

Degree programme	Type	Course
Microbiology	OB	3

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

It is recommendable to have studied or are studying Microbiology, Genetics, Molecular Biology of Eukaryotes, Virology and Molecular Biology of Prokaryotes.

Objectives

The primary goal of this course is to ensure that students can continue to design methods for the genetic manipulation of microorganisms.

During the course, the learning objectives are:

- Analyze various microbial vectors, assess their applications, and construct new ones.
- Implement cloning methodologies and strategies.
- Understand how each microorganism's characteristics (such as immune systems, recombination abilities, and other functions) affect the experimental design.
- Choose the most appropriate genetic transfer technique for each case.
- Develop effective strategies for the generation, enrichment, and selection of mutants.
- Create genetic fusions and understand their diverse applications.
- Identify the key features of bacterial targets for drug development, vaccines, and diagnostic tests.

Learning outcomes

- CM11 (Propose strategies for molecular cloning, mutant generation and genetic improvement using omics analysis with ethical responsibility and gender perspective to provide innovative responses to the needs and demands of society.) Propose strategies for molecular cloning, mutant generation and genetic improvement using omics analysis with ethical responsibility and gender perspective to provide innovative responses to the needs and demands of society.
- CM12 (Integrate knowledge and skills of molecular biology and genomics to develop and present academic work in the field of microbiology, either in English or in one's own language or others and working individually and in groups.) Integrate knowledge and skills of molecular biology and genomics to develop and present academic work in the field of microbiology, either in English or in one's own language or others and working individually and in groups.
- KM18 (Identify the methods of study of nucleic acids for their sequencing, modification and interpretation of their expression products.) Identify the methods of study of nucleic acids for their sequencing, modification and interpretation of their expression products.
- SM15 (Use bibliography and databases related to molecular biology and genomics, both in English and in one's own language.) Use bibliography and databases related to molecular biology and genomics, both in English and in one's own language.
- SM16 (Relate the factors that control the different levels of gene expression with adaptation to existing environmental conditions and their application in biotechnology.) Relate the factors that control the different levels of gene expression with adaptation to existing environmental conditions and their application in biotechnology.
- SM18 (Relate the processes of transfer and conservation of genetic information with its diverse applications in genetic engineering.) Relate the processes of transfer and conservation of genetic information with its diverse applications in genetic engineering.

Contents

The content of the course consists of the following topics:

Unit 1. DNA introduction systems in bacteria. Natural transformation in gramnegative and grampositive bacteria. State of competence. Molecular mechanisms associated with natural transformation. Induced transformation. Electrotransformation. Design and optimization of transformation systems in bacteria lacking natural transformation. Other Systems of DNA transference.

Unit 2. DNA vectors and cloning strategies in bacteria. Requirements of cloning vectors. Expression vectors. T-type vectors. Mobilizable vectors. Suicide vectors. Shuttle vectors. Integrational vectors. Genetic characteristics of vector accepting cells. Construction of DNA libraries *in vitro* and *in vivo*. Cloning by complementation: anabolic or catabolic genes. Regulatory gene isolation methods. Obtaining virulence genes. Cloning of toxic genes.

Unit 3. Bacterial gene fusions. Transcriptional and translational fusions. Gene fusions in polycistronic units. Fusion vectors: general characteristics. Random gene fusions. Methods for the construction of gene fusions. Construction of gene fusions by PCR, OE-PCR and Gibson assembly. Applications and examples of gene fusions.

Unit 4. Mutagenesis in bacteria. Random mutagenesis *in vivo*. Use of chemical or physical methods. Criteria and methods for the selection and enrichment of mutants. Transposons. Minitransposons. Plasposons. Transposomes. Methods for the identification and confirmation of mutants. *In vitro* mutagenesis of cloned genes.

Unit 5. Gene substitution in bacteria and generation of knockouts. Obtaining mutants by gene disruption and by gene substitution. Lambda Red system. Obtaining scarless mutants. Counter selection systems. I-SceI system. Use of CRISPR/Cas9 technology to obtain mutants. Methods for the identification and confirmation of mutants. Systems for the reintroduction of altered genes in the bacterium of origin. Insertion into the chromosome of new genes or constructs.

Unit 6. Application of omics to the genetic engineering of microorganisms. Sequencing and NGS. Transcriptomics. Proteomics. The metaomics' strategies: metagenomics, metatranscriptomics, metabolomics.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Seminars	14	0.56	CM11, CM12, KM18, SM15, SM16, SM18
Tutorship	1	0.04	CM12
Reading recommended texts	15	0.6	SM15
Preparation of posters and questionnaires	38	1.52	CM11, CM12, KM18, SM15, SM16, SM18
Study	50	2	CM11, CM12, KM18, SM16, SM18
Participatory Master Classes	30	1.2	CM11, CM12, KM18, SM15, SM16, SM18

The course is organized in two modules:

Theoretical module: where participatory masterclasses are combined with problem-based learning sessions where theoretical concepts are worked through the resolution of practical cases.

Seminar Module: through collaborative learning, students analyze different aspects of experimental designs found in current scientific articles. At the beginning of the course, following the guidelines set by the teaching staff, students choose a project related to the field of genetic engineering of microorganisms, which they will use to create a poster. The schedule of activities-defining the classroom work sessions, the presentation and debate of the work done, as well as the submission deadlines for the proposed tasks-will be provided by the teaching staff at the start of the course.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Participation in the classroom	10%	0	0	CM12, SM16, SM18
Written test (resolution of practical cases)	40%	2	0.08	CM11, CM12, KM18, SM15, SM16, SM18
Seminars	50%	0	0	CM11, CM12, KM18, SM15, SM16, SM18

Seminar module evaluation

The assessment of the seminars is carried out through the evaluation of different activities related to a project from which a poster will be developed. The following will be assessed:

- a) The initial and follow-up submissions, with a maximum grade of 2 points out of 10.
- b) The poster, with a maximum grade of 5 points out of 10.
- c) The defense of the poster during the classroom presentation, with a maximum grade of 2 points out of 10.
- d) The self-assessment, with a maximum grade of 1 point out of 10.

To pass this assessment module, the student must obtain a grade equal to or higher than 5.

Theoretical module evaluation

The assessment for this activity is carried out through a written individual exam, which will account for 80% of this module.

During the theoretical module sessions, assessment activities worth up to 20% of this module may be conducted.

To pass this module, it is necessary to obtain a score of 5 points or higher.

If the grade obtained in the written individual exam is less than 5, a make-up exam may be taken.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two-thirds of the final score of the course or module.

Students who have passed the module may submit to a grade improvement test waiving the grade obtained previously in the individual written exam. The scheduled date for the second chance test is that of the second chance examination. Students wishing to take the grade improvement test must communicate it by mail to the teacher responsible for the subject at least 72 hours before the day scheduled for the second chance examination.

The final grade of the course will be the average of the grades obtained in both modules, being necessary to have passed separately each of them.

The student will be graded as "Non-evaluable" if the weight in of all conducted evaluation activities is less than 67% of the final score.

Single assessment

The evaluation of the theoretical module consists of a single test that will be the same as that of the type of continuous assessment, this test will account for 50% of the final grade for the subject and the same system of evaluation will be applied for the recovery than for continued evaluation.

The evaluation of the activities of the seminar module will mean 50% of the final grade for the subject. The students who take advantage of the single evaluation may deliver all the evidence together (including the oral presentation) on the same day as the one set for the synthesis test. The single assessment test will be carried out coinciding with the same date set in the calendar for the last continuous assessment test.

Use of AI

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as literature or information searching, text correction, translations, etc. Students must clearly identify which parts have been generated using this technology, specify the tools used, and include a critical reflection on how they influenced the process and the final result of the activity. A lack of transparency regarding the use

of AI in this evaluable activity will be considered a lack of academic honesty and may result in a partial or total penalty on the activity's grade, or more severe sanctions in serious cases.

The commission of any irregularity in an evaluation activity (academic fraud, plagiarism, or improper use of AI, unless such use is expressly authorized in the course guide), which may lead to a significant variation in the grade, means that this activity will be graded with a 0. In the event that the course guide stipulates that obtaining a minimum grade in this evaluation activity is an essential requirement to pass the course, or if several irregularities occur in the evaluation activities of the same course, the final grade for the course is 0. Regardless of this, a disciplinary proceeding may be initiated against the student who incurs any of these irregularities.

Bibliography

As reference bibliography of basic concepts it is recommended:

Larry Snyder i Wendy Champness. Molecular Genetics of Bacteria (3rd or 4th Edition). ASM press (ISBN: 978-1-55581-399-4 and ISBN:978-1-55581-627-8).

https://bibcercador.uab.cat/permalink/34CSUC_UAB/15r2rl8/cdi_askewsholts_vlebooks_9781118685112

Jeremy W. Dale and Simon F. Park. Molecular Genetics of Bacteria, (5th Edition) Wiley-Blackwell (ISBN: 978-0-470-74184-9).

Other recommended texts as well as links of interest will be available to the student in the Moodle classroom of the subject.

Software

There is no specific software for this subject

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	73	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	731	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	732	Spanish	second semester	morning-mixed