School of Molecular & Cellular Biology

MCB 493, Spring 2025

Neurobiology of Mental Illness, 3 credit hours

Course Instructor

Dr. Patrick Sweeney
Burrill Hall Room 513
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Course TA

Jared Butts
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Office Hours: TBD

Class Meeting Schedule

Class: Tuesday, Thursday, 3pm-420pm, 2055 Sidney Lu Mechanical Engineering Building
Office Hours:
Professor Sweeney: Friday, 1pm-2:30pm; 513 Burrill Hall
Jared Butts: TBD

Course Overview and Description

This course will provide an overview of the neural circuitry regulating emotion and discuss how this circuitry may be disrupted in psychiatric disorders. Diseases covered in class will include anxiety disorders, psychotic disorders, depression, fear disorders, and eating disorders. Lectures and readings will cover the physiology, symptomology, and current treatment strategies for treating mental illness, and the most current biological understanding of the neural circuit mechanisms involved in these disorders. A particular emphasis will be placed on the use of rodent animal models for dissecting the neural causes of physiological and pathological emotion regulation, and understanding how changes in cellular and molecular pathways impact the neural circuitry regulating emotion.

The course will consist of a combination of lectures and journal club presentations presented by Dr. Sweeney on recent scientific literature related to the topics discussed in class. Lectures will cover the basic methodology for studying neuropsychiatric disorders in animal models, the underlying biology of these disorders, and the current treatment strategies for treating patients with neuropsychiatric disorders. Professor-led journal club presentations will cover recent primary literature related to pre-clinical neuropsychiatric research. Students will learn to read and analyze the primary literature, and design experiments to address new questions in the field.

Course Prerequisites, Requirements met

MCB 314: Introductory Neuroscience
MCB 461: Cell and Molecular Neuroscience (recommended)

Student Learning Outcomes

At the end of the course students will be able to:

- Describe the major causes and symptomology of major mental Illnesses
- Relate how changes in specific cellular signaling pathways impact neural circuitry to regulate behavior
- Analyze critical gaps in the understanding and treatment of mental illness
- Read and discuss meaningfully primary and review literature

Course Text/Materials Information

Required Reading

Required weekly reading assignments will derive from textbook chapters, review articles, and primary research articles. The textbook for this course (Charney and Nestler's Neurobiology of Mental Illness, 5th edition) can be purchased via multiple sites, and information about how to purchase the book is included on the canvas course site. 2 copies of the textbook are available to sign out at the School of MCB learning center. Required review articles and journal articles for the course will be provided on canvas. Reading materials will be posted online at the start of the semester. Students are expected to read the assigned readings prior to lecture. See course schedule below for specific required reading.

Course Website, Course Tools (Canvas, Moodle, LON-CAPA, Zoom, etc.)

Canvas

Grading Information and Breakdown

Instructional Activity	Occurrences	Point Value	Total Points
Participation and Attendance	1	20	20
Paper critique 1	1	10	10
Paper critique 2	1	10	10
Exam 1	1	20	20
Exam 2	1	20	20
Exam 3	1	20	20
Total			100

Course Calendar with Daily Schedule of Topics, Readings and Assignment Due

Week	Topics	Reading Assignments: due prior to following weeks lectures	Assignments
January 21	• Course overview • Animal models in psychiatric research		

January 23	• Viral vector tools for studying neural circuitry • In vivo imaging and neural activity mapping • Linking circuit dynamics with behavior	• "Viral vectors for neural circuit mapping and recent advanced in trans-synaptic anterograde tracers" • "In vivo circuit analysis". Section 1. Chapter 7 • "Optogenetics and related technologies for psychiatric disease research: current status and challenges". Section 1. Chapter 6	
January 28	• Neural circuit manipulation strategies: optogenetics and chemical genetics • Neuropharmacological approaches • Linking circuit activity with behavior	• "Selective manipulation of neural circuits"	
January 30	• Modern molecular biological approaches • Tools for linking genes to behavior • Reverse genetic approaches (gene mutations and behavior) • **In class review for exam 1**	• "Cre-Lox Neurogenetics: 20 years of versatile applications in brain research and counting: • "Methods for in vivo gene manipulation". Section 1. Chapter 4 • "Single cell sequencing of brain cell transcriptomes and epigenomes"	
February 4	• **Exam 1**		**Exam 1: In class on February 4**

February 6	• Mood disorders: symptoms and treatments	• "Major Depressive Disorder" Belmaker and Agam. NEJM • "Diagnosis and epidemiology of depression". Section 3. Chapter 23 • "Current treatments for treating depression". Section 3. Chapter 31	
February 11	• Mood disorders: animal models and neural circuitry	• "Animal models of mood disorders". Section 3. Chapter 26	
February 13	• Mood disorders: molecular pathways impacting mood circuitry	• "Circuit-based frameworks of depressive behaviors: The role of reward circuitry and beyond"	
February 18	• Journal club presentation: Mood disorders	TBD	**Paper critique**
February 20	• Anxiety disorders: Diagnoses and epidemiology	• "Diagnosis and epidemiology of anxiety, obsessive-compulsive, and trauma and stressor-related disorders". Section 4. Chapter 32 • "Post-Traumatic Stress Disorder" Shalev and Marmar. NEJM	
February 25	• Anxiety disorders: symptoms and treatments	• "Generalized anxiety disorder" Stein and Sareen. NEJM • "Social anxiety disorder"	

		Leichsenring and Leweke. NEJM • "Current and experimental treatments for anxiety disorders". Section 4. Chapter 40	
February 27	• Anxiety disorders: Animal models and neural circuitry	• "The neurobiology of resilience". Section 4. Chapter 38. • "Animal models and assays probing anxiety related behaviors and neural circuits". Section 4. Chapter 35.	
March 4	• Anxiety disorders: From signaling pathways to neural circuitry	• "What are fear and anxiety? Listening to the brain". Section 4. Chapter 36. • "Synaptic and circuit mechanisms of anxiety disorders: animal and human studies". Section 4. Chapter 37.	
March 6	• Psychotic Disorders: Diagnoses and epidemiology	"Diagnoses and epidemiology of psychotic disorders". Section 2. Chapter 12.	
March 11	• **In class review for exam 2**		
March 13	• **Exam 2**		**Exam 2 in class on March 13**
March 18	• Spring break		
March 20	• Spring break		

March 25	• Journal club: Anxiety disorders		
March 27	• Psychotic Disorders: symptoms and treatment strategies	Penzo et al. "The paraventricular thalamus controls a central amygdala fear circuit"	**Paper critique**
April 1	• Psychotic Disorders: Animal models and neural circuitry	• "Current treatments for psychotic disorders". Section 2. Chapter 22 • "The neurobiology and treatment of bipolar disorder" Section 2. Chapter 20.	
April 3	• Journal club: Psychotic Disorders	• "Animal and cellular models of psychotic disorders". Section 2. Chapter 15. • "Neurodevelopmental mechanisms for psychotic disorders: Animal and human studies" Section 15. Chapter 19.	
April 8	• Eating disorders:	TBD	**Paper critique**
April 10	• Eating disorders: symptoms and treatments	• "Neurobiology of eating disorders: animal and human studies". Section 7. Chapter 66	
April 15	• Eating disorders: animal models and neural circuitry	• "Anorexia Nervosa" Mitchell and Peterson. NEJM • "Bulimia Nervosa" Mehler. NEJM	
April 17	• Eating disorders: From signaling pathways to neural circuitry	• "Genetics and neurobiology of eating disorders"	
April 22	• Journal club: eating disorders		
April 24	• Future directions of psychiatric research: new treatment strategies	TBD	**Paper critique**

April 29	• Future directions of psychiatric research: new treatment strategies	• "Novel approaches for treating anxiety disorders". Section 4. Chapter 39. • "New approaches for treating depression". Section 4. Chapter 30.	
May 1	• Exam 3 review	• "Novel approaches for treating psychotic disorders". Section 2. Chapter 21	
May 6	• **Exam 3**		**Exam 3: In class on May 6**

See Below

MCB Curriculum Policies

DRES Accommodations:

- We are committed to providing a learning environment where our students can succeed. If you require special accommodations, please contact us and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak Street, Champaign, call 217.333.4603, or email disability@illinois.edu. We will try to meet all accommodations once the process has started. Please note that accommodations are not retroactive to the beginning of the semester, but begin the day you contact your professor, instructor or coordinator with a current letter of accommodation from DRES.
- If a student believes that they need DRES accommodations, they should contact DRES at disability@illinois.edu.

Class Absences:

- Regular class attendance is required for all students taking this course. Course attendance and participation will constitute 20% of the overall grade for this course. Students are permitted to miss 2 classes per semester for any reason without any penalty to participation grade. Any absences beyond this must be accompanied by an excused absence (i.e. sick or other emergency). It is a small course and I keep track of who attends class regularly. Failure to regularly attend class may result in a deduction of your attendance and participation grade.
- The Office of the Dean of Students will only provide informative letters to instructors for protracted illness of 3 or more days, certain emergencies and to be present during the serious illness of immediate family members (parents, legal guardian, spouse/partner, siblings, children, or grandparents). These letters do not excuse you from class but merely provide information for the instructor to consider with regard to excusing the absence and permitting make-up work. Students must request absence letters from the Office of the Dean of Students after the student has returned to class but not more than 10 business days after the last date of absence.
- Absences that may be excused without a letter include circumstances beyond the student's control such as medical treatment, surgery related to prolonged illness or injury, pregnancy, legal matters, citizenship or naturalization processes, or acts of nature which cause destruction to a primary residence or disrupt air travel. All will require documentation.
- Absences that may also be excused without a letter include a conference or job, graduate or professional school interviews, though a best effort should be made to schedule these events to minimize class attendance disruption. All will require documentation.
- Absences planned for the items listed in previous bullet point must be communicated to your instructor or course coordinator at least two weeks in advance of the absence. Failure to do so may result in the loss of opportunity to reschedule the missed class period and the portion of the grade associated with this class period.

Exam Absences:

- If you must miss an exam due to unforeseen circumstances, you are required to contact your instructor or course coordinator within 24 hours of the absence. You will then have 48 hours from the absence in which to submit documentation to your instructor or course coordinator. You must also submit an online Absence Form if one is available on your course website. Course personnel will evaluate documentation and decide whether or not there will be an option to compensate for the missed exam through either a make-up exam or proration. Failure to follow this procedure will result in a zero for the exam.
- If you find yourself ill, you must submit confirmation of a visit with a medical practitioner within 24 hours of your absence. The confirmation cannot be provided by a relative, even if the relative is a practitioner.
- If you must miss an exam for a conference or job, graduate or professional school interviews, the exam may be prorated. A best effort should be made to schedule these events around exams.
- If the absence is a result of a protracted illness of 3 days or more, you should follow the procedure for obtaining a letter from the Office of the Dean of Students. The request may be made once the student returns to class but not more than 10 business days after the last date of absence.

Exam Conflicts:

- If you have a regularly scheduled University course that conflicts with the exam, you should complete the online Conflict Exam Request Form on the course website. This request must be made by 5:00 pm not less than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.
- Work schedules should be adjusted, if at all possible, in order to eliminate a conflict with scheduled exams. Please plan accordingly at the beginning of the semester. If eliminating a conflict is not possible, the student should complete the online Conflict Exam Request Form on the course website. This request must be made by 5:00 pm not less than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.
- Students that are formally participating in officially recognized groups, such as athletic teams and performing groups, with a conflict should request a conflict exam by 5:00 pm not less than 3 days prior to the exam via the online Conflict Request Form. Formal participation does not include general meetings of RSOs or any other recognized groups. Documentation of the event will be required prior to scheduling the conflict exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.
- Students with DRES accommodations should also submit the online Conflict Request Form by 5:00 pm no later than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.

Final Exam:

- There is no final exam for this course. The three exams are not cumulative and will consist only of material discussed since the last exam.

Grades:

Final grades for the course will be assigned based on the outline above. Grades for individual assignments will be based as follows:

A: 92-100
A-: 90-92
B+: 87-89.9
B: 84-86.9
B-: 80-83.9
C+: 77-79.9
C: 74-76.9
C-: 70-73.9
D: 60-70
F: <60

Journal Club questions and participation: 4 journal club presentations will occur during lectures throughout the semester. Dr. Sweeney will present each of these papers during class hours. Selected papers will complement lecture topics and cover cutting-edge findings related to the scientific topics covered in the previous week's lectures. Students are expected to read the paper ahead of class and prepare questions related to the paper. For 2 of the 4 journal clubs, students must submit a 1 page summary of the paper indicating the following:
-background and goal of the study (what scientific question is the study addressing?)
-experimental approaches used to address this question
-primary results of the study
-limitations of the study and future directions

Written journal club summaries are due prior to the class covering that paper.

Paper summaries will be graded using the following rubric:
10: outstanding
8: excellent
6: good
4: poor
0: absent/no presentation

Students can choose which 2 papers to submit, and are only required to submit assignments for 2 of the 4 papers. Each summary will count for ten points towards the overall grade for the course. Material covered in the paper may appear on exams

Participation and attendance: Students are expected to attend all lectures and actively participate in class discussions. Students will be permitted to miss 2 lectures without any penalty to their grade.

Exams: There will be 3 non-cumulative exams for this course. Exams will consist of multiple choice questions pertaining to the lectures and reading assignments.

Academic Integrity:

- The Code of Policies and Regulations Applying to All Students will be applied in all instances of academic misconduct committed by students. This applies to all exams, presentations, assignments and materials distributed or used in this course. You can review these policies at the following website:

http://admin.illinois.edu/policy/code/index.html and specifically here: http://studentcode.illinois.edu/article1/part4/1-401/

- Science cannot exist without honesty. The faculty and staff in MCB require students, as scientists-in-the-making, to hold the highest standards of scientific and academic conduct. Any form of cheating on any graded work in courses is unacceptable.
- We require that all graded work be entirely your own, and that anything you write using the words of other writers be correctly attributed. Some specific points follow.
- On written or electronic assignments, the answers that you turn in for grading must be written in your own words, formulated from your own understanding of the material. While you may be working with other students in the course, you must formulate and submit your own answers. Copying or paraphrasing the work of another student, or allowing another to copy or paraphrase your work, is unacceptable. Since we cannot monitor you as you complete your work, we have only the appearance of your work from which to judge. If the work you submit resembles that of another student too closely, we may conclude that it was not your original work. Always make a conscious effort to complete your work on your own and to protect it from the view of others, in order to ensure that it will be seen as your own. You must also make a conscious effort to protect your passwords and accounts. Failure to adhere to these standards may result in a grade of zero for the entire assignment for all persons involved.
- On written or electronic assignments, if you use a statement taken directly from any book or other publication, including the course textbook, you must provide a citation. That is, you must put the text in quotes and put the author of the publication in parentheses after the quotation. Failure to do so will result in zero credit for that answer. Further, using only the words of another author as your entire answer or as the majority of your answer to any question is never sufficient to earn credit. If the majority of your work has been taken directly from a publication, you are likely to receive no credit for the work, since you would not be demonstrating knowledge beyond the ability to copy. Even if you quote another, your answer must be substantially your own words, drawn from your own understanding of the material.

Electronic Media/Device Use:

- Use of any social or electronic media to share course information, request course information or make confidential course information public is prohibited. Any use of this type may earn you a zero on an assignment or exam or a more extreme penalty at the discretion of the instructor.
- Any violation of the social media policy **on your account** may result in a zero on an assignment or exam or a more extreme penalty at the discretion of the instructor.
- No electronic devices, including smart watches, are allowed at exams.

Course Material:

- Students are welcome and encouraged to make audio recordings of course lectures.
- The material recorded is intellectual and copyrighted property of the University of Illinois Board of Trustees and may be made for personal use only.
- Video recordings of any kind are strictly prohibited.
- Posting of audio recordings or transcriptions on social or electronic media platforms is strictly prohibited.
- Posting or redistributing of course material in any format is strictly prohibited