CellPress

Molecular Cell

Forum

Diversity, Equity and Inclusion in the Laboratory: Strategies to Enhance Inclusive Laboratory Culture

Andrea G. Marshall,[1,17] Zer Vue,[1,17] Heather K. Beasley,[1,17] Kit Neikirk,[1] Dominique Stephens,[1] Celestine N. Wanjalla,[2] Steven M. Damo,[3,4] JoAnn Trejo,[5] Piere Rodriguez-Aliaga,[6] Colwyn Ansel Headley,[7] Haysetta Shuler,[8] Kaihua Liu,[9] Nathan Smith,[10] Edgar Garza-Lopez,[11] Taylor Barongan,[1] Estevão Scudese,[12] Elsie Spencer,[13] Jennifer Heemstra,[14] Arnaldo Diaz Vazquez,[15] Sandra A. Murray,[16,*] and Antentor Hinton, Jr.[1,18,19,*]

[1]Vanderbilt University, Department of Molecular Physiology and Biophysics, Nashville, TN 37232 USA
[2]Department of Medicine, Division of Infectious Diseases Vanderbilt University, Nashville, TN 37232 USA
[3]Center Structural Biology, Vanderbilt University, Nashville, TN 37232 USA
[4]Fisk University, Department of Life and Physical Sciences, Nashville, TN 37208 USA
[5]Department of Pharmacology, School of Medicine, University of California, San Diego, La Jolla, CA 92093, USA
[6]Department of Biology, Stanford University, Stanford, CA 94305, USA
[7]Department of Cardiovascular Medicine, Stanford University, Stanford, CA 94305, USA
[8]Department of Biological Sciences, Winston-Salem State University; Winston-Salem, NC 27110 USA
[9]Department of Anatomy of Cell Biology, University of Iowa, Iowa City, IA 52242, USA
[10]School of Medicine and Dentistry, University of Rochester Medical Center, Rochester, NY 14642, USA
[11]Department of Internal Medicine, University of Iowa, Iowa City, IA 52242, USA
[12]Laboratory of Biosciences of Human Motricity (LABIMH) of the Federal University of State of Rio de Janeiro (UNIRIO), Rio de Janeiro Brazil; Sport Sciences and Exercise Laboratory (LaCEE), Catholic University of Petrópolis (UCP), Brazil
[13]Teachers College, Columbia University, New York, NY 10027 USA
[14]Washington University in St. Louis, Department of Chemistry, St. Louis, MO 63130, USA
[15]University of Texas Southwestern Medical Center, Graduate School of Biomedical Sciences, Dallas, TX 75390 USA
[16]University of Pittsburgh, Department of Cell Biology, Pittsburgh, PA 15261 USA
[17]These authors contributed equally
[18]X: @phdgprotein86
[19]X: @AtHinton_Author
*Correspondence: smurray@pitt.edu (S.A.M.), antentor.o.hinton.jr@vanderbilt.edu (A.H.)
https://doi.org/10.1016/j.molcel.2023.09.011

Building a diverse laboratory that is equitable is critical for the retention of talent and the growth of trainees professionally and personally. Here, we outline several strategies including enhancing understanding of cultural competency and humility, establishing laboratory values, and developing equitable laboratory structures to create an inclusive laboratory environment to enable trainees to achieve their highest success.

Introduction

Culture can be defined as the collection of shared beliefs, customs, values, behaviors, and artifacts that is influenced by a variety of factors such as historical events, geography, religion, language, and social structures.[1] Laboratory culture is beginning to shift in recognition of the need to evolve towards a diverse, equitable, and inclusive environment that is conducive to the learning of all persons, including those traditionally excluded because of their ethnicity or race in science, technology, engineering, mathematics, and medicine (STEMM). Historically underrepresented, underserved groups face disproportionately high rates of ineffective and toxic mentoring[2] even when mentors have the best intentions. Intentional mentoring[3] often underscores the importance of nurturing a social paradigm that encourages and embraces cultural diversity within laboratories. Here we describe practices that have been successfully applied to create welcoming, and productive, laboratories for trainees (Table 1).

While the business case of diversity relating to productivity is well understood, it is worth emphasizing that diversity and inclusion enhance innovation, excellence, and productivity across a range of fields including STEMM.[5] Yet an emphasis on increased productivity completely neglects the ethical reasons for diversity, and that diversity often improves other aspects of an organization which are typically overlooked by common metrics, such as openness and social consciousness.[6] This is because principles included in interdependence, such as openness, fair evaluation, and honesty, have been shown to be beneficial for STEMM researchers.[1]

While onboarding in a laboratory group typically focuses on teaching laboratory safety, skills, and techniques necessary to thrive within teams, it may be important to incorporate training that communicates shared values and fosters cultural competency. Here we discuss this in the context of the goal of diversity-centered programming and planning within the laboratory environment to cultivate a culture of interdependence, which rests on shared collaboration between principal investigators (PIs) and institutions.

Embracing a culturally diverse laboratory

Cultural competency is important and necessary in the laboratory setting. Cultural diversity affects lab workers and

Table 1. Key aspects and things to consider for creating an inclusive laboratory

What to consider	Why it is important
Ensure trainees understand instructions and are comfortable with asking questions for clarification.	Unclear instructions in an environment where students are not comfortable asking questions can frustrate trainees. This results in lost time and money as they may need to repeat projects and on the extreme, leave before completing the project.
Holding events or excursions to celebrate awards and publications in the laboratory.	Adopting a "work hard, play hard" attitude can be important to ensure that trainees are rewarded for their time and effort. This may be done through celebrating accomplishments—such as with dinners and different team-building activities with laboratory members, or free activities such as hiking. Just as accomplishments are recognized, failures should not be lingered on, but rather be recontextualized as learning experiences and expected intermediates in the overall training process.[4]
Offer scales on cultural humility and cultural competency.	These scales can allow for monitoring of how culturally inclusive laboratories are and can aid in direct training. Institutions should shoulder the burden of administering institutional tests of cultural humility, to both faculty and trainees, through established scales. From there, for individuals or laboratories which are consistently scoring lower on such scales, institutions and/or PIs may work together to provide training and interventions to understand how to improve cultural humility in the laboratory.
Create sub-leaders in the laboratory so historically underrepresented, underserved groups individuals can get training in being a leader.	This recognizes and formalizes the hard work individuals are doing in the laboratory while fostering leadership capabilities of the trainees. Gratitude should be expressed frequently to recognize hard work, formalize the aspects that PIs place in high regard, and help individuals understand how they may ultimately be promoted to higher positions (PDs and co-leaders) in the laboratory. The goal is to create a positive, supportive environment that fosters collaboration, innovation, and interdependence, thereby improving the quality of research and advancing scientific knowledge.
Develop a culture of interdependence that ensures trainees assist their historically underrepresented, underserved groups and learn how to be effective collaborators.	It can aid in reducing stress on trainees, create a sense of community that reduces the chance of them leaving the STEMM pipeline. The end goal is to create a community foundation in the laboratory where trainees feel motivated to take time to help someone else with an experiment due to the interdependent nature of the work. Trainees should never feel obligated to work late but should be altruistic in their efforts to assist others.
Form accountability groups for "cultural safety," "writing," and "mentoring."	Establishes laboratory teams, encourages regular meetings with other laboratories, and allows for more opinions to be offered regarding mentoring and other topics of culture.
Offer regular training and professional development.	Ensures that trainees are becoming experts not just in their specific field of science but also growing holistically.
Accept feedback through multiple methods, including anonymized methods, and adjust styles accordingly.	It is important to lead by example, taking the time to ensure that all staff and trainees are able to offer their suggestions and changing in accordance with them demonstrates a willingness to improve.
Work to establish strong early infrastructure in a laboratory and an inclusive laboratory.	This starts the laboratory off with a head start, forging collaborations with historically underrepresented, underserved groups scientists early on and encouraging recruitment of historically underrepresented, underserved group trainees.
Encouraging growth through individual trainings and other methods such as "life coaches."	Makes it clear the laboratory is focused on the personal growth of trainees in addition to their professional growth and ensures they will thrive in future positions.

(*Continued on next page*)

Table 1. *Continued*

What to consider	Why it is important
Promote work-life balance, time off after long streaks of work, and volunteering at organizations which contextualize the work.	Reduces burnout and aids in helping laboratory members place the significance of their work in broader context. Interdependence in a lab promotes a healthy work-life balance, but caution must be exercised to prevent alienating trainees or setting them up for future failure. While supportive PIs are generally preferred by trainees, it's vital that the PI strikes a balance between support and instilling a sense of discipline and structure to foster a strong work ethic in trainees. A balanced approach to mentorship is essential to create a productive and positive work environment in the lab while ensuring the success of all members.
Incorporate institutional changes including discussion groups, participation programs, and trainings.	These small changes can result in formalizing an institutional culture of shifting towards strong work life balance as well as ensure PIs are getting training in how to create interdependence culture.
Adopting general inclusive language and recognizing cultural diversity in the laboratory.	As part of having cultural humility, it is important to recognize differences in holidays or cultures that dismissive language can trivialize.
Support trainee mental health. PIs can encourage mental health by allowing individuals to take mental health wellness days. Similarly, they may modify grant timelines depending on mental health to attempt to minimize how taxing grant applications are.	Mental health is a common issue among students and trainees. Laboratory-employed therapists can further allow individuals to communicate with someone if they do not feel comfortable reaching out to anybody in the laboratory. However, given these are beyond the means for many PIs, these should be petitioned to be a standard at the institution.
Avoiding rejection outright rejection of trainee ideas.	PIs should exercise mindfulness in various aspects of lab management. For instance, creating a constantly stressful environment or outright rejecting trainee ideas can be detrimental. Instead, trainee ideas should be considered, and if not pursued, clear reasons for not implementing them should be provided, with emphasis on learning and development.

the community it serves. To be culturally competent, lab professionals need great communication skills and must acknowledge and address their biases. Cultural competency is the choice to become aware of one's own cultural beliefs and values and how these may differ from those of other cultures. The iceberg analogy, in which PIs consider a small portion of an individual trainee's unique perspective and past cultural experience while neglecting much of the trainee's personal and cultural identity which remains below the surface, represents a typical mode of laboratory interaction. Such an approach may result in cultural differences being neglected. Cultural competency allows mentors to emphasize, understand, and appreciate the work and unique circumstances of trainees coming from different cultural backgrounds. Furthermore, it allows for an understanding of why people act in certain ways and possess specific values, such as needing adjusted schedules for specific holidays,[7] or recent sociopolitical events that may have temporarily lowered performance. Being empathetic to these differences in culture manifesting in productivity is an important aspect of cultural competency for PIs. Individuals should not be forced to assimilate into the dominant culture but rather be able to share their culture. Recognizing this continuum of cultural competency separates Western standards from the individuals and works to avoid cultural destructiveness and cultural indifference (Figure 1).

Similar to the concept of cultural competency is cultural humility. Cultural humility incorporates a continual reflection of stereotypes and encourages one to be critical of their own unconscious biases.[8] This stems from an understanding that differences may occur, and individuals from a certain cultural background should be treated with humility in mind but also should not be considered as a monolith but rather as individuals. A key way to utilize cultural humility is through the HUMBLE model[9] as well as understanding how certain cultures may dictate differences in schedules and openness of various faiths, whether it is incorporating praying during the scientific process or meditation to restore mental health.

Cultural humility and competency are complementary principles that synergize to create a laboratory environment that is open to individuals from all cultures. Separating these two concepts can impede progress as subconscious biases may arise. When they are not utilized together, stereotypes may unconsciously bias laboratory members, resulting in toxic or hostile work environments.

Laboratory structure

Building an inclusive and equitable laboratory environment also requires that "hidden curriculum" be brought into the open so that everyone has access to the information they need to thrive. One way to achieve this is through a clear and developed laboratory structure that allows trainees multiple contact points in the event of an issue. For larger laboratories, the PI may have multiple experts, or existing individuals in the laboratory they designate project directors (PDs) for certain topics. These individuals may have some

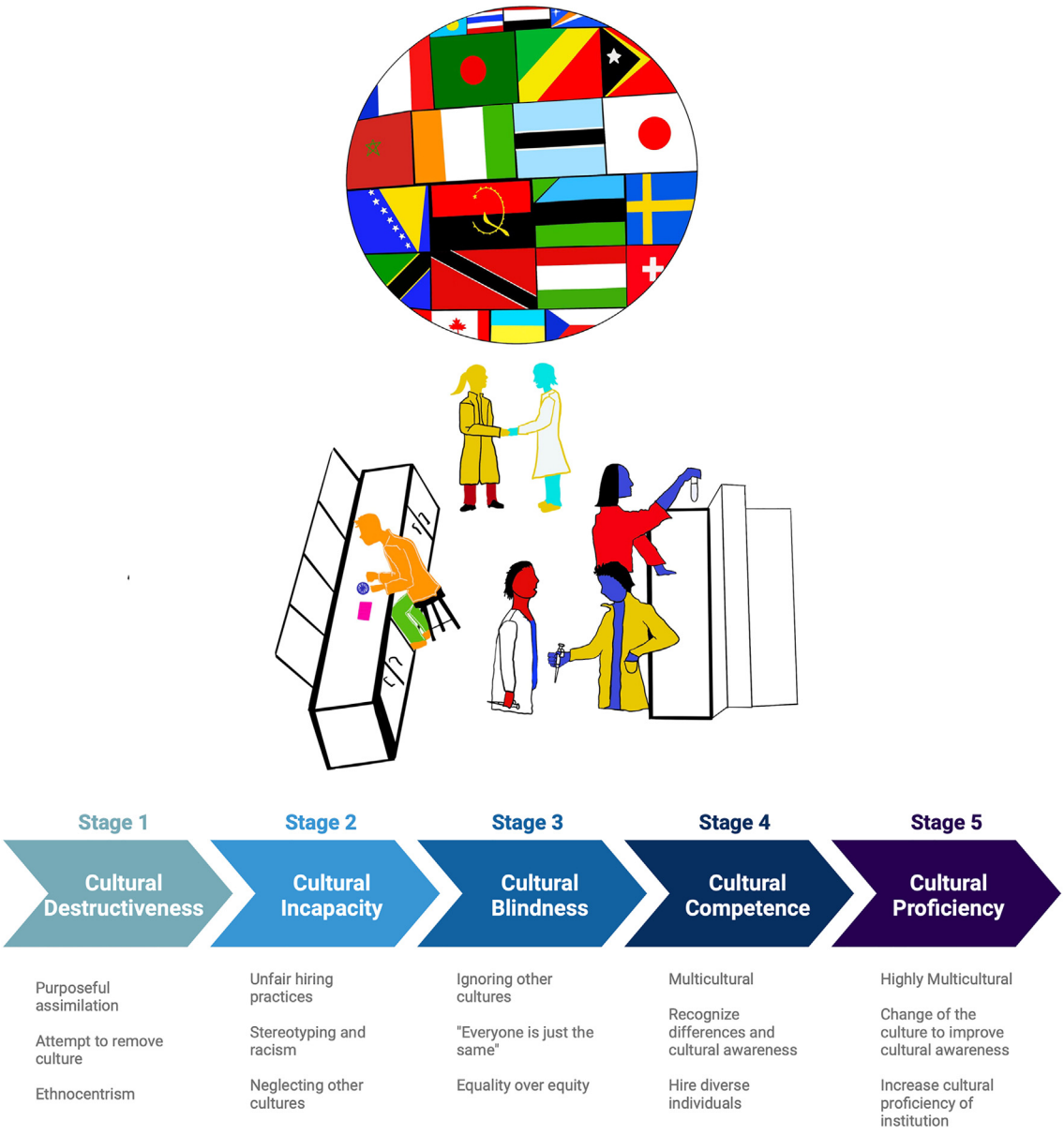

Figure 1. Cultural competency as a continuum and the necessity of it in creating a diverse and multicultural lab

There can be several levels of cultural competency or incompetency. Stage 1 encompasses actively hurtful practices which seek to minimize one's culture. Stage 2 includes a negligence of other cultures which can manifest as sterotyping and other harmful practices. Stage 3 is often the most subtle, as cultures are ignored which can be detrimental in its own ways through not recognizing the individuality in cultures. Stage 4 has competency that recognizes the differences and seeks to promote diverse individuals to improve innovation. Stage 5 shows complete cultural humility in an interdependent laboratory. In this continuum, laboratories must continually evaluate their current practices.

overlapping expertise but should mainly possess different skills. Instead of bearing the burden of surface-level training in many areas, these PDs can become masters in their certain expertise, and thus, many forms of mentoring can effectively be carried out in the laboratory setting. In addition, they can aid in organizing talks for the overall laboratory with other intra- and inter-institutional experts. This can ensure that everybody has rudimentary training in critical components for inclusive laboratories, including knowledge of filling different mentoring roles such as casual or intentional.[3]

Another function of these PDs is assisting in organizing daily meetings. For example, laboratories may also include dedicated regularly scheduled days to emphasize mindfulness, individual one-on-one meeting days, journal clubs, writing accountability groups, and enrichment days. This allows for the laboratory to build a community, offer improvement in other aspects of life, receive more direct forms of mentoring, and encourage regular meetings.[3,10] However, these should include flexibility; for example, allowing individuals to omit meetings due to family or work overload.

In selecting these PDs, there is flexibility dependent on the PI's needs. We believe that the title, accompanied by adjusted compensation to reflect their increased responsibilities, should be based on performance and desire to foster diversity, thus encouraging individuals to be productive and inclusive in the laboratory. However, PIs should be mindful not to create a competitive environment or significant pay inequities across similar titles. PDs should be allowed autonomy to move up and give more time to mentoring and promoting other members of the laboratory. While this creates a position with more power, PIs should ensure that PD's ultimate aim is to offer specialized support to the laboratory and its members. Similarly, the PI should ensure that in selecting these PDs they do not select existing laboratory members who may be exclusionary or act as gatekeepers. To ensure PDs continue acting as both productive trainees as well as promoting inclusion, the PI should regularly check in with trainees personally to make sure PDs are being effective and implement regular anti-racist mentor training for them.[4]

Beyond this, in larger laboratories, further hierarchies may be created, including "co-leaders" which may be early-career scientists who assist the PDs. In this way, these positions can give ambitious and historically underrepresented, underserved students a chance to be leaders, learn how to mentor individuals, and prepare for their future careers. This structure also generates smaller groups within the lab, which can foster intimate collaboration. This allows various groups led by PDs to cultivate distinct atmospheres that attract different personality types. For example, while the PI may have a more approachable, hands-on style, some trainees may prefer a hands-off mentorship style where individuals can work independently. Having a specific PD with this work style can allow for a healthy intermediate to be formed that is conducive to the work style of the trainee. Together, PIs, PDs, and co-leaders can act as reflections for what they want their trainees to be through acting respectfully, giving adequate explanations, being reasonable, communicating clearly, elucidating the importance of research, and establishing clear procedures.

In addition to serving as mentors, these PDs and co-leaders hold significant value in developing leadership skills. They should be responsible for tasks including verifying findings, ensuring that all results are correctly stated, manuscripts are prepared correctly, future studies and grant proposals have required elements, data is treated properly with the correct level of protection, and no plagiarism is occurring. Alongside training provided by PIs and institutions, this position emulates that of a PI acclimating individual to the responsibilities associated with being a PI. Notably, expanding leadership talent pools can illustrate to the laboratory and other institutions that historically underrepresented, underserved groups of individuals can thrive in leadership roles, thus creating a positive feedback loop of cultivating inclusive leadership to undo long-standing disparities in leadership positions for women and historically underrepresented, underserved groups.

Formulating productive laboratory values

In the process of establishing and maintaining a laboratory, formulating central pillars can ensure the laboratory is focused on key aspects and aspirations, but these must be clearly communicated. For example, laboratories may adopt a more rigid and evenly paced structure, such as 4- or 5-day work weeks. In contrast, some labs may adopt structures that are based around "working hard and playing hard" in which certain bursts may require long hours, but this is compensated by increased time off and time at conferences. To minimize ambiguity, PIs must adopt measures such as maintaining open-door policies and group chats to facilitate continuous communication among laboratory members.

In addition, for many STEMM laboratories, isolation from the impact of the research arises as a result of a lack of contextualization, resulting in many individuals, while conceptually understanding the importance of their research, feeling disconnected or meaningless. Mentors can reconnect their research to the actual outcomes by creating laboratory volunteer days (e.g., in a translational lab, a day volunteering at a clinical facility to see individuals who may be impacted by the research). Isolation can also arise during a transition period when there is a turnover of members in a laboratory, such as senior members who have contributed significantly to mentoring junior members. Furthermore, new members may experience a sense of isolation and unfamiliarity with the lab's culture and procedures as they try to integrate into the existing social and professional networks. To combat these challenges, PIs and their PDs should continuously organize community-building sessions where new and current members can interact and learn about each other.

Effective, intentional, and clear mentoring is fundamentally important for trainees.[3] This is established by a mentoring contract, which necessitates mutual consent and ongoing assessment of advancement, as well as reflection on the need for the adoption of new methods. In addition, an individual development plan (IDP) guarantees that the objectives of both the individual and the organization are comprehended and that measures are taken to achieve those objectives.[11] These can be continued on a weekly basis, for example, through a day dedicated to goal-setting to ensure that goals are being formulated and met. This can also allow for understanding unmet needs, and if additional co-mentors are necessary, to ensure all goals are being met. During this process, time should be taken by recontextualizing grant writing and manuscripts to not view them as tedious processes through mechanisms such as writing accountability groups.[3] In these ways, laboratory values can formulate an environment in which members feel like they are succeeding in all ways, not just academically.

In formulating laboratory values, fluidity and adaptability are key principles. It is critical that the shared values create space for all identities and cultures to thrive rather than requiring conformity to a specific culture or set of norms. Individuals in leadership positions, such as PIs, should continuously assess the effectiveness of their values and interventions and adjust their approaches to learn from their trainees, such as through anonymous feedback channels, specialized trainee meetings, or accountability partnerships with other labs that prioritize the mental well-being of their members. However, since PIs have limited time, they must tailor their

strategies to focus on those with the most significant effort-to-effect ratio.

For new PIs, formulating the laboratory can be a critical junction in creating initial inclusive values. While setting up the laboratory, a universal inclusive design should be established so the laboratory may become accessible for disabled individuals. Beyond this, the laboratory's decorations can be created with multicultural individuals, thereby creating an environment that is not oppressive, while also serving as a mechanism for new PIs to broaden their network to individuals with distinct cultures. While the laboratory values will likely alter in both definition and mechanism across time, ensuring that the laboratory is culturally sensitive and accessible establishes a baseline receptiveness to other cultures.

How to create a culture of interdependence

Importantly, we believe that laboratory culture needs to be treated with the same consideration as laboratory safety, as the socioemotional effects of laboratory culture on trainees can be profound.[1,12] However, while it is easy to observe if laboratories are lacking adequate safety procedures, evaluating the supportiveness of laboratory culture is considerably more challenging. From an institutional perspective, just as safety audits are performed for machinery, the same may be done for the culture. Differences in perceived factors—such as safety, supportiveness, and work-life balance—between leadership and trainees, as reported by anonymous surveys, can importantly identify potential issues or red flags. Indeed, this remains an issue as many laboratory heads have more positive views regarding laboratory culture than the actual members of the laboratory.[13] In ensuring there is a safe laboratory culture, however, PIs will need to be responsible for formulating much of the culture and ensuring it permeates across laboratory members.

Building an inclusive laboratory is not only avoiding toxicity but takes active steps to ensure a diverse laboratory and reduce overt bullying, harassment, or other forms of misconduct. Even with these steps, more subtle forms of microaggressions[14] and implicit bias still may be neglected and permeate the laboratory environment. PIs should try to acknowledge unconscious biases that may lead them to stereotype students from certain cultural backgrounds and universities. Paramount principles include actively seeking out collaborations and opportunities with historically underrepresented, underserved groups, addressing racism head-on in laboratories and using anti-racism policies to guide mentoring and running of the laboratory.[4] For example, inclusive laboratories can give students a much-needed second chance. Sometimes students may find themselves in an environment that does not match their cultural values. As such conflict may arise, and with lack of training, this may escalate to a toxic environment. If historically underrepresented, underserved groups are judged based on a single negative experience, this can contribute to their exodus from the STEMM pipeline. By focusing on growing their skills so they can be productive in laboratories, laboratories can serve to promote historically underrepresented, underserved groups instead of only helping "worthy" individuals.

The coalescence of these values will collectively create a laboratory culture that values interdependence, the diametric opposition to independence. Unlike an attitude that values competition, interdependence values principles that span cultural and organizational barriers to create innovative solutions. This approach promotes collaboration, creativity, and mutual support, leading to greater success for the entire lab. Given that students appreciate a sense of community in laboratory culture,[1] this may be achieved through formulating strong interdependence. This is not to say that competition cannot exist in such a form of interdependence, as individuals should have an environment where they want to thrive. Competition should be a driving force for individual growth which exists secondary to the overall growth of the laboratory members as a whole.

In a lab environment, creating a culture of interdependence may require time and effort from the PI and other leaders. It may also require adjustments based on feedback received. The tone of communication and implicit biases of lab members can significantly impact the formation of this culture. Cultural humility and competency are critical components in establishing a culture of interdependence in a lab. Shared values form the basis of culture, and respecting both national and cultural holidays can demonstrate the laboratory's recognition and encouragement of individual cultural expression. Beyond culture, there may be a bias in STEMM fields towards viewing the work of other fields, such as humanities or social sciences, as less relevant. This is in opposition to a culture of interdependence, which should promote both intra- and inter-disciplinary collaborations.

The PI and the individuals they appoint to leadership positions are often seen as the driving force behind laboratory culture, influencing the atmosphere, governance, and communication styles of the lab.[1] However, they are just one of many factors that contribute to the overall culture of a laboratory. To promote collaboration in a laboratory, institutional support and encouragement for labs to work together is necessary. One way this can be accomplished is by formally pairing up multiple labs under "research groups" that span different disciplines to draw on multiple perspectives. Further, PIs and other senior leaders can be given training to understand the importance of interdependence and how to foster it. This approach removes the burden of understanding how to implement interdependence from PIs, avoiding potential resistance due to perceived time commitments. One manner by which institutions can support interdependence is by hosting "interdependence meetings" in which researchers from different labs and disciplines can come together to discuss their work and potential areas for collaboration. This type of meeting can promote open communication, idea-sharing, and collaboration across research areas. In addition, institutions can support interdependence by establishing structures that promote collaboration, such as shared equipment or research spaces. By providing training and opportunities for collaboration, institutions can help to promote a collaborative and innovative research environment.

Conclusion

Building an inclusive laboratory is a dynamic process and requires time on the part of the PI, existing members, and the institution to cater to the needs of the trainees. Here we discussed several techniques to establish strong laboratory

values and avoid toxicity to different cultures. Importantly, the scientific community should recognize the wholeness of individuals and create laboratories that focus on encouraging the growth of individuals in all aspects of their lives.

ACKNOWLEDGMENTS

We have received support from NSF EES2112556 and NSF EES1817282 (to S.M.D.); The United Negro College Fund/Bristol-Myers Squibb E.E. Just Faculty Fund; BWF Career Awards at the Scientific Interface Award; BWF Ad-hoc Award; NIH Small Research Pilot Subaward to 5R25HL 106365-12 from the National Institutes of Health PRIDE Program; DK020593; the Vanderbilt Diabetes and Research Training Center for 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 (to A.H., Jr.); a Hereditary Disease Foundation Postdoctoral Fellowship (to P.R.-A.); Doris Duke CSDA 2021193 (to C.N.W.); K23 HL156759 (to C.N.W.); Burroughs Wellcome Fund 1021480 (to C.N.W.); NIGMS R35GM127121 and NIGMS K12 GM068524 (to J.T.); the National Heart, Lung, and Blood Institute (1T32HL098049), and Stanford University Propel Post-Doctoral Fellowship (to C.A.H.).

DECLARATION OF INTERESTS

The authors declare no competing interests.

REFERENCES

1. Hildt, E., Laas, K., Miller, C.Z., and Taylor, S. (2022). Student views on the culture of STEM research laboratories: Results from an interview study. Account. Res., 1–38.

2. Marshall, A.G., Vue, Z., Palavicino-Maggio, C.B., Neikirk, K., Beasley, H.K., Garza-Lopez, E., Murray, S.A., Martinez, D., Crabtree, A., Conley, Z.C., et al. (2022). An effective workshop on "How to be an Effective Mentor for Underrepresented STEM Trainees. Pathog. Dis. *80*, ftac022.

3. 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.

4. Chaudhary, V.B., and Berhe, A.A. (2020). Ten simple rules for building an antiracist lab. PLoS Comput. Biol. *16*, e1008210.

5. 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.

6. Fine, C., and Sojo, V. (2019). Women's value: beyond the business case for diversity and inclusion. Lancet *393*, 515–516.

7. Cheng, L.-R.L. (2007). Cultural intelligence (CQ) a quest for cultural competence. Communication Disorders Quarterly *29*, 36–42.

8. Murray, S.A., Hinton, A., and Spencer, E.C. (2022). Developing cultural humility in immunology and STEMM mentoring. Trends Immunol. *43*, 259–261.

9. Tervalon, M., and Murray-García, J. (1998). Cultural humility versus cultural competence: A critical distinction in defining physician training outcomes in multicultural education. J. Health Care Poor Underserved *9*, 117–125.

10. Barry, K.M., Woods, M., Martin, A., Stirling, C., and Warnecke, E. (2019). A randomized controlled trial of the effects of mindfulness practice on doctoral candidate psychological status. J Am. Coll. Health. *67*, 299–307.

11. Vincent, B.J., Scholes, C., Staller, M.V., Wunderlich, Z., Estrada, J., Park, J., Bragdon, M.D.J., Lopez Rivera, F., Biette, K.M., and DePace, A.H. (2015). Yearly planning meetings: individualized development plans Aren't just more paperwork. Mol. Cell *58*, 718–721.

12. Maestre, F.T. (2019). Ten simple rules towards healthier research labs. PLoS Comput. Biol. *15*, e1006914.

13. Van Noorden, R. (2018). Some hard numbers on science's leadership problems. Nature *557*, 294–296.

14. Marshall, A., Pack, A.D., Owusu, S.A., Hultman, R., Drake, D., Rutaganira, F.U.N., Namwanje, M., Evans, C.S., Garza-Lopez, E., Lewis, S.C., et al. (2021). Responding and navigating racialized microaggressions in STEM. Pathog. Dis. *79*, ftab027.