

# BIO490S - Methods in Computational Biology & Genomics

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Hours: Mon 3-5, Wed 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
Tu - Lecture	Aug 30	Welcome/Syllabus/"What is 'Genomics'?"	
Th - "Lab"	Sep 1	Setup - Terminal Basics	
Tu - Lecture	Sep 6	How We Got Here - History of "Genomics"	
Th - "Lab"	Sep 8	Intro to git	
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	Statistical 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	