

MBioS 478/578: Bioinformatics
Fall 2009

Overview: This course will introduce senior undergraduates and graduate students to the field of bioinformatics. Students will learn how to use computational tools to analyze (1) protein and nucleic acid (DNA and RNA) sequences; (2) functional genomics and genome expression data; and (3) protein structures. Additional topics will include algorithms used in bioinformatics data analysis, modeling of biological networks and pathways, and the analysis of metabolomics data.

Prerequisites: MBioS 301 or MBioS 303 or CPT S 355

Instructors: John Wyrick, Ping Ye

Guest Instructors: Mark Lange and Robert Morris

Teaching Assistant: McKenna Kyriss

Contact information: John Wyrick: BLS 241, jwyrick@wsu.edu
Ping Ye: BLS 431, pye@wsu.edu
Mark Lange: Clark 341, lange-m@wsu.edu

Scheduled class periods:

Lecture: Tu,Th 4:15 - 5:05 pm in Abelson 201

Computer Lab: Th 5:00 - 8:00 pm in Abelson 228 and 229

Text: None

Course website: http://www.bioinformatics.wsu.edu/bioinfo_course/index.htm

Grading:

- Lab assignments (10% for undergraduates, 5% for graduate students).
- Three exams (30% each for undergraduates, 25% each for graduate students).
- Written analysis of assigned bioinformatics research article (20%, graduate students only).

Plagiarism and Cheating: The writing assignment you prepare should be entirely your own work. If you wish to use written material from another source (either published or unpublished), then the words should be quoted and a reference provided to the source. Anyone caught plagiarizing or cheating on an exam will receive a failing grade for the course.

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, please visit the Disability Resource Center (DRC). All accommodations MUST be approved through the DRC (Washington 217). Please stop by or call 509-335-3417 to make an appointment with a disability specialist.

Outline:

Week 1 (Aug 25, 27)

Instructor: John Wyrick

§ Overview and expectations

§ Introduction to DNA, genes, and genomes

NO LAB

Week 2 (Sept 1, 3)

Instructor: John Wyrick

§ Algorithms and programming languages

LAB 1: Writing a simple Perl program

Week 3 (Sept 8, 10)

Instructor: John Wyrick and Ping Ye

§ Sequence alignment I

- Pair-wise Alignment Methods
- BLAST

LAB 2: Sequence Alignment and BLAST

Week 4 (Sept 15, 17)

Instructor: John Wyrick

§ Sequence alignment II

- Multiple Sequence Alignment
- Motif searching

LAB 3: Multiple Sequence Alignment, Motifs, and Patterns

Week 5 (Sept 22, 24)

Instructor: John Wyrick

§ Biological databases

§ Sequence motif applications and databases

LAB 4: Learning about Databases

Week 6 (Sept 29, Oct 1)

Instructor: John Wyrick

§ **Exam 1 (Sept 29)**

§ Lecture on Statistics (Oct 1)

NO LAB

Week 7: (Oct 6, 8)

Instructor: John Wyrick and Robert Morris

§ Phylogenetics

§ Introduction to DNA microarray & high-throughput sequencing

LAB 5: Building Phylogenetics Trees

Week 8: (Oct 13, 15)

Instructor: John Wyrick

§ Microarray data analysis
§ High-throughput sequencing data analysis
LAB 6: Microarray data analysis I

Week 9 (Oct 20, 22)

Instructor: Ping Ye

§ Data mining and analysis methods

- Clustering algorithms
- Data Visualization

LAB 7: Microarray Analysis II

Week 10 (Oct 27, 29)

Instructor: Ping Ye

§ Microarray data analysis

§ Exam 2 (Oct 29)

NO LAB

Week 11 (Nov 3, 5)

Instructor: Ping Ye

§ Introduction to protein sequence and structure

§ Protein sequence analysis

LAB 8: Protein structure prediction

Week 12 (Nov 10, 12)

Instructor: Ping Ye

§ Predicting affects of mutations on protein function

LAB 9: Analysis of protein SNPs

Week 13 (Nov 17, 19)

Instructor: Ping Ye

§ High-throughput technology and network biology

- Technology and applications
- Principles of network biology

LAB 10: Network analysis

Week 14 (Dec 1, 3)

Instructor: Mark Lange

§ Systems biology and metabolomics

- Biology networks and pathways
- Metabolomics

LAB 11: Systems Biology modeling

Week 15 (Dec 8, 10)

Instructor: Ping Ye

§ Introduction to mathematical modeling

NO LAB

Week 16 Final Exam (Thursday, Dec 17 from 3:10-5:10 pm)