

BIOL 568: Bioinformatics Programming Computational Analysis for Biologists

FALL 2009

Instructor: [Scott Kelley](mailto:skelley@sciences.sdsu.edu) ; Office Hours *by Appointment* ; email: skelley@sciences.sdsu.edu
Day/Time/Location/Credits: **Monday and Wednesday; 2 – 4:20 PM; LS126; 3 Credits**

Grading:

- 32% - Labs, Homework, and Quizzes (on Reading – prepare for class)
- 12% - Lab Practicals
- 28% - Midterm
- 14% - Python Exam
- 14% - Final Project

Computational resources **limit enrollment to number of available computers.**
ASSIGNMENTS EMAIL: biol568sdsu@gmail.com

LS-126 Open Hours: Check whiteboard in class.

Textbooks (2):

- Bioinformatics for Dummies, 2nd Edition
- (Optional) How to Think Like a Computer Scientist: Learning with Python – free online!

Content: The content includes fundamental concepts in Bioinformatics (computational algorithms), working knowledge of Bioinformatics software and resources and practical programming skills.

Learning Objectives: Students will

- Master and apply computational algorithms for biological research
- Use modern biological software applications for analyzing molecular sequence data
- Learn fundamental programming concepts
- Gain basic programming skills useful for analyzing biological data

General Course Overview

This course is designed for biology students who wish to quickly develop practical Bioinformatics skills relevant to biological studies, with an emphasis on biological sequence analysis. This course includes hands-on learning in a lecture/lab format. The first part of each class will include a short lecture (30-45 minutes) on Bioinformatics concepts or programming language basics. The rest of the class will then be spent practicing on the computer. The professor will be available during the lab time to provide additional instruction and help students debug their code during the completion of in-class exercises or class projects. Students will also be encouraged to help one another with concepts and exercises. Instruction methods will include group-learning approaches approximating industrial models, particularly the “Extreme Programming” approach.

State Budget Cuts Cause Faculty Furloughs:

The devastating California state budget cuts prohibit faculty and staff at SDSU from working on two days per month during the 2009/10 academic year.

The faculty furlough prohibits faculty members from teaching, being on campus, doing research, and consulting with students on two days per month. Furlough days are listed on the schedule.

On those days, classes and office hours are cancelled and telephone and e-mail messages will not be answered. *You will still be responsible for material listed in the schedule.*

To avoid faculty and staff furloughs at SDSU in the future, you may want to contact your legislators in Sacramento so that they better understand how cutting the state budget for higher education affects your education and your future.

There will be two parts to the course:

Part 1: Bioinformatics Tools and Concepts

Part 2: Useful Programming skills for biologists

Part 1 of the course will cover *ESSENTIAL TOOLS* for biologists, including:

National Center for Biotechnology Information Resources: Pubmed, BLAST, PSI-BLAST, Entrez, Genomics, Sequence Databases, Sequin

Sequence Manipulation, Sequence Alignments, Phylogenetics: CLUSTAL W, BioEdit, PAUP*, Phylip, Mr. Bayes, Arlequin, Treeview

Modelling Software, Protein & RNA: Protein Explorer, MFOLD RNA structure prediction

Part 2 of the course will cover *USEFUL PROGRAMMING SKILLS* for biologists.

This second part of the course will introduce programming concepts and teach them in the easy-to-learn *Python programming language* used heavily in Bioinformatics.

NO BACKGROUND IN PROGRAMMING NECESSARY!

Assuming no prior programming experience, the course will teach programming skills and tasks handy to biologists in many fields. The focus will be on “parsing” sequence databases, but the course will cover other topics like crunching numbers and searching online databases.

Textbooks (2)

Part 1: Bioinformatics for Dummies, 2nd Edition (BFD)

Part 2: How to Think like a Computer Scientist: Learning with Python (HTCSLP) 2nd Edition – ***FREE BOOK ONLINE!***

See **BLACKBOARD** for instructions on how to **complete and turn in Python Assignments.**

Date		Topic	Reading	Exercise/Project
Aug	31	Course Introduction; Searching Pubmed	BFD Ch.2	BFD Lab1
Sep	2	Nucleotide Sequence Databases	BFD Ch.3	BFD Lab2
	7	HOLIDAY: LABOR DAY		
	9	Protein & Specialized Databases FURLOUGH DAY NO CLASS	BFD Ch.3,4	BFD Lab3
	14	Working with a Single DNA Sequence	BFD Ch.2,5	BFD Lab4
	16	Working with a Single Protein Sequence I	BFD Ch.6	BFD Lab5
	21	Working with a Single Protein Sequence II	BFD Ch.6	BFD Lab6
	23	Similarity Searches on Sequence Database	BFD Ch.7	BFD Lab7
	28	Comparing Two Sequences	BFD Ch.8	BFD Lab8
	30	Building a Multiple Sequence Alignment	BFD Ch.9	BFD Lab9
Oct	5	Working with Protein 3-D Structures	BFD Ch.11	BFD Lab 11
	7	Editing & Publishing Alignments	BFD Ch.10	BFD Lab10
	12	Phylogeny and RNA FURLOUGH DAY NO CLASS	BFD Ch.12	BFD Lab14
	14	Bioedit & Phylogeny		BFD Lab12
	19	Bioedit & Phylogeny		BFD Lab 12
	21	Lab Practical		
	26	Review Session		
	28	MIDTERM		
Nov	2	Variables, Expressions & Statements	HTCSLP 1&2	Python Lab 1
	4	Functions	HTCSLP Ch.3	Python Lab 2
	9	Conditionals, Fruitful Functions	HTCSLP Ch.4,5	Python Labs 1&2 due , Python Lab 3, 4
	11	HOLIDAY: VETERAN'S DAY		
	16	Iteration ("For" Loops)	HTCSLP Ch.7	Python Labs 3&4 due , Python Lab 5
	18	<i>Python Exam</i>		
	23	FURLOUGH DAY NO CLASS		
	25	FURLOUGH DAY NO CLASS		
	30	Lists	HTCSLP Ch.8	Python Lab 8
Dec	2	Dictionaries	HTCSLP Dictionaries!	Python Labs 7&8 due , Python Lab 9
	7	Files	HTCSLP Files and Exceptions!	Python Lab 10 Python Lab 9 due
	9	Object Oriented Programming		
		FINAL PROJECT DUE		

