

**Draft:** September 18, 2014

Syllabus

Biodemography: Integrating Genetics and Social Science Research

Fall 2014: Sociology 875

Instructor: Jason Fletcher

[jmfletcher@wisc.edu](mailto:jmfletcher@wisc.edu)

Course Time: 2:15-4:45 PM

Place: 8146 Social Sciences

Office Hours: Tuesday 1:45-3:30 SS 4401 or By appointment

Course Overview:

Beginning with the sequencing of the human genome in 2003, the possibilities of a new integration between genetic and social science research have increased substantially. Recently, many traditional social science research datasets have added important biospecimen collection activities, including the measurement of genetic sequence data. Examples include the Add Health, the Health and Retirement Study, Fragile Families as well as many international datasets.

The purpose of the course is twofold. First, we aim to gain an intermediate understanding of biological, evolutionary, and genetic theories and facts that then can be deployed to gain novel insights into traditional social science research questions. Ideally, students would complete the course with the tools and ideas to begin a project that combines genetic and social science data, methods, and theories into a dissertation chapter or related research activity. The second aim of the course is to collectively begin an assessment of a book proposal by Dalton Conley, Christopher Dawes, and Jason Fletcher whose aim is to create a cross-over scientific/popular book that focuses on the novel insights into the world that have come (so far) from the integration of social science and genetics, broadly construed.

The course will begin with an overview, mostly from genetics and biology, of basic concepts. We will aim to utilize both foundational academic papers and also online video lectures and research presentations throughout the course in order to foster discussions of the material. The course will then transition into reading and discussing state-of-the-art journal articles in the integration of genetics and social science research. We will discuss data resources, methodological differences across disciplines, and ideas to extend the research in this area into new directions.

Requirements: Students will make at least two presentations during the course, outlining an assigned paper and outlining a potential research project and will complete a short paper (literature review or research proposal outline, 5-10 pages) on a topic related to genetics and social science.

Pre-requisites: there are no formal prerequisites, but students who have not had prior courses in data analysis and statistical methods may struggle.

## Course Objectives:

Students will be able to understand and formulate research questions that combine some aspects of genetics (or biology) and social science research

Students will gain a basic/intermediate understanding of concepts from the natural sciences that are relevant for conducting interdisciplinary work merging the natural and social sciences

Students will understand theoretical and empirical issues in current research on genetics and social science

Students will contribute to a close reading and discussion of the book project by Fletcher and colleagues.

## Grades

Your grades will include of three parts

1. Class participation (30%)

This is a seminar; you are required to attend each class prepared to discuss the assigned readings. Each student will closely read and give comments to book chapters under preparation.

2. Student Presentation (40%)

Each student will make a short presentation on a genetics/social science paper, discussing the research question, the data, the empirical approach, the limitations, and key findings.

Second, each student will make a presentation of his/her short paper topic.

3. Short Paper (30%)

Each student will prepare a 5-10 page paper that either (1) surveys a specific part of the literature or (2) outlines a potential research project that integrates the biological and social sciences, discussing data, empirical approach and main hypothesis.

## **There is no textbook for the course**

## Data Opportunities

[HRS](#)

[Add Health info](#)

[Fragile Families](#)

[dbGap](#)

[NHANES](#)

[WLS](#)

[Biomarker Network](#)

## **Week 1 (9/4)**

Course Overview and Examples, Discussion

Heritability studies

Adoption Studies

Caspi/GxE

Student Interests

Data

**Assignment:** Due 9/10 (by email), read Conley, Fletcher, and Dawes and outline at least three concepts, claims, issues, etc that you disagree with or you think are overstated (or are interested in pursuing further).

Readings

Wiki Mendel document.

Plomin et al. Genetic Basis of Complex Human Behaviors. Science 1994

Freese, Jeremy. 2008. "Genetics and the Social Science Explanation of Individual Outcomes." American Journal of Sociology 114:S1-S35.

Turkheimer, Eric. 2000. "Three laws of behavior genetics and what they mean." Current Directions in Psychological Science 9:160 - 164.

Jencks, Christopher. 1980. "Heredity, Environment, and Public Policy Reconsidered." American Sociological Review 45:723 - 736.

Manski, Charles F. 2011. "Genes, Eyeglasses, and Social Policy." Journal of Economic Perspectives 25:83 - 94.

D'Onofrio, Brian M., Benjamin B. Lahey, Eric Turkheimer, and Paul Lichtenstein. "Critical need for family-based, quasi-experimental designs in integrating genetic and social science research." American journal of public health 103, no. S1 (2013): S46-S55.

Caspi A, et al. Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5- HTT Gene. Science 2003; 301: 386-389.

Caspi, A., J. McClay, T. E. Moffitt, *et al.* 2002. "Role of genotype in the cycle of violence in maltreated children." *Science* 297:851-854.

Conley, Dalton, Jason Fletcher, and Christopher Dawes. "The Emergence of Socio-Genomics." Contemporary Sociology: A Journal of Reviews 43.4 (2014): 458-467.

Not Required

Spittel, Michael L., Erica L. Spotts, and Bethany G. Deeds. "Integration of Behavioral, Social Science and Genetics Research: Exploring Public Health Significance." *American journal of public health* 103, no. S1 (2013): S5-S7.

Sacerdote, Bruce. "How large are the effects from changes in family environment? A study of Korean American adoptees." *The Quarterly Journal of Economics* 122.1 (2007): 119-157.

Lewontin. *The Analysis of Variance and the Analysis of Causes*. AJHG 1974

Visscher et al. Heritability in the genomics era—concepts and misconceptions. *Nature Reviews Genetics* 2008

Conley et al. Testing the key assumption of heritability estimates. *AJHG*. 2014

Boardman, Blaylock, and Pampel. Trends in the Genetic Influences on Smoking, *JHSB* 2010

Thompson, Owen. "Genetic mechanisms in the intergenerational transmission of health." *Journal of health economics* 35 (2014): 132-146.

Lee, James J., and Carson C. Chow. "Conditions for the validity of SNP-based heritability estimation." *Human genetics* (2014): 1-12.

Shostak, Sara, Peter Conrad, and Allan V. Horwitz. 2008. "Sequencing and Its Consequences: Path Dependence and the Relationships Between Genetics and Medicalization." *American Journal of Sociology* 114:S287-S316.

Devlin, B., M. Daniels, and K. Roeder. 1997. The heritability of IQ. *Nature* 388:468-471.

Thompson, P. et al. (2001). "Genetic Influences on Brain Structure." *Nature Neuroscience* 4 (12): 1-6.

## **Week 2 (9/11)**

Genetics Primer; Sequence and Variation concepts, Mutations

Homework: Bring in 3 suggestions of good (and bad) parts of the two websites or videos

Videos

Coursera videos at Learn UW

Required: Broad Timeline, Genomics in Medicine

Not Required: Lab Tour, [Genetics 101](#)

Websites:

<http://gslc.genetics.utah.edu>

<http://www.dnafb.org/1/>

Readings

Attia, J., et al. (2009) How to use an article about genetic association: A: Background concepts. JAMA, 301, 74-81

Wiki: DNA Fingerprinting and Human Genetic Variation

Check, E. "How Africa Learned to Love the Cow," Nature 2006; 444: 994–996.

McGuffin, Peter, Brien Riley, and Robert Plomin. "Toward behavioral genomics." Science 291.5507 (2001): 1232-1249.

<http://www.sciencemag.org/content/291/5507/1232.full>

Conley, Dalton. "The promise and challenges of incorporating genetic data into longitudinal social science surveys and research." Biodemography and Social Biology 55.2 (2009): 238-251.

Not Required

Annas, George J., and Sherman Elias. "23andMe and the FDA." New England Journal of Medicine 370.11 (2014): 985-988.

Jakobsson, Mattias, Sonja W. Scholz, Paul Scheet, J. Raphael Gibbs, Jenna M. VanLiere, Hon-Chung Fung, Zachary A. Szpiech et al. "Genotype, haplotype and copy-number variation in worldwide human populations." Nature 451, no. 7181 (2008): 998-1003.

Tishkoff SA, et al., "Convergent Adaptation of Human Lactase Persistence in Africa and Europe," Nature Genetics 2007; 39(1): 31–40.]

**Week 3 (9/18)**

Genetic Discovery: Candidate Genes and GWAS

False positives, Replication, Population Stratification, Power Analysis, Multiple Comparisons, GREML,

Note: Dan Benjamin at CDE 9/23

Videos

<https://hceconomics.uchicago.edu/video/genetics-and-behavior-intellectual-journey-candidate-gene-studies-gwas>

<https://hceconomics.uchicago.edu/video/genetics-and-behavior-power-problem-gene-discovery>

<https://hceconomics.uchicago.edu/video/genetics-and-behavior-gwas-social-science-outcomes>  
<https://hceconomics.uchicago.edu/video/genetics-and-behavior-gwas-panel>  
<https://hceconomics.uchicago.edu/video/genetics-and-behavior-return-pedigree-studies>

**Student Led Reading:**

Rietveld, Cornelius A., Sarah E. Medland, Jaime Derringer, Jian Yang, Tõnu Esko, Nicolas W. Martin, Harm-Jan Westra et al. "GWAS of 126,559 individuals identifies genetic variants associated with educational attainment." *Science* 340, no. 6139 (2013): 1467-1471.

**Reading**

Attia, J., et al. (2009) How to use an article about genetic association: B: Are the results of the study valid? *JAMA*, 301, 191-197.

Chabris, Christopher F., Benjamin M. Hebert, Daniel J. Benjamin, Jonathan Beauchamp, David Cesarini, Matthijs van der Loos, Magnus Johannesson et al. "Most reported genetic associations with general intelligence are probably false positives." *Psychological science* (2012): 0956797611435528.

Chabris, Christopher F., James J. Lee, Daniel J. Benjamin, Jonathan P. Beauchamp, Edward L. Glaeser, Gregoire Borst, Steven Pinker, and David I. Laibson. "Why it is hard to find genes associated with social science traits: Theoretical and empirical considerations." *American journal of public health* 103, no. S1 (2013): S152-S166.

Hirschhorn, J., & Daly, M. (2005) Genome-wide association studies for common diseases and complex traits. *Nature Reviews Genetics*, 6, 95-108.

Cordell, H., & Clayton, D. (2005) Genetic epidemiology 3: Genetic association studies. *Lancet*, 366, 1121-1131

Benjamin, Daniel J., David Cesarini, Matthijs JHM van der Loos, Christopher T. Dawes, Philipp D. Koellinger, Patrik KE Magnusson, Christopher F. Chabris et al. "The genetic architecture of economic and political preferences." *Proceedings of the National Academy of Sciences* 109, no. 21 (2012): 8026-8031.

Eichler, E. E., Flint, J., Gibson, G., Kong, A., Leal, S. M., Moore, J. H., & Nadeau, J. H. (2010). Missing heritability and strategies for finding the underlying causes of complex disease. *Nature Reviews Genetics*, 11(6), 446-450.

**Not Required**

Maher, Brendan. 2008. "The Case of the Missing Heritability." *Nature* 456:18-21.  
Visscher, Peter M., Matthew A. Brown, Mark I. McCarthy, and Jian Yang. 2012. "Five Years of GWAS Discovery." *American Journal of Human Genetics* 90:7-24.

Price, Alkes L., Nick J. Patterson, Robert M. Plenge, Michael E. Weinblatt, Nancy A. Shadick, and David Reich. "Principal components analysis corrects for stratification in genome-wide association studies." *Nature genetics* 38, no. 8 (2006): 904-909.

Price, Alkes L., Noah A. Zaitlen, David Reich, and Nick Patterson. "New approaches to population stratification in genome-wide association studies." *Nature Reviews Genetics* 11, no. 7 (2010): 459-463.

#### **Week 4 (9/25)**

##### Race

Guest Lecture/Discussion: Dalton Conley

##### Videos

Coursera videos at Learn UW

Required: Genes and Health, Moving Beyond Race

#### **No Student Led Reading**

##### Readings

Wade Chapters 1, 4, 5

Witherspoon, David J., Stephen Wooding, Alan R. Rogers, Elizabeth E. Marchani, W. Scott Watkins, Mark A. Batzer, and Lynn B. Jorde. "Genetic similarities within and between human populations." *Genetics* 176, no. 1 (2007): 351-359.

Novembre, John, Toby Johnson, Katarzyna Bryc, Zoltán Kutalik, Adam R. Boyko, Adam Auton, Amit Indap et al. "Genes mirror geography within Europe." *Nature* 456, no. 7218 (2008): 98-101.

Dar-Nimrod, Ilan and Steven J. Heine. 2011. "Genetic essentialism: On the deceptive determinism of DNA." *Psychological Bulletin* 137:800-818.

##### Not Required

Hellenthal, G., Busby, G. B., Band, G., Wilson, J. F., Capelli, C., Falush, D., & Myers, S. (2014). A genetic atlas of human admixture history. *science*, 343(6172), 747-751.

Phelan, J. C., Link, B. G., Zelner, S., & Yang, L. H. (2014). Direct-to-Consumer Racial Admixture Tests and Beliefs About Essential Racial Differences. *Social Psychology Quarterly*, 0190272514529439.

Turkheimer, Eric. 2011. "Genetics and Human Agency: Comment on Dar-Nirod and Heine." *Psychological Bulletin* 137:825-828.

El-Haj, Nadia Abu. 2007. "The Genetic Reinscription of Race." *Annual Review of Anthropology* 36:283-300.

Fujimura, Joan and Ramya Rajagopalan. 2011. "Different differences: The use of 'genetic ancestry' versus race in biomedical human genetic research." *Social Studies of Science* 41:5-30.

### **Week 5 (10/2)**

Approaches to Gene-Environment Interactions

Orchids and Dandelions, Diathesis-Stress Hypothesis, Gene-environment correlation

Also: James Fowler Hilldale Lecture on 10/2

### **Student Led Reading**

Thompson, Owen. "Economic Background and Educational Attainment The Role of Gene-Environment Interactions." *Journal of Human Resources* 49.2 (2014): 263-294.

Readings

Dobbs

Shanahan, Michael J. and Scott M. Hofer. 2005. "Social context in gene-environment interaction: Retrospect and prospect." *Journals of Gerontology: Series B* 60B:65-76.

Reiss, David, Leslie D. Leve, and Jenae M. Neiderhiser. "How genes and the social environment moderate each other." *American journal of public health* 103.S1 (2013): S111-S121.

Fletcher, Jason M., and Dalton Conley. "The Challenge of Causal Inference in Gene-Environment Interaction Research: Leveraging Research Designs From the Social Sciences." *American journal of public health* 103.S1 (2013): S42-S45.

Duncan, Laramie E. and Matthew C. Keller. 2011. "A critical review of the first 10 years of candidate gene-by-environment interaction research in psychiatry." *American Journal of Psychiatry* 168:1041-1049.

Boardman, Jason D. 2009. "State-level moderation of genetic tendencies to smoke." *American Journal of Public Health* 99:480-486.

Fletcher, Jason M. 2012. "Why Have Tobacco Control Policies Stalled? Using Genetic Moderation to Examine Policy Impacts." *PLoS ONE* 7:e50576.



Wagner, Brandon, Jiang Li, Hexuan Liu, and Guang Guo. "Gene–Environment Correlation: Difficulties and a Natural Experiment–Based Strategy." *American journal of public health* 103, no. S1 (2013): S167-S173.

Thomas, D., (2010) Gene-environment-wide association studies: emerging approaches. *Nature Reviews Genetics*, 11, 259-272

Not Required

Lee, D., Brooks-Gunn, J., McLanahan, S. S., Notterman, D., & Garfinkel, I. (2013). The Great Recession, genetic sensitivity, and maternal harsh parenting. *Proceedings of the National Academy of Sciences*, 110(34), 13780-13784.

Fletcher, Jason M. "Enhancing the Gene-Environment Interaction Framework Through a Quasi-Experimental Research Design: Evidence from Differential Responses to September 11." *Biodemography and social biology* 60.1 (2014): 1-20.

Dick, Danielle M. 2011. "An interdisciplinary approach to studying gene environment interactions: From twin studies to gene identification and back." *Research in Human Development* 8:211-226.

Pescosolido, Bernice, Brea L. Perry, J. Scott Long, Jack K. Martin, John I. Nurnberger Jr., John Kramer, and Victor Hesselbrock. 2008. "Under the Influence of Genetics: How Transdisciplinarity Leads Us to Rethink Social Pathways to Illness." *American Journal of Sociology*.

Risch, Neil, Richard Herrell, Thomas Lehner, Kung-Yee Liang, Lindon J. Eaves, Josephine Hoh, Andrea Griem, Maria Kovacs, Jurg Ott, and Kathleen Ries Merikangas. 2009. "Interaction Between the Serotonin Transporter Gene (5-HTTLPR), Stressful Life Events, and Risk of Depression: A Meta-Analysis." *JAMA* 301:2462-2471.

Caspi, Avshalom, Ahmad R. Hariri, Andrew Holmes, Rudolf Uher, and Terri E. Moffitt. 2010. "Genetic sensitivity to the Environment: The Case of the Serotonin Transporter Gene and Its Implications for Studying Complex Diseases and Traits." *American Journal of Psychiatry* 167:509-527.

Karg, Katja, Margit Burmeister, Kerby Shedden, and Srijan Sen. 2011. "The serotonin transporter promoter variant (5-HTTLPR), stress, and depression meta-analysis revisited: evidence of genetic moderation." *Archives of General Psychiatry* 68:444-454.

10/9: Class Cancelled: IGSS

### **Week 6 (10/16)**

Genetics of Tie Formation: Spouses, Friends, and Kinship Patterns  
Discussion of IGSS papers?

**Student Led Readings:** Discussion of IGSS papers  
Student provided overview: Oxytocin

#### Readings

Domingue, Benjamin W., Jason Fletcher, Dalton Conley, and Jason D. Boardman. "Genetic and educational assortative mating among US adults." *Proceedings of the National Academy of Sciences* 111, no. 22 (2014): 7996-8000.

Christakis, Nicholas A., and James H. Fowler. "Friendship and natural selection." *Proceedings of the National Academy of Sciences* 111, Supplement 3 (2014): 10796-10801.

Fowler, James H., Jaime E. Settle, and Nicholas A. Christakis. "Correlated genotypes in friendship networks." *Proceedings of the National Academy of Sciences* 108.5 (2011): 1993-1997.

#### **Week 7 (10/23)**

##### Economics

Mendelian Randomization, Genoeconomics

#### **Student Led Reading:**

Hinke Kessler Scholder, Stephanie, George L. Wehby, Sarah Lewis, and Luisa Zuccolo. "Alcohol exposure in utero and child academic achievement." *The Economic Journal* 124, no. 576 (2014): 634-667.

#### Readings

Fletcher, Jason M. "The promise and pitfalls of combining genetic and economic research." *Health economics* 20.8 (2011): 889-892.

Beauchamp JP, et al., *Molecular Genetics and Economics, Journal of Economics Perspectives* 2011; 25(4): 57-82.

Benjamin, Daniel J., David Cesarini, Christopher F. Chabris, Edward L. Glaeser, David I. Laibson, Vilhelmur Guðnason, Tamara B. Harris et al. "The Promises and Pitfalls of Genoeconomics\*." *Annual Review of Economics* 4 (2012): 627.

#### Not Required

Lawlor, Debbie A., Roger M. Harbord, Jonathan A. C. Sterne, Nic J. Timpson, and George Davey Smith. 2008. "Mendelian Randomization: Using genes as instruments for making causal inferences in epidemiology." *Statistics in Medicine* 27:1133-1163.

Wehby, George L., Robert L. Ohsfeldt, and Jeffrey C. Murray. "Mendelian randomization equals instrumental variable analysis with genetic instruments." *Statistics in medicine* 27.15 (2008): 2745-2749.

## **Week 8 (10/30)**

TBD: Biomarker Discussion?

Telomeres

Student Led Reading: Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature*, 435(7042), 673-676.

TED Talk:

[http://www.ted.com/talks/paul\\_zak\\_trust\\_morality\\_and\\_oxytocin?language=en](http://www.ted.com/talks/paul_zak_trust_morality_and_oxytocin?language=en)

Readings

Theall, Katherine P., Sarah McKasson, Emily Mabile, Lauren F. Dunaway, and Stacy S. Drury. "Early hits and long-term consequences: tracking the lasting impact of prenatal smoke exposure on telomere length in children." *American journal of public health* 103, no. S1 (2013): S133-S135.

Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D., & Cawthon, R. M. (2004). Accelerated telomere shortening in response to life stress. *Proceedings of the National Academy of Sciences of the United States of America*, 101(49), 17312-17315.

Recommended

Stanton, S. J., LaBar, K. S., Saini, E. K., Kuhn, C. M., & Beehner, J. C. (2010). Stressful politics: Voters' cortisol responses to the outcome of the 2008 United States Presidential election. *Psychoneuroendocrinology*, 35(5), 768-774.

11/6: Class Cancelled APPAM

## **Week 9 (11/13)**

Population Processes—Health, Economics, and Genetics

Videos

<https://www.youtube.com/watch?v=egxe1g09XD0>

<https://www.youtube.com/watch?v=-EgHasXGOxY>

[http://www.aeaweb.org/webcasts/2014/Growth\\_Jan6\\_am/index.php](http://www.aeaweb.org/webcasts/2014/Growth_Jan6_am/index.php)

Student Led Reading:

Justin Cook (2014) [The Natural Selection of Infectious Disease Resistance and Its Effect on Contemporary Health](#)

Readings

Ashraf, Quamrul and Oded Galor. 2013. "The "Out of Africa" Hypothesis, Human Genetic Diversity, and Comparative Economic Development." *American Economic Review* 103:1-46.

d'Alpoim Guedes, Jade Theodore C. Bestor, Theodore Carrasco, Rowan Flad, Ethan Fosse, Michael Herzfeld, Carl C. Lamberg-Karlovsky, Cecil M. Lewis, Matthew Liebmann, Richard Meadow, Nick Patterson, Max Price, Meredith Reiches, Sarah Richardson, Heather Shattuck-Heidorn, Jason Ur, Gary Urton, and Christina Warinner. 2013. "Is Poverty in Our Genes?: A Critique of Ashraf and Galor" *Current Anthropology* 54:71-79.

Not Required

Michalopoulos, S. (2012). The origins of ethno-linguistic diversity. *American Economic Review*, 102(4), 1508-1539.

Ramachandran, S., Deshpande, O., Roseman, C., Rosenberg, N., Feldman, M., & Cavalli Sforza, L. (2005). Support from the relationship of genetic and geographic distance in human populations for a serial founder effect originating in Africa. *PNAS*, 102(44), 377-392.

[The Diffusion of Development](#) with Romain Wacziarg, *Quarterly Journal of Economics*, vol. 124, no. 2, pp. 469-529, May 2009.

### **Week 10 (11/20)**

Politics and Crime

Student Assignment Due—critique of Fletcher “Macrogenoeconomics” Chapter

Student Led Reading:

Readings

Smith, Kevin, John R. Alford, Peter K. Hatemi, Lindon J. Eaves, Carolyn Funk, and John R. Hibbing. 2012. "Biology, ideology, and epistemology: How do we know political attitudes are inherited and why should we care?" *American Journal of Political Science* 56:17 - 33.

Fowler, James H., and Christopher T. Dawes. "In defense of genopolitics." *American Political Science Review* 107.02 (2013): 362-374.

Aspinwall, Lisa G., Teneille R. Brown, and James Tabery. "The double-edged sword: Does biomechanism increase or decrease judges' sentencing of psychopaths?." *Science* 337.6096 (2012): 846-849.

Disgust

<http://www.nytimes.com/2012/01/24/science/disgusts-evolutionary-role-is-irresistible-to-researchers.html>

Inbar, Y., Pizarro, D., Iyer, R., & Haidt, J. (2012). Disgust sensitivity, political conservatism, and voting. *Social Psychological and Personality Science*, 3(5), 537-544.

11/27: Class Cancelled: Thanksgiving Break

### **Week 11 (12/4)**

New directions: Epigenetics and Microbiome

Video: Ghost in our Genes (PBS)

<https://www.youtube.com/watch?v=fMxgkSgZoJs>

Agouti Mice

<https://www.youtube.com/watch?v=Xjq5eEslJhw>

<https://www.youtube.com/watch?v=wFsxVkuChdU>

Webinar: <http://webinar.sciencemag.org/webinar/archive/promise-microbiome>

<http://ics.webcast.uwex.edu/Mediasite6/Catalog/Full/5e041f7db1654480a990568c000d79e121>

Readings

Szyf, Moshe. "The Dialogue Between Social Environments and the Genome." *American journal of public health* 103, no. S1 (2013): S9-S11.

Szyf M, McGowan P, and Meaney MJ. The Social Environment and the Epigenome. *Environmental and Molecular Mutagenesis* 2008; 49: 46–60.

Miller G. The Seductive Allure of Behavioral Epigenetics. *Science* 2010; 329: 24–27.  
Colter PNAS

Cole, Steven W. "Social regulation of human gene expression: mechanisms and implications for public health." *American journal of public health* 103.S1 (2013): S84-S92.

Microbiology: Microbiome science needs a healthy dose of skepticism. *Nature Commentary*

Not Required

Gilbert, Jack A., Janet K. Jansson, and Rob Knight. "The Earth Microbiome project: successes and aspirations." *BMC Biology* 12.1 (2014): 69.

### **Week 12 (12/11)**

Student Project Presentations