

Syllabus

CSUF Biology 407

Genes & Genomes: Topics in Molecular Evolution

Fall, 2009

Schedule # 18925, MW 2:30-3:45 MH287

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Office Hours: Tues. 1:30-5
Primary Course Home Web Site: <http://biology.fullerton.edu/biol407/>
(We will also use the Blackboard course site, accessed through your portal)

Catalog Description: Analysis of evolutionary pattern and process at a molecular biology level, emphasizing applications in biology such as investigating genetic change within populations, estimating phylogenies, charting the evolution of gene families, and comparing the content and organization of genomes.

Prerequisites: Upper-division undergraduate status with completion of the Biology Core Curriculum (Biology 171, 172, 273, and 274) or equivalent coursework, and one of the gateway courses, Biology 309 “Intermediate Molecular Biology” or Biology 303 “Intermediate Cell Biology,” although exceptions can be made with explicit permission from me. As the instructor, I am entitled to administratively drop students who lack prerequisites so please let me know if you have had courses at other universities that do not show up on your CSUF transcript. If you are a graduate student, you should enroll for Biology 507 instead, which has its own syllabus.

Satisfies: Three (non-lab) units in the Molecular Biology and Biotechnology or Cellular and Developmental Biology Concentrations upper-division elective units in the Molecular Biology category. For students in other concentrations, this course satisfies Biology elective units.

Enrollment: Adding the course after the first week might or might not be possible, depending on the announced College-wide policy for late adds of courses and on whether or not I grant permission. If you are an Open University student, please contact Lyn Richie-Walker (Academic Advisement Center, UH-123 or lrichie-walker@fullerton.edu or at Ext. 7645) for the current requirements for Open University enrollment.

Objectives: This course will cover methods for analyzing the genetic change within populations, gene and genomic sequence data, comparative genomics, evolution of gene families, and evolution of genome structure and organization. The objective is to gain an overview of the processes and patterns of the evolution of genetic material, from specific genes to entire genomes. An evolutionary perspective and a comparative approach can provide tools that will enhance the investigation of problems in molecular biology and biotechnology. This course will also provide a foundation for understanding evolutionary approaches that are increasingly widespread in both theoretical and empirical applications of molecular biology, including fields related to health professions and biotechnology.

Required Materials: A single textbook is required: *Evolution*, by Nicholas H. Barton et al., 2008 (hereafter abbreviated **EV**), Cold Spring Harbor Laboratory Press (<http://www.cshlpress.com>). This is an excellent new book illustrating evolutionary topics with molecular biology examples.

Recommended free on-line books (some sections could be required) are available at NCBI:

1. Sequence – Evolution – Function: Computational Approaches in Comparative Genomics, by E. V. Koonin et al. (2002):

<http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=sef.TOC&depth=1>

2. Genomes, 2nd Edition, by T. A. Brown (2002):

<http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=genomes.TOC&depth=2>

3. Introduction to Genetic Analysis, by A. J. F. Griffiths et al. (2000):

<http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=iga.TOC>

A full listing of potentially useful and free books is at:

<http://www.ncbi.nlm.nih.gov/sites/entrez?db=Books>

Web access is required. In particular I will expect you to regularly access the official course website (or the course Blackboard site, if so announced) to access study questions (SQs) related to the text reading, as well as primary literature assignments, provided for downloading in pdf format.

The text will provide a foundation for our exploration of current methods and theory related to experimental approaches in the study of the molecular evolution of genes and genomes. The text will be supplemented with selected articles from the primary literature, specifically chosen to introduce a broad variety of topics of central importance in this emerging field. Some examples of potential topics include:

- * Databases and sequence matching: database searching: protein sequence versus protein structure; homology; mathematical, statistical, and theoretical aspects of sequence database searches
- * Comparative genomics: genome content; genome structure; genome evolution
- * Transposable elements: types; history; evolutionary dynamics; as a major component of genomes; the origin and persistence of selfish gene elements
- * Coevolution between genes of the nuclear, mitochondrial, or chloroplast genomes that are functionally integrated
- * Phylogenetic analysis: sampling properties of sequence data; approaches for multiple sequence alignment; parsimony, distance, likelihood, and Bayesian analysis; hypothesis testing
- * The relationship between phylogenetics and population genetics: coalescent theory; maximum likelihood estimation of population genetic parameters
- * Molecular evolution and development: gene duplication and divergence; gene family organization; evolutionary variation in coordinated gene expression; examples of gene regulation pathways co-opted for novel functions
- * Molecular evolution integrated at lower levels: biochemistry; cell biology; physiology; relationship of genotype to phenotype
- * Molecular evolution integrated at organism and higher levels: population biology; biogeography; ecology; systematics and conservation

We will emphasize the assigned text, supplemented by about one primary literature article per week, which will normally be presented by two students (see below). You will be expected to complete assigned reading before coming to class. During most of the course, I expect to give regular quizzes at the start of the scheduled class time, so you will **always** need to be ready with

a blank sheet of paper for **every** normal class meeting (although I might not give a quiz every class period). To study for these quizzes, I will provide links on the web-based course schedule (<http://biology.fullerton.edu/biol407/schedule.html>) to text chapter review questions intended to guide your study of these often-complex topics. and specific assignment these new or revised web pages on the web-based course schedule in time for you to complete your review question and other assignments. If you do not have home access to the Web or if you prefer the much faster interface of an on-campus connection, you will need to go the library and purchase a \$15 access card to be able to use various campus computer labs. Material comprising the course web sites is considered an integral part of this course, not just supplementary material. In addition to our main course website, it is possible I will require that you self-enroll in our course Blackboard site at <http://blackboard.fullerton.edu>, but please note that the schedule and other aspects of this course are not on Blackboard. For the first two midterm exams (after the first and second of three class units), you will also need to purchase at least two Scantron forms #886-E or equivalent (with space for completion of both multiple-choice and short-answer questions).

For all but the first few weeks of class, a pair of students will be assigned to lead a 20-minute discussion of a primary literature article related to the assigned discussion topic as part of the normal discussion period, about once a week. In general, I will select the subtopic and a related primary literature article for you, with the goal of focusing on accessible, interesting, concise, and current examples of the study of molecular evolution, also attempting to cover a broad range of topics, especially emphasizing emerging trends in the analysis of genomes. When it is your turn to lead the group discussion, you will also be expected to read some other foundational or otherwise related articles that you will locate through library research. You are encouraged to research your topic more broadly. You will also be expected to provide the other students and myself with a study outline for your primary article, at least one class period before your presentation date. You will also be expected to independently write up an essay related to your presentation, due in the following class session. This will be graded and you will have one opportunity to revise your essay to earn back up to half of the points you missed, if needed. Further details will be provided in class, including a rubric for self- and peer-evaluation of your presentation. The emphasis will be on involving the entire class in a discussion of your topic and article, avoiding long uninterrupted presentations by you. There will also be a final project involving a similar “final presentation” based on your individual reading of an appropriate primary literature article, located by you through library research. Two class sessions are reserved near the end of the semester for these presentations.

Blogs: The newest version of Blackboard now has various new interfaces with interesting possibilities to enhance student learning. During a three-week trial period, I will post items to our course’s Blackboard site under “Course Documents” and will assess whether a sufficient number of students are blogging actively and appropriately. Please report to me whether you find this to be a valuable study aid, and please let me know whether you would like me to assess your weekly blog activity with a small number of points, available to everyone. My tentative plan is to make it easy for you to discuss the assigned review questions with other students or me, and I will also try to post a limited number of selected interesting links, ideas, discoveries, or controversies related to marine biology. If after three weeks there is sufficient activity to justify continued blogging, I will assign 2 to 5 points per week to award active bloggers. To earn the maximum points assigned per week, you should post two to four contributions (depending on their original content). Asking a well-worded question is a perfectly good way to qualify provided that you have already read the assigned reading and you still have a non-trivial

question. Another way is to post a follow-up response to the help another student with a question. If someone has already answered a question, you can give another example or respond in another way that is a valuable contribution to the conversation. If you previously asked a question, you can post a follow-up to another student’s answer to demonstrate that you now understand the answer. Even better is if you extend the blog in interesting ways. What I do not want is for students to merely post copied portions of the text section. You should use your own words or alternatively bring in alternative sources besides the text, properly cited. People who copy the text inappropriately, who plagiarize other sources, or who fail to abide by generally accepted core rules of “netiquette” (<http://www.albion.com/netiquette/corerules.html>) risk being blocked from blogs and will have to forfeit any possibility of earning associated points.

Grades: The following summarizes approximate points you can earn towards your final grade (estimates for the number of quizzes and assignments and point totals are tentative):

2 midterms (50 pts. each), 1 final (100 pts.)	200
About 14 quizzes (5 pts. each)	70
3 take-home genomics assignment(s) (20 pts. each)	60
1 primary literature group presentation (30 pts.)	30
1 primary literature independently written essay (50 pts.)	50
Web assignments, blogs, or other misc. assignments (2-5 pts. each)	25-60
Regular attendance (estimated from quizzes and sporadic roll taking)	30
Regular participation in class discussions (assessed by me)	30
Final Presentation Preparation (distribution of abstract and study guide)	20
Final Presentation and Leading Class Discussion	50
Total Points	565-600
Extra credit possible for attending seminars (5 pts. each)	15

Course mechanics: As described above and indicated on the attached schedule, this course is divided into three units. There will be two mid-term exams (50 points each) at the end of Units 1 and 2, and these will especially emphasize the same review questions you will study in preparation for quizzes. The final exam (100 points) will be given in the regularly scheduled time during finals week. It will emphasize the articles we have covered in Unit 3 but will be integrated with the more foundational topics that we have covered in the first two units. For example, I will likely ask you questions similar to the earlier review questions but specifically addressing issues we have discussed in the assigned primary literature articles. You will also have two essay assignments (30 points each) related to discussion assignments or activities. A specific rubric will be used as the basis for assessing your essay. Written assignments must be turned in at the beginning of the class period on the announced due date, with late papers subject to a deduction starting at 10 percent and increasing with time. Still, it is much better to turn in an assignment late than not at all. A physician’s note may be required in the event that you have missed an exam, assignment, or quiz due to illness. There will be no make-up quizzes but I might decide to pro-rate multiple missed scores if you have had a valid excused absence.

The following +/- grading scale will be used in this course (% of total available points):

A	92-100	C	69-71
A-	88-91	C-	66-68
B+	85-87	D+	60-65

B	80-85	D	55-59
B-	77-79	F	0-54
C+	72-76		

These cut-off levels are based on my experience in how students perform in all of my classes, and will never be raised but they might be lowered in your favor. Lowering the cut-off scores on the point distributions in the class would depend on my own assessment of how the final scores reflect the overall performance of students in the class. In general, I prefer to adjust individual exams instead of the final cut-off scores if I find that the exam was more difficult than I intended.

A modest number of extra credit points will be awarded for attending the Biology Seminar Series (W at 4-5 p.m., MH-513, or as announced; for schedule see <http://biology.fullerton.edu/events>) or other official seminars presented on this or another campus, provided there is some connection to evolutionary biology. You will also need to turn in a seminar write-up to document your attendance will be announced in class. The seminar write-ups will be worth 5 possible points for up to a maximum of three seminars that you attend (15 points total). I reserve the right to announce in class well in advance that I will double the number of potential points for one or two seminars that I think would be especially valuable to attend, so it is possible that as much as 25 points extra credit could be earned. Students are also encouraged to enroll for one unit Biology 480D (section 1; schedule # 18688) to attend the seminars on a regular basis. These students will receive the 15 (to 25) points contingent on their satisfactory performance as described in the syllabus for Biol. 480. I will occasionally announce other seminars for which you can earn extra credit, in case you cannot attend Biology's regular seminar series due to a schedule conflict, but see the bulletin board outside MH287 for many posted seminars that will likely be permitted as substitutes. For your required seminar reports, I am flexible in the approach you take, but one approach might be to answer the following three questions in a manner that demonstrates thoughtfulness: 1) What is the basic take-home message? 2) What question(s) would (or did) you ask the speaker? and 3) How can you suggest that this research might be extended? You should do your best to take appropriate notes in the seminar but then go home and rewrite them into an organized format, preferably with a word processor. Remember, your write-ups need to have thoughtful responses to these questions in order to get the maximum extra credit points possible.

Assignments: Expect there to be a considerable amount of reading and selected writing assignments throughout this course. The College of NSM is currently campaigning for students to study two hours per week outside of class for every enrolled unit, which means that you should plan on studying about six hours per week outside of class for Biology 407. This is reasonable and I will try my best to not assign more than this estimated workload. You will be expected to read much of the text (see schedule). It is highly recommended that you do not try to read the entire assignment in one sitting. This is very difficult, especially if you put it off until the night before class. If the idea of completing regular reading with written quiz responses or take-home assignments does not appeal to you then PLEASE drop the course now while the process is relatively painless. You will be expected to have read the assigned reading **before** each discussion session and have engaged in **active** (not passive) learning. I will do my best to try to ensure that you can succeed in this course and actually enjoy what you are learning if you follow these general study suggestions. There will not always be a right or wrong answer to an assigned question. I do not want to read exactly what I have said in class or what is in your reading. I want you to use your own words. For those times that I might assign take-home

writing assignments, if I find that you have essentially copied portions of the book with minimal rearrangements then you will receive a low score. The use of word processors for completing writing assignments is generally required. The use of spell-checkers is encouraged. Likewise, please do your very best to make the writing in your regular quizzes and exam essay responses as legible as possible. Please understand that it could normally take one to two weeks to return a written essay assignment, due to the amount of time devoted to each essay's grading. Your proofreading and rewriting efforts will consequently reap just rewards in essay points assigned. Please always feel free to discuss your questions on comments I write on your essays or other exam/quiz questions, especially if you do not understand the concepts behind the question. I encourage email questions to me at any time or come to my office hours. Please try not to ask involved questions just before the start of class.

Furlough Issues: As you are probably aware, CSUF's budget for this year has been significantly reduced affecting all areas of the campus. Faculty and staff are required to take furlough days without pay meaning that instruction and usual services will be disrupted at various times during the year. Please note that students have no furlough dates. You will be expected to complete assigned work even if the class is not meeting formally. This semester, the Biology Department Office will be closed on designated staff furlough days, which are posted outside MH282. Further, classes will not meet formally on those days where I have scheduled an instructor furlough day. The specific days when a class will not meet will vary from course to course and instructor to instructor. These days have been identified in the course syllabus and alternative work assignments will be announced in class, as these dates approach. This includes at one scheduled midterm exam date that will either be administered by a guest exam proctor or else administered online through Blackboard's new Respondus exam management tool. This is a very difficult time for all of us. We are working to provide the best education possible given the resources available to us.

Academic Dishonesty Policy: Any assignment that you turn in must be completed individually. The work must be your own even if you are encouraged to work together with your classmates to research or study course material. Use online or library sources of information and work together but when you write your answers, your work must reflect your own independent thinking. When you use information from sources external to yourself, you need to reference the source appropriately (literature citation, URL for web-derived material). Just because you referenced a source does not give you the right to insert segments, verbatim, into papers you write. As instructor, I have access to the plagiarism detection through our site license to turnitin.com and I may use this if I suspect that your writing has been copied from another source.

Academic Integrity: I assume that by remaining enrolled in this class your intentions are HONORABLE, and that you accept responsibility for dutiful attendance, earnest effort toward understanding the subject and pledge that you will not cheat on exams. Any assignment that you turn in must be completed individually. The work must be your own even if you are encouraged to work together with your classmates to research or study course material. Use online or library sources of information and work together but when you write your answers, your work must reflect your own independent thinking. When you use information from sources external to yourself, you need to reference the source appropriately (literature citation, URL for web-derived material).

- Plagiarism is the unacknowledged used of another's words or ideas as your own. Use your

own words when writing. Use quotation marks and cite the source of any phrase that you "use". Changing one or two words in a sentence is still plagiarism. Just because you referenced a source does not give you the right to insert segments, verbatim, into papers you write. You must put the information into your own words. I may rely on a course account with TurnItIn.com (<http://turnitin.com>) in order to check that you have not plagiarized your essays or other required written assignments.

- Cheating is the use of another's work as your own. Copying another student's homework, looking at another student's exam, and using information from another student to enhance your performance on a task are all examples of cheating.

Students who violate university standards of academic integrity are subject to disciplinary sanctions, including failure in the course and suspension from the university. University policies are strictly enforced in this course. Please familiarize yourself with the academic integrity guidelines found in the current student handbook.

Cheating will not be tolerated and could result in both a failing grade in the course and formal reporting to the CSUF Vice President for Student Affairs, where additional action will be taken.

Rules About Withdrawing from Courses: CSUF has a policy (UPS 300.016) regarding withdrawal from classes. After the first census date, students may be granted withdrawal only by presentation of documentation outlining a physical, medical or emotional condition that prevents completion of the course. Poor academic performance is not evidence of a serious reason for withdrawal. Students unable to produce official documentation will be required to take the grade they have earned in the class.

Major Fields Test in Biology: IF YOU ARE A SENIOR BIOLOGICAL SCIENCE MAJOR WHO IS PLANNING TO GRADUATE IN JUNE, AUGUST, or DECEMBER 2010/January 2011: You are required to take the Major Fields Test in Biology in order to graduate. There is no cost to you to take the exam, which is paid for by the Department of Biological Science. The exam will next be offered in mid-March, so please plan ahead to take this exam then. You will receive the details about signing up for the exam early in spring semester.

Provisions for Disabled Students: The University requires students with disabilities to register with the Office of Disabled Student Services (DSS), located in UH-101 and at (714) 278-3112, in order to receive prescribed accommodations appropriate to their disability. Students requesting accommodations should inform the instructor during the first week of classes about any disability or special needs that may require specific arrangements/accommodations related to attending class sessions, completing course assignments, writing papers or quizzes/tests/examinations. More valuable information about the services provided by DSS to students is at: <http://www.fullerton.edu/disabledservices/FSHBContents.htm>

Classroom Safety: In the event of an emergency such as earthquake or fire:

- Take all your personal belongings and leave the classroom. Use the stairways located at the east, west, or center of the building.
- Do not use the elevator. They may not be working once the alarm sounds.
- Go to the lawn area towards Nutwood Avenue. Stay with class members for further instruction.

- For additional information on exits, fire alarms and telephones, Building Evacuation Maps are located near each elevator.
- Anyone who may have difficulty evacuating the building, please see me after class.
- Dial 911 on any campus phone, pay phone, or blue emergency phones to connect directly to University Police. Dialing 911 on your cell phone will connect with the Highway Patrol. Tell CHP dispatcher that CSUF Police is the responding agency. Stay on the line until asked to hang up.
- If you want to bring visitors to the classroom, you must obtain permission from the instructor in advance and must sign a volunteer form.
- There is no smoking within 20 feet of every campus building. This especially includes the MH balcony because the air intake for MH is directly above these balconies.

Email and Phone Logistics: Due to the increase in SPAM email, please ALWAYS put “BIOL407” or something similar in the subject of your email. Also, please remember to end your email with your name and current email address. It is my policy to respond to email questions or comments that meet these criteria within 48 hours. Under most circumstances, I will reply even sooner. Alternatively, feel free to call my office at extension 3749.

Office Hour Logistics: Many students are confused on their first visit to my office. In order to get to my office (MH217C) you must first gain access to the outside door (MH207) by calling me on the campus phone (extension 3749) just outside that door.

Course Schedule:

Please see the current on-line schedule: <http://biology.fullerton.edu/biol407/schedule.html>. The schedule for this course is web-based and is subject to change during the course. If there are problems, please contact me as soon as possible. Print out a copy in case you lose access to the course web site for some reason, but check back frequently for potential schedule updates, posted no later than Thursday at 5 p.m. for the following week. I will attempt to keep schedule and assignment changes to a minimum.

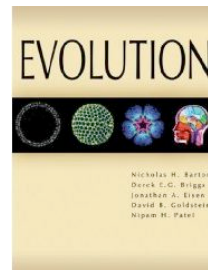


Genes & Genomes

Biol. 407 & 507 - Prof. Eernisse
California State University, Fullerton

Provisional Discussion Schedule Fall 2009

Schedule Numbers 18925 & 19010 (507)
MW 2:30-3:45 MH287



All chapter references are to [Baron et al. 2008](#)
Buy *Evolution* at [Titan Shops](#) or at [Amazon.com](#)

Wk	Dates	DISCUSSION TOPIC	ASSIGNM	Chapt. DQ'S
1	Aug 24 Aug 26	Introduction to Course (Online web lecture by Dr. Joe DeRisi) The History of Evolutionary Biology: Evolution and Genetics	Complete before class Ch. 1 (Notes)	See below DQs1
2	Aug 31 Sep 2	The Origin of Molecular Biology Evidence for Evolution	Ch. 2 (Notes) Ch. 3 (Notes)	DQs2 DQs3
3	Sep 7 Sep 9	Labor Day The Origin of Life	— Ch. 4 (Notes)	— DQs4
4	Sep 14 Sep 16	The Last Universal Common Ancestor and the Tree of Life Diversification of Bacteria and Archaea. I: Phylogeny and Biology	Ch. 5 (Notes) Ch. 6 (Notes) - Genomics Project 1 Due	DQs5 DQs6
5	Sep 21 Sep 23	Diversification of Bacteria and Archaea. II: Genetics and Genomics Midterm 1	Ch. 7 Unit 1: EA Chs. 1-7	DQs7 —
6	Sep 28 Sep 30	The Origin and Diversification of Eukaryotes Multicellularity and Development	Ch. 8 Ch. 9	DQs8 DQs9
7	Oct 5 Oct 7	Diversification of Plants and Animals Evolution of Developmental Programs	Ch. 10 (Notes) Ch. 12	DQs10 DQs12
8	Oct 12 Oct 14	Generation of Variation by Mutation and Recombination Variation in DNA and Proteins	Ch. 13 (Notes) - Genomics Project 2 Due Ch. 14 (Notes)	DQs13 DQs14
9	Oct 19 Oct 21	Random Genetic Drift (Instructor Furlough Day* -- No Class Meeting) Midterm 2 (Instructor Furlough Day* - Guest Proctor or Online)	Ch. 15 (Notes) Unit 2: EA Chs. 8-15	DQs15 —
10	Oct 26 Oct 28	Population Structure Selection on Variation	Ch. 16 (Notes) Ch. 17 (Notes)	DQs16 DQs17
11	Nov 2 Nov 4	Measuring Selection Phenotypic Evolution	Ch. 19 (Notes) Ch. 20 (Notes) - Start Final Projects	DQs19 DQs20
12	Nov 9 Nov 11	Species and Speciation Veterans Day	Ch. 22 (Notes) - Genomics Project 3 Due —	DQs22 —
13	Nov 16 Nov 18	Evolution of Genetic Systems/Evolution of Novelty Human Evolutionary History	Ch. 23 (Notes)/Ch. 24 (PP. as announced Ch. 25	DQs23 - DQs24 DQs25
	Nov 23-27	Fall Break - No Classes		

14	Nov 30 Dec 2	Current Issues in Human Evolution (Instructor Furlough Day* -- No Class Meeting) Student Final Presentations	Ch. 26 (Notes) TBA	DQs26 —
15	Dec 7 Dec 9	Student Final Presentations Review	TBA Chs. 19-26	
		Final Exam (1/3 Units 1-2 and 2/3 Unit 3 - Chs. 19-20, 22-26)	Dec 16 (W) 2:30-4:20 MH287	

* Furlough Days on Oct. 19 and Nov. 30 will have no class meeting, but please note that an Exam is scheduled for Oct. 21. Professor Eernisse will also be unavailable on the following furlough dates, subject to change by announcement: Sept. 17 (Th), Sept. 25 (Fr), Oct. 20 (Tu), Oct. 22 (Th), Nov. 5 (Th), Dec. 14 (Mo).

Return to:

- [Genes & Genomes Home Page](#)
- [Biological Science Home Page](#)

This page was last updated Sept. 10, 2008 --de