

## **Mentorship in Research - Addiction Sciences Laboratory**

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### **Overview of the Addiction Sciences Laboratory**

Drugs of abuse are imposters in the brain that mimic our own natural neurotransmitters, but they do so in ways that cause changes in the brain that can last a lifetime. People respond to drugs of abuse in different ways. No one chooses to become a drug addict, and only a fraction of users become addicts. Drug addiction causes personal devastation, health deterioration and has extreme societal cost. This attests to the power of drugs of abuse to control one's mind, body and behavior. Scientific research on addiction is central to the field of neuroscience. Drugs of abuse alter the way we walk, talk, think, feel and learn. Knowledge on addictions is essential for everyone, and is particularly important for health practitioners.

The Addiction Sciences Laboratory at Northeastern University focuses on the neurobiology, immunology and genetics associated with acute and chronic exposure to drugs of abuse. Its goals are to understand the science of how drugs work in the brain and the body, to create new pharmacological treatment strategies for people who are addicted and motivated to recover from their addiction, to take a leadership role in educating students and the public on the science of substance abuse, and to work diligently towards preventing drug addiction. The lab takes an eclectic approach, but the major scientific focus is on the neurochemical mechanisms by which drugs act on the brain and body, and how genetic, epigenetic and environmental factors alter drug responses to predispose or protect an individual from becoming addicted.

### **Graphic Syllabus** (read bottom up)

I have designed a mentoring program in biomedical research that teaches undergraduate students approaches and strategies for originating and performing biomedical research. My goal is to mentor students who are strongly motivated towards scientific research, providing them with a laboratory environment and a faculty mentor who can guide them forward throughout their educational experience at NU. Working independently and then in teams, each student develops the ability to conceive, critique and execute a research aim of high scientific significance and impact. Each student first gets introduced to how to search the biomedical literature and use library resources to help them target in on significant publications in areas of addiction research. They get access to a community database of folders containing scientific literature by topic, as a guide to help them with their selection of an area of initial research interest. A student can add literature to any folder, or can create their own folder. Students who share the same primary interest focus are then recruited into an interest focus team, and I mentor each team.

Each team then works towards identifying a major scientific problem of high significance where there is an identifiable "gap" in scientific knowledge. How impactful would "filling the gap" be? Would filling the gap make a vertical leap in the scientific field? As a team, we share ideas with each other and draft a hypothesis, a goal and a specific aim as a group output. This is a 1 page write-up that will be in the style of the Specific Aims section of an NIH grant. Students have access to my grants as examples. The ambition is to create a "think tank" where ideas get generated that otherwise wouldn't have surfaced, and in doing so build enthusiasm, comradery and a team mentality.

The different teams then enter a "peer review" phase where each team critiques the others and provide feedback (NIH-like format: Significance, Innovation, Approach, and Achievability). This phase introduces students to the peer review process, facilitates the revision process, and leads to the development of a finely-tuned hypothesis, goal(s) and/or specific aim(s). In this way, students learn how to generate important and meaningful hypotheses, while also getting heavily invested in an important idea which members of the team can then "job share" in the laboratory environment.

Throughout this process, students embark on working in the Addiction Sciences Laboratory. In addition to specific laboratory techniques, there is a spectrum of knowledge and skills that students learn related to productive lab work, research methods and ethics, and data analysis and presentation (summarized in the graphic syllabus). Most notably, students learn how to work collaboratively together on a project, develop laboratory skills, data organization and record keeping, issues related to the use of animal models in biomedical research, data analysis, data presentation, scientific writing and how to present data. Leadership skill development and community outreach is an additional component. Students become educated in addiction as a societal and economic problem throughout this process, and learn to become "ambassadors" who disseminate scientific knowledge on drug addiction into their communities.