Licence Biologie

Fall 2025

UNBIO1-101 Evolutionary Biology (6 ECTS)
https://moodle.bio.ens.psl.eu/

1. Short Description

This course aims to familiarize students with the fundamental principles and tools of evolutionary theory. The main objective is to understand the underlying processes responsible for the forms of life observed in nature, ranging from diversity within ecological communities to the variety of molecular characteristics. The course will explore essential concepts such as natural selection, genetic drift, mutation, and recombination. Particular attention will be given to the study of the origin of species and the preservation of genetic variability within natural populations. We will also examine how different hypotheses are tested through experiments. Methods of phylogenetic inference will be introduced, providing insights into the major stages and transitions in the history of life. During the course we will highlight contemporary research in evolutionary biology.

The class is taught in English and French; there is no maximum class size.

Keywords: phylogenetics, speciation, adaptation, population genetics, quantitative genetics

2. Registration

Students external to the ENS Biology Department can attend and validate the class 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: Biology Department, 3rd floor - Room 316, at ENS, 46 rue d'Ulm, Paris.

Building entry with access card only (visitors must use the intercom at the entrance). The floor and class rooms are accessible without a badge. The building, floor and class room are accessible to people with disabilities.

Total duration (in person): 36 hours

Homework will consist in reading assigned papers and preparing their presentation and discussion in class. For exact dates/time of the class this year, refer to the course website or to “Detailed Schedule and Content” section below

4. Instructors and Contact Information

Primary instructor: Henrique Teotónio (teotonio@bio.ens.psl.eu). The preferred method of contact is by email. We also have an “Open Door” policy (room 609), where students are welcome to ask questions about the course content or opportunities for research in evolutionary biology, provided meetings are scheduled in advance by email (for a maximum of 2h/week during the semester). General class announcements will be posted on Moodle.

5. Course Communications

Course communication will use the Moodle platform, including general class announcements. Course material (lecture slides, papers, exercises) will be made available on Moodle as needed.

6. Course Prerequisites

Prerequisite: Enrollment in a biological sciences program.
Co-requisite: External students must also enroll in the Molecular Biology and Genetics course offered by the Department of Biology.

7. Course Format, Teaching Methods, Special Activities

Course format and teaching methods: The course combines lectures with homework and interactive activities. Sessions will be led by the primary instructor and faculty from the Department of Biology and other institutions. One lecture will feature a special research presentation by a visiting speaker. Students will also work in groups to read and present research or opinion papers, followed by in-class discussions to encourage active participation.

8. Expected Learning Outcomes

- Understand the fundamental concepts of evolutionary biology, including, but not limited to: adaptation, fitness, natural and sexual selection, stochasticity, neutrality, genetic drift, mutation, recombination, migration/gene flow, genetic diversity, heritability, homology, orthology, canalization, phenotypic plasticity, macro vs micro-evolution;
- Interpret phylogenetic trees and models of macroevolution, speciation, genome evolution, phenotypic evolution and the maintenance of genetic diversity;
- read, analyze, and present current research articles in evolutionary biology;
- follow master courses in advanced genetics, ecology and evolutionary biology;

9. Detailed Schedule and Content

Classes take place from 9:00 AM to 12:00 PM, including a 20-minute break.

Date	Time	Topic	Lecturer
16-Sep	9h	History and Methods of Research in Evolutionary Biology	Henrique Teotónio (ENS)
7-Oct	9h	Phylogeny (Classification, Relatedness, Reconstruction Methods)	Renaud deRosa (ENS)
14-Oct	9h	Phylogeny (Evolution History of Some Groups)	Renaud deRosa (ENS)
21-Oct	9h	Phenotypic Evolution (Heritability, Phenotypic Plasticity); Student Paper Assignment	Henrique Teotónio (ENS)
28-Oct	9h	Adaptive Landscapes (Pleiotropy, Mutation, Selection)	Henrique Teotónio (ENS)
4-Nov	10h	Abstracts of Assigned Paper Due. In Class Discussion about them: On Constraints and Stasis	Henrique Teotónio (ENS)
18-Nov	9h	Genetic Drift (IBD, Wright-Fisher population genetics)	Gillaume Achaz (UPC)
2-Dec	9h	Molecular Evolution (Drift-Mutation equilibrium)	Gillaume Achaz (UPC)
9-Dec	9h	Selection (Drift, Selection and Diploidy)	Gillaume Achaz (UPC)
16-Dec	9h	Speciation (Drift, Adaptive and Ecological Speciation)	Henrique Teotónio (ENS)
6-Jan	9h	Levels of Selection (Evolutionary Transitions, Genetic Conflicts, Social Evolution)	Henrique Teotónio (ENS)
6-Jan	9h	Research Seminar - Human Evolution	Paul Verdu (MNHN)
13-Jan	9h	Exam	Moniteur

10. Evaluation and Grading

Students will have a mid-term assignment. Each student will be assigned a research or opinion paper on October 20th. A written abstract of the assigned paper must be submitted to the primary instructor by 7:00 PM (19:00) on November 3rd. An in-class discussion of the papers will take place on November 4th, and all students are expected to attend. Evaluation of the abstract and participation in the discussion will account for 30% of the final grade.

The remaining 70% of the grade will come from a 3-hour written exam at the end of the semester, on January 13th. Students may bring their lecture notes, including printed slide presentations. Internet access, mobile phones, and computers (even offline) will not be allowed during the exam. Students requiring special accommodations must submit their requests at least one week before the exam.

To validate and credit the course, the combined score of the written assignment (30%) and the exam (70%) must be at least 10 out of 20. Grades will be posted on the Department's student database by January 19, 2026. Students who wish to improve their grade may request an oral exam, but only if their overall course grade is between 9 and 12. The oral exam can raise the grade to a maximum of 13. These exams will be held during the week of January 26–30, 2026, and students must contact the primary instructor the week before to schedule the meeting.

11. Suggested Readings

Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B., & Patel, N. H. (2007). Evolution. Cold Spring Harbor Laboratory Press.

Darwin, C. (1859). On the origin of species. John Murray.

Futuyma, D. J. (1998). Evolutionary biology (3rd ed.). Sinauer Associates.

Gayon, J. (1998). Darwinism's struggle for survival: Heredity and the hypothesis of natural selection. Cambridge University Press.

Lewontin, R. C. (1974). The genetic basis of evolutionary change. Columbia University Press.

Provine, W. B. (1971). The origins of theoretical population genetics. University of Chicago Press.

Thomas, F., Raymond, M., & Guégan, J.-F. (Eds.). (2016). Biologie évolutive. De Boeck Supérieur.

No special equipment or materials are required for this course.

12. Absence, Class Participation, Classroom Behavior Policies

Students are expected to arrive on time, attend all classes, and actively participate in course activities. Extended absences should be communicated to the instructor in advance. The “Open Door” policy is not for catching up on missed lectures.

To maintain a positive learning environment, attention should remain on class tasks, and distractions such as texting, chatting, phone calls, or unrelated web browsing should be avoided. The goal is a safe, inclusive, and focused space where everyone can succeed.

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.