BME 410L: Introduction to Biomaterials and Tissue Engineering

Units: 4
Lecture: TBD (two 80-minute lectures per week)
Lab: TBD (one 170-minute lab session per week)

Location: TBD

Instructor: Prof. Megan L. McCain
Office: DRB 318
Office Hours: TBD (one hour per week and by appointment)
Contact Info: mlmccain@usc.edu

Teaching Assistants: TBD
Office:
Office Hours:
Contact Info:

Course Description
In-depth survey of the cells, materials, and techniques used to engineer human tissues for applications in regenerative medicine and drug screening.

Extended Course Description
This course has both lecture and lab components. The first part of the course focuses on characteristics and sources of cells, with an emphasis on human stem cell acquisition and differentiation and associated ethical considerations. The second part focuses on the synthesis and characterization of biomaterials and techniques for engineering 2-dimensional (2-D) and 3-D scaffolds. The final part focuses on tissue engineering approaches specifically for the heart, as well as pathways of commercialization and translation for engineered tissues and Organs on Chips. During the lab sessions, students will be trained in many of the fundamental techniques introduced in the lectures, including cell culture, microscopy, biomaterial characterization, and microfluidic device fabrication. Students will be assessed through in-class work, group presentations, article summaries, exams, and lab reports.

Learning Objectives
(1) Describe the key features of cells and extracellular matrix that are pertinent to the form and function of human tissues.
(2) Compare and contrast common types of human stem cells, biomaterials, and techniques for engineering 2-D and 3-D scaffolds for tissue engineering.
(3) Implement several lab techniques routinely used in biomaterials and tissue engineering.

Course Outcomes
(1) Interpret and critique data from research papers related to tissue engineering.
(2) Collaborate with classmates to communicate important findings from research articles to the public.
(3) Demonstrate proficiency with several fundamental experimental techniques in tissue engineering.
(4) Generate professional images, graphs, analyses, descriptions, and interpretations of experimental data.

(5) Summarize the current state of tissue engineered products for regenerative medicine and drug screening in society today.

(6) Evaluate the ethical implications of different tissue engineering strategies.

**Relationship to BME Student Outcomes (a-k):**

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multi-disciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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<thead>
<tr>
<th>Course outcomes ↓</th>
<th>Student Outcomes →</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
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**Course Preparation**

Pre-/Co-Requisites: Chem 322A: Organic Chemistry; BISC 220L: Cell Biology and Physiology

**Course Notes**

Lecture slides are posted on Blackboard at least 24 hours before each lecture. All other course materials (syllabus, assignment descriptions, lab protocols, etc.) will also be posted on Blackboard.

**Technological Proficiency and Hardware/Software Required**

Students are required to bring an internet-enabled device with browser capabilities, such as a cell phone or a laptop to class. If you require an internet-enabled device, the USC Computing Center Laptop Loaner Program - USC Information Technology Services provides loaner laptops at the general-use computing centers in King Hall, Ahmanson Information Commons at Leavey Library, and Waite Phillips Hall. This service is only available to currently enrolled USC students with a valid USCard. To check out a laptop, go to the service desk at an USC computing center and log
into the laptop checkout webpage. https://itservices.usc.edu/spaces/computingcenters. For more information about the program, see: https://itservices.usc.edu/spaces/laptoploaner

**Required Reading Assignments**
Students should read the assigned reading materials (posted on Blackboard) before each lecture. Because this course does not follow a single textbook, students are highly encouraged to take notes during lecture and use the supplemental reading material as needed to clarify concepts from the lectures. Any topics that appear only in reading material (and not in lectures) will NOT be tested.

**Description and Assessment of Assignments:**

**In-Class Work:** Open-note quizzes, polls, or other similar assignments will be given in class throughout the semester at unannounced times and will be administered using Blackboard. The lowest two in-class work grades will be dropped to accommodate student illness, travel schedules, etc. There is no option to make-up in-class work.

**Group Presentations:** Twice in the semester, students will work in groups of 3-4 to present a journal club article in the form of a public science museum display during regular class time. All students will be assigned the same grade for the content of the presentation. More details regarding the presentation and a rubric will be distributed in a separate document.

**Article Summaries:** On presentation days, non-presenting students will read one of the articles (of their choice) that will be presented that day. Students will be asked to respond to a series of questions related to summarizing and critiquing the article. More details regarding the article summary and a rubric will be distributed in a separate document.

**Exams:** Two midterm exams will be administered during regular class time and a final exam will be administered during the final exam period. Midterm exams will not be cumulative. The final exam will be cumulative. Exams will focus on lecture material. Students may be tested on material that appears in lecture and not reading assignments, but not vice versa.

**Pre-labs:** Before each lab session, students will answer a series of questions related to comprehension of the protocol for that lab session to ensure that students read the protocol and lab time is used effectively.

**Lab Reports:** Throughout the semester, students will complete four lab reports. Each lab report relates to 2-4 lab sessions and will be similar in format to a short journal article, with sections for Introduction, Materials and Methods, Results (including figures), and Discussion. More details regarding lab reports and a rubric will be distributed in a separate document.

Students are expected to spend 8 hours per week on work outside of class, on average.

**Assignment Submission Policy**
Article summaries, pre-labs, lab reports, and group presentation files are to be submitted via Blackboard before the start date of the lecture or lab indicated on the syllabus. Article summaries and lab reports will be accepted late, but 10% of the total possible points will be subtracted every
24 hours, starting immediately after the due date and time. Late pre-lab assignments or group presentation files will not be accepted.

**Grading Timeline**
All assignments will be graded and grades will be posted on Blackboard within one week of the due date.

**Grading Breakdown**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>% of Grade</th>
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<tbody>
<tr>
<td>In-class work (~15)</td>
<td>5</td>
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<tr>
<td>Group presentations (2)</td>
<td>20</td>
</tr>
<tr>
<td>Article summaries (2)</td>
<td>6</td>
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<tr>
<td>Midterm exams (2)</td>
<td>24</td>
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<tr>
<td>Final exam (1)</td>
<td>16</td>
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<tr>
<td>Pre-labs (13)</td>
<td>5</td>
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<tr>
<td>Lab reports (4)</td>
<td>24</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
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</table>

**Grading Scale**
Final letter grades will be assigned based on the mean and standard deviation (SD) of the class:

(mean + 0.75*SD) and above = A
(mean + 0.25*SD) to (mean + 0.75*SD) = A-
(mean – 0.25*SD) to (mean + 0.25*SD) = B+
(mean – 0.75*SD) to (mean - 0.25*SD) = B
(mean – 1.25*SD) to (mean – 0.75*SD) = B-
(mean – 1.75*SD) to (mean – 1.25*SD) = C+
(mean – 2.25*SD) to (mean – 1.75*SD) = C
(mean – 2.75*SD) to (mean – 2.25*SD) = C-
(mean – 4.25*SD) to (mean – 2.75*SD) = D
(mean – 4.25*SD) and below = F

Depending on the class distribution, grades may be altered from this structure, but only in a way that favors the students.

**Regrade Policy**
Regrade requests are due within one week of the date they are returned to the students. Students must type a justification for their request and submit it to Prof. McCain, stapled to the original assignment. Each student is limited to two regrade requests for any type of assignment throughout the semester. This does not include administrative errors (incorrect point additions, etc.), which should be brought to the attention of a TA immediately for correction without penalty.

**Collaboration Policy**
Students may work together on article summaries, pre-labs, and lab reports, but every student should write and submit their own individual assignments. Excluding multiple choice questions,
any identical (or nearly identical) assignments will be given zero points. The Turnitin feature on Blackboard will be used to check for plagiarism. Students may not work together for in-class work or exams. Plagiarism or other forms of academic misconduct will result in a zero grade for the assignment and will be reported to USC’s Office of Student Judicial Affairs and Community Standards, as detailed at the end of the syllabus.

**Technology Policy**
During class time, students should use their devices only to participate in activities guided by the instructor or for note-taking. Use of devices for other purposes is not permitted. Device use for non-academic purposes that distracts the instructor or other students will result in no credit for in-class work for the day. During exams, device use is strictly prohibited and will result in a zero grade for the exam. Restroom use during exams is permitted, but all devices must be left with the instructor or TA at the front of the classroom.

**Communication Policy**
If a student has a question, he/she should follow these steps in order: (1) consult the syllabus; (2) ask a classmate; (3) review lecture slides and reading material; (4) ask a TA at office hours; (5) ask the instructor at office hours; (6) email the TA; (7) email the instructor. Emails that require short responses (at the discretion of the instructor or TA) will be answered within 24 hours between 9am-5pm on business days. Responses received on weekends or holidays will be delayed to the next business day. Emails that require a long response (at the discretion of the instructor or TA) will not be answered over email. Instead, the student will be directed to office hours.

**Attendance Policy**
Attendance for student presentations, lab sessions, and exam periods is mandatory and will only be excused in case of an emergency, at the discretion of the instructor. If a student knows in advance that he/she will be absent on the day of an exam, presentation, or lab for an important occasion (at the discretion of the instructor), notify the instructor as soon as possible or at least two weeks in advance such that arrangements can be made. Notifications given with less than two weeks notice cannot be excused.

**Course Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Readings</th>
<th>Assignments</th>
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<tbody>
<tr>
<td>1</td>
<td>Lecture 0: Course introduction</td>
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<td></td>
<td>Lecture 1: Human cell and tissue structure</td>
<td>PTE Ch. 7</td>
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<td>Lab 0: Intro to lab</td>
<td>Lab policies</td>
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<td>Lecture 2: Cell harvesting and culture</td>
<td>PDF: cell culture</td>
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<td>Lecture 3: Structure and function of tissue</td>
<td>MBoC Ch. 4, 6</td>
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<td>Lab 1: Cell culture and passaging</td>
<td>Lab 1 protocol</td>
<td>Pre-lab 1</td>
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<td>Lecture 4: Human embryonic stem cells</td>
<td>PTE Ch. 29</td>
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<td>Lab 2: Transmitted light microscopy and cell staining</td>
<td>Lab 2 protocol</td>
<td>Pre-lab 2</td>
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<tr>
<td>Week</td>
<td>Lecture/Exercise</td>
<td>Topic</td>
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<td>4</td>
<td>Lecture 5: Adult stem cells</td>
<td>PTE Ch. 31</td>
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<td>Lecture 6: Induced pluripotent stem cells</td>
<td>PTE Ch. 30</td>
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<td>Lab 3: Fluorescent microscopy</td>
<td>Lab 3 protocol</td>
<td>Pre-lab 3</td>
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<td>5</td>
<td>Lecture 7: Stem cell differentiation</td>
<td>PTE Ch. 4</td>
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<td>Lecture 8: Gene editing</td>
<td>PDF: gene editing</td>
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<td>Lab 4: Image processing and analysis</td>
<td>Lab 4 protocol</td>
<td>Pre-lab 4</td>
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<td>6</td>
<td>A Presentations - Groups 1-5</td>
<td>Groups 6-10 only: Group 1-5 article of choice</td>
<td>Groups 6-10 only: Group 1-5 article summary</td>
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<td>A Presentations – Groups 6-10</td>
<td>Groups 1-5 only: Group 6-10 article of choice</td>
<td>Groups 1-5 only: Group 6-10 article summary</td>
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<td>Lab 5: Gelatin hydrogel fabrication</td>
<td>Lab 5 protocol</td>
<td>Lab report 1 (labs 1-4) Pre-lab 5</td>
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<td>Midterm exam 1 (Lectures 1-8)</td>
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<td>Lecture 9: Introduction to biomaterials</td>
<td>PDF: biomaterial properties PTE Ch. 25</td>
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<td>Lab 6: Mechanical characterization of hydrogels</td>
<td>Lab 6 protocol</td>
<td>Pre-lab 6</td>
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<td>8</td>
<td>Lecture 10: The extracellular matrix</td>
<td>PTE Ch. 10</td>
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<td>Lecture 11: Natural biomaterials</td>
<td>PDF: natural biomaterials</td>
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<td>Lab 7: PDMS stamp fabrication and coverslip spin-coating</td>
<td>Lab 7 protocol</td>
<td>Lab report 2 (labs 5-6) Pre-lab 7</td>
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<td>Lecture 12: Non-degradable synthetic biomaterials</td>
<td>PDF: synthetic hydrogels</td>
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<td>Lecture 13: Photolithography and microcontact printing</td>
<td>Microntact printing review</td>
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<td>Lab 8: Microcontact printing</td>
<td>Lab 8 protocol</td>
<td>Pre-lab 8</td>
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<td>10</td>
<td>Lecture 14: Microfluidics and Organs on Chips</td>
<td>PDF: microfluidics PDF: Organs on Chips</td>
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<td>Lecture 15: Degradable synthetic biomaterials</td>
<td>PTE Ch. 23</td>
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<td>Lab 9: Immunostaining</td>
<td>Lab 9 protocol</td>
<td>Pre-lab 9</td>
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<td>Lecture 16: Engineering 3-D tissues: porous scaffolds, nanofibers, and self-assembly</td>
<td>PDF: 3-D scaffold fabrication</td>
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<td>Lecture 17: Bioprinting</td>
<td>PDF: bioprinting</td>
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<td>Lab 10: Imaging and image analysis</td>
<td>Lab 10 protocol</td>
<td>Pre-lab 10</td>
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<td>B Presentations - Groups 1-5</td>
<td>Groups 6-10 only: Group 1-5 article of choice</td>
<td>Groups 6-10 only: Group 1-5 article summary</td>
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</tbody>
</table>
Statement on Academic Conduct and Support Systems

Academic Conduct: Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free & confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.
Instructions for Lab Reports

You will submit four Lab Reports throughout the semester. Each Lab Report relates to experiments performed over 2-4 lab sessions. For each Lab Report, follow the guidelines below and refer to your Lab Protocols for additional guidelines for each specific Lab Report. Use Times New Roman, size 11, double spacing, 1” margins.

Introduction (0.5-1 page)
- Provide background information needed to understand the purpose of your experiments
- Explain the purpose of your experiments
- Briefly describe any cells, materials, and/or techniques you will use
- State clearly your objective and/or hypothesis

Materials & Methods (1-2 pages)
- Summarize the materials and procedures you used in your own words (do not copy from lab protocols)
- Include important technical details (concentrations, incubation times, etc.)
- Use sub-sections to separate different procedures

Results (2-4 pages, including Figures and Tables)
- Describe your results (including failures) while referring to every figure and table
- In most cases, do not list numbers in the text. Instead refer to trends shown in figures/tables.
- Figure and Tables
  o Present images, graphs, and other data as figures or tables. Each figure or table should be numbered and have a short caption.
  o Every graph should have labeled axes
  o Every image should have a scale bar
  o For fluorescent images, the color key should be in the caption

Discussion (0.5-1 page)
- Briefly summarize your findings
- Discuss any expected or unexpected findings
- Explain how your findings relate to the hypothesis/objective you indicated in the Introduction
- Critique your experimental design and identify any limitations
Rubric for Lab Reports

<table>
<thead>
<tr>
<th>Points</th>
<th>Accuracy</th>
<th>Completeness</th>
<th>Clarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Content is correct and relevant.</td>
<td>All necessary sections and details are present and complete.</td>
<td>Content is clear and professional with an appropriate level of detail.</td>
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<tr>
<td>1</td>
<td>Content is somewhat correct and/or relevant.</td>
<td>Some necessary sections and details are present and complete.</td>
<td>Content is somewhat clear and professional and/or the level of detail is somewhat high or low.</td>
</tr>
<tr>
<td>0</td>
<td>Content is incorrect and/or irrelevant.</td>
<td>Sections and details are not present and/or complete</td>
<td>Content is not clear and professional and/or the level of detail is high or low.</td>
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### Additional Feedback:

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**Instructions for Group Presentations**

**Step 1:** Enter the “Group Presentations” folder on Blackboard. Click on the Google Sheets link to find your teammates and presentation day.

**Step 2:** Consult with your teammates and select one of the articles posted in the “Group Presentations -> Articles” folder. Reserve it with the same Google Sheets link. Each article can only be selected by one group. Article selection is first come, first serve. Article reservation is due two weeks before your presentation day.

**Step 3:** Work with your teammates to prepare a poster based on your article. You should design your poster as a display for a science museum. Thus, your poster should be clear and understandable to a person in the general public with a high school-level knowledge of science.

Open the poster and slide templates in the “Group Presentations -> Templates” folder. There are two options for poster layout (described below). Each template has a section for the title and then four sections for content. The slide template has one slide for each section, with the same dimensions as the sections on the poster (excluding the title section). Thus, you can work on the full poster or you can work on individual slides and copy/paste them onto the poster as they are completed. When completed, the content of the poster and slides should be identical. Use the templates only as a guide for the placement of the sections. You and your teammates should decide on formatting details (font style, size, colors, etc.).

Fill in each section of your poster using the guidelines below. You may need to use sources outside your paper to address all the components. Cite any images or information that is not common knowledge.

**Introduction & Background**
- Describe the societal problem the paper is addressing
- Describe the biological problem the paper is addressing
- Indicate the hypothesis or objective of the paper

**Methods & Results**
- You don’t have time or space to describe every material, method, and result in the paper. Instead, describe a subset of materials, methods, and results that are most relevant to the topics you are learning in this class and important for the paper overall.
- You have two options for how you present these sections:
  - Option 1: Methods in one section/slide, Results in the second section/slide
  - Option 2: paired Method-Result in one section/slide, another paired Method-Result in the second section/slide

**Limitations & Future Applications**
- Describe two limitations of the approach or technology described in the paper
- Describe two future directions related to how this research can be used to benefit society
- Describe important ethical issues that need to be considered when translating this research to society
Step 4: Work with your teammates to prepare an oral presentation of your poster. Your presentation should be 12 minutes long with 3 minutes for discussion/questions. Your presentation should also be designed for a person in the general public with a high school-level knowledge of science. In class, you will present your poster using the five slides (title and four sections).

Step 5: Submit both the poster and slides to Blackboard in the “Group Presentations -> Submissions” folder at least one hour before the start of class on the day you are presenting.

Step 6: Present your slides/poster in class on the day indicated on the syllabus.
## Rubric for Group Presentations

<table>
<thead>
<tr>
<th>Points</th>
<th>Accuracy</th>
<th>Specificity</th>
<th>Clarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The information is correct.</td>
<td>The information is specific and relevant.</td>
<td>Sentences are clear with an appropriate level of detail.</td>
</tr>
<tr>
<td>1</td>
<td>The information is mostly correct.</td>
<td>The information is somewhat specific and relevant.</td>
<td>Sentences are somewhat clear and the level of detail is somewhat high or low.</td>
</tr>
<tr>
<td>0</td>
<td>The information is incorrect.</td>
<td>The information is very general and/or irrelevant.</td>
<td>Sentences are not clear and the level of detail is high or low.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points</th>
<th>Slide Format</th>
<th>Presentation Style</th>
<th>Teamwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Poster/slides are neat and professional (good balance of text and images, font style and size is appropriate, text and images are aligned, space is used properly).</td>
<td>Oral presentation was professional (presenters spoke at an appropriate pace and volume, presenters faced the audience, the presentation was approximately at the time limit).</td>
<td>Students demonstrated teamwork (presentation was rehearsed, all team members contributed, presentation was cohesive in style).</td>
</tr>
<tr>
<td>1</td>
<td>Poster/slides are somewhat and professional.</td>
<td>Oral presentation was somewhat professional.</td>
<td>Students somewhat demonstrated teamwork.</td>
</tr>
<tr>
<td>0</td>
<td>Poster/slides are not neat and professional.</td>
<td>Oral presentation was not professional.</td>
<td>Students did not demonstrate teamwork.</td>
</tr>
</tbody>
</table>

- **Introduction & Background**
  - Accurate (0-2)
  - Specific (0-2)
  - Clear (0-2)

- **Methods OR Method/Result 1**
  - Accurate (0-2)
  - Specific (0-2)
  - Clear (0-2)

- **Results OR Method/Result 2**
  - Accurate (0-2)
  - Specific (0-2)
  - Clear (0-2)

- **Limitations & Future Directions**
  - Accurate (0-2)
  - Specific (0-2)
  - Clear (0-2)

- **Slide Format**
  - 0-2

- **Presentation Style**
  - 0-2

- **Teamwork**
  - 0-2

**TOTAL (maximum points = 30)**

**Additional Feedback:**

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Syllabus for BME 410L, Page 13
Instructions for Article Summaries

On the presentation days that your group is NOT presenting, enter the “Group # Presentations” folder on Blackboard, followed by “Articles”. Select the article you would like to read and reserve it with the Google Sheets link posted in that folder. Each article will have a cap to ensure that every article is read. Article selection is first come, first serve. Articles will be posted and available for selection two weeks before each presentation day.

For your article, answer the questions listed below. Your responses should be clear, concise, and understandable to a person with a general background in this area of research (such as the TAs or your classmates).

1. (1-3 sentences) Describe the societal and biological problem that the paper is addressing.

2. (1-2 sentences) Describe one way to study this problem today and one of its limitations.

3. (3-5 sentences) Describe the methods for ONE of the major experiments from the paper. Do not include any technical details (concentration, timing, etc.), unless they are critical to understanding the experiment. Also indicate the control and experimental conditions.

4. (2-4 sentences) For the same experiment you described in #3, describe the main result and why it is important.

5. (1-2 sentences) Describe one limitation of the article related to overall scientific approach or technology (i.e., do not comment on writing style, format of figures, etc.).

6. (1-2 sentences) Describe one experiment you think the authors should do next.

7. (1 sentence) Pose a question for the presenters. Also post it on the message board found in the same Blackboard folder so that the instructor can select questions to ask during the presentations.

Type your responses and submit via the “Submit Article Summary” link in the same Blackboard folder. The assignment is due by 3:30pm on the due date. Students may work together, but every student should write and submit their own individual article summaries. Refer to the syllabus for the detailed collaboration and assignment submission policies.
Rubric for Article Summaries

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<th></th>
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<th>Specific (0-2)</th>
<th>Clear (0-2)</th>
<th>Weight</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Describe the societal and biological problem that the paper is addressing</td>
<td></td>
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<tr>
<td>Describe one way to study this problem today and one of its limitations</td>
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<tr>
<td>Describe the methods for one experiment and indicate control and experimental conditions.</td>
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<tr>
<td>Describe the main result from the same experiment and why it is important</td>
<td></td>
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<td></td>
<td>1x</td>
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</tr>
<tr>
<td>Describe one limitation of the article</td>
<td></td>
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<td>0.5x</td>
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</tr>
<tr>
<td>Describe one experiment you think the authors should do next.</td>
<td></td>
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<tr>
<td>Pose a question for the presenters</td>
<td></td>
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TOTAL (maximum points = 30)

Additional Feedback:

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