Syllabus
Computer Lab in Molecular Systematics
CSUF Biology 402

Department of Biological Science

Spring, 2011

Schedule # 18872
Discussion: MoWe 11:00-11:50, MH289
Lab: We 1:00 to 3:50, MH289

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Office: MH217C, Enter Rm. 207
Office Hrs.: Mo 1-3 Tu & Th 4-5 or by appointment (changes will be announced)

Main Course Website: http://biology.fullerton.edu/biol402/

Please Note: We will also use the course's Titanium website, especially for making assignments and readings available to you. Please see the Main Course Website for links to the lecture and lab schedules for the course, and expect these to be updated frequently.

Catalog Description: To gain practical and theoretical experience with software-based methods in molecular systematics, with emphasis on Internet resources for molecular biologists, acquisition of gene protein sequences, multiple sequence alignment, PCR primer design, phylogenetic analysis, and controversies in the field.

Prerequisites: Completion of biology lower-division core. This integrated discussion/lab course is for upper-division undergraduate, graduate students, or by permission of the instructor. Upper-division computer science or chemistry students pursuing interests in genomics or bioinformatics are welcome. This upper-division course will be challenging for students who are weak in molecular biology because of the nature of the advanced topics discussed. However, many students develop a much better integration of their molecular and organismal biology training in this course. Some basic computer experience with word processors and web browsers is necessary but familiarity with particular computers or software is not. If you enjoy using your own computer you can likely handle the mechanics of software use in this class.

Objectives: Students will read and discuss relevant primary or review literature and complete computer lab exercises. Subjects emphasized include navigation of Internet resources for molecular biologists, gene and protein sequence data acquisition, similarity searches, multiple sequence alignment, molecular secondary structure prediction, sequence evolution simulations, and especially phylogenetic analysis of sequence alignments. The goal is to develop the ability to test hypotheses with molecular systematics methods and present results in a scientific manner.

Learning Goals:

1. Become proficient at assembling appropriate DNA or protein data sets for testing phylogenetic hypotheses, for example, downloading a data set from a primary literature article and build on this to incorporate more recently available sequences in GenBank.
2. Learn how to interpret trees with respect to alternative phylogenetic hypotheses.
3. Compare existing sequences in order to design effective primers for polymerase chain reaction (PCR). Your experimental design should allow someone later at a lab bench to generate data appropriate for estimating a phylogeny for a specific group of organisms.
4. Assemble contigs of sequence profile files, perform multiple sequence alignment, and prepare data in a format suitable for phylogenetic analysis.
5. Perform "tree searching" phylogenetic analyses that demonstrate your understanding of key concepts in the field, including the appropriate use of different optimality criteria and search algorithms, and effective interpretation of resulting trees.
6. Develop an experimental approach to estimating trees, including assessing the robustness of different parts of the tree results.
7. Draw on your skills in interpreting phylogenetic results to critically evaluate the strengths and limitations of assigned primary literature studies in molecular systematics.
8. Learn how to assemble and present a phylogenetic study in a format that is similar to what would be expected if you were to submit your study to a journal for publication.
9. Develop an appreciation for and general understanding of controversies in the field of molecular systematics as well as new opportunities presented by emerging genomic technologies.
10. Build on experience in presenting scientific results, leading up to the final project presentation that is similar to a talk at a scientific meeting.

Required Materials: There is one required textbook for this course:

Hall, Barry G. 2011. "*Phylogenetic Trees Made Easy: A How-To Manual, 4th Edition*." Sinauer Associates, Inc., Sunderland, Massachusetts.

Please note that earlier editions of this text are NOT acceptable. The 4th Edition emphasizes entirely different software from previous editions.

The web lecture and lab schedules will specify reading assignments, and many of these will not be in the above text. In such cases, the readings will be provided in PDF format, either from a direct link on the online schedule, or as a "Topic" item in the new Titanium course website interface. Please be patient as a complete revision for the course material is ongoing. Selected reading and "Exercise" write-ups will be provided as handouts, as announced in class.

It is required that you bring a memory stick to each lab session, as we will use these routinely to transfer files between computers. You are encouraged to bring your own laptop computer to class and you will be able to complete many of the lab exercises on your own laptop, if you so desire. However, if you have a PC, not a Macintosh, laptop, there might be occasions where you will be responsible for finding equivalent software solutions for any exercises that use Macintosh software on the lab's computers, which are Macintosh computers. You can store your files on a MH 289 hard disk in your Documents folder, when you log in as "Biol402" student (details announced in class). <u>You should also routinely back up your files to a memory stick or email them as attachments to yourself. Please note that you are responsible for the safe keeping of your files with responsible back-ups as no single copy will be completely safe</u>.

You should purchase a folder or 3-ring binder in order to organize your own notes on assignment procedures and to hold the selected hard copy handouts and assignments. You will be expected to bring this notebook with you to class routinely. The exercises build on each other so it is important that you have access to your notes and handouts from earlier ones. Likewise, the effective organization of your electronic data files is essential to your success in the course.

Additional requirement for enrolled Masters students: In keeping with University policy, any graduate students enrolled in the course will need to also complete an appropriate additional assignment based discussion of primary literature articles. This additional assignment will have a point value of 50 points, with total point tallies adjusted accordingly. Details of this assignment, which will be on a molecular systematics topic, will be announced in class. It will involve both literature research and writing expectations designed to meet the following University policy:

A. Graduate students enrolled in 400-level courses will be expected to:

1. Complete at least one additional assignment beyond that required of undergraduate students in the same course.
2. Demonstrate, in their written and oral performance in the course, quality higher than that expected of an undergraduate.
3. Demonstrate competence in areas required by a graduate-level course

B. The graduate course requires:

1. The identification and investigation of theory or principle.
2. The application of theory to new ideas, problems, and materials.
3. Extensive use of bibliographic and other resource materials with emphasis on primary sources of data.
4. Demonstration of competence in the scholarly presentation of the results of independent study.
5. Evidence of advanced skill in reading critically, writing clearly and arguing persuasively.

Grades:

Summary

1) Lab exercise reports (15-30 points each, approx. 180 points total)
2) Independent final project (90 points total)
3) Quizzes (5 points each, approx. 60 points total)
4) Other assignments (5-10 points each, approx. 50 points total)
5) Midterm exams (60 points each, 120 points total)
Approximate Total Points: 500 (or 550 for enrolled graduate students, see above)

The most important aspect of this course is the successful completion of lab exercise reports write-ups, including an independent final written project and oral presentation. A separate but also important emphasis reflects your completion of reading and other assignments associated with the discussion periods. These will be assessed with regular in-class quizzes each worth 5 points and similar questions on two non-cumulative midterm exams. You should expect a quiz at the beginning of each class session. The second midterm is the last exam and will be well before finals week. The late semester is devoted to your presentation and write-up of your final project.

1) Lab exercise reports (15-30 points each, approx. 150 points total) – This course is organized around a series of exercises designed to give you first-hand experience with the concepts and skills required for molecular systematics. Specific objectives that you are expected to meet and report organization components that you are expected to include will be specified in the assignment hand out or in a separate rubric.

Unless announced otherwise, you will be required to turn in a hard copy of each write-up, to be turned in to me at the beginning of the lab meeting on the due date. If you are unable to attend class for reasons of illness, please turn the write-up in to my mailbox in the Biology Office (MH282), but with only one lab a week it is extremely important to attend every lab. Missing lecture and especially lab because you are not ready to turn in a lab write-up is much worse than turning in your write-up a day late. You are allowed a single up-to-1-week late submission without penalty. You will receive additional instructions on how to turn any electronic version of your data set(s) or parts of your write-up if that is also required. Such data files should be named rigidly following the announced guidelines. If you get unexpected results, I may need to be able to directly examine or test any data file that you have assembled in support of your hard-copy report. Please get used to naming the enclosing folder for each exercise starting with your first or last name, e.g. "Bob Exercise 1" so you and I know whose folder it is. There will also be very important conventions in naming files that will need to be closely followed. An example might be "Ex1c_nex.txt" for the third ("c") updated version of your Exercise 1 data text (".txt") file in "Nexus" format. More details will follow. Please keep electronic files well organized so that if I need to consult them during lab troubleshooting or during grading, I can find them in your folder on the lab computer assigned to you. In general, the exercises will be designed so that you can complete the data analysis portion within the weekly lab period and, in some cases, might depend on software that is licensed for use or otherwise available only on the lab Macintosh computers. The lab will normally be opened for your use only during the time scheduled for lab. There is currently no guarantee of additional opportunities for you to use the lab during another time so it is important to use lab time effectively, especially for exercises that depend on the lab's custom software. Opportunities for you to make up lab exercises will be limited in some or most cases, but please ask if you have a legitimate excuse for your absence.

2) Independent final project (90 points total; 25 points for an abstract (must be submitted on time and be carefully edited, for inclusion in our annual meeting program), 25 points for an oral presentation in one of the last few class sessions, and 40 points for the written report due by regularly scheduled Final Exam. This final project will essentially be your last, and most important, assigned exercise. The written part will build on the report completion skills emphasized in the previous exercises, with a format similar to one you would use for the submission of an article for publication in an appropriate scientific journal. The first part of your final project will be an abstract that must be turned in by a date to be announced in advance of the presentations. This will be critiqued and you will have an opportunity to revise it for inclusion in the final meeting-style compilation of abstracts. It is critical that you meet the deadlines for submission, revision, and resubmission or no points will be given for the abstract. The oral presentation will require that you present a 12-15 minute summary of your final project, followed by a 5-minute period when you will be expected to answer questions from the audience. Your presentation should be supported by appropriate graphics, normally as a Microsoft PowerPoint or Adobe Acrobat (PDF) slide presentation. The format will be the same as you would expect if you were to present your research at an appropriate scientific conference. You must assume that your audience is not already familiar with specific aspects of your study, but can assume they will be reasonably familiar with the basic methods and terminology of molecular systematics. Assessment will be based on how well you meet the requirements of a rubric for each of the three aspects of your final project: abstract, presentation, and write-up.

3) Quizzes (5 points each, approx. 60 points total) – You should expect a brief (usually with two questions) quiz for any particular lecture period, although I will sometimes elect to not have a quiz for a particular date with no prior notice. Quizzes will normally be short-answer questions related to the assigned material and particularly related to on-line review questions linked to the on-line lecture schedule to help you guide your studying. The quizzes might bring in other aspects of the assigned material as well so you still need to read and comprehend the entire assigned pages. I am substantially revising the course exercises to reflect the rapid pace of change in this field, and the new availability of powerful new software and web resources for comparative analyses, as well as newer "phylogenomic" and "barcode" approaches that were not common the last time this course was taught. Review questions assigned for a week will be posted at least by the end of the previous week, or possibly sooner. There will be no make-up for quizzes for any reason. If you have a legitimate excuse for missing a quiz, I can pro-rate the missed quiz. An example of a legitimate excuse would be an illness with an accompanying note from your physician.

4) Other assignments (5-10 points each, approx. 50 points total) – I plan to assign some take-home or on-line assignments for material that I feel would be best learned by giving you hands-on problem solving experience.

5) Midterm exams (60 points each, three exams total) will be confined to the 50-minute lecture portion of the course on the scheduled date, unless otherwise announced. Because of their short duration, do not expect that everything you have studied will be on the exam. Instead, they will be designed to assess your overall comprehension and integration of the concepts and important themes covered.

Scale: Grades will be assigned based on the following scale (i.e., percentage of the total possible points): The following +/– grading scale will be used in this course:

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**		

The cut-off levels might be lowered in your favor but will not be raised.

You can turn in one exercise write-up and one assignment late. After that, any late write-up/assignment turned in late without a valid excuse will be subject to a standard penalty of at least 10 percent reduced possible score (increasing the later it is turned in). However, it will be much better to turn in any exercise write-up or assignment late than not at all. In special cases, where I anticipate that the majority of the class will be unable to complete an assignment by the announced due date, I may elect to postpone the due date. Explanatory email messages to me at least one day before a class meeting will help me make such decisions. Because we have MH289 available for the lab component of this course for only 3 hours per week, you will be expected to use the scheduled lab time expediently and, if necessary, complete exercises at available computers at home or in drop-in campus computer labs. The lab exercises (including the final project) are emphasized as the most important component of this course.

Extra Credit: Some extra credit points (max. 15) will be available for attending and appropriately reporting on specific optional activities such as selected seminars related to the course, with a maximum of 5 points per activity. Other academic seminars related to the course topic will generally also qualify for extra credit. You need to provide a thoughtful 1-2 page seminar write-up and this will be evaluated for the assignment of up to 5 points extra credit. The departmental seminar series will be posted outside MH289 and at: http://biology.fullerton.edu/events/

MAKE-UP POLICY
Missed exams or assignments (but see above) that are feasible to make up can be made up or rescheduled ONLY under the following conditions:

1. Arrangements are made a week or more prior to the exam or assignment for important, unavoidable conflicting activities (e.g., surgery, out-of-town job interview, etc.). Documentation is required.
2. For illness, personal tragedy, or unavoidable emergencies, call me or leave a message with the department before the assignment or within two days thereafter.

Contact me to confirm whether you meet the requirements for make-up exams or assignments. That is **your** responsibility. Failure to follow the above guidelines will result in a zero grade for an exam or assignment. Failure to complete any graded assignment may result in a lowered grade or a grade of "incomplete" for the course.

Assignments: Expect there to be a considerable amount of reading and selected writing assignments throughout this course. The College of NSM has an established campaign 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 402. This is reasonable and I will try my best to not assign more than this estimated workload. 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 lecture 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, your score will reflect how well you demonstrate your understanding based on comprehension of reading and thoughtful discussion of the questions I pose. You should use a word processor for completing each writing assignment. Some hand-written portions, such as figure labeling or captions, are acceptable if they make sense and are legible. 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 will normally take about 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 to avoid asking involved questions just before the start of class.

Academic Integrity Policy: 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). Just because you referenced a source does not give you the right to insert segments, verbatim, into papers you write.

• 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.

Withdrawal Policy: The CSUF policy regarding withdrawal from classes (UPS 300.016) will be followed. After the first two weeks of the semester, students may be granted withdrawal ONLY by presenting compelling evidence 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. Please refer to the CSUF Class Schedule for information on the last day to withdraw with a W grade. Important dates concerning registration or drops are on the inside cover of the CSUF Spring 2009 Class Schedule or at: http://www.fullerton.edu/admissions/.

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 (657) 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

Major Fields Test in Biology: IF YOU ARE A SENIOR BIOLOGICAL SCIENCE MAJOR WHO IS PLANNING TO GRADUATE IN JUNE, AUGUST, or DECEMBER 2011/January 2012: 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.

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.

Emergency Procedures Notice to Students: The safety of all students attending California State University Fullerton is of paramount importance. During an emergency it is necessary for students to have a basic understanding of their personal responsibilities and the University's emergency response procedures. In the event of an emergency, please adhere to the following guidelines.

Before an emergency occurs-

1. Know the safe evacuation routes for your specific building and floor.
2. Know the evacuation assembly areas for your building.

When an emergency occurs-

1. Keep calm and do not run or panic. Your best chance of emerging from an emergency is with a clear head.
2. Evacuation is not always the safest course of action. If directed to evacuate, take all of your belongings and proceed safely to the nearest evacuation route.
3. Do not leave the area. Remember that faculty and other staff members need to be able to account for your whereabouts.
4. Do not re-enter building until informed it is safe by a building marshal or other campus authority.
5. If directed to evacuate the campus, please follow the evacuation routes established by either parking or police officers.

After an emergency occurs-

1. If an emergency disrupts normal campus operations or causes the University to close for a prolonged period of time (more than three days), students are expected to complete the course assignments listed on the syllabus as soon as it is reasonably possible to do so. In the event of an emergency that disrupts normal campus operations or causes the University to close for a prolonged period of time due to circumstances such as an earthquake, we will do our best to continue the class via Blackboard, if it is available. Therefore, as soon as possible after such as event and at least once a day, check the class Blackboard site and your CSUF email for messages and instructions.

2. Students can determine the University's operational status by checking the University's web site at http://www.fullerton.edu, calling the University's hotline number at 657-278-4444, or tuning into area radio and television stations. Students should assume that classes will be held unless they hear or read an official closure announcement.

EMERGENCY CALLS: DIAL 9-1-1
All campus phones and cell phones on campus reach the University Police Department

Non-emergency line: (657) 278-2515

24-hour recorded emergency information line: (657) 278-4444

Tentative Schedule: The schedule for this course is web-based and is subject to change during the course. In particular, expect it to be revised substantially within the first few weeks, due to an ongoing revision to the course exercises. Please save a bookmark to the discussion and lab schedules:
http://biology.fullerton.edu/biol402/lecture.html
http://biology.fullerton.edu/biol402/lab.html
If there are problems, please contact me as soon as possible. Please check back frequently for potential schedule updates, which I will attempt to keep to a minimum after the first few weeks.

Acceptable Use of Electronic Devices: You are permitted and encouraged to use any sort of computing device, including smart phones, for the completion of course objectives or to take notes. You are not permitted to surf the web, phone texting, phone calling, or use such electronic devices for uses unrelated to the course during discussion or lab meetings. If you have an urgent need for such communication, please let me know.

Email and Phone Logistics: Due to the increase in SPAM email, please ALWAYS put "402" or in some form 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 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.