**Department of Epidemiology and Biostatistics**

**College of Public Health**

**University of Georgia**

**Syllabus**

**Course Information**

Course Title: Molecular Epidemiology

Course Number: EPID 8200

Building: Russel Hall

Room: 217

Day(s): Tuesday Thursday

Time: 11:15AM-12:30 PM

**Prerequisites:** None Required. Introduction to Epidemiology is recommended. Familiarity with population genetics, ecology and evolution is helpful.

**Instructor Information**

Professor Justin Bahl

Office Location: Wright Hall, suite 251

Phone:

Email: Justin.Bahl@uga.edu

Office Hours: By appointment

I encourage students to communicate with me if you have questions or concerns. E-mail is the preferred way to communicate rather than telephone, text message, or other means. **Please include EPID8200 in the subject line.** Do not use the “mail” function within eLC to communicate with the instructor.

**Course Description and Details**

Molecular Epidemiology is an interdisciplinary field that integrates genomics, epidemiology, biostatistics, and bioinformatics to study the role of genetic and environmental factors in the occurrence and distribution of chronic diseases as well as the transmission dynamics, evolution, and control of infectious diseases. This course provides students with the theoretical foundations and practical skills necessary to apply molecular techniques to epidemiological research. Students will gain a working knowledge of basic genetics, molecular biology, and bioinformatic techniques needed to critically assess molecular epidemiological studies.

Students will understand the ways molecular techniques are used to determine epidemic causes and origins, assess the incidence and prevalence of infectious diseases and strains of disease organisms with particular disease characteristics (e.g., drug resistance), determine and survey for predisposing genetic risk factors in chronic diseases, track the dynamics and spread of established and emerging diseases, and trace disease transmission in limited outbreaks and criminal cases.

Students will also consider the impact of large scale molecular epidemological studies on health policy, and the ethical dilemmas surrounding molecular surveillance and genetic disease testing.

**Evaluation will be based on participation in discussions and computational labs, a research project and a written essay on a topic of the student's choice with advice from the instructor.**

**TOPICAL OUTLINE**

Basic principles of genetics and molecular biology

Ideas from population genetics and molecular evolution

Laboratory and bioinformatic tools

Molecular epidemiology of infectious disease

Molecular epidemiology of chronic disease

Forensic molecular epidemiology

Molecular epidemiology in health policy

Ethical issues in molecular surveillance and genetic databasing

Group analysis of case studies throughout the course.

This syllabus is a general plan for the course; deviations announced to the class may be necessary

**Course Learning Objectives**

Upon completion of this course, each student should understand the following subject matter:

1. Common molecular and genetic measures available for molecular epidemiology research;
2. Genetic testing: candidate gene and genome-wide studies;
3. Molecular epidemiology of infectious diseases and chronic diseases;
4. Integration of bioinformatics, next-generation sequencing into modern

molecular epidemiology study;

1. Ethics issue in molecular epidemiology.

Ultimately, students will develop a framework for interpreting, assessing, and incorporating genetic measures in the disease research.

**Course Schedule**

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| **Week** | **Date(s)** | **Chapter(s)/Topic(s)** | **Assignments/Exams** |
| 1 | 8-Jan | Course Overview - History of Molecular/Genomic Epi |  |
| 2 | 15-Jan | Fundamental Concepts of Molecular Genetics and Statistical Genomics |  |
| 3 | 22-Jan | Inheritance and Basic Concepts of Population Genetics - Genomic Evolution |  |
| 4 | 29-Jan | Phylodynamics |  |
| 5 | 5-Feb | Virtual Lecture by Shirlee Wohl, Friday Feb 9. | Reading Hospital Acquired Infections and Antibiotic Resistance |
| 6 | 12-Feb | Origins and Evolution of HIV |  |
| 7 | 19-Feb | Genomic Epi of Influenza/Respiratory Pathogens |  |
| 8 | 26-Feb |  | Midterm: project selection and data description |
|  | 4-Mar | Spring Break |  |
| 9 | 11-Mar | Wastewater Surveillance |  |
| 10 | 18-Mar | Molecular Epi across biological scales/Molecular Epi of Emerging pathogens/animal disease |  |
| 11 | 25-Mar | Heritability and genealogies |  |
| 12 | 1-Apr | Concepts of Gene Mapping; Linkage, Association, Linkage Disequilibrium, GWAS, and Marker Maps |  |
| 13 | 8-Apr | Project work days |  |
| 14 | 15-Apr | Molecular Epi of Cancer/Heart Disease/Diabetes |  |
| 15 | 22-Apr | Ethics and Genomic Epidemiology |  |
|  | 29-Apr |  | Final projects and Essays due |

**Textbooks & Other Course Materials**

Required reading and reference materials will be available on eLC. Readings from recommended textbooks will also be available as an eBook through the UGA libraries.

**Assessments & Grading**

**10% Participation**: Students will be expected to contribute to class discussions on readings. In particular, students will be expected to have read the paper prior to attending class, be prepared to summarize the manuscript, and highlight critical questions arising from the study. In addition, students will participate in a computational lab component critical to successfully complete the mid-term and final projects.

**20% Midterm**: Project selection and data description. Students will select and describe an infectious disease genomic epidemiology hypothesis that they will test for the final project. The mid-term will include a descriptive analysis of the data available. This will provide the foundation for the final project.

**30% Essay**: A short review. The essay should take the format of the PLoS Pearls type articles. In short, a Pearl is to describe within a short space a small number of significant and interesting facts about a topic in the world genomic epidemiology. Specifically, the topic should focus on a chronic disease, gene environment interactions or other relevant topic. The essays are meant to be current, the audience is meant to be broad. Thus, an article should be readable by scientists working on epidemiology, and they should avoid details relevant only to insiders in a field. The essay should summarize succinctly the key exciting and important facts on a topic at a level that would allow it to be used in a graduate course. The essay should be no more than 1500 words with 1-2 figures/tables and a maximum of 20 references.

**40% Final Project**. Infectious Disease Genomic Epidemiology. This product will be worked on throughout the course. Students will execute a project that they design based on the mid-term assignment. The Analysis will be an application of the tools introduced during the computer labs. The final assignment should follow the format of the journal Emerging Infectious Diseases Dispatch type article. Dispatches are updates on infectious disease trends and research that include descriptions of new methods for detecting, characterizing, or subtyping new or reemerging pathogens. These articles are a maximum of 1200 words, have 15 references and have a 50 word abstract, maximum of 4 figures/tables total, e.g. 2 figures and 2 tables; 1 figure and 3 tables; 4 figures and no tables. Include subheadings in body of text. Refer to this link for further information on the format. https://wwwnc.cdc.gov/eid/page/authors-resource-instructions#2.6%20Dispatch

**Grading Policy**

A traditional A-F grading scheme will be used. The following grading scale will be used: A 93-100, A- 90-93, B+ 87-90, B 83-87, B- 80-83, C+ 77-80, C 73-77, C- 70-73, D 60-70, F <60

**Attendance Policy**

This is an in-person class. Attendance is mandatory. Please notify the instructor if you need to be absent.

**University Honor Code and Academic Honesty Policy**

UGA Student Honor Code: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others." A Culture of Honesty, the University's policy and procedures for handling cases of suspected dishonesty, can be found at www.uga.edu/ovpi.

**AI Policy:** We encourage you to use AI tools to explore the field and help you study. However, you must take full responsibility for any AI-generated materials you incorporate in your course products. If you include AI-generated materials in your course products, it should be cited like any other reference material. All information incorporated into course products must be verified, ideas must still be attributed, and facts must be true.

Use of artificial intelligence or word mixing software to write your paper or disguise plagiarized work is considered unauthorized assistance in this course. Suspected unauthorized assistance, or other violations of UGA’s “A Culture of Honesty,” will be reported to the Office of Academic Honesty.

**Student Access and Accommodations**

Accommodations for Disabilities (e.g., *If you plan to request accommodations for a disability, please register with the Disability Resource Center. They can be reached by visiting Clark Howell Hall, calling 706-542-8719 (voice) or 706-542-8778 (TTY), or by visiting* [*http://drc.uga.edu*](http://drc.uga.edu)*.)*

**Mental Health and Wellness Resources**

* If you or someone you know needs assistance, you are encouraged to contact Student Care and Outreach in the Division of Student Affairs at 706-542-7774 or visit https://sco.uga.edu/. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services.
* UGA has several resources for a student seeking mental health services (https://caps.uga.edu/well-being-prevention-programs-mental-health/) or crisis support (https://healthcenter.uga.edu/emergencies/).
* If you need help managing stress anxiety, relationships, etc., please visit BeWellUGA (https://caps.uga.edu/well-being-prevention-programs-mental-health/) for a list of FREE workshops, classes, mentoring, and health coaching led by licensed clinicians and health educators in the University Health Center.
* Additional resources can be accessed through the UGA App.

**General Disclaimers**

The course syllabus is a general plan for the course; derivations announced to the class by the instructor may be necessary.