Teaching Guide				
Identifying Data				2019/20
Subject (*)	Genomics		Code	614522006
Study programme	Mestrado Universitario en Bioinformática para Ciencias da Saúde			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Optional	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Vila Taboada, Marta	E-mail	marta.vila.taboada@udc.es	
Lecturers	Becerra Fernandez, Manuel Cerdan Villanueva, Maria Esperanza Vila Taboada, Marta Vizoso Vázquez, Ángel José	E-mail	manuel.becerra@udc.es esper.cerdan@udc.es marta.vila.taboada@udc.es a.vizoso@udc.es	
Web				
General description	Denomínase xenómica ao conxunto de ciencias e técnicas dedicadas ao estudo integral do funcionamento, a evolución e a orixe dos xenomas. A xenómica usa coñecementos derivados de distintas ciencias como son: xenética, bioloxía molecular, bioquímica, informática, estatística, matemáticas, física, etc. A diferenza da xenética clásica que a partir dun fenotipo, xeralmente mutante, busca o ou os xenes responsables de devandito fenotipo, a xenómica ten como obxectivo predicir a función dos xenes a partir da súa secuencia ou das súas interaccións con outros xenes. As ciencias xenómicas están en plena expansión, sobre todo grazas ás tecnoloxías avanzadas de secuenciación de ADN e aos avances en bioinformática.			

Study programme competences / results	
Code	Study programme competences / results
A8	CE8 - Understanding the basis of the information of the hereditary material, its transmission, analysis and evolution
A9	CE9 ? To understand the benefits and the problems associated with the sequencing and the use of biological sequences, as well as knowing the structures and techniques for their processing
B1	CB6 - Own and understand knowledge that can provide a base or opportunity to be original in the development and/or application of ideas, often in a context of research
B2	CB7 - Students should know how to apply the acquired knowledge and ability to problem solving in new environments or little known within broad (or multidisciplinary) contexts related to their field of study
B5	CB10 - Students should possess learning skills that allow them to continue studying in a way that will largely be self-directed or autonomous.
B6	CG1 -Search for and select the useful information needed to solve complex problems, driving fluently bibliographical sources for the field
B7	CG2 - Maintain and extend well-founded theoretical approaches to enable the introduction and exploitation of new and advanced technologies
B8	CG3 - Be able to work in a team, especially of interdisciplinary nature
C1	CT1 - Express oneself correctly, both orally writing, in the official languages of the autonomous community
C2	CT2 - Dominate the expression and understanding of oral and written form of a foreign language
C3	CT3 - Use the basic tools of the information technology and communications (ICT) necessary for the exercise of their profession and lifelong learning
C7	CT7 ? To maintain and establish strategies for scientific updating as a criterion for professional improvement.
C8	CT8 - Rating the importance that has the research, innovation and technological development in the socio-economic and cultural progress of society

Learning outcomes

Learning outcomes	Study programme competences / results		
Knowledge about the molecular tools used in genomics	AJ8 AJ9		
Knowledge about structural, functional and evolutionary genomics	AJ8	BJ1 BJ2	CJ8
To set up experiments and analyse and interpret data using DNA microarrays		BJ6 BJ7	CJ2 CJ3
Knowledge about the mechanisms involved in the evolution of genomes and the molecular and bioinformatic tools used in that kind of studies		BJ5 BJ8	CJ1 CJ7

Contents	
Topic	Sub-topic
Introduction: from Molecular Genetics to Genomics	Molecular markers Applications ot recombinant DNA technologies PCR and real-time quantitative PCR Sanger sequencing DNA editing techniques
The Human Genome Project	Approaches for whole genome sequencing
Next Generation Sequencing (NGS)	Platforms Paired-end libraries Data files
Whole genome sequencing	Mate-pair libraries Annotation Comparative genomics Palaeogenomics
Metagenomics	Application
Clinical Genomics	Amplicon-seq Panel-seq Exome-seq Comparative genomic hybrisidation (CGH-array) Pharmacogenomics
Single Nucleotide Polymorphisms (SNPs)	Genome wide association studies (GWAS) Digital genetic testing
Functional Genomics	Transcriptome analysis: microarrays and NGS (RNA-seq, CHiP-seq) ENCODE project Epigenomics
Hands on	Introduction to the Integrative Genomics Viewer (IGV) Solving exercises using GALAXY and/or GENOMESPACE Gene expression analysis using BABELOMICS Pharmacogenomic analysis using PHARMGKB

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
ICT practicals	B2 B5 B8 C3	21	42	63
Mixed objective/subjective test	A8 A9 B2 C1 C2 C3	2	8	10
Guest lecture / keynote speech	A8 A9 B1 B6 B7 C1 C2 C7 C8	21	52.5	73.5

Personalized attention		3.5	0	3.5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
ICT practicals	Hands on: students solve exercises using their own laptop.
Mixed objective/subjective test	Assessment of the learning process. Tests may include multiple choice questions, problem solving and computer exercises. Instructors will decide whether scheduling a separate test for the computer exercises depending on the progress of the group.
Guest lecture / keynote speech	Each instructor will explain the basic contents of each topic interacting as much as possible with the students.

Personalized attention	
Methodologies	Description
ICT practicals	The instructors will carefully supervise the student's work during the hands-on sessions. In the event of having officially certified "part-time" students, the instructors will take the appropriate measures so that their scores are not affected.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Guest lecture / keynote speech	A8 A9 B1 B6 B7 C1 C2 C7 C8	Students must attend at least 80% of the lecturers in order to pass the subject. Scores will depend on the result of a multiple choice test. In addition, similar calculations to the ones worked during lectures may be required.	70
ICT practicals	B2 B5 B8 C3	Students must attend at least 80% of the hands on sessions in order to pass the subject. Scores will depend on the result of an exam: students will use their own laptop to solve a set of exercises. This exam may be scheduled not to overlap with the "theory" test.	30

Assessment comments
In the event of having officially certified "part-time" students, the instructors will take the appropriate measures so that their scores are not affected.

Sources of information	
Basic	- Campbell, AM & Heyer LJ (2007). Discovering Genomics, Proteomics & Bioinformatics. Pearson Benjamin Cummings - Robison PN, Piro RM, Jäger M (2018). Computational Exome and Genome Analysis. CRC Press, Taylor & Francis Group - Kulkarni S, Pfeifer J (2015). Clinical Genomics. A guide to Clinical NGS. Academic Press, Elsevier - Brown TA (2018). Genomes4. Garland Science, Taylor & Francis Group - Pevsner J (2015). Bioinformatics and Functional Genomics. Wiley Blackwell
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Introduction to molecular biology/614522004 Genetics and molecular evolution/614522005
Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus
Fundamentals of bioinformatics/614522008
Other comments
Do not take this course unless your level of English is B1 or higher.

(*)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.