

**Molecular and Cellular Technology on
Biohealth professional Master's degree
Syllabus in Detail**

Study plan for semester 1 of Master TCMB

Unit UE		Unit element constitutive ECUE		Credits	Coeff.	Workload	Assimilation	Workload division				Evaluation	
Code UE	Intitule UE	Code ECUE	Intitule ECUE				Self-Study	Course	DW	PW	PPW	CC	RM
11	Biology and Cellular Technologies	111	Cell, Bio-membrane and Signaling	3	1,5	42h	40h	21h	7h	14h			X
		112	Cell-based study techniques	3	1,5	42h	40h	21h	7h	7h	7h		X
12	Microbiology and Molecular Immunology	121	Internship: Microbiological diagnostics and bio-health applications	3	1,5	42h	40h	21h	7h	7h	7h		X
		122	Molecular Immunology	3	1,5	42h	40h	21h	7h		14h		X
13	Genetics and genomics technologies	131	Genome research methodologies	3	1,5	42h	40h	21h	7h	7h	7h		X
		132	Recombinant DNA technologies	3	1,5	42h	40h	21h	7h	7h	7h		X
14	Entrepreneurial skills & Bioinformatics	141	Bioinformatics	3	1,5	35h	50h	14h	7h		14h	X	
		142	Business development & entrepreneurial soft skills	3	1,5	35h	50h	14h	7h		14h	X	
15	Cellular biotechnology and quality control	151	Internship: Cell Culture: Methodologies and Laboratory Quality Management System	3	1,5	42h	40h	14h		14h	14h	X	
		152	Bioanalytical approaches	3	1,5	42h	40h	21h	7h	14h		X	
		Global / Semester 1		30	15	406H	420H	189H	63H	70H	84H	3	7
		Percentages / type of Workload				100%		46,6%	15,6%	17,2%	20,6%	30%	70%

Scientific and technical competencies

Bioanalytical and technological competencies in the cellular and molecular area

Managerial, informatically and quality control competencies

Internship: 1/ Cell culture: Methodologies & Laboratory Quality Management System; 2/ Microbiological diagnostics and bio-health applications (see organization in practical personal work)

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Biology and Cellular Technologies

Credit Number: 6

UE Code: 11

University: Tunis El Manar

Institution: Faculty of Sciences of Tunis

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester: 1

ECUE1	Code	Title	
	111	Cell, Bio-membrane and Signaling	
Responsible	Course	Said GLAI	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language		French	
ECUE2	Code	Title	
	112	Cell-based study techniques	
Responsible	Course	Oifa MASMOUDI	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload				Self-study	Value		Evaluation	
	Course	DW	PW	PPW		Coef	Cred	% CC	% Exam
ECUE 1: Cell, Bio-membrane & signaling	21h	7h	14h		40h	1.5	3		X
ECUE 2: Cell-based study techniques	21h	7h	7h	7h	40h	1.5	3		X
Total UE	42h	14h	21h	7h	80h	3	6		

ECUE 1: Cell, Bio-membrane & signaling

1. Required and recommended prerequisites for participating in the module

Knowledge in Cell Biology, Molecular Biology, Intercellular Communication Systems, and Biochemistry.

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Provide excellent training in molecular biology and cellular physiology, both theoretically and practically. To master the basic techniques and equipment used in molecular biology and cellular physiology that are essential for understanding cellular function and behavior.

Competencies: Master and implement analytical processes and product quality control validation.

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Video presentations. video presentations and conferences by recognized scientists in the field

5. Exam form (Oral presentation, essay, ...)

Mixed System: Continuous Assessment and Final Exams

6. Study and examination conditions

Practical teaching in the technological platform units of the Faculty of Sciences of Tunis.

7. Reading list (title of manuals, articles)

Reference books and articles – Reference conferences – books on cellular technology -Books on cellular biology

8. Content (The content description must clearly indicate the weighting of the content and the level)

8.1. Course

1-Introduction: Lipid Composition of the Membrane

- Phospholipids
- Fatty acids: different types and major species
- Membrane fluidity: role of fatty acids and their macroscopic structure
- Sphingolipids
- Glycolipids
- Steroids

2-Introduction: Protein Structure and Function

- Different types of membrane proteins
- Hydrophobic amino acids and membrane design
- Anchoring of proteins in the membrane
- Peripheral proteins
- Transmembrane proteins
- Different types of transmembrane transport

3-Introduction: The Mitochondrial Membrane

- Transport via the outer mitochondrial membrane
- Membrane carbohydrates
- Glycosylation of proteins at N or O of membrane proteins
- Glycolipids
- Concept of Glycocalyx

4-Introduction to Cell Biology

- Molecular components of the cytoskeleton
- Cell adhesion molecules
- Cellular compartments
- Intracellular trafficking and dynamics of membrane transport

5-Functional Regulation of Cell Adhesion

- Adhesive interactions and regulation of cellular functions

- Mechanical and/or kinetic properties of adhesion
- Regulation of cell adhesion
- Regulation of steric repulsion
- Regulation of expression and functionality of adhesion receptors: conformational modifications
- Microaggregation (clustering)

8.2. Practical work

Manipulations will be performed to study cellular behavior:

- Extraction of membrane phospholipids
- Study of cellular response to its environment: chemical injury, mechanical injury, peptidomimetic ligands
- Qualitative and quantitative study of cellular Respiratory Oxidative Burst
- Study of cellular signaling
- Study of intercellular interactions in physiological and pathological contexts (mixed culture

ECUE 2: Cell-based study techniques

1. Required and recommended prerequisites for participating in the module

Cell Biology, Molecular Biology and Biochemistry

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Master the concepts and methodologies related to the study of signaling pathways involved in the cellular response to its environment (migration, differentiation, proliferation and metabolism) as well as their implications in pathophysiological processes. Provide a theoretical and practical foundational knowledge in molecular dynamics and the interactions of macromolecules in the modulation of intracellular signaling pathways.

Understand the roles of molecular dynamics in the compartmentalization and regulation of major cellular physiological functions.

Competencies: Design, optimize, and validate bioassays in accordance with ethical guidelines

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

lessons, practical work

5. Exam form (Oral presentation, essay, ...)

essay

6. Study and examination conditions

Mixed System: Continuous Assessment and Final Exams

7. Reading list (title of manuals, articles)

.....

8. Content *(The content description must clearly indicate the weighting of the content and the level)*

8.1. Course

1-	Observation Methods - Methods and Techniques for Cell Observation - Photonic Microscopes - Electron Microscopes - Sample Preparation Techniques
2-	Applications of Optical Fluorescence Microscopy - Study of Molecular Interactions - Detection of Apoptosis - Study of Cellular Traffic and Molecular Mobility - FRAP and Applications - Photoactivation and Applications - Live Cell Imaging - Analysis of Cell Division - Analysis of Cell Migration - Analysis of Phagocytosis - Analysis of Cellular Cytotoxicity - Analysis of Immunological Synapse Formation - Analysis of Protein Redistribution
3-	Cellular Technology (Practical Work) - Methodologies and Good Practices in Cell Culture - Cell Culture, Cell Fusion, Viral Transformation - Extraction and Concentration of Cellular Products - Quantitative Approaches (Fluorescent and Isotopic Labeling), Biomarkers - Cellular Study Models Mimicking Physiopathological Disorders: Migration Model, Differentiation Model, Proliferation Model, and Cytotoxicity Model - Cryopreservation of Cells
4-	Study of Proliferation, Migration, and Cell Death Processes - Basic Events of the Eukaryotic Cell Cycle: Regulation of the Cell Cycle - Model Organisms for the Study of the Cell Cycle - Techniques for Analyzing the Cell Cycle - Control Systems of the Cell Cycle - Mechanisms of Cell Differentiation and Cell Death

8.2. Practical work : Cell Technology

1.	Quantitative Approach (Fluorescent and Isotopic Labeling), Biomarkers.
2.	Cell Study Models Mimicking Physiopathological Disorders: Migration Model, Differentiation Model, Proliferation Model, and Cytotoxicity Model. Methods for Studying Viability, Cytotoxicity, and Genotoxicity. Use of Fluorochromes to Monitor Intracellular Molecular Dynamics (e.g., DAF, DHE, DHR, JC10) using Epifluorescence Microscopy. Bioprocesses for Production: Industrial Scale Cell Cultures, Purification Processes

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Microbiology and Molecular Immunology

Credit Number: 6

UE Code: 12

University: Tunis El Manar

Institution: Faculty of Sciences of Tunis

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester: 1

ECUE1	Code	Title	
	121	Microbiological diagnostics and bio-health applications	
Responsible	Course	Naouel KLIBI	
Coordinator	PW/DW/PPW	Badia ESSEGHAÏER	
Creation date			Version 1
Modified at			
Language			
ECUE2	Code	Title	
	122	Molecular Immunology	
Responsible	Course	Asma GATI	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE 1: Internship: Microbiological diagnostics and bio-health applications	21h	7h	7h	7h	40h	1.5	3	X	
ECUE 2: Molecular Immunology	21h	7h		14h	40h	1.5	3		X
Total UE	42h	14h	7h	21h	80h	3	6		

ECUE 1: Microbiological diagnostics and bio-health applications

1. Required and recommended prerequisites for participating in the module

Molecular Biology Knowledge - Cellular Immunology - Nature, Structure, and Regulation of Gene Expression. Students should have knowledge in General Microbiology, Environmental Microbiology, Biotechnology, Food Science, Genetics, and Organic Chemistry.

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Understanding the methods of identification of bacteria and viruses used routinely in diagnostics
Understanding the use and enhancement of the properties of microorganisms of interest when they are beneficial for themselves (e.g., cells, proteins), for their products (e.g., exo-enzymes, antibiotics), and for their ability to transform and degrade certain substances in order to derive useful compounds to improve human health. Studying different examples of microbial biotechnologies applied in the field of bioscience

Competencies: Manage and process biological data:

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Reference works and articles – Reference conferences – Videoprojection

5. Exam form (Oral presentation, essay, ...)

Essay

6. Study and examination conditions

Mixed system: continuous assessment and final exams

7. Reading list (title of manuals, articles)

Cell biology works, Cell technology works, conferences by recognized scientists in the field

8. Content (The content description must clearly indicate the weighting of the content and the level)

8.1. Course

- Bacteriological Diagnosis
- Virological Diagnosis
- Applications of Microorganisms in Biosafety
- 1. Choosing Microorganisms**
 - Finding Microorganisms in Nature: Screening Techniques**
 - Development of Strains: Genetic Manipulation of Microorganisms**
 - Conservation of Microorganisms
- 2. Main Products of Microbiology in Health**
 - Antibiotics, Enzymes, Amino Acids, Vitamins and Flavors, Bioconversion Products, Exopolysaccharides, Biopolymers, Immunosuppressants, Anti-cancer Agents)
- 3. Biotechnological Applications of Microorganisms in Health**
 - Production of Therapeutic Molecules such as Vaccines, Hormones, Antibodies, Blood Proteins, and Growth Factors
 - Production of Antibiotics, Bacteriocins, and Antifungals-Gene and Phage Therapy- Probiotics and Health

8.2. Practical work : Cell Technology

1. Study of soil microorganisms: Isolation, subculturing, and obtaining pure bacterial cultures.
2. Identification of different bacteria (Gram-negative bacilli and Gram-positive cocci) using morphological, staining, and metabolic methods.
3. Study of antibiotic sensitivity in the identified bacteria.

4. Techniques for isolating and selecting microorganisms of biomedical interest (bacterial isolates producing antibiotics or antifungals). 5. Projects in pairs on the valorization and applications of microorganisms in health.

ECUE 2: Molecular Immunology

1. Required and recommended prerequisites for participating in the module

Molecular Biology Knowledge - Cellular Immunology - Nature, Structure, and Regulation of Gene Expression. Students should have knowledge in General Microbiology, Environmental Microbiology, Biotechnology, Food Science, Genetics, and Organic Chemistry.

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: To prepare students for careers in clinical and/or fundamental research in immunology. This course will provide both theoretical and practical training on the physiology of the immune response in both normal and pathological contexts. Additionally, it will inform students about new diagnostic and therapeutic tools.

Compétenceis: Mise en œuvre des techniques complexes et innovantes de Criblage des biomolécules.

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Reference works and articles – Reference conferences – Video projection Practical teaching in the technological platform units of the Faculty of Sciences of Tunis."

5. Exam form (Oral presentation, essay, ...)

essay

6. Study and examination conditions

Continuous assessment and final exams

7. Reading list (title of manuals, articles)

reference works and articles

8. Content (The content description must clearly indicate the weighting of the content and the level)

8.1. Course

Applied Immunology - Cells and Molecules of Immunity - Immunology and Cellular and Molecular Immunopathology.

1 Physiology and Organization of the Immune System

2- Innate Responses

2- Adaptive Responses

3 Dialogue in Immunology

4 Antiviral Immunology

5 Tumor Immunology

6 Transplantation and Autoimmunity

7 Immunity at Interfaces

8 - Neuroimmunology

9 Immunotherapy

8.1. Practical work

"Practical teaching in the technological platform units of the Faculty of Sciences of Tunis."

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Genetics and genomics technologies

Credit Number: 6

UE Code: 13

University: Tunis El Manar	Institution: Faculty of Sciences of Tunis
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	1

ECUE1	Code	Title	
	131	Genome research methodologies	
Responsible	Course	Maha MEZGHANNI	
Coordinator	PW/DW/PPW	Hedia BOURGUIBA	
Creation date			Version 1
Modified at			
Language			
ECUE2	Code	Title	
	132	Recombinant DNA technologies	
Responsible	Course	Salwa ZEHDI	
Coordinator	PW/DW/PPW	Ghada BARAKET	
Creation date			Version 1
Modified at			
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Genome research methodologies	21h	7h	7h	7h	40h	1.5	3		X
ECUE2: Recombinant DNA technologies	21h	7h	7h	7h	40h	1.5	3		X
Total UE	42h	14h	14h	14h	80h	3	6		

ECUE 1: Genome research methodologies

1. Required and recommended prerequisites for participating in the module

Molecular Biology Knowledge - Genetics - Nature and Structure of Genes

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Present the methodological approaches that have allowed for the establishment of genome structures and their decoding, as well as the new genome sequencing technologies, including Next-Generation Sequencing (NGS).

Competencies: Implementation of quality management systems for laboratories in the bioindustry

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

"Reference works and articles – Reference conferences – Video projection Practical teaching in the technological platform units of the Faculty of Sciences of Tunis."

5. Exam form (Oral presentation, essay, ...)

essay

6. Study and examination conditions

Continuous assessment and final exams

7. Reading list (title of manuals, articles)

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8. Content (The content description must clearly indicate the weighting of the content and the level)

8.1. Course

1. THE STUDY OF GENOMES: GENOMICS

1.1. - Objectives of Genome Study Projects

- 1.1.1. - Establishment of Genome Programs
- 1.1.2. Genome Research Centers

1.2. Specificities of Genome Programs

1.3. Maps of the Human Genome

- 1.3.1. Linkage Maps
- 1.3.2. Physical Maps
- 1.3.3. Mapping Methods

1.4. Development of Genetic Maps in Humans

2. GENOME ANALYSIS

2.1. I- Genome Sequencing

2.1.1. Strategies for Genome Sequencing

- a. Hierarchical Sequencing
- b. Random Sequencing

2.1.2. Evolution of Sequencing Techniques:

- a. First Generation Sequencing: Sanger
- b. Massively Parallel DNA Sequencing "NGS": Second and Third Generation Sequencing

2.2. Genome Assembly

- 2.2.1- Assembly Tools and Programs: the "Phred-Phrap-Consed" System
- 2.2.2- Creation of Scaffolds
- 2.2.3- Finishing and Closing Gaps: Combinatorial PCR
- 2.2.4- The Quality Problem of Genomes

2.3. Genome Annotation

- 2.3.1- EST Sequencing Methods
- 2.3.2- "Ab Initio" Methods
- 2.3.3- Functional Annotation
- 2.3.4- Relational Annotation

2.4. **IV- Genome Projects and Trends**

2.5. **V- Genome Publications**

2.6. **VI- Banks and Databases**

3. GENOMIC MEDICINE

3.1. The Human Genome: General Overview

3.2. The 1000 Genomes Project

3.3. The HapMap Project

3.4. The Epigenome

3.5. The Variome

3.6. The Microbiome

3.7. Personalized Genomic Medicine

8.2. Practical Work

1-Data Mining of Genomes: Application on Some Analysis Tools

2-Research and Analysis of SNP Polymorphisms

3- Analysis of NGS Data using Galaxy

ECUE 2: Recombinant DNA technologies

1. Required and recommended prerequisites for participating in the module

Molecular Biology Knowledge - Genetics - Nature and Structure of Genes

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Provide a lesson on recombinant DNA technologies and their applications by presenting the different cloning and expression vectors, as well as the methods of screening, gene transfer, and mutagenesis. The new genome editing methods such as CRISPR-Cas and TALEN will also be discussed

Competencies: Design of Experimental Strategy Planning for Complex Systems

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Reference works and articles – Reference conferences – Videoprojection – Practical teaching in the technological platform units of the Faculty of Sciences of Tunis

5. Exam form (Oral presentation, essay, ...)

essay

6. Study and examination conditions

Continuous assessment and final exams

7. Reading list (title of manuals, articles)

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8. Content *(The content description must clearly indicate the weighting of the content and the level)*

8.1. Course

- 1. Tools of Genetic Engineering Enzymatic Tools**
 - 1.1. Enzymatic Tools
 - 1.2. Vectors: Plasmids, Bacteriophages, Cosmids, Artificial Chromosomes, pYAC, pBAC, Shuttle Vectors
- 2. Cloning Methods**
 - 2.1. Cloning Vectors, Expression Vectors
 - 2.2. Cloning Steps
 - 2.3. Genomic Libraries, Complementary DNA Libraries
- 3. Screening Methods and Probe Labeling**
 - 3.1. Principles of Nucleic Acid Hybridization
 - 3.2. DNA Labeling by Nick Translation
 - 3.3. DNA Labeling by Random Priming
- 4. Gene Transfer In Vivo and In Vitro**
 - 4.1. Cloning and Expression Hosts: Bacteria, Yeasts, and Mammalian Cells
 - 4.2. Production of Transgenic Animals by Microinjection into the Pronucleus.
 - 4.3. Production of Transgenic Animals by Direct Insertion of Transgene into the Germ Line.
- 5. Inactivation of Genes In Vivo**
 - 5.1. Knock-out Invalidated Genes
 - 5.2. Insertion of a Knock-in Gene
 - 5.3. Genetic Engineering on Chromosomes
- 6. Targeted Genome Modifications**
 - 6.1. Mega-nucleases (EMRHE)
 - 6.2. Zinc Finger Nucleases (ZFN)
 - 6.3. Transcription Activator-Like Effector Nucleases (TALEN)
 - 6.4. CRISPR–Cas9 System

Therapeutic Cloning

8.1. Practical Work

PW1: Ligation of DNA into the Cloning Vector

PW2: Transformation of Competent Bacteria

PW3: Preparation of Recombinant Plasmids

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Entrepreneurial skills & Bioinformatics

Credit Number: 6

UE Code: 14

University: Tunis El Manar

Institution: Faculty of Sciences of Tunis

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester: 1

ECUE1	Code	Title	
	141	Bioinformatics	
Responsible	Course	Afef NAJJARI	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language			
ECUE2	Code	Title	
	142	Business development & entrepreneurial soft skills	
Responsible	Course		
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload				Self-study	Value		Evaluation	
	Course	DW	PW	PPW		Coef	Cred	% CC	% Exam
ECUE1: Bioinformatics	14h	7h		14h	50h	1.5	3	X	
ECUE2: Business development & entrepreneurial soft skills	14h	7h		14h	50h	1.5	3	X	
Total UE	28h	14h		28h	100h	3	6		

ECUE 1: Bioinformatics

1. Required and recommended prerequisites for participating in the module

GNU/Linux for Biology (Level 1)

Computer Science: Basic Office Tools, Web Browsing, Understanding Software, Having an Email, Computer, Keyboard, Mouse

Biology: Biomolecules such as DNA, RNA, proteins, medications, toxins.

Biostatistics (Level 1): Basic concepts and definitions in statistics

The 2 Workshops: Cellular and Molecular Biology; Immunology, Genetics, and Biochemistry

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: GNU/Linux for Biology (Level 1)

1. Introduction to biomolecule databases
2. Mastery and use of the GNU/Linux operating system (Ubuntu)
3. Using Shell and Bash commands
4. Using regular expression language
5. Exploring Biomolecule Databases
6. Knowing how to search for information and extract necessary data

Biostatistics: R for Biology (Level 1)

1. Manipulating the R environment
2. Manipulating data
3. Choosing the appropriate comparison test
4. Choosing the appropriate association or correlation test
5. Manipulating Figures

Competencies: Mastering foreign languages and communication techniques.

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

eLearning – courses, tutorials, and exams are available at <http://bioinformatics.tn>, with the possibility of forums, chat, exercises, and assessments using a highly effective individual monitoring system. The evolution of the options will be driven by needs, requests, and working conditions (internet, computers).

5. Exam form (Oral presentation, essay, ...)

Continuous assessment: attendance, seriousness, mid-term exam, final exam

6. Study and examination conditions

A continuous assessment regime of their knowledge and a final exam that will evaluate their work at the end of the semester

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

Course and Practical Work

Chapter I: 4 hours of lectures

1. General Introduction: Moodle and e-learning
2. Introduction: GNU/Linux? Working Environment of the Bioinformatician
3. Section I: Installing a Workstation under GNU/Linux**
4. Section II: Choosing a Distribution and a Desktop Environment**
5. Section III: Installing New Programs

Chapter II: 4 hours of lectures + 4 hours of practical work

1. Introduction: Using GNU/Linux
2. Section I: Executing a Unix Command or a Program
3. Section II: Navigating Directories, Listing, Creating, and Deleting a File

4. Section III: Searching for Files with Find and Locate
5. Section IV: Displaying a File with More, Cat. Searching for a String with Grep and Egrep

Chapter III: 3 hours of lectures + 5 hours of practical work

Introduction: Syntax of Regular Expressions and Meta-characters

1. Section I: Literal and Numeric Characters (a-z0-9)** **Section II: Groupings: Parentheses, Brackets, and Braces
2. Section III: Positioning: Caret and Dollar Sign** **Section IV: Quantifiers: Plus Sign, Asterisk, Question Mark
3. Section V: Alternatives, Escape Symbols

Chapter IV: 4 hours of lectures + 4 hours of practical work

Introduction: Information Retrieval and Search Engines

4. Section I: Databases - Structures and Concepts
5. Section II: Databases for Biology: PubMed, NCBI, UniProt, EMBL, Swiss-Prot, DrugBank
6. Section III: Ubuntu and Biological Databases-Tools for Querying Databases:Software and Packages

R for Biology

- Manipulating the R Environment- Manipulating Data
- Choosing the Right Comparison Test
- Choosing the Right Association or Correlation Test- Figure Manipulation

Chapter I: Familiarization with the R Environment

Section I: Installing R and Package

Section II: Data Manipulation

Chapter II: Choosing Statistical Tests

Section I: Comparison of Mean

Section II: Comparison of Proportions

Section III: Correlation

Section IV: Regression

Section V: Graphing

Section VI: Survival Curves

ECUE 2: Business development & entrepreneurial soft skills

1. Required and recommended prerequisites for participating in the module

Concept of Strategic Management and Entrepreneurship in Bioinformatics: GNU/Linux for Biology (Level 1)

Concept of Strategic Management and Entrepreneurship

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills:

1. Creation of Biotechnology Companies

- Raise awareness among students about entrepreneurship, as future creators, acquirers, intrapreneurs, project leaders, and facilitators.
- Familiarize students with the various steps that lead to the effective realization of an entrepreneurial project.
- Evaluate the socio-economic and political stakes at both local and international levels regarding entrepreneurship and business creation in the field of biotechnology.
- Introduce students to the Business Model.
- Explain to students the principles of project financing.
- Teach students how to identify and find sources of funding and support for innovative projects.

2. Soft Skills in Entrepreneurship

- Develop students' attitudes and skills in entrepreneurship.

- Stimulate students' creative thinking and initiative in terms of researching innovative ideas and identifying business opportunities in the biotechnology sector.

3. Strategy for Biotechnology Companies-

- Introduce students to strategic management.
- Train students on networks, alliances, and partnerships in the biotechnology sector.
- Master the strategic deployment of biotechnology companies.
 - Develop entrepreneurial spirit and foster the desire to undertake.
 - Demonstrate the ability to engage in creative and innovative thinking.
 - Identify the necessary resources for a given project and the corresponding budget
 - Demonstrate the ability to assess the risks associated with a given project (predict potential constraints for the implementation of the project).
 - Promote the emergence and identification of innovative ideas for entrepreneurial projects within the student community, in order to enable high-potential projects to materialize.
 - Encourage students to work in teams and reflect on their approach to realizing their projects, on the feasibility of the projects, and on the actions to be implemented for the realization of the entrepreneurial project.
 - Evaluate the socio-economic and political issues at the local and international levels regarding entrepreneurship and business creation, and raise awareness of the opportunities available within the Tunisian entrepreneurial environment.

Competencies: Iture manageriale et ouverture industrielle

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Team project on a business model an innovative project that will be evaluated continuously

5. Exam form (Oral presentation, essay, ...)

Continuous assessment: attendance, seriousness, mid-term exam, final exam

6. Study and examination conditions

7. Reading list (title of manuals, articles)

ALEXANDER OSTERWALDER, YVES PIGNEUR (2011), Business Model Nouvelle Génération, Ed PEARSON.
BOURET J., HOARAU J. & MAULEON F.,(2014), "Le réflexe Soft Skills: Les compétences des leaders de demain", Ed Dunod.
LEGER JARNIOU C., (2013), "Le grand livre en Entrepreneuriat", Ed DUNOD.
Fayolle A. & DEGEORGE J.M. (2012), "Dynamique entrepreneuriale : Le comportement de l'entrepreneur", Ed Deboek.
VERSTRAETE Thierry et SAPORTA Bernard, Création d'entreprise et Entrepreneuriat, Les Editions de l'ADREG, 2006.

8. Content (The content description must clearly indicate the weighting of the content and the level)

Course and Practical Work

1. General Introduction: What is Entrepreneurship?

Objective: Familiarize with the phenomenon and all its facets Interactive

Method: Reading articles and discussions

Practical Work: Development of an entrepreneurial project in biotechnology

2. Acquisition, Franchise, etc.

Objective: Distinguish between entrepreneurial logics

Interactive Method: Case studies / Video projections

Practical Work: Development of an entrepreneurial project in biotechnology

3. The Entrepreneurial Profile? How to Develop an Entrepreneurial Mindset? The motivations for entrepreneurship, attitudes, attributes, and behaviors of the entrepreneur

Objective: Understand the profile of an entrepreneur: a source of inspiration

Interactive Method: Interviews and presentations of testimonials from an entrepreneur in biotechnology / E-type Test: What type of entrepreneur are you?

Practical Work: Development of an entrepreneurial project in biotechnology

4. The Tunisian Entrepreneurial Environment? Support and Assistance System for Entrepreneurship
(logistical support, regulatory support, financial support: microcredits, venture capital, business angels, etc.)

Objective: To become aware of the opportunities offered within the Tunisian entrepreneurial environment (opportunities and threats).

Interactive Method: Documentary research and role-playing.

Practical Work: Development of an entrepreneurial project in biotechnology.

5. Session 5: From Idea to Opportunity and from Opportunity to the Development of an Entrepreneurial Project?

Sources of ideas, idea/business opportunities, the entrepreneurial process, feasibility study, etc.

Objective: To identify (define) and study entrepreneurial action (idea, feasibility, etc.).

Interactive Method: Brainstorming: searching for innovative ideas.

Practical Work: Development of an entrepreneurial project in biotechnology

6. Business Model versus Business Plan? What is a Business Model?

Objective: To identify the different components of a Business Model.

Interactive Method: Example of a Business Model / Business Model of the project.

Practical Work: Development of an entrepreneurial project in biotechnology.

7. Session 7: Business Model versus Business Plan?

Objective: To develop a Business Model / Business Plan for an entrepreneurial project.

Interactive Method: Group support.

Practical Work: Presentation of the project.

**Description sheet of a Teaching Unit (UE)
& of the Constituent Elements of a Teaching Unit (ECUE)**

Title of the UE

Cellular Biotechnology and Quality control

Credit Number: 6

UE Code: 15

University: Tunis El Manar

Institution: Faculty of Sciences of Tunis

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester: 1

ECUE1	Code	Title	
	151	Internship: Cell Culture: Methodologies and Laboratory Quality Management System	

Responsible	Course	QualiPro Mariem Azzabi	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language	French		
ECUE2	Code	Title	
	152	Bioanalytical approaches	
Responsible	Course	Fethi Oueslati	
Coordinator	PW/DW/PPW		
Creation date			Version 1
Modified at			
Language			

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

<i>The constituent elements</i> (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Internship: Cell Culture: Methodologies and Laboratory Quality Management System	14h		14h	14h	40h	1.5	3	X	
ECUE2. Bioanalytical approaches	21h	7h	14h		40h	1.5	3	X	
Total UE	35h	7h	28h	14h	80h	3	6		

ECUE 1: Cell Culture: Methodologies and Laboratory Quality Management System

1. Required and recommended prerequisites for participating in the module

Biology ,Nanosciences, Nanotechnologies

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills: Introduction to the scientific aspects and challenges of the nanoscience and nanotechnology revolution, particularly in the field of biology

Presentation of different aspects of the richness of nanoscience developments in the field of biology.

Competencies: Research and self-development, entrepreneurial projects, and soft skills

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Participation in online webinars learning in case of a critical health situation

5. Exam form (Oral presentation, essay, ...)

essay

6. Study and examination conditions

Final exam

7. Reading list (title of manuals, articles)

8. Content *(The content description must clearly indicate the weighting of the content and the level)*

Fundamentals of Quality

In just a few hours of classes, students will be able to grasp the concepts underlying any quality system, allowing them to immerse themselves in the practical aspects of the quality system of the faculty during directed and tutored work.

1. Fundamentals of Quality

Quality System(s): management, assurance, control, audits, HS (Health and Safety), traceability, validation, qualification, training, processes, document management, continuous improvement, etc.

ISO Standards, etc.

Good practices (laboratory, manufacturing, etc.)

Certifications.

2. Requirements, Principles, and Scope of Application

Quality

Quality Management System

Product and service

Scope of application

The quality function

Principles of quality management

The quality management system

Organization of the quality management system

Responsibility of the person in charge of quality management

Document control

Handling of complaints

ECUE 2: Bioanalytical approaches

1. Required and recommended prerequisites for participating in the module

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Skills:

Competencies: Research and self-development, entrepreneurial projects, and soft skills

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

5. Exam form (*Oral presentation, essay, ...*)

essay

6. Study and examination conditions

Final exam

7. Reading list (title of manuals, articles)

8. Content (*The content description must clearly indicate the weighting of the content and the level*)

8.1.Course



Study plan for semester 2 of Master TCMB

Unit UE		Unit element constitutive ECUE		Credits	Coef.	Workload	Assimilation	Workload division				Evaluation	
Code UE	Intitule UE	Code ECUE	Intitule ECUE				Self-Study	Course	DW	PW	PPW	CC	RM
21	Diseases and diagnostic tools	211	Molecular Methods in Human Pathology	3	1,5	42	40	21	7	14			X
		212	Cellular and molecular aspects of pathologies	3	1,5	42	40	21	7	14			X
22	Innovative Molecular Technologies & Biotherapies	221	RNA technology and transcriptomics	3	1,5	42	40	21	7	14			X
		222	Immuno-technology and Biotherapy	3	1,5	42	40	21	7	14			X
23	Proteomics & Applied Bioanalytical Techniques	231	Proteomics methodologies	3	1,5	42	40	21	7	14			X
		232	Applied bioanalytical techniques in metabolomics and toxicology	3	1,5	42	40	21	7	7	7		X
24	Internship Entrepreneurial and Bio-informatics II & Communication skills	241	English Certification and Technical Communication	2	1	28	30	14	7		7	X	
		242	Management of Innovative Projects	2	1	28	30	14		7	7	X	
		243	Structural Bioinformatics	2	1	28	30	14	7		7	X	
25	Cellular biotechnology and quality control	251	Internship: Autoimmune disease diagnosis	3	1,5	35	50	14		7	14		X
		252	Cytomics, Pathologies and Cytological Techniques	3	1,5	35	50	21		7	7		X
			Global / Semester 2	30	15	406H	430H	202H	56H	98H	49H	3	8
			Percentages / type of Workload			100%		50%	13,8%	24,1%	12,1%	27%	73%

Scientific and technical competencies

Bioanalytical and technological competencies in the cellular and molecular area

Managerial, informatically and quality control competencies

Internship: 1/ Autoimmune disease diagnosis; (see organization in practical personal work)

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Diseases and diagnostic tools

Credit Number: 6

UE Code: 21

University:

Institution:

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester:

2

ECUE1	Code	Title	
	211	Molecular Methods in Human Pathology	
Responsible	Course	Maha MEZGHANNI	
Coordinator	PW/DW/PPW	Hedia BOURGUIBA	
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	
ECUE2	Code	Title	
	212	Cellular and molecular aspects of pathologies	
Responsible	Course	Oifa MASMOUDI	
Coordinator	PW/DW/PPW		
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation		
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam	
Molecular Methods in Human Pathology	21	7	14		40	1.5	3	30%	70%	
Cellular and molecular aspects of pathologies	21	7	14		40	1.5	3	30%	70%	
Total UE	42h	14h	28h		80h	3	6	100%		

ECUE 1: Molecular Methods in Human Pathology

1. Required and recommended prerequisites for participating in the module

Molecular Biology, genetics

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

- This teaching aims to provide the methodological approaches and diagnostic tools used in human pathology. Through this UE, the student will deepen his knowledge of cutting-edge technologies used in clinical medicine and in pharmacology and biotherapies.
- The competencies concerned are: CS1-CS2-CS4-CS6

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Specialization: it is related to all program

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Lessons, practical work, analysis of articles

5. Exam form (Oral presentation, essay, ...)

Classical exam, essay, presentation

6. Study and examination conditions

Assimilation and self-study

7. Reading list (title of manuals, articles)

Outils de Diagnostic prénatal

Outils de Diagnostic des facteurs génétiques multiples impliqués dans une maladie génétique "complexe"

La médecine personnalisée

Edition génomique par CRISPR/CAS9 : soigner les maladies héréditaires avant la naissance

8. Content (The content description must clearly indicate the weighting of the content and the level)

I- Objectives of the diagnosis: Prevent & Predict

II-Prediction and Artificial Intelligence (AI) in medicine

1-Predictive medicine: what prevention is it?

2-Predictive medicine: what benefit and for whom?

a- Case of monogenic diseases

b- Case of complex diseases

3-An AI diagnoses diseases more accurately than doctors

III-Tools for identifying multiple genetic factors involved in a "complex" genetic disease

1-The candidate gene strategy

2-The whole genome approach (Genome Wide Scan)

3-The "Genome Wide Association Study" (GWAS) approach

IV- Personalized medicine

1-Sequencing of the personal genome

2-Pharmacogenetics and pharmacogenomics

3-Prescribing the best possible medication

4-The multiple pill: polypill

5-Tests for susceptibility to complex diseases

V-Modeling of biological data in the case of infectious diseases (Ebola, Zika, AIDS, etc.) and disease X

VI-Prenatal diagnosis and genetic disease study tools

1- Fluorescent in situ hybridization: FISH

2- FISH on metaphase

Cytogenetic diagnosis of syndromes microdeletions

Diagnosis of recurrent chromosomal abnormalities in malignant hematological diseases

Characterization of chromosomal abnormalities detected by karyotype

Detection of balanced cryptic telomeric translocations

3- Interphase FISH

4- Methods of global genome analysis

M-FISH and SKY: the karyotype in colors

Comparative Genomic Hybridization (CGH) array Comparative Genomic Hybridization (aCGH): The most widely used reference technique for the study of chromosomal abnormalities in constitutional pathologies.

New technologies: MLPA (Multiplex Ligation-dependent Probe Amplification)

SUPERVISED WORK: Analysis of articles

ECUE 2: Cellular and molecular aspects of pathologies

1. Required and recommended prerequisites for participating in the module

Cellular Biology, Molecular Biology, Microbiology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

- Understand the emergence of pathologies associated with the cellular, molecular and genetic levels. Have the scientific bases necessary to consider therapeutic approaches.
- The cellular and molecular levels will include an integrated approach. Teachings in endocrinology, neuroendocrinology, neuropathology, infectiology and oncogenetics are integrated into this module.

The competencies focused: CS1-CS3-CS5-CS7

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Physiology and cellular and molecular biology

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Lessons, practical work, analysis of articles

5. Exam form (Oral presentation, essay, ...)

Classical exam, essay, presentation

6. Study and examination conditions

Assimilation and self-study

7. Reading list (title of manuals, articles)

1. Physiologie cellulaire et moléculaire des grandes fonctions
2. Physiologie et pathologies des systèmes neuroendocriniens
3. Dérèglements pathologiques
4. Immunopathologie
5. Epidémiologie

8. Content (The content description must clearly indicate the weighting of the content and the level)

Cellular and molecular pathophysiology of major functions

- A- Brain physiology and pathologies during development and aging
 - Mechanisms of neurodevelopment and neurodegeneration.
 - Effects of toxins on the developing brain: epidemiology and behavioral impact.
 - Development and pathologies of the spinal cord
 - Cerebral ischemia and brain tumors
 - Molecular pathophysiology of neurodegenerative diseases
- B- Physiology and pathologies of endocrine systems
 - Cellular and molecular aspects of endocrine and neuroendocrine regulation
 - Techniques used in endocrinology and neuroendocrinology, from the molecular scale to the cellular scale to integrated aspects.
 - Neuroimmunoendocrine deregulations and neuroendocrine tumors
- C- Molecular bases of the different types of cell death
 - Apoptosis
 - Necrosis
 - Autophagy
 - Necroptosis
 - Anoikosis
 - Oxidative apoptosis
 - Oxidative inflammation
- D- Methodological approaches to the study of cellular pathologies
 - Markers of oxidative stress: products of the oxidation of cellular constituents
 - Markers of apoptosis: actors of apoptosis (Casp, Bcl-2, AIF, IAP, Cytochrome C, Mitochondrial transmembrane potential
 - Applications by flow cytometry
 - Proteins of reticulum stress, mitophagy, etc.

Practical work:

- Studies of cellular and/or integrated models of these pathologies.
- Cytotoxicity study
- Interaction between immune cells and tumor line

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Innovative Molecular Technologies & Biotherapies

Credit Number: 6

UE Code: 22

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	2

ECUE1	Code	Title	
	221	RNA technology and transcriptomics	
Responsible	Course	Souheila GUERBOUJ	
Coordinator	PW/DW/PPW	Samir BEN ALI	
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	
ECUE2	Code	Title	
	222	Immuno-technology and Biotherapy	
Responsible	Course	Mouna STAYOUSSEF	
Coordinator	PW/DW/PPW	Rym BOUHAHA	
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

<i>The constituent elements</i> (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
RNA technology and transcriptomics	21	7	14		40	1.5	3	30%	70%
Immuno-technology and Biotherapy	21	7	14		40	1.5	3	30%	70%
Total UE	42h	14h	28h		80h	3	6	100%	

ECUE 1: RNA technology and transcriptomics

1. Required and recommended prerequisites for participating in the module

Molecular biology, genetic engineering, biochemistry

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

This teaching aims to train and introduce students to the theoretical and technical knowledge of TOTAL RNA SEQUENCING (TOTAL RNA - SEQ) as well as the different fields of application of whole transcriptome sequencing.

Competencies: CS1-CS2-CS6

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory related to modules as genomics, and genetic engineering

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)
lessons, practical work

5. Exam form (Oral presentation, essay, ...)

Oral, classical exam, internship

6. Study and examination conditions

Self-study and internship

7. Reading list (title of manuals, articles)

Books of molecular biology and biotechnology

8. Content (The content description must clearly indicate the weighting of the content and the level)

I- Introduction (Reminders):

RNA: structure and types

Expression of genetic material:

a- Transcription and RNA polymerases Translation

b- General structure of a transcribed gene

Analysis of the quantity of mRNA in cells:

a- Northern blot / b- RT-PCR / c- Real-time PCR / d- DNA chips

Analysis of the transcription initiation rate of a gene

a- S1 nuclease mapping / b- Analysis of the transcription initiation rate of a gene by run-off / c- Analysis of the transcription initiation rate in a cellular system

II- Small interfering RNAs:

Introduction: Discovery of RNA interference

siRNAs (small interfering RNA) / miRNAs (micro RNA)

Examples of enzymatic complexes involved in RNA interference

a- The Drosha-Pasha complex (DGCR8)

b- The RNase DICER

c- The RLC complex (RISC-Loading Complex) and the RISC complex (RNA-Induced Silencing Complex)

Roles of siRNA – miRNA in the inhibition of translation initiation

a- General case

b- Mechanism of inhibition of translation initiation by miRNA

Use of interfering RNAs to study the function of a gene

Use of interfering RNAs as targets and therapeutic tools

Applications for the treatment of human diseases (examples of HIV, hepatitis B, neurodegenerative diseases and cancers)

III- Contributions of genomics:

RNomics and new approaches:

a- Full-length cDNA project / b- Tilling arrays / c- RNAseq and Deep sequencing / d- Exome sequencing

Comparative genomics:

a- Bioinformatics research of new ncRNAs / b- How to detect an RNA by comparative analysis / c- ENCODE 14 mammals project and 12 drosophila project

SUPERVISED WORK

PW1: Extraction of total RNAs

PW2: RNA treatment with DNase I, quality control and concentration estimation

PW3: Synthesis of complementary DNA (cDNA) and RT-PCR

ECUE 2: Immuno-technology and Biotherapy

1. Required and recommended prerequisites for participating in the module

Cellular biology, molecular biology, immunology, biochemistry

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Students will be trained and familiarized with innovative technologies for biotherapies which constitute a real toolbox (biomarkers, vectors, experimental models, processes, etc.) and therapeutic innovation in the fields of Actions in Immunobiotherapy or Restorative and Regenerative Medicine

Competencies: CS1-CS2-CS4-CS7

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Specialization related to immunology and technology

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Lectures, lessons, practical work

5. Exam form (Oral presentation, essay, ...)

Oral presentation, classical exam

6. Study and examination conditions

Self-study

7. Reading list (title of manuals, articles)

Innovation sur les anticorps

Les vaccins

Les immunomodulateurs et le transfert adoptif de cellules pour lutter contre le cancer, l'inflammation, les maladies auto-immunes et infectieuses

8. Content (The content description must clearly indicate the weighting of the content and the level)

1. Immunopathology

Anti-infectious immunity

Immune deficiency

Autoimmunity

Anti-tumor immunity

2. Immunotherapies

Concepts: The place of immunology in biotherapy

Principle of clinical trials

The procedure for establishing a clinical trial

Regulation: structures, regulatory procedures, related therapeutic products

3. Cellular therapies

Tools: Advanced cytometry techniques

Tools: Immunomonitoring

Tools: Cellular imaging

Tools: Proteomic analysis

Potential of stem cells: differentiation and immunogenicity

Dendritic cells: therapeutic applications

NK, NKT cells: applications in cancerology

General principles of allogeneic HSC transplantation and the role of immunomodulation

Regulatory T lymphocytes and therapeutic applications: GVH, autoimmune diseases, cancer

Cells mesenchymal: control of GVH, tissue repair

Vaccine formulations and Adjuvantization

4. Molecular immunotherapy & Monoclonal antibodies

Concepts: History of the techniques for obtaining mAbs

General presentation of the different mAbs used in the clinic and their mechanisms of action

Molecular and cellular engineering

Use of mAbs in antitumor therapies

Monoclonal antibodies and immunosuppression: application to autoimmune diseases

Cytokines and receptors

Complements and activating molecules

TLR ligands and immunotherapy

5. Cellular and molecular biotherapies

Cellular therapy: embryonic stem cells, induced stem cells, etc.

- Tissue therapy

- Cytokines, innovative pharmacologies (recombinant proteins, etc.)

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Proteomics & Applied Bioanalytical Techniques

Credit Number: 6

UE Code: 23

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	2

ECUE1	Code	Title	
	231	Proteomics methodologies	
Responsible	Course	Taoufik GHRAÏRI	
Coordinator	PW/DW/PPW		
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	
ECUE2	Code	Title	
	232	Applied bioanalytical techniques in metabolomics and toxicology	
Responsible	Course	Naouel KLIBI	
Coordinator	PW/DW/PPW	Badia ESSEGUAÏER	
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
Proteomics methodologies	21	7	14		40	1.5	3	30%	70%
Applied bioanalytical techniques in metabolomics and toxicology	21	7	7	7	40	1.5	3	30%	70%
Total UE	42h	14h	21h	7h	80h	3	6	100%	

ECUE 1: Proteomics methodologies

1. Required and recommended prerequisites for participating in the module

Molecular biology, Structural Biochemistry, genetics, enzymology,

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Techniques for preparing samples from human samples; Use of proteomic techniques for monitoring therapy, the appearance of toxic effects and predicting response to treatment

Separation techniques, in particular chromatography and its interface with ESI and MALDI (A 2-hour practical demonstration) Mastery of cytomic techniques and methods and their application in biotechnology and pharmacotoxicology

Competencies: CS2-CS5

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Define the importance of metabolomic and toxicological studies in the field of health
Relationships between pathology and modification of metabolism
Links between toxicology (drugs and/or inorganic substances) and biological environments
Complexity of analysis of biological matrices and need for purification
Strategies for sample purification
Preliminary treatments
Purification and fractionation
Phase change separation techniques

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

5. Exam form (Oral presentation, essay, ...)

Oral presentation, essay, practical work, internship

6. Study and examination conditions

Self-study

7. Reading list (title of manuals, articles)

Biochemistry, molecular biology

8. Content (The content description must clearly indicate the weighting of the content and the level)

A. The different types of proteomic analyses

Scientific concept

Descriptive proteomics and technologies

a- Protein separation by two-dimensional (2D) electrophoresis and two-dimensional chromatography (2D-LC)

b- Protein identification by mass spectrometry (MS and MS/MS)

Principle of proteomic analysis by mass spectrometry

Proteomic databases

Differential and quantitative proteomics:

a- In vitro approach by fluorochrome labeling:

2D-DIGE technologies

ICAT technologies

iTRAQ technologies

Protein microarrays

b- In vivo approach by the SILAC method (Stable Isotope Labeling with Aminoacids in Cell culture)

c- Proteomics and topological subcellular localization of protein production: MELK technology (Multiple-Epitope-Ligand "Kartography").

Interactome study

a- Phage display technologies

b- Double hybrid technologies

The different proteomic approaches: Shotgun proteomics and Bottom-up proteomics

B- Applications of proteomics in clinical biology

Diagnostic or therapeutic studies (vaccine targets) on pathogenic agents

Characterization of different strains of pathogenic agents

Identification of proteins involved, either in the pathogenicity of these strains or in host-pathogen interactions,

Evaluation and development of new drugs

New pharmacological targets

Creation of diagnostic tools: establishment of protein profiles and development of specific markers of pathologies:

Autoimmune diseases, cancerous pathologies, renal pathologies (study in particular of "urinary" proteomics), and pathologies of the central nervous system, particularly neurodegenerative pathologies (study of "spinal" proteomics from LCR)

PRACTICAL AND SUPERVISED WORK

Protein extraction and separation

Extraction and separation of membrane and cytosolic lipids

Analysis of 2D electrophoresis gels

Analysis by different types of chromatography

Visit to a proteomics platform

Protein extraction and separation

Regulation of the expression of a reporter gene in yeast and applications

ECUE 2: Applied bioanalytical techniques in metabolomics and toxicology

1. Required and recommended prerequisites for participating in the module

Cellular Biology, Structural Biochemistry, Molecular Biology, enzymology, histological techniques

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Acquire theoretical and practical skills relating to Strategies for preparing and purifying biological samples (tissues, cells, organs, blood, serum, gastric juice, urine, saliva, cerebrospinal fluid, bile, etc.) in relation to metabolomics and toxicology.

Techniques for analyzing inorganic elements (SAA and SEA)

Techniques for analyzing organic substances by liquid and gas chromatography and coupling with mass spectrometry

Apply this knowledge through targeted practical work and visits.

Competencies: CS2-CS8

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Roles of trace elements in the body and the problems associated with their deficiency as well as poisoning by inorganic elements.

Dosage of inorganic elements in biological environments in order to establish a diagnosis or alleviate poisoning.

Develop areas of biochemistry complementary to those taught in the Bachelor's degree modules,

Address the basic concepts used in proteomics

Acquire good theoretical knowledge dealing with mass spectrometry.

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Techniques for dosing inorganic elements

Flame and graphite furnace Atomic Absorption Spectroscopy (AAS).

Plasma Atomic Emission Spectroscopy (SEA).

Advantages and limitations of AAS and SEA.

General aspects of chromatographic techniques

Mechanisms associated with separation in liquid and gas chromatography.

Parameters affecting the separation and detection of organic compounds by liquid and gas chromatography

5. Exam form (Oral presentation, essay, ...)

Practical work and classical exam

6. Study and examination conditions

Accompanied by teacher

7. Reading list (title of manuals, articles)

Practical teaching in the technological platform units of the Faculty of Sciences of Tunis. Practical teaching in the histology and Ana pathology laboratories of the university hospital (Hospital Mongi Slim, La Marsa and Faculty of Medicine of Tunis)

Practical teaching will be provided in the imaging and histology platform of the Faculty of Medicine of Tunis

8. Content *(The content description must clearly indicate the weighting of the content and the level)*

Part I: Generalities on metabolomic and toxicological studies as well as sample preparation strategies

Introduction: Definition of metabolomic and toxicological studies

Section I: Why do metabolome and toxicology?

Section II: Relationship between pathology and modification of metabolism

Section III: Complexity of biological matrices and need for sample purification

Chapter II:

Introduction: Nature of samples and sample preparation strategies.

Section I: Preliminary treatment of the sample (Homogenization, dissolution, etc.)Section II; Purification and fractionation of samples

Section III: Solvent extraction techniques

Section IV: Solid phase extraction techniques Liquid grafted phase extraction

Section V: Solid phase micro-extraction (extraction principle and parameters)

Part B Analysis of inorganic elements by atomic absorption and emission spectrometry

Chapter I

Introduction: Introduction to the origin of trace elements and their roles in the body and the problems associated with their deficiency as well as metal poisoning and spectroscopic analysis techniques.

Section I: Necessity of the dosage of inorganic elements in biological matrices

Section II: Flame Atomic Absorption Spectroscopy and Graphite Furnace

Section III: Graphite Furnace Atomic Absorption Spectroscopy

Chapter II

Introduction: Limitation of flame SEA and advantages of high temperature

Section I: Definition of plasma and its particularities

Section II: Instrumentation of the atomic emission spectrometer SEA by plasma

Section III: Principle of atomic emission spectroscopy SEA by plasmaSection

IV: Different types of plasma

Section VII: Application of SEA for the search for inorganic elements from biological matrix

Section VIII: Comparison between Atomic Absorption and Atomic Emission spectroscopy

Part C Chromatographic separation techniques

Chapter I

Introduction: History of chromatography

Section I: Definition and classification of chromatographic techniques

Section II: Theory of chromatography

Section III: Retention quantities in chromatography

Chapter II

Introduction: Classification of liquid chromatographic techniques

Section I: Principle and instrumentation

Section II: Separation mechanisms

Section III: How to optimize a column chromatography analysis

Section IV: Detectors and application

Section V: Application of HPLC for the search for substances allowing the diagnosis of a pathology

Chapter III

Introduction: Classification of gas chromatographic techniques (GC)

Section I: Instrumentation

Section II: Characteristics of injection systems

Section III: Properties of columns in GC

Section IV: Stationary phases

Section V: Parameters affecting separation in GC

Section VI: Choice of stationary phases and polarity

Section VII: Detectors in GC

Section VIII: Application of GC for the search for diagnostic substances of a pathology

Part D Coupling GC-MS and LC-MS

Chapter I

Introduction: introduction to GC-MS and its applications

Section I: Components of a mass spectrometer

Section II: ionization sources

Section III: Types of ions obtained according to the ionization source

Section IV: Principle of separation of the ions formed:

Section V: GC-MS acquisition modes

Section VI; Screening optimization methodology

Section VII: application of GC-MS for the identification of unknown substances

**Description sheet of a Teaching Unit (UE)
& of the Constituent Elements of a Teaching Unit (ECUE)**

Title of the UE

Internship: Entrepreneurial and Bio-informatics II & Communication skills

Credit Number: 6

UE Code: 24

University: _____ **Institution:** _____

Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	2

ECUE1	Code	Title	
	241	English Certification and Technical Communication	
Responsible	Course	Hajer MESTAYSSER	
Coordinator	PW/DW/PPW		
Creation date	2018-2019		Version 1
Modified at	2023-2024		Version 2
Language	French		
ECUE2	Code	Title	
	242	Management of Innovative Projects	
Responsible	Course	Nihel ZIADI	
Coordinator	PW/DW/PPW		
Creation date	2018-2019		Version 1
Modified at	2023-2024		Version 2
Language	French		
ECUE3	Code	Title	
	243	Structural Bioinformatics	
Responsible	Course	Afef NAJJARI	
Coordinator	PW/DW/PPW		
Creation date	2018-2019		Version 1
Modified at	2023-2024		Version 2
Language	French		

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cre d	% CC	% Exam
English Certification and Technical Communication	14	7		7	30	1	2	100%	
Management of Innovative Projects	14		7	7	30	1	2	100%	
Structural Bioinformatics	14	7		7	30	1	2	100%	
Total UE	42h	14h	7h	21h	90h	3	6	100%	

ECUE 1: English Certification and Technical Communication

1. Required and recommended prerequisites for participating in the module

Basic English of Bachelor

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Competencies: CS9-CS10-CS11

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

With all program

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

lectures, lessons, practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Oral presentation, essay, classical

6. Study and examination conditions

Self-study

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

English for certification: Attain at least the Common International Reference Level. Be able to understand fairly long speeches and follow a complex argument; understand current events; read articles and reports on contemporary issues in which the authors adopt a particular attitude or a certain point of view; communicate with a degree of spontaneity and ease; participate actively in a conversation, present and defend one's opinions; express oneself clearly and in detail on a wide range of subjects relating to one's interests; develop a point of view on a current topic and explain the advantages and disadvantages of different possibilities; write clear and detailed texts on a wide range of subjects; write an essay or report transmitting information.

Communication French understanding and restitution of a presentation; specialized; participation in video conferences; scientific; presentation of scientific reports; public speaking training (meetings, interviews, etc.); pronunciation training in a language laboratory.

ECUE 2: Management of Innovative Projects

1. Required and recommended prerequisites for participating in the module

Concept of strategic management and entrepreneurship

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Management of innovative projects:

-Train students in project management

-Introduce students to marketing in innovative companies -Master the concepts of SCM in innovative projects -

Introduce students to intercultural management

Competencies: CS9-CS10-CS11

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Creation of innovative companies (stages, business model and financing)

development of entrepreneurial spirit (soft skills)

Innovation strategies of biotechnology companies

Understanding the business models of biotechnology companies

Knowing the management professions in the biotechnology sector

Intercultural management

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)
lectures, lessons, practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Oral presentation, essay, exam

The assessment of students will be done through:

team project on a business model of an innovative project that will be assessed continuously

a continuous assessment system of their knowledge and a final exam that will sanction their work at the end of the semester.

6. Study and examination conditions

Self-study

7. Reading list (title of manuals, articles)

Books and articles and reference documents

Florice, S. et Miller, R. (2003), "An exploratory comparison of the management of innovation in the New and Old Economy." R&D Management, 35(5): 501-525
Lynn, G., Morone, J., et Paulson, A. (1996), "Marketing discontinuous innovation: The probe and learn process." California Management Review, 38(3): 8-37.

Dougherty, D. (2001), "Reimagining the differentiation and integration of work for sustained product innovation." Organization Science, 12(5): 612-631.

Mac Cormack, A., Verganti, R. et Iansiti M. (2001), "Developing Products on "Internet Time": The Anatomy of a Flexible Development Process." Management Science, 47(1): 133-150.

Trompenaars C., (2003), *Le choc des cultures - La fin du dilemme*, Editions d'Organisation.

Turner R., (2009), *The Handbook of Project-Based Management, leading strategic change in organizations*, Third Edition, Mc Grow.

Hofstede G., (2010), *Cultures et organisations*, Pearson Education.

8. Content

 (The content description must clearly indicate the weighting of the content and the level)

Theme I: The basics of project management

Section 1: What is a project?

Section 2: Managing a project

Section 3: Managing risks

Section 4: Basic documents of a project

Theme II: Preparing and managing a project

Section 1: The QQQCCP method

Section 2: Preparing a project

Theme III: The organizational structure

Section 1: What is structure?

Section 2: What is contingency?

Section 3: The different organizational structures

Theme IV: Marketing and commercialization of innovative product

Section 1: What is marketing and commercialization?

Section 2: The 4Ps of innovative products

Section 3: Marketing strategies for innovative products

Theme V: Supply Chain Management and technological alliances

Section 1: SCM

Section 2: Technological alliances

Theme VI: Intercultural management

Section 1: National cultures and corporate cultures

Section 2: Theories of intercultural management

Section 3: Intercultural communication

ECUE 3: Structural Bioinformatics

1. Required and recommended prerequisites for participating in the module

Computer science: web browsing, concept of software, saving a file, having an email Keyboard, mouse
Biology: Biomolecules: proteins, drugs, toxins

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Sequence Analysis (Principles and Methods)

3D Structure of Proteins: Modeling and Design

Comparison and Manipulation of 3D Structures of Proteins and Biomolecules

Studies of Active Sites of Proteins

Interactomics Database: Protein-Protein Interaction and Intracellular Signaling Pathways

Docking and Molecular Targets of Drugs

Competencies: CS3-CS5-CS7-CS10

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory, relationship with all program :

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

lessons, practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Classical and internship

Mixed system: attendance, seriousness, mid-term exam, final exam

6. Study and examination conditions

Accompanied by the teacher

7. Reading list (title of manuals, articles)

Method: Online – courses are available on <https://wiki.edubuntu.org/kmezhoud/Bioinformatics>

Moodle with forum, chat, online exercise and automatic assessment (in progress) The evolution of the options will be led by the needs, requests and criticisms of the students

8. Content (The content description must clearly indicate the weighting of the content and the level)

Chapter I Sequence alignment (4h lecture + 4h tutorial)

Section I: Scores

Section II: Algorithms and sequence comparison programs

Section III: Evaluation of results

Section IV: Programs: FSTA, BLAST

Chapter II Prediction of 3D protein structures (4h lecture + 4h tutorial)

Section I: 3D structure prediction methods

By sequence homology

By elbow recognition

Ab initio

Section II: Manipulation and superposition of 3D protein structures with software

Chapter III Interactomics (4h Lecture + 4h tutorial)

Section I: Prediction of protein interactions based on sequence homology

Section II: Signaling pathways and visualization software

Chapter IV Docking and molecular targets (2h lecture + 2h tutorial)

Section I: Search engine and zone prediction software contact between a small molecule (drug - toxin) and protein

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Cellular biotechnology and quality control

Credit Number: 6

UE Code: 25

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	2

ECUE1	Code	Title	
	251	Internship: Autoimmune disease diagnosis	
Responsible	Course	Asma GATI	
Coordinator	PW/DW/PPW		
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	
ECUE2	Code	Title	
	252	Cytomics, Pathologies and Cytological Techniques	
Responsible	Course	Atf AZZOUNA	
Coordinator	PW/DW/PPW	Mouna ANTIT BEN REJEB	
Creation date		2018-2019	Version 1
Modified at		2023-2024	Version 2
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
Internship: Autoimmune disease diagnosis	14		7	14	50	1.5	3	30%	70%
Cytomics, Pathologies and Cytological Techniques	21		7	7	50	1.5	3	30%	70%
Total UE	35h		14h	21h	100h	3	6	100%	

ECUE 1: Internship: Autoimmune disease diagnosis

1. Required and recommended prerequisites for participating in the module

Cellular Biology, Biochemistry, Immunology, physiology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Knowledge: familiarity with information, theory, and subject knowledge about the relationship between disease and the autoimmune reaction

Skills: cognitive and practical abilities used to apply knowledge of immunology in disease diagnosis.

Competencies: integration of knowledge, skills, and social and methodological abilities in learning

Competencies focused are: CS2-CS10-CS11

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Optional, Provide training on imaging techniques from the subcellular level to the organism scale, as well as flow cytometry and cell sorting, as well as technological and methodological development.

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

5. Exam form (Oral presentation, essay, ...)

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

ECUE 2: Cytomics, Pathologies and Cytological Techniques

1. Required and recommended prerequisites for participating in the module

Cellular biology, histology, cytology, cellular physiology, Molecular biology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Knowledge: familiarity with theoretical information's about the differences between the tissues and their functions

Skills: master basic and specialized techniques for performing histological sections. apply these techniques in the field of histopathology and histophysiology

Competencies: determining the relationship between tissue structures and the functioning of body systems and apparatus. Analysis of histo-cytological sections and mastery of means of detecting tissue and cellular anomalies

Competencies: CS2-CS3-CS7-CS10-CS11

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory, master the histological, cytological and histochemical techniques

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

Lessons, practical work, projects, seminars, internship

5. Exam form (Oral presentation, essay, ...)

Oral presentation, classical exam, practical exam, essay

6. Study and examination conditions

Teacher support and personal work

7. Reading list (title of manuals, articles)

References in histology:

ARON M. & GRASSE P., 1966- Précis de Biologie Animale. *Masson et Cie Ed.*

DUBREUIL G. & BAUDRIMONT A., 1959- Manuel théorique et pratique d'histologie. *Ed. Vigot Frères.*

GARTNER P. LESLIE & HIATT L. JAMES, 1997- Atlas en couleur d'histologie. *Deuxième édition française. Traduction dirigée par Bernaudin J. F.. Ed. pradel.*

GARTNER P. LESLIE & HIATT L. JAMES, 1992- Atlas d'histologie. *Traduction Amar-Costesec Alain. Ed. De Boeck.*

LAROUSSE MEDICAL, 2003- *Ed. Larousse.*

POIRIER J. & RIBADEAU DUMAS J. L., 1993- Histologie. *Ed. Masson*

POIRIER J. & RIBADEAU DUMAS J. L., 2002- Histologie. Les tissus. *Ed. Masson.*

SCIENCE ET VIE, HORS SERIE, 1999- Les merveilles du corps humain. Edition spéciale. N° 208.

SCIENCE ET VIE HORS SERIE, 2004- Le corps humain et son histoire. N° 226

BOUAZIZ-AZZOUNA A., 2010- Histophysiology. Centre de publication universitaire (Tunisie)

8. Content *(The content description must clearly indicate the weighting of the content and the level)*

Chapter 1: The origin of tissues: cellular differentiation and plasticity

Embryologic development and differentiated cellular state

Concepts of totipotent, pluripotent and multipotent stem cells

Cellular differentiation and plasticity: concepts of regulation, specification, determination and induction

Different molecular factors of inducing signals implied in coordination of stem cell division and differentiation

Chapter 2: examples of cellular differentiation

Neuronal differentiation

Appendage differentiation

Eye differentiation

....

Chapter 3: developmental dysregulation: abnormalities and associated pathologies

causes of dysregulation

examples of dysregulation

different pathologies

oncogenesis

epigenetic influences

Chapter 4: Embryonic biotechnologies

Technologies of Medical Assistance of Procreation

Technologies of cellular trans-differentiation

Technologies of cellular therapy

Technologies of genic therapy

Technologies of tissular engineering

.....

Practical work

Common techniques in histology and cytology

Histological and cytological Image analysis

immunohistochemistry and diagnosis pathology

Study plan for semester 3 of Master TCMB

Unit UE		Unit element constitutive ECUE		Credits	Coef.	Workload	Assimilation	Workload division				Evaluation	
Code UE	Intitule UE	Code ECUE	Intitule ECUE				Self-Study	Course	DW	PW	PPW	CC	RM
31	Cell metrology and imaging systems	311	Metrology for imaging systems	3	1,5	42	40	21		14	7		X
		312	Flow cytometry and diagnostics tools	3	1,5	42	40	14	14	14		X	
32	Biomolecule screening & pharmacology	321	Biomolecule Screening Techniques	3	1,5	42	40	21	7	7	7		X
		322	Internship: Methods applied to Pharmacology	3	1,5	42	40	21	7		14		X
33	Analytical methods, validation and quality approach	331	Management of quality in the health sector	3	1,5	42	40	14	14	14		X	
		332	Pharmaceutical production processes and quality control procedures	3	1,5	35	50	21		14			X
34	Entrepreneurial ecosystem and innovation	341	Success preparation and communication	2	1	28	30	14	7	7		X	
		342	The entrepreneurial ecosystem	2	1	28	30	14	7	7		X	
		343	Innovation, Technology Transfer and Intellectual Property	2	1	28	30	14	7	7		X	
35	Emerging professional skills	351	Legislation, Biosafety, Biosecurity and Bioethics	2	1	28	30	14	7	7			X
		352	Internship: Monoclonal Antibodies production process	2	1	28	30		7	7	14	X	
		353	Techniques and Methodologies in Microbiology	2	1	28	30	14		7	7	X	
			Global / Semester 3	30	15	406H	430H	182H	77H	105H	49H	7	5
			Percentages / type of Workload			100%		44%	18%	25,9%	12,1%	60%	40%

Scientific and technical competencies

Bioanalytical and technological competencies in the cellular and molecular area

Managerial, informatically and quality control competencies

Internship: 1/ Monoclonal Antibodies production process; 2/ Methods applied to Pharmacology (see organization in practical personal work)

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Cell metrology and imaging systems

Credit Number: 6

UE Code: 31

University:

Institution:

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma: Professional Master

Pathway: Cellular and Molecular Technologies in Biohealth

Semester: 3

ECUE1	Code	Title	
	311	Metrology for imaging systems	
Responsible	Course	Rym Bouchendira	
Coordinator	PW/DW/PPW	Rym Bouchendira	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language			
ECUE2	Code	Title	
	312	Flow cytometry and diagnostics tools	
Responsible	Course	Asma Gati and BD Industries	
Coordinator	PW/DW/PPW	Asma Gati	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language			

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Metrology for imaging systems	21		14	7	40h	1.5	3		X
ECUE2: Flow cytometry and diagnostics tools	14	14	14		40h	1.5	3	X	
Total UE	35h	14h	28h	7h	80h	3	6		

ECUE 1: Metrology for imaging systems

1. Required and recommended prerequisites for participating in the module

Knowledge in Molecular Biology - Cellular Immunology - Cellular Biology, Physiology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Confirmation of measuring equipment used to demonstrate conformity of processes and products.

Master the concept of unit of measurement and measurement error

Write measurement reports

Determine measurement uncertainties by adopting physical means and statistical calculations
Acquisition of the principles of metrology in business: generic requirements and application guides for the management of the measurement process.
Understand the place of metrology in quality systems

3. Relation to the curriculum/intended learning outcomes (*Mandatory / Optional / Specialization*) *Names of other study programs with which the module is shared*

Methods for studying cellular functioning and dysfunction.
2- Techniques and application of flow cytometry
3- Techniques and applications in cytology

4. Teaching and didactical methods (*For example, lectures, lessons, practical work, projects, seminars, etc.*)

5. Exam form (*Oral presentation, essay, ...*)

Continuous control

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (*The content description must clearly indicate the weighting of the content and the level*)

Chapter I: Introduction: terminology and management structures

Introduction :
Section I: Definition of metrology.....
Section II: Metrology Vocabulary (VIM)
Section III: Definition of the measurement chain
Section IV: Organization of metrology at the international and national level.....
Section V: Meter Convention, role of the CIPM, the CGPM and the BIPM....

Chapter II: Physical quantities

Introduction :
Section I: Measurable quantity and identifiable quantities
Section II: Systems of units; Invariance of a quantity.....
Section III: Equation with units, Equation with dimensions.....

Chapter III: Measurement

Introduction :
Section I: The new international system of units.....
Section II: Calibration chain and traceability.....
Section III: Connection of company standards to national standards

Chapter IV: Concepts of errors, Correction and Uncertainty

Introduction :
Section I: Random error, systematic error and correction.....
Section II: Composition of the error (and correction)
Section II: Uncertainty: definition and evaluation using type A and type B methods...
Section III: Identification of uncertainties: Cause and effect diagram (5M).....

Chapter V: Estimators

Introduction :
Section I: Reminder of statistical concepts: random variable, parent population, sample, distribution law, mean, standard deviation, variance
Section II: Estimation of Mathematical Expectation: Average value.....
Section III: Estimation of variance and Experimental standard deviation.....
Section IV: Law of generalized propagation of uncertainties.....
Chapter VI: Expression of the measurement result

Introduction :
Section I: Structured approach to estimating measurement uncertainty: the GUM approach.....
Section II: The different probability laws (Uniform law, normal law, etc.).....
Section III: Compound standard uncertainty.....
Section IV: Expanded uncertainty and level of confidence.....
Section V: Standardization of measurement: Standard ISO 10012, ISO 19036

ECUE 2: Flow cytometry and diagnostics tools

1. Required and recommended prerequisites for participating in the module

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2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Contribution and areas of application of flow cytometry in biotechnology

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

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4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

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5. Exam form (Oral presentation, essay, ...)

Final exam and project

6. Study and examination conditions

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7. Reading list (title of manuals, articles)

Reference books and articles – Reference conferences – Video projection Practical teaching in the Technological Platform Units of the Faculty of Sciences of Tunis. Practical teaching in the university hospital histology and pathology laboratories (Hospital Mongi Slim, La Marsa and Faculty of Medicine of Tunis).....

8. Content (The content description must clearly indicate the weighting of the content and the level)

A General

B- Technical principles of flow cytometry

Cellular samples

Hydrodynamic centering

Optical circuits

Collection of emitted light

The signals collected

Signal conversion

Phenotypic characterization of the main lymphocyte subpopulations

Polychromatic analysis (6 colors) of T lymphocyte activation markers

Purification by magnetic sorting followed by elutriation of subpopulations of cells; verification by flow cytometry of the cell purifications carried out. F-

ADVANTAGE AND LIMITATIONS OF Flow Cytometry

Quantitative analysis

Detection sensitivity

Working speed

Simultaneous analysis of several

parameters G- Cell sorting

H- Main applications of flow cytometry

Analysis of signal transduction by flow cytometry

Cell cycle and proliferation analysis

Calcium flow analysisApoptosis analysis

H. Cytometry by image analysis

Analysis of images of fixed preparations: Digitization, enhancement, segmentation, region approach, contour approach, shape filtering, parameterization, gray level transformation

Analysis of living cell dynamics in videomicroscopy: acquisition of image sequences, global approaches, structural approaches

Application examples

I- High-throughput screening technique using “Fluorescent BarCoding” (FBC) technique. **A- Bio-reactive bioassays, and molecular diagnosis (BioMagreb)**

Production, purification and characterization of biomolecules

Develop and optimize bioprocesses

Development, optimization and evolution of bioprocesses, which are used to produce biological substances, reagents and large-scale bioassays in industry.

Development: Application of genetic engineering techniques, culture of animal cells and microorganisms for the production of innovative biomolecules and chromatography techniques to purify molecules

WORK IN TECHNOLOGY PLATFORM (PAQ-FST AND PARTNERS)

B- CELLULAR ENGINEERING FROM RESEARCH TO INDUSTRY (EPISKIN L'OREAL)

Stem cell engineering

The stem cell niche: conceptual and technological issues for the study of normal and tumor mechanisms

Concepts and issues

Example of modeling the bone niche in 3D culture within a biomaterial

Corneal engineering: towards increasingly complex models (EPISKIN) 3D models

Multistratified epithelium without stroma
Epithelium with stroma (hemi-cornea)
Complete reconstructed cornea.

Potential sources of cells capable of differentiating into human corneal epithelial cells
Human embryonic stem cells (hESCs)

Human induced pluripotent stem (hiPS) cells

Reconstructed skin: a tool for studying pharmacotoxicology and creating an *in vitro* model (EPISKIN)

From human skin to skin equivalents: motivations that prompted their development

Simple models developed for safety testing. Three-dimensional models and efficiency tests. .

Skin reconstructed in matrices of human or animal origin
Skin reconstructed in a biological matrix of biosynthetic origin

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)		
Title of the UE		
Biomolecule screening & pharmacology		
Credit Number: 6		
UE Code: 32		

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	3

ECUE1	Code	Title	
	321	Biomolecule Screening Techniques	
Responsible	Course	Sadok Boukhchina	
Coordinator	PW/DW/PPW	Faouzi Sakouhi and partners	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		

ECUE2	Code	Title	
	322	Methods applied to Pharmacology	
Responsible	Course	Fethi Oueslati	
Coordinator	PW/DW/PPW	Fethi Oueslati	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Biomolecule Screening Techniques	21	7	7	7	40	1.5	3		X
ECUE2: Internship: Methods applied to Pharmacology	21	7		14	40	1.5	3		X
Total UE	42h	14h	7h	21h	80h	3	6		

ECUE 1: Biomolecule Screening Techniques

1. Required and recommended prerequisites for participating in the module

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Master of the different imaging processes used in biology.

Knowledge of technological advances in terms of equipment and software for image analysis and peptide synthesis microdissection and genomic and proteomic methods

Ability to provide technical solutions as part of a scientific and/or technical-commercial approach.

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

lessons, practical work, projects

5. Exam form (Oral presentation, essay, ...)

Continuous controls presentation

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

PRIMACEN Technology Platform

B- Screening techniques and Laser microdissection:

cellular and molecular localization: from the animal to the cell. (MRI, in vivo imaging, confocal microscopy, electron microscopy, histological stains, immunohistochemistry, in situ hybridization, autoradiography)

cellular and intracellular dynamics: cell migration, cell/cell interactions, endo/exocytosis, intracellular trafficking, membrane diffusion (intravital microscopy, videomicroscopy, TIRF),
signal transduction: ligand/receptor interaction, protein/protein interaction, study of second messengers (radiobinding, F-techniques, calcium),
functional proteomics and genomics: expression of the genome (sequencing, conventional PCR, quantitative PCR, DNA chips) and the proteome (2D, 3D Gels, chromatography, mass spectrometry, western blot).
Recording of ionic currents. These lessons will be provided within the imaging and cellular technology platform, with the aim of highlighting the different applications and imaging processes seen in class.

C- Instrumentation in medical imaging

Methodologies, concepts and use of isotopic tracers.

Molecular modeling, NMR and MRI.

Analytical microscopy.

Bio-tracer monitoring

LEGISLATION AND CONTROL OF COSMETIC PRODUCTS AND BODY HYGIENE PRODUCTS

The legislation

Cosmetic ingredients

The cosmetic file

Classification

General composition

excipients

the additives

additives

the active ingredients (or active ingredients or specific principles)

Manufacturing

Types of checks carried out during production

Raw material control

Finished product control

Bacteriological controls

Tolerance check

eye irritation test

primary skin irritation test

skin irritation test

Awareness test:

photosensitization test applied to solar products;

mucosal irritation test: reserved for lipsticks, products for intimate use or mouthwashes performed on the hamster's cheek mucosa).

Cell culture test

Efficiency check

consumer tests: clinical tests carried out on 20 to 50 subjects by a dermatologist or beautician.

PRACTICAL WORK :

- Introduction and familiarization with molecular technologies in genomics and proteomics and cellular tools
- Active participation of QIAGEN
- Low and high throughput PCR
- interfering RNA
- Cloning
- Nucleotide sequencing

ECUE 2: Internship: Methods applied to Pharmacology

1. Required and recommended prerequisites for participating in the module

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Become familiar with blood sample processing and conditions spectroscopic measurements of copper by SAA

Pretreatment conditions (Protein precipitation, Centrifugation, etc.)

Choice of extraction conditions (Type of solvent, pH, Volume)

Optimization of analysis conditions

- Light source and bandwidth
- Nebulization flow
- Spectral correction
- Thermal program

Preparation of standard solutions for dosing (calibration curve)

Determination of sample concentration and conclusion .

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, seminars, etc.)

, lectures, lessons, practical work, projects

5. Exam form (Oral presentation, essay, ...)

Final exam

6. Study and examination conditions

Reference books and articles – Reference conferences – Video projection Practical teaching in the Technological Platform Units of the Faculty of Sciences of Tunis.

Transfer of Routine Work within the PRIMACEN platform, Microbiology Laboratory, BioDesert FST Platform

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

Introduction : introduction to LC-MS and LC-MS/MS coupling

Section I : Constituents of a mass spectrometer

Introduction systems

Ionization sources

Ion dispersion system or analyzers

Detection system

Section II : Ionization Sources

Principles and mechanisms of electrospray ionization,

Principles and mechanisms of chemical ionization at atmospheric pressure

Principles and mechanisms of photochemical ionization

Criteria for choosing an ionization source

Section III : Types of ions obtained depending on the ionization source

Sector IV : Tandem spectrometry

Section V ; acquisition modes in LC-MS/MS

Principle of the product ion acquisition mode
Principle of the precursor ion acquisition mode
Principle of MRM or SRM acquisition mode
Principle of loss of neutral mode

Section VI: Screening and dosing optimization methodology

For the search for unknown substances
For the search for known substances
Criteria for identifying known substances
Quantification of substances by LC-MS/MS

Section VII : Application of LC-MS/MS for the identification of unknown substances**Section VII I Quality control procedures for medicines**

Know the drug control standards
Become familiar with the analysis and quality control methods of the finished product and raw materials

Chapter I**Section I : Classification of finished product quality control methods****Section II : I- Medication control standards****Section III : Pharmaco-technical control methods**

Evaluation of parar

Gravimetric and volumetric analysis

Evaluation of mechanical properties of drugs

Friability

- Particle size control of biopharmaceutical behavior

Disaggregation (objectives and achievement)

Dissolution (objectives and achievement)

Dissolution monitoring techniques

Section VI: Methods for controlling the purity of the finished product

Concept of related substances

Conditions linked to the use of HPLC and GC (suitability test and normative requirements)

Section VII Methods for dosing the finished product and control of content uniformity

UV and derivative spectroscopy

chromatographic

Chapter II**Section I : Classification of methods of analysis of raw materials****Section II : Identification methods**

Determination of physicochemical constants (melting point, ebilution point, density, viscosity, refractive index, etc.)

IR, UV and rotational power
spectroscopy Principle and application

Methods based on chemical reactions of coloring or precipitation

Section III : Impurities and techniques used

Classification of impurities

Inorganic impurities

Organic impurities

Residual solvents

Analytical techniques used

SEA

Liquid chromatography

GC- headspace

Section IV: Assay Methods

Titrimetry

Redox

Complexometric
Acid-base
Potentiometric

Description sheet of a Teaching Unit (UE) & of the Constituent Elements of a Teaching Unit (ECUE)

Title of the UE

Analytical methods, validation and quality approach

Credit Number: 6

UE Code: 33

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	3

ECUE1	Code	Title	
	331	Management of quality in the health sector	
Responsible	Course	Leila Guellez (Pyramid Consulting)	
Coordinator	PW/DW/PPW	Mariem Azzabi (QualityPRO)	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language			
ECUE2	Code	Title	
	332	Pharmaceutical production processes and quality control procedures	
Responsible	Course	Emna Gaies	
Coordinator	PW/DW/PPW	National Center of Pharmacovigilance	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Management of quality in the health sector	14	14	14		40h	1.5	3	X	
ECUE2: Pharmaceutical production processes and quality control procedures	21		14		50h	1.5	3		X
Total UE	35h	14h	28h		90h	3	6		

ECUE 1: Management of quality in the health sector

1. Required and recommended prerequisites for participating in the module

Knowledge of quality assurance and control, regulatory affairs, industrial property, hygiene

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Contribution of nurseries and incubators in the creation of startups

Analysis of the functioning of the biotechnology company and identification of sectors of Activity

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandator

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Continuous control and project

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

Master the international skills recognition procedures

Deploy the requirements of normative standards for any evaluation process in health organizations

ISO 15189, ISO 17025, Health accreditation standards

Develop the process of normative and regulatory monitoring as tools for Quality Management in the health field

Chapter I: Introduction

International health skills recognition system

Organization in Tunisia

Chapter II: Organization of standardization in the world and in Tunisia

Standardization structures: ISO, INNORPI, AFNOR...
Global global health normative environment: Pernorm...
Tunisian normative base

Chapter III: Normative monitoring methodology

Typology of standards

Process for establishing and adopting standards

Normative monitoring: strategic monitoring and risk management tool

Role of standards for the recognition of skills in the health field: context,

requirements and accreditation process

Standards monitoring tools

Normative monitoring procedure

Chapter IV: Practical application cases

ISO 17025 standard for the accreditation of calibration and testing laboratories

ISO 15189 standard for the accreditation of medical laboratories

ISO 13485 standard for medical devices

Risk management applied to medical devices according to ISO 14971 and ISO 31000

Visits: Visit to the Standardization Directorate INNORPI

Visit to health organizations that have adopted an approach consistent with reference standards

1. Required and recommended prerequisites for participating in the module

Pharmacology, Biology cell

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Familiarize yourself with the good manufacturing practice guides
Know the composition, routes of administration of drugs and the role of each constituent as well as learn about the regulatory bases and quality management which govern the field of the pharmaceutical industry

Define pharmaceutical operations for dry forms and wet or liquid forms
Know the characteristics of each operation and the means used
Learn about the formulation processes for galenic forms intended for oral route (multi doses, unit forms or splittable unit forms)

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Mandatory

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

lessons, practical work, projects

5. Exam form (Oral presentation, essay, ...)

Final exam and presentation

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

Chapter I

Section I: Definition and origins of drugs

Section II : Constitution of medicines

Active ingredient

Excipient

Preservatives, colorings and flavorings

Section III: Classification of exceptions

Excipients of mineral origin

Excipients of organic origin

Section IV: Roles of excipients

Dissolution

Absorption

Make it easier to use

The conversation

Modulate the release

Vectorization

Section V: Drug formulation

Definition

Routes of administration and dosage forms

Chapter II

Section I : National regulations

Law 73-55 of 03/08/1973

Law 90-1400 of 03/09/1990

Section II : Quality standards in the pharmaceutical industries

GMP Good Manufacturing Practices

ICH International Harmonization Conference
International standardization standards relating to ISO quality
European Pharmacopoeia Phar Euro

United Stat Pharmacopeia USP

Section III : Good manufacturing practices

Definition

Areas of application of BPF

-

PART B Pharmaceutical operations

Introduction :

Section I : Definition of pharmaceutical operation

Section II : Classification of pharmaceutical operations

Operation for dry forms

Operation for wet or liquid forms

Section III Operation of crushing or pulverizing solids

Objective

Materials used

- compressed air micronizer or jet mill
- fluted or non-fluted roller mills
- ball mill.

Section IV : Sieving operation

Section V: Preparation of powder mixtures

Objective

Stage

Materials

- mixing drums
- mixers

Section VI : Dissolution operation

Definition

Factors involved in dissolution

- Solubility
- Dissolution speed
- Types of agitators

Section VII: Filtration operation

Definitions

Retention mechanisms

Filter characteristics

Section VIII Dispersals

Emulsions

Stability of emulsions:

Main emulsifiers used in pharmacy

Formulation of emulsions

- Pendant lights

Preparation of suspensions

By chemical means

By physical means

Stability conditions

Section IX : Desiccation or drying

Desiccation processes

Freeze-drying or cryodesiccation

Section X : Granulation and other treatments leading to granules, spheres and “vectors

Goals
Granulation Processes
Section XI- Sterilization
Definition
Sterilization methods and mechanisms

PART C

Processes for manufacturing dosage forms

Chapter I

Section I: Dosage forms of medicines

Medicines intended for the oral route
Solid forms Emulsions/suspension
Liquid forms
Oral dosage forms Multi-dose forms
Multiple doses
Unit forms
Splittable unit forms

Section II : Formulation of Liquids for oral use

Composition
Distribution of liquids

Section III : Formulation of Emulsions and Oral Suspensions

Formulation of Emulsions
Formulation of suspensions
Preparation of syrups (equipment and clarification)

Section IV : Powders and granules for oral solutions or suspensions

Tablets
Type of tablets
Manufacture of tablets (composition and granulation) -
Compression of tablets

-Tablet coating processes
Coating
Film coating

**Description sheet of a Teaching Unit (UE)
& of the Constituent Elements of a Teaching Unit (ECUE)**

Title of the UE

Entrepreneurial ecosystem and innovation

Credit Number: 6

UE Code: 34

University:	Institution:
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Training area: Sciences and Technologies	Mention : Biotechnologies et Biohealth
Diploma of Pathway	
Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	3

ECUE1	Code	Title	
	341	Success preparation and communication	
Responsible	Course	Lamia Krichen	
Coordinator	PW/DW/PPW	Imen Smaoui	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		
ECUE2	Code	Title	
	342	The entrepreneurial ecosystem	
Responsible	Course	Nihel ZIADI	
Coordinator	PW/DW/PPW	CEED CEED Tunisia (Company)	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		
ECUE3	Code	Title	
	343	Innovation, Technology Transfer and Intellectual Property	
Responsible	Course	Faten El Meddeh	
Coordinator	PW/DW/PPW	Mariam Azzabi	
Creation date	September 2019		Version 1
Modified at	September 2021		Version 2
Language	French		

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

The constituent elements (ECUE)	Workload				Value		Evaluation		
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Success preparation and communication	14	7	7		30h	1	2	X	
ECUE2: The entrepreneurial ecosystem	14	7	7		30h	1	2	X	
ECUE3: Innovation, Technology Transfer and Intellectual Property	14	7	7		30h	1	2	X	
Total UE	42h	21h	21h		90h	3	6		

ECUE 1: Success preparation and communication

- 1. Required and recommended prerequisites for participating in the module**
- 2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)**

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Be able to analyze a group communication situation and manage it

Be able to present a group project and a personal project

Demonstrate an ability to project oneself positively into the future through the presentation of a life project that arises from the training of the co-constructed master's degree

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Specialization

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)
practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Oral presentation

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

Chapter I: Interpersonal communication and management

1. Introduction to interpersonal communication
 - The principles of communication
 - The components of the communication process
 - Definition of Interpersonal Communication
 - The elements of effective interpersonal communication
 - Active listening
 - Retro information (feedback)
 - The questioning
 - Reformulation
 - Non-verbal communication
3. Communication at the service of the manager
 - Communication and teamwork
 - Communication styles of a manager

Chapter II: Persuasive communication

- The source
- The form of the message
- The content of the message
- The receiver
- Persuasive effect of mass media
- Persuasion and social influence mechanisms

Chapter III:

- Definition
- Lead and decide as a group
- Group performance
- Conflict and conflict resolution

Chapter IV: NLP

- The origins of NLP
- The map is not territory (presupposition N1 of NLP).
- The behavior is not the person (PN Assumption #2)
- NLP and changes

Chapter V: Oral communication

Conduct an interview
Doing a presentation

ECUE 2: The entrepreneurial ecosystem

1. Required and recommended prerequisites for participating in the module

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Develop the entrepreneurial spirit and give a taste for entrepreneurship Demonstrate the ability to think creatively and innovatively
Identify the resources required for a given project and the corresponding budget - Demonstrate an ability to assess the risks associated with a given project (predict the – constraint potential for the implementation of the project
Promote the emergence and identification of innovative ideas for an entrepreneurial project within ;the student community, in order to enable projects with high potential to come to fruition Encourage students to work in teams and reflect on their approach to - carrying out their projects, on its feasibility and the actions to be implemented for the realization of the .entrepreneurial project
Evaluate the social, economic and political issues at the local and international level in terms of entrepreneurship and business creation and raise awareness of the possibilities offered within the Tunisian entrepreneurial environment

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Specialization

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Oral presentation

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

This course will provide a better understanding of the steps that lead to the development of an entrepreneurial project through the feasibility study and the writing of a Business Plan.

Objectives and Learning Outcomes

Apply appropriate tools (competitive analysis, market analysis, market research, HR, budget analysis, etc.)

Know the steps that lead to writing a Business Plan;

Know how to write a Business Plan

Chapter 1: Feasibility studies

Section I: Strategic study Market study

Section II: Study of human resources

Section III: Technical study

Section IV: Economic and financial study

Section III: Tax and social legal study

Chapter 2: Business Plan

Section I: Usefulness and content of a BP

Section II: Development of a BP

Business plan summary

The company, its offering and its market

Marketing plan ;

Production and operation plan

Human resources plan

Investment plan

The profitability

The financial plan

The partners

Section II: Entrepreneurship

Objective: Become familiar with the phenomenon and all its facets Interactive method: Reading articles and discussions

TD: Development of the entrepreneurial project in biotechnology

Chapter 1: the different logics and entrepreneurial forms? Creation ex-nihilo,

Intrapreneurship, Spin-off, Business takeover, franchise,...

Objective: Distinguish entrepreneurial logics

Interactive method: Case studies/Video screenings

TD: Development of the entrepreneurial project in biotechnology

Chapter II: The entrepreneurial profile? How to develop your entrepreneurial behavior?

Entrepreneurial motivations, attitudes, attributes and behaviors of the entrepreneur Objective:

Know the profile of an entrepreneur: source of inspiration

Interactive method: Interview and presentation of testimony from a biotechnology entrepreneur/E-type

Test: What type of entrepreneur are you?

TD: Development of the entrepreneurial project in biotechnology

Chapter III: The Tunisian entrepreneurial environment?

Entrepreneurship support and support system (logistical support, regulatory support, financial support: microcredits, venture capital, business angles, etc.)

Objective: Become aware of the possibilities offered within the Tunisian entrepreneurial environment (opportunities and threats)

Interactive method: Documentary research and role plays

TD: Development of the entrepreneurial project in biotechnology

Chapter IV: Business Model versus Business Plan?

What is a Business Model?

Objective: Identify the different boxes of a Business model
Interactive method: Example of a business model/Business Model of the project
TD: Development of the entrepreneurial project in biotechnology

Chapter VI: Business Model versus Business Plan?

Objective: Develop a BM/BP of an entrepreneurial project
Interactive method: Group support
TD: Presentation of the entrepreneurial project in biotechnology

Chapter V: From the idea to the opportunity and from the opportunity to the development of an entrepreneurial project?

Sources of ideas, business ideas/opportunities, the entrepreneurial process, the feasibility study...
Objective: Identify (understand) and study entrepreneurial action (idea, feasibility, etc.)
Interactive method: brainstorming: search for innovative ideas
-TD: Development of the entrepreneurial project in biotechnology

CEED Tunisia (Company)

Raise students' awareness of entrepreneurship, as future creators, buyers, intrapreneurs, leaders project, guides...
-Introduce students to the different stages that lead to the effective realization of an entrepreneurial project
Evaluate the social, economic and political issues at the local and international level in terms of entrepreneurship and business creation in the field of biotechnology
Introduce students to the Business Model
Explain to students the principle of project financing
Teach students to identify and find sources of financing and aid for innovative projects
2- Soft skills in entrepreneurship
develop students' attitudes and skills in entrepreneurship
stimulate the creative spirit and initiative of students in terms of research for innovative ideas and identifying business opportunities in the biotechnology sector
3- Strategy of biotechnology companies:
Introduce students to strategic management
Train students on networks, alliances and partnerships in the biotechnology sector
Mastering the strategic deployment of biotechnology companies
4- Management of innovative projects:
-Train students in project management
-Introduce students to marketing in innovative companies -Master the notions of SCM in innovative projects -Introduce students to intercultural management

ECUE 3: Innovation, Technology Transfer and Intellectual Property

1. Required and recommended prerequisites for participating in the module

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

This course covers innovation, technology transfer and intellectual property, drivers of growth and solutions to socio-economic, social and environmental challenges. Students will be introduced to concepts such as patent drafting or mapping in order to strengthen their abilities and skills in using the intellectual property system

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

Specialization

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

practical work, projects, seminars

5. Exam form (Oral presentation, essay, ...)

Oral presentation

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

ECUE objectives

Introduction to innovation, technology transfer and intellectual property,

Introduction to concepts such as drafting or patent mapping

Chapter I: Innovation

Introduction

Section I: Definition of innovation

Section II: Different types of innovation

Section III: Different innovation process models

Section IV: Economics of innovation

Chapter II: Technology transfer

Introduction Section I: Innovation and technology transfer

Section II: Evaluation, marketing and transfer of research results Top-approach

down

Chapter III: Intellectual Property (IP)

Introduction

Section I: Introduction to the general principles of intellectual property

Section II: What is an invention patent?

Section III: Basic notions of patent drafting

Section IV: Methodology for carrying out patent mapping

Chapter IV: Conferences and seminars

Section I: Innovation ecosystem, transfer of technology and Pi in Tunisia.

Section II: Testimonials from actors in the innovation and IP system

**Description sheet of a Teaching Unit (UE)
& of the Constituent Elements of a Teaching Unit (ECUE)**

Title of the UE

Emerging professional skills

Credit Number: 6

UE Code: 35

University:

Institution:

Training area: Sciences and Technologies

Mention : Biotechnologies et Biohealth

Diploma of Pathway

Diploma:	Professional Master
Pathway:	Cellular and Molecular Technologies in Biohealth
Semester:	3

ECUE1	Code	Title	
	351	Legislation, Biosafety, Biosecurity and Bioethics	
Responsible	Course	Emna Gaeies	
Coordinator	PW/DW/PPW	Olfa Masmoudi and Partners	
Creation date		Septemembr 2019	Version 1
Modified at		Septemembr 2021	Version 2
Language		French	
ECUE2	Code	Title	
	352	Internship: Monoclonal Antibodies production process	
Responsible	Course	Mouna Stayyousef	
Coordinator	PW/DW/PPW	Sebei Ouladi Caminov	
Creation date		Septemembr 2019	Version 1
Modified at		Septemembr 2021	Version 2
Language		French	
ECUE3	Code	Title	
	353	Techniques and Methodologies in Microbiology	
Responsible	Course	Naowel KLIBI	
Coordinator	PW/DW/PPW	Badaa Essghaeir	
Creation date		Septemembr 2019	Version 1
Modified at		Septemembr 2021	Version 2
Language		French	

The constituent elements of the UE: hours C/DW/PW/PPW/Self-Study, credits, evaluation (CC/RM)

<i>The constituent elements</i> (ECUE)	Workload					Value		Evaluation	
	Course	DW	PW	PPW	Self-study	Coef	Cred	% CC	% Exam
ECUE1: Legislation, Biosafety, Biosecurity and Bioethics	14	7	7		30	1	2		X
ECUE2: Internship: Monoclonal Antibodies production process		7	7	14	30	1	2	X	
ECUE3: Techniques and Methodologies in Microbiology	14		7	7	30	1	2	X	
Total UE	28h	14h	21h	21h	90h	3	6		

ECUE 1: Legislation, Biosafety, Biosecurity and Bioethics

1. Required and recommended prerequisites for participating in the module

Legislation and patent in biotechnology

Analysis of the functioning of the biotechnology company and identification of sectors of activity

Knowledge of the ethical and regulatory aspects of the use of cells, tissues and products from the human and/or animal body

Knowledge of integrated systems applications and specialized cell and tissue culture.

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

5. Exam form (Oral presentation, essay, ...)

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content (The content description must clearly indicate the weighting of the content and the level)

ECUE 1 Legislation and patent in biotechnology

Patent law

Legislative codes of intellectual property (national and international law)

Trademark law for bio-industries and pharmaceutical laboratories

Evolution of the regulatory context in the biotechnology sector

Evolution of the regulatory context in the field of medicines

Criteria for granting a patent and duration of protection

Supplementary protection certificate: continuity of patent protection

Marketing authorization legislation for health products

Patent protection in the biotechnology sector

Activities of biotechnology companies and protection of intellectual property

patent categories in the biotechnology and pharmaceutical sector:

the product patent

process patents

therapeutic indication patents

Patents relating to biotechnological inventions

Ways to reduce the risks of imitation by competitors

Intellectual property rights and licensing/patent practices

National and international patent conventions and treaties

Patent grant criteria and duration of protection

BioPredic International (Company)

Products and services

Cell culture, production of primary cells, cell lines (including the HepaRG® liver line) and tissues (human and animal) for research, the pharmaceutical, chemical and cosmetic industries

A- IMMUNOBIOOTHERAPIES : research and innovation on antibodies, vaccines, immunomodulators and adoptive transfer of cells to fight cancer, inflammation, autoimmune and infectious diseases.

B- REGENERATIVE MEDICINE : Transplantation and the development of innovative solutions as alternatives to the shortage of organs and for the immunological monitoring of transplanted patients.

New therapeutic approaches (biomaterials, tissue engineering, cell therapy, gene therapy) applied to osteoarticular diseases, dermatology, oncology, pulmonology, as well as rare, neurodegenerative and cardiovascular diseases.

EPISKIN L'OREAL (Company)

A- Tools and Methods for exploring cellular activities

Methods for studying the structure and ultrastructure of cells

Subcellular fractionation and functional exploration

Method for exploring cell proliferation: cell counting, MTT test, DNA quantification; Feulgen staining

Nucleolar organizers, nuclear morphometry and evaluation of chromatin texture

Cellular test: measurement of mitochondrial activity and potential, measurement of the activity of intracellular enzymes (effector and initiator caspases, antioxidant enzymes), measurements of delayed ROS levels, measurements of intracellular metabolites

B- “Innovative technologies for biotherapies” : Toolbox (biomarkers,

vectors, medical devices, instrumentation, experimental models, processes, solutions software...).

Supporting therapeutic innovation within the framework of the 3 DAS (Domains of Strategic Actions) of the division (Immunobiotherapy, Radiopharmaceuticals, Restorative and regenerative medicine).

A- Biosecurity

Introduction to BiSecurity

Principles of Laboratory Biosafety: Introductions to Toxin Microbiology

Laboratory-acquired infections

Pathogen Risk Assessment

General safety practices in containment laboratories

Fundamental and biotechnological risks and issues of cell culture
Operational practices at containment level 2
Decontamination techniques
Decontamination in the laboratory
Chemical disinfectants
Biomedical waste management

B- Biosecurity

Introduction to Biosecurity
Biosecurity risks and classification
biosecurity risks
Working with small animals in confinement

LABORATORY RISK ASSESSMENT Methodology.

Define the situation
Define risks and characterize risks.
Implement risk mitigation measures, as needed Biosecurity risk assessment
Biosecurity risk assessment
Implement risk mitigation measures, as needed
SCENARIO AND EXERCISES

ECUE 2: Internship: Monoclonal Antibodies production process

1. Required and recommended prerequisites for participating in the module

Immunology and Immunotechnology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

5. Exam form (Oral presentation, essay, ...)

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content *(The content description must clearly indicate the weighting of the content and the level)*

ECUE 3: Techniques and Methodologies in Microbiology

1. Required and recommended prerequisites for participating in the module

Microbiology

2. Module objectives/intended learning outcomes (Knowledge, Skills and Attitudes)

Key question: What learning outcomes should students achieve in the module?

For example, in terms of: Knowledge: familiarity with information, theory, and/or subject knowledge.

Skills: cognitive and practical abilities used to apply knowledge.

Competencies: integration of knowledge, skills, and social and methodological abilities in work or learning

Adapt to the Microbiology bench

carry out a screening of the strains producing the molecules of interest from a soil sample

Know how to handle bacteria in pure and mixed culture

Identify bacteria using classic phenotypic methods

Confirm identification by a molecular method (specific PCR

And finally understand the origins of biological hazards within an industry.

3. Relation to the curriculum/intended learning outcomes (Mandatory / Optional / Specialization) Names of other study programs with which the module is shared)

/ Optional

4. Teaching and didactical methods (For example, lectures, lessons, practical work, projects, seminars, etc.)

practical work, projects

5. Exam form (Oral presentation, essay, ...)

Project

6. Study and examination conditions

7. Reading list (title of manuals, articles)

8. Content

(The content description must clearly indicate the weighting of the content and the level)

Screening of strains producing antibacterial substances from a soil sample :

Sampling, dilutions, isolation on selective media and subcultures and screening of strains producing molecules of interest by different methods (spot method, well method and disk method)

Phenotypic characterization of the isolated strains (morphological, dyeing and biochemical)

Molecular characterization of isolated strains (specific and universal PCR)

Methods for analyzing environmental contamination (of premises, surfaces, equipment and air): sampling, filtration and dilution, spreading on selective media, counting and identification of germs

Liste des enseignants-chercheurs de la FST intervenant en TCMB

Légende : M1S1 (niveau 1^{ère} année Master, 1^{er} Semestre), M1S2 (niveau 1^{ère} année Master, 2^{ème} Semestre), M2S3 (niveau 2^{ème} année Mster, 3^{ème} Semestre)

Prénom et NOM	Grade	Expertise	ECUE enseignés	Niveau
Olfa MASMOUDI	Professeur Responsable du master	Biologie cellulaire	- Cell-based study techniques - Cellular and molecular aspects of pathologies - Biomolecule Screening Techniques	M1S1 M1S2 M2S3
Asma GATI	Professeure	Immunologie	- Molecular Immunology - Autoimmune disease diagnosis - Flow cytometry and diagnostics tools	M1S1 M1S2 M2S3
Maha MEZGHANNI	Professeure	Génétique	- Genome research methodologies - Molecular Methods in Human Pathology	M1S1 M1S2
Taoufik GHRAÏRI	Professeur	Biochimie	- Proteomics methodologies - Bioanalytical approaches and validation	M1S1 M2S3
Salwa ZEHDİ	Professeure	Génétique	Recombinant DNA technologies	M1S1
Raja MARRAKCHI	Professeure	Immunologie	Cytomics, Pathologies and Cytological Techniques	M1S2
Sadok BOUKHCHINA	Professeur	Biochimie	Biomolecule Screening Techniques	M2S3
Souheila GUERBOUJ	Professeure	Génétique	RNA technology and transcriptomics	M1S2
Naouel KLİBI	Professeure	Microbiologie	- Microbiological diagnostics and bio-health applications - Techniques and Methodologies in Microbiology	M1S2 M2S3
Badia ESSEGHAÏER	Maître assistante	Microbiologie	- Microbiological diagnostics and bio-health applications - Techniques and Methodologies in Microbiology	M1S2 M2S3
Rym BOUCHENDIRA	Maître assistante	Physique	Metrology for imaging systems	M2S3
Nihel ZİADI	Maître assistante	Sciences de gestion	- Business development & entrepreneurial soft skills - Management of Innovative Projects	M1S1 M1S2
Afef NAJJARI	Maître assistante	Bio-informatique	- Bioinformatics - Structural Bioinformatics	M1S1 M1S2
Hedia BOURGUİBA	Maître assistante	Génétique	- Genome research methodologies - Molecular Methods in Human Pathology	M1S1 M1S2
Ghada BARAKET	Maître assistante	Génétique	Recombinant DNA technologies	M1S1
Samir BEN ALI	Maître assistant	Génétique	RNA technology and transcriptomics	M1S2
Mouna STAYOUSSEF	Maître assistante	Immunologie	- Immuno-technology and Biotherapy - Monoclonal antibodies production process	M1S2 M2S3
Rym BOUHAHA	Maître assistante	Génétique	Immuno-technology and Biotherapy	M1S2
Faten EL MEDDAH	Maître assistante	Didactique	- Success preparation and communication - Biosecurity and Bioethics	M2S3 M2S3
Asma GHARBI	Maître assistante	Sciences juridiques	Legislation, Biosafety	M2S3
Hajer MESTAYSSER	Maître assistante	English	English Certification and Technical Communication	M1S2

Liste des enseignants-chercheurs externes à la FST intervenant en TCMB

Prénom et NOM	Institution	Grade	Expertise	ECUE enseignés	Niveau
Said GLAI	Institut National de Neurologie, (Service polyvalent de Biologie clinique UTM)	Maître-Assistant	Biochimie	- Cell, Bio-membrane and Signaling - Methods applied to Pharmacology	M1S1 M2S3
Samia DHARI	Centre de Recherche en Microélectronique et Nanotechnologie (Université de Sousse)	Maître-Assistante	Sciences des Matériaux Nano-biophysique	- Nanobiology & Nanobiotechnology - Innovation, Technology Transfer and Intellectual Property	M1S1 M2S3
Fethi OUESLATI	Centre de Biotechnologie de Borj Cédria	Maître-Assistant	Chimie analytique	- Bio-analytical techniques - Pharmaceutical production processes and quality control procedures	M1S2 M2S3
Jihène ZOUITEN	Centre de Biotechnologie de Borj Cédria	Maître-Assistante	Entreprenariat	The entrepreneurial ecosystem	M2S3
Emna GAÏES	Centre National de Pharmacovigilance	PhD Maître-Assistante	Pharmacology & toxicology	Methods applied to Pharmacology	M2S3

Jérôme LEPRINCE	PRIMACEN (Université Normandie Rouen)	PhD, Chargé Recherche INSERM	Protéomique et méthodes analytiques	• Biomolecule Screening Techniques	M2S3
David VAUDRY	PRIMACEN https://primacen.crihan.fr	PhD, Chargé Recherche INSERM	Génomique et cytomique	• Biomolecule Screening Techniques	M2S3

Liste des intervenants non-universitaires associés à la formation en TCMB

Prénom et Nom	Organisation	Diplôme	Expertise	UE Concernées	Niveau
Walid SABEI	CEO CAMINNOV https://www.caminnov.com/	PhD	Biologie cellulaire et Moléculaire	• Monoclonal antibodies production process	M2S3
Christian PELLEVOISIN	EPISKIN L'ORÉAL www.episkin.com cpellevoisin@episkin.com	PhD Scientific Directeur	Ingénierie cellulaire et tissulaire	• The entrepreneurial ecosystem & Innovation • Internship of Professional emergency	M2S3
Belhassen ZOUARI	DG : Appareillage et Equipement Scientifique	Ingénieur	Système de criblage et imagerie	• Cellular metrology and metrology for imaging systems	M2S3
Ali ACHOURI	DG : Laboratoire GENERIKA pour l'industrie http://www.generikatn.com/	Ingénieur	Pharmaceutiques à usage humain, vétérinaire, parapharmaceutiques et Cosmétiques	• Analytical Méthodes & validation & Quality approches	M2S3
Habiba GHAZELI	Laboratoire GENERIKA pour l'industrie http://www.generikatn.com/	Ingénieur	Développement analytique et contrôle qualité	• Analytical Méthodes & validation & Quality approches	M2S3
Leila GUELLOUZ	lgc_pyramides@yahoo.fr Pyramid Conseil	Ingénieur	Expertise en normes qualité	• Quality management in biotechnology	M2S3
Wafa MAKHLOUF	CEED: Centre pour l'Entreprenariat et le Développement Exécutif www.ceed-tunisia.tn	Entreprenariat	Directrice exécutive CEED	• Entrepreneurial ecosystems and innovation	M2S3
Rym KHELIFI	Youtech	Ingénieur	Assurance qualité en bioindustrie	• Quality management in biotechnology	M2S3

Liste des Partenaires universitaires associés à la formation en TCMB

Etablissement	Secteur d'activités	Nature de partenariat
Faculté de Médecine de Tunis FMT	Plateforme Cytométrie en Flux et génomique et USCR de microscopie	Formation et stage
Institut Pasteur de Tunis IPT	Diagnostic des maladies auto-immunes et ateliers de cytométrie	Formation et stage
Institut National de Neurologie INN	Service polyvalent de Biologie Clinique	Formation et stage
Institut des Hautes Etudes Commerciales IHEC	Compétence entrepreneuriale et management de projet	Formation

Liste des partenaires du milieu professionnel et socio-économique associés en TCMB

Etablissement	Secteur d'activités	Nature des partenariats
Laboratoire National de Contrôle des Médicaments LNCM	Méthode analytique et validation	Formation et stage
Centre nationale de pharmacovigilance CNPV	Méthodes appliquées à la pharmacologie	Formation et stage
ADWIA	Pharmaceutique	Visite et stage
CAMINNOV	Production des anticorps monoclonaux	Formation et stage
WEPREDIC BIOPREDIC International	Bio-industrie et ingénierie cellulaire et tissulaire	Formation et stage
FERILLIA	Centre Assistance Médicale à la Procréation Clinique la Rose	Formation et stage
Médis	Industrie pharmaceutique Tunisienne et Africaine	Stage
Hikma Lab	Industrie pharmaceutique	Stage