| Teaching Guide | | | | |
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| Identifying Data | | | | 2023/24 |
| Subject (*) | Genomics | | Code | 610441015 |
| Study programme | Máster 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 | BioloxíaDepartamento profesorado máster | | | |
| Coordinador | Vila Taboada, Marta | E-mail | marta.vila.taboada@udc.es | |
| Lecturers | Becerra Fernandez, Manuel<br>Vila Taboada, Marta | E-mail | manuel.becerra@udc.es<br>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 | |
|---|---|
| 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 | 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 | | |
| To learn the basics of the different molecular techniques used in genomics, with particular emphasis in NGS | AR3<br>AR11 | | CC3 |
| To acquire an updated view about the current scope and future perspectives of structural, functional and evolutionary genomics | AR3<br>AR11 | BR1<br>BR5<br>BR9 | CC2<br>CC8 |
| To understand how genomes evolve and how molecular and bioinformatic tools are used for that purpose | AR3<br>AR11 | BR1<br>BR5<br>BR9 | CC2<br>CC8 |
| DNA microarrays: experimental set up and data analysis. | AR3<br>AR11 | | |

| Contents | |
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| Topic | Sub-topic |

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|---|---|
| Next Generation Sequencing (NGS) | Platforms<br>Paired-end libraries<br>Introduction to data analysis |
| Whole Genome Sequencing | Annotation<br>Comparative genomics |
| Metagenomics | Metabarcoding |
| Clinical genomics | Amplicon-seq<br>Panel-seq<br>Exome-seq<br>Pharmacogenomics |
| Single Nucleotide Polymorphisms (SNPs) | Genome wide association studies (GWAS)<br>Digital genetic testing |
| Functional genomics | Transcriptome analysis: microarrays and NGS (RNA-seq) |
| Computer lab | 1. Using GALAXY for analysis of NGS data.<br>2. Gene expression analysis using GALAXY.<br>3. Farmacogenomic analysis using PHARMKGB.<br>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.<br>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 |
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| 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.<br>Mark "A with distinction" will only be awarded to outstanding students passing the subject in May.<br>Students will be scored as "ABSENT" (Non presentado) only when not involved in any of the assessed activities.<br>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.<br>Implications of PLAGIARISM in the qualification: the current UDC regulations will be applied. |

| 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<br>- Bowtell, D., Sambrook, J. (2003). DNA Microarrays. Cold Spring Harbor Laboratory Press.<br>- E. Rinaldis, A. Lahm. (2007). DNA microarrays: current applications. Wymondham: Horizon Bioscience<br>- McLachlan, G. J., Do, K-A., Ambroise, C (2004). Analyzing Microarray Gene Expression Data. Wiley-Interscience. John Wiley & Sons<br>- Brown, T. A. (2018). Genomes4. Garland Science<br>- Pevsner, J. (2015). Bioinformatics and Functional Genomics. Wiley Blackwell<br>- Kulkarni, S., Pfeifer, J. (2015). Clinical Genomics. A guide to Clinical NGS. Academic Press, Elsevier<br>- 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<br>- Zhanjiang, Liu (2007). Aquaculture genome techonologies. Blackwell<br>- Dale Jeremy (2008). From genes to genomes: concepst and applications of DNA technology. John Wiley & Sons<br>- (). .<br>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 |
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| Subjects that it is recommended to have taken before |

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| 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<br>Campus Faculty of Sciences ProgramTo help<br>achieve a sustainable immediate environment and comply with point 6 of the<br>"Environmental Declaration of the Faculty of Sciences (2020)", the<br>documentary works to be carried out in this subject will be requested in<br>virtual format and computer support. |

**(*)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.**