

# Teaching guide

## IDENTIFICATION DETAILS

|                                      |                                       |               |      |
|--------------------------------------|---------------------------------------|---------------|------|
| Degree:                              | Biotechnology                         |               |      |
| Field of Knowledge:                  | Science                               |               |      |
| Faculty/School:                      | Experimental Science                  |               |      |
| Course:                              | INTEGRATED LABORATORY III             |               |      |
| Type:                                | Compulsory                            | ECTS credits: | 6    |
| Year:                                | 3                                     | Code:         | 2036 |
| Teaching period:                     | Sixth semester                        |               |      |
| Area:                                | Work Placement                        |               |      |
| Module:                              | Experimental Methods in Biotechnology |               |      |
| Teaching type:                       | Classroom-based                       |               |      |
| Language:                            | English                               |               |      |
| Total number of student study hours: | 150                                   |               |      |

| Teaching staff                 | E-mail                   |
|--------------------------------|--------------------------|
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## SUBJECT DESCRIPTION

The subject of Integrated Laboratory III aims to give students a solid training in lab work in order to provide them

with a better access to the labour market, and also to further their theoretical education as a part of the degree course.

The Laboratory Course III aims to solidly train the student in basic Molecular, Cellular Biology and Biochemical Engineering techniques in order to consolidate the degree's theoretical contents, as well as to facilitate the student's access to the job market.

The Laboratory III is a compulsory, 150 hours semester course that is taught during the third year of the Biotechnology Degree. This course is part of the subject Practicum, which belongs to the Experimental Methods in Biotechnology module. The lab work has been designed as real-life, professional experimental situations, in view of the contents of the different subjects taken during the 3rd year of the Biotechnology degree, and it will be held in the University labs. The course is intended to provide the students not only with the basic laboratory skills needed in a biotechnology or a bioscience lab, but also with other personal qualities such as critical thinking, teamwork or experimental accuracy, which are essential in the research practice.

## GOAL

Gain the basic knowledge required, along with the essential skills, to work in a biotechnology or bioscience lab in the context of a scientific project and acquire critical thinking.

The specific aims of the subject are:

Understand and perform cell culture techniques

Understand and perform cell and molecular biology techniques such as protein expression, Western blot, immunofluorescence...

Integrate all these techniques into the context of a scientific project

Develop critical analysis of the results

Lab organization and biosecurity rules

Presentation and public defense of the results

Learn how to work as a team in the lab

## PRIOR KNOWLEDGE

The knowledge acquired during the previous degree courses is required for the Lab Course III

## COURSE SYLLABUS

1. Transfection-based exogenous gene expression in mammalian cells. Evaluation of transfection efficiency by fluorescence microscopy.
2. Learning the basics of Epithelial-Mesenchymal Transition (EMT) by using cellular systems:
  - Cell migration studies: transwell.
  - Analysis of the subcellular localisation of EMT-related markers by fluorescence microscopy.
  - Expression analysis of EMT-related markers by Western blot.
  - Cell proliferation assays.
3. Molecular identification of yeast. RFLP (Restriction Fragment Length) analysis.
4. Grape-juice microfermentations by different yeast strains: harvesting, biomass and pH measurements, reducing sugar assessment, ethanol concentration and total acidity analysis.

## EDUCATION ACTIVITIES

**PRACTICAL SESSIONS:** The students will perform different experiments in the laboratory under the instructor supervision. They will use the experimental and theoretical knowledge acquired during the previous Biotechnology degree courses. A lab guide outlining the different lab sessions to be performed during the course will be supplied to the student beforehand. During and after completion of the lab sessions the student should also document all the experimental progress as well as the initial analyses, interpretation of the experiments and significant conclusions in the lab notebook.

**LABORATORY SEMINARS** Work sessions in the classroom or in the lab, conducted by the instructor, in which the students will be asked to present and discuss the results obtained during the practical laboratory session.

**TUTORIALS:** Tutorial sessions can be organized by the instructor when required by the student, following the scheduled hours. During these sessions the student can raise questions or discussions related to the lab sessions. The tutorials will guide the students throughout the learning process and help them to gain a deep understanding of the subject.

**Lab III WEBSITE:** The website facilitates the instructor-student communication and supports the lab-based activity, providing the student with information about the course, as well as additional material and media to improve the learning process.

## DISTRIBUTION OF WORK TIME

| CLASSROOM-BASED ACTIVITY   | INDEPENDENT STUDY/OUT-OF-CLASSROOM ACTIVITY   |
|--|---|
| 70 hours   | 80 hours  |
| Practical classes: exercises, practical cases and experimental work carried out in the laboratory<br><br>Seminars, round tables, workshops, tutorials, debates<br>Evaluation | Autonomous study: theoretical study and preparation of face-to-face activities.<br>Virtual network work |

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## SKILLS

### Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

### General Skills

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

To have acquired the ability for analytical, synthetic, reflective, critical, theoretical and practical thought.

To be able to plan time effectively.

To foster a concern for knowledge as a key tool in the personal and professional growth process of a student.

To develop capacity for and a commitment to learning and personal development.

To develop oral and written communication skills.

To understand the fundamental laws and principles of physics, mathematics, chemistry and biology as the foundation for the mental structure of a biotechnician.

To acquire the skills needed for experimental work: design, preparation, the compilation of results and the obtainment of conclusions, understanding the limitations of an experimental approach.

### Specific skills

To understand the mathematical and physical foundations of the basic instrumental techniques of use in a biotechnology experimentation laboratory.

To be able to apply the most widely used instrumental techniques in a biotechnology experimentation laboratory: chromatography, electrophoresis, absorption, cytometry, purification and quantification of macromolecules, centrifugation, etc.

To work suitably in a laboratory with biological material (bacteria, fungi, viruses, animal and plant cells, plants and animals) and with regard to the safety, handling and disposal of biological waste.

To be able to design and suitably execute an experimental protocol based on theoretical knowledge in a host of subjects.

To be familiar with and apply the rules and general principles of health and safety in laboratories.

To organise and suitably plan work in the laboratory.

To identify and define laboratory instruments and materials.

To be able to describe, quantify, analyse and critically assess the results of experiments performed in the laboratory.

To be able to approach a subject by means of rigorous, profound and comprehensive thought.

Capacity for written and oral communication of the knowledge acquired.

To be able to apply the theoretical knowledge acquired for solving problems and practical cases linked to the various subjects.

To be able to assess the knowledge acquired.

## LEARNING RESULTS

Acquire safe laboratory practices.

Correctly identify and handle the regular tools and materials in the lab such as electrophoresis and protein transfer systems, incubator, inverted and immunofluorescence microscope, ELISA plate reader or tissue culture hood among others.

Subculture of mammalian cells and exogenous gene expression.

Evaluate cell migration abilities of mammalian cells and the cell proliferation abilities of different cell lines.

Protein expression and subcellular localisation analyses.

Molecular identification of different yeast strains.

Perform and analyse alcoholic yeast fermentation.

Employ the fundamentals and concepts acquired during the lab sessions in order to infer the results.

Draw conclusions from experimental results.

Elaborate a lab notebook to document the experiments, as well as any observations or insights.

Oral presentation of the experimental results.

Interpretate obtained results, both orally and in writing

## LEARNING APPRAISAL SYSTEM

Both attendance and active participation in the lab sessions will be considered for the course evaluation. Attendance to all practical sessions is mandatory and essential to be eligible for the final exams. Non-attendance to any of the lab sessions without the corresponding justification will result in not passing the course. Arriving more than 15 minutes late to the lab for two days will count as a non-justified absence, implying not passing the course. Each student must keep a lab notebook updated on the work done in the laboratory. This notebook may be revised by the teacher at any time during the practical sessions. This course will be passed by getting a grade equal or higher to 5 (out of 10) which could be obtained by:

**1.- Oral communication skill (15%)** This activity will be evaluated during the seminar sessions. A minimum grade of 4.5 out of 10 will be necessary to consider the work for the global average.

**2.- Experimental work (50%)** This practical work will be assessed by a practical exercise at the end of the course. The practical work will take into account the work undertaken and results achieved in the laboratory (20%) and the submission of a final report on the experiment (30%). A minimum grade of 4.5 out of 10 will be necessary to consider the work for the global average.

**3.- Final written examination (35%)** This will be carried out at the end of the course and will comprise questions and problems related to the practical laboratory sessions. A minimum grade of 4.5 out of 10 or higher will be necessary to pass the course. The exams will be face-to-face as long as the health situation allows it.

The parts with a minimum grade of 4.5 out of 10 or higher will be kept to the second call. Students in 2nd or successive enrollments must contact the teacher to request to take advantage of this system. Plagiarism behaviors, as well as the use of illegitimate means in the assessment tests, will be sanctioned in accordance with those established in the University's Assessment Regulations and Coexistence Regulations.

## BIBLIOGRAPHY AND OTHER RESOURCES

### Basic

Bruce Alberts ... [et al.] ; With problems by John Wilson, Tim Hunt. Molecular biology of the cell / New York : Garland Science, 2014.

Sambrook J, Fritsch EF, Maniatis T. Molecular cloning. A laboratory manual. Cold Spring Harbor, New York: Cold Spring Harbor Laboratory Press; 1989.

Brown, T.A. Gene cloning and DNA analysis. An introduction. 6th edition Ed. Wiley-Blackwell; 2010.

Schuler M.L. y Kargi F. Bioprocess Engineering. Basic Concepts. Prentice Hall, Upper Saddle River, New Jersey. 2014.

## Additional

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Justus, C. R., Leffler, N., Ruiz-Echevarria, M., & Yang, L. V. (2014). In vitro cell migration and invasion assays. *Journal of visualized experiments : JoVE*, (88), 51046. <https://doi.org/10.3791/51046>

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