BIO490S - Methods in Computational Biology & Genomics

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Office: BioSci 311 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 woudl 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 possibilites for a senior thesis.

Schedule

Day	Date	Topic	Due
Tu - Lecture	Aug 30	Welcome/Syllabus/"What is 'Genomics'?"	

Th - "Lab"	Sep 1	Setup - Terminal Basics	
Tu - No Class	Sep 6	Labor Day -- No Class	
Th - Lecture	Sep 8	How We Got Here - History of "Genomics"	
Tu - Lecture	Sep 13	Genomic Methods (Long v. Short Reads)	
Th - "Lab"	Sep 15	Intro to bin/bash language	
Tu - Lecture	Sep 20	SNPs v. Genomes	
Th - "Lab"	Sep 22	Writing a Script, Loops/Boolean	Project Choice
Tu - Lecture	Sep 27	Misc-omes: Transcriptomes/Epigenomes/etc	
Th - "Lab"	Sep 29	Regular Expressions - grep	HW: Regular Expression/grep
Tu - Lecture	Oct 4	Statistical Methods (pt I) - BLAST, BUSCO, measures of similarity	
Th - "Lab"	Oct 6	Stat Methods pt 1	
Tu - Lecture	Oct 11	Statistical Methods (pt II) - Permutation Tests, experimental stats	
Th - "Lab"	Oct 13	Stat Methods pt 2	Project Sketch (Methods)
Tu - No Class	Oct 18	Fall Break -- No Class	
Th - Lecture	Oct 20	Future Genomic Tech - TenX, long reads, Oxford Nano	
Tu - Lecture	Oct 25	Statistal Methods (pt III) - Bayesian Stats, Simulations	HW: Statistical Methods
Th - "Lab"	Oct 27	Stat Methods pt 3	
Tu - Lecture	Nov 1	What can we learn from genomes? (Pop Gen, PSMC)	
Th - "Lab"	Nov 3	Submitting to the Cluster	
Tu - Lecture	Nov 8	Admixture/PopGen from Genomes	HW: Paper Assessment
Th - "Lab"	Nov 10	Downloading Public Data - SRA	
Tu - Lecture	Nov 15	Genomic "Islands" of Speciation	Project Rough Draft 1
Th - "Lab"	Nov 17	Using Software - Readme.txt and Flags!	
Tu - Lecture	Nov 22	New Directions in Genomics: Introns & Alternative Splicing	
Th - "Lab"	Nov 24	Git repositories and version tracking	
Tu - Lecture	Nov 29	Non-Model Genomics - Possibilities and Pitfalls	
Th - "Lab"	Dec 1	Project Presentations/Student Choice Lecture	
Tu - Lecture	Dec 6	Project Presentations	Final Project (Present)
Th - "Lab"	Dec 8	Project Presentations	Final Project (Present)
Exam		Final Exam - In Class Activity/Mini-Project	