

Training matters! Narrative from a Black scientist

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ABSTRACT As STEM (Science, Technology, Engineering, and Math) professionals, we are tasked with increasing our understanding of the universe and generating discoveries that advance our society. An essential aspect is the training of the next generation of scientists, including concerted efforts to increase diversity within the scientific field. Despite these efforts, there remains disproportional underrepresentation of Black scientists in STEM. Further, efforts to recruit and hire Black faculty and researchers have been largely unsuccessful, in part due to a lack of minority candidates. Several factors contribute to this including access to opportunities, negative training experiences, lack of effective mentoring, and other more lucrative career options. This is a narrative of a Black male scientist to illustrate some of the issues in retaining Black students in STEM and to highlight the impact of toxic training environments that exists at many institutions. To increase Black participation in STEM careers, we must first acknowledge, then address, the problems that exist within our STEM training environments in hopes to inspire and retain Black students at every level of training.

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I write this today as the curtain of systemic racism and oppression has lifted on our nation. I write this today knowing that difficult conversations about race are happening all across America. As a result of tremendous sacrifices and lives lost, there have been demonstrations and rallies internationally demanding change, prompting governments, organizations, and companies to issue statements claiming that Black Lives Matter (Asmelash, 2020). While the rage has sparked the demand for equity in our society, what does this mean for science?

My heart is heavy with these discussions as I have reflected on my own journey in science and revisit the toxic environment that often makes up our science culture. The journey has been long and brutal. It has taken me from first realizing that I wanted to become a scientist, to having this dream deferred by racism, to adopting a persona of persistence and resilience, and finally becoming a professor and cell biologist. This trek through science is one that is not traversed by many Black people (Graf et al., 2018).

When confronted by the pervasiveness of racism in science, I remember surviving the assault by learning about the resilience story of Carl Brashear (Robbins, 2000). In 1970, Master Chief Petty Officer Brashear became the first African American master diver in the Navy, and he showed unwavering strength and persistence in

the face of racism. Brashear faced an onslaught of racism during his training that endangered his life countless times, but he persisted and eventually won the admiration of his fellow divers. Upon reflection, his story has many signs of an abusive hazing relationship. However, at the time, I thought emulating his behaviors of persistence was the answer to success in science. I thought, "All you have to do is not give up." I focused on what I thought I could control and kept the Japanese proverb, "Fall down seven, stand up eight" above my bench. I worked long hours, made many mistakes, but always got right back up to the bench to try again. I never saw myself as the brightest or smartest, but I would tell myself "I will be the one who does not give up." When I recall these stories and talk to students about my journey, I would always say I wanted to be like the cockroach. Because, as is commonly known, you can never get rid of the cockroach. What I never realized with this persistence or "grit" mentality was that it never addressed the problems of systemic racism within the culture of science (Das, 2020). This message of persistence is akin to blaming the victim and not dealing with the root problems in science, including the lack of mentoring, implicit bias, and hostile teaching and training environments (Barber et al., 2020; Team, 2020).

In her book, *We Want to Do More Than Survive*, Bettina Love talks about the idea of teaching persistence or "grit" to African American students as the educational equivalent to the Hunger Games, a fictional competition where participants battle to the death until there is only one victor (Love, 2019). Instead of addressing institutional barriers to success for African Americans in science (i.e., dismantling the Hunger Games arena), we prepare them to survive in a toxic environment. We tell African American students at a young age that the system is structured against them and that they

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have to be twice as good and work twice as hard as white students (Thomas and Wetlaufer, 1997; Cavounidis and Lang, 2015; Danielle, 2015). We heap a tremendous amount of pressure and responsibility on their shoulders without ever addressing the question, why is it like this? We are in effect training them for the Hunger Games. As they enter college as science majors, they are pitted against each other, and the few victors move into science careers.

This Hunger Games analogy (Love, 2019) is reflective of my thinking early on in my science career. As a freshman marine biology major, I imagined myself, like Brashear, a soldier during basic training. I was a member of the “people of color” (POC) squad that was given the least amount of resources and the most dangerous duties. As part of the POC squad, we moved forward through our college years. I saw many fellow soldiers drop from science, and there were only a handful of us left when I reached my junior year (Koenig, 2009).

Recently, Michael Eisen, Editor-in-Chief of *eLife*, authored an opinion article entitled “Racism in Science: We need to act now” (Eisen, 2020). In this article, he reflected on the current racial climate in science and examined his role as both a principle investigator (PI) of a research laboratory and an editor of a prestigious journal. Of note, he highlighted the dire lack of African Americans he had worked with over his career, including the number of researchers he trained in his laboratory, senior editors, and even reviewers for the articles sent for publication to *eLife*. I appreciated his honesty in shedding light on the issue that so many people whisper about in department hallways or during coffee breaks at national conferences. Based on my journey, I truly understand this lack of diversity, as so few of us are victors in the scientific Hunger Games.

As we struggle as a nation with the role of policing within our society, I find similarities between aggressive policing in the Black community and training of Black and Brown students (North, 2020). There are strong implicit biases that we hold within our training environment, and Black students usually find themselves very quickly judged (or prejudged) for a perceived lack of commitment, motivation, or focus (Park *et al.*, 2020). They are also stereotyped as lacking in quantitative abilities (especially the ability to do math) (McClain, 2014). Taken together, these biased judgements result in a lack of trust regarding their data (Steele, 1997). In other words, research supervisors may implicitly expect Black students to be untrustworthy. This is extremely problematic because educational research shows that one of the greatest determinants of students’ success is their teachers’ expectations (Boser *et al.*, 2014). Consequently, it is predictable that if research supervisors expect Black students to be untrustworthy, they will fail.

As PIs, we must trust our research students because they are extensions of ourselves in the laboratory. Due to our inability to spend significant amounts of time at the bench, we must trust our students to figure it out and get the work done. Inevitably, experimental approaches will fail; however, based on my experiences in science, Black students are often not given the benefit of the doubt. Instead, I have seen mis/distrust of their commitment, values, and abilities that creates the narrative that they are not motivated, do not care about science, and/or are unable to get the work done, resulting in a broken trainer/trainee relationship. I have witnessed too many Black students fall victim to a “one strike” policy. This was true of me in my early training in marine biology, where I was asked to leave after only 6 months of working in a laboratory. The professor suggested that I had a lack of commitment to my project and was told by other lab members that they collected “my” data, thus providing justification to ask me not to continue. However, what the professor did not know (or care to ask about) was that the other lab members deemed me as someone who did not belong. Conse-

quently, without my knowledge, they collected data on my project and sent it to the PI, thereby working to reinforce the narrative of my lack of commitment. This experience significantly hindered my access to research opportunities and blacklisted me from any other marine biology labs at my university because I was labeled as uncommitted to science. This ended my career in marine biology. I lost the Hunger Games.

As a graduate student, I found another opportunity in a cell biology laboratory, and I tried to apply lessons learned from my earlier participation in the Games. I overcommitted to lab work, blocking out any activities related to my culture or personal life. Instead, I dedicated myself completely to the lab. Working 12-h days, I found that my research was progressing, but I was burning out and losing any desire toward a research career. In particular, my burnout was connected to the perception that any interest in my culture and community would not be allowed or accepted or would signal a lack of adequate commitment to science. In effect, I was learning that being a scientist meant that I could not be Black. This, coupled with the constant microaggressions that I faced from professors in classes, among my graduate cohort, and my laboratory colleagues, broadcasted the message that I was an intruder in science. Luckily, I received good mentoring and advice on how to succeed in my graduate program, learning that it was not a sprint, but a marathon. I learned how to balance my personal and professional life, and I always kept them separate. Additionally, the mental image of the resilient cockroach helped me repeatedly during my graduate training, from failing my qualifying exams and failed experiments at the bench to rejections of papers and fellowship applications. While all scientists know that being a scientist means accepting significant amounts of failure, I could not help but feel that the failures I experienced were more frequent, more recognized by others, and even expected by some. This culture of expected failure for people of color (*i.e.*, presumed incompetence), combined with implicit biases and microaggressions, can establish significant barriers for entering and staying in STEM training environments (Smith *et al.*, 2007).

To overcome barriers to success in STEM, I worked hard to become a professor in cell biology. I believed that as a professor, I could make a difference, change the environment, and contribute to the change that is so desperately needed. However, I have discovered that the current science culture is just as toxic as when I was a student. Yes, there are programs targeting the inclusion of historically underrepresented groups. There are also a growing number of institutions that are adopting inclusive teaching strategies. Further, we are seeing hiring committees require diversity statements from their applicants as well as receiving implicit bias trainings (Wood, 2019). However, there remains nearly a complete lack of Black faculty members at universities and colleges (Jayakumar *et al.*, 2009; Garrison, 2013; Li and Koedel, 2017). This is, in part, because we have not changed the systemic racism that exists within our training environments. In fact, this racism comes from our noninclusive faculty bodies (Hardy, 2020). In essence, we have nearly a complete absence of Black faculty in STEM because so few Black trainees survive the Hunger Games. More troubling, if they survive, they may be found otherwise unacceptable.

Changing the system starts with the belief that Black students can be scientists, followed by acting to proactively encourage and support Black students in STEM. As Eisen states, “This is a solvable problem, we have chosen not to solve it” (Eisen, 2020). Recruiting Black students and scientists at every level is a good start, but without changing the scientific environment to be more welcoming and affirming, those recruited to science will continue

to be traumatized. In other words, while increasing access to science is required, it is not sufficient. The dominant majority in science also needs to identify and address their own biases to create antiracist environments. This will only happen when scientists from all groups recognize our convergent interests to advance our universal missions, which is to increase our understanding of the world around us and to solve research questions that will benefit our communities. This is best achieved by a diverse and inclusive scientific workforce for greater knowledge, discovery, and innovation.

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"To acknowledge our ancestors means we are aware that we did not make ourselves, that the line stretches all the way back, perhaps to God; or to Gods. We remember them because it is an easy thing to forget: that we are not the first to suffer, rebel, fight, love and die. The grace with which we embrace life, in spite of the pain, the sorrow, is always a measure of what has gone before."—Alice Walker. I thank K. Diggs-Andrews and L. Márquez-Magaña for assistance in editing of the manuscript. I also thank K. Watson and K. Uwaezuoke for discussions and providing a different perspective on STEM education. B. Riggs is supported through a National Science Foundation CAREER award 1553695.

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MEET THE AUTHOR



I am an associate professor and cell biologist at San Francisco State University. My research group investigates questions surrounding cell organization in mitosis and partitioning and inheritance of organelles during cell division. I am a strong advocate for curricular and training reform toward greater equity and inclusion in our science community.

Additionally, I believe that increases in diversity in STEM will lead to greater discoveries that are necessary to address the multitude of issues in our world. I have been especially proud of my role in training the next generation of scientists, which I believe must reflect the diversity in our society. I grew up in South Los Angeles and faced educational policies, including a school busing initiative and academic tracking, two programs which have contributed to professional disparities in STEM. Through persistence, determination, hard work, and serendipity, I am a scientist today and *I will continue to work to bring others with me.*

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