

**Sociology 636b**  
**Ecology & Evolutionary Biology 636b**  
**Topics in Biosocial Science**

**Wednesday 4:30–6:30 p.m.**

**Spring Term 2018**

**Location: Room 335, 17 Hillhouse Ave.**

Nicholas A. Christakis, MD, PhD, MPH  
Goldman Professor of Social and Natural Science  
Department of Sociology  
Department of Ecology and Evolutionary Biology  
Department of Biomedical Engineering  
Department of Medicine  
Yale University

telephone: (203) 436–4747

email: [nicholas.christakis@yale.edu](mailto:nicholas.christakis@yale.edu)

website: <http://www.NicholasChristakis.net> or <http://www.HumanNatureLab.net/>

twitter: @NACristakis

office hours: by appointment, in Room 303, 17 Hillhouse Ave.

**Course Description:**

This graduate seminar (with limited enrollment, but open to all graduate students at Yale, and 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). A set of proposed topics and 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 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 both instructors before the material is submitted. Students found guilty of violations of academic integrity are subject to one of several nasty penalties, according to the rules of Yale University.

While there are no pre-requisites for this course, a year-long course in biology is recommended.

**Class 1: January 17**  
**Course Introduction**

**Class 2: January 24**  
**Reductionism, Essentialism, Determinism, Positivism**

J.R. Hibbing, "Ten Misconceptions Concerning Neurobiology and Politics, Along with Responses and Rejoinder," *Perspectives on Politics*, 2013; 11: 475-489  
along with Responses and Rejoinders, *Perspectives on Politics*, 2013; 11: 490-524

**Class 3: January 31**  
**The Social as a Cause of the Biological**

- 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
- 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
- S.A. Tishkoff, et al., "Convergent Adaptation of Human Lactase Persistence in Africa and Europe," *Nature Genetics* 2007; 39: 31-40
- T.S. Simpson et al., "Genetic Evidence for High-Altitude Adaptation in Tibet," *Science* 2010; 329: 71-75
- E. Check, "How Africa Learned to Love the Cow," *Nature* 2006; 444: 994-996
- 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.

**Class 4: February 7**  
**Animal Society and Culture**

- 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.
- G.G. Gallup Jr., "Chimpanzees: Self-recognition," *Science* 1970; 167, 86-87
- 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
- S. deSilva and G. Wittemyer, "A Comparison of Social Organization in Asian Elephants and African Savannah Elephants," *International Journal of Primatology* 2012; 33: 1125-1141
- 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, F.B.M. deWaal, D. Reiss, "Self-recognition in an Asian Elephant," *PNAS: Proceedings of the National Academy of Sciences* 2006; 103: 17053-17057
- 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
- L. Weilgart, H. Whitehead, and K. Payne, "A Colossal Convergence," *American Scientist* 1996; 84: 278-287
- 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
- K.N. Laland and V.M. Janik, "The Animal Cultures Debate," *Trends in Ecology and Evolution* 2006; 21: 542-547.
- 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 5: February 14**

#### **Social Networks, Social Interactions, and Friendship**

- R.M. Seyfarth and D.L. Cheney, "The Evolutionary Origins of Friendship," *Annual Review of Psychology* 2012; 63: 153-177
- J. Tooby and L. Cosmides, "Friendship and the Banker's Paradox: Other Pathways to the Evolution of Adaptations for Altruism," *Proceedings of the British Academy*, 1996; 88: 119-143
- C.L. Apicella, F.W. Marlowe, J.H. Fowler, and N.A. Christakis, "Social Networks and Cooperation in Hunter-Gatherers," *Nature* 2012; 481: 497-501
- 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
- J.H. Fowler, J.E. Settle, and N.A. Christakis, "Correlated Genotypes in Friendship Networks," *PNAS: Proceedings of the National Academy of Sciences* 2011; 108(5): 1993-1997
- 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
- 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, Hernández-Lloreda MV, Hare B, Tomasello M. "Humans have evolved specialized skills of social cognition: the cultural intelligence hypothesis." *Science* 2007; 317: 1360-1366.

### **Class 6: February 21**

#### **Behavior Genetics**

- J.P. Beauchamp, et al., "Molecular Genetics and Economics," *Journal of Economics Perspectives* 2011; 25: 57–82
- Ebstein, RP et al. Genetics of Human Social Behavior. *Neuron* 2010; 65: 831-844.
- C.A. Rietveld et al., "GWAS of 126,559 Individuals Identifies Genetic Variants Associated with Educational Attainment," *Science* 2013; 340: 1467-1471
- C.F. Chabris, B.M. Hebert, D.J. Benjamin, J. Beauchamp, D. Cesarini, M. van der Loos, M. Johannesson, P.K. E. Magnusson, P. Lichtenstein, C.S. Atwood, J. Freese, T.S. Hauser, R.M. Hauser, N.A. Christakis, D. Laibson, "Most Reported Genetic Associations with General Intelligence Are Probably False Positives," *Psychological Science* 2012; 23: 1314-1323; doi:10.1177/0956797611435528
- 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.
- J.E. DeNeve, N.A. Christakis, J.H. Fowler, and B.S. Frey, "Genes, Economics, and Happiness," *Journal of Neuroscience, Psychology, and Economics* 2012; 5: 193-211.
- D. Golan, E.S. Lander, and S. Rosset, "Measuring Missing Heritability: Inferring the Contribution of Common Variants," *PNAS: Proceedings of the National Academy of Sciences* 2014; 111: E5272-5281.

### **Class 7: February 28**

#### **Gene-Environment Interactions**

- 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
- G.M. Slavich and S.W. Cole, "The Emerging Field of Human Social Genomics," *Clinical Psychological Science* 2013; 8: 667-669
- B.L. Fredrickson, et. al., "A Functional Genomic Perspective on Human Well Being," *PNAS: Proceedings of the National Academy of Sciences* 2013; 110: 13684-13689.
- 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
- E. Do and H. Maes, "Narrative Review of Genes, Environment, and Cigarettes," *Annals of Medicine* 2016; 48: 337-351.

**Class 8: March 7**  
**Social Epigenetics**

- G. Miller, "The Seductive Allure of Behavioral Epigenetics," *Science* 2010; 329: 24–27
- M. Szyf, P. McGowan, M.J. and Meaney, "The Social Environment and the Epigenome," *Environmental and Molecular Mutagenesis* 2008; 49: 46–60
- D.K. Morgan, E. Whitelaw, "The Case for Transgenerational Epigenetic Inheritance in Humans" *Mammalian Genome* 2008; 19: 394-397
- B.G. Dias and K.J. Ressler, "Parental Olfactory Experiences Influence Behavior and Neural Structure in Subsequent Generations," *Nature Neuroscience* 2014; 17: 89-96
- M. Szyf, "Lamarck Revisited: Epigenetic Inheritance of Ancestral Odor Fear Conditioning," *Nature Neuroscience* 17, 2–4 (2014) doi:10.1038/nn.3603
- 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
- L. Lam et al., "Factors Underlying Variable DNA Methylation in a Community Cohort," *PNAS: Proceedings of the National Academy of Sciences* 2012; 109: 17253-17260.
- C.S. Moller-Levet et al., "Effects of Insufficient Sleep on Circadian Rhythmicity and Expression Amplitude of the Human Blood Transcriptome," *PNAS: Proceedings of the National Academy of Sciences* 2013; 110: E1132-E1141
- A. Ost et al., "Paternal Diet Defines Offspring Chromatin State and Intergenerational Obesity," *Cell* 2014; 159: 1352-1364.

**March 9–25**  
**NO CLASS, Spring Break**

**Class 9: March 28**  
**Swarm Intelligence and Animal Voting**

- I.D. Couzin, "Collective Cognition in Animal Groups," *Trends in Cognitive Sciences* 2009; 13: 36-43
- M. Nagy, Z. Ákos, D. Biro, and T. Vicsek, "Hierarchical Group Dynamics in Pigeon Flocks," *Nature* 2010; 464: 890-893
- I.D. Couzin, C.C. Ioannou, G. Demirel, T. Gross, C.J. Torney, A. Hartnett, L. Conradt, S.A. Levin, and N.E. Leonard, "Uninformed Individuals Promote Democratic Consensus in Animal Groups," *Science* 2011; 334: 1578-1580
- I.D. Couzin, J. Krause, N.R. Franks, and S.A. Levin, "Effective Leadership and Decision-making in Animal Groups on the Move," *Nature* 2005; 433: 513-516
- J. R.G. Dyer, A. Johansson, D. Helbing, I. D. Couzin, and J. Krause, "Leadership, consensus decision making and collective behaviour in humans," *Phil. Trans. R. Soc. B* 2009; 364: 781-789.
- G. Tziralis and I. Tatsiopoulos, "Prediction Markets: An Extended Literature Review," *Journal of Prediction Markets* 2007; 1: 75-91.
- H. Shirado and N.A. Christakis, "Locally Noisy Autonomous Agents Improve Global Human Coordination in Network Experiments," *Nature* 2017; 545: 370-375
- J. Krause, G.D. Ruxton, and S. Krause, "Swarm Intelligence in Animals and Humans," *Trends in Ecology & Evolution* 2010; 25: 28-34

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

Kin Recognition  
Gene-Culture Co-Evolution  
Partner Choice, Monogamy, and Pair Bonding  
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  
Philosophers on the “State of Nature”

**Class 10: April 4**

**Class 11: April 11**

**Class 12: April 18**

**Class 13: April 25**