



## Study Plan

**School:** School of Sciences and Technology

**Degree:** Master

**Course:** Biochemistry (cód. 133)

### 1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI7652	Bioinformatics and Biochemical Simulation	Biochemistry	4	Semester	104
QUI7653	Quality Control	Chemical Engineering	5	Semester	130
MVT7654	Clinical Microbiology	Biology	5	Semester	130
QUI7655	Advanced Biochemical Methods	Biochemistry	5	Semester	130
MAT7656	Experimental Planning	Mathematics	4	Semester	104
QUI7657	Stress and Cellular Death	Biochemistry	5	Semester	130
FIL7658	Ethics of Scientific and Technological Research in Life Sciences	Philosophy	2	Semester	52

### 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI7659	Biomaterials	Chemistry	3	Semester	78
QUI7660	Clinical Biochemistry	Biochemistry	6	Semester	156
QUI7661	Biochemical Pharmacology	Biochemistry	6	Semester	156
QUI7662	Pharmaceutical Chemistry	Chemistry	5	Semester	130
QUI7663	Advanced Topics in Medical Biochemistry	Biochemistry	10	Semester	260

### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI7665	Research Seminar	Biochemistry	1	Semester	26

#### Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
QUI7664	Advanced Courses	*** TRANSLATE ME: Bioquímica, Sociologia e Química ***	9	Semester	243

#### Mandatory alternatives

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Dissertation				
	Internship				

### 2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Mandatory alternatives</b>					
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: { \ }newline

1.º Semestre { \ }newline

- 7 UC Obrigatórias num total de 30 ECTS { \ }newline

2.º Semestre { \ }newline

- 5 UC Obrigatórias num total de 30 ECTS { \ }newline

3.º Semestre { \ }newline

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

- 1 UC Optativa num total de 9 ECTS { \ }newline

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Para obtenção do grau, é necessário também a aprovação em Dissertação, com o total de 50 ECTS, no 3.º e 4.º Semestre. \*\*\*

## Program Contents

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### **Bioinformatics and Biochemical Simulation (QUI7652)**

1. Historical perspective of Bioinformatics.
2. Data bases and SRS.
3. Algorithms 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 properties.



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### **Quality Control (QUI7653)**

#### 1. Evolution of Quality Concepts

Control of quality during the séc XX

National system of quality. Subsystems of the SPQ

The Portuguese Institute of the Quality. Normalization, metrology and qualification. Certification and accreditation of organizations

Politics and objectives of the quality. Quality management. Improving the quality. Quality assurance

Costs of quality

#### 2. Tools of Quality

The seven basic tools of quality

Tools of Planning or Tools of Management

#### 3. Control of quality in a laboratory

Best laboratorial practices

Vocabulary. Deviation evaluation and reduction

#### 4. Sampling

Definition. Types of sampling

Plan of sampling for variable or for attributes

#### 5. Statistics Applied to the Quality

Statistical control of the process using the control charts

#### 6. Metrology

General principles

Good practices in the laboratory

Qualification and calibration

Standards and references

#### 7. Norms ISO, EN, EP

Series ISO 9000, 14000, 17025, OSHAS 18001:

System HACCP ISO 22000

Integrated system.

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### **Clinical Microbiology (MVT7654)**

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.

Practical

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.



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### **Advanced Biochemical Methods (QUI7655)**

- 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) Production of antibodies; iii) Detection and quantification of biomolecules using antibody based techniques; iv) Application of antibodies in diagnostics; v) Application in therapeutics.

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### **Experimental Planning (MAT7656)**

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.

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### **Stress and Cellular Death (QUI7657)**

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, hidroxy, superoxide, peroxy, alkoxy and nitric oxide.
5. Non-radicals reactive species, hydrogen peroxide, hypochlorous acid, singlet oxygen and peroxy nitrite.
6. Enzymatic and non-enzymatic antioxidants mechanisms.
7. Oxidative stress, adaptation, damages, repair and death.
8. Detection of free radicals and other reactive species.
9. Biotransformation and stress.
10. Reactive species, inflammatory states, aging, nutrition, pathologies and therapy.

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### **Ethics of Scientific and Technological Research in Life Sciences (FIL7658)**

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.



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### **Biomaterials (QUI7659)**

Historical introduction to biomaterials.

Introduction to the biomaterial science - materials types (metals, ceramics, polymers, composites), properties, method of mechanical, structural and superficial characterisation.

Fundamentals of biomaterials - materials types (PMMA, PEG/PEO, PLA/PGA, PTFE, collagen, carbon, among others), hydrogels, tissue engineering, surface films.

Tissue-biomaterial interaction - biofilm, protein adsorption, biocompatibility, toxicology, degradation.

Applications - joint and bones replacement, cardiovascular implants, tendon and ligaments replacement, contact lens, orthodontology, controlled drug release. Biosensors. Ethics and future perspectives.

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### **Clinical Biochemistry (QUI7660)**

Basic concepts in Clinical Biochemistry. Diagnostic value of biochemical tests. The problematic of Clinical Biochemistry Lab Quality management. Biological specimens. Collection and handling of biological samples. Quality control. Techniques and methods of analysis used individually or automatic analyzers. Reference values and their clinical significance

Physiology and pathophysiology of several organs and systems. Biochemical markers used in diagnosis and monitoring of diseases. Plasmatic proteins. Nutritional markers. Liver function and main disorders. Serum enzymes markers on hepatic cardiac, pancreatic and muscular diseases. Plasmatic lipoproteins, metabolic disorders and risk of cardiovascular disease. Carbohydrate metabolism and glucose homeostasis. Diabetes mellitus. Hypoglycemia and inborn errors of carbohydrate metabolism. Kidney and renal function. Water and electrolytes balance. Disorders of renal and liver function. Endocrine function and main hormonal disorders. Tumoral markers.



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### **Biochemical Pharmacology (QUI7661)**

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

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### **Pharmaceutical Chemistry (QUI7662)**

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.



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### **Advanced Topics in Medical Biochemistry (QUI7663)**

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. &#946;-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.

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### **Research Seminar (QUI7665)**

N/A

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### **Advanced Courses (QUI7664)**

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.