

## **Introduction to Neuroscience Research**

### **Integrative assessment**

The whole course is centered around the integrative assessment. In teams of 3 or 4, the students work on a term-long multidisciplinary research project.

During the first weeks, the students give 3-minute oral presentations on topics assigned by the teacher. The purposes of these are multifold: 1) to acquire a background necessary for the project in anatomy of the brain, functions of the different parts of the brain, biochemistry of neurons, electric fields produced by the neurons, basics of EEG measures; 2) to engage the students in a collaborative effort from the beginning; 3) to practice researching a topic and presenting it to peers; 4) to develop scientific communication skills.

In the following weeks, there will be group work, searching the literature and learning how to approach a technical paper. In parallel, few standard experimental designs in neuroscience will be explored following which students will develop their own research questions, hypotheses and experimental design. The students will also familiarize themselves with the Muse EEG head set and the software used for the collection and analysis. A research protocol and a letter of consent will be written. Ethical concerns will be discussed.

Then the experiments planned will be tested in a pilot run and preliminary analyses will be performed and reviewed in class. This will lead to extensive testing and more detailed analysis. Basic statistical methods will be covered in class, again through students' short presentations. As we go along, there will be many opportunities for reflection on the process.

The term will conclude on the discussion of the validity of the results and a final presentation by each team.

The presentations and group work will be evaluated, by the teacher and by peers. Frequent informal feedbacks will be given during the discussions. The evaluation of the main steps of the project will be based on a grid of performance criteria achievement (see page 3).

Tentative plan

week	theme	Pedagogical and <i>assessment activities</i>	Performance criteria
1	Introduction		
2	Brain anatomy + functions	Student presentations, by teams. Informal game to help remember names, locations and functions.	1.4
3	Electricity in the brain, from neuron to EEG measures	Student presentations, by teams. Meditation with the Muse headband. Discussion on Muse feedback and how this is related with the electrical field emitted by the brain. <i>5-minute quiz on material seen the previous week (individual).</i>	1.4
4	The Muse headband and related software. The main steps of an experiment in neuroscience	Exploration of experiments built in Muse related software. Deconstruction of the steps of a standard experiment.	1.1 to 1.5 and 2.1 to 2.2
5	Searching the literature; Establishing a research question and a hypothesis	In-class group activity on hypothesis design and testing. Student presentations, by teams.	1.1 to 1.5, 2.1
6	Designing the protocol of the experiment. Ethics	Teams draft their protocol and letter of consent and present them to the group for comments and discussion. Work on REB proposal.	2.1 and 2.2, 2.3
7	Pilot test	Intro to basic statistical tools	2.3 and 2.4
8	Preliminary analysis	Teams present their preliminary results. Discussions about hurdles encountered and ways to overcome them.	2.1 and 2.2
9	testing	Team presentation of published papers related to their project. Discussions about the variety of models and how to establish their validity.	2.3 and 2.4
10	testing	Team presentation of published papers related to their project. Discussion about methods.	2.3 and 2.4
11	Analysis of raw data	Why and how to process data. Activity on using a specialized software.	2.4
12	Analysis of the results	Activity on application of statistical tests.	2.4
13	Analysis of the results	Discussion on the interactions between the disciplines. Critical look at the results.	2.4
14	Discussion of results and process	Reflection on the process	3.1 to 3.3
15	Final presentations of the results	Final evaluation	3.4

## **Performance Criteria from plan cadre**

- 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
- 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
- 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