		Teaching	g Guide			
	Identifyin	g Data			2019/20	
Subject (*)	Molecular Genetics			Code	610G02020	
Study programme	Grao en Bioloxía				'	
		Descrip	otors			
Cycle	Period	Yea	ar	Туре	Credits	
Graduate	1st four-month period	Thir	rd	Obligatory	6	
Language	Galician	Galician				
Teaching method	Face-to-face					
Prerequisites						
Department	Bioloxía					
Coordinador	Insua Pombo, Ana Maria		E-mail	ana.insua@udo	c.es	
Lecturers	Insua Pombo, Ana Maria		E-mail	ana.insua@udo	c.es	
	Martinez Martinez, M. Luisa			m.l.martinez@u	ıdc.es	
	Vila Sanjurjo, Antón			anton.vila@udo	:.es	
Web		'				
General description	This course focuses on the conce	ptual and metho	odological bases n	ecessary to understa	nd the organization, expression,	
	variation and manipulation of genetic material. It provides a molecular perspective to the knowledge adquired in "Genetics"					
	(second year) and knowledge necessary to address "Population Genetics and Evolution", "Cytogenetics" and related					
	courses of third and fourth year.					

	Study programme competences		
Code	Study programme competences		
A5	Analizar e caracterizar mostras de orixe humana.		
A11	Identificar e analizar material de orixe biolóxica e as súas anomalías.		
A12	Manipular material xenético, realizar análises xenéticas e levar a cabo asesoramento xenético.		
A15	Deseñar e aplicar procesos biotecnológicos.		
A29	Impartir coñecementos de Bioloxía.		
A30	Manexar adecuadamente instrumentación científica.		
A31	Desenvolverse con seguridade nun laboratorio.		
B1	Aprender a aprender.		
B2	Resolver problemas de forma efectiva.		
В3	Aplicar un pensamento crítico, lóxico e creativo.		
B5	Traballar en colaboración.		
В7	Comunicarse de maneira efectiva nunha contorna de traballo.		

Learning outcomes			
Learning outcomes	Study	/ progra	mme
	cor	mpetend	ces
General knowledge and understanding of the molecular basis of the organization, expression, variation and manipulation of	A11	B1	
genetic material.	A12	B2	
	A15	В3	
	A29	B5	
		В7	

Knowledge of the basic methodologies used in Molecular Genetics.		B1	
	A11	B2	
	A12	В3	
	A15	B5	
	A29		
	A30		
	A31		
Ability to use sources of information of interest in Molecular Genetics.	A5	B1	
	A11	B2	
	A12	В3	
	A15		
	A29		
Ability to interpret and transmit Molecular Genetics information.	A29	B1	
		B2	
		В3	
		B5	
		В7	

	Contents
Topic	Sub-topic
1 DNA REPLICATION	Semiconservative DNA replication: the Meselson and Stahl experiment. Modes of
	replication. Enzymology of the replication. DNA replication in Escherichia coli. DNA
	replication in eukaryotes. Telomere synthesis. Replication of mitochondrial and
	chloroplast DNA.
2 SYNTHESIS AND PROCESSING OF RNA	Classes of RNA. RNA polymerases. Promoters and transcriptional apparatus.
	Transcription in prokaryotes and eukaryotes: initiation, elongation and termination.
	Interrupted genes: exons and introns. Processing of eukaryotic pre-mRNA. Synthesis
	and processing of pre-rRNA. Synthesis and processing of pre-tRNA. RNA edition.
	Revision of gene concept.
3 TRANSLATION	Central dogma in molecular biology. Ribosomes and tRNAs. Translation cycle:
	initiation, elongation, and termination. Genetic code and genetic decoding. Peptydil
	transferase reaction. The ribosome: composition. Phylogenetic conservation of rRNA.
	Role of rRNA in initiation. Role of RNA in decoding. Role of RNA in peptydil transfer.
	The hypothesis of the RNA world.
4 MUTATION AND DNA REPAIR	Molecular basis of spontaneous mutations: replication errors, unequal crossing over,
	spontaneous chemical changes. Molecular basis of induced mutations: chemical and
	physical agents. Repair mechanisms: direct reversal of damaged DNA, excision
	repair, mismatch repair, repair of double-strand breaks, translesion synthesis.
5 MOLECULAR MECHANISM OF GENETIC	The role of genetic recombination. Gene conversion. Models of homologous
RECOMBINATION	recombination: Holliday model and double-strand break model. Enzymes required for
	recombination. Site-specific recombination. Immunoglobulin gene rearrangements.
6 TRANSPOSABLE GENETIC ELEMENTS	Transposable elements in prokaryotes: insertion sequences, composite transposons
	and noncomposite transposons. Replicative and non replicative transposition.
	Transposable elements in eukaryotes: transposons and retrotransposon. Evolutionary
	significance of transposable elements.
7 RECOMBINANT DNA TECHNOLOGY	Restriction enzymes. Cloning vectors. DNA libraries: construction and screening.
	Southern and northern blotting. PCR. Restriction maps. DNA sequencing.
	Site-directed mutagenesis.

8 APPLICATIONS OF RECOMBINANT DNA	Expression of eukaryotic genes in E. coli. DNA transfer to eukaryotic cells. Transgenic
TECHNOLOGY	animals. Transgenic plants. Gene therapy. Genetic diagnosis. Genome editing:
	CRISPR/Cas9 technology.
9 GENOMICS	Structural genomics: molecular markers and genetic maps. DNA fingerprinting.
	Structural genomics: physical maps and genome annotation. Functional genomics:
	DNA microarrays, RNA-seq and reverse genetics. Comparative genomics.
	Metagenomics. Synthetic biology.
10 REGULATION OF GENE EXPRESSION IN BACTERIA	Jacob and Monod?s operon model for the regulation of lac genes in E. coli. Positive
	control of the lac operon. The arabinose operon of E. coli: positive and negative
	control. The triptophan operon of E. coli: negative control and attenuation.
	RNA-mediated regulation.
11 REGULATION OF GENE EXPRESSION IN	Changes in chromatin structure. DNA methylation. Transcriptional control.
EUKARYOTES	RNA processing control. Control of mRNA stability. Control at the level of translation.
	RNA interference. Epigenetics.
PRACTICE 1: DNA EXTRACTION	Genomic DNA extraction. Agarose gel electrophoresis for DNA. DNA quantification.
PRACTICE 2: PCR	PCR amplification of the CHD gene. Analysis of an intron polymorphism for bird
	sexing.
PRACTICE 3: DOT-BLOT	Nucleic acids hybridization: detection of microsatellite sequences by dot-blot
PRACTICE 4: BIOINFORMATICS.	Analyses and comparison of nucleic acid sequences. Primer design.

	Planning			
Methodologies / tests	Competencies	Ordinary class	Student?s personal	Total hours
		hours	work hours	
Guest lecture / keynote speech	A5 A11 A12 A15 B2	28	42	70
	B3 B7			
Seminar	A5 A11 A12 A15 A29	8	12	20
	B1 B2 B3 B5 B7			
Laboratory practice	A5 A11 A12 A15 A30	15	7.5	22.5
	A31 B1 B2 B3 B5 B7			
Supervised projects	A5 A11 A12 A15 A29	0	29.5	29.5
	B1 B2 B3 B5 B7			
Mixed objective/subjective test	A5 A11 A12 A15 A29	6	0	6
	B1 B2 B3 B7			
Personalized attention		2	0	2

	Methodologies			
Methodologies	Description			
Guest lecture /	The teacher explains the main contents of each lesson.			
keynote speech				
Seminar	Resolution/discussion of questions and problems related to the subject.			
Laboratory practice	The student conducts laboratory experiences following a protocol, under the supervision of the teacher.			
Supervised projects	Solving of a practical case related to Bioinformatics, as well as, three questionnaires with exercises and questions related to			
	some aspect of the subject. Both activities are done in groups. The practical case shall be delivered in writing.			
Mixed	Different types of questions (essay, multiple-choice, short answer, and multiple-matching) and problem solving.			
objective/subjective				
test				

Personalized attention	
Methodologies Description	



Supervised projects	Individually or in group, students can attend tutorial sessions to consult any doubts that might arise from the different activities.	

		Assessment	
Methodologies	Competencies	Description	Qualification
Supervised projects	A5 A11 A12 A15 A29	Assessment will be based on the proportion of correct answers, the clarity of the	30
	B1 B2 B3 B5 B7	explanations, the quality of the presentation, and the reasoning used in answers. The	
		practical case represents 20% of the final grade and will be graded at the group level	
		by means of the delivered written (10%) and at the individual level (10%).	
		Questionnaires represent 10% of the final grade and will be graded at the individual	
		level only. Individual evaluations will be carried out through a short answer test	
		(phrase, word, number or symbol), which could be face to face or via Moodle.	
Mixed	A5 A11 A12 A15 A29	The degree of general knowledge and understanding of the subject will be assessed.	70
objective/subjective	B1 B2 B3 B7	It will consist of two parts.	
test		One is related to the theoretical content and represents 60% of the score.	
		The other is related to the laboraroty practices and represents 10% of the score.	

## **Assessment comments**

To pass the course, the score must be 5 or higher, but at least a 4 is required in all tests corresponding to theory, laboratory practices, and practical case. If the sum of the score of all activities is higher than 5, but the score on one the tests is lower than 4, the final score is 4.9 (failing score).

The grade of Non Attendance (NP) will be applied to the students that do no attend the official exam.

Preferably, first class honors will be awarded in January among students with a score of 9 or higher.

A mid-term exam will be held. A score of 4 or higher will be maintained until July.

In July there will be a second opportunity to take the tests corresponding to theory, laboratory practices, and practical case. First opportunity's scores of questionnaires and group grades of practical case will be maintained.

In the case of justified exceptional circumstances, additional measures may be taken, so that the student can pass the subject, such as flexibility in the delivery date of supervised projects, flexibility in practice schedules or a global assessment test of the learning results.

Sources of information			
Basic	- Klug, W.S., Cummings, M.R., Spencer, C.A (2013). Conceptos de Genética . Pearson/Prentice Hall, Madrid		
	- Pierce, B.A. (2010). Genética: un enfoque conceptual. Médica Panamericana, Madrid		

## Complementary

- Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2010). Biología molecular de la célula. Omega, Barcelona
- Benito, C., Espino, F.C. (2013). Genética: conceptos esenciales. Médica Panamericana, Madrid
- Brooker, R.J. (2018). Genetics: analysis and principles (6th ed.). McGraw-Hill, New York
- Brown, T.A. (2008). Genomas (3ª ed.). Médica Panamericana, Buenos Aires
- Cox, M.M., Doudna, J.A., O'Donnell (2012). Molecular biology: principles and practice. W.H. Freeman, New York
- Craig, N.L., Cohen-Fix, O., Green, R., Greider, C., Storz, G., Wolberger, C. (2014). Molecular biology: principles of genome function. Oxford University Press, Oxford
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2015). Introduction to genetic analysis (11th ed.). W.H. Freeman, New York
- Hartwell, L.H., Goldberg, M.L., Fischer, J.A., Hood, L., Aquadro, C.F. (2015). Genetics: from genes to genomes (5th ed.) . McGraw-Hill, New York
- Herráez, A. (2012). Biología molecular e ingeniería genética. Elsevier, Ámsterdam
- Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. (2012). Lewin genes: fundamentos. Médica Panamericana, Madrid
- Lewin, B. (2008). Genes IX. McGraw-Hill. México
- Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., Scott, M.P. (2016). Biología celular y molecular (7ªed). Médica Panamericana, Madrid
- Perera, J., Tormo, A., García, J.L. (2002). Ingeniería genética. Vol. I: Preparación, análisis, manipulación y clonaje de DNA. Síntesis, Madrid
- Perera, J., Tormo, A., García, J.L. (2002). Ingeniería genética. Vol. II. Expresión de DNA en sistemas heterólogos. Síntesis, Madrid
- Russell, P.J. (2010). iGenetics: a molecular approach (3rd ed.) . Benjamin Cummings, San Francisco
- Snustad, D.P., Simmons, M.J. (2012). Genetics (6th ed.). John Wiley and Sons, New York
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2014). Molecular biology of the gene. Pearson, Boston

Consultar a plataforma Moodle para fontes de información adicionais.

## Recommendations

Subjects that it is recommended to have taken before

Biology: Basic Levels of Organisation of Life I (Cells)/610G02007

Biochemistry I/610G02011 Biochemistry II/610G02012

Microbiology/610G02015

Genetics/610G02019

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Population Genetics and Evolution/610G02021

Cytogenetics/610G02022

Other comments

Recommendations: Attend class and follow the development of the course regularly. Check Moodle and email regularly to obtain the materials and know the schedule of activities. Attend tutorials to resolve any questions or difficulties that may arise. Consult the recommended bibliography. Keep up-to-date with course work.

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.