Teaching Guide				
Identifying Data				2023/24
Subject (*)	Genomics		Code	610441015s
Study programme	Máster Universitario en Bioloxía Molecular, Celular e Xenética (semipresencial)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishGalicianEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	BioloxíaDepartamento profesorado máster			
Coordinador	Vila Taboada, Marta	E-mail	marta.vila.taboada@udc.es	
Lecturers	Becerra Fernandez, Manuel Vila Taboada, Marta	E-mail	manuel.becerra@udc.es marta.vila.taboada@udc.es	
Web				
General description	Genomics applies recombinant DNA, Sanger DNA sequencing and Next Generation Sequencing methodology, and bioinformatics to sequence, assemble, and analyze genomes. Diciplines in genomics emcompass several areas of study, including structural and functional genomics, comparative genomics, and metagenomics, and have led to an "omics" revolution in modern biology.			

Study programme competences / results	
Code	Study programme competences / results
A3	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A11	Skills of understanding the structure, dynamics and evolution of genomes and to apply tools necessary to his study.
B1	Analysis skills to understand biological problems in connection with the Molecular and Cellular Biology and Genetics.
B5	Ability to draft, represent, analyze, interpret and present technical documentation and relevant data in the field of the branch of knowledge of the master's degree in the native language and at least in another International diffusion language.
B9	Skills of preparation, show and defense of a work.
C2	Ability to know and use appropriately the technical terminology of the field of knowledge of the master, in the native language and in English, as a language of international diffusion in this field
C3	Using ICT in working contexts and lifelong learning.
C8	Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To learn the basics of the different molecular techniques used in genomics, with particular emphasis in NGS	AR3 AR11		CC3
To acquire an updated view about the current scope and future perspectives of structural, functional and evolutionary genomics	AR3 AR11	BR1 BR5 BR9	CC2 CC8
To understand how genomes evolve and how molecular and bioinformatic tools are used for that purpose	AR3 AR11	BR1 BR5 BR9	CC2 CC8
DNA microarrays: experimental set up and data analysis.	AR3 AR11		

Contents

Topic	Sub-topic
Whole Genome Sequencing	Annotation Comparative genomics
Next Generation Sequencing (NGS)	Platforms Paired-end libraries Introduction to data analysis
Metagenomics	Metabarcoding
Clinical genomics	Amplicon-seq Panel-seq Exome-seq Pharmacogenomics
Single Nucleotide Polymorphisms (SNPs)	Genome wide association studies (GWAS) Digital genetic testing
Functional genomics	Transcriptome analysis: microarrays and NGS (RNA-seq)
Computer lab	1. Using GALAXY for analysis of NGS data. 2. Gene expression analysis using GALAXY. 3. Pharmacogenomic analysis using PHARMKGB. 4. Introduction to the Intregative Genomics Viewer (IGV).

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
ICT practicals	A3 A11 B1 B5 B9 C2 C3	3	24	27
Guest lecture / keynote speech	A3 A11 B1 C8	2	40	42
Objective test	A3 A11 B1 C8	2	0	2
Personalized attention		4	0	4
(*)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	The students work on their own web-based investigations and present their results to each other (active learnning).
Guest lecture / keynote speech	The instructors explain the main contents of each topic interacting as much as possible with the students. The student will be able to attend the face-to-face sessions synchronously through TEAMS. Sessions will be recorded for viewing asynchronously.
Objective test	Test conducted through the Moodle platform to evaluate the knowledge acquired.

Personalized attention	
Methodologies	Description
ICT practicals	Instructors will typically be available via email/MS TEAMS. Students can arrange for in-person tutoring sessions.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Objective test	A3 A11 B1 C8	In order to pass the subject, all students will have to take a multiple choice test and/or short-answer questionnaire.	70

ICT practicals	A3 A11 B1 B5 B9 C2 C3	All students will have to submit two reports following the guidelines provided by each instructor. In these reports, students will answer questions and/or solve exercises using their own computer and the software introduced during the computer labs.	30

Assessment comments
Students scoring at least 50 (out of 100) points but not reaching the aforementioned thresholds (ICT practicals: 15 out of 30 points; Objective test; 28 out of 70 points) will be awarded a 4.5 (out of 10) score. When resitting, they can choose to take both exams or only the failed one.Mark "A with distinction" will only be awarded to outstanding students passing the subject in May.Students will be scored as "ABSENT" (Non presentado) only when not involved in any of the assessed activities.In the case of exceptional circumstances, lecturers may assist the student to improve his/her learning process and/or catch up on missed work/assessments. The student is responsible for liaising with his/her lecturer to organise this assistance by e.g. applying for: an extended deadline to present his/her work or taking an exam in a different date. The coordinator can request evidence about the reason for such an application.Implications of PLAGIARISM in the qualification: the current UDC regulations will be applied.

Sources of information	
Basic	- McLachlan, G. J., Do, K-A., Ambroise, C (2004). Analyzing Microarray Gene Expression Data. Wiley-Interscience. John Wiley & Sons - Brown, T. A. (2018). Genomes4. Garland Science - E. Rinaldis, A. Lahm. (2007). DNA microarrays: current applications. Wymondham: Horizon Bioscience - Bowtell, D., Sambrook, J. (2003). DNA Microarrays. Cold Spring Harbor Laboratory Press. - Allison, David B., et al (2006). DNA microarrays and related genomics techniques design, analysis, and interpretation of experiments. Chapman & Hall/CRC - Kulkarni, S., Pfeifer, J. (2015). Clinical Genomics. A guide to Clinical NGS. Academic Press, Elsevier - Pevsner, J. (2015). Bioinformatics and Functional Genomics. Wiley Blackwell - Robison, P.N., Piro, R.M., Jäger, M. (2018). Computational Exome and Genome Analysis. CRC Press, Taylor & Francis Group
Complementary	- Dale Jeremy (2008). From genes to genomes: concepst and applications of DNA technology. John Wiley & Sons - Zhanjiang, Liu (2007). Aquaculture genome techonologies. Blackwell - Sensen, Christoph W. (2005). Handbook of genome research genomics, proteomics, metabolism, bioinformatics, ethical & legal issues . Wiley-VCH - (). . RECURSOS EN INTERNET: Biological database compilation at NAR: http://nar.oupjournals.org/content/vol29/issue1DOE Joint Genome Institut. Why sequence them? http://www.jgi.doe.gov/sequencing/why/index.htmlEMBL (European Molecular BIology Laboratory), Bioinformatics. http://www-db.embl.de/jss/servlet/de.embl.bk.emblGroups.EmblGroupsOrg/serv_0?t=0ExPASy (Expert Protein Analysis System). http://us.expasy.org/GeneMark: http://opal.biology.gatech.edu/GeneMark/GenomeNet (Kyoto University Bioinformatics Center).http://www.genome.jp/Genoscope. Le séquençage des génomes. http://www.genoscope.cns.fr/externe/Francais/Sequencage/GOLD (Genomes Online Database). http://www.genomesonline.org/Human genome: advanced annotation tutorial.http://www.mad-cow.org/00/annotation_tutorial.htmlHuman Genome Project Information.http://www.ornl.gov/sci/techresources/Human_Genome/home.shtmlIañez Pareja, E. (1997). Introducción a los Proyectos Genoma. http://www.ugr.es/~eianez/Biotecnologia/genoma-2.htmlKEGG (Kyoto Encyclopedia of Genes and Genomes). http://www.genome.jp/kegg/kegg2.htmlNacional Human Genome Research Institute: http://www.genome.gov/NCBI (National Center for Biotechnology Information). http://www.ncbi.nlm.nih.gov/The Sanger Institute.http://www.sanger.ac.uk/TIGR (The Institute for Genomic Research). http://www.tigr.org/tRNAscan-SE 1.21. http://www.genetics.wustl.edu/eddy/tRNAscan-SE/The WWW Virtual Library: Model Organisms: http://www.ceolas.org/VL/mo/

Recommendations
Subjects that it is recommended to have taken before
Cellular Techniques/610441001 Molecular Techniques/610441002 Genetic Variation Mechanisms/610441005 Regulation of gene expression/610441006 Bioinformatics and Biomolecular models /610441021
Subjects that are recommended to be taken simultaneously
Proteomics/610441014 Chromosomes. structure. function and evolution /610441016 Human Genetics/610441017 Genetic Toxicology /610441018
Subjects that continue the syllabus
Project/610441023
Other comments
Do not take this subject if your level of English is lower than B1.Green Campus Faculty of Sciences Program: to help achieve a sustainable immediate environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary works to be carried out in this subject will be requested in virtual format and computer support.