NEUROSCI 217: Introduction to Cognitive Neuroscience

SUMMER SESSION 1, 2024
MAY 16 – JUNE 24

Location: LSRC DIBS B029 (DIBS Cube Classroom)
Times: 2:00 - 4:05 PM Monday, Tuesday, Thursday
Instructor: Anna Smith (Instructor), Rod Bailey (Teaching Laboratory Manager)
Instructor's Zoom Room: 774 047 1884
Textbook: CogLab5 (online)

Course Description:

The modern discipline of Cognitive Neuroscience is a marvel of technology and interdisciplinary thought in philosophy, psychology, and biology. Continuous with its sister discipline of cognitive psychology and enabled by advances in noninvasive neuroimaging techniques, cognitive neuroscience is concerned with the neural basis of mental operations; how the "software" of the human mind runs on the brain's organic "hardware." This six-week summer course was designed to be Duke's first laboratory-based undergraduate course in human neuroscience. Each week will feature a different core research area, filling out students' understanding of how we sense and perceive, remember events, process emotions, attend to our environments, and make decisions.

Learning Objectives:

1. Identify brain regions relevant to cognition and relate them to their functions
2. Describe and implement common methods in cognitive neuroscience
3. Compare and contrast sensorimotor pathways
4. Relate theoretical frameworks to behavioral and neural data
5. Interpret and synthesize information from primary sources in cognitive neuroscience

background figure originally from McLeod et al. (1998)

About the Instructor

Name: Anna Smith, M.S.
Please Call Me: Professor Smith or Anna (she/her)
Office Hours: Wednesdays, 10am to noon (drop-in Zoom or in-person by appointment)
Office: Reuben-Cooke 207
Email: anna.p.smith@duke.edu
Ask me about: content and concerns about the class, your research interests, or applying to graduate school. Please allow 24 hours for email responses and be aware that there is no guarantee of responses after 5pm or on weekends.

About me: I am a cognitive scientist and Psychology & Neuroscience PhD candidate. As a fifth year, I am "ABD" (all but dissertation) and will graduate in the Spring of 2025. My area of specialization is in the measurement of "generative thought," or how the brain deploys past experiences to generate new ideas, as in the case of mind wandering, future thinking, creative cognition, imagination, and aesthetic experience. I worked last summer as a Duke Learning Innovation Fellow to re-design this class into a heavily experiential summer course. I look forward to sharing our teaching lab resources and my interest in these topics with you all!

Class Structure and Participation:

This course employs hands-on activities wherever possible. As NEUROSCI 217 is a core course for the neuroscience major, we use an array of traditional and active learning approaches to match the content of lecture-based analogs of this course offered during the year. Brief, low-stakes quizzes on lecture content will ensure that topical coverage is met. For homework, in place of textbook readings, students will complete online experiment simulations or prepare for in-class laboratory demonstrations. Each in-class lab demonstration involves a Pre-Lab (in preparation for the day) and Post-Lab worksheet (to record and reflect upon empirical observations). To further supplement lecture content, we will complete readings together, "journal club-style," as a group and individually for the final written assignment. In place of a final exam, students will complete an 8-10 page literature review on a core cognitive neuroscience topic of their choice.

Textbook

This class uses the companion website to CogLab5 (ISBN#: 9781285461083), which is accessed here: https://faculty.cengage.com/titles/9781285461083
Please click "view as a student" and select the 1-term access to CogLab5 for $50.

Absences

As this course is small, activities-based, and condensed, absences disproportionately impact individual and group learning. Therefore, attendance each day is necessary. Attendance will not be taken directly, but many deliverables detailed in this syllabus require students to be physically

present. If you need to make up work or request an extension, please contact the instructor with the appropriate form. Excused absences for short-term illness will require submission of an Incapacitation Form or Dean's Excuse. You may also submit a Religious Observance Notification form. To learn more about Duke's official policy regarding excused absences, please go to: http://trinity.duke.edu/undergraduate/academic-policies/illness and https://trinity.duke.edu/undergraduate/academic-policies/religious-holidays.

Students with Disabilities

We encourage students with disabilities, including "invisible" disabilities such as chronic diseases and learning disabilities, to talk with me as soon as possible about appropriate accommodations. If you have a documented disability and may require accommodations, please see: https://access.duke.edu/requests/

Duke Community Standard

All students are expected to adhere to the Duke Community Standard and conduct themselves honorably in both academic and non-academic endeavors. The current Duke University standard for academic integrity can be found at: https://trinity.duke.edu/undergraduate/academic-policies/community-standard-student-conduct

You are expected to follow this standard at all times. Please note that the community standard prohibits "unauthorized use" of AI, which differs between courses; ours is detailed below. Additional information about what constitutes academic dishonesty can be found here: https://students.duke.edu/get-assistance/community-standard/

Use of Technology

Laptops: Students will be individually assigned a MacBook Pro equipped with lab demonstration software for classroom use. They will be kept in their cart between classes for charging and safekeeping. You may not alter any system settings or install any new software on these laptops. Please log out of your accounts at the end of Summer Session 1 to protect your own privacy.

Equipment: Our lab equipment is fragile, so please prepare for class by reviewing relevant lab protocols. Please do not bend the headsets and do turn off technology before returning it to storage. Food and drink should be kept out of the teaching laboratory and away from all electronics in the classroom. We will have a short break approximately halfway through the two hour-long class period. The portable EEG devices use saline pads and will require some manual manipulation to make proper contact with the scalp, especially if you have long or dense hair. These demonstrations will be done in small groups or in pairs and instructions for how to optimize scalp contact for students who volunteer to wear the headsets will be sent in advance.

Use of AI: There is only one major written assignment in this course; therefore, we expect all work submitted by students to be fully their own. The one approved use of AI in this course is to seed your literature search. Therefore, you may use AI to recommend the first round of papers you read or initial keywords you use to search databases. Thereafter, please peruse reference

sections and learn to navigate databases on your own; doing so exposes you to articles and keywords you may not encounter otherwise, as well as typical citation practices.
You may not use sentences written by you that have been reworked by AI software. Do not use AI to automatically summarize papers, as scientific literacy (which includes learning to efficiently skim paper abstracts) is one of our learning objectives. Synthesis, revision, and refinement of ideas is the bread and butter of scientific writing. If you choose to use AI to assist your literature search, please provide screenshot documentation in an appendix of your final paper, after the References section. If the source of your written work is unclear, I may require you to meet with me to explain the ideas and your writing process. If you have any questions about what is permitted, reach out to me.

Deliverables:

Separate assignment sheets will be provided and lecture slides will be uploaded to Canvas.
Note: if something is due at the end of the day, it is due at midnight.

Lab Worksheets (20%)

We will have a number of in-lab activities that entail preparation (Pre-Lab) and reflection (Post-Lab). Pre-Lab worksheets will detail any contextual information to know going into the lab experience, such as setup instructions, safety information, and prior reading. Post-Lab worksheets will provide a structure for recording your measurements and observations during the demonstration itself, with a final brief reflection to be completed after class before the end of the day. Together, both worksheets are worth 20% of your total grade.

CogLab5 Activities (15%):

This course uses an online textbook companion site that runs classic cognitive behavioral paradigms in the browser. These simulated experiments come with reading and multiple choice questions. Your performance on the task is not part of the grade; however, cognitive psychologists are used to sorting through online participant data and we can spot run-throughs that were not given participants' full attention! This completion grade is worth 15% of your overall grade, so please apply yourself for the average of 20 minutes it takes to complete these simulations.

Quizzes (20%):

Quizzes in this class are designed to be low-stakes and to be completed in the first 20 minutes of class. They will be multiple-choice and will relate to basic takeaways from the preceding week's lecture content. There will be 5 quizzes of 10 questions each, and the lowest score will be dropped. The last unit will substitute an "exit ticket" in place of a quiz. Unlike the other quizzes, the exit ticket will be free-response and will ask for a brief summary of what you learned that day and a reflection on your experience in this class.

Final Paper (40%):

Instead of a final, you will write an 8-10 page (double-spaced) research paper that synthesizes current research in one of the domains of cognitive neuroscience covered in this course. Please see the *Uses of Technology* section above for this course's AI policy. Sound paper topics include visual perception, olfaction, taste perception, auditory perception, tactile/haptic perception, attention, declarative memory, nondeclarative memory, working memory, cognitive control, and emotion. You may also decide to write a paper on the physics and applications of a method or technology such as MRI, EEG, PET, fNIRS, or TMS, provided that you can cover it in a comparable level of depth. Paper topics are due in Week 3, and you will receive feedback on whether the scope of your topic choice is appropriate.

Grading Scheme

A+	100% to 97%	C+	< 80% to 77%
A	< 97% to 93%	C	< 77% to 73%
A-	< 93% to 90%	C-	< 73% to 70%
B+	< 90% to 87%	D+	< 70% to 67%
B	< 87% to 83%	D	< 67% to 63%
B-	< 83% to 80%	D-	< 63% to 60%
		F	< 60% to 0%

Schedule:

(this schedule is subject to change)

Date	Topic	Due Today
Week "0" (5/15/24)		
Thursday (5/16)	Syllabus, Introductions	• Read syllabus prior to class
Week 1 (5/22)	**Overview**	
Monday	History of Cognitive Neuroscience	• Read Posner & DiGirolamo (2000)
Tuesday	Methods and Principles of Modern Cognitive Neuroscience	• Anatomy Pre-Lab Worksheet
Thursday	Structural and Functional Anatomy of the Human Brain	• Anatomy Post-Lab Worksheet (end of day)
Week 2 (5/27)	**Primary Sources in Cognitive Neuroscience**	
Monday: Memorial Day	*No Class*	*No Class*

Tuesday	Scientific Publication and Tips on Reading Articles	Quiz 1 (on anatomy and methods slides) • *Science* Magazine column on reading by E. Pain • (optional: funny version by A. Ruben)
Thursday	Journal Club in Class: Bornstein et al. (2023) Introduction to final paper	• Article Summary Worksheet filled out for Bornstein et al. (2023)
Week 3 (6/3)	Sensation and Perception	
Monday	The "Distance Senses:" Audition and Vision	Quiz 2 (on scientific literacy slides) • Submit your paper topic along with 3 sources and 3-5 keywords
Tuesday	Alpha Waves Demonstration	• Alpha Waves Pre-Lab Worksheet
Thursday	Chemical and Mechanical Senses: touch, taste, and smell	• Alpha Waves Post-Lab Worksheet
Week 4 (6/10)	Attention	
Monday	Endogenous and Exogenous Attention	Quiz 3 (on sensory slides) • CogLab: Spatial Cuing
Tuesday	P300 Demonstration	• P300 Pre-Lab Worksheet
Thursday	Consciousness and Mind Wandering	• P300 Post-Lab Worksheet (end of day)
Week 5 (6/17)	Memory	
Monday	Neuroplasticity and LTP	Quiz 4 (on attention and consciousness/MW slides) • CogLab: Production Effect
Tuesday	Declarative and Nondeclarative Memory	• CogLab: Encoding Specificity
Thursday	Memory Demonstration Stations	• Memory Demonstration Post-Lab Worksheets (end of day)
Week 6 (6/24)	Executive Function and Emotion	
Monday (last day)	Working Memory, Cognitive Control, Theories of Emotion	Quiz 5 (on memory slides) • CogLab: Wason Selection Task, Monty Hall • Exit Ticket in class
Tuesday: Reading Period	*No Class*	*No Class*
Thursday (6/27)	*No Class*	• Term Paper Due (end of day)

References:

Bornstein, A. M., Aly, M., Feng, S. F., Turk-Browne, N. B., Norman, K. A., & Cohen, J. D. (2023). Associative memory retrieval modulates upcoming perceptual decisions. *Cognitive, Affective, & Behavioral Neuroscience*, *23*(3), 645-665.

McLeod, P., Plunkett, K. & Rolls, E.T. (1998). Introduction to connectionist modeling of cognitive processes. Oxford University Press: Oxford

Pain, E. (2016). How to (seriously) read a scientific paper. *Science*, *10*.

Posner, M. I., & DiGirolamo, G. J. (2000). Cognitive neuroscience: origins and promise. *Psychological bulletin*, *126*(6), 873.

Ruben, A. (2016). How to read a scientific paper. *Science, 20*.