Teaching Guide				
Identifying Data				2019/20
Subject (*)	Chromosomes. structure. function and evolution		Code	610441015
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	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Mendez Felpeto, Josefina	E-mail	josefina.mendez@udc.es	
Lecturers	Mendez Felpeto, Josefina	E-mail	josefina.mendez@udc.es	
Web	http://xenomar.es			
General description	This material is an advanced approach to the study of the eukaryotic chromosome structural and dynamic point responsible for packaging, transmission, maintenance and regulation of DNA function in different cellular contexts system. The Contents aim to complete previous knowledge acquired by students in matters related to Genetics and Molecular Biology at the undergraduate or graduate studies, helping to establish a conceptual view from up state of the art research.			

Study programme competences	
Code	Study programme competences
A1	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.
A6	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.
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
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.
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.
B7	Personal progress skills : that are able to learn from freelance way, adapting to new situations, developing necessary qualities as the creativity, skills of leadership, motivation for the excellence and the quality.
B9	Skills of preparation, show and defense of a work.
C1	Adequate oral and written expression in the official languages.
C2	Mastering oral and written expression in a foreign language.
C3	Using ICT in working contexts and lifelong learning.
C4	Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.
C5	Understanding the importanceof entrepreneurial culture and the useful means for enterprising people.
C6	Acquiring skills for healthy lifestyles, and healthy habits and routines.
C7	Developing the ability to work in interdisciplinary or transdisciplinary teams in order to offer proposals that can contribute to a sustainable environmental, economic, political and social development.
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		
Understand the knowledge of genetics from the perspective of eukaryotic chromosome as a structural and dynamic system.	AR1 AR3 AR6 AR11	BR1 BR2 BR3 BR4 BR5 BR6 BR7 BR9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8
Ability to understand the organization of genes, genomes and chromosomes from a comparative and focused on the relationship between structural, functional and evolutionary aspects perspective.	AR1 AR3	BR1 BR2 BR3 BR4 BR5 BR6 BR7 BR9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8
Increase the theoretical knowledge in the analysis of the structure, function and evolution of chromosomes in eukaryotes.	AR1 AR3	BR1 BR2 BR3 BR4 BR5 BR6 BR7 BR9	CC1 CC2 CC3 CC4 CC5 CC6 CC7 CC8

Contents	
Topic	Sub-topic
Block 1.- Structural organization of hereditary material.	The hereditary material DNA / RNA Levels of organization. The eukaryotic chromosome Chromosomes and chromosomal proteins Maintaining the chromosomal organization of the human chromosome protozoa.
Block 2. Chromatin and chromosome dynamics	Chromosome dynamics. Control of the cell cycle and mitosis. Euchromatin and heterochromatin. The Histone variants and histone code. Chromosomes and function: polytechnics and lampbrush chromosomes.
Block 3. Chromosomes and evolution.	Karyotypes in different taxa. Comparative analysis. Cytotaxonomy and evolutionary aspects.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A6 A11 B1 C5 C6 C7	4	4	8
Seminar	A3 B3 B4 B5 B6 B9 C1 C2 C3	2	20	22
Objective test	B2 B7 C4 C8	1	15	16
Laboratory practice	A1 A3 C8	7	7	14

Oral presentation	B1 B4 B5 B6 B7 B9 C3	1	11	12
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**
Guest lecture / keynote speech	Professor transmit theoretical knowledge in keynote sessions related to the thematic blocks of matter. The contents shall comply with the previous knowledge acquired by students in their undergraduate studies or degree.
Seminar	Students will develop and produce a single seminar dossier with more specific knowledge than provided in lectures. It will be presented to the rest of his colleagues in the field corresponding to the schedule. A report it will be given in writing to the teacher and will be presented orally in class.
Objective test	Students will take an individual exam that will assess the knowledge acquired at the end of the course.
Laboratory practice	Methodologies for working with chromosomes are made. Activities to apply the adquired knowledge to chromosome techniques
Oral presentation	Referred to the seminar dossier prepared singly or jointly by the students. If the work is done in groups, each student will present a part of the seminar. They quality of the report/seminary will be assessed in terms of content and references. Both the submitted writen report and oral presentation will contribute to the assessment.

Personalized attention	
Methodologies	**Description**
Laboratory practice Oral presentation Seminar	Personal attention is understood as an orientation focused on improving and increasing the previous basic knowledge of students, learning to discern the most appropriate literature to the subject of the seminars and improve the standard of scientific methodology. The teacher will help the students solving doubts that may arise in performing the activities entrusted to it. It will take in the timetable of tutorials available to the teacher.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A1 A3 C8	They include the development of own basic and applied research in practical situations chromosomes. Ability A and B	10
Oral presentation	B1 B4 B5 B6 B7 B9 C3	Students will prepare a written seminar that will be presented orally to the rest of his teammates on a specific aspect of the subject. Ability A,B	10
Guest lecture / keynote speech	A6 A11 B1 C5 C6 C7	Students must attend the teacher's explanations, assistance will be evaluated positively. Ability ....A 1,3,6,9,11 and B 1,3,4,5,6,7 ,9	5
Seminar	A3 B3 B4 B5 B6 B9 C1 C2 C3	Students will present a written seminar part of the art. Quality, consistency and timeliness of scientific content will be assessed. It is a mandatory activity. Ability A,B	35

Objective test	B2 B7 C4 C8	The objective examination or test will show students the knowledge acquired on the core issues of matter It is a mandatory activity. Ability A,B	40

Assessment comments
Os alumnos semipresenciais deberán asistir a Práctica/Visita. Ademais de traballar nun seminario específico para solventar a non asistencia as sesións maxistrais e as presentacions orais. A proba obxectiva e obligatoria. Os alumnos NO PRESENTADOS serán aqueles que non asistan a ninguha das 5 metodoloxías propostas.

Sources of information	
Basic	ELGIN, S.C.R. and WORKMAN, J.L. 2000. Chromatin Structure and Gene Expression. Oxford University Press, New York.LI, W.H. 1997. Molecular Evolution. Sinauer, MA.LIMA-DE-FARIA, A. 2008. Praise of Chromosome "Folly". World Scientific/Imperial College Press.LYNCH, M. 2007. The origins of Genome Architecture. Sinauer Associates, Sunderland, MA.NEI, M. & KUMAR, S. 2000. Molecular Evolution and Phylogenetics. Oxford University Press, NY.REECE, R.J. 2004. Analysis of Genes and Genomes. Ed. Wiley & Sons.SUMNER, A.T. 2003. Chromosomes: Organization and Function. Blackwell Publishing.VAN HOLDE, K.E. 1988. Chromatin. Springer-Verlag, NY.VERMA, R.S. & BABU, A. 1995. Human Chromosomes: Principles and Techniques.2ª Ed. McGraw-Hill.WEINGARTEN, C.N. 2009. Sex Chromosomes: Genetics, Abnormalities and Disorders. Springer.WOLFFE, A.P. 1998. Chromatin: Structure & Function. Academic Press, San Diego, CA. ZLATANOVA, J. & LEUBA, S.H. 2004. Chromatin Structure and Dynamics: State-of-the-Art. Elsevier, Amsterdam.

Complementary	Annunziato AT (2005) Split decision: what happens to nucleosomes during DNA replication? J. Biol. Chem. 280:12065-12068Arents G, Moudrianakis E (1995) The histone fold: a ubiquitous architectural motif utilized in DNA compaction and protein dimerization. Proc. Natl. Acad. Sci. U S A 92:11170-11174Brown DT (2001) Histone variants: are they functionally heterogeneous. Genome Biol. 2:1-6Luger K, Mäder AW, Richmond RK, Sargent DF, Richmond TJ (1997) Crystal structure of the nucleosome core particle at 2.8 A resolution. Nature 389:251-260Cairns BR (2005) Chromatin remodeling complexes: strength in diversity, precision through specialization. Curr. Opin. Genet. Dev. 15:185-190 Downey M, Durocher D (2006) Chromatin and DNA repair: the benefits of relaxation. Nat. Cell Biol. 8:9-10Eirín-López JM, Ausió J (2009) Origin and evolution of chromosomal sperm proteins. Bioessays in press Eirín-López JM, Frehlick LJ, Ausió J (2006) Protamines, in the footsteps of linker histone evolution. J. Biol. Chem. 281:1-4 Eirín-López JM, González-Romero R, Dryhurst D, Méndez J, Ausió J (2009) Long-term evolution of histone families: old notions and new insights into their diversification mechanisms across eukaryotes. In: Pontarotti P (ed) Evolutionary Biology: Concept, Modeling, and Application. Springer-Verlag, Berlin Heidelberg, p in pressGrigoryev SA (2004) Keeping fingers crossed: heterochromatin spreading through interdigitation of nucleosome arrays. FEBS Lett. 564:4-8Henikoff S (2005) Histone modifications: Combinatorial complexity or accumulative simplicity? Proc. Natl. Acad. Sci. U S A 102 Henikoff S, Ahmad K (2005) Assembly of variant histones into chromatin. Annu. Rev. Cell. Dev. Biol. 21:133-153Kasinsky HE, Lewis JD, Dacks JB, Ausió J (2001) Origin of H1 histones. FASEB J. 15:34-42Kimmins S, Sassone-Corsi P (2005) Chromatin remodelling and epigenetic features of germ cells. Nature 434:583-589Lewis JD, Saperas N, Song Y, Zamora MJ, Chiva M, Ausió J (2004) Histone H1 and the origin of protamines. Proc. Natl. Acad. Sci. U S A 101:4148-4152Malik HS, Henikoff S (2003) Phylogenomics of the nucleosome. Nat. Struct. Biol. 10:882-891Ramakrishnan V, Finch JT, Graziano V, Lee PL, Sweet RM (1993) Crystal structure of globular domain of histone H5 and its implications for nucleosome binding. Nature 362:219-223Strahl B, Allis CD (2000) The language of covalent histone modifications. Nature 403:41-45van Holde KE, Zlatanova J (1995) Chromatin higher order structure: chasing a mirage? J. Biol. Chem. 270:8373-8376Vignali M, Workman JL (1998) Location and function of linker histones Nat. Struct. Biol. 5:1025-1028Woodcock CL, Dimitrov S (2001) Higher-order structure of chromatin and chromosomes. Curr. Opin. Genet. Dev. 11:130-135Recursos Webhttp://www.udc.es/grupos/xenomar/chromevol/Welcome.htmlhttp://www.ncbi.nlm.nih.gov/http://www.timetree.org/ http://tolweb.org/tree/phylogeny.htmlhttp://research.nhgri.nih.gov/histones/http://www.ebi.ac.uk/msd-srv/oca/oca-docs/oca-home.htmlhttp://www.chromdb.org/http://www.ensembl.org/index.htmlhttp://swissmodel.expasy.org/

Recommendations
Subjects that it is recommended to have taken before
Genetic Variation Mechanisms/610441005 Proteomics/610441013 Human Genetics/610441016
Subjects that are recommended to be taken simultaneously
Protein Structure and Dynamics/610441011 Genomics /610441014 Bioinformatics and Biomolecular models /610441020
Subjects that continue the syllabus
Stem Cells and Cell Therapy/610441009 Genetic Toxicology /610441017 Project/610441022
Other comments