

Statistical Analysis of Genomics

ECES 490/690

3 credits

Mon 5 – 7:50 p.m.

Location: Bossone 605

Instructor:

Dr. Gail Rosen

gailr@ece.drexel.edu

215-895-0400

Bossone 403

Office hours: Wednesday 12:30-2:30

Course Overview:

This course will focus on developing the computational and database navigational skills required to analyze genomic data that have become available with the development of high throughput genomic technologies. Students will learn Python and R to analysis genomics. Many third party packages to analyze genomics such and assess the statistical significance of results will be learned. The goals will be achieved through lecture and lab exercises that focus on genomic databases, programming for importing and pre-processing genomic data, high performance programming for analysis of high-throughput metagenomic analyses, and use of high-performance computing for phylogenetic reconstruction.

Statement of Expected Learning:

1. An understanding of genomes, their features, how they vary, and the forces that drive this variation. This will be assessed through class tutorials and the class project.
2. To show competency in basic bioinformatics techniques related to genome annotation, sequence alignment, metagenomic analyses, and phylogenetics.

The achievement of this objective will be assessed through in class tutorials and project.

3. To show a working knowledge of bioinformatics programming through unix scripting and Python and/or R. The achievement of this objective will be assessed through in class tutorials and class project.

Course Reading Materials

None required

Suggested: Python/Bash/R cookbooks and tutorials

Expected letter grade-breakdown

A+ = 98% or more; A = 92 - 97.99%; A- = 90 - 91.99%

B+ = 88-89.99%; B = 82 - 87.99%; B- = 80 - 81.99%

C+ = 78-79.99%; C = 72 - 77.99%; C- = 70 - 71.99%

D+ = 68-69.99%; D = 62 - 67.99%;

F = 59.99% or less

Grading Policy:

ECES Undergraduates (ECES 490)

Lecture

20 pts Weekly Quizzes and Quiz Questions

30 pts One Tutorial

50 pts Data Analysis Project

ECES Graduates (ECES 690)

Lecture

20 pts Weekly Quizzes and Quiz Questions

30 pts One Tutorial

50 pts Data Analysis Project

Details on specific assignments:

General Code of Conduct:

Students are expected to refrain from disruptive activity during class. Cell phones must be turned off or silenced (i.e. on vibrate). Text messaging and phone calls will not be allowed. Use of computers and electronic devices must be limited to note-taking or in-class computational exercises. Students must also refrain from talking out of turn and may be asked to leave the class should they fail to abide by these rules.

Attendance Policy

Absences must be excusable, resulting from a circumstance that is beyond the student's control (e.g. illness, family crisis, necessary travel). You must provide us with a written statement (e-mail or note) regarding the reason for your absence. Otherwise, every unexcused will be deducted from the course grade (1 point per absence). Students missing classes should consult an instructor to inquire about missed assignments (i.e. in-class activities).

Policy on Missed Exams and Deadlines:

Generally speaking, we will not give make-up assignments or exams. As such, **excusable** absences or missed deadlines (see above) will require that we adjust the point value from your other assignments and exams. For example, if an undergrad did not take exam 2 (worth 15 course points) due to a legitimate excuse, their final grade would be calculated out of 85 total course points instead of 100. **HOWEVER, A STUDENT WILL RECEIVE AN INCOMPLETE FOR THE COURSE SHOULD THEY FAIL TO COMPLETE 80% OF THEIR TOTAL COURSE POINTS (i.e. 80 course pts for undergrads; 96 course pts for grads).**

All unexcused late assignments (turned in before the answer key is posted) will receive a 10% deduction per day late.

Policy on Academic Dishonesty

For Drexel's policy on academic dishonesty, visit:

http://www.drexel.edu/provost/policies/academic_dishonesty.asp

Unless group/team activity is required, it is assumed that ALL work be solely that of the individual student whose name is associated with the work. ANY form of cheating (copying, plagiarizing, using another's work, permitting another student to use your work, falsifying data, etc.) will not be tolerated and can result in immediate disciplinary action, including the possibility of dismissal.

Students who violate these policies (e.g. through cheating or plagiarism) may receive a 0 on the relevant assignment or, in more serious cases, may receive an F for the course. Furthermore, students in violation of these policies may be sent before the Drexel Office of Judicial Affairs:

<http://www.drexel.edu/judicial/default.html>

Students with Disabilities

Students with disabilities requesting accommodations and services at Drexel University (e.g. extra time for exams), need to present a current accommodation verification letter (AVL) to the professor before accommodations can be made. This will need to be done 2 weeks in advance of the first exam (by Jan. 21). AVL's are issued by the Office of Disability Services (ODS). For additional information, contact ODS at

3201 Arch St., Street, Suite 210, Philadelphia, PA 19104, **215.895.1401** (V), or **215.895.2299** (TTY). Or visit their website at www.drexel.edu/ods.

COURSE SCHEDULE

Date	Lecture topic	Every week a tutorial assignment must be completed
March 30	<i>Introduction to Shell scripting and Biopython</i> <i>Shell Scripting and Python for accessing sequences via NCBI</i> <i>Introduction to Proteus</i>	List of Tutorials given
April 6	<i>Intro to Metagenomics and Syllabus Review</i> <i>Intro to Remote and Standalone BLAST</i> <i>Building Custom BLAST Databases and BLASTing Locally</i>	Choose Tutorial by April 8
April 13	<i>Qiime, MG-RAST, IMG/M, NCBI SRA Archive</i> <i>Introduction to QIIME and QIIME on Proteus</i>	Choose Project by April 21st
April 20	Phylogenetics	Tutorials 1 and 2
April 27	Comparative Taxonomy using 16S rRNA	Tutorials 3 and 4
May 4	Assembly and Binning	Tutorials 5 and 6
May 11	Taxonomic Identification from WGS DNA Clustering and Alignment	Tutorials 7 and 8 Project Progress Reports due
May 18	Functional annotation of metagenomes (protein families and metabolic pathways) <i>HMMer for gene discovery and homology</i> <i>HuManN for metabolic pathways</i>	Tutorials 9 and 10
May 25	<i>Memorial Day</i>	
June 1	Metatranscriptomic Analyses Project Help	Tutorial 11
June 8	Project Presentations	

Finals Week: More Project Presentations