

Georgia Institute of Technology, Wallace H. Coulter Department of Biomedical Engineering

BMED 7011 A Integrative Core: Introduction to Experiments & Modeling **FALL 2026**

2:35 - 3:50 PM T/R Emory University HSRB1 N100

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Office hours: Sign up, <https://calendly.com/hayneslab/dr-haynes-bmed-7301-office-hours>

DESCRIPTION: In graduate school you are not just an information consumer, you are an *investigator* who generates new knowledge and capabilities. The goal of this course is to ask outstanding questions and develop an implementation plan. As an important part of this training, we will also learn how to evaluate other scientists' ideas.

Biomedical engineers tackle complex, high-impact problems at the intersection of biology and engineering, spanning areas such as drug development, stem cell research, nanomedicine, tissue engineering, and genetic engineering. These challenges require approaches that differ from those used by clinicians or basic research scientists, emphasizing engineering-driven problem definition, quantitative analysis, and team-based solution development.

This course addresses these themes through the writing and evaluation of research proposals. Student teams will develop an NIH-style R21 proposal focused on **molecular mechanisms in cancer, stem, or differentiated cells**, while individuals will critically review proposals from other teams. Emphasis will be placed on innovative problem formulation, non-animal models (New Approach Methodologies, NAMs), and proposal strategies aligned with current NIH priorities. Course activities also provide practical preparation for NIH F31 applications, academic and startup career paths, and the effective use of AI tools for information gathering and scientific writing.

You will work in teams with a faculty facilitator who guides **problem identification** and approach development without providing solutions. Because these challenges are complex, effective teamwork is essential. Success in this course requires **self-directed learning**, rigorous information gathering outside of class, strong communication and interpersonal skills, and engagement with ethical issues in biomedical research.

COURSE MATERIALS:

There are no required textbooks for this course. Use of Web of Science or a comparable literature search engine is essential. The course will also include discussion of AI prompt engineering.

ASSESSMENT:

Based on observations of your work in the group meetings, group presentations, proposal evaluations, along with homework and quiz, your facilitator will assess you in four areas: Problem identification (Significance), Knowledge building (Scientific premise), Innovative (Hypothesis) Approach (Controls) and Team skills (Collaboration/Evaluation).

GRADING:

Teamwork	10 pts (5+5)
Ethics Reflection	5 pts
AI Prompt	10 pts (5+5)
Quad Chart	5 pts
State of Art Tech	5 pts
NAM contribution	5 pts
Biosketch	5 pts
Final Proposal	25 pts (5+10+10)
Reviews	20 pts (10+10)
Lay communication	5 pts
Participation & attendance	5 pts

DUE DATES: Will be posted on Canvas

Final proposal (8 pages excluding reference pages and AI use statement):

1 page introduction to resubmission

1 page specific aims

~2 page background, significance, state of art, gap

~3.5 page of approach

~0.5 page of timeline and milestones

2 page of references

1 page AI use example and statement

PROPOSAL TOPIC - FALL 2026 Section A:

EZH2 regulator mechanisms in cancer, stem, or differentiated cells. EZH2 is an evolutionarily conserved protein-modifying enzyme that acts from the earliest stages of human development through adult cell function, methylating protein targets to enhance or inhibit their activities and helping coordinate cellular responses to internal signals as well as bacterial and viral challenges.

Statement on Academic Integrity: Georgia Tech strives to cultivate a community grounded in trust, academic integrity, and honor. Students are expected to uphold the highest ethical standards in all academic work. Review Georgia Tech's Academic Honor Code (<https://policylibrary.gatech.edu/student-life/academic-honor-code>) in the Policy Library and the Student Code of Conduct (<https://policylibrary.gatech.edu/student-life/student-code-conduct>) on the Office of Student Integrity website.

Statement on Mental Health and Well-Being: Your instructors and the Biomedical Engineering (BME) Department are committed to supporting student mental health and well-being. While course instructors can be a point of support, students are strongly encouraged to make use of Georgia Tech's formal mental health resources. Additional information is available at: <https://mentalhealth.gatech.edu/>

- The Center for Mental Health Care and Resources (CMHCR) is Georgia Tech's primary hub for student mental health services. CMHCR is located in the Smithgall Student Services Building and can be reached at 404-894-2575. Normal hours of operation are Monday-Friday, 8:00 a.m.-5:00 p.m. CMHCR provides access to individual and group counseling, academic and personal support services, assessment and testing for learning disabilities, and referrals to additional mental health providers. They can assist with acute concerns, crises, or longer-term support needs.
- In addition to centralized services, the BME Department hosts a satellite counselor, Kate Silverio, located in Room 1105 of the Whitaker Building (rear of the academic office). The BME Satellite Counselor offers brief (15-minute) appointments, in person or virtual, for non-emergency concerns and for guidance on navigating campus mental health resources. Appointments can be scheduled by emailing kate.silverio@studentlife.gatech.edu.
- If you require immediate mental health support:
 - During business hours (8:00 a.m. - 5:00 p.m.): Call 404-894-2575 or visit Suite 238 in the Smithgall Student Services Building.
 - After hours: Call 404-894-2575 and select the option for the after-hours counselor.
 - In an emergency: Call Georgia Tech Campus Police at 404-894-2500 or 911.

Use of Artificial Intelligence (AI): This course permits limited and transparent use of AI tools to support learning, such as brainstorming, outlining, literature search assistance, and improving clarity or grammar of text you have substantively authored. AI may not be used to generate final scientific content, original analysis, proposal text, figures, or reviews submitted as your own work unless explicitly allowed for a specific assignment. Any AI use must be clearly disclosed, including the tool used and the nature of assistance provided. Undisclosed or inappropriate use may constitute a violation of Georgia Tech's Academic Honor Code, and students must comply with Georgia Tech data privacy and security guidelines.

Statement on ADA: If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

CLASS SCHEDULE (Fall 2026)

Date	Class	Tentative Topic Schedule	Assignments and Notes
T 8/25	1	Steps in research; diseases & cell basics. Survey large fields, cultivate small ones; 3 Carpenters	Read assigned paper(s) before the next class.
R 8/27	2	Discussion: EZH2 in cell-related diseases reviews. Importance of appropriate models & cutting-edge techniques.	Come having read the paper(s).
T 9/01	3	Literature search, paper evaluation, and introduction to quad chart. WoS think, pair, share. AI prompt engineering. Planning, simple R21 format description, brainstorming pitching activity. (Distribution of ideas)	
R 9/03	4	Quad chart presentations, team forming, and intro to cutting edge tech assignment	Quad chart presentations (5 pts) and form proposal teams
T 9/08	5	Prep technique presentation (no classroom lecture)	
R 9/10	6	Technique presentations	Cutting edge tech (5 pts)
T 9/15	7	Techniques presentations	Team working plan (5 pts)
R 9/17	8	Proposal Evaluation Rubric; mechanics of lab operation	
T 9/22	9	Applying to F31 & I-Corps. In class activity to prepare biosketch.	
R 9/24	10	Anatomy of R21: Aims, Approach, References. Specific Aims Page Explanation and Example Analysis	AI Prompt for background research (5 pts)
T 9/29	11	Elevator pitches: Why is the idea important? Why is it creative/new?	
R 10/01	12	Elevator pitches if needed. Significance & Innovation preparation exercise	NIH Biosketch Due (5 pts)
T 10/06	No class	Fall Break	
R 10/08	13	Why research is tedious. Approach development practice (Narrowing Idea, Tunnel)	
T 10/13	14	Design considerations for <i>in vitro</i> disease models	
R 10/15	15	Update team plan; successes and failures. Virtual Office Hour for Significance & Innovation doc.	Significance and Innovation due (5 pts)
T 10/20	16	Approach: good controls; what success looks like; what results mean	
R 10/22	17	Correlation vs. causation	AI Prompt for grammar/writing (5 pts)
T 10/27	18	Scaling & bioengineered systems	

		("Ugly babies")	
R 10/29	19	Responsible Conduct in Research: plagiarism, collaborations, credit, co-authorship	
T 11/03	20	R21 review process: critique, meeting, score, confidentiality	
R 11/05	21	Academic versus VC pitch	Full proposal Due (10 pts)
T 11/10	22	In-class review preparation activity	
R 11/12	23	Study Section	Scores and Reviews (10 pts) Study section particip (5 pts)
T 11/17	24	Study Section	Study section particip (5 pts)
R 11/19	25	Team proposal revision work; lay-pitch preparation	
T 11/24	26	Introduction to Revision + Proposal Revision	
R 11/26	No class	Holiday	
T 12/01	27	Lay Abstract workshop	Lay abstract (5 pts) Team reflection (5 pts)
R 12/03	28	Proposal Revision workshop	
T 12/08	29	Guest Lecture + course wrap-up	Revised Proposal (10 pts) Ethics reflection (5 pts)
		No Final Exam	