

BMED 7310 – Stem Cell Engineering
Fall 2026, TR 8:00–9:15 am, Ford Environmental Sci & Tech L1105

Instructor	Felipe G. Quiroz, PhD Assistant Professor Wallace H. Coulter Department of Biomedical Engineering felipe.quiroz@emory.edu HSRB-I at Emory, E184. Phone: 404-251-5435
Office Hours	Office hours by appointment only. All students are encouraged to attend one individual (Zoom or in-person) consultation of 20 min with Prof. Quiroz. These optional one-on-one meetings will be held between Sept 30 and Oct 3. Students interested in joining this optional consultation must email Prof. Quiroz to schedule a time by Sept 25.
Textbook	None. Recommended reading materials will be chosen from a combination of landmark research papers, current review articles, and recent research papers that provide the necessary supporting information. Related reading materials will be posted on an ongoing basis on Canvas.
Learning objective	Stem Cell Engineering is an emerging and rapidly evolving field with the potential to transform the biomedical application and utility of human stem cells. Biomedical engineers are uniquely poised to drive progress in the field. Upon completion of this course, students will be able to (1) interpret and assess experimental approaches in state-of-the-art stem cell engineering research, (2) communicate stem cell engineering concepts and related research progress to a broad audience, and (3) apply the necessary biological and bioengineering tools to propose and conduct biomedical engineering research with stem cells. Overall, students who perform well in the course will gain the ability of integrating progress in stem cell biology with cutting-edge bioengineering approaches to advance research ideas in the space of stem cell engineering.
Scope	This <i>graduate-level course</i> is designed to provide a foundation in the application of bioengineering approaches for the molecular-level manipulation and dissection of human stem cells, including their translation into therapies. The progression of the course content is intended to lead <i>graduate students</i> through the conceptual process of identifying and engineering an appropriate type of stem cell, based on functional attributes for a desired biomedical application.
Course Format	This course consists of two 75-minute meetings per week. Discussing the primary literature and surveying established cellular mechanisms and bioengineering principles/approaches, the meetings will introduce fundamental concepts, extant gaps, and biomedical applications in the space of stem cell engineering. Building on this foundation, students will contribute rapid-fire talks (+Q&A) on research ideas for future progress in Stem Cell Engineering.

Learning environment

Prof. Quiroz and BMED7310 students will collaborate to create an active learning environment. The meetings will help prime students to enable and stimulate their independent research. Students are expected to frequently contribute their questions and viewpoints to enrich in-class discussions. Instructor-student and student-student interactions will showcase respect, fostering an environment where all students are empowered to bring their unique experiences and perspectives. Prof. Quiroz is committed to implementing changes that help support student learning.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. [Review Georgia Tech's Honor Code](#) and the [student Code of Conduct](#). Any student suspected of cheating or plagiarizing an assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate the basic expectations. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the target learning environment. Students should commit to the ideals of Georgia Tech while in this class.

Accessibility and well-being

Prof. Quiroz strives to make BMED7310 accessible to all students, including those with disabilities that may adversely impact their learning experience. If you have circumstances (e.g., visual, hearing, learning disabilities) that may benefit from accommodation, please inform Prof. Quiroz so that he can collaborate with you on any accommodations. For example, the [Office of Disability Services](#) at Georgia Tech works with instructors to provide note taking services for students who have a demonstrated need for accommodations. In cases where you have a major outside life emergency that is affecting you and your ability to engage in the course, please inform Prof. Quiroz so that we can work with you. For help with stress and personal difficulties, we also encourage you to reach out to Georgia Tech's [Center for Mental Health Care](#). The Office of the VP-Dean of Students also offers a [referral resource](#) if you have concerns about a fellow student.

Grading

(1) Participation/attendance	20%
(2) Leading Edge of Stem Cell Eng (Report 1)	20%
(3) Leading Edge of Stem Cell Eng (Report 2)	20%
(4) Rapid-fire talk	20%
(5) Concept Note	20%
Total	100%

Unless a student is specifically contacted by Prof. Quiroz regarding low participation, students should expect to receive full credit for participation/attendance. Assignments (2)-(5) will be graded on a scale from 0-10, following an assignment-specific scoring rubric included below. There will not be an in-class final. The final grade cutoffs for the course are:

90 to 100%	A (Excellent)
80 to 89%	B (Good)
70 to 79%	C (Satisfactory)
60 to 69%	D (Passing)
<60%	F (Failure)

Late assignment policy: Documented requests for late submission, clearly communicated in advance of the deadline, will be considered on a case-by-case basis. Otherwise, the following applies. All leading-edge submissions and the Concept Note are due by 5 PM on the indicated dates. Late submissions after 5 PM and until 11:59 PM will incur a 10% grade reduction. Additional delays and up to 24 hours will receive a total 25% grade reduction. Unless specifically authorized by Dr Quiroz, tardier submissions will not be graded. The PPT file for the Rapid-fire talk is due by 12 PM the day prior to the scheduled presentation. Late submissions between 12:01 PM and 8 PM will incur a 20% reduction in the final grade. Unless agreed with Dr. Quiroz, tardier submissions will not be accommodated.

Originality and collaboration: All assignments in this course assess the preparation and progress of an individual student. Each student is expected to create original text and visuals that they can reasonably argue as their own. Students are allowed to consult with their peers and are encouraged to use this feedback to improve their skills and submitted/presented materials. Students commit to reviewing and abiding by Georgia Tech's [academic honor code](#). Related, on the use of AI tools, students are expected to follow the following heuristics, which were *copied* and adapted from [guidelines](#) by the College of Computing at Georgia Tech. *We treat AI-based assistance, such as ChatGPT and Copilot, the same way we treat collaboration with other people: you are welcome to talk about your ideas and work with other people, both inside and outside the class, as well as with AI-based assistants. However, all work you submit must be your own. You should never include in your assignment anything that was not written directly by you without proper citation (including quotation marks and in-line citation for direct quotes). Including anything you did not write in your assignment without proper citation will be treated as an academic misconduct case. If you are unsure where the line is between collaborating with AI and copying AI, we recommend the following heuristic: Never hit "Copy" within your conversation with an AI assistant. You can copy your own work into your own conversation, but do not copy anything from the conversation back into your assignment. Instead, use your interaction with the AI assistant as a learning experience, then let your assignment reflect your improved understanding. You should*

not use AI directly integrated into your composition environment: just as you should not let a classmate write content into your submission, so also you should avoid using tools that directly add content to your submission.

Submission requirements

When contacting Prof. Quiroz for predefined course activities and assignments, students are asked to [email](#) with the following assignment-specific subject lines. Emails sent without the requested subject line or to the wrong email will not be considered compliant with the submission guidelines.

TOC alerts: BMED7310_TOC-alerts_Last name

Consultation: BMED7310_Consultation_Last name

Leading Edge Report 1: BMED7310_LeadingEdge_R1_Last name

Leading Edge Report 2: BMED7310_LeadingEdge_R2_Last name

Research Idea feedback: BMED7310_Idea-feedback_Last name

Rapid-fire slides: BMED7310_Rapid-fire_Last name

Concept Notes: BMED7310_Concept-Note_Last name

Leading Edge of Stem Cell Eng.

Stem Cell Engineering is a rapidly evolving field. The lectures in this course serve to introduce topical areas, but student exposure to leading advances will occur primarily through examination of the scientific literature. *Students in BMED7310 will help address a key question: what current scientific advances and approaches best exemplify the state-of-the-art and future opportunities in stem cell engineering?* To tackle this question, BMED7310 students will collectively define and recognize the leading edge of stem cell engineering. As a strategy to survey this research landscape spanning fundamental biology, bioengineering and medicine, BMED7310 students will collectively monitor the latest research published in twenty leading journals (see list below) in the space of stem cell engineering. Each student will contribute two reports for the BMED7310 Leading Edge of Stem Cell Eng. Each report will consist of research highlights on three 2026 breakthroughs ([original research](#)) in areas relevant to stem cell engineering.

The resulting collection of reports will be curated into the 2026 issue of BMED7310 Leading Edge of Stem Cell Eng, which will be shared with the Coulter BME community. The highlighted research from the issue will be discussed in the final class of the course.

More about the report:

Due dates: The first report will be due September 29 by 5 PM ET.

The second report will be due November 7 by 5 PM ET.

Audience and format: busy biomedical engineering colleagues with an interest in research areas relevant to stem cell engineering. The research highlights capture their attention and keep them informed of the latest progress and findings in the field. **Format:** Arial 12; 1-inch margins; single spaced. Each research highlight has a minimum of 100 words and at most 200 words. Prof. Quiroz will provide examples of research highlights and the required formatting.

Target literature: Students should sign up to receive the Table of Contents (TOC) alerts of at least five of the twenty leading journals in the space of stem cell engineering. *Students will [email Prof. Quiroz](#) by 8/25 at 5 PM with a list of their selected five journals.* Students are encouraged to monitor the TOC of any of the additional fifteen journals. For each report, students must review at least one paper from their selected five journals and at least one from two additional journals assigned by Prof. Quiroz –which will be assigned by 9/1. The third paper can be chosen from any of the twenty journals. Only 2026 papers are eligible for review. One of these breakthroughs must have a publication date between January and July, and one must have a publication date at most one month prior to the submission of the report. The third research highlight can have any 2026 publication date (i.e., January through December). For Report 1, none of the submitted research highlights can be represented in the 2024 BMED7310 Leading Edge of Stem Cell Eng (available on Canvas). For Report 2, none of the submitted research highlights can be represented in the top-quality 2026 highlights from Report 1, which will be made available on Canvas.

Scoring rubric: (1) Compliance with submission guidelines (0-3 points); (2) Relevance of chosen papers to Stem Cell Engineering (0-3 points); (3) the Research highlight effectively introduces the topic, key approaches, the most salient new findings or gaps addressed, and a perspective on how the work impacts the field (0-4 points). The scoring rubric does not directly penalize underdeveloped writing skills, but items (1) and (3) demand proof-reading and attention to the quality of the writing. Students should strive to effectively communicate the research.

List of target journals:

Nature
Nature Biotechnology
Nature Methods
Nature Nanotechnology
Nature Communications
Nature Biomedical Engineering
Nature Medicine
Nature Materials
Nature Cell Biology
Molecular Therapy
Cell
Cell Stem Cell
Molecular Cell
Cell Reports
Science
Science Advances
Science Translational Medicine
Advanced Materials
Advanced Healthcare Materials
Advanced Functional Materials

Rapid-fire talk

Each student will develop a Research Idea by the end of the course. This research idea will be delivered in a rapid-fire talk format and as a 1-page Concept Note (see assignment 5 for details). The research idea cannot be an obvious derivative of the student's ongoing research. Targeting current gaps and biomedical opportunities in stem cell engineering, as supported by the literature, a convincing Research Idea demonstrates the student's understanding of the field at large and the student's ability to identify and communicate significant research avenues for future development.

More about the rapid-fire talk:

Timeline: Talks will take place on any of the following meeting dates: Nov 19, Nov 24, Dec 1, and Dec 3. Students will be informed of their assigned date by Oct 13.

Due dates: (1) [Optional] Students interested in receiving feedback on their Research Idea may share a working title and an NIH-style [project narrative](#) with Prof. Quiroz by Oct 24. This optional deliverable will not be graded. **(2)** PowerPoint slides are due by 12 PM noon the day prior to the presentation (see timeline above).

Format: a convincing pitch of the research idea delivered in *exactly* 5 minutes, using three PowerPoint slides. Animations are not allowed. Each talk will be followed by 4 minutes of questions and answers. Students are expected to actively engage in probing the speaker.

Scoring rubric: (1) Compliance with guidelines (0-3 points); **(2)** Relevance of Research Idea to Stem Cell Engineering (0-3 points); **(3)** The talk effectively introduces the biomedical gaps/opportunities, the key idea, and the unique aspects of the proposed research (0-4 points). The scoring rubric does not directly penalize underdeveloped presentation skills, but items (1) and (3) demand attention to the quality of the pitch and slides. Students should strive to effectively communicate the uniqueness and significance of their research idea.

Concept Note

The Concept Note is the written component of the Research Idea communicated in the Rapid-fire talk –see that section for more details on the guidelines and timeline to develop a Research Idea.

Details of the Concept Note:

Due date: Dec 10 by 5 PM ET.

Format: a complete 1-page concept paper must be single-spaced in 12-point Arial with 1-inch margins and include:

- (1) Full name of student in the Header section.
- (2) Project title.
- (3) Introduction: An overview of the background and rationale needed to communicate the proposed research idea, including a clear statement of the key idea and overall goal(s).
- (4) Approach: brief description of a scientifically sound research approach to advance the proposed idea. This section must include a statement on *Challenges and Alternatives*.
- (5) Unique aspects: A numbered list of the most innovative or unique aspects of the proposed research.

(6) [Optional] Any remaining space within the 1-page limit may be used to add other sections/details. Figures are not allowed.

(7) References: strong support from scientific literature is key to conveying the significance and novelty of a research idea. Quality references matter: a maximum of twenty references are allowed. References are not included in the 1-page limit. They should be numbered and cited using brackets (e.g., "because of their known pluripotency [1]"). Each reference must be reported in full (any scientific format that includes authors, full paper title, and journal information).

Scoring rubric: **(1)** Compliance with guidelines (0-2 points); **(2)** Relevance of the Research Idea to stem cell engineering (0-2 points); **(3)** The text effectively communicates the biomedical gaps/opportunities, the key idea, and unique aspects of the proposed research (0-3 points); **(4)** The proposed research approach is sound—so that feasibility is reasonably high based on current tools and consideration of challenges/alternatives (0-3 points). The scoring rubric does not directly penalize underdeveloped writing skills, but items (3)-(4) demand proof-reading and attention to the quality of the writing. Students should strive to effectively communicate the rationale, uniqueness, and significance of their research idea.

Schedule

See the table below for a detailed course schedule. Students will be informed well in advance if any changes are necessary.

BMED 7310 Class schedule

Week	Date	Lecture Topic	Notes	Instructor
1	T 8/25	Course Overview and Student Input		Quiroz
	R 8/27	Stem cell biology: tissue-resident stem cells	TOC alerts due 8/27	Quiroz
2	T 9/1	Stem cell biology: cell fate decisions and differentiation		Quiroz
	R 9/3	Stem cell biology: niches		Quiroz
3	T 9/8	Stem cell biology: quiescence		Quiroz
	R 9/10	Induced pluripotent stem cells		Quiroz
4	T 9/15	Genome engineering		Quiroz
	R 9/17	Epigenome engineering		Quiroz
5	T 9/22	Protein engineering toolbox		Quiroz
	R 9/24	Synthetic genes for cellular engineering		Quiroz
6	T 9/29	Cell fate engineering		Quiroz
	R 10/1	Biomaterials for stem cell engineering	Report 1 due 10/2	Quiroz
7	T 10/6	Fall break		
	R 10/8	Advances in organoid engineering		Quiroz
8	T 10/13	Advances in cellular reprogramming		Quiroz
	R 10/15	Top research stories from Report 1 -- BMED7310 Leading Edge of Stem Cell Eng		Quiroz
9	T 10/20	Engineering safety into human pluripotent stem cell technologies		Quiroz

	R 10/22	No class (emphasis on idea generation)	Dates for rapid-fire talks assigned by 10/13	No class (emphasis on idea generation)
10	T 10/27	Stem cell engineering for immunotherapy		Quiroz
	R 10/29	Stem cell engineering in vivo	Request feedback by 10/24	Quiroz
11	T 11/3	Student-voted* focus area 1 (TBD)		TBD
	R 11/5	Student-voted* focus area 2 (TBD)	Virtual meeting (Zoom)	TBD
12	T 11/10	Stem cell-based therapies		Quiroz
	R 11/12	Chemical reprogramming of stem cells	Report 2 due 11/7	Quiroz
13	T 11/17	Ethical considerations in stem cell engineering		Quiroz
	R 11/19	Rapid-fire talks (group 1)	G1 talks due 11/18	G1 students
14	T 11/24	Rapid-fire talks (group 2)	G2 talks due 11/23	G2 students
	R 11/26	Official School Holiday		
15	T 12/1	Rapid-fire talks (group 3)	G3 talks due 11/30	G3 students
	R 12/3	Rapid-fire talks (group 4)	G4 talks due 12/2	G4 students
16	T 12/8	Discussion of the 2026 issue of BMED7310 Leading Edge of Stem Cell Eng.		Quiroz
	12/10	No in-class final	Concept Note due	

BMED7310 students helped shape the content of the course. They voted to select two final focus areas from the following six topics:

- (1) Rejuvenation and stem cell senescence.
- (2) Modeling early embryogenesis with human stem cells.
- (3) Development and applications of brain organoids.
- (4) 3D printing of stem cell engineered tissue constructs.
- (5) Quality control in stem cell products.
- (6) Scalable manufacturing of stem cells.