

Human evolutionary genomics, BIO 450/550

Fall 2017, 3 credits, Tuesdays and Thursdays 11am - 12.20pm, Park 152
gokcumenlab.org/Bio-425525

Instructor

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Office Hours: Thursday 3.30pm - 5pm or by appointment @Cooke 641

Course Description

This course conveys genomics approaches to tackle the questions: “What makes us human?” and “Why are we different from each other”. Specifically, this course will introduce the state-of-the-art concepts and methodologies in human evolutionary genomics exploring topics such as ‘human genomic variation’, ‘ancient admixture’, ‘gene-phenotype-environment interactions’, ‘adaptive developmental evolution’, ‘nature vs. nurture’, ‘genetic bases of disease’, and ‘experimental and statistical approaches to associate genotype to phenotype’. The course is aimed at students in biological sciences and related fields with a strong interest in evolutionary genetics and human genomic variation. Also, this course is of relevance to advanced students in a number of disciplines, including biomedical sciences and anthropology. After taking this course, each student will have the knowledge regarding the contemporary theoretical and methodological state of human evolutionary genomics. ***The course involves discussions about controversial subjects, including but not limited to race and racism, biological bases of sex, genetically modified organisms, eugenics, etc. The students are expected to contribute to these discussions with rigor and utmost respect to other students’ opinions.***

Course Objectives

After taking this course, the student will be able to:

- Critically understand the general theoretical and methodological foundations of human population genetics and comparative primate genetics
- Get accustomed to large genomic data-sets
- Articulate, discuss and present research reports from different subfields genomics
- Understand the fundamentals of modern scientific processes in genomics, such as experimental design, peer-review, ethical considerations, etc.
- Write a short research proposal/review regarding human evolutionary genetics and learn grant/manuscript evaluation process.

Texts and Reading Materials

Links to relevant scientific papers, databases and computational tools will be provided on the course website. The material is mainly based on “Human Evolutionary Genetics” by Jobling et al. This book is “not” required. However, it is a good book and explains some of the rather dense concepts in a straightforward and clear manner. It is available through the bookstore and a copy of it will be reserved in the library for the class for reference. For those who are interested in further reading: “Gene: An intimate history” by Siddharta Mukherjee is a nice review of the history of medical genetics. “Neanderthal Man: In search for lost genomes” is an entertaining personal account by one of the pioneers of ancient genomics”.

Outcome Measures and Grading

At the heart of this course will be critical reading and discussion of recent scientific papers provided by the instructor. So **READ AND DISCUSS!**

- **25%** of your grade will be based on the results of in-class, unannounced quizzes before the discussion to measure the preparedness of the students. The questions in these quizzes will involve main points highlighted in the assigned papers for that day or main themes highlighted during previous in-class discussions. The worst quiz score will be discarded for final assessment.

- Students will present one assigned paper in the class. The presentation will make up **25%** of the student's grade. You can find the suggested papers and corresponding weeks for the presentation in the class website. **Please make sure to put your name in the schedule in the website no later than September 4.** These presentations should include 5-10 slides that describing an introduction to the question at hand, the methodology used to make the analysis, the results of the paper and the potential conclusions drawn from the result. The presentation should not be more than 20 minutes, followed by a question-answer session led by the presenter. One great way to measure the effectiveness of your presentation is to make sure that your fellow students in the class understand the content. If there are no questions from the audience, that is not a good sign. There will be some resources for you to draw upon in the class website for preparing a good presentation.

- **BIO 450 students** will be asked to write a short, 2,000-4,000 word review paper on a given topic. It is encouraged for the student to build on the presentation that he/she gave and expand this to a more comprehensive review paper. Synthesis of literature discussed in the class are encouraged in addition to a basic literature research relevant to the topic at hand. Each student should schedule a 15-30 minute meeting with the instructor ***before*** starting the review paper to finalize the topic. These papers will be "peer" reviewed in class and revisions are allowed based on these reviews. A short (250-500 word) response to the reviewer's comments should be included in the final submission. The final assessment of these papers along with the responses to the peer-review will make **40%** of the student's grade. The topics and some resources about writing a scientific review can be found in the class website. **The first version of these reviews should be emailed no later than December 1 (7pm) as pdf documents through e-mail to the instructor. The final version of the reviews are due December 16 (7pm).**

- **BIO 550 students** will be asked to write a short, 2,000-4,000 word proposal on a given topic. It is encouraged for the student to build on the presentation that he/she gave and expand this to a proposal. Synthesis of literature discussed in the class are encouraged in addition to a basic literature research relevant to the topic at hand. The proposal should involve a short literature review, 2 aims, description of a plausible methodology, as well as the the impact and significance of the proposed research. Each student should schedule a 15-30 minute meeting with the instructor ***before*** starting the proposal to finalize/discuss the topic. These proposals will be "peer" reviewed in class and revisions are allowed based on these reviews. A short (250-500 word) response to the reviewer's comments should be included in the final submission. The final assessment of these papers along with the responses to the peer-review will make **40%** of the student's grade. The topics and some resources about writing a scientific review can be found in the website. **The first version of these proposals should be emailed no later than December 1(7pm) as pdf documents through e-mail to the instructor. The**

final version of the proposals are due December 16 (7pm).

- **10%** of your grade will be based on a short review (~500 words) of a fellow-student's paper/proposal. Essentially, you will praise and criticize sections of a draft paper with the intent of potential improvements in writing, content, clarity, etc. You will also give them a grade (Excellent, Good, Fair and Poor). In the last class, we will discuss these reviews briefly to see what you like and dislike about the papers. **These reviews are due the last day of class to be discussed in the class and after handed out to the instructor at the end of the class.**
- Reference to the university undergraduate [Incomplete Policy](#) and any additional instructor requirements and comments regarding incomplete grades.
- If you require classroom or testing accommodations due to a disability, please contact Accessibility Resources, located at 25 Capen Hall. AR can be reached by phone at (716) 645-2608 or by email at stu-accessibility@buffalo.edu. Please inform me as soon as possible about your needs so that we can coordinate your accommodations.
- The grades will not be given on a curve. If everybody does great work, than everybody will get an A. **Remember**, this is a high level course and it is expected that the students demonstrate a thorough and comprehensive understanding of the basic concepts of human evolutionary genomics at the end of the course. **WORK HARD!**

The letter grades will be assigned in the following manner:

95-100% = A; 85-94%=A-; 75-84%=B+, 65-74%=B, 55-64%=B-, 50-54%=C+, 45-49%=C, 40-44%=C-, 30-39%=D+, below 30%=D-. Unattendance or extreme poor performance will lead to an F.

Attendance and late submissions

The attendance is mandatory and consistent absence will result in failure. This is a discussion class. As such, without attendance, it has no value. For every day after the deadline 10% penalty will be applied to the grading of that paper. Submissions more than 3 days will not be accepted without a legitimate, solid excuse.

Integrity

If you plagiarize or cheat, you will directly receive an F for the course. There is no tolerance for this particular issue. Please see this webpage, if you have questions - <http://undergrad-catalog.buffalo.edu/policies/course/integrity.shtml>

Use of electronics

I **strongly discourage** use of electronics (laptops, smartphones, tablets) in the classroom. NO PHONES, COMPUTERS, ETC. (Unless you have a legitimate excuse). Simply put, you will learn better without them. Please see this article if you want to understand where I am coming from regarding this:

<http://www.newyorker.com/tech/elements/the-case-for-banning-laptops-in-the-classroom>

Learning outcomes

<p>Critically understand the general theoretical and methodological foundations of human population genetics and comparative primate genetics</p>	<ul style="list-style-type: none"> - Participation in class discussion based on their readings - Unannounced quizzes - In-class Presentation - Proposal/review paper that the students will turn-in - Peer-review of their fellow students' papers
<p>Get accustomed to large genomic data-sets</p>	<ul style="list-style-type: none"> - Participation in class discussion based on their readings - In-class Presentation - Proposal/review paper that the students will turn-in - Peer-review of their fellow students' papers
<p>Articulate, discuss and present research reports from different subfields genomics</p>	<ul style="list-style-type: none"> - Participation in class discussion based on their readings - In-class Presentation - Proposal/review paper that the students will turn-in - Peer-review of their fellow students' papers
<p>Understand the fundamentals of modern scientific processes in genomics, such as experimental design, peer-review, ethical considerations, etc.</p>	<ul style="list-style-type: none"> - Participation in class discussion based on their readings - In-class Presentation - Proposal/review paper that the students will turn-in - Peer-review of their fellow students' papers
<p>Write a short research proposal/review regarding human evolutionary genetics and learn grant/manuscript evaluation process.</p>	<ul style="list-style-type: none"> - Proposal/review paper that the students will turn-in - Peer-review of their fellow students' papers

Course Schedule

Week	Tuesday	Thursday	Reading
Aug 29, 31	Why study human evolution? Watch: https://www.youtube.com/watch?v=0Rnq1NpHdmw	What is the genome and how is it relevant to human biology?	(1)
Sep 5, 7	Why and how are our genomes different from each other?	Why and how are our genomes different from each other (2)?	(2, 3)
Sep 12, 14	Neutrality, genetic drift and selection	Why is there variation among humans?	(4, 5)
Sep 19, 21	Who are our evolutionary cousins?	Primate diversity	(6, 7)
Sep 26, 28	The origins and journeys of humans	Human migrations I: Out of Africa	(8, 9)
Oct 3, 5	Human migrations II - peopling of Eurasia, the impact of agriculture	Human migrations III - Into the new lands - Peopling of the new world	(10–12)
Oct 10, 12	Ancient hominin interactions	Ghost populations in Africa Read: http://www.biorxiv.org/content/early/2017/06/05/145409	(13, 14)
Oct 17, 19	Non-neutral forces shaping genomes	Recent human adaptations	(15–17)
Oct 24, 26	Phenotypes from our archaic cousins?	Modeling human evolution	(18, 19)
Oct 31, Nov 2	From genes to phenotype I - Animal models of human genetic variation	From genes to phenotype II - Cancer Genomics	(20, 21)
Nov 7, 9	From genes to phenotype III - Human disease - Association studies	Developmental disorders vs. environmental interaction	(22–24)
Nov 14, 16	Evolution of human brain	Human neurological disorders	(25–27)
Nov 21, 23	What makes us human?	Turkey day - No class!	(1)
Nov 28, 30	Human genetics and culture (THE FIRST DRAFTS ARE DUE)	Human social structures	(28, 29)
Dec 5, 7	Genomes by design - Ethical considerations of human genetics Read: http://www.newyorker.com/magazine/2015/11/16/the-gene-hackers	Peer-Review discussion session and final comments <i>The peer-reviews are due</i> ***	(30, 31)

* The final versions of the review papers/proposals are due on December 16th.

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