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The Minority Scientists' Experience: Challenging and Overcoming Barriers to Enhancing Diversity and Career Advancement

Tonya J. Webb,* Mireia Guerau-de-Arellano,[†] Harlan P. Jones,[‡] Cherié L. Butts,[§] Luis Sanchez-Perez,[¶] and Luis J. Montaner^{||}

Minority groups face barriers in accessing quality health care, professional advancement, and representation in immunology research efforts as a result of institutional racism that if unaddressed can perpetuate a lack of diversity. In 2021, the AAI Minority Affairs Committee convened a cross section of academic and industry scientists from underrepresented groups at various stages of their professions to discuss how best to address the toll racism takes on study design and scientific careers. Panelists drew directly from their own experiences as scientists to share perspectives and strategies for countering a lack of representation in clinical research, responding to microaggressions, navigating academic advancement, and providing effective mentorship. The session reinforced the need for minority scientists to take an active role in advocating for diversity, engaging mentors, and taking responsibility to face rather than avoid institutional obstacles. Overall, increased dialogue and institutional awareness of the experience of scientists from underrepresented groups in research remain the best tools to ensure a health equity mindset and advancement of their careers. *The Journal of Immunology*, 2022, 208: 197–202.

Today's urgent national attention on race and racism challenges institutions and individuals, including scientists, to contribute their voices and actions to ending the toll racism takes on society and science careers. In this important and timely discussion, panelists drew from their experiences and shared their perspectives on strategies for dealing with barriers to diversity, equity, and inclusion that persist in society and science. The session, open to all meeting attendees, sought to provoke dialogue on the part of all participants about the

individual and institutional actions—and inaction—that perpetuate barriers to career advancement.

Promoting minority self-efficacy and persistence in research careers by engaging in a community of practice

Presented by Harlan P. Jones, M.S., Ph.D., Associate Professor. Ethnic Heritage: African American

To understand how to engage and promote diversity and inclusion, there are four key terms—efficacy, persistence, community, and practice—that must be defined. Efficacy is defined as the power to produce change. Persistence is the action or fact of perseverance. Community is a unified body of individuals, for example, the people with common interests living in an area. Finally, practice is defined as how we carry out or apply a certain issue.

One may ask, “How do we improve the health of all through biomedical and behavioral science research?” Research focused on addressing social determinants of health include factors such as access to quality health care, economic stability, community and social contact, food quality and stability, neighborhood and physical environment, as well as education (1). Education is the most important factor because, as the United States becomes more diverse, the biomedical research workforce will increasingly require the broader participation of individuals who historically have been underrepresented in scientific research communities. Diversity has been described as a trigger for innovation. Therefore, diversity and innovation in the biomedical and behavioral science workforce will likely lead to an increase in health and promote a better lifestyle for all served. Thus, it is critical to identify the catalyst that drives a community and that leads to a certain practice within that community.

The United States is changing in terms of diversity in its racial and ethnic groups; therefore, it is important to assess the

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participation of all groups in the academic pipeline (2). It has been reported that within the educational pipeline, underrepresented minorities, in particular, African Americans and Hispanics, participate at lower rates than their nonminority counterparts in medicine and in the biomedical sciences (2). When one investigates the critical checkpoints or stop gaps that may deter underrepresented groups from reaching their full potential, one can start by assessing faculty demographics (3). For example, the data demonstrate that although there have been some improvements at specific transition points, representation of underrepresented populations has remained stagnant at the faculty level for nearly 12 y.

To determine the factors that contribute to the dearth of a diverse faculty pool, one must consider the factors that are important for success in biomedical research fields in academia (Fig. 1) (4). It is essential to conduct research, and funding is critical for advancement in academic research careers. However, as shown by Ginther et al. (5), Black scientists are less likely to receive funding compared with their Asian and White counterparts. These data suggest that there is a gap in Black applicants and perhaps other diverse populations, or that these individuals do not have the opportunity to pursue research funded by major sources, such as the National Institutes of Health (6). Further, a study by Taffe and Gilpin (7) reports on how the funding pipeline for underrepresented groups narrows over time. Therefore, although the general population is growing more diverse, there is a contraction or stagnation of the diversity of individuals who pursue terminal degrees and independent biomedical research careers. Elements that influence diversity in the biomedical pipeline include mentorship, institutional support, messaging from funding sources, as well as conscious and/or unconscious factors, such as stigmas and biases (8). It has been shown that self-efficacy can directly affect persistence (7).

The question becomes, how does one gain self-efficacy in the biomedical field? Regardless of the field, there are some commonalities within a workforce community. For example, all professions, including biomedical research, involve an intense socialization process, in which individuals work together toward a common goal. Science requires socialization to exchange ideas and address difficult problems. Consequently, one must consider what is required to fit into this socialization. One must have the ability to speak and write scientifically. Notably, one must feel like they are able to become a part of such a socialized structure in the field of science. Thus, it is important to understand the mechanisms responsible for creating that feeling to combat feelings of “imposter syndrome” (9).

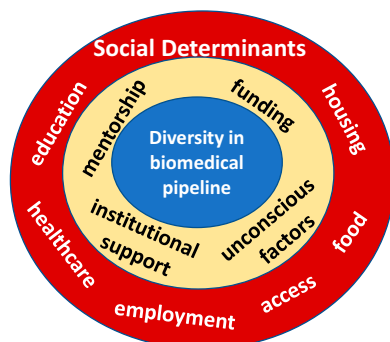


FIGURE 1. Factors that influence diversity in the biomedical pipeline.

In this case, it may appear that some individuals have more training or experience. Individuals from underrepresented groups may lack a sense of efficacy or confidence because of a shortage of role models or coaches (10).

How does one overcome these issues to successfully become a part of the scientific community? One must understand the norms and expectations in the field. There are social expectations, perceptions, and unconscious biases that all play a role in shaping one’s perceptions and image. In these communities of practice, underrepresented groups may not be aware of these societal expectations. Importantly, without this information, one may not understand fully how to create the efficacy and the persistence required to engage in such communities. The lack of engagement by underrepresented groups may have a broader impact by reducing the rate of greatly needed novel discoveries.

How do we change this outcome? Think about the implications of a community of practice and open up to new ways of thought. To increase diversity, we should think about how we include new members within the community. In addition, we need to gain key insider knowledge around what it means to be an underrepresented minority and the challenges that they face. Moreover, we need to expand the community by the inclusion of diverse groups to develop a shift from teaching to learning and modeling. When we think about inclusion and diversity, we need to think about those who can reach back and help one another.

The importance of fostering a health equity mindset across the biomedical research ecosystem

Presented by Cherié L. Butts, Ph.D., Medical Director. Ethnic Heritage: African American

We must first define key terms important in framing the conversation around a mindset: health equality, health equity, underrepresented, and underserved. Health equality means everyone receives the same services regardless of need. Health equity adjusts according to need to ensure the best health outcomes for all, which is similar to discussions on precision medicine. The goal is a clear path for each person to know how to access the care they need.

Two terms often used interchangeably are underserved and underrepresented. Underserved are individuals who are disadvantaged due to a lack of resources. This dearth could be because of lower socioeconomic status, lack of education, or living in rural communities far from accessible care. The term underrepresented is tied to identity (ethnicity, race, LGBTQ, immigrants, veterans, people with disabilities, etc.). It is important to note that not everyone who is underrepresented is underserved; therefore, use of the terms interchangeably is a disservice to each, because those who are underserved can be any race, ethnicity, or gender.

Underrepresented individuals are critical in the context of clinical research of new therapies because participants should reflect the array of individuals with disease. Those who conduct research will determine the epidemiology of a disease, identify the number of individuals of different ethnic, racial, or other relevant groups, and aim to include reflective percentages in the research accordingly. This will be the focus of this discussion.

Representation in clinical research helps with elucidating the scientific basis for responses to therapies, in particular, safety and efficacy. Unfortunately, research often lacks participation from certain groups, especially Black/African American, Hispanic/LatinX, and other populations (11). In many instances,

these groups are also disproportionately impacted. This fact could be because of a higher incidence, prevalence, or development of more severe forms of disease (12). Although there are many reasons for a group being disproportionately affected, one we identified is delayed diagnosis. Given that it can take years to achieve a correct diagnosis (due to missed diagnoses or misdiagnoses), it is not surprising to see more severe forms of disease.

This observation raises two key points: it has been established that early diagnosis and prompt treatment lead to better health outcomes. Therefore, a delay in diagnosis is a major concern. Along the journey toward a correct diagnosis, the disease has likely changed. A simple lack of treatment leads to more severe disease, but a misdiagnosis results in the prescription of irrelevant treatment that may cause biochemical changes and can alter the disease state. Thus, it is important to consider addressing fundamental issues such as the time to diagnosis for those disproportionately impacted.

Inclusion of these individuals is important, not only when developing novel therapies but also when developing devices or diagnostics. Thorough evaluation of diagnostics, screening tools, and devices used as endpoints for clinical research is needed. Biases during development can lead to false-negative or false-positive results, and ultimately result in screening failures for individuals from underrepresented groups (13). Relevance of diagnostics is often overlooked because investigators are focused on research for the therapy, while the path leading to a proper diagnosis may be severely impeded by poorly designed screening tools that provide misinformation.

Although studies on health disparities highlight a lack of interest in clinical research participation, investigators should understand that eligibility may be limited by biases introduced with screening tools or diagnostics. Studies on health equity tend to concentrate on addressing systemic barriers to quality health care. Removal of gaps and barriers can improve health outcomes, provided there is a clear path to access care. Notably, a better experience with health care is inherently likely to increase enthusiasm for participating in clinical research. Overall, it is important to foster health equity across the health care ecosystem. Achieving this outcome will require a culture shift, as well as individuals who are intentional about policies and practices to ensure sustainability. Efforts to address this gap must be coordinated across organizations to ensure solutions are sustainable.

Furthermore, one must consider how each experiment contributes to the advancement of biomedical research—with special attention to applicability to specific populations, disease states, or other aspects. Health equity is not only about clinical research, nor is it limited to the biopharmaceutical industry. The majority of clinical research is conducted at academic medical centers. Government is a factor in the equation, given that studies are regulated by the U.S. Food and Drug Administration, and the National Institutes of Health also conducts clinical research. Therefore, the entire ecosystem is a stakeholder: academia, government, industry, hospitals, and health care systems are all involved. Thus, we should consider important questions in designing fundamental biology and animal model experiments: What aspect of the human condition does it address? What does it represent? Are there risk factors beyond race and ethnicity, such as gender, age, and geography? Another factor to consider, particularly with infections, is the sequence

of life events. There may be individuals who experienced viral infections at a young age, which impacts susceptibility to infections or inflammatory conditions when older. This history should be a consideration across the entire spectrum of biomedical research and represents a call to action for all scientists to be intentional about experimental design.

We must also consider such factors when reviewing datasets and assessing how generalizable results are. Never assume or extrapolate based on a faulty premise. The potential for fallacy has greatest risk with the increasing reliance on machine learning and related measures that predict outcomes based on limited information. Consider the implications of limited datasets very carefully when conducting research, analyzing data, and drawing conclusions from publications. We will achieve health equity only by being honest about the data and what it can tell us. If we acknowledge gaps in data, it will enable identification of what remains to be learned. As a result, when developing new treatments, screening tools, diagnostics, and clinical measurement tools, we will have a full understanding of what is appropriate based on any patient profile.

Be a mentor, be present, and be a leader

Presented by Luis Sanchez-Perez, Ph.D., Associate Director of Preclinical Translation. Ethnic Heritage: Hispanic

The focus of the session was to discuss how to be a leader by promoting diversity and career development in academia and industry. First, one needs to identify a mentor with the appropriate approach to promote trainee growth. Mentorship is defined as the influence, guidance, or direction provided by a mentor, who is a special and experienced person in a company or institute.

A mentor not only influences one professionally but also personally. We are all familiar with growing as a professional. It has been discussed throughout one's career development. However, it is important to find a mentor who allows one to grow personally and promotes discussions that are challenging and productive. To advance an individual's needs, several mentors are often needed to focus and promote career development and personal growth (Fig. 2).



FIGURE 2. Tenets of being an effective mentor.

Mentors that focus and promote scientific growth are critical and can be called professional mentors. These mentors influence the type of scientist one will become (14). They teach critical thinking, grant writing, and experimental design. In addition, they provide advice about coursework and workshop participation.

Another area of mentorship is one involving emotional intelligence and the personal aspects of growth. These are the mentors who will influence you to become the leader that you want to be. These mentors could be peers, family members, or people within the scientific community, with whom you will meet throughout your experiences and will drive you to become a leader who will engage and generate change. How does one find these mentors and grow from experiences? One must be present, which involves three elements: participate, engage, and manifest. These are the qualities that we all must master to grow from experiences.

To be a leader who commands authority, we must be good at listening. We need to be able to take things to completion, grow and nurture colleagues, and generate change. The best leaders care for the growth of others, and they are committed to the growth of the collective. These priorities allow for embracing diversity and change, and welcoming those with different views. Building a community is another element of being a leader. One needs to be aware of individuals' actions, as well as gain an understanding of different personalities.

In summary, a leader has empathy, stewardship, and the ability to listen. These qualities help one build communities and are natural in the process of inclusion and change. To be an effective mentor and leader, one needs to be anchored on values, which stabilize the entire process because values are not malleable. Engage in activities, discussions, and training workshops that will allow you to become who you want to be.

How to be an ally in front of microaggressions

Presented by Mireia Guerau-de-Arellano, Pharm.D., Ph.D., Associate Professor with Tenure. Ethnic Heritage: Hispanic, Catalan.

One of the pivotal elements that called me to research is the diversity of the environment. Research brings together people from different countries, colors, and backgrounds, and we are all working together with curiosity to solve problems. Despite this diversity, certain groups may have very distinct experiences in the research community. Low retention rates and scarcity of leadership positions for women and people of color support this concept.

To understand why certain groups experience an environment differently, we need to define the concept of privilege. Privilege occurs when one group has something of value that is denied to others simply because of the group to which they belong. For instance, when confronted with a challenging situation, such as achieving promotion and tenure, the majority may feel that everyone has to go through similar hurdles to reach the end goal. However, someone lacking certain privileges may have many additional dangers and hurdles to which the privileged group is blind. Microaggressions are one of the elements that contribute to making the route of the nonprivileged person much harder (15).

Microaggressions are those everyday slights, indignities, put-downs, and insults that people of color, women, LGBTQ, or marginalized individuals experience during their daily inter-

actions. Microaggressions may be based on race, class, nationality, citizenship status, language, sexual orientation, religion, physical ability, or age, among others.

I was curious about microaggressions in the research environment and gathered real-life microaggressions that researchers experienced at the national and international level. Women shared microaggressions that implied sexual objectivization, research/motherhood incompatibility, and perceived research incompetence. In one situation, a woman who climbed onto a table to fix a tilted projector was told by a male colleague, "I guess we should throw some quarters on the table," implying that women are sexual objects. In another situation, a female postdoctoral scientist discussing how tired she was because her baby was fussy all night was told by a male researcher, "Why do you do this [research]? Just quit and have another baby." This statement implies that women must choose between a career in science and motherhood.

Black, Indigenous, and people of color often experience microaggressions that imply not belonging, "otherness," or not being worthy. Similarly, a faculty member stating to a Black faculty member, "You're so lucky to be Black because of all the diversity jobs," implies that the hire of Black faculty is not based on merit or research contributions and is therefore undeserved. It is also important to note that, although possibly well intentioned, "I don't see color" statements invalidate the hardships that Black, Indigenous, and people of color go through and miss the beauty in appreciating differences.

Citizenship, language, and religion microaggressions are also common. As one example, Asian postdocs who are extremely productive and have published in the top impact journals for a laboratory have been repeatedly told that they should not aspire to a faculty position in the United States, implying that Asian researchers are great for bench research but cannot succeed as independent scientists. A common microaggression about religion is the comment, "Really, it's ridiculous that anyone believes in God. You can't be a real scientist if you believe in God," implying that religious people cannot be scientists.

There are numerous examples, but the real question is, where do these microaggressions come from? Microaggressions happen casually, frequently, and often without any harm intended, and it is believed that they originate from our implicit biases. These biases are implicit associations we make for certain groups based on our cultural and societal experiences, exposure to media, things heard at home, etc. Implicit biases do not make us bad or good, they are just the outcome of an evolutionary process by which we associate many attributes based on one single attribute. Although this bias can help one make quick decisions, making inferences in the context of diversity, equity, and inclusion can deter the advancement of people who in the past did not have those advantages. This assumption can cause one to put people in a box and, perhaps, not see the full potential of an individual. To mitigate such implicit biases, it is important that we educate ourselves. Project Implicit (<https://implicit.harvard.edu/implicit/takeatest.html>) provides a free and easy way to test our implicit associations toward race, gender, LGBTQ, and more.

Microaggressions may seem innocuous, but they actually take a real psychological and physical toll on the recipient. Microaggressions lead to anger, depression, and physical health problems, and reduce productivity and problem-solving abilities. All of these impacts are important to consider because

microaggressions will make our academic, learning, or work environment isolating and hostile, and thus deter us from our goal of solving pressing human health problems.

So how can we respond to microaggressions? The most typical reaction to a microaggression is to freeze. Often, we do not know what to say or what to do. Therefore, one way to combat microaggressions is to have one or multiple strategies to analyze the situation and provide a favorable outcome. One option is to apply the principles of nonviolent communication, which use a four-step process in which you (1) state an observation without values associated with it, (2) determine how you feel about it, (3) assess your needs or values, and (4) make a very specific request (Fig. 3). In the example of the scientist who climbed onto the table and coins were mentioned, one response could be: (1) When I hear that you are going to throw coins on the table at me, (2) I feel that I am being treated as a sexual object. (3) I need to be respected as a woman, as a professional, and as a scientist. (4) Would you be willing to apologize in front of the group, as well as take steps toward making this a more inclusive environment? In this example, the person who was the target of microaggression is the respondent. However, other people can and should respond, as silence is equivalent to complicity to the microaggression. In addition, recipients who lack privilege may not be in a position to respond. This position could be because they received the microaggression from their current mentor or from a faculty member who will vote on their tenure. All people who observe a microaggression, and particularly those who hold some privilege, can serve as an ally. Allyship is an ongoing process where we advocate, support, and use our own voices for people whose voices are not being heard. Allies play a critical role in creating inclusive and respectful workplace cultures.

If we are ready to go further, we can proactively resist microaggressions by creating inclusive and positive environments where appreciating humanity and uniqueness drives our day-to-day interactions. Being aware of our implicit biases allows us to make more conscious, equitable, and inclusive decisions during hiring and promotion. We can use empathy and humanity as guiding principles to view each individual as a unique human being who deserves respect. To move toward this goal, we

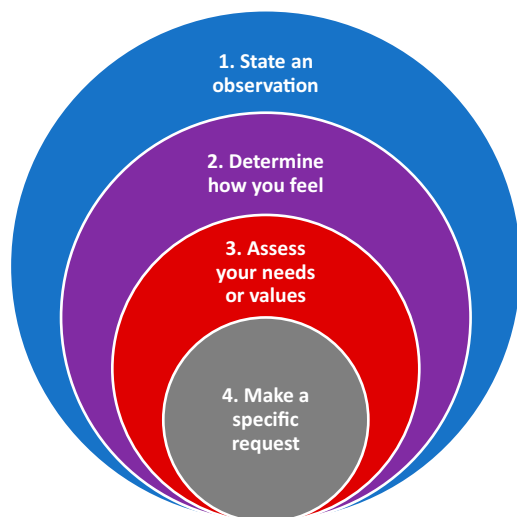


FIGURE 3. Applying the principles of nonviolent communication to address microaggressions.

make a call to create groups devoted to allyship within our research work environments.

Strategies to address the minority scientist experience

Presented by Luis J. Montaner, D.V.M., M.Sc., D.Phil., Vice President, Scientific Operations, Kean Family Endowed Chair Professor. Ethnic Heritage: Hispanic, Puerto Rican.

Luis J. Montaner, D.V.M., M.Sc., D.Phil. (Wistar Institute) shared insights from his 25-y career as a minority scientist and mentor to minority students and faculty. He stressed that “minority status” often requires navigating systems resistant to change and dealing with others’ preconceived ideas, assumptions, microaggressions, and unequal access to resources and environments. Both on the mainland United States and in Puerto Rico, the minority experience is still mired in systematic and institutional racism, which we all need to acknowledge and find strategies to address. Dr. Montaner’s advice to today’s minority scientists focused on four main strategies.

First, accept and embrace the fact that you will be viewed in part through your minority status. Wear this identity with pride and do not shy away from sharing the fact that you are the product of people who had the vision to invest in you and the hope of a future where others will follow in your footsteps. When you learn that others may gossip that your minority status is the reason you were selected for a specific initiative or program, remember that it is not by accident that you are underrepresented in the scientific workforce and that our society wants and needs to invest in you. It is not just about you. It is about ensuring your success so that you will inspire others to enter and stay in the scientific pipeline. To illustrate this point, Dr. Montaner gave the example of when he first began at Wistar as an Assistant Professor, Dr. Giorgio Trinchieri, who recruited him, offered to support him on a minority supplement to one of his R01s. He recalled other faculty saying that he should not apply, because these supplements were meant for starting scientists with fewer resources. They equated need by minority scientists to be restricted to “other environments” and to graduates from lower-ranked schools than Oxford University, where he obtained his doctorate. However, Dr. Montaner credits the support he received through minority programs as what allowed him to compete for independent grants successfully, and he encouraged minority scientists to not shy away from seeking out and taking advantage of every opportunity to move forward.

Second, be present and look to make opportunities on your own. This statement means showing up to local networking events, mixers, abstract sessions, etc. It is often in the most unexpected of interactions or places that your next collaboration or job opportunity may emerge. By showing up and being present, you are creating opportunities to advance your path as opposed to relying on others to do so for you. Creating opportunities on your own is key to success. Examples include making connections with established programs in your network and exploring how you can align your research with existing strengths in your institution. However, beware of giving your attention to naysayers, as they are out there, and often project their own bias when giving advice on what they think you can and cannot do. When this happens, it is important to ask yourself: Should I absorb or ignore this advice? Creating your own opportunities means you need to expect and manage these

situations without letting them set you back. Be very selective as to whom you listen, and when in doubt, get second and third opinions. Related to being aware of what feedback to internalize, minority scientists need to learn to reject any thoughts of impostor syndrome. Acknowledge that you belong and draw strength from the many people who have and will invest in your career. In summary, you need to have the confidence to move forward. Do not shy away from showing up, speaking out, or making your presence known because that is how opportunities emerge.

Third, seek out mentors. One must identify mentors who want to work with you and help you succeed. However, to find such mentors, you must seek them out. Waiting to be assigned a mentor and passively waiting to hear from them what to do is the antithesis of being present or making this mentorship opportunity work. Dr. Montaner further stated that seeking out mentors is a career-long process. He acknowledged that as a chaired professor, he still seeks out mentors, because science never stops from evolving, and new career directions often stress the need to secure support from people who may help you advance.

How to find a mentor? Seek out and introduce yourself in a meeting. Make an appointment with target faculty in the same or a nearby institution who are working on a similar topic. Create your own networking opportunities by organizing a workshop, hosting a speaker, or joining peer societies with professional advancement programs. Make certain that mentors know you are working to keep your interactions productive by providing clear short- and long-term plans on which to focus input. Carefully tracking progress for short-term and long-term goals is key to sustaining mentorship relationships.

Finally, fully realize your power to attract positive attention. Dr. Montaner noted that minority students, scientists, and junior faculty often do not realize that their position gives them access to invite senior scientists to come see their poster at a meeting, introduce themselves in networking events, or seek appointments. For example, if a senior faculty member is speaking at a conference and staying after the session to take questions, standing among peers at coffee breaks, or attending a poster session, these actions mean they are receptive to being approached. Indeed, Dr. Montaner stated that, as a student, he would often preidentify key senior faculty members to target at conferences and would approach them at abstract or coffee

sessions. Minority students or young faculty should exercise their free license to promote themselves at networking events.

Dr. Montaner closed by acknowledging that for him, the minority scientist experience has been more empowering than limiting by adapting these strategies throughout his career.

The session was moderated by Tonya J. Webb, Ph.D., Associate Professor with Tenure (African American) and Harlan P. Jones.

Disclosures

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