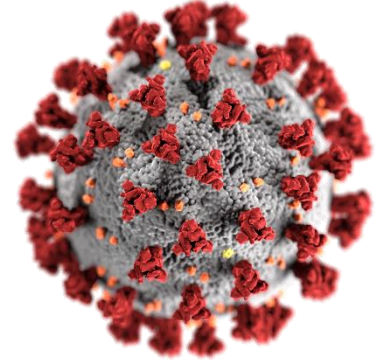


Computational Biology Lab of Emerging Infectious Disease



Course Syllabus for BSC 4450L Fall 2023

Laboratory time: U01 U03 Friday 9-11:50 AM
Laboratory time: U02 U04 Friday 1-3:50 PM
Laboratory location: AHC5-212

Faculty contact: Dr. Liberles

Email: jliberle@fiu.edu

Office hours: Wednesday 4-6 PM or by appointment (request by email)

Office hour location:

<https://fiu.zoom.us/j/9070428214?pwd=dGtWOFB1Tk1HdmdPTzRtQzJRNmZtQT09>

Teaching assistant 1: Ernesto Marin

Email: emari048@fiu.edu

Office Hours: Thursday 9-11AM

Office hour location: <https://fiu.zoom.us/j/5948107341>

Teaching assistant 2: Hiram “Brady” Duarte

Email: hduar008@fiu.edu

Office Hours: Monday 9-11AM

Office hour location: <https://fiu.zoom.us/j/2750459578>

Note: This lab course takes place in an active learning classroom (not a lab).

Pre-requisites: Genetics (PCB3063) OR General Biochemistry (BCH3033).

Important Information

Before starting this course, please review the following pages:

- [Accessibility and Accommodation](#)
- [Academic Misconduct Statement](#)

*The professor reserves the right to change or modify the syllabus at any time during the semester.

The course curriculum

COVID-19 is caused by a coronavirus that emerged about in 2019. This virus has crossed the species barrier and is effectively spreading through human-to-human transmission.

Coronaviruses are not foreign to our immune system and most human infections caused by coronaviruses are mild. Two other coronaviruses, SARS-CoV and MERS-CoV, have also crossed the species barrier, spread by human-to-human transmission, and caused recent outbreaks with high mortality. The SARS-CoV outbreak in 2002-2003 resulted in about 8,000 cases with a mortality rate of 10%. The MERS-CoV outbreak began in 2012 and is ongoing, but currently geographically limited to the Middle East. So far, the MERS-CoV outbreak has resulted in >2,500 cases with a mortality rate of ~35%. SARS-CoV-2, the cause of the COVID-19 pandemic, is the most infectious among these coronaviruses. By the start of this semester, SARS-CoV-2 has caused over 765 million known COVID-19 infections with a global death toll approaching 7 million humans. As on May 5, 2023 the World Health Organization no longer considers COVID-19 a “public health emergency of international concern.”

Researchers across the globe have developed vaccines for COVID-19 and today, we also have antiviral therapies available. However, novel mutations are part of the process of evolution, and new variants, like the Delta and Omicron variants, are cause for concern. Not only may the variants spread faster, the protection from the developed vaccines, previous infection, and antivirals may be affected. Thus, ***your mission for this class is to investigate how proteins in SARS-CoV-2 and the other coronaviruses are evolving and to use an evolutionary study to propose drug and vaccine targets that will work for SARS-CoV-2, its current and future variants, as well as for other coronaviruses.***

Course goals

In this research-based lab, we are going to investigate SARS-CoV-2 in an evolutionary context and analyze where the different SARS-CoV-2 proteins mutations in the variants are located and what their functional impact may be. You will use this information to propose broadly neutralizing antiviral drug-targets and vaccine targets.

You will

- Participate in a course-based undergraduate research experience
- Learn about the structure and function of the virus' proteins
- Investigate how SARS-CoV-2 and other coronaviruses and their different proteins have evolved until now and discuss how they may evolve in the future
- Write a research proposal for how to identify a broadly neutralizing antiviral or vaccine target
- Perform your proposed research
- Suggest broadly-neutralizing antiviral and vaccine targets for SARS-CoV-2 and perhaps other coronaviruses
- Make an informed but speculative, argument for why your targets may or may not work based on your results
- Prepare an abstract (if you would like to present it outside of class too this is starting point)
- Prepare and present your research as a poster (can potentially be used for future conference presentations)

Student Learning Objectives

During this course you will gain experiences and skills in:

- How to use basic bioinformatics tools and how to interpret results
- Where to find sequence and protein structure data and relevant peer-reviewed literature.
- How to make an integrative protein family analysis encompassing molecular evolution, structural biology, and biochemistry.

- How to perform simple hypothesis testing and box plotting in Spyder using pre-written Python scripts and how to analyze the results
- How the research process works
- How to make a poster
- Soft skills such as communication, teamwork, and time management

Lab Routine

Phase 1:

You will work on mastering basic bioinformatics tool and applications while as a class building a knowledge base of virus information. Before each lab, you will review information about the bioinformatics tools of the day and about the virus biology that you will work on. There will be a quiz and a discussion of this material at the beginning of lab, followed by an introduction to the lab modules. During the time devoted to lab modules, you will work independently but in groups on completing various modules that will result in different types of data. You will analyze your data and compile it in a summarized form in your lab course specific database. Your database entry includes a brief description of how your data was generated. Each group will complete a slightly different assignment so together the class will generate data quickly. Each class meeting will include giving a brief summary of main findings from the previous class followed by an interactive discussion.

Phase 2:

You will work in a group of 3-4 students. The data in the class database can be used as inspiration or as preliminary data for your group's research project. Each group will keep an electronic lab notebook that will be checked by the TA. As a group, you will propose and execute a research project including making a poster and presenting it in class. During the lab, each group will provide an update, followed by a class discussion (including brainstorming as needed), you will work on your project with your group, you will participate in discussions about your research, and you may need to work on problem solving for your group or for someone else. Part of your grade is for being a good team player and this means both within your group and with the class as a whole.

Grading Policy, Assignments & Assessments

Each phase of the course contributes to the final grade in the proportions shown in the table:

| <u>Phase 1</u> | | <u>Phase 2</u> | |
|--------------------------|------|--|--------------|
| Database entries (5x20) | 100p | Electronic Lab notebook | 50p |
| Written summaries (5x20) | 100p | Abstract (2x25) | 50p |
| Quizzes (4x20) | 80p | Introduction | 25p |
| Discussion in lab | 50p | Results & conclusion | 25p |
| Ready4Lab (4x10) | 40p | Poster recording 5-10 min | 70p |
| Presentation | 50p | Poster live 5-10 min presentation in class | 70p |
| Research proposal | 50p | Poster | 90p |
| | | Being a good team player (5x10) | 50p |
| | | Final exam | 100p |
| | | Total (Phase 1+ Phase 2) | 1000p |

Grade Scale

| | | |
|----|--|---------------|
| A | | 90-100% |
| B+ | | 88-89.9% |
| B | | 80-87.9% |
| C+ | | 78-79.9% |
| C | | 70-77.9% |
| D | | 60-69.9% |
| F | | Less than 60% |

General Policies

- Come prepared to lab, it will be more fun for everyone!
- Be a good team player!
- Database entries are due at the end of lab and summaries are due 11:59PM on the day of the lab. Late entries are penalized 20% for day 1, 40% for day 2, 60% for day 3. Late submissions will not be accepted after the next lab has started.
- If you miss a lab session without a valid reason, your team player points will be affected.
- Missing a lab session means that you will work on making up that section outside of class before the next class and only limited support may be available outside of office hours.
- Quizzes are given at the beginning of lab and then discussed. Makeup quizzes are provided only if the quiz was missed due to a valid reason. Thus, make sure to be on time.
- Some work will need to be done outside of lab hours.
- Cheating is not tolerated! Students who cheat or plagiarize from someone else or an internet or other source will be reported for misconduct.
- See also Make-up policy below

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.

Required Course Materials

- Laptop connected to the internet. Most bioinformatics tools will be available online, but a few must be downloaded and installed on your computer. **A limited number of laptops are available for in class use.**
- Ready4Lab – Preparatory material for each lab will be posted on Canvas. This material must be studied in preparation for the quiz/discussion for part 1. An online Ready4Lab quiz in Canvas will count towards your grade. You have 3 attempts to complete the Ready4Lab quiz.
- For the research project, reading material may be specific to each group or it may be shared. It will depend on the direction of your research projects. This material should be referenced on your poster.

Make-up policy

This is a lab course and attendance is mandatory. If you have an excused absence, let your instructor know as soon as possible.

For unexcused absences:

- Catch up on the study material and complete missed activities. Each lab builds on previous labs so you need to complete all lab activities. Reach out to the instructor if you have any questions or need assistance.
- If you miss ONE lab without an excused absence, it must be completed and emailed to the instructor before the following lab or it will result in Zero points for all activities that day. Late entries are penalized 20% for day 1, 40% for day 2, 60% for day 3. Late submissions will not be accepted after the next lab has started. If you miss TWO labs, 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 unexcused absences.

For excused absences:

- Catch up on the study material and complete missed activities. Each lab builds on previous labs so you need to complete all lab activities. Reach out to the instructor if you have any questions or need assistance.
- Missed lab activities: Review the activity guides and complete the activities. Reach out to your instructor 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 may be accommodated instead of the group project. Contact your instructor.

Tentative schedule for Fall 2023

| Day | Date | Lab focus |
|------|-------|---|
| 1 | 9/1 | Introduction & Databases <i>Computer setup</i> |
| 2 Q | 9/8 | BLAST <i>Methods & Computer literacy</i> |
| 3 Q | 9/15 | MSA, tree building & analysis <i>Visualizing and Analyzing Science</i> |
| 4 Q | 9/22 | Protein structure & evolution <i>Visualizing protein structure & Integrating structure, sequence and evolution</i> |
| 5 Q | 9/29 | Data analysis & hypothesis testing Presentation assembly Project introduction |
| 6 P | 10/6 | Presentations Project proposal |
| 7 | 10/13 | Project start Data collection <i>How to write an introduction</i> |
| 8 | 10/20 | Project updates Data collection Data/hypothesis testing Analyzing results <i>How to present the results & how to draw conclusions from your research data</i> |
| 9 | 10/27 | Project updates Data collection Data/hypothesis testing Analyzing results <i>How to write an abstract I</i> |
| 10 | 11/3 | Wrap up <i>How to write an abstract II</i> |
| | 11/10 | Holiday |
| 11 | 11/17 | Making posters <i>How to make a poster</i> |
| | 11/24 | Thanksgiving break |
| 12 P | 12/1 | Poster presentations |
| 13 E | 12/8 | Final exam |

Q = Quiz, P = Presentation, E = Exam

Syllabus is subject to change at the discretion of the professor