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# Not just in the past: Racist and sexist biases still permeate biology, anthropology, medicine, and education

Rui Diogo<sup>1</sup>  | Adeyemi Adesomo<sup>1</sup> | Kimberly S. Farmer<sup>1</sup> | Rachel J. Kim<sup>1</sup> | Fatimah Jackson<sup>2</sup> 

<sup>1</sup>Department of Anatomy, College of Medicine, Howard University, District of Columbia, Washington, USA

<sup>2</sup>Department of Biology, Howard University, District of Columbia, Washington, USA

## Correspondence

Rui Diogo, Department of Anat., College of Medicine, Howard University, Numa Adams Bldg, Room 1101, 520 W St. NW, Washington, DC 20059, USA.  
Email: [rui.diogo@howard.edu](mailto:rui.diogo@howard.edu)

## Abstract

In the past decades, it has been increasingly recognized that some areas of science, such as anthropology, have been plagued by racist, Western-centric, and/or sexist biases. Unfortunately, an acculturation process to racism and sexism has been occurring for generations leading to systemic inequities that will take a long time to disappear. Here, we highlight the existence of current examples of how racism, Western-centrism and sexism within: (1) the most popular anatomical atlases used in biological, anthropological and medical education; (2) prominent natural history museums and World Heritage Sites; (3) biological and anthropological scientific research publications; and (4) popular culture and influential children's books and educational materials concerning human biology and evolution.

## KEYWORDS

anatomy, anthropology, biology, scientific biases, Western-centrism

## 1 | INTRODUCTION

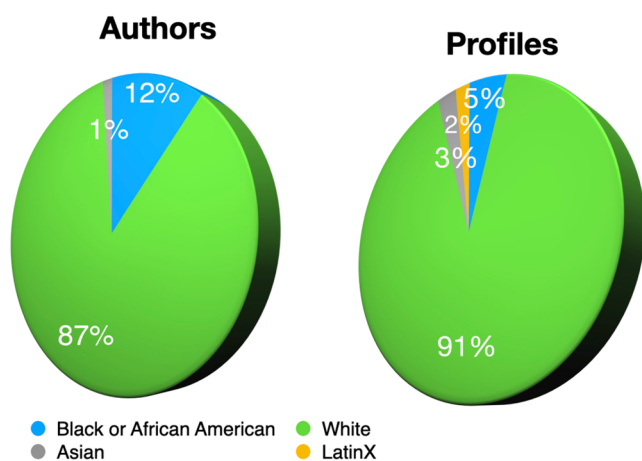
In recent years, and particularly in the last years after the recent rise of the #MeToo and Black Lives Matter movements, many scholars have questioned some dark aspects of our scientific past (e.g., Athreya and colleagues<sup>1-8</sup>). Even the scientific and societal legacies of one of the scientists that continues to be idolized by a substantial number of Western scientists nowadays, Charles Darwin, has recently been questioned both within the scientific literature and the mainstream media.<sup>9-11</sup> An example is a 2021 book edited by Jeremy Desilva, *A most interesting problem: what Darwin's Descent of Man got right and wrong about human evolution*. In the book's chapter "On the races of man," Agustin Fuentes explicitly states that Darwin was racist and sexist and that such biases influenced his scientific works, which in turn had huge scientific and societal repercussions:

In his overview of differences (and similarities) [between human 'races'], Darwin draws from published books and studies but relies heavily on

individual accounts of personal experience (including his own). This reliance on individual accounts poses a problem, given the substantive bias shown by the individuals on whom he relies (European colonialists, scientists, and travelers)... Given his overview of the 'data', Darwin... asserts that mental abilities are key differences and the most different (and in his view the most deficient) are people from sub-Saharan Africa and those of African descent... Darwin's ethnocentric, Eurocentric, and anti-African biases come through loud and clear throughout, despite his attempt at a neutral 'science'....

Concerning the mainstream media, the scholar Adam Rutherford<sup>12</sup> published an article entitled "How should we address Charles Darwin's complicated legacy?" in one of the most respected newspapers worldwide, *The Guardian*. However, such publications do not mean that suddenly all Western scholars are recognizing the dark past of science and how it affects current science and how it is perceived or disseminated to the broader public and to our children.

## SCIENCE TEXTBOOK SURVEY RESULTS



**FIGURE 1** The overwhelming majority of authors are “white” with only 12% of the authors being black. Ironically the only textbooks selected for instruction with black authors were only found on the Historically Black Colleges and Universities (HBCU) campuses. The overwhelming majority of profiles with photos (91%) are “white” with only 5% of the profiles being black, 2% latinX and 3% Asian. Not a single scientist of Native American descent has been detectable in any of the textbooks. Moreover, the report also showed that concerning gender, only 19% of the science textbooks were authored by men. Source: Figure adapted from a recent *Science Textbook Survey Report*,<sup>13</sup> showing the demographics of the authors of the science textbooks analyzed in that survey.

Another problem is that, as shown in a recent Science Textbook Survey Report,<sup>13</sup> in countries such as the United States the scientific textbooks that are used to educate the next generations continue to be mainly written by “white” men (i.e., European descendants). This is not a problem by itself: the problem is that this pattern means that there is an underrepresentation of “others” as authors of such textbooks, and therefore of their take on the topics discussed in those books. This fact, together with other structural factors, contributes to the propagation of longstanding racist, Western-centric and/or sexist narratives and the exclusion of the points of view and narratives of “others” (Figure 1).

Consequently, concerning the still prevalent narratives idolizing authors such as Darwin, criticisms to them made by authors such as Fuentes often receive two main types of reactions by Western scholars. One, the most troubling, is to be defensive to the point of either denying the obvious or stating that having scientists recognizing such facts might be “dangerous” to science. For instance, in a recent Science E-letter about an editorial article written by Fuentes,<sup>10</sup> 12 scientists—many of them particularly renowned—reacted to Fuentes’ factual statements by stating things such as: “we fear that Fuentes’ vituperative exposition will encourage a spectrum of anti-evolution voices.”<sup>14</sup> According to such a reasoning, to not let “others” defend their omniscient and morally flawless God (creationists), or to not “lose” people to “their” ideas, we scientists should create our own omniscient and flawless deities, such as an idealized

Darwin. The other typical type of reaction is to recognize the obvious—that is, that anthropology and biology were particularly involved in the development of scientific racism, but to then claim that the legacies of that scientific past are now negligible. This line of thinking is a common mistake committed by scientists, historians, the media, politicians, and the broader public, as if we are now at the top of “progress” in terms of the development of science.<sup>15</sup> This fallacious narrative is, in itself, a scientific and societal legacy of an erroneous scientific notion supported since millennia ago by scholars such as Aristotle, which became omnipresent in Western thought and science: the notion of a *scala naturae*—often named, in English, a ladder-of-life or chain of being (Figure 2).<sup>16</sup>

This fallacious narrative is also a way to somehow minimize the societal and scientific price paid by such a problematic history of science, and therefore to deny, or at least to diminish, the current existence of systemic racism and sexism. Acknowledging the mistakes of the past is, of course, crucial to avoid repeating them, but is surely not sufficient, particularly if the systemic effects of past racist and sexist ideas blind us from recognizing that they are still influencing the way we think. Systemic racism, Western-centrism and sexism cannot be completely deleted overnight because they lead to unconscious biases that are particularly problematic as they are much more difficult to detect, as attested by the fact that even the so-called “greats,” such as Aristotle, Linnaeus, and Darwin, were victims of such biases. One of us discussed this topic in a recent book, *Meaning of life, human nature, and delusions—how tales about love, sex, races, Gods and progress affect our lives and Earth’s splendor*.<sup>15</sup>

Importantly, the fields of biology, anthropology, medicine, and education provide some of the most powerful examples of the importance of the power of place in both science and society. The term power of place refers, here, to Browne’s books about Darwin’s life and works and how they subsequently became so influential in science and Western society. As she recognized in *Darwin Voyaging*<sup>17</sup>: “[In Victorian society] scientific ideas and scientific fame did not come automatically to people who worked hard and collected insects... a love of natural history could not, on its own, take a governess or a mill-worker to the top of the nineteenth-century intellectual tree... nor can it, on its own, explain Darwin.” As explained by her in *Power of Place*,<sup>18</sup> Darwin’s idolization did not occur despite his Eurocentric and racist ideas and support for colonialism and imperialism, although it should be emphasized that he opposed slavery, but in great part because of that. It is surely not a coincidence that, apart from the *Origin*,<sup>19</sup> it is precisely Darwin’s books about humans,<sup>20,21</sup> that are so commemorated by Western scholars, as it happened recently with *Descent*’s 150th anniversary. There were no such commemorations for the 150th anniversary of his books about corals<sup>22</sup> or volcanic islands,<sup>23</sup> for example.

Therefore, it is crucial to make an effort to denounce the existence of current scientific biases, as they will have direct repercussions for the next generations, including children that will become scientists, scientific illustrators, and educators. With this aim in mind, we built a multidisciplinary team made of scholars studying biology and anthropology, as well as medical students, representing



**FIGURE 2** “Ascent of Life,” by F. Besnier, 1886, illustrating the notion of a ladder of life, which has been, and continues to be, so influential in both science and popular culture.



different genders, ethnic and cultural backgrounds, and career stages to have a broader perspective of current scientific and educational biases that might not have been perceived by a more homogenous group of people. Accordingly, in this paper we will focus on the existence of current examples of racism, Western-centrism and sexism within: (1) the most used anatomical atlases in biological, anthropological and medical education; (2) prominent natural history museums and World Heritage Sites; (3) biological and anthropological scientific research publications; and (4) popular culture and influential children's books and educational materials concerning human biology and evolution. We hope that the type of examples provided in this paper will generate discussions on how to change the vicious cycle of acculturation and systemic racism and sexism that is still far too

prevalent, and too neglected, in biological, anthropological and medical sciences and education.

## 2 | ANATOMICAL ATLASES USED IN BIOLOGICAL, ANTHROPOLOGICAL, AND MEDICAL EDUCATION

Millions of students across the globe use anatomical atlases to become biologists, anthropologists, and medical practitioners or researchers. The history of the field of anatomy has since millennia been deeply connected with the notion of *scala naturae* (Figure 2) and, accordingly, with racist, Western-centric, and sexist biases.<sup>24</sup>



Since the 17th century, in particular, the history of primate and human comparative anatomy became deeply intermixed with the rise of scientific racism and of the “innate-type-of-racism” that became prevalent within 18th century scholarly community, that is, the idea that some people are born, and will always be, “inferior.” This idea contrasts with the “cultural-type-of-racism,” in which “others” were commonly seen as “inferior” because how they lived, what they ate, and so on. In this sense comparative primate/human anatomy and biological anthropology are truly the mother and father of scientific racism.<sup>24</sup>

Within the field of anatomy, the notion of power of place to which we referred to in Section 1 clearly applies to the so-called “father” of human anatomy, who is also often idolized by Western scholars and historians of science: Claudius Galenus, more commonly known as Galen (130 to about 210 AD). Many narratives related to Galen's idolization are not accurate at all, including the one about him being the “father of human anatomy.” This inaccuracy is because his descriptions of “human anatomy” were mostly based on dissections of the “Barbary ape” (*Macaca sylvanus*) and of other nonhuman animals. What led so many scholars, and nonscholars, to idolize Galen, and to blindly use his descriptions of monkeys and other nonhuman animals as the “basis of human anatomy” for more than a millennium, was in great part due to nonscientific reasons. For instance, it was related to the fact that, although he somehow remained a “pagan,” he believed in one God and developed the idea that every organ in the human body was created by that God in the best possible form and for its perfect use, an idea that fit in well with Christianity.<sup>25,26</sup>

Most current anatomical atlases, including those used by students worldwide, are deeply affected by racist, sexist and Western-centric biases, for example, predominantly showing “white” people and, among them, mostly men. This is particularly troubling when such atlases are used in historically “black” universities, such as Howard University. One of us (R. D.) has to teach, and three of us (K. F., R. K., and A. A.) as medical students have to learn, human anatomy by using one such atlas, Netter's atlas of anatomy (“#1 bestseller in medical education and training” according to Amazon, as per March 11, 2022).<sup>27</sup>

Is the huge phenotypical diversity of modern humans (e.g., Figure 3), truly represented in that atlas? For a quick answer, you just need to look at Figure 4, which is just an example of the common pattern within the 181 figures of that atlas in which we can see the color of the skin of the people that are illustrated: 78 show “white” men, 22 show “white” woman, two show people of ambiguous color/sex, 77 show “white” people with ambiguous sex, and only one (about 0.5%) shows a “darker” woman and one (about 0.05%) shows a “darker” man. The notion of a “white-man” prototype is clearly suggested in the captions of that atlas. For instance, the drawing shown in Figure 4 is respectively labeled “thorax anatomy,” but this figure obviously does not show a “normal” or “ideal” human thorax, because “whites” are much less numerous than “non-whites” and men are less numerous than women. What is truly shown is a minority (men) within a minority (“white” people). To give one more example,

which is also used at Howard University, let's refer to the most used “dissector” (used to help specifically with the dissections of human bodies), Grant's Dissector.<sup>28</sup> There are literally no “darker” people shown in that book. And as usual women are almost always shown after men, and usually just to “highlight” sexual differences, with the penis and other male urogenital structures being shown before the clitoris and other structures of women, and so on.

### 3 | NATURAL HISTORY MUSEUM DISPLAYS AND WORLD HERITAGE SITES

In 2021, a scientific paper that included one of us (RD) was widely discussed by both scholars and the media worldwide because it empirically showed that the depictions of our evolutionary past that we see over and over in academic textbooks, natural history museums, documentaries, and so on (see below) are in great part based in preconceived ideas or artistic gut-feelings, rather than in the application of sound scientific methods.<sup>29</sup> For scientists, at least for those within natural sciences, it should not be surprising at all that the visual depictions we see about our evolutionary history (such as Figure 5) are not based on scientific data. This is because they are often based on just a few bones, without any direct knowledge about the color of the skin, hair. As emphasized in our Campbell et al.<sup>29</sup> paper, this fact is often not perceived by the broader public, specially not by the dozens of millions of children that visit natural history museums worldwide every year. They think that what they are seeing is the truth. Seeing is believing: how can natural history museum exhibits, often made by scientific illustrators', and usually organized by renowned scientists, not completely reflect reality?

A particularly powerful example that they often do not reflect reality was provided by a journalist in one of the media articles about that paper, as that example concerned one of the most renowned natural history museums, located in the capital of the United States, which receives about 4–5 million visitors annually, many of them children: the Smithsonian National Museum of Natural History. The example concerned the illustration shown in Figure 5, made by a very influential paleo artist (John Gurche), which was displayed on the website of that museum for a time. That figure not only gives the wrong idea that human evolution is somewhat linear, but also mainly follows the old notion of a scala naturae or ladder of life (Figure 2) that continues to be omnipresent in our Western society. For instance, contrary to what is suggested in that Figure 5, and in the more “popular culture” current version of the same “marching to progress” notion shown in, for example, Figure 6, there is literally no scientific evidence supporting a progressive “whitening of the skin” within humans before they left Africa. A lighter skin pigmentation only evolved in humans that migrated out of Africa to regions with higher or lower latitudes and less exposure to ultraviolet radiation, such as Northern Europe (see, e.g., Jablonski & Chaplin<sup>30</sup>). As can be seen in current depictions such as that of Figure 6, apart from racist and Western-centric biases, they are also plagued by the same type of sexist biases that have been so common since long ago, suggesting

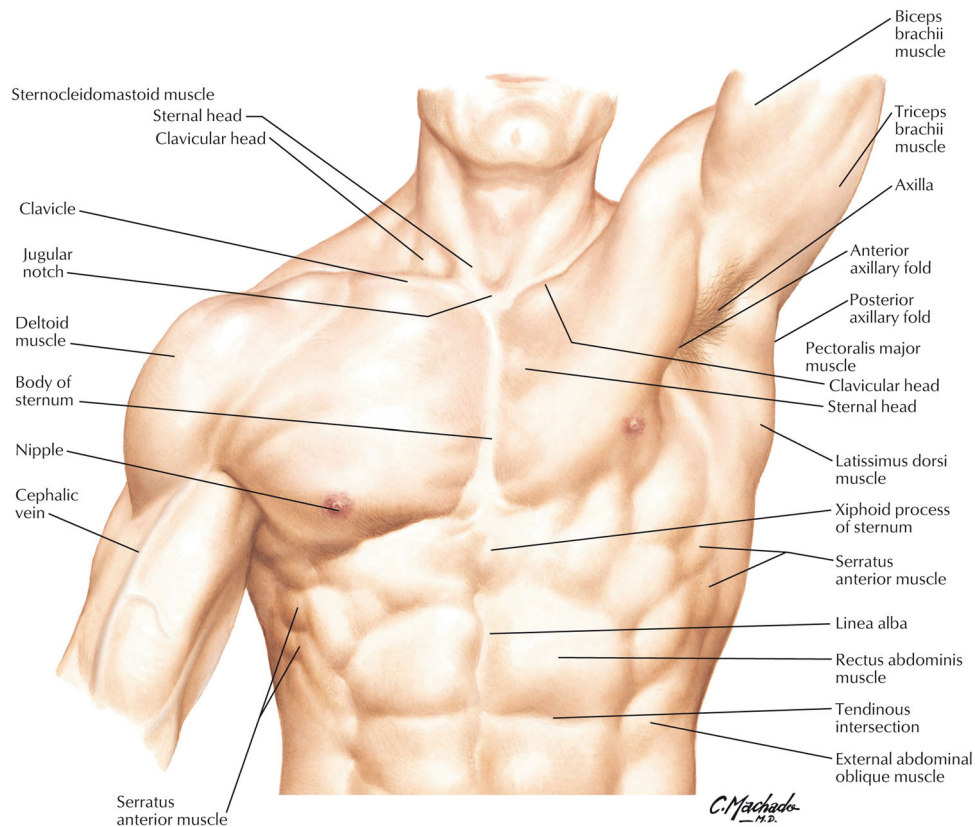


**FIGURE 3** Human diversity. Source: Adapted from [geneticliteracyproject.org](http://geneticliteracyproject.org).

that women mainly did not play a role in human evolution. That is, the model for the pinnacle of evolution is not only a “white” person, actually even his hair also has a lighter tone, but a “white man.”

One of the main roles of natural history museums is to collect, preserve, research, and present historically important material to the general public for the purpose of education, entertainment, scientific dissemination, and bringing awareness about other animals, evolution, and our place in nature. When organizing a human evolution exhibit in particular, two important fields begin to merge and interplay with one another: science and art. Science gives the

opportunity to present evidence-based facts to the general public, while art, at its root, is a display of subjective creativity. It is therefore imperative that both scientists and scientific illustrators/paleoartists try to be aware about such biases (conscious and unconscious). In the case shown by Figure 5, we assume that nobody involved in the process had a conscious intention to show an erroneous “march to progress” narrative involving a “progressive whitening of the skin.” However, the main problem with such depictions is that they concern details that are not based on direct data, for example, color of the skin, hair, and so on. Therefore, these depictions may fall into the trap



**FIGURE 4** The figures used in almost all the anatomical atlases in the U.S. and many other countries showing what the “human thorax” looks like actually show cases that represent a minority within a minority: ‘white’ males. Source: Adapted from Netter.<sup>27</sup>



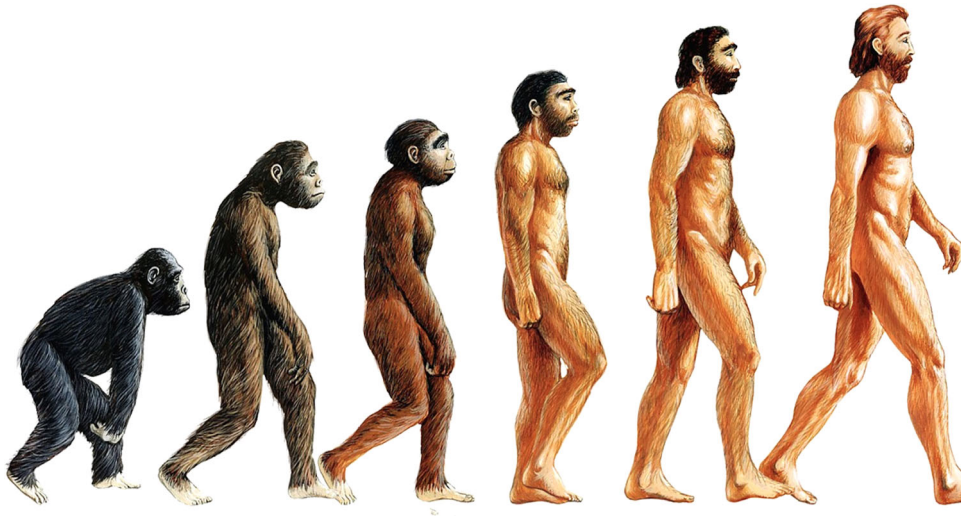
**FIGURE 5** Figure depicting two persistent inaccurate tales about human evolution—a linear type of evolution, characterized by a ‘progressive’ lightening of the skin, previously used by the Smithsonian National Museum of Natural History, a museum that is visited by millions of visitors each year, many of them kids. Created by John Gurche (from [www.reddit.com/r/Naturewasmetal/comments/kihwi/the\\_evolutionary\\_history\\_of\\_the\\_human\\_face/](http://www.reddit.com/r/Naturewasmetal/comments/kihwi/the_evolutionary_history_of_the_human_face/)).

of prevailing unconscious biases. A minority of people actively and knowingly promote racist and sexist narratives; the true problem of systemic biases is indeed the majority of people that accept them unconsciously and thus unknowingly apply them in their daily-lives or jobs.

Moreover, as noted above, natural history museums must be careful to make sure that the broader public that visits them is seeing displays that are showing art that is backed by science. It is thus imperative that the subjective tone of the artist/scientific illustrator is tapered out of museums, so that the more science based facts can be highlighted. For example, when reconstructing paleoart for a human evolutionary exhibit, the artist must attenuate their subjective opinions and align their artwork according to the scientific evidence. So, in cases such as Figure 5, while the artists might not be able to escape from unconscious biases, as it happens to all of us, they should make an effort to understand what is known and unknown about human evolution, including the fact that human evolution is not linear and that there is no scientific evidence supporting that there was a “progressive whitening of the skin” before humans left Africa. Moreover, it is also imperative that the scientists overseeing the depictions done by the scientific illustrators carefully review them before they are displayed to the broader public.

A particularly disturbing picture in which such a detailed review clearly was not done, and that both illustrates the process, and power, of enculturation and its profound connection with art,





**FIGURE 6** Current version of the notion of the march towards evolutionary “progress,” leading to the “pinnacle of evolution” “white” Western males. Strikingly, such inaccurate representations are often seen in websites, TV shows, popular books and even educational materials published not only in Western countries, but also in many other countries. Source: Image freely available, and copyright free, from <https://medium.com/paperkin/where-is-evolution-taking-the-human-race-6ddaf7eaddba>.



**FIGURE 7** Photograph entitled “what South Africa’s caves can tell you about humankind”, displayed in the site “The Cradle of Humankind”, which is recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Heritage Site. The display shows a linear type of human evolution in which our most ‘primitive’ ancestors are much darker than the now ‘typical’ *Homo sapiens*, represented as often by a non-African, non-‘dark’ person, as if living ‘dark’ people are merely a relict of our evolutionary past. Source: Modified from [theculturetrip.com/africa/south-africa/articles/what-south-africas-caves-can-tell-you-about-humankind/](http://theculturetrip.com/africa/south-africa/articles/what-south-africas-caves-can-tell-you-about-humankind/).

science, and scientific biases, and allows us to discuss a myriad of other topics such as scientific neocolonialism (Figure 7). The picture was taken in one of the world’s oldest and most famous anthropological sites, located just outside of Johannesburg, South Africa. The site is named The Cradle of Humankind because it contains some of the oldest human fossils to date, and is recognized

by The United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Heritage Site. This picture includes a display highlighting the typical Western-centric and racist biased way of portraying human evolution: our ancestors were “dark,” modern people are “whiter.” In fact, what all these current displays (Figures 5 and 7) have in common is precisely the scientific racist idea promoted

by evolutionary biologists and anthropologists centuries ago that “darker” people are not fully humans, or at least not fully “modern humans” (see, e.g., Diago and colleagues<sup>15,24,31–34</sup>). Think about the impact that the display shown in Figure 7 would have to a “white” kids seeing it with his family. Together with thousands of other images the child is bombarded with, through TV, educational books, movies, natural history museums, and so on, he or she might likely gradually start to accept that only those like them, with a lighter color of skin, are truly fully human, or at least are somehow “superior” or more “normal” or “ideal.” Now, think about the impact that the same image will make to a child, or adult, that has a darker skin tone (Figure 7). Clearly, what such a child or adult is seeing in that display is not the reality of human evolution, but instead the importance of the power of place in both science and society. Specifically, the power of place of Northern Europeans, and later of the Northern Americans that descended from them, in science within the last centuries. In other words, such displays have in themselves a high value as anthropological documents because they tell us a lot about the profound links between biases, beliefs, the power of place, racism, sexism, and Western-centrism. Basically, in a way these artistic and so-called “scientific” illustrations continue to play a major function that they always played, from the beginning of scientific racism. Namely, they are saying to a dark-skinned child that, if one or more of these traits that represent the “pinnacle” of the ladder of life, being “white,” a man, and not having a dark hair color, does not apply to you, then you must know that you are far down that ladder, at a “lower,” “inferior” position. You should be well aware of that, and behave accordingly: know thy place. Unfortunately, we know too well, through scientific studies, examples of how those that have

been historically oppressed or subjugated by such racist and sexist narratives many times do end up by internalizing those narratives created by the oppressors, subjugators, or those in power. For instance, the profoundly sad illustration of the result of long-standing institutionalized racism in the United States has been shown with scientific studies involving dolls, in which, when African American children were asked to choose between “white” and “black” dolls, or even when asked which of the two was a “better person,” they tended to choose the “white” one (see, e.g., Williams<sup>35</sup>).

As explained in Moser's<sup>36</sup> book, sexist narratives concerning human evolution have been used and continue to be used to tell women to know their place. These narratives have also been combined with art to reinforce this message. Politics, art, and science are deeply connected in history, and this continues to be so. Moser noted that most images/displays about human evolution, in both artistic and scientific works, have historically focused on men (e.g., “cave-men”), as if women were indeed completely inert, or even totally inexistent, for millions of years. This pattern applies to three of the “crucial moments of human evolution”: discovery of fire, stone tool building and use and cave painting (Figure 8). Referring specifically to Figure 8, Moser<sup>36</sup> wrote: “in the... mural, featuring the Cro-Magnons, a male artist is seen adding the final touches to his depiction of a great beast on the cave wall... significant is the omission of women, which was an explicit instruction that Osborn [the scholar] gave to Knight [the painter]... this omission adds another dimension to the sexual division of labor in reconstructions, introducing the notion that women were not involved in areas of cultural achievement such as the production of art.”



**FIGURE 8** “Cro-Magnon artists,” by Charles Knight, 1924, illustrating the ‘cave-men’ sexist narrative that continues to be omnipresent in popular culture nowadays: that the major evolutionary innovations that occurred within human evolution, such as cave painting, stone tool building or the discovery of fire, were necessarily done by men. *Source:* modified from Moser.<sup>36</sup>



#### 4 | SCIENTIFIC RESEARCH PUBLICATIONS AND SEXISM

What occurs when the children that were acculturated from a young age with displays such as those we previously mentioned become biologists and anthropologists? The answer seems obvious: despite all the effort that one, including the authors of this paper, might consciously try to do to deconstruct some of these biases, such an acculturation process and educational system ends up by leading to at least some repercussions. For instance, women have been and importantly continue to be portrayed in scientific works, textbooks, natural history museums, educational materials (see below) and so on as passive players, or simply as nonexistent, in narratives about human evolution. Such representations combine the old misogynistic views of scholars such as Aristotle, who viewed women as “inferior” with evolutionary inaccuracies/assumptions constructed by scientists such as Darwin to support old narratives of women as “coy” or evolutionarily “passive” in contrast to “an the provider”. It is important to note that recently there has been a lot of work unpacking such concepts in anthropology and archeology (i.e., queer theory, feminist theory, and so on), but unfortunately such studies continue to be underdiscussed and undervalued in evolutionary anthropology and many other scientific fields (see, e.g., Saini<sup>7</sup>; Holland<sup>37</sup>). An example of such recent works is Marylene<sup>38</sup> book *L'homme préhistorique est aussi une femme—Une histoire de l'invisibilité des femmes* [Prehistoric man is also a woman—A history of the invisibility of women].

A case study that shows how such misogynistic narratives continue to influence researchers, including the most renowned ones, today was discussed in a recent paper by García-Campos et al.<sup>39</sup> The paper revealed that one of the most famous fossils in Europe, Sierra de Atapuerca, Spain, and belonging to *Homo antecessor*, is from a girl between 9 and 11 years old (Figure 9), and not from a boy, as had been previously believed until now. The new evidence came from an analysis of the canine teeth of the previously called “boy from the Gran Dolina,” in reference to the title of an emblematic popularization book by José María Bermúdez de Castro. The authors of that 2021 paper, which included Bermúdez de Castro, recognized in the press release of the paper that there was no scientific reason for Bermúdez de Castro to have previously asserted that the remains of the fossil were of a boy. “It arose randomly... when José María [Bermúdez de Castro] decided to make the book, he chose this masculine name, but for no specific reason... it has been necessary to wait for these new techniques to be able to know the sex with certainty,” explained García-Campos. It is true that knowing the sex with certainty is a very difficult proposition given the limitations of assessing sex in prepubertal individuals, but the problem is that such decisions are too frequent to be truly “random”: almost all depictions of our past show men, or at the most women as completely passive, evolutionarily. So, the children that have grown up seeing such sexist displays came to internalize such biases and, unconsciously, to fall into their trap when they become scientists, perpetuating the vicious cycle of systemic sexism (Figure 10).

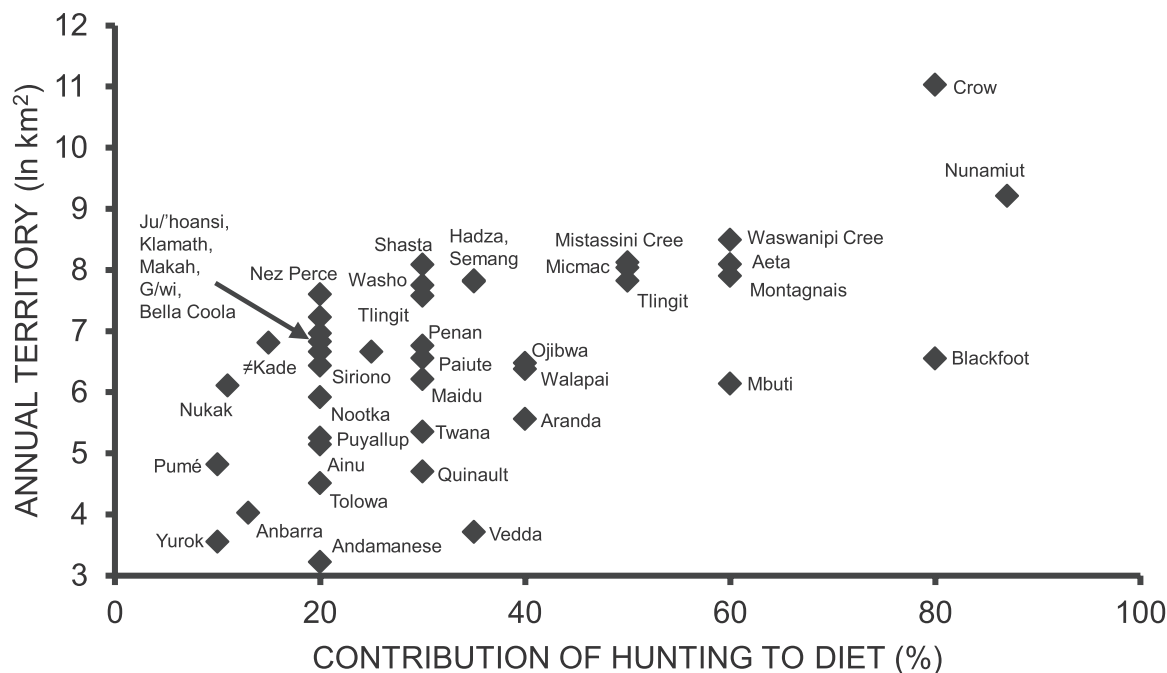


**FIGURE 9** Analysis of the teeth of the “boy from the Gran Dolina” shows that the teeth were actually from... a girl. Source: Image adapted from [twitter.com/archaeologyEAA/status/1372105138236706818/photo/2](https://twitter.com/archaeologyEAA/status/1372105138236706818/photo/2).

The data available from a plethora of fields such as archeology, psychology, neurobiology, and anthropology clearly falsify the sexist narratives that have been used to support the “coyness” and evolutionary “passivity” or “irrelevance” of women. For instance, in the case of the García-Campos et al.,<sup>39</sup> paper, the data show that the “boy that actually was a girl” was likely actively involved in a process of interaction between groups, which help us to further rethink the role of women in “prehistorical societies.” As recognized by the authors, the findings of the paper put in question “the traditional gender roles that are still preserved in which the woman is at home and the man at work” and helps “to change the collective imagination of the female in the cave with two young or tanning skins” and to “show us that women participated in hunting work and in disputes over territory.”

Of course, apart from being scientifically inaccurate, such misogynistic “scientific” narratives were and will always be, self-contradictory. For instance, evolutionarily men cannot just have had their cake and eat it too: they cannot be both “men the hunter-savior,” “men the toolmaker,” and “men the cave-painter,” all at the very same time. If, as the misogynistic narratives suggest, they were the hunters, providers, and saviors of their whole communities, being so brave that they all go on for several kilometers a day to hunt huge dangerous animals to bring food to, and “save,” everybody, including the “poor passive” women, when did they have time to invent fire, produce stone tools, and do cave painting? More logically, within such a narrative, the individuals that often travel less would be the ones that would have more time and more often be in the right place (e.g., nomadic temporary settlements) to do innovative and artistic tasks. And what the scientific data do show is that in numerous hunter-gatherer societies, women often travel smaller distances to





**FIGURE 10** The size of foragers' annual ranges plotted against the percent dependence on hunting in several current forager human societies: contrary to still predominant sexist narratives, in most of these societies the bulk of the diet comes from gathering plants and fungi—a task mainly done by women—not by hunting. *Source:* Modified from Kelly.<sup>40</sup>

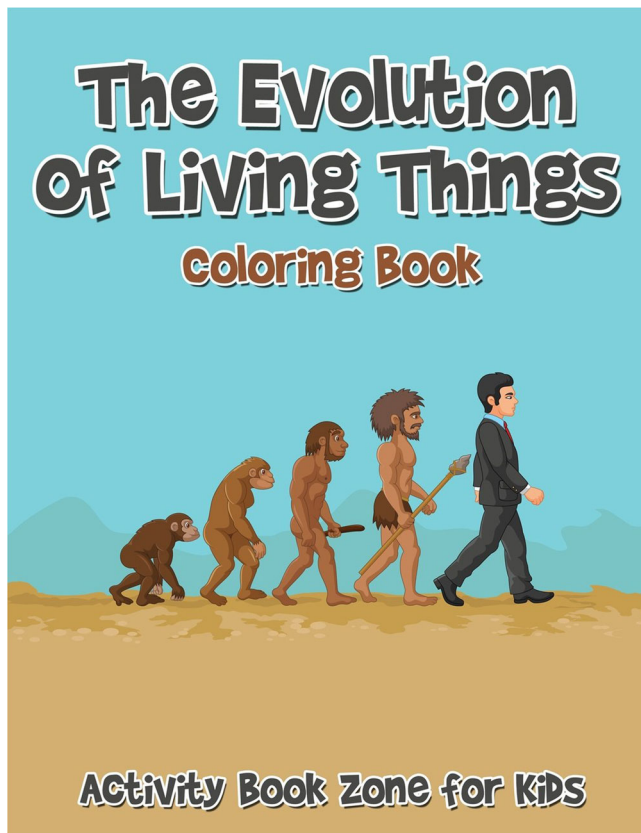
gather wild plants and fungi (e.g., Kelly<sup>40</sup>). Moreover, also against the still prevailing manly-made narratives, gathering plants and fungi actually provided/provides the main bulk of the diet within most studied hunter-gatherer groups, as summarized in Kelly.<sup>40</sup> As stated in Hrdy's<sup>41</sup> book, "when anthropologists reviewed a sample of 15 traditional societies, in 8 of them the presence or absence of the father had no apparent effect on the survival of children to age 5, provided other caregivers in addition to the mother were on hand in a position of help."

Kelly's<sup>40</sup> book further puts into question such sexist narratives about women being evolutionarily "passive" by noting that the "effective foraging distance for plants is shorter, in general, than it is for large game since many plant foods provide lower return rates than those of large game... since large game is usually procured by men, women's foraging should normally determine when and where camp is moved." Therefore, among for instance the Agta, "since hunting depends on mobile animals, it is not an important consideration [in determining moves]... men and women freely voice their opinion on residence change, but women, who must carry out the most gathering, have the final say." Moreover, it should be noted that in numerous hunter-gatherer groups, such as within the so-called "Central African forest pygmies," "in many cases, women are equal partners with men in... collective hun's", as explained by Bahuchet.<sup>42</sup> (see also, Haas et al.<sup>43</sup>).

Similarly, more and more scientific studies are supporting the idea that it is likely that women were not so "passive" as explained in, for example, a paper by Martínez-Sevilla et al.<sup>44</sup> A similarly recent paper questions sexist narratives about men being "natural leaders,"

by showing that very likely a woman occupied a highly prominent position in a major European society about four millennia ago.<sup>45</sup>

One clear example of how sexist narratives about "coy" and "sexually passive" women still permeate current academia is that many current scientists continue to discuss what they call the "puzzle" of female orgasm (see, e.g., Pavlicev and Wagner<sup>46</sup>). This particular example was discussed by one of us in a recent book<sup>15</sup> and paper,<sup>47</sup> so we will just briefly summarize some key points here. As noted in those publications, historically the notion that females having orgasms would be "puzzling" was never based on any kind of scientific data, or even sound evolutionary theory, but plainly in misogynistic narratives that were constructed to show that women were "naturally," or evolutionarily, as stated in Darwin's *Descent* (1871), "passive." The case of Darwin's *Descent* is indeed a good example of this, because Darwin constructed these narratives about women's "natural" passivity and coyness even though they clearly contradicted what he knew about, and observed within, the natural world. For example, in the *Descent* Darwin acknowledges that his observations support the fact that in most nonhuman mammalian taxa females are often the ones that sexually actively select their partners, within a phenomenon that for him was crucial in biological evolution, sexual selection. However, as a Victorian, Darwin could not accept that women were the "selectors" or "active" sexual players, so he argued that this role of women only applied to early human evolution, when we were "savages," and that, later in human evolution the situation was reversed to a condition that would clearly be an exception within mammals: men begun to be the ones that sexually select the "naturally coy" women. Furthermore, he also



**FIGURE 11** How the indoctrination of racist, Western-centric and sexist narratives works: one of the many, and most popular, books currently available at numerous online stores such as Amazon, for children, to “learn the science of evolution.” *Source:* Modified from [www.amazon.com/Evolution-Living-Things-Coloring-Book/dp/1683762851](http://www.amazon.com/Evolution-Living-Things-Coloring-Book/dp/1683762851).

stated, in the same book, that this Victorian pattern of marked gender inequalities and the sexually passive role attributed to women in Victorian society were “superior” to the more similar importance attributed to both genders found in many “savage” non-Western hunter-gatherer human societies.

Of course, it should have already occurred to the numerous current researchers that continue to study what they define as the “puzzle” of female orgasm that the very fact that they see it as a “puzzle” indicates that the problem is surely not with the female orgasm per se, but with the fallacious and sexist way they see biological and human evolution. For instance, a clear fallacy of such narratives about the very passive and coy sexual nature of females versus the huge sexual appetite of males is that it would obviously lead to an absurd evolutionary situation: about half, or actually more than half as it occurs with human females, of the members of species within sexual organisms would not have a drive to do something that is obligatory for the survival of that species: reproduction. Reproduction is a condition for existence for sexual animals, as is eating or drinking water, so saying that it is a “puzzle” that one of the sexes has pleasure having/drive to have sex is as absurd as saying a priori that it is a “puzzle” that one of the sexes wants to drink water or eat.

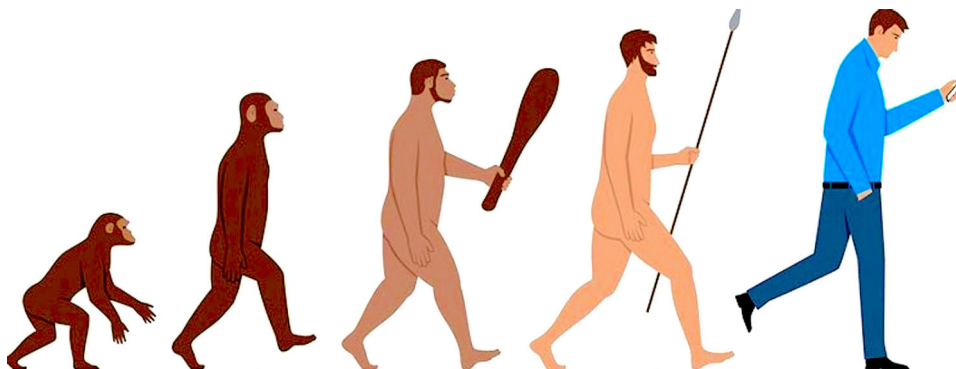
Indeed, if we, as scientists, would be truly able to approach such scientific topics in a neutral, unbiased way unaffected by systemic sexism, and systemic racism, we would instead probably raise questions such as: if according to such sexist narratives women are supposed to be “coy,” “less sexual,” “sexually passive,” and so on, why are women the ones that actually have more frequently, on average, multiple orgasms (e.g. Puts et al.<sup>48,49</sup>). In addition, various studies indicate that women experience, on average, more complex, elaborate, and intense orgasms than men (e.g., Mah and Binik<sup>50,51</sup>). Ackerman<sup>52</sup> noted that “men’s oxytocin levels quintuple during orgasm... but a Stanford University study showed that women have even higher levels of oxytocin than men do during sex, and that it takes more oxytocin for a woman to achieve orgasm... drenched in this spa of the chemical, women are able to have more multiple orgasms than men, as well as full body orgasms”. Furthermore, the clitoris normally has about 8000 sensory receptors, compared to half as many in an ordinary penis, and its sole known function is to provide ecstatic pleasure to its bearing, contrary to the penis (e.g., Browning<sup>53,54</sup>).

## 5 | EDUCATIONAL MATERIALS, CHILDREN'S BOOKS, AND POPULAR CULTURE

We now come full circle to address a crucial question. Many of those children that were acculturated and educated with stories plagued by racist, Western-centric and sexist biases, later become scientists and repeat the same type of biases in their own publications, or in natural history museums or World Heritage displays that they help to organize. So, how do we expect the media, artists, book publishers and illustrators, and so on react to that? They will tend to accept many narratives published by scientists, such as the “man-the-provider”/“woman-the-passive,” and/or the subliminal messages included in those visual displays, for example, “ladder-of-life/ progressive whitening of the skin,” as facts. Accordingly, they will tend to reproduce their biases in their own work (Figures 6, 11–13). This is true today as it was decades ago, when almost all the movies or books that children would see or read in Western countries often contained racist and sexist narratives. For example, stories such as the Little Mermaid or Snow White, which continue not only to be read/seen by dozens of millions of children, but also are recycled into new Hollywood movies, portray women in a strikingly misogynistic way. Mirroring the biased “scientific” “man-the-provider” narrative they portray women that just want to find a “prince”—a “white,” and preferably rich, prince, of course—and be “happy forever,” as if that was the only true aspiration and goal that a woman seeks in life. The sexist and racist biases were recently implicitly recognized by the Disney TV channels, which now include a content advisory notice for racism for films such as Dumbo, Peter Pan and Jungle Book, stating: “this film includes negative depictions and/or mistreatment of people or cultures... these stereotypes were wrong then and are wrong now.” The notice adds that, rather than removing the content, they



**FIGURE 12** One other example among an endless number of others that could be shown: an “educational” video for children, about “evolution & types of humans,” made by the renowned Peekaboo kids/Dr Binocs, is plagued by erroneous racist, Western-centric, and sexist narratives and stereotypes. Source: Modified from [www.youtube.com/watch?v=mmCGDsFfl2c](http://www.youtube.com/watch?v=mmCGDsFfl2c).



**FIGURE 13** The evolutionary “march to Western progress” is not only extremely popular in Western countries, but also in non-Western ones—an example of this, within many others, is this figure from a popular South Korean internet blog. Source: Modified from [blog.naver.com/jinisoo/221307817718](http://blog.naver.com/jinisoo/221307817718).

“want to acknowledge its harmful impact, learn from it and spark conversation to create a more inclusive future together.” In this particular respect, the inclusion of such notes, as well as the release in recent years of several movies such as *Moana* and *Encanto* that feature non-“white” girls that are smart, strong, have agency, and are not just look for a prince, are examples of the type of steps that can lead to a change of the status quo.

From the discussion above, it can be said that the more recent evolutionary version (Figures 5–7) of the old notion of the ladder-of-life that has been so prominent in the last decades is in a way even more damaging, at a scientific and societal level, than the original Ancient Greek version (Figure 2). Within the latter, including the way it was later used by the Christian church in general, nonhuman animals were viewed as inferior to humans, with Western humans being at the pinnacle of the ladder just below angels, Gods, and so on. But non-Western humans were not at the top of the ladder necessarily because they were at a lower, less “advanced” position together with nonhuman animals, as it is the

case with the type of evolutionary ladder-of-life we now so often see in the media and popular culture (Figures 5–7). For many Ancient Greek scholars non-Westerns were “inferior” just because of the way they behaved, or what they ate, and so on—“cultural type of racism” (see, e.g., Gould<sup>55</sup>)—and thus that was not a “fixed” condition, while for many Christian thinkers non-Westerns were often seeing instead as “degenerate” humans. This reasoning developed because for those Westerner Christian thinkers, humans were made by God, and of course the “first humans” made in the “image of God” had to be like them and not dark-skinned such as for instance many Sub-Saharan Africans and Australian aborigines were/are. That is, from the more “light-skinned” people, such as Adam and Eve, made directly by God, there was then a “degeneration” leading to the “savages.” Instead of the inaccurate racist “facts” constructed within the umbrella of scientific racism, such theists created religious “facts” to explain such a degeneration, for example that it was the punishment, curse of Ham, and so on, for committing a sin or losing their faith in God, and so on.<sup>15</sup>



However, there is a very important difference between the two narratives, which is often not fully appreciated, or rather ignored, or neglected, by historians of science and scientists. While such a theist “degeneration” leads to “inferiority,” it does not lead for instance to the inevitable “natural” extinction of “inferior” people, as it did for a huge number of evolutionary biologists in the 19th and early 20th centuries and as it is sublimely suggested in evolutionary depictions. As explained for instance by Brantlinger<sup>56</sup>:

Both in *Voyage* and in his later writings, Darwin at times looked forward to the complete triumph of civilized over primitive or “lower” races. “How long will the wretched inhabitants of N.W. Australia go on blinking their eyes without extermination?” Darwin wondered in 1839; and in 1860 he wrote that “the white man is ‘improving off the face of the earth’ even races nearly his equals.” Further, the progress of the world seemed to dictate not just the peaceful transformation of “savagery” into its opposite but, for better or worse, its violent liquidation: [Darwin wrote] “looking to the world at no very distant date, what an endless number of the lower races will have been eliminated by the higher civilized races throughout the world” ... After all, the [original] subtitle of *The Origin of Species by Means of Natural Selection reads: The Preservation of Favored Races in the Struggle for Life*.

What is particularly disturbing, and often also neglected or minimized in scholarly discussions, is how such biased scientific ideas do continue to influence the media, popular culture, “educational” textbooks (e.g., Figure 11), and “educational” videos (e.g., Figure 12). Such “educational” materials are currently influencing millions of children worldwide, including those that will become scientists: *acculturation, coming full circle*. The most formative and influential years of life occur during childhood, as children's brains are developing cognitively, socially, emotionally, and physically during that time. Many scientists try to distance themselves from such images by arguing that they are made by artists or lay people that do not really know science or the history of science, and therefore that such displays have nothing to do with science. But that is simply not true, as we can clearly see in this paper: those displays are instead mainly mirroring the racist and sexist narratives that were commonly promoted and supported by scientists and that many scientists nowadays continue to perpetuate, consciously (e.g., James Watson) or unconsciously (e.g., as many the cases discussed above). Moreover, older children go to high schools and universities where the textbooks they will read are mostly written by those that have essentially dominated the scientific discourse in the last centuries in Western countries: Western “white” men. Clearly, there is much work to be done to teach children accurate, representative, and more objective information about human evolution. We *all* owe it to our children to not perpetuate such racist or sexist narratives.

For instance, can we scientists exclusively blame the authors of the book, who are collectively named “Activity Book Zone for Kids” and have authored hundreds of books for children. Or the illustrator that did the cover for that book, for what is shown in that cover, when natural history museums and World heritage Sites continue to show similar figures? Such illustrators take their inspiration from the type of drawings and displays done by renowned scientists or scientific illustrators, or from covers of previous books or images shown in the media or social media that were in turn inspired by these same people. It is a complex vicious cycle, from which scientists cannot simply be absolved, and surely should not try to bury their heads in the sand as if this cycle has nothing to do with them. Unless we scientists can confront this issue without taboos, and in an *active* way, once for all, in an open, humble, informed way, we are condemning the next generations, including the next scientists that will become highly influential around the globe, to perpetuate such erroneous racist, sexist, and Western-centric narratives. Indeed, note that in the cover of the book shown in Figure 11 there is much more than just obvious Western-centrism: women are of course missing—the “cave-men” paradigm—and there is an obvious similarity in the color of the first four figures while the fifth is the one to grab our attention. Indeed, when doing a Google search of “human evolution”—at the moment we wrote this paper—a woman first appears after the 28th result. Out of the first 100 results, there are only three images of women and each of those images also include men.

It is indeed extremely disturbing, and profoundly telling, that the supposedly “educational” video for children shown in Figure 12, about “evolution and types of humans” is plagued by such racist, Western-centric, and sexist images and narratives. For instance, after discussing our “ancestors,” at the moment the video displays the image shown in Figure 12 the narrator then starts to speak about progress, with only the “white” businessman being then present. This video was made by the renowned Peekabook kids/Dr Binocs, and posted in Youtube just about 1.5 years ago (October 13, 2020) and already has more than 1 million views, presumably a huge number of them children, appearing as the top—first place—result when one searches for “human evolution for kids” in YouTube. So, this video, or the book shown in Figure 11, are clearly not “hidden” exceptions. They are instead rather very popular examples of the current evolutionary version of the ladder-of-life that continues to be so prevalent within our culture.

Another clear example is a book that is the first/top one to appear when one searches for “human evolution kids' books” on Amazon, at the time this paper was written. The book is authored by “Professor Beaver,” who publishes several “nonfiction educational” books for the Canadian School Curriculum and is described by Amazon as:

Professor Beaver publishes high quality books for children of all ages, ranging from non-fiction educational books, picture based books and books specifically for the Canadian School Curriculum. Our books are created to entertain and educate children at the

same time, focusing on interesting topics and blending those with essential learning goals for children from K-12. Inspired by a deep love of teaching our in-house authors create the most uniquely crafted content that help children enjoy the learning process while they relate everyday activities to curriculum lesson plans designed by Canadian School Boards both federally and provincially.

This description clearly shows how there is indeed a very thin red line between “nonfiction educational books,” “science,” the use of academic authority by using the name “professor,” and racist, sexist, and Western-centric scientific biases, narratives, and stereotypes. For the broader public and surely for the children that see this description and these videos and books, that line is literally often perceived as nonexistent. This blurred line is further emphasized by the official description of the book: “Charles Darwin theorized that humans evolved from apes... he has scientific facts and years of research to back him up... this book will give you a general overview of Darwin's study... your child may not yet touch genetics in school but it's always an excellent idea to prep him/her up for the subject... buy this book today.”

Importantly, such “educational” materials, or images in general, are not only used/displayed in Western countries, but also in many other countries around the globe. This is a crucial point because, as explained above, such “educational” images and “scientific” displays were historically often used by politicians and local colonizing authorities to precisely show those they wished to colonize “thy place” and teach them that they were inferior and should behave accordingly, for example as “natural slaves” (e.g., Diogo and colleagues<sup>15,24,31,33,34,36</sup>). One illustrative example is shown in Figure 13, which is taken from a Korean internet blog. This image, found through the popular South Korean search engine Naver, shows a linear depiction of human evolution that ends with a “modern” “civilized” man of European descent—clean, shaven and dressed in business casual clothes with presumably a smartphone in hand, symbolizing “progress”: something that “others” should imitate. The image perpetuates the typical racist, Western-centric, sexist, and classist bias toward a non-Western audience. The depiction in the middle is made to be a “cave-man” by adding the typical “cave-man” club—which is, in itself, mainly an erroneous depiction of human evolution, but, if the club was removed, the image could be any man with a darker skin tone and a stereotypical connected hairline with the beard. Actually, it is important to emphasize that during our discussions for this paper, our coauthor Adeyemi Adesomo felt that he, for instance, could identify with that third figure and was both appalled by, and shocked with, this specific figure. This stresses again the importance of including diverse point of views to discuss these topics in a broader, more informed way. In this sense, the depiction of a club in such depictions of human evolution is not only used to convey a more “animalistic” tone to contrast to the “civilized” “white” man, but also presumably a symbol of violence, which clearly

contrasts from the “sophisticated” technology used by the “white” man. Moreover, as noted above, the depiction of the “white” man further enforces a classist idea, that is, an idea built upon the prejudice against a specific social class or favor for a specific social class. To depict the most evolved human to be a “white” man centered in a technological Western world, is excluding all other types of societies/people that may operate, or see themselves, differently.

## 6 | CONCLUSION

There have been changes, in the last decades in particular, concerning the recognition, and correction, of how racist, sexist, and Western-centric biases have affected the history of science. However, despite this welcomed recent pattern, science in general, and biology and anthropology in particular, as well as “educational” materials related to these two disciplines and to human evolution in general, continue to be permeated by such biases in a way that is far greater than it is often recognized by scholars, the media, and the broader public. “Those who cannot remember the past are condemned to repeat it” is a popular quote—often credited to Spanish philosopher George Santayana, but the point here is that apart from acknowledging the wrongdoings of the past, it is also crucial to do the same with those of the *present*. The type of examples provided in this paper are therefore critical to emphasize this point and to help starting discussions on how to change the vicious cycle of acculturation and systemic racism and sexism that still affects, to a certain extent, biological, anthropological and medical sciences and education. Accordingly, we should *all* make an *active* effort to recognize and correct the type of biases and factual scientific errors outlined in this publication so that anatomical atlases, research studies, natural history museums, world heritage sites, and educational materials do not perpetuate the diminishing echoes of racism, Western-centrism, sexism, and classism. This is because, if we do take an *active* effort to recognize, emphasize and correct such biased ideas that continue to permeate science, education and thus society in general, our children will be condemned to internalize and propagate the same insidious and damaging ideas and thus to impose or suffer the same type of discrimination, subjugation, oppression and eventually atrocities that have been previously justified by them.

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## DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no data sets were generated or analyzed during the current study.

## ORCID

Rui Diogo  <http://orcid.org/0000-0002-9008-1910>Fatimah Jackson  <http://orcid.org/0000-0001-6737-2181>

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#### AUTHOR BIOGRAPHIES

**Rui Diogo** is an Associate Professor of Anatomy at the Howard University College of Medicine, and combines his studies on

biological and anthropological issues to address broader societal topics.

**Adeyemi Adesomo, Kimberly S. Farmer, and Rachel Kim** are medical students at the Howard University College of Medicine that are very interested on these broader societal topics and how they are related to past and current medical practices.

**Fatimah Jackson** is a Full Professor of the Biology Department of Howard University, as has done extensive work on the topic of racism.

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