Study Plan

School: School of Sciences and Technology
Degree: Master
Course: Biochemistry (cód. 589)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI10249M	Bioinformatics and Biochemical Simulation	Biochemistry	3	Semester	78
MAT11886M	Numerical Optimization	Mathematics	3	Semester	78
QUI10251M	Control of Quality	Chemical and Biochemical Engineering	6	Semester	156
QUI10252M	Stress and Cellular Death	Biochemistry	6	Semester	156
MVT10253M	Clinical Microbiology	Veterinary Medicine	6	Semester	156
QUI10254M	Advanced Biochemical Methods	Biochemistry	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI07660M	Clinical Biochemistry	Biochemistry	6	Semester	156
QUI11887M	Advanced Subjects in Biochemistry	Biochemistry	9	Semester	234
QUI11888M	Biochemical Pharmacology	Biochemistry	6	Semester	156
QUI10256M	Pharmaceutical Chemistry	Chemistry	6	Semester	156
QUI02599M	Biomaterials	Chemistry	3	Semester	78

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIL10250M	Ethics of Scientific and Technological Research in Life Sciences	Philosophy	3	Semester	78

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Group of Options					

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI10257M	Advanced Courses	Biochemistry Veterinary Medicine Chemistry	6	Semester	156
QUI10242M	Toxicology of most Relevant Pollutants	Biochemistry	3	Semester	78
CMS11889M	Immunity and Environment	Biochemistry	3	Semester	78
QUI02597M	Bioreactors	Chemical and Biochemical Engineering	6	Semester	156
QUI02602M	Production of Liquid Biofuels	Chemical and Biochemical Engineering	6	Semester	156
QUI10241M	Chemistry of Soil and Sediments	Chemistry	6	Semester	156
QUI10111M	Microbiology of fermentation	Chemical and Biochemical Engineering	6	Semester	156

Dissertation
Internship

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					
Internship					

Conditions for obtaining the Degree:

*** TRANSLATE ME: Para aprovação na componente curricular deste Mestrado, é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares:

1.º Semestre{\}newline

- 6 UC Obrigatórias num total de 30 ECTS

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2.º Semestre{\}newline

- 5 UC Obrigatórias num total de 30 ECTS

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3.º Semestre{\}newline

- 1 UC Obrigatórias num total de 3 ECTS{\}newline

- 1 UC Optativa num total de 6 ECTS{\}newline

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Para obtenção do grau, é necessário também a aprovação em Dissertação/Estágio, com o total de 51 ECTS, no 3.º e 4.º Semestre. ***

Program Contents

Back

Bioinformatics and Biochemical Simulation (QUI10249M)

1. Historical perspective of Bioinformatics. 2. Data bases and SRS. 3. Algorihtms for sequences alignment 4. Sequences search. Motifs, profile and domains. 5. Servers and tools for genome analysis. 6. Genes and regulator sequences identification. 7. Analysis of biochips. 8. Phylogenetic analysis. 9. Genome and cancer, from genotype to phenotype. 10. Three-dimensional structure of proteins. Mono and three-dimensional alignments. 11. Structural data Bases. The Protein Data Bank. The format of type files .pdb. 12. Protein modelling by homology. Modelling by homology based on Web. 13. Introduction to Monte-Carlo simulations. 14. Introduction to molecular dynamic simulations of temporal behaviour of macromolecules. Applications to a proteins and cell membranes models. 15. Results analysis of simulation. 16.Analysis of equilibrium simulation.17 Radial distribution functions. 18. Mechanical properties. 19. Fluctuations. 20. Correlation functions. 21. Dynamic proprieties.

Back

Numerical Optimization (MAT11886M)

Scientific method and experimental design.
Analysis of variance models: fixed effects (single and multiple factor), random effects (single and multiple factor) and mixed effects.
Multiple comparisons.
Complete and incomplete block designs. Latin square designs.
Non-parametric approaches.
Simple linear regression model and multiple regression model (estimation, inference, prediction, model adequacy and validation). Diagnostics for influence points, outliers,
multicollinearity and autocorrelation. Model selection.
Nonlinear Regression.

Back

Control of Quality (QUI10251M)

1 Concepts and Definitions
1.1 General concepts. Quality and its historical evolution.
1.2 Control of the quality.
1.3 Definition of the politics of development of the quality
1.4 National system of Quality (SPQ). Main subsystems of the SPQ.
1.5 The Portuguese Institute of the Quality. Normalization, metrology and qualification.

2 Costs of the quality
2 Quality costs concerning the safety at work.
2 Costs of the non quality.

3 Quality tools
3.1 The seven basic tools of quality.

4 Sampling
4.1 Definition. Types of sampling.
4.2 Different steps for plans sampling implementation.
4.3 Plan of sampling for variable
4.4 Plans of sampling for attributes.

5 Statistics Applied to the Quality
5.1 Control charts utilization

6 Norms of Quality Management
6.1 Beddings and vocabulary - ISO 9000: 2000
6.2 System management of quality - ISO 9001: 2008
6.3 Improvement of performance - ISO 9004: 2000
6.4 Systems of security management and health - OSHAS 18001:1999.

Back

Stress and Cellular Death (QUI10252M)

1.Oxygen is a toxic gas. 2.Cell processes implicated in ROS formation and RNS 3. Models organisms used in stress studies. 4. Reactives species with biochemical importance, transition metals, sulphur, hidroxyl, superoxide, peroxyl, alkoxyl and nitric oxide. 5. Non-radicals reactive species, hydrogen peroxide, hypochlorous acid, singlet oxygen and peroxynitrite. 6. Enzymatic and non-enzymatic antioxidants mechanisms. 7. Oxidative stress, adaptation, damages, repair and death. Detection of free radicals and other reactive species. 9.Biotransformation and stress. 10. Reactive species, inflamatory states, aging, nutrition, pathologies and therapy.

Back

Clinical Microbiology (MVT10253M)

Theoretical

1The Microbiologist and the Clinical Analytical Lab security and quality control. 2Selection, collection, manipulation and transportation of clinical samples for microbiological analysis. 3Sterilization, pasteurization, disinfection and asepsis. 4 Microbiological agents and chemotherapy of viral and bacterial infections. 5Laboratory diagnosis of infectious diseases. 6Clinical bacteriology: classification, morphology and physiology. 7Clinical Micology: morphology and general biology. 8Clinical virology viral structure and classification of vírus infecting humans. Diagnosis, pathogeny, prevention and control of infectious virus.

Pratical

1 Isolation and identification of some microorganisms earlier described. 2 Bacteriological examination of fezes, urine and other biological fluids. 3 Antibiograms. 4 Several serological tests for antibody detection: IFAT, ELISA, DAT, SDS-PAGE and WESTERN BLOT. 5 PCR technique in the diagnosis of viral infections.

Back

Advanced Biochemical Methods (QUI10254M)

1 – Spectral methods of analysis of biomolecules for qualitative and quantitative determination

2 – Methods of analysis based on the use of probes for analysis without the use of chemical reagents – Biosensors. Relevance of Electrochemistry in the context of contemporary Biochemistry: exposure and conversation about common cases and of cutting edge. Reagents, materials and equipment essential to the implementation of electrochemical methods in biochemistry. Electrochemical techniques (e.g., potentiometry, voltammetry, amperometry and electrochemical impedance spectroscopy) of (a) analysis of species with biochemical interest and (b) development/characterization of electrochemical biosensors.

3 – Immunochemistry methods – concepts and applications: i) Antibodies and antigens; ii) Productioon of antibodies; iii) Detection and quantification of biomolecules using antibody based techniques; iv) Application of antibodies in diagnostics; v) Application in therapeutics.

Back

Clinical Biochemistry (QUI07660M)

Back

Advanced Subjects in Biochemistry (QUI11887M)

Module I: Lipidaemia e cholesterolaemia. Cholesterol: distribution and function. Metabolism of cholesterol and biliary acids. dislipidaemia: Classification and Related diseases; Prevention and therapy.
Module II: Pancreatic beta cell and Diabetes Mellitus: from physiology to pathology. β-cell dysfunctions: causes and consequences.
Module III: Metabolism and metabolic pathologies. Metabolic pathways. Metabolic correlations and metabolic control and regulation. Clinical correlations. Tracers with interest Biochemical markers with interest on diagnosis and monitoring of some metabolic pathologies.
Module IV: Genetic Pathologies- physiological aspects, screening and testing for genetic traits, special perspectives on genetic disorders
Module V: Molecular therapy - therapeutic nucleic acids, methods for gene delivery, clinical application of gene therapy, ethical and social problems of gene therapy.
Módulo VI: Foods Biochemistry – Concepts and technological, nutritional and sensorial aspects;
Módulo VII: Chemistry Applied to the study of Heritage – review over the constituent materials of art pieces, pathologies and modification processes, techniques and methodologies in the study of art work.
Módulo VIII: Biochemical and Biotechnological Processes applied to Heritage – methodologies for the biodegradation characterization and evaluation. Metabolic activity and dynamic of the populations. New biotechnological approaches to work art preservation.
Módulo IX: Development and innovation in Agriculture - the Biochemical approach.

Back

Biochemical Pharmacology (QUI11888M)

Structural relationship and activity
Pharmacokinetics
Absorption, distribution, metabolism and excretion
Pharmacokinetic Models
Pharmacodynamics
Action and pharmacological effect
Receivers
Drug-receptor interaction
Characteristics of a receiver
Dynamics of activation of a receptor
-Receptor binding interaction
Union drug-receptor
Pharmacodynamic interaction
Increase or decrease the effects due to mechanisms of drug action
Effect of drugs
Quantitative pharmacodynamic models
Maximum effect and potency of a drug
Effect of agonist and antagonist drugs
Individual variation in response to a drug
Different classes of drugs
Drugs that act at synapses and junctions Neuroeffector
Drugs with actions on the central nervous system
Autacoids
Drugs affecting renal and cardiovascular functions
Drugs affecting gastrointestinal function
Chemotherapy anti-microbial and anti-parasitic
Chemotherapy of neoplastic diseases
Immunomodulators
Drugs that act on the blood and organs
Hormones and their antagonists

Back

Pharmaceutical Chemistry (QUI10256M)

1. Introduction to Pharmaceutical Chemistry. Denomination and classification of drugs.
2. Drugs and their action: mechanisms of action and receptors as therapeutic targets.
3. Quantitative structure-activity relationships: SAR, QSAR, 3DQSAR.
4. Structure and pharmacokinetic parameters: Absorption, Distribution, Metabolism and Excretion of drugs. Prodrugs.
5. Methods of search, discovery and isolation of new drugs; contributes from different Natural Products Chemistry, Asymmetric Synthesis, Heterocyclic Chemistry, Combinatorial Chemistry and Supramolecular Chemistry.
6. Discovery, design, development and production of new drugs.
7. Study of some important drugs: chemical structure, synthesis, mechanism of action, structure-activity relationship, metabolism and applications.
8. Preparation, isolation and analysis of drugs.

Back

Biomaterials (QUI02599M)

Historical introduction to biomaterials.
Introduction to materials science ? types of material (metals, ceramics, polymers, composites), and their properties; methods of mechanical, structural and superficial characterisation.
Fundamentals of biomaterials ? types of material (Ti, alloys, amalgams, calcium phosphates, carbon, polyHEMA, UHMWPE, PMMA, PEG/PEO, PLA/PGA, PTFE, bisGMA, ionomers, silicones, chitosan, collagen, others); hydrogels; tissue engineering scaffolds; surface films.
Tissue-biomaterial interaction ? biofilm; protein adsorption; biocompatibility; toxicology; osseointegration; degradation.
Applications ? joint and bone replacement, cardiovascular implants, tendon and ligament replacement, contact lens, orthodontology, controlled drug release. Biosensors. Ethics and future perspectives.

Back

Ethics of Scientific and Technological Research in Life Sciences (FIL10250M)

1. The axiological dimensions of the Life Sciences' scientific and technological research;
2. the main lines of scientific and technological progress in life sciences;the importance of technology and techno science;
3. Techno science and the manipulation of human nature: the emerging bioethical issues;
4. In search of a reliable criterion of decision: the human nature;
5. Major theoretical models in bioethics:
6. The concepts of Freedom, Autonomy, Dignity of the Human Person and their use in bioethics.
7. Social, economic and political ethics of Scientific and Technological Research in Life Sciences.
8. Practical cases.

Back

Advanced Courses (QUI10257M)

This course is composed by 3 modules (3 ECTS each) on different subjects of advanced biochemistry. The students will be able to choose between several modules proposed each year.

Back

Toxicology of most Relevant Pollutants (QUI10242M)

1. Origin, distribution and persistence of pollutants with toxicological relevance.
2. Toxicity of pollutants on individuals, populations and communities.
3. Methods for assessing the toxicity of pollutants.
4. Routes, methods of exposure and toxicity factors supporting cast.
5. Principles for assessment of toxic hazards. Markers of exposure and toxicity.
6. Biological mechanisms of response and adaptation.
7. Integration of knowledge from the molecular to the global level, the individual to the ecosystem.

Back

Immunity and Environment (CMS11889M)

I – Fundamental Mechanisms in Immunity:
• Cells from the imune system;
• Mediators and antibodies;
II – Environment and imune system Interactions:
• Mechanisms of Hypersensitity – allergic disease;
• Allergens – Structure and function;
• Allergens and cross reactions;
• Allergenicity mechanisms of allergens;
• Air pollutants (indoor e outdoor) and hypersensitivity reactions;
III – Environmental allergens:
• Acari, animal epithelia, fungal spores and pólen
• Sampling methodologies and thecniques for detection, quantification and monitoring;
• Exposures and health impacts – risk assessment;
• Environmental risk factos – climate change and geographical factors;
• Risk prevention and forecast;
IV - Common Allergic Diseases
V - Occupational and Environmental Allergy
VI – Other hypersensitivity conditions

Back

Bioreactors (QUI02597M)

Introduction to fermentation technology. Cultures in liquid and solid state. Types of fermenters: Completely Stirred Tank Reactor, bubble column, expanded bed, fluidized bed, packed bed, "air lift". Operation and performance of bioreactors. Contribution of upstream and downstream processes to the fermentation process. Product Concentration. Productivity.
Sterilization. Batch sterilization system of liquids. System of continuous steam injection. Filters for sterilizing air and liquid.
Agitation of the culture medium. Factors affecting the transfer of oxygen. Solubility of oxygen. Factors affecting the transfer of oxygen to the cell.
Microbial cultures in bioreactors and production of primary and secondary metabolites. Anaerobic cultures: production of biogas.
Fotobioreactors: production of algal biomass. Types of systems and technology. Principles of operation. Limiting factors, and potential advantages. Productivity and applications.

Back

Production of Liquid Biofuels (QUI02602M)

1.Consumo Energy;
2. Biomass for energy: Concepts and markets;
3. Biodiesel.
3.1 Physical and chemical properties of oils for biodiesel production
3.2 Catalysis (homogeneous vs. heterogeneous)
3.3 Enzymatic Catalysis
3.4 Properties of biodiesel;
4. bioethanol
5. biomethanol
6. Catalytic processes (Fischer-Tropsch Synthesis);
7. Thermal Processes
7.1Conversão Thermal combustion;
7.2 Pyrolysis and liquefaction;
7.3 Gasification;
8.Combustíveis synthetic liquid oxygen;

Back

Chemistry of Soil and Sediments (QUI10241M)

1. Surface geochemistry
1.1 Constituents of soil and sediments
1.2. Weathering Processes
2. Composition of soils and sediments
2.1 Solid Phase
2.2 Liquid Phase
2.3 Gaseous Phase
2.4 Complex Colloidal Soil and ion exchange processes
3. Soil reaction
3.1 Acid soils
3.2 Alkaline soils
4. Growth of plants and plant elements
5. Soil pollution
5.1 Fertilizers
5.2 Pesticides
5.3 Organic wastes
5.4 Case studies (eg. Abandoned mines)
6. Remediation process
6.1 Main processes involved in Phytoremediation:
6.1.1 Phytostabilization
6.1.2 Phytovolatilization
6.1.3 Phytoextraction
6.1.4 Bioremediation of waters (case study).

Back

Microbiology of fermentation (QUI10111M)

Microbiology Overview of fermentation processes. Microorganisms of interest in fermentation processes. Importance of Microorganisms on the quality of wines. The wine microorganisms and their natural habitat. Microbial growth. Controlling factors. Measures of microbial growth. Microorganisms of winemaking interest: biochemical, morphological and genetic differences. Nutrition and culture media. Cellular transport of nutrients. Principles of microbial metabolism. The transformation of must into wine. Alcoholic fermentation. Biochemistry of fermentation. Malolactic fermentation. Bioconversion of malic acid. Biochemistry and physiology of the malolactic fermentation. Winemaking, mixed populations: growth and kinetics. Application of starters.
Microorganisms.of wine spoilage.
Practical: Isolation of microorganisms from a spontaneous fermentation of grape juice. Characterization of the performance of a yeast strain during grape fermentation.