

PSL Master in Life Sciences – M2

Semester S1, 2026-27

UNBIO1-074. *Interdisciplinary Tutorials in Neuroscience*. (9 ECTS)

<https://www.edu.bio.ens.psl.eu/spip.php?article101>

1. Short Description of Course

Aims: In depth study of a research topic related to neuronal networks, based on modeling, data mining, development of data analysis tools, computational neurophysiology... done under the close supervision of both a theoretician and an experimental researcher.

Themes: Understanding the brain will require the development of effective abstractions and simplifications of its complexity. Research in this field is active at the interface between theoretical and experimental neuroscience.

This module offers insight into such interdisciplinary research in a tutorial setting with active theoretical and experimental neuroscientists.

Organisation: Discussion with mentors, supervised bibliographical analysis (necessary but not sufficient), possible data mining and analysis, and modeling.

Maximum class size: 10 students.

Tutorials happen typically in English.

Keywords: Neuroscience, Computational Neurophysiology, Modelling, Data Analysis.

2. Registration

Students external to the ENS Biology Department can attend and validate the course if the primary instructor has been contacted beforehand and agreed (see contact information below). Following approval, students need to register online at least one week before the course starting date:

<https://www.enseignement.biologie.ens.fr/?article207>

3. Location and Timeline

Location: Tutorials are essentially an out-of-classroom formation. Interaction with course organizers will be essentially by email. Interactions with tutors will be an ensemble of emails, videoconferences, database sharing, and in-person meetings in the lab, depending on the convenience of the tutor, the student and the project.

Late September, the primary instructor will propose the list of topics proposed by tutors. A short description of each subject, often with some references, will also be provided. Students will have some days to rank at least four topics according to their preferences and/or skills. The primary instructor will then distribute the topics at best. Students will (early October) establish a first contact with their tutor and establish together a task plan.

Total duration (in person): Variable

Total duration (online): Variable

Homework will again be variable but the student has to consider at least the equivalent of three weeks full-time. This time will be distributed through the semester. The timing will be tuned upon informal agreement between the student and the tutor.

4. Instructors and Contact Information

Primary instructor: Mariano Casado (he/his), casado@biologie.ens.fr

Secondary instructor: Boris. Barbour (he/his), barbour@biologie.ens.fr

Several expert tutors located in Parisian labs.

Preferred method of contact: email.

5. Course Communications

Course material will be made available by the Tutors.

Announcements from instructors will be sent by email.

6. Course Prerequisites or Co-requisites

Students should be motivated by interdisciplinary approaches in Neuroscience and be capable of benefiting from both theoretical and experimental aspects of Neuroscience research. A formal solid ground in Neuroscience is necessary.

Programming skills are almost always needed. Precise programming requirements may be announced for each topic. Python or MatLab are the most often used programming languages. Reliable proficiency in one of these languages is necessary from the very beginning, this course is not intended to initiate the student to programming.

7. Course Format, Teaching Methods, Special Activities

This is a hands-on-learning course. No lectures, no classroom. Given the largely personal nature of the work, students are strongly encouraged to use their own computer. Laptops are almost always sufficient, but you should be able to eventually install necessary software packages and libraries. When heavy calculation capacity is needed, tutors will provide access to the appropriate computing resources.

8. Expected Learning Outcomes

The work will consist in depth study of a research topic related to neuronal networks, based on modeling, data mining, development of data analysis tools, computational neurophysiology... Everything done under the close supervision of a researcher.

Upon completion of the course, based on knowledge and skills gained, students will be able to tackle a subject at the edge of contemporary research in Computational Neuroscience or Neurophysiology.

9. Detailed Schedule and Content

Late September, the primary instructor will propose the list of topics proposed by tutors. A short description of each subject, often with some references, will also be provided. Each subject will be different and will depend on a different tutor, whose research is always located in a Parisian lab. Students will have some days to rank at least four topics according to their preferences and/or skills. The primary instructor will then distribute the topics at best. Students will (early October) establish a first contact with their tutor and establish together a task plan.

A written report will be produced by early January. An oral defense will be organized for mid-January.

10. Evaluation and Grading

9 ECTS. Written report (to be produced by early January), oral presentation mid-January. The document will take the form of an internship report or a scientific article, with the usual sections.

<u>Assessment Categories</u>	<u>Percentage of final grade</u>
Report	50%
Oral defense	50%
Total	100%

Possible re-take with the same scheme than the original examination (report plus oral defense). Re-take grading will be linear (x1) for the first 10 points, and corrected by a factor (x0.2) for the following 10 points. Timing for re-takes will be agreed for the convenience of both, the student and the instructors.

11. Required or Suggested Resources

Each tutor will indicate the specific resources (books, articles, websites, MOOCs) necessary to accomplish his/her specific project.

12. Absence, Class Participation, Classroom Behavior Policies

Students are expected to communicate promptly (and fluently) with tutors. Both parts will show the necessary flexibility to establish a task plan and plan regular interviews to make the project advance. To foster a positive learning environment, students and tutors have a shared responsibility. We seek to create a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand. Would any relational or pedagogical issue happen with the tutor, the student should communicate with the primary instructor.

Disclaimer: Information contained in this syllabus may be subject to change with reasonable advance notice, as deemed appropriate by the primary instructor of the course.