SYLLABUS

1. Course description

Degree:	**Biotechnology**
Subject:	**Molecular Genetics**
Module:	**Biochemistry and Molecular Biology**
Departament:	**Molecular Biology and Biochemical Engineering**
Academic Year:	**2017-2018**
Semester:	**Second semester**
Credits:	**4,5 ECTS**
Course:	**2º**
Type:	**Basic**
Lenguge:	**Spanish**

Teaching Model:	**B1**	
a. Basic teaching (EB):		**60%**
b. Practical teaching (EPD):		**40%**

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2. Lecturers

2.1. Coordinator Rafael Rodríguez Daga

2.2. Profesors	
Name:	**Rafael Rodríguez Daga**
School:	**Experimental Sciences**
Departament:	**Molecular Biology and Biochemical Engine**
Area:	**Genetics**
Category:	**Associated professor**
Tutorial clases:	**Thursdays 13-15h**
Office:	**CABD EDIF. 20**
E-mail:	**rroddag@upo.es**
Phone:	**954977551**

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3. Topics

Introduction. Objectives and knowledge to learn. The information flow in the cell. Central Dogma of Molecular Biology.

Item 1. Transcription.

RNA polymerases, transcription factors, formation of the initiation complex, transcription cycle. Promoter TATA box, site of transcription initiation. Regulatory elements: silencers, enhancers. Insulators. Locus control regions (LCRs). Binding regions to nuclear matrix (MARs). RNA modifications: processing introns, alternative splicing. 5 'capping, trimming (rRNA, tRNA) and polyadenylation. mRNA quality control.

Item 2. Regulation of transcription.

Chromatin modifications. CG island methylation, Methylation-Acetylation - Deacetylation of histones. Incorporation of histone variants. Compaction of chromatin: euchromatin and heterochromatin. Frome gene silencing to protein in vivo.

RNA interference. Differential expression (tumor cells) and analysis of gene expression by microarrays.

Item 3. Translation.

Translation. Ribosomes, tRNAs, genetic code. Codon-Anticodon. Codon usage. Initiation elongation and termination of translation. Polysomes. Coupling transcription and translation.

Item 4. Translational regulation mechanisms.

Ternary complex, Regulation of translation mediated by uORFs (GCN4), Regulation of translation by hairpin (ferritin, IRE). Cap-independent translation (IRES). Protein quality control.

Item 5. DNA Replication, recombination and repair.

Replication. Replicons. DNA polymerases. Replication forks. Telomeres and telomerase. The mutation at the molecular level. DNA repair and mutation. Mutagens

agents. Homologous and non-homologous recombination. Transposition

Item 6. Molecular basis of eukaryotic cell proliferation.

The cell cycle and its control points. Mechanisms of cell cycle regulation by cyclin-CDK complexes. Cell cycle regulation by phosphorylation. Regulation of CDK activity by CKIs. CKIs: types and mechanisms of action. Monitoring checkpoints mechanisms. The DNA damage and the mitotic checkpoints: molecular mechanisms.

PRACTICAL TEACHING TOPICS.

The subject Molecular Genetics has two scheduled practices, organized in five separate sessions. During the practice, two different model organisms, the fission yeast *S. pombe,* one of eukaryotic organisms in which cell cycle control mechanisms is better known, and *C. elegans*, a small nematode that has emerged in recent years as an excellent model organism for studying numerous biological problems such as aging, or nervous system development and function. *C elegans* allows the use of iRNA technique to transiently control gene expression of target genes in a ease and effective way.

PRACTISE I. Gene silencing by RNA interference (RNAi) in *Caenorhabditis elegans*. Production of transient mutants.

Summary

The interference RNA technique (iRNA) allows temporary and selective inactivation of a gene transcript by expression of an antisense RNA. This technique is used in many organisms, but is particularly effective and easily accomplished in *C. elegans*.

In the practise we will inactivate by iRNA genes involved in coordination of movement, body symmetry and genes responsible for the formation of dauer, a stage of resistance of this worm. This practice will be also implemented by using RNAi in thermosensitive mutant of genes required for dauer formation. The goal will be to infer the genetic pathway which determine the decision of entering in the dauer lifestyle during early development of *C. elegans.* ruta genética que determina la decisión del modo de vida *daue*r durante el desarrollo de *C. elegans*.

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PRACTISE II. Analysis of conditional mutants in genes that control cell cycle in the fission yeast *S. po*mbe.

Summary

The objective of this practice is to introduce students to the mechanisms of cell cycle regulation. We will analyse a collection of thermosensitive mutants in genes governing different transitions during cell cycle progression. Through analysis of these mutants we will design gene pathways that explain the observed phenotypes and discuss the consequences of the deregulation of the mechanisms of cell proliferation control.