

Genetics 885: Genomic and Proteomic Analysis –Fall 2016 (3 credits)

Monday/Wednesday Lecture: 2:25-3:15 pm; Genetics/Biotechnology Center - Rm 1408

Monday Computer Lab: 3:30 – 5:30 pm; CALS computer lab, Animal Science Room 150

Course wiki: https://wiki.genetics.wisc.edu/wiki/pages/N623i9M0/Course_Overview.html

Instructors

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Description

With the availability of genome sequences and high-throughput techniques, organismal physiology can now be examined on a global scale by monitoring the behavior of all genes or proteins in a single experiment. This course will present modern techniques in genomics and proteomics, with particular focus on analyzing the data generated by these techniques. Course material will cover genomic sequencing, comparative sequence analysis, phylogeny construction and phylogenomics, transcription factor motif discovery, DNA microarray analysis, techniques in mass spectrometry, proteomic screening methods, and protein-interaction network analysis.

In addition to lecture time, the course includes a weekly computer lab where students get hands-on experience analyzing genomic and proteomic datasets. In addition, students conduct a semester-long computational project of their choice that uses multiple computational methods discussed in class.

Grades

60%: Class Project

10% One page project summary - due Wednesday, Oct. 5

20% Two-three page description of methods and preliminary results - due Monday, Nov. 7

30% Final Presentation and seven-ten page final paper (with additional pages for figures and references) in manuscript format - due Monday, Dec. 5

20% Labs/Homeworks - announced weekly

20% Attendance/Discussion

Class Paper:

Project Summary (due Oct 3) The one-page project summary should present one paragraph of background or introduction to your problem, followed by specific aims or questions you would like to address. You do not need to have a firm understanding of what programs you will use, but you should have some goals in mind. You should also list which instructor you have agreed to work with; most students find it useful to discuss the project with their advisor before the report is due.

Preliminary Results (due Nov 7): The project update should be 2-3 (1.5-line spacing) pages, with additional pages for figures and references. In addition to a short introduction paragraph, students should clearly list what their data set(s) are, what programs and approaches they plan to apply, and list preliminary results and future plans. Students should have begun their projects by the time this paper is due. Don't forget to include references where relevant.

Final Paper (**extension to Dec 7**): The final class paper should be 7-10 pages (1.5 line spacing), with additional pages for figures and references, in manuscript format (e.g. Introduction, Materials and Methods, and Results and Discussion). Extensive writing on the data collection is not necessary (e.g. buffer conditions, etc) but a sufficient description of the generated or published datasets should be given. Cite clearly what data processing or analysis was done by you versus others (especially if using published datasets where some analysis has already been done). Make the methods clear enough that the reader can understand what was done (what programs run, how data were normalized, etc). Don't forget to include references were relevant.

Final Class Presentation (Dec 12 & Dec 14):

In the last week of class, each student will give a 7 minute presentation (with 2 additional minutes for questions) on their class project. The goal is to give 1-2 slides of background with the rest of the presentation focusing on methods, results, and challenges.

Policies

Readings and labs will be posted on the web site.

Attendance is expected unless you give prior notice of a conflict.

Assignments must be turned in on time. Two or more late assignments will affect your overall course grade.

Collaborative work is encouraged, but you need to list all contributors.

Participation is required and factored into the final grade. An A grade for the course requires significant participation in lecture discussions.

Syllabus, Readings and Lecture Slides

GENOME-SCALE SEQUENCE ANALYSIS

W Sept 7: Introduction / Sequencing and Analysis - Nicole

M Sept 12: Genome Assembly (Abyss Lab) - Nicole

W Sept 14: Genome Assembly (Part II) - Nicole

M Sept 19: Read mapping (Bowtie Lab) - Guest Lecturer for Lab, Jeremy Glasner

W Sept 21: Transcript assembly vs. Read mapping - Guest Lecturer Jeremy Glasner

GENE EXPRESSION ANALYSIS

M Sept 26: RNA-seq transcriptomic analysis (Intro to R Lab) - Audrey

W Sept 28: Gene expression data analysis - Part I - Audrey

M Oct 3: Gene expression data analysis – Part II (edgeR Lab) - Audrey

W Oct 5: Clustering analysis – Part I – Audrey

M Oct 10: Clustering analysis – Part II (Clustering Lab) - Audrey

COMPARATIVE GENOMICS

W Oct 12: Structural Annotation - Nicole

M Oct 17: Functional Annotation (Coffee Genome Lab) - Nicole

W Oct 19: BLAST - Part I - Nicole

M Oct 24: BLAST - Part II and Orthology (High-throughput BLAST Lab) - Nicole

W Oct 26: Phylogenetic Profiles and Machine Learning - Nicole

M Oct 31: Phylogeny (Phylogeny Lab) - Nicole

W Nov 2: Metagenomics - Nicole

FUNCTIONAL GENOMICS & PROTEOMICS

M Nov 7: ChIP-seq and long-range enhancers (ChIP-seq lab) - Audrey

W Nov 9: Motif analysis – Part I - Audrey

M Nov 14: Motif analysis – Part II (MEME Lab) - Audrey

W Nov 16: High-throughput Functional Genomics - Audrey

M Nov 21: Network analysis (Cytoscape Lab) - guest lecturer, Tony Gitter

W Nov 23: NO CLASS - Thanksgiving

M Nov 28: Publishing & proposing 'omic data (Lab: Help with class projects) - Audrey

W Nov 30: Mass-spec proteomics – Part I - Audrey

M Dec 5: Proteomics & metabolomics (Intro to PERL Lab)

W Dec 7: Integrative data analysis & Final Wrap-up - Audrey ** Class papers due by midnight!

M Dec 12: Project Presentations ** 2:25 - 5:30 pm, room 1408 Genetics-Biotech

W Dec 14: Project Presentations ** 2 - 3:30 pm, room 1408 Genetics-Biotech