Sociology 636a
Ecology & Evolutionary Biology 636a
Topics in Biosocial Science

Wednesday 4:30–6:30 p.m.
Fall Term 2022
Location: Room 335, 17 Hillhouse Ave.

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Course Description:

This graduate seminar (with limited enrollment, but open to all graduate students, and to undergraduates with permission) will cover topics at the intersection of the natural and social sciences, including behavior genetics, gene-environment interactions, gene-culture co-evolution, social epigenetics, and diverse other topics. We will focus on the ways in which our genes and our bodies are in a (short and long) conversation with our social environment. To what extent does our genetic makeup influence our behaviors? To what extent do our behaviors and social experiences influence our genes? To what extent do our genes increase or decrease our risk for particular outcomes given particular environmental exposures? What are the biological bases of resilience? And how does the social environment come to regulate our genome? How do social exposures reshape neural and endocrine processes? How do social exposures "get under our skin"? How are they literally embodied?

This class is a topical seminar, meaning that the material covered each year will vary, and that it will be driven by student interest and fresh scientific discoveries. We are going to run this seminar jointly, and students will suggest topics, articles, critiques, and so on, at will. Students will also lead classes, and suggest topics and readings for those classes. As a result, the syllabus will likely change as the semester progresses. Each student will lead one or more classes (depending on enrollment and topics). In 2022, we will also make use of my recent book (published in 2019), *Blueprint: The Evolutionary Origins of a Good Society* to help shed light on some of the topics. A set of proposed topics and provisional set of readings for the first part of the course is laid out below.

Course Requirements:

- class participation (20%)
- in-class presentation(s) (30%)
- final paper (50%)

Students will sign up to lead or co-lead one or two of the classes during the semester (depending on enrollment and topics chosen).

The final paper (approximately 20 pages) may either be: 1) an actual research paper the student is working on, 2) a research proposal, or 3) a more conventional term paper or literature review. Guidelines for each and the due date will be discussed in class.

You should ensure that any written work you submit for evaluation is the result of your own research and writing, and that it reflects your own approach to the topic. You must also adhere to standard citation practices and properly cite any books, articles, websites, etc..

Remember: Academic integrity is a core institutional value at Yale. This includes, among other things, truth in presentation; diligence and precision in citing works and ideas; and acknowledging collaborations with others. In view of our commitment to maintaining the highest standards of academic integrity, the Graduate School Code of Conduct specifically prohibits the following forms of behavior, as you might easily expect: cheating on all forms of assessment; falsification or fabrication of data; plagiarism (i.e., the failure in any written exercise to acknowledge ideas, research, or language taken from others); and multiple submission of the same work without obtaining explicit written permission from the instructor before the material is submitted. Students found guilty of violations of academic integrity are subject to various unhappy penalties, according to the rules of Yale University.

While there are no pre-requisites for this course, some prior exposure to biology is recommended.

Class 1: August 31
Course Introduction

Class 2: September 7
Social Order, and Reductionism, Essentialism, Determinism, and Positivism

N.A. Christakis, *Blueprint: The Evolutionary Origins of a Good Society*, New York: Little Brown, 2019 – Chapters 1-4 and 12.
J.R. Hibbing, "Ten Misconceptions Concerning Neurobiology and Politics," *Perspectives on Politics*, 2013; 11: 475-489

Class 3: September 14
Social Exposures and Biological Outcomes

E. A. Maguire, et al., "Navigation-Related Structural Change in the Hippocampi of Taxi Drivers," *PNAS: Proceedings of the National Academy of Sciences* 2000; 97: 4398-4403.
P. Kristensen and T. Bjerkedal, "Explaining the Relation Between Birth Order and Intelligence," *Science* 2007; 316: 171
A. Mani, S. Mullainathan, E. Shafir, J. Zhao, "Poverty Impedes Cognitive Function," *Science* 2013; 341: 976-980
J.L. Hanson, A. Chandra, B.L. Wolfe, and S.D. Pollak, "Association Between Income and the Hippocampus," *PLoS ONE* 2011; 6: e18712.
L. Jin, F. Elwert, J. Freese, and N.A. Christakis, "Preliminary Evidence Regarding the Hypothesis that the Sex Ratio at Sexual Maturity May Affect Longevity in Men," *Demography* 2010; 47: 579- 586
J.S. House, KR Landis, and D. Umberson, "Social Relationships and Health," *Science* 1988; 241: 540–545
D. Lauderdale, "Birth Outcomes for Arabic-Named Women in California Before and After September 11," *Demography* 2006; 43: 185–201
R.M. Sapolsky, "The Influence of Social Hierarchy on Primate Health," *Science* 2005; 308: 648–652
R. Gascesa et al., "Environmental Factors Shaping the Gut Microbiome in a Dutch Population," *Nature* 2022; 604: 732-739.

Class 4: September 21
Gene-Culture Co-Evolution; the Idea of Exophenotypes

N.A. Christakis, *Blueprint: The Evolutionary Origins of a Good Society*, New York: Little Brown, 2019 – Chapters 10 and 11.
P.J. Richerson, R. Boyd, and J. Henrich, "Gene-Culture Co-evolution in the Age of Genomics," *Proceedings of the National Academy of Sciences* 107 (2010): 8985-8992.
K.N. Laland, J. Odling-Smee, and S. Myles, "How Culture Shaped the Human Genome: Bringing Genetics and the Human Sciences Together," *Nature Reviews Genetics* 2010; 11: 137-148.
S.A. Tishkoff, et al., "Convergent Adaptation of Human Lactase Persistence in Africa and Europe," *Nature Genetics* 2007; 39: 31–40
R.P. Evershed, et al., "Dairying, Diseases, and the Evolution of Lactase Persistence in Europe," *Nature* July 27, 2022.

T.S. Simpson et al., "Genetic Evidence for High-Altitude Adaptation in Tibet," *Science* 2010; 329: 71-75
K. Laland, "Extending the Extended Phenotype," *Biology and Philosophy* 2004; 19, 313–325.
J.S. Turner, "Extended Phenotypes and Extended Organisms," *Biology and Philosophy 2004;* 19, 327–352.
E. Jablonka E, "From Replicators to Heritably Varying Phenotypic Traits: The Extended Phenotype Revisited," *Biology and Philosophy* 2004; 19, 353–375.
R. Dawkins, "Extended Phenotype – But Not Too Extended. A Reply to Laland, Turner, and Jablonka, *Biology and Philosophy* 2004; 19: 377-396.

Class 5: September 28
Animal Society and Culture

T. Clutton-Brock, "Social Evolution in Mammals," *Science* 2021; 373: eabc9699.
K.N. Laland and V.M. Janik, "The Animal Cultures Debate," *Trends in Ecology and Evolution* 2006; 21: 542-547.
S.K. Watson, et al., "Vocal Learning in the Functionally Referential Food Grunts of Chimpanzees," *Current Biology* 2015; 25: 495-499.
E.J.C. van Leewen, K.A. Cronin, and D.B.M. Haun, "A Group-Specific Arbitrary Tradition in Chimpanzees (Pan troglodytes)," *Animal Cognition* 2014; 17: 1421-1425.
S. Yamamoto, T. Humle, and M. Tanaka, "Basis for Cumulative Cultural Evolution in Chimpanzee: Social Learning of a More Efficient Tool-Use Technique," *PLoS ONE* 2013; 8: e55768
A. Whiten, J. Goodall, W.C. McGrew, T. Nishida, V. Reynold, Y. Sugiyama, C.E.G. Tutin, R.W. Wrangham, C. Boesch, "Cultures in Chimpanzees," *Nature* 1999; 399: 682–685
C. Boesch, "Teaching Among Wild Chimpanzees," *Animal Behavior* 1991; 41: 530-532
K. McComb, C. Moss, SM Durant, L Baker, and S Sayialel, "Matriarchs as Repositories of Social Knowledge in African Elephants," *Science* 2001; 292: 491-494
J.M. Plotnik, R. Lair, W. Suphachoksahakun, and F.B.M. deWaal, "Elephants Know When They Need a Helping Trunk in a Cooperative Task," *PNAS: Proceedings of the National Academy of Sciences* 2011; 108: 5116-5121
J. Mann, M.A. Stanton, E.M. Patterson, E.J. Bienenstock, and L.O. Singh, "Social Networks Reveal Cultural Behaviour in Tool-using Dolphins," *Nature Communications* 2012; 3: 980
L.M. Aplin, et al, "Experimentally Induced Innovations Lead to Persistent Culture Via Conformity in Wild Birds," *Nature* 2014; 518: 538-541 doi:10.1038/nature13998
I.B. Bartal, J. Decety, and P. Mason, "Empathy and Pro-Social Behavior in Rats," *Science* 2011; 334: 1427-1430. [with Correction in January 27, 2012 issue of *Science* 335: p. 401]

Class 6: October 5
Social Networks, Social Interactions, and Friendship

N.A. Christakis, *Blueprint: The Evolutionary Origins of a Good Society*, New York: Little Brown, 2019 – Chapters 7 and 8.
J.H. Fowler, C.T. Dawes, and N.A. Christakis, "Model of Genetic Variation in Human Social Networks," *PNAS: Proceedings of the National Academy of Sciences* 2009; 106: 1720-1724
N.A. Christakis and J.H. Fowler, "Friendship and Natural Selection," *PNAS: Proceedings of the National Academy of Sciences* 2014; 111 (S3): 10796-10801
B.W. Domingue, et al., "The Social Genome of Friends and Schoolmates in the National Longitudinal Study of Adolescent to Adult Health," *PNAS: Proceedings of the National Academy of Sciences* 2018; doi: 10.1073/pnas.1711803115

L. Yengo, et al., "No Evidence for Social Genetic Effects or Genetic Similarity Among Friends Beyond that Due to Population Stratification: A Re-Appraisal of Domingue et al (2018), *bioArxiv* 2019; https://www.biorxiv.org/content/biorxiv/early/2019/05/21/643304.full.pdf

K.V.A. Johnson and R.I.M. Dunbar, "Pain Tolerance Predicts Human Social Network Size," *Scientific Reports* 2016; 6: 25267.

B Hare, V. Wobber, and R. Wrangham, "The Self-Domestication Hypothesis: Evolution of Bonobo Psychology Is Due to Selection Against Aggression," *Animal Behaviour* 2012; 83; 573-585

C. Theofanopoulou, et al., "Self-Domestication in Homo Sapiens: Insights from Comparative Genomics," *PLoS ONE* 2017; 12: e0185306

Herrmann E, Call J, Hernàndez-Lloreda MV, Hare B, Tomasello M. "Humans have evolved specialized skills of social cognition: the cultural intelligence hypothesis." *Science* 2007; 317: 1360-1366.

Class 7: October 12
Behavior Genetics and Gene-Environment Interactions

Ebstein, RP et al. Genetics of Human Social Behavior. *Neuron* 2010; 65: 831-844.

T.J. Polderman, et al., "Meta-analysis of the Heritability of Human Traits Based on Fifty Years of Twin Studies," *Nature Genetics* 2015; 47:702-709.

C.A. Rietveld et al., "GWAS of 126,559 Individuals Identifies Genetic Variants Associated with Educational Attainment," *Science* 2013; 340: 1467-1471

A. Ganna et al., "Large Scale GWAS Reveals Insights into Genetic Architecture of Same-Sex Sexual Behavior," *Science* 2019; 365: eaat7693. And Critiques and Responses in *Science* 2019; 366: 1460-1462.

W.D. Hill et al., "Genome-Wide Analysis Identifies Molecular Systems and 149 Genetic Loci Associated with Income," *Nature Communications* 2019; 10: 5741.

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

A. Caspi, A.R. Hariri, A. Holmes, R. Uher, T.E. and Moffitt, "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* 2010; 167: 509-527

L.E. Duncan and M.C. Keller, "A Critical Review of the First 10 Years of Candidate Gene-by-Environment Interaction Research in Psychiatry," *American Journal of Psychiatry* 2011; 168: 1041-1049

R. Border et al., "No Support for Historical Candidate Gene or Candidate Gene-by-Interaction Hypotheses for Major Depression Across Multiple Large Samples, *American Journal of Psychiatry* 2019; https://doi.org/10.1176/appi.ajp.2018.18070881

J.N. Rosenquist, A.J. O'Malley, S.F. Lehrer, A. Zaslavsky, J.W. Smoller, and N.A. Christakis, "Genotype-Phenotype Association of FTO with Body Mass Index Depends on Birth Era," *PNAS: Proceedings of the National Academy of Sciences* 2015; 112(2): 354-359

October 19
NO CLASS, Fall Break

Class 8: October 26
Social Epigenetics

G.M. Slavich and S.W. Cole, "The Emerging Field of Human Social Genomics," *Clinical Psychological Science* 2013; 8: 667-669

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

B.G. Dias and K.J. Ressler, "Parental Olfactory Experiences Influence Behavior and Neural Structure in Subsequent Generations," *Nature Neuroscience* 2014; 17: 89-96

Szyf M. Lamarck Revisited: Epigenetic Inheritance of Ancestral Odor Fear Conditioning. *Nature Neuroscience* 2014; 17: 2-4.

D.K. Morgan, E. Whitelaw, "The Case for Transgenerational Epigenetic Inheritance in Humans" *Mammalian Genome* 2008; 19: 394-397

E.W. Tobi et al, "DNA Methylation as a Mediator of the Association Between Prenatal Adversity and Risk Factors for Metabolic Disease in Adulthood," *Science Advances* 2018; 4: eaao4364.

F. Guenard, Y. Deshais, K. Cianflone, J.G. Kral, P. Marceau, and M.C. Vohl, "Differential Methylation in Glucoregulatory Genes of Offspring Born Before Versus After Maternal Gastrointestinal Bypass Surgery," *PNAS: Proceedings of the National Academy of Sciences* 2013; www.pnas.org/cgi/doi/10.1073/pnas.1216959110

J.R. Swartz, A.R. Hariri, and D.E. Williamson, "An Epigenetic Mechanism Links Socioeconomic Status to Changes in Depression-Related Brain Function in High-Risk Adolescents," *Molecular Psychiatry* 2017; 22: 209-214.

C. Afseth, et al., "Vertical Transmission of Horizontally Acquired Social Information in Sticklebacks: Implications for Transgenerational Plasticity," *Proceedings of the Royal Society B* 2022; 289: 20220571.

During the latter part of the semester, for five class sessions, we will pick topics to discuss. Possibilities include the following, as well as any others students may suggest:

COVID-19
Swarm Intelligence
Kin Recognition
Biology of Love and Partner Choice
Monogamy, Pair Bonding, and Polygamy
Facial Symmetry and Beauty
Neural correlates of social decision-making and experience (self perception, confidence, risk taking, novelty seeking, cooperation, etc.)
Animal Cognition and Decision Making
Neuroplasticity
Evolution of Cooperation
The Genetics of Personality
Race, Caste, Groups, and Genetics
Convergent Evolution in Social Processes
Evolution of Music and Art
Biological and Social Emergence
Biologically Inspired Engineering
Human Pheromones
Animal Communication
Evolution Shaping Human Minds for Fitness or Accuracy
Philosophers on the "State of Nature"

Class 9: November 2

Class 10: November 9

Class 11: November 16

Class 12: November 30

Class 13: December 7