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

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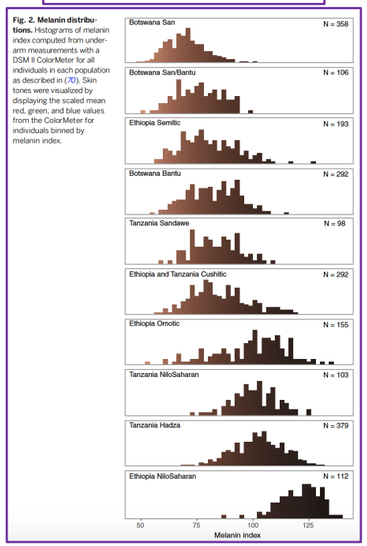
Introduction

Race-based interactions in human societies are largely borne out of a **social construct** and has **no biological/scientific basis** (Reich, 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: we 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 (Yudell *et al*., 2016 and Chou, 2017 in http://sitn.hms.harvard.edu/flash/2017/science-genetics-reshaping-race-debate-21st-century/).

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

"...the use of biological concepts of race in human genetic research...is problematic at best and harmful at worst." Yudell *et al*. 2016

Skin pigmentation is highly variable within Africa



Crawford *et al.* 2017

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 this 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, DDB1, TMEM138, OCA2 and HERC2. These six genes will be the focus in our case study, wherein, 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 genes/alleles across a wider 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: Melanosomes, 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.**

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