PH256/C256/CMPBIO156   Human Genome, Environment and Public Health
Instructors: Lisa F. **Barcellos**, PhD, MPH and Nina T. **Holland**, PhD
Offered: Spring Semester 2019**,** T/Th 2-4 p.m.
Units: 4.0 (Letter Grade, S/U)
Course Format: Lecture, Lab and Journal Article Discussion
Location: 12 Haviland Hall
Class Numbers: CMPBIO156: 33168
                           PH256: 33197
                           C256: 26976

Course Description: This introductory course will cover basic principles of human/population genetics and molecular biology relevant to understanding how data from the human genome are being used to study disease and other health outcomes. The latest designs and methods for genome-wide association studies and other approaches to identify genetic variants, environmental risk factors and the combined effects of gene and environment important to disease and health will be presented. The application of biomarkers to define exposures and outcomes will be explored. Laboratory work will provide hands-on experience with modern tools of molecular and genetic epidemiology, including data analysis. The course will cover recent developments in genomics, epigenomics and other 'omics', including applications of the latest sequencing technology and characterization of the human microbiome. The current role of genomics and environment in personalized/precision medicine and health will be presented. Ethical, legal and social issues will be discussed. Examples from public health will be emphasized, including the application of these important fields to studies of chronic and infectious diseases. Students will also participate in critical review of journal articles relevant to molecular and genetic epidemiology.

Prerequisites: Introductory level biology/genetics course, or consent of instructor. *Introductory biostatistics and epidemiology courses strongly recommended.*

Course Objectives:
- To understand basic concepts in human and population genetics
- To understand fundamentals of study design and methods of data analysis in molecular and genetic epidemiology
- To learn computer and laboratory tools for molecular and genetic epidemiology studies
- To learn about bioinformatics resources for studies of human health and disease
- To understand the relevance of molecular & genetic epidemiology and genomics to public health

SPRING 2019 SYLLABUS:

Week	Date	Subject	Instructor (s)
1	1/22	-Overview of Course	N. Holland L. Barcellos
	1/24	-Introduction to Genetic Epidemiology *-Computer lab accounts/testing and signed agreements*	L. Barcellos
2	1/29	-Concepts in Population Genetics	L. Barcellos
	1/31	*-Computer Lab #1*: Introduction to PLINK and LDlink	O. Solomon B. Rhead

3	2/5	-**<u>Mini Quiz #1</u>** -*Journal Club #1* **(See Reading List, <u>Population Genetics</u>)**	L. Barcellos
	2/7	-Family Studies in Genetic Epidemiology	L. Barcellos
4	2/12	-Concepts in Genetic Association Studies I -*Homework #1 due (Population Genetics)*	L. Barcellos
	2/14	-*Computer Lab #2*: More PLINK	O. Solomon B. Rhead
5	2/19	-Concepts in Genetic Association Studies II	L. Barcellos
	2/21	-*Computer Lab #3*: More PLINK and Power Calculations	O. Solomon B. Rhead
6	2/26	-Methods for Genetic Studies in Diverse Populations -*Homework #2 due (Linkage and Association)*	L. Barcellos
	2/28	-*Computer Lab #4:* fastSTRUCTURE	O. Solomon B. Rhead
7	3/5	-**<u>Mini Quiz#2</u>** -*Journal Club #2* **(See Reading List, <u>Linkage & Association</u>)**	L. Barcellos N. Holland
	3/7	-Molecular Epidemiology: Biomarkers as a Tool ***HANDOUT MIDTERM EXAM***	N. Holland
8	3/12	-Introduction to Epigenomics and Human Health & Disease -*Homework #3 due (Association Study Topics)*	N. Holland
	3/14	-*Computer Lab #5*: Introduction to R	O. Solomon B. Rhead
9	3/19	-*Computer Lab #6*: DNA Methylation Data Analysis using R	O. Solomon B. Rhead
	3/21	-Approaches to DNA Methylation Studies ***MIDTERM EXAM DUE* (bCourses) on Friday 3/22 at 11 p.m.**	L. Barcellos
10		*SPRING BREAK! ENJOY (Week of 3/25 -3/29) NO CLASS*	
11	4/02	-Research Involving Human Subjects and Ethical Issues	N. Holland
	4/04	- **<u>Mini Quiz #3</u>** -*Journal Club #3* **(See Reading List, <u>DNA Methylation</u>)**	L Barcellos N. Holland

12	4/9	-Human Biospecimens and Biorepositories - *Lab #1:* Sample Collection for DNA Extraction **-Homework #4 due (Human Subjects and DNA Methylation)**	N. Holland
	4/11	-Biomonitoring: From Lead to Exposome	N. Holland
13	4/16	- *Lab #2:* DNA Quantification, Cell Cultures and Biospecimens - *Journal Club #4* (See Reading List, <u>Public Health Genomics</u>)	N. Holland
	4/18	*-Computer Lab #7: UCSC Genome Browser*	B. Rhead L. Barcellos
14	4/23	-<u>**Mini Quiz #4**</u> -Omics: Transcriptomics, Proteomics, Metabolomics and Microbiome ***HANDOUT FINAL EXAM PART II***	N. Holland
	4/25	-Novel Methods of Molecular Cytogenetics	N. Holland
15	4/30	-Pharmacogenomics and Precision Medicine (Cool Guest!) **-Homework #5 due (UCSC Genome Browser)**	D. Johnson
	5/2	**-** Wrap-up! Review and Proposal Instructions for Final Exam	N. Holland L. Barcellos
	5/13	***FINAL EXAM PART I* (IN CLASS) MONDAY 11:30-2:30 p.m.**	
	5/16	***FINAL EXAM PART II* (Submitted to bCourses) by 5 p.m.**	

Grading:

- Attendance & participation (Journal Club):   10%
- Midterm (written take-home) examination: 25%
- **Final examination (I and II):**   **40% (See below)***
- Homework (five assignments, lowest dropped):   20%
- Mini Quizzes (four quizzes, lowest dropped):   5%

Instructor Contact Information:

Professor: Lisa F. Barcellos
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Professor: Nina T. Holland
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Graduate Student Instructor: Olivia Solomon
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Office Hours: see bCourses

Attendance: Attendance (sign-in) is taken each week. If you are going to miss a class you are encouraged to contact the instructors or GSI ahead of time. Attendance each week of the semester is critical to success in the course. **If you are absent for more than 3 class sessions, you will be dropped from the course.** *Excused absences will be for medical (with documentation) or family emergencies only.*

Lecture Slides and Course Reading Assignments: Slides will be posted on bCourses for each class. All Reading Assignments (see **Reading List**) will be posted on bCourses. Don't get behind on reading!

Strict Laptop and Phone Use Policy: **This will be discussed on the first day of class**. Phones are **NOT** to be used in class. If you need to use your phone you will need to step out of class. *Using phones during lecture will result in an absence for that class meeting.* Laptops are not allowed, generally, with exceptions (Computer Laboratory and Journal Club Discussions). They are **NOT** allowed during lectures.

Homework Assignments: These will be posted on bCourses and are due before class begins on dates listed in syllabus. Assignments should be submitted via the bCourses site as pdf or word document submission through bCourses. Last name must be included in file name as shown: (LASTNAME_256_Homework1_2019.pdf). In addition, First and Last name should be included at the top of the document. There will be a place for you to insert this information in each homework assignment.

Journal Club: **Four** sessions are planned (see Syllabus). One or two articles are discussed at each session and will be posted on bCourses (see Reading List). The *format* for these sessions will be described in class. **Students are required to prepare very brief written responses to posted questions ahead of time for one article**. All students are expected to participate in discussion and will work in groups. **Written responses (hardcopies) are collected at end of each session for credit**. No exceptions.

Mini Quizzes: Short quizzes will be given throughout the semester (see Syllabus). Quizzes will be at beginning of class, so be sure to be on time. Make-ups or additional time for late arrivals will not be possible. Quizzes will cover lecture material and reading assignments.

Final Exam: The exam is comprised on one or two parts (Part I and II) depending on enrollment. Note: for students who complete Part I and II: each will contribute 20% to the 40% total of the final course grade.

All graduate students are required to enroll in PH256/C256. They will complete both Part I and II of the Final Exam.

Undergraduate Public Health majors who are completing PH256 to fulfill the senior capstone requirement are required to enroll in PH256/C256. They will complete both Part I and II of the Final Exam.

Non PH undergraduate majors, including Data Science majors may enroll in CMPBIO 156. They will be required to complete Part I only of the Final Exam.

Part I: In class, comprehensive written exam that takes place during Final Exam week.

Part II: Students enrolled in PH256/C256 are **required** to prepare a brief research proposal to conduct a future study that will address novel hypotheses or fill the gaps of knowledge related to cancer or other health conditions.

Details will be given in class. A cohort with extensive environmental exposure data and biological specimens will be the basis of the study. Students are asked to consider how to take advantage of the cohort and design a study with high impact/public health significance. The structure of the proposal is based on NIH R21 format.

Students with Disabilities:
Accommodations will be made for students with disabilities. Please see: http://www.dsp.berkeley.edu/ for details. **Please provide your written request to the instructor(s) and GSI within the first 2 weeks of the course**.

Mental Health:
If you are experiencing stress, anxiety, or other forms of distress during the semester, we hope to be a resource for you. Please reach out to the GSI or Professor for support. There are also many resources available to you.

All registered Berkeley students are eligible to use Counseling Psychological Services. You do not have to purchase the Student Health Insurance Plan to use these services. The first five counseling sessions are free for registered Berkeley students. Counselors can provide support in academic success, life management, career and life planning, and personal growth and development.

UC Berkeley, Counseling and Psychological Services:
- Please call (510) 642-9494 or stop by the office on the 3rd floor of the Tang Center to make an appointment with a counselor.
- **Drop-in counseling for emergencies**: Monday - Friday, 10:00AM - 5:00PM
- **After hours counseling:** In the case of emergencies at night or on weekends, call (855) 817-5667 for free assistance and referrals. Request to speak with a counselor.
- **For emergency support:** Call UCPD 911 or (510) 642-3333

24 Hour Crisis Hotlines:
- Alameda County Crisis Line: (offers confidentiality, TDD services for deaf and hearing impaired callers and translation in 140 languages)   Call 1-800-309-2131
- National Crisis Help Line: Call 1-800-273-TALK
- Crisis Text Line: Text HOME to 741741
- National HopeLine Network: Call 1-800-SUICIDE

We also ask that you look out for your fellow peers. If you see any of the signs below that may indicate your classmate may need assistance, please use the resources above or reach out to the GSI or Professors.

- Withdrawing from other people
- Changes in weight or eating patterns
- Changes in sleeping patterns
- Fatigue or lack of energy
- Increased anxiety or irritability
- Feeling worthless or hopeless

Other Campus Resources:
- Let's Talk: Informal Drop-In Counseling   https://uhs.berkeley.edu/counseling/lets-talk
- Self-Help Resources   https://uhs.berkeley.edu/counseling/self-help
- Be Well at Cal   https://uhs.berkeley.edu/bewell

Academic Dishonesty:

Academic dishonesty is **not** acceptable at UC Berkeley. Academic dishonesty is any action that may result in creating an unfair academic advantage for oneself or unfair academic disadvantage for another member of the academic community. Therefore, any exam, quiz, paper, and/or homework assignment submitted by you that bears your name should be your own original work. In all of your assignments, including your homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. 'Proper attribution' means that you have fully identified the original source and extent of your use of the words or ideas of others that you reproduce in your work for this course, usually in the form of a footnote, parentheses or quotations. If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from the instructors or your GSI beforehand. **Cheating** and **plagiarism** are forms of academic dishonesty and are NOT TOLERATED under any circumstance. Any evidence of academic dishonesty will result in a score of zero (0) on that assignment or exam, and will be reported as soon as possible to the **Center for Student Conduct** (http://sa.berkeley.edu/conduct). This will result in a permanent scar on your academic record. In 2015, UC Berkeley launched the Turnitin service to support academic integrity and the campus honor code (https://teaching.berkeley.edu/berkeley-honor-code). Turnitin is an opt-in tool enabled through bCourses that allows Instructors and GSIs to check student assignments for originality. We will use Turnitin in this course for all written assignments.

As a member of the campus community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits. **This also includes signing of the attendance sheet.** Signing another student's name in class is also a violation of the campus honor code. Both parties will be held responsible and will be penalized. The consequences of cheating and academic dishonesty are substantial, including a formal discipline file, possible loss of future internship, scholarship, or employment opportunities, and denial of admission to graduate or medical school.

Recommended Texts (On Reserve in PH/Biosciences Library):

<u>Recommended:</u>

Genetic Epidemiology: Methods and Applications, First edition, M. Austin (ed) (2013) CAB International.

Human Genetics, 11th Edition, R. Lewis (2015) McGraw-Hill.

Molecular Epidemiology: Principles and Practices, eds. N. Rothman et al., (2012) IARC.

Genetics from Genes to Genomes, 5th Edition, Hartwell, Hood, Goldberg, Reynolds, Silver, eds. (2015).

A Statistical Approach to Genetic Epidemiology: Concepts and Applications, Ziegler and Konig, eds. (2010) Wiley-VCH; also available electronically.