

**ECON 496/695**  
**Economics, Biology & Genetics**  
Department of Economics, George Mason University  
Spring 2023

**Instructor:** Prof. Jonathan Beauchamp  
**Contact:** [jbeauch@gmu.edu](mailto:jbeauch@gmu.edu)  
**Class meetings:** Tuesday 10:30am – 1:10pm, Music/Theater Building 1008  
**Office hours:** By appointment

**TA:** Gareth Markel  
**Contact:** [gmarkel@gmu.edu](mailto:gmarkel@gmu.edu)  
**Office hours:** By appointment

### Course description

This course will cover new and old research at the intersection of economics, biology, and genetics. We will address questions such as: Do nature and nurture influence economic behavior and outcomes, and how? Are there genetic variants that influence economic preferences and outcomes? What are the effects of brain neurochemistry on economic decision-making? We'll discuss important policy issues such as the implications (or lack thereof) of these findings for inequality, intergenerational mobility, and for economists and policy makers generally; the implications of the rapidly improving predictive power of genetic data; and the implications of new technologies that allow some form of genetic selection or engineering. The course will involve engaged discussion of important academic articles. It will require a good understanding of introductory econometrics and statistics, but no previous background in biology or genetics is required.

### Format

Weekly class meetings will have the following two core components:

- *Lectures:* I will usually give a lecture that covers a core topic of the course during the first part of the class meeting.
- *Seminar-style discussions:* during the second part of the class meeting, I will usually lead a seminar-style discussion of the week's assigned readings. This is an important component of the course, and you must have read the assigned readings prior to class and be prepared to engage in meaningful discussion of these readings during class.

### Course website

The course website on **Blackboard** is accessible through <https://mymasonportal.gmu.edu>. The Blackboard site will also be used to post lecture slides, distribute assignments, manage class communications, etc.

## Course readings

You will be assigned one or several articles to read each week, and these will be critically discussed during the week's seminar-style discussion. The (tentative) reading list is at the end of this syllabus; only readings preceded by a star (\*) are required.

## Evaluation

Task	Weight	(Due) date
8 short reaction papers	25%	(See below)
3 problem sets	15%	Feb. 20 Mar. 20 Apr. 24
Midterm	30%	April 4
Final presentation	15%	May 2
Class participation and attendance	15%	Every class

You will have to write **8 short reaction papers**. As shown in the tentative schedule below, there are 11 planned seminar-style discussions; before any 8 of these, you will have to submit a written reaction paper on the week's assigned readings. Each reaction paper must show you've read and engaged with the week's assigned readings; it should briefly summarize the readings and mention key take-aways, but should also discuss policy implications, ideas for further research, and/or possible questions raised by the readings (e.g., What surprised you? Where do you disagree?). Each reaction paper must be 250 to 350 words in length; text must be double-spaced and you must use font size 12. You must submit each reaction paper in PDF format on the Blackboard course website by 9pm on the day *prior to* the discussion. The first reaction paper is due on Monday, January 30.

There will be **3 problem sets**.

- Problem sets must be submitted through Blackboard by 11:59pm on their due date in PDF format. Neither paper nor email submissions will be counted.

The **midterm** will be held in class on Tuesday April 4 from 10:30am to 1:10pm (during class time).

- The midterm will test the materials covered up to (and including) March 28.
- Some questions on the exams may be different for graduate and undergraduate students. Graduate students are expected to show a more in-depth understanding of the materials.

Each student will have to form a pair with a classmate and give a **final presentation** during class time on May 2 (in the last week of class).

- Further details will be given in class.

Students will be evaluated on **class participation and attendance**.

- An important component of this course is the seminar-style discussion of assigned readings. You must read the required articles prior to class and engage in meaningful discussion of these articles during class.
- Evaluation will also be based on class participation and attendance and on whether you adhere to the class rules below.

## **Class rules**

- Students should attend all class meetings and arrive on time. Students who need to miss a class for a good reason should let me know in advance if possible.
- The use of laptops, iPads, etc, is allowed only for the purpose of taking class notes and viewing relevant lecture materials. The use of the internet, Facebook, emails, and all other computer applications that are not essential for the current lecture or discussion, is strictly prohibited. The use of phones, iPods, etc, is strictly prohibited.
- Food will typically not be permitted in class; I may grant exceptions for small snacks that do not disrupt class activities.
- Students must prepare name tags, bring these to class, and put these on their desks each week.
- Students must be prepared to engage in class discussion!

## **Academic Integrity**

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at <http://oai.gmu.edu>. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person or previous work without giving appropriate credit; paraphrased material must also be credited. Credit can be given through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. If you have any doubts about what constitutes plagiarism, please see me.

## **Disability Accommodation**

Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit <http://ds.gmu.edu> for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with me. Disability Services is located in Student Union Building I (SUB I), Suite 2500, and can be contacted at [ods@gmu.edu](mailto:ods@gmu.edu) or 703.993.2474.

## Tentative course schedule

Course week	Date	Event/topic
1	Jan. 24	Lecture: <i>Syllabus + Introduction and motivation</i> + <i>Neuroeconomics, brain chemistry, and decision making</i>
2	Jan. 31	Lecture: <i>Nature and nurture I: Heritability and the ACE model</i> Seminar-style discussion
	TBD	Tutorial: <i>Econometrics review 1</i> (optional)
3	Feb. 7	Lecture: <i>Nature and nurture II: Limitations and extensions of the ACE model</i> Seminar-style discussion
	TBD	Tutorial: <i>Econometrics review 2</i> (optional)
4	Feb. 14	Lecture: <i>Nature and nurture III: Some history + other topics</i> Seminar-style discussion
5	Feb. 20	Problem set 1 due
	Feb. 21	Lecture: <i>Nature and nurture IV: Interpretation + policy implications</i> Seminar-style discussion
6	Feb. 28	Lecture: <i>Molecular genetics and econ I: Intro, candidate-genes, stat. power</i> Seminar-style discussion + review of solutions to problem set 1
7	Mar. 7	Lecture: <i>Molecular genetics and econ II: GWAS and polygenic scores</i> Seminar-style discussion
	Mar. 13-17	Spring recess
8	Mar. 20	Problem set 2 due
	Mar. 21	Lecture: <i>Molecular genetics and econ III: Gene-environment interactions</i> Seminar-style discussion
9	Mar. 28	Seminar-style discussion + review of solutions to problem set 2 Midterm review session
10	Apr. 4	Midterm
11	Apr. 11	Lecture: <i>Molecular genetics and econ IV: Mendelian Randomization</i> Seminar-style discussion + review of solutions to the midterm
	TBD	Tutorial: <i>Econometrics review 3</i> (optional)
12	Apr. 18	Lecture: <i>Molecular genetics and econ V: Other topics</i> Seminar-style discussion
13	Apr. 24	Problem set 3 due
	Apr. 25	Lecture: <i>Other uses of genetics and biology in economics</i> Seminar-style discussion + review of solutions to problem set 3
14	May 2	Student presentations

## Reading list (tentative)

Starred readings are the (tentative) required readings that will be discussed during the seminar-style discussions. Other readings are optional.

### Neuroeconomics (Week 1 lecture + Week 2 discussion)

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

Camerer, C., Loewenstein, G., & Prelec, D. (2005). Neuroeconomics: How neuroscience can inform economics. *Journal of Economic Literature*, 43(1), 9-64.

Fehr, E., & Rangel, A. (2011). Neuroeconomic foundations of economic choice—recent advances. *The Journal of Economic Perspectives*, 25(4), 3-30.

Declerck, C.H., Boone, C., Pauwels, L., Vogt, B. and Fehr, E. (2020). A registered replication study on oxytocin and trust. *Nature Human Behaviour*, 4(6), 646-655.

### Nature and nurture I: Heritability and the ACE model (Week 2 lecture + Week 3 discussion)

\*Cronqvist, H., & Siegel, S. (2015). The origins of savings behavior. *Journal of Political Economy*, 123(1), 123-169.

\*Pinker, S. (2004). Why nature & nurture won't go away. *Daedalus*, 133(4), 5-17.

### Nature and nurture II: Limitations and extensions of the ACE model (Week 3 lecture + Week 4 discussion)

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

Sacerdote, B. (2010). Nature and nurture effects on children's outcomes: What have we learned from studies of twins and adoptees. *Handbook of social economics*, 1, 1-30.

Fagereng, A., Mogstad, M. and Rønning, M. (2021). Why do wealthy parents have wealthy children?. *Journal of Political Economy*, 129(3), 703-756.

### Nature and nurture III: Some history + other topics (Week 4 lecture + Week 5 discussion)

\*Björklund, A., Lindahl, M., & Plug, E. (2006). The origins of intergenerational associations: Lessons from Swedish adoption data. *The Quarterly Journal of Economics*, 121(3), 999-1028.

\*Turkheimer, E. "Three laws of behavior genetics and what they mean." *Current Directions in Psychological Science* 9.5 (2000): 160-164.

Bowles, S., & Gintis, H. (2002). The inheritance of inequality. *The Journal of Economic Perspectives*, 16(3), 3-30.

### Nature and nurture IV: Interpretation + policy implications (Week 5 lecture + Week 6 discussion)

\*Harden, K.P., 2018. Why progressives should embrace the genetics of education. *The New York Times*.

\*Lewis-Kraus, G., 2021. Can Progressives Be Convinced That Genetics Matters? *The New Yorker*.

\*Morris, D. (2021). The Culture War is Coming for Your Genes. *Quillette*.

Dobzhansky, T. (1973). Is genetic diversity compatible with human equality? *Social biology*, 20(3), 280-288.

Goldberger, Arthur S. (1979). "Heritability." *Economica*, 46(184): 327-47.

Jencks, Christopher. (1980). "Heredity, environment, and public policy reconsidered." *American Sociological Review*, 45(5): 723-36.

### Molecular genetics and economics I: Intro, candidate-genes, stat. power (Week 6 lecture + Week 7 discussion)

\*Chabris, C. F., Hebert, B. M., Benjamin, D. J., Beauchamp, J., Cesarini, D., van der Loos, M., ... & Freese, J. (2012). Most reported genetic associations with general intelligence are probably false positives. *Psychological Science*.

\*Dreber, A., Apicella, C.L., Eisenberg, D.T., Garcia, J.R., Zamore, R.S., Lum, J.K. and Campbell, B. (2009). The 7R polymorphism in the dopamine receptor D4 gene (DRD4) is associated with financial risk taking in men. *Evolution and Human Behavior*, 30(2), 85-92.

\*Kuhnen, C.M., & Chiao, J.Y. (2009). Genetic determinants of financial risk taking. *PloS ONE*, 4(2), e4362.

Beauchamp, J. P., Cesarini, D., Johannesson, M., van der Loos, M. J., Koellinger, P. D., Groenen, P. J., ... & Christakis, N. A. (2011). Molecular genetics and economics. *The Journal of Economic Perspectives*, 25(4), 57-82.

### **Molecular genetics and economics II: GWAS and polygenic scores (Week 7 lecture + Week 8 discussion)**

\*Belsky, D.W., Domingue, B.W., Wedow, R., Arseneault, L., Boardman, J.D., Caspi, A., Conley, D., Fletcher, J.M., Freese, J., Herd, P. and Moffitt, T.E., 2018. Genetic analysis of social-class mobility in five longitudinal studies. *Proceedings of the National Academy of Sciences*, 115(31), pp. E7275-E7284.

\*Regalado, A., 2019. 23andMe thinks polygenic risk scores are ready for the masses, but experts aren't so sure. *MIT Technology Review*.

\*Resnik, B., 2018. How Scientists are Learning to Predict Your Future with Your Genes. But What are the Limits?. *Vox*, August, 25, p.9.

Karlsson Linnér, R., Biroli, P., Kong, E., Meddens, S.F.W., Wedow, R., ... & Beauchamp, J. (2019). Genome-wide association analyses of risk tolerance and risky behaviors in over one million individuals identify hundreds of loci and shared genetic influences. *Nature Genetics*.

Lee, J.J., Wedow, R., Okbay, A., Kong, E., Maghzian, O., ... & Cesarini, D. (2018). Gene discovery and polygenic prediction from a genome-wide association study of educational attainment in 1.1 million individuals. *Nature Genetics*, 50(8), 1112–1121.

### **Molecular genetics and economics III: Gene-environment interactions (Week 8 lecture + Week 9 discussion)**

\*Barcellos, S.H., Carvalho, L.S. and Turley, P., 2018. Education can reduce health differences related to genetic risk of obesity. *Proceedings of the National Academy of Sciences*, 115(42), pp. E9765-E9772.

\*Caspi, A., McClay, J., Moffitt, T. E., Mill, J., Martin, J., Craig, I. W., ... & Poulton, R. (2002). Role of genotype in the cycle of violence in maltreated children. *Science*, 297(5582), 851-854.

Harden, K.P., 2021. "Reports of my death were greatly exaggerated": Behavior genetics in the postgenomic era. *Annual Review of Psychology*, 72, pp.37-60.

### **CRISPR, embryo selection, and genetic engineering (Week 11 discussion)**

\*2019. How genetic engineering will reshape humanity. *The Economist*.

\*The Broad Institute. Research Highlights: CRISPR. <https://www.broadinstitute.org/research-highlights-crispr> (Website and video).

\*The Broad Institute. Questions and Answers about CRISPR. <https://www.broadinstitute.org/what-broad/areas-focus/project-spotlight/questions-and-answers-about-crispr> (Website and video).

\*Kolata, G. and Belluck, P., 2018. Why are scientists so upset about the first CRISPR babies. *The New York Times*.

\*Regalado, A., 2019. China's CRISPR twins might have had their brains inadvertently enhanced. *MIT Technology Review*.

\*Turley, P., Meyer, M.N., Wang, N., Cesarini, D., Hammonds, E., Martin, A.R., Neale, B.M., Rehm, H.L., Wilkins-Haug, L., Benjamin, D.J. and Hyman, S., 2021. Problems with using polygenic scores to select embryos. *New England Journal of Medicine*, 385(1), pp.78-86.

### **Molecular genetics and economics IV: Mendelian Randomization (Week 11 lecture + Week 12 discussion)**

\*Millwood, I.Y., Walters, R.G., Mei, X.W., Guo, Y., Yang, L., Bian, Z., ... & Zhou, G. (2019). Conventional and genetic evidence on alcohol and vascular disease aetiology: a prospective study of 500 000 men and women in China. *The Lancet*, 393(10183), 1831-1842.

\*Tyrrell, J., Jones, S. E., Beaumont, R., Astley, C. M., Lovell, R., Yaghootkar, H., ... & Wood, A. R. (2016). Height, body mass index, and socioeconomic status: Mendelian randomisation study in UK Biobank. *BMJ*, 352, i582.

Davies, N.M., Holmes, M.V. and Smith, G.D. (2018). Reading Mendelian randomisation studies: a guide, glossary, and checklist for clinicians. *BMJ*, 362, k601.

**Molecular genetics and economics V: Other topics (Week 12 lecture + Week 13 discussion)**

\*Beauchamp, J.P. (2016). Genetic evidence for natural selection in humans in the contemporary United States. *Proceedings of the National Academy of Sciences*, 113(28), 7774-7779.

\*Benjamin, D. J., Cesarini, D., van der Loos, M. J., Dawes, C. T., Koellinger, P. D., Magnusson, P. K., ... & Visscher, P. M. (2012). The genetic architecture of economic and political preferences. *Proceedings of the National Academy of Sciences*, 109(21), 8026-8031.

**Other uses of genetics and biology in economics (Week 13)**

Becker, G. S. (1976). Altruism, egoism, and genetic fitness: Economics and sociobiology. *Journal of economic Literature*, 14(3), 817-826.

Cox, D. (2007). Biological basics and the economics of the family. *The Journal of Economic Perspectives*, 21(2), 91-108.