BME1401/CSE1401/MCB1401
Honors Core – Computational Molecular Biology
Spring 2011

Lecture: Castleman 201, Mon/Wed 11-11:50am

Lab: ITE 138, Fri 10-10:50am (section 001D) and 11-11:50am (section 002D)

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 thousands 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 covered in lectures or labs 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 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
Wed Jan 19	Preface	Course structure. What is computational genomics? Evolution and DNA sequence.		
Fri Jan 21	Ch 1			Lab1: Introduction to Matlab & Databases
Mon Jan 24	Ch 1	Anatomy of a genome	Computer algorithms	
Wed Jan 26	Ch 1	Structure and function of DNA, replication	Probabilistic models and statistical sequence analysis	
Fri Jan 28	Ch 1			Lab2: Exercise 1.1-1.3
Mon Jan 31	Ch 2	Transcription, translation, genetic code	Gene Finding	
Wed Feb 2	Ch 2	Anatomy of a gene: enhancers, promoters, UTR's, and ORF's	Hypothesis Testing	
Fri Feb 4	Ch 2			Lab3: Exercise 2.1-2.3
Mon Feb 7	Ch 3	Homology, orthology, and paralogy	Global and local sequence alignment	
Wed Feb 9	Ch 3	Gene duplication and deletion	Multiple sequence alignment	
Fri Feb 11	Ch 3			Lab4: Exercise 3.1-3.4
Mon Feb 14	Ch 5	Mutation, polymorphism	Genetic distance, modeling sequence evolution	
Wed Feb 16	Ch 5	Mitochondrial DNA & Human evolution	Phylogenetic trees	
Fri Feb 18	Ch 5			Lab5: Exercise 5.1-5.3
Mon Feb 21	Ch 6	Evolution and Natural Selection	Quantifying natural selection	
Wed Feb 23	Ch 6	HIV & the immune system	Estimating Ka/Ks	
Fri Feb 25	Ch 6			Lab6: Exercise 6.1-6.3
Mon Feb 28	Ch 7	SARS and viral evolution	Structure and representation of phylogenetic trees	
Wed Mar 2	Ch 7	Virus-host interactions	Tree inference – distance matrices, neighbor joining	
Fri Mar 4	Ch 7			Lab7: Exercise 7.1-7.3
Mon Mar 7	Spring recess			
Wed Mar 9	Spring recess			
Fri Mar 11	Spring recess			

Date	Text	Biology Topics	Computer Science Topics	Computer Lab
Mon Mar 14	Ch 9	Gene Expression	Measuring gene expression with microarrays	
Wed Mar 16	Ch 9	Yeast, diauxic shift, cell cycle	Data clustering	
Fri Mar 18	Ch 9			Lab8: Exercise 9.1-9.3
Mon Mar 21	Ch 10	Circadian clock	Motif representation and scoring	
Wed Mar 23	Ch 10	Mechanisms of gene regulation	Motif finding	
Fri Mar 25	Ch 10			Lab9: Exercise 10.1-10.3
Mon Mar 28	--	Final project topic selection		
Wed Mar 30	--			
Fri Apr 1	--			Submit FP topic; start literature review
Mon Apr 4	--	Progress report (15' presentation) on literature review		
Wed Apr 6	--			
Fri Apr 8	--			Submit literature review; start defining analysis strategy
Mon Apr 11	--	Progress report (15' presentation) on analysis strategy		
Wed Apr 13	--			
Fri Apr 15	--			Submit analysis strategy; start data analysis
Mon Apr 18	--	Progress report (15' presentation) on preliminary data analysis results		
Wed Apr 20	--			
Fri Apr 22	--			Submit preliminary results; start final project presentation
Mon Apr 25	--	25' final project presentation		
Wed Apr 27	--			
Fri Apr 29	--			Submit final report