Teaching Guide				
Identifying Data				2020/21
Subject (*)	Regulation of gene expression		Code	610441006
Study programme	Mestrado Universitario en Bioloxía Molecular , Celular e Xenética			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	3
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Cerdan Villanueva, Maria Esperanza	E-mail	esper.cerdan@udc.es	
Lecturers	Cerdan Villanueva, Maria Esperanza Freire Picos, María Ángeles	E-mail	esper.cerdan@udc.es maria.freirep@udc.es	
Web	ciencias.udc.es/bcm			
General description	This course is focussed on the mechanisms of gene expression regulation in the nucleous and the cytoplasm as well as the cellular machineries involved in those processes.			
Contingency plan	CONTINGENCY PLAN In case of a new closure due to covid19: 1. There will be no changes in the contents. 2. All classes and activities will be conducted by video conference by TEAMS. Laboratory practices will be replaced by online activities in Moodle or Teams 3. The mechanisms for personalized attention to students will be through email, videoconference or chat implemented in TEAMS. 4. The evaluation will be online, but there will be no changes in the percentages assigned to the exam, practical exercises and activities.			

Study programme competences / results	
Code	Study programme competences / results
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.
A3	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A5	Skills of understanding the microorganisms' role as pathogenic agents and as biotechnological tools.
A6	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A9	Skills of understanding the structure and dynamics of proteins to individual and proteomic level, as well as the techniques that are necessary to analyze them and to study their interactions with other biomolecules.
A10	Skills of modifying genes, proteins and chromosomes with biotechnological applications
A11	Skills of understanding the structure, dynamics and evolution of genomes and to apply tools necessary to his study.
A13	Skills to become a professional in health, pharmacy, veterinary, animal production, biotechnology or food sectors.
B1	Analysis skills to understand biological problems in connection with the Molecular and Cellular Biology and Genetics.
B2	Skills of decision making for the problem solving: that are able to apply theoretical knowledges and practical acquired in the formulation of biological problems and the looking for solutions.
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
B5	Correct oral and written communication on scientific topics in the native language and at least in another International diffusion language.

B6	Skills of team work: that are able to keep efficient interpersonal relationships in an interdisciplinary and international work context, with respect for the cultural diversity.
B9	Skills of preparation, show and defense of a work.
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		
Skills of make presentations regarding the actual knowledge state in the field. Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability Analysis skills to understand biological problems in connection with the Molecular and Cellular Biology and Genetics Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability Skills of decision making for the problem solving: that are able to apply theoretical knowledges and practical acquired in the formulation of biological problems and the looking for solutions.	AR1 AR2 AR3 AR5 AR6 AR9 AR10 AR11 AR13	BR1 BR2 BR3 BR5 BR6 BR9	CC3 CC8
.-Skills to be critical with the results and the hypothesis as well as evaluation and interpretation of results .	AR13	BR1 BR2	CC8

Contents	
Topic	Sub-topic
Topic 1	Introduction to techniques and methodology to study the regulation of gene expression.
Topic 2	The transcriptional machinery in eukaryotes. Transcripcional general factors (TFII) and TAFs. The mediator complex and the complex SRB10 kinase.
Topic 3	The complexes that remodel chromatin. ATP-hydrolyzing complexes. SWI/SNF and ISWI complexes.
Topic 4	SAGA complex and counterparts. Acetylation and regulation of gene expression: HATs. The gene repression processes and deacetylation. The repression mechanisms of gene methylation.
Topic 5	Specific transcripcion factors. The signaling cascades and specific transcription factors. Nuclear receptors and transcriptional control.
Topic 6	New concepts in the regulation of gene expression. Transcripcion factories and other models.
Topic 7	RNA processing and nucleous-cytoplasm transport: the machinery of RNA cleavaje and polyadenylation, transport across the Nuclear Pore Complex and factors involved. Cytosolic polyadenylation.
Topic 8	RNA secondary structures and protein-factors with RNA-binding domains in the regulation of mRNA levels. mRNA stability.
Topic 9	RNA and protein translation. Local protein translation. The 3´-UTRs in the translation efficiency process. RNA Editing.
Topic 10	micro and siRNAs in the regulation of Gene Expression: basic and applied aspects.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours

Seminar	A5 A6 A9 A10 A11 B3 B5 B6 B9 C3 C8	2	8	10
Laboratory practice	A2 A1 A3 B1 B2	7	7	14
Guest lecture / keynote speech	A5 A6 A9 A10 A11	8	16	24
Problem solving	A13 B1 B2	2	8	10
Objective test	A5 A6 A9 A10 A11 A13	2	14	16
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Seminar	The students will prepare a scientific presentation about a subject related to the mechanisms of gene expression regulation and will present it to the class. The presentation will be followed by a debate.
Laboratory practice	Experimental work in the laboratory about genetic engineering and gene expression analysis.
Guest lecture / keynote speech	Magister lectures about the principal topics of the learning program
Problem solving	Learning based on problem solving. The students will have to solve a problem with the aid of previous information about the subject.
Objective test	The exam will include questions based in multiple option selection and also problems. This will allow to modulate the final qualification of each student

Personalized attention	
Methodologies	**Description**
Seminar Laboratory practice Problem solving	Students will be oriented before and during the preparation of seminars and the development of the practical course. They will involve interpretation of results. The problems and case solving will also need an orientation from the teachers. Students with part-time dedication or waiver of presence should contact the teachers of the subject in the early going to establish a schedule of activities to acquire and evaluate in a complementary way the competences. Titotial schedules: Pfra. Esperanza Cerdán Tuesday, wednesday and Thursday from 12.30 to 14.30 Pfra. Mª Angeles Freire Monday 13-15 or previous appointment by e-mail. Some doubts may also be solved directly by e-mail.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Seminar	A5 A6 A9 A10 A11 B3 B5 B6 B9 C3 C8	Students give their peers a seminar about sppecific aspects of work of other scientists on an issue related to regulation of gene expression. Half-presential students will have a specific activity combining the seminar contents and the problem solving	15

Laboratory practice	A2 A1 A3 B1 B2	The collection and management of information from databases and scientific suits available on the web. A practical case will be carried out by students. It will also be a laboratory session focussed on a transcriptional regulation experiment.	25
Guest lecture / keynote speech	A5 A6 A9 A10 A11	Althought the theorethical knowledges will be teached and ellaborated in magister clases, we will take into consideration the assistence to the theorethical clases and the student´s participation.	10
Problem solving	A13 B1 B2	We will present problems on different subjects related with the gene expression regulation to verify if the students are able to use the infomation that was given to them, or other that they find, in order to solve them. Half-presential students will have a specific activity combining the seminar contents and the problem solving	25
Objective test	A5 A6 A9 A10 A11 A13	It will consist in an exam that may include multiple answer questions, or case solving and will allow to mudulate the student final evaluation note.	25

Assessment comments
Half-presential students will have a specific activity combining the seminar contents and the problem solving (40%). Students with part-time dedication or waiver attendance may choose to be evaluated in a final exam if they do not qualify for continuous evaluation.

Sources of information	
Basic	- Lodish, Berk, et al (2013). Molecular and Cellular Biology 7th Ed. WH Freeman - Watson, Baker, Bell et al., (2006). Biología Molecular del Gen, 5º Ed. Panamericana - Lodisch et al., (2005). Biología Molecular de la célula . Panamericana - Meister, G. (2011). RNA Biology. Wiley-VCH Artículos e textos especializados iránse actualizando na plataforma. Baker, S.P. & Grant, P.A. 2007, "The SAGA continues: expanding the cellular role of a transcriptional co-activator complex", Oncogene, vol. 26, no. 37, pp. 5329-5340. Bhaumik, S.R. & Green, M.R. 2002, "Differential requirement of SAGA components for recruitment of TATA-box-binding protein to promoters in vivo", Molecular and cellular biology, vol. 22, no. 21, pp. 7365-7371. Cho, E.J. 2007, "RNA polymerase II carboxy-terminal domain with multiple connections", Experimental & molecular medicine, vol. 39, no. 3, pp. 247-254. Daniel, J.A. & Grant, P.A. 2007, "Multi-tasking on chromatin with the SAGA coactivator complexes", Mutation research, vol. 618, no. 1-2, pp. 135-148. Gao, R., Mack, T.R. & Stock, A.M. 2007, "Bacterial response regulators: versatile regulatory strategies from common domains", Trends in biochemical sciences, vol. 32, no. 5, pp. 225-234. Gao, R. & Stock, A.M. 2009, "Biological Insights from Structures of Two-Component Proteins", Annual Review of Microbiology, Kim, H.J., Seol, J.H., Han, J.W., Youn, H.D. & Cho, E.J. 2007, "Histone chaperones regulate histone exchange during transcription", The EMBO journal, vol. 26, no. 21, pp. 4467-4474. Koch, F., Jourquin, F., Ferrier, P. & Andrau, J.C. 2008, "Genome-wide RNA polymerase II: not genes only!", Trends in biochemical sciences, vol. 33, no. 6, pp. 265-273. Li, X.Y., Bhaumik, S.R., Zhu, X., Li, L., Shen, W.C., Dixit, B.L. & Green, M.R. 2002, "Selective recruitment of TAFs by yeast upstream activating sequences. "EN-GB">Implications for eukaryotic promoter structure", Current biology : CB, vol. 12, no. 14, pp. 1240-1244. Malik, S. & Roeder, R.G. 2005, "Dynamic regulation of pol II transcription by the mammalian Mediator complex", Trends in biochemical sciences, vol. 30, no. 5, pp. 256-263. Ng, H.H. & Bird, A. 2000, "Histone deacetylases: silencers for hire", Trends in biochemical sciences, vol. 25, no. 3, pp. 121-126. Wu, J.I., Lessard, J. & Crabtree, G.R. 2009, "Understanding the words of chromatin regulation", Cell, vol. 136, no. 2, pp. 200-206.

Complementary	-Cheng B. and David H. Price Properties of RNA Polymerase II Elongation Complexes Before and After the P-TEFb-mediated Transition into Productive Elongation. JBC. 282, 21901?21912. 2007. -Sims, R.J.; Belotserkovskaya R. and Reinberg, D. Elongation by RNA polymerase II: the short and long of it?. Genes & Dev.18, 2437-2468.2004. -Wäle S. and Kehlenbach RH. The part and the whole: Functions of Nucleoporins in nucleocytoplasmic transport. Trends in Cell Biol 20: 461-469. 2010. -Simpson, G.G., Dijwel, P.P., Quesada, V., Henderson, I. and Dean, C. ?FY is an RNA 3´end-processing factor that interacts with FCA to control the Arabidopsis floral transition.? Cell 13, 777-797. 2003. -Ghazy, M.A., He, X., Singh, B.N., Hampsey, M. and Moore C.>The essential N terminus of the Pta1 scaffold protein is required for snoRNA transcription termination and Ssu72 function but is dispensable for pre-mRNA 3´-end processing.? Mol. Cell Biol 29, 2296-2307. 2009. -Graber, J.H., McAllister, G.D. and Smith, T.F.?Probabilistic prediction of Saccharomyces cerevisiae mRNA 3´-processing sites.? Nucleic Acids Res. 1851-1858. 2002. -Bently, D. ?Rules of engagement: co-transcriptional recruitment of pre-mRNA processing factors.? Curr. Opin. Cell Biol. 17, 251-256. 2005. -Murchison, E. P. and Hannon, G.J. ?miRNAs on the move: miRNA biogenesis and the RNAi machinery?Current Opinion in Cell Biology 16, 223?229.2004. -Wang, Y., Chih Long Liu, John D. Storey, Robert J. Tibshirani, Daniel Herschlag, and Patrick O. Brown. ?Precision and functional specificity in mRNA decay?. PNAS 99, 5860?5865. 2002. -James E.C. Jepson Robert A. Reenan ?RNA editing in regulating gene expression in the brain.? Biochimica et Biophysica Acta 1779, 459?470.2008. Wu, H., Neilson, J.R., Kumar,Manocha, M.,Shankar, P.,Sharp, P.A. and Manjunath, miRNA Profiling of Naý¨ve, Effector and Memory CD8 T Cells>.? PloS One 10 | e1020.

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Molecular Techniques/610441002 Advanced Cellular Biology/610441003 Molecular Microbiology /610441010 Protein Structure and Dynamics/610441011 Bioinformatics and Biomolecular models /610441020
Subjects that continue the syllabus
Other comments
Is important that the students attend to the personal titorials to solve doubts.

(*)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.