



Backstory

Climbing the mountain of adversity and removing barriers along the path

Antentor Hinton, Jr.,^{1,*} Haysetta D. Shuler,^{2,3} Sandra A. Murray,⁴ Jamaine Davis,⁵ and Steven Damo⁶

Introduction

Despite diversity, equity, and inclusion (DEI) efforts being targeted across the country, the importance of DEI is only now being discussed in academia. This includes efforts to address the low recruitment and retention rates of Black, and other historically underrepresented,

Above image: From left to right and top to bottom: Antentor Hinton, Jr., Haysetta D. Shuler, Sandra A. Murray, Jamaine Davis, Steven Damo are faculty members at various institutions, which include R1 research institutions and HBCUs. They are research collaborators as well as on diversity, equity, and inclusion (DEI) initiatives.



underserved scientists in science, technology, engineering, mathematics, and medicine (STEMM).¹ This leaky education pipeline can create an inequitable space, as well as negatively affect scientific innovation, which has been shown to be dependent on the diversity of highly educated professionals in STEMM.^{1,2} As a result, institutions have placed greater emphasis on expanding DEI initiatives, proposing new ideas, and using data-supported DEI and mentoring techniques to improve inclusion.³ These changes require institutional commitment and multiple stakeholders, including historically Black colleges and universities (HBCUs).⁴ Increasingly, STEMM professionals are publishing articles to highlight systemic inequities within STEMM, while offering insight into potential institutional DEI efforts.⁵ Supported through personal experience, these articles can highlight often neglected issues, such as microaggressions, and create larger discussions within the field.

However, how researchers in the STEMM field can actively contribute to diversity and inclusion has remained a topic of discussion. In this backstory, five faculty members from American institutions were interviewed, who coordinated a recent series of workshops entitled *Project Strengthen*⁶ that may improve the retention of underrepresented minorities. Workshops, such as *Project Strengthen* can be an alternative to maximizing access to research careers (MARC) programs for resource-limited institutions. These five scientists have a long history of DEI contributions, including the June 2023 cover article for *Cell*, which focused on Juneteenth and STEMM.⁷ Specifically, in this backstory, the faculty members were asked to delve into their journey, describe what DEI means, and offer advice on how to promote DEI and mentoring across STEMM institutions.

What does DEI entail?

Hinton: DEI entails an understanding of ideas and exchanges of traditions across cultural norms. DEI and STEMM intersect to develop a thriving, supportive environment that pushes discoveries toward becoming more culturally competent and innovative. In this way, DEI encompasses many fields including mentoring, leadership, and science.

Shuler: There is no one clear way through which DEI may be implemented or entailed, as international diversity can take many shapes and forms, with definitions that depend on the demographic breakdown and definitions of diversity. Thus, DEI is a collection of interrelated concepts that organizations and communities use to foster fairness, acceptance, and equal opportunities for all, regardless of background, identity, or perspective.

Murray: DEI entails rectifying historical and current practices of discrimination and neglect. DEI efforts include bringing previously excluded individuals to the discussion and decision tables while providing them with the tools, opportunities, and respect needed to contribute and thrive.

Damo: DEI centers on providing opportunities for all, especially those who come from populations that have been historically excluded.

Davis: DEI entails a reflection of society. As such, DEI ensures that all members of society have an equal voice. The contributions and voices can naturally vary, but DEI works to recognize and fill in gaps in previous approaches that may not have benefited everyone in society.

What is your inspiration behind DEI?

Hinton: DEI is not a performative action, but rather an essential part of me. I want to create a more accommodating place for others as I do not want to be the only person like me in the highest levels of academic institutions. Although no Black science members have won a Nobel Prize in Physiology and Medicine and few have been initiated into the National Academy of Science, I believe a rising flood lifts all. Globally, many of these same issues manifest, as certain countries may often be excluded from winning the Nobel Prize in Physiology and Medicine. I want to help advance the careers of all scientists, regardless of their race or background, while providing inspiring role models for the next generation of STEMM professionals. For me, DEI helps address the historical inequities within our academic institutions.

Institutions have placed greater emphasis on expanding DEI initiatives, proposing new ideas, and using data-supported DEI and mentoring techniques to improve inclusion.

DEI is a collection of interrelated concepts that organizations and communities use to foster fairness, acceptance, and equal opportunities for all, regardless of background, identity, or perspective.

¹Department of Molecular Physiology and Biophysics, Vanderbilt University, Nashville, TN 37232, USA

²Department of Biological Sciences, Winston-Salem State University, Winston-Salem, NC 27110, USA

³Shuler Consulting, Winston-Salem, NC 27110, USA

⁴Department of Cell Biology, University of Pittsburgh; Pittsburgh, PA 15261, USA

⁵Department of Biochemistry, Cancer Biology, Neuroscience, Pharmacology, Meharry Medical College, Nashville, TN 37208, USA

⁶Department of Life and Physical Sciences, Fisk University, Nashville, TN 37208, USA

*Correspondence: antentor.o.hinton.jr@vanderbilt.edu

<https://doi.org/10.1016/j.isci.2023.108510>

Shuler: DEI initiatives are inspired by historical understanding, social movements, and empirical research. The benefits of diversity, as well as the challenges posed by systemic inequities, have been the subject of many studies in different fields. DEI practices are still influenced by the results of this research. In more equitable and inclusive spaces, every individual should have equal opportunities for success.

Murray: I have a passion for inspiring individuals to participate in scientific research who may have been excluded in the past. There is so much to be gained, in terms of innovation and discovery, by diversifying the entire scientific workforce. We as a nation cannot afford to exclude individuals who could bring unique perspectives to the myriad of problems that remain to be solved. These beliefs inspire me to reach out to others and mentor them throughout their academic journey.

Damo: As a student, I did my best to work hard, learn, and excel in the lab, but I realized that this was not enough. We all need support from mentors, advocates, and champions. It's more difficult for people from historically excluded backgrounds to gain access to quality mentorship. I made it my career mission to do what I can to make STEM more equitable for everyone.

Davis: My passion for DEI was first ignited during elementary school. I was puzzled about why African American history was not seamlessly woven into American history courses? I was confused by the omission of the instrumental role enslaved Africans and African Americans played in shaping the United States into the nation it is today. Most schools never taught how Africans developed functional societies and contributed to medicine, science, and other disciplines, as the focus was always on the European perspective. The trove of African, Asian, Middle Eastern, and Indigenous stories and vibrant legacies deserves to be taught in our educational system so every segment of our society is enriched in our shared journey.

Why are DEI efforts still needed?

Hinton: As previously discussed,⁸ a true meritocracy is a lie. Minority students face unique challenges including microaggressions, burnout, John Henryism,⁹ and a lack of quality mentors. For example, individuals with disabilities are one of the largest minority groups that is often neglected. It is only through addressing these issues that we can begin to undo the systemic barriers, which require institutional changes. However, any mentor who understands these challenges can better tailor their mentorship experience to support minority trainees.^{8,10} While the need for diversity in STEM is clear, both from a financial and equity perspective, the only way we can actually do that is through DEI measures.

Shuler: By developing organizational and social systems through DEI, we are enhancing morality, economics, society, and development. We believe that DEI promotes fairness and justice. Moreover, inclusion often leads to innovation and creativity by including new perspectives and skill sets into the decision-making process.

Murray: We have yet to achieve the desired level of DEI in STEM; therefore, additional DEI efforts and programs are critically needed. Past discriminatory practices in this country have resulted in problems that include social exclusion, disparities (e.g., health, living, salary, education, and resources), and unfair treatment. The effects of these practices still linger well after; however, many of these inequitable practices have not gone away. Therefore, DEI programs are needed to continue efforts to correct current problems, while remedying the consequences of past practices. DEI programs aim to establish fair hiring and admission processes, ensuring fair treatment for all employees and trainees. Importantly, they provide for training programs that stimulate open discussion, communication, dialogue, and listening. Communication between senior leadership, faculty, staff, and trainees is needed to correct historical inequities and develop a sense of inclusion throughout the institution, thus leading to stronger communities whose combined efforts will drive scientific discovery and innovation forward.

Damo: Despite advances made in recent years, there is still a clear lack of representation among the professoriate. For example, the US population comprises ~13% African Americans, yet <2% hold faculty positions and <5% earn doctorates (see https://nces.ed.gov/programs/digest/d20/tables/dt20_317.10.asp?current=yes).

Davis: DEI efforts are still needed because the STEM workforce does not reflect the demographics in the US. There are two examples that I will mention to illustrate the importance of DEI, wealth and health gaps. The typical white American family has approximately 10 times as much wealth as the typical Black/African American and Hispanic/Latino family, which has barely changed over the last two decades (see <https://home.treasury.gov/news/featured-stories/racial-differences-economic-security-racial-wealth-gap>). Realizing there are a variety of factors that may contribute to this wealth gap, it's striking to see that in many institutions, we see diversity in the frontline workers; however, the Boards of Trustees/Advisors and senior leadership are not diverse. Greater diversity across senior leadership and the Boards of Trustees/Advisors will likely help to narrow this gap. The health gap is just as striking. Social determinants of health (SDOH) are non-medical/biological factors, which include where we are born, grow, work, live, and play. Using county-level data, the study done by Snyder et al., 2023, revealed that a 10% increase in the representation of Black primary care physicians was associated with higher life expectancy of Black individuals living in that county.¹¹ Beyond the US, global issues also remain similar, where many countries do not have the resources or "prestige" to thrive,

Past discriminatory practices in this country have resulted in problems that include social exclusion, disparities (e.g., health, living, salary, educational, resources), and unfair treatment. The effects of these practices still linger well after; however, many of these inequitable practices have not gone away.

despite the high quality of scientists in these countries. Therefore, DEI efforts are not only important for new discoveries in science, but it is also critical for the quality of health and life.

For individuals with more traditional science backgrounds, how can DEI be implemented in your area of specialty?

Hinton: DEI can serve as a way to meet like-minded individuals across different STEM fields. For example, showcasing the vast talent across the entire scientific community, such as the 1000 Black scientists list (see <https://crosstalk.cell.com/blog/1000-inspiring-black-scientists-in-america>). I founded and worked with the Community of Scholars. Through this community, I've been able to work with many members on scientific projects, despite our original project focusing on DEI.

Shuler: The application of DEI principles to traditional science can enhance its accuracy, completeness, and groundbreaking nature. Ultimately, science aims to illuminate the intricacies of the world, and using DEI often ensures that this knowledge is complete.

Murray: DEI practices can and should be implemented in all areas. For those of us with more traditional scientific backgrounds, it is important to embrace the perspectives that a diverse research team brings to a research program. Diversity in the research lab will increase the ways that scientific problems can be approached, analyzed, and solutions can be obtained. A diverse team encourages staff to bring their authentic selves to a research environment without fear of exclusion. To establish and retain a diverse team, it's important to recruit and hire individuals from diverse groups while providing them with the tools and supportive environment they need to flourish. As a faculty leader, this means becoming proactive by serving on the recruitment and selection committees to ensure we are attracting and selecting students and faculty from a variety of backgrounds. At times, this may also involve speaking at various campus events and establishing local social networks. Actively seeking out diverse talent can help to address diversity issues and retain diverse talent in STEM. However, once recruited, it is important to listen to the needs and concerns of these individuals while cultivating a sense of belonging with the lab and department by treating them with respect, including them in discussions, providing encouragement, and helping them develop their skills in a psychologically safe place.

Diversity in the research lab will increase the ways that scientific problems can be approached and analyzed and solutions obtained. A diverse team encourages staff to bring their authentic selves to a research environment without fear of exclusion.

Damo: We routinely leverage collaborative groups of people with training from different scientific backgrounds to solve the most pressing interdisciplinary problems. I think it's natural to adopt this same mindset toward creating a more equitable environment for our scientists where we value the entire person in addition to their academic pedigree.

Davis: DEI can be implemented through intentional and synergistic partnerships. For example, my area of expertise/specialty is structural biology, which studies how biological molecules are built and how they work. However, there is a lot of technology that is expensive and smaller institutions may not have access to this. To expand access to advanced training and collaboration, as a faculty member at an HBCU, I partnered with the Structural Biology Grid (SBGrid) program at Harvard Medical School to secure a grant that will provide training and access to faculty at local HBCUs, minority-serving institutions and tribal college/universities. Through this partnership, each partner brings their own area of expertise that will increase the diversity of the field's workforce.

Assuming you are at a resource-limited institution, how can you perform broad-reaching programs like *Project Strengthen*?

Hinton: Drs. Ricardo Correa and Ulises M. Ricoy have done some amazing research and STEM education proposals that engage underrepresented individuals by innovatively reimagining how to use existing resources.¹² Despite hundreds of scientists at resource-limited institutions who are similarly doing amazing work, it is often not published. In the US, I think a big avenue to consider, especially in the case of HBCUs, is to form collaborations with larger institutions when possible. It should also be remembered that while some institutions may be considered "resource-limited" in the US, considered in a global context, they may still have a relatively high amount of resources. Thus, resource-limitations should be considered on a global stage and forming collaborations with international collaborators can aid.

Finally, just thinking outside the box helps. *Project Strengthen* may not have the extensive research component of MARC programs; however, it is also much more affordable and scalable as it can be hosted by anyone, anywhere. In some ways, these sorts of programs can provide comparable benefits by exposing trainees to the fundamental knowledge they need to succeed in STEM.

Shuler: Developing broad-reaching educational programs like *Project Strengthen* requires creativity, collaboration, dedication, and a keen understanding of available assets in resource-limited settings.

Murray: Although resources are always needed, targeted DEI efforts can still happen even with limited. Partnering with local programs and institutions is one way. This can be done by gathering information on possible resources (e.g., articles, webinar, workshops, focus groups) found on listed on the web, or advertised at nearby universities. This resource list could be updated and shared with members of the institution, or shared online on websites or through webinars. Another way is to organize teams of individuals to attend conferences and workshops, while encouraging them to bring the information back to the institution in the form of seminars, workshops, or educational moments in meetings. Inviting speakers from nearby institutions for planned workshops or symposiums could also be useful. These networks can also help creating new opportunities, such as by submitting grant applications for new/exiting programs, or working with program officers at funding

agencies to develop new funding mechanisms that would allow resource-limited institutions apply for funding for their broad-reaching training programs.

Damo: Minority-serving institutions do a great job at producing outstanding outcomes despite limited financial resources. Moving forward, I think it's important to create sustainable mutually beneficial partnerships among several different institutions that could lead to broad-reaching programs.

Davis: *Project Strengthen* was actually started at an HBCU with limited resources. However, Winston-Salem State has an abundance of knowledgeable and caring faculty/staff with diverse skillset and expertise. Broad-reaching programs like *Project Strengthen* can be implemented in the same manner. It is essential to identify the areas/goals that will enhance the learning environment for students and create programs that will help to achieve those goals. Access to programs like *Project Strengthen* means that more HBCU students will apply and gain acceptance to graduate and professional schools across the country. Schools looking to recruit these students can give workshops and lectures within the *Project Strengthen* curriculum, while establishing summer research programs or activities to diversify their graduate/professional student cohorts.

Project Strengthen involves multiple high-quality slideshows that the workshop series were based on, how does one find such resources to make workshops for themselves?

Hinton: There is a wealth of information out there, so it is more about finding it. PubMed and Google Scholar can be used to search for DEI and STEM education articles. This also includes searching for specific journals that focus on STEM education including *Advances in Physiology Education* and *CBE—Life Sciences Education*. Searching fields outside of STEM, such as *Harvard Business Review*, can provide insight into approaches that could be applied to STEM environments.

Murray: There is no lack of talent outside of those traditionally trained in STEM disciplines. We employed a high school-age student who recently received her GED and she has been doing high-quality scientific illustrations for our writing team for the past two years. Her work is routinely incorporated into scientific manuscripts, and some illustrations have made it to the cover of three high-impact journals. Talking to your STEM students, as well as students in other departments, could uncover a variety of skill sets that would fit right in your lab, department, or institution. This interdisciplinary approach can help produce high-quality slideshows, illustrations, computer programs, and much more while introducing non-traditional staff and trainees to science and mentorship. Our scientific illustrator intends to go to college, something she had given up on before joining the team.

Damo: Although, there are many great resources to choose from, more are needed. In particular, telling the stories of those scientists who have been historically excluded can be very impactful in shaping the identity of the next generation of STEM scholars. I would encourage anyone who is motivated to find the time to contribute to these efforts.

Davis: All these resources are widely available through websites and publications. In searching for these resources, looking at STEM education-focused journals can be helpful. Beyond this, searching for opportunities to expose students to STEM, such as through enrichment activities (summer research programs, conferences), showcasing faculty and STEM professional work, career paths, communities for students (e.g., ABRCMS, SACNAS), and more, all offer avenues to find resources.

How does DEI influence your research perspective?

Hinton: DEI keeps you thinking about how to get more people involved and engaged in science. DEI isn't about watering down science, but rather increasing rigor and innovation by increasing the amount of perspectives and talent across the STEM workforce. Having people from different backgrounds, including international scientists, is highly important. In my laboratory, these collaborations have provided access to samples from populations I wouldn't otherwise have access to. It also allows me to engage my community, as I can use my expertise to teach individuals in my community about how mitochondria are involved in public health issues, including diabetes. This can help inspire the community to reach the next level, whether that is pursuing clinical care or inspiring them to engage with scientific research, thus creating a positive feedback loop to inspire the next generation. With diversity, you can have new perspectives that could lead to new discoveries,² as people from different backgrounds can view science differently. In this way, DEI is not tangential to science, but integral to scientific innovation.

Shuler: The DEI shapes organizational research from a variety of perspectives, influencing how research is designed, conducted, interpreted, and applied. Thus, DEI is not antithetical to research but, rather, consistently informs and shapes how we view and conduct research. For example, by having diverse perspectives, I know that new avenues of research could be had, either from new ideas, but even from thinking about and applying data differently.

Murray: Being a mentor and working with individuals from different backgrounds has been mutually beneficial. It has opened new opportunities for investigation, pushed me to think differently, and motivated me to try new approaches and consider alternative research conclusions. The fresh perspectives of a diverse research team provide all sorts of new insights, as a diverse staff team asks novel questions, provides answers, and considers new approaches toward addressing a problem.

Damo: As a faculty member at an HBCU, I take great care in intentionally incorporating my students' perspectives toward shaping our overarching research agenda. Over the past few years, our lab has undergone an impactful transformation by focusing on understanding the molecular mechanisms of diseases that disproportionately affect those from historically excluded populations.

Davis: DEI has shaped how I think about ways to improve human health and combat diseases. My research combines genetics, health disparities, and structural biology to understand human diseases with the goal of discovering novel treatments. As a structural biologist, I began to wonder how genetic ancestry can influence disease manifestation and treatment using a structural biology lens. Although novel genetic

variants are constantly being reported for many human diseases and can differ across racial/ethnic groups, they are not always equal. Therefore, we need to study how genetic variants impact the structure and function of proteins. DEI also influences how I communicate my research. For example, presenting figures of protein structures in a variety of colorblind-friendly color schemes, as not everyone sees color the same way.

What are the main challenges you faced in implementing initiatives such as *Project Strengthen* and how may they be overcome?

Shuler: To promote DEI in these fields, *Project Strengthen* initiatives should be implemented for underrepresented undergraduate students. These endeavors, however, pose a variety of challenges for leaders:

1. The cost of labs, equipment, software, and faculty is a significant factor in many *Project Strengthen* initiatives. In institutions with limited resources, allocating enough funds can be challenging.
2. Not all faculty members see the value or urgency of *Project Strengthen*. Time and effort are required to convince them of the importance of the initiative and ensure their participation.
3. Underrepresented students may come from cultures where pursuing STEM disciplines isn't the norm and may face family/community pressure to pursue different careers.
4. Although mentorship is essential, finding faculty or professionals who can empathize with the particular difficulties faced by underrepresented students can be challenging.
5. The potential for resistance to change from more established faculty and leadership.

Murray: Balancing DEI work and the demands of a traditional research career, including teaching and lab management, can be challenging, especially for new faculty. This highlights the importance of time management and delegation.¹³ Institutional/lab policies such as protected volunteer time can ensure that DEI is recognized and prioritized. I feel more senior faculty can further be important in encouraging/delegating trainees to participate in volunteer work (DEI, teaching, student leadership, training, etc.), thus, faculty can be the catalyst for new opportunities by providing student group mentorship and sponsorship.

Now that DEI has become a political issue, do you think about it differently and must it change?

Hinton: The current political climate is more of a branding issue from previous attempts to address social inequities in the nation. DEI is more than just hiring policies, it also involves ensuring that faculty, staff, and trainees of all backgrounds have access to the support they need to succeed in the workplace. The ideals DEI stands for are not going away, but evolving under new pressure and the terminology might change along the way. For example, DEI encourages faculty to learn data-supported educational and intentional mentoring practices, which are especially helpful to underrepresented students. DEI also encourages institutional leaders to think about more inclusive practices and fostering collaborative leadership skills among their employees.¹⁴ It is increasingly clear that DEI as a term has become a dog whistle, so rethinking what we are doing, how we are doing it, and how we describe it to our fellow colleagues and the public is paramount.

Shuler: In recent years, in the US, DEI has gained more political attention. In spite of this, the fundamental principles of DEI remain constant regardless of the political climate. To achieve the fundamental ideals of DEI, everyone must be given an equal chance to succeed while valuing and acknowledging all voices. Human rights, respect, and comprehension are emphasized within the ideals and goals of DEI. The politicization of DEI will influence how we address inequities in the workplace.

Murray: While DEI has become a political issue, I believe that does not alter the fact that DEI is still critically needed and is the correct thing to do if we are to achieve equity in the nation. For some individuals and institutions, attacking DEI is an opportunity to dismantle programs that benefit everyone while ignoring the reality of race in America. We cannot lose focus of need and benefits of achieving DEI. Beyond this, we cannot pretend that DEI only exists in the US; while the political issues around it have been more apparent in the US, maintaining DEI is important for global equity, not just equity in the US.

Damo: DEI has always been and will be a political issue. Sometimes society can be more preoccupied with specific language/labels and less focused on the true meaning of the message. It's important to continue to advocate for an environment that is conducive to producing the best science, one where everyone has an opportunity regardless of background.

Davis: I am more interested in why people are against DEI. There is plenty of data that supports the benefits of DEI. Why wouldn't everyone want to ensure we are all represented?

What's next? What breakthroughs in DEI/mentoring do you imagine or hope to see in upcoming years? Any next plans?

Hinton: I am inspired by the younger generation, who are more sensitive and accepting of others and their ideas. I see younger individuals from all backgrounds often on the frontlines fighting for DEI in spite of politics changing the face of DEI. Therefore, as they become STEM professionals and leaders, I think DEI practices will become more accepted and more common. Part of this is DEI expanding beyond countries' borders. Increasingly, international collaboration, spanning continents, will happen to create change and new innovation across institutions separated by vast distances.

Beyond this, to me, it is increasingly becoming clear that mentoring is being recognized as the science that it is. Techniques, such as quotients, show that we will be constantly reimagining how mentoring is practiced in STEMM. Mentoring, thus, will likely continue to play a role and, if anything, become only more important. I see general professional and career development training already becoming increasingly common, but I think that mentoring increasingly will shift to focus on holistic and individualized mentoring techniques, which tailor mentoring to an individual's life experiences and challenges. Alongside leadership training, large groups of individuals will gain these fundamental professional skills, while mentoring can supplement it to offer guidance that considers the entire life history of an individual. In this way, we can ensure that DEI is continued to practice, in spite of changes in policies.

Shuler: Considering current trends in DEI and student mentorship, we can predict future advancements and breakthroughs. DEI initiatives are incorporating more data-driven approaches and creating a more inclusive culture in STEMM. I also do see artificial intelligence being more included in future approaches, which can positively impact society.

Murray: I predict artificial intelligence will be increasingly used to facilitate non-bias DEI activities related to recruitment, evaluation and promotion. I also expect learning and writing accountability groups¹⁵ will be more common and be used to learn new technical skills and motivate fellow colleagues. There may be technological advancements that will allow mentors and mentees to rapidly learn new technical information.

Damo: The demographics of our society, both in the US and globally, are rapidly changing as the minority will become a collective majority in terms of population. I think in the US more large public research institutions will soon become minority-serving institutions. Globally, countries that have not had an opportunity to participate in science on a global scale will increasingly be given this chance. I think this presents a unique opportunity to reevaluate how STEMM trains the next generation.

Davis: The general community is missing from STEMM. We need to actively engage more community members in STEMM. One of the things we have learned during the COVID-19 pandemic is that the public wants to understand the science. We need to think of creative ways to build and sustain trust in science and medicine.

Final thoughts

The fundamental ideals and goals of DEI are here to stay and, despite many improvements, we still have a long way to go to ensure equity in STEMM. As DEI is banned in some states and federal rulings, such as those against Affirmative Action, appear, DEI should continue to be actively promoted and treated as a science. Programs like *Project Strengthen* epitomize this by making STEMM more accessible to future scientists.

ACKNOWLEDGMENTS

The UNCF/Bristol-Myers Squibb E.E. Just Faculty Fund, Career Award at the Scientific Interface (CASI Award) from Burroughs Wellcome Fund (BWF) ID # 1021868.01, BWF Ad-hoc Award, NIH Small Research Pilot Subaward to 5R25HL106365-12 from the National Institutes of Health PRIDE Program, DK020593, Vanderbilt Diabetes and Research Training Center (DRTC) Alzheimer's Disease Pilot & Feasibility Program. CZI Science Diversity Leadership grant number 2022- 253529 from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation (AHJ). NSF EES2112556, NSF EES1817282, NSF MCB1955975, and CZI Science Diversity Leadership grant number 2022-253614 from the Chan Zuckerberg Initiative DAF, an advised fund of Silicon Valley Community Foundation (to S.D.).

REFERENCES

- Hinton, A.O., Jr., Termini, C.M., Spencer, E.C., Rutaganira, F.U.N., Chery, D., Roby, R., Vue, Z., Pack, A.D., Brady, L.J., Garza-Lopez, E., et al. (2020). Patching the leaks: Revitalizing and reimagining the STEM pipeline. *Cell* 183, 568–575.
- Hofstra, B., Kulkarni, V.V., Munoz-Najar Galvez, S., He, B., Jurafsky, D., and McFarland, D.A. (2020). The Diversity–Innovation Paradox in Science. *Proc. Natl. Acad. Sci. USA* 117, 9284–9291.
- Hinton, A., and Lambert, W.M. (2022). Moving diversity, equity, and inclusion from opinion to evidence. *Cell Rep. Med.* 3, 100619.
- Shuler, H.D., Spencer, E.C., Davis, J.S., Damo, S., Shakespeare, T.I., Murray, S.A., Lee, D.L., and Hinton, A. (2022). Learning from HBCUs: How to produce Black professionals in STEMM. *Cell* 185, 2841–2845.
- Davis, J., Damo, S., Spencer, E.C., Murray, S.A., Shuler, H.D., Vue, Z., Heemstra, J.M., Diaz Vazquez, A., and Hinton, A. (2023). Catalyst for change: future of DEI in academia. *TRECHEM* 5, 245–248.
- Barongan, T., Neikirk, K., Shao, B., Vue, N., Spencer, E.C., Kabugi, K., Conley, Z., Vang, L., Vue, M., and Vang, N. (2023). Project Strengthen: A STEMM-Focused Career Development Workshop to Prepare Underrepresented Minority Students for Graduate School. *iScience* 26, 107766.
- Mays, A., Byars-Winston, A., Hinton, A., Marshall, A.G., Kirabo, A., August, A., Marlin, B.J., Riggs, B., Tolbert, B., Wanjalla, C., et al. (2023). Juneteenth in STEMM and the barriers to equitable science. *Cell* 186, 2510–2517.
- Hinton, A.O., Jr., Vue, Z., Termini, C.M., Taylor, B.L., Shuler, H.D., and McReynolds, M.R. (2020). Mentoring minority trainees: minorities in academia face specific challenges that mentors should address to instill confidence. *EMBO Rep.* 21, e51269.
- Rolle, T., Vue, Z., Murray, S.A., Shareef, S.A., Shuler, H.D., Beasley, H.K., Marshall, A.G., and Hinton, A., Jr. (2021). Toxic stress and burnout: John Henryism and social dominance in the laboratory and STEM workforce. *Pathog. Dis.* 79, ftab041.
- Shuler, H., Cazares, V., Marshall, A., Garza-Lopez, E., Hultman, R., Francis, T.-K., Rolle, T., Byndloss, M.X., Starbird, C.A., Hicsasmaz, I., et al. (2021). Intentional mentoring: maximizing the impact of underrepresented future scientists in the 21st century. *Pathog. Dis.* 79, ftab038.
- Snyder, J.E., Upton, R.D., Hassett, T.C., Lee, H., Nouri, Z., and Dill, M. (2023). Black Representation in the Primary Care Physician Workforce and Its Association With Population Life Expectancy and Mortality Rates in the US. *JAMA Netw. Open* 6, e236687.
- Torres, D.J., Romero, A., Colgan, W., and Ricoy, U.M. (2021). A low-cost computational approach to analyze spiking activity in cockroach sensory neurons. *Adv. Physiol. Educ.* 45, 145–153.
- Murray, S.A., Davis, J., Shuler, H.D., Spencer, E.C., and Hinton, A. (2022). Time management for STEMM students during the continuing pandemic. *Trends Biochem. Sci.* 47, 279–283.
- Ruiz, A.E., DeLong, A., and Hinton, A. (2022). Creating a positive feedback loop in leadership to accelerate cultural change. *Trends Parasitol.* 38, 1020–1022.
- Spencer, E.C., Neikirk, K., Campbell, S.L., Powell-Roach, K.L., Morton, D., Shuler, H., Murray, S.A., and Hinton, A. (2022). Intentional and unintentional benefits of minority writing accountability groups. *Trends Microbiol.* 30, 1015–1018.