Course Syllabus

Lecture: Tuesdays and Thursdays 11:00am-11:50am
Location: 11:00 to 11:50 a.m., Green Hall 0-S-6

Professor Sam Trejo
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"Genes are rarely about inevitability, especially when it comes to humans, the brain, or behavior. They're about vulnerability, propensities, tendencies."

Course Description

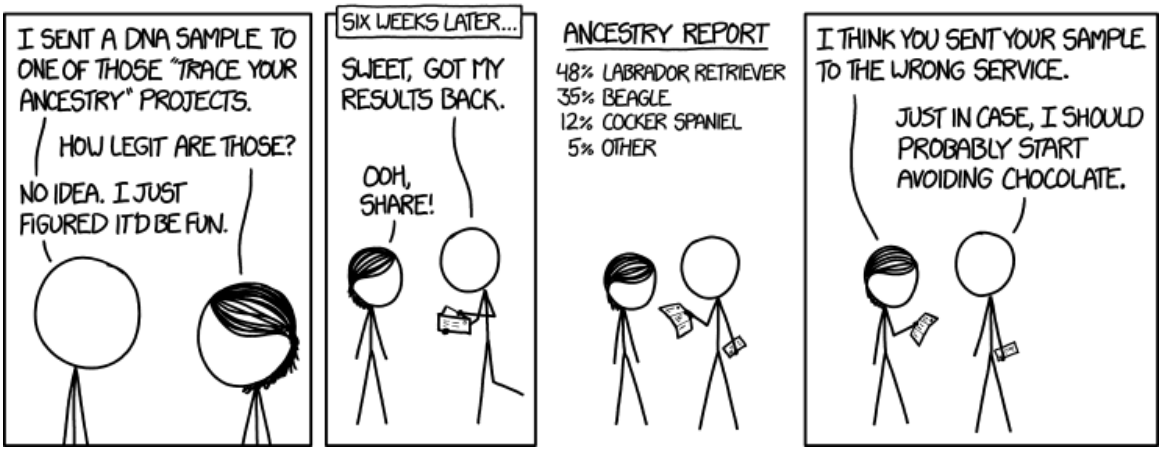
The world is in the midst of a growing revolution. Scientific advances in collecting and analyzing DNA, spurred by the completion of the Human Genome Project in 2003, are beginning to redefine how we understand ourselves and others. During the past decade, tens of millions of people in the United States alone have explored their own genome using direct-to-consumer services like 23andMe. Over that same period, researchers have made great strides connecting genes to a range of valued social, economic, and health outcomes, from education to obesity to depression.

An interdisciplinary group of social scientists—comprised of sociologists, economists, psychologists, and epidemiologists, among others—is working to integrate this genetic data into existing models of social behavior. Which DNA differences affect obesity? Through what mechanisms do genes influence a person's chances of developing depression? Can genetic risk for antisocial behavior be modified by environmental conditions? As genetic data pours into social science research, old debates that intersect genes with is-

sues surrounding individual intelligence, criminal justice, political polarization, privacy, and race begin to resurface.

Researchers wrestling with these questions must also begin to consider how people will respond to the influx of information on genetic risk and ancestry. Ever-improving genomic technologies make it possible for us to begin interpreting, interacting with, and even manipulating our DNA. How can we prevent the use of genetic discoveries for validating—or worse yet, biologically reifying—social inequality?

In this course, we explore the new field of social genomics—what the genome tells us about our collective past, society today, and various potential futures. We begin by discussing the ugly history of discourses surrounding the heritability of social and behavioral outcomes. We then move into an overview of the key concepts of human molecular genomics, including genetic inheritance, ancestry, population stratification, polygenicity, pleiotropy, and genetic prediction. Finally, we review recent discoveries at the intersection of genomics and the social sciences and discuss their implications for society.



Assignments & Grading

Your final grade will weight the assessments as follows:

Participation	25%
Midterm Exam	25%
Academic Paper Presentation	12.5%
Final Presentation	12.5%
Final Paper	25%

Participation: Students are expected to attend class and actively participate in precept sections.

Midterm Exam: A midterm exam is scheduled for October 14th.

Academic Paper Presentation: Each week, one pre-selected student will give a timed 10-minute presentation on a selected reading. Each student's week of presentation will be assigned at the start of the semester. This discussion should include the paper's motivation, data, methods, results, limitations, and potential extensions.

Final Presentation: During the final weeks of precept, students will give a 10-minute presentation on their final paper topic. This presentation must include their main question, a preliminary argument, and the type of evidence they intend to bring to bear.

Final Paper: Each student will prepare a term paper that explores a social, ethical, or policy issue related to human genomics, broadly defined. The paper may not strictly be a literature review and instead must synthesize sources to advance a novel argument. To select a topic, each student should consider which facets of genomics and society are most compelling to them. Each paper must be 8 to 10 pages (double-spaced, 1" margins, Time New Roman font) and are due via e-mail on December 14th (Dean's Date).

Course Reading

Required Texts

The Genome Factor: What the Social Genomics Revolution Reveals about Ourselves, Our History, and the Future by Dalton Conley & Jason Fletcher (Princeton University Press, 2017).

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1. **Introduction (9/2)**
   - *The Genome Factor* Chapter 1
   - Pinker 2004. *Why Nature and Nurture Won't Go Away*. Daedalus.
   - Conley 2019. *From Fraternities to DNA: The Challenge Genetic Prediction Poses to Insurance Markets*. The Milbank Quarterly.
   - Conley 2021. *A New Age of Genetic Screening is Coming—-and We Don't Have Any Rules for It*. Washington Post.
   - Watch: Three Identical Strangers (2018)

2. **Heritability I (9/9)**
   - *The Genome Factor* Chapter 2

3. **Heritability II (9/14)**
   - Jencks 1980. *Heredity, Environment, and Public Policy Reconsidered*. American Sociological Review.

4. **Adoption Studies (9/16)**
   - Harden 2018. *Why Progressives Should Embrace the Genetics of Education*. New York Times.
   - Harden 2020. *Success Requires Luck. Why Don't We Spread It Around?* Boston Globe.

5. **Twin Studies (9/21)**
   - Polderman et al. 2015. *Meta-Analysis of the Heritability of Human Traits Based on Fifty Years of Twin Studies* Nature Genetics.

6. **Twin & Adoption Study Robustness (9/23)**
   - Conley et al. 2013. *Heritability and the Equal Environments Assumption: Evidence from Multiple Samples of Misclassified Twins*. Behavior Genetics.

7. **Human Molecular Genetics I (9/28)**
   - *The Genome Factor* Appendix 1 & Appendix 2
   - Mills & Tropf 2020. *Sociology, Genetics, and the Coming of Age of Sociogenomics*. Annual Review of Sociology.

8. **Human Molecular Genetics II (9/30)**
   - *The Genome Factor* Chapter 3

9. **Candidate Gene Studies (10/5)**
   - Chabris et al. 2012. *Most Reported Genetic Associations with General Intelligence Are Probably False Positives*. Psychological Science.
   - Chabris et al. 2015. *The Fourth Law of Behavior Genetics*. Current Directions in Psychological Science.

10. **Genome-Wide Association Studies (10/7)**
   - Hamer 2000. *Beware the Chopsticks Gene*. Molecular Psychiatry.
   - Martin et al . 2017. *Human Demographic History Impacts Genetic Risk Prediction Across Diverse Populations*. American Journal of Human Genetics.

11. **Polygenic Scores (10/12)**
   - Ward 2018. *The 'Geno-Economists' Say DNA Can Predict Our Chances of Success*. The New York Times Magazine.
   - Belsky & Harden 2019. *Phenotypic Annotation: Using Polygenic Scores to Translate Discoveries from Genome-Wide Association Studies from the Top Down*. Current Directions in Psychological Science.
   - Herd et al. 2019. *Genes, Gender Inequality, and Educational Attainment*. American Sociological Review.

12. ***Midterm Exam*** **(10/14)**

13. **What is a "Genetic" Effect? (10/26)**
   - *The Genome Factor* Chapter 4
   - Young et al. 2019. *Deconstructing the Sources of Genotype-Phenotype Associations in Humans*. Science.

14. **Social Genetic Effects (10/28)**
    - Kong et al. 2018. *The Nature of Nurture: Effects of Parental Genotypes*. Science.
    - Zimmer 2018. *You Are Shaped by the Genes You Inherit. And Maybe by Those You Don't*. The New York Times.
    - Sotoudeh et al 2019. *Effects of the Peer Metagenomic Environment on Smoking Behavior*. Proceedings of the National Academy of Sciences.

15. **Problems with Polygenic Scores (11/2)**
    - Trejo & Domingue 2019. *Genetic Nature or Genetic Nurture? Introducing Social Genetic Parameters to Quantify Bias in Polygenic Score Analyses* Biodemography and Social Biology.
    - Harden & Koellinger 2020. *Using Genetics for Social Science*. Nature Human Behavior.

16. **Race & Ancestry I (11/4)**
    - *The Genome Factor* Chapter 5
    - Martschenko, Trejo, & Domingue 2019. *Genetics and Education: Recent Developments in the Context of an Ugly History and an Uncertain Future*. AERA Open.

17. **Race & Ancestry II (11/9)**
    - Fujimura et al. 2014. *Clines Without Classes: How to Make Sense of Human Variation*. Sociological Theory
    - Reich 2018. *How Genetics is Changing our Understanding of 'Race'*. The New York Times.
    - Holmes 2018. *What Happens When Geneticists Talk Sloppily About Race*. The Atlantic.

18. **Gene-Environment Interactions (11/11)**
    - *The Genome Factor* Chapter 7
    - Herd et al. 2019. *Genes, Gender Inequality, and Educational Attainment*. American Sociological Review.

19. **Epigenetics (11/16)**
    - Aristizabala et al. *2019. Biological Embedding of Experience: A Primer on Epigenetics*. Proceedings of the National Academy of Sciences.

20. **Genes & Identity I (11/18)**
    - Nelson 2016. *The Social Life of DNA: Race, Reparations, and Reconciliation After the Genome*. Beacon Press. [Chapter 1 & Chapter 4]

21. **Genes & Identity II (11/23)**

- Nelson 2016. *The Social Life of DNA: Race, Reparations, and Reconciliation After the Genome*. Beacon Press. [Chapter 5]
  Martschenko 2020. *DNA Dreams': Teacher Perspectives on the Role and Relevance of Genetics for Education*. Research in Education.

22. **Genes & Social Inequality I (11/30)**

- Harden 2021. *The Genetic Lottery: Why DNA Matters for Social Equality*. Princeton University Press. [Chapter 11]

23. **Genes & Social Inequality II (12/2)**

- Harden 2021. *The Genetic Lottery: Why DNA Matters for Social Equality*. Princeton University Press. [Chapter 12]

24. **Analyzing Our DNA (12/7)**

- *The Genome Factor* Epilogue
- Martschenko Smith 2021. *Genes Do Not Operate in a Vacuum and Neither Should Our Research*. Nature Genetics.
- Watch Gattaca (1997) and/or My Zoe (2021) [Optional]

Presentation Papers

(i) Ding et al. 2009. *The Impact of Poor Health on Academic Performance: New Evidence Using Genetic Markers*. Journal of Health Economics.

(ii) Evangelou & Ioannidis. *Meta-Analysis Methods for Genome-Wide Association Studies and Beyond*. Nature Reviews Genetics.

(iii) Dudbridge 2013. *Power and Predictive Accuracy of Polygenic Risk Scores*. PLOS Genetics.

(iv) Rietveld et al. 2014. *Replicability and Robustness of Genome-Wide Association Studies for Behavioral Traits*. Psychological Science.

(v) Baud et al. 2017. *Genetic Variation in the Social Environment Contributes to Health and Disease*. PLOS Genetics.

(vi) Domingue et al. 2018. *The Social Genome of Friends and Schoolmates in the National Longitudinal Study of Adolescent to Adult Health*. Proceedings of the National Academy of Sciences.

(vii) Daetwyler et al. 2008. *Accuracy of Predicting the Genetic Risk of Disease Using a Genome-Wide Approach*. PLOS One.

(viii) Belsky et al. 2017. *Genetic Analysis of Social-class Mobility in Five Longitudinal Studies*. Proceedings of the National Academy of Sciences.

(ix) Novembre et al. 2008. *Genes Mirror Geography Within Europe*. Nature.

(x) Simonti et al. 2016. *The Phenotypic Legacy of Admixture Between Modern Humans and Neandertals*. Science.

(xi) Fujimura et al. 2014. *Clines Without Classes: How to Make Sense of Human Variation*. Sociological Theory.

(xii) Young et al. 2018. *Relatedness Disequilibrium Regression Estimates Heritability Without Environmental Bias.* Nature Genetics.

(xiii) Hellenthal et al. 2014. *A Genetic Atlas of Human Admixture History*. Science.

(xiv) Barcellos et al. 2019. *Education Can Reduce Health Differences Related to Genetic Risk of Obesity*. Proceedings of the National Academy of Sciences.

(xv) Fletcher 2012. *Why Have Tobacco Control Policies Stalled? Using Genetic Moderation to Examine Policy Impacts*. PLOS One.

(xvi) van Otterdijk & Michels 2016. *Transgenerational Epigenetic Inheritance in Mammals: How Good is the Evidence?*. The FASEB Journal.

(xvii) Johfre et al. 2021. *Measuring Race and Ancestry in the Age of Genetic Testing*. Demography.

(xviii) Horvath & Raj 2018. *DNA Methylation-Based Biomarkers and the Epigenetic Clock Theory of Ageing*. Nature Reviews Genetics.

(xix) Yang et al. 2010. *Common SNPs Explain a Large Proportion of the Heritability for Human Height*. Nature Genetics.

(xx) McDermott et al. 2014. *Assortative Mating on Ideology Could Operate Through Olfactory Cues*. American Journal of Political Science5.

(xxi) Boyce 2016. *Differential Susceptibility of the Developing Brain to Contextual Adversity and Stress*. Neuropsychopharmacology.

(xxii) Guo et al. 2015. *Peer Influence, Genetic Propensity, and Binge Drinking: a Natural Experiment and a Replication*. American Journal of Sociology.

Course Calender

TUESDAY		THURSDAY	
Aug 31st *-Summer Recess-*		Sep 2nd Introduction	**1** ●
7th *-No Class-*		9th Heritability I	**2** ●
14th Heritability II	**3** ●	16th Adoption Studies	**4** ●
21st Twin Studies	**5** ●	23rd Twin & Adoption Study Robustness	**6** ●
28th Human Molecular Genetics I	**7** ●	30th Human Molecular Genetics II	**8** ●
Oct 5th Candidate Gene Studies	**9** ●	7th Genome-Wide Association Studies	**10** ●
12th Polygenic Scores	**11** ●	14th **Midterm Exam**	**12** ●
19th *-Fall Recess-*		21st *-Fall Recess-*	
26th What is a Genetic Effect?	**13** ●	28th Social Genetic Effects	**14** ●
Nov 2nd Problems With Polygenic Scores	**15** ●	4th Race & Ancestry I	**16** ●
9th Race & Ancestry II	**17** ●	11th Gene-Environment Interactions	**18** ●
16th Epigenetics	**19** ●	18th Genes & Identity I	**20** ●
23rd Genes & Identity II (Pre-Recorded)	**21** ●	25th *-Thanksgiving Recess-*	
30th Genes & Social Inequality I	**22** ●	Dec 2nd Genes & Social Inequality II	**23** ●

● = Professor Conley ● = Professor Trejo

Presentation Schedule

TUESDAY	THURSDAY	PRECEPT
Aug 31st *-Summer Recess-*	**1** Sep 2nd n/a	3rd *-No Class-*
7th *-No Class-*	**2** 9th n/a	**3** 10th n/a
4 14th n/a	**5** 16th n/a	**6** 17th n/a
7 21st n/a	**8** 23rd n/a	**9** 24th Julia Cunningham (Ding '09)
10 28th n/a	**11** 30th Gregory Scholars (Evangelou 2013)	**12** Oct 1st n/a
13 5th n/a	**14** 7th David Veldran (Dudbridge '13)	**15** 8th n/a
16 12th n/a	**17** 14th **Midterm Exam**	**18** 15th n/a
19th *-Fall Recess-*	21st *-Fall Recess-*	22nd *-Fall Recess-*
19 26th Germalysa Ferrer (Rietveld '14)	**20** 28th Courteney Wiredu (Baud '17)	**21** 29th Nica Evans (Domingue '18) Jordan Kaplan (Daetwlyer '18)
22 Nov 2nd Benjamin Roberts (Belsky '18)	**23** 4th Alison Araten (Novembre '08)	**24** 5th Christian Hernández (Simonti '16) Isabelle Nimick (Young '18)
25 9th Naomi Frim-Abrams (Hellenthal '14) Adrienne Brookins (Fujimura '14)	**26** 11th Khari Franklin (Barcellos '18)	**27** 12th William Lack (Fletcher '12)
28 16th Angelo Kayser-Browne (van Otterdijk '16)	**29** 18th Alicia Liu (Johfre '21)	**30** 19th Simran Khanna (Horvath '18)
31 23rd Kathy Palomino (Yang '10)	25th *-Thanksgiving Recess-*	26th *-Thanksgiving Recess-*
32 30th Sarah Gemmell (McDermott '14)	**33** Dec 2nd Laura Hirschfield (Boyce '16)	**34** 3rd Noë Wolf (Guo '15)