

Developing Decolonial Consciousness in Biology Students Through Critical Reflection Assignments

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Abstract

There is a growing call to decolonize curricula in academia, including in scientific disciplines. In the biology classroom, this includes highlighting a diverse array of scientists and illuminating injustice and exploitation carried out by Eurocentric biologists and medical professionals. Despite this general roadmap, literature presenting and assessing classroom modules on decolonizing science is lacking. Here, I present an activity designed to shed light on the deep, historical relationship between natural history collections and the exploitation of slaves and Indigenous peoples and encourage students to critically evaluate how society influences science. Due to COVID-19, this activity was conducted remotely and included two synchronous discussion sessions and three asynchronous homework activities for Mammalogy students. Assignments were evaluated for student outcomes including reflections on their previous educational experiences related to the unjust history of science and engagement with decolonial theory. In the four homework questions in which students could interpret and answer from either a biological or decolonial perspective, 84% of students offered at least one response consistent with decolonial theory. Based on student responses, this three-week module successfully engaged upper-level biology students in decolonial thinking.

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Supporting Materials: Supporting Files S1. Developing Decolonial Consciousness – Homework 1; S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet; S3. Developing Decolonial Consciousness – Homework 2; S4. Developing Decolonial Consciousness – Primate spreadsheet; S5. Developing Decolonial Consciousness – Homework 3; S6. Developing Decolonial Consciousness – Discussion 2 question sheet; S7. Developing Decolonial Consciousness – Letter to the museum; and S8. Developing Decolonial Consciousness – Museum responses.

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Learning Goals

Students completing this activity will:

- Understand the historical connection between colonialism and natural history museum collections and biodiversity studies.
- Become more critical of power dynamics in science.
- Become familiar with how society influences science and scientists.
- Collaborate with fellow students to learn and discover from their peers.
- Develop scientific thinking skills.

Learning Objectives

Students completing this activity will be able to:

- Recognize possible colonialist aspects of specific museum collections.
- Think critically about the relationship between science and society including how scientists plan field research, and who is considered a scientist.
- Develop arguments about the effect of colonialism on our understanding of science as a process for revealing truths about the world.
- Critically evaluate how science is presented to them in their education.
- Construct a letter to persons with the authority to influence policies surrounding colonialist aspects of their mission and to decolonize their collections.

INTRODUCTION

Recent developments in technology and methodology have allowed scientists to leverage museum specimens for cutting-edge research. Natural history museum advocates cite such research in making the case that specimen collection is essential (e.g., 1, 2) and that organismal biology courses should be preserved in the university curriculum (3). Natural history collections serve a vital role in biology research by storing a wealth of biodiversity. The specimens and act of collecting in the field both help train future naturalists (3). Training the next generation of biologists in biodiversity is especially important as we strive to mitigate the 6th mass extinction (4).

Over the past decade, biology instructors have highlighted the utility of museum specimens in the classroom (5). Efforts to engage undergraduate students in research museums include both long-term tiered programs (6) and lab activities (e.g., 7, 8). Just as natural history research relies on the latest scientific techniques, classroom instruction should be designed using research-based pedagogy (e.g., inquiry-based activity in 8).

One significant change to pedagogy in recent years is the call to decolonize curricula (e.g., 9), with much of the literature published in the humanities and social sciences (e.g., 10, 11). Educators and researchers make the case that academics must acknowledge the structural inequities perpetuated (and in some cases established)

by the Eurocentric university system while striving to dismantle the system to create an inclusive educational community. The Eurocentric university system solidified Eurocentric history and science as the only acceptable perspective in academia, dismissing Indigenous knowledge and non-European voices (10). A consistent message in the decolonizing literature is that curricula in Eurocentric institutions must recognize the historical and continued erasure of contributions from marginalized people and the long history of exploitation to further Eurocentric academic pursuits (9). By decolonizing curricula, a more diverse array of perspectives is introduced to students, and historical power dynamics are acknowledged and addressed to promote inclusivity (9).

In her 2019 book, *Superior: The Return of Race Science*, Angela Saini outlined the close relationship that Eurocentric science had with eugenics and race science and warned that white supremacists are currently cherry-picking from genomic data to masquerade their prejudice as science (12). Only by acknowledging and reckoning with our history can science avoid such relationships moving forward. For instructors seeking a shorter overview than Saini's, Beth Baker summarized the history of Eurocentric science, as well as the current genomic research developments that account for how social and environmental factors play a role in human health alongside genomics (13).

A growing number of scientists (many from underrepresented backgrounds) have pushed to decolonize science. Physicist Chanda Prescod-Weinstein used the proposed 30-meter telescope on Maunakea, Hawaii as evidence of the importance of decolonizing science (14, 15). This proposed telescope led to a widely publicized conflict between Eurocentric scientists and Native Hawaiians – the astronomers prioritized their science over the concerns of Indigenous peoples. Prescod-Weinstein pointed out that this imperialist attitude has long been engrained in Eurocentric science and stressed the importance of moving beyond the Eurocentric view of science. She compiled a [decolonizing science reading list](#) that is especially relevant for physicists and astronomers. Given the historical precedent of negative impacts that genetic research has had on Indigenous Peoples (e.g., violations of informed consent with the Havasupai Tribe; 16), Maui Hudson and fellow Indigenous colleagues outlined steps that geneticists must take in order to improve Indigenous Peoples' representation in genomic research, including enhanced transparency, community involvement, and improved equity (17). In a review paper, biologist Danielle N. Lee illuminated early animal behavior scholars from underrepresented backgrounds whose narratives had been overlooked or erased in order to highlight their contributions to science and society that could be featured in biology lectures (18). Outside of higher education, Canada made strides in decolonizing science curricula by forming collaborations between the Ministry of Education and Indigenous communities (19).

Despite the growing call for decolonizing science, STEM faculty are rarely trained on how to lead students in conversations on privilege and inequality and therefore may avoid it entirely (20). Even social scientists admit it can be challenging to confront difficult topics in the classroom (e.g., 21), and it may often fall to faculty of color to do the majority of work for diversity initiatives in their department (22). Data on how STEM students engage with class materials grounded in inclusive pedagogy and

decolonizing curricula are lacking. Here, I present an activity conducted remotely with upper-level students in a Mammalogy course along with an overview of their written reflections.

This three-week activity was conducted with 34 upper-level students majoring in a biology field. In the syllabus, students were informed by the course professor: "You will have the opportunity to see and learn about a large number of groups of mammals, including around 100 families, and you will also be learning to recognize around 65 species of mammals that are found in Michigan. You will learn about them in both lecture and lab, and our goal is to coordinate the two parts of the course as closely as we can." A primary challenge the lab instructor faced was designing an activity to address the relationship between colonialism and museums while simultaneously upholding the main objectives outlined by the course professor. The activity was designed to shed light on the deep, historical relationship between natural history collections and the exploitation of slaves and Indigenous peoples and encourage students to critically evaluate how society influences science and to engage in decolonial theory.

Intended Audience

This activity engaged upper-level biology majors as well as conservation biology master's students at a large research university. This activity could be implemented with first-year students and non-majors.

Required Learning Time

Two one-hour laboratory class discussions and three homework assignments were devoted to the activity. Each homework assignment took between 15 and 30 minutes for students to complete.

Prerequisite Student Knowledge

Students should be able to find and communicate information and pose thoughtful questions. Students should have a general understanding of mammals, primates, and natural history museums. If necessary, a short "behind-the-scenes" museum video can be provided to improve student understanding of natural history museums (e.g., overview of a museum examples from the [University of Michigan](#) and the [Smithsonian](#); [alcohol collection](#); [preparing a specimen](#)).

Prerequisite Teacher Knowledge

For this activity, the instructor should be generally familiar with natural history museums and zoology collections (overview available in reference 8) and feel comfortable facilitating a Socratic discussion with their students. The instructor should be familiar with the history of exploitation in the name of science (such as Henrietta Lacks, Tuskegee Syphilis Experiment; 12 and 13). If the instructor wishes to use a different museum for evaluation, I recommend they explore the collections on [VertNet.org](#) prior to altering the assignment.

SCIENTIFIC TEACHING THEMES

Active Learning

In homework 1, students were asked to reflect on short readings, choose the most impactful statements, and describe how they responded to the readings. In the first discussion hour, students shared their reactions and discussed implications of the readings. In homework 2, students chose their favorite primate

family to evaluate in detail and pose a question. These questions were compiled and answered in the second discussion by a museum representative. In homework 3, students read their peers' work and responded to one another.

Assessment

Students were formatively assessed during both discussions and on each of their three homework assignments. Feedback on student homework was provided by the instructor. Students received participation points for attending each discussion and homework points for thoughtful homework responses. Because this activity was designed to allow students to engage in the subject/s of their choosing (biology, museum collections, decolonial theory, or a combination), no rubric was used, and students received a passing grade for completion of homework and attending discussion. However, the activity was assessed by the instructor by reading through the homework for signs that students were choosing to engage in decolonial theory.

Inclusive Teaching

The instructor used homework 1 to make students aware of the role that colonialism played in museum collections, as well as the concept of decolonizing science. The homework questions, as well as class discussions, were designed to allow students with varying amounts of exposure to these concepts to share and reflect. Students who felt comfortable gave their permission to have their homework responses shared anonymously, which allowed students to read and respond to their peers' perspectives. In addition to highlighting the unethical history of science, this activity challenged students to think of how they can be more inclusive as scientists.

LESSON PLAN

Please refer to Table 1 for the teaching timeline of this activity. Prior to the emergency remote transition online due to COVID-19, students attended two 80-minute lectures and one 3-hour lab each week. Each week of lab focused on a different group of mammals (e.g., Carnivora, Chiroptera, marsupials) that students must learn to identify. Lab handouts were written for groups of three students to work together to critically examine museum specimens to find identifying characteristics and draw from lecture material to answer questions about their morphology and natural history. After the transition online, students attended lecture asynchronously and the lab handouts were re-written for individuals to complete asynchronously with video footage of specimens.

Before Discussion 1

One week before Discussion 1, post homework 1 (Supporting File S1. Developing Decolonial Consciousness – Homework 1) on the course learning management system (LMS). The announcement read: "I have two 1-page readings (homework 1 linked) for you to reflect on before next Wednesday's lab discussion. Answer the 5 questions and submit them here (LMS assignment link). After you finish reflecting on both readings, watch this [short video](#). Please let me know if you have any questions or concerns."

For each reading excerpt, students were asked to highlight the most impactful 1-3 sentences. The first excerpt, Reading A, was from a blog written by Chanda Prescod-Weinstein on colonialism and science, with a focus on her field, physics (14).

After the excerpt, students were asked to write their answer to the following: "What can biologists learn from this physicist's perspective on astronomy?" The second excerpt, Reading B, was from a Science magazine article on the deep ties between museum collecting and the slave trade (23). After the excerpt, students were asked to write their answer to the following: "What were your initial reactions to this excerpt?" To encourage students to synthesize their reflections on both readings, students were then asked: "Based on both readings, what are your thoughts on museum collections? Thoughts on on-going field work?" To complete their homework, students were asked to watch a [10-minute seminar by Danielle N. Lee](#) at SACNAS 2019 (24), reflecting on her experiences conducting fieldwork in Tanzania as a Black American scientist.

Discussion 1

On the day of Discussion 1, students attended either a morning or afternoon class discussion for 60 minutes via video conferencing (BlueJeans) and received class credit for attendance. The instructor began the discussion with a brief speech acknowledging and addressing her identity and its history with Eurocentric science (Supporting File S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet). The goal of this speech was to demonstrate vulnerability by the instructor to encourage students to feel comfortable doing the same, establish a serious introspective tone, and set ground rules for discourse. After the brief speech, the instructor led the class discussion with probing questions (Supporting File S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet). The first discussion question that the instructor asked was: "Is there something from either reading you wish you'd known earlier?" The instructor had eight discussion questions to pose as she felt conversation lull (Supporting File S2 Developing Decolonial Consciousness – Discussion 1 instructor sheet). When students were asked to share impactful statements that they highlighted from Reading B, this provided the instructor an opportunity to challenge students to scrutinize the author's language on science and slavery. For example, in her impactful response to Kean's piece that was summarized in Reading B, Rae Wynn-Grant pointed out "Scholars quoted in the article use "we" and "us" when talking about people who are surprised by scientists' connection to the slave trade. This in-group construction suggests an underlying assumption that neither the Africans and African-Americans enslaved nor their descendants, who experienced and survived 400+ years of the transatlantic slave trade, were scientists then or are scientists today" (25). In their discussion, the students pointed out problematic themes including Eurocentric scientists discounting others and that science is good no matter the cost. To wrap up the discussion, the instructor informed students that one goal of this discussion was to make them equipped to work on the last question of the Primates lab handout, to be completed asynchronously in one week (Supporting File S3. Developing Decolonial Consciousness – Homework 2).

Homework 2

Homework 2 was written to allow students to digitally engage with a collection and encourage them to make connections between the collection and their reflections from Homework 1. The lab week of Primates was selected to anchor the decolonial activity because the established lab activity was comparatively short (12 families for students to learn) and because of the geographic distribution of primate species.

After the standard identification and natural history questions in the lab handout for Primates, students were asked to select one primate family to explore in the University of Michigan Museum of Zoology (UMMZ) collection. After selecting the family, they used the [online digital database VertNet](#) to find out the number of specimens in the UMMZ collection, the source locality (i.e., country of origin) of each specimen, the collection date, and any other relevant information. To provide students with the colonialist histories of the countries of collection and foster callbacks to their reflections from Homework 1, the instructor provided students with a spreadsheet that included the species, year of collection, country of collection, and brief overview of the country's colonial history (collected and synthesized from Wikipedia; Supporting File S4. Developing Decolonial Consciousness – Primate spreadsheet). For example, the colonialist history of Brazil read “Portugal 1500-1822, Amazon tribes currently in conflict with President Bolsonaro.” To conclude, students were asked: “If you could share one piece of information about your selected primate family with the UMMZ Chair, what would it be? If you could ask the UMMZ Chair to address one question about the primate specimens in our collection, what would it be?” (Supporting File S3. Developing Decolonial Consciousness – Homework 2). These two questions were written to allow students to choose how they engaged with the material presented in Homework 2. They could select to focus on the biology, museum collecting, colonial ties, or a combination of themes.

Homework 3

Student responses to homework 2 were compiled and organized into a draft letter to the UMMZ Chair on Google Docs. In homework 3 (Supporting File S5. Developing Decolonial Consciousness – Homework 3), students were asked to select a second primate family, read its section in the letter, and write a follow-up question or comment in the Google Doc. They were also asked to select one question or recommendation that they thought was especially important to ask the UMMZ Chair.

Discussion 2 and Beyond

Based on some of the questions and comments students had regarding the UMMZ collection, the instructor organized a second discussion with her students and the UMMZ mammal collection manager. Prior to the discussion, the instructor compiled a list of questions and sent them to the collection manager (Supporting File S6. Developing Decolonial Consciousness – Discussion 2 question sheet). This 60-minute discussion took place via BlueJeans two weeks after the first discussion. The collection manager provided students with an overview of the history of UMMZ, transforming from a “collect to collect” institution to “collect to answer particular research questions” institution. This discussion allowed students to have some of their questions answered, including how modern-day collecting works (i.e., permits, permissions, collaborations), how UMMZ used to collect primates and how they acquire them now, and what we know about missteps by UMMZ collectors and how to address them. If conversation lulled, the instructor used her question sheet to pose additional questions to the collection manager (Supporting File S6. Developing Decolonial Consciousness – Discussion 2 question sheet).

A finalized letter regarding the UMMZ primate collection was emailed to the newly appointed UMMZ Chair on July 1, 2020, as well the Director of the Natural History Museum (Supporting

File S7. Developing Decolonial Consciousness – Letter to the museum). Responses from both were compiled and shared with the students (Supporting File S8. Developing Decolonial Consciousness – Museum responses).

TEACHING DISCUSSION

The primary teaching goal for the mammalogy laboratory throughout the semester was to foster a collaborative environment where students learn and discover from their peers. The secondary goal was to promote student self-efficacy throughout the semester so that they consider themselves as scientists, rather than just biology students. Students had spent seven previous laboratory class periods working together in-person, prior to the transition to online education. This activity began on their second week of remote learning.

Assessment of Activity

Student responses from homework assignments 1-3 were collected, except for individuals who did not give their permission to be included in the study (32 responses collected; IRB 177992). Student responses from homework 1 were read to identify how many students reflected on their previous educational experiences that failed to acknowledge the unjust history of science or museum collecting, while homework 2 and 3 were read to identify the percentage of students engaging in decolonial theory. Students engaging in decolonial theory had at least one homework response that touched on colonialism (addressing imperialist power structure, ethics, racism, oppression, or permission to collect) or justice (addressing informing the public, providing credit to local collaborators, acknowledgement, transparency, or teaching students about colonialism's tie to collections).

Eleven out of 32 students expressed concern or frustration that their previous experiences in the classroom or museum setting had not touched on historical injustice carried out by Eurocentric science. For example, one student commented: “I took a museums studies course, and one thing I found kind of strange was our lack of discussion on scientific museums. I think they should be more included in these discussions because there are a lot of important contextual histories with specimens that should be discussed. Science is not in a bubble but should include these stories in teaching about their collections.” Another student declared: “I think it is very important to acknowledge the problematic parts of scientific history. Given the way these things are normally taught, we tend to not be aware of the shadier details surrounding discovery.” 84% of students engaged in decolonial theory in at least one of four questions from homework 2 and 3.

Reflection on Activity

As lab instructor, I was overwhelmed by the pandemic itself, as well as the requirement to rapidly transition hands-on in-person lab activities to online course materials. Because of unexpected stress of the COVID-19 pandemic, I was not sure if I had the cognitive ability to foster an impactful discussion with my students on decolonizing science. I was nervous as I introduced the lesson on BlueJeans, but my concerns abated as the students' discussion proved to be critical, introspective, and challenged the status quo of biology at their institution.

Students discussed that there must be a bigger effort to make science inclusive and cited that much of science is communicated exclusively in English. They criticized their own perceptions of how they perceive scientists. They voiced that colonialism and science is not talked about enough, and that the history of science typically “glorifies old white guys.” Students shared their own experience and expertise: one student reflected on his experience as an American scientist of color conducting field work abroad, while another discussed the reparations that fields such as art history and paleontology are doing. A common theme that students returned to was acknowledgement and giving credit to those historically erased, and that the fact that Eurocentric science has a controversial history should not be an excuse to ignore it. The students’ engagement in the discussion did not come out of nowhere. From January 9 until March 11, they attended in-person laboratories each week designed to foster collaboration and teamwork which may have helped enable a productive discussion of a challenging and uncomfortable topic.

Modification and Extension

The decolonizing science activity presented here was originally designed to be an in-person activity. The original plan was to have students complete homework 1 prior to lab and discuss their reactions to the readings during Primates lab in small groups for ten minutes and as an entire class for ten minutes. After the 20-minute discussion, students would rotate between different primate stations in small groups. Each station would have between one and three primate families for students to examine for identifying traits. Each station would also contain a printed handout detailing the collection information for the families present including year of collection, country of collection, and brief overview of the country’s colonial history. Students would be asked to write down one question or comment on the handout so that the handout accumulated student work, and students could begin engaging with their peer’s anonymous reactions. Remote teaching allowed the instructor to more than double the discussion time with her students. In hindsight, I believe working remotely and asynchronously allowed students the time needed to reflect that I might not have seen in the originally designed activity. By combining synchronous discussions and asynchronous student reflections, I believe I achieved my original goals. As one student pointed out: “My favorite lab for this course was the Primates lab. Even though it ended up being virtual, I thought that the discussion we had to supplement the lab was really meaningful and brought another level of appreciation and consciousness to looking at these specimens.”

For universities with museum collections, this activity can be modified for their primate or bat collections. For institutions without a museum collection, instructors can either use the specimens presented within this activity and continue to communicate with UMMZ staff or they can select a public museum to evaluate, such as the Field Museum, American Museum of Natural History, or the Smithsonian National Museum of Natural History. The letter of questions compiled from Homework 2 could be sent to their curators and collection managers.

To scale this activity up to a larger course, I would recommend that teaching assistants (TAs) read the full sources of both student readings (14, 15, 23), as well as the race and biology article (13) so that they have the background to lead discussion. Rather

than hold a discussion as an entire class, the instructor questions (Supporting File S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet) can be turned into a discussion worksheet in which small groups work on while the TA circulates to moderate discussions, answer questions, and listen for insightful comments. The class as a whole could then share their biggest takeaways and the TA could highlight the interesting comments they overheard. For large courses looking to expand their conversations on science and society, Homework 1 could stand alone or be further scaffolded with additional readings (e.g., 13). Homework 1 can also be used as a jumping off point when discussing genetics and race, rather than museum science and field research.

I designed and implemented a decolonizing science discussion activity that was successfully integrated into a natural history course on mammals. I hope this galvanizes more biology instructors to begin having similar discussions, and expanding upon this activity to create lectures, discussion modules, courses, and academic seminars dedicated to decolonizing science.

SUPPORTING MATERIALS

- S1. Developing Decolonial Consciousness – Homework 1
- S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet
- S3. Developing Decolonial Consciousness – Homework 2
- S4. Developing Decolonial Consciousness – Primate spreadsheet
- S5. Developing Decolonial Consciousness – Homework 3
- S6. Developing Decolonial Consciousness – Discussion 2 question sheet
- S7. Developing Decolonial Consciousness – Letter to the museum
- S8. Developing Decolonial Consciousness – Museum responses

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REFERENCES

1. Tewksbury JJ, Anderson JGT, Bakker JD, Billo TJ, Dunwiddie PW, Groom MJ, Hampton SE, Herman SG, Levey DJ, Machnicki NJ, del Rio CM, Power ME, Rowell K, Salomon AK, Stacey L, Trombulak SC, Wheeler TA. 2014. Natural history’s place in science and society. *BioScience*. 64:300-310. <https://doi.org/10.1093/biosci/biu032>.
2. McLean BS, Bell KC, Dunnum JL, Abrahamson B, Colella JP, Deardorff ER, Weber JA, Jones AK, Salazar-Mirallas F, Cook JA. 2016. Natural history collections-based research: progress, promise, and best practices. *J. Mammal*. 97:287-297. <https://doi.org/10.1093/jmammal/gyv178>.
3. Schmidly DJ. 2005. What it means to be a naturalist and the future of natural history and American universities. *J. Mammal*. 86:449-456. [https://doi.org/10.1644/1545-1542\(2005\)86\[449:WIMTBA\]2.0.CO;2](https://doi.org/10.1644/1545-1542(2005)86[449:WIMTBA]2.0.CO;2).
4. Payne JL, Bush AM, Heim NA, Knope ML, McCauley DJ. 2016. Ecological

- selectivity of the emerging mass extinction in the oceans. *Science*. 353:1284–1286. doi: 10.1126/science.aaf2416.
5. Powers KE, Prather LA, Cook JA, Woolley J, Bart HL, Monfils AK, Sierwald P. 2014. Revolutionizing the use of natural history collections in education. *Sci. Educ. Rev.* 13:24-33.
 6. Hiller AE, Cicero C, Albe MJ, Barclay TLW, Spencer CL. 2017. Mutualism in museums: A model for engaging undergraduates in biodiversity science. *PLoS Biol.* 15:e2003318. <https://doi.org/10.1371/journal.pbio.2003318>.
 7. Linton D, Monfils A, Phillips M, Ellwood L, Cook J. 2019. An investigation of island biogeography using data from online natural history collections. (Version 2.0). QUBES Educational Resources. doi:10.25334/Q4ST7D.
 8. Walsh LL, Giffen CJ, Thompson CW. 2019. Teaching biodiversity with museum specimens in an inquiry-based lab. *CourseSource*. <https://doi.org/10.24918/cs.2019.45>.
 9. Dei GJS. 2016. Decolonizing the university: the challenges and possibilities of inclusive education. *Social. Studies.* 111:23-61. <https://doi.org/10.18740/S4WW31>.
 10. Wane J, Shahjahan RA, Wagner A. 2004. Walking the talk: Decolonizing the politics of equity of knowledge and charting the course for an inclusive curriculum in higher education. *Can. J. Dev. Studies.* 25:499-510.
 11. Bhambra GK, Niñanco J, Gebrial D. 2018. *Decolonizing the University*. London, UK: Pluto Press.
 12. Saini A. 2019. *Superior: The Return of Race Science*. Boston, MA: Beacon Press.
 13. Baker B. 2021. Race and biology. *Bioscience*, 71: 119–126.
 14. Prescod-Weinstein C. 2015. Decolonising Science Reading List. <https://medium.com/@chanda/decolonising-science-reading-list-339fb773d51f>
 15. Prescod-Weinstein C, Walkowicz LM, Nord B, Neilson HR. 2020. Reframing astronomical research through an anticolonial lens — for TMT and beyond. arXiv: 2001.00674.
 16. Sterling RL. 2011. Genetic research among the Havasupai: A cautionary tale. *Virtual Mentor*, 13: 113-117. doi: 10.1001/virtualmentor.2011.13.2.hlwa1-1102.
 17. Hudson M, Garrison NA, Sterling R, Sterling R, Caron NR, Fox K, Yracheta J, Anderson J, Wilcox P, Arbour L, Brown A, Taulii M, Kukutai T, Haring R, Te Aika B, Baynam GS, Dearden PK, Chagné D, Malhi RS, Garba I, Tiffin N, Bolnick D, Stott M, Rolleston AK, Ballantyne LL, Lovett R, David-Chavez D, Martinez A, Sporle A, Walter M, Reading J, Carroll S. 2020. Rights, interests and expectations: Indigenous perspectives on unrestricted access to genomic data. *Nat Rev Genet*, 21: 377-384. <https://doi.org/10.1038/s41576-020-0228-x>
 18. Lee DN. 2020. Diversity and inclusion activism in animal behaviour and the ABS: a historical view from the U.S.A. *Anim. Behav.* 164:273-280. <https://doi.org/10.1016/j.anbehav.2020.03.019>.
 19. Aikenhead GS, Elliott D. 2010. An emerging decolonizing science education in Canada. *Can. J. Sci. Math. Techn.* 10:321–338. <https://doi.org/10.1080/14926156.2010.524967>.
 20. Killpack TL, Melón LC. 2016. Toward inclusive STEM classrooms: what personal role do faculty play? *CBE Life Sci. Educ.* 15:es3. <https://doi.org/10.1187/cbe.16-01-0020>.
 21. Jakubowski LM. 2001. Teaching uncomfortable topics: An action-oriented strategy for addressing racism and related forms of difference. *Teach. Socio.* 29:62-79.
 22. Turner CSV, González, JC, Wong K. 2011. Faculty women of color: The critical nexus of race and gender. *J. Div. Higher Educ.*, 4:199-211. <https://doi.org/10.1037/a0024630>.
 23. Kean S. 2019. Historians expose early scientists’ debt to the slave trade. *Science*. 4 April 4 2019. <https://www.sciencemag.org/news/2019/04/historians-expose-early-scientists-debt-slave-trade>.
 24. Lee DN. 2019. Plenary Session and Featured Speakers. 2019 SACNAS: The National Diversity in STEM Conference.
 25. Wynn-Grant R. 2019. On reporting scientific and racial history. *Science*. 365: 1256-1257. doi: 10.1126/science.aay2459

Table 1. Developing decolonial consciousness – teaching timeline. Activities included asynchronous homework assignments and synchronous video-conference discussions (morning and afternoon discussion groups).

Activity	Description	Estimated Time	Notes
Preparation for Discussion 1			
Students complete homework 1	<ol style="list-style-type: none"> 1. Students assigned two short readings. 2. Students highlight impactful sentences and answer three questions. 3. Students watch a 10-minute video. 	30 minutes	<ul style="list-style-type: none"> • Homework 1 is provided in Supporting File S1. Developing Decolonial Consciousness – Homework 1. • Students have one week to complete homework 1 (due morning of Discussion 1).
Discussion 1			
Instructor-facilitated discussion	<ol style="list-style-type: none"> 1. Instructor leads discussion with students. 2. Students refer to their completed homework 1. 	60 minutes	A discussion sheet for probing questions is provided for instructors in Supporting File S2. Developing Decolonial Consciousness – Discussion 1 instructor sheet.
Homework 2			
Students complete homework 2	<ol style="list-style-type: none"> 1. Students pick a primate family to investigate using VertNet. 2. Students share one piece of information and pose one hypothetical question. 	30 minutes	<ul style="list-style-type: none"> • Homework 2 is provided in Supporting File S3. Developing Decolonial Consciousness – Homework 2. • Instructors may choose to change the museum that students investigate. Instructors should test VertNet.org and create spreadsheets in this case. • Collect student permission to anonymize and share their answers • Students have one week to complete homework 2.
Homework 3			
Instructor organizes student answers to homework 2	<ol style="list-style-type: none"> 1. Instructor shares student responses on a Google doc 	60 minutes	<ul style="list-style-type: none"> • An example of the Google Doc is provided in Supporting File S7. Developing Decolonial Consciousness – Letter to the museum.
Students complete homework 3	<ol style="list-style-type: none"> 2. Students select a second primate family and reads and responds to student responses for that family. 	15 minutes	<ul style="list-style-type: none"> • Homework 3 is provided in Supporting File S5. Developing Decolonial Consciousness – Homework 3. • Students have one week to complete homework 3 (due morning of Discussion 2).
Discussion 2			
Instructor organizes student questions and sends them to museum expert. Instructor facilitates a discussion between students and museum expert.	Opportunity for students to have their questions heard and answered	60 minutes	An example of the questions compiled for the museum expert can be found in Supporting File S6. Developing Decolonial Consciousness – Discussion 2 question sheet.
After Discussion 2			
Send letter to museum administrators	Instructor compiles student homework responses and sends to museum administrators.	~ 60 minutes	<ul style="list-style-type: none"> • An example of the letter is provided in Supporting File S7. Developing Decolonial Consciousness – Letter to the museum. • The administrators’ responses are available in Supporting File S8. Developing Decolonial Consciousness – Museum responses.