BME1401/CSE1401/MCB1401/PNB1401
Honors Core – Computational Molecular Biology
Spring 2012

Lecture: ~~MSB 215~~ Beach Hall 302, Mon/Wed 11-11:50am

Lab: E2 305, Fri 10-10:50am (section 001D) and 11-11:50am (section 002D)

Instructors:

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Teaching Assistants:

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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/four 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 25-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	Case Study Topics	Computer Lab
Wed 1/18	Ch 1	Course overview and intro to computational genomics			
Fri 1/20	Ch 1				Lab 1: Introduction to Matlab & biological databases
Mon & Wed 1/23 & 1/25	Ch 1	DNA structure/function, and replication	Probabilistic models and statistical sequence analysis	Genome Anatomy & Annotation	
Fri 1/27	Ch 1				Lab 2: Exercises 1.1 – 1.3
Mon & Wed 1/30 & 2/1	Ch 2	What is a gene?	Gene finding and hypothesis testing	A Sampling of Interesting Genes	
Fri 2/3	Ch 2				Lab 3: Exercises 2.1 – 2.3
Mon & Wed 2/6 & 2/8	Ch 3	Genetic changes over evolutionary time	Sequence alignments and next gen re-sequencing	Eye of the Tiger	
Fri 2/10	Ch 3				Lab 4: Exercises 3.1 – 3.4
Mon & Wed 2/13 & 2/15	Ch 5	The mitochondrial genome	Genetic distance, modeling sequence evolution, and phylogenetic trees	Human Evolution	
Fri 2/17	Ch 5				Lab 5: Exercises 5.1 – 5.3
Mon & Wed 2/20 & 2/22	Ch 6	Natural selection, HIV biology, and basic immunology	Quantifying natural selection and estimating Ka/Ks	Host-Pathogen Co-Evolution	
Fri 2/24	Ch 6				Lab 6: Exercises 6.1 – 6.3
Mon & Wed 2/27 & 2/29	Ch 7	Virus-host interactions and SARS biology	Structure and representation of phylogenetic trees and tree inference methods	Epidemiology of SARS	
Fri 3/2	Ch 7				Lab 7: Exercises 7.1 – 7.3
Mon & Wed 3/5 & 3/7	Ch 9	Mechanisms of gene regulation	Measuring gene expression with microarrays, data clustering, and RNA-seq	Case Studies in Gene Regulation	
Fri 3/9	Ch 9				Lab 8: Exercises 9.1 – 9.3
Mon & Wed 3/12 & 3/14	Spring Recess – No Class				
Fri 3/16					

Mon & Wed 3/19 & 3/21	Ch 10	DNA and protein binding sequences	Motif representation/scoring and motif finding	The Regulatory Genome	
Fri 3/23	Ch 10				Lab 9: Exercises 10.1 – 10.3
Date	**Text**	**Biology Topics**	**Computer Science Topics**	**Case Study Topics**	**Computer Lab**
Mon & Wed 3/26 & 3/28	--	Final project topic selection			
Fri 3/30	--				Submit FP topic; start literature review
Mon & Wed 4/2 & 4/4	--	Progress report (15’ presentation) on literature review			
Fri 4/6	--				Submit literature review; start defining analysis strategy
Mon & Wed 4/9 & 4/11	--	Progress report (15’ presentation) on analysis strategy			
Fri 4/13	--				Submit analysis strategy; Start data analysis
Mon & Wed 4/16 & 4/18	--	Progress report (15’ presentation) on preliminary data analysis results			
Fri 4/20	--				Submit preliminary results; start final project presentation
Mon & Wed 4/23 & 4/25	--	25’ final project presentation			
Fri 4/27	--				Submit final report