BISC577: Computational Biology Laboratory

Organizers: Vsevolod (Seva) Katritch & Adam MacLean

Time and Location: 2:00 - 3:50pm Tue, RRI 421

Description: This course provides practical experience in a range of computational biology topics and applications. Students will work with programming languages and bioinformatics software packages to perform molecular structure and dynamics, genomic, proteomic, epigenomic, and systems biology analyses.

Goals:
- To gain familiarity and competency in programming methods for computational biology applicable to genomic, transcriptomic, and proteomic analyses, and the principles underlying these computational methods.
- To develop skills in the use and application of molecular biology, genomic and proteomic databases and ancillary software tools.
- To develop programming skills that enable systems-level insight into complex biological processes, e.g. molecular networks or dynamical systems.

Text: There is no required textbook. Handouts will be distributed in class.

Background Reading:
Bioinformatics and Computational Biology Solutions Using R and Bioconductor (Statistics for Biology and Health) *by Robert Gentleman, Vincent Carey, Wolfgang Huber, and Rafael Irizarry.*

Course Contents: This course will cover the following topics: sequence assembly, read mapping, gene ontology, phylogenetic trees and coalescence, epigenomics, genomic variation, RNA-seq in bulk and single cells, single molecules, gene recognition, RNA and protein structure, docking, molecular dynamics, systems biology, etc.

Homework: Three homework projects will be assigned throughout the semester. Each project should be submitted by the specified due date. Points will be subtracted for projects submitted late.

Grade: Course grades will be calculated from homework project grades.

Course Schedule

Class	Date	Topic
1	08/27	Protein Structure & Modeling 1 (Katritch)
2	09/03	Protein Structure & Modeling 2 (Katritch)
3	09/10	Protein Structure & Modeling 3 (Katritch)
4	09/17	Molecular Dynamics (Di Felice)
5	09/24	Sequence Assembly 1 (Chaisson)
6	10/01	Sequence Assembly 2 (Chaisson)
7	10/08	Phylogeny and Coalescence (Calabrese)
8	10/15	Gene Ontology Tools (Mi)
9	10/22	Molecular Networks (Sun)
10	10/29	Structural Genomics (Rohs)
11	11/05	RNA-seq Analysis (Chen)
12	11/12	Systems Biology 1 (MacLean)
13	11/19	Systems Biology 2 (MacLean)
14	11/26	Systems Biology 3 (MacLean)
15	12/03	Genetics & Evolution (Chiang)