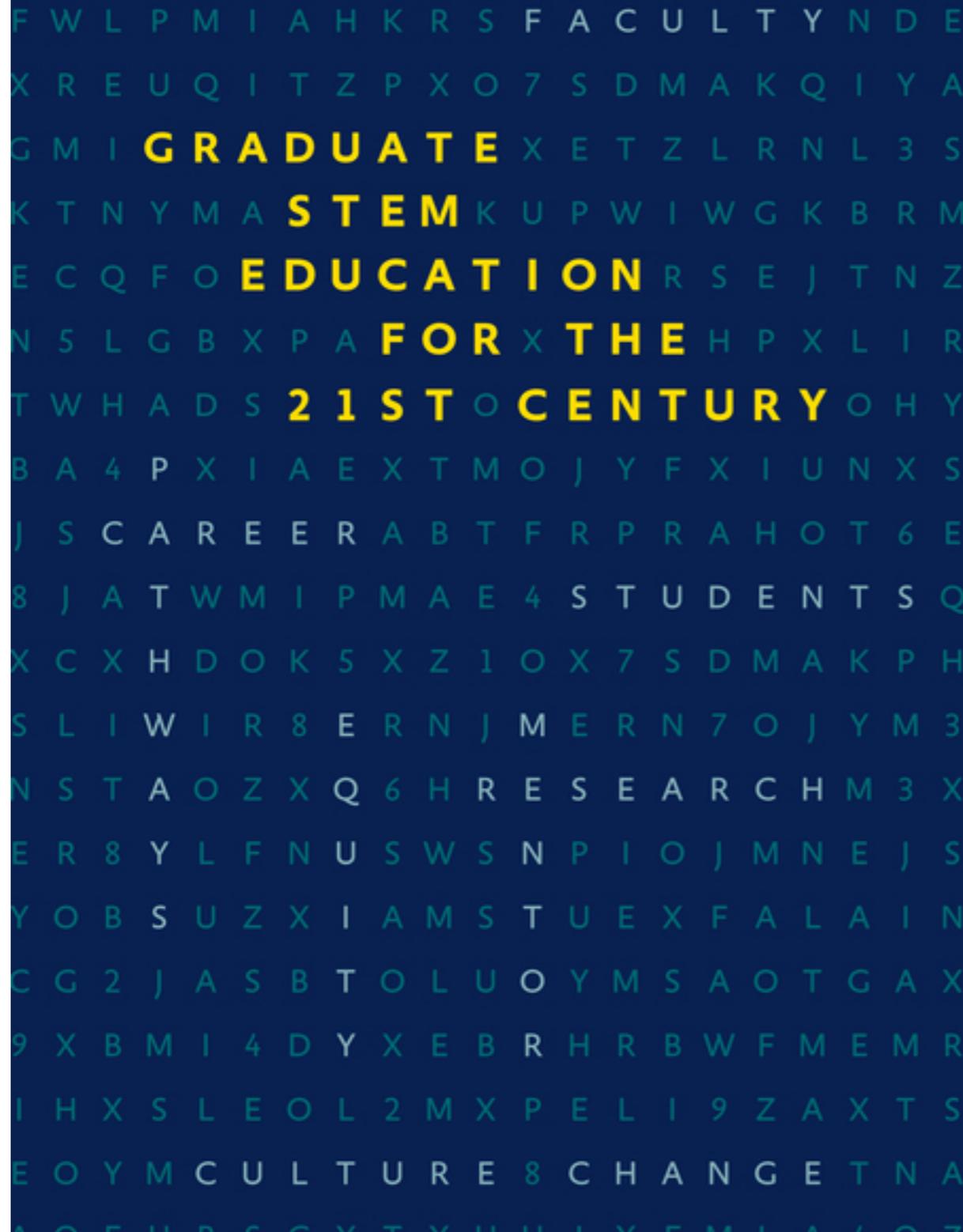


Graduate education activities to foster awareness of social implications of genetics

John Novembre
Department of Human Genetics
Department of Ecology & Evolution
University of Chicago

CONSENSUS STUDY REPORT

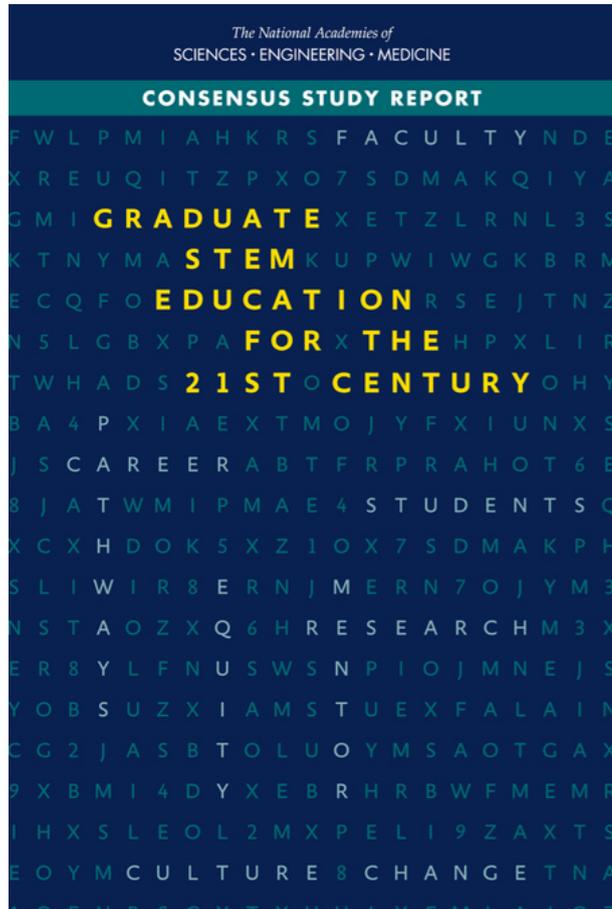


“It is more important than ever that scientists and engineers consider the societal impacts of science and technology...”

“Graduate STEM education in the 21st century” Report (2018)
by National Academy of Sciences

Motivations...

- Contemporary genetics research has far-reaching impacts
 - Direct-to-consumer testing, forensics, personalized medicine, pre-implantation genetic diagnosis, germ-line editing
- Unexpected audiences for population genetics:
 - Stormfront (Aaron Panofsky and Joan Donovan, 2019)
 - Preprint circulation outside academia (Jed Carlson and Kelley Harris, 2020, bioRxiv)
- Racial labels in biology curricula can increase students scores on metrics of prejudice, “Learned inequality” (Brian Donovan, 2017)
- Some hope...
 - “Towards a more human genetics education” (Brian Donovan et al, 2019); Understanding human genetic variation can dampen prejudice



“Today, all STEM graduate students supported by NSF and NIH training grants must take courses on the responsible conduct of research—the ‘**microethics**’ of authorship rules, research misconduct, and publishing norms, among others—but **few graduate programs teach or discuss the ‘macroethics’ of scientific and technological impacts on society** (Herkert, 2004).”

“Graduate STEM education in the 21st century” Report (2018)
by National Academy of Sciences

The RCR course as one location for discourse

- UChicago BSD Responsible Conduct of Research course
“Advanced topics” edition (4th & 5th year PhD students)
 - Two sessions with brief lectures followed by discussion:
 - 1. History of eugenics and social impacts of genetic engineering (Joe Thornton)
 - Background: Eugenics history, including its presence in the US, and support came from a wide range including progressive voices
 - Case-study/Discussion of CRISPR-editing human embryos
 - 2: Genetics, race, and discrimination (John Novembre)
 - Background: Primer on human genetic variation; history of the Genetic Information Non-discrimination Act (GINA) and its gaps
 - Discussion: Direct-to-Consumer genetic testing, polygenic prediction

Additional room in a graduate curriculum

- In graduate-level human genetic variation course, a discussion session:

May 29

Student-Led Discussion: Social and political implications of modern and ancient DNA variation studies [JN/AD/JB]

Review article:

Noah A Rosenberg, Michael D Edge, Jonathan K Pritchard, Marcus W Feldman (2019) Interpreting polygenic scores, polygenic adaptation, and human phenotypic differences. Evolution, Medicine, and Public Health 1: 26–34

Articles for discussion:

David Reich, How Genetics Is Changing Our Understanding of 'Race', New York Times, March 23, 2018

How not to talk about race and genetics, BuzzFeed, March 30, 2018

Letters: Race, Genetics, and a Controversy New York Times, April 2, 2018.

Ian Holmes, What Happens When Geneticists Talk Sloppily About Race, The Atlantic, April 25, 2018.

Coop et al, Letters: 'A Troublesome Inheritance' New York Times, Aug 8, 2014

Amy Harmon, Why White Supremacists Are Chugging Milk (and Why Geneticists Are Alarmed) New York Times, October 17, 2018

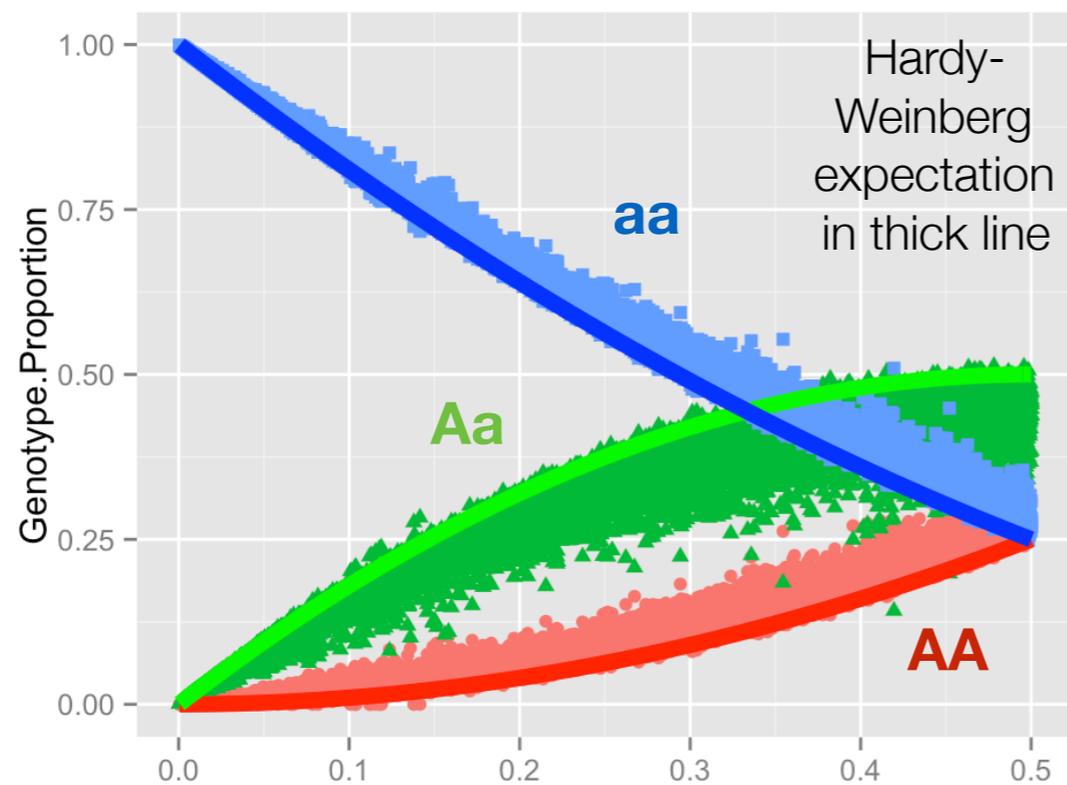
- Departmental seminar invitations to ELSI speakers
- Departmental journal clubs sessions on ELSI issues

Additional room in a graduate curriculum

- Lab expectations document:
 - **“Every lab member is expected to become aware and conversant around issues of racism and eugenics that have impacted the history of genetics as a field. Every lab member is expected, in preparing their talks, papers, and communications online or with the press, to be aware and counteract possible misperceptions and misappropriation of their work for racist ends. One useful practice is for sensitive communications, ask others to read your work looking for possible phrasings that may be misinterpreted or misread.”**

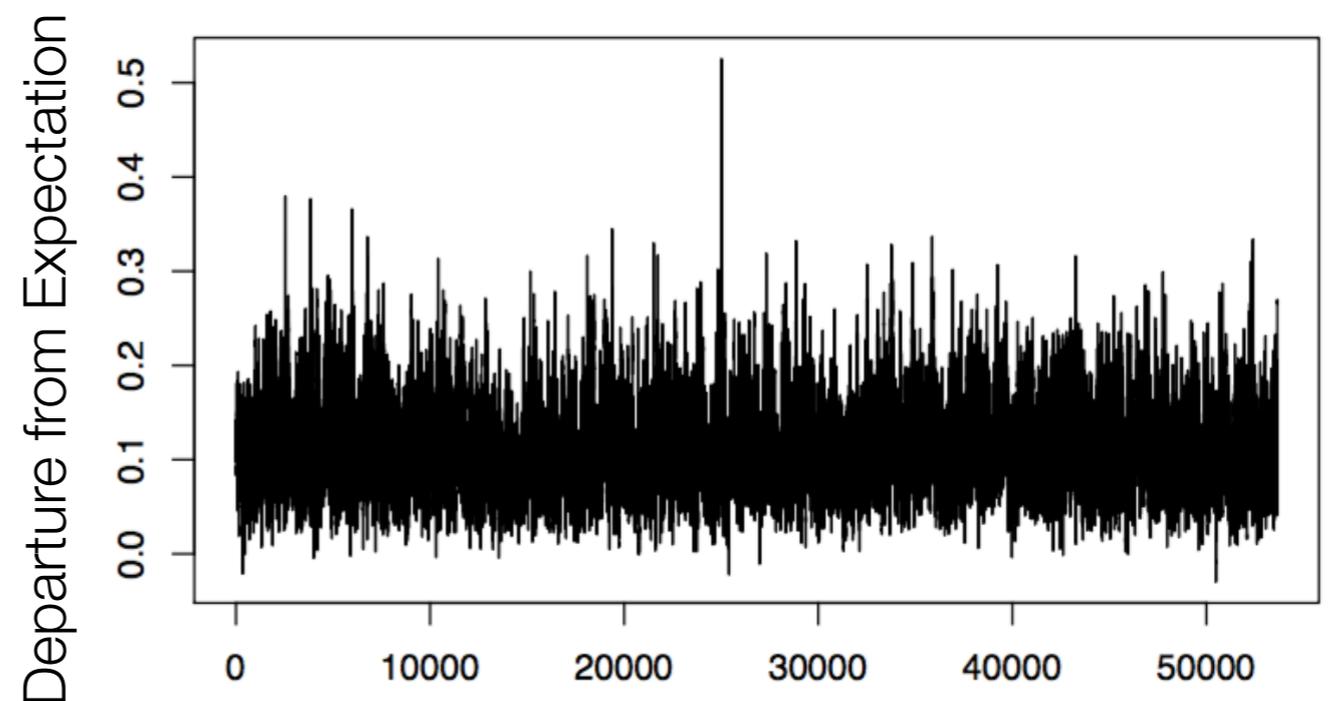
Additional room in a graduate curriculum

- In division-wide “Quantitative Bootcamp”: a case-study with Hardy-Weinberg proportions that has an example of how skin pigmentation loci are among the most differentiated in the human genome
- <https://github.com/StefanoAllesina/BSB-QBio3/tree/master/>



Frequency of A allele

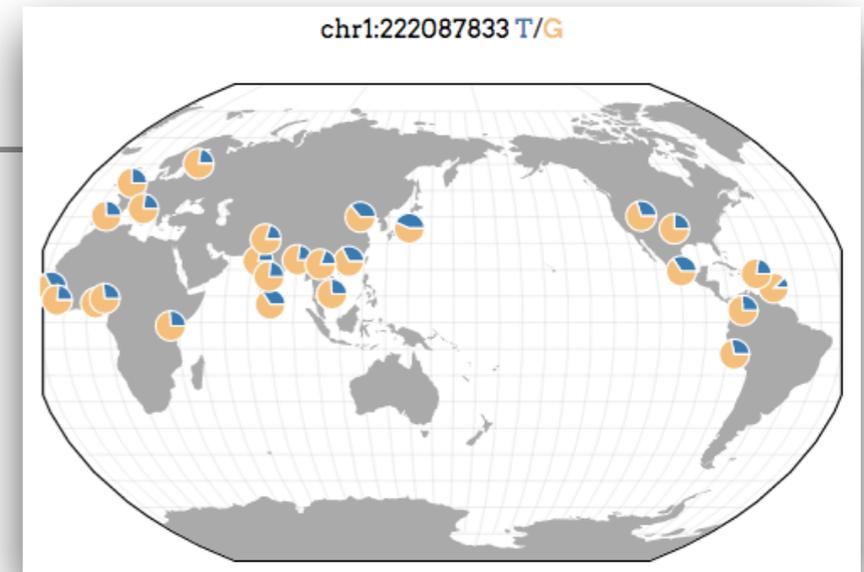
**Global Population data (HGDP)
Chr 15**



Position in genome along chromosome 15

Principles

- Transparently show human genetic variation
- For discussions, establish ground rules / “guard rails”
 - Emphasize mutual respect
 - Discomfort (even physical) is natural
 - Leniency as we stumble over words and try to articulate our thoughts
 - We converse to understand and engage with other voices
- During discussion:
 - As you listen, try to understand what values, evidence, and interpretations are driving alternative perspectives
 - We converse to improve our thinking



<http://popgen.uchicago.edu/ggv>



<https://www.indiamart.com/proddetail/traffic-safety-guard-rails-12580370673.html>



<https://uncommongroundmedia.com/theory-mind-increasing-polarisation/>

Challenges and needs

- “One off” experiences: need metrics of success/ growth
- “Flying by the seat of the pants”: Coaching for how to moderate these discussions
- The danger of “backfiring” effects (“Lewandowsky effect” Lewandosky et al, 2012; see B Donovan et al, 2019)
- Lack of teaching materials / curricula
- Overall, there is a strong need for educational research in this arena to provide more principled approaches

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 - Aaron Panofsky (UCLA)
 - Molly Przeworski (Columbia)
 - Soraya de Chadarevian (UCLA)

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Thanks and over to Dana for Q & A