**PSYC GU4440 Topics in Neurobiology:**

**Applications of Neuroimaging in Aging and Disease**

3 points

Fall 2022

Instructor: **Yunglin Gazes** Office: TBD

Class Time: **Thursdays 12:10-2:00pm** Office hours: by appointment

Class Location: **TBD** Email: **YL2107@cumc.columbia.edu**

**Course Bulletin Description**: This course will traverse the most widely used neuroimaging techniques and explore how each one is applied to understand the workings and failures of the brain in aging and diseases. Students will learn the strengths and weaknesses in each neuroimaging technique and gain basic understanding of the neurological conditions that can be investigated with each technique.

**Prerequisites**: PSYC UN1001 The Science of Psychology or an equivalent introductory psychology course.

**Full Description**: With the growing availability of neuroimaging techniques, it is essential to gain fundamental knowledge of the available techniques for investigating various brain conditions. Each week, we will focus on one neuroimaging technique. Articles will be assigned demonstrating how the technique is applied to various neurological conditions. The focus of the course will be on the applications of each technique rather than on technical details of how each technique works. Thus, knowledge of physics or scripting is not necessary. Some discussions of image processing will be provided whenever pertinent to the effective application of the technique, and students will become familiar with the most popular neuroimaging processing softwares. Optional guidance on the analysis of some imaging data can be provided for any curious student, but it is definitely not a course requirement.

**Learning Objectives:** At the completion of this course, students will:

* Gain working knowledge of the most widely used neuroimaging techniques.
* Be able to identify the neurological conditions that can be investigated with each technique.
* Learn the strengths and weaknesses for each technique.

**Role in the Psychology Department Curriculum**: PSYC GU4440 is a seminar course open to PhD students and advanced undergraduate students in Psychology. It fulfills the following requirements:

* + - * For PhD students, with prior DGS permission, this course could be used to fulfill one of the seminar requirements for the MA or the MPhil.
      * For Neuroscience & Behavior majors, this course could be used to fulfill the P5 Advanced Psychology Seminar requirement.
      * For Psychology majors and concentrators, this course could fulfill the seminar requirement and/or the Group II distribution requirement.
      * PhD students in Psychology and senior and junior Psychology and Neuroscience & Behavior majors will have enrollment priority.

**Readings**: Readings will comprise empirical and review papers. Journal articles and review chapters will be posted to Canvas as pdfs.

**Schedule**: The schedule below is preliminary and subject to minor adjustments as needed.

9/08 Introduction

9/15 Diffusion weighted imaging (DWI) and T1-weighted imaging

9/22 FLAIR: white matter hyperintensity

9/29 BOLD fMRI - Paper proposal due

10/06 Arterial Spin Labeling (ASL): cerebral blood flow

10/13 Magnetic Resonance Spectroscopy (MRS)

10/20 PET imaging

10/27 Tumor and Stroke

11/03 Multiple Sclerosis - Paper outline due

11/10 Parkinson’s Disease

11/17 Alzheimer’s Disease

12/01 Aging and Cognitive reserve

12/08 Machine learning in diagnosis of neurodegenerative diseases

\*Final paper due at 5pm EST on 12/15

**Course Components**

**Weekly writing response** will consist of your reaction to the readings for the week. It can be questions that arose based on the readings, or critique of the article, or new ideas that the articles might have inspired in you. The only material that should not be included are facts or questions that can easily be found in textbooks or looked up online. In other words, the writings should reflect your synthesis of the readings and not factual regurgitation from the readings. Writing responses can be anywhere from a few sentences up to a paragraph or two and have to be posted on CourseWorks/Canvas each week by 5pm EST the Tuesday before each class. Students are encouraged to comment on each other's writing responses over CourseWorks/Canvas.

**Presentation**: Each student will be randomly assigned to present in two lectures. Dates of presentations will be posted on the first day of class. The presentation will provide a summary of the article and an evaluation of the research conducted. Then the presenters will host a discussion on the topic. Presentation duration can range from 20-30 min while discussion time will be flexible. The week before each presentation, presenters are encouraged to discuss the presentation with the professor.

**Final paper** will provide an opportunity for students to design a study using any combination of the techniques discussed in the course to address a research question relevant to a neurological condition. We will work on the paper throughout the semester. The paper will address:

1. Aims - What are the goals of the study?
2. Background and significance - Why are the goals important?
3. Approach - How will the study be conducted?

Final paper should be 10-15 pages double-spaced but the focus should be on content rather than the length of the paper.

**Grading**: Course grade will be assigned based on the weighted average according to the breakdown below.

10% in class participation

10% weekly writing response

10% attendance

30% 2 presentations

40% final paper

Course letter grade will be assigned based on the following, all inclusive intervals:

97-100: A+ 87-89: B+ 77-79: C+ 60-69: D  
93-96: A 83-86: B 73-76: C <60: F  
90-92: A- 80-82: B- 70-72: C-

**Course Policies**

**Fostering an Inclusive Classroom**: My aim is to foster a learning environment that supports a diversity of perspectives and experiences and honors your identities. Please reach out to me with any concerns or suggestions you may have to better address your learning needs and to improve the effectiveness of this course. I look forward to working together to create a classroom community built on mutual respect and inclusivity.

Students who may require special accommodations, such as closed captioning or modifications to visual content for the online presentations, should make an appointment with me as soon as possible. You should also contact the Office of Disability Services (ODS) in Lerner Hall before the start of the course to register for these accommodations. The procedures for registering with ODS can be found at <https://health.columbia.edu/content/disability-services> or by calling (212) 854-2388.

Since synchronous participation online in this class is essential to the class discussions, students should contact their academic advisors if there are issues with technology, quiet space, or internet access at home.

**Promoting Wellness**: Many of us have periods in which our mental health and well-being suffer. I urge you to take care of yourselves – and of each other. Please prioritize your mental health and wellbeing and know that there are many resources available to you both within our classroom community and throughout the university:

<https://health.columbia.edu/content/counseling-and-psychological-services>

<http://blogs.cuit.columbia.edu/nightline/>

<https://universitylife.columbia.edu/student-resources-directory#health>

We are in this together. Please reach out for help if you need it, and, if you see others who are struggling, please make sure they know how to find the support they need.

**Ensuring Academic Integrity**: As members of this academic community, we are responsible for maintaining the highest level of personal and academic integrity, which includes presenting only our own work on assignments. You can find detailed definitions and examples in Columbia University’s Guide to Academic Integrity (https://www.cc-seas.columbia.edu/integrity). Any questions of academic integrity will be automatically referred to Columbia’s office of Student Conduct and Community Standards. The semester progresses very quickly, and there is a lot of material to learn. If you find yourself in a situation – e.g., starting an assignment too late – in which it seems like the best option may be to violate your academic integrity, please see me. Together, we can work out a solution. It is far better to have a few points deducted from an assignment than to compromise your academic integrity and potentially put your academic standing at the university in jeopardy. Plagiarism—whether intentional or inadvertent—is a serious violation of academic integrity. If you have any questions about what constitutes plagiarism and/or how to properly cite sources, please come to me. I am more than happy to help.

Syllabus is subject to revision. Updates will be posted on CourseWorks (Canvas) within the relevant Modules section.