

BIOL 4830 POPULATION GENETICS SPRING 2016

Dr. Jennifer Cooper
Office hours: Monday 2-3
Wednesday 12-1
Thursday 1-2

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Write BIOL 4830 in the subject line!

COURSE PREREQUISITES

Completion of Introductory Genetics BIOL 3350 (or equivalent) with a grade of D or better.

COURSE DESCRIPTION

This course focuses on examining how the forces of evolution contribute to population-level genetic variation, and the current molecular, statistical and bioinformatics approaches toward measuring that variation. The topics to be discussed include: the history of population genetic research, the forces of evolution (natural and sexual selection, genetic drift, inbreeding, gene flow, mutation), F-statistics, coalescence, quantitative traits, comparative genomics, human population genetics, and the use of population genetics in conservation, biogeography and ecological studies will also be discussed. Throughout the course, a focus on modern techniques will unite theory with current research in the field.

Familiarity with the concepts of genetics presented in the pre-requisite course is absolutely necessary. There is some mathematical-based theory and statistical problem-solving in this course, therefore a student must possess basic algebra skills and a basic understanding of probability. For a student to be successful a minimum of 15 hours of preparation and/or review are needed outside of class. **If you are not prepared to dedicate the time and effort needed for this course, you should reconsider your enrollment.**

REQUIRED TEXTS/MATERIALS

- *Population Genetics*. Hamilton, M.B. 2009. Wiley---Blackwell. ISBN: 9781405132770
- I will not be making PowerPoint lectures available for student download. You are responsible for taking notes.

CENSUS DATE

This course cannot be taken for credit. It can only be taken for a letter grade. Students can only drop this course prior to the census date of February 24.

GRADING

Grades are determined by the points you earn during the course. I will not assign +/- grades, only whole letter grades. A total of 1000 points are available. It is expected that students will keep track of their scores (including copies of all graded materials) for the duration of the term.

In-class exams

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|--------|------------|
| Exam 1 | 150 points |
| Exam 2 | 200 points |
| Exam 3 | 250 points |

Study group activities:

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| Article summaries (4, points variable) | 100 points |
| Online exercises (4, points variable) | 100 points |
| Poster (participation 100 pts, presentation 100 pts) | 200 points |

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|-------|-------------|
| Total | 1000 points |
|-------|-------------|

PERSONAL INTEGRITY AND CLASSROOM BEHAVIOR

It is assumed that you have read and understand the university's position on academic integrity and student discipline. Inappropriate behavior (including, but not limited to, cheating and/or **plagiarism**) will be dealt with as severely as university and state regulations allow.

You are allowed to take notes on your laptops, but any mis-use of this privilege (such as checking email, etc) will result in a 50 point penalty from your semester point total (half a letter grade). Cell phone use is forbidden. **Do not text in class.**

LECTURE EXAMS

The exams will be given in a mixed format (multiple choice, short answer/essay, graph interpretation). Exams 2 and 3 will include material from earlier exams. I do not recycle exam questions. **Do not make the mistake of underestimating the difficulty of exams.** As you progress through the course, your study skills and work ethic will likely improve, which is why I have allotted an increasing number of points to be earned through each exam.

Students who arrive after the first exam of the day has been turned in will not be allowed to take the exam, and will receive a zero grade for the exam. If you must leave the room for personal reasons, you will not be allowed to finish the in-class exam. Your partially finished exam will be graded as it stands. If you plan to miss an exam for any reason, you must take an alternate exam before the in-class exam is scheduled to take place. If you miss an exam unexpectedly, you must provide documentation of a legitimate reason for doing so; otherwise, you will not be allowed to take the alternate exam, and you will receive a zero grade for the missed exam.

STUDY GROUPS

You will be assigned to a study group at the beginning of the semester. Study groups will consist of 4 students. You will work very closely with your study group members throughout the semester... you will sit as a group in lecture, and you will work as a team to write article summaries, perform data analysis homework assignments, and create a scientific poster. Part of your grade is dependent on your teamwork, thus every group member must do their share of the work! To ensure that each group member is contributing, I will be using online submission platforms and co-authorship grading (see the relevant sections below). **You will also evaluate your group members at the end of the semester.**

ARTICLE SUMMARIES (SUBMITTED VIA TURN-IT-IN ON BB)

I will post pdf's of the articles on BB several days before the assignment is due. Each group member will take a turn at being lead author on an article (55 points), with the other group members being co-authors (15 points). **There are 4 article summary assignments, so the total points you can earn sums to 100.** Late submissions will have 20% deducted for each day the assignment is overdue.

Lead authors will write a rough draft summary of each section of the article **in their own words**, for a total of 2-3 pages. This summary will be posted to BlackBoard at least 48 hours before the assignment due date, using the Wiki specific to your assigned study group. Co-authors will then provide **very explicit instructions** on how to improve the summary, **focusing on conceptual and analytical aspects (not just editorial aspects)**. Co-authors must offer at least 3 substantive conceptual/analytical comments to receive full credit. Co-author comments are due 24 hours before the assignment due date. The lead author will then submit the final draft via TurnItIn on BB. Be very careful to avoid plagiarism, because the TurnItIn software is very good at detecting even a single plagiarized sentence. You may be tempted to lift phrases directly out of the article...resist this temptation, because such phrases are highlighted by the software, and **if there are more than a few phrases (6-8 words in a row) used verbatim within a single summary, I will award every group member 0 points for the assignment (co-authors will not be penalized if they warned the lead author about specific examples of plagiarism in the rough draft).**

ONLINE SIMULATION EXERCISES (SUBMITTED VIA EMAIL AS AN MS WORD DOCUMENT)

The Hamilton textbook has a set of online data analysis exercises associated with it. You will complete the homework assignments by the date indicated on the course schedule. Each group member will take a turn at being lead author on a homework assignment (55 points each), with the other group members being co-authors (15 points). **There are 4 homework assignments, so the total points you can earn sums to 100.** Late submissions will have 20% deducted for each day the assignment is overdue.

All group members will complete the homework exercises, either together or on their own. Lead authors will write a rough draft summary of each component of the simulation exercise, including any relevant data or screenshots of graphs and results. Focus on describing the concept or process that was being explored each component of the simulation, and discuss

what you learned. Within the summaries, refer directly to specific components of your graph images or results tables, using dots and stars or by circling an area or number. (I.e. "You can see in the graph of allele frequency changes that the frequency of the q allele begins to decline at the 10th generation [star], but the frequency of heterozygotes remains above 40% until the 100th generation [circled].") This summary will be posted to BlackBoard 48 hours before the assignment due date, using the Wiki specific to your assigned study group. **Co-authors will then provide very explicit instructions** on how to improve the summary, **focusing on conceptual and analytical aspects (not just editorial aspects)**. Co-authors must offer at least 3 substantive conceptual/analytical comments to receive full credit. Co-author comments are due 24 hours before the assignment due date. The lead author will then submit the final draft via email. **Avoid plagiarism on these assignments; I have copies of the work submitted in previous semester, and I will be making comparisons.**

POSTER PRESENTATION

Poster presentations will be created using the Wiki specific to your assigned study group. Each study group will select a topic relevant to evolutionary biology, and perform a small literature review which includes **exactly** 4 recent (no older than 2009) primary literature articles. Each student will focus on reading one of the 4 articles, become intimately familiar with the work, and incorporate the most important aspects of the article within the larger, conceptual poster. The poster will be presented in the Poster Session (during the Final Exam period).

Participation points (100) can only be earned by documenting your contributions on Blackboard.

Each group member's contribution to the poster will be documented using the following structure:

1. Each group member chooses an article to summarize.
2. Each group member creates a new wiki page for their poster contribution, with a title like "Poster, Betsy Ross,".
3. Group members will post their on their wiki, and other group members will use the "Comments" tab to make suggestions and revisions.
4. More lengthy discussions can be documented on the group's Discussion Board (use the Board only for the poster project, please...don't use it for homework assignments, etc.).
5. To earn full points, a group member must:
 - a. post their own work on their own wiki
 - b. make constructive comments regarding **every other** group member's work on member wikis
 - c. discuss the formatting, organization, and printing of the poster on the Discussion Board

Any contributions which are documented in other ways (texting, Google Docs, etc.) won't be considered for credit.

To find primary literature articles relevant for your topic:

- Go to the CSU Stanislaus library website (link on University homepage).
- Choose "Find Books and Articles", then choose "Databases A-Z", then choose "Biological Abstracts."
- Search on a combination of terms to find articles about the topic your group finds most interesting. Read the abstracts, and choose the article that the entire group feels is interesting and understandable.
- Click the "FIND IT!" link to access the full-text PDF. **Email me the 4 article PDFs for my approval.**

It is easy to use Microsoft PowerPoint to prepare a poster presentation, simply by adding components (text boxes, images) to a single slide. You must format the slide as a custom size and indicate how large a print you want your final poster to be. **Your poster must be a minimum of 30 x 40 inches in size.** It must be printed on a large format printer at a professional printing service (Kinko's, Staples, etc).

On campus, the ASI Marketing Department also prints posters, and their color printing service is often much cheaper than off-campus. However, their turn-around time may be longer. Talk to your print shop ahead of time to find out at what size they print posters, cost, and how long it takes.

Color printing is not required, but your poster will be assessed by other students and color posters tend to achieve higher assessments.

- The main goal of a poster is to relate the main points of your topic with as little effort as possible on the part of the audience to read, interpret, and understand.
- Use a suitable font size (can be read from about four feet away).
- Include a Title, a list of student presenters, and a Literature Cited section.
- Graphics are required (figures, special equations, photos). Graphics should be high resolution, and should convey the most important ideas in the poster. Don't add images just for "pizzazz".
- Clearly explain the ideas with short, concise sentences. **Use bullet points instead of paragraphs when you can.**
- For each figure, use an explanatory caption. You can outline each figures with a colored box, and outline the relevant paragraph/list in the Results or Discussion with the same color...this will help readers associate figures with text.
- Specific facts, data or images taken from the 4 articles must be cited within the poster text, using APA format.

COURSE OBJECTIVES

- Understand the molecular basis for population-level diversity
- Understand the processes that result in changes in allele frequencies
- Demonstrate knowledge of the molecular patterns of change that underlie population-level evolution
- Demonstrate knowledge of factors leading to the evolution of and influencing the expression of complex traits

All assignments are due by 3 pm on the date specified.

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| Simulation 1 | Drift Decline in H |
| Simulation 2 | Fixation Indices |
| Simulation 3 | Mutations |
| Simulation 4 | Neutral Theory |

| Day | Lecture | Chapter | Assignment |
|------------|--|----------------|------------------------------|
| Feb 3 | Syllabus, Mendelian Genetics, Hardy-Weinberg | Ch 2.1 | |
| Feb 10 | Hardy-Weinberg cont. | Ch 2.2-2.3 | Article 1 due |
| Feb 17 | Exam 1 (first hour of class) Fixation and heterozygosity | Ch 2.5 | |
| Feb 24 | Inbreeding CENSUS DATE Feb 24 | 2.6 | Simulation 1 due |
| March 2 | Gametic disequilibrium | Ch 2.7 | |
| March 9 | Genetic drift and effective population size | Ch 3 | Article 2 due |
| March 16 | Genetic drift and effective population size cont. | | |
| March 23 | Population structure and gene flow | Ch 4 | Article 3 due |
| March 30 | SPRING BREAK | | Poster topic deadline |
| April 6 | Population structure and gene flow cont. | | Poster PDF's deadline |
| April 13 | Exam 2 (first hour of class) Mutation | Ch 5 | Simulation 2 due |
| April 20 | Mutation cont. | | |
| April 27 | Natural selection | Ch 6 | Simulation 3 due |
| May 4 | Natural selection cont. | Ch 7 | Simulation 4 due |
| May 11 | Natural selection cont. | | Article 4 due |
| May 18 | Exam 3 (entire class period) | | |
| May 25 | Poster session in classroom during regular lecture period | | |