Teaching Guide				
Identifying Data				2021/22
Subject (*)	Cytogenetics		Code	610G02022
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Optional	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Gonzalez Tizon, Ana Maria	E-mail	ana.gonzalez.tizon@udc.es	
Lecturers	Gonzalez Tizon, Ana Maria Martinez Lage, Andres	E-mail	ana.gonzalez.tizon@udc.es andres.martinez@udc.es	
Web				
General description	This is a course focusing on the study of eukaryotic chromosome from the structural, functional and evolutionary perspective. In this area seek to improve the knowledge acquired in the molecular genetics and genetic materials. Special emphasis on the organization of the genetic material and their implications in the evolution of genomes, their variation and handling will be done.			
Contingency plan	In the case of a new confinement by covid19: 1. There will be no changes in the contents. 2. All classes will be held by videoconference by TEAMS. 3. The personalized attention mechanisms will be via email, videoconference or chat implemented in TEAMS. 4.The evaluation will become online, but there will be no changes in the percentages assigned to the exam and other assessable activities. 5. Students will be provided with the bibliography necessary to complete the course successfully. In the event that the capacity of the classroom assigned for the expository teaching and the interactive groups is exceeded, the center (Faculty of Sciences) will be in charge of managing this inconvenience. .			

Study programme competences	
Code	Study programme competences
A1	Recoñecer distintos niveis de organización nos sistemas vivos.
A2	Identificar organismos.
A11	Identificar e analizar material de orixe biolóxica e as súas anomalías.
A16	Realizar cultivos celulares e de tecidos.
A26	Deseñar experimentos, obter información e interpretar os resultados.
A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B6	Organizar e planificar o traballo.
B7	Comunicarse de maneira efectiva nunha contorna de traballo.
B8	Sintetizar a información.
B9	Formarse unha opinión propia.
B10	Exercer a crítica científica.
B11	Debater en público.
B13	Comportarse con ética e responsabilidade social como cidadán e como profesional.

C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C2	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C3	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C4	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Learning outcomes	Study programme competences		
Deepen your knowledge of the organization of hereditary material with an evolutionary approach through the study of chromosomes and their variations.	A1 A11 A16 A26 A30 A31	B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11	C1 C2 C3 C4 C6 C7 C8
To understand the fundamentals involve when learning about chromosome and familiar with the basic methodology employed for the study of chromosomes. Tools for cytogenetics.	A1 A2 A11 A16 A30 A31	B1 B2 B3 B5 B6 B11 B13	C1 C2 C3 C4 C6 C7 C8
Search and use of different literature and databases that allow carrying out the scientific approach to a topic related to chromosomes sources, organization, function and evolution. Management information sources of interest in cytogenetics.	A29	B3 B8 B9 B10 B13	C1 C2 C3 C4 C6 C7 C8

Contents	
Topic	Sub-topic
Topic 1. Organization and structure of the eukaryotic chromosome	O DNA no cromosoma: DNA de copia única, DNA moderadamente repetitivo, DNA altamente repetitivo, secuencias esenciales: CEN, TEL e ARS. A proteínas cromosómicas: histonas e non histonas. Tipos, modificacións e funcións.

Topic 2. From chromatin to metaphase chromosome	Organización da cromatina en interfase: o nucleosoma, a fibra fundamental, os bucles e as SARs. Os territorios cromosómicos. Organización do cromosoma en metafase: condensinas e andamio de proteínas non histónicas. Tipos de cromatina. O cariotipo.
Topic 3. The longitudinal differentiation of chromosomes	O bandeo de cromosomas. Tipos de bandas. Significado estructural e funcional das bandas. As isocoras.
Topic 4. Chromosome replication and trancription	Ciclo celular e replicación. Replicación da cromatina e acoplamento das histonas. A transcripción da fibra de cromatina: eucromatina e heterocromatina. Os cromosomas plumosos e os cromosomas politénicos.
Topic 5. Mitosis and changes in cell division	Características principais da mitosis Intercambio entre cromátidas Control da separación de cromátidas irmáns
Topic 6. Meiosis and changes of chromosome behaviour	Caracterísiticas principais da meiosis Complexos sinaptonémicos Recombinación e nódulos de recombinación Os quiasmas: frecuencia e distribución Segregación cromosómica e cromatídica
Topic 7. Chromosome sex determination	Sistemas cromosómicos de determinación do sexo A haplodiploidía. Heterocromatinización e sexo. Orixen dos cromosomas sexuais
Topic 8. Structural chromosome changes	Delecions: clases e orixen. Consecuencias xenéticas Duplicacions: clases, oricen, consecuencias e relevancia no proceso evolutivo. Inversions: clases, orixen, comportamento meiótico, consecuencias e relevancia no proceso evolutivo. Translocacions: clases, orixen, comportamento meiótico, consecuencias e relevancia no proceso evolutivo.
Topic 9. Poliploydy, haplodiploydy and anepuloydy	Orixen, identificación, tipos, comportamento meiótico, consecuencias, e importancia evolutiva. Os cromosomas B Amplificación xénica
Topic 10. Methodologies and development of technologies	Hibridación in situ fluorescente. Cariotipos espectrales. Citometría de fluxo. Microdisección e microclonación de cromosomas ou bandas cromosómicas.
Laboratory practices	1. Cultivos celulares e obtención de cromosomas metafásicos 2. Inducción de bandas cromosómicas e estudo da actividade NOR 3. Elaboración de cariotipos

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A2 A11 B2 B3 B6 B8 B9 B10	21	42	63

Laboratory practice	A11 A16 A26 A29 A30 A31 B1 B3 B4 B5 B7 B13 C1 C2 C3 C4 C6 C7 C8	14	28	42
Mixed objective/subjective test	A11 B2 B3 B8	2	20	22
Seminar	A2 A11 B1 B2 B3 B5 B6 B9 B10	7	0	7
Workbook	B1 B3 B5 B6 B9 B10	0	6	6
Oral presentation	B1 B2 B3 B5 B8 B9 B10 B11	2	4	6
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**
Guest lecture / keynote speech	Nas clases maxistrais o profesor explicará os contidos fundamentais de cada tema do programa e sinalará as actividades asociadas a este. Estas incluirán a consulta de bibliografía, a resolución de boletíns de cuestións e problemas, ou a eleboración dun traballo que o alumno deberá elaborar en grupo ou individualmente.
Laboratory practice	Laboratory practices related to the development of chromosomes and karyotypes were developed. It will be know the cell cultures, making the karyotype and develop some method of chromosome banding.
Mixed objective/subjective test	A proba mixta consistirá en preguntas curtas ou de tipo test e resolución de problemas.
Seminar	Os traballos tutelados consistirán na resolución de boletíns de problemas e cuestións, así coma na elaboración de traballos relacionados con algún aspecto da materia.
Workbook	O alumno leerá un ou dos artigos científicos para ampliar e profundizar nos contidos tratados no temario, e que expondrán na presentacion oral.
Oral presentation	Consistirá na exposición oral de un ou dos artigos científicos, acompañada de una presentación en power point, que posteriormente aloxaráse na plataforma Moodle da materia, para a súa consulta de cara a completar ou ampliar contidos da materia. A exposición será de un máximo de 10-12 minutos. Esta actividade realizarase por parellas. Ambos membros do grupo deben repartirse a exposición do traballo.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Oral presentation Workbook Seminar Laboratory practice	Throughout the course, the teacher will be available during the hours of interactive lectures, group tutorials / small group and individual tutoring for answering questions, guiding the development of seminars / group work and all matters related to the organization of matter.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Mixed objective/subjective test	A11 B2 B3 B8	Avaliarase mediante unha proba obxectiva os coñecementos adquiridos durante as clases expositivas e as clases en grupo interactivo.	40
Oral presentation	B1 B2 B3 B5 B8 B9 B10 B11	Avaliarase a exposición oral e a presentación en power point do traballo realizado polo alumno tendo en conta a capacidade para extraer o más relevante dos artículos científicos empregados, a capacidade de traballar en grupo, a expresión oral e corporal, e a capacidade de síntese.	20

Seminar	A2 A11 B1 B2 B3 B5 B6 B9 B10	O profesor elaborará dous cuestionarios con preguntas e exercicios que o alumno resolverá e entregará ao profesor para a súa avaliación.	20
Laboratory practice	A11 A16 A26 A29 A30 A31 B1 B3 B4 B5 B7 B13 C1 C2 C3 C4 C6 C7 C8	Take into account the interest to learn techniques on chromosomes, skill in the laboratory experiments ability to solve chromosomes and the attitude and ability to function in the laboratory.	20

Assessment comments
Laboratory practices are mandatory. To pass the subject, the student must obtain at least 50% of the score assigned to the mixed test and another 50% of that of the laboratory practices. It will be considered NOT PRESENTED when the student has not participated in more than 20% of the scheduled assessable activities. This criterion applies to the January call. In the July call, to obtain the grade NOT PRESENTED, it will be enough to not appear for the objective tests (theory and practical exams). For the evaluation of the July call, the student, in addition to the theory and practical exams, must present the bulletins of solved problems and the power point presentation of the oral presentation. In the event that these last two activities were already evaluated in the January call, the grade obtained will remain for July. For students with part-time dedication and exemption from attendance, the teacher will adopt the measures that he deems appropriate to avoid damaging her grade (flexibility in the delivery dates of the assessable activities). Instead of the oral presentation, these students will make a 2-3 page summary that must be delivered in pdf to the teacher for evaluation. The fraudulent performance of tests or assessment activities will directly imply the application of current regulations in the UDC.

Sources of information	
Basic	- Pierce BA (2008). Genetics, a conceptual approach. New York, Freeman - Klug WS, Cummings MR (2011). Essentials of Genetics. San Francisco, Pearson - Pierce BA (2011). Fundamentos de Genética, conceptos y relaciones. Buenos Aires, Médica Panamericana Nesta materia, os profesores recomendarán artículos científicos de revisión, publicados recentemente, para que o alumnado dispoña de bibliografía e referencias actuais sobre cada un dos temas da materia.Os artículos estarán aloxados na plataforma moodle dende o primeiro día de clase.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Biology: Basic Levels of Organisation of Life I (Cells)/610G02007 Genetics/610G02019 Molecular Genetics/610G02020
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Attendance at the master classes enables the treatment of doubts or questions that may arise in the course of the explanations, facilitating the understanding of the topics. The study must contemplate the habitual consultation of at least the recommended bibliography. Study and group work favors understanding and develops a critical spirit. Doubts and difficulties raised by any aspect of the subject must be resolved as soon as possible, raising them in face-to-face classes or attending individualized tutorials. Given that part of the recommended bibliography for this subject is in English, it is advisable to have knowledge of this language, at least at the level of comprehension of written texts.Green Campus ProgramGreen Campus Program of the Faculty of SciencesTo help achieve a sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary works carried out in this matter:to. They will be requested mainly in virtual format and computer support.b. If done on paper:- Plastics will not be used- They will be printed on both sides.- Recycled paper will be used- Drafts will be avoided.

(*)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.