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Juneteenth in STEMM and the barriers to equitable science

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Abstract

We are 52 Black scientists. Here, we establish the context of Juneteenth in STEMM and discuss the barriers Black scientists face, the struggles they endure, and the lack of recognition they receive. We review racism's history in science and provide institutional-level solutions to reduce the burdens on Black scientists.

Introduction

June 19, 1865, independence day, commonly referred to as Juneteenth, celebrates freedom of the last large body of enslaved Black Americans following the American Civil War. Although the Emancipation Proclamation, which declared free those slaves residing in states in open rebellion against the United States, took effect more than 2 years prior, it was not until Union troops liberated Texas that more than 250,000 slaves gained their freedom. However, some in the United States remained enslaved through convict leasing and sharecropping. Following Juneteenth came the Reconstruction Era (1865–1877) in the United States, a tumultuous time when the North and South began reunification and ideologies of freedom and equality clashed, leading to the ratification of the 14th and 15th Amendments to the Constitution to protect the rights of Black peoples—defined here as people of ancestral African origin, including peoples of African American, African, Afro-Caribbean, and mixed ancestry—in the face of race riots, lynchings, and black codes (restrictive laws designed to limit the advancement of Black individuals to retain cheap labor), including Jim Crow laws. Black and White America developed along segregated and unequal paths. As segregation and intentional underinvestment occurred across education, many Black individuals did not learn to read or write, hampering career opportunities. Across the mid- to late 1900s, the powerful civil rights movements led to the repeal of many segregationist laws. Even so, some of their effects remained unchanged: Black individuals still faced discrimination and unequal opportunities for education, and to this day, Black communities lack resources.

It took over 150 years for Juneteenth to be recognized as a federal holiday in the summer of 2021, following multiple police killings of Black individuals that gained media prominence in the preceding year. Juneteenth recognizes and celebrates freedom, civil rights, and the potential for the advancement of Black people in the United States. Yet, it also serves as a

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day of reflection and hope that a nation might someday live up to its core founding principle—equality for all. Shortly after freeing Black Americans, the US state legislatures enacted harsh laws to curtail their progress; thus, as formal slavery declined, institutional slavery arose. These laws have had generational impacts: today, Black scientists continue to suffer institutional slavery, leading to lower pay, lesser access to resources, and fewer advancement opportunities. In addition to cultural erasure, undervalue, isolation, stereotype threat, and tokenism, Black scientists face many obstacles to attaining an education and persisting in the fields of science, technology, engineering, mathematics, and medicine (STEMM). As the official correspondence from The White House states, "Juneteenth not only commemorates the past. It calls us to action today." Juneteenth is a rallying call for all, but it is especially a call for action from scientists. Even though scientific innovation prospers from a richly diverse field, science has historically existed as a bastion for harboring racism.

In this commentary, we seek to explain some of the history of Black individuals in the United States. This includes the initial gap in and continued barriers to income attainment, which have inhibited their growth. We discuss the racist institutions that still exist in science, including lack of recognition for awards and disparities in funding rates. We also consider the toll that institutional racism takes on the mental health of Black individuals, a toll that unfortunately has led to suicides. Finally, we note the double binds for those with intersectionality—e.g., those underrepresented by a combination of gender, sexual orientation, disability status, and race. Together, these limitations inhibit the progression of individuals through the elitist STEMM pipeline.[1] Given the continued exclusion of Black scientists at different levels of STEMM training, it is important to recognize the relevance of Juneteenth as well as how it may contribute to future improvements. We offer steps that institutions, as well as wider bodies, should take to reduce the impact of racism in science (Figure 1). Importantly, we further consider Juneteenth a pillar for growth and propose steps to improve mentoring, institutional support, and training to reduce remaining institutional barriers.

Historical context of Juneteenth

While some may find it easy to view the 150 years since Juneteenth as a long time, we should remember that Jim Crow laws lasted into the 1960s, and the individuals who helped to enact these laws might still be alive today or have exerted considerable influence over institutions governing science. For example, consider that, during the 1900s, there were fewer Black students in higher education because of prohibitory laws.[2] Legacy status policies perpetuate the effects of historical discrimination by giving preference to students whose families attended institutions for generations while barring those who were historically and systematically excluded. For example, if a university had policies of racial segregation until the 1960s, a Black American student could not have had a grandparent attend the university. Thus, legacy status policies would effectively exclude Black American applicants. After emancipation, many Black individuals were at an immediate economic disadvantage due to generational wealth lost from unpaid labor during slavery. Because of this initial gap and continued barriers to income attainment, the wealth gap between White and Black Americans continues to increase. This is not simply a matter of "work ethic," as even when adjusting for a multitude of factors, including education, socioeconomic status,

gender, and geographical regions, Black individuals have lower income achievements and lifespans.

In the past, science has been misused to validate racist ideology. For example, the president of the Behavior Genetics Association justified the notion that interracial marriage could result in harmful genetics using the same ideas on which leading geneticists such as Mendel built their theories of genetics. In other cases, neglect of science has led individuals to make claims about purportedly different pain tolerances in Black individuals, notions that persist today. Black people were used as test subjects without consent and without any pain mitigation—this information remains in medical texts today. In STEMM, it is a common view, among both mentors and trainees, that science should be above culture or race.[3] Ideally, this might be the case; however, race is not a biological concept but rather strictly a social construct. Nevertheless, it is applied to biological topics to promote racist ideologies. Race-based discrimination and trauma can have measurable biological consequences, some of which are inheritable, such as epigenetics. Thus, STEMM fields must still discuss race as it concerns science because of its prevalent racism problem. Moreover, in research, self-identified race often encompasses and plays a role in many social determinants of health such as discrimination, socioeconomic position, and environmental exposures.

Juneteenth in science and meaning

Juneteenth is an important day not for claiming victory over an issue but rather for recognizing the first steps toward fixing it. Juneteenth can stand as a beacon for scientists to refuse the misuse of racist ideology based on pseudoscience, and it promotes hope and freedom. However, Juneteenth should also be a day of reflection on how science has a racism problem as well as the potential mechanisms to fix it. We represent a group of eager and dedicated scientists that looked to join the professoriate to contribute to discovery and innovation. We persevered through our training and continued to have enthusiasm for science and share this love with our trainees.

The fact that many underrepresented individuals, even when adjusting for productivity, feel decreased interest in faculty-level positions illustrates the nature of science’s racism problem.[4] Given the academic barriers Black students face, they are at risk for burnout and depression, even more so than majority students, a phenomenon linked to a lack of advisors and mentors who look like their mentees or who at least display cultural humility and expertise in mentoring students outside of their own race.[5] In tandem, historic and contemporary experiences of racism and oppression that are unique to Black individuals can cause issues such as psychological stress from the consistent undermining of their worth and value, which can lead to John Henryism, or chronic stress-linked hypertension in Black individuals.[5] Juneteenth can thus serve as day for one to refocus and ask the wider community what can be done about these issues in a truthful and nonperformative fashion, not only on Juneteenth but over the 364 days that follow.

National trends show increased diversification of the United States population; however, these same trends are not reflected in science by and large, despite shortages in the field.[6] Despite making up nearly one-third of the population, underrepresented individual groups constitute less than 15% of doctorate degrees earned. This disparity is not due to ability

but rather persistent barriers including micro- and macro-inequities. While these barriers are not unique to STEMM, past studies have shown that discrimination in science is even higher than in other fields.[7] In the 21st century, US science is no longer openly promoting racist agendas, yet new challenges exist. For example, many artificial intelligence models rely on biased data, resulting in more difficulty recognizing Black individuals and causing issues such as a higher chance of being subject to increased security searches. Artificial intelligence models, such as ChatGPT, are built on databases that are fundamentally racist. In short, despite its advances, the scientific enterprise remains structurally racist.

Research institutions do not function on a pure meritocracy. They must adjust their mechanisms to create equality of opportunity and equity of outcome/reward. As US state legislators ban Black-written books in their states, Black scientists might easily begin to wonder if their scientific discoveries might be next. This highlights the importance of Juneteenth in reaffirming the freedom of science and discovery for all individuals in STEMM. Racism can quickly cause science to devolve into pseudoscience. Racist and other exclusionary agendas can easily cloak themselves as "science," masking themselves through convoluted study designs, abstract statistics, and technical words that can mislead the general public. As science becomes increasingly accessible to the general public, racist agendas can now more easily use science to disinform. All scientists must pursue and accomplish anti-racism efforts to achieve change at the system level. Juneteenth can remind us of what we still need to change, but doing so requires action from funding bodies, institutions, and the wider community.

Changing institutions to fulfill Juneteenth's promise

Create and foster a culture of inclusivity and support—Institutions should work toward creating a culture of inclusivity and support where all scientists feel valued, protected, and respected. This involves implementing diversity and inclusion initiatives, providing tailored mentorship and networking opportunities, and fostering a sense of community and belonging. Organizations within an institution (e.g., Duke's Black Think Tank, Penn's Fontaine Society, and Penn's Trainee Advocacy Alliance) can also provide this support. Institutions should also provide sponsorship opportunities, promote diversity in leadership positions, and address any discriminatory practices or biases that exist in the academic setting. Addressing systemic inequalities, such as racial and gender discrimination, as well as creating safe spaces for people from underrepresented groups to discuss their experiences and receive support, can help reduce stress and anxiety that contribute to mental health issues. Many of these steps should be incorporated into hiring and promotion practices. Finally, it is important to develop and nurture a culture of support and collaboration that encourages scientists and physicians to seek help and care for each other.

Mechanisms to protect trainees in the pipeline by combating suicidal threats and overcoming mental health struggles and challenges—Black scientists experience significantly greater levels of stress due to an increased workload, diversity tax, a lack of feeling like they belong, and both implicit and explicit biases, which may manifest as micro- and macroaggressions. Recent student deaths in the chemistry field, including two

tragic losses of Black students, underscore the urgent need for improved mentorship that considers not only students' scientific pursuits but also their daily challenges and real-life issues. Thus, mentors who fail to acknowledge and help with the struggles students face outside the lab may contribute to their mental health issues and impede their success. It is essential that mentors encourage and sponsor their students to achieve their full potential. By providing holistic mentorship, mentors can help foster a supportive environment where students can thrive academically and personally. Additionally, establishing a mentoring committee can provide trainees with an enhanced self-identity. Protecting historically excluded scientists from suicide requires a multi-faceted approach that involves addressing the underlying factors that contribute to mental health struggles and providing support and resources to help individuals cope with these challenges. Institutions must provide resources to overcome these issues because they are causing loss of life. Revitalizing the wellness of Black scientists will allow them to thrive, prosper, and become future leaders. In total, the entire scientific community has to work together for students to reach their next career stage.

One of the most critical steps to improve the wellness of Black scientists is to provide greater access to mental health resources, including counseling, therapy, support groups, employee assistance programs, and crisis support, to help them cope with the stress, anxiety, depression, and pressures of their work. Providing culturally competent and trauma-informed mental health services that consider historically excluded scientists' specific needs and experiences can help ensure appropriate support. Encouraging open discussions about mental health and promoting awareness of mental health issues, including depression, anxiety, and suicidal ideation, can help reduce the stigma associated with seeking help. These resources must be easily accessible, cheap, and stigma-free, and institutions should offer them on campus or through partnerships with local mental health providers. Alongside this, mentorship, career development workshops, and networking events can help historically excluded scientists navigate their academic and professional careers more effectively and reduce the stress associated with career advancement. Training on cultural competency, mentorship skills, and ways to address discrimination and bias must be enacted at all levels of higher education.

Consider work-life integration—The demands of academia, including long work hours, high levels of stress, and pressure to publish, can contribute to mental health challenges among scientists, particularly historically excluded scientists. Promoting work-life balance, including flexible work arrangements, vacation time, and supportive policies for parental leave, can help reduce stress and improve overall well-being. This is especially important to many Black scientists who are subject to "diversity taxes" in which they are asked to take on unpaid activities, such as mentoring other underrepresented trainees, or forced to take on more responsibilities because of microaggressions.[8] Work-life balance is not just about time off but also about pay that is cost-of-living adjusted. Institutions can also address work-life balance by providing flexible work arrangements, such as telecommuting, job sharing, or flexible hours, to help scientists manage their workloads and reduce stress.

The need to reduce "White superiority"—Institutions must make substantial structural changes to achieve equity in the scientific community. One critical requirement

is that they address personal microaggressions and environmental microaggressions that perpetuate inequality.[8] Microaggressions are subtle actions that reinforce to Black individuals that they do not belong at the institution and can exacerbate feelings of imposter syndrome.[8] Institutions must consider how they reinforce White superiority or normalization by removing pictures, naming techniques, and other symbols. It is important for individuals to see people who look like them and feel as though they can thrive. We challenge our majority colleagues to envision a world where all the symbols of intellectual prominence and success do not look like them. How would that make you feel? What might this do to your career aspirations and belief in yourself? We are not asserting that we should erase the past or diminish legitimate scientific achievements that should be celebrated. But we must come to terms with the reality that only certain groups of people were historically allowed to do science and given the resources that facilitated their achievements. It is comparable to only celebrating the winning sports team while all their competitors played the games blindfolded with their hands tied behind their backs.

Moreover, promoting diversity in hiring practices is crucial, as increased representation of marginalized groups will foster a more inclusive environment. Opportunities for bias in the hiring process can be mitigated by applying Holistic Review to develop interview questions and job descriptions, reducing the utilization of proxies of success in evaluation, and requiring DEI training for committees prior to conducting interviews.

Diversity, equity, and inclusion (DEI) offices must be established and empowered within institutions. These offices should have authority to implement changes effectively. Institutions must provide leadership in these offices with a substantial budget line item in the overall budget and not rely solely on them to obtain their own funding, nor on one lone DEI officer to carry out the institution’s mission. Instead, they must seek buy in and engagement from senior leaders across schools and departments toward the shared goals. This will give the office autonomy that truly enables them to carry out the objectives set forth by their institutions. This structural support is essential for institutional change.

DEI reimagined

To reach true equity in science, scientific institutions and society at large have many remaining steps to take along parallel roads. When hiring Black faculty, institutional structures must provide support, such as assistance in managing positions, finding senior mentors, and engaging individuals in various capacities. Importantly, Black individuals need mentors who look like them and can offer support at every career level. This requires promoting Black faculty and offering them the resources they need to succeed, including mentor networking and a clear pathway to leadership. While DEI is important, it places diversity at the forefront rather than equity. Diversity is only transformative when the underlying institutions are inclusive and equitable. Notably, this requires equity that embraces and inclusion that does not require assimilation but rather a coexistent harmony.[9] Institutions must stop requiring individuals to abandon their culture and rather recognize the advantages of a multicultural environment for both career and personal development. Thus, diversity alone is not enough; truly creating innovation in the field requires including diverse individuals, previously untapped talents and ignored creativity in the conversation

and creating supportive spaces for them to voice how they think greater inclusion can be fostered.

Student interventions are necessary—Juneteenth should also be a time to break down barriers that prevent Black students from participating in research. At the earliest levels, this can include increasing science education during grade school and research exposure during high school to better prepare individuals for college and instill a life-long relationship with science. One way to do this is through course-based research experiences, which formalize early-career research as part of the curriculum and aid in students' sense of scientific identity. Thus, as compared with traditional classroom models, these models introduce Black individuals to what it is like to be a scientist and give them a sense of ownership over their projects. Beyond this, institution's admission councils have the responsibility to move away from GPA (grade-point average) and GRE (Graduate Record Examination) cut-offs and rather employ holistic views that consider the extenuating factors of each candidate. In such a framework, a diverse team of mentors can support Black individuals in different areas of their personal and professional development, encouraging them to utilize their individual strengths in a multi-disciplinary approach with multiple mentors. Universities can provide resources to help build cohort support networks. Critically, this could move many institutions away from exclusively dyadic mentoring and toward more dynamic forms, including mentoring networks, group mentoring, and nested mentoring, all of which can better support students.[10]

While universities often focus on early-career students for retention, they must make equal efforts for faculty. One analysis found that even if the number of historically excluded scientists who attain a PhD exponentially increased, the disparities in faculty positions would not change because of certain hiring biases and early-career retention deficiencies,[11] thus showing the importance of focusing on postdoctoral and faculty-level interventions. Major factors that contribute to the hemorrhaging of postdocs are financial concerns, including lack of support in grant writing, and career mentorship. One mechanism that has been explored with promising results, especially at institutions primarily serving historically excluded individuals, such as Historically Black Colleges and Universities, is visiting professorship programs that offer research collaborations and continued training.[12] Similarly, mentored training for early-career faculty can be essential. For example, the Howard Hughes Medical Institute has employed Mentorship Skills Development courses, which have resulted in stronger mentors who are more culturally sensitive.[13] Support also comes from broadening training and increasing the number of workshop facilitators who are both intra- and inter-institutional. Together, these training modalities can ensure that early-career faculty feel equipped to secure grants and stay in academia.

All of these solutions should principally focus on readdressing and realigning goals, as well as offering psychosocial support, with data-led metrics to adjust mentoring in accordance with the needs of all involved parties. Importantly, mentoring should not simply be a trial of many things to see what sticks but rather a calculated, analytic mechanism that routinely involves training on how to mentor. However, the solutions raised here are conditional on first fixing broader issues of scientific racism. Although grant training is important for historically excluded faculty members, it is for naught if they are still passed up

because of unequal funding and selection rates. Increasingly, inclusion is essential to create collaborative environments, and open communication and leadership training are needed for positive change. Yet, they remain just a Band-Aid for the wider wound of systematic inequities that still exist beyond STEMM. Federal recognition of Juneteenth has shown that policy is necessary to advance equity in science. Therefore, for many of the issues laid out here, institutional changes can show—and have shown—a demonstrable effect. But policy-level changes are paramount.

Funding is an issue, but so is the lack of prestigious awards—Gaps in funding attainment remain: Black scientists have a lower success rate of NIH grants.[14] Although NIH and other funding agencies have set up mechanisms to increase access to funding, because racism is intrinsically woven into systems, these mechanisms still don't guarantee equitable funding.[14] There are also challenges in funding rates because of novel research often proposed by Black scientists. For example, research focused on health disparities is subject to lower funding rates. This underscores inherent biases that may still exist in the peer review process. While peer review is undoubtedly important, current grant systems need restructuring to begin closing the funding gap that still exists between Black principal investigators and their majority counterparts. Beyond increasing the diversity of these peer review boards and discernment toward novel research often proposed by Black scientists, new mechanisms of funding may also support this change. While philanthropic organizations are increasing their investments and resources in support of DEI initiatives and Black scientists, funding considerations should focus on more than simply building capacity. They should also adopt collaborative funding models within peer funder networks. This collaborative strategy may result in less restrictive funding strategies and the opportunity for multiple funding sources that contribute to an array of budget support structures.

In addition to funding disparities, prestigious award selection is wholly inequitable. Despite the numerous contributions of Black scientists to various scientific disciplines, there are no Black Nobel laureates in scientific fields. This glaring omission underscores the need for recognizing and celebrating the achievements of Black scientists, who have often overcome unique and significant challenges to contribute to scientific knowledge and innovation. The absence of Black Nobel laureates in scientific fields reflects systemic biases but also perpetuates the false notion that Black scientists are not making groundbreaking discoveries or impacting their respective fields. Even beyond the Nobel, as we look to other prestigious awards, fellowships, and academy membership for junior, mid-career, and senior faculty, we observe a stunning omission of Black scientists. One issue in addition to racist exclusion and lack of acknowledgment of our scientific achievements is the lack of Black scientists on many award selection committees. When groups of people do not have seats at decision-making tables, there are often no dissenting voices to push back against omissions and exclusions. Voices that represent all interested parties need to be in the room. Thus, in addition to the inclusion of more Black scientists on award selection committees, we offer a goodwill challenge to all of our colleagues: search harder and look beyond the people in your immediate networks to consider the pioneering research of so many Black scientists. These steps are required to ensure that Black scientists receive the recognition they deserve for their accomplishments. Collectively, scientific bodies, universities, and

biomedical journals must highlight that Black individuals are also conducting remarkable research.

How are we going to support our Black women?

Historically, Black women have been subject to entirely deeper forms of discrimination because of their race and gender. Today, supporting Black women in science is paramount, as they often lack sufficient protection, face overwork, and encounter numerous challenges in their careers.[15] Despite being more educated than Black men, Black women experience a “double bind” because of their race and gender,[15] as they navigate both of these identities in a predominantly White, male-dominated field, marked by factors such as lower selection for conferences despite higher application rates compared to their well-represented counterparts.[15]

To address these challenges, institutions must implement policies and practices to safeguard the well-being of Black women in science. This includes providing mentorship, fostering an inclusive work environment, and ensuring fair workload distribution to prevent overworking. With equity at the forefront, institutions must focus on closing the pay gap. Notably, this requires funding—a hard pill for many institutions to swallow. However, just as many argue that the cumulative capital and human toll that Black individuals have suffered continuously across the history of the United States requires repayments, closing the pay gap is necessary to begin dismantling the inequities that persist in science. To facilitate this, new leadership strategies that go beyond traditional managerial roles and center on evidence-based innovation to create diverse, thriving environments are required.

In addition to structural support, it is crucial to recognize and include Black women scientists in educational materials such as textbooks. Unfortunately, despite already limited acknowledgment in STEMM fields, Black women face the potential to have their work further obscured. For example, recent laws targeting some books highlighting the accomplishments of Black women in science face censorship and banning, further reinforcing the need for recognition and representation. Challenging these attempts at censorship and advocating for the inclusion of Black women’s scientific achievements in educational materials are vital steps toward achieving true equity and equality in the scientific community. While support for Black women is important, intersectionality exists beyond gender for Black individuals, and greater support for sexual and gender minorities, individuals with disabilities, and other underrepresented populations are similarly key.

Conclusion

Juneteenth did not mark the declaration of freedom for enslaved Black individuals; rather, more than 2 years after the Emancipation Proclamation, Juneteenth is recognized as the date the last enslaved individuals in Galveston, Texas, learned of their freedom. These people, however, were not the last who were freed country-wide. For example, many Black Americans (including one of our authors) observe August 8th as Emancipation Day instead of Juneteenth. While the origins of the 8th of August are not fully understood, it is believed to stem from the day that then-state military governor Andrew Jackson freed enslaved people on his property in Tennessee. Sam Johnson, who was emancipated during this time,

organized the first celebrations in the states of Kentucky and Tennessee. Regardless of which day is celebrated, the spirit of Juneteenth is legacy. The date stands not for the ideals of where diversity in science should be but rather where they are. Work is required to get science to where it should be—a truly equitable space. It is not a matter of knowing what to do, as this has been clearly elucidated by countless individuals. Rather, it is one of deciding whether we will take the steps needed to achieve the ideals Juneteenth sets out. Juneteenth recognizes independence, but for it to reach its full potential, including in STEMM, we must enshrine true equity and equal opportunity.

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REFERENCES

1. Allen-Ramdial S-AA, and Campbell AG(2014). Reimagining the Pipeline: Advancing STEM Diversity, Persistence, and Success. Bioscience 64, 612–618. 10.1093/biosci/biu076. [PubMed: 25561747]

2. Margo RA (1990). Race and Schooling in the South, 1880–1950: An Economic History (University of Chicago Press).

3. Byars-Winston A, Leverett P, Benbow RJ, Pfund C, Thayer-Hart N, and Branchaw J (2020). Race and Ethnicity in Biology Research Mentoring Relationships. J. Divers. High. Educ. 13, 240–253. 10.1037/dhe0000106. [PubMed: 32922623]

4. Gibbs KD, McGready J, Bennett JC, and Griffin K (2014). Biomedical Science Ph.D. Career Interest Patterns by Race/Ethnicity and Gender. PLoS One 9, e114736. 10.1371/journal.pone.0114736. [PubMed: 25493425]

5. Hish AJ, Nagy GA, Fang CM, Kelley L, Nicchitta CV, Dzirasa K, and Rosenthal MZ (2019). Applying the Stress Process Model to Stress-Burnout and Stress-Depression Relationships in Biomedical Doctoral Students: A Cross-Sectional Pilot Study. CBE-Life Sci. Educ 18, ar51. 10.1187/cbe.19-03-0060. [PubMed: 31622166]

6. Whittaker JA, Montgomery BL, and Martinez Acosta VG (2015). Retention of Underrepresented Minority Faculty: Strategic Initiatives for Institutional Value Proposition Based on Perspectives from a Range of Academic Institutions. J. Undergrad. Neurosci. Educ. 13, A136–A145. [PubMed: 26240521]

7. Kovtun O, Leneva N, Bykov YS, Ariotti N, Teasdale RD, Schaffer M, Engel BD, Owen DJ, Briggs JAG, and Collins BM (2018). Race- and gender-based bias persists in US science. Nature 561, 561–564. 10.1038/d41586-018-02175-y. [PubMed: 30224749]

8. Marshall A, Pack AD, Owusu SA, Hultman R, Drake D, Rutaganira FUN, Namwanje M, Evans CS, Garza-Lopez E, Lewis SC, et al. (2021). Responding and navigating racialized microaggressions in STEM. Pathog. Dis 79, ftab027. [PubMed: 34048540]

9. Mays AM, Muglia LJ, and Langford GM (2022). Working toward social justice: Finding the correct words. Faseb. J. 36, e22195. 10.1096/fj.202200060R. [PubMed: 35157338]

10. Montgomery BL, and Page SC (2018). Mentoring beyond hierarchies: Multi-mentor systems and models (National Academies of Sciences).

11. Gibbs KD Jr., Basson J, Xierali IM, and Broniatowski DA (2016). Decoupling of the minority PhD talent pool and assistant professor hiring in medical school basic science departments in the US. Elife 5, e21393. 10.7554/eLife.21393. [PubMed: 27852433]

12. Campbell AG, Leibowitz MJ, Murray SA, Burgess D, Denetclaw WF, Carrero-Martinez FA, and Asai DJ (2013). Partnered research experiences for junior faculty at minority-serving institutions enhance professional success. CBE-Life Sci. Educ. 12, 394–402. 10.1187/cbe.13-02-0025. [PubMed: 24006388]

13. Pfund C, Sancheznieto F, Byars-Winston A, Zárate S, Black S, Birren B, Rogers J, and Asai DJ (2022). Evaluation of a Culturally Responsive Mentorship Education Program for the Advisers of Howard Hughes Medical Institute Gilliam Program Graduate Students. CBE-Life Sci. Educ 21, ar50. 10.1187/cbe.21-11-0321. [PubMed: 35862583]

14. Dzirasa K (2020). Revising the a priori hypothesis: Systemic racism has penetrated scientific funding. Cell 183, 576–579. [PubMed: 33125883]

15. Ford HL, Brick C, Azmitia M, Blaufuss K, and Dekens P (2019). Women from some under-represented minorities are given too few talks at world's largest Earth-science conference. Nature 576, 32–35. 10.1038/d41586-019-03688-w. [PubMed: 31797914]

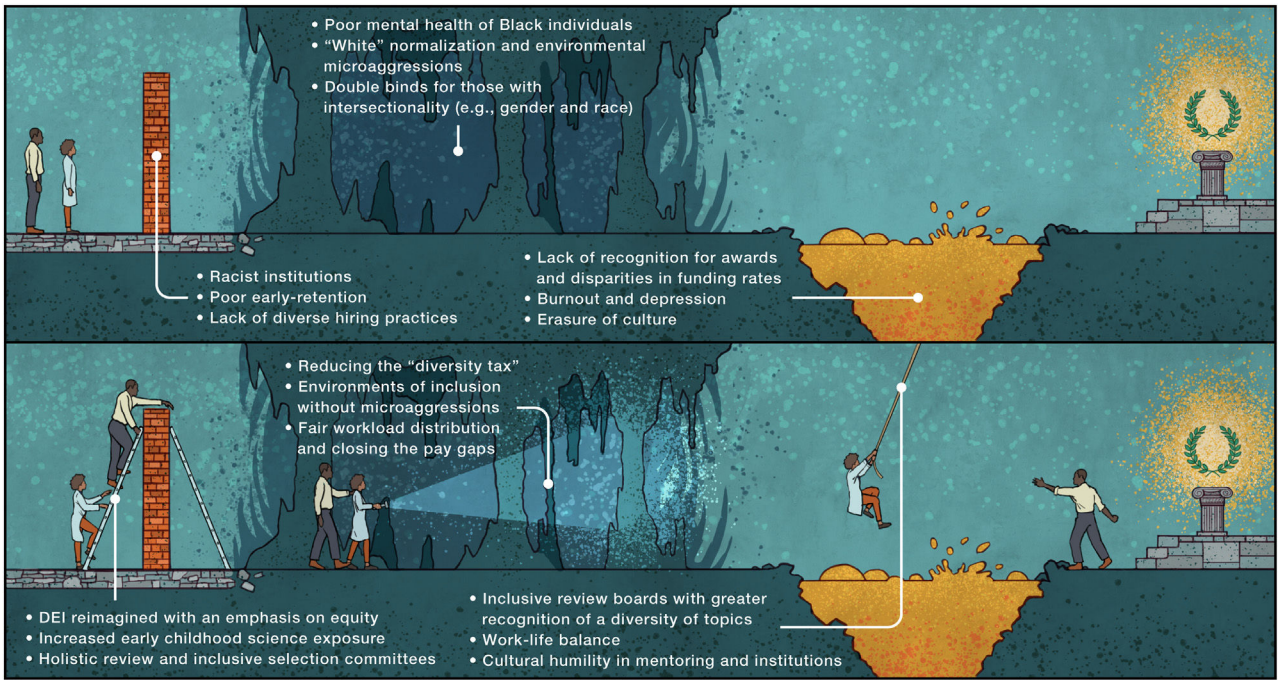

Figure 1. Overcoming scientific racism as a community

(Top) This figure depicts the barriers Black scientists face in academia. (Bottom) The bottom part of the figure depicts Black scientists overcoming those challenges.