

Brain Mapping and Connectomics Syllabus (supervised by Dr. Arshad M. Khan)

Contact Information

Dr. Christina D'Arcy: Instructor of Record

cebond@utep.edu

Vanessa Navarro

vinavarro@miners.utep.edu

Scheduled Lab Hours

MW 2:30-5:20

Room: Bio 108

Lab Goal

The goal of the HHMI Brain Mapping lab is to generate real-world research that is published in a peer-reviewed journal. This makes the Brain Mapping lab unique – you will not just learn a variety of research techniques, and you will not just mimic real research by participating in a semester-long project. You will participate in an actual dissertation project and your work will be shared with the scientific community. Along the way you will pick up histological and anatomical research techniques, expand your critical thinking skills, be exposed to professional science writing, and be asked to produce written work in a professional format. In order to achieve the primary course goal of becoming an author on a peer-reviewed scientific publication, you must: **be prepared to put in a large amount of time** working on the project, and **produce high quality work** that meets the stringent standards of the scientific journal this project will be published in.

Project Goal

You will be working on the fear chemoarchitecture project. The goal of this project is to map the distribution patterns of neurons expressing specific chemicals in the brains of rats that have been exposed to and activated by various fear conditions by a collaborating team of researchers in Albany, NY. There are many different neuronal circuits that participate in the fear response from changes in metabolism to alterations in sensory and memory processing, but the location and types of neurons that are involved in these processes are still largely uncharted by science. This makes it difficult to understand how fear *effects* and *affects* brain functions and how it might be disordered in certain medical conditions. Because different neurons express different neurotransmitters, one way to see brain circuits is as a pattern of interacting chemical systems. Our project is concerned with describing, in a very precise and rigorous way, various chemical systems present in the brain and their interactions, as a way of gaining information about brain circuitry. The project findings will be mapped to a reference atlas (the Swanson 2004 atlas of the adult male rat brain), so that they will be easy for other investigators to use and to integrate with their own data.

Because there are so many different neurotransmitters expressed in the brain, this is a long-term project which you will share not only with collaborators across the country, but also with collaborators across time. Your work, along with the work of your current and future collaborators will be published as a series of papers that each focus on a particular set of neurotransmitters and brain regions that we will work together to select as a class.

Student Contribution to the Project

In groups of four students, you will stain rat brain tissue to visualize functional markers in the brain, and map their distribution patterns to the Swanson atlas. Each group will be responsible for staining and mapping one brain. Each group member will be responsible for an equal amount of this work. Some of the mapping will be completed as a group; whatever is left will be divided equally amongst the group members. You will prepare a report of your findings, and present your maps to your instructor for quality assessment and inclusion in a paper to be published in a peer-reviewed journal, assuming that quality requirements are met.

Policies

Protection of data: Because you will be conducting actual research, the information you generate in this lab is the intellectual property of [institution omitted]. It does not belong to you. All staining procedures must be written up in your lab notebook, which **cannot be removed from the laboratory**. You will be allowed to remove the Illustrator files containing your maps from the lab, so that you may work on them at home or at the library, **but an up-to-date copy of mapping files must remain on the lab computers at all times**. If questions arise amongst the scientific community concerning the staining, your lab notebooks will be referred to. If questions arise as to the integrity of the mapping, your Illustrator files will be referred to. **Your lab notebook is considered a legal document**. This is serious business.

Required items:

- 1) Composition book (bound pages...not tear-out perforated, lined or grid...your choice).
- 2) Pen
- 3) Sharpie
- 4) **Number 0** round **watercolor** brush or liner with **natural bristles**. Winsor & Newton Cotman brushes are one example. Michaels, Hobby Lobby and Art Center are local suppliers. The brush tips should not have hairs that splay out to the side and should come to a fine point. Avoid artificial bristles like golden taklon or white nylon. These brushes will be used in manipulating slices of tissue-paper-thin brain, so choose your tool carefully!
- 5) Lab coat

Excused Absences, Unexcused Absences and Tardiness: Absences may be excused for the following reasons: professional development (such as attendance at a conference), military duties, membership on a [institution omitted] sports team that requires you to leave town for a game, hospitalization or illness, or death in the family. If you know you will need to miss a day of lab, inform your instructor as soon as possible. **The instructor must be presented with supporting documentation for any absence to be considered excused, regardless of the reason for the absence**. Having an excused absence does not excuse you from completing any assignments that may have been due on that date. Coordinate with your team members in order to figure out division of duties, etc. so that your absence does not impose undue burden to your teammates.

One unexcused absence will result in the reduction of your grade by one letter-grade, and two or more unexcused absences will result in an automatic grade of F. Remember, "F" is not for "Fail;" "F" is for "Fired." If behavior could get you fired from a job, it can get you "fired" from your course grade.

If you are delayed from arriving to class on time and able to **safely** contact your team members, notify them of what is going on and work with them to resolve any work imbalance. This lab reflects real life as a scientist, thus, requires real-life problem solving with your research team 😊

Academic dishonesty: In accordance with the policies of [institution omitted], academic dishonesty is considered wholly intolerable. Academic dishonesty is essentially any form of cheating. Students found to commit academic dishonesty will be disciplined following [institution omitted] established procedures, which you can read about here: [link omitted].

Plagiarism: Plagiarism is a form of academic dishonesty and will not be tolerated whatsoever. **If any part of an assignment submitted by a student is plagiarized, the entire assignment will be considered plagiarized and will count as a 0.** Particularly flagrant and deliberate plagiarizers will be referred to the Dean of Students, in accordance with [institution omitted] policies on academic dishonesty.

ADA accessibility: Students with disabilities who require accommodations must contact the Center for Accommodations and Support Services (CASS) as soon as possible at [link omitted]. The CASS office is [location omitted], and their website is [link omitted].

Use of HHMI Brain Mapping lab equipment: This lab is funded by a grant with the HHMI. Your tuition and lab fees do not contribute to the setup and maintenance of this facility or its equipment. Therefore, **your use of the facility and equipment is a privilege, not a right.** You may not be present in the lab without the course instructor being present, and you may not use any equipment without the permission of your course instructor. If you violate these stipulations or use the facilities and/or equipment in a disrespectful or irresponsible manner, the TA or course instructor may throw you out of lab and disallow you from attending lab.

Grading

Participation and Attendance	50%
Notebook and Quizzes	10%
Blogging	10%
Project Development and Abstract	20%
Final Maps*	10%

Assignments

Participation and Attendance: This is a research lab. We are finding the answers to questions no one else has answered before. As such, coming into the lab is essential. Your team, your class, and your collaborating scientist are depending on you to do your part.

Notebook and Quizzes: As a scientist, there is nothing more valuable than keeping clear, detailed, and honest records of the what you did and how you did it in order to produce the data you observe, record, and report. Keeping accurate records will be essential, and *one* of the ways we check notebook content is to conduct notebook-based in-class quizzes. You will have the opportunity to review your notebook contents at the start of class in preparation for the quiz/ potentially use your notebook to furnish information during the quiz.

Blogging: Taking time to think about your science is all a part of the process. Blogging, will be similar to your lab notebook in that you will document your progress each week, including any staining that you did and any mapping that you completed. How many sections did you mount? How many sections did you parcellate, etc. But it is also where you can reflect on problems you encounter, articles you have read, and how your data fits into a bigger picture.

Project Development and Abstract: Your teams will work together to develop a project to tackle. Part of this will involve reading through scientific papers, and part of it will involve a careful selection of what you will test and how you will set up the experiment (including what areas of the brain we want to examine, why they are important to examine, and what are some signals we want to examine and why). Additionally, we will work together to develop individual, group, and class abstracts that summarize your findings and determine how to present your data on a poster for a professional conference. Participation and demonstration of critical thinking are keys to succeeding in this grade category.

Final Maps: For the grade, your instructor will evaluate not the final map, but *each step taken to obtain it*. Throughout the semester, you will be observed in how well you contribute to your team's maps, your intellectual discussions that take place during the course of mapping, your care in maintaining ordered and clearly-labeled layers, your attention to detail in maintaining line thickness, your honesty in noting regions of ambiguity, and your rationale behind your brain region boundaries (parcellations). *It is not about the destination, but the journey.

While not assigned a grade, your maps will be subject to the critique and examination of the scientific community. Your Illustrator files will be used to assess the quality of your maps by the lab Principle Investigator. High-quality maps will be those that adhere to the reference standards established, that reflect uncertainties in parcellations and transfers carefully, that are assigned to an atlas level(s) correctly and in a thoughtful manner (meaning you didn't just draw a line across the section), and that demonstrate a subtle and refined understanding of the chemoarchitecture underlying parcellations. Such maps will contribute to the poster and future publications. If your maps meet these standards for inclusion, you become eligible for inclusion as an author in subsequent professional communications and reports using this data (see your instructor for further details).

Team Contract

I will be on time

I will be respectful of my teammates and their time

I will respect the safety of others and will obey all safety rules and encourage my teammates to do so

When working as a group I will contribute intellectually to the task at hand

I will do my part to complete research outside of lab that my teammates are depending on me for

I will not allow my teammates to wallow in egregious amounts of my unfinished work

If I fail in these duties to my team I understand that my final grade will suffer a loss of points in an amount corresponding to the severity of my failure of my team

Signature

Printed Name

Date