COURSE SYLLABUS

Bioinformatics for Biologists (BSC 4434)

Fall semester 2018

Class hours: **MW 11-12:15**

Academic Health Center 5 212A/B

Office hours in AHC4-311: **Mon & Wed 12:15-1, Thurs 10:30-1**

Prerequisites: BSC1010, BSC1011, PCB3063

Instructor: Jessica Liberles, Ph.D.

Department of Biological Sciences

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2 Learning Assistants

COURSE DESCRIPTION

Introduction to bioinformatic resources/methods for biologists, including development and implementation of a research project. Accessing, searching, retrieving, and analyzing data, including sequence alignment, phylogenetic analysis, and protein structure prediction.

COURSE OBJECTIVES

In Bioinformatics for Biologists you will learn the theory behind fundamental bioinformatics methods, while identifying how to strategically apply these applications. Thus, this course has one theoretical part and one applied part each week. Project based learning will be frequently used.

At the end of the course, you will be able to:

- Use bioinformatics tools to study biology
- Recognize how to correctly apply bioinformatics tools to different situations
- Describe common bioinformatics algorithms
- Determine which combination of data and bioinformatics algorithm is appropriate to address a certain biological question
- Identify the characteristics and limitations of bioinformatics tools to critically analyze the results obtained
- Interpret the results of bioinformatics analyses in a biological context
- Be familiar with peer-review and the importance of reproducible research
- Navigate the command-line interface with basic proficiency

Students will be assigned a group project. For the project, groups of 3-4 students will form a research team and together investigate an assigned specific question using bioinformatics methodology. The project is written up as a research paper and will be peer-reviewed. More details will be provided during the semester.

COURSE OUTLINE

This course has two parts. Part I includes the first 8 weeks and part II includes the last 7 weeks.

Part I – Learn to do Bioinformatics
The first part of the class will be at high pace and based on lectures, modules, activities, and the textbook. The high pace is needed to build a foundation necessary for doing any type of bioinformatics.

This course follows a "flipped" instructional model, in the sense that lectures and other material for Part I will be presented in 7 online Modules. Students are expected to study these modules before coming to the first class of each week (typically Mondays). During class, we will use the materials from the modules to actively work on bioinformatics questions individually and in groups. The class also includes interactive lectures based on the modules and the activities. Importantly, these lectures will integrate the results of the activities in a greater bioinformatics and biological context.

Part II – Do Bioinformatics to Learn
The second part of the course is a research simulation. Based on a survey of research interests and career goals during Part I, you will be placed into groups. Each group will be assigned a research project and each person in the group will have a specific objective to complete. The group project can only be completed if the group collaborates to integrate the different objectives and together writes a research paper that presents, analyzes, and discusses the project and its results.
Peer-review and the reproducibility of research results are two crucial components for the advancement of science through publication. You will perform a peer-review of another group's paper while your paper is being reviewed as well.

REQUIRED

USB MEMORY: For storing data generated to be used again in class.

TEXTBOOK: BIOINFORMATICS AND FUNCTIONAL GENOMICS, 3rd edition
Author: Jonathan Pevsner ISBN-13: 978-1118581780
Publication Date: October 26, 2015 Publisher: Wiley-Blackwell

RECOMMENDED

LAPTOP or MACBOOK to bring to class

GRADING

PART I

7 Quizzes (6 best count)	180p
Activity participation	120p
Applied test 1	100p
Theory test 1	100p
Total Part I	**500p**

PART II

Project draft 1 & 2	50p
Project peer-review	50p
Project paper final	150p
Applied test 2	100p
Final exam	150p
Total Part II	**500p**
FINAL TOTAL (Part I + Part II)	**1000p**

GRADE SCALE

Grade	Points Per Credit Hour	Tentative point scale
A	4.00	>925
A-	3.67	>895-925
B+	3.33	>865-895
B	3.00	>825-865
B-	2.67	>795-825
C+	2.33	>765-795
C	2.00	>695-765
D	1.00	>595-695
F	0.00	<595

NOTE: The tentative point scale shows the optimal scenario. It is not absolute but serves as a guide. The point scale may need to be adjusted based on difficulty levels of quizzes and tests.

TENTATIVE SCHEDULE

	Week	Dates	Focus	Online module to be completed before Monday of the given week
Part I	1	Aug 20 Aug 22	Introduction Basic Molecular Biology Basic Bioinformatics	
	2	Aug 27 – Q Aug 29	Genomes Database Sequence alignments & BLAST	Week 2
	3	Sept 3 – NC Sept 5 – Q	Finding and retrieving sequence information Bash/command line	Week 3
	4	Sept 10 – Q Sept 12	Assembling a Dataset Phylogenetic trees	Week 4
	5	Sept 17 – Q Sept 19	Tree analysis	Week 5
	6	Sept 24 – Q Sept 26	Proteins: domains and structure Protein modeling 1	Week 6
	7	Oct 1 – Q Oct 3	Proteins: domains and function Protein modeling 2 Structure predictions	Week 7
	8	Oct 8 – Q Oct 10	Prediction of disease causing SNPs Pathways & interactions Pathways, regulation, interactions	Week 8
	9	Oct 15 Oct 17	**Theory test** **Applied test 1**	
Part II	10	Oct 22 Oct 24	**Project launch** Project	Project related literature/videos + Textbook sections announced in class Project update: Are all group members working towards a clear goal? Draft 1: For within group feedback on each section including reproducibility. Also feedback from instructor. Draft 2:
	11	Oct 29 Oct 31	**Project update** Project	
	12	Nov 5 Nov 7	**Draft 1** due at 11:59PM Project	
	13	Nov 12 – NC Nov 14	 **Draft 2** due at **7:00 AM (before class)** & **Peer-review 1** performed in class and due at end of class	

	14	Nov 19	**Peer review** feedback given in class in class.	For feedback from another group including reproducibility. Also feedback from instructor. Peer review: is the writing sound, does the protocol work, anything missing or unclear? Rubric provided. Project revision: Improve based on the peer review.
		Nov 21	Project	
	15	Nov 26	**Applied test 2**	
		Nov 28	**Project due at the beginning of class**	
FINALS WEEK Dec 3-8				

Green means quiz or something is due Yellow means test or exam NC means no class – holiday

Days marked **Q** will have a quiz based on the online material due that day plus, the previous week's in-class activities. The quiz with the lowest grade will not count towards the final grade.

ABOUT THE CLASS

1. ***Be prepared and attend every class*** – familiarize yourself with the material prior to class and study it after class. *Attendance is mandatory!*
2. ***Missed exams, tests, deadlines*** – if you miss an exam, a test, or a deadline you must provide proper documentation in order to take the exam/test at a different time or to get an extended project deadline. If an exam falls on a religious holiday that you observe, let the instructor know during the first two weeks of class and the exam date will be changed.
3. ***Focus***! – in the computer lab, we are doing bioinformatics and web searches must be appropriate to the topic. Phones are kept silent and out of sight (this is the default – if your specific situation necessitates incoming phone access during class, let the instructor know).
4. You are expected to know the relevant parts of the **FIU student Handbook** that apply to you (undergraduate or graduate) and oblige in appropriate behavior.
5. ***Early Alert*** – in an effort to help you succeed in your academic courses, FIU utilizes an Early Alert system. Instructors are now able to notify students' academic advisors if there are concerns about class performance. If an alert is submitted, your academic advisor will send you a message via your Student Dashboard (accessed via your MYFIU page) to discuss ways to improve your performance. Please respond to any communication you receive from your academic advisor about an early alert. Our goal with this program is to help you to be successful by identifying any issues as early on as possible and working to address them.

Syllabus is subject to change at the discretion of the Professor