



Experimental Design and Reproducibility in Science

Teacher: Inês Fragata (cE3c), Leonor Rodrigues (cE3c) and Diogo Godinho (IGC)

Calendar: March 18th – 22nd 2024 (provisional calendar)

Duration: 36 hours (contact hours)

Schedule: 9h-12h30 and 14h-17h30, Monday-Thursday; 9h-13h and 14h-18h Friday

Objectives

The objective of this course is to provide participants with basic knowledge on a) the fundamental aspects of experimental design and b) workflows, platforms and tools to increase reproducibility at all scientific levels.

Topics:

- Why is a clear experimental design important?
- Key aspects of experimental design.
- Estimation of sample size.

- Why is reproducibility in science important?
- Working with Github.
- Data processing workflows.
- Notebooks (R and Jupyter).
- Manuscript and data repositories.

Detailed Plan:

- **Why is a clear experimental design important?** We will highlight the importance of correctly planning an experiment to avoid taking wrong conclusions and benefit the most from the data collected.
- **Key aspects of experimental design:** Participants will learn how to define variables and establish protocols starting from a clearly defined question.
- **Estimation of sample size:** Participants will learn how to use power analysis.
- **Why reproducibility is important:** We will go through the reasons why is it important to keep our research reproducible for others and for ourselves.
- **Working with Github:** Participants will become familiar with the use of Github as a tool to detail steps of data analysis and data processing and even manuscript writing.
- **Data processing workflows:** Participants will become familiar with different workflows that allow to create reproducible steps in data processing using open-source tools.
- **Notebooks (R and Jupyter):** Using two of the most common scripting languages in biology, participants will see how notebooks can be used to create fully automated and reproducible analyses.
- **Manuscript and data repositories:** We will discuss the advantages of sharing documents in these types of platforms.
- Participants will be given an exercise in which to apply the acquired knowledge on experimental design and reproducibility.

Participants have to be present at 85% of the contact hours (this means that they can miss one half-day), and actively participate in all activities.

This course can give credits to PhD programmes at FCUL or of programmes with partnership from FCUL and other institutions with 6h-7h of contact hours per ECT, as a function of specific requirements. **For these students additionally to the exercises done during the week the delivery of a written report done after the course is mandatory.** For programmes with less hours of contact per ECT (6h/ECT, getting 6 ECTs from the course) students need to do an additional assignment (summary report). If needed 1 or 2 additional hours of contact may be added. Such report(s) are also advised for other students requesting accreditation of the course in their institutions.

Nº (min, max) students: 10 – 24

Minimum formation: - Bachelor's degree in biology or related areas. No previous knowledge is necessary.

Directed to: PhD or MSc students in Biology or related areas, postdocs and other professionals working in related areas

Fee: Free for 1st year PhD students in Doctoral programmes at FCUL (e.g. Biologia), Biodiversity, Genetics and Evolution (BIODIV UL; UP), Biology and Ecology of Global Changes (BEAG UL, UA) and Sustainability Science (UL, several institutions), when the course counts credits for their formation, in which case the delivery of a final report done after the course is mandatory; the course is also free for more advanced PhD students of the BIODIV programme (ULisboa or UPorto); 50 € for more advanced PhD students of cE3c; 80 € for PhD students of the PEERS network (CFE); 125 € for FCUL Master students and unemployed; 180 € for BTI, BI and other PhD students; 250 € for Professional and postdocs.

When the maximum number of students is reached, 12 vacancies will be available for non-paying 1st year PhD students mentioned above, being, by order of preference students from: 1) cE3c; 2) BIODIV (not from cE3c); 3) FCUL (not from cE3c); 4) Sustainability Science (not from cE3c or FCUL); 5) BEAG (not from cE3c or FCUL).

Deadline for applications: February 9th 2024

How to apply

Candidates should fill in the following FORMULARY:

<https://inqueritos.ciencias.ulisboa.pt/index.php/997878?lang=pt>

This formulary is strictly confidential, as explained in the introduction, and the data are required because the cE3c Advanced Courses are also offered as part of the PRR programme of FCUL.

When filling the formulary mind to:

- 1) FILL ALL THE MANDATORY FIELDS
- 2) UPLOAD CV AND MOTIVATION LETTER, both mandatory; use the names as instructed there
- 3) If you want to resume later SAVE the formulary, otherwise you will need to fill everything again
- 4) At the end SUBMIT the formulary before exiting

For any doubts please contact the cE3c coordinator of the cE3c courses Margarida Matos, email mmmatos@fc.ul.pt and the teacher Inês Fragata irfragata@fc.ul.pt