Máster en Iniciación a la Investigación en Ciencia y Tecnología de los Alimentos
62021 - Herramientas moleculares en Ciencia de los Alimentos

Guía docente para el curso 2013 - 2014

Curso: 1, Semestre: 2, Créditos: 3.0

Información básica

Profesores

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Recomendaciones para cursar esta asignatura

Actividades y fechas clave de la asignatura

Inicio

Resultados de aprendizaje que definen la asignatura

El estudiante, para superar esta asignatura, deberá demostrar los siguientes resultados...

1:
He/she knows and is able to differentiate between different methodologies used in molecular biology for the study of the bacterial behaviour in different environments of the food science.

2:
He/she has acquired critical ability to analyze the methodology and the results obtained in scientific articles related to Molecular Biology applied in Food Science, and to discuss their conclusions.

3:
He/she is able to design an experiment using adequate fluorescent markers for the study of the processes related with the bacterial response in a food environment.

4:
He/she is able to design an experiment to identify a genomic sequence of interest in Food Science.

5:
He/she is able to design a mutation in a bacterial organism of interest in food science.

6:
He/she is able to use different computer tools for experiment design and analysis.

7:

He/she is able to communicate in an oral presentation and a written work the steps for the study of a practical case related to the subject.

Introducción

Breve presentación de la asignatura

The main objective of the subject is the knowledge and dissemination of molecular tools applied to Food Science, concerning both research and food industry. The subject has a great correlation between the theoretical and practical contents. Thus, the student will integrate the tools of the subject in a research activity.

Contexto y competencias

Sentido, contexto, relevancia y objetivos generales de la asignatura

La asignatura y sus resultados previstos responden a los siguientes planteamientos y objetivos:

The main objective of this subject is the use and integration of different molecular tools. Therefore, the theoretical and practical contents have been coordinated. The theoretical classes are aimed to introduce the tools, their bases, advantages and disadvantages. As a complement, in the practical activities the student becomes familiar with these techniques and he/she can apply his/her theoretical knowledge for the design of experiments and analysis of results.

Contexto y sentido de la asignatura en la titulación

This subject is included in the “Master of Initiation to Food Science and Technology Research” which aims to provide with scientific and methodological background to deepen in that field. In this sense, we will use important molecular tools in the Biotechnology field with a promising future in Food Science. Given the multidisciplinary nature of this knowledge, our subject allows to complement other subjects of the Master, such as "Investigation of microorganisms in foods, water and environment", "Food Enzymology", "Detection and characterization of antimicrobial compounds in food", “Investigation of moulds and mycotoxins in food”, "Techniques and strategies for protein isolation and purification" or "Methodology for the study of bacterial inactivation and survival".

Al superar la asignatura, el estudiante será más competente para...

1:
To critically interpret and analyze scientific articles related to Molecular Biology in Food Science.

2:
To study the physiological changes in the microorganisms in different food environments.

3:
To identify the present organisms in food with Molecular Biology techniques.

4:
To create mutations in genes of interest in Food Science.

5:
To communicate scientific results in this field.

Importancia de los resultados de aprendizaje que se obtienen en la asignatura:

The acquired knowledge and the tools used in the subject will allow complementing the microbiological, genetic and molecular formation of the Master students. These matters are acquiring a great importance in Food Science, since they offer novel, economic and fast solutions to traditional problems. Thus, the students who attend this subject will extend their

qualification to occupy a position in R&D departments or in analytical laboratories of the food industry. In addition, the acquired tools will complement the research formation necessary for the accomplishment of a Ph.D. in Food Science. This knowledge will facilitate the acquisition and understanding of the new Molecular Biology techniques arising in the field and the transference to the Food Science field.

Evaluación

Actividades de evaluación

El estudiante deberá demostrar que ha alcanzado los resultados de aprendizaje previstos mediante las siguientes actividades de evaluacion

1:

Continuous evaluation:

ACTIVITY 1. Individual written activity. Design an experimental plan for the study of a practical case introduced by the lecturer. The application of the used tools in the classes will be needed to accomplish this objective (60% of the final mark).

The accomplishment of this activity will allow proving the achievement of the first six proposed learning results. The completion of this written work is considered compulsory. The grades will rank from 0 to 10 and will represent 60% of the final mark of the student in the subject.

2:

ACTIVITY 2. Oral presentation of the individual activity in which the student will explain the steps followed during the work, the obtained results and the possible explanations that can be made depending on the used methodology (40% of the final mark).

The completion of this activity will allow complementing the evaluation of the first six proposed learning results and to prove the acquisition of the seventh learning result. The completion of this written work is considered compulsory. The grades will rank from 0 to 10 and will represent 30% of the final mark of the student in the subject.

3:

Global evaluation:

The students not following the continuous evaluation will be evaluated by a global test. This will consist of the same activities that are included in the continuous evaluation. The qualification percentages of each activity and the criteria will be the same for the continuous evaluation and for the global one.

Evaluation criteria and demanded require

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EVALUATION ACTIVITY 1 (10%). The activity of the student will be evaluated during the classes, especially:

- Degree of autonomy
- Degree of initiative (for example, use of alternative and/or complementary tools)
- Active participation in the accomplishment of the experiments in laboratory.

EVALUATION ACTIVITY 2 (60%).

Approach to the problem and possible solutions (20%).

Appropriate use of the tools taught in the course (20%).

Bibliography: understanding, interpretation, correct data collection (20%).

EVALUATION ACTIVITY 3 (30%):

Exposition ability (organization of the materials, coherence, structure, etc.) (20%)

Discussion of the results (10%)

System of qualifications:

0-4.9: Fail (S).

5.0-6.9: Good (AP).

7.0-8.9: Very good (NT).

9.0-10: Excellent (SB).

The system of qualifications will be expressed by numerical marks in agreement with the Art. 5 of R.D. 1125/2003 (BOE 18 of September), that states the European system of credits and the system of marks in the official university degrees valid in all the national territory.

Actividades y recursos

Presentación metodológica general

El proceso de aprendizaje que se ha diseñado para esta asignatura se basa en lo siguiente:

The subject is structured in 5 participative lectures and 5 practical exercises that will be carried out in the computers room and in the laboratory. In addition, the approach and presentation of a research work will be made. For these activities the student will need 60 individual working hours. The lectures will be used to introduce the last techniques of Molecular Biology, focusing on their use in Food Science. In these lectures software tools for data analysis will be introduced. In the practical classes a problem will be introduced, with real data, for whose solution the use of the software introduced in the theoretical classes will be needed. In some cases, the student will have to collect these data by designing and making an experiment. The basic tools for the accomplishment of these activities will be available in the educational digital ring (Anillo Digital Docente: ADD).

Actividades de aprendizaje programadas (Se incluye programa)

El programa que se ofrece al estudiante para ayudarle a lograr los resultados previstos comprende las siguientes actividades...

1:

Lectures:

Topic 1. Introduction.

Estimated duration: 3 hours in-person (0.45 ECTS).

Contents:

-Context of the subject, historical importance of the new Molecular Biology techniques, advances, new methodological objectives.

- Basic aspects of Molecular Biology. Genetics: nucleotides, synthesis and structure. Proteomics: translation, post-translational modifications.

Topic 2. DNA Polymerase Chain Reaction (PCR).

Estimated duration: 3 hours in-person (0.45 ECTS).

Contents:

- DNA structure and synthesis: template, primer, enzyme and other components.

- DNA template: function, types, requirements.

- DNA primer: function, types, requirements.

- Enzyme: function, types, requirements.

- Other components: function, types, requirements.

- New PCR techniques: qPCR-RT.

- PCR applications in Food Science: identification of microorganisms by 16S sequencing (bacteria) or ITS (yeasts and moulds) identification of adulterations, frauds, etc.

Topic 3. Bioinformatics.

Estimated duration: 3 hours in-person (0.45 ECTS).

Contents:

- Databases of public access: Pubmed, Swiss-Prot.

- Tools for analysis of nucleic acid and protein sequences.

- Tools for analysis of DNA microarrays.

- Construction of phylogenetic trees.

- Design of primers for the PCR reaction.

Topic 4. Methods based on the fluorescence emission.

Estimated duration: 3 hours in-person (0.45 ECTS).

Contents:

- Basic knowledge.

- Detection systems: fluorescence microscopy and flow cytometry.

- Most used fluorescent probes.

- Applications in food science.

Topic 5. Cloning strategies and generation of mutant organisms.

Estimated duration: 3 hours in-person (0.45 ECTS).

Contents:

- Concept of gene.

- Genetic systems.

- Gene deletion and addition. Tools and reagents. Characteristic as a function of the organism.

- Creation of gene reporters. Green Fluorescent Protein (GFP). *lac* system. Variations. Detection.

- Opportunities in the use of mutant organisms in Food Science.

2:

Practical in-person classes

Practical class 1. Bioinformatics I.

Estimated duration: 3 hours in-person (0.45 ECTS).

Space: Computers room

Contents:

- Search and analysis of genomic sequences of different organisms.

- Design of DNA primers.

Practical class 2. Bioinformatics II.

Estimated duration: 3 hours in-person (0.45 ECTS).

Space: Computers room

Contents:

- Practical Case: analysis of microarray experiments. Study of results obtained in a real case of Food Microbiology. Comparisons with alternative techniques.

Practical class 3. Design of PCR experiments.

Estimated duration: 3 hours in-person (0.45 ECTS).

Space: Computers room and laboratory

Contents:

- Practical Case: PCR identification of microorganisms. Design of DNA primers for 16S ribosomal gene. Amplification of the 16S ribosomal gene. Sample preparation for sequencing.

Practical class 4. Fluorescence experiments.

Estimated duration: 3 hours in-person (0.45 ECTS).

Space: Computers room and laboratory

Contents:

- Practical case: study of cell viability by fluorescent probes. Experiment design. Data collection in the laboratory. *In silico* data analysis. Conclusions.

Practical class 5. Design of mutant organisms.

Estimated duration: 3 hours in-person (0.45 ECTS).

Space: Computers room

Contents:

- Practical case: creation of a specific mutant by an *in silico* program.

3:

Independent work.

A practical case will be introduced by the lecturer. To solve the case, the student will have to design synthetic organisms with the tools used in the course. After designing the constructions, the student will select a specific fluorescent probe to study the case. The student will speculate on the expected results and the limitations of the techniques.

4:

Oral presentation

After handing in the written work the student will defend the research project in an oral presentation in the classroom. The parameters to evaluate will be the clarity in the presentation and the organization of the work. Furthermore, the defense of the work will be evaluated by questions from the rest of the students and the lecturer.

This table indicates the in-person and dedication hours of the student to each activity.

ACTIVITY	IN-PERSON HOURS	FACTOR	DEDICATION HOURS	TOTAL
Lectures	15	0.5	7.5	22.5
Practical classes	15	0.5	7.5	22.5
Independent work and elaboration of report			25	25
Office hours			3	3
Evaluation			2	2
Total	**30**		**45**	**75**

Planificación y calendario

Calendario de sesiones presenciales y presentación de trabajos

The calendar of the Master and the program of the lectures and practical classes of the subjects will appear in the month of June in the website of the Faculty of Veterinary, in the following direction:

http://veterinaria.unizar.es/postgrado.php.

The lectures and practical classes will be carried out in the computers room of the Faculty of Veterinary (Zootechnics Building), in the Postgraduate seminar room of the Faculty of Veterinary (Zootechnics Building) and in the laboratory of Food Technology (Zootechnics Building).

Presentation of the work: 3 weeks after the end of the lectures and practical classes. It will be carried out in the Postgraduate Seminar room of the Faculty of Veterinary (Zootechnics Building).

The hours of tutorship will be previously agreed with the lecturer. In addition, not in-person office hours will be available through ADD e-mail.

Referencias bibliográficas de la bibliografía recomendada