Course guide
390339 - BMEBT - Molecular Biology and Biotechnology Tools

Last modified: 13/01/2024

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Roig Villanova, Irma

Others: Roig Villanova, Irma
Elangovan Vennila, Elansurya

PRIOR SKILLS

Knowledge of Biology at the high school level

REQUIREMENTS

It is highly recommended to have taken and passed the first year General Biology course or equivalent.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Biochemistry: bio-molecules, enzymology and metabolism.
2. Biochemistry: Molecular biology and biotechnological tools.
3. Biochemistry: Biotechnological basis for obtaining and propagation of organisms.

TEACHING METHODOLOGY

The directed learning hours consist of theoretical classes (large group) in which the teacher makes a presentation to introduce the general learning objectives related to the basic concepts of the subject, trying to motivate and involve the students to actively participate in their learning . Support material is used through ATENEA.
Practical sessions in small groups so that the students practice some of the techniques related to molecular biology and genetic engineering. Before carrying out the practice, the students must read the protocol and supoort material that the teacher has prepared in order to know the objectives of the practice. Usually, after each session tasks are proposed outside the classroom, which must be done either individually or in groups and which are the basis of the directed activities.
Extra hours of autonomous learning must also be considered, such as those devoted to protocol reading, solving the proposed problems or self-learning tests for the different contents through the virtual campus ATENEA or on paper.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course Molecular Biology and Biotechnological Tools, the student must be able to:
- Understand the molecular bases and mechanisms of gene transmission and expression.
- Know the biotechnological tools and the methodologies applied to genetics, genomics, transcriptomics and proteomics.
- Know the development and application of tools for the management and analysis of biological data.
- Know and correctly apply the information obtained in the different databases specific of the subject.
- Understand and correctly relate the different specific computer applications for the management and processing of biotechnological data (Bioinformatics).

STUDY LOAD

Type	Hours	Percentage
Hours small group	20,0	13.33
Self study	90,0	60.00
Hours large group	40,0	26.67

Total learning time: 150 h

CONTENTS

MOLECULAR GENETICS

Description:
In this content we work:
Basic concepts of molecular genetics
Definition of genomics, proteomics, metabolomics and transcriptomics
Genetic engineering within molecular biology

Related activities:
Activity 1: Theoretical classes
Activity 2: Individual assessment tests
Activity 3: Laboratory practices

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

(ENG) MUTAGÈNESIS I METODOLOGIA BÀSICA DE L'ENGINYERIA MOLECULAR

Description:
In this content we work:
Mutant types and detection
Degradation and synthesis of nucleic acids in vitro
Restriction enzymes and their applications
DNA sequencing
Polymerase chain reaction

Related activities:
Activity 1: Theoretical classes
Activity 2: Individual assessment tests
Activity 3: Laboratory activities

Full-or-part-time: 35h
Theory classes: 11h
Laboratory classes: 4h
Self study : 20h

SEQUENCES AMPLIFICATION AND OBTENTION OF RECOMBINANT DNA

Description:
In this content we work:
Cloning techniques
Genomic libraries
Cloning vectors
Expression of recombinant DNA

Related activities:
Activity 1: Theoretical classes
Activity 2: Individual assessment tests
Activity 3: Laboratory activities

Full-or-part-time: 33h
Theory classes: 7h
Laboratory classes: 6h
Self study : 20h

GENE TRANSFERENCE TO DIFFERENT TYPES OF ORGANISMS

Description:
In this content we work:
Gene transfer to yeast and insects
Gene transfer to plants
Gene transfer to cells or whole animals

Related activities:
Activity 1: Theoretical classes
Activity 2: Individual assessment tests
Activity 3: Laboratory activities

Full-or-part-time: 53h
Theory classes: 15h
Laboratory classes: 6h
Self study : 32h

(ENG) BIOINFORMÀTICA

Description:
Relationship between Biology and bioinformatics
Software tools
Sequence Analysis
Comparative and functional genomics

Related activities:

Activity 1: Theoretical classes
Activity 2: Individual assessment tests
Activity 3: Laboratory activities
Activity 4: Activities with computers

Full-or-part-time: 25h
Theory classes: 5h
Laboratory classes: 4h
Self study : 16h

ACTIVITIES

ACTIVITY 1: THEORETICAL CLASSES

Material:
Class presentations (power point files), support material in ATENEA and basic bibliography of the subject.

Full-or-part-time: 103h
Theory classes: 38h
Self study: 65h

ACTIVITY 2: INDIVIDUAL EVALUATION TESTS

Description:
Short questions and topics to be developed related to the theoretical content of the classes, the laboratory and the computer sessions

Specific objectives:
Evaluation of the capacity of autonomous learning of tthe student.

Material:
Tables and calculator

Delivery:
Resolution of the test by the student . Registration by the teacherof the verification of the autonomous and directed learning of the student. The results are considered for the proposed global evaluation.

Full-or-part-time: 2h
Theory classes: 2h

ACTIVITY 3: LABORATORY PRACTICES

Description:
2-hour laboratory practices. Attendance to laboratory practices is mandatory.

Specific objectives:
At the end of the practices, the student must be able to:
- Work in the laboratory following environmental and safety guidelines.
- Assess the importance of the organization of laboratory work.
- Correctly carry out the operations of handling laboratory material and biological samples.
- Correctly use laboratory instruments.
- Evaluate own results and refer them to the results of colleagues.

Material:
Material and reagents necessary to carry out the practices.
Detailed protocol/script of the practices to be carried out and questionnaire.

Delivery:
Registration by the teacher of the verification of the student's directed learning.
The results are considered for the qualification of the laboratory activities.

Full-or-part-time: 23h
Laboratory classes: 10h
Self study: 13h

ACTIVITY 4: BIOINFORMATICS PRACTICES

Description:
Practices in a computer room (or with students personal laptops) of 2 hours of duration

Specific objectives:
At the end of the practices the student must be able to:
Assess the potential and / or limitations of the models that can be used to simulate different biological processes.
Obtain adequate and updated information from the different biotechnological databases.
Use programs to solve specific sequence analysis problems
Evaluate own results and reference them to the results of colleagues

Material:
Internet access, access to Atenea, practice protocol and individual computer

Delivery:
Registration by the teacher of the verification of the student's directed learning.
The results are considered for the qualification of the activities.

Full-or-part-time: 22h
Laboratory classes: 10h
Self study: 12h

GRADING SYSTEM

The final grade is the weighted sum of the following partial grades:
N1: Grade of the test of the first part of the subject
N2: Grade of the test of the second part of the subject
N3: Grade of the tests of laboratory activities.
N4: Grade of the poster.
Final grade = 0.35N1 + 0.35N2 + 0.2N3 + 0.1N4

EXAMINATION RULES.

For the practical sessions in the laboratory it is necessary to bring the protocol/script of practices and to respect the rules punctuality, safety and hygiene.
Attendance at laboratory practices is mandatory.

BIBLIOGRAPHY

Basic:
- Izquierdo Rojo, Marta. Ingeniería genética y transferencia génica. Madrid: Pirámide, 2001. ISBN 8436815637.
- Walker, J.M.; Gingold, E.B. Biología molecular y biotecnología. 2a ed. Zaragoza: Acribia, 1997. ISBN 842000829X.
- Wong, Dominic W. S. The ABCs of gene cloning. 2nd ed. New York: Springer, 2006. ISBN 0387286632.
- Brown, C. M.; Campbell, I.; Priest, F. G. Introducción a la biotecnología. Zaragoza: Acribia, 1989. ISBN 8420006661.
- Bu'Lock, John D.; Kristiansen, Bjørn. Biotecnología básica. Zaragoza: Acribia, DL 1991. ISBN 8420007048.
- Trevan, Michael D. Biotecnologia : principios biológicos. Zaragoza: Acribia, 1989. ISBN 9788420006710.
- Montoliu i José, Lluís; Martínez Mojica, Francisco J. Editando genes : recorta, pega y colorea : las maravillosas herramientas CRISPR. Primera edición. Pamplona: Next Door Publishers, febrero 2019. ISBN 9788494924514.

Complementary:
- Montoliu, Lluís. ¿Por qué mi hijo tiene una enfermedad rara?. Primera edición. Pamplona: Next Door Publishers, febrero 2023. ISBN 9788412630008.
- Montoliu, Lluís; Romero Márquez, Jesús. Genes de colores. Primera edición. Pamplona: Next Door Publishers, abril 2022. ISBN 9788412489422.
- Mestres i Naval, Francesc. De generació en generació : com rebem i transmetem els gens. Barcelona: Edicions de la Universitat de

Barcelona, [2022]. ISBN 9788491687863.