University of Florida

PSB4343C | Laboratory in Cognitive Neuroscience

Spring: 2023

Delivery Format: On-Campus

Instructor Name: Eric Porges, PhD
Room Number: HPNP 1101

https://phhp.ufl.edu/files/2014/10/HPNP-Building-Map.pdf
Email Address: eporges@phhp.ufl.edu
Office Hours: By appointment

Teaching Assistants: Jason DeFelice, MS

Preferred Course Communication: email

Prerequisites

PSB3340, EXP3604, PSY3213L, and STA2023

PURPOSE AND OUTCOME

Course Overview

Practical training in the foundations of cognitive neuroscience with a strong focus on cognitive experiments with human participants. Engage in theoretical work and practical experiments addressing behavioral, cognitive, and physiological processes relationships between biological processes.

Relation to Program Outcomes

This course is designed to provide students with an overview of the cognitive neuropsychological and neuroscience approaches that are used to study the neural bases of cognition in healthy individuals and clinical populations. We will cover various technologies available for measuring brain structure and function and the limitations of these techniques. Techniques to be covered include structural and functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), event-related potentials (ERPs), positron emission tomography (PET), and transcranial direct-current stimulation (tDCS). The application of these methods will be illustrated with research examples from various areas in cognitive neuroscience (e.g., pain, movement disorders, and exercise studies). The goal is for students to not only be able to understand the methodologies covered in the course, but to also be able to come up with appropriate ways to apply them and critically evaluate research that uses these methodologies.

Course Objectives and/or Goals

By the end of the semester, students should:

- Understand the physiological basis of the various techniques used in cognitive neuroscience research
    - Appreciate the strengths and weakness of these techniques
- Be aware of the methodological considerations that are integral to cognitive neuroscience research
- Understand how cognitive neuroscience methods are applied in research with healthy individuals and patient populations
- Be able to evaluate the application of cognitive neuroscience methods in the scientific literature
- Be able to apply aspects of these methods to a research question of interest

DESCRIPTION OF COURSE CONTENT

Topical Outline/Course Schedule

Section 1: Methods Lectures

January 12: Class introduction; historical background; brain organization

Eric Porges PhD, Department of Clinical and Health Psychology

- Review Class Syllabus

January 19: Diffusion tensor imaging (DTI)

Joseph Gullet, PhD, Department of Clinical and Health Psychology

- Chanraud S, Zahr N, Sullivan EV, Pfefferbaum A. (2010). MR diffusion tensor imaging: a window into white matter integrity of the working brain. Neuropsychology Review, 20(2), 209-225

AND Cognition and Neuropsychology

Jason DeFelice, MS

- Clare, Linda. (2010). Neuropsychological Assessment. 10.1002/9780470669600.ch25.
- Sutterer, M. J., & Tranel, D. (2017). Neuropsychology and cognitive neuroscience in the fMRI era: A recapitulation of localizationist and connectionist views. Neuropsychology, 31(8), 972–980.

January 26: Psychophysiological and Neuroendocrine Methods – RESEARCH PROPOSAL GROUPS FORMED

Karen Smith PhD, Child Emotion Lab at the Waisman Center University of Wisconsin-Madison

- Smith, K. E., Leitzke, B. T., & Pollak, S. D. (2020). Youths' processing of emotion information: Responses to chronic and video-based laboratory stress. Psychoneuroendocrinology, 122, 104873.
- Porges, E. C., Smith, K. E., & Decety, J. (2015). Individual differences in vagal regulation are related to testosterone responses to observed violence. Frontiers in psychology, 6, 19.

Febuary 2: Positron emission tomography (PET); experimental design in functional studies

Steve DeKosky, MD

- Gulyás, B., & Sjöholm, N. (2007). Principles of positron emission tomography. In F. G. Hillary & J. DeLuca (Eds.), Functional neuroimaging in clinical populations, 3–30. Guilford Press.

- Culham, J. C. (2006). Functional neuroimaging: Experimental design and analysis. In R. Cabeza & A. Kingstone (Eds.), Handbook of functional neuroimaging of cognition, 53–82. MIT Press. (OPTIONAL)

AND Scientific Literature Search Methods

Destin Shortell, MS

- No required readings

AND Literature review paper described by instructor

Eric Porges, PhD

- Read Literature Review Assignment in Syllabus

February 9: Magnetic resonance imaging (MRI) and functional MRI (fMRI)

Jeff Boissoneault, PhD, Department of Clinical and Health Psychology

- Ward, J. (2010). The imaged brain. In J. Ward, The Student's Guide to Cognitive Neuroscience, 2nd Edition (pp. 48-77). New York: Psychology Press.
- Bandettini, P.A. (2006). Functional magnetic resonance imaging. In C. Senior, T. Russell, & M.S. Gazzaniga, Methods in mind (pp. 193-235). Cambridge, MA: MIT Press.

February 16: Magnetic resonance spectroscopy (MRS)

Eric Porges PhD, Department of Clinical and Health Psychology

- Porges, E. C., Woods, A. J., Edden, R. A., Puts, N. A., Harris, A. D., Chen, H., ... & Cohen, R. A. (2017). Frontal gamma-aminobutyric acid concentrations are associated with cognitive performance in older adults. Biological psychiatry: cognitive neuroscience and neuroimaging, 2(1), 38-44
- Hupfeld, K. E., Hyatt, H. W., Alvarez Jerez, P., Mikkelsen, M., Hass, C. J., Edden, R. A., ... & Porges, E. C. (2021). In vivo brain glutathione is higher in older age and correlates with mobility. Cerebral Cortex, 31(10), 4576-4594.

February 23: Transcranial magnetic stimulation

Destin Shortell, MS, Department of Clinical and Health Psychology

- Sandrini, M., Umiltà, C., & Rusconi, E. (2011). The use of transcranial magnetic stimulation in cognitive neuroscience: a new synthesis of methodological issues. Neuroscience and biobehavioral reviews, 35(3), 516–536.
- Sanan, A. (2017). How Does Transcranial Magnetic Stimulation work? For NeurOasis TMS. Retrieved from https://www.youtube.com/watch?v=DM9q7ltZzq0.

March 2: Transcranial direct-current stimulation (tDCS) – RESEARCH PROPOSAL APPROVAL DEADLINE

Adam Woods, PhD, Department of Clinical and Health Psychology

- Woods, A. J., Antal, A., Bikson, M., Boggio, P. S., Brunoni, A. R., Celnik, P., ... & Knotkova, H. (2016). A technical guide to tDCS, and related non-invasive brain stimulation tools. Clinical Neurophysiology, 127(2), 1031-1048.

March 9: Psychophysiology

Eric Porges, PhD, Department of Clinical and Health Psychology

- Porges, E. C., Smith, K. E., & Decety, J. (2015). Individual differences in vagal regulation are related to testosterone responses to observed violence. Frontiers in psychology, 6, 19. (NOTE: Same paper as Jan 20)
- Lamb, D. G., Porges, E. C., Lewis, G. F., & Williamson, J. B. (2017). Non-invasive vagal nerve stimulation effects on hyperarousal and autonomic state in patients with posttraumatic stress disorder and history of mild traumatic brain injury: preliminary evidence. Frontiers in medicine, 4, 124.

March 16: (NO CLASS) Spring Break

March 23: MRI LAB

Eric Porges, PhD / Jens Rosenberg, PhD

- Reading: review fMRI lecture readings.

March 30: Animal models – FINAL PAPER TOPIC APPROVAL DEADLINE

Carly Logan, PhD, Department of Neuroscience

- Smith, S. M., Zequeira, S., Ravi, M., Johnson, S. A., Hampton, A. M., Ross, A. M., Pyon, W., Maurer, A. P., Bizon, J. L., & Burke, S. N. (2022). Age-related impairments on the touchscreen paired associates learning (PAL) task in male rats. *Neurobiology of aging*, *109*, 176–191.
- Bechard, A. R., Logan, C. N., Mesa, J., Padovan-Hernandez, Y., Blount, H., Hodges, V. L., & Knackstedt, L. A. (2020). Role of prefrontal cortex projections to the nucleus accumbens core in mediating the effects of ceftriaxone on cue-induced cocaine seeking. *Addiction biology*, 26(2), e12928. (OPTIONAL)

April 6: Pain and aging

Aprinda Indahlastari, PhD, Department of Clinical and Health Psychology

- Farrell M. J. (2012). Age-related changes in the structure and function of brain regions involved in pain processing. Pain medicine (Malden, Mass.), 13 Suppl 2, S37–S43.

April 13: Research Proposal Group presentations

No required readings

April 20: Research Proposal Group presentations

No required readings

April 27: (NO CLASS) Reading Day (note FINAL PAPER DUE by April 20th at 11:59pm)

Course Materials and Technology

The website for this course can be accessed through Canvas. You can sign onto the website using your Gatorlink username and password. Here you will find class announcements, a copy of the syllabus, links to the assigned readings, the discussion board, and a copy of the lecture slides.

There is no required textbook for this course. Readings will be required for each week of the course and will be provided on the course website.

For technical support for this class, please contact the UF Help Desk at:

- helpdesk@ufl.edu
- (352) 392-HELP - select option 2
- https://helpdesk.ufl.edu/

Additional Academic Resources

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

Writing Studio*:* 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

On-Line Students Complaints: View the Distance Learning Student Complaint Process.

ACADEMIC REQUIREMENTS AND GRADING

Assignments

Quizzes: Starting on the second day of class, you will be given a quiz on the lecture and readings from the previous week. Quizzes will consist of small number of short answer, multiple choice, or true/false questions. Each quiz will be worth 5 points. Quizzes will be administered promptly at the beginning of class. No makeup quizzes will be administered for unexcused absences (e.g. Doctor's note). The lowest quiz grade will be dropped.

Lecture Questions. For each class with a reading(s) assigned, you will be required to post a thoughtful question or comment regarding the reading(s) **and** a limitation of the method/study covered in the reading(s). These will be posted on that week's discussion board on Canvas. (Due Thursdays, before class starts). These can be brief, but should show a thoughtful engagement with the material. An example of a limitation, one could discuss the significant cost associated with MRI limiting its use to high resource environments.

Lab Session: You will be required to participate in the lab session, which will occur during a normally scheduled class (TBD) in the Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) facility's Phillips 3T Scanner Suite, located within the McKnight Brain Institute (MBI). Students will be asked questions and interact with the process in real time. They will also have the opportunity to ask questions themselves and observe MRI-based data collection. Students will be required to complete a Lab Session Reflection assignment.

Lab Session Reflection Assignment: Write a 1-page (double-spaced) summary of what you experienced during the lab session. Your answer should address: (1) what you learned or found unusual during the session and (2) what considerations researchers should make when working with the equipment and accommodating patients or research subjects. **Due one week after lab session (March 30th by 11:59PM).**

Research Proposal: You will be assigned to small groups of 3-4 students for a group project. Each group will choose a cognitive neuroscience method of interest and design a study that applies that method to a particular cognitive domain or clinical population. During the last two weeks of class, groups will present their proposal to the class. The proposal (a PowerPoint

presentation) should include a background, methods, specific aims and hypotheses, and discussion section. The background section should provide a rationale for the study, as well as a brief overview of relevant background studies. The methods section should outline how you would design and carry out your experiment. In the specific aims section, you would state your general question or topic of interest, along with specific hypotheses about what you would expect to find if you were to conduct the proposed study. You should create a results section emulating data that would have been collected, if the study had been actually completed. Your discussion section should outline limitations of your study, as well as implications for future studies and, if relevant, clinical application. Note that you are only presenting a hypothetical study and results and will not actually run the study or analysis.
Your group must receive approval for your topic by the end of class on February 23rd. Presentations will be graded on content and methodology as well as presentation quality. Each student's grade will consist of a group grade (up to 75 points), which will be given to every member of your group, and an individual grade (up to 25 points) based on your individual portion of the presentation.

Literature Review: Students will be tasked with selecting a cognitive neuroscience topic of interest and conducting a literature review on that topic. Each student must obtain approval for their proposed topic.
To obtain approval, 1) submit a brief description (no more than 5 sentences) via Canvas to Dr. Porges and the TA before class on March 2nd. Dr. Porges will discuss with each student their topic, and provide feedback. 2) Submit a 1 paragraph formal proposal incorporating this feedback.

For the literature review students will independently seek out at least 10 peer-reviewed journal articles on the topic. The review will have an introduction (~1 page), summaries as well as thoughts and critiques on the individual studies, and a synthesizing conclusion demonstrating original thoughts on the topic and integrating the selected literature. (at least 2 pages).

When engaging with specific populations or cohorts, person first language should be used as appropriate. More information can be found here https://apastyle.apa.org/style-grammar-guidelines/bias-free-language/disability .

Students should evaluate and critique the appropriateness of the cognitive neuroscience methodologies used in the studies. An example literature review will be shared in class.

Grading Rubric for literature review: 15% introduction, 25% conclusion integrating all studies, 25% summarizes/describes at least 10 studies in the same topic; 25% critiques methods (neuropsychological and/or neuroscientific) for each study, and 10% clear organization, coherent flow.

This literature review will serve as your final exam and will be due on April 20th before 11:59PM (midnight). Your paper will be submitted on the Canvas website.

Class Participation: Each class member's participation is essential and will form part of their grade. Everyone is expected to read the assigned articles each week and to come to class prepared to engage in a discussion about the readings. In addition, starting in the third week of class, the last hour of each class period will be devoted to working on the group projects. Students are expected to work on the research proposal in class with group members. The instructor and/or TA will be available to answer questions and provide assistance as you work on your projects. Participation in the group discussions will also count toward your participation grade.

Extra Credit: You can earn 5 extra credit points, which will be added to your participation grade. Attend a research presentation on campus or elsewhere that focuses on a study or group of studies that use at least one cognitive neuroscience method. Write a 1-page (double-spaced) summary of the presentation. Briefly describe the research question, the neuroscience method that was used, and the results. Explain whether you think the neuroscience method was appropriate for the purposes of the study and give the rationale for your opinion. The summary must include the title of the presentation, name of the presenter, name of the seminar series (e.g., UF Neurology Grand Rounds), and date of the presentation. A few seminar series on campus that may include relevant presentations can be accessed at the following websites. I will also post an announcement on the class website if I hear of other relevant seminars on campus.

- Neurology conference schedule: https://neurology.ufl.edu/
- UF Department of Neuroscience: https://neuroscience.ufl.edu/
- UF Health Science Center: https://ufhealth.org/education
- Department of Biomedical Engineering: http://www.bme.ufl.edu/
- Institute on Aging: http://aging.ufl.edu/

You may also watch an archived lecture video provided on the NIH website if the lecture is related to cognitive neuroscience. Videos can be accessed at http://videocast.nih.gov/PastEvents.asp?c=124. You can look for videos by topic by clicking on one of the links on the left-hand side. You're most likely to find relevant lectures under the "Neuroscience" link.
If you're not sure that a presentation will count towards extra credit, it is recommended that you get approval before attending and writing your summary.
Extra credit will be due on the same day as the literature review.

Grading

Grade Break Down

Requirement	Due date	Points or % of final grade
Quizzes	Most weeks, at the start of class	25%

Literature Review	4/20/23	30%
Research Proposal	4/13/23	20%
Discussion Questions	Every week, before the start of class	10%
Class Participation	Every week	10%
Lab Session Reflection	3/30/23	5%

Grade % to Letter

Percentage Earned	Letter Grade
>93	A
<90-93	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-
<60	E

More information on UF grading policy may be found at:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Exam Policy

The literature review (described above) will serve as your final exam.

Policy Related to Make up Exams or Other Work

Late work will be penalized 10% per late day (0 credit after 10 days) unless 1) arrangements are made with me prior to the due date, or 2) there is a documented emergency. Be prepared to provide documentation of any emergencies that may arise (e.g., a doctor's note if you are out sick, a police report if you have a car accident). This policy will be strictly enforced.

Please note: Any requests for make-ups due to technical issues MUST be accompanied by the UF Computing help desk (http://helpdesk.ufl.edu/) correspondence. You MUST e-mail me within 24 hours of the technical difficulty if you wish to request a make-up.

Policy Related to Required Class Attendance

Attendance is required. Lectures and discussions reinforce material in the reading and often add new concepts, ideas, and interpretations that will optimize your learning in the course. Excessive absences will lower your participation grade in the class. Students attending class are expected to arrive on time. Quizzes will be opened promptly at the beginning of class.

Please email in advance if you plan on being absent or are sick.

Please note all faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details:

https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior

Please be considerate of your fellow classmates by turning off cell phones and other electronic devices during class. Excessive absences or engaging in non-class related activities (e.g., texting, using Facebook) during class will also lower your participation grade.

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

"**We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity**."

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

"On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/

http://gradschool.ufl.edu/students/introduction.html

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

Recording Within the Course:

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Online Faculty Course Evaluation Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

SUPPORT SERVICES

Accommodations for Students with Disabilities

If you require classroom accommodation because of a disability, it is strongly recommended you register with the Dean of Students Office http://www.dso.ufl.edu within the first week of class or as soon as you believe you might be eligible for accommodations. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please do this as soon as possible after you receive the letter. Students with disabilities should follow this procedure as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The **Counseling and Wellness Center** 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: http://www.counseling.ufl.edu. On line and in person assistance is available.

- **U Matter We Care** website: http://www.umatter.ufl.edu/. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.

- The **Student Health Care Center** at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: https://shcc.ufl.edu/

- Crisis intervention is always available 24/7 from: Alachua County Crisis Center: (352) 264-6789
  http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx

- **University Police Department**: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).

- **UF Health Shands Emergency Room / Trauma Center:** For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

Inclusive Learning Environment

Public health and health professions are based on the belief in human dignity and on respect for the individual. As we share our personal beliefs inside or outside of the classroom, it is always with the understanding that we value and respect diversity of background, experience, and opinion, where every individual feels valued. We believe in, and promote, openness and tolerance of differences in ethnicity and culture, and we respect differing personal, spiritual, religious and political values. We further believe that celebrating such diversity enriches the quality of the educational experiences we provide our students and enhances our own personal and professional relationships. We embrace The University of Florida's Non-Discrimination Policy, which reads, "The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans'

Readjustment Assistance Act." If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see your instructor or refer to the Office of Multicultural & Diversity Affairs website: www.multicultural.ufl.edu