Cognitive Neuroscience Research Internship

Spring 2022 Syllabus

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Wednesday Instructors:
Raphael Geddert, raphael.geddert@duke.edu (he/him)
- Office Hours: Monday 10:00 AM or by appointment
- Zoom: https://duke.zoom.us/j/7510357345

Miles Martinez, miles.martinez@duke.edu (he/him)
- Office Hours: Friday 10:30 AM or by appointment
- Zoom: https://duke.zoom.us/j/98900186178

Research Team Mentors:
TBD

Class meeting time: Monday & Wednesday 3:05 - 4:20 PM
Class location:
- Duke Institute for Brain Sciences (DIBS) Rm: Teams Room
  OR
- Zoom: https://duke.zoom.us/j/93014782267?pwd=S0E4SFlPZ21vcEdxZnpBWDhIR0s0QT09

This class will be a **Hybrid** online and in person class. Refer to the calendar for details!

Resources and all course materials are available on our **BOX FOLDER**
Discussions of course material will take place on our course Slack channel (CNRI-Intern).
Announcements will be posted to Slack, with an accompanying email to all interns.

Program Overview

The Cognitive Neuroscience Research Internship (CNRI) is a semester-long program that introduces the basics of conducting research in motivation and decision sciences (e.g., psychology, behavioral economics, human neuroscience, and related fields). Participants in the program do not need prior background in research; instead, this program will provide opportunities for learning about research methods and applications, through both career development activities and hands-on experiences. Over the course of the semester, students will (a) gain a basic understanding of behavioral science topics and concepts, (b) learn how to read scientific articles, (c) receive an introduction to coding in Python and

other programs relevant for behavioral science experiments (e.g., PsychoPy, Qualtrics), and (d) become part of a supportive community with a track record of helping undergraduates grow as scholars and researchers. We hope to prepare students for success in their future research endeavors at Duke and beyond.

Course Description

Throughout the semester, you will participate in two overarching lines of activities: **cohort-based research education** and **smaller team-based research experience**. In our **cohort-based research education,** we strive to create a birds-eye view of life as a researcher. To achieve this, you will participate in introductory lectures to provide a foundational understanding of the common questions, methods, and techniques used to investigate human behavior. These are followed by journal clubs to develop skills in reading, analyzing, and critiquing primary research articles and end with panels to provide more detailed information into how graduate school works, applications, and what job options are available to researchers and data scientists. Alongside these experiences, you will also receive an introduction to programming in Python with the goal of building your own behavioral experiment.

Our course is structured to maximize interaction, through interactive lectures, group activities/problem solving, and discussions about how to take scientific questions and translate them into behavioral tasks. We will first review the basics concepts of research and of computer programming as well as introduce the language (Python!) we will use for scripting. We will next review the big topics we cover as researchers and start to review Python coding/syntax basics. We will then spend some time reviewing primary literature through journal clubs while learning about how we construct scientific paradigms. Our cohort-based education will culminate in applying your knowledge of behavioral research and programming to build an experimental paradigm.

In contrast, **our team-based research experiences** aim to provide a more granular look into the daily life of research. You will be divided into small teams and paired with teams of graduate students or post-docs to work on specific research projects. These experiences mirror the more "typical" research assistant duties and expose our interns to how research is carried out from design to data collection to data analysis. Our small teams also provide more one-on-one mentorship to help develop research questions and interests**.**

This internship will be intensive. Learning the basics of research as well as Python require consistent engagement and a touch of grit. We encourage you to remain open to error messages (I promise there's useful info in there!) and to learn from each other (research is more fun with friends).

Cohort-Based Research Education Overview

Monday Classes

Monday classes will be devoted to engaging with conceptual topics in cognitive neuroscience as well as to give you practice in reading and digesting scientific articles. During these classes, your graduate student lead will provide an overview of a specific topic within cognitive neuroscience (e.g., cognitive control), after which you all will discuss the journal article for that week.

Each week, a CNRI intern (one of you!) will lead the discussion for the specific journal article. This involves reviewing the specific motivation that led to the study question(s), the methods used to address the question, the results, as well as the strengths and weaknesses of the overall paper. Guidelines for these discussions can be found in the Google Drive under the Monday Lectures folder and we encourage you to use this template for reading all articles in the program.

Wednesday Classes

Wednesday classes will be devoted to learning Python with the semester goal of building your own experimental task (in small teams). During these classes, we will introduce and practice with different concepts in Python and computer programming. Classes will include some lecture components but mostly focus on actively reading, writing, and editing code. It is important that for these classes you bring a laptop or let the instructor know beforehand!

The best way to get comfortable and confident working in Python is to practice. Therefore, Wednesday classes will, for the most part, have homework components to complement the material learned in class. While we will not be grading your homework, everything we will have you do will help move you towards the ultimate goal of building your task.

Team-Based Research Experience Overview

You will be assigned research teams the second week of the program. Prior to assignment, we will have you fill out a survey to gauge your interest in the available research projects. While we will try our best to match your interests to what is available, we will be limited in the number of spaces available on each team.

Over the course of the weeks following, we expect you and your research teams to hold weekly meetings to discuss progress on tasks and projects. Each research team will differ both in terms of the topics they cover (e.g., investigating curiosity or examining emotion regulation) and in what specific stage of research they are in (e.g., experimental design, data collection, data analysis), so what you do on a week to week basis might evolve as projects move along.

At the end of the semester, your team will present a short (5-10 min) overview of the work you completed.

Core Values

Research comes with a set of unique challenges and unique opportunities. We hope to reflect the values that have helped us navigate these waters as we teach and collaborate with you all this semester.

- **Curiosity:** leaning into new and unexpected experiences
- **Community:** supporting and respecting one another
- **Transparency:** being open and honest with your knowns and unknowns
- **Ingenuity:** thinking with a creative flair

Course Activities: How will you learn?

1. Attend class sessions

Synchronous participation in the class sessions is expected of all students for whom that is possible. The class sessions will include a mix of lectures, online demonstrations, interactive games and decision problems, and opportunities for questions and discussions. You will understand the material better and be more prepared for the homework and final project if you are present for the sessions.

If you cannot attend a lecture -- for example, because you have a short-term illness -- a recording of the session will be made available for one week thereafter. If you have a long-term illness that prevents you from accessing course material for more than a week, please contact the instructor immediately.

Recordings or other distribution of class materials are not permitted and will be considered a violation of the Duke community standard.

All slides and other materials from the class sessions will be posted to the class Google Drive site within 24 hours after each session.

2. Complete the group activities and participate in interactive discussions

We will be covering a lot of material in this class, most of which will be new to you all. The concepts and the nitty gritty of coding can be overwhelming and frustrating, so to help ensure your learning, we expect active participation throughout lectures and workbook accompaniments.

There will also be weekly group homework assignments in which you apply concepts from class to complex coding problems. These problems are intended to be challenging and we encourage you all to work on them together.

3. Invest in final group project

The fundamental skills you learn during lecture and through homework will culminate in building behavioral experiments in small teams. We will be practicing throughout the semester on how to ask behavioral research questions and how to translate them into code to build an experimental task.

Towards the middle of the semester, we will start to brainstorm your scientific questions of interest. This will require some background literature reviews to see what research is out there and how we can fill the gaps. Before we begin building, you will work with your team to write a proposal that documents your literature search, your scientific question and how you plan on testing your question.

We will then spend the remaining weeks of the semester building your study. At the end of the semester we will (pending COVID) run your experiment in a Duke population.

4. Participate in Research Activities

To further your insight in the realm of research, you will also be paired into research teams comprising around 2 interns paired with 2 graduate student or post-doc mentors. In these research teams, you will complete more specific and topical research-based activities to give an in-depth view into the every-day tasks of life as a researcher. This also gives you all an opportunity to start experiencing the work and expectations for research assistants.

Course Calendar: How is the course organized?

Class Held Online and **Class Held In-Person,** **(subject to change as the semester progresses)**

Week	Date	Monday	Wednesday	Homework/Other
1	01/24 - 01/26	Introduction to CNRI + Research Methods Abby Hsiung	Introduction to Python Class and Computer Programming	
2	01/31 - 02/02	Information seeking/curiosity Abby	Data types and Booleans An introduction to Control Flow (conditionality)	Complete Research Team survey, Python Homework 1

3	02/07 - 02/09	Introduction to Memory Allie Sinclair	Control Flow 2 (lists and loops)	Assignment to Research Teams Python Homework 2
4	02/14 - 02/16	Emotion Regulation Rachael Wright	Functions and Methods	Python Homework 3
5	02/21 - 02/23	Moral Decision-Making Paul	Libraries and Packages, An introduction to PsychoPy	Python Homework 4 Install PsychoPy
6	02/28 - 03/02	Food Decision Making Deborah	Creating Stimuli Randomization/Counterbalancing, Team Assignment/Project Review	PsychoPy Ex. 1 Experiment Proposal assigned
7	03/07 - 03/09	**Spring Break**	**Spring Break**	**Spring Break**
8	03/14 - 03/16	Sleep and Cognition + RS JH	Collecting and Storing Responses	**Experiment Proposal: Due 03/16**
9	03/21 - 03/23	FMRI Neurofeedback Ben	User Testing and Debugging	Task Building
10	03/28 - 03/30	FMRI & Value-based DM Jaime	Experiment Building: Design and Outline	Task Building
11	04/04 - 04/06	Grad Student Panel	Experiment Building: Control Flow Implementation	Task Building
12	04/11 - 04/13	Faculty Panel	Experiment Building: Collecting Data	Task Building
13	04/18 - 04/20	Last Class (Project Blitz)	Experiment Building: Final Touches	**Final Experiment: Due Friday 4/22**
14	04/25 - 04/27	Start of Exams	Exams	

**Note this week, we will have our Python course on Monday and our Concepts course on Wednesday