Universitat Autònoma de Barcelona

2017/2018

Population Genetics

Code: 101959
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	OB	2	2

Contact

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Use of languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

There are no official prerequisites but knowledge of Genetics and Statistics is presupposed. Also a basic level of reading comprehension of English is highly recommended.

Objectives and Contextualisation

Genetics of Populations 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. So Population Genetics is the study of polymorphism and divergence.

Genetics of Populations 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 Genetics of Populations 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 12 subjects 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; the understanding of the effect of the different factors considered on the genetic constitution of populations; the ability to reason and contrast theoretical models through empirical observations and experimentation.

Skills

- Apply knowledge of theory to practice.

- Apply scientific method to problem solving.
- Be able to analyse and synthesise.
- Describe and interpret the principles of the transmission of genetic information across generations.
- Develop self-directed learning.
- Measure and interpret the genetic variation in and between populations from a clinical, conservational and evolutionary perspective, and from that of the genetic improvement of animals and plants.
- Reason critically.
- Use and interpret data sources on the genomes and macromolecules of any species and understand the basics of bioinformatics analysis to establish the corresponding relations between structure, function and evolution.

Learning outcomes

1. Apply knowledge of theory to practice.
2. Apply scientific method to problem solving.
3. Be able to analyse and synthesise.
4. Define genetic conservation strategies for endangered populations.
5. Develop self-directed learning.
6. Enumerate and describe the forces that modulate genetic variation in populations in isolation or in conjunction.
7. Infer how the genetic variation of populations is maintained by Mendelian inheritance.
8. Reason critically.
9. Use genomic information to infer the evolutionary processes of genes, genomes and organisms.

Content

Content

Lessons 1 y 2. Phenotypic diversity and genetic variability.

Lessons 3 and 4. Organization of genetic variation.

Lessons 5 and 6. Inbreeding.

Lessons 7 and 8. Natural selection.

Lessons 9 and 10. Genetic drift.

Lessons 11 and 12. Mutation.

Lesson 13. Migration and population structure.

Lesson 14. Evolution of populations.

Methodology

The teaching methodology includes three types of activities: theory lessons, problem-solving seminars, and individual tutoring sessions.

Theory lessons. They serve to provide the student with the basic conceptual elements and the minimum information needed so that he/she can then develop autonomous learning. PowerPoint presentations will be made available to the student through the Virtual Campus.

Problem-solving seminars. These seminars, which will be held in two small groups (max. 30 students), will serve to answer questions and to learn how to reason and apply knowledge by solving problems. Problems will be delivered weekly, some of which will be solved in class, while others will be left for

autonomous or group work outside of class hours.

Tutorials. Three individual tutoring sessions are planned for students who wish to do so with the teacher in his office. These tutorials serve to gauge the student's progress in understanding the subject and to help with the most difficult concepts.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Problem-solving seminars	15	0.6	2, 1, 5, 8, 3
Theory classes	30	1.2	4, 6, 7, 3, 9
Type: Supervised			
Individual tutorials	3	0.12	4, 6, 7, 3, 9
Type: Autonomous			
Lesson study	50	2	4, 6, 7, 3, 9
Problem solving	42	1.68	2, 1, 5, 8, 3

Evaluation

The evaluation of the subject will be based on problem assignments and participation in problem-solving seminars (30%), and on exam scores (70%).

Problem assignments

A list of problems will be delivered weekly to the students to work on their own or in groups. Students must individually submit the solved problems to the teacher through the Virtual Campus before the next problem-solving seminar. The set of problems turned in by each student will be evaluated and the grade obtained will represent 30% of the final grade.

Exams

There will be a partial examination of the first part of the subject (Topics 1-6) and another partial examination of the second part of the subject (Topics 7-14). The partial examination of each part of the subject will include a multiple choice test and two problems to be solved by the student.

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 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 final exam to pass the subject.

The final 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 exams will account for 70% of the final grade.

When the number of evaluation activities performed by the student is less than 50% of those programmed, it will be classified as "non-evaluable".

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Final exam	70%	3	0.12	2, 4, 6, 7, 8, 3, 9
Parcial exams	70%	6	0.24	2, 4, 6, 7, 8, 3, 9
Weekly problem assignments	30%	1	0.04	2, 1, 5, 8, 3

Bibliography

The basic textbook for this subject is:

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

Other useful reference books are:

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

Hedrick, P. W. Genetics of Populations (4ª edición) Jones & Bartlett. 2009.

Antonio Fontdevila y Andrés Moya. Introducción a la Genética de Poblaciones, Síntesis. 2000.

Useful links:

Campus Virtual de la UAB: https://cv2008.uab.cat/