UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

GENETICS

Enrollment year	2019/2020
Academic year	2020/2021
Regulations	DM270
Academic discipline	BIO/18 (GENETICS)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	BIOLOGICAL SCIENCES
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	2nd semester (01/03/2021 - 14/06/2021)
ECTS	9
Lesson hours	72 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	SEMINO ORNELLA (titolare) - 6 ECTS OLIVIERI ANNA - 3 ECTS
Prerequisites	To deal with the content of the course, basic knowledge of chemistry and mathematics and notions of biology of the animal and plant cell are necessary.
Learning outcomes	Aim of this course is to achieve an adequate level of knowledge of: (1) the mode of transmission of hereditary characters at cellular, individual and population level. This will provide the student with the ability to evaluate the genetic variability of living organisms (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; (2) the structural and functional characteristics of the genetic material; (3) gene expression in prokaryotic and eukaryotic organisms.

Course contents

Part 1. Mitosis and meiosis. Mendel's laws and simple Mendelian ratios. The chromosome theory of heredity. Sex-linked inheritance. Extrachromosomal inheritance. Analysis of pedigrees. Sex determination. Testcross and analysis of two and three character-hybrids. Probability and genetic event. Chi-Square analysis. Chromosome mapping in Eukaryotes. Genetic association and rate of recombination. Cis and trans association. Three point mapping. Interference. Physical mapping; polytenic chromosomes. Karyotype. Genomic mutations, chromosome mutations (variation in number and structure). Monosomy and trisomy in humans. Genetic analysis in Prokaryotes: conjugation, transformation, transduction. Population genetics. The Hardy-Weinberg (H-W) principle. Genetic structure of populations. Evaluation of the genetic variability, consequences of mutation, genetic drift, migration, assortative union and natural selection. Founder effect and bottleneck.

Part 2. The molecular nature of genetic material (experiments of Griffith, Avery, Hershey/Chase). DNA and RNA as genetic material. The organization of DNA in chromosomes. DNA replication (experiment of Meselson/Stahl). The chemical bases of DNA and RNA. Transcription, RNA polymerase in Prokaryotes and Eukaryotes. Promoters and terminators. Organization, properties and characteristics of the genetic code. Colinearity gene-proteins: exons and introns. Gene mutations and metabolic chains. Mutations: molecular and functional definition (frame-shift, nonsense, missense).

Topics object of exercises:
- Mitosis and meiosis.
- Mendel's laws.
- Analysis of pedigrees.
- Association, genetic maps.
- Molecular Genetics: transcription, translation and genetic code. Population genetics, Hardy-Weinberg equilibrium.

Teaching methods

The course consists of lectures; integrated by exercise sessions. These sessions will be held during the course period and will allow students to practice on topics of formal, population and molecular genetics.

Reccomended or required readings

- A.J.F. Griffiths et al. – W.H. Freeman and Company– Introduction to Genetic Analysis.

- P.J. Russell – Benjamin Cummings - iGenetics. A Molecular Approach.

- D.P. Snustad e M.J. Simmons - John Wiley & Sons Inc- Principles of Genetics.

Assessment methods

There will be a single final exam for the Genetics course (there are no intermediate exams). The final exam consists of two parts. The first is a written text with exercises covering formal, population and molecular genetics. Students who pass the written text will sustain an oral exam over the entire program of the course. The oral exam is usually offered a few days (2-4) after the written text.

Further information

The course has a dedicated web site on the e-learning portal of the University of Pavia, Kiro, that students can access using their login credentials.
It is worth to mention that some of the topics in this course, especially those of “population genetics”, 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.

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