SUBJECT GUIDE

Pharmaceutical Biotechnology

Academic Year 2018-2019
(Last update: 28/05/2018)
(BBM2 Department Approval on 7/06/2018)
(Microbiology Department Approval on 9/05/2018)

MODULE	SUBJECT	YEAR	SEMESTER	CREDITS	TYPE
Biology	Pharmaceutical Biotechnology	3º	1º	6	Compulsory

PROFESSORS AND GROUPS [1]	CONTACT DETAILS- TUTORING HOURS (Postal address, phone, emails, etc.)
Departamento BBM2 • Rafael Salto González (A and C) • Abdelali Daddaoua (B) • Dámaso Vilchez Rienda (B) • Antonio Suárez García (D) • Olga Martínez Augustín (E) • Alberto Manuel Vargas Morales (E)	Dpt. of Biochemistry and Molecular Biology 2, 4th floor, Faculty of Pharmacy. Nº 398, 385b, 392b, 393, 396 y 385. E-mails: rsalto@ugr.es, asuarez@ugr.es, avargas@ugr.es, daddaoua@ugr.es, e.damaso@go.ugr.es, omartine@ugr.es Dpt. of Microbiology, 4th floor, Faculty of Pharmacy. Nº 702; Nº 429 E-mails: maguiler@ugr.es manzanera@ugr.es, cmgodo@ugr.es, gasilva@ugr.es , agon@ugr.es
Departamento Microbiología • Margarita Aguilera Gómez (B, D and E) • Maximino Manzanera Ruiz (A, C) • Carmen María González Domenech (P) • Alejandro González Martínez (P) • Tatiana Robledo Mahón (P)	BBM2 TUTORING HOURS - WEBPAGE LINK [1] http://farmacia.ugr.es/BBM2/ MICROBIOLOGY TUTORING HOURS Margarita Aguilera Gómez: M, W 12.30-14.30 and F 9.30 a 11.30 Maximino Manzanera Ruiz: M, W and F 9:30-11:30. Prof. Manzanera tutoring hours will take place at the "Instituto del Agua" during second semester and non lective period

DEGREE	OTHER DEGREES
PHARMACY	Health Science Area, Nutrition, Food Science and Technology, Biochemistry and Biotechnology

[1] Please look up the updates at the link "Acceso Identificado > Aplicaciones > Ordenación Docente"
(∞) Esta guía docente debe ser cumplimentada siguiendo la "Normativa de Evaluación y de Calificación de los estudiantes de la Universidad de Granada" (http://secretariageneral.ugr.es/pages/normativa/fichasugr/ncg7121/!)

PREREQUISITES and/or RECOMMENDATIONS (when proceeds)

It is strongly recommended the student has studied and passed Structural and Metabolic Biochemistry, Microbiology I and Microbiology II, obtained B1 English level for non-english students (or B2 recommended), good writing skills and presentation preparation and capable of searching for, translating a scientific journal manuscript.

BRIEF DESCRIPTION OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)

This subject is intended to teach the basic concepts of the applications of Pharmaceutical Biotecnology. The student will be taught the general techniques of DNA manipulation and transfer, cloning, mutagenesis, Bioinformatics, DNA sequencing, recombinant protein synthesis and protein engineering, cell culture, transgenesis, genome editing and the essential methods of gene expression analysis. Besides, the microbiology section will teach the use of microorganisms and their mechanisms for pharmaceutical drug production. The students will learn the main characteristics of the microorganisms, biofermentation, scale-up processing used in Biotechnological industry.

GENERAL AND SPECIFIC ACADEMIC ABILITIES AND COMPETENCES

- General abilities:
- **CG1.** Identify, design, collect, analyze, control and produce drugs and medicines and other health products and raw interest in human or veterinary use materials.
- **CG13.** Develop information and communication skills, both oral and written, to deal with patients and users of the center where play their professional activity. Promoting work and collaboration capabilities in multidisciplinary teams and those related to other health professionals.
- **CG15.** Recognize own limitations and the need to maintain and update professional skills, with particular emphasis on self-learning of new knowledge based on scientific evidence
- Specific ability:
- **CE21.** Develop skills to identify therapeutic and biotechnological production of target drugs and use of gene therapy.

OBJECTIVES (IN TERMS OF EXPECTED RESULTS FROM THE TEACHING PROGRAMME)

BMM2 MODULE

The main outcome of this teaching programme consists in the localisation, analysis, assimilation, interpretation and processing of biological information for the identification and evaluation of therapeutic targets for biotechnological drug design.

R1- Utilization of bioinformatics tools for extrtaction, analysis, interpretation and processing of biological information from biological databases

R2 - Analysis, interpretation and processing of biological information of genes and their products

R3 - Use tools for information of scientific papers

R4 - Extraction and interpretation of biological information from scientific papers

R5 - Characterize the different techniques of manipulation, amplification, cloning, modification and storage of genetic information in various hosts

R6 – Compare techniques for controlled gene expression to produce different types of proteins in living organisms

R7 – Characterize and evaluate the methodology for molecular analysis of the genetic variability of the human being, its impact on their health and drug response.

R8 - Analyze and characterize the main techniques for the transfer of genetic information and their use in gene therapy

R9 - Characterize different experimental design methodologies for the development of a biotechnological product

R10 - Plan and develop an analytical proposal for the development of a human biotechnology product

R11- Evaluate the bioethical implications of genetic and biotechnological manipulation of living organisms

MICROBIOLOGY MODULE

R12 - Handling all theoretical and practical information on Culture Collections of Microorganisms / Biotechnology industrial companies

R13 - Knowing the peculiarities / differential characteristics that make bacteria, viruses and eukaryotic microorganisms with potential biotechnological agencies

R14 - Designing selective media and culture conditions for the isolation of strains with biotechnological interest

R15 - Management and production of microbial polymers with therapeutic use

R16 - Developing the process of recombinant synthesis, molecular modification and production of proteins with therapeutic use

R17 - Designing a recombinant vaccine

R18 - Commissioning of the production of a recombinant drug

R19 - Identifying the factors in the control of mass production or industrial level of recombinant

R20 - Identify safety levels for handling microorganisms and quality control of recombinant products

THEORETICAL PROGRAMME

Biochemistry and Molecular Biology BBM2 - MODULE

Part One: Introduction to Biotechnology and Genetic Engineering

OBJECTIVE: Place the student in the general principles of Genetic Engineering in Biotechnology

Unit 1. Introduction to Biotechnology. Objectives of Biotechnology. Conceptual and historical framework. The biotechnological process. Biological systems used in biotechnology. Biotechnology Research. Social and business dimension. Public perception. Ethics and Law. (1h)
Objectives: Give an overview of the concept of Biotechnology or describe the objectives, development and general techniques of biotechnology or understand the social and ethical importance of biotechnology or importance in the Degree in Pharmacy or programmed Activity: Test self-assessment skills acquired

Unit 2. Organization of genetic material in prokaryotes and eukaryotes. Types of nucleic acids. Genomes, chromosomes, mitochondrial DNA, genes and operons. Epigenetics. Genetic code. Concepts of replication, transcription and translation. DNA recombination and repair. Expression and regulation. Changes post-transcriptional and post-translational. (1h)
Objectives: Learn more about the gene organization of living things or know the importance of epigenetics in gene expression or understand the molecular basis of gene expression and regulation

Unit 3. Bioinformatics. Database. NCBI, PubMed, PMC and OMIM. Extraction of biological and genetic information. Sequence analysis of nucleic acids and proteins. (3h)
Objectives: Know the main bioinformatic databases, structure and utility; Extract information about genes, molecular diseases and scientific articles; Research/Query the database PDB and use data visualization software and modeling of protein structures; Understand the utility of phylogenetic analysis: phylogeny, functional analysis, structural analysis; Know the main software for the analysis and comparison of sequences: BLAST, CLUSTALW.

Unit 4. Recombinant DNA technology. Concept of recombinant DNA and genetic engineering. Enzymes used in genetic engineering. DNA polymerases and polymerase chain reaction (PCR). PCR and semiquantitative RT-PCR. Nucleic acid detection. DNA sequencing. (3h)
Objectives: Know the general types of enzymes used in molecular biology: nucleases, polymerases, ligases and restriction enzymes Importance or nucleic acid hybridization to identify polynucleotide sequences; Know the most important techniques for the amplification of DNA by PCR; Know the current methods for sequencing nucleic acids and proteins.

Unit 5. Strategies cloning issue. Vectors. Introducing genetic material into the host. Libraries: utility, construction and analysis. (3h)
Objectives: Know the characteristics of the general cloning vectors: plasmids, bacteriophages and cosmids; Know optimized vectors for recombinant DNA ligation; Know general and specific techniques for transformation and transfection; Understand what are the libraries and know their main types: genomic, cDNA and expression.

Unit 6. Expression vectors and recombinant proteins. Fusion proteins. Heterologous expression. Vectors for expression in eukaryotes. Performance optimization and expression. (2h)
Objectives: Know the minimum characteristics of the expression vectors or inducing promoters in expression vectors; Understand the benefits and uses of fusion proteins; Know the criteria for the expression of proteins in homologous or heterologous systems or know the basis for improvement in the expression of recombinant proteins

Part Three: Biotechnology in Medicine and Pharmacy. Diagnosis, Therapy and Gene Therapy.
OBJECTIVE: Place the student in the context of Biotechnology applied to Pharmacy and Medicine.

Unit 7. Systems Biology. Involvement of -omics techniques in pharmaceutical and biotechnology research. Genomics, transcriptomics, proteomics, metabolomics. Protein sequencing. Other -omic. Uses in the molecular classification of diseases and validation of molecular targets. Massive DNA sequencing. (1h)
Objectives: Familiarize students with the concept of systems biology, reductionism versus holism or know the main methods of analysis omic; Know the use of -omics approach in the molecular classification of diseases; Know the use of -omics approach in the identification and validation of molecular targets

Unit 8. Human Genetic variability in. HapMap. Haplotype and chromosomal markers. Direct and indirect molecular diagnosis of genetic mutations. Karyotype. Clinical and forensic applications. Pharmacogenetics. Hospital and business context of genetic analysis. (3h)
Objectives: Learn the basics of genetic variability in the human being o Define and chromosomal marker haplotype; Describe the different types of chromosomal markers; Utility or chromosomal markers in the molecular diagnosis of genetic variants; Define karyotypes-genomes and their clinical utility; Develop clinical, forensic and hospital profits analysis of genetic variability; The current and future business environment associated with the analysis of genetic variability.

Unit 9. Protein engineering. Structure-function. Rational design and directed evolution. Altering the genetic material.

Mutations and usefulness. Random mutagenesis and directed. Novo protein design. Pharmaceutical uses. (3h)
Objectives: Understand the techniques of studying the relationship function in protein structure and the basic methods of studying the interaction are known protein-ligand or know the basic techniques of protein mutagenesis, both random and site-specific; Skills in the program management and modeling visualization of protein structures to design mutations; Existence and examples of drugs of first and second generation based on the recombinant expression and mutagenesis of recombinant proteins.

Unit 10. The cell as biotechnology and therapeutic tool factory. Mammalian cell culture. Recombinant protein production. Humanized antibodies. Useful in evaluation of molecular targets. Stem cells. Tissue engineering and organ culture. Regenerative medicine. (2h)
Objectives: Know the differences and main characteristics of primary cultures and established cell lines or know the different types of mammalian cells used in biological experimentation; Know the basic methods of protein expression in cells in culture and humanized antibodies; Know the molecular basis of growth, differentiation and cell death applied to regenerative medicine; Know the methodological options used in building tissues ex vivo

Unit 11. Gene therapy: a method for treating genetic diseases. GM systems by vectors. Antisense RNA. Silencing. Use in gene therapy and for the study of gene expression in mammals. (2h)
Objectives: Familiarize students with the concept of gene therapy; know the main methods of genetic modification currently used in gene therapy; Learn the basics of gene silencing and its use in validation of molecular targets and gene therapy; To know the limitations and ethical constraints of gene therapy and regenerative

Unit 12. Animal models in Biomedicine and Biotechnology. Embryos, clones and transgenics. Animals and genetically modified foods. (1h)
Objectives: Understand the concepts of genetically modified food and genetically modified organisms or analyze the production techniques of transgenic foods or describe several examples of the application of genetic engineering and cell culture techniques for the production transgenic plants resistant to herbicides, insects and drought and nutritional improvements and delayed maturation or transgenic animals: Improvements in production and / or nutritional composition or transgenic animals as models for the study and treatment of human disease

MODULE MICROBIOLOGY: FUNDAMENTALS AND POTENTIAL USES OF MICROORGANISMS IN BIOTECHNOLOGY

OBJECTIVE: The student must acquire the fundamentals of essential uses of microorganisms in the evolution of biotechnology applied to health sciences.

Unit 13. Microorganisms and Biotechnology. Features of cultivation and maintenance. Characteristics related to the synthesis of the product of interest. Genetic stability. Other properties. Search optimization and conservation of microorganisms of biotechnological interest. Cultivation, control and elimination of microorganisms. (2h)
Objectives: Know the molecular basis for the use of the microorganism in biotechnology process; Develop the particular requirements to be met by microorganisms of biotechnological use; Describe procedures or cultivation of microorganisms of biotechnological interest; Learn to design search strategies, selection, optimization and conservation of microorganisms of biotechnological interest; Understand the strategies for managing the microorganism of use in biotechnology

Unit 14. Major bacteria of biotechnological interest Morphological and structural characteristics. Growth rate and experimental cultivation. Physiological, nutritional and metabolic diversity. Major bacterial strains of biotechnological interest (1h)
Objectives: Know the main bacterial strains of biotechnological interest or describe the characteristics of the main bacterial strains of biotechnological interest

Unit 15. Main virus of biotechnological interest. Phagotherapy and the discovery of antibiotics by phages. Phage-display for

the selection of protein variants. Wild oncolytic viruses: the vaccinia virus, poliovirus and adenovirus. And modified recombinant. Application of gene therapy virus (2h)
Objectives: Describe the main virus of interest in biotechnology, knowing or viral vectors, construction and application in purification of proteins of interest, viruses in gene therapy and virus oncogenic therapy

Unit 16. Main eukaryotic microorganisms of biotechnological interest Desirable and undesirable characteristics of eukaryotic microorganisms of biotechnological interest. Morphological, structural and physiological characteristics major eukaryotic microorganisms. Methods of isolation, selection and cultivation of eukaryotic microorganisms of biotechnological interest. Yeast strains main use in biotechnology. (1h)
Objectives: Develop the particular characteristics of the biotechnology use yeasts; Describe or culture procedures biotechnological utilization of yeasts.

Unit 17. Production subject microbial polymers (polysaccharides and poly-beta-hydroxy-alkanoates) for use as excipients in medicaments. Manipulating the culture conditions to produce new bacterial polyesters. Genetically engineering microorganisms to produce polysaccharides (xanthan) and poly-beta-hydroxy-alkanoates. (2 h)
Objectives: Knowing polymers or microbial origin and biotechnology utility as an alternative to synthetic polymers; Know the methods of overproduction by selective and scheduled handling of microorganisms.

Unit 18. Production of primary metabolites. Production of organic acids and amino acids. Citric acid, glutamate and other amino acids. Production of ethanol (2 h)
Objectives: Know the primary and metabolites biotechnological utility; Identify resources and emerging industries with applicability in pharmaceutical biotechnology.

Unit 19. Production of antibiotics and non-antibiotic secondary metabolites. Secondary metabolites with antibiotic activity, antitumor, inhibitors of cholesterol synthesis and immunosuppressants. (2 h)
Objectives: Know the natural function of antibiotics; Biosynthesis and industrial production of beta-lactam antibiotics; Synthetic antibiotics.

Unit 20. Recombinant vaccines: antibacterial, antiviral and DNA. Traditional vaccines against recombinant (1.5 h)
Objectives: Know the fundamental differences between vaccines made from microorganisms and genetically engineered; Know the main routes of administration of vaccines and their requirements in the synthesis. Know bacterial vaccines: BCG, oral cholera, oral typhoid; Viral vaccines: measles, rubella, mumps, MMR, varicella; Toxoid vaccines: tetanus, diphtheria; DNA vaccines; Therapeutic vaccines.

Unit 21. Production of proteins of pharmaceutical interest in microorganisms: insulin, growth hormone, erythropoietin, monoclonal antibodies (2h).
Objectives: Identify genetic traits of certain microorganisms for use in the production of specific proteins; Analyze the importance of the genetic background in terms of the protein to be expressed; Know the application or microorganisms and viruses to search for proteins of interest.

Unit 22. Industrial Fermentations topic: Culture media (sources of C and N). Water and minerals, vitamins, growth factors, oxygen and antifoam. Bioreactors: Design and construction. Control reagent addition, and physical conditions (agitation, heating and cooling, mass transfer, aeration). Monitoring system (electrodes, probes, translators, mass spectra and spectrophotometers). Operating modes. Sterilization. Reactors solid substrate. (2h)
Objectives: Understanding the value or cost of finding means to economic performance; Recover waste as a source of nutrients to generate biotechnology products; Identify the critical factors during production of molecules of interest; Recognize the role of the development of production processes

Unit 23. Quality Control of biotechnological products and Biosafety issues

Objectives: Learning the special requirements in manufacture of sterile products of pharmaceutical interest (antibiotics, vaccines, nutraceuticals) to minimize the risk of microbial contamination, particulate and pyrogen throughout the whole process of development and validation, as well as personnel and processing equipment; Understand the importance of Hazard Analysis and Critical Control Points (HACCP). To know general requirements of risk assessment and approval processes of biotechnological products by regulatory entities and administrations FDA, EMA, etc. (2h)

PRACTICAL LESSONS (1.5 C):

1. **Expression of a recombinant protein in *E. coli* and in eukaryotic cells in culture**: the gene for green fluorescent protein (GFP), which will be cloned , transformed and expressed in E. coli is amplified.

2. **Methods for searching and screening microorganisms manufacturing biopharmaceutical products**, such as antimicrobial substances, enzymes, vitamines, etc. It will be explained and used the serial dilutions technique, and specific culture media for identifying potential new antibiotics.

READING-BIBLIOGRAPHY

- Herráez, A. *Texto Ilustrado de Biología Molecular e Ingeniería Genética*. 2ª Ed. Elsevier. Madrid. 2012.
- Clark D, Pazpernik N. *Biotechnology – Academic Cell Update*, APCell Press 2012.
- Fitzgerald-Hayes M. y Reichsman F. (eds) *DNA and Biotechnology* 3rd. Elsevier, 2010.
- Glick BR, Pasternak JJ, Patten CL. *Molecular Biotechnology: Principles and applications of recombinant DNA* 4th. ASM Press, Washington, 2010.
- Perera J, Tormo A, García JL. *Ingeniería genética*, vol. I y II, Editorial Síntesis, Madrid, 2002.
- Crommelin, D.J.A., Sindelar R.D. and Meibohm B. (Eds.) *Pharmaceutical Biotechnology. Fundamentals and applications (3ed).* Informa Healthcare. New York. 2008
- Barnum, S.R. *Biotechnology. An introduction.* Thomson Brooks/Cole. Belmont. USA. 2005.
- Braun, V. and Gotz F. (Eds.). *Microbial Fundamentals of Biotechnology.* John Wiley & Sons, Chichester (UK) (2002).
- Gad S.C. (ed) *Hanbook of Pharmaceutical Biotechnology.* Wiley Interscience. 2007
- Kayser, O. y Müller, R.H. (eds). *Pharmaceutical Biotechnology.* Wiley Interscience. 2004
- Lewin, B. *Genes IX*. Jones and Bartlett publishers. Sudbury. USA. 2008.
- Simpson, R.J. *Proteins and proteomics. A laboratory manual.* Cold Spring Harbor Laboratory Press. New York. 2003.
- Walsh, G. *Pharmaceutical Biotechnology: Concepts and Applications.* Wiley. 2007

COMPLEMENTARY BIBLIOGRAPHY:

- **RELEVANT LEGISLATION ABOUT GENETICALLY MODIFIED ORGANISMS**
- Directive 90/220/CE del Consejo de 23 de abril de 1990 sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente. Diario Oficial de las Comunidades Europeas (DOCE). 08-05-1990
- Commission Regulation (EC) No 49/2000 of 10 January 2000 amending Council Regulation (EC) No 1139/98 concerning the compulsory indication on the labelling of certain foodstuffs produced from genetically modified organisms of particulars other than

those provided for in Directive 79/112/EEC

- Commission Regulation (EC) No 50/2000 of 10 January 2000 on the labelling of foodstuffs and food ingredients containing additives and flavourings that have been genetically modified or have been produced from genetically modified organisms
- Commission Decision 2002/623/EC of 24 July 2002 establishing guidance notes supplementing Annex II to Directive 2001/18/EC of the European Parliament and of the Council on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC Official Journal L 200 of 30.7.2002.
- Opinion of the Economic and Social Committee on the "Proposal for a Regulation of the European Parliament and of the Council on genetically modified food and feed" (COM(2001) 425 final — 2001/0173 (COD)). Official Journal C 221, 17/09/2002 P. 0114 – 0120
- Council Decision of 3 October 2002 establishing, pursuant to Directive 2001/18/EC of the European Parliament and of the Council, the summary notification information format for notifications concerning the deliberate release into the environment of genetically modified organisms for purposes other than for placing on the market Official Journal L 280 , 18/10/2002 P. 0062 – 0083
- Decisión del Consejo, de 3 de octubre de 2002, por la que se establecen unas notas de orientación complementarias al anexo VII de la Directiva 2001/18/CE del Parlamento Europeo y del Consejo sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente y por la que se deroga la Directiva 90/220/CEE del Consejo. Diario Oficial de las Comunidades Europeas (DOCE). 18-10-2002
- Common Position (EC) No 17/2003 of 4 March 2003 adopted by the Council, acting in accordance with the procedure referred to in Article 251 of the Treaty establishing the European Community, with a view to adopting a Regulation of the European Parliament and of the Council on transboundary movements of genetically modified organisms
- Common Position (EC) No 22/2003 of 17 March 2003 adopted by the Council, acting in accordance with the procedure referred to in Article 251 of the Treaty establishing the European Community, with a view to adopting a regulation of the European Parliament and of the Council on genetically modified food and feed
- Common Position (EC) No 20/2003 of 17 March 2003 adopted by the Council, acting in accordance with the procedure referred to in Article 251 of the Treaty establishing the European Community, with a view to adopting a regulation of the European Parliament and of the Council on additives for use in animal nutrition (1)
- Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed
- Regulation (EC) No 1830/2003 of the European Parliament and of the Council of 22 September 2003 concerning the traceability and labelling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms and amending Directive 2001/18/EC. Official Journal L 268 , 18/10/2003 P. 0024 – 0028
- Commission Regulation (EC) No 65/2004 of 14 January 2004 establishing a system for the development and assignment of unique identifiers for genetically modified organisms. Official Journal L 010 , 16/01/2004 P. 0005 – 0010
- Royal Decree 9/2003, de 25 de abril, por la que se establece el régimen jurídico de la utilización confinada, liberación voluntaria y comercialización de organismos modificados genéticamente. Jefatura del Estado (BOE:100-2003). 26-04-2003

RECOMMENDED LINKS

NCBI http://www.ncbi.nlm.nih.gov/

BIOEDIT http://www.mbio.ncsu.edu/bioedit/bioedit.html

BLAST http://blast.ncbi.nlm.nih.gov/Blast.cgi?PAGE=Nucleotides/

GENBANK http://www.ncbi.nlm.nih.gov/genbank

ExPASy http://expasy.org/

GENECARDS V3 - HUMAN GENES http://www.genecards.org/

PROTEIN DATA BANK http://www.rcsb.org/pdb/home/home.do

OMIM ® - Online Mendelian Inheritance in Man ® http://www.ncbi.nlm.nih.gov/omim/

PUBMED http://www.ncbi.nlm.nih.gov/pubmed/

WATCUT http://watcut.uwaterloo.ca/watcut/watcut/template.php?act=snp_new

NEBCUTTER http://tools.neb.com/NEBcutter2/

VIRTUAL RIBOSOME http://www.cbs.dtu.dk/services/VirtualRibosome/

PRIMER3 http://frodo.wi.mit.edu/primer3/

TEACHING METHODOLOGY

The teaching methodology will use the case method and problem-based learning. In this way students learn based on experiences and real life situations, allowing them build their own learning in a context that approximates their environment. Several groups of students to work autonomously, guided by the teacher, to find the answer to a question or solve a problem.

Introductory activity to collect information from students and guide them, keynote sessions for the presentation and implementation of the content knowledge to be applied to solving problems, active participation in class and forums: For this, among others, the following activities web, scheduled activities, independently and in groups to solve the problems, seminars and laboratory work. The implementation of activities will be supported via the Virtual Campus SWAD. an orientation guide and monitor each task specifying competencies, learning outcomes, activities and products / means of assessment, evaluation criteria and instruments to be used will be provided.

	ACTIVITIES	ABILITIES	HOURS	ECTS	%	
Presencial	THEORY CLASSES	CG1, CEM3.5, CEM5.1, CEM5.2, CO21	40	1.6	26.67	40 %
	PRACTICE CLASSES	CG1, CEM3.5, CO17, CO19, CO22, CO23	16	0.64	10.67	
	SEMINARS	CG1, CEM3.5, CEM5.1, CEM5.2, CO21	1	0.04	0.66	
	TEST-EXAMS	CG1, CEM3.5, CEM5.1, CEM5.2, CO17, CO20, CO23	3	0.12	2	
No Pr.	ACTIVITIES-PROGRAM	CG1, CG15, CEM3.5, CO17, CO18, CO20, CO21, CO23	5	0.2	3.3	60 %
	GROUP WORK	CG1, CG15, CEM3.5, CO17, CO18, CO19, CO20, CO22	30	1.2	20	
	AUTONOMOUS WORK	CG1, CG15, CEM3.5, CO17, CO18, CO19, CO29, CO21	55	2.2	36.7	
Total			150	6	100	

EVALUATION (ASSESSMENT INSTRUMENTS, EVALUATION CRITERIA AND PERCENTAGE OF THE FINAL RATE, ETC.)

According to the rules of evaluation and qualification of students of the University of Granada, adopted on 20 May 2013, the evaluation will be continuous with the exception under those rules by which a single final wrtitten test will be made.

CONTINUOUS EVALUATION

GENERAL EVALUATION CRITERIA

The assessment will be integrated in the learning process through the implementation and execution of units of evaluation.

In the evaluation, the Professor will assess:

- Systematic attendance to magistral lessons and sessions planned
- Attendance to presentation oral autonomous work and other activities (seminars, etc.)
- Involvement and active participation of students - Individual and group work of students
- Grades obtained in written tests
- Continuous monitoring and planned activitie s and tasks according to the requirements, deadlines and criteria

EVALUATION PROCEDURE

The evaluation of the subject in both modules should weigh classroom and non-attendance student activities. Therefore, the relative weight applied to calculating the final grade will be 70% of the rate in the written test individual, the 20% from overall non-attendance activities and 10% of the rate from practice test. Individual written test will consist of two parts: 50% value of the rate by a multiple-choice test on basic objectives of the subject, qualifying if 50% of the test is passed, and 50% by witten test of knowledge. Regarding the practical training, the evaluation of the practices will be carried out by trial and solvency of acquired knowledge in solving practical problems with daily monitoring of the quality of experimental and technical work as well as student motivation. The calculation of the final grade will depend on the following conditions. It is compulsory to overcome the practical requirement and individual written tests with a minimum rating of 5. The student must attend at least 75% of the theoretical lessons to compute non-attendance activities delivered. The final grade for the course will be between 0 and 10 points and will correspond to the average of the final marks obtained in Biochemistry and Microbiology modules. They are offset provided the minimum score in some or modules is equal to or greater than 4.

NON-CONTINUOUS EVALUATION

According to Article 8.2 of the " Rules for the evaluation and assessment of students at University of Granada" adopted on May 20, 2013: "To obtain the approval for the final unique evaluation assessment, the student, in the first two weeks of the student enrollment date, he/she must submit especifically to the Director of Department a motivate requirement for the approval. The Director of department shall transmit it to the corresponding faculty, proving the reasons for which the student will not be able to follow the continuous assessment system". Students who have chosen this system will have to make and pass a written format similar to continuous assessment on the entire agenda (90 % of score) test, and proof of practical training (10 % of score). For the calculation, it is a prerequisite pass both tests with a minimum rating of 5.

Students who have chosen this system and had been admitted to it, during the first two weeks teaching, will have to make and pass a written test of similar format to the continuous assessment of the entire agenda (90 % of score), and a test of the practical training (10 % of the score). For the calculation, it is compulsory to overcome the practical test requirement and individual written tests with a minimum rate of 5.

APPENDIX

Students are required to act in the assessment tests in accordance with the principles of individual merit and authenticity of the exercise. Any contrary action with the use of not permitted means, even if detected after the evaluation process of the test, shall be subject to numerical final rating 0. Besides the fact shall be communicated to the academic authorities. In case it is necessary to check the authenticity of the information submitted to the evaluation, teachers will proceed to confirm the acquisition of skills by oral test examination.

ADDITIONAL INFORMACION

More information can be found in web pages from the Departments BBM2 and Microbiology.