ABSTRACT
Race and racism are considered standard subject matter in introductory college courses in the social sciences, but remain relatively absent in biological science courses (Donovan, 2015; Morning, 2011). Given a resurgence of biologically deterministic racial science (e.g., Risch et al., 2002; Shiao et al., 2012) and ongoing racial tensions in the United States, it is imperative that biology professors actively engage students in introductory and upper-level courses. This paper presents a tested approach used in an introductory natural science course (for undergraduate, non-science majors) at a mid-sized regional university. A biocultural focus is advocated for teaching about the fallacies (i.e., biological race concept) and realities of race (i.e., racism) (e.g., see Gravlee, 2009; Thompson, 2006). Further, an emphasis is placed on using a visual approach for relaying these complex and sensitive topics.

Key Words: race; racism; social sciences; natural science.

Preparing To Teach
Student and faculty preparedness strongly impact classroom environments. Though researching and preparing content is necessary, considerations of audience composition and method of content delivery are also crucial in setting the stage to teach about race.

Identity Impacts Learning
Students arrive in our classrooms with varying identities that impact their learning experience. College science classrooms are primarily “white” spaces, from the faculty and enrolled students to the language and approaches that can lead students of color to feel excluded (e.g., see Archer et al., 2015; Ryu, 2015; Tanner & Allen, 2007). Therefore, though science content is often the focus of our courses, scientific spaces are not identity neutral in that gendered and racial factors influence learning through a sense of belonging (Johnson, 2007). As a result, white students and students of color may understand race in very different ways both in their lives and within the classroom (Ninivaggi, 2001). Table 1 provides two...
models to explain how students conceptualize race. For white students, the struggles are awareness and overcoming discomfort, while students of color are challenged to overcome realized and unrealized feelings about societal perceptions of race and racism.

Faculty racial identity also impacts classroom environments. Faculty of color usually face the harshest teaching climate, because “white fragility” can contribute to students misconstruing such topics as politically or personally motivated (Pittman, 2010). Though white faculty teaching (mostly) white students often face less resistance, pushback should be anticipated and can be combated by reflecting on one’s own defensiveness about white privilege and discussing these experiences in the classroom (Ninivaggi, 2001).

**There Are Many Contexts in Which to Teach About Race**

Teaching preparation tends to focus on how time will be spent in class, forgetting that opportunities before and after class are also valuable in promoting learning. Table 2 presents considerations and approaches before, during, and after class. Consideration of the type of learning (e.g., lecture or activity) and time spent on learning in each context is warranted.

**Faculty Should Directly Address Classroom Tension**

It is challenging to create a classroom environment that allows students to feel relaxed enough to participate, yet self-aware of how to appropriately speak about such subjects. Three strategies for addressing tension include acknowledging the unspoken discomfort, setting expectations for discussion up front, and highlighting your own experiences with handling discomfort. Humor can help diffuse tension (e.g., “Who here finds this subject uncomfortable? Don’t worry, you’re normal.”) where appropriate (e.g., Garner, 2012; Hunsecker, 2015). Sometimes simply stating what students are feeling allows space for them to relax in such contexts.

Setting expectations in the classroom is key. Discussion contracts or lecture slides with key considerations are helpful (e.g., “Please challenge ideas instead of attacking people.”). Consider also giving students a script for communicating ideas to limit misunderstanding (e.g., “I am struggling to understand . . .” instead of “I don’t want to sound racist, but . . .”), and assuring students they will not be asked to speak unless they volunteer. With time, examples from previous courses can be used to highlight how students might react. For example, some students will refuse to discuss race intellectually by claiming such topics promote “racism”; preemptively describing times when such behaviors have been invoked in class and how you handled them provide concrete examples of expected behaviors.

Sharing personal experience can be a powerful tool in engaging students in difficult situations. For faculty of color, stories of how you have had to confront racism in your life and/or the classroom (which students are often unaware of) can humanize the subject. For white faculty, sharing the first time you recognized and had to challenge your own privilege (and/or alter your behavior as a result) can be powerful for white students who may assume you consider yourself “exempt” from criticism.

**Teaching About Race Bioculturally**

In teaching about race and racism, three themes must be emphasized:

1. The idea of biologically distinct races is not supported by research on genetic or physical (biological) differences among humans.
2. Yet, social and cultural constructions of race and its use as an identifier are real.
3. Race is not biologically determined, but racism has impacts on our biology.

Visuals provide information from a different perspective than verbal or written communications and are heavily used in modern American society. Because race in the United States is based on meaning ascribed to visible differences in bodily form, it is helpful to use visuals to convey concepts (see, e.g., Barnes-Karol & Broner, 2010; Harper, 2002). McGrath and Brown (2005) suggest visuals may promote retention of diverse students in STEM through a more approachable way of communicating scientific ideas. Visual learning also pushes students to confront how impactful media is in shaping our worldview (Kromidas, 2004). Visuals can include both static (e.g., photos) and dynamic (e.g., videos) media. Static media should include a mixture of scientific imagery and popular

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**Table 1. Conceptual framework for learning about race, by race.**

<table>
<thead>
<tr>
<th>White Students (Helms, 1990)</th>
<th>Students of Color (Cross &amp; Vandiver, 2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Contact</strong></td>
<td>1. Pre-encounter</td>
</tr>
<tr>
<td>Unaware of own race and little to no concept of racism</td>
<td>Internalization of racist messages (personal significance unrealized)</td>
</tr>
<tr>
<td><strong>2. Disintegration</strong></td>
<td>2. Encounter</td>
</tr>
<tr>
<td>Aware of racism and uncomfortable with this topic</td>
<td>Coping mechanisms vary</td>
</tr>
<tr>
<td><strong>3. Reintegration</strong></td>
<td>3. Immersion/emersion</td>
</tr>
<tr>
<td>Victim blaming used to cope</td>
<td>Desire to be with members of own race and to learn more about African and African American experience</td>
</tr>
<tr>
<td><strong>4. Pseudo-independent</strong></td>
<td>4. Internalization</td>
</tr>
<tr>
<td>Pull between feeling that change must happen and confronting one's own discomfort</td>
<td>Reframe internalized messages with positive self-image of one’s race</td>
</tr>
<tr>
<td><strong>5. Immersion/Emersion</strong></td>
<td>5. Commitment</td>
</tr>
<tr>
<td>Seek out white role models who typify “anti-racist” stance</td>
<td>Commitment to solving problems faced by one’s race</td>
</tr>
<tr>
<td><strong>6. Autonomy</strong></td>
<td></td>
</tr>
<tr>
<td>Comfort in multicultural settings, positive association with change</td>
<td></td>
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</tbody>
</table>
Table 2. Contexts for teaching about race.

<table>
<thead>
<tr>
<th>Contexts, Questions</th>
<th>Options</th>
<th>Suggested Approaches</th>
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| Before class (What will students do to prepare for class?) | Readings    | 1. Pick a reading outside of your textbook, unless this topic is explicitly covered.  
2. Reading quizzes enforce key concepts from readings. |
|                     | Activities  | 1. Implicit bias or privilege tests challenge students to consider internalized ideas or unrealized privileges. |
| During class (What will students do in class?)         | Lecture     | 1. In general education courses, discussions cannot be closely monitored; use mini-lectures to convey content between activities. |
|                     | Activities  | 1. Exploratory activities (or labs) allow students to collect data and explore why notions of biological races are invalid.  
2. Reflective activities allow students to articulate understanding and apply concepts; allow faculty to check/correct misunderstandings.  
3. Case studies (e.g., using historical or comparative census data to explain cultural variation in racial categories). |
| After class (What will students do to reflect on their learning?) | Homework   | 1. Challenge students to apply concepts learned in class (e.g., teach a friend this perspective, develop plan to address racism in real life). |

Cultural content (e.g., memes, cartoons), as scientifically derived visuals acculturate students to academic forms of communication, whereas popular imagery is readily familiar. A list of suggested dynamic resources is provided in Appendix A.

Theme 1: The Biological Race Concept Is “Unscientific”

Start by Defining “Key Terminology”

The terms “race,” “ethnicity,” and “genetic ancestry” are often misconstrued as overlapping concepts in scientific and popular literature (Yudell et al., 2016). Definitions of race can vary on a spectrum from biological to sociocultural (Hart & Ashmore, 2006; Hartigan, 2006; Overby, 2005) and shift depending on context (e.g., “How do scientists define race?” versus “What does race mean to you?”). Below are definitions that can be used to distinguish between terms:

1. **racial group (race):** a culturally variable term describing a group of people who are perceived as sharing biological features (e.g., skin color, eye shape, hair texture, etc.).
2. **ethnic group (ethnicity):** a culturally variable term describing a group of people who share or are perceived to share cultural features (e.g., language, dress, cuisine, etc.).
3. **genetic ancestry:** a biological term to describe “an individual’s relationship to other individuals in their genealogical history” (Yudell et al., 2016, 565) due to shared genes.

In the United States, race and ethnicity are misunderstood as overlapping concepts, which may complicate student understanding (Mukhopadhyay et al., 2014). Additionally, because immigration and national identity are an important part of American culture, definitions are shifting (e.g., are Middle Easterners white or Asian?). A simple visual to reinforce distinctions is: race (cultural) ≠ ethnicity (cultural) ≠ genetic ancestry (biological). Detailed examples can also help: two people whose race is black might have different ethnicities if one is Nigerian and the other is American. In this example, skin color might define race, while geography, language, and cultural norms define ethnicity.

Introduce and Debunk Common Myths About Racial Variation

Three misconceptions are pervasive about the nature of human genetic variation and race. First, the physical traits (phenotypes) we use to assign individuals to races are not discrete (distinct, non-overlapping expression), but rather continuous (spectrum of expression), variants. Blood type is good example of a discrete variant that is not useful for racial identification, whereas skin color is a continuous variant most often linked to race. Using Figure 1 ask students “How many skin colors are there?” and “If we divide these children into two groups-light and dark skinned- where would you place the breakpoint?”

Second, most traits do not co-vary. A particular hair color, for example, is not tied to a particular skin color. As a result, no matter the number or combination of traits used, there is no reliable way to assign people to racial groupings (Mukhopadhyay et al., 2014). Ask students, “What would happen if we asked two people to independently categorize races in our classroom and list defining traits? Would their answers be 100% the same?” A visual approach is presented in Figure 2. Ask students to identify the race(s) of the four people and any physical distinctions or similarities. American students will identify differences in skin color first, followed by differences in facial characteristics. After revealing that the four females live in (from left to right) Namibia, Egypt, Mali, and Kenya, students can reflect on why the class did not consider these women as the same race (i.e., because traits varied widely).
Third, ask students to evaluate Figure 3 by asking, “Do you think Taylor Swift and Kanye West are more genetically similar than these two penguins?” Some will go with the obvious physical differences and answer “no,” while others who have taken coursework in biology (or who suspect the answer is complex) will answer “yes.”

Faculty can cite historic genetic findings (e.g., Lewontin, 1972) or more recent genetic work (e.g., Venter et al., 2001) highlighting how little genetic variation is present in humans. Though estimates vary, introduce the fact that up to 95 percent of human variation can be found within human groups (5 percent between). Because our eyes tell us differently, it is useful to explain that physical features (phenotypes) vary widely because they are complex traits affected by genetic potential (genes), interaction with the physical environment (environment), and human behaviors (culture). Figure 4 can be used to highlight how genetic variation is organized globally versus how we interpret genetic differences based on what is observable phenotypically.

○ Theme 2: Race Is Socially Real But Constructed in Different Ways across the Globe

Once students can conceptualize why race is not rooted in biology, they may erroneously conclude that race is not real; therefore, time must be spent discussing what race is and how ideas about race are subjectively based on social and cultural upbringing. Faculty who skip this second piece will see that students of color, in particular, become frustrated given their experiences with racism are very real. To reconstruct race as “real,” several key points must be conveyed.

The Concept of Race in the United States is a Recent Invention

The concept of race in the United States arose in the early 1600s with the beginning of slavery and colonization, to justify inequalities among people of varied races (see review in Mukhopadhyay et al., 2014). In the ensuing 400-plus years, racist policies have been revised but systems of inequality still exist that favor white (or white-presenting) Americans over people of color. A perceptible shift in racial identity can be viewed through the broad lens of globalization, which not only brought people of different cultures together but also influenced who was “white” and who was not. Because students may assume that race has always been a qualifying characteristic and that current racial categories have always been the norm, it is useful to contextualize how much categories have changed. Figure 5 highlights an example of how American race concepts have changed.

Figure 1. Example of continuous variation in skin color. Images from Pixabay.com, Public-Domain-Image.com; no attribution required under CC0 Public Domain.

Figure 2. Illustrating physical variation across the African continent. (Left to right) “The daughters of a small community of bushmen living in Namibia” on 18 July 2009. Photo by Nicolas M. Perrault, licensed under Creative Commons CC0 1.0 Universal. “Egyptian woman in Luxor” on 3 June 2007. Photo by David Dennis, licensed under Creative Commons CC BY-SA 2.0. “A Bozo girl in Bamako” in August 2007. Photo by Ferdinand Reus, licensed under Creative Commons CC BY-SA 3.0. “A Swahili Wedding in Mombasa, Kenya” in January 2010. Photo by Amelia Hubbard (author).

Figure 3. Genetic variation in humans versus penguins. (Left to right) “Two penguins on a nature reserve in Antarctica” on 12 December 2007. Photo by PMATAS, licensed under Creative Commons CC BY-SA 4.0. “YouTube presents Taylor Swift,” San Francisco in September 2011. By Marcin Wichary, licensed under Creative Commons CC by 2.0. “Kanye West at the 2009 Tribeca Film Festival” on 21 April 2009. Photo by David Shankbone, licensed under Creative Commons CC by 3.0.

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Though Americans today consider Colin Farrell white, many immigrants (Irish, Italian, Greek, Jewish, Eastern European) were considered distinct from the white U.S. population (note: “no category” indicates periods prior to immigration of these groups). Were we to add, for example, Emma Watson (British), all census categories would be “white.”

**People Outside the United States Understand Race in Different Ways**

Many Americans are unaware of the fact that we are W.E.I.R.D.—Western, Educated, Industrialized, Rich, Democratic—comprising roughly 12 percent of the world’s population (Henrich et al., 2010). The implications of this exceptionality should be considered when exploring scientific studies, which focus almost exclusively on the Western world, thus making what we think of as “normal” highly skewed. Students, therefore, have to be reminded that our way of seeing the world, including how we understand race, is unusual.

As in the United States, historical, political, and economic reasons in different areas of the globe shape who gets to be in the majority racial category. Using Hispaniola (Haiti and the Dominican Republic, DR) as an example, we can begin to see the complexities of racial identity in a different context. Like other islands in the Caribbean, Hispaniola was colonized by several nations (San Miguel, 2005). By American racial standards, Haitians are black and (most) Dominicans are Hispanic. Haiti, occupied by the French, was primarily a plantation and African slave-based economy, while the DR comprised small farms and ranches with little use of slavery in its economy, allowing racial and cultural distinctions between areas to develop (San Miguel, 2005). Today, Dominicans have a complex racial hierarchy that distinguishes between indigenous, precolonical identities, those descended from Hispanic colonists, and Dominicans with slave ancestry (Howard, 2001). American actresses Zoë Saldana and Michelle Rodriguez (Figure 6) both have one Puerto Rican and one Dominican parent. They are both fluent in Spanish, but have no obvious accent. Why then do they have different racial assignments, and what are the cultural distinctions between them?

In the United States, skin color is a defining physical characteristic of race, but language can also come into play when individuals come from a Spanish-speaking locale. Saldana is labeled black and not Hispanic in the United States because her skin color is more important in our cultural ideas about race than her ethnic heritage. Interestingly, because Rodriguez is light-skinned, language and nationality become defining characteristics that distinguish her from white Americans. In the DR, skin color defines race because an important aspect of Dominican racial identity is rejection of their African (i.e., Haitian) history by using terms that subvert the use of color (Howard, 2001). “Indio” as a category was once considered a catch-all, including individuals with indigenous (Taino Indian) heritage, but today is used as a more politically correct way of...
Figure 6. A comparison of the U.S. versus Dominican racial categories. (Left to right) "Zoe Saldana at Guardians of the Galaxy Q&A at Yahoo HQ” on July 22, 2014. Photo by Ernest Aguayo, licensed under Creative Commons CC BY-NC-ND 2.0. “Michelle Rodriguez at the 2013 San Diego Comic Con International in San Diego, California” on 20 July 2013. Photo by Gage Skidmore, licensed under Creative Commons CC BY-SA 3.0.

describing someone with dark(er) skin, like Saldana (Howard, 2001). In contrast, Rodriguez’ light skin qualifies her race as blanco (white) or trigueño (wheat-colored) (Howard, 2001).

○ Theme 3: Racism Impacts Health and, Therefore, Biology

This millennium has seen a resurgence in claims linking biological race and disease susceptibility (e.g., Shiao et al., 2012), despite greater evidence that social perceptions of race are culpable (e.g., see Hoffman et al., 2016). As such, biological disciplines can use “racialized medicine” as an opportunity to show the impacts of race on health outcomes and elaborate on the nature of science, namely that science can be misapplied and/or misinterpreted. Four points should be emphasized.

Racism Causes Stress and Poor Health

Medical communities are not wrong to examine race in health contexts, as the challenges of living in an unequal society can elevate stress levels affecting physiological, emotional, and physical well-being; however, in many cases, doctors assume biological differences among races (not racism) impact human health (Goodman, 2000). A study by Madrigal et al. (2009) tested the idea that microevolutionary differences amassed during the period of slavery could explain differences in rates of hypertension between black Americans and other racial groups (“slavery hypothesis”). The team found low rates of hypertension among black individuals in the Caribbean and Africa, with high rates among black Americans. Racial differences in diet and genetics were discounted as strong factors, whereas hypertensive rates were strongly linked to racism-induced stress. Similar results come from other studies looking at health disparities resulting from discrimination and racism, such as heart disease (e.g., Lukachko et al., 2014), pre-term birth (e.g., Raglan et al., 2016), and low birthweight (e.g., Earnshaw et al., 2013). A visual approach can be to load slides with headlines from varied studies highlighting the health risks of racism-induced stress.

Race is not Genetic Ancestry

Although genetic ancestry can indicate increased chances of having a particular disease (i.e., a “family genetic history”), race cannot. An excellent example is the global distribution of different kinds of hemoglobinopathies (e.g., sickle-cell anemia and thalassemia), which represent evolved adaptations against malaria in areas where this disease is (or was) endemic (e.g., see Aidoo et al., 2002; Steinberg, 2008). Associating such conditions with a single race, as sickle cell is with black patients, means that the condition may go misdiagnosed or underdiagnosed in individuals who have genetic ancestry in regions affected by malaria but do not present as black. Conversely, individuals perceived as black (regardless of their actual genetic ancestry) may be assumed to have sickle cell anemia when their symptoms result from a different cause.

Racism is Real, “Reverse Racism” is Not

Students may enter the classroom with the notion that racism is not as pervasive today as in the past, hindering their understanding of its impact on health. In the United States, a consequence of this thinking has been the introduction of ideas about “reverse racism,” or false notions that white Americans are being discriminated against by policies perceived to favor people of color (Norton & Sommers, 2011). Such feelings have been linked to an economic downturn in which many white Americans have been, for the first time, exposed to financial hardships historically experienced mostly by racial and ethnic minorities. In short, when everyone was forced to confront the reality of economic instability, the problem became “real.” This kind of “whitewash” against racism can also be observed in other post-colonial, melting pot societies such as the United Kingdom, South Africa, Brazil, and Australia.

Still, lived experience is powerful and governs the way we perceive racism. To teach about the bias of lived experience, you can use two activities. First, poll students for their feelings about affirmative action (e.g., a “handout,” a system requiring revision, an effective system, etc.) using clickers or personal devices to maintain anonymity. Second, provide an explanation of affirmative action—in short, it protects people of all races (and other marginalized identities) from discrimination in the workplace, and in hiring situations favors diversity when two or more applicants are equally qualified—then, poll again. In my experience, around 30 percent of students shift their ideology from affirmative action as “handout” to a “necessary” system. If pressed, most students selecting affirmative action as “handout” will articulate personal stories in which they assume white friends “lost” job opportunities, though few can also articulate the policy and know its historical development. By displaying results from the polling, faculty can use this change in understanding to discuss how our lived experiences and assumptions often influence how we view others (especially when we are misinformed).

Zoë Saldana
US: Black
DR: indio

Michelle Rodriguez
US: Hispanic/Latina
DR: blanco or “trigueño”
In a few cases, students may complete the above activity and not change their answers. In fact, social psychologists have extensively documented how difficult it is for people to revise pre-existing ideas (e.g., see Nyhan & Reifler, 2015). Therefore, the final approach should be to inundate students with facts and figures illustrating the many ways people of color in the United States are discriminated against—from mortgages, to health insurance benefits, to economic wealth, to educational mobility, and so on. The statistics are staggering, and when faced with this reality, students usually begin to realize that “reverse racism” is a fallacy.

Racism is about More than Saying Hurtful Things to Others

For students to understand the enormity of racism and its impacts, they must understand what constitutes racism. People easily recognize racially motivated attacks on individuals as racism (i.e., interpersonal racism), because the perpetrator is easy to identify. In contrast, racism as an oppressive system (i.e., institutional racism) is more difficult to comprehend because people of all races are conditioned to expect these systems to exist through our unconscious bias (Omi, 2010). Figure 7 can assist students in recognizing this distinction.

Begin by asking students, “Which of these individuals is racist?” Individual A will be quickly identified because he practices overt forms of racism through deliberate acts of hatred against people of different races (i.e., interpersonal) and supports laws and systems that discriminate by race (i.e., institutional). Individual B’s racism is harder to identify, but also present. There is no direct interpersonal attack, and he is actively working to remain “color neutral”; however, in this act of colorblind support he still benefits from white privilege while doing nothing to dismantle racist systems. In short, he is taking the easiest steps toward not behaving in a racist way, while ignoring that racist institutions are still acting on people of color around him. For some students this revelation will be uncomfortable, but most will realize that remaining neutral supports racist systems. The same concept applies to students who might articulate that labels give power to race or feel the best approach is to not acknowledge race.

Unpacking and Assessing Understanding

Whether through an in-class or out-of-class assignment, it is important to deconstruct the learning process to help students process what they have learned and assess learning outcomes. As a final assignment students should be asked to write a reflective piece articulating what they perceive as core concepts of the lesson and how to apply what they have learned to their everyday lives; for students of color, an alternative is “one thing” they wish white Americans understood. Without such reflection students can feel hopeless to enact change or quickly slide back into colorblind tendencies (Hunsecker, 2015). As such, it is critical that students are challenged to consider what options they have to enact change in small (and large) ways and view themselves as part of the ultimate solution.

Conclusion

Race has become an unavoidable topic in the college classroom. This paper describes an approach used in an introductory level course, but the content is applicable for courses from the high school level to advanced college courses. Such topics can be used to explain the nature of science and its applications to social problems today, and are especially appropriate for biomedically focused courses. Though most of the ideas presented here are not novel, this paper provides a comprehensive and pragmatic overview of ways in which this complex subject can be approached. A primary goal in writing this piece was to help faculty gain confidence and comfort in teaching these topics; as noted above, preparation is key. Because race is a deeply personal experience, faculty must not forget feelings and identities at play in the classroom, or that a “decontextualized” approach to science is misinformed and potentially damaging. Now more than ever, it is crucial that faculty add such discussions of diversity to the classroom environment.

References


Appendix A: Dynamic Visuals

Dynamic Visuals: Activities and Simulations
- American Anthropological Association website: “Race: Are We So Different?” (see the “Lived Experiences” section)

Dynamic Visuals: Videos*
  - Episode 1: The Differences Between Us (covers social and biological ideas about race) (60 min.)
  - Episode 2: The Story We Tell (tracks the recent development of the race concept in the Western world) (60 min.)
  - Episode 3: The House We Live In (covers examples of institutional racism in the United States) (60 min.)
- Cracking the Codes: The System of Racial Inequity, Shakti Butler (World Trust, 2014) (75 min.)
  - Speakers from varying perspectives and races
  - Includes a conversation guide
- Mirrors of Privilege: Making Whiteness Visible, Shakti Butler (World Trust, 2006) (50 min.)
  - Features white activists discussing how they have come to understand their own privileges
* Segments of each video can easily be located on YouTube.