SYLLABUS & COURSE INFORMATION

SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MINNESOTA

PUBH 8445, SECTION 001

Statistics for Human Genetics and Molecular Biology
Fall 2019

COURSE & CONTACT INFORMATION

Credits: 3
Meeting Day(s): Tuesday and Thursday
Meeting Time: 9:45 – 11:00 AM
Meeting Place: MoosT 1-435

Instructor: Dr. Saonli Basu
Email: saonli@umn.edu
Office Phone: 612-624-2135
Fax: 612-626-0660
Office Hours: Monday 2:00 – 3:00 PM
Office Location: Mayo A454-3

COURSE DESCRIPTION

The course will provide details on the construction and application of different mathematical and stochastic models in genetic studies. We will learn about segregation analysis, multipoint linkage, population-based and family-based association analysis. Different aspects of population genetics such as testing Hardy-Weinberg equilibrium, likelihood estimation of allele frequencies, population structure, linkage disequilibrium, and haplotyping will also be discussed. Students will learn both the theory and application of statistical genetics and gain hands-on experience with analyzing genetic data using available R packages or other analysis software.

COURSE PREREQUISITES

This is a 3 credit course. Prequisites are Stat 8101-2 or equivalent; PubH8432; or instructor's consent. Some experience with R is useful; background in Molecular Biology is desirable.

COURSE GOALS & OBJECTIVES

By the end of the course, students should have a good understanding of the theories behind heritability estimation, linkage analysis and association studies. We will also learn about different software packages for pedigree based analysis and for genome-wide association studies.

METHODS OF INSTRUCTION AND WORK EXPECTATIONS

Course Workload Expectations
Statistics for Human Genetics and Molecular Biology is a 3 credit course. The University expects that for each credit, you will spend a minimum of three hours per week attending class or comparable online activity, reading, studying, completing assignments, etc. over the course of a 15-week term. Thus, this course requires approximately 135 hours of effort spread over the course of the term in order to earn an average grade.

- There will be 6 homeworks, due approximately every 2 weeks.
- A final project.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (https://z.umn.edu/studentconduct).

COURSE TEXT & READINGS

There is no textbook for this class.

The materials will also be drawn from:

• Lange, K.: Mathematical and Statistical Methods for Genetic Analysis (Statistics for Biology and Health), Springer 2002.

• Laird, NM. and Lange, C.: The Fundamentals of Modern Statistical Genetics (Statistics for Biology and Health), Springer 2011.

• Thompson, EA.: Statistical Inference from Genetic Data on Pedigrees by Eli. IMS,Beachwood, Ohio. 2000

COURSE OUTLINE/WEEKLY SCHEDULE

Week	Topic
Week 1	• **Review of Statistical Theory** (Likelihood Theory, Hypothesis testing, EM algorithm, Linear Models)
Week 2	• **Basic principles of population genetics** (Background, HWE, linkage equilibrium, linkage disequilibrium, different methods for allele frequency estimation, selection)
Week 3	• **Kinship and Genetic Identity Coefficients**
Week 4	• **Mixed Effect Model Variance Estimation**
Week 5 - 7	• **Association Studies**
Week 8 - 9	• **Population Structure; Cryptic Relatedness**
Week 10 - 11	• **Rare Variant Association, Pathway Analysis**
Week 12 - 13	• **Meta Analysis**
Week 14	• **Student Presentations**

SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at www.sph.umn.edu/student-policies/. Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

EVALUATION & GRADING

Course evaluation will be based on homework assignments (60%) and a final project (40%). A letter grade will be determined from the percentage of points each student receives. The curve for final grades will be: A = 95-100; A-= 90-94; B+ = 85-89; B = 80-84; B- = 75-79; C+ = 70-74; C = 65-69; C- = 60-64; F = below 60. For those registered S/N, S = 60-100.

Evaluation/Grading Policy	Evaluation/Grading Policy Description
Scholastic Dishonesty, Plagiarism, Cheating, etc.	You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see https://z.umn.edu/dishonesty The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://z.umn.edu/integrity. If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam. Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (http://z.umn.edu/iuplagiarism).
Late Assignments	
Attendance Requirements	
Extra Credit	

CEPH COMPETENCIES

Competency	Learning Objectives	Assessment Strategies