

NEUROFEEDBACK

Class Times: Tu/Th 11:00am-12:20pm in *Pettengill (PGILL) G54* | **Office Hours:** Tu 2-3pm/Th 5-6pm/by appointment

Instructor

Dr. Justin Hulbert
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Course Materials

Course materials will be posted on **Lyceum**.

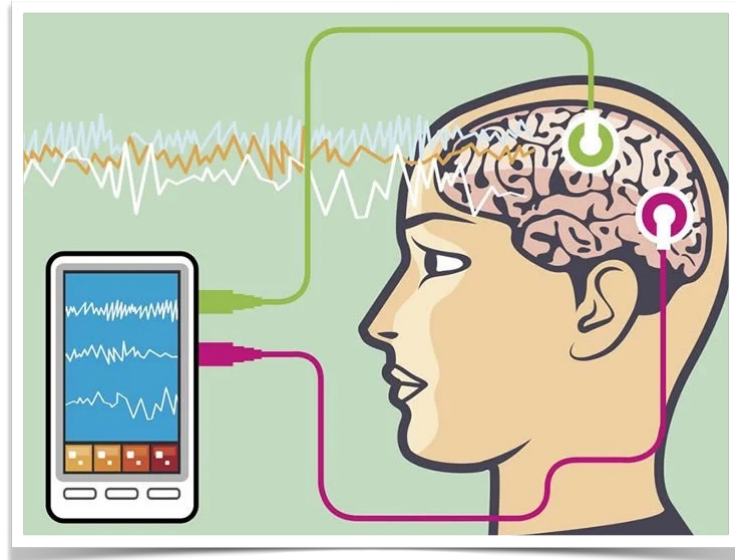
Prerequisite(s)

NS/PY 160 (Introduction to Neuroscience) or PSYC 215 (Medical Psychology). Not open to first-year students.

Assessments

- Perusall Annotations*: **25%**
- TINS Spotlights (2): **20%**
- Article Presentation‡: **10%**
- Grant Pitch‡: **10%**
- Grant Proposal‡: **25%**
- Research Participation: **5%**
- Final Reflection: **5%**
- Extra Credit: **up to 7 extra percentage points**

**I'll drop your lowest 3 scores*
‡Indicates group assignment



Course Overview

There is much yet to learn by studying how the brain responds to different challenges and opportunities. But can brain signals themselves be used to drive intellectual and physical improvements in healthy individuals, as well as in clinical populations? This seminar explores the evolution of neurofeedback techniques that allow individuals to self-regulate via near real-time representations of their own brain activity. Various methodologies (e.g., electroencephalography, functional magnetic resonance imaging), applications (e.g., rehabilitation, treatment of neuropsychological disorders, meditation, and cognitive and athletic enhancements), theoretical implications, limitations, and ethics of neurofeedback will be examined through in-depth discussion and critical analysis of the empirical literature, case studies, and related texts. Students will also have the opportunity to experience neurofeedback firsthand and propose their own testable implementation of its use.



Learning Objectives

By the end of this course, you will be able to:

- Explain the physiological basis of EEG, ERPs, and fMRI signals, including their relative strengths and limitations in neurofeedback research.
- Evaluate empirical and public claims about neurofeedback applications by analyzing evidence and assessing credibility.
- Critically assess the value of neurofeedback in investigating causal relationships between brain function and behavior.
- Collaboratively propose logically sound experiments designed to test specific hypotheses related to neurofeedback.
- Participate in research and debates around methodological and ethical concerns related to neurofeedback.

Joint Responsibilities

Achieving the broad aims of this course requires commitments from all of us. Below you will find an outline of some of those responsibilities. Did I leave something out? Let me know—we can discuss additional responsibilities/group norms as a class.

- **Your instructor agrees to...**
 - a) Make himself available outside of class during posted office hours (and by appointment, as necessary) to answer questions, provide extra help, and discuss matters related to the course of study.
 - b) Respond in a timely fashion (typically by the end of the next school day) to email queries. Note that you should not expect responses to emails sent after working hours until the following school day. In the event that more time is required to fully address the student query, the instructor will acknowledge receipt of the email and provide the student with an estimated response time or suggest meeting in person.
 - c) Facilitate a thoughtful, considerate, and engaging learning environment.
 - d) Classroom technology and circumstances permitting, post to Lyceum a recording of the class within 24 hours of each meeting for the benefit of students who were ill or otherwise unable to attend class due to extenuating circumstances. These recordings may also be used to review material covered in class.
 - e) Provide adequate time to complete assignments, minimize changes to the published schedule/ assignments, and immediately notify students about any such changes.
 - f) Provide comprehensive and fair assessments of materials presented or assigned. Assignments, with a level of feedback commensurate with the nature and aims of the task, will be returned to students in a timely fashion.
 - g) Create and welcome opportunities for students to



Best Practices

You are encouraged to:

- Let me know if I can clarify a concept or slow down
- Ask questions during lecture so that everyone benefits

To make the most of office hours, it is recommended that you:

- Avoid waiting until the last minute (e.g., before a due date) to attend. Seeking help well in advance of deadlines will leave you plenty of time to act on advice discussed.
- Email the instructor in advance or bring with you a concise list of topics/questions you wish to discuss, if possible. Itemizing in this way helps ensure all your questions are addressed and saves you time in the long run. That said, *dropping by for a spontaneous, broader chat is also most welcome.*

provide feedback on the course/teaching throughout the semester.

- **You are responsible for...**
 - a) Showing up to class regularly, on time, and prepared, as detailed in the below Attendance policy.
 - b) Checking your **Bates email** and **Lyceum** regularly for important announcements about the course, including alterations due to weather emergencies and other Unforeseen Events.
 - c) Giving your participation, readings, and assignments the time and effort they deserve. There is no substitute for a deep and focused consideration of the material, spaced out over time and considered actively.
 - d) Substantively participating in class discussions and other relevant activities. This could, for instance, involve asking/answering questions related to the offered course materials. Note that a top-notch level of participation does not necessitate responding to every question raised in class or online; active or passive efforts to welcome contributions from everyone in the class are also looked upon favorably. Though you are welcome to challenge your fellow students' or your instructor's thoughts and conclusions, please do so in a fashion that is respectful. Challenge ideas, not the person raising them. More information can be found in the Diversity and Inclusion section, below.
 - e) Submitting assignments and annotations on time, digitally via Lyceum and Perusall, respectively. Extensions may be granted for extenuating personal circumstances or illness. Please reach out as soon as you think you may need an extension so we can work out an arrangement. To promote equity and acknowledge life's challenging circumstances, I will also automatically drop your three lowest Perusall scores (see Perusall Annotations section below).



Otherwise, any late (non-Perusall) assignment will immediately be subject to a 10% penalty, with an additional 10% penalty leveled against that assignment's score for every 24 hours it remains late. The late penalty for Perusall is somewhat different. Perusall will automatically award partial credit for annotations made after the deadline based on when the comment was made. The credit for your annotations linearly decreases from 100% at the deadline to 0% at the end of the late annotation period. For example, comments made three-quarters through the late annotation period will receive 25% of the credit they would have received if made on time. This "late annotation period" is three hours in duration, meaning that annotations made after that point (i.e., when class starts) won't receive any credit, though you're welcome to continue annotating/discussing not for credit. But note that I will also drop your three lowest Perusall scores (meaning that you can miss three annotation assignments without it affecting your course grade). *No late work will be accepted after 11:59pm on day final examinations end for the semester (according to the published academic calendar).*

- f) Using electronic devices wisely and respectfully. See section on In-Class Electronic Device Policy, below.
- g) Upholding academic integrity. See the sections on Academic Integrity and Use of Artificial Intelligence (AI), below.

Assessments

- **Perusall Annotations** (25% of course grade)
 - I've heard a shocking rumor: Many college students regularly don't read the assigned materials or give them more than a quick skim! The reason for this is likely manifold. The materials may be too costly, too dry, too plentiful, too heavy to lug around in the form of a physical textbook. As an instructor, I attempt to balance these legitimate criticisms with the imperative to expose students to the necessary background material to spark insight

and discussion. To this end, I have decided to adopt Perusall, which is free for you to use. Throughout the semester, you will be required to read and annotate certain course materials using this collaborative e-reader with sophisticated data analytics.

- Perusall helps students learn more effectively by collaboratively annotating the readings and communicating with your classmates. Collaboration gets you help whenever you need it, makes learning more fun, enables you to help others (which research shows is also a great way for you to learn), and helps me make class better by emphasizing information that you need. Perusall also can *read the assigned materials aloud* (in a number of voices/different speeds) and allow you to take notes (just for yourself—though you can easily share them with other students if you'd like)! Learn more about how you, as a student, can use Perusall here: <https://new.perusall.com/perusall-for-students>.
- If you have a question or information to share about a passage in the readings, highlight the text and type in a comment as an annotation. You can also respond to a classmate's annotation in threads in real time or upvote questions you find helpful. Simply click the question mark to indicate "I have the same question" or the green checkmark to indicate "this answer helped my understanding." Good annotations contribute to the class by stimulating discussion, explaining your thought processes, helping others, and drawing attention to good points. If a particular classmate's point is relevant, you can explicitly "mention" them (using the @ symbol) and they will be immediately notified, even if not presently signed on. I'd encourage everyone to check in on the Perusall discussion again after doing a first pass on a reading and respond to comments and questions or possibly add new commentary based on newfound understanding. Remember that annotations will be visible to other students, as well as to me (though, aside from some discussion prompts especially early on in the semester, I will refrain from annotating directly—it is generally your space to explore and learn).
- Research shows that the following behaviors on Perusall predict higher end-of-semester grades and long term mastery of the subject. Accordingly, I will consider these factors in calculating your Perusall score:
 - Contributing thoughtful questions and comments to the class discussion, spread throughout the entire reading (some examples: <https://perusall.com/downloads/scoring-examples.pdf>)
 - Aim to contribute a *minimum of 4 questions/comments* per Perusall assignment for credit—but keep in mind that the quality of the annotations is key (e.g., 100



annotations that do little to add to the conversation would be worth less than 4 that prompt critical engagement)

- Starting the reading early and sending a good amount of time on reading/annotating the assigned materials
 - Breaking the reading into chunks (going back to the assignment multiple times)
 - Reading all the way to the end of the assigned material, including references and any supplements
 - Posing thoughtful questions and comments that elicit responses from classmates
 - Answering questions from others
 - Upvoting others' thoughtful questions and helpful answers
- Based on the overall body of your annotations, you will receive a score for each assignment that generally follows the benchmarks listed in the rubric below. Note that a score of 2 does *NOT* mean that you earn the equivalent 67% on that assignment (regardless of what Lyceum's grade book might say)—so don't get frightened. A score of 2 is actually pretty solid, translating to an 85%, whereas a score of 1 translates to a 70% and a score of 3 translates to 100%. Just keep track of the holistic grades on Perusall and use those equivalents to calculate your Perusall grade. Remember, I drop your three lowest scores—but don't get complacent; 0s beyond those will translate to 0%).
 - Perusall may offer suggestions within assignments to help you improve your score. Once your assignment has been graded, you can also click on a score in your "My Scores" page (on Perusall, not in Lyceum's grade book) to get overall feedback on your score.

Score	Characteristics
3	Your contributions demonstrate <i>exceptionally</i> thoughtful and thorough reading of the assignment; you provided exceedingly helpful answers and/or insightful commentary. It is likely that this high score will be rarely given.
2	Your contributions meet expectations by demonstrating thoughtful and thorough reading of the assignment. You asked good questions, provided helpful answers, and/or otherwise interacted with your fellow students in a helpful way. You should aim for at least this score. Learn from your past scores to improve the quality of your future annotations.
1	Your contributions fell below expectations, demonstrating only superficial reading or limited coverage.
0	You did not make the required contributions by the deadline or they demonstrated reading of only part of the assignment that was merely superficial.

- In some cases, we will use Perusall during our class time together. Other annotated reading assignments will be done outside of our meetings. Students' reactions to the course readings prior to class will be used to guide the use of our time together in class. Thus, it is important that you complete these annotated reading assignments by the deadline given (*by 8:00am on the day of the associated class meeting*—this will give me some time to go through your annotations). Annotations made after this point will not be accepted for grading. Also remember that I drop your lowest three Perusall scores (which could be ones for which you didn't submit by the deadline). The assigned readings and due dates can be found in the below schedule, as well as on Perusall/Lyceum.
- To get started with Perusall:
 1. Log on to Lyceum and navigate to our course.
 2. Navigate to the section for the first week of class.
 3. Click "EXTERNAL TOOL: Neurofeedback Perusall" to link your accounts.
 4. Because the accounts are now linked, *use the Perusall links provided in Lyceum whenever you want to use Perusall for this course* (e.g., to complete an assignment), rather than trying to sign in to Perusall's website directly. For easy reference, I've placed this same link to the platform at the top of each week's Lyceum section. Feel free to use any of these links to access Perusall (they'll all take you to the same place), but please use the links in Lyceum, rather than trying to access Perusall directly. This will help make sure that you get credit for your work.
- Again, I will *drop your your three lowest Perusall assignment scores*. This way, if you happen to miss one (or two...or three) assignments or were still trying to grasp what makes for high-quality annotations, your Perusall grade won't suffer. Perusall will automatically award partial credit for annotations made after the deadline based on when the comment was made. The credit for your annotations linearly decreases from 100% at the deadline to 0% at the end of the late annotation period. For example, comments made three-quarters through the late annotation period will receive 25% of the credit they would have received if made on time. This "late annotation period" is three hours in duration, meaning that annotations made after that point (i.e., when class starts) won't receive any credit, though you're welcome (encouraged even!) to continue annotating/discussing after that point for everyone's edification.
- The "Help" feature in Perusall can be quite, well, helpful in answering your questions. You can also find a Perusall FAQ here or submit a support request here: <https://support.perusall.com/hc/en-us/categories/360002173133-Students>
- **TINS-style Spotlights** (*worth a total of 20% of your final grade based on two equally weighted papers*) refer to expert summaries of particularly groundbreaking empirical articles published in

major journals like Trends in Neurosciences (or TiNS for short, <https://www.cell.com/trends/neurosciences/authors#32>). These “Spotlights” are not merely a distillation of what could be gleaned from the abstract of the target article; instead they are designed to highlight broader implications for the field and/or the public. For that reason, the Spotlights are written for an audience broader than those in the narrow specialization/field of the target article. For instance, Spotlights are frequently assigned to undergraduate and graduate students, in addition to being of interest to a wide range of researchers. Indeed, you'll be assigned some example Spotlights prior to embarking on these assignments that can be used as models. Further guidance (and a rubric) will be provided and discussed in class. But some basic parameters can be found below:

- Each Spotlight should consist of a short (no more than 50-word) abstract and main text of up to 1000 words (roughly 2 single-spaced pages or 4 double-spaced pages), excluding text in boxes, tables, figure legends, abstract, and references (of which there can be a maximum of 10).
- While Spotlights are typically not the place to excessively criticize the work of others, you will be expected to provide a thoughtful, constructive critique of the work, including its methodology and claims.
- You'll have your choice of one out of two possible target articles to Spotlight for your first assignment. You'll have even greater leeway in selecting the target article for your second Spotlight. Specifically, you will be able to choose from any article cited in two reviews we'll read for class, provided that your chosen target article is empirical (i.e., it presents the results of a new study, rather than being a review, theoretical, or perspective paper) and is not, itself, assigned for this course.
- Even though your Spotlight will focus on a target article, you may have to read and perhaps reference additional articles to help place it in context. To that end, you may, of course, draw from the other articles you've read for this course and/or conduct a broader literature search.
- **Article Presentation** (10% of your final grade) of an assigned empirical article related to specific application of neurofeedback (athletic training, emotion regulation, meditation, or memory—see tentative schedule below for article selection) will be carried out in small groups (~3 students per group) and delivered in class. This assignment is designed to afford you an excellent opportunity to practice effectively summarizing and critiquing published experimental research in a live format. To this end, you will work collaboratively with your group members prepare and present a 10- to 15-minute PowerPoint/Keynote/Google Slides presentation about the article you reviewed in the above assignment.
 - Your presentation should summarize the relevant background, the study's central hypothesis(es), the main experimental approaches to answer the central question of the article, and the most important findings (your group should plan on explaining at least

one main figure/table thoroughly). Your presentations should end with a critical evaluation of the study, addressing the following questions: Are the conclusions drawn justified? Are the experimental approaches reasonable for the questions asked? In your opinion, what are important follow-up questions originating from the work presented in this publication?

- As this is a lot to pack into a short time, it is imperative that you refine and rehearse your talk prior to the class presentation. We will go over tips for short presentations in class prior to the deadline, and a rubric will be provided. Note that adequate preparation for your presentation may mean identifying and reading an additional article or two, so as to ensure that you have the relevant conceptual grounding.
- After your formal presentation, you are expected to take questions from your audience for a few minutes. Audience members could (and should) ask you anything from questions of clarification to deep conceptual or applied ones.
- A designated group member should be sure to upload their group's presentation to Lyceum (in PowerPoint, Keynote, or .pdf form—convert to one of these formats if you created your presentation using Google Slides) by 11 am (before class) on their scheduled presentation day.
- **Grant Pitch** (*10% of your final grade*) gives you and your small group of ~3 students the opportunity to present a proposed research study that you designed to test a specific hypothesis related to neurofeedback (which could be of theoretical or applied interest). The group presentation should last no longer than 10 minutes (this is a hard cutoff) and may incorporate any audiovisual aids you deem appropriate (slides, posters, videos, etc.) in order to effectively convince your audience (your neuroscience peers) to fund your project (i.e., to give you money to run your study, as opposed to other projects). While the funding will be make-believe (sorry, we just don't have the budget to throw around thousands of dollars), your fellow students will actually vote on how to allocate that "money." (Before you get any ideas, know that you and your group members will be recused from voting to fund your own project.) Think of it like Shark Tank but for science. So, while you'll likely want to use some type of persuasive storytelling to convince your audience of your proposal's value and make it memorable, a winning project will have plenty of substance/empirical grounding to go along with the clever marketing. In other words, your claims and predictions should be based on existing evidence/peer-reviewed literature, points that should be made clear to the audience. Some class time will be dedicated to group work for the Grant Pitch and written Proposal, but this assignment will also require substantial work outside of class. Basic guidance can be found below:
 - You will be expected to motivate the study, as well as to clearly lay out your hypothesis(es) and the basic methodology that you will use to test it (them).
 - The above information should be accompanied by a realistic budget estimate—realistic in the sense that the quoted figure would actually be enough to bring a real-life version

of your project to completion, even if the figure itself is large. Be sure to consider the cost of labor, equipment, software, travel, participant payments, etc. The maximum budget for the project is \$1,000,000, though your proposal may not require that full amount (making it easier to fund).

- Given the short format of the presentation, you won't be able to cover all the low-level details (that might also risk the audience nodding off). But the more you have worked out those low-level details, the better, as you will be expected to lay everything out in your written Grant Proposal (see below for details) and answer any questions that come up in the Q&A session that follows your presentation.
- You are welcome to propose a study that involves fMRI or other neuroimaging methodologies (or even EEG-fMRI combinations—see, for example, Ciccarelli et al., 2023, *Front. Hum. Neurosci.*, for a review of the existing literature), but if you're hoping to minimize your proposed budget, maximize the accessibility of the required technology, and even (if you so choose) collect some preliminary/pilot data using the Emotiv Epoch+ devices and associated software to which we have access in this course, then you are encouraged to think about designing your study around EEG or ERP methodologies. If you, for instance, were able to actually implement the experiment in EmotivPro Builder or PsychoPy, collect some data using the Epoch+ devices, and run some preliminary analyses on EmotivPro Analyzer to demonstrate proof of concept for the larger proposed study, you run less risk of making unrealistic claims based on technologies that you may not have experience using. If this were a real grant proposal, most funding bodies would expect that you had such a track record and preliminary data to support your project. That said, proposing an EEG/ERP-based neurofeedback study is not required for this assignment, nor is collecting any pilot data.
- If you do elect to collect preliminary/pilot data for this assignment, it is important to note that this work is NOT considered research according to the definition used by the Institutional Review Board (IRB). This is because it is not designed to develop or contribute to generalizable knowledge outside of the class assignment for which it is expressly intended as a skill-building exercise. *As such, any data you might collect cannot be used for other purposes, presented, or published outside of the context of this course.* It is still important to consider relevant ethical considerations, however, including the use of a consent form that clearly indicates that this work is for a class assignment and not generalizable research. If you plan to collect any preliminary data, please be sure to speak with me first, so that we can make sure your protocol is ethically sound.
- **Grant Proposal** (25% of your final grade) is an extension of the Grant Pitch described above. Like the Pitch, it is also a group project. But, unlike the Pitch, it will be submitted in the form of a more detailed piece of scientific writing that follows a more conventional format—one that is well worth practicing for those intending to pursue a scientific career. Further specifications and

resources will be offered in class (along with opportunities for feedback from me and your peers). Your Grant Proposal (one submission per group) should be submitted to Lyceum by 3:15pm on Wednesday 12/11 (note this is non-standard due date/time for our class; it was determined by when the Registrar set the final exam schedules, though you won't need to be physically present at the time, as there is no separate exam). In the end, your Proposal should be 5-10 pages in length (double-spaced) and contain:

- A title
- An abstract
- A research plan with:
 - One or more specific aims, followed by:
 - Background and significance (with citations)
 - (Optional) Preliminary data
 - Research design and methods (including relevant ethical concerns)
 - Budget and justification
 - Timeline
 - References
- **Research Participation** (5% of your final grade) is a valuable way to get first-hand exposure to the variety of research conducted within the Psychology and Neuroscience programs. There will be a number of student and faculty research projects recruiting participants this semester. You are expected to be involved in the equivalent of 2 *credits* worth of participation or do an alternative writing assignment. Additional participation credits will be considered for Extra Credit (see below). A brief video overview of the participation credit system can be found at <https://youtu.be/foLi2deanR8>. Importantly:
 - You only get credit for participating in approved studies. All eligible studies are listed on <https://www.bates.edu/psychology/participate-in-research/student-participation/>. Participation in any experiment that is not included in that list of approved experiments will *not* count for credit.
 - It will take some time for research studies to be posted as students finalize their thesis experiments, so do not worry if you don't see any experiments posted right away. But don't wait until the end of the semester. Keep checking the website every week or so, and things will pick up by the end of September/early October, as thesis students post their projects.
 - Each study has a fixed number of units assigned to it based on the average length of time that it will take to participate. Typically, 1 hour worth of participation is equal to 1 credit, with each quarter hour represented by 0.25 credits. Be sure to check the number of credits when you sign up for the experiment. If an experiment is worth 0.5 credits, for instance, you will get 0.5 credits whether it takes you 25 minutes or 35 minutes to complete it.

- Please note the restrictions listed for each experiment and do not participate in projects for which you are not eligible.
- To sign up for an experiment, please follow the link to the online appointment scheduler for that project. Please be respectful of the experimenter's time and make sure that you *keep your appointment and arrive punctually*. If you are unable to keep your appointment, please notify the experimenter as soon as possible.
- Please note that, for online studies in which your participation is entirely Internet-based, you will be given the experiment number and a code word for that study at the end of the survey. You will then be asked to enter that information in another web form in order to get credit for the project (the separation is meant to maintain the confidentiality of your data). If you don't enter the correct experiment number and code word, you will not receive credit.
- If you would prefer to opt out of this research participation requirement (or if you're not eligible for any available studies), you may instead complete alternative assignments designed to familiarize you with the other side of research participation: running a study involving human participants. Specifically, you would be asked to summarize chapters from Ritter et al.'s (2012) "How to Run Experiments: A Practical Guide to Research with Human Participants." Each reasonable summary would yield the equivalent of 1 participation credit (i.e., you'd need to submit two solid summaries to earn 2 credits, participate in 2 credits worth of eligible research, or complete a combination of the two—note that no partial credit will be given for summaries). The goal is not to rewrite what has already been written; instead, you will be asked to summarize the chapter in another modality: *as a slideshow, as a video, or as a podcast*. Get creative—for instance, you could act out or sing a song about the dos and don'ts around interacting with participants. Further details for the "Research Participation Alternative Assignments" can be found under the "General" section at the top of our Lyceum page.
- For credit, you must have completed your research participation and/or alternative assignment(s) by the last day classes are held for the semester (12/6 at 4pm)—but don't wait until the last minute!
- **Final Reflection** (5% of your final course grade) provides a thoughtful reflection of what you learned in this course, including why you feel you did/did not meet the learning objectives established by the instructor and for yourself. Your reflection should be organized, go beyond simply parroting back course material verbatim, and include how some of the big lessons from this course could be applied to your education, personal life, and/or career going forward. While your submission should be a polished product, having been fine-turned through careful editing, you are welcome to adopt a format that reflects your own preferred style. You could, of course, format this as a standard written term paper, but you could instead produce a video, animation, comic book, podcast, website, or interpretive dance... OK, it might be hard to fulfill

the requirements of this assignment through purely interpretive dance. But you do have pretty wide latitude here. If you're unsure as to whether your plan is appropriate, check with me. To give you a general guideline, your submission should be roughly equivalent to a 2-3 page (double-spaced, 11-or 12-point font) paper with reasonable margins. Your Final Reflection should be submitted to Lyceum by the end of the designated final exam period for the course (i.e., by 3:15pm on Wednesday 12/11). It is OK to submit a link to your reflection (if, e.g., you posted a video to Youtube or created a website); however, you should not continue to edit the material after the deadline (at least until I've had a chance to grade it).

- **Extra Credit**

- **Additional research participation credits** (or alternative writing assignments) above the required 2 credits worth will be considered extra credit counted toward your final course grade (up to a maximum of 2 additional percentage points, 1 for each additional credit equivalent). While research participation will be accepted in increments of .25 credits, there is no partial credit for the alternative writing assignments; each satisfactory summary earns the equivalent of 1 credit (so don't try turning in half a summary and expect .5 credits ;-).
- **Reverse-engineering one of Emotiv's "Performance Metrics"** will earn you up to 5 percentage points added to your overall course grade. Emotiv offers a number of proprietary metrics that are claimed to track interest, excitement, frustration, engagement, relaxation, boredom, attention, cognitive stress, and cognitive load (currently in beta). Although Emotiv provides general descriptions for each one of these metrics (<https://www.emotiv.com/pages/performance-metrics>), there is very little information about how they are derived from the device's various sensors, other than that they are "driven by our proprietary machine-learning algorithms, AI, and the world's largest EEG data set". As an independent (and totally optional) extra credit project, you are invited to see if you can design your own custom algorithm that produces output broadly similar to one of Emotiv's Performance Metrics. For example, is there some weighted combination of alpha power recorded over a certain part of the scalp that, together with head motion, roughly tracks Emotiv's "Relaxation" metric? For credit, you need to detail your methodology and provide some type of test results quantifying how close your output comes to that of Emotiv. You may team up with other students in the class for this extra credit assignment, but it is intended to be largely independent, with minimum guidance offered by the instructor. As such, this might be an especially good activity for those with some previous experience with computer programming/machine learning/signal processing or who are motivated to develop these skills independently.

Grading Scale

A+	≥97%
A	93-96.99%
A-	90-92.99%
B+	87-89.99%
B	83-86.99%
B-	80-82.99%
C+	77-79.99%
C	73-76.99%
C-	70-72.99%
D+	67-69.99%
D	63-66.99%
D-	60-62.99%
F	<60%

You can easily calculate your current grade by inserting the assignments/exams, grades received, and weights (given above, in percentages) by hand or using this handy calculator: <https://www.rapidtables.com/calc/grade/grade-calculator.html>. Note that your Perusall score should be entered *after* dropping your lowest three scores and that any extra credit should be added on *after* the calculation is performed.

Attendance

Your attendance and preparation are critical to your learning and, in turn, your grade in the course. As such, you are expected to attend each class having completed the assigned reading for the day. The more active your reading (by thinking deeply about the issues raised, connections to broader themes and examples, and identifying/answering questions arising) and engagement during class, the more you will be able to gain. So, even if I don't take formal attendance and/or there is no separate participation grade, it is to your advantage to be fully present and prepared in class on a regular basis.

Of course, I recognize that illness, serious family emergency, or other extenuating circumstances may sometimes keep you from attending class. Under normal circumstances (and classroom technology permitting), class recordings will be provided online within 24 hours of the each class meeting for anyone who may have missed it for these reasons (or if you simply want to review the recording later, in combination with the lecture slides that will be posted to Lyceum). Be advised, however, that the recordings do not capture the full in-class experience and should not be used as a substitute for attendance unless absolutely necessary.

If you are going to miss more than one class in a row, please provide me with official notification from the Health Services, Counseling and Psychological Services, or the Office of Student Support and Community Standards. Again, you remain responsible for working with me to address missed work under these circumstances. For additional information on the Bates College policy regarding course attendance and

student responsibilities in cases of expected and unexpected absence, please consult <http://www.bates.edu/student-affairs/student-support-and-advising/course-attendance-policy-guidelines-for-absences/>.

Religious Holiday Observance

Bates recognizes the right of students to fulfill their religious obligations and practices. In recognition of Bates' commitment to a diverse and inclusive student body and the variety of religions observed and practiced by our students, I have consulted the Multifaith Calendars posted online by the Office of the Multifaith Chaplain when developing this syllabus so that conflicts between in class examinations and major religious holidays may be avoided. Given the range of faiths embraced by members of our community, however, it may not be possible to avoid all conflicts between scheduled examinations and religious holidays. *Please let me know within the first three weeks of the semester if there is a conflict between a scheduled examination, paper, or project due date and a significant religious holiday you observe.* The Office of Accessible Education will continue to be available to proctor makeup exams for students who miss an exam due to observance of a significant religious holiday.

Unforeseen Events

Should an unforeseen event (e.g., a weather emergency) force us to cancel class or alter the venue, I will inform you via the class email list as soon as possible. Please check your Bates email regularly, as important class-related communications will come through this channel.

Accessibility

Bates College is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me.

If you have a disability, or think you may have a disability, you may also want to meet with the Director of Accessible Education, to begin this conversation or request an official accommodation. You can find more information about the Office of Accessible Education and Student Support (AESS), including contact information, here: <https://www.bates.edu/accessible-education/>. Note that processing time for new accommodation requests is generally 2 weeks, according to the AESS website. And, once approved, some types of accommodations may take several weeks to fulfill, so it is important to make the request as soon as possible. Once approved through the Office of Accessible Education, AESS will email me an official Letter of Accommodations (copying you). Although accommodations may be approved at any point in the semester, they are *not* retroactive.

Diversity and Inclusion

It is essential that our classroom be a place in which people feel comfortable expressing their thoughts, feelings, and opinions without fear of unduly critical or judgmental responses. Everyone in the classroom (students and instructors, alike) are expected to be respectful of the widely varied experiences and backgrounds represented by the classroom members as a group. Disrespect or discrimination on any basis will not be tolerated. Whether inside or outside the classroom, if you encounter sexual harassment, sexual violence, or discrimination based on race, color, religion, age, national origin, ancestry, sex, sexual orientation, gender identity/expression, or disability, you are encouraged to report it to Gwen Lexow, Director of Title IX and Civil Rights Compliance at Bates, at glexow@bates.edu or 207- 786-6445. Additionally, please remember that Bates faculty are concerned about your well-being and development, and we are available to discuss any concerns you have. Students should be aware that faculty are legally obligated to share disclosures of sexual violence, sexual harassment, relationship violence, and stalking with the college's Title IX Officer to help ensure that your safety and welfare are being addressed.

In-Class Electronic Device Policy

Although there are many benefits to taking handwritten notes and potential distractions associated with the use of devices like laptops, tablets, and phones in class (e.g., Mueller & Oppenheimer, 2014; Fried, 2008), you may still opt to use a laptop or tablet in this class *as long as it contributes to learning*. If it is seen to invite distraction to you or others, however, you may be asked to refrain from using it in class. There will be some class sessions where we will use technology together, and in those instances, all students should make arrangements to bring a laptop or tablet to class (smartphones may not be suitable for some of these in-class activities). If you do not have access to such a device or have any questions or concerns, please email with me so that we may find a suitable workaround. For example, the library has several Chromebooks available to check out to Bates students for 1-week loan (with a 1-week renewal). And students who don't own a laptop have the option of checking out a long-term loaner (either laptop or Chromebook) from the IT Service Desk.

Academic Integrity

All members of the Bates community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship. Your academic work is governed by The Bates College Statement on Academic Integrity (<https://www.bates.edu/student-conduct-community-standards/student-conduct/academic-integrity-policy/>) and by any additional standards I set in this syllabus or in individual assignments.

Academic integrity includes:

- Following exam/assignment rules
- Using only permitted materials during an exam/assignment
- Viewing exam materials only when permitted by your instructor
- Keeping what you know about an exam to yourself

- Incorporating proper citation of all sources of information
- Submitting your own original work
- Not submitting work done for another course to this course

Academic misconduct includes, but is not limited to, the following:

- Disclosing exam content during or after you have taken an exam
- Accessing exam materials without permission
- Copying/purchasing any material from another student, or from another source including open artificial intelligence, that is submitted for grading as your own
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam or assignment without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.

Violations of academic integrity are serious and can result in severe consequences at both the course and college levels. Depending on the circumstances of the violation, I will assign a failing grade for the assignment and/or the course, require work to be redone, and/or impose other consequences; in addition, I will refer the matter to the Dean of Students for possible institutional action. The Bates College Statement on Academic Integrity and procedures for suspected violations can be found here: <http://www.bates.edu/student-affairs/student-conduct/academic-integrity-policy/>.

Use of Artificial Intelligence (AI)

The use of generative AI tools (e.g. ChatGPT, Google Gemini, Dall-e, etc.) is permitted in this course for the following non-exam-related activities:

- Brainstorming and refining your ideas
- Fine tuning your research questions
- Finding information on your topic (noting that AI is subject to hallucinations)
- Drafting an outline to organize your thoughts
- Checking grammar and style

The use of generative AI tools is *not* permitted in this course for the following activities:

- On timed exams for any purpose, including (but not limited to) researching, brainstorming, drafting, writing, or revising
- Impersonating you in classroom contexts, such as by using the tool to compose discussion board prompts assigned to you
- Completing group work that your group has assigned to you, unless it is mutually agreed upon that you may utilize the tool

- Writing a draft of a writing assignment
- Writing entire sentences, paragraphs or papers to complete class assignments (even if you introduce superficial changes to the writing)

Remember that *you* are responsible for any work you submit, and you may be asked to explain the points you raised in other contexts that do not afford you the support of AI (e.g., on an exam, in discussion).

Student Services

- **The Student Academic Support Center (SASC)** provides peer-led support for introductory and intermediate level courses in mathematics, statistics, programming, natural sciences, life sciences, and quantitative social sciences. Additionally, SASC provides support for students using a variety of quantitative skills required for courses across the curriculum. The Student Academic Support Center also provides a variety of workshops in quantitative skills, time management, note-taking, and study skills. Course-Attached Tutors (CATs) are embedded in courses with the highest demand for tutoring. CATs provide assistance outside of class in the form of weekly help sessions and private appointments. SASC is located in the Peer Learning Commons (PLC) on the Ground Floor of Ladd Library. Students are invited to stop by, without an appointment, to the drop-in hours in Ladd to meet with a tutor, study independently, meet up with classmates, or to discuss learning strategies. Students who wish to set up an individual appointment can discuss options with a Resource Representative at the PLC check-in desk. For more information go to www.bates.edu/sasc or email sasc@bates.edu.
- **The Student Writing & Language Center (SWLC)** empowers Bates students in becoming more effective writers, speakers, language-users, and language-learners. Tutors provide a supportive environment for you to understand and generate ideas for your writing assignments in any subject or course; to draft, revise, and edit your writing for any purpose, context, or audience; to practice and get feedback on your oral presentations; and to study or practice writing and communicating. SWLC tutors are Bates students just like you, trained to listen to and guide you in using writing and language to achieve your personal and academic goals. Drop in to the SWLC anytime we're open to meet with a writing or language tutor. They're located in the Peer Learning Commons on the Ground Floor of Ladd Library. You can also search for subject-specific support hours or make appointments with a tutor using the Penji app: <https://web.penjiapp.com/>. For more information about the SWLC please visit www.bates.edu/swlc or email swlc@bates.edu.
- **Bates Counseling and Psychological Services (CAPS)** offers assistance and referral to address students' personal, social, career, and study skills needs. Services for students include:
 - Crisis and same-day emergency mental health consultations
 - Confidential assessment, counseling services (individual and small group), and referrals

- CAPS is located on the second floor of the Health Services Building (31 Campus Ave). You can contact them at 207-786-6200 for assistance M-F from 9:00 to 5:00 (out of hours emergency assistance can be obtained via Campus Security at 207-786-6254 or by calling 988). For additional information, see: <https://www.bates.edu/counseling-psychological-services/>.

Course Planning

This course requires you spend a good amount of time outside of our class meetings reading, studying, completing major assignments, and otherwise preparing to participate fully and get the most out of the experience (and a commensurate grade). For every hour you spend in class (1.33 hours x 2 lectures = 2.66 hours/week), federal regulations specify that you spend *at least* 2 hours outside of class doing coursework/preparation. That alone would account for 5-6 hours of time spent outside of class. But this is Bates, which has its own standard of 10-15 hours of academic work per week per course credit. That includes class time, meaning that you should be spending roughly 7.34-12.34 hours per week outside of class doing the reading, assignments, studying, etc. Some weeks (e.g., before a major deadline) may require more of your time outside class, but if you plan in advance and commit to dedicating regular outside time to your studies each week, it will be more manageable, with fewer week-to-week fluctuations. While the material we cover in class and the assigned readings (which include peer-reviewed research articles from academic journals) may be rather unfamiliar to many students (and, therefore, will take extra time to grasp fully), other students already may have had previous experience with the methods and topics covered in class. If you find you need to read the material slowly and multiple times, that's not a bad sign—it's a sign that you're putting in the effort required to succeed in the course and retain the knowledge/skills for later (go you!). But if you are worried about falling behind or desiring more advanced work, please send me an email and/or drop by office hours so we can discuss the way forward. I am happy to discuss study/reading strategies and/or try to find additional materials to support your journey through the course and toward your personal goals.

Prospective memory involves remembering to carry out some intended action in the future. There's no reason you can't take steps now to improve your ability to carry out the appropriate actions on time, even before we cover the topic. So please, please, please take the time to review all the deadlines provided in the schedule at the end of this syllabus. Transfer them to your personal calendar immediately (and add reminders). Doing so will help you avoid scheduling conflicts and allow you to carve out the necessary time to perform your best.



Additional Resources

There are treasure troves of information about neuroscience, psychology, and related disciplines sprinkled around the interwebs—much of it can be accessed for free. If you find yourself struggling to understand a

concept, I'd encourage you to search around, carefully evaluate the quality of the sources, and share useful finds with the rest of the class. Below are some resources I have identified:

- APA formatting and general reference:
 - Purdue Online Writing Lab (OWL): https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide
 - I posted some additional reference materials inside the "APA Style/Scientific Paper Writing Tips" submodule inside of the "Course Introduction" of Lyceum.
 - Middlebury Library: <https://middlebury.libguides.com/citation/apa7>
 - ECU Library: <https://libguides.ecu.edu/c.php?g=982594&p=7463742>
 - Video Tutorials: <https://apastyle.apa.org/instructional-aids/tutorials-webinars>
 - APA Dictionary of Psychology: <https://dictionary.apa.org>
- Searchable article databases (and tutorials):
 - Bates Library: https://libguides.bates.edu/sb.php?subject_id=688
 - Psychology Resources: <https://www.bates.edu/psychology/resources-for-students/technical-resources/>
 - APA Database Tutorials: <https://www.apa.org/pubs/databases/training/tutorials>
 - Google Scholar: <https://scholar.google.com>
- Free textbooks & related resources:
 - Neuroscience/Biological Psychology/Medical Psychology:
 - Neuroscience Online: <https://nba.uth.tmc.edu/neuroscience/toc.htm>
 - Neuroanatomy Online: <https://nba.uth.tmc.edu/neuroanatomy/index.html>
 - Open Neuroscience Initiative (Lim): https://drive.google.com/file/d/1n08qgzhG5-RgkoqL_Aa4y1UBSycUcy5g/view
 - Neuroscience (Ju): <http://neuroscience.openetext.utoronto.ca>
 - Foundations of Neuroscience (Henley): [https://med.libretexts.org/Bookshelves/Pharmacology_and_Neuroscience/Foundations_of_Neuroscience_\(Henley\)](https://med.libretexts.org/Bookshelves/Pharmacology_and_Neuroscience/Foundations_of_Neuroscience_(Henley))
 - Psychology as a Biological Science (Lindberg): <https://nobaproject.com/textbooks/psychology-as-a-biological-science>
 - Introduction to Neuroscience (Hedges): <https://open.umn.edu/opentextbooks/textbooks/1303>
 - Biological Psychology (Hove & Martinez): <https://open.umn.edu/opentextbooks/textbooks/biological-psychology>
 - Introduction to Biological Psychology (Hall): [https://socialsci.libretexts.org/Bookshelves/Psychology/Biological_Psychology/Introduction_to_Biological_Psychology_\(Hall_Ed.\)](https://socialsci.libretexts.org/Bookshelves/Psychology/Biological_Psychology/Introduction_to_Biological_Psychology_(Hall_Ed.))
 - Biological Psychology (Keys): [https://socialsci.libretexts.org/Courses/Sacramento_City_College/Psyc_310:_Biological_Psychology_\(Keys\)](https://socialsci.libretexts.org/Courses/Sacramento_City_College/Psyc_310:_Biological_Psychology_(Keys))

- Interdisciplinary Explorations of Neuroscience (May): <https://opentextbooks.rug.nl/interdisciplinaryexplorationsofneuroscience/>
- The Nervous System in Action (Mann): <https://michaeldmann.net/The%20Nervous%20System%20In%20Action.html>
- Neuroscience for Pre-Clinical Students (<https://open.umn.edu/opentextbooks/textbooks/neuroscience-for-pre-clinical-students>)
- Computational Cog Neuro (O'Reilly et al.): <https://compcogneuro.org/>
- Science of Sleep (Shook): <https://open.umn.edu/opentextbooks/textbooks/the-science-of-sleep>
- Society for Neuroscience's Brain Facts: <https://www.brainfacts.org/>
- Research methods:
 - Crump et al.: <https://crumplab.github.io/ResearchMethods/index.html>
 - Cuttler et al.: <https://open.umn.edu/opentextbooks/textbooks/75>
 - University of Minnesota: <https://open.lib.umn.edu/psychologyresearchmethods/>
 - Bhattacharjee: https://scholarcommons.usf.edu/oa_textbooks/3/
- Statistics:
 - De Anza: <https://openstax.org/details/introductory-statistics>
 - Saylor: <https://open.bccampus.ca/browse-our-collection/find-open-textbooks/?uuid=929d4a8d-30b2-4ced-8b50-c39447dc0b74>
 - Brown University Statistics Visualizations: <https://seeing-theory.brown.edu>
 - VassarStats: <http://vassarstats.net>
 - Effect Size Calculator: https://katherinemwood.shinyapps.io/lakens_effect_sizes/
 - Jamovi Open Stats: <https://www.jamovi.org>
 - Power analysis guide using G*Power: https://www.psychologie.hhu.de/fileadmin/redaktion/Fakultaeten/Mathematisch-Naturwissenschaftliche_Fakultaet/Psychologie/AAP/gpower/GPowerManual.pdf
 - Help choosing an appropriate statistical test:
 - <http://www.statsflowchart.co.uk>
 - <https://stats.idre.ucla.edu/other/mult-pkg/whatstat/>
 - <https://www.statstutor.ac.uk/resources/uploaded/tutorsquickguidetostatistics.pdf>
 - https://www.central7.net/wp-content/uploads/2015/09/stats_flow_chart_v2014.pdf
- Cognitive neuroscience methods/tools:
 - Functional Neuroimaging: <https://imaging.mrc-cbu.cam.ac.uk/imaging/Cbulmaging>
 - FSL fMRI Analysis (free, multi-platform software and tutorials):
 - <https://fsl.fmrib.ox.ac.uk/fsl/fslwiki>
 - https://open.win.ox.ac.uk/pages/fslcourse/website/online_materials.html

- Brain viewers:
 - Allen Brain Atlas: http://human.brain-map.org/mri_viewer
 - Gallant Lab: <https://gallantlab.org/brain-viewers/>
 - Neurosynth: <https://neurosynth.org/>
- Event-related potentials (ERPs): <https://erpinfo.org>
- Neurofeedback: Open-source Python/Matlab framework (OpenNFT): <http://opennft.org/>
- Videos:
 - 2-Minute Neuroscience: <https://www.youtube.com/channel/UCUgZq9PkDp1xaEivtcfJPSg>
 - TED Studies: <https://www.ted.com/read/ted-studies/neuroscience>
 - Khan Academy: <https://www.khanacademy.org/test-prep/mcat/behavior#concept-intro>
- Effective studying:
 - <https://www.samford.edu/departments/academic-success-center/how-to-study>

Tentative Course Schedule

Date (day)	#	Topics	Readings/Assignments <i>(due by 8am unless otherwise specified)</i>
9/5 (th)	1	A Meeting of the Minds <ul style="list-style-type: none"> ▶ Emotiv demo (BrainViz) ▶ Getting-to-know-you survey: https://forms.gle/skhLrK6pxUxA1vYP8 ▶ Course overview (syllabus) ▶ Making the most of Perusall activity ▶ In-class Perusall annotation of deCharms (2008, <i>Nat. Rev. Neurosci.</i>) 	
9/10 (tu)	2	Mitigating Pain <ul style="list-style-type: none"> ▶ Strategies for reading empirical articles ▶ In-class reading/discussion of deCharms (2005, <i>PNAS</i>) 	<ul style="list-style-type: none"> • Have read: <ul style="list-style-type: none"> • Syllabus • Have read & annotated: <ul style="list-style-type: none"> • deCharms (2008, <i>Nat. Rev. Neurosci.</i>) from class Thursday • Sitaram et al. (2016, <i>Nat. Rev. Neuro.</i>)
9/12 (th)	3	Operant Conditioning and Allostasis <ul style="list-style-type: none"> ▶ Basics of operant conditioning 	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Fetz (1969, <i>Science</i>) • Mirifar et al. (2022, <i>Rev. Neurosci.</i>)
9/17 (tu)	4	fMRI Primer <ul style="list-style-type: none"> ▶ Human neuroanatomy refresher 	<ul style="list-style-type: none"> • Have watched/read and annotated: <ul style="list-style-type: none"> • FSL Course Preparatory Lectures Parts 1 & 2 (each is ~40 min. long) • deCharms (2007, <i>TICS</i>)

Date (day)	#	Topics	Readings/Assignments (due by 8am unless otherwise specified)
9/19 (th)	5	EEG & ERP Basics <ul style="list-style-type: none"> ▶ Intro to Emotiv Performance Metrics and Extra Credit Assignment ▶ EmotivPro Builder & Analyzer demos <ul style="list-style-type: none"> • https://www.emotiv.com/blogs/tutorials/basics-of-neural-oscillations (section 4) ▶ PsychoPy demo <ul style="list-style-type: none"> • https://www.emotiv.com/blogs/tutorials/basics-of-event-related-potentials (section 4) ▶ Emotiv Labs 	<ul style="list-style-type: none"> • Have read and annotated: <ul style="list-style-type: none"> • Emotiv's Basics of Neural Oscillations Tutorial (sections 1-3) • Have watched (no annotations): <ul style="list-style-type: none"> • EEG: https://youtu.be/zUgLSDS2W_g (3 min.) • ERPs: https://youtu.be/knXmJrCDEh8 (4.5 min.) • Generation: https://youtu.be/donFt1Hdr9Q?si=rsPKl0aVm6Jxs5j (5.5 min.) • Time-frequency analysis: https://youtu.be/dxpf8Pyj774 (4 min.) • Fourier analysis: https://youtu.be/GMCSnasvAWQ?si=vWIKyxWKAxwCokEU (5.5 min.) • If possible, bring to class: <ul style="list-style-type: none"> • Laptop w/ ability to install software
9/24 (tu)	6	Basic Research Methods <ul style="list-style-type: none"> ▶ Critique/design challenge ▶ Assign Human Subjects Training (Biomed) https://www.bates.edu/institutional-review-board/training-requirements-for-all-human-subjects-researchers/ - due 10/8 	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Weiskopf et al. (2007, <i>MRI</i>) • Ros et al. (2020, <i>BRAIN</i>)
9/26 (th)	7	Small-N Designs, Control Conditions, and Implicit Neurofeedback <ul style="list-style-type: none"> ▶ Basics of small-N designs 	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Sorger et al. (2019, <i>NeuroImage</i>) • Ramot & Martin (2022, <i>TiCS</i>)
10/1 (tu)	8	Ethics of Working with Human Participants <ul style="list-style-type: none"> ▶ Neuroethics debate ▶ Discuss TINS Spotlight assignment #1 for 10/10 	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Nakazawa et al. (2016, <i>AJOB Neuroscience</i>) • Kalokairinou et al. (2022, <i>Neuroethics</i>)
10/3 (th)	9	Cognitive Enhancements <ul style="list-style-type: none"> ▶ Mishra & Gazzaley (2015) <i>TiCS</i> Spotlight ▶ Presentation groups/articles assigned 	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Da Silva & De Souza (2021, <i>Psychology & Neuroscience</i>) • Debettencourt et al. (2015, <i>Nature Neuroscience</i>)

Date (day)	#	Topics	Readings/Assignments (due by 8am unless otherwise specified)
10/8 (tu)	10	Grant Proposal Assignment, Explained <ul style="list-style-type: none"> ▶ Why are we doing a group project? ▶ Groups assigned ▶ Grant brainstorming ▶ Spotlight workshop 	<ul style="list-style-type: none"> • Have completed & uploaded by 11am: • CITI training (Biomed) certificate
10/10 (th)	11	Group Work <ul style="list-style-type: none"> ▶ Short presentation tips ▶ Course feedback survey (online, anonymous) ▶ Time to prepare Group Presentations ▶ Time to continue brainstorming Grant Proposal topics, design, and division of labor 	<ul style="list-style-type: none"> • Have submitted TINS-style Spotlight #1 for (pick <u>one</u>) by 11am: • Koizumi et al. (2016, <i>Nat. Hum. Behav.</i>) • Schöenberg et al. (2021, <i>Prog. Neuropsychopharm. Biol. Psychiatry</i>)
10/15 (tu)	12	Group Presentations	<ul style="list-style-type: none"> • Have submitted (by 11am, one per group): • Presentation slides • Be prepared to present one of the following in class: <ul style="list-style-type: none"> • Athletic training - Mikicin et al. (2015, <i>Acta Neurobiologie. Exp.</i>) • Emotion regulation - Bressler et al. (2023, <i>Neuropsychologia</i>) • Meditation - van Lutterveld et al. (2017, <i>NeuroImage</i>) • Memory - Rozenfurt et al. (2017, <i>Neurobiol. Learn. Mem.</i>)
10/17 (th)	--	No Class (Fall Recess)	
10/22 (tu)	13	Connectivity-Based Neurofeedback	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Watanabe et al. (2017, <i>TiCS</i>) • Shibata et al. (2011, <i>Science</i>)
10/24 (th)	14	Inducing Brain Plasticity	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Marins & Tovar-Moll (2022, <i>TINS</i>) • Sampaio-Baptista et al. (2021, <i>Cell Reports</i>)

Date (day)	#	Topics	Readings/Assignments (due by 8am unless otherwise specified)
10/29 (tu)	15	Grant-Writing Workshop ▶ Discuss TINS Spotlight assignment #2 for 11/12	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Enriquez-Geppert et al. (2017, <i>Front. Hum. Neurosci.</i>) • Have skimmed: <ul style="list-style-type: none"> • https://writingcenter.unc.edu/tips-and-tools/grant-proposals-or-give-me-the-money/
10/31 (th)	16	Clinical Applications	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Murphy & Bassett (2017, <i>CDBME</i>) • Dudek & Dodell-Feder (2021, <i>Neuro. Bio. Rev.</i>)
11/5 (tu)	17	Building Resilience and Emotion Recognition	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Keynan et al. (2019, <i>Nat. Hum. Behav.</i>) • Ruiz et al. (2011, <i>HBM</i>)
11/7 (th)	18	Group Work	<ul style="list-style-type: none"> • Have submitted (by 11am) TINS-style Spotlight #2 for an <i>unassigned empirical</i> article cited in <u>either</u>: <ul style="list-style-type: none"> • Murphy & Bassett (2017, <i>CDBME</i>) • Dudek & Dodell-Feder (2021, <i>Neuro. Bio. Rev.</i>)
11/12 (tu)	19	Detecting Consciousness and Communicating ▶ In-class reading of Nachev & Husain (2007, <i>Science</i>); Greenberg (2007, <i>Science</i>); Owen (2007, <i>Science</i>)	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Owen et al. (2006, <i>Science</i>) • Farwell & Donchin (1988, <i>Electroencephalogr. Clin. Neurophysiol.</i>)
11/14 (th)	20	Brain-Computer Interfaces	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Gao et al. (2021, <i>TiCS</i>)
11/19 (tu)	21	Return to Causality	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Kvamme et al. (2022, <i>NeuroImage</i>) • Have skimmed and be prepared to give a short (3-minute) verbal summary (no slides/handouts) of an <i>unassigned empirical</i> paper cited in Kvamme et al. (2022), indicating how it's connected to the larger issue of causality

Date (day)	#	Topics	Readings/Assignments (due by 8am unless otherwise specified)
11/21 (th)	22	Neurofeedback in the Media and Society	<ul style="list-style-type: none"> • Have read & annotated: <ul style="list-style-type: none"> • Kober et al. (2023, <i>Heliyon</i>) • Come prepared with one or more examples of neurofeedback being discussed in the public (non-academic) sphere (e.g., on reddit, TikTok, YouTube, etc.), along with your analysis (to share verbally with the class) of how well it aligns with the scientific research
11/26 (tu)	--	No Class (Thanksgiving Recess)	
11/28 (th)	--	No Class (Thanksgiving Recess)	
12/3 (tu)	23	Grant Proposal Peer Review ▶ Time to practice pitches	<ul style="list-style-type: none"> • Each group should bring to class 4 printed copies of your <i>rough</i> grant proposal
12/5 (th)	24	Final Grant Pitches	<ul style="list-style-type: none"> • Have submitted (one per group): <ul style="list-style-type: none"> • Any audio-visual aids (including any slides) used for your group Pitch • By 4:00pm on Friday 12/6 (tomorrow) have completed Research Participation or submitted Alternative Assignments
12/10 (tu)	25	No class (Final Exam Period)	
12/11 (w)	25	No class (Final Exam Period)	<ul style="list-style-type: none"> • By 3:15pm on Wednesday 12/11 have submitted to Lyceum: <ul style="list-style-type: none"> • Grant Proposal (single group submission) • Final Reflection
12/12 (th)	--	No Class (Final Exam Period)	

Schedule is subject to change to improve pacing and/or accommodate unforeseen events (e.g., severe weather, pandemic, alien abduction). Check announcements over email.