Teaching Guide				
Identifying Data				2022/23
Subject (*)	Regulation of gene expression		Code	610441006s
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	3
Language	SpanishEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	Bioloxía			
Coordinador	Freire Picos, María Ángeles	E-mail	maria.freirep@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.			

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	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.
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.
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

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	CC2
.-Skills to be critical with the results and the hypothesis as well as evaluation and interpretation of results .	AR1 AR3	BR1 BR2	CC2

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**
Supervised projects	A5 A6 A9 A10 A11 B3 B5 B6	2	20	22
Laboratory practice	A1 A2 A3 B1 B2	7	7	14
Problem solving	A13 B1 B2	2	20	22
Objective test	A5 A6 A9 A10 A11 A13 C2	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
Supervised projects	The students will prepare a scientific memory about a subject related to the mechanisms of gene expression regulation and will present it to the class. The teachers will monitor the entire process in persolalized tutorials.
Laboratory practice	Experimental work in the laboratory about genetic engineering and gene expression analysis.
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**
Problem solving Laboratory practice Supervised projects	Students will be oriented before and during the preparation scientific memory 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. Titorial schedules: Pfra. Esperanza Cerdán Tuesday, wednesday and Thursday from 12.30 to 14.30. Previous appointment ither by e-mail or Teams platform Pfra. Mª Angeles Freire Monday 13-15 or preferably by previous appointment ither by e-mail or Teams platform.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Problem solving	A13 B1 B2	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 C2	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
Laboratory practice	A1 A2 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 the students. It will also be a laboratory session focussed on a transcriptional regulation experiment.	25
Supervised projects	A5 A6 A9 A10 A11 B3 B5 B6	Students prepare a portfolio 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	25

Assessment comments

Sources of information

Basic	- Lodish, Berk, et al (2013). Molecular and Cellular Biology 7th Ed. WH Freeman - Meister, G. (2011). RNA Biology. Wiley-VCH - Lodisch et al., (2005). Biología Molecular de la célula . Panamericana - Watson, Baker, Bell et al., (2006). Biología Molecular del Gen, 5º Ed. Panamericana 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 /610441011 Protein Structure and Dynamics/610441012 Bioinformatics and Biomolecular models /610441021
Subjects that continue the syllabus
Other comments
.Is important that the students attend to the personal titorials to guide the works and to solve doubts. .Green Campus Science Faculty Program. To contribute to achieving an immediate sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary work carried out in this area:A. They will be requested mainly in virtual format and computer support.B. To do on paper:- Plastics will not be used.- Double-sided prints will be made.- Recycled paper will be used.- Drafts will be avoided.