," leading to feelings of anxiety. Additionally, her lab members actively impeded her progress by preventing her access to training opportunities.

> I feel like sometimes they're trying to be very intimidating to me. Um, I think also it's been in my lab setting, um, where I was supposed to get training on a certain technique and a student didn't want me to get trained so I remember the machine had broken down and it was a Mass Spec machine. So when I started thinking about, you know, getting back trained again, you know, because the machine, when he was trying to show me stuff, it broke down. So he told me, he's like, well you're not going to be able to get trained because the door is going to be locked and I'm not going to let you in. (Year 2)

While navigating those challenges, she noted that her PI did not advocate for her, despite being aware of what her lab members were doing. She had to advocate for herself but was also concerned that she could appear too angry while doing so. She described another instance in which an undergraduate research assistant was condescending to her and tried to take over her project. After consulting with her psychologist from her university's counseling center and processing her anger, she was able to confront him and regain autonomy over her project. However, a lab member retaliated by relabeling her test tubes incorrectly, which then required her to completely redo the experiment.

> The research assistant. I'm having a lot of issues with him. So I have my thesis research project, and my PI, um, wanted me to this anxiety test. So he's been doing it for a while. So he wanted me to shadow him, so I shadowed him to see how he does it. I wanted to make sure I did it right. So, when it comes to doing the experiment, I come into the lab and he [the research assistant] tells me that he's going to do my experiment and I'm going to assist him in front of another student and I thought, "Who is this person that he just talked to me like that?" This is my research project; you just can't take it over. I was so angry and that's why I've been talking to the psychologist because sometimes it's very hard for me to express myself when I'm very upset. I sort of calmed down and did not go back 'til so I could speak with him individually. So, I came back the next day and I told him, I was like, no, this was never the agreement. This is my experiment, this is my project. You're going to assist me because you're the research assistant. I'm doing the experiment. (Year 2)

As Yvonne made meaning of her experiences with her lab members and PI, she revealed that she felt specifically targeted by their actions and attributed their behavior to racial discrimination. When she experienced hostility from her lab mates, she would question herself first and consider whether or not she might have done something wrong. However, upon observing how the research assistant interacted with a new White student, she realized the interaction was completely different, and the hostility she felt was race related.

Yvonne's experiences with hostility from her lab mates changed the way she coped with racism. In her first year, her response to gender- or race-based discrimination was to ignore it and push forward in achieving her goals. At this stage, the frequency and intensity of the hostility created more anxiety and awareness of how others' perceptions of her might affect her progress. However, Yvonne was intentional in seeking support for processing her experiences. Seeing a psychologist allowed her to discuss her experiences in a neutral, confidential space while providing tools for advocating for herself and speaking confidently when her lab members were hostile. Yvonne also identified other Black women at her institution to lessen feelings of isolation and validate her experiences with discrimination.

Despite her negative experiences, and lack of support from her PI, Yvonne noted that she would still choose her lab because of the potential to publish high-impact papers. She felt her PI's strong record of high-impact publications would enable her to succeed as a scientist and open doors for training, collaboration, and publication opportunities that would otherwise be inaccessible.

Years 3 and 4: Self-Advocacy in an Isolating Lab Environment. In her later years, Yvonne dealt with the continuous isolation and negativity that she encountered in her lab environment as well as the lack of support from her mentor through self-advocacy and family support and by using reframing techniques from her psychologist and seeking out other educational and training experiences. Her other coping strategies included avoidance and staying focused. She explained,

> I sort of keep my distance. I've been doing that lately, keeping, I guess I've been doing the avoidance strategy, to stay away from them, just to stay away from the negativity. Because I feel like when I'm around them it's so negative to the point it just brings me down. And my focus right now is just get my PhD, get out and go on with my life. So I just keep my distance now from like everybody when they're like negative. Because I'm like if you can't be like positive around me or like team oriented there's no point in me really wasting my time interacting with you when I'm going to keep dealing with the negativity. The only time I make sure I interact with them is when I need to get an experiment done or something that I have to do for the lab. (Year 3)

This decision to distance herself from others in her lab highlights that she is an agent of personal change, a main tenet of Black feminist thought framework. She noted that her PI seemed more intentional about supporting the professional development of the White students in her lab and meeting their needs. Another Black female lab member confirmed this perspective and raised questions about the extent to which their PI values them, as Black women. Notably, Yvonne felt that the competitive nature of her lab made it difficult to seek support from this lab mate. She explains,

> It seems like the White students they gravitate toward each other, they're more emotionally supportive, and the minority students are all by themselves and I used to be, or me and another minority student we used to be sort of a little bit closer, but I think with all the tension going on with the competition for publication, now there's tension between me and the other minority student but she's almost out [of graduate school] so it doesn't even matter. (Year 3)

Yvonne went on to describe how she intentionally advocated for her needs with her PI. She stated,

> I told him like I need more emotional support from him, for him to say, you know, I did a good job, to give me feedback when I need it, so I don't know if I'm doing something wrong, you know, um, if I can improve on something what do I need to improve on. I mean, he looks like he's trying but it's just not, to me it's not genuine, it's like he's stretching to do it, but when he's around the Anglo Saxon or Caucasian students it's like it's genuine, it comes like from the bottom of his heart, like he enjoys supporting them, so that's been the biggest challenge for me dealing with that stuff. (Year 3)

Yvonne's negative identity-based experiences affected her confidence in achieving her career goals. As she contemplated her future beyond graduate school, she was worried that she would not be a successful scientist, because the stereotypes others hold about Black people would keep her from receiving the support she needed to be successful. She was also concerned that she would not have anyone who would reach out to her.

> I'm worried about judgment based on skin complexion and even gender and how that will hinder me from being a successful scientist so I think I have what it takes to be a successful scientist, it's just what other people are going to perceive me as when they see me or when I go to apply for a postdoc or a position as a scientist or professor. I think I worry more about that, because I think it can affect you down the line, especially when you're looking for support. If people sort of judge you in a certain light based on something that you cannot change, it can sometimes hinder your progress, so I think that worries me more in just being successful at doing research. I think I have what it takes to be a successful scientist, it's just the support I'm worried about, and the judgment I might endure. (Year 3)

In the fourth year of graduate school, she continued to note that self-advocacy, support from her family and psychologist, staying focused, and maintaining a positive, future-oriented attitude were ways that she coped with stressors. However, this time she stated that the effects of these stressors included fatigue, depression, shaking, and heart racing. She also stated that the stressors put her behind professionally, because she had to go behind the scenes and find other people to mentor her or ask them questions like requesting to read over her proposal or share postdoc opportunities. She sought this mentorship from individuals within her institution, via a biomedical research training program, and outside her institution, including a former postdoc and individuals she met at a disciplinary conference. Fortunately, she got her own research grant allowing her to go to a lab and learn the techniques she was not allowed to learn in her own lab. She recalled,

> It's [applying for a research grant] just like a lot of extra work you have to do, but I'm willing to do it because this is what I want to do, and nobody has the right to stop me from doing

what I want to do with my life. This is something I'm passionate about and I think I realized that, because through all that I've been through in the lab I still keep pushing on, and I still stay in the lab till the wee hours in the morning because I love research, I love science, and there's just no way, no matter what I go through somebody can take it away from me. (Year 4)

Yvonne also sought out Black women and minoritized seminar speakers who had successfully attained tenure-track faculty positions and were doing research. She recalled, "Just talking to them about their experiences has been helpful." These instances of seeking outside mentorship and inspiration from minoritized scholars seemed to be a way to alleviate her previously described worries about not receiving support as a Black scientist.

She also noted that knowing your potential and what you are good at is a way to manage stressors. She stated, "I know I'm good at research, I know I'm good at science, and nobody can tell me I'm not. So, no matter what people throw my way it's like you just can't stop me because I know I'm good." Along these optimistic lines, she recalled a positive reframe that she once heard that has helped her get over hurdles, "It might seem like it's a huge sacrifice now but actually the gain that you get after you get the PhD is much bigger."

This same year, Yvonne experienced a "culturally insensitive" moment with her lab members in which she was criminalized based on the color of her skin. She recalled how her PI created a set of policies about wasting resources. When she came back to her lab from a vacation, after not taking a break in years, and began performing her electrophysiology experiments, she was accused of not washing utensils correctly and wasting both oxygen in the oxygen tank and artificial cerebrospinal fluid (aCSF). These accusations were reported to her PI. When he spoke to her, he noted that the lab members "have a good point" and that she was wasting resources and "affecting their morale." That same year, she offered another example of a postdoc accusing her of using her aCSF. However, when they went back to Yvonne's bench and she showed the postdoc exactly how much she had used and that postdoc was mistaken, the postdoc held firm to "No, you did wrong" and did not apologize.

When making meaning of this event, she explained how these were examples of others being quick to falsely accuse her of something, noting, "It's like you're automatically assumed to be doing something wrong." The interviewer asked Yvonne why she thought her race or skin color was leading to this perception, and she explained,

I think with people, in general, I think it's just a notion that, you know, if you're dark skinned you're basically considered a bad person, that you're not good, you don't do any right. And that's like, that's—it's just mainstream society and it's even across the world, you know, that issue, because we have a lot of people who are constantly trying to change the pigment in their skin, and make their skin lighter, so they become more acceptable. So, I think it's just a lot of people, some people maybe, they don't want to be sort of an outsider where they go against the norm that everybody is believing, so they just go along with everybody else, so they won't be isolated. Then I think there's just some people who out of fear, or maybe their own insecurity that they hold firm to these belief systems. Even if the truth is right in their face, so I think there's a lot of

different issues, but it really starts with the individual themselves, how they were raised, their value system, and if they can discern between what's real and what's not, and not feel pressured to go along with what everybody else is, you know, saying or doing or believing. (Year 4)

We believe that Yvonne's evaluation of this event reflects an awareness of the historical and social factors that have informed her treatment in the lab. It seems as if she was not taking these affronts personally, but instead saw these as matters that must be confronted by the perpetrators of such racial hostilities.

As a resolution to this particular experience, Yvonne detailed that now, when she is in the lab, she has to document how much solution she is using and whether she has turned off the oxygen tank so that she will not be accused of wasting resources. She noted that it is "petty" for her to have to do all of this and that it can also be stressful. However, she also said, "I don't even care anymore because I'm at the end, this is my last year and I'm finishing up my paper, and getting my dissertation report together, so I'll be out, I don't have to really worry about any of that stuff anymore."

Year 5: Postgraduate Career Goals. The following year, Yvonne defended her dissertation, received her PhD, and began a postdoctoral fellowship at a public research university. She did not ask her PI for a recommendation, but instead relied on her own network to attain this fellowship. She admittedly is bothered because she does not feel like she has the same support and access to her PI's network as other students in her lab. She explains,

I'm not too happy about it. I just realize it's going to be harder for me to be really successful as a scientist, which I don't like. I really love science. I don't see myself giving up. Even if it's going to be a little difficult. (Year 5)

In 10 to 15 years, she sees herself being married with children and having her own lab that focuses on mental health and health disparities. She would also like to solve questions using not just basic science research and clinical translational research but also biotechnology.

Summary of Yvonne's Journey to the PhD. Early on, Yvonne identified that her feelings of isolation at her institution and within her program were rooted in feeling out of place due to differences in gender, racial, and class identities, as well as her instructors' and peers' low expectations of her ability as a Black scientist and their subsequent hostile, dismissive behavior in classroom and laboratory settings. To combat racism and poor mentorship, she sought emotional support and learned skills related to self-advocacy, positive reframing, and allocation of her energy and attention. These supports and skills informed the agency and confidence that she displayed in a hostile academic environment.

Case 3: Clarissa
Expectations at the Start of the PhD. Clarissa is a first-generation college student and biracial woman. Both of her parents were born in the United States, and her graduate school was located in the southwestern region of the country. Throughout

her graduate program, Clarissa navigated negative assumptions about her abilities as a scientist and lack of support with incidences related to gendered racism.

In her interview before graduate school, Clarissa expressed her concerns about fitting in in graduate school, given that she began in community college and came from "a poor family." She revealed that her concerns were based on her experiences of feeling dismissed while attaining her undergraduate degree.

In her view, there was a strong disconnect between professors and students. As she considered the implications of this on her future goals for graduate school and beyond, she noted that, while she is passionate about research, she would prefer to teach at the community college level or high school level, where she can truly prioritize teaching and connect with her students. She noted that it is important to her that she teaches minoritized students, so that "there are more of us." In her experience, the students in her community did not even have the option to consider graduate school, as the quality of education available to them did not adequately prepare them for anything beyond high school.

As she prepared for her first year in graduate school, she highlighted her plans to identify a mentor from a similar background who would be more understanding of her experience. When asked about the differences between her non-White mentors and White mentors, Clarissa explains that she did not have to explain her circumstances to her non-White mentors:

> There was a clear difference … they just understand what you're talking about. For example, I worked three jobs through college and a lot of my [White] mentors didn't understand why I was doing that myself. Like, they thought I had a choice. I didn't ever have to explain that to the other ones. They were willing to work with me. But I had mentors that flat out told me to quit my job. And I was like, where do you want me to live? There's just a disconnect. My African-American mentor was also very supportive of my music, and White mentors that I've had in the past, never understood why I would take music classes on the side and why I was in a band. They were like, you need to focus on science. And only my [non-White] mentors said, no, you need to balance out yourself. You need to do things that you enjoy. Make sure you keep your music. I mean it was just those little differences. (Year 0)

Here, Clarissa reveals how White mentors put her in a position where she had to explain herself, whereas her non-White mentors honored her agency and were supportive of her activities outside school. As she progresses in her career, she plans to continue seeking support from non-White mentors with the expectation that non-White mentors will be more receptive of her choices.

Years 1 and 2: Managing Tokenization and Unmet Expectations for Support. At the end of her first year of graduate school, Clarissa reflected on an overall successful year, with challenges related to gendered racism and racial microaggressions from her peers and professors. In several instances, she was encouraged to apply for fellowships targeted at diversity. She revealed that this made her feel like she was being used as a token for training and conference grants. When asked whether race influences how she was perceived as a scientist, she recalled an incident in which one of her peers said, "You don't

look like the typical scientist." She asked her peer, "What does that mean?" and expanded, sharing,

> I was like, "Whatever." Whatever. That pissed me off. I don't know, she, she did seem like she never—she hadn't seen someone who looks like me so therefore I don't look like a scientist? How narrow-minded is that? That's a horrible conclusion to make. (Year 1)

Clarissa reflected on how the lack of Black women in her field created narrow perceptions of what scientists look like, and how they are to carry themselves. In line with the Black feminist framework, she recognized how her social identities shaped others' perceptions about her and coped with these feelings by trying to combat negative stereotypes about her work ethic. She would work extremely long hours, often sleeping in the lab, with little work–life balance. As her frustrations with her program and challenges with work–life balance grew, she sought support from older Black students and her family members.

At the end of her second year of graduate school, Clarissa had several highlights, including improved work–life balance, more focus on activities that contribute to her wellness, an upcoming submission to a top-tier journal, and positive feedback from her PI about her work ethic and output. Though she was cognizant that her accomplishments are important, she revealed that she still struggled with imposter syndrome and did not feel that she deserved to be there. This was exacerbated by an incident in which one of her male Asian peers was asked to leave the program due to poor performance. In her mind, if someone who "belonged" there was asked to leave the program, she definitely did not belong there. This brought forth strong feelings of insecurity:

> I guess I'm still just not totally secure in my deserving to be here. That sounds so horrible but that's the truth. You know, I just told you, I've just been lucky. In no way, shape, or form do I feel like you know … I mean I did the work, right but I still feel deep down inside I feel like you know it's just luck, I guess. (Year 2).

She noted that, while her PI was extremely supportive of her professional endeavors, he had limited experience with minoritized students, as she was his first. As a result, he had a difficult time processing experiences with racism and often invalidated her own experiences with racism within her program. Even when she provided specific examples of her experiences, or when her PI witnessed them, he insisted it was not true, and that racism was not taking place.

> I'm just realizing that my PI has never worked with a minority before so he may not know, you know, people who study social situations, he may not know. He has no context. Also, he fundamentally does not believe in racism. So like I mean he just has no experience with it, so all of these things like I'm finding out. Because I'll be like oh that looks weird, or I'll tell him something that [name] has done and he'll be like no that's not racist. He asked me because he's part of the graduate student advising program, so he asked me like oh you know how are you finding it here? You know he wants to know, and I'll tell him. He won't believe me because he just has no context.

There's not a reality for him so that's what I mean when he's never a minority, he's never had to deal with one and so it's a new experience for him. (Year 2).

She also grappled with whether or not to continue being open with her PI about her experiences with racism, fearing that she would come off "paranoid and angry." Although she had been candid about her feelings and interpersonal experiences with members of the lab, her PI often responded with surprise or assertions that these experiences were not real. She revealed that this often made her feel crazy, as there was no one around to witness or validate her experiences.

Clarissa recalled one incident in which one of her lab mates was present and validated her experiences—she was mistaken for another Black woman in the program, despite having no resemblance. In this instance, one of her lab mates picked up on the microaggression and affirmed that what she thought happened did in fact occur. As she made meaning of this experience, she highlighted the importance of validation and having lab mates who can serve as an outlet for her race-related stressors.

It helps that my lab mate recognized what it was immediately. That helped me. Usually, I just end up feeling crazy, like could that be, did he ask me that because of what I am? And he did. And when my PI says no, that frustrates me because I'm not crazy. There's no other logical reason why he would have done that, so it helped that my lab mate was there and said "oh my god, did he just do that because of that?", and I was like, I think he did, you know? That helped. But yeah, it just makes me uncomfortable honestly. As I have continued to build experiences like that. I'm just like God, I'm not going to stay in academia. It's uncomfortable, right? They want to know why we don't stay. There you go. (Year 2)

Here, Clarissa reflects on the interconnected experiences of Black women in academia, where microaggressions like these are common. She adds that, while such experiences are not unique to academia, she feels that many in academia have few interactions with minorities, leading to awkward and inappropriate behavior. In these instances, she highlights that the support she gets from her peers who are comfortable talking about cultural differences related to race, region of origin, and gender help to fill the gaps of support she did not get from the PI.

In addition to gendered racism from her peers, Clarissa witnessed racist attitudes from senior scientists at her institution. She revealed that, for some people, she presents as Latina. As a result, people felt comfortable making racist statements about Black people in her presence. In one incident, a staff scientist told her he had to leave his state because of "all the Black people." She responded by informing him that she was half Black. At the time she was recounting this incident, Clarissa revealed that, though this had taken place, she was still angry that people are still so uninformed.

At the end of her second year, Clarissa appeared to have accepted the reality of her environment and her relationship with her PI. She still grappled with whether or not to be open with her PI about her experiences with gendered racism. This internal tension was fueled by concerns that being honest about her experiences would make her appear angry or paranoid, leading to her becoming further marginalized. She appeared to

have come to terms with the limitations of their mentor–mentee relationship.

The intellectual mentorship is there … Every mentor I have had previously there has been a level of emotional mentorship … Umm we don't—he and I don't talk about these things and when we do, he doesn't believe me. I just don't know if I am going to get that from him and then I don't know how I feel about that. I don't know if I want that from him. (Year 2)

This realization is a critical turning point for the way she chose to navigate her mentoring relationship. At this stage, she exercised her agency by accepting her PI's limitations, and choosing to seek validation and support elsewhere.

Years 3 and 4: Gaining Independence and Finding Validation from Black Women. At the end of her third year, Clarissa expressed more comfort with being in an environment that is culturally different from her previous experiences, where she was surrounded by more people of color. She also expressed a greater sense of independence, as her PI had taken more of a hands-off approach. She now felt like a "real scientist."

Notably, she identified a Black woman at her institution to mentor her, as was her goal before graduate school. She highlighted how valuable this support was to her, as she now had someone she felt comfortable speaking to while feeling validated in her experiences.

Umm I met, actually also this past year I had been looking, um, in past years for a female mentor and haven't been able to find one, and I was pretty sad about that. But I found one this year and umm she's Black so that's so exciting and she came from [institution's name] and she's amazing. She's just like crazy on fire so I, it's so embarrassing I met her and I started crying. Yeah, I don't think she noticed but I was like oh I'm so happy to meet you. I was like all misty and I think I hid it pretty well, and then ever since then we have been having lunches and you know she'll read stuff if I need her to or I ask for her advice, she's great. (Year 3)

The validation she received from her new mentor and other Black students is especially helpful, as she has accepted that her PI may never understand her experiences as a Black woman. Her relationship with her new mentor also enabled her to connect with a small group of other Black women across the sciences program. She notes that her new mentor encouraged the group to have lunch together and organize outings to celebrate publications and other achievements.

Clarissa also expressed more awareness of her experiences related to gender alone. When asked which of her identities affected the way she was treated that year, she revealed that it's "woman more than Black nowadays." The effect of being in a male-majority area of study and male-majority lab made those challenges now feel more salient. She noted that, while she was aware that her PI treated her more delicately, because she was a woman, she felt increasingly frustrated about the responsibilities she was assigned. For example, she noticed that she was doing most of the cleaning-related tasks in her lab. When asked about her role in the lab, she described herself as the "main girl so [she] cleans a lot." She expressed frustration with this, noting that her male lab members are not as proactive about

cleaning tasks. Though she experienced these gender-related microaggressions and overt sexism in her lab, they occurred more frequently outside the lab. In her view, the societal focus on race and ethnicity made people more conscious of their biases. However, gender-based microaggressions remain common, as people are not as aware of their gender biases.

> People aren't conscious of their gender biases at all and so I think that always comes more into play nowadays, especially in my field, structural biology is, is male, it's male run so there always is that sexual undertone you know if the guy sort of thinks you're pretty you're going to have a better chance … I hate it, but that's just how it is. (Year 3)

She went on to describe the dynamic with a collaborator who made advances toward her and gave her more attention than other women. This is especially conflicting, as she noted that "it wasn't pleasant or welcome attention," but she wanted to make progress on her goals. Ultimately, she grew frustrated with the environment and lack of support and gave up on the collaboration.

Clarissa's experiences with gender and race that year were marked by two key changes. First, she now had a consistent source of support from two groups of Black women at her institution. This support changed the way she processed race-based microaggressions, as she now had a group of people who could relate. Given this, it is possible that the validation of those experiences enabled her to process her frustrations with gender-related stressors. Next, her heightened awareness of her womanhood showed up in the way she discussed her career goals. At that stage, her concerns about academia were more related to her desire to have children and be present in their lives. She noted that her recent marriage also brought her concerns about time flexibility more into focus.

At the end of her fourth year of graduate school, Clarissa's confidence continued to grow as she felt a greater sense of independence in her lab. She also noted changes in her self-perception related to her intellectual abilities. Before, encountering something she did not know drove her into a cycle of self-doubt, and feelings of non-belonging. Now she can tackle unknowns without questioning her overall intelligence. She noted that her stress levels were significantly lower as a result of her confidence.

In her discussion of her changes in confidence and greater independence, Clarissa noted that the independence she experienced in her lab was not easily given to her due to her gender. As previously noted, her PI treated her differently from her male colleagues, and approached her projects with a level of delicacy he reserved for women. She highlighted differences in the way she had to gain independence compared with her other colleagues:

> I have to fight for my independence and my male, White male lab mate has always been given it without much of a struggle. He's just been given, there's a respect or just an understanding that he, he knows what he's doing, whereas I always have to prove it. I'm always questioned, you know if I say something there are a lot of follow-up questions to make sure I know what I'm talking about, which is totally fine if it was applied across the board, which it is not. If he says something, it's

accepted as right the first time. You know what I'm saying? (Year 4)

Here, Clarissa highlights how her identity as a Black woman results in different outcomes compared with her White male counterparts. She recognizes that, as a Black woman, she still has to fight harder for her independence.

Clarissa also reported changes in the way she reacted to microaggressions and gendered racism. Although she continues to experience them on a regular basis, her response is now to laugh them off and try not to let offensive comments get to her. She noted that, in the past, the comments used to make her upset and cause significantly more stress. At this stage, she found it more beneficial to her well-being to ignore them.

> I mean it's daily, right? I mean I don't know if you have been in academia, but it is daily, right? Oh, let me touch your hair, oh your hair is crazy, oh I'm Black because I like hip hop, it's constant, but you can either be upset or you can just be like oh these people just don't know. (Year 4)

Here, she was exercising her agency by adjusting her coping strategies to such incidents. She recognized that the microaggressions remain constant and chooses to engage in a coping strategy that feels more sustainable for her. Clarissa explained that, although gendered racism still got to her sometimes, her past experiences indicate that reacting to it or confronting her colleagues was often unproductive. In her view, they were not setting out to be offensive. Rather, she attributed their words and behavior to their limited experiences with people from other backgrounds. Clarissa also expressed that this approach helped to manage the way others perceived her. In previous interviews, Clarissa expressed a fear of being perceived as angry or paranoid. She felt like she had to go out of her way to communicate in a manner that was void of emotion in order to make her colleagues more receptive to what she had to say. She toned herself down to be more digestible to her colleagues, as she has now learned what scares or intimidates them. Instead, she became a more reserved, quieter version of herself. In an effort not to be the "loud Black person," she purposely avoided being too expressive, overly friendly, or laughing a lot. She admitted that, while this approach can be exhausting, it felt easier than dealing with the consequences of being misunderstood or making her colleagues uncomfortable. She also noted that she observed this strategy with other established Black women faculty at her institution:

> Like I see, there's, the one PI I keep talking about, she's African American and she is—I got this, the face from her, that's directly from her. Her face is either absolutely blank, or smile, that's it. And like at first it put me off, because I was like I don't know what this person actually thinks, feels, and I didn't like her you know for it. And then I realized that it was a strategy, and I started doing it too. (Year 4)

Year 5: Postgraduate Career Goals. In her final year of graduate school, Clarissa's confidence in her identity as a scientist was even stronger. When asked about her confidence in meeting her future goals and securing a postdoc, she responded with high confidence and an acknowledgment that she had the

needed skills to pivot and pursue a postdoc in climate and environmental research.

Clarissa also appeared to have more personal acceptance for her assertiveness and outspokenness. This may be attributed to her continued support from other Black women at her institution. Her group continued to meet twice a month for lunch and discuss their experiences with gendered racism in graduate school. This was valuable to her, as she no longer tried to have conversations about race with her other colleagues. With this group, she received the validation she needed to process her experiences with more clarity:

> Yeah, because, well, I mean they see it like you don't feel crazy. Right? Like "am I just being sensitive or did that just happen?" And then you'll tell them and they're like, "Oh, yeah. [laughs] Oh, yeah, this happened to me." Like it can't be a coincidence. It's happening to all of us. Right? It's just nice to get a little reality check and then like "Okay, that did happen. You're not crazy." [laughs] And you're fine. Because you can say that stuff to people all day that have never experienced it and they may be sympathetic but that's not the same. (Year 5)

Clarissa continues to exercise her agency by being selective about where and from whom she seeks support and validation. She noted that she now felt less sensitive to the gendered racism and microaggressions compared with previous years. In previous years, she held on to those moments much more. At this stage, she "doesn't care anymore," even though microaggressions occur just as frequently. Despite this shift in perspective, she still found academia to be a foreign place, where she could not fully relax. As she considered her postdoc options, she indicated a preference for an intellectually rigorous female mentor from a similar background, an experience she longed for as a graduate student. This was due to her experiences with her own PI, who despite best intentions, was unable to provide her with the support she needed. She noted that her decision to pursue a postdoc was based mostly on her desire to change fields.

The following year, Clarissa completed her PhD in biochemistry and accepted a postdoc position in her field. Although her postdoc was not in her preferred area of study, she successfully secured a fellowship to support her position and felt comfortable leading her research. In discussing her choice to do a postdoc and the type of mentor she wanted, Clarissa expressed that this lab appealed to her because the PI had very visible research and engaged in a lot of collaborative research. Notably, Clarissa did not mention wanting support from her postdoc PI. As Clarissa thought about her long-term future, she remained committed to a career that provided her with some work–life balance. As she considered having children and the stress of academia, she planned to move away from academia, as she did not believe that being a PI would enable her to have the balance she would like to have while parenting. She hoped to remain in a research-focused career in her field.

Summary of Clarissa's Journey to the PhD. Throughout her graduate career, Clarissa was cognizant of how her intersecting identities affected her experiences, especially how she was perceived as a legitimate scientist. She employed a variety of coping strategies to address lowered expectations and other mani-festations of gendered racism. She was intentional about the coping strategies she chose, as she did not want to confirm the "angry Black woman" stereotype. This influenced how she exercised her agency, including the manner in which she communicated with her colleagues and whether or not she brought concerns to her PI. This internal tension, around being both a Black woman and scientist, ultimately led to her identifying and securing a Black woman mentor at her institution. This decision gave her access to a long-standing community of Black women in science programs. She also learned strategies for navigating gendered racism in academia from a Black woman faculty member.

DISCUSSION

This research longitudinally explored how three Black women navigated gendered racial experiences as they moved toward successful completion of their biomedical PhD programs. The backgrounds of our participants were diverse, with one woman being a first-generation American and one being of mixed race. Yet they shared similarity of experiencing and dealing with gendered racism in a biomedical environment.

Reflecting the findings of earlier work, in this study, we reported on the gendered racialized experiences these three Black women rising scientists experienced. However, our findings go beyond existing research to provide deeper insights into how these successful women navigated and revised their coping strategies over the time of PhD training. Annual interviews and longitudinal research methods revealed how they started with coping strategies that focused primarily on "proving them wrong" (Shavers and Moore, 2014; McGee and Bentley, 2017) but over time shifted to alternative, less energy-demanding approaches. Although there are commonalities about how and when these shifts took place, each of the three presents a slightly different variation on this theme. The intersectionality of their identities and their personal and professional evolutions over time became evident when their experiences and responses were interpreted through the Black feminist framework. All three found resources that helped them to separate each identity into its saliency at different times while also seeing how those identities were too interwoven to separate. Despite the strain of gendered racism, they were able to persist, successfully complete their PhDs, and move on to postdoctoral training. Until efforts to reduce or even eliminate systemic racial and gendered bias are successful, Black women scholars will continue to face these stressors and threats to their well-being.

Initially, all of the women reported experiencing low expectations and doubts about their legitimacy as scientists. These interactions were informed by racial bias, gendered racial stereotypes, and a low critical mass of minoritized students in their biomedical programs. Additionally, all three referred to dealing with these doubts and expectations by "proving others wrong" by working harder, a finding that has been revealed in previous research about Black college students in STEM (McGee and Martin, 2011). Monica shifted from this strategy around the time when her PI had given her more control in the lab and her confidence as a scientist increased. She opted to not try to change others' opinions about her, but instead leaned into behaviors that were more internally focused, like laughing at one's stereotypical gendered racial expectations. Clarissa also

chose to conserve her energy upon experiencing related, negative identity-based encounters. Like Monica, she would find humor or compassion in the perpetrators' ignorance, instead of being upset over the offensive comments.

Compared with the other women, Yvonne's experiences were blatantly racially hostile. She shifted from "proving others wrong" and expecting support from her PI to strategically distancing herself from others in her lab, engaging in self-advocacy, and seeking alternative training experiences. Yvonne also recognized that, unlike her non-Black lab mates, she lacked the support of her PI and the ability to access his network, making it harder to "be a successful scientist." However, she was adamant about not giving up and actively sought outside mentorship and training opportunities. These modified coping strategies showcase that the women are agents of change in their personal lives. This type of agency serves as another aspect of the Black feminist thought framework. The women chose how to continue engaging during their encounters, giving themselves permission to change their minds and behaviors, leading to empowerment, personal wellness, and academic persistence.

All three women went to their doctoral mentors for support and for validation of their gendered racial experiences. However, their mentors did not always believe them, contributing to their feelings of isolation and stress. In the absence of this support, they turned to other Black women and Black students. These relationships contributed to their optimism and persistence. This support and validation helped them reperceive their experiences, place them into a social and historical context, and persist. This finding further highlighted the importance of cultural awareness within mentorship (Byars-Winston *et al.*, 2018; Womack *et al.*, 2020) and an understanding of social context when supporting Black women (Jones *et al.*, 2021b). Helping mentors to fully understand the lived experiences of Black women rising scientists is crucial to any change in STEM training environments.

At the beginning of the PhD program, all three women discussed their career goals in terms of their desire to help others—Monica and Yvonne expressed their desire to use their research to help people manage health issues, while Clarissa's goal was to help students at the high school level become more confident in math and science. While they all saw themselves as scientists, they were also acutely aware of the common experiences of Black women in academia and determined to overcome the low expectations of others to achieve their goals. By the end of their PhDs, their career goals were largely informed by their experiences with gendered racism and their observations of how other Black women in academia were treated.

Monica intentionally chose a career outside academia after her PhD but did not rule academia out completely. Even though she was discouraged by how the Black women at her institution were treated, she still saw academia as an opportunity to be a mentor for other Black women and provide a reference for success. Yvonne chose a career within academia and saw herself having her own lab. She expressed the importance of doing this work in a supportive environment where her scientific expertise was honored. Clarissa chose a postdoc outside academia and maintained that her long-term goal was to work outside academia.

Although their career motivations were informed by their common experiences as Black women, all three women expressed more individualized motivations for their career choices. Yvonne and Clarissa emphasized that their families would come first, and their careers needed to accommodate their requirements for work–life balance. Even though Monica desired a family, she felt that she needed to solidify her career first. She reflected on the "double whammy" of Black womanhood, and felt she needed to prioritize her career to ensure tenure. In addition to more self-focused motivations, all three women maintained their motivations to help others as they mapped out their long-term goals. As they exercised agency in their own careers, they saw themselves as agents of change for other Black women. In discussing their career choices at the end of their PhDs, all three women expressed more of an awareness of how starting a family would play a role in their careers.

Using a Black feminist framework allocated the opportunity to see the ways in which the participants recognized how their interconnected social identities shaped their interactions as Black women in biomedical graduate programs. They experienced low expectations and doubts about their legitimacy as scientists. They were also misidentified as other Black women in their programs. These interactions were informed by racial bias, gendered racial stereotypes, and a low critical mass of minoritized individuals in biomedical programs.

A particularly novel aspect of this study is the revelation that how the participants chose to cope with negative experiences was informed by the intersecting nature of their social identities changed over time. The women showed that they shifted from trying to prove others wrong by working harder, choosing to not invest energy in a response. At times, this looked like finding humor in a situation. At other times, this shift looked like acceptance of another person's awareness and knowledge.

In one participant's case, when it came to negative identity-based encounters, she shifted who she sought understanding or support from and went to individuals who would have had similar experiences due to their shared racial and gendered racial identities. This example, like many of the other reported static and dynamic coping strategies (i.e., work harder, disengage, seek social support, acceptance), revealed that the women were agents of change in their personal lives. This type of agency serves as another aspect of the Black feminist framework; the women chose how to continue engaging during the encounters and gave themselves permission to change their minds and behaviors. This agency led to empowerment, personal wellness, and academic persistence.

Also of note, all the women went to their doctoral mentors for support and for validation of their gendered racial experiences. However, their mentors did not always believe them, contributing to their feelings of isolation and stress. In the absence of emotional support and advocacy from their doctoral mentors, they turned to other Black women and Black students. These relationships contributed to their optimism and persistence. This support and validation helped them reperceive, place their experiences in a social and historical context, and subsequently persist. This finding further highlighted the importance of cultural awareness (Byars-Winston *et al.*, 2018; Womack *et al.*, 2020) and an understanding of social context when supporting Black women (Jones *et al.*, 2021b).

Limitations

It is important to note a limitation of the current study. We did not explicitly ask about experiences of gendered racism or specifically gendered racial stereotypes. If we did, we may have heard more responses about the pressures to be a strong Black woman, an experience that has been observed in several previous studies about Black women's experiences in academic and workplace communities (Lewis *et al.*, 2013; McGee and Bentley, 2017).

Implications and Future Research

The findings from this study have several implications about mentoring and mentoring programs at the graduate level. First, the experiences of the Black women in this study highlight the importance of strong mentoring skills and clear expectations among faculty mentors. Throughout their programs, respondents in this study often felt invalidated and unsupported by their mentors. Despite their efforts to communicate their experiences with their mentors, they quickly learned that their mentors were unable to provide the support they needed.

At the individual level, it is critical that mentors are equipped with the tools to create supportive, validating work environments for their students (Byars-Winston and Butz, 2021). It is also critical that mentors believe Black women when they reveal instances of gendered racism. This includes learning how to be vigilant about identifying hostile behavior directed toward Black women from students, staff, and other faculty. Wilkins-Yel and colleagues (2023) noted that to believe women of color when they disclose sexist or racist interactions and proceed to take swift and immediate action is both an example of instrumental support and an anti-oppressive advocacy strategy. Finally, the findings support the approach and effectiveness of multiple mentoring relationships, or a mentoring network, for STEM majors as it is unrealistic for any one person to have everything someone is looking for (McReynolds *et al.*, 2020).

At the institutional level, there are several implications for leadership and identity-conscious STEM programming. While the women in this study successfully persisted, the additional stress they endured due to gendered racism was largely unaddressed, even when they made efforts to disclose their experiences. Institutions have a responsibility to be accountable for what happens to students, especially when the hostilities presented by members of the institution impact student well-being, and potentially, academic persistence. Previous literature also highlights several ways in which institutions can be more supportive to women experiencing gendered racism. First, senior administrators should understand the significance of issues faced by URM women in STEM and proactively create consequences for actors who do not attend to those issues or mitigate gendered racism (Armstrong and Jovanovic, 2017; Jones *et al.*, 2021b). Second, institutions should implement professional development programs that teach the tenets of effective mentoring practices and culturally aware mentoring (Byars-Winston *et al.*, 2018). Mentoring trainings that promote cultural self-awareness as well as awareness of cultural differences and insensitivities may increase the mentor's confidence and comfort with recognizing and intervening upon hostile, gendered racial interactions (Womack *et al.*, 2020). McGee (2021) proposed that guidelines for STEM mentoring programs should consider: 1) the dynamic intersections of students' social identities and STEM identities, and 2) discourage color-evasive and assimilationist approaches

for supporting URM student retention." Finally, it is imperative that institutions be more intentional about hiring more faculty of color in STEM (McGee, 2021). As noted throughout this study, Black women found the most valuable support from those who looked like them and could validate their experiences, even if it meant identifying someone outside their programs.

Future research can explore how coping strategies impact career progression, and identification of intragroup differences. While this study offered some insight into the postdoctoral experiences, it would be beneficial to have a deeper understanding of how experiences at the postdoc level may trigger the use of coping mechanisms, and how this affects their decision making around whether or not to stay in academia. Given the recommendation to hire more Black women faculty, it is critical to understand how experiences related to holding more than one marginalized identity may result in potential faculty leaving academia (Kalet *et al.*, 2021). It would also be beneficial to gain a deeper understanding of whether (and under what circumstances) Black women in postdocs or in their careers make a deliberate effort to validate other Black women or serve as a sounding board, mentor, or source of support. Within this study, participants noted how important their support systems were in their progression and their desire to create support systems for other Black women so that they do not have to go through what participants went through.

There continue to be calls from every corner of the scientific community for the need for greater diversity in academic science. The stories of these three women shine a light on how their lived experiences during training can dissuade them from this career path, as well as drain the energy it requires to cope with these experiences. Despite all these barriers, all three finished their PhDs with a high degree of expressed optimism, positive reframing, and a future orientation. These strengths of Black women set the foundations for them to become successful scientists and role models in academia. But changes in the scientific environments, and mentoring provided to others like them, must be made if they are to achieve their potentials.

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