Universitat Autònoma de Barcelona

2017/2018

Molecular Microbiology

Code: 100952
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OB	2	2

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

+ Students are advised to review the scientific-technical content on which this subject is based
+ It is advisable to take this course once all the subjects programmed in the first and second years of the Degree of Microbiology have been studied, especially the subjects of Microbiology, Genetics, Molecular Biology of Eukaryotes and Virology, since it is essential to have reached the competences of all of them to reach those associated to the subject of Prokaryotic Molecular Biology.

Objectives and Contextualisation

It is a compulsory subject of the Biotechnology Bachelor, which introduces students to the knowledge of Molecular Biology of Prokaryotes. This subject is fundamental in the formation of the student since it enables him to understand the functioning of prokaryotes at the molecular level, allowing an understanding of the potential of microorganisms at the productive level as well as their possible applications.
The specific objectives to be achieved in this subject are the following:
• Know how to identify at the molecular level the mechanisms and microbiological processes
• Know how to identify the structure of the prokaryotic genetic material, know its mechanisms of replication and repair as well as the organizational variability they present and the relationship between these mechanisms and the cell cycle.
• Recognize the factors that control gene expression in prokaryotes and relate them to existing environmental conditions.
• To know the molecular mechanisms existing in prokaryotic organisms to control the entry of exogenous genetic material.
• Know the different genetic elements existing in prokaryotes, their distribution capacity and control systems for expression of the genes they include.
• Recognize the molecular basis of antibiotic resistance, its origins, transmission mechanisms and the impact they have on infectious processes.

Skills

- Describe the molecular, cellular and physiological bases of the organisation, functioning and integration of living organisms in the framework of their application to biotechnological processes.
- Interpret experimental results and identify consistent and inconsistent elements.
- Reason in a critical manner
- Work individually and in teams

Learning outcomes

1. Describe the molecular, cellular and physiological bases of the organisation, functioning and integration of microorganisms in the framework of their application to biotechnological processes.
2. Interpret experimental results and identify consistent and inconsistent elements.
3. Reason in a critical manner
4. Work individually and in teams

Content

The subject is organized in two distinct parts
• Participatory theoretical classes
• Resolution of practical cases, in which the theoretical concepts developed in the theoretical classes will be applied for the resolution of problems and real cases of the subject matter.
The content of the subject consists of the following subjects:

Lesson 1. The bacterial coromosoma. Structure of the bacterial chromosome. Start replication. Replication, termination and segregation of the bacterial chromosome. Cellular division. The bacterial cell cycle.
Lesson 2. Gene Expression in Prokaryotes I. Structure of bacterial promoters. Monocistronic and polycistronic RNAs. Start and elongation of the bacterial transcript. Bacterial transcription terminators. Degradation of the mRNA. Transcription in archaea. Transcriptional attenuation and regulation of transcription.
Lesson 3. Gene expression in prokaryotes II. Global modulators of gene expression. Multigenic networks. Stressful response. Repression by catabolite. Positive and negative transcriptional regulation. Transcriptional regulators. Bacterial operons. Posttranscriptional regulations. Regulones. Regulatory RNAs.
Lesson 4. Mutagenesis and DNA repair systems in bacteria. Conditional lethal mutations. Suppressor muttations. Mismatch repair. Photoreactivation. Reparation by excision. Adaptive response to alkylating agents. Emergency repair response or SOS system.
Lesson 5. Bacterial Restriction. DNA restriction and modification systems. Types of restriction enzymes. In vivo regulation of restriction-modification. Mcr / Mrr System
Lesson 6. The bacterial-bacteriophage cell system. Attenuated and lytic bacteriophages. Lambda and P22 bacteriophages as attenuated bacteriophage models. Restricted and generalized transduction. Phage conversion.
Lesson 7. Mobile genetic elements inbacteria. Insertion sequences. Transposons. Transposition mechanisms and their regulation. Mutagenesis with transposons. Mobile pathogenicity islands. Integrones. Other Mobile genètic elements.
Lesson 8. Plasmids and conjugation. Molecular structure and property of plasmids. Mechanisms of maintenance. Aggregation and cointegration of plasmids. Replication. Incompatibility groups. Plasmid conjugation in Gram-negative and Gram-positive cells. Mobilization of the bacterial chromosome. Other conjugative elements (ICEs). Importance of the conjugative elements in the evolution of the microbial world.
Lesson 9. Transformation. Natural transformation. Competence state. Molecular mechanisms associated with natural transformation. Induced transformation.

Lesson 10. Mechanisms of antimicrobial resistance. Plasmid resistance. Chromosomal resistance. Mechanisms of antimicrobial inactivation. Synthesis of alternative enzymes. Resistances by alternative metabolic pathways. Modifications of cellular structures by plasmid enzymes. Mechanisms of distribution of plasmid resistances.

Methodology

The subject of Molecular Microbiology consists of two modules of activities:
Theoretical module: composed of participatory master classes.
Case studies module: consisting of sessions in which practical cases and problems will be solved.
These classes are sessions with a reduced number of students with the dual mission of:
A) To facilitate the understanding of the knowledge exposed in the theoretical classes. The resolution of practical cases should enable the student to integrate theoretical knowledge with practical aspects.

B) To train the student to design basic experiments associated with the subject of the subject and to know how to interpret the obtained data.
At the beginning of the course the student will receive a dossier with a proposal of problems that must be developed during the course. The sessions of this module deal with methodological aspects and solve some of the problems of the dossier.
Throughout the course will be hanging in the virtual campus problems of the various subjects of the program so that the student can work autonomously. After 10 days from the publication of these problems, will be hung on the virtual campus their solutions so that the work can be checked.
With the aim that the concepts to be used in the sessions of resolution of practical cases are always coordinated with the contents already developed in the theory classes, in certain moments of the course reordering and / or exchanges between the classes of theory and problems. The autonomous activities of this subject are: study, reading of texts and resolution of problems. Finally, the student also has individual tutorials, which will be held in the office C3-421 in hours previously agreed.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Participatory master classes	32	1.28	1, 3
Practical cases resolution	18	0.72	1, 2, 3, 4
Type: Supervised			
Individual tutorials	1	0.04	1, 2
Type: Autonomous			
Autonomous practical cases resolution	30	1.2	1, 2, 3, 4
Reading of recommended texts	5	0.2	1
Study	58	2.32	1, 2, 3

Evaluation

The evaluation of the course will be individually through two written tests in
those the student must prove their level of theoretical concepts achievement through solving problems.
The first test will take place in the middle of the semester and will include the concepts developed up during theoretical sessions be resolution of practical cases. The second will be held at the end of the semester and will include all the concepts studied in the lectures through solving problema. The final assessment will be the average of the results obtained in both tests as long as partial none of them has received a rating of less than 4. This average will necessarily be equal or greater than 5.

If it is lower, the student must submit to a recovery examination at which could
choose to be examined of the whole subject or that it has obtained the lowest qualification. The final qualification will be determined by the average of the marks obtained in the recovery exam with that obtained in which it has not been repeated. To pass the course, this average must be equal to or greater than 5.
Students who have not passed the value of any of the two partial tests or any of them, shall examine the pending partial the recovery day. If the recovery is made by the two partials the final rating will be that obtained in the final exam which must be at least 5 in order to pass the course.
Students who have completed the course through the exams may be submitted to a note improving test to be held on the date scheduled for the test of recovery.
The presentation to this test could be improved by grade material corresponding to a single part or both and involve the waiver previously obtained qualification in partial exams. If the improvement is for two partial the

final grade for the course will be achieved in this test and it must be equal or greater than 5.If the improvement is only by a partial qualification of the subject the final course qualification will be the average obtained with the unrecovered exam. Students wishing to improve test whether a note or for both partials will notify the teacher responsible for the course in writing at least 72 hours prior scheduled for the assessment of recovery.
Due to limitations on the granting of honors, we will be able to schedule tests specifically for this purpose.That student has not participated in 50% of the planned evaluation activities, receive No rating assessable.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Written exams	100% of the total of the subject	6	0.24	1, 2, 3, 4

Bibliography

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

Jeremy W. Dale i Simon F. Park. **Molecular Genetics of Bacteria, (5th Edition)**

Wiley- Blackwell (ISBN: 978-0-470-74184-9)

All bibliography related with the matter will be avalaible through the Campus Virtual.