BME1401/CSE1401/MCB1401: Honors Core – Computational Molecular Biology
Fall 2008

Lecture: FS 202, Mon/Wed 11-11:50am

Lab: Engineering II 305, Fri 10-10:50am (section 001) and 11-11:50am (section 002)

Instructors:

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Textbook: N. Cristianini and M.W. Hahn, *Introduction to computational genomics: a case studies approach*, Cambridge University Press, 2007. Textbook website: http://www.computational-genomics.net/.

Course outline: This course is an introduction to computational genomics through lectures, computer lab exercises, and mentored research projects. Started in 1995 by the completion of the first genome sequence of a free-living organism, *H. influenzae*, the genomic era has already led to hundreds of complete genome sequences deposited in public databases and many more genome projects at various stages of completion. The huge amounts of available genome data are revolutionizing biomedical research, but fully exploiting them requires powerful computational and statistical methods. The main objective of the course is to provide students with a general understanding of the field of computational genomics, including current problems and research. Students will become familiar with fundamental molecular biology concepts and computational techniques, and will learn how to use the Matlab bioinformatics toolbox for solving problem in genomics.

Grading and course policies: Grading will be based on in-class quizzes, computer lab assignments, and team final projects, with each of the three components contributing equally to the final grade. In-class quizzes will be given at the beginning of class on Mondays. Computer assignments will be assigned on Fridays and will be due by midnight the following Wednesday. Assignments must be submitted electronically via HuskyCT (see below). *No late assignments and make-up quizzes will be allowed*. The lowest quiz and computer assignment grade will be omitted from the computation of the final grade. The last five weeks of the class will be devoted to a final project done in teams of three students. For the project you will pick a computational genomics topic not discussed in lectures and research it in more depth. You will be required to give weekly progress reports, submit a written final report of 15-20 pages, and give a 15-minute presentation at the end of the semester. The final project component of the grade will include participation in discussions of progress reports and final presentations of other teams.

HuskyCT: We have a HuskyCT (formerly Vista/WebCT) site for the class; you can access it by logging in with your NetID and password at https://huskyct.uconn.edu/. You must use HuskyCT for submitting assignments and check it regularly for class materials, grades, problem clarifications, changes in class schedule, and other class announcements.

Academic honesty: You are expected to adhere to the highest standards of academic honesty. All submitted solutions must be your own work. You may discuss ideas and concepts with other people, but *must not share written solutions or computer code*. Use of published materials is allowed, but the sources should be explicitly stated in your submission. Violations will be reviewed and sanctioned according to the University Policy on Academic Integrity.

Students with disabilities: If you have a documented disability for which you are or may be requesting an accommodation, you are encouraged to contact the instructor and the Center for Students with Disabilities or the University Program for College Students with Learning Disabilities as soon as possible to better ensure that such accommodations are implemented in a timely fashion.

Tentative Course Schedule

Date	Text	Biology Topics	Computer Science Topics	Computer Lab
Mon Aug 25	Preface	Course structure. What is computational genomics? Evolution and DNA sequence.		
Wed Aug 27	Ch 1	Anatomy of a genome	Computer algorithms	
Fri Aug 29	Ch 1			Lab1: Introduction to Matlab & Databases
Mon Sep 1	Labor Day - no class			
Wed Sep 3	Ch 1	Structure and function of DNA, replication	Probabilistic models and statistical sequence analysis	
Fri Sep 5	Ch 1			Lab2: Sequence retrieval, Exercise 1.1-1.3
Mon Sep 8	Ch 2	Transcription, translation, genetic code	Gene Finding	
Wed Sep 10	Ch 2	Anatomy of a gene: enhancers, promoters, UTR's, and ORF's	Hypothesis Testing	
Fri Sep 12	Ch 2			Lab3: Sequence analysis, Exercise 2.1-2.3
Mon Sep 15	Ch 3	Homology, orthology, and paralogy	Sequence alignment I	
Wed Sep 17	Ch 3	Gene duplication and deletion	Sequence alignment II	
Fri Sep 19	Ch 3			Lab4: Exercise 3.1-3.4
Mon Sep 22	Ch 5	Mutation, polymorphism	Genetic distance, modeling sequence evolution	
Wed Sep 24	Ch 5	Mitochondrial DNA & Human evolution	Phylogenetic trees	
Fri Sep 26	Ch 5			Lab5: Exercise 5.1-5.3
Mon Sep 29	Ch 6	Evolution and Natural Selection	Quantifying natural selection	
Wed Oct 1	Ch 6	HIV & the immune system	Estimating Ka/Ks	
Fri Oct 3	Ch 6			Lab6: Exercise 6.1-6.3
Mon Oct 6	Ch 7	SARS and viral evolution	Structure and representation of phylogenetic trees	
Wed Oct 8	Ch 7	Virus-host interactions	Tree inference – distance matrices, neighbor joining	
Fri Oct 10	Ch 7			Lab7: Exercise 7.1-7.3
Mon Oct 13	Ch 9	Gene Expression	Measuring gene expression with microarrays	
Wed Oct 15	Ch 9	Yeast, diauxic shift, cell cycle	Data clustering	
Fri Oct 17	Ch 9			Lab8: Exercise 9.1-9.3

Date	Text	Biology Topics	Computer Science Topics	Computer Lab
Mon Oct 20	Ch 10	Circadian clock	Motif representation and scoring	
Wed Oct 22	Ch 10	Mechanisms of gene regulation	Motif finding	
Fri Oct 24	Ch 10			Lab9: Exercise 10.1-10.3
Mon Oct 27	--	Final Project: topic selection		
Wed Oct 29	--			
Fri Oct 31	--			Topic & specific aims submission
Mon Nov 3	--	Progress reports (10' presentation) on final projects: Literature review and specific aims of chosen		
Wed Nov 5	--			
Fri Nov 7	--			Literature review & hypothesis submission
Mon Nov 10	--	Progress reports (10' presentation) on final projects: Define hypothesis/analysis strategy and identify data sources		
Wed Nov 12	--			
Fri Nov 14	--			Analysis strategy submission
Mon Nov 17	--	Progress reports (10' presentation) on final projects: Preliminary results		
Wed Nov 19	--			
Fri Nov 21	--			Preliminary results submission
Mon Nov 24	Thanksgiving recess - No classes			
Wed Nov 26	Thanksgiving recess - No classes			
Fri Nov 28	Thanksgiving recess - No classes			
Mon Dec 1	--	Final project presentations		
Wed Dec 3	--			
Fri Dec 5	--			