Course Description
This course is designed to prepare the graduate student on the theory and methods of genetics of complex diseases using association studies. Major topics include: Mendelian inheritance, design strategies for genetics association studies, bias in genetic studies and population stratification, SNP selection, genotype, diplotype and haplotype analyses, linkage disequilibrium, Hardy-Weinberg equilibrium (HWE) and clinical genetics.

Course Prerequisites: One of the following courses:
EPI821/CPH621 or EPI820/CPH504 or BIOS806/CPH506

Instructors
Lorena Baccaglini, DDS, MS, PhD (Co-Director)
Associate Professor
Department of Epidemiology
College of Public Health
Phone: (402) 552-6634
e-mail: Lorena.Baccaglini@unmc.edu

Tricia D. LeVan, PhD (Co-Director)
Associate Professor
Director of Facility for Mutation and Methylation Analysis
Department of Epidemiology and Internal Medicine
College of Public Health
Phone: (402) 559-3985
e-mail: tlevan@unmc.edu

Class Time and Location
Tue, Wed and Fri 1:30-4:30pm
COPH Room 2001

Office Hours
By Appointment

ADA Policy
Students with disabilities who are in need of accommodations should contact the Student Disability Services office (see below). In order to be eligible for accommodations, the student is responsible for registering with this office and providing documentation of disability. The student must register and provide documentation well in advance of the semester for which the accommodation is needed (6 weeks is suggested). Once the request has been approved, an individualized accommodation plan will be formulated, and an official “Letter of Disability Accommodation” will be issued to the student. Instructors will not provide classroom accommodations without prior approval.

Student Disability Services Contact: Kelly Swoboda
Course Format

The course will include lectures, reading assignments, in-class exercises, quizzes, and homework assignments. Students are expected to complete all assignments by the posted deadline.

Course Assignments

Homework Assignments (50%): There will be two problem-based homework assignments. The assignments will consist of a series of questions, short exercises and calculations. Major topics covered in the assignments are:

Assignment 1: Inheritance, SNPs, MAF, genotype, heterozygosity, genotyping methods and rare genetic case study
Assignment 2: Calculation and interpretation of haplotypes, diplotypes, LD, HWE, and pedigrees

Assignments will be graded on a 0-100 scale. For each day that an assignment is late, 10 points will be deducted from the grade.

Quizzes (40%): Throughout the course, students will be challenged through quizzes on material covered in prior modules (graded from 0 to 100). To simulate real-life future work environments, students will be asked to solve in-class exercises posed by the instructors using a team science approach.

Participation (10%): Students will earn up to 100 points for active participation, equivalent to 10% of the total grade. Half of the points will be earned through full class attendance (with equal weights assigned to each module), and half of the points will be assigned by the course instructors based on students’ participation throughout the course. To encourage active discussions and maximize involvement of all students within a secure academic environment, these points are based solely on participation level, not on the correctness of students’ questions and answers during the learning process.

Course Website

http://my8.unmc.edu (use your Outlook username and password)

Course Texts

The primary course material consists of textbooks, handouts and PowerPoint slides of the lecture. All materials other than the textbooks are provided on Blackboard. Textbooks are on reserve in the library.

Recommended:


Grading

Assignments: 50%, Quizzes: 40%, Participation: 10%
Final Grade Calculation

The final grade will be computed as a weighted sum:

<table>
<thead>
<tr>
<th>Grade Point</th>
<th>4.0</th>
<th>4.0</th>
<th>3.67</th>
<th>3.33</th>
<th>3.0</th>
<th>2.67</th>
<th>2.33</th>
<th>2.0</th>
<th>1.67</th>
<th>1.33</th>
<th>1.0</th>
<th>0.67</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final %</td>
<td>100-98</td>
<td>97-93</td>
<td>92-90</td>
<td>89-88</td>
<td>87-83</td>
<td>82-80</td>
<td>79-78</td>
<td>77-73</td>
<td>72-70</td>
<td>69-68</td>
<td>67-63</td>
<td>62-60</td>
<td>&lt; 60</td>
</tr>
<tr>
<td>Grade</td>
<td>A+</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
<td>D</td>
<td>D-</td>
<td>F</td>
</tr>
</tbody>
</table>

Course Learning Objectives:

Upon completion of this course, students will be able to:

- Identify and discuss advantages and limitations of genetic epidemiologic study designs
- Assess bias unique to genetic studies and develop techniques to minimize bias
- Select single nucleotide polymorphisms (SNPs) for candidate genes
- Calculate linkage disequilibrium (LD)
- Calculate Hardy-Weinberg Equilibrium (HWE)
- Perform allele, genotype, diplotype and haplotype analyses
- Use the results of epidemiologic data analyses to make causal inferences
- Critique genetic studies using universal reporting guidelines as templates
- Communicate genetic epidemiologic concepts and findings orally and in writing in accordance with professional standards
- Identify, search and interpret genetic databases
Academic Integrity and Professional Conduct

UNMC Policy. The University of Nebraska Medical Center has established a policy on academic integrity and professional conduct. This policy may be found in the UNMC Student Handbook. All graduate students are expected to adhere scrupulously to this policy. Cheating, academic misconduct, fabrication, and plagiarism are viewed as serious matters and will lead to disciplinary action as described in the UNMC Student Handbook under Procedural Rules Relating to Student Discipline. Additional materials related to Responsible Conduct in Research can be found in the UNMC Student Handbook.

Cheating: A general definition of cheating is the use or attempted use of unauthorized materials or information for an academic exercise. Examples of cheating include:

1. Using unauthorized materials such as books, notes, calculators or other aids during an examination or other academic exercises;
2. Receiving unauthorized assistance from another person during an exam or exercise such as copying answers, receiving answer signals, conversation or having another person take an examination for you;
3. Providing assistance to another person during an exam or exercise, such as allowing your answers to be copied, signaling answers or taking an exam for someone else;
4. Obtaining answers and/or other information from someone who has previously taken an examination;
5. Including all or a portion of previous work for another assignment.

Academic misconduct: Academic misconduct is defined as the falsification of official documents and/or obtaining records, examinations or documents without authorization. Examples are:

1. The unauthorized acquisition of all or part of an unadministered test;
2. Selling or otherwise distributing all of part of an unadministered test;
3. Changing an answer or grade on an examination without authorization;
4. Falsification of information on an official university document such as a grade report, transcript, an instructor’s grade book or evaluation file or being an accessory to an act of such falsification;
5. Forging the signature of an authorizing official on documents such as letters of permission, petitions, drop/add, transcripts, and/or other official documents;
6. Unauthorized entry into a building, office, file or computer data base to view, alter or acquire documents.

Plagiarism: Plagiarism is the appropriation of another person’s ideas, processes, results, or words without giving appropriate credit, i.e. an appropriate attribution or citation. Examples are:

1. In the methods section of a thesis, a graduate student describes a procedure used in research for the thesis. The procedure was developed by a fellow graduate student in the laboratory of their major professor; however, neither the student who developed this procedure nor the major professor was given credit in the thesis. This implies that the author of these had himself developed the procedure.
2. In the background section of a thesis, a graduate student quotes verbatim the results of a previous investigator’s work but fails to credit the individual through citation. The work is recent and thus cannot be considered common knowledge.

Plagiarism Tutorial: All students are expected to review and complete the Plagiarism Tutorial on the left hand drop down menu on Blackboard. All cases of plagiarism are academic misconduct, and any academic misconduct will result in a zero for the assignment or a charge of academic misconduct.
# EPI 941: Epidemiologic Methods in Applied Clinical Genetics I
## Course Outline

This schedule may change as the semester progresses. Changes will be posted via Blackboard.

<table>
<thead>
<tr>
<th>Module</th>
<th>Lecture and in-class exercises*</th>
<th>Instructor</th>
<th>Assignments and Quizzes</th>
<th>Recommended Readings</th>
</tr>
</thead>
</table>
| 1      | Course overview, introduction to cellular genetics, DNA and gene structure, DNA replication, transcription and translation, monogenic and polygenic disorders, mitosis and meiosis, alleles, loci, genotype, Mendelian inheritance, clinical genetic syndromes | Baccaglini/LeVan | ---                     | Ziegler Ch. 1  
Ziegler Ch. 2 |
| 2      | Germline and somatic gene mutations, single nucleotide polymorphisms (SNPs), minor allele frequency (MAF), evolutionary forces, heterozygosity, 1000 Genome Project, HapMap, genotyping methodologies, pedigrees, penetrance, expressivity. Hands-on search of dbSNP genetic database, OMIM, PolyPhen. | Baccaglini/LeVan | Quiz 1                 | Ziegler Ch. 3 |
| 3      | Haplotypes, diplotypes, phase, linkage disequilibrium (LD), Hardy-Weinberg equilibrium (HWE), Haploview introduction, haploblocks, hotspots. Hands-on calculation of HWE, allele and genotype analysis | Baccaglini/LeVan | Assignment 1 due       | Ziegler Ch. 2  
Ziegler Ch. 10  
Ziegler Ch. 13 |
| 4      | Study designs in genetic epidemiology, overview of candidate gene and genome-wide association studies. Hands-on genotyping laboratory experience | Baccaglini/LeVan | Quiz 2                 | Ziegler Ch. 10  
Khoury Ch. 6  
Khoury Part III  
Manuscript for review: Blackboard |
| 5      | Critical review of published genetic studies. Manuscript critiques and STREGA | Baccaglini/LeVan | Assignment 2 due       | Khoury Ch. 10  
Strega: Blackboard |

*Each module will last 3 hours.*