

Course Syllabus

Lecture: Wednesdays 2:30pm-5:00pm

Location: <https://uwmadison.zoom.us/j/93296321465>

Professor Sam Trejo

Office: Social Sciences 4440

Office Hours: Tuesdays 11:00am-12:30pm

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“The laws of genetics apply even if you refuse to learn them.”

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 income to obesity to depression.

Recently, many social science datasets have added biospecimen collection activities, including the measurement of genetic sequence data. Examples include longitudinal studies such as Add Health, the Health and Retirement Study, the Wisconsin Longitudinal Study, and the Fragile Families and Child Wellbeing Study as well as large national biobanks like the UK Biobank and All of Us. 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. A new field of social genomics centers around notions of individual genetic risk, as well as how social environments mediate and moderate genetic influences. 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 researchers continue to wrestle with these questions, social scientists are also beginning to consider how people will respond to the influx of information on genetic risk and ancestry. Troublingly, recent molecular genetic discoveries may pave the way for the creation of new dimensions of human difference. 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?

The purpose of the course is twofold. First, students will build an understanding of biological, evolutionary, and genetic theories that can be deployed to gain novel insights into traditional social science research questions. Second, students will formulate research questions to begin a project that combines genetic and social science data, methods, and theories into a dissertation chapter or related research activity. We will begin with an overview of basic concepts from human genomics and then transition into reading and discussing cutting edge journal articles in social genomics. We will discuss data resources, methodological differences across disciplines, and ideas to extend the research in this area into new directions.

Requisites: None

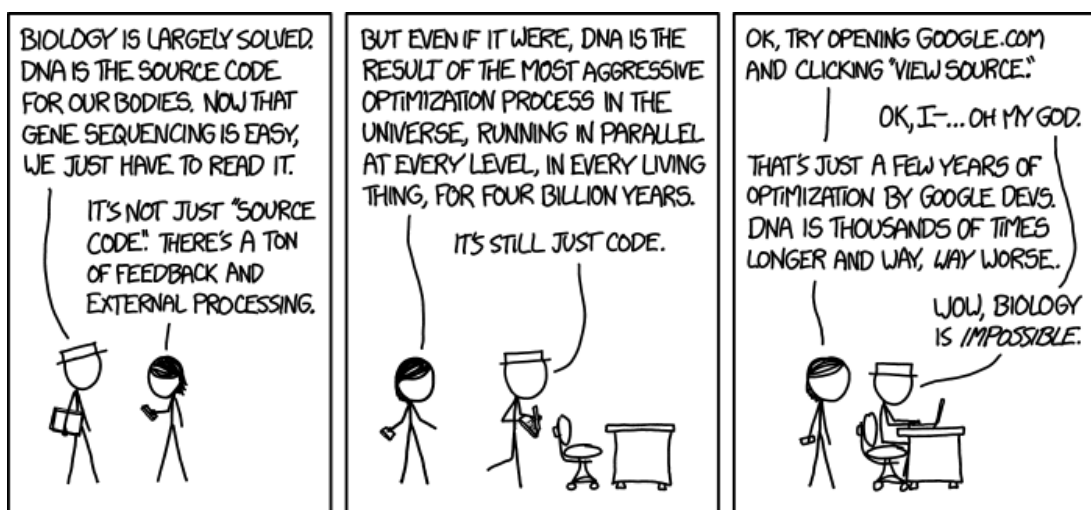
Course Designations and Attributes: Social Science Breadth Attribute (S)

Instructional Mode: Online Only (Synchronous)

Learning Objectives

After completing this course, students will be able to:

- understand and formulate research questions that combine aspects of the natural sciences and the social sciences.
- describe how gene-environment correlations, and gene-environment interactions, and social genetic effects complicate the interpretation of genetic discoveries.
- understand the latest theoretical and empirical issues in the field of social genomics.
- articulate concerns that social scientists have about the proliferation of genetic data and certain applications of genomic prediction.



Prerequisites

There are formal *no prerequisites* for this course, apart from being a curious seeker after truth. However, students with no prior training in statistical analysis may find the course's methodological discussions challenging.

Course Website

I will post all course materials, including lecture slides and required readings to the course Canvas website. The address is <https://canvas.wisc.edu/courses/240623>.

Credit Hours

This course counts for **3 credits**.

Course Structure

This class meets for one, 150-minute class period each week over the spring semester and carries the expectation that students will work on course learning activities for about 6 hours out of the classroom for every class period. This syllabus contains information about meeting times and expectations for student work.

Preparing for Class

You are expected to read the required texts *before* the class period which the materials are discussed. Lectures will follow the material presented in the readings.

Laptop Use

A growing body of evidence suggests that the use of laptops, tablets, and phones in classrooms tends to be detrimental to learning. In general, I discourage their use on during lecture. However, if you want to use a device during class, I ask that you contact me outside of class to make this request. For more context on this policy, see [this video](#).

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).

Assignments & Grading

The typical UW–Madison grading scale will be used. The maximum score in the course is 100 points: 100-93 = A, 92-88 = AB, 87-83 = B, 82-78 = BC, 77-70 = C, 69-60 = D, <60 = F. Your final grade will weight the assessments as follows, with late assignments counting for only half credit:

Participation	10%
Guest Speaker Questions	10%
Academic Paper Presentation	25%
Final Presentation	25%
Final Paper	30%

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

Guest Speaker Questions: In weeks with guest speakers, students are required to email me 3 discussion questions for the guests about their articles or academic expertise by the midnight before class.

Academic Paper Presentation: Each week, one pre-selected student will give a timed 15-minute presentation on the required 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. The slides for these class presentations need to be e-mailed to me 48 hours in advance of class so I can review them and provide feedback.

To aid this discussion, every other student in the class is also expected to read the main reading in advance and prepare a 3-slide presentation on it. The first slide discusses the good points of the paper, the second slide the bad points of the paper, and the third slide explains how you would extend the research. These will be loaded up in advance to a class Box folder. I will randomly pick one person to present their three slide overview in 5-minutes after the main presentation.

Final Paper: Each student will prepare a 5-10 page paper that either (a) surveys a specific part of the literature or (b) outlines a potential research project that integrates the biological and social sciences, discussing data, empirical approach, and the main hypothesis. This paper is due at the end of the semester.

Final Presentation: During the final week of class, students will give a 15-minute presentation on their final paper topic.

Attendance Policy

You may miss one class without penalty. After that, unless you have an excuse, you will be docked three percentage points out of a hundred on your final grade for each unexcused absence. If an extenuating circumstance causes you miss class, please let me know in advance via e-mail and we will work out a solution. The course will respect all religious holidays; let me know if this affects your attendance or other work in the course.

Academic Integrity

In my class, you must take full responsibility for what you say or write. If you use words or ideas that are not your own in any paper or presentation, cite your sources. I expect students to conform to the highest standards of academic integrity in this course. Do not lie, cheat, or try to pass off someone else's work as your own.

University Statement: By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct Community Standards for additional review.

For more information, refer to more information from the Office of Student Conduct and Community Standards [here](#).

Accommodations for Disabilities

If you have a disability, I will happily adapt this course to your needs in accordance with University policy. If any condition limits your ability to participate fully, please request appropriate academic accommodations from the McBurney Disability Resource Center. Please do not be a stranger—I will help to the best of my ability.

McBurney Disability Resource Center Statement: The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accom-

modations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Please find more information and resources from the McBurney Disability Resource Center [here](#).

COVID-19

I will make every effort to accommodate students who become ill or are asked to isolate or quarantine.

Course Reading

* denotes optional reading

Introduction & Overview

- Mills & Trope 2020. *Sociology, Genetics, and the Coming of Age of Sociogenomics*. Annual Review of Sociology.
- Conley 2014. *How I Became a Sociogenomicist*. Contexts.
- Freese 2018. *The Arrival of Social Science Genomics*. Contemporary Sociology.
- Harris & McDade 2018. *The Biosocial Approach to Human Development, Behavior, and Health Across the Life Course*. RSF: The Russell Sage Foundation Journal of the Social Science.
- Martschenko, Trejo, & Domingue 2019. *Genetics and Education: Recent Developments in the Context of an Ugly History and an Uncertain Future*. AERA Open.

Heritability & Eugenics

- *The Genome Factor* Chapter 1 & Chapter 2
- Trope et al. 2017. *Hidden Heritability Due to Heterogeneity Across Seven Populations*. Nature Human Behavior.
- Visscher, Hill, & Wray 2008. *Heritability in the genomics era—concepts and misconceptions*. Nature Reviews Genetics.
- *Lewontin 1974. *The Analysis of Variance and the Analysis of Causes*. American Journal of Human Genetics.
- *Jencks 1980. *Heredity, Environment, and Public Policy Reconsidered*. American Sociological Review.
- *Sacerdote 2007. *How Large are the Effects from Changes in Family Environment? A Study of Korean American Adoptees*. The Quarterly Journal Of Economics.
- *Manski 2011. *Genes, Eyeglasses, and Social Policy*. Journal of Economic Perspectives.
- *Branigan, McCallum, & Jeremy Freese 2013. *Variation in the Heritability of Educational Attainment: An International Meta-analysis*. Social Forces.
- *Polderman et al. 2015. *Meta-analysis of the Heritability of Human Traits Based on Fifty Years of Twin Studies*. Nature Genetics.

Molecular Genetic Data

- *The Genome Factor* Appendix 1 & Appendix 2
- Attia et al. 2009. *How to Use an Article About Genetic Association*. JAMA.
- Novembre et al. 2008. *Genes Mirror Geography Within Europe*. Nature.

What is a Genetic Effect?

- *The Genome Factor* Chapter 3
- Trejo & Martschenko Draft Book Chapter
- Chabris et al. 2015. *The Fourth Law of Behavior Genetics*. Current Directions in Psychological Science.
- Young et al. 2019. *Deconstructing the Sources of Genotype-Phenotype Associations in Humans*. Science.

Genome-Wide Association Studies & Polygenic Scores

- Dudbridge et al. 2013. *Power and Predictive Accuracy of Polygenic Risk Scores*. PLOS Genetics.
- Visscher et al. 2017. *10 Years of GWAS Discovery: Biology, Function, and Translation*. American Journal of Human Genetics.
- Lee et al. 2018. *Gene Discovery and Polygenic Prediction from a Genome-Wide Association Study of Educational Attainment in 1.1 Million Individuals*. Nature Genetics.
- *Bulik-Sullivan et al. 2015. *LD Score Regression Distinguishes Confounding from Polygenicity in Genome-Wide Association Studies*. Nature Genetics.
- *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.
- *Wand et al. 2020. *Improving Reporting Standards for Polygenic Scores in Risk Prediction Studies*. medRxiv.

Social Genetic Effects & Genetic Assortment

- *The Genome Factor* Chapter 4
- Domingue et al. 2016. *Assortative Mating and Differential Fertility by Phenotype and Genotype Across the 20th Century*. PNAS.
- Domingue et al. 2017. *The Social Genome of Friends and Schoolmates in the National Longitudinal Study of Adolescent to Adult Health*. PNAS.
- Belsky et al. 2018. *Genetic Analysis of Social-Class Mobility in Five Longitudinal Studies*. PNAS.
- Kong et al. 2018. *The Nature of Nurture: Effects of Parental Genotypes*. Science.
- *Trejo & Domingue 2019. *Genetic Nature or Genetic Nurture? Introducing Social Genetic Parameters to Quantify Bias in Polygenic Score Analyses*. *Biodemography & Social Biology*.

Gene-Environment Interactions I

- Walter et al. 2016. *Association of a Genetic Risk Score With Body Mass Index Across Different Birth Cohorts*. JAMA.
- Barcellos, Carvalho, & Carvalho 2019. *Education Can Reduce Health Differences Related to Genetic Risk of Obesity*. PNAS.
- Herd et al. 2019. *Genes, Gender Inequality, and Educational Attainment*. *American Sociological Review*.
- Domingue et al. 2020. *Interactions between Polygenic Scores and Environments: Methodological and Conceptual Challenges*. *Sociological Science*.
- *Boardman, Daw, & Freese al. 2013. *Defining the Environment in Gene–Environment Research: Lessons From Social Epidemiology*. *American Journal of Public Health*.
- *Wedow et al. 2018. *Education, Smoking, and Cohort Change: Forwarding a Multidimensional Theory of the Environmental Moderation of Genetic Effects*. *American Sociological Review*.

Gene-Environment Interactions II

- *The Genome Factor* Chapter 7
- Johnson, Sotoudeh, & Conley 2020. *Polygenic Scores for Plasticity: A New Tool for Studying Gene-Environment Interplay*. bioRxiv.
- Johnson et al. 2021. *Multiple Mechanisms of Genetic Moderation: The Case of Childhood Genetic Moderation of Household Stress*. bioRxiv.
- *Domingue et al. 2020. *Distinguishing Between Interaction and Dispersion Effects in the Analysis of Gene-Environment Interaction*. bioRxiv.

Race & Ancestry

- *The Genome Factor* Chapter 5
- Fujimura et al. 2014 *Clines Without Classes: How to Make Sense of Human Variation*. Sociological Theory.
- Martin et al. 2017 *Human Demographic History Impacts Genetic Risk Prediction across Diverse Populations*. American Journal of Human Genetics.
- Mills & Rahal 2020 *The GWAS Diversity Monitor Tracks Diversity by Disease in Real Time*. Nature Genetics.
- *Duncan et al. 2017 *Analysis of Polygenic Risk Score Usage and Performance in Diverse Human Populations*. Science Advances.
- *Wojcik et al. 2019. *Genetic Analyses of Diverse Populations Improves Discovery for Complex Traits*. Nature.
- *Micheletti et al. 2020. *Genetic Consequences of the Transatlantic Slave Trade in the Americas*. American Journal of Human Genetics.

Genes, Ethics, & Identity

- Nelson 2016. *The Social Life of DNA: Race, Reparations, and Reconciliation After the Genome*. Beacon Press. Chapter 4 & Chapter 5.
- Martschenko 2020. *DNA Dreams': Teacher Perspectives on the Role and Relevance of Genetics for Education*. Research in Education.
- Martschenko & Smith 2021. *Genes Do Not Operate in a Vacuum and Neither Should Our Research*. Nature Genetics.

Genetic Fortune

- Kweon et al. 2020. *Genetic Fortune: Winning or Losing Education, Income, and Health*. Working Paper.

Genes & Equality

- *The Genome Factor* Epilogue
- Harden 2018. *Why Progressives Should Embrace the Genetics of Education*. The New York Times.
- Harden 2020. *Success Requires Luck. Why Don't We Spread It Around?* The Boston Globe.
- Harden 2021. *The Genetic Lottery: Alternate Possible Worlds*. Princeton University Press. ([Link](#))

Epigenetics

- Birney, Smith, & Grealley 2016. *Epigenome-Wide Association Studies and the Interpretation of Disease-omics*. PLOS Genetics.
- van Otterdijk & Michels 2016. *Transgenerational Epigenetic Inheritance in Mammals: How Good is the Evidence?* The FASEB Journal.
- Horvath & Raj 2018. *DNA Methylation-Based Biomarkers and the Epigenetic Clock Theory of Ageing*. Nature Reviews Genetics.
- van Dongen et al. 2018. *DNA Methylation Signatures of Educational Attainment*. npj Science of Learning.
- *Linnér et al. 2018. *An Epigenome-Wide Association Study Meta-Analysis of Educational Attainment*. Molecular Psychiatry.
- *Aristizabala et al. 2019. *Biological Embedding of Experience: A Primer on Epigenetics*. PNAS.

Biomarkers

- DeSantis et al. 2007. *Racial/Ethnic Differences in Cortisol Diurnal Rhythms in a Community Sample of Adolescents*. Journal of Adolescent Health.
- Sweet et al. 2013. *The High Price of Debt: Household Financial Debt and its Impact on Mental and Physical Health*. Social Science & Medicine.
- Goosby, Cheadle, & Mitchell 2018. *Stress-Related Biosocial Mechanisms of Discrimination and African American Health Inequities*. Annual Review of Sociology.
- Cheadle et al. 2020. *Race and Ethnic Variation in College Students' Allostatic Regulation of Racism-related Stress*. PNAS.

Course Calender

WEDNESDAY	
Jan 27th Introduction & Overview	1
Feb 3rd Heritability & Eugenics	2
10th Molecular Genetic Data (Kamil Sicinski)	3
17th What is a Genetic Effect? [Individual Meetings]	4
24th Genome-Wide Association Studies & Polygenic Scores	5
Mar 3rd Social Genetic Effects & Genetic Assortment (Ben Domingue)	6
10th Gene-Environment Interactions I	7
17th Gene-Environment Interactions II (Rebecca Johnson)	8
24th Race & Ancestry	9
31st Genes, Ethics, & Identity (Daphne Martschenko)	10
Apr 7th Genetic Fortune (Philipp Koellinger) [Peer Feedback]	11
14th Genes & Equality (Paige Harden)	12
21st Epigenetics (Lauren Schmitz)	13
28th Biomarkers	14