

CREST - GENES

Cours doctoraux 2018 – 2019

Introduction to Social Science Genetics

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A growing number of social science data sources are providing molecular genetic data and researchers all over the world are interested in utilizing this information in order to better understand various social phenomena. In this course, we will learn about the history of social science and behaviour genetics as well as about the state of the art research and cutting-edge methods. After attending this workshop, participants should have a basic understanding of the fundamental advantages of integrating genetics into social science. They should understand the basic technical terms from quantitative genetics literature and be able to read and interpret studies concerning social science genetics. They should be able to conduct basic quantitative genetics analyses and interpret their findings. Participants need an interest and a basic understanding of quantitative social science research and some experience concerning the software R & Stata.

We will start with a general introduction of genetics in social sciences discussing potential research questions we can answer using genetic data. We subsequently learn about the theory behind twin and family models and how to estimate heritability as the proportion of observed variance in an outcome, which is explained by genetic effects. We move on to see how heritability is measured using molecular genetic data and discuss various challenges and applications. We use Plink software to prepare genetic data and GCTA software to estimate quantitative genetic models.

We will discuss how genetic variants are discovered, which are associated with social science outcomes of interest and how we can utilize these results in social science research in terms of controlling for confounding effects, dealing with genetic heterogeneity in social science models, estimating gene-environment interaction models and using genes as instrumental variables. Substantively, we will rely on recently published genetic discovery studies on educational attainment, subjective well-being and fertility.

Lessons

1. Introduction to Social Science Genetics
2. Genome-wide association studies
3. Heritability studies
4. Polygenic scores
5. Gene-environment interaction
6. Genetic correlations and pleiotropic
7. Computer session: Genetic data and software
8. Computer session: Heritability estimation
9. Computer session: Polygenic scores and gene-environment interaction
10. Computer session: Working with GWAS summary results

References

- Belsky, D. W., & Israel, S. (2014). Integrating genetics and social science: genetic risk scores. *Biodemography and Social Biology*, 60(2), 137–55. <http://doi.org/10.1080/19485565.2014.946591>
- Cesarini, D., & Visscher, P. M. (2017). Genetics and educational attainment. *Npj Science of Learning*, 2(1), 4. <http://doi.org/10.1038/s41539-017-0005-6>
- Conley, D. (2009). The promise and challenges of incorporating genetic data into longitudinal social science surveys and research. *Biodemography and Social Biology*, 55(2), 238–251.
- Conley, D., Domingue, B., Cesarini, D., Dawes, C., Rietveld, C., & Boardman, J. (2015). Is the Effect of Parental Education on Offspring Biased or Moderated by Genotype? *Sociological Science*, 2, 82–105. <http://doi.org/10.15195/v2.a6>

- Conley, D., & Fletcher, J. (2017). *Genome Factor. What the Social Genomics Revolution Reveals about Ourselves, Our History and the Future*. Princeton University Press.
- Courtiol, A., Tropf, F. C., & Mills, M. C. (2016). When genes and environment disagree: Making sense of trends in recent human evolution. *Proceedings of the National Academy of Sciences*, 113(28), 7693–7695. <http://doi.org/10.1073/pnas.1608532113>
- Domingue, B. W., Fletcher, J., Conley, D., & Boardman, J. D. (2014). Genetic and educational assortative mating among US adults. *Proceedings of the National Academy of Sciences*, 111(22), 7996–8000.
- Mehta, D., Tropf, F. C., Gratten, J., Bakshi, A., Zhu, Z., Bacanu, S.-A., ... Wu, J. Q. (2016). Evidence for Genetic Overlap Between Schizophrenia and Age at First Birth in Women. *JAMA Psychiatry*, 73(5), 497–505. <http://doi.org/10.1001/jamapsychiatry.2016.0129>
- Mills, M. C., & Tropf, F. C. (2016). The Biodemography of Fertility: A Review and Future Research Frontiers. *Kölner Zeitschrift Für Soziologie Und Sozialpsychologie*, 55(Special Issues Demography), 397–424.
- Neale, M. C., & Cardon, L. R. (1992). *Methodology for genetic studies of twins and families*. Dordrecht, the Netherlands: Kluwer Academic Publishers.
- Okbay, A., Beauchamp, J. P., Fontana, M. A., Lee, J. J., Pers, T. H., Rietveld, C. A., ... Benjamin, D. J. (2016). Genome-wide association study identifies 74 loci associated with educational attainment. *Nature*, 533(7604), 539–542. <http://doi.org/10.1038/nature17671>
- Rietveld, C. A., Cesarini, D., Benjamin, D. J., Koellinger, P. D., Neve, J.-E. De, Tiemeier, H., ... Krueger, R. F. (2013). Molecular genetics and subjective well-being. *Proceedings of the National Academy of Sciences*, 110(24), 9692–9697.
- Tropf, F. C., Barban, N., Mills, M. C., Snieder, H., & Mandemakers, J. J. (2015). Genetic influence on age at first birth of female twins born in the UK, 1919-68. *Population Studies*, 69(2), 129–145.
- Tropf, F. C., & Mandemakers, J. J. (2017). Is the Association Between Education and Fertility Postponement Causal? The Role of Family Background Factors. *Demography*, 54(1), 71–91. <http://doi.org/10.1007/s13524-016-0531-5>
- Tropf, F. C., Stulp, G., Barban, N., Visscher, P., Yang, J., Snieder, H., & Mills, M. C. (2015). Human fertility, molecular genetics, and natural selection in modern societies. *PLoS One*, 10(6), e0126821.

Cours	Lundis	09 avril 2018 16 avril 2018	de 10h00 à 13h00 de 10h00 à 13h00	salle 2001 salle 2002
	Mardis	10 avril 2018 17 avril 2018	de 10h00 à 12h00 de 10h00 à 12h00	salle 2001 salle 2002

à l'ENSAE, - 5 Av. Henry Le Chatelier - Palaiseau (REB B Massy Palaiseau & bus 9106 C ou B)

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