COURSE SYLLABUS

Bioinformatics for Biologists (BSC 4434)

Spring semester 2023

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

Email: jliberle@fiu.edu

Class hours: M/W 5-6:15PM

Office hours: M/W 6:15-7PM in the classroom and Tu 12-2:30 PM on Zoom (link in Canvas)

Prerequisites: BSC1010, BSC1011, PCB3063

Cross-listed with BSC 5459 (Advanced Bioinformatics for Biologists) for graduate students

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, protein structure prediction, and more.

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

Students will be assigned a group project. For the project, groups of 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

TEXTBOOK: Bioinformatics, 4th Edition
Andreas D. Baxevanis (Editor), Gary D. Bader (Editor), David S. Wishart (Editor)
ISBN: 978-1-119-33558-0 May 2020 656 Pages

Computer access at home and preferably able to bring laptop or Macbook to class

COURSE OUTLINE

Part I – Learn to do Bioinformatics (7 weeks)

The first part of the class will be at high pace and based on lectures, activities, and the textbook. The high pace is needed to build a foundation necessary for doing any type of bioinformatics research for part II.

This course follows a "semi-flipped" instructional model, in the sense that some lectures and other material for Part I will be presented in online Modules. Students are expected to study these modules before coming to class as specified in the schedule below.

During class, we will use the materials from the modules to actively work on bioinformatics activities. The activities are designed to have a mix of tasks to be done individual and in a group of 4. The class also includes interactive lectures to complement the modules and the activities. These lectures will integrate the results of the activities in a greater bioinformatics and biological context.

The activities will be completed during class and checked for a completion grade.

Grading components (Part I)

- 5 Quizzes in Wednesday's class
- Applied test 1 – online test, multiple choice
- Theory test 1 – written theory test (multiple choice, short answer, essay questions)
- Module completion

Part II – Do Bioinformatics to Learn (7 weeks + Finals week)

The second part of the course is a research simulation. New groups will be formed. 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. Research is a team sport and team player point are part of the grade. These include e.g., attendance, contributing, communication, and meeting deadlines as agreed.

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 by another group.

Grading components (Part II)

- Project draft 1 – a rough draft
- Project draft 2 – a complete draft
- Project peer review
- Final project research paper
- Team player points
- Applied test 2
- Final exam

GRADING

PART I

Modules	6 x 20p
Weekly quizzes	5 x 30p
Applied test 1	100p
Theory test	100p
Total Part I	**470p**

PART II

Project draft 1	40p
Project draft 2	70p
Project peer-review	50p
Project paper final	150p
Applied test 2	100p
Final exam	100p
Team player	20p
Total Part II	**530p**
FINAL TOTAL (Part I + Part II)	**1000p**

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

SYLLABUS HONESTY STATEMENT

FIU defines academic misconduct in the Student Conduct and Honor Code (Code) as, “any act or omission by a Student, which violates the concept of academic integrity and undermines the academic mission of the University in violation of the Code.” Code violations include, but are not limited to: academic dishonesty, bribery, cheating, commercial use, complicity, falsification, and plagiarism. The Code is available here: https://studentaffairs.fiu.edu/get-support/student-conduct-and-academic-integrity/student-conduct-and-honor-code/index.php

STUDENTS WITH DISABILITIES STATEMENT

The Disability Resource Center collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The DRC provides FIU students with disabilities the necessary support to successfully complete their education and participate in activities available to all students. Students that have a diagnosed disability and plan to utilize academic accommodations are asked to please contact the Center at 305-348-3532 or visit the DRC, located at the Graham Center GC 190. Students are required to contact their instructor regarding their accommodations so the proper arrangements with the DRC office can be made (preferably during the first week of lab). Official written documentation from the DRC office must be provided to your instructor.

LIBRARY

The library provides access to literature and Web of Science, a large database of peer reviewed literature with a great search feature. It may also have laptops for rent.

MAKE-UP POLICY

While attendance is not mandatory, if you miss class, you will miss a learning opportunity. If you have an excused absence, let your instructor know as soon as possible. Remember, if you fail the P3 app you must forward the email to your instructor for the absence to be excused.

For unexcused absences:

- Catch up on the study material on the class website and read the recommended parts of the textbook. Reach out to the instructor if you have any questions or need assistance.
- If you miss ONE in-class activity without an excused absence, it must be completed and emailed to the instructor before the following class or it will result in Zero points. If you miss TWO in-class activities, contact your instructor.
- If you miss a quiz or a test without an excused absence, you will get Zero points.
- Team player points will be affected by missed classes.

For excused absences:

- Catch up on the study material on the class website and read the recommended parts of the textbook. Reach out to the instructor if you have any questions.
- Missed in-class activities: Review the activity guides and complete the activities. Reach out to your instructor and LAs for assistance during office hours or to schedule an appointment. When you have completed the activity, e-mail it to your instructor.
- Missed quizzes and tests: Contact your instructor to schedule a make-up quiz or test.
- For long-term or multiple excused absences, an individual project will be accommodated instead of the group project. Contact your instructor.

TENTATIVE SCHEDULE

	Week	Dates	Focus	Online module
Part I	1	Jan 9 Jan 11	Introduction Databases	Module 1
	2	Jan 16 *holiday* Jan 18 Quiz 1	BLAST @NCBI	Module 2
	3	Jan 23 Jan 25 Quiz 2	BLAST command-line Multiple Sequence Alignments	Module 3
	4	Jan 30 Feb 1 Quiz 3	Phylogenetic trees Tree analysis	Module 4
	5	Feb 6 Feb 8 Quiz 4	Protein domains and structure Structural analysis	Module 5
	6	Feb 13 Feb 15 Quiz 5	Protein modeling Protein predictions	Module 6
	7	Feb 20 Feb 22	**Theory test** **Applied test 1**	
Part II	8	Mar 6 Mar 8	**Project launch** Project: Introduction	
	9	Mar 13 Mar 15	Project: Phylogenetics Project: Prediction and analysis in Spyder ClinVar	**Draft 1 due 11:59PM on Mar 17.**
	10	Mar 20 Mar 22	Project: SQLite, sql queries Project: Statistical hypothesis testing with Spyder, PolyPhen-2 accuracy	
	11	Mar 27 Mar 39	Project: AlphaFold, cBioPortal Project: Figures and narrative	
	12	Apr 3 Apr 5	Project Draft 2: writing Project Peer review	**Draft 2 due 11:59PM on Apr 3.** Draft 2: For feedback from another group including reproducibility. Also feedback from instructor and LAs. Peer review: is the writing sound, does the protocol work, anything missing or unclear? Rubric provided.
	13	Apr 10 Apr 12	Project: Revision Project: Revision/applied review	
	14	Apr 17 Apr 19	**Applied test 2** Project deadline (in class)	**Final paper due in class on April 19.**
	Finals week	TDB	**Final exam**	

Quiz

Deadline

Test

Syllabus is subject to change at the discretion of the Professor