Principles of Genetic Association Studies
[Prin Genetic Assoc Stds – EPID677]

Spring 2015

Time: Thursday, 4:00 – 6:50 pm

Location: Drachman Hall, A119 & MEZCOPH Computer Lab, Drachman Rm A319

Instructors: Stefano Guerra, MD, PhD
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Email: stefano@email.arizona.edu

Yann Klimentidis, PhD
MRB, rm 115
Phone: (520) 621-0147
Email: yann@email.arizona.edu

Office Hours: by appointment

Teaching Assistant: None

Course Description:
The course will focus on the principles, methods, and challenges to dissect the genetics of complex diseases using association studies. It will consist of a theoretical component and a hands-on, applied component (using R software for genetic data analysis in a computer lab). Specific topics will be: Epidemiological design strategies for genetic association studies; Selection of positional and/or functional candidate genes; Linkage disequilibrium and population stratification; Allele, genotype, diplotype, and haplotype analyses; GWAS and integration with other biomarkers; Gene-by-environment interactions, genomic prediction, and use of online genetic databases.

Course Prerequisites:
EPI573A and EPI576A, or approval by instructors.

Course Learning Objectives:
To provide an overview of the concepts, methods, and hands-on applications to design, conduct, and interpret genetic association studies and to conduct genotype and haplotype analyses.
Course Notes:
Hand-outs and papers of interest will be distributed in class and/or posted electronically.

Recommended Text:

Alternative Texts:
- Duncan Thomas: “Statistical Methods in Genetic Epidemiology”, Oxford University Press

Course Requirements:
Class attendance and completion of in-class exercises; Mid-term in-class exam; one paper critique presentation; and a final exam.

Grading:
Midterm: 20%; in class exercises: 25%; final: 25%; paper critique: 20%; participation: 10%. Grading scale: 100-90: A; 80-89: B; 70-79: C; 60-69: D; below 60: F. This scale may be revised by instructors, if necessary. The lowest in-class exercise will be dropped. In-class exercises must be turned in at the end of class.

Class Attendance/Participation: Students are expected to attend lectures and participate actively in discussion.

Communications: You are responsible for reading emails sent to your UA account from your professor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic methods. The official policy can be found at: [http://www.registrar.arizona.edu/emailpolicy.htm](http://www.registrar.arizona.edu/emailpolicy.htm)

Disability Accommodation: If you anticipate issues related to the format or requirements of this course, please meet with me. I would like us to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations. The official policy can be found at: [http://catalog.arizona.edu/2012%2D13/policies/disability.htm](http://catalog.arizona.edu/2012%2D13/policies/disability.htm)

Academic Integrity: All UA students are responsible for upholding the University of Arizona Code of Academic Integrity, available through the office of the Dean of Students and online: The official policy found at: [http://deanofstudents.arizona.edu/codeofacademicintegrity](http://deanofstudents.arizona.edu/codeofacademicintegrity)

Classroom Behavior: (Statement of expected behavior and respectful exchange of ideas) The Dean of Students has set up expected standards for student behaviors and has defined and identified what is disruptive and threatening behavior. This information is available at: [http://deanofstudents.arizona.edu/disruptiveandthreateningstudentguidelines](http://deanofstudents.arizona.edu/disruptiveandthreateningstudentguidelines)

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Students are expected to be familiar with the UA Policy on Disruptive and Threatening Student Behavior in an Instructional Setting found at:
http://policy.arizona.edu/disruptive-behavior-instructional and the Policy on Threatening Behavior by Students found at:

**Grievance Policy:** Should a student feel he or she has been treated unfairly, there are a number of resources available. With few exceptions, students should first attempt to resolve difficulties informally by bringing those concerns directly to the person responsible for the action, or with the student's graduate advisor, Assistant Dean for Student and Alumni Affairs, department head, or the immediate supervisor of the person responsible for the action. If the problem cannot be resolved informally, the student may file a formal grievance using the Graduate College Grievance Policy found at:
http://grad.arizona.edu/academics/policies/academic-policies/grievance-policy

**Grade Appeal Policy:** [http://catalog.arizona.edu/2012-13/policies/gradappeal.htm](http://catalog.arizona.edu/2012-13/policies/gradappeal.htm)

**Syllabus Changes:** Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate.
**Course Schedule** (may be revised):

<table>
<thead>
<tr>
<th>Date / location</th>
<th>Topic</th>
<th>Lecturer</th>
<th>Assignment due at the end of class</th>
<th>Book chapters / notes</th>
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<tbody>
<tr>
<td>January 15 / Computer Lab - A319</td>
<td>Syllabus, introduction, introduction to R and genetic data</td>
<td>YC Klimentidis</td>
<td>Notes (class 1)</td>
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<tr>
<td>January 22 / A119</td>
<td>Basic molecular genetics / Genotyping</td>
<td>YC Klimentidis</td>
<td>ZG Chpt 1, 3 / Notes (class 2)</td>
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<tr>
<td>January 29 / A119</td>
<td>The nuts and bolts of genetic association studies</td>
<td>S Guerra</td>
<td>Notes (class 3)</td>
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<tr>
<td>February 5 / A119</td>
<td>Mendelian inheritance / linkage disequilibrium / genetic association studies I</td>
<td>S Guerra</td>
<td>ZG Chpt 2, 5, 10, 11 / Notes (class 4)</td>
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<tr>
<td>February 12 / A119</td>
<td>Genetic association studies II / Phenotypic characterization / Gene-by-Environ. and GWAS: principles</td>
<td>S Guerra</td>
<td>ZG Chpt 10, 11, 13, 14 / Notes (class 6)</td>
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<td>February 19 / Computer Lab - A319</td>
<td>Population genetics / dataset analysis in R</td>
<td>YC Klimentidis</td>
<td>Exercise 1</td>
<td>ZG Chpt 4</td>
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<tr>
<td>February 26 / A119</td>
<td>In-class midterm examination / genetic association studies III</td>
<td>S Guerra</td>
<td>ZG Chpt 13 / Notes (class 7)</td>
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<td>March 5 / A119</td>
<td>Missing heritability: GxE, GWAS, GenexGene, rare variants, Mendelian Randomization</td>
<td>S Guerra</td>
<td>ZG Chpt 14 / Notes (class 8)</td>
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<td>March 12 / Computer Lab - A319</td>
<td>Online genetic databases; data quality control; population stratification</td>
<td>YC Klimentidis</td>
<td>Exercise 2</td>
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<td>March 26 / Computer Lab - A319</td>
<td>Statistical tests for genetic associations</td>
<td>YC Klimentidis</td>
<td>Exercise 3</td>
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<td>April 2 / Computer Lab - A319</td>
<td>Statistical tests for genetic association, cont.</td>
<td>YC Klimentidis</td>
<td>Exercise 4</td>
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<td>April 9 / Computer Lab - A319</td>
<td>Genetic risk scores, Gene-by-environment interactions</td>
<td>YC Klimentidis</td>
<td>Exercise 5</td>
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<td>April 16 / Computer Lab - A319</td>
<td>Genomic prediction analysis: basic concepts and applications</td>
<td>YC Klimentidis</td>
<td>Exercise 6</td>
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<td>Date</td>
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| April 23 / A119 | 1st Half: Guest Lecture – Dr. Jin Zhou – Statistical Genetics  
2nd Half: Class overview                                               | YC Klimentidis / S Guerra                        |
| April 30 / A119 | Paper critique presentations                                                  | S Guerra / Students                        |
| May 13 / A119  | Final Exam 6:00 – 8:00 PM                                                       | Copy of slide presentation                    |