BIO 400/500 Bioinformatics and genome analysis (4 credits; Spring 2018)

Course description: Computerized analysis of genetic information from a biological perspective. Lectures focus on assumptions, limitations, and strategies of bioinformatics algorithms and statistics. Labs use computers to address biological questions.

Learning outcomes: Improve skills to address biological questions using current computer assisted tools; learn the terminology/language of bioinformatics; learn the strengths and limitations of various computer tools; and gain an understanding of algorithms and assumptions of bioinformatics

Instructor: Dr. Derek Taylor, Hochstetter Hall 220, Office hours: Wed. 12:00-2:00. Tel: 645-2880.

T.A.: Ozgur Taskent (recepozg@buffalo.edu)

Room and time: lecture M 2:00 – 3:50 Fronczak 454, lab W 10:00-11:50 (Sec. 1) or W 2:00-3:50 (Sec. 2) Cooke 218

Course requirements/evaluation: Students are expected to participate in a group term project and complete weekly lab problems; Project Paper: 60%, Group Presentation: 10%, Exam 1: 15%, Exam 2: 15% (exams are short answer and based on lecture and lab materials)

Note: The topic, raw data, and problem solving can and should be a group effort, but the text and preparation of the term paper is the individual responsibility of each student. This course follows the University Academic Integrity policy. Please refer to the incomplete policy in the undergraduate catalog. Students with disabilities requiring accommodation should register with Disability Services and inform the instructor.

Optional Textbook: Concepts in Bioinformatics and Genomics (Jamil Momand and Alison McCurdy. Oxford University Press)

Week			Reference	Evaluation
Jan 29	Mon.	Introduction to bioinformatics	Chapter 1	
Jan 31	Wed. (Lab)	Obtaining a bioinformatics toolkit		
Feb 5	Mon.	Sequencing and assembly	Chapter 2,9	
Feb 7	Wed. (Lab)	Finding and assembling genetic data	Chapter 6	
Feb 12	Mon.	Language of genomics; alignment	Chapter 5	
Feb 14	Wed. (Lab)	Sequence alignment and quality		
Feb 19	Mon.	Models of sequence evolution and optimality criteria	Chapter 12	
Feb 21	Wed. (Lab)	Test for signal and substitution model fit		
Feb 26	Mon.	Search and optimality algorithms	Chapter 8	
Feb 28	Wed. (Lab)	Building a tree		
Mar 5	Mon.	Confidence and error in trees	Chapter 8	
Mar 7	Wed. (Lab)	Statistics for trees		
Mar 12	Mon.	Confidence and error part 2		
Mar 14	Wed. (Lab)	Testing hypotheses with real sequence data		
Mar 19-23		**SPRING RECESS**		
Mar 26	Mon.	***10-12 minute Data presentations***		**Bio 500 only**
Mar 28	Wed. (Lab)	Introduction to coding for bioinformatics	Chapter 13	
Apr 2	Mon.	Exam 1 in Lecture room		**Exam 1**
Apr 4	Wed. (Lab)	Introduction to coding for bioinformatics part 2	Chapter 13	
Apr 9	Mon	Prediction of RNA structure		
Apr 11	Wed. (Lab)	RNA structure prediction		
Apr 16	Mon.	Genome Evolution	Chapter 9	
Apr 18	Wed. (Lab)	Using regular expressions in biology		
Apr 23	Mon	Detecting positive selection and functional regions in genomes		
Apr 25	Wed. (Lab)	Software tools for detecting selection		Optional draft submission deadline
Apr 30	Mon.	***10-12 minute presentations of project 2***		**Undergraduate student groups**
May 2	Wed. (Lab)	Project analysis		
May 7	Mon.	Exam 2 in Lecture room		**Exam 2**
May 9	Wed. (Lab)	Open -- Submit hard copy of Project paper		**Project Deadline!**

Learning outcome	Depth	Skills	Number
Understand that biology has a chemical, physical, and mathematical basis.	1	learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Promote familiarity with a range of methods and techniques relevant to the application of biological sciences.	2	learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Inspect data and apply basic statistics to their analysis and communication.	2	learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Demonstrate the ability to integrate the physical sciences (chemistry, physics, and mathematics) with biology.	1	learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Integrate knowledge across biological sub disciplines.	1	learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Determine the veracity and value of published information.	1	Analyze real genomic data, learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Use knowledge foundations to illustrate concepts and compare examples.	1	Analyze real genomic data, learn basic data exploration, graphing and statistical analysis for genomics	Exam, project
Communicate the results of scientific investigations in forms, both oral and written, standard to the discipline.	2	Analyze real genomic data, learn basic data exploration, graphing and statistical analysis for genomics	Exam, project