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Equity, Social Justice and Biology: Demystifying Race with Genetics of Human Skin Color (Version 1.0)

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MC MONTGOMERY COLLEGE

EQUITY, SOCIAL JUSTICE AND BIOLOGY: DEMYSTIFYING RACE WITH GENETICS OF HUMAN SKIN COLOR

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Introduction

Race-based interactions in human societies are largely borne out of a social construct and has no biological/scientific basis (Rusch, 2018 in <https://www.nytimes.com/2018/03/23/opinion/sunday/genetics-race.html>). Racial biases are often based on skin color, and features like height, eyes, and hair. Although these physical differences may appear distinct, they are determined by only a minute portion of the genome, yet as a species have been estimated to share 99.9% of our DNA with each other. The few differences that do exist reflect differences in environments and external factors, not core biology (Yusufi et al., 2016 and Chou, 2017 in <http://dx.doi.org/10.1002/ajpa.23711>).

Addressing the lack of scientific basis for the idea of "race" in human populations is vital and meaningful in the Biology courses. Montgomery College serves students from more than 150 countries and our classrooms have students from diverse cultures and economic backgrounds (See Figure below). In this case study, students in Principles of Biology I (BIOL 150), an introductory biology course for majors will synthesize the information available on the genetic basis of skin color patterns in human population to debunk the "race" idea. The "Big Picture" of this case study will be for students to understand that variations in skin color has been driven by selection pressures that different populations were subjected to, and that the genetic variations resulting in various skin colors do not correlate to the social

Case Study: Preliminary Plan

Recent genome-wide studies has led to discovery of several loci involved in the expression of human skin pigmentation (Rees & Harding, 2012; Crawford et al., 2017). The activity built around the case study will address the existing inherent bias associated with skin color.

Crawford et al. (2017) identified four genomic regions where genetic variation is associated with skin color. Within the four genomic regions, the researchers focused on six genes associated with pigmentation: SLC24A5, MFSD12, OAS1, TMEM138, OCA2 and HERC2. These six genes will be the focus in our case study, whereas, the students will predict the genotypes of individuals from different parts of the world. This will be done by identifying a subset of well-characterized genotypes across a wide geographic distribution that the students will utilize to predict genotypes of different populations.

First part of the case study will address multiple alleles/genes concept. Before working on this part of the case study, the students will be reviewing:

- Chemical structure of Nucleic Acids, proteins, and chromosomes.
- Cell structure and function: Mitochondria, etc.
- Mendelian genetics and deviations from the pattern.

In the second part, the student groups will discuss the variations in the expression of these genes/alleles that could result in different levels of skin pigmentation. Students often struggle in understanding the concept of gene expression when discussing the operon models. Use of familiar examples like skin color may improve their learning experience and mastery of the content.

Outcomes

- This case study in a freshman, gateway STEM course can be a signature assignment as part of General Education Program requirements.
- This example on genetics of human skin color will motivate the students address the inherent biases on race using a positive shared experience.
- This study will complement the initiatives at Montgomery College that address issues of Equity and Inclusion.

References

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Module Description:

This resource is a poster on a case study on the genetics of human skin color. Race-based interactions in human societies were largely borne out of a social construct and has no biological/scientific basis (<https://www.nytimes.com/2018/03/23/opinion/sunday/genetics-race.html>). Such interactions and racial bias often are strongly influenced by the variations in skin color between individuals involved in the interaction. In the case study that I will be writing, students in Principles of Biology I (BIOL 150), an introductory biology course for majors will synthesize the information available on the genetic basis of skin color patterns in human population to debunk the “race” idea. Montgomery College serves students from more than 150 countries and our classrooms have students from diverse cultures and

economic backgrounds.

Teaching Setting:

This poster describes a case study that is designed for students in an introductory biology course for majors.

QUBES Citation:

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Related Materials and Opportunities:

The case study described in this resource is still under development. If you are interested in providing feedback on the case study, feel free to email the author at vedham.karpakakunjaram@montgomerycollege.edu. We also encourage you to “[Watch](#)” this resource so that you’ll be notified when the author shares a new version with information about the completed case study.

The author attended and presented this poster at the [2018 QUBES/BioQUEST Summer Workshop](#), *Wicked Problems: Investigating real world problems in the biology classroom*. The workshop had a large case component, and some participants began developing case studies at the workshop. If you would like to learn more about what to expect at a QUBES/BioQUEST Summer Workshops, check out these blog posts written by [Lillian Senn](#), [Mark Slabodnick](#), [Jenny Hazlehurst](#), and [Darcy Taniguchi](#), 4 future faculty volunteers who attended the 2018 Summer Workshop.

The [2019 QUBES/BioQUEST Summer Workshop](#), titled *Evolution of Data in the Classroom: From Data to Data Science*, will be held at the College of William & Mary in Williamsburg, VA on July 14-19, 2019 and will focus on data science for undergraduate biology education. If you are interested in attending, we encourage you to [sign up for updates here](#).

The 2019 workshop organizers are seeking four highly motivated future faculty volunteers who will help with the day to day logistics of the workshop in exchange for a registration fee waiver. If you are interested in being a future faculty volunteer, learn more about the [Future Faculty Program](#) on the workshop website. Applications will open early 2019.

If you adopt and adapt this module, you are highly encouraged to share your adaptation back with the QUBES community using the QUBES Resources System for sharing Open Education Resources.

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