

**1. General information****Course:** MOLECULAR BIOLOGY**Type:** CORE COURSE**Degree:** 402 - UNDERGRADUATE DEGREE PROGRAMME IN BIOTECHNOLOGY**Center:** 601 - E.T.S. AGRICULTURAL ENGINEERS AND MOUNTS AB**Year:** 2**Main language:** Spanish**Use of additional languages:** English**Web site:****Code:** 60613**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 10**Duration:** First semester**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** ANGELA RUBIO MORAGA - Group(s): 10

| Building/Office | Department | Phone number | Email | Office hours |
|------------------------------|--|--------------|----------------------|----------------------|
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2. Pre-Requisites

They have not been established but it is highly recommended to have studied "Biomolecular Chemistry", "Cellular and Tissue Biology" and "Biology"

3. Justification in the curriculum, relation to other subjects and to the profession

Molecular Biology is a discipline that is in continuous development, in which our knowledge has advanced enormously, although there are still many processes that are not fully resolved. The study of cellular structures from the point of view of their molecular constituents, in particular protein and nucleic acid molecules, has allowed us to understand the processes of regulation of genetic expression, the cellular response to DNA damage, etc. The skills and knowledge provided by this subject are essential to establish the basic principles of molecular components and communication processes and the flow of information in both prokaryotes and eukaryotes. The contents of the subject have direct or indirect applications in professional areas such as basic research, molecular diagnosis, the pharmaceutical and agri-food industries, and any biotechnological activity. Molecular Biology is essential to understand the experimental basis of the concepts that will be taught in other subjects, particularly Genetic Engineering (third year), but also in all other subjects related to molecular biology and Biotechnology.

4. Degree competences achieved in this course**Course competences**

| Code | Description |
|------|---|
| CB01 | Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge. |
| CB02 | Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area. |
| CB03 | Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues. |
| CB04 | Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences. |
| CB05 | Have developed the necessary learning abilities to carry on studying autonomously |
| CE09 | Apply and develop methodologies derived from molecular biology and genetic engineering. |
| CG01 | Organizational and planning skills. |
| CG02 | Capacity for analysis and synthesis. |
| CG03 | Ability to work in multidisciplinary teams collaboratively and with shared responsibility. |
| CG05 | Ability to apply knowledge in practice. |
| CT01 | Know a second foreign language. |
| CT02 | Know and apply the Information and Communication Technologies. |
| CT03 | Use correct oral and written communication. |
| CT04 | Know the ethical commitment and professional deontology. |

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Know the fundamentals of the responses of microorganisms to stress conditions and some of the adaptations of organisms to extreme environments, along with examples of biotechnological applications

Understand the need for expression regulation in eukaryotic cells.

Know the plant metabolism and main metabolic pathways.

Know the different gene regulation strategies of eukaryotic organisms.

Know the proteins involved in gene expression and its regulation.

6. Units / Contents**Unit 1: Tools and techniques in Molecular Biology**

Unit 2: Genomes and the flow of biological information
Unit 3: Structure and function of chromosomes
Unit 4: Transcription
Unit 5: Transcription regulation
Unit 6: RNA processing
Unit 7: Translation
Unit 8: Regulatory RNAs
Unit 9: Protein modification
Unit 10: Plant secondary metabolites
Unit 11: Plant metabolic pathways
Unit 12: Responses of microorganisms to stress conditions
Unit 13: Adaptations of organisms to extreme environments

| 7. Activities, Units/Modules and Methodology | | | | | | | |
|--|----------------------------------|--|--------------------------------------|-------|----|-----|--|
| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
| Class Attendance (theory) [ON-SITE] | Lectures | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 1 | 25 | N | - | In the master classes, the teaching staff will explain the fundamental contents of each subject of the program and will point out the activities associated with it. |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 0.8 | 20 | Y | Y | All students will carry out the laboratory practices corresponding to the subject. The realization of the practices are NOT repeatable, however they are recoverable. In the ordinary call, a procedural test of the practices will be carried out. In this test, the students will have to respond individually to questions related to the practices. To make an average with the different evaluable training activities, the student must obtain a grade equal to or greater than 4. The student who obtains a grade lower than 4, may recover this part in the Extraordinary call |
| Group tutoring sessions [ON-SITE] | Group tutoring sessions | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 | 0.2 | 5 | N | - | Group work and transversal activities |
| Formative Assessment [ON-SITE] | Assessment tests | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 0.2 | 5 | Y | Y | The student will have the opportunity to take two partial tests to remove theoretical content in in the ordinary call |
| Study and Exam Preparation [OFF-SITE] | Self-study | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 2.6 | 65 | N | - | Autonomous work by the student to be able to acquire the knowledge that enables them to acquire the skills of the subject |
| Writing of reports or projects [OFF-SITE] | Self-study | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 1 | 25 | N | - | Autonomous work at home to develop and prepare activities such as workshops or seminars and group tutorials |
| Workshops or seminars [ON-SITE] | Workshops and Seminars | CB01 CB02 CB03 CB04 CB05 CE09 CG01 CG02 CG03 CG05 CT01 CT02 CT03 CT04 | 0.2 | 5 | Y | N | Exhibition and information search work |
| Total: | | | 6 | 150 | | | |
| Total credits of in-class work: 2.4 | | | Total class time hours: 60 | | | | |
| Total credits of out of class work: 3.6 | | | Total hours of out of class work: 90 | | | | |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

| 8. Evaluation criteria and Grading System | | | |
|---|-----------------------|----------------------------|--|
| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
| Theoretical papers assessment | 10.00% | 10.00% | The different works presented by the students will be evaluated through direct observation and/or forms and/or delivery of works. There is no minimum grade in this evaluation system to be able to make a weighted average with the rest |
| | | | A procedural test will be carried out on the contents dealt with in each of the practical sessions carried out in the ordinary call. To make an average with the rest of the evaluation systems, it is also a requirement to obtain a grade equal to or greater than 4. The student will have another opportunity in the extraordinary |

| | | | |
|---------------------|----------------|----------------|--|
| Laboratory sessions | 20.00% | 20.00% | call. The realization of the laboratory practices in the continuous evaluation is recoverable but NOT repeatable. In the non-continuous evaluation, the student who has not done the practices will have the opportunity to take a laboratory test and/or a procedural test on the contents covered in the practical sessions on the day of the ordinary call. To make an average with the rest of the evaluation systems, it is also a requirement to obtain a grade equal to or greater than 4. The student will have another opportunity in the extraordinary call with the same requirements as in the ordinary one. The note of this section will be kept for two academic years in case of not passing the subject when making the weighted average of the evaluation systems and not reaching 5.00 |
| Test | 70.00% | 70.00% | The student in the continuous call, may ask the teacher to be able to eliminate matter through two partial tests that will constitute 45% of the theory section, thus leaving 25% for the ordinary call (70% theory). A request will be carried out through a form posted on the Virtual Campus Forum, published in a timely manner. The weighted average of the three tests in the "Theory" section will be carried out. In turn, the weighted average can be made with the rest of the evaluation systems, if the weighted average of the theory is equal to or greater than 4. In the case of obtaining less than 4, the student will have the opportunity to go to the extraordinary call with 70% corresponding to the theoretical content. To make an average with the rest of the evaluation systems, it is also a requirement to obtain a grade equal to or greater than 4 in the extraordinary call. The student who chooses the non-continuous evaluation will have the opportunity to go to the ordinary and the extraordinary call to be able to be evaluated of the 70% that corresponds to the section of evaluation of theoretical contents. To make an average with the rest of the evaluation systems, it is also a requirement to obtain a grade equal to or greater than 4. |
| Total: | 100.00% | 100.00% | |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The final grade for the course will be calculated taking into account the percentages in the table above. It is necessary to obtain a grade equal to or greater than 4.00 in the practical evaluation system and test (theory) to be able to make a weighted average with the 3 evaluation systems. The subject will be passed when the weighted average of the grade obtained with the 3 evaluation systems is equal to or greater than 5.00.

The contents and/or specific sections of this guide may be modified if the social and health situation due to the pandemic requires it. In any case, students will be notified of said changes through the virtual campus.

Non-continuous evaluation:

Students may opt for non-continuous evaluation as long as they have not participated in 50% of the evaluation or have finished the school period. If this change is not communicated, it is understood that the student remains on the continua. To communicate the change to non-continuous evaluation, the student will fill out a form that will be posted after the second partial test and before the ordinary call on the virtual campus. In the case of not completing this form on time, the mark of the partial tests will be taken into account with the mark obtained or with a zero in case of no show.

The final grade for the course will be calculated taking into account the percentages in the table above. It is necessary to obtain a grade equal to or greater than 4.00 in the practice and test (theory) section in order to make a weighted average with the 3 evaluation systems. The subject will be passed when the weighted average of the grade obtained with the different evaluation systems is equal to or greater than 5.00.

The contents and/or specific sections of this guide may be modified if the social and health situation due to the pandemic requires it. In any case, students will be notified of these changes through the virtual campus.

Specifications for the resit/retake exam:

The same criteria as for the ordinary call will be followed.

The grades obtained in the different theoretical tests, carried out throughout the course and in the ordinary call will not be kept for the extraordinary call.

The qualifications of the practical activities (resolution of problems or cases and laboratory practices) and theoretical works will be maintained for two successive courses.

The contents and/or specific sections of this guide may be modified if the social and health situation due to the pandemic requires it. In any case, students will be notified of these changes through the virtual campus.

Specifications for the second resit / retake exam:

Only students who meet the requirements set out in the Student Assessment Regulations of the University of Castilla-La Mancha may access this call. This evaluation will consist of a compulsory test that will account for 100% of the final grade for the subject, the test will consist of a theoretical part that will account for 80% of the grade and another practical part in the laboratory that will account for 20% of the final grade. The student will have to get a grade greater than or equal to 4 to make the weighted average between theory and practices. The subject is passed if the weighted average grade between both parts is greater than or equal to 5.

| 9. Assignments, course calendar and important dates | |
|--|-------|
| Not related to the syllabus/contents | |
| Hours | hours |
| Unit 1 (de 13): Tools and techniques in Molecular Biology | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3.5 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 20 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |

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|---|--------------|
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 2 (de 13): Genomes and the flow of biological information | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .18 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 1 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 3 (de 13): Structure and function of chromosomes | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 4 (de 13): Transcription | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 5 (de 13): Transcription regulation | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 6 (de 13): RNA processing | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 7 (de 13): Translation | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 8 (de 13): Regulatory RNAs | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 9 (de 13): Protein modification | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 10 (de 13): Plant secondary metabolites | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |

| | |
|--|--------------|
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .5 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .42 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .44 |
| Unit 11 (de 13): Plant metabolic pathways | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 3 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .52 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .4 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 12 (de 13): Responses of microorganisms to stress conditions | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Unit 13 (de 13): Adaptations of organisms to extreme environments | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 1.5 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | .38 |
| Formative Assessment [PRESENCIAL][Assessment tests] | .38 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 2 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | .38 |
| Global activity | |
| Activities | hours |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 20 |
| Writing of reports or projects [AUTÓNOMA][Self-study] | 25 |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 25 |
| Formative Assessment [PRESENCIAL][Assessment tests] | 5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 65 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | 5 |
| Workshops or seminars [PRESENCIAL][Workshops and Seminars] | 5 |
| Total horas: 150 | |

| 10. Bibliography and Sources | | | | | | |
|---|---|---------------------------------|------|-------------------|------|-------------|
| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
| Craig, N., Cohen-Fix, O., Green, R., Greider, C., Storz, G., Wolberger, C. | Molecular Biology: Principles of Genome Function | Oxford | | 978-0199658572 | 2014 | |
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