

COURSE SYLLABUS

Bioinformatics for Biologists (BSC 4434)

Fall semester 2019

Instructor: Jessica Liberles, Ph.D., Department of Biological Sciences

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Class hours: T/Th 12:30-1:45

Classroom: Academic Health Center 5 212A/B

Office hours (held in AHC4-311, use the phone by the elevators to call the instructor's office)

Mon 10-12 & Tues 10-12

Prerequisites: BSC1010, BSC1011, PCB3063

2 Learning Assistants & 4 Writing 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.

REQUIRED

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

TEXTBOOK: BIOINFORMATICS AND FUNCTIONAL GENOMICS, 3rd edition

Author: Jonathan Pevsner • ISBN-13: 978-1118581780 • Year: 2015 • Publisher: Wiley-Blackwell

RECOMMENDED

LAPTOP or MACBOOK to bring to class

COURSE OUTLINE

Part I – Learn to do Bioinformatics (7.5 weeks)

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 8 online Modules. Students are expected to study these modules before coming to the first class of each week. 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.

A typical week in class:

Tuesday

10-15 min: quiz or follow-up on written assignments, straighten out potential question marks and add clarity to muddy points.

20-30 min: lecture and introduction to activities

20-50 min: activities on your own, in pairs, by group

5 min: Q&A as a class

Thursday

5-10 min: Clarifications and Q&A

10-50 min: work on activities on your own, in pairs, by group

10-20 min: Go over activities as a class

2 min: muddy points

The instructor, LAs, and WAs will be assisting with activities, providing demos, and discussion in the smaller groups during activity time. Every student must do their own work but working in parallel with another student is recommended.

The grading components for Part I consist of

- 3 Bi-weekly summaries – summarize what you have learned and the activities from the previous week, prompt provided (typed about 1 page, Arial 11). These are Pass/Fail.
Pass on first attempt 40p
Pass on second attempt 30p
- 3 Quizzes
- Muddy points – at the end of class, write down what is unclear including any questions you have
- Applied test 1 – online test, multiple choice
- Theory test 1 – written theory test (multiple choice, short answer, essay questions)
- Attendance is mandatory

Part II – Do Bioinformatics to Learn (7.5 weeks)

The second part of the course is a research simulation. For Fall 2019, the class will work on select projects in cancer genomics. 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. The LAs will help with the research and figures. The Writing Assistants that will help improve your written paper.

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.

The grading components of Part II consist of

- Project draft 1 – a rough draft
- Project draft 2 – a complete draft
- Project peer review – review another groups paper and have your paper reviewed by another group
- Consult with a WA – Group consult with a Writing Assistant to improve the paper outside of class
- Consult with a LA – Group consult with a Learning Assistant to improve the paper outside of class
- Final project paper
- Elevator pitch for your research project (as an individual)
- Final exam – written test that covers all material from class (multiple choice, short answer, essay questions)

GRADING

PART I

3 Bi-weekly written assignments (P/F)	120p
Muddy points (random)	20p
3 Quizzes	90p
Applied test	100p
Theory test	100p
Attendance	70p
Total Part I	500p

PART II

Project draft 1 & 2	50p
Project peer-review	50p
Group consult with a WA	50p
Group consult with a LA	50p
Project paper final	140p
Project elevator pitch	10p
Final exam	150p
Total Part II	500p
FINAL TOTAL (Part I + Part II)	1000p

Attendance is mandatory. Muddy points are randomly distributed. Extra credit opportunities are given in class.

GRADE SCALE

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.

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

TENTATIVE SCHEDULE

	Week	Dates	Focus	To read by Tuesday	Online module to be completed before Tuesday of the given week
Part I	1	Aug 27 Aug 29	Introduction Molecular Biology Basic Bioinformatics	Chap 1	Watch Module 1a online lectures before Thursday and read syllabus WA1 due Sept 1 at 11:59 PM, mv to Sept 15
	2	Sept 3 Sept 5	Sequence alignments Databases/BLAST	Chap 2, pg 19-41	Module 1b & 2
	3	Sept 10 – Q Sept 12	BLAST Bash/command line	Chap 4	Module 3 WA2 due Sept 15 at 11:59 PM, mv to Sept 22
	4	Sept 17 Sept 19	Bash/command line Assembling a Dataset Multiple Sequence Alignments	Chap 6, pg 205-222	Module 4
	5	Sept 24 – Q Sept 26	Phylogenetic trees Tree analysis	Chap 7	Module 5 WA3 due Sept 29 at 11:59 PM
	6	Oct 1 Oct 3	Protein domains and structure Protein modeling	Chap 6, pg 222-235 Chap 12, pg 551-575	Module 6
	7	Oct 8 – Q Oct 10	Pathways & interactions Review Theory test	Chap 14, pg 670-685	
	8	Oct 15 Oct 17	Applied test 1 Project launch		
	9	Oct 22 Oct 24	Structure predictions Project Prediction of pathogenic SNPs Project		Project related literature/videos + Textbook sections announced in class Project update (in class): Are all group members working towards a clear goal? Draft 1 due 11:59 PM on Sunday Nov 3
Part II	10	Oct 29 Oct 31	Project Project		
	11	Nov 5 Nov 7	Project – Think Tank Project		Draft 1: For within group feedback on each section including reproducibility. Also feedback from instructor, LAs, and WAs.
	12	Nov 12 Nov 14	Draft 1 feedback Project Project		Draft 2: For feedback from another group including reproducibility. Also feedback from instructor, LAs, and WAs.
	13	Nov 19 Nov 21	Dr. McCartney visits Draft 2 due at midnight Peer-review 1 performed in class and due at end of class		Peer review: is the writing sound, does the protocol work, anything missing or unclear? Rubric provided.
	14	Nov 26 Nov 28	Draft 2 and Peer review feedback, revisions No Class Thanksgiving		
	15	Dec 3 Dec 5	Project revision Project due at the beginning of class ELEVATOR PITCH		
**** FINALS WEEK Dec 9-14 ****					



Green means quiz or that something is due



Yellow means test or exam



Reminder to submit the weekly writing assignment due by 11:59 PM every other **Sunday** for Part I.

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. ***Accommodations*** - If you need any accommodations, please talk to the instructor as as soon as possible.
5. 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.
6. ***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****