



CONSERVATION GENETICS (6 CFU)

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	BIO/18 (GENETICS)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	EXPERIMENTAL AND APPLIED BIOLOGY
Curriculum	Biologia ambientale e biodiversità
Year of study	2°
Period	1st semester (01/10/2021 - 14/01/2022)
ECTS	6
Lesson hours	60 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	TORRONI ANTONIO (titolare) - 3 ECTS LOMBARDO GIANLUCA - 0 ECTS OLIVIERI ANNA - 3 ECTS
Prerequisites	As illustrated by its name, this is a genetics course specifically addressing animal and plant species conservation. To get the full benefits of the course, the student should therefore have previously attended (usually during the previous bachelor of science program) a course on the "Principles of Genetics" and should have acquired the bases of the subject.
Learning outcomes	The aim of this course, which consists of 24 hours of frontal lectures (Part 1) and 36 hours of laboratory activities (Part 2), is to provide knowledge on the genetic aspects, the molecular techniques and the statistical approaches that are employed in animal and plant conservation studies. At the end of the course, the student is expected to (1) understand, be able to discuss and present the results of recent

studies, published in international journals, performed for example in endangered populations or species; (2) plan and carry out, also in an experimental setting, some of the genetic, molecular and statistical analyses required in modern studies on conservation genetics.

Course contents

Part 1 (Prof. Antonio Torroni, 24 lecture hours). Gene pool and genetic diversity: how they change in time and space. The Hardy-Weinberg Law and its applications. Genetic structure of natural populations: roles of mutation, fragmentation, genetic drift, migration, assortative mating and natural selection. Proportion of polymorphic loci. Allelic diversity. Measures of heterozygosity. Mutation-selection balance. Mutational load. The meaning of "dominant" and "recessive" traits. Measures of genetic diversity at different resolution levels and by using different molecular techniques (protein electrophoresis, genes/nuclear sequence analyses, restriction fragment length polymorphisms, PCR, microsatellites, DNA sequencing, RAPDs and AFLPs). Ancient DNA analysis: some paradigmatic cases. Mitochondrial DNA (mtDNA) and its peculiarities. The non-recombinant portion of the Y chromosome. Advantages and disadvantages of uniparental genetic systems. DNA barcoding. The phylogeographic approach applied to endangered species: recent studies from the international literature. Genetic consequences of domestication.

Part 2 (Prof. Anna Olivieri, 36 hours of lab activities). Each student will extract his/her DNA from the buccal mucosa. Quantification of extracted DNA. PCR amplification of target sequences. Sequencing of the mitochondrial DNA control region. Electrophoresis on agarose gels. Purification of amplicons. RFLP analysis of mtDNA and Y-chromosome sequences. Alignment and analysis of DNA sequences. Classification of sequences and haplotypes into haplogroups. Integration of haplotypes into a phylogenetic tree.

Teaching methods

Part 1 of the course, held by Prof. Torroni, consists of 24 lecture hours carried out with PowerPoint presentations. These lectures explain the topics described in the previous section (see Program and content) and also aim to provide some theoretical knowledge in preparation for the following lab activities (Part 2 of the course). Part 2 is taught by Prof. Olivieri, and consists of experimental activities (36 hours) in a dedicated and well-equipped laboratory. These lab activities are also described in the previous section.

Reccomended or required readings

The text book suggested for both parts of the Course is "Fondamenti di Genetica della Conservazione" by R. Frankham, J.D. Ballou, D.A. Briscoe, Zanichelli – Bologna.

Some parts of the program (basic knowledge of population genetics, molecular analyses) are described in greater detail in the text books used for the course of General Genetics (laurea triennale), for instance: iGENETICA or iGENETICA FONDAMENTI by Peter J. Russell, EdiSES s.r.l. – Napoli.

Some of the topics discussed in the lectures (consequences of domestication, DNA barcoding, etc.) are not present in the text books

mentioned above. For these it is strongly suggested to search for and acquire additional material online.

Assessment methods

There will be a single final exam for both parts of the course (no intermediate exams).

The exam consists of:

- a) a power point presentation (20-25 minutes) of two or more articles from the international literature, reporting analyses of genetic variation in animal or plant species. The topic of the presentation is chosen by the candidate;
- b) an oral exam on the topics of the program and the laboratory activities.

Further information

The course program is available online at <http://genmic.unipv.eu/site/home/didattica.html> following the link "Courses".

Sustainable development goals - Agenda 2030

Most of the topics in this course are in line with the 2030 Agenda for Sustainable Development, in particular with Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems / halt biodiversity loss.

[The goals](#)