Teaching Guide				
Identifying Data				2022/23
Subject (*)	Cellular Techniques		Code	610441001s
Study programme	Máster Universitario en Bioloxía Molecular, Celular e Xenética (semipresencial)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	BioloxíaDepartamento profesorado máster			
Coordinador	Yañez Sanchez, Julian	E-mail	julian.yanez@udc.es	
Lecturers	Bernal Pita da Veiga, María de los Ángeles Castro Castro, Antonio Manuel Insua Pombo, Ana Maria López Armada, María José Rioboo Blanco, Carmen Yañez Sanchez, Julian	E-mail	angeles.bernal@udc.es antonio.castro@udc.es ana.insua@udc.es maria.jose.lopez.armada@col.udc.es carmen.rioboo@udc.es julian.yanez@udc.es	
Web	campusvirtual.udc.gal/login/index.php			
General description	Experimental subject focused on microscopy (including image analysis), plant and animal cell culture, flow cytometry and cytogenetic techniques.			

Study programme competences	
Code	Study programme competences
A1	Skills of working in a sure way in the laboratories knowing operation handbooks and actions to avoid incidents of risk.
A2	Skills of using usual techniques and instruments in the cellular, biological and molecular research: that are able to use techniques and instruments as well as understanding potentials of their uses and applications.
A13	Skills to become a professional in health, pharmacy, veterinary, animal production, biotechnology or food sectors.
B3	Skills of management of the information: that are able to gather and to understand relevant information and results, obtaining conclusions and to prepare reasoned reports on scientific and biotechnological questions
B4	Organization and work planning skills: that are able to manage the use of the time as well as available resources and to organize the work in the laboratory.

Learning outcomes			
Learning outcomes	Study programme competences		
To understand the theoretical foundations on which microscopy (including image analysis), (plant and animal) cell culture, flow cytometry and cytogenetic techniques are based.	AR1 AR2		
To acquire basic skills in the management and use of instrumental and units required for the development of cellular techniques.	AR1 AR2 AR13		
To know the applications of the different cellular techniques.	AR2		
To design, plan and conduct experiments regarding the techniques learned.	AR1 AR2	BR3 BR4	
Adequate oral and written expression in the official languages. Using ICT in working contexts and lifelong learning. Ability to manage times and resources: developing plans, prioritizing activities, identifying critical points, establishing goals and accomplishing them.			

Contents

Topic	Sub-topic
Microscopy and image analysis	Fundamentals, techniques and applications of light and electron microscopy. Fluorescence and confocal scanning microscopy: advanced techniques and applications. Introduction to image processing and image analysis
Cellular cultures	Introduction to cell cultures. Types of cell cultures. Cell culture requirements. Quantification of cellular parameters. Contamination. Cytotoxicity. In vitro cultures of plant tissues. Callus. Cultivation of plant cells in suspension.
Flow cytometry	General principles and methods of cytometry. Sample preparation and standardization of analysis procedures. Functional analysis of cells.
Cytogenetic techniques	Chromosome preparation and karyotype. Conventional in situ hybridization. Advanced techniques of fluorescence in situ hybridization (FISH).

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Document analysis	A2	0	40	40
Laboratory practice	A1 A2 A13 B3 B4	28	42	70
Supervised projects	A2 B3 B4 C1 C3 C8 C9	0	19	19
Mixed objective/subjective test	A2 B3	2	15	17
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
Document analysis	This methodology involves watching videos of lectures, reading documents prepared by the lecturers and/or reading bibliographic documents on the theoretical-practical fundamentals and aspects related to the different techniques used in Cell Biology.
Laboratory practice	Practical sessions represent an indispensable part of the course, in which practical aspects and applications of the different cellular techniques will be approached. Practical sessions will be developed in concrete laboratories and places: laboratories of the Faculty of Sciences, Laboratories of Biomedical Research Institute (INIBIC), Scientific Research Support Services (SAI) of UDC. Students will develop laboratory protocols and attend demonstrations about the use of research units.
Supervised projects	Students must carry out works, resolve problems and/or questions about specific aspects of the techniques used.
Mixed objective/subjective test	It will consist of a written exam with questions-test and/or short answer questions about theoretical and practical contents and applications of the cellular techniques.

Personalized attention	
Methodologies	Description
Supervised projects Document analysis	Students (individually or in small groups) may consult their doubts about the contents and activities of the subject via phone and/or electronic support. A forum on the Virtual Campus/Teams may be used for the formulation of doubts/comments.

Assessment			
Methodologies	Competencies	Description	Qualification
Supervised projects	A2 B3 B4 C1 C3 C8 C9	The ability to design (and plan) experiments, interpretate data and solve problems will be assessed.	30

Mixed objective/subjective test	A2 B3	The acquisition of knowledge about the theoretical foundations and applications, clarity of explanations, ability to integrate and link information handled and the ability to interpret data and solve problems will be taken into account.	50
Laboratory practice	A1 A2 A13 B3 B4	Attendance, skill in scheduled tasks and knowledge of the potential risks in laboratory practices will be assessed.	20

Assessment comments
The exam will take place through the "Virtual Campus" on the dates specified in the official calendar. Attendance at the practical lessons is a necessary condition to be evaluated. In case of not passing the evaluation in the first opportunity of the call, the grades obtained in the supervised works and practices will be kept for the second opportunity. Honors will be awarded preferably among students (face-to-face and non-face-to-face) presented in the evaluation corresponding to the first opportunity of the call. Fraudulent performance of the tests or assessment activities, once verified, will directly imply the failing grade "0" in the call.

Sources of information

Basic	CULTIVOS CELULARESBasra, A.S. (2000). Plant growth regulators in agriculture and horticulture. Their role and commercial uses. Ed. Food Products Press. Benítez Burraco, A. (2005). Avances recientes en Biotecnología vegetal e ingeniería genética de plantas. Editorial Reverté.Boulton, A.A. e col. (1992). Practical cell culture techniques. Humana Press.Butler, M. (2008). Animal cell culture and technology. Taylor & Francis, 2nd edition.Collin, H.A. e Edwars, S. (1998). Plant cell culture. Guilford Bios Scientific Publishers.Davis, J.M. (2011). Animal cell culture. Essential methods. Wiley-Blackwell.Doyle, A. e Griffiths, J.B. (2000). Cell and tissue culture for medical research. John Wiley and Sons. Fedoroff, S. e Richardson, A. (1992). Protocols for neural cell culture. Humana Press. Freshney, R.I. (2010). Culture of animal cells. A manual of basic technique and specialized applications. Wiley-Liss, Inc. 6ª Edition.Hammond, J., McGarvey, P., Yusibov, V. (1999). Plant Biotechnology. New products and Applications. Springer Verlag. Loyola-Vargas, V.M. e Vázquez-Flota F. (2006). Plant cell culture protocols. Humana Press. 2nd Edition. Pollard, J.W. e Walker, J.M. (1997). Basic cell culture protocols. Humana Press.Shaw, A.J. (1996). Epithelial cell culture. A practical approach. Oxford University Press. Taji, A., Kumar, P., Lakshmanan, P. (2002). In vitro plant breeeding. Food Products Press.Trigiano, R.N. e Gray, D.J. (2004). Plant development and biotechnology. CRC Press.Tzfira, T. e Citovsky, V. (2006). Agrobacterium-mediated genetic transformation of plants: biology and biotechnology. Curr. Opin. Biotechnol. 17:147?154.Vunjak-Novakovic, G.& Freshney, R.I. (2006). Culture of cells for tissue engineering. Wiley-Liss, Inc.TÉCNICAS DE MICROSCOPÍA E ANÁLISE DE IMAXEWatt, Ian M. (1996). The principles and practice of electron microscopy. Cambridge University PressHoppert, M. (1998). Electron microscopy in microbiology. Bios Scientific PublishersBozzola, John J. (1999).Electron microscopy : principles and techniques for biologists. Jones and Bartlett Publishers.Dykstra, Michael J. (2003). Biological electron microscopy theory, techniques, and troubleshooting. Kluwer Academic/Plenum PublishersRobin Harris. (1991). Electron microscopy in biology a practical approach. Oxford University Press.Hunter, Elaine Evelyn. (1984). Practical electron microscopy a beginner's illustrated guide. Praeger, cop.Slayter, Elizabeth M. (2000). Light and electron microscopy. Cambridge University PressHerman, B. (1998). Fluorescence microscopy. Bios Scientific PublishersDonat-P. Häder. (1992). Image analysis in biology. CRC Press, cop. Pertusa, JF. (2003). Técnicas de Análisis de imagen. Aplicaciones en Biología. Publicaciones de la Universidad de Valencia. CITOMETRÍA DE FLUXOOrmerod, M.G. (2009). Flow Cytometry: A Basic Introduction. 2a Ed. IRL Practical Approach series. Oxford University Press.Shapiro, H.M. (2004). Practical flow cytometry. Wiley-Liss. 4a ed. New York.TÉCNICAS CITOXENÉTICASCzepulkowski, B. (2001). Analyzing chromosomes. BIOS Scientific Publishers, Oxford.Gersen, S.L., Keagle, M.B. (2013). The principles of clinical cytogenetics. Springer, New York.Gosden, J.R. (1994). Chromosome analysis protocols. Humana Press, Totowa (New Jersey).Kianian, S.F., Kianian P.M.A. (2016). Plant cytogenetics: methods and protocols. Spinger, New YorlLiehr, T. (2006). Multicolor FISH in human cytogenetics. Karger, Basel.Liehr, T. (2009). Fluorescence in situ hybridization (FISH)-application guide. Springer-Verlag, Berlin.Leitch, A.R., Schwarzacher, T., Jackson, D. (1994). In situ hybridization: a practical guide. Bios Scientific Publishers, Oxford.Verma, R.S. e Babu, A. (1989). Human chromosomes: manual of basic techniques. Pergamon Press, New York.
Complementary	- Artigos científicos sobre temas relacionados coa materia proporcionados a través da plataforma Moodle.- Páxinas webXeralPubMed: http://www.ncbi.nlm.nih.gov/pubmedCultivos Celulares-https://inmunomundo.files.wordpress.com/2015/12/cultivo-celular.pdf-http://www.lgcstandards-atcc.org/Citometría-Cytometry: http:www3.interscience.wiley.com/cgi-bin/jhome/33945Microscopía e Análise de imaxehttp://zeiss-campus.magnet.fsu.edu/index.htmlhttp://www.microscopyu.com/tutorials/http://www.olympusfluoview.com/index.htmlhttp://w3.uniroma1.it/MEDICFISIO/microscopy.htmhttp://rsbweb.nih.gov/ij/index.htmlhttp://www.invitrogen.com/site/us/en/home/support/Research-Tools/Fluorescence-SpectraViewer.html

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus
Other comments
Program Green Campus Empower of SciencesTo help to achieve some sustainable immediate surroundings and fulfil with the point 6 of the Environmental Statement of the faculty of Sciences (2020), the documentary works that realise in this matter:to. They will request mostly in virtual format and computer supportb. To realise in paper:-they will not employ plastic-they will realise impressions to double expensive-they will employ paper recycled-they will avoid the realisation of draftsTo Environmental Statement is available in:https://ciencias.udc.es/images/Facultade/Green_Campus/Regulamento_Comit%C3%A9_Green_Campus_FCiencias.pdf