COURSE FRAMEWORK (plan-cadre)

Course title: Introduction to Research in Neuroscience	Competency # 021M Explore a contemporary issue from a transdisciplinary perspective.	Ponderation: 3-0-3
Course Number: 365-BXP-DW		Credits: 2
Ministerial competency: To deal with a contemporary issue from a cross-disciplinary perspective.		

Number	*Statement*	*Number of hours*
1	To present a research problem.	10
2	To analyze the research problem.	25
3	To propose solutions.	10
		Total 45 hours

Semester # 1,2,3,4	
What courses have prepared students to take this course? N/A	*What does this course prepare students to take later on in the program?* Students taking this course are eligible to participate in the Summer Research in Neuroscience Internship program, where they would work on projects in university or hospital labs in Montreal.
Progress through the competencies In days where one wonders if a machine could ever replace a human brain, our students are very curious to understand how their brains work. *How are small electrical signals transformed into emotions?* This course will take them into a quest combining Natural Sciences, Engineering and Social Sciences. A term-long research project based on students' interests will lead them through all aspects of a research problem, including ethical considerations. Teams will have to design, conduct and analyze an experiment using electroencephalography (EEG). A class with students from a large variety of programs will allow for diversity of strengths and experience and foster rich discussions with multiple points of view.	*Course description* In this course, students will experience how to collect scientific knowledge with the goal of better understanding the brain. Throughout the semester, students will research individually topics assigned by the teacher and give short oral presentations to the group, leading to class discussions. Through this peer instruction, basic notions in neuroanatomy, neurochemistry, physiology, electromagnetism, computer programming, neuropsychology, behavioral psychology, statistics, ethics, etc. will be covered at a level accessible to students from any program. In parallel, students will work in small teams on a term project, forming the corner stone of the course. They will complete an experiment where electrical signals from the brain will relate to a specific research question of their choice in neuropsychology. The project will include all the steps of an authentic experiment: design, writing of proposal for research ethics board approval, planning, subject recruitment, data collection, data pre-processing, data analysis, discussion of results and presentation to an audience. Guidance will be provided through activities specific to each aspect of the research process.

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	A central objective is to develop the student's ability to participate productively in a multidisciplinary research project in a small team. The targeted skills to develop include critical thinking, self-efficiency, ability to communicate efficiently, collaboration skills, integration of knowledge, good organization during a long-term project, and perseverance despite difficulties. Students having completed this course may opt to participate in the Summer Research in Neuroscience Internship program and apply their new knowledge and competencies in a research lab in Greater Montreal area.

Learning outcomes of the course *(At the end of this course, the student will be able to…):*

As part of element of competency 1: Present a research problem,

- Map the connections between several disciplines included in neuroscience;
- Search appropriately accessible scientific literature;
- Establish reasonable research questions and sound hypotheses;

*As part of element of c*ompetency 2: Analyze the research problem,

- List the different steps involved in the design of a neuroscience experiment;
- Write an acceptable proposal for a research ethics board;
- Acquire and analyze data with scientific rigor;

*As part of element of c*ompetency 3: Propose solutions,

- Apply critical thinking on experimental results to answer the research question;
- Communicate effectively the scientific ideas and conclusions with people from different backgrounds.

Note: we interpret "solutions" in the large sense of "reflection on outcomes of research".

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Course Title: 365-BXP-DW
Competency #021M Explore a contemporary issue from a transdisciplinary perspective.

Elements of competency	Performance Criteria	Course components	Pedagogical activities	Assessment activities	Timeframe
1. Present a research problem.	1.1 Justification of the choice of research problem 1.2 Brief description of the main issues involved in the problem 1.3 Clear formulation of the main dimensions of the problem 1.4 Appropriate use of language and concepts from the disciplines 1.5 Clear formulation of the research question	The students will first acquire a background in the various disciplines of neuroscience and then choose a research question for the project they will do over the term. This question should be of interest to them, informed by published literature and appropriate to be investigated within the scope of the course and with the experimental material made available by the teacher. At least for the first installments of the course, this material will include portable EEG headbands and open source software.	• Screening of published papers to learn how to select good research questions, write hypotheses and describe the methods. • Short student oral presentations on topics from the various disciplines chosen by the teacher. • Class discussions of presented material. • Discussions about ethical considerations related to experiments with human subjects. • Group activities to learn how to collect EEG data and to understand what kind of data will be available.	Including but not limited to: • Teacher and peer assessments of presentations • Quizzes on presentations • Teacher, peer and self-assessments of participation in group activities • Teacher evaluation of the research question	**Weeks 1 to 4**

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2. Analyze the research problem.	2.1. Relevant description of a research approach or method 2.2. Appropriate selection of research data 2.3. Proper application of the approach or method used 2.4. Appropriate use of an analytical framework	In the first stages of planning of the experiment, hypotheses are set, appropriate methods are chosen and a proposal for the Research Ethics Board is written. Then, stimuli are prepared, subjects are recruited, pilot experiments are run, and preliminary analyses are performed. Next, the actual testing of subjects is taking place and the full data set is analyzed.	• In small teams, the students explore the methods applicable to their research question and present to the class for feedback. • Workshops on how to build an ethics proposal. • Workshops on the use of selected hardware and software. • Workshops on statistical analysis of data (t-test, p value, etc.). • Frequent team presentations to report on progress done.	Including but not limited to: • Teacher and peer assessments of presentations • Quizzes on material from the workshops • Teacher, peer and self-assessments of participation in group activities • Teacher evaluation of the proposal (hypotheses, methods, ethical concerns) • Teacher evaluation of pilot experiments and preliminary analysis	**Weeks 3 to 12** The overlap is intentional

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3. Propose solutions.	3.1 Clear description of the main contributions from the disciplines 3.2 Pertinent explanation of the interaction among various disciplines 3.3 Justification of solutions proposed 3.4 Assessment of the strengths and weaknesses of the proposed solutions	In the final stages of the project, analyses are critically evaluated, and results are interpreted at the team level with support from the teacher. The process is pursued at the class level to enlarge the discussion. The students will be expected to show how they integrated the various disciplines of the course in their project. Final reports and public oral or poster presentations are used to present the findings and limitations of the results to an audience. Presenters will need to be able to defend their work in front of their peers.	• Workshops on data analysis. • Team presentations to class. • Class discussion on interpretation of results. • Group activities to highlight good practices for scientific communications.	Including but not limited to: • Teacher evaluation of the final report on the project • Teacher, peer and self-assessments of participation in group activities • Teacher, peer and self-assessment of final oral presentation	**Weeks 10 to 15**