



PSYC 248

BEHAVIORAL NEUROSCIENCE



Fall Semester 2024: September – December 2024

Lecture: Monday, Wednesday, and Friday, 2:20 – 3:20 PM, Theater 200

Lab: Thursday, 1:20 – 4:30 PM, Olin-Rice 371H

Contact Information

Instructor: Jean-Marie N. Maddux, Ph.D. (pronouns: she/her/hers)

Office: Olin-Rice, Room 324

E-mail: jmaddux@macalester.edu

Office Phone: (651) 696-6118

Office Hours (student drop-in hours): Monday, 12:00 – 1:00 PM

Wednesday, 3:30 – 4:30 PM

or by appointment (e-mail me to set up an appointment)

Preceptors

Jordan Vellón (pronouns: he/him/his); e-mail: jvellon@macalester.edu

Nox Matse (pronouns: she/her/hers); e-mail: nmatse@macalester.edu

Course Time and Location

Lecture meets on Monday, Wednesday, and Friday from 2:20 – 3:20 PM, in Theater Building room 200. Lab meets on Thursday from 1:20 – 4:30 PM, in Olin-Rice room 371H.

Course Prerequisite: PSYC 100 or PSYC 180.

Required Text (available for sale or rent at the bookstore and on reserve at the library)

Pinel, J.P.J., & Barnes, S.J. (2021). *Biopsychology* (11th ed.). Pearson Education, Inc.

Required Primary Literature (will be made available on the Moodle course page)

Additional readings (e.g., journal articles and review papers) will be assigned throughout the course of the semester. Reading, understanding, discussing, and critiquing primary literature is an important part of this course.

Course Description

Neuroscience, the scientific study of the nervous system, is an inherently interdisciplinary field involving multiple levels of analysis. This course serves psychology students, as a biological psychology menu option (elective), and neuroscience students, as a required intermediate course toward the neuroscience major. This course approaches the study of brain, mind, and behavior from systems-level and behavioral perspectives. Current issues are examined within an integrative framework that begins with a focus on neuroanatomy, functional neural circuits, and diffuse modulatory neurotransmitter systems. This lays the groundwork for later study of the

neural substrates of motivated behaviors (e.g., eating, sex, drug use), learning, memory, emotion, as well as aspects of neurodevelopment and neuroplasticity. Research methods and tools of behavioral neuroscience are featured throughout the course, through careful examination of primary journal articles and through hands-on experiences in weekly laboratory sessions. Science is a methodical process, and we will approach topics in this course through that lens.

Learning Outcomes

The primary goal of this course is to help you develop an understanding of biopsychological theory and research, with an appreciation not only for the major findings of the field, but also for the methods employed in generating those findings. Upon successful completion of this course, students should be able to:

1. Identify, describe, explain, and communicate the major concepts, theoretical perspectives, methods, and empirical findings in the field of behavioral neuroscience. This will include:
 - a. Describing brain anatomy, structure, and function
 - b. Understanding the action potential of neurons and the important events that take place in the synapse
 - c. Understanding how synaptic events and systems-level events contribute to our understanding of drug abuse, and other behavioral/neurobiological disorders
 - d. Describing how the study of complex phenomena, such as learning and memory, are studied by neuroscientists
 - e. Further considering “simple” behaviors, such as eating, which aren’t simple at all
 - f. Understanding the neural bases of some neurological and behavioral disorders
2. Effectively read, understand, and critique the primary literature (i.e., journal articles) of the field.
3. Think critically to assess existing findings in the field, and think creatively to suggest new ways to advance it.
4. Appreciate how a science of behavior contributes to an understanding of brain-behavior relationships.
5. Consider the importance and relevance of animal research in furthering our understanding of the neurobiological substrates of behavior.
6. Design and conduct experiments!

Course Outline

Pinel & Barnes (2021):

Chapter 1: Biopsychology as a Neuroscience

Chapter 3: Anatomy of the Nervous System

Chapter 4: Neural Conduction and Synaptic Transmission

Chapter 5: The Research Methods of Biopsychology

Chapter 9: Development of the Nervous System: Sections 9.7 – 9.14

Chapter 10: Brain Damage and Neuroplasticity: Sections 10.15 – 10.21

Chapter 11: Learning, Memory, and Amnesia

Chapter 12: Hunger, Eating, and Health

Chapter 13: Hormones and Sex: Sections 13.1 – 13.7, 13.10 – 13.11, 13.13 – 13.14, 13.16

Chapter 15: Drug Use, Drug Addiction, and the Brain’s Reward Circuits or

Chapter 17: Biopsychology of Emotion, Stress, and Health (class vote for Chapter 15 or 17)

Please note that the textbook chapter readings will be supplemented with primary literature readings, which will be assigned as we move through the material.

A Note on Communication

E-mail is the primary form of communication outside of the classroom. If you are not already doing so, please get in the habit of checking your Macalester College e-mail daily.

I try my best to respond to e-mails as soon as I can, but please be patient. I will respond to e-mails within 36 business hours. I do not check e-mail from my phone, and I do not always check e-mail on weekends and evenings. Hence, please plan accordingly when you need to communicate with me.

Assignments are to be submitted via Moodle, not e-mail. You also need to monitor our Moodle course page frequently, as that is where readings will be posted as we move through the semester.

Assessment

You will receive a single grade for lecture and lab, but the activities and scoring for the lecture and lab are separate until final grades are calculated. The lecture component of the course will account for 64% of your final grade, and the lab component will account for 36% of your final grade. Please note that any material from the assigned chapters of the textbook is fair game to appear on an exam, even if it was not explicitly covered in the lectures. Also please be aware that discussion topics and issues raised during lectures or labs could appear on an exam. Thus, it is in your own best interest to attend the lectures and labs, and actively participate in discussion. Final grades for the course will be based on the following:

Lecture Component: 64%

Exams: 3 exams in class and the final exam during finals period.

The final exam is cumulative.

Exam 1: 12%

Exam 2: 13%

Exam 3: 14%

Final Exam: 17%

Journal Article Review: 8%

Lab Component: 36%

Brain Anatomy Quiz: 6%

Histology (rat brain) and Microscopy Quiz: 6%

Journal Club Presentation: 6%

Primary Literature Worksheets: 5% (5 worksheets at 1% each)

Conditioning Lab Report: 6%

Psychopharmacology Lab Report: 7%

Grading Scale

The grading scale is as follows:

Numeric Grade	Letter Grade
93 - 100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
67 - 69	D+
63 - 66	D
60 - 62	D-
0 - 59	NC (No Credit)

A Note on Screens/Devices in Class

I urge you please to be as engaged as possible during class so that you can optimize your learning and the learning of your classmates. If you intend to use electronic devices (e.g., tablet, laptop, cell phone) to take notes or to access course materials during class, please consider turning off notifications from social media. If you are expecting an important, time-sensitive call or text, please briefly step out of class to attend to it. If I think you are using your electronic devices for purposes unrelated to class, I will ask you to please refrain from doing so.

Attendance Policy

Attendance plays an essential role in learning; you are warmly invited, encouraged, and expected to attend all class/lab meetings. Attendance will be important not only for your learning, but also for our ability to build a community together and maintain a sense of connection and commitment to one another during the semester. Your presence in class matters.

I recognize that there are unavoidable circumstances that sometimes make it impossible for you to attend class. If you will not be in class for any reason, it is your responsibility to inform me in advance via e-mail. Students with disabilities should discuss their accommodations with me early in the course to work out a plan that aligns with maintaining course expectations and goals.

Please keep in mind that each student is responsible for the material presented in every class – whether the student has attended or was unable to attend. If you miss a class, it is your responsibility to get the missed information from the course preceptor or a classmate. Lecture slides will be made available to all students in the class via Moodle. Please note that in-person class sessions are not recorded.

Participation Policy

Participation is distinct from attendance and is also an essential part of this course. Please come to each class on time, fully prepared, and willing to actively participate. Being “fully prepared” means, in part, having thoroughly read the assigned material prior to class. “Active participation” means you will freely share your thoughts, observations, and questions regarding the material that we are covering. You will find that your active participation has a beneficial effect on learning and the quality of the course experience for everyone.

It is important to remember that we all have different styles of expression. If you have not been able to participate in a class discussion for any reason but want to demonstrate your active engagement, please send me an email after class with a comment or an idea you had that you would have liked to share, but were not able to during class.

Policy on Late Assignments, Missing Class, and Flexibility Tokens

Completing assignments and other course work when they are due is important for keeping up with our material. Late assignments will be accepted for one week following their due date, but they will be penalized 20% of their grade. After one week, late components will no longer be accepted.

Although I sincerely hope that you will be able to complete the course requirements when they are due, I realize that other aspects of your life may interfere with your ability to do this. To accommodate this reality, I offer 4 flexibility tokens to be used at your discretion in order to balance the demands on your time. Flexibility tokens can be used to: miss a day of in-class work, get a 72-hour extension on a written assignment without penalty (*does not apply to

journal club oral presentation*), take one lab quiz late (*does not apply to practical lab quiz*), or take one in-class exam late (* does not apply to the final exam*). Flexibility tokens may be used as follows:

- Miss a day of in-class work: 1 token
- Get a 72-hour extension on written assignment: 1 token
- Take lab quiz late (up to one week maximum): 2 tokens
- Take in-class exam late (up to one week maximum): 3 tokens

You do not need to explain to me why you are using a token, but you do have to inform me via e-mail in advance of the assignment due date that you are using a token. You do not need to use a token for religious observances, COVID-related absences, or accommodations via Disabilities Services.

Once all of your tokens are used, extensions will only be granted in extreme circumstances with appropriate documentation (e.g., illness/medical emergency).

Academic Integrity Policy

Students are expected to maintain the highest standards of honesty in their college work; violations of academic integrity are serious offenses. Students found guilty of any form of academic dishonesty — including, for instance, forgery, cheating, and plagiarism — are subject to disciplinary action. Examples of behavior that violates this policy, as well as the process and sanctions involved, can be found on the Academic Programs website:

<https://www.macalester.edu/academicprograms/academicpolicies/academicintegrity/>.

Artificial Intelligence (AI) Use Policy

Using AI can impede your learning. The assignments in this class challenge you to develop creativity, critical-thinking, and problem-solving skills that AI does not have. Using AI technology could limit your capacity to do this type of work, and as the instructor, I urge you not to miss out on the educational opportunities that this course will provide. As is the case for all courses at Macalester College, work submitted by you for this class should reflect both your own *ideas* and your own *language* and you should properly cite any resources you have consulted. If you have any questions about citation or about what constitutes academic honesty in this course or at Macalester College in general, please feel free to raise these questions in class and/or contact me to discuss your concerns.

Disability Accommodation

In accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act, Macalester College works hard to ensure that all facilities and programs are accessible to all students. Accommodations are based on individual need substantiated by the appropriate process. What is reasonable is also determined by what is essential to this course. Any students who believe that they may need accommodations due to disability impacts should contact Disability Services by emailing disabilityservices@macalester.edu, or by calling 651-696-6748 to schedule an appointment to discuss your individual needs. Students should then follow up with me directly to discuss accommodations for this course.

Religious Observance

In an effort to respect religious diversity, I request that students who plan to observe a religious holiday during scheduled class meetings/class requirements talk to me about reasonable consideration by the end of the second week of the course.

Health and Wellness Statement

I strongly encourage you to make your well-being a priority. Investing time in thinking well about yourself will help you engage more fully in your academic experience. Remember that beyond being a student, you are a human being with your own experiences, thoughts, emotions, and identities. It is important to acknowledge any stressors you may be facing; these can be emotional, physical, cultural, financial, etc., and can affect your academic experience. I encourage you to remember that you have a body with needs. It is important to eat when you are hungry, drink water, use the restroom, and step out of (or away from) class if you are upset or need some air. Please do what is necessary so long as it does not interfere with your or others' ability to be present in the course. Outside of the classroom, strategies to support your well-being include eating and sleeping well, moving your body, and connecting with others. If you are having difficulties, please don't hesitate to contact me and/or find support from other resources, including those offered by the [Hamre Center](https://www.macalester.edu/health-and-wellness/counseling/): <https://www.macalester.edu/health-and-wellness/counseling/>.

Sexual Misconduct/Title IX Statement

Macalester is committed to providing a safe and open learning and living environment for all students, staff, and faculty. Any community member experiencing sexual harassment, sexual violence, relationship violence, or stalking, is encouraged to seek help and support.

Please be aware that as a faculty member, it is my responsibility to report disclosure about sexual harassment, sexual misconduct, relationship violence, and stalking to the Title IX Office. The purpose of this report is to ensure that anyone experiencing harm receives the resources and support they need. I will keep this information *private* and it will not be shared beyond this required report.

You may also contact Macalester's Title IX Coordinator directly (phone: 651-696-6258 ; e-mail: titleixcoordinator@macalester.edu); she will provide you with supportive measures, resources, and referrals. Additional information about how to file a report (including anonymously) is available on the [Title IX website](#).

If you prefer to speak with someone confidentially, or need 24/7 support, there are resources available on- and off-campus to assist you:

- [Counseling Services](#) at the Hamre Center – on-campus counseling resource for students **Free, Urgent, Phone Counseling (Press 2) is available to Macalester students anywhere in the world, 24/7/365.** Speak to a licensed mental health counselor 24 hours a day by calling Hamre Center at 651-696-6275, then press or say option 2 when prompted.
- [Center for Religious and Spiritual Life](#) – chaplains may be reached via 651-696-6298 or email religiouslife@macalester.edu
- [SOS Sexual Violence Services of Ramsey County](#) 651-266-1000 (24-Hour Crisis Hotline staffed by trained advocates)
- [Rape, Assault, and Incest National Network \(RAINN\)](#) 1-800-656-4673 (24-Hour Hotline and Live Chat)
- Additional local and national resources can be found at <https://www.macalester.edu/title-ix/find-support/>

MAX Center Resources

The [MAX Center](https://www.macalester.edu/max/#/0) (<https://www.macalester.edu/max/#/0>) is Macalester's academic resource center. I strongly encourage you to take full advantage of any and all of the excellent resources they provide there, as they are committed to supporting all students to succeed at Macalester.

Library Resources

Working to integrate neuroscientific literature into your research can be a complex process. Consulting with the research and instruction librarians for psychology and neuroscience will save you time and help you discover better, more scholarly sources. You can make an appointment using the Ask Us page on the library website, which can be accessed at <https://www.macalester.edu/library/askus/>, or email your librarian(s) directly.

Course Schedule: Lecture Component

Please note: The Course Schedule is subject to change based on class progress and the instructor's discretion.

Please note that the textbook chapter readings will be supplemented with primary literature readings, which will be assigned as we move through the material.

Day and Date	Topic	Required Reading	Assignment Due
W Sept. 4	Introduction to the course and each other	-----	
F Sept. 6	What is biological psychology/behavioral neuroscience?	Chapter 1	
M Sept. 9	Approaches to the study of brain and mind: Class Discussion	Kandel & Squire, 2000 Gazzaniga, 2010 Niv, 2021	
W Sept. 11	Ethics: Class Discussion	Ohl & Meijboom, 2015 Brosnan et al., 2013	
F Sept. 13	Anatomy of the Nervous System	Chapter 3	
M Sept. 16	Anatomy of the Nervous System	Chapter 3 and Paluzzi et al., 2012	
W Sept. 18	Anatomy of the Nervous System	Chapter 3	
F Sept. 20	Anatomy of the Nervous System	Chapter 3 and Diffuse Modulatory Systems of the Brain (Bear, Connors, & Paradiso, 2016)	
M Sept. 23	Neural Conduction and Synaptic Transmission	Chapter 4	
W Sept. 25	Neural Conduction and Synaptic Transmission	Chapter 4	
F Sept. 27	Neural Conduction and Synaptic Transmission	Chapter 4	
M Sept. 30	Neurotransmitters and Receptors	Chapter 4	
W Oct. 2	Neurotransmitters and Receptors	Chapter 4	
F Oct. 4	EXAM 1	-----	EXAM 1
M Oct. 7	Research Methods of Neuroscience (Note: Recorded video lecture, as instructor is out of town at Society for Neuroscience conference)	Chapter 5	
W Oct. 9	Research Methods of Neuroscience (Note: Recorded video lecture, as instructor is out of town at Society for Neuroscience conference)	Chapter 5	

Day and Date	Topic	Required Reading	Assignment Due
F Oct. 11	Research Methods of Neuroscience	Chapter 5	
M Oct. 14	Research Methods of Neuroscience	Chapter 5	
W Oct. 16	Flex Day (coverage will vary depending on progress through material)		
F Oct. 18	Fall Break – No class	-----	
M Oct. 21	Experience and Development	Chapter 9: Sections 9.7 – 9.14	
W Oct. 23	Experience and Development	Chapter 9: Sections 9.7 – 9.14 and Huggins and Curlik (2019)	Huggins and Curlik (2019) Worksheet #1
F Oct. 25	Neuroplasticity and Brain Damage	Chapter 10: Sections 10.15 – 10.21	
M Oct. 28	Neuroplasticity and Brain Damage	Chapter 10: Sections 10.15 – 10.21	
W Oct. 30	Flex Day (coverage will vary depending on progress through material)		
F Nov. 1	EXAM 2	-----	EXAM 2
M Nov. 4	Learning and Memory	Chapter 11	
W Nov. 6	Learning and Memory	Chapter 11	
F Nov. 8	Learning and Memory	Chapter 11 and Winters et al. (2004)	Winters et al. (2004) Worksheet #2
M Nov. 11	Learning and Memory	Chapter 11	
W Nov. 13	Ingestive Behavior (Hunger and Eating)	Chapter 12	
F Nov. 15	Ingestive Behavior (Hunger and Eating)	Chapter 12	
M Nov. 18	Ingestive Behavior (Hunger and Eating)	Chapter 12	
W Nov. 20	Ingestive Behavior (Hunger and Eating)	Chapter 12 and Myers (2007)	Myers (2007) Worksheet #3
F Nov. 22	Sexual Behavior	Chapter 13: Sections 13.1-13.7, 13.10-13.11, 13.13-13.14, 13.16	
M Nov. 25	Sexual Behavior	Chapter 13: Sections 13.1-13.7, 13.10-13.11, 13.13-13.14, 13.16	

Day and Date	Topic	Required Reading	Assignment Due
W Nov. 27	Thanksgiving Break – No class	-----	
F Nov. 29	Thanksgiving Break – No class	-----	
M Dec. 2	Sexual Behavior	Chapter 13: Sections 13.1-13.7, 13.10-13.11, 13.13- 13.14, 13.16 and Dominguez and Hull (2010)	Dominguez and Hull (2010) Worksheet #4
W Dec. 4	EXAM 3	-----	EXAM 3
F Dec. 6	Drug Use, Drug Addiction, and Brain Reward Circuits or Emotion, Fear, and Stress (determined by class vote)	Chapter 15 or Chapter 17	
M Dec. 9	Drug Use, Drug Addiction, and Brain Reward Circuits or Emotion, Fear, and Stress (determined by class vote)	Chapter 15 or Chapter 17	
W Dec. 11	Drug Use, Drug Addiction, and Brain Reward Circuits or Emotion, Fear, and Stress (determined by class vote)	Chapter 15 or Chapter 17 and Journal Article for Worksheet #5	Worksheet #5 (content determined based on outcome of class vote)
M Dec. 16	FINAL EXAM (cumulative) 10:30 AM – 12:30 PM	-----	FINAL EXAM (cumulative)
W Dec. 18	No class meeting – Upload your Journal Article Review by this date at the latest		Journal Article Review

Course Schedule: Laboratory Component

Please note: The Course Schedule is subject to change based on class progress and the instructor's discretion.

Day and Date	Activity	Quiz or Assignment Due
Thursday September 5	Introduction; Lab Safety	
Thursday September 12	Sheep Brain Dissection 1	
Thursday September 19	Sheep Brain Dissection 2	
Thursday September 26	Rat Brain Histology and Microscopy	Sheep Brain Anatomy Quiz
Thursday October 3	Conditioning 1	Rat Brain Anatomy Quiz
Thursday October 10	Conditioning 2	
Tuesday October 15 (Note: Meet Tuesday instead of Thursday because of Fall Break)	Journal Club 1	Student Presentations
Thursday October 24	Journal Club 2	Student Presentations and Conditioning Lab Report Due
Thursday October 31	Rat Handling and Injection Workshop	
Thursday November 7	Psychopharmacology 1	
Thursday November 14	Psychopharmacology 2	
Thursday November 21	Psychopharmacology 3	
Thursday November 28	No Lab – Thanksgiving Break	
Thursday December 5	Journal Club 3	Student Presentations and Psychopharmacology Lab Report Due

Photography and Videography Policy: We will work with live rats during several of our lab sessions. Although the rats are adorable, and I appreciate your enthusiasm in working with them, I ask that you please refrain from taking photographs and/or videos of our rat subjects. Your cooperation in this matter is greatly appreciated.

IACUC Information: All work with live rats in this course has been approved by the Macalester College Institutional Animal Care and Use Committee (IACUC). The Macalester College IACUC acts to review and ensure that animal welfare standards and ethical principles are applied at the highest possible level in any animal use or research conducted at or in association with the college. The goal of each IACUC is to ensure the humane care and use of any animals used in research, and compliance with guidelines and regulations, while maintaining flexibility to best meet the unique needs of the institution. Active participation by research scientists allows for the scientific needs of research investigators to be considered; participation by nonaffiliated members incorporates a public conscience; and the involvement of veterinarians ensures appropriate medical care and animal well-being. A program of continuing education for IACUC members and researchers ensures that animal care and use standards and ethical principles continue to align with best practices. As at other educational and research institutions, the Macalester College IACUC derives its authority from the law. IACUCs are mandated by the Health Research Extension Act (HREA) of 1985 and the Animal Welfare Act.