

NE 430: Neural Cell and Tissue Engineering

Meeting time: Tuesday/Thursday, 11:00 AM – 12:20 PM

Location: 3217 Everitt Laboratory

Credit hours: 3

Semester: Fall

Prerequisites: NE 330 or instructor consent

Instructor Information

Name Min Jee Jang, Ph.D.
Contact Information mjjang@illinois.edu
Office Location 3110 Everitt Laboratory
Office Hours By appointment only

TA Information

Kyungwon Ko (ko25@illinois.edu)

Course Description

This course will expose students to cutting-edge technologies and strategies currently used to engineer the nervous systems at the genetic, cellular and tissue levels. This course will first introduce students to genetic manipulation technologies and their therapeutic applications in neurodegenerative and neurodevelopmental disorders. Students will then learn contemporary strategies for directing the differentiation of stem cells to neural cells and tissue and its translation into cell therapies. The course will also cover the various applications of modern tissue engineering and imaging techniques to basic neuroscience and translational research.

Course Objectives

Upon completion of this course, students should:

- Understand and be able to explain molecular mechanisms of neurological and mental disorders.
- Understand how engineered genetic technologies can be used to modulate biological systems and treat neurological disorders.
- Understand the basic principles of stem cells, their ability to form neural tissues via directed differentiation protocols, and their potential as cell-based therapeutics.
- Research and report an area of neural cell and tissue engineering, applying concepts from lecture and the scientific literature.
- Clearly and concisely communicate in oral and written forms the rationale, approach, and significance of published research in the neural cell and tissue engineering field.

Course Format

- Two 80-min classes that mix lecture delivery with interactive discussion
- Students are expected to spend 3 hours in class per week and 6 hours outside of class.

Textbook and Reading Materials

No required textbook. Review articles and research papers will be assigned as reading materials.

Tentative Schedule

Week	Topic		Assignment
1	Course introduction (8/25)	Fundamentals of neuroscience (8/27)	Weekly log #1

Week	Topic		Assignment
2	Recombinant DNA technology (9/1)	Genetically manipulated organisms (9/3)	Weekly log #2
3	Gene delivery vectors (9/8)	Genetic reporter systems (9/10)	Weekly log #3
4	Genetic sensors for neural activity and signaling (9/15)	Genetic actuators for neuromodulation (9/17)	Weekly log #4
5	Gene editing (9/22)	Gene therapy for neurological disorders (9/24)	Weekly log #5
6	Review (9/29)	Midterm #1 (10/1)	
7	Fundamentals of neurodevelopment (10/6)	Neural cell patterning (10/8)	Weekly log #6
8	Stem cell basics (10/13)	iPSC and cell reprogramming (10/15)	Weekly log #7
9	Cell therapy for neurological disorders (10/20)	No class (BMES, 10/22)	
10	Organ-on-a-chip (10/27)	Organoid (10/29)	Weekly log #8
11	Biomaterials for neural tissue engineering (11/3)	Tissue-device interface (11/5)	Weekly log #9
12	Implants and tissue transplantation therapy (11/10)	Hydrogel-tissue hybrid for tissue clearing (11/12)	Weekly log #10
13	No class (SFN, 11/17)	Buffer day	
14	Fall break		
15	Review #2 (12/1)	Midterm #2 (12/3)	
16	In-class proposal writing workshop (12/8)	Final proposal due (12/10, 11:59 pm)	

Course Website

<https://canvas.illinois.edu/courses/74030>

Grading

Attendance:	10%
Weekly logs:	25%
Midterm exams:	40%
Final proposal:	25%

Overall Course Grade

- A+ > 97% > A > 93% > A- >= 90%
- B+ > 87% > B > 83% > B- >= 80%
- C+ > 77% > C > 73% > C- >= 70%
- D+ > 67% > D > 63% > D- >= 60%
- F < 60%

Course Policies

- **Attendance:** Attendance is recorded live by the TA during each class. To accommodate illness, travel, or emergencies, we enforce a **strict 3 no-question-asked absence policy**. Do not email the instructor or TA with excuses or doctor's notes for these three missed classes. Official university documentation will be only reviewed and considered to excuse your absence for university-related manners.
- **Course-related communications:** Course announcements will be sent out to the class roster via Canvas; please check your email regularly. For general course questions and information, please first consult the syllabus. If your question/issue is still not answered/addressed, please email the TA at ko25@illinois.edu or the course instructor at mjjang@illinois.edu.
- **Laptops and mobile devices:** Mobile devices should be on silent and out of sight during class. Laptops may be used for course-related tasks only (e.g., to take notes or investigate relevant topics). **NO electric devices are allowed during quizzes and exams. Any student found in possession of a prohibited device during an exam or quiz may be subject to disciplinary action in accordance with the academic integrity policy.**

COVID Policies

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community, including wearing a facial covering properly, maintaining social distance (at least 6 feet from others at all times), disinfecting the immediate seating area, and using hand sanitizer. Students are also required to follow the campus COVID-19 testing protocol.

Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/buildingemergency-action-plans/>

Academic Integrity

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <https://studentcode.illinois.edu/>.

Academic dishonesty will result in a sanction proportionate to the severity of the infraction, with possible sanctions described in 1-404 of the Student Code (<https://studentcode.illinois.edu/article1/part4/1-404/>). Every student is expected to review and abide by the Academic Integrity Policy as defined in the Student Code: <https://studentcode.illinois.edu/article1/part4/1-401/>. As a student it is your responsibility to refrain from infractions of academic integrity and from conduct that aids others in such infractions. A short guide to academic integrity issues may be found at <https://provost.illinois.edu/policies/policies/academic-integrity/students-quick-referenceguide-to-academic-integrity/>. Ignorance of these policies is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

In this course you are expected to produce your own work in all assignments. Written assignments will be submitted through SafeAssign, a software tool that compares your writing against a large database as well as to the work of your current classmates and previously submitted assignments. Assignments with close matches to other work will be flagged and investigated.

Anti-Racism and Inclusivity

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (<https://bart.illinois.edu/>). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Disability Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, e-mail disability@illinois.edu or go to <https://www.disability.illinois.edu>. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously undiagnosed disability. You may access these by visiting the DRES website and selecting "Request an Academic Screening" at the bottom of the page.

Family Educational Rights and Privacy Act

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/> to request appropriate accommodations. This should be done in the first two weeks of classes.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: <https://wecare.illinois.edu/resources/students/#confidential>.

Other information about resources and reporting is available here: <https://wecare.illinois.edu/>.