Interdisciplinary Methods of Neuroscience

Course Description and Syllabus

This experiential course is designed in collaboration with the instructor and neuroscience faculty members to engage students in interdisciplinary and innovative methodologies spanning molecular, cellular, developmental, systems, behavioral, and cognitive neuroscience. Students will explore authentic research questions and gain experience in acquiring, analyzing, and interpreting experimental findings. The course provides broad and integrative exposure to contemporary neuroscience approaches while cultivating students' ability to apply these methods to real-world research questions. Through iterative engagement, structured reflection, and collaborative discussion, students will develop a deeper understanding of methodological strengths and limitations, ethical considerations, and future research directions.

Each faculty-led module integrates directed readings, structured discussions, and methodological immersion through literature analysis and, where feasible and ethically appropriate, hands-on work involving experimental techniques, data acquisition, analysis, and interpretation. Students will spend six class sessions (80 minutes each) over three weeks with each instructor in the following sequence:

(1) **Foundational Instruction:** The instructor provides direct instruction and structured discussion on a specific research technique and its applications.
(2) **Laboratory Immersion:** Students visit the instructor's laboratory to observe how the technique operates and gain introductory hands-on experience. A curated list of research questions suitable for the technique will be provided for students to select.
(3) **Experimental Application:** In collaboration with the instructor, students conduct initial experiments addressing their selected research question, followed by preliminary data analysis and interpretation.
(4) **Iteration and Optimization:** Students are encouraged to repeat experiments to confirm reproducibility or refine and optimize their initial findings.
(5) **Data analysis:** Students will be given time in consultation with the instructor to analyze the data that they have collected and provided biological interpretation of the data.
(6) **Data presentation:** The last session will be allocated for students to share their research findings and have a discussion with the class and obtain feedback from the instructors and peers. Peer discussion and evaluation are strongly encouraged to foster scientific dialogue, critical thinking, and interdisciplinary synthesis.

Throughout the semester, students will engage with five individual instructors (15 weeks in total). All sessions will incorporate structured reflections on experimental design, methodological rigor, translational relevance, and potential future directions should more time or resources be available to train the forward-looking research mindset in students. Outcomes are intended to extend beyond the classroom, enabling students to consider how their findings may contribute to advancing scientific knowledge or improving healthcare applications. At the end of the course, students will be prepared to critically evaluate and integrate interdisciplinary methodologies in addressing fundamental, pre-clinical, translational, and clinical questions at the interface of brain and behavior.