

Surviving as an underrepresented minority scientist in a majority environment

Erich D. Jarvis

Department of Neurobiology, Duke University Medical Center, Durham, NC 27710; Howard Hughes Medical Institute, Chevy Chase, MD 20815

ABSTRACT I believe the evidence will show that the science we conduct and discoveries we make are influenced by our cultural experience, whether they be positive, negative, or neutral. I grew up as a person of color in the United States of America, faced with challenges that many had as members of an underrepresented minority group. I write here about some of the lessons I have learned that have allowed me to survive as an underrepresented minority scientist in a majority environment.

THE DIRECT INFLUENCE OF E. E. JUST ON MY CAREER

I am honored to be the recipient of the 2015 Ernest Everett Just Award from the American Society for Cell Biology and to write this associated essay. Just had an impact on my scientific life well after his death in 1941. I was a beginning graduate student at the Rockefeller University in New York City at the end of the 1980s, struggling to get a grip on the drama that was unfolding in my life. I had graduated from Hunter College in New York City with a double major in biology and mathematics, published several papers from my undergraduate research, was accepted into top-tier graduate programs, and then my grandfather, who helped support me, died of a heart attack, his brothers died soon after, my homeless father was shot and killed, my first child was on the way, and although technically being a middle-class person of color with a house I inherited from my grandfather, I lived in a Bronx ghetto neighborhood where we often



Erich D. Jarvis

heard gunshots several nights a week. Most of those gunshots were not meant for target practice, including the one that killed my father. One of my mentors at Rockefeller at the time, Peter MacLeish, an African-American assistant professor in the lab of Nobel laureate Torsten Wiesel and professor next door at Weill Cornell Medical College, sat me down in his office to talk about my life. At the end of our conversation, MacLeish gave me his copy of a book published five years earlier (1983) titled *The Black Apollo of Science: The Life of Ernest Everett Just* by Kenneth R. Manning. MacLeish said, "I want you to read the book, and then come back and talk to me."

I read the book and identified with Just's experience. Like Just, my mother was single, raising multiple (four) children. I had been ill on and off at a young age (6–8 years old), intermittently taken out of school, and partly as a result was delayed in my education, being below grade level in reading and writing. One physician even told my mother that I could become mentally retarded due to a blow my father had made to my back. He did it in a state of anger for me going into his pants pockets and eating some of his drugs (which he had synthesized as a student of chemistry) and also for my brother and me throwing toys and clothes out the window in our Harlem apartment. Most importantly, Just was an African American who was struggling to survive as a scientist in a Caucasian majority environment (I say environment instead of world, because the majority of the world was and still is not Caucasian). Just had been considered for a faculty position at Rockefeller in the 1930s for his genius in cell

DOI:10.1091/mbc.E15-06-0451

Erich D. Jarvis is the 2015 recipient of the E. E. Just Award from the American Society for Cell Biology.

Address correspondence to: Erich D. Jarvis (jarvis@neuro.duke.edu)

© 2015 Jarvis. This article is distributed by The American Society for Cell Biology under license from the author(s). Two months after publication it is available to the public under an Attribution–Noncommercial–Share Alike 3.0 Unported Creative Commons License (<http://creativecommons.org/licenses/by-nc-sa/3.0>).

"ASCB®," "The American Society for Cell Biology®," and "Molecular Biology of the Cell®" are registered trademarks of The American Society for Cell Biology.

biology but was rejected in part due to a scientific dispute with a former mentor and collaborator, Jacques Loeb at Rockefeller, and in part due to his race. I came back to MacLeish, had that discussion with the resolve that if Just could make it through his hardships, so could I. And further, Just's hardships were orders of magnitude more difficult than mine, due in part to greater discrimination and lower expectations for him.

It was at that time I began to appreciate how much of a profound impact ethnicity, culture, and gender can have on an individual's career. Before then, I was surrounded by persons of diverse backgrounds, many of whom looked like me. However, now I was at a mostly Caucasian institution, clearly one of the world's best in biomedical science, faced with culture shock of wondering why did most of the students have a shared experience different from me? Although they had their struggles, why were mine different and, in many cases, tougher? In this essay, I discuss some of the answers to these questions and lessons learned that helped me survive as an underrepresented minority scientist, all of which I hope will be helpful for all scientists and all people as they navigate their careers.

THEY KILLED HIM BECAUSE OF THE COLOR OF HIS SKIN

I was born in New York City in 1965, at a high point of the Civil Rights movement, including the signing of the Voting Rights Act. My maternal grandparents and paternal great-grandparents were from North Carolina and Virginia, having moved north to New York either in the late 1800s or during the Great Depression of the 1930s, most being descendants of slaves. I remember the day when I was watching a black-and-white television at my maternal grandparents' house in Queens, New York, where we lived after my mother divorced in the early 1970s, about a news story of the anniversary of Martin Luther King Jr.'s death. Being between 6 and 7 years old and an inquisitive child, I asked my mother, "Why did they kill him?" She seemed to have a hard time explaining it to me, and finally came out with it was because the color of his skin, he was black, a Negro, and wanted to bring peace to all. I remember looking at my skin, feeling afraid, and wondering, "Are they going to kill me one day?" From that time onward as a child, I remember wanting my skin to become white, my hair straighter, and my nose and lips thinner. My family was diverse, and I envied those who looked more European than me. I internalized a feeling of "less than." It now makes me wonder how young African-American children feel today, when they see on the news stories about young black men killed by police with the reason partly linked to ethnicity.

BEING TRAINED TO PERSEVERE IN THE FACE OF DAUNTING OBSTACLES

Following my father's conversion to a Japanese sect of Buddhism (Soka Gakkai), my mother converted as well and taught us (her children) its philosophies. Although her mother, a Baptist Christian, secretly told us kids that she thought it was the devil's religion, many of the views of Buddhism made sense to me. I applied them to my life, including that I am responsible for my own destiny, must pursue my most ambitious dreams, dream the impossible, and that, no matter what, all obstacles can be overcome as long as you work at it.

Although I stopped practicing the faith-based part of the religion in my teens, I still followed the philosophical views, which I found I needed to get through the "less than" internalized feelings. I first applied them to pursue a career in dancing. I was accepted into the High School of Performing Arts, was on scholarships at the Joffrey Ballet and Alvin Ailey Dance schools in New York, and performed with the Westchester Ballet Company. But at the end my senior year,

I was at a junction between choosing opportunities for a career in dance or something else I fell in love with, science. I chose science, following my mother's training of doing something that has a positive impact on society. I thought I could accomplish that better as a scientist than as a dancer. So again, I applied my training in Buddhism and now in the arts, into the sciences as an undergraduate student at Hunter College of the City University of New York. I found that the transition between dance and science was natural, as both required discipline, creativity, hard work, and, often, acceptance of failure before something works.

Hunter was and still is an ethnically diverse school, although I did not realize that at the time, because it looked like the rest of New York City's melting pot. There I was taken under the wing of Rivka Rudner, a molecular microbiologist studying ribosomal genes, which synthesize proteins. I invested many hours in the lab, sometimes staying overnight to finish my experiments, and pursued projects that eventually led me to publish six research papers with her, including two as first author and one as senior corresponding author (three of which were published by the time I graduated). We developed molecular tools to map the chromosomal organization of the protein synthesis genes in bacteria and determined how their organization affected their genome evolution and function. Making such discoveries, working with collaborators, and publishing these papers gave me the confidence that I could be a scientist.

At this juncture, I was considering the choices of applying to medical school, graduate school, or both to pursue a MD/PhD. This was a struggle many from economically challenged backgrounds face, where there is a drive in the family to have my "son/daughter the doctor." Although I prepared for and performed well on entrance exams for both kinds of degrees, I decided to focus on the basic science PhD route because this was where my passion was, and it felt more closely connected to my artistic side.

THE ONLY WAY I FOUND I WAS ABLE TO OVERCOME THE FEELING OF LESS THAN WAS BY BEING SUCCESSFUL

I applied to and was accepted into many of the top graduate programs in the country in addition to Rockefeller, including MIT, Harvard, Yale, Princeton, Johns Hopkins, Berkeley, and the University of California, San Francisco. During my interviews, some of the faculty members I interviewed with cautiously informed me that they were surprised that an African-American kid from Harlem had achieved what I did and were wondering how I did it. I did not have an answer and was wondering, "What did I do?" I never thought that I could not. More ethnically sensitive questions and statements came from students. At one place, in a group conversation, a student told me that I should be careful of going to a specific neighborhood, because there are "blacks and Puerto Ricans there and it is dangerous." I stared back at the person speechless, with a half-smile, wondering to whom does he think he is talking? That is the kind of neighborhood I come from; my wife at the time was Puerto Rican. Were she and I dangerous? Another place had two of their students, one African American and the other Caucasian, contact me on separate occasions to say that if I did not accept their offer for graduate school, there would be no more African-American students in their PhD program. I wondered whether I needed their program, or they needed me. Why was this happening?

I accepted the offer to join the graduate student program at Rockefeller but found a different experience from my previous schools. At Hunter, as at many institutions with a diverse population, there was a hold-your-hand support system practiced by the faculty. At Rockefeller, it was sink or swim, as it is at many Research 1 institutions. I was swimming and sinking in my first four years as a graduate

student. I had never heard of parents being able to purchase a car for their children after they graduate college; instead, I was helping my parents keep out of financial troubles. There was an unspoken feeling among a very small number of students that I was there to fill a quota, and although tiny, it was enough to contribute to me feeling that way too. At the same time, my father was killed, elders in my family were dying of natural but still more long-term preventable causes, I was taking care of a family, I had failed my first prelim examination (which I passed the second time), and I was struggling to get my experiments to work. I began to again internalize feelings of less than. I had felt that I did not belong in this sink-or-swim world, despite that fact that I had by then seven publications with my undergraduate advisor. But I did not give up. I worked hard, trying different ways of overcoming these obstacles, and in my last two years of graduate school, my earlier life experience training kicked in. Once the small amount of negative influence around me moved on, I found my groove and quickly progressed in my research, publishing three papers from my graduate research (including one as first author).

I decided to break the rules and stay on as a postdoctoral fellow in the same lab where I did my PhD, that of Fernando Nottebohm at Rockefeller, because I felt I was just beginning to really swim. My litmus test for making decisions was asking: "What are people going to remember me for after I die?" Whether I followed standard rules or made a significant impact in science? From the three years of my postdoctoral research, I published three papers on the molecular biology of vocal learning, eventually 10 altogether, in high-impact journals, including *Nature*. I had finally overcome the feeling of less than. I found that the only way I could overcome the feeling of less than was to be successful in what I set out to do to.

THE COLOR OF MY SKIN AND MY GENDER IS EITHER A DISADVANTAGE OR AN ADVANTAGE, BUT RARELY NEUTRAL

My postdoctoral years were the mid-1990s, a period during which funding in science had been looking grim. Very good people were applying for academic jobs and not getting them. Politicians were being blamed for decreasing funding to science and making it harder for us to make new discoveries and contribute to society. I made a vow to myself that I was going to figure out a way to succeed and survive by doing the best science I could do. I worked very hard, sometimes too hard. I applied for a small number of professorship research positions and received offers from all.

Once again, similar to my experience as a graduate student, faculty members at these institutions appeared to be surprised that a person of color, an African American, born in the United States, had accomplished what he did. Suddenly, was I heavily recruited, like an up-and-coming basketball star. I felt that the color of my skin and the drive to increase diversity among the academic ranks combined with my scientific successes suddenly made me a commodity. This was the first time in my life, at 32, when I felt the color of my skin was an advantage. Then I was told about a Duke University tuition benefit program in which, if I were a faculty member for more than five years, Duke University would pay for 100% of up to two of my children's tuition at Duke or up to 75% of Duke's rate at any other university in the world. Finding this out floored me. It washed away generations of oppression for me in an instant. African Americans were not allowed to be students at Duke before the early 1960s, soon before I was born, and still had a hard time being accepted. My parents and grandparents would not have been able to get into Duke, regardless of their talents. And now, my children (I had two) would later be able to get a high-quality, expensive college tuition

paid for, anywhere in the world. It hit me that this was an affirmative action program for Caucasians that had been around for generations. I cried, and accepted Duke's offer. I was now in one of the world's leading neuroscience programs with the resources I needed to accomplish the science I wanted to achieve and make sure my children had an opportunity for a high-quality education.

From this experience, I learned that the color of my skin or my gender or that of anyone else is either an advantage or a disadvantage, but rarely neutral. For most of my life it had been a disadvantage, but for once and at that moment, it was an advantage. I wanted it to be neutral, but this was beyond my immediate control. It also made me realize that the affirmative action programs I had benefited from, such as the National Institute of General Medical Sciences Minority Biomedical Research and Minority Access to Research Careers programs as an undergraduate and graduate student were affirmative action programs that offset a disadvantage that many underrepresented students and others do not realize that they have.

I HAVE TWO JOBS: BE THE BEST SCIENTIST I CAN BE AND HELP CURE SOCIETY'S RACIAL DISEASE

After I arrived at Duke in 1998, I was inducted into many initiatives to help diversify the scientific workforce, including the push for women in science. I wondered, as a man, what did I know about women? But there was an assumption that a person of an underrepresented minority background knew more of what was needed for any minority to succeed, including women in science, relative to white males. There may be some truth to this, but certainly not an absolute truth. I began to realize that as a young professor at Duke University, and within the scientific community generally, I was being unintentionally asked to take on two jobs: 1) be the best scientist I could be, as expected of everyone else; and 2) help cure society's racial disease, unlike everyone else. After two years, I made the conscious decision that I could not do both jobs well at the same time. I decided on job 1, to pursue being the best scientist I could be, and only taking on those few tasks for job 2 in which I felt I could make the biggest impact.

However, I felt that job 1 could indirectly help cure society's disease. There were many people before me who had taken on activist roles in bringing down obstacles and opening up opportunities for others like me to become scientists. I felt what we needed more of now was underrepresented minority scientists leading by example, so that others would not say they are there because of a quota, that they are less than, and that they have an advantage because of the color of their skin. This is what I set out to do as a scientist and professor at Duke University. To do so, I had to learn how to say *no* to many requests, balanced with *yes* for those that had the biggest impacts. Before doing so, I would often consult with others to get a second opinion. I also would also encourage others who were not underrepresented minorities to help with job 2, as I felt the cure to this disease required participation and education of everyone and not just underrepresented minorities.

OVERCOMING CULTURE SHOCK AND LEARNING HOW TO REACH OUT

When I first arrived at Duke, I had a similar but more stark experience than at Rockefeller, where I felt I was in the middle of Europe in terms of ethnicity. This was despite the fact that, relative to the rest of the country, there was a high proportion of African Americans in the surrounding population. I recall interviewing a female Hispanic student our department brought in as a candidate for graduate school; during the interview, she opened a booklet that included the Duke student demographics. African Americans were in the low

single digits, and Hispanics even lower. She actually cried in my office, wondering whether she had any chance of getting in, and if she did, would she really be accepted culturally? Pertaining to faculty, years later in 2006, the dean called a meeting of African-American faculty members of the medical school to discuss our views of the now infamous Duke lacrosse case, in which an African-American female stripper accused team members of rape (later turned out to be false). At the meeting, I learned that I was only the second basic science African-American faculty member in the medical school, out of more than 200, in more than 28 years. The hiring of clinical faculty fared better in absolute numbers, although not proportionally, as there were more than 1800 clinical faculty members. Basically, some others and I, including students, were feeling culture shock.

The ethnic diversity at Duke and some other Research 1 schools has changed quite a bit, particularly, at the student level, since I became a professor in the late 1990s. The change was ushered in by purposeful efforts made by leadership, including the Duke President's Council on Black Affairs chaired by President Nannerl Keohane, the Dean's Council on Diversity led by Nancy Andrews, admissions offices of the medical schools and graduate schools led by Brenda Armstrong and Jacklynn Looney, respectively, and now the Office of Biomedical Graduate Diversity started by Dona Chickarashi; this last office is now led by one of the students I mentored at Duke and the second African-American student to graduate from our neurobiology department, Sherilynn Black. What I have learned from these experiences about surviving as an underrepresented minority in the sciences is that many such students do not take proactive steps to reach out, seek help, and get answers to concerns they have. They wait for someone to come to them. But they must learn how to reach out in order to survive. For institutions, creating a culture of inclusion and a space for these students to air their thoughts is a great help.

ACCEPT ALL APPROACHES AND BY ANY MEANS NECESSARY

I have seen from firsthand experience how cultural background plays a strong role in the way we go about conducting our science. Growing up as a child in the 1960s and 1970s, my perception was that you were either a "Martin Luther King family" or a "Malcolm X family." The Martin Luther King family adopted the belief of loving and accepting everyone to bring about world peace; the Malcolm X family adopted the belief of achieving equality by any means necessary. We were a Martin Luther King family. In this regard, in my laboratory, I brought together people of diverse ethnicities and cultures with diverse ways of thinking, and found that this diversity led to more rapid advances in our science relative to a mono-ethnic or mono-gender group. But I have stolen from Malcolm X's thinking as well and have taken the approach to addressing scientific questions by any means necessary, as long as it does not harm anyone. In this manner, I have incorporated molecular biology, anatomy, physiology, evolutionary biology, genetics, and computational biology into our research program to address questions on the brain mechanisms and evolution of vocal learning and spoken language. An analogy is the marriage between physics and biology that led to the discovery of the structure and genetic code of DNA. If I had not been trained to think in this way as a child from a diverse background, it might have been harder for me to learn how to do so as an adult.

ACCEPTING ALL OF ME

Growing up in the United States, we are often trained to think in a black-and-white world. Further, black was considered bad, white good, and any drop of blackness meant that you were considered

black. Although the definition of mulatto existed, it or admixture was not a recognizable category in the check box of many forms. You had to pick and choose, which became the title of a popular song by one my cousins, a Native American singer, Pura-Fe. My perception of growing up and how I was treated was mainly (~80%) African, with a mixture of (~10% each) Native American and European. However, my family had debates about exactly what we were. I decided at a young age to investigate the discrepancies, which I still continue to do to this day. In contrast to perception, based on the oral history of my elders and many others (and even in contrast to some of their own perceptions), my ancestors have been admixed over and over again between these three ethnic groups for several hundred years. My oral history calculations are 48% African, 37% European, and 14% Native American, each of multiple ethnic groups from these ancestral populations. But my genetic ancestry from ancestry.com, 23andMe, and whole-genome sequencing shows 49% African, 49% European, and less than 1% Native American. There are various reasons for the oral and genetic discrepancies, including that either the oral tradition is wrong or there is not sufficient Native American DNA diversity in the databases. One thing that genetics taught me is that my African and European ancestries are heavily admixed from seven different ethnic groups each, and this is not because they were already admixed before arrival in the Americas—most of the admixtures occurred after arrival in the Americas.

The biggest lesson I learned from taking a cultural and scientific perspective in trying to figure out who I am, was that I had to learn to accept all of me in order to help propel me along my scientific journey more successfully. Neither I nor anyone else is really living in a black-and-white world. Our current president, Barack Obama, is considered the first "African-American" president of the United States. But like me, he is as much European as he is African. So what happened to the European part in the minds of Americans? It is buried, not thought about, because we still live with this social disease of racism. If you can transcend that thought, accept all of who you are, all of who we are, then I think you have a much greater ability to communicate and interact with the broader world and advance in your science or whatever path in life you choose.

In closing, the challenges that Ernest Everett Just faced externally and internally and the approach he took to try to overcome them has influenced how I handled trying to overcome the challenges I faced. Some of my challenges were easier, and some different, due in part to others making it more possible for me to succeed than was possible in Just's time. I suspect and hope that my brief story here will help the next generation to overcome their challenges, which will invariably have overlap and differences. One such difference I predict is that the countries and thus the environments in which science is highly valued will have less of a black-and-white view of the world, in part due to a greater understanding of human and thus species genetics, and due in part to greater numbers of admixed peoples according to current racial categories. I hope that my story can be of comparable help to underrepresented minorities and the majority. Finally, I note that not all formulas work for all people. My PhD advisor, Fernando Nottebohm, said he would tell his son to "understand 100% of what I say, but only believe in 50% of it." This meant to me that not all formulas work for all, but there is always room for improvement and change, and sometimes we get things wrong, need to recognize when we do, correct them, and then move on.

For further reading on my life story in the sciences written by others see publications by Rimer (1989), Dreifus (2003), Adler (2006), Blakeslee (2005), NOVA (2005), and Berstein (2015a, 2015b). For

reading about some of the past and recent scientific discoveries I have contributed to that I feel are broadly important see publications by Jarvis (2004), Jarvis *et al.* (2005, 2014), Petkov and Jarvis (2012), Pfenning *et al.* (2014), Whitney *et al.* (2014), and Zhang *et al.* (2014a,b).

ACKNOWLEDGMENTS

I acknowledge the support of my mother, father, stepfather, grandparents, other family members, and friends, as well as my undergraduate advisor Rivka Rudner and graduate advisor Fernando Nottebohm, who helped me get to where I am now. I also acknowledge the opportunities and funding provided to me by the National Institutes of Health (particularly the National Institute of General Medical Sciences), the National Science Foundation, the Howard Hughes Medical Institute, the Society for Neuroscience Scholars Program, Hunter College, The Rockefeller University, Duke University, and many others, without which it would not have been possible for me to progress as a scientist.

REFERENCES

- Adler J (2006). Song and dance man. *Smithsonian* November. www.smithsonianmag.com/making-a-difference/song-and-dance-man-135440722.
- Berstein R (2015a). Following the birdsong of science. *Science Careers* January 19. http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2015_01_19/caredit.a1500015.
- Berstein R (2015b). Science by any means necessary. *Science* 347, 686. www.sciencemag.org/content/347/6222/686.short.
- Blakeslee S (2005). Minds of their own: birds gain respect. *New York Times* February 1. www.nytimes.com/2005/02/01/science/minds-of-their-own-birds-gain-respect.html.
- Dreifus C (2003). A conversation with: Erich Jarvis: a biologist that explores the minds of birds that learn to sing. *New York Times*, January 7. www.nytimes.com/2003/01/07/science/conversation-with-erich-jarvis-biologist-explores-minds-birds-that-learn-sing.html.
- Jarvis ED (2004). Learned birdsong and the neurobiology of human language. *Ann NY Acad Sci* 1016, 746–777.
- Jarvis ED, Güntürkün O, Bruce L, Csillag A, Karten H, Kuenzel W, Medina L, Paxinos G, Perkel DJ, Shimizu T, *et al.* (2005). Avian brains and a new understanding of vertebrate brain evolution. *Nat Rev Neurosci* 6, 151–159.
- Jarvis ED, Mirarab S, Aberer AJ, Li B, Houde P, Li C, Ho SYW, Faircloth BC, Nabholz B, Howard JT, *et al.* (2014). Whole genome analyses resolve the early branches to the Tree of Life of modern birds. *Science* 346, 1320–1331.
- Manning KR (1983). *The Black Apollo of Science: The Life of Ernest Everett Just*, New York: Oxford University Press.
- NOVA (2005). ScienceNOW profile of Jarvis. www.pbs.org/wgbh/nova/nature/erich-jarvis.html.
- Petkov CI, Jarvis ED (2012). Birds, primates, and spoken language origins: behavioral phenotypes and neurobiological substrates. *Front Evol Neurosci* 4, 121–24.
- Pfenning A, Hara E, Whitney O, Rivas MV, Wang R, Roulhac PL, Howard JT, Wirthlin M, Lovell PV, Ganapathy G, *et al.* (2014). Convergent transcriptional specializations in the brains of humans and song learning birds. *Science* 346, 1256846.
- Rimer S (1989). Random death claims a man who struggled to regain life. *New York Times* May 27. www.nytimes.com/1989/05/27/nyregion/random-death-claims-a-man-who-struggled-to-regain-life.html.
- Whitney O, Pfenning AR, Howard JT, Blatti CA, Liu F, Ward JM, Wang R, Audet JN, Kellis M, Mukherjee S, *et al.* (2014). Core and region enriched gene expression networks of behaviorally regulated genes and the singing genome. *Science* 346, 1256780.
- Zhang G, Jarvis ED, Gilbert MTP (2014a). A flock of genomes. *Science* 346, 1308.
- Zhang G, Li C, Li Q, Li B, Larkin DM, Lee C, Storz JF, Antunes A, Greenwold MJ, Meredith RW, *et al.* (2014b). Comparative genomics reveals insights into avian genome evolution and adaptation. *Science* 346, 1311–1320.