UAB
Universitat Autònoma de Barcelona

Population Genetics

2026/2027

Code: 100794
Credits: 6

Degree programme	Type	Course
Biology	OP	4

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

There are no official prerequisites but knowledge of Genetics and Statistics is presupposed, as well as a basic level of reading comprehension in English.

Objectives

Population Genetics is the study of genetic differences that occur naturally among organisms. Genetic differences between organisms of the same species are called polymorphisms whereas the differences that have accumulated between different species constitute genetic divergence. Population Genetics is the study of polymorphism and divergence.

Population Genetics is one of the few biological sciences that combine theory, empirical information and experimentation. For this reason it is an enormously formative science. The theory of Population Genetics has developed considerably since the time of Fisher, Haldane and Wright, the founders of this science. In this respect, this course can be considered introductory and the mathematical level necessary to follow the lessons is quite elementary.

The Population Genetics course is in the 2nd year of the Genetics Degree (2nd semester) and aims to provide students with the basic fundamentals of this science. The syllabus of the course consists of several lessons that include: (1) a description of the variation that has been detected in the natural populations through different techniques; (2) an explanation of the expected characteristics in an ideal population of infinite size and random mating; (3) a review of factors influencing the genetic makeup of a population; and (4) a treatment of Molecular Population Genetics which includes an explanation of the Neutralist Theory of Molecular Evolution.

The main training objectives of the subject are: the understanding of the probabilistic aspects of the hereditary transmission in the populations, understanding the origin and maintenance of populations of genetic variation, understanding the effect of the different factors considered on the genetic constitution of populations, as well as the ability to reason and contrast theoretical models through empirical observations and experimentation.

Learning outcomes

1. Be able to analyse and synthesise.
2. Work in teams.
3. Apply statistical and computer resources to the interpretation of data.
4. Be able to organise and plan.
5. Students must have and understand knowledge of an area of study built on the basis of general

secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
6. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
7. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
8. Propose new methods or well-founded alternative solutions.
9. Critically analyse the principles, values and procedures that govern the exercise of the profession.
10. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
11. Correctly interpret results from population genetics studies.
12. Explain and describe the dynamics of genes in populations across generations.
13. Identify and explain the forces that modulate the genetic variation of populations when they act in isolation or in unison.
14. Describe the principles of natural and artificial selection.
15. Apply the fundamental principles of genetics to the management of populations to achieve their conservation.
16. Explain the impact of the different factors in evolutionary change.

Contents

GENETIC VARIATION

Lesson 1. Genetic variation
Lesson 2. Hardy-Weinberg equilibrium
Lesson 3. Linkage disequilibrium
Lesson 4. Inbreeding

MECHANISMS OF EVOLUTIONARY CHANGE

Lesson 5. Natural selection
Lesson 6. Genetic drift
Lesson 7. Mutation
Lesson 8. Migration

MOLECULAR POPULATION GENETICS

Lesson 9. Molecular evolution
Lesson 10. Detection of natural selection

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Problem solving	45	1.8	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Theory classes	30	1.2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Problem-solving seminars	15	0.6	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16
Individual tutorials	3	0.12	1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16
Lesson study	50	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16

Teaching methodology includes three types of activities: theory lessions, problem-solving classes, and tutorial sessions.

Theory lessons will provide the student the basic concepts and information needed to learn autonomously later on. Powerpoint presentations used in class will be available through the Virtual Campus.

Problem-solving classes, which will be done in two reduced groups, will be used to answer questions and learn to reason and apply the adquired knowlegde to the resolution of problems. Weekly problems will be available for the student to work on and they will be solved later in class.

Tutorial sessions can be individual or in small groups for those students that wish to do so. They can be done online or in person. This tutorial sessions are useful to gauge the advance in the comprehension of the subject and to provide help with the most difficult concepts.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
2nd partial exam	40%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Problem assignments	20%	1	0.04	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
1st partial exam	40%	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

The evaluation of the subject will be based on problem assignments and participation in problem-solving seminars (20%), and on exam scores (1st partial exam 40%, 2nd partial exam 40%, recovery of partial exams 80%).

Problem assignments

At certain moments along the course, a list of problems will be delivered to the students to work on their own or in groups. Students must submit the solved problems through the Virtual Campus. The set of problems turned in will be evaluated and the grade obtained will represent 20% of the final grade.

Exams

There will be a partial examination of the first part of the subject and another partial examination of the second part of the subject. Each partial examination will include a multiple-choice test and problems to be solved by the student. Each of the partial exams will account for 40% of the final score.

Students who pass a partial exam (grade of 5 or higher) will release this part of the subject. Students who get a

grade equal to or greater than 4 can compensate (and therefore release the corresponding part of subject) if the average grade with the other partial exam is equal to or higher than 5. Students who fail or do not present themselves to a partial exam, should attend the retake exam of the corresponding part of the subject.

The retake exam will follow the format of the partial exams and will also include a multiple-choice test and problems to be solved by the student. The grade obtained in the retake exam will account for the same weight as the partial exams. In order to calculate the weighted average of the exams and the problem assignments, the student must obtain a minimum score of 5 in the exam and 4 in the assignments.

To be eligible for the reexamination process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as \"Not Evaluable\" if the weighth of all conducted evaluation activities is less than 67% of the final score.

Single evaluation

The students that choose for the single evaluation option, must do a single exam where all the contents of the course program will be evaluated. The exam will include a multiple-choice test and problems to be solved by the student. The grade of this exam will represent 80% of the final grade of the course. This exam will be on the same date fixed for the last exam of the continuous evaluation option and a reexamination oportunity will apply in the same way that in the continuous evaluation case. The students that choose for the single evaluation option will have an available set of problemes to be solved. The answers to these problems will be delivered on the same day fixed for the exam. This work will represent the remaining 20% of the final grade of the course.

Use of artificial intelligence

For this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in study support tasks, such as bibliographic or information searches, text correction or translation into another language, but their use is not allowed in evaluated activities (submissions and exams). Any work that includes AI-generated fragments will be considered a lack of academic honesty and may result in a partial or total penalty in the grade of the activity, or greater penalties in serious cases.

The performance of any irregularity in an evaluation act (academic fraud, plagiarism or improper use of AI, unless such use is expressly authorized in the teaching guide) that may lead to a significant variation in the grade, means that this act will be graded with a 0. If the teaching guide provides that, in order to pass the subject, it is an essential requirement to have obtained a minimum grade in this evaluation act or that there are several irregularities in the evaluation acts of the same subject, the final grade will be 0. Apart from this, a disciplinary process may be initiated against the student who incurs in these irregularities.

Bibliography

The basic textbooks for this subject are:

Hartl, D.H. A Primer of Population Genetics. Sinauer (3rd ed.) 2000.

Hamilton, M. D. Population Genetics. Wiley-Blackwell (1st ed.) 2009.

Nielsen and Slatkin. An introduction to population genetics, Sinauer. 2013.

Other useful reference books are:

Hartl, D. H. and A. G. Clark. Principles of Population Genetics (4th ed.) Sinauer. 2007.

Hedrick, P. W. Genetics of Populations (4th ed.) Jones & Bartlett. 2009.

Useful links:

UAB Virtual Campus: https://cv.uab.cat/

Software

Excel (spreadsheet) will be used during this course to solve problems.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE