

Advanced Bioinformatics – BIOL6900

Fall 2017; Tuesday and Thursday 11:00 am – 12:15 pm

Instructor: Xiangjia (Jack) Min; Phone: 1945; e-mail: xmin@ysu.edu

Office/LAB: 3012/13 Ward Beecher

Office hours: MWF, 10:00 am – 12:00 pm; Tu Th, 10:00 – 11:00 am

Textbook: Bioinformatics and Functional Genomics

By Jonathan Pevsner, 3rd Edition, WILEY-LISS 2015

Reference:

Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins
edited by A.D Baxevanis and B.F. Ouellette. Third Edition, 2005.

Course website: <http://proteomics.ysu.edu/courses/>

Supplementary materials: recently published research/review papers in bioinformatics will be posted online.

COURSE OBJECTIVES: The objective of this course is to learn theories and tools in bioinformatics for solving problems in data mining and systems biology at the genome level. The course will include both formal lectures and projected-based exercises. Students are expected to obtain excellent training in data analysis of molecular biology, genomics, and bioinformatics. The main focus will be on (1) bioinformatics tools and the integration of these tools to interpret, analyze, and mine complex biological data, (2) biological data and databases, and the integration of biological data to understand and solve problems in genome/systems biology.

COURSE TOPICS:

The course will include three modules:

August 24 Introduction

Part 1. Analyzing DNA, RNA, and protein sequences

1. 8/24 Access to sequence data and literature.
2. 8/29 Lab1 (WB3013)
3. 8/31 Pairwise sequence alignment /BLAST
4. 9/5 Lab2
5. 9/7 Biological databases: Data retrieval
6. 9/12 Lab3
7. 9/14 Lab4 – Basic Linux and windows command
8. 9/19 Lab5 - stand-alone-BLAST
9. 9/21 Multiple sequence alignment
10. 9/26 Lab6
11. 9/28 Molecular phylogeny and evolution
12. 10/3 Lab7
- 10/5 Reivew
- 10/10 Test I**

Part 2. Genomewide analysis of RNA and protein

- 13. 10/12 Microarray data analysis/Next generation sequencing.
- 14. 10/17 Lab8
- 15. 10/19 Protein analysis and proteomics.
- 16. 10/24 Lab9
- 17. 10/26 Biological pathways and “systems biology”.
- 18. 10/31 Lab10
- 11/2 Wrap up Project I

11/7 Test 2.

11/14 Project 1 report due

Part 3. Genome biology

- 19. 11/9 EST2Genome (Min’s research) (extra reading – EST review/OrfPredictor)
- 20. 11/14 Lab11 (EST mapping / alternative splicing (**Project 2 begins**))
- 21. 11/16 Genome analysis
- 22. 11/21 Lab11 (Gene prediction)
- 23. 11/23 (11/22 -24) holidays**
- 24. 11/28 Lab12 (Genome rearrangement)
- 25. 11/30 – 12/7 Alternative splicing (project 2 continued)

12/12 (12:00 pm) Project 2 report due

Final exam: 12/14 (12:00 pm) (report due)

EVALUATION: There will be **three tests** and **two project reports**. Three exams (60% of course grade) and Project 1: 30% of course grade and Project 2 report: 10%.

Project I:

Each student is required to complete a research project (Project 1), toward the middle of the semester each student will submit a report.

Choose one protein / gene family of your interest (consisting of 10 – 30 members from multiple species. The more complete your data set, the better). Perform the following analyses (but not limited to these analyses):

- (1) Retrieve the sequence information (both cDNA and protein) about this gene and the gene family;
- (2) Search, retrieve, and read literature related to this gene family;
- (3) Conduct analysis – blast (all kinds); domain search, multiple sequence alignment, phylogenetic and evolutionary analysis, pathway; gene expression, subcellular location prediction, 3-D structure, etc. (All information based on the first and second part you have learned)
- (4) Write a report in a journal format, and also you may be prepared to present your data in Quest if desired.

Project II:

Identifying alternatively splicing genes in fungi. A project report will be required.