Teaching Guide				
Identifying Data				2020/21
Subject (*)	Genomics		Code	610441014
Study programme	Mestrado Universitario en Bioloxía Molecular , Celular e Xenética			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
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.			
Contingency plan	In case of another lockdown becaus of covid19: 1. Contents will be the same. 2. In-person instruction will change to virtual-only. This means that all lectures (theory and computer labs) will be hosted using MS TEAMS. 3. Tutoring sessions and any other communication will take place by means of email, videocalls or chat as implemented in MS TEAMS. 4. The only change in the assessment will be that all students will be evaluated online. 5. The recommended reference list will remain the same. If needed, instructors will provide with any reading and/or course resources to the students.			

Study programme competences	
Code	Study programme competences
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	Correct oral and written communication on scientific topics in the native language and at least in another International diffusion language.
B9	Skills of preparation, show and defense of a work.
C2	Mastering oral and written expression in a foreign language.
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

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**
The Human Genome Project	History and results
Whole Genome Sequencing	Mate-pair libraries Annotation Comparative genomics Palaeogenomics
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 BABELOMICS. 3. Farmacogenomic analysis using PHARMKGB. 4. Introduction to the Intregative Genomics Viewer (IGV).

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
ICT practicals	A3 A11 B1 B5 B9 C2 C3	7	21	28
Guest lecture / keynote speech	A3 A11 B1 C8	14	28	42
Objective test	A3 A11 B1 C8	2	0	2
Personalized attention		3	0	3
(*)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	OUr 7-hour, computer lab curriculum was developed to accompany the lecture course in Genomics. 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.

Objective test	Written exam.

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**	**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	Attendance to computer labs is mandatory. Distance learners will have to check how to proceed. 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.

Sources of information	
Basic	- Allison, David B., et al (2006). DNA microarrays and related genomics techniques design, analysis, and interpretation of experiments. Chapman & Hall/CRC - Bowtell, D., Sambrook, J. (2003). DNA Microarrays. Cold Spring Harbor Laboratory Press. - E. Rinaldis, A. Lahm. (2007). DNA microarrays: current applications. Wymondham: Horizon Bioscience - 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 - Pevsner, J. (2015). Bioinformatics and Functional Genomics. Wiley Blackwell - Kulkarni, S., Pfeifer, J. (2015). Clinical Genomics. A guide to Clinical NGS. Academic Press, Elsevier - Robison, P.N., Piro, R.M., Jäger, M. (2018). Computational Exome and Genome Analysis. CRC Press, Taylor & Francis Group

Complementary	- Sensen, Christoph W. (2005). Handbook of genome research genomics, proteomics, metabolism, bioinformatics, ethical & legal issues . Wiley-VCH - Zhanjiang, Liu (2007). Aquaculture genome techonologies. Blackwell - Dale Jeremy (2008). From genes to genomes: concepst and applications of DNA technology. John Wiley & Sons - (). . 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 /610441020
Subjects that are recommended to be taken simultaneously
Proteomics/610441013 Chromosomes. structure. function and evolution /610441015 Human Genetics/610441016 Genetic Toxicology /610441017
Subjects that continue the syllabus
Project/610441022
Other comments
Do not take this subject if your level of English is lower than B1.

(*)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.