

BIO490S - Methods in Computational Biology & Genomics

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Hours: Tues 3-5, Thurs 10-12

Learning Objectives

1) teaching programming basics within a biology framework (i.e. basic building blocks for students to use biological software)

- a) using command line interfaces
- b) accessing supercomputers/clusters
- c) building scripts
- d) using biological programs (bwa, samtools, etc)

2) the statistics that underlie these tools, the whole suite of measures used in "genomics" and probably not covered in Bio 204

3) combine #1 & #2 to test one of a range of biological questions, answerable with RNAseq data, such as: what is the effect of hibernation (lemur), morph type (cricket), tissue type (crayfish), closing mechanism (venus flytrap), and salty ecotypes (cotton) on gene expression across the tree of life.

Prerequisites

- One of BIO201/202
- STA101 or higher OR BIO204
- Some coding background (computer language independent)

Audience

Junior and Senior Biology Majors - Upper level students, who may be considering a future in research and want a broad introduction to many concepts and methods as well as a brief, hands-on, research-like experience. The goal would be to add many of tools to their resumé and in turn increase productivity as a lab technician after school or as an early graduate student, or even open up possibilities for a senior thesis.

Schedule

Day	Date	Topic	Due
M - Lecture	Aug 29	Welcome/Syllabus/"What is 'Genomics'?"	
W - "Lab"	Aug 31	Setup - Terminal Basics	
M - No Class	Sept 5	Labor Day -- No Class	
W - Lecture	Sept 7	How We Got Here - History of "Genomics"	
M - Lecture	Sept 12	Genomic Methods (Long v. Short Reads)	
W - "Lab"	Sept 14	Intro to bin/bash language	
M - Lecture	Sept 19	SNPs v. Genomes	
W - "Lab"	Sept 21	Writing a Script, Loops/Boolean	Project Choice
M - Lecture	Sept 26	Misc-omes: Transcriptomes/Epigenomes/etc	
W - "Lab"	Sept 28	Regular Expressions - grep	HW: Regular Expression/grep
M - Lecture	Oct 3	Statistical Methods (pt I) - BLAST, BUSCO, measures of similarity	
W - "Lab"	Oct 5	Stat Methods pt 1	
M - Lecture	Oct 10	Statistical Methods (pt II) - Permutation Tests, experimental stats	

W - "Lab"	Oct 12	Stat Methods pt 2	Project Sketch (Methods)
M - No Class	Oct 17	Fall Break -- No Class	
W - Lecture	Oct 19	Future Genomic Tech - TenX, long reads, Oxford Nano	
M - Lecture	Oct 24	Statistical Methods (pt III) - Bayesian Stats, Simulations	HW: Statistical Methods
W - "Lab"	Oct 26	Stat Methods pt 3	
M - Lecture	Oct 31	What can we learn from genomes? (Pop Gen, PSMC)	
W - "Lab"	Nov 2	Submitting to the Cluster	
M - Lecture	Nov 7	Admixture/PopGen from Genomes	HW: Paper Assessment
W - "Lab"	Nov 9	Downloading Public Data - SRA	
M - Lecture	Nov 14	Genomic "Islands" of Speciation	Project Rough Draft 1
W - "Lab"	Nov 16	Using Software - Readme.txt and Flags!	
M - Lecture	Nov 21	New Directions in Genomics: Introns & Alternative Splicing	
W - "Lab"	Nov 23	Git repositories and version tracking	
M - Lecture	Nov 28	Non-Model Genomics - Possibilities and Pitfalls	
W - "Lab"	Nov 30	Project Presentations/Student Choice Lecture	
M - Lecture	Dec 5	Project Presentations	Final Project (Present)
W - "Lab"	Dec 7	Project Presentations	Final Project (Present)
Exam	Dec 14	Final Exam - In Class Activity/Mini-Project	