THE OHIO STATE UNIVERSITY

SYLLABUS

College of Medicine

Department of Biomedical Informatics / BMI 5730

Introduction to Bioinformatics

Spring 2023

Instructor: Amy Hite, Ph.D.

Email address: amy.hite@osumc.edu

Office hours:

Zoom meeting is scheduled every Tuesday 9:30-10:30 or upon request.

Meeting ID: 912 0124 3101

Passcode: **233615**

Link: https://osu.zoom.us/j/91201243101?pwd=OU5hVS9oY3dJQXFYTkNjdHhLVEtqdz09

Class Meeting Schedule:

This is an asynchronous online course and there is no regular meeting time.

Course Policies:

All College and Program course policies apply to this course.

Course Description:

This course introduces students to basic topics of bioinformatics, including sequence analyses, genomics, transcriptomics, proteomics, and associated databases. This course is designed to introduce future biologists and physicians to bioinformatics database searching, tools usage and result evaluation. Upon completion of the course, students should be more comfortable working with the vast amounts of genomics, proteomics, and biomedical data and bioinformatics tools that will be relevant to their work in the coming decades. Familiarity or background in molecular biology and computer science is recommended.

Prerequisites:

While there are no strict requirements, a successful student should have basic knowledge of computer science principles, statistical analysis methods and molecular biology. Review sessions for statistical analysis methods and molecular biology will be provided in class.

Course Learning Outcomes:

The goal of this course is to introduce trainees to the basic definitions, theories, database and tools that serve as the foundations for the sub discipline of Biomedical Informatics known as bioinformatics.

Upon completion of this course, students will be familiar with core concepts of bioinformatics and have:

1. An appreciation for different scales of biological data, in particular their origin, derivation, and utility;
2. An understanding of the contributing theoretical frameworks that underlie modern bioinformatics analysis of these biological datasets; and
3. Critical evaluation skills that allow for the analysis and application of informatics interventions informed by items (1) and (2) to address real-world biological and clinical problems.

HOW THIS ONLINE COURSE WORKS

Mode of delivery: This class is taught online. Guest lecturers will be brought into the class as content experts to demonstrate various aspects of the clinical and translational research informatics scientific domain.

Pace of online activities: This course is divided into **weekly modules** that are released one week ahead of time. Students are expected to keep pace with weekly or biweekly deadlines but may schedule their efforts freely within that time frame.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Attendance and participation requirements: Because this is an online course, your attendance is based on your online activity and participation. The following is a summary of students' expected participation:

- **Participating in online activities for attendance**:
  You are expected to log in to the course in Carmen every week (During most weeks you will probably log in many times). Effective online activities entail providing good answers

to questions or discussions. Effective comments add to our understanding of the underlying conceptual material, challenge, and clarify the ideas expressed by others, integrate material from past class work or other courses, and shows evidence of analysis rather than mere opinion.

- **Office hours and live sessions**: optional
  All live, scheduled events for the course, including our office hours, are optional. Week 15 will be implemented as live sessions but students will have an option to record and upload their presentation videos.
- **Participating in discussion forums**:
  As part of your participation, some weeks you can expect to post in discussion forums on the week's topics.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

Recommended/optional

1) Pevsner, Jonathan. Bioinformatics and Functional Genomics. 3rd. Hoboken, New Jersey: John Wiley & Sons, Inc., 2015.
2) Dr. István Albert. Biostar Handbook, 2018.

Additional readings, as assigned by the week's instructor, may be found on the Carmen site.

Course technology

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)
- Recording a slide presentation with audio narration (go.osu.edu/video-assignment-guide)
- Recording, editing, and uploading video (go.osu.edu/video-assignment-guide)

Required equipment

- Computer: current Mac (MacOs) or PC (Windows 10) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at go.osu.edu/office365help.
- R, free for all (https://www.r-project.org/)

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated

ASSIGNMENT CATEGORY	POINTS
Online Activities/Discussion Questions/Participation	20
Assignments	40
Final Project	40
Total	100

Descriptions of major course assignments

Discussion Questions

Description: Students are required to write two questions that demonstrate understanding of the reading; are relevant and interesting; and are well-written with no spelling, punctuation or grammatical errors. These are to be posted by 5:00 p.m. on Monday of the next week following the lecture/lab.

Academic integrity and collaboration: Your questions and responses should be your own original work.

Assignments / Homework

Description: We have five homework assignments. Each assignments worth 8 points, covers 1~3 lectures/labs.

Academic integrity and collaboration: Getting help on the assignment is permitted. Collaborating, or completing the assignment with others is permitted. Copying or reusing previous work is not permitted. Open-book research for the assignment is permitted and encouraged.

Final Project

Description: Description: For the final project, 2~3 students form a team to perform omics data analysis based on any topics reviewed in class. We will also provide some sample project ideas. Each project should involve (1) one or more datasets (2) analysis of the dataset (3) clinical/biological implications of the analysis.

Academic integrity and collaboration: Getting help on the assignment is permitted. Collaborating, or completing the assignment with others is permitted. Copying or reusing previous work is not permitted. Open-book research for the assignment is permitted and encouraged.

Late assignments

Late submissions will not be accepted. I am usually very flexible in granting accommodations before an assignment is due. I am never flexible in accepting work, or excuses, after the due date has passed. Please refer to Carmen for due dates.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call 614-688-4357 (HELP) at any time if you have a technical problem.)

- **Grading and feedback:** For assignments, you can generally expect feedback within 7 days.
- **Email:** I will reply to emails within 24 hours on days when class is in session at the university**.**
- **Discussion board:** I will check and reply to messages in the discussion boards within 48 hours on school days**.**

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic integrity policy

See **Descriptions of major course assignments**, above, for my specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct,

so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.
If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities.

No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at go.osu.edu/ccsondemand. You can reach an on-call counselor when CCS is closed at 614-292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

SLDS contact information: slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools

Safety and health requirements: All teaching staff and students are required to comply with and stay up to date on all University safety and health guidance, which includes wearing a facemask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses.

COURSE SCHEDULE

Refer to the Carmen course for up-to-date assignment due dates.

Week	Dates	Topics
1	1/9 - 1/13	Introduction to Bioinformatics Molecular biology and central dogma
2	1/16 - 1/20	Bioinformatics databases and tools **Lab 1** – Bioinformatics database at NCBI
3	1/23 - 1/27	Pairwise sequence alignment BLAST sequence alignment
4	1/30 - 2/3	R studio and R **Lab 2** – R programming basics

5	2/6 - 2/10	NGS databases
6	2/13 - 2/17	Using data from NGS databases **Lab 3** – Statistical analysis of NGS data
7	2/20 - 2/24	Generating NGS sequence and assessing QC Introduction to mapping and data formats
8	2/27 - 3/3	Accessing OSC and Unix command line basics **Lab 4** – Introduction to Unix command line
9	3/6 - 3/10	NGS read mapping and variant calling **Lab 5/6** – NGS reads mapping and Variant calling
	3/13 - 3/17	Spring Break
10	3/20 - 3/24	RNA-seq Introduction
11	3/27 - 3/31	**Lab 7** – RNA-seq data analysis
12	4/3 - 4/7	Proteomics and Mass Spec
13	4/10 - 4/14	Proteomics tools **Lab 8** –Hands-on practice with Scaffold -2
14	4/17 - 4/21	**Final Project Due**