FEATURE ARTICLE

Why Biologists & Biology Teachers Are Uniquely Qualified to Discuss the Issue of Biological Race

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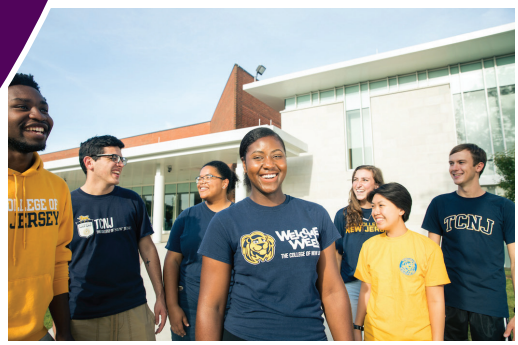

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Abstract

The damaging outcomes of racist ideologies continue to influence all aspects of society. This in spite of the fact that at their core these ideologies rely on a fundamentally false assumption: that biologically *there are different races among humans. The source of this fallacy is pseudoscience and historical prejudice, and yet even scientists and medical professionals continue to apply misconceptions about biological race when performing research or practicing medicine. Scientific educators are in a unique position to dismantle the central damaging assumption, and here we provide a straightforward approach that educators can employ for engaging in this conversation. It is organized around four questions that build sequentially and integrate the latest science with a history of the topic: How did the myth of biological subcategories of humans become ingrained as a scientific concept? How has scientists' approach to taxonomy changed since Linnaeus's first human classifications? What does biology now tell us about variation within the human species? Why is it critical to debunk this myth? We provide answers with which scientific educators can re-center the conversation around historical and scientific facts, while highlighting how misapplication of the evidence harms the integrity of science as a field.*

Key Words: *biological race; racism; antiracism; human evolution; pseudoscience; social construct.*

○ Introduction

We live in an age of scientific wonder, where human ingenuity has decoded the genome and unlocked potential cures for society's most devastating illnesses. And the urgency with which the scientific community has deployed its advances has been nothing short of astonishing. Witness the rapid production of mRNA technology to fight the COVID-19 pandemic and its variants. In a matter of months, the scientific community pulled off the equivalent of a moonshot and demonstrated the value of its expertise when brought to bear against a crisis. Yet, the wonder of science continues to fall decidedly short when it comes to addressing the fallacy that biologically there are different races of humans. This is so in spite of the fact that scientists are just as qualified to provide clarity on this topic with authority, insight, and purpose, and many in the scientific community are pressing to make their voices heard on the matter of race (Outram et al., 2018). In the absence of a consistent and comprehensive effort by science educators to explain the fallacy of biological race, individuals who lack the scientist's specialized knowledge and methods for research have taken over. These pseudoscientists are quick to provide nonscientific explanations for human difference that obscure what it means to do scientific work, undo nearly two centuries of advancements in the field, and sow divisions.

> *There are no traits whose different varieties can be used to define nonoverlapping, separate groups of humans.*

This trend of blurring the lines between biological fact and a social construction on matters of race is not new. There is a long history of conflating the myth of different biological races among humans with the complex reality of the social diversity in personal identities and cultures. The inability to dislodge this fallacy of distinct biological races from public discourse has permitted the myth to fester, take on the air of "scientific" legitimacy, and be coopted. A clear example of such scientific racism is the practice of White nationalist groups using genetic ancestry tests to generate narratives and interpretations that support their worldview (Panofsky & Donovan, 2019). A less overtly racist, yet equally problematic, example is the medical practice of "race norming" that leads to patients of different racial groups receiving different levels of care (Madhusoodanan, 2021). Thus, the myth of biological differences among racial groups goes beyond simply providing a sense of entitlement to the dominant group and weakening our ability to distinguish evidence-based fact from a social construction. Ultimately, it allows for the long-term entrenchment of racialized policies and practices that lack scientific evidence and have real-world consequences.

Addressing the persistent racist ideologies that have resulted from this misunderstanding is a shared responsibility of all citizens, and we do not claim to have a solution to the problem of racism in America. However, undoing the damage created by the tension between myth

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and reality, specifically in scientific thought, should be addressed by biology educators who can speak up as experts and set the record straight. This is not to say that the task of disentangling fact from fiction regarding biological race is straightforward, it is in fact daunting, if for no other reason than everyone carries an inherent sense of their own biology. Therefore, our goal in writing this essay is to provide a roadmap to biology educators for navigating this very contentious issue. We outline four questions and answers that educators can use to explain why scientists reject the concept of different ***biological*** races based on evidence, history, and scientific methodology.

○ How Did the Myth of Distinct Biological Races of Humans Become Ingrained in Early Scientific Thinking?

The origin of the concept that the human species can be divided into subcategories, or races, dates back several centuries. However, the idea was codified in the mid-18th century by the naturalist Carolus Linnaeus in his book ***Systema Naturae*** (Linnaeus, 1735). Linnaeus classified all living beings into one unifying hierarchical system. Within his system, Linnaeus grouped species into larger categories, or genera, based primarily on appearance and geography, and then assigned two names to all living beings (e.g., ***Homo sapiens*** for humans) based on their genus and species. His work set the stage for a naturalist's (or scientist's) way of looking at the biological world (Hannaford, 1996, pp. 203–205).

Other 18th-century thinkers—including Louis Leclerc, Comte de Buffon, and Johann Blumenbach—used Linnaeus's methodology to subdivide species into subcategories (Gossett, 1997, pp. 35–36). For example, humans were classified into distinct "varieties" based arbitrarily on a single physical trait—skin color, different shades of which were correlated with geography. Linnaeus originally contributed to this discussion with four skin-color classifications: White European, Reddish American, Tawny Asian, and Black African (Linnaeus, 1735). However, he later added physical attributes that spoke to behavior, character, and morality (Linnaeus, 1758). For example, he described White Europeans with positive traits like "muscular, wise, and governed by rites" while he depicted Black Africans negatively as "lazy, sly, sluggish, neglectful, and governed by caprice" (Hannaford, 1996, p. 204). With these descriptions, Linnaeus himself blurred the lines between scientific observation and subjective opinion.

In addition, Linnaeus fell victim to the implicit bias of his time, which relied on religion to explain nature as a "Great Chain of Being" that descended in a hierarchy from God. Thus, Linnaeus's system became ***the*** system of biological classification in part because it fit perfectly with what Europeans already believed about the world around them. Therefore, Linnaeus's view not only helped legitimize scientific racism, it also supported the ranking of human "varieties" into the preexisting hierarchical racialist structure that placed White Europeans at the top.

○ How Has Scientists' Approach to Taxonomy Changed Since Linnaeus's First Human Classifications?

In the mid-19th century, the religious framework that had driven scientific thought for millennia started to unravel. Naturalists contributed to this disentanglement by actively reversing the steps of scientific investigation. Rather than starting with a religious framework for the natural world and then fitting observations about their surroundings into that model, scientists used their (ideally) unbiased observations as a starting point and then developed models for the natural world based on those empirical observations. In biology, this paved the way for Charles Darwin (1859) and Alfred Russel Wallace (1858) to develop a new explanation for the origin of all species. Rather than starting as Linnaeus did, with what turns out to be the false assumption that species are fixed and unchangeable, they proposed what is now supported by over 150 years of scientific evidence, namely that species are constantly evolving. This constant change is what generates both the new variability seen in traits within a species (e.g., offspring are different from their parents), and ultimately—if there is enough time and there are enough differences—even new life forms. This leads naturally to their beautiful conclusion that all organisms are descended from common ancestors and continue to evolve as the planet itself evolves.

With this new realization, scientists began recategorizing organisms based on evolutionary relationships, in other words those that reflected common ancestry. In some cases, a trait used by Linnaeus did happen to reflect an evolutionary relationship; for example, he grouped animals that feed their young with milk as mammals, and, as it turns out, all mammals inherited this trait from a common ancestor. However, there were numerous examples where easily observed traits were misleading. For example, Linnaeus placed fungi in the plant kingdom since they also grew from soil. However, we now know that fungi are more closely related to animals than plants. In fact, in order to detect true relationships, scientists now rely on a host of fields, from morphology and geography to the fossil record, molecular biology, biochemistry, reproductive behavior, statistics, and ecology. The result of this reevaluation is a major realignment of groups of organisms, freeing them from the constraints of Linnaeus's hierarchical categories based on divine creation, and placing them instead on what has been called the Tree of Life, with its many diverging branches. The ever-branching nature of evolution and speciation shows that there is no intrinsic ranking of organisms as inferior or superior to others in some universal or divine sense. Organisms adapt to their particular spatial-temporal environments based on variation that happens to be present within the population, not toward a divine ideal nor in a progressive march toward an intrinsic or predetermined outcome.

Unfortunately, although the work of Darwin and Wallace moved us a step toward delineating the boundaries between scientific understanding and societal norms and attitudes, western thinkers continued to blur the lines. The entrenched hierarchical structure of late 19th-century and early 20th-century Europe was simply combined with Darwin's theory of how evolution happens, via natural selection, to argue that certain categories of humans were naturally predisposed to fail and were a burden on society. Darwin himself struggled with how to reconcile evolutionary theory with the prevailing views of race in his time (Shields & Bhatia, 2009). In his book on human evolution, ***The Descent of Man, and Selection in Relation to Sex,*** Darwin argued that humans were a single species with a common origin: "all the races agree in so many unimportant details of structure and in so many mental peculiarities, that these can be accounted for only by inheritance from a common progenitor; and a progenitor thus characterized would probably deserve to rank as man" (1874, p. 608). But Darwin was also open to the idea that humans could be grouped into races or subspecies, and he predicted, "At some future period, not very distant as measured by centuries, the civilized races of man will almost certainly

exterminate, and replace, the savage races throughout the world" (1874, p. 156). Contemporaries of Darwin, as well as later thinkers, went even further and generated frameworks that explicitly advocated for racist social and economic policies. Examples include Herbert Spencer, whose "social Darwinism" coined the phrase "survival of the fittest"; Francis Galton (Darwin's half-cousin), who invented the term ***eugenics*** to describe his theory of biological heredity; and Lothrop Stoddard and Madison Grant, who wrote polemics against race mixing. All drew upon a belief in hierarchical differences between humans that presumed superiority and inferiority (Gossett, 1997, pp. 145–75). These theories provided ideological succor for Jim Crow, Nazism, forced sterilizations of people deemed unfit to reproduce, and such racist and anti-Semitic immigration policies as the Chinese Exclusion Act of 1882 and the Immigration Act of 1924 (the Johnson-Reed Act).

Thus, the misuse of scientific theory again generated pseudoscientific justifications for racist ideologies, producing the distorted view of humanity that persists to this day. In fact, as recently as 1997 a man named Mostafa Hefny, who considers himself Black and has brown skin, was designated legally as a White man by the US government. Why? Because according to the US Office of Management and Budget's system of identification, all people from Egypt are White. To correct his status, Hefny had to sue the US government (Saini, 2019).

The legacies of social Darwinism and scientific racism decided Hefney's fate, and that underlines our belief that scientists must speak out and set the record straight. A good place to start is by updating the phrase "race is a social construct" to the expression "race is a social construct with no biological basis."

○ What *Does* Biology Now Tell Us About Variation Within the Human Species?

When the scientific framework of evolution is applied to the case of *Homo sapiens*, we see—as we see with all species—not a fixed species but variation in individual traits both in current populations and in the historical data we have on *Homo sapiens*. However, the variation that has been measured is all within the human species; there are no traits whose different varieties can be used to define nonoverlapping, separate groups of humans. Furthermore, it has been and continues to be the case that circumstances (e.g., our global distribution) are extremely unlikely to result in the evolution of new, different, clearly separable subspecies (races) of *Homo sapiens* any time in the foreseeable future.

The most robust scientific evidence for these conclusions comes from studying genetic sequences, including those that are involved in regulating visible traits such as skin color. When this methodology is applied to different populations of humans, the result is clear: no unique DNA sequences have been discovered for any category of humans as defined by skin color (Rosenberg, 2002; Witherspoon, 2007). In fact, by every single measure applied to date, human populations share one common gene pool—the term used for the genetic makeup of a population—and are therefore one biological race. Even the versions of genes that are found in larger proportions in some populations, such as the sickle cell trait, are also present in every population of humans studied to date. Thus, within the human species, variation in skin color—like the variation seen for every other trait that has been followed—is itself simply a reflection of the natural genetic variability one observes when comparing the genetic makeup of multiple members of any species.

This molecular data bolsters the well-supported theory in paleontology that our entire species originated in Africa 200,000–300,000 years ago, making it the birthplace of all humans. Fossils of early humans outside of Africa are all younger and have been estimated to be 100,000–220,000 years old in places like Greece, China, and Israel, but the significant migration out of Africa that led to modern Eurasian populations occurred between 40,000–60,000 years ago (Bergström et al., 2021). This migration data is also in perfect agreement with the molecular data. For example, non-African populations represent only a portion of the total genetic variation found on the African continent—in other words, the greatest genetic diversity in humans is found in Africa, and populations outside of Africa tend to be less genetically diverse (Tishkoff, 1996; Wong, 2008).

Taken together the science now tells us that Linnaeus, Darwin, and others were not incorrect in observing that there is variation in human skin color, they were simply profoundly mistaken in saying that this trait could be used to delineate boundaries between groups of humans. Not only is variation in skin color continual across the human species, but the trait itself is determined by a complex mix of genetics and environment. Therefore, just as we know that we cannot use traits such as height to separate humans into distinct categories, we cannot do so by skin color either.

○ IV: Why Is It Critical to Debunk This Myth?

In an environment where the false narrative of different biological races of humans persists, not only among White supremacists but also with vast numbers of Americans, scientific racism can flourish. This is perhaps most evident in the public policies, laws, and practices of fields where decisions turn on scientific knowledge, such as the field of medicine. It remains the case today, for example, that the algorithms used to program many medical instruments rely on assumptions about the Black body that separate African Americans from the human norm (for example some respirometers are programmed such that they require a Black person to be in worse medical health than other patients in order to get treatment). In fact, it was recently reported in April 2021 in an article on STAT+ that the preeminent journal in the medical profession, the *Journal of the American Medical Association* (JAMA), is currently facing criticism for its egregious and continual mishandling of race. Therefore, it is critical for science educators to intervene in the confusion over myth versus scientific evidence. By continually drawing the distinction between fabrication and evidentiary fact, we not only support the integrity of scientific investigation, we also remind the public that science is just one of the many ways to understand the world. This allows us to further our quest to understand the composition of humans as a species, while serving as a firewall against the misuses of science in society.

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