

**University of Washington
Institute for Public Health Genetics
School of Public Health**

**PHG 301
PUBLIC HEALTH GENOMICS: INTRODUCTION TO GENETIC EPIDEMIOLOGY
3 Credits
Winter, 2013
Mondays & Wednesdays, 3:30- 4:50
Location TBD**

Instructors

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Course Overview and Curriculum Content

This course offered by the Institute for Public Health Genetics will survey a wide range of approaches for investigating the genetic and environmental causes of disease, and provide examples of how genetic epidemiologic research findings can be used in public health and clinical practice to improve the health of individuals and populations. We will also touch on the ethical, societal, political and legal dimensions that can arise when using information on genetic and environmental factors in research and practice. This course will develop students' ability to understand the basic approaches used to identify genetic and environmental factors in health and disease, and how the application of this information can be used improve population health, as well as to appreciate the ethical, legal and social implications that can arise in both research and translation to practice.

Course Learning Goals/Objectives

By the end of the course each student will be able to:

- Define genetic epidemiology
- Describe the fundamental concepts critical to genetic epidemiology
- Describe the major study designs used in genetic epidemiology
- Be able to collect family health information and draw a pedigree using a software program
- Describe the relationship and impacts of genetic epidemiology on public health
- Describe the benefits and harms of direct to consumer genetic testing
- Explain how genetic epidemiologic findings can be applied in public health using current examples
- Critically analyze media presentations that present genetic science and its applications

Course Evaluation and Grading Expectations

The course grade will be based upon a midterm, final examination, and a weekly set of responses to discussion questions based on the readings. The midterm will account for 25% of your grade, the final exam for 40%, and the discussion question responses, 30%. The midterm and the final exam will be a

combination of complex multiple choice and true/false questions. Both exams will be administered using the Catalyst web-based testing system.

All exams and assignments are subject to the University of Washington's Student Conduct Code including sanctions and disciplinary actions [<http://www.washington.edu/students/handbook/conduct.html>] Grading will conform to the University of Washington's Standard Grading Policy as detailed at http://www.washington.edu/students/genocat/front/Grading_Sys.html#GRADE

Disability-related Needs

To request academic accommodations due to a disability, please contact Disability Resources for Students (DRS), 448 Schmitz, (206) 543-8924 (V), (206) 543-8925 (TTY). If you have a letter from DRS, please present the letter to me so we can discuss the accommodations you might need in this class.

Course Readings and Schedule

The following section outlines the reading assignments and sets forth a preliminary timetable. It is possible, if not likely, that the timetable and reading assignments will be amended during the course, depending on our pace and new developments. Please note that reading assignments should be completed prior to our coverage of that portion of the outline in class.

January 7, 2013: Introduction to Course and to Faculty

Investigating disease in populations: What is genetics? What is epidemiology? And what do they mean together?

- Review the Talking Glossary of Genetic Terms (<http://www.genome.gov/Glossary/>) and the Excite Glossary of Epidemiology Terms (<http://www.cdc.gov/excite/library/glossary.htm>) to use as reference throughout the course.

Module 1: Family Health History

January 9, 2013

Family Data: Will we become our parents?

- Bennett RL, Steinhaus KA, Uhrich SB, O'Sullivan CK, Resta RG, Lochner-Doyle D, Markel DS, Vincent V, Hamanishi J. Recommendations for standardized human pedigree nomenclature. Pedigree Standardization Task Force of the National Society of Genetic Counselors. *Am J Hum Genet.* 1995 Mar;56(3):745-52.
- Progeny Software www.progenysoftware.com/
- Who's on the Family Tree? Now It's Complicated. *New York Times*, July 4, 2011.

January 14, 2013:

Movie and Discussion Session

- **Cracking the Code of Life** (Nova) <http://www.pbs.org/wgbh/nova/body/cracking-the-code-of-life.html>)

January 16, 2013:

Family Health History as a Public Health Tool

- Berg et al. National Institutes of Health State-of-the-Science Conference Statement: Family History and Improving Health. *Ann Intern Med* December 15, 2009 151:872-877
- Claassen L, et al. Using family history information to promote healthy lifestyles and prevent disease; a discussion of the evidence. *BMC Public Health* 2010, **10**:248 doi:10.1186/1471-2458-10-248
- Utah Family Health History Toolkit:
<http://health.utah.gov/genomics/familyhistory/toolkit.html>

January 23, 2013:

Studying genetic causes of disease in families.

- <http://www.nature.com/scitable/topicpage/mendelian-genetics-patterns-of-inheritance-and-single-966>
- <http://www.nature.com/scitable/topicpage/gene-mapping-and-disease-34600>
- Claassen L, et al. Using family history information to promote healthy lifestyles and prevent disease; a discussion of the evidence. BMC Public Health 2010, **10**:248 doi:10.1186/1471-2458-10-248

January 28, 2013:

Social vs. biologic definitions of family and implications for public health

- McGrath BB & Edwards KL. When family means more (or less) than genetics. The intersection of culture, family and genomics. J Transcultural Nurs. 2009;3:270-77

Module 2: Genes in Populations

January 30, 2013

Equilibrium and Disequilibrium: Looking at genetic variation in populations

- Attia J, Ioannidis JP, Thakkinstian A, McEvoy M, Scott RJ, Minelli C, Thompson J, Infante-Rivard C, Guyatt G (2009a) How to use an article about genetic association: A: Background concepts. Jama 301:74-81.
- Unit 5 from "Essentials of Genetics" Miko, I. & LeJeune, L., eds. Cambridge, MA: NPG Education, 2009. Review Units 5.3-5.4

February 4, 2013

Ancestry Testing: Looking Back and Moving Forward

- Charmaine D. Royal, John Novembre, Stephanie M. Fullerton, David B. Goldstein, Jeffrey C. Long, Michael J. Bamshad, Andrew G. Clark. **Inferring Genetic Ancestry: Opportunities, Challenges, and Implications.** *American Journal of Human Genetics*, 2010; 86 (5): 661-673 DOI: 10.1016/j.ajhg.2010.03.011
- DNA Tests Find Branches but Few Roots. New York Times, November 25, 2007.

February 6, 2013:

Movie and Discussion Session

- The Human Family Tree (<http://shop.nationalgeographic.com/ngs/product/genographic-products/the-human-family-tree-dvd>)

Midterm Exam

Module 3: Genetic Epi Study Design and Screening

February 11, 2013

What can we learn from unrelated people about genetic risk? Overview of case-control studies and measures of association

- Clarke GM, Anderson CA, Pettersson FH, Cardon LR, Morris AP, Zondervan KT. Basic statistical analysis in genetic case-control studies. Nat Protoc. 2011 Feb;6(2):121-33. Epub 2011 Feb 3.

February 13, 2013

Genes and Disease in Individuals and in the Population

- Review the following articles from the Nature Education Scitable website on Genes and Disease (<http://www.nature.com/scitable/topic/genes-and-disease-17>) :

- <http://www.nature.com/scitable/topicpage/complex-diseases-research-and-applications-748>
- <http://www.nature.com/scitable/topicpage/mendelian-genetics-patterns-of-inheritance-and-single-966>
- Review websites for the HapMap project and the 1000 genomes project

February 20, 2013

Screening and Utility of Genomic Information

- Institute of Medicine, Report on Genomics in Public Health, pp. 32-54
- Burke, W, Genetic Testing, N Engl J Med, Vol. 347, No. 23, December 5, 2002

February 25, 2013

23 and what? Current topics in direct to consumer genetic testing

- <http://ghr.nlm.nih.gov/handbook/testing/directtoconsumer>
- Genetics & Public Policy Center. Direct-to-consumer Genetic Testing: Empowering or Endangering the Public?, May 30, 2008, http://www.dnapolicy.org/policy.issue.php?action=detail&issuebrief_id=32
- Locate and Review Websites for the following companies: 23andMe, DeCode, Navigenics

Module 4: Epigenetics, Gene Expression and Gene-Environment Interactions

February 27 2012

Movie and Discussion Session

- Ghosts in Your Genes (PBS) <http://www.pbs.org/wgbh/nova/genes/>

March 4, 2013

Epigenetics

- Mark A. Rothstein, Yu Cai, Gary E. Marchant. THE GHOST IN OUR GENES: LEGAL AND ETHICAL IMPLICATIONS OF EPIGENETICS Health Matrix Clevel. 2009 Winter; 19(1): 1–62. PMID: PMC3034450
- Jablonka E et al. **Transgenerational Epigenetic Inheritance: Prevalence, Mechanisms, and Implications for the Study of Heredity and Evolution.** *The Quarterly Review of Biology*, 2009; 84 (2): 131 DOI: 10.1086/598822
- Valentina Bollati, Andrea Baccarelli. Environmental Epigenetics. *Heredity*. 2010 July; 105(1): 105–112. PMID: PMC3133724

March 6, 2013

Gene Expression

- Matthew V Rockman and Leonid Kruglyak. Genetics of global gene expression. *Nature Reviews* November 2006; 7: 862-71
- http://genome.wellcome.ac.uk/doc_WTD020757.html

March 11 2013

Nature vs. Nurture – is it still a relevant question? Examples of Gene-Environment Interactions

- Khoury MJ, et al. Do we Need Genomic Research for the Prevention of Common Diseases with Environmental Causes? *Am. J. Epidemiol.* 2005. 161: 799-805.
- Study Says DNA's Power to Predict Illness Is Limited. *New York Times*. April 2, 2012. <http://www.nytimes.com/2012/04/03/health/research/dnas-power-to-predict-is-limited-study-finds.html>
- DNA has limits, but so does study questioning its value, geneticists say. *Nature Newsblog*. April 4, 2012. <http://blogs.nature.com/news/2012/04/questioning-value-personal-genomics.html>

March 13 2013

Are you what you eat? Genetics of taste and Nutrigenomics

- Nutrigenetic Testing: Tests Purchased from Four Web Sites Mislead Consumers. 2006 Report from the GAO. <http://aging.senate.gov/events/hr162gk.pdf>
- An Agenda for Personalized Medicine: Ng PC et al., Nature; Oct 2009 http://www.gis.a-star.edu.sg/internet/site/data/sup_data/2249/an_agenda_for_personalized_medicine.pdf
- Nutrigenetics Testing: Tests Purchased from Four Web Sites Mislead Consumers. 2006 Report from the GAO. <http://aging.senate.gov/events/hr162gk.pdf>
- <http://learn.genetics.utah.edu/content/begin/traits/ptc/>

- Final Exam