

**PSYCHOLOGY 8937
SEMINAR IN BEHAVIORAL GENETICS
SPRING 2008**

**ANALYSIS OF SNP DATA
THURSDAY, 12:30-2:00
N218 ELLIOTT HALL**

Objectives: The course is intended to provide students with an introduction and overview to the statistical analysis genetic data, with a specific focus of SNP data. It is assumed that students have had an introduction to behavioral genetics, know the basics of quantitative genetic analysis, know how to process twin/family data, and have completed the study of statistics at least through the intermediate graduate level. At the end of the course it is expected that students should be able to independently undertake and interpret the various analytical procedures covered.

Requirements: It is assumed that students will have access to computers that will allow them to download the relevant (and free) statistical software (not decided yet what that will be). In addition, students should have access to some standard statistical software (e.g., SPSS, SAS). My hope is to develop a series of lab assignments, but this is the first time trying to teach this and it is always a challenge to have good assignments. Students who are taking this course for credit will be expected to complete the assignments and to make a short presentation in the seminar.

Readings: Unfortunately there is no good text book. The closest thing is the following:

Thomas, D. C. (2004). *Statistical methods in genetic epidemiology*. New York: Oxford University Press.

This is a good book, but its primary focus on linkage makes it less than optimal for our purposes. So, as an alternative we will use a series of journal articles.

Course Website: Readings will be available from the course website (<http://www.psych.umn.edu/courses/spring08/mcguem/psy8937/default.htm>), which can also be linked through the Department of Psychology's main web page.

Topics & Schedule: This is the first time I have offered a course on this topic, so students will need to be flexible. The topics we will cover in the order they will be covered are as follows:.

1. Structure, Function and Variation in the Human Genome
2. Analysis of single marker data (e.g., case control)
 - a. Tests for Hardy-Weinberg Equilibrium (HWE)
 - b. Alternative tests in the Case-Control design
 - c. Alternative Tests in the regression framework
 - d. Stratification
 - e. Cryptic Association
3. Family-based association methods
 - a. Test based on the trio design
 - b. Family generalization

4. Other approaches for dealing with stratification
5. Analysis of Multiple Marker Data
 - a. Marker Selection
 - i. Genomic Databases
 - ii. Alternative Strategies
 - b. Simple Methods (e.g., Bonferroni)
 - c. Methods based on Hotelling's T^2
 - d. Methods based on principal components analysis
 - e. Haplotype-based methods
6. Approaches to Correct for Multiple Testing
7. Interaction (GxG; GxE)
8. GWAS

Meeting Dates: Thursdays – January 24, 31; February 7, 21, 28; March 13 & 27;
 April 3, 10 & 24; May 1 & 8 (12 meetings)
 No Meetings – February 14; March 6, 20 (Spring Break); April 17

READINGS

TOPIC #1: STRUCTURE, FUNCTION AND VARIATION IN THE HUMAN GENOME

Cardon, L. R., & Abecasis, G. R. (2003). Using haplotype blocks to map human complex trait loci. *Trends in Genetics*, 19(3), 135-140.

Cavalli-Sforza, L. L. (2007). Human evolution and its relevance for genetic epidemiology. *Annual Review of Genomics and Human Genetics*, 8, 1-15.

Crawford, D. C., Akey, D. T., & Nickerson, D. A. (2005). The patterns of natural variation in human genes. *Annual Review of Genomics and Human Genetics*, 6, 287-312.

Little, P. F. R. (2005). Structure and function of the human genome. *Genome Research*, 15(12), 1759-1766.

Mitchell-Olds, T., Willis, J. H., & Goldstein, D. B. (2007). Which evolutionary processes influence natural genetic variation for phenotypic traits? *Nature Reviews Genetics*, 8(11), 845-856.

Serre, D., & Hudson, T. J. (2006). Resources for genetic variation studies. *Annual Review of Genomics and Human Genetics*, 7, 443-457.

TOPIC #1: SIMPLE ASSOCIATION STUDIES

Balding, D. J. (2006). A tutorial on statistical methods for population association studies. *Nature Reviews Genetics*, 7(10), 781-791.

Healy, D. G. (2006). Case-control studies in the genomic era: a clinician's guide. *Lancet Neurology*, 5(8), 701-707.

PSY 8937, Spring 2008
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