

BME6938 – Special Topics: Cancer Systems Biology

BME 6938 Section CSB1 Spring 2025

Day	Periods	Time	Location
Tuesdays	5-6	11:45am – 1:40pm	MAEA 327
Thursdays	6	12:50pm – 1:40pm	BLK 315

Instructor:

Meghan C. Ferrall-Fairbanks, PhD

mferrall.fairbanks@bme.ufl.edu

(352)846-2762

Office Hours: See Canvas for details

Teaching Assistant/Peer Mentor/Supervised Teaching Student – None

Course Description

This graduate-level course in Cancer Systems Biology offers a comprehensive exploration of how omics data analysis and mathematical modeling can elucidate complex cancer processes. Students will develop foundational knowledge in cancer biology and systems biology, acquire translational skills for clinical applications, and cultivate independent, creative problem-solving abilities. Through the use of the NCI-funded Seven Bridges Cancer Genomics Cloud platform, learners will gain hands-on experience analyzing publicly available multi-omics datasets. Emphasizing a cross-disciplinary perspective and collaboration, the course also prepares students for effectively working in teams to prepare them for their futures roles in academia, industry, and government. This is a 3-credit course.

Course Pre-Requisites / Co-Requisites

No formal pre-requisite requirements for this course. Students with a basic knowledge of engineering principles, biology, calculus, and a scientifically inquisitive nature will find themselves well-prepared for the information discussed in this course.

Course Objectives

Through participation in this course, students will:

- Develop a solid understanding of cancer biology and systems biology principles
- Utilize mathematical models and computational tools to enhance understanding of cancer processes
- Analyze biological data using computational methods to derive actionable insights for cancer diagnosis, treatment, and prevention
- Cultivate independent thinking and creativity in addressing open questions in cancer research
- Engage with diverse perspectives and collaborate across disciplines on team projects
- Integrate multi-omics data (genomics, transcriptomics, proteomics) to explore complex cancer mechanisms
- Learn to extract meaningful insights from large-scale datasets and model emergent properties in cancer systems
- Practice summarizing complex omics analyses into multiple modes of professional scientific communication (scientific abstract, poster presentation, oral presentation, and grant applications)

Materials and Supply Fees – None

Required Textbooks and Software

Required Textbooks: No specific textbook is required for this course. Course notes and assigned readings are derived from various published sources and these materials will be distributed through the Canvas course website.

Required Software: Students will learn how to find publicly available omics datasets and analyze using popular omics analysis pipelines in The Seven Bridges Cancer Genomics Cloud (CGC), powered by Velsera and funded by the NCI. This is a flexible cloud platform that enables analysis, storage, and computational of large cancer datasets in a user-friendly portal. More information about this platform is available at: <https://www.cancergenomicscloud.org/>

Recommended Materials

Over the semester, the students and instructor will collectively identify useful resources for the class. Information on these resources will be distributed through the course website on Canvas.

Required Computer

UF student computing requirement: <https://news.it.ufl.edu/education/student-computing-requirements-for-uf/>

Course Schedule

The schedule below is tentative and may change according to needs and circumstances. Any revisions will be announced in class and will be posted on Canvas. Generally, Thursday class periods will focus on more traditional lectures to provide background for the Tuesdays class periods that are a double-block period and will focus more on practical, hands-on problem-solving. Students must bring their laptop/computing device for Tuesday's class sessions.

Week	Day	Topic
1	T 1/14	Lecture: Course Overview
	R 1/16	Lecture: Introduction to Cancer Systems Biology
2	T 1/21	Lecture: Fundamentals of Systems Biology Modeling
	R 1/23	Lecture: Fundamentals of Systems Biology Modeling
3	T 1/28	CGC: Cancer Genomics Cloud Platform Basics
	R 1/30	Lecture: RNA sequencing methods
4	T 2/4	CGC: RNA sequencing analysis
	R 2/6	Lecture: Single-cell RNA sequencing methods
5	T 2/11	NO CLASS – Systems Approaches to Cancer Biology (SACB) Meeting
	R 2/13	Lecture/Discussion: SACB Recap
6	T 2/18	CGC: Single-cell RNA sequencing analysis
	R 2/20	Lecture: DNA sequencing methods
7	T 2/25	CGC: DNA sequencing analysis
	R 2/27	Lecture: Proteomics methods
8	T 3/4	CGC: Proteomics analysis
	R 3/6	Review: Content Review
9	T 3/11	Exam: Midterm
	R 3/13	Case Study 1: Multi-Omics Application
10	T 3/18	NO CLASS – SPRING BREAK
	R 3/20	NO CLASS – SPRING BREAK
11	T 3/25	CGC: Case Study 2: Multi-Omics Integration
	R 3/27	Case Study 3: Multi-Omics Integration
12	T 4/1	Presentations: Project Pitch Day
	R 4/3	PD Lecture: Data Visualization
13	T 4/8	CGC: Seven Bridges Tool Recap
	R 4/10	PD Lecture: Effective Presentation Skills
14	T 4/15	Project Group Work
	R 4/17	Project Group Work
15	T 4/22	Presentations: Project Presentations

Important Dates

T Mar 11	Midterm Exam (11:45am, MAEA 0327)
T Apr 1	Project Pitch Day (due on Canvas by 11:45am)
T Apr 22	Project Presentations (due on Canvas by 11:45am)
R May 1	Project Letter of Intent Reports (due on Canvas by 10:00am)

COURSE POLICIES =====

Attendance Policy, Class Expectations, and Make-Up Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies.

Attendance: This course is designed to give students practical experience at learning common tools used by systems biologists and biomedical engineers, and it is critical for students to regularly attend class ready to engage with the content. Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://gradcatalog.ufl.edu/graduate/regulations/>. Absences will be excused under the following conditions:

- 24 hours ahead of time that you have a legitimate, unavoidable absence
- Verifiable medical or family emergency
- Travel for a student conference – provided all excuse request prior to travel
- Need to come to class late or leave early for a legitimate reason
- Contact the instructor at least 24 hours before missing class due to interview, conference, UF official sporting event

Class Expectations

- **Be an engaged learner.** Students are expected to attend and participate in class. The material you will learn is very application based and is not taken from a single source. In case of an absence, ask a classmate for lecture material, review the recommended readings, and access supporting slides and activities on Canvas. Don't be afraid to ask for help during class or office hours. Be an active learner – ask yourself questions during lectures, as you read, and as you attempt problems.
 - Don't wait until the day before the exam or assignment deadline to get clarification on the material.
 - Check Canvas for class updates, assignments, announcements, lessons, calendar, and resources.
 - When using a laptop or other device in class, you shouldn't be on Facebook, Netflix, Hulu, etc. or do other things that are not class related. If the instructor asks you to put your device away, please do so.
 - You need to notify your instructor if you need accommodations from the Disability Resource Center. Your instructors want to help you.
- **Communication.** Address the instructor as Dr. Ferrall-Fairbanks or Prof. Ferrall-Fairbanks in all communications. Dr. Ferrall-Fairbanks will do her best to be available to all students for questions and discussions. Please allow up to 48 hours for Dr. Ferrall-Fairbanks to respond or longer if the email is sent at night or during the weekend, holidays, or breaks.
 - Please only use your official UF email address to communicate with Dr. Ferrall-Fairbanks. Dr. Ferrall-Fairbanks prefers that you use Canvas when sending messages for automatic association with the class. If reaching out via your UF email address, please include BME6983 in the subject line.
 - Announcements will be shared periodically during class and on Canvas. It is your responsibility to attend class and read any emails/announcements from Canvas. Emails, announcements, and feedback may occur outside business hours.
 - After each assignment is graded, you are responsible for reviewing your instructor's feedback.
- **Generative AI Tools Policy.** Generative AI is a powerful new tool that can help learners to engage with a topic of interest. Please be aware of the limitations of generative AI including the tendency to hallucinate (invent) incorrect responses. The use of generative AI tools (e.g. NaviGator, ChatGPT) is permitted in this course for the following activities with appropriate citation/disclosure:
 - As part of your study regimen to help you better understand course material (keeping in mind AI can and does give incorrect responses)
 - Brainstorming and refining your ideas
 - Fine tuning your problem statement and solutions
 - Finding information and troubleshooting code
 - Drafting an outline to organize your thoughts
 - Checking grammar and style; rewording and editing
 - Creating individual images, icons, or graphics to be used in presentations or assignments

The use of generative AI tools is **not** permitted in this course for the following activities:

- Substitute AI for primary sources of information (textbooks, lecture materials, scientific literature).
- Impersonating you in classroom contexts, such as using the tool to create answers for assignments or provide feedback to classmates
- Completing group work that your team has assigned to you, unless it is mutually agreed upon that you may utilize the tool
- Use AI to do the writing of any substantive portion of an assignment for you (e.g. writing entire sentences, paragraphs, or abstracts/reports to complete class assignments). I will treat this as plagiarism and an honor code violation, the same as hiring any other external person, entity, or service to complete your assignments for you.

You are responsible for the information you submit based on your AI query (for example, that it does not violate intellectual property law or contain misinformation/incorrect information). Your use of AI tools must be reported in the assignment. Any assignment that is found to have used generate AI tools in unauthorized ways, will receive a 30% penalty. When in doubt about permitted usage, please ask for clarification

- **Changes to the Syllabus.** Occasionally, course policies may need to be changed due to unforeseen circumstances or to improve the course. The instructor reserves the right to make necessary changes.

Make-Up Policy

- Assignments: Assignments may be submitted late with a 5% per day late penalty.
- Midterm Exam: The midterm exam may only be made up if scheduled in advances for an approved conflict and this will likely include an earlier midterm exam time than the scheduled for the rest of the class.

GRADING =====

Evaluation of Grades

Student performance will be assessed by:

- Assignments that will be assigned approximately per new methodology/tool and will account for 25% of the final grade.
- The project and its accompanying reports/presentations will account for 35% of the final grade. The end goal of the project is to work in small teams to apply the tools and techniques we discussed in class to generate a short research proposal with preliminary data your team developed. The project will be evaluated based on an in-class presentation of a pitch of your team’s proposed research project, a final presentation of your team’s proposed research project/plan with preliminary data your team generated with publicly available datasets in an oral presentation given on the last day of class, and a written grant proposal (NIH R03-style) detailing a proposed research plan using cancer systems biology, multi-omics approaches, and preliminary data your team has generated.
- One midterm exam will be administered around Week 9 of and will each account for 25% of the final grade. This midterm exam will assess fundamental concepts in modeling and systems biology approaches and methodology discussed in class.
- Participation will account for 15% of the final grade.

Assessment	Percentage of Final Grade
Assignments	25%
Midterm Exam	25%
Project	35%
Participation	15%
	100%

Grading Policy

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Percent	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0.00
Grade	93.4-	90.0-	86.7-	83.4-	80.0-	76.7-	73.4-	70.0-	66.7-	63.4-	60.0-	0-
Points	100	93.3	89.9	86.6	83.3	79.9	76.6	73.3	69.9	66.6	63.3	59.9

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)
[Grades and Grading Policies](#)

CLASSROOM ENVIRONMENT =====

Professional Conduct

- Students are expected to engage with the instructor and fellow students in a courteous and professional manner when participating in the classroom via Canvas.
- Any student who behaves in a disrespectful or disorderly manner may be asked to leave the classroom.

Inclusion Statement

It is my intention that students from all backgrounds and perspectives will be well served by this course and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful and welcoming learning environment for every other member of the class.

Lived Name / Pronoun Statement

I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

RELEVANT UNIVERSITY POLICIES =====

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services.

A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Plagiarism

Plagiarism is a common infraction to the UF Honor Code. If you are confused as to what constitutes plagiarism, see <https://guides.uflib.ufl.edu/c.php?g=147797&p=967443>. Plagiarism on any of your assignments **will be reported to the Dean of Students as a UF Student Honor Code violation**. Also, note that **copying solutions for any assignment, regardless of the source (e.g. other students, pirated website solutions), will be treated as plagiarism**. If you have any questions or concerns, please consult your instructor in this class. Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- BME Graduate Academic Advisor, Ade Kumuyi, 352-273-9321, grad@bme.ufl.edu
- HWC OE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

CAMPUS RESOURCES =====

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another

and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 352-392-1575; and the University Police Department: 352-392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 352-392-1161.

University Police Department at 352-392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://elearning.ufl.edu/>.

Career Connections Center, Reitz Union, 352-392-1601. Career assistance and counseling;
<https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 352-392-2010 or 352-392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>;
<https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.