# BINF 402 / BIOL 418
# Bioinformatics & Computational Biology II

Spring 2025

School of Systems Biology
George Mason University
Manassas, VA

**Instructor:** Chris Lockhart
**Email:** clockha2@gmu.edu
**Phone:** Microsoft Teams
**Office:** Virtual
**Office Hours:** By appointment ([Microsoft Bookings](Microsoft Bookings))

**Meeting Place:** Online (Zoom)
**Meeting Time:** Mondays, 4:30-7:10pm
**Course Website:** Canvas

**Credits:** 3

## Course Description

Continuation of BINF401 and studies in-depth several algorithms and methods used in bioinformatics and computational biology. Students will learn sequence alignment and assembly algorithms, hidden Markov models, classification and prediction methods, and genome annotation. These techniques will then be applied to current bioinformatics problems. Programming assignments are incorporated in the course program.

**Recommended Prerequisites:** [BINF 401](BINF 401)

## Learning Outcomes

By the end of this course, students will be able to:
1. Perform common bioinformatics analyses using Python
2. Use and discuss next-generation sequencing pipelines
3. Develop clustering & predictive models for bioinformatics datasets, including datasets of biological sequences
4. Implement mathematical modeling frameworks for systems biology

## Course Material

[Hasija, Y. & Chakraborty, R. (2021) Hands on data science for biologists using Python.](#)
Available from GMU library.

## Tentative Course Topics

| Date | Topic |
|------|-------|
| 1/27 | Syllabus & expectations<br>Review of biological principles |
| 2/3 | Introduction to Python<br>***Problem set #1 assigned*** |
| 2/10 | Manipulation of biological sequences |
| 2/17 | Introduction to Biopython<br>***Problem set #1 due*** |
| 2/24 | Manipulation of biological sequences, part 2 |
| 3/3 | ***Midterm exam*** |
| 3/17 | Next-generation sequencing & computational pipelines<br>***Problem set #2 assigned*** |
| 3/24 | Next-generation sequencing data analysis |
| 3/31 | Annotating sequences with Hidden Markov models<br>***Problem set #2 due*** |
| 4/7 | Introduction to machine learning |
| 4/14 | Classification algorithms<br>***Problem set #3 assigned*** |
| 4/21 | Classification with biological sequences |
| 4/28 | Clustering algorithms<br>***Problem set #3 due*** |
| 5/5 | Systems biology & compartmental models |

Each lecture is a 2½ hour presentation with a 10-minute break.

## Course Policies

**Grading scale (points):** A+ (≥97), A (94-96.9), A- (90-93.9), B+ (87-89.9), B (84-86.9), B- (80-83.9), C+ (77-79.9), C (74-76.9), C- (70-73.9), D (60-69.9), F (<60).

**Grading policy:** Students will be graded on participation (10%), problem sets (45%), a midterm exam (20%), and a final project (25%).
- Class participation will be met by attending class and completing weekly in-class quizzes/exercises. To earn a full participation grade, you must be in class to complete at least 10 out of 13 quizzes (no quiz will be administered the week of the midterm exam).

- Problem sets will be equally weighted (15% each) and assigned according to the course schedule on 2/3, 3/17, and 4/14. Problem sets are due two weeks from when they are assigned.
- The midterm exam will be administered on 3/3. This exam will cover material learned to date.
- In place of a final exam, there will be a final project due on the scheduled final exam day (5/15). There will be 3 project topics to choose from. You will submit your Python source code and a written report. A project rubric will be provided.

**Late assignments:** Except for extensions granted due to emergency, illness, quarantine, work-related, or other documented reasons, late problem sets will be penalized by the number of days late, and late problem sets will not be accepted after they are reviewed in class. Late submissions of the final project will not be accepted.

**Course recordings:** All synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Zoom and will only be accessible to students taking this course during this semester.

**Other considerations:** If there are any schedule issues related to religious holidays, please inform me the first week of class.

## Course Logistics

**Content distribution:** The course uses Canvas for distributing lecture materials, submission of homework, and grading. Canvas can be accessed by visiting https://canvas.gmu.edu/ and logging in with your MasonID and password.

**Virtual classroom and office hours:** Zoom will be used for online lectures and office hours. Zoom lecture links will be distributed by the instructor.

**Communication:** I will use Mason email to distribute class updates and communicate with students (see Email section in Student Responsibilities). If you wish, please share your name and gender pronouns with me and how best to address you in class and via email. Communication over email is largely preferred, and I will respond to student emails promptly within 48 hours.

## Course Technology Requirements

**Software and hardware:** This course uses Canvas as a learning management system available at https://canvas.gmu.edu/. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OS X 10.15 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps download speed or higher). Activities and assignments in this course will use web-conferencing software (Zoom). In

addition to the requirements above, students are required to have a device with a functional camera and microphone.

This course also requires students to produce Python code. My recommendation is to download Python3 through the Anaconda distribution (https://www.anaconda.com/). We will discuss installing Python in class.

**Technical help:** If you have difficulty with accessing Canvas, please contact the ITS Support Center at (703) 993-8870 or support@gmu.edu. If you have trouble with using the features in Canvas, email courses@gmu.edu.

## Student Responsibilities

**Email:** Students must use their Mason email account to receive important University information, including communications related to this class. Per University policy, I will not respond to messages sent from or send messages to a non-Mason email address.

**Academic integrity:** The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow always are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me, or consult the Academic Integrity website at https://oai.gmu.edu/.

**Generative AI policy:** Use of generative AI (e.g., ChatGPT) is strongly discouraged. If you use these tools, you must follow the fundamental principles of the Honor Code. This includes being honest about the use of generative AI for submitted work and giving credit through accurate citations.

**Disability accommodations:** Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit http://ds.gmu.edu/ for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with me. Disability Services is in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474.

## Student Services

**University writing center:** Take advantage of the Writing Center as you work on written assignments in this course. You can book a free 45-minute appointment to meet with a tutor on Zoom or to submit a draft for written feedback. Tutors will work with you on any phase of a writing project. They can help you develop your ideas, provide feedback on a draft, answer your questions, and show you strategies for brainstorming, organizing, drafting, revising, and editing. To schedule an appointment, go to writingcenter.gmu.edu, register with the center, and make an appointment using the online scheduler. Watch this short video (https://youtu.be/LA-B0Szoe28) for more detailed guidance on making an appointment and send any questions to wcenter@gmu.edu.

**University Libraries:** University Libraries provides resources for distance learning students (See the Library website: https://library.gmu.edu/for/online).

**Counseling and psychological services:** The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance (See the Counseling and Psychological Services website: https://caps.gmu.edu).

**Family Educational Rights and Privacy Act (FERPA):** The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights (See the Registrar's Office website: registrar.gmu.edu/ferpa/).

## Course Materials and Student Privacy

Video recordings of class meetings that are shared only with the instructors and students officially enrolled in a class do not violate FERPA or any other privacy expectation. Video recordings that only include the instructor (no student names, images, voices, or identifiable texts) may be shared without violating FERPA (but see University Policies: Privacy, for some qualifications and recommendations). All course materials posted to Blackboard or other course site are private to this class; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.

**Video conferencing or recordings:** Video recordings – whether made by instructors or students — of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class. Live video conference meetings (e.g., Zoom) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class.

## Common Course Policies

This course adheres to the common course policies set by George Mason University, which includes polices about Academic Standards, Accommodations for Students with Disabilities, FERPA, and Title IX. These policies are described in more detail at the following link: https://stearnscenter.gmu.edu/home/gmu-common-course-policies/.