BIOL 4830 POPULATION GENETICS FALL 2012

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COURSE PREREQUISITES
Passing grade in Introductory Genetics BIOL 3350 (or equivalent.)

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 a substantial amount of mathematical-based theory and statistical problem-solving in this course, therefore a student must possess basic algebra skills and a basic understanding of probability. Experience indicates that 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
- A **reliable** internet connection
- I will not be making PowerPoint lectures available for student download. You are responsible for taking notes during lecture.

CENSUS DATE
Students must attend the first three class sessions or they will be dropped from the course.
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 September 19.

GRADING
Grades are determined by the points you earn during the course. I reserve the right to use +/- grades, rather than 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.

Midterm exam	200 points
Final exam (cumulative)	200 points
Quizzes (5, instructor graded)	100 points
Article summaries (4, peer graded)	100 points
Avise reading summaries (5, peer graded)	50 points
Study group activities:	
Homework assignments (P1, P2, P3, P4, P5, instructor graded)	200 points
Poster presentation and evaluations	150 points

STUDY GROUPS
You will be randomly 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 analyze data sets and perform homework assignments (poster presentations will be an

individual assignment, not a study group activity). Part of your grade is dependent on your teamwork, **thus every group member must do their share of the work!**

Each study group will nominate a study group leader, and this position is worth 20 points extra credit. The leader will

1. Report on the performance of each group member in work sessions.
2. Provide an electronic copy of each written assignment.

ATTENDANCE AND PARTICIPATION

Regular attendance is vital to your success in this course. Therefore, I will be taking roll at the beginning of lecture every week. **Each absence is worth 5 points, and each tardy arrival is worth 2 points.** These points are deducted from your semester total of points earned (out of 1000 possible). The only excused absences are personal medical issues, court dates, and military service, and documentation must be presented (physician's note, jury duty slip, etc).

If you have a laptop computer, you are strongly encouraged to bring it to class, as in-class data analysis exercises will be a common activity. You are allowed to take notes on your laptops, but any mis-use of this privilege (such as checking emil, etc) will result in a 5 point penalty from your semester point total. Cell phone use is forbidden. **Do not text in class. It is rude.**

LECTURE EXAMS

The lecture exams will be given in a mixed format (multiple choice, problem solving, essay). The final exam is cumulative; that means that it will include material covered in the previous exams. I do not recycle exam questions.

Students who arrive after the first exam of the day has been turned in will not be allowed to take 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 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, and do not have documentation of a legitimate reason for doing so, you will not be allowed to take the alternate exam, and your total exam points will be based on the average of your other in-class exams.

Exam answers will be recorded on both blue books and Scantron 882-E forms. Erase thoroughly…**if the machine reads your erased answer as incorrect, the automatic score is the grade I record**. When you turn in your exam, you may be required to show photo identification.

QUIZZES

Scheduled quizzes will take place at the *beginning* of the class period. If you miss class, you miss the points. Quizzes will cover material from readings and Problem Boxes (see below). Answers will be recorded on the quiz document.

READINGS AND SUMMARIES (INDIVIDUAL ACTIVITY)

1. Watson, E., M. Richards, and H. Bandelt. 1997. Mitochondrial footprints of human expansions in Africa. American Journal of Human Genetics 61:691-704.
2. Noonan, J.P. 2010. Neanderthal genomics and the evolution of modern humans. Genome Research 20(5):547-553.
3. de Oliveira, L.O., B.A. Venturini, A.A.B. Rossi, and S.S. Hastenreiter. 2010. Clonal diversity and conservation genetics of the medicinal plant *Carapichea ipecacuanha* (Rubiaceae). Genetics and Molecular Biology 33(1):86-93.
4. Olsen, J.B., S.J. Miller, W.J. Spearman,and J.K. Wenburg. 2003. Patterns of intra-and inter-population genetic diversity in Alaskan Coho salmon: implications for conservation. Conservation Genetics 4:557-569.

For each article:

- Go to the CSU Stanislaus library website (link on University homepage).
- Click "Articles" tab.
- Down at the bottom, click "Databases by title."
- Choose "Biological Abstracts."
- Search on a combination of author and title terms to find the specific article.
- Once you have located the abstract, click the "FIND IT!" link to access the full-text PDF.
- Read and **summarize each section of the article in your own words**. Type a 1pg summary for submission.

Five additional readings will come from a book titled "Genetics in the Wild", by John C. Avise. Pdf's of these readings will be sent to you via email approximately 10 days before the summary is due. Type a ½ page summary for submission.

Summaries of both types of readings (primary literature and Avise book) will be peer graded. A portion of the points available will be awarded by me, based on the accuracy of your grading. Therefore, if you do not submit a summary of a particular reading, you cannot participate in peer grading, and you lose the entirety of the available points.

HOMEWORK (STUDY GROUP ACTIVITY)
Each chapter in the Hamilton textbook has boxes scattered throughout the text, labeled either "Problem Boxes" or Interactive Boxes". You will complete the following assignments by the date indicated on the course schedule.

Problem Boxes: Work each problem indicated. This work will not be submitted for a grade, because answers to problems are in the back of each chapter. You are working these problems to prepare for similar problems on quizzes and exams. with online exercises at http://www.blackwellpublishing.com/hamiltongenetics/.

Interactive Boxes: Perform the analyses described. Print any relevant data or results, and write a 3---5 sentence summary of what you learned from each. Document calculations by hand on paper (even if you use a calculator/software to solve problems). Staple all sheets *before* class, and turn in assignments at the beginning of class (when you walk in).

P1	Complete Problem Boxes: 2.1, 2.2, 2.3 Turn in Interactive Boxes: 1.1, 2.1, 2.2, 2.3, 2.6
P2	Complete Problem Boxes: 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3 Turn in Interactive boxes: 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3
P3	Complete Problem Boxes: 6.1, 6.2 Turn in Interactive boxes: 5.1, 5.2, 5.3, 6.1
P4	Complete Problem Boxes: 7.1, 8.1, 8.2 Turn in Interactive boxes: 7.1, 7.2, 7.3, 7.5, 8.1, 8.2
P5	Complete Problem Boxes: 9.1, 9.2, 10.1 Turn In Interactive boxes: 9.1, 9.2, 9.3, 9.4, 10.1, 10.2

POSTER PRESENTATION (STUDY GROUP ACTIVITY)
Poster presentations allow for a personalized interaction between the presenter and the individual audience members, as conference attendees walk through the poster session browsing the selections. Posters have the added advantage of being less intimidating to present, since the audience has something to read and the presenter can mainly clarify points and field questions.

Each student in the class will select a different recent primary literature article (hint: must have a methodology section) relating directly to population genetics. The paper must be no older than 2006. Each student will pretend to be a co-author on the paper, get intimately familiar with the work, and present it as a poster at the end of semester Poster Session. To find an article, search the Biological Abstracts through the library's webpage. If you need help finding a paper, come in and ask for help! Sign-ups begin Nov 4. To sign up:

1) Email me, and include the following information: Authors.Year. Title. Journal Name. (YOUR NAME)
2) I will review each submission, and I will notify you if your paper is not available or acceptable.

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 for class must be printed on a large format printer at a professional printing service (Kinko's, Staples, etc).** Although I provide some rough guidelines for pricing below, talk to your print shop ahead of time to find out at what size they print posters, cost, and how long it takes.

- The main goal of a poster is to relate the main points of your paper with as little effort as possible on the part of the audience to read, interpret, and understand. Only present the main points.

- Use a suitable font size (can be read from about four feet away).
- Sections should have appropriate labels (Introduction, Methods, etc).
- Include a Title, Authors and Addresses, Abstract, Introduction, Methods, Results & Discussion.
- Graphics are required (figures, special equations, photos).
- Only include Literature Cited if you use a major source in the body of the poster (even though the original paper has lots of references).
- Present as clearly as possible with as little text as you can get away with (used bulleted lists instead of paragraphs when you can).
- Use graphics to explain sections when possible.
- Do NOT duplicate the same information in your figures/tables and a verbal results/discussion. Use an explanatory caption to explain how the data shown in the figure supports the conclusion in the caption.

USEFUL WEBSITES ON POSTER PRESENTATION

Flinn, C. 2000. Developing a Poster Presentation in the Social Sciences. <http://writingcenter.gmu.edu/resources/workshops/socscienceposter/sld001.htm>.

Kiefer, K.M. Palmquist, L. Barnes, M. Levine, D. Zimmerman, and J. Robinson. 2009. Poster Writing Guide from the Writing Center at Colorado State University. <http://writing.colostate.edu/guides/speaking/poster/>.

Purrington, C. 2007. Advice on designing scientific posters. <http://www.swarthmore.edu/NatSci/cpurrin1/posteradvice.htm>.

Stoss, F. 2008. Designing Effective Poster Presentations by The University of Buffalo's Art And Sciences Libraries. <http://ublib.buffalo.edu/libraries/asl/guides/bio/posters.html>.

PRINTING YOUR POSTER

FedEx Kinkos www.kinkos.com (800) 463---3339 1451 Geer Rd, Turlock, CA 2225 Plaza Pkwy # C11, Modesto, CA

Services:
Black and white or full color, several paper types, online print orders

Time to print:
Approximately 2 hours for black and white, 24 hours for color. Send your file by e---mail and it will be ready for pick up when you arrive.

Cost:
30" x 36" Color $58, B&W $6

Staples (209) 632---2209 1850 Countryside Dr, Turlock, CA

Services:
Black and white or full color, several paper types, online print orders and mail delivery

Time to print:
2---3 hours for color, black and white 1 hour

Cost:
36" x 48" Color $84, B&W 7
24" x 36" Color $45, B&W $4

PERSONAL INTEGRITY

It is assumed that you have read and understand the university's position on academic integrity and student discipline. Students are expected to conduct themselves responsibly and will treat instructors and their fellow students with courtesy and respect. Inappropriate behavior (including, but not limited to, cheating and/or **plagiarism**) will be dealt with as severely as university and state regulations allow.

STUDY RECIPE (FOR STUDYING ALONE)

This course has a reputation for being challenging. Students often complain that they study "all the time" but that their hard work doesn't pay off in good grades. This is often because their study strategy simply needs tweaking. I have developed the perfect recipe for studying, based on our current understanding of the neurophysiology of learning and long-term memory formation.

Using the recipe I provide below, you will maximize the benefit gained from each single minute of study time. If you also study the number of hours I recommend (15 hours outside of class, not including homework assignments) then you will enhance your chances of earning the grade you want.

For each day's lecture notes, you should do 4 "drive-bys" of the information. Don't read textbook chapters more than once… that is a waste of time. Use your textbook the way I have described below. Your study environment should be isolated from external noise and distraction (no TV, no music, no kids, no throwing the ball for your dog).

1. **Take detailed notes in lecture.** Indicate with a special mark each time I move on to a new PowerPoint slide. Don't try to write every single word on the slide; instead, **listen to what I am saying** and write abbreviated summaries and main ideas based on what comes out of my mouth.
2. **DRIVE-BY 1 (LEARNING)**: This study session is for **learning and understanding** the material I introduced in lecture.
   - This study session should be accomplished the same day as the lecture (ie. don't have a sleeping period in between the lecture and the study session).
   - It should last a minimum of 1 hour, but will probably take 2-3 hours.
   - In the first 15 minutes, read through the notes and remind yourself of the general topic.
   - The remaining time should be spent in carefully reviewing each slide in turn, with your textbook open to the pages covering that material.
   - Read about every concept or process in the notes, and then read about it in the textbook.
   - Think about the examples provided, and imagine other examples. Define terms in your own words.
   - Try to work multiple problems for each equation discussed in lecture.
   - Don't stop until you have completed processing every slide of that day's lecture notes.
3. **DRIVE-BY 2 (CONSOLIDATION)**: This study session is for **consolidating your understanding** of the lecture material, and forming a clear connection in your mind between concepts, processes, and structures.
   - This study session should be accomplished the day following the lecture.
   - It should last a minimum of 1 hour. You will not use your textbook for this session, except to clarify your understanding of a particular fact.
   - In the first 15 minutes, review each slide and remind yourself of what you learned the day before.
   - Return to your notes on slide 1, cover with a sheet of paper, and write down what you can remember (definitions, concepts, equations). You must **write** as much as you can possibly squeeze out of your memory. Don't cheat by glancing at the notes! This process is called **"active challenging"** and it quite literally builds a neural and biochemical pathway in your brain. We use this process when we form long-term memories. The action of writing (not typing) seems to amplify the effect.
   - Uncover your notes and compare them with your memory work. Use a colored highlighter to highlight any mistakes or misunderstandings. Then move on to the next slide.
   - Don't stop until you have actively challenged yourself on every slide of that day's lecture notes.
4. **DRIVE-BY 3 (LONG-TERM MEMORY FORMATION)**: This study session is for **building the long-term memory** of the lecture material.
   - Repeat every step described for drive-by 2, paying careful attention to the mistakes highlighted in that study session. Highlight new mistakes with a different color.
5. **DRIVE-BY 4 (LONG-TERM MEMORY RETRIEVAL)**: This study session is for **reinforcing the long-term memory** of the lecture material. **LONG-TERM MEMORY RETRIEVAL IS THE ACTION PERFORMED DURING EXAMS.** The more often you repeat this session, the more you reinforce the neural pathway for retrieving the long-term memory of each fact.

All assignments are due at 5pm on the date specified.

Week	Lecture	Chapter	Assignment
Aug 22	Syllabus, Study Group assignments Review of Mendelian Genetics, Hardy-Weinberg	Ch 1, Ch 2.1---2.2	---
Aug 29	Hardy-Weinberg, fixation, heterozygosity, inbreeding	Ch 2.3---2.6	Avise 1 due
Sept 5	Gametic disequilibrium, Genetic drift and effective population size	Ch 2.7, Ch 3	Article 1 due
Sept 12	Genetic drift, Population structure and gene flow	Ch3, Ch 4	Quiz 1 P1 due
Sept 19	Gene flow cont., Mutation ***CENSUS DATE***	Ch 4, Ch 5	Article 2 due
Sept 26	Mutation cont., Natural Selection fundamentals	Ch 5, Ch 6	Quiz 2 P2 due
Oct 3	Natural selection cont.	Ch 6	Article 3 due
Oct 10	**NO CLASS**		P3 due (by email)
Oct 17	Natural selection, further models	Ch 7	Quiz 3 Avise 2 due
Oct 24	**MIDTERM EXAM**		Avise 3 due
Oct 31	Molecular evolution	Ch 8	Article 4 due
Nov 7	Molecular evolution cont.	Ch 8	Quiz 4 Avise 4 due
Nov 14	Quantitative traits	Ch 9	Avise 5 due
Nov 21	**NO CLASS**		P4 due (by email)
Nov 28	Mendelian quantitative traits	Ch 10	Quiz 5
Dec 5	**POSTER SESSION**		P5 due
Dec 12	**Final Exam in classroom during regular lecture period**		

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

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	5:00							
	6:00							
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