COURSE NUMBER: PHC6937

TITLE: **Genetic Data Analysis**

DESCRIPTION: An introduction to statistical procedures in human genetics, Hardy-Weinberg equilibrium, basic linkage analysis, linkage disequilibrium, and association with disease. The goal is to prepare students for potential research in statistical genetics, but is also open to a wider community.

PREREQUISITES: The students should be at the level of a second year master student in biostatistics or a closely-related field, having a familiarity with linear algebra, basic statistics including maximum likelihood, simple hypothesis testing and linear regression.

CREDIT HOURS: 3
SEMESTER/TIME/LOCATION: Spring 2017/Tuesday, 11:45a-1:40p & Thursday 12:50p-1:40p/CTRB #5235

INSTRUCTORS: Fei Zou, Professor of Biostatistics
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Office hours: Tuesdays 2pm-4pm (after class) or by appt.

PURPOSE: To introduce the variety of statistical methods commonly used in analyzing animal, plant and human genetic data, with a focus on decomposition of trait variation, linkage analysis, disease mapping and association studies.

LEARNING OBJECTIVES: The objectives of PHC6937:

1. basic population and quantitative genetic principles, including classical genetics, chromosomal theory of inheritance, and meiotic recombination
2. an exposure to QTL mapping methods of complex quantitative traits and linkage methods to detect co-segregation with disease
3. methods for assessing marker-disease linkage disequilibrium, including case-control approaches
4. methods for genome-wide association and stratification control.

GRADING: The course grade will be based on homework assignments (approximately every 2 weeks, 45%), a take-home midterm exam (25%),

class participation (10%), and a final presentation (20%). Criteria for the final presentation project will be described later in the course.

BOOKS: -Siegmund and Yakir (2007) The Statistics of Gene Mapping. Springer (**optional**)
- Lynch and Walsh (1998) Genetics and Analysis of Quantitative Traits. Sinauer Associates, Inc. MA. (**optional**)
-Neale BM, Ferreira MAR, Medland SE, Posthuma D (2008) Statistical Genetics. Gene mapping through linkage and association. Taylor and Francis, New York (**optional**, mainly helpful for early introductory material).
- Lange, K. (2002) Mathematical and Statistical Methods for Genetic Analysis, 2nd edition. Springer, New York. (**optional**, but contributes some reading material early in the course. Copies in McG 3102)
- An Introduction to R, Venables and Smith. http://cran.r-project.org/doc/manuals/R-intro.pdf Free!

Topics to be covered:

1. Introduction to Genetics
2. Introduction to R, with genetics examples
3. Introduction to basic genetic principals on segregation, recombination models, map functions
4. QTL mapping methods with experimental population
5. Introduction to population and quantitative genetics
6. Linkage analysis on human pedigree data
7. Association mapping
8. Introduction to Bayesian statistical genetic methods