DEGREE CURRICULUM

MICROBIOLOGY I

Coordination: DE LA TORRE RUIZ, M. ANGELES

Academic year 2019-20

MICROBIOLOGY I 2019-20

Subject's general information

<table>
<tr><td>Subject name</td><td>MICROBIOLOGY I</td></tr>
<tr><td>Code</td><td>101613</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
</table>
</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>7.5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>2</td><td>0.8</td><td>4.7</td></tr>
<tr><td>Number of groups</td><td>4</td><td>2</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Coordination</td><td>DE LA TORRE RUIZ, M. ANGELES</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>75 hores presencials
112.5 hores no presencials</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Català 10%
Castellà 90%</td></tr>
<tr><td>Office and hour of attention</td><td>Maria Ángeles de la Torre (coordinadora)
Despatx: 1.19 Horari consulta: De 9 a 17 horas excepto horas de clase
Telèfon: 973702410

Para cualquier consulta se recomienda ponerse previamente en contacto con la profesora via e-mail (la dirección que consta en la ficha) o vía telefónica

Neus Colomina
Centre: IRB-Lleida
Departament: Ciències Mèdiques Bàsiques
Despatx: b.3.13 Horari consulta: A convenir
Telèfon: 973702414-2438</td></tr>
</table>

MICROBIOLOGY I 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COLOMINA GABARRELLA, M. NIEVES	neus.colomina@udl.cat	1	
DE LA TORRE RUIZ, M. ANGELES	mariaangeles.delatorre@udl.cat	9,3	
PUJOL CARRION, NURIA	nuria.pujol@udl.cat	4	

Subject's extra information

La asignatura Microbiología I se ha diseñado como un curso de iniciación en el conocimiento del mundo microbiano. Se estudiarán los aspectos fundamentales del mundo microbianao, desde el punto de vista molecular, fisiológico, evolutivo, bioquímico, estructural, taxonómico, ecológico y biológico. Se trata de dar una visión de los microorganimos como herramienta y material de estudio básico en Biotecnología.

El estudiante necesitará posser conocimientos de Bioquímica, Química, Informàtica y Biologia Celular adquiridos durante el primer curso de la titulación de Biotecnología y de Genética, asignatura que se impartirà paralelamente a Microbiologia I.

Para un buen aprovechamiento de esta asignatura se recomienda haber aprobado las asignaturas de primer curso Bioquímica, Biologia Molecular, Química General y Orgánica y Biologia Celular

Para cualquier consulta se recomienda ponerse previamente en contacto con las profesoras via e-mail (la dirección que consta en la ficha), a través de SAKAI redireccionando al correo de la ficha o vía telefónica

Learning objectives

To pass the subject, the student should be able to:

1. Knowing the basics of the structure, biochemistry, molecular microbial physiology and genetics.

2. To demonstrate knowledge of the importance that microorganisms have on human health.

3. To demonstrate knowledge of evolutionary development of the microbial world and their possible biotechnological application along with comparative genomic analyses.

4. To know the main concepts of microbial ecology.

5. To demonstrate knowledge about the main microbial models and their interaction with other living beings.

6. Resolving cases and problems related to the use of microorganisms as biotechnological tools.

7. To demonstrate knowledge about the operation of a microbiology laboratory and about physiological, genetic and molecular manipulation of some model microorganisms.

Competences

General skills Graduates in Biotechnology must have:

• Being able to search and selectively use information sources needed to achieve the training objectives.

• To interpret the scientific and technical information with a critical sense, and being able to make presentations based on this information.

• Being able to make understandable written and oral reports on the work done, with a justification based on the theoretical and practical knowledge gained (Strategic competence of UDL).

• Teaming up with a multidisciplinary approach and ability to make a rational and efficient distribution of tasks between team members.

• Being able to communicate at the international level in their professional development (Strategic competence of UDL)

• To use tools and techniques of information and communication for data analysis and preparation of oral and written reports and other training and professional activities (Strategic competence of UDL)

• To respect the fundamental rights of equality between men and women, the promotion of human rights and values ??of a culture of peace and democratic values ??(Strategic competence of UDL).

• To know and properly use their own scientific and technical vocabulary of the different areas of biotechnology.

• Working in the laboratory using criteria of quality and good practice.

• To know and to use the software and specific databases in different areas of biotechnology.

•To use the scientific method to analyze data and design experimental strategies biotechnological applications.

• Being able to form a critical judgment about the implications of biotechnology to ethical, legal and environmental level.

• To convey strategies and technological applications in the enterprise, based on the general fundamentals of business economics.

Specific skills (According to the document Curriculum)

• To understand the fundamental aspects of the structure, metabolism, genetics and ecology of prokaryote and eukaryote microorganisms related to possible technological use of them.

• To know how to make good use materials and techniques most commonly used in a laboratory of molecular microbiology and clinical. • Understand the methodology most commonly used to genetically engineer microorganisms

Subject contents

According to the Syllabus: Microorganisms: structure, function, metabolism and ecology. Microbial Molecular Biology, Genetics and Microbiology. Microbiological techniques. Microbial Ecology. Microorganisms of biotechnological interest. Applications of Microbiology in the world of Biotechnology.

Topic 1. **INTRODUCTION**. Concept and historical development of Microbiology as a science

Topic 2. **THE MICROBIAL CELL.** The prokaryotic cell. The eukaryotic microbial cell: algae, fungi, protozoa. Microbial samples microscopy and staining techniques.

Topic 3. **MICROBIAL NUTRITION AND GROWTH.** Microbial nutrition: requirements of carbon, phosphorus, nitrogen and sulfur. Growth factors. Variety of nutrient uptake. Culture media. Pure crops. Growth curve: phases, counts of total and viable cell numbers. Continuous cultivation. Environmental factors. Microbial growth in the

natural environment.

Unit 4. **MICROBIAL METABOLISM**. Basics of microbial metabolism. Microbial anabolism and catabolism. Chemiolitotrophy. Phototrophy. Anaplelotic reactions. Biosynthesis of the cell wall.

Topic 5. **MICROBIAL GENETICS.** Mutations and mutagenesis. SOS system: detection mechanisms and DNA damage. Two-component systems. Microbial cell cycle. Genetic variability: microbial genetic exchange mechanisms. Bacterial Conjugation. Microbial transformation. Transduction. Cloning Vectors. Transposons. Integrons. Gene expression in microorganisms. Microbial genomics. General characteristics of microbial genomes. Microbial proteomics. Evolution.

Unit 6. **CONTROL OF MICROBIAL GROWTH.** Action of physical agents. Action of chemical agents. Antibiotics. Other antimicrobial chemotherapeutic agents. Microbial resistance to drugs.

Unit 7. **MICROBIAL ECOLOGY.** Microorganisms in the world: Microbial ecosystems. Interactions microorganisms-biosphere, microorganisms-plants, microorganisms-animals. Microbial intervention in nutrient cycles. Biofilms and biotechnology implications. Microbial ecology of the human body: positive and negative interactions. Toxins and mechanisms of microbial toxicity. Infection and defense mechanisms of the human body. Vaccines

Unit 8. **HUMAN UTILIZATION OF MICROORGANISMS. BIOTECHNOLOGICAL APPLICATIONS DERIVED FROM MICROORGANISMS**. Applications of microbial biotechnology. Most relevant products in Biotechnology obtained from microbial activity: drugs (insulin antibiotics, vaccines), amino acids, organic acids, surfactants, biopolymers. Microbial enzymes. Transgenic plants. Bioinsecticides. Bioremediation. Biodeterioration.

PRACTICAL ACTIVITIES:

PRACTICES IN THE COMPUTER CLASS:

Design of oligonucleotides to amplify genes of interest. Management of microbial databases. *In silica* cloning. Creation of mutants in silica. Study of the conservation of specific amino acids in biotechnological interest microorganisms and their conservation in different biological systems.

CLASSES OF PROBLEMS: Students work in groups of 4 people discussing and solving various problems resulting from the practical application of the theoretical concepts taught in the lectures. Various materials are used: computer and paper for the consultation of students. At the end of the sessions the students must present a group report. The two problem sessions score a total of 10% of the final grade.

TUTORED SEMINARS: A possible list of topics to be chosen by the students is presented (to be carried out by each of the 13 working groups). At the end of the course each group will publicly expose the chosen subject. Each student will receive a group grade. (5%) and an individual grade (5%). These seminars constitute 10% of the final grade.

LABORATORY PRACTICES:

• Practice 1: Preparation of culture media for the isolation of bacteria and fungi. Techniques of sterilization and preparation of laboratory material. Pharyngeal swab. Liquid and solid crops.

• Practice 2. Microorganism staining techniques. Microscopy. Observation of bacterial and fungal cultures.

• Practice 3. Identification of Enterobacteria through a gallery of biochemical tests (ENTEROTUBE)

• Practice 4. Extraction of a bacterial plasmid using a commercial kit, DNA visualization (electrophoresis). Transformation of bacteria and selection of recombinants in plaque. Evidence of genetic recombination from the expression of beta-galactosidase.

• Practice 5. Yeast genetics. Sexual reproduction and Mendelian segregation of a dominant character.

• Practice 6. Microbial growth curve.

• Practice 7. Analysis of heat-sensitive mutants of *Saccharomyces cerevisiae*. Use of minimal means and selective means. Selection markers.

Attendance is mandatory. A written test will be conducted to demonstrate that the student has understood the development and content of all practices.

Methodology

Tipus d'activitat	Descripció	Activitat presencial alumne		Activitat no presencial alumne		Avaluació	Temps total
		Objectives	**Hours**	**Student work**	**Hours**	**Hours**	**Hours**
Mastre Class	Master Class. Big Group	Explanation of the main concepts	**40**	Study: To know, to understand and to synthesize knowledge	**91.5**	3	**134.5**
Ploblems and cases	Participatory class. Medium Group.	Resolution of Problems and Cases	**4**	To learn to solve problems and cases	**4**	**1**	**9**
Seminari	Participatory class. Medium Group.	To performs activities of discussin and aplication of theorethical concepts.	**6**	To solve problems. To discuss.	**12**	0.5	**18.5**
Laboratory	Laboratory Practice Medium Group	Performance of the Practice. To understand phanomena, to measure	**21**	To understand, to discuss and to study.	**3**	1	**24**
Computer Class	Computer practice. Medium Group	Performance of the Practice. To understand phanomena, to measure	**4**	Estudiar i Realitzar memòria	**2**	0.5	**6.5**
Directed activities	**Student work (individual and in group)**	To guide the student to work	**1**	To carry out a Bibliographical work.	**15**		**12**
Others							
Total			**75**		**112.5**	6	**193.5**

Evaluation

Exams	Problems	Laboratory	Seminars	Bioinformatics
53%	5%	30%	7%	5%

Type of Activity	Evaluation of the activity		% Evaluation
	Procediment	**Número**	
Lectures	Written exam based on the theorethical program of the subject	1	**53**
Problems	Written exercise based on the application of theoretical concepts	1	**5**
Laboratori	Written exercise based on the experimental work developed in the laboratory	1	**30**
Seminari	Written/Oral tests	1	**7**
Aula informàtica	Written test	1	**5**
Total			**100**

Bibliography

Basic Bibliography

- M.T. Madigan, J.M. Martinko y J. Parker. Biología de los Microorganismos (12ª-14ª Edición). Addison-Wesley, Madrid .
- Prescott, Harley y Klein. Microbiología (7ª-10ª Edición). McGraw-Hill Interamericana, Madrid.
- Willey, Sherwood and Woolverton. Prescottt´s principles of Microbiology. McGraw-Hill Interamericana, Madrid.
- Salyers and D.D. Whitt. Microbiology: Diversity, Disease and the Environment. Fitzgerald Science Press, Bethesda, Maryland.

Complementary Bibliography

- B. R. Glick and J.J. Pasternak. Molecular Biotechnology. Principles and applications of recombinant DNA, 3rd edition. ASM Press, Washington.
- Hurst, C.J., Crawford, R.L., Garland, J.L., Lipsin, D.A., Mills, A.L. and Stetzenbach, L.D. Manuel of Environmental Microbiology. ASM, Press.
- Martin Dworkin. The Prokariotes. Springer.
- A.H. Varnam. Environmental Microbiology. ASM Press, Washington.
- J.L. Ingraham, J.L. y C.A. Ingraham, C.A. Introducción a la Microbiología (2 vols.). Editorial Reverté, Barcelona.