PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH

TRAINING OFFER

L.M.D

ACADEMIC LICENSE

ESTABLISHMENT	FACULTY	DEPARTMENT
HASSIBA BENBOUALI UNIVERSITY OF CHLEF	SCIENCE OF NATURE AND LIFE	BIOLOGY

FIELD	SECTOR	SPECIALITY
SCIENCE OF NATURE AND LIFE	BIOLOGY SCIENCE	MOLECULAR BIOLOGY

I-Semi-annual organizational sheet of the specialty's teachings

(S5 and S6)

Semestre 5 :

Teaching units		Volume Weekly schedule				Coeff	Credits	Assessment Method	
	14-16 weeks	C	DW	PW	Others *			Continuous (40%)	Exam (60%)
Fundamental TU									
FTU 3.1.1									
Matter 1: Foundations of Molecular Biology	90h00	3h00	3h00	-	10h00	4	8	X	X
FTU 3.1.2									
Matter 1 : Elements of molecular genetics of microorganisms	90h00	3h00	3h00	-	10h00	4	8	X	X
Methodology T U									
MTU1									
Matter 1 : Molecular Biology Techniques	67h30	1h30	1h30	1h30	3h00	3	5	X	X
Discovery TU									
DTU1									
Matter 1 : Introduction to microbial biotechnology	45h00	1h30	1h30	-	1h30	2	3	X	X
DTU2									
Matter 2 **:** Genotoxicology	45h00	1h30	1h30	-	3h00	2	4	X	X
Transversal TU									
TTU1									
Matter 1 **:** Scientific English	22h30	1H30	-	-	1h30	1	2	X	X
Total Semester 5	**360**	**12h00**	**10h30**	**1h30**	**29h00**	**16**	**30**		

*** personal work**

Semestre 6 :

Teaching units		Volume Weekly schedule				Coeff	Credits	Assessment Method	
	14-16 weeks	C	DW	PW	Others *			Continuous (40%)	Exam (60%)
Fundamental TU									
FTU 3.2.1									
Matter 1: Genetic engineering	90h00	3h00	3h00	-	-	4	8	X	X
FTU 3.2.2 (O/P)									
Matter 1 : Signage and regulation of gene activity	67h30	3h00	1h30	-	1h30	4	8	X	X
Methodology T U									
MTU1									
Matter 1 : 3D structure of Biological Macromolecules	45h00	1h30	1h30	-	3h00	2	4	X	X
Matter 2 : Bioinformatics	67h30	1H30	1h30	1h30	1h30	3	4		
Discovery TU									
DTU1									
Matter 1 : cellular biochemistry	67h30	1h30	1h30	1h30	1h30	3	4	X	X
TUD 2									
Transversal TU									
TTU1									
Matter 1 **:** mini-project	45h00					1	2	X	X
Total Semester 6	**382.5h**	**10h30**	**9h00**	**3h00**	**7h30**	**17**	**30**		

Overall summary of training: (indicate the separate global VH in progress, DW,PW... for the 06 teaching semesters, for the different types of TU)

UE / VH	FTU	MTU	DTU	TTU	Total
Course	540	277.5	112.5	67.5	997.5
DW	405	247.5	22.5		675
PW	270	90	67.5		427.5
Personal work	687	292	77.5	47.5	1104
Others (Mini projet)				60	60
Total	1902	907	280	175	**3264**
Credits	122	36	17	5	**180**
% in credits for each TU	67.78	20	9.44	2.78	100%

II - Detailed programme by subject of the semesters S5 and S6

Semester: *5*

Fundamental Teaching Unit 1 (FTU 3.1.1): Foundations of molecular biology Subject 1: Foundations of molecular biology

Credits: 8

Coefficient: 4

Objectives of education

The educational content of this UEF describes the structure and function of nucleic acids and proteins. At the end of this UEF, the student will have acquired in-depth knowledge about the organization and functioning of the human genome and other eukaryotic organisms, along with alterations affecting the human genome and molecular repair mechanisms.

Recommended prior knowledge.

This subject requires basic knowledge of chemistry, biostructural chemistry, genetics and general microbiology.

Content of the subject:

Chapter 1: DNA

1- DNA carrying genetic information

1.1. Highlight: GRIFFITH experiment
1.2. In vitro transformation (DAWSON and SIA, ALLOWAY)
1.3. Analysis of the transforming factor: AVERY, MC LEOD and MC CARTY (1944).
1.4. General conclusion

2- Structures DNA properties

2.1. Chemical nature of DNA
2.1.1. The nitrogenous bases.
2.1.2. Bases modified in DNA
2.1.3. Important properties of nitrogenous bases
2.1.4. The chemical transformation of bases.
2.1.5. Nucleosides.
2.1.6. Chemical composition of a nucleotide.
2.1.7. The nucleotide bond
2.2. DNA spatial structure.
2.2.1. The structure revealed by X-ray diffraction (Watson and Crick)
2.2.2. The double helix.
2.2.3. DNA double helix isoforms (form A, B, and Z)
2.3. Some properties of DNA
2.3.1. The hyperchromatic effect.
2.3.2. Melting temperature
2.3.3. Hysteresis phenomenon
2.3.4. Physicochemical properties of DNA often used in practice.

3- DNA replication

3.1. Experimental study of replication

3.1.1. Watson and Crick Postulate

3.1.2. Work by MESELSON and Stahl

3.2. Prokaryotic replication.

3.2.1. General data.

3.2.2. Replication Flow.

3.3. Replication in eukaryotes.

3.3.1. Cell cycle reminders

3.3.2. Replication: General data, DNA polymerases, major events.

4- DNA mutability

4.1. Possible natural origins of mutations.

4.1.1. Physical alterations (cosmic rays, radioactivity, uv...).

4.1.2. Chemical Alteration.

4.2. Types of mutations

4.2.1. Point mutations.

4.2.2. Chromosomal mutations (large expansions).

4.2.3. Genome mutations.

5- DNA repair (maintaining the integrity of DNA).

5.1. Prevention: cell protection systems (superoxide dismutase, acid base balance, reducing systems).

5.2. The fidelity of replication.

5.2.1. Mechanism of Redress

5.2.2. Excision repairs

5.2.3. Recombination repair

5.2.4. Direct repair (Photoreactivation)

Chapter II: ARNs

1- Description, structure and properties.

1.1. General characteristics of NRAs.

1.2. The different types of RNA.

1.3. Ribosomal RNAs (prokaryotic and eukaryotic)

1.3.1 MRNAs.

1.3.2. The tRNAs (spatial structure, unusual bases, important sites in tRNAs)

1.3.3. Small nuclear RNAs (NSARs)

1.3.4. Small cytoplasmic RNAs (scRNA)

Chapter III: The biosynthesis of proteins.

1. The transcript

1.1. Definitions and general data.

1.2. Transcription in eukaryotes.

1.2.1. RNA polymerases.

1.2.2. Transcription of protein coding genes and synthesis of mRNA

1.2.2.1. Gene structure reminders in eukaryotes (intron and exon).

1.2.2.2. Initiation of transcription.

1.2.2.3. Elongation.

1.2.2.4. Termination

1.2.2.5. Maturation.

a. Cap formation on the 5’ end of the pre-messenger.
b. Poly-adenylation.
c. RNA splicing.

2. The translation

2.1. The genetic code
2.1.1. Principles and definition.
2.1.2. Code characteristics.
2.1.2.1. Universality of the code.
a. Exceptions observed in some mitochondria.
b. Exceptions observed in yeasts.
c. Exceptions observed in some protozoa.
2.1.2.2. The code does not overlap.
2.1.2.3. Code degeneration.
2.2. Codon/anticodon relationship: Wobble phenomenon.
2.2.1. Principle and definition.
2.2.2. Different types of Wobble.
2.3. Translation mechanism in eukaryotes
2.3.1. Ribosomes
2.3.2. Translation steps
2.3.2.1. Initiation
2.3.2.2. Elongation
2.3.2.3. Termination

Chapter IV: The regulation of gene expression

1. Different levels of regulation

1.1. Regulation by modification of the primary structure of DNA

1.2. Transcriptional regulation

1.3. Post-transcriptional regulation

1.4. Translation regulation

Semester: *5*

Fundamental teaching unit 2 (FTU 3.1.2): Molecular genetics of microorganisms

Subject 1: Molecular genetics of micro-organisms

Credits: 8

Coefficient: 4

Objectives of education

This unit complements the previous one. It focuses on structural aspects and the genetic and molecular mechanisms used for gene expression in bacteria, eukaryotic microorganisms and viruses. Fundamental knowledge will be acquired on the organization and functioning of the microbial genome and the ability to compare with that of higher (human) eukaryotes.

Recommended background knowledge

This unit requires in particular knowledge of general microbiology, but also knowledge of genetics, structural biochemistry and virology.

Content of the subject:

Part 1: Bacteria

Chapter 1: The bacterial genome

1. Bacterial genome structure

1.1. The bacterial chromosome.

1.2. The mobile genetic elements

1.2.1. Plasmids

1.2.1.1. Plasmid General Organization

1.2.1.2. Plasmid classification

- Plasmids R
- Fertility plasmids (or factor F).
- Plasmid Col
- Degradation plasmids.
- Virulence plasmids

1.2.1.2. Plasmid properties.

1.2.2. Transpose

1.2.2.1. General transposon structure

1.2.2.2. Different types of transposons

1.2.2.3. Transposition mechanisms in bacteria

a. Transposition with replication of the transposon.

b. Conservative transposition

c. Consequences of transposition on bacterial genome expression

1.2. Organization of prokaryotic genes

2. Bacterial genome replication

3. Alterations and repair mechanisms of the bacterial genome

Chapter 2: Horizontal gene transfers

1. Transformation
2. Conjugation
3. Transduction
4. Genetic map

Chapter 3: Protein biosynthesis

1. Transcript

1.1. Initiation
1.2. Elongation
1.3. Termination
2. Translation mechanism
2.1. Synthesis of an aminoacyl-tRNA.
2.2. Structure is a function of the ribosome.
2.3. Translation initiation.
2.4. Elongation.
2.5. Termination.

Chapter 4: Regulation of gene expression

1. Operon definition and concept.
2. The inductible operons: lactose operon.
3. Repressible operons: Tryptophan operon.
4. Expression modulator system: attenuation.
5. Regulation by DNA sequence inversion

Part 2: Mushrooms (Yeast as a model system)

1. Yeast biology reminders
1.1. General.
1.2. Culture and nutrition.
2. The yeast genome.
3. The transcriptome of yeast.
4. The yeast proteome
5. Analysis of biochemical mutations, tetrads
6. Gene supplementation and conversion.
7. Mitochondrial genetics.
8. Transposable elements.
9. Tools and means of yeast genetic transformation: practical applications
10. Cell division and cycle.
11. Sexual reproduction in yeasts (haplodiplobionic cycle)

Part 3: Viruses

1. Virus structure and classification

2. Nucleic acids of viruses.

2.1. DNA genomes.

2.2. RNA genomes.

2.3. Case of bacteriophages.

3. Viral cycle

3.1. Lytic cycle

3.2. Lysogenic cycle

4. Replication of viral genetic material

4.1. Replication of DNA viruses (T4 bacteriophage study model)

4.2. Replication of RNA viruses

Semester: 5

Methodology Teaching unit MTU1 : Techniques of Molecular Biology Subject: Techniques of Molecular Biology

Credits: 6

Coefficient: 3

Objectives of education.

The objective of this unit is to acquire many skills both disciplinary and transversal in generic and molecular biology, as well as the mastery of basic techniques and equipment used in molecular biology which are essential for the whole of biology.

Recommended background knowledge

This unit requires in particular knowledge of genetics and general biochemistry

Content of the subject:

- Extraction and purification of chromosomal DNA and plasmid DNA.
-The techniques of RNA extraction
- Transformation of bacteria.
- Electrophoresis and analysis of DNA digested by restriction enzymes.
- Concepts and principles on:

• Development of genomic banks and DNAs
• Cloning, sequencing techniques
• PCR and RTPCR
• Southern blot, Northern blot, Western blot, Dot blot
• molecular hybridization

Semester: 5

Discovery teaching unit (DTU1): Introduction to microbial biotechnology Subject: Introduction to microbial biotechnology

Credits: 2

Coefficient: 1

Objectives of education

Biotechnology exploration teaching provides an opportunity for students to discover the importance of applied technology in research and production of goods or services in the health, environment and bioindustries sectors.

Recommended background knowledge

This unit requires in particular knowledge of genetics, general microbiology but also knowledge of experimental techniques of Molecular Biology.

Content of the subject:

Microorganisms: cell structure and organization (bacteria, fungi, viruses).

Microbial growth: kinetics, trophic types, nutrients, metabolism. Elements of microbial systematics.

Control of bacterial populations: decontamination and conservation processes. Artificial transfer of **genetic information:** Transformation in prokaryotes, transfection in eukaryotes.

Nucleic acid manipulation: extraction, purification, assay, electrophoresis. Restriction and modification enzymes. Plasmids. Construction of recombinant vectors.

Detection, characterization and identification of nucleic acids: radioactive markings and cold markings. Molecular hybridization.

Amplification: PCR

Semester: 5
Discovery teaching unit DTU2: Genotoxicology Subject: Genotoxicology
Credits: 4
Coefficient: 2

Objectives of education

DNA interactions with various genotoxic agents, induced damage to DNA, mechanisms for restoring genome integrity and concepts of laboratory biosecurity

Recommended background knowledge

This unit requires in particular knowledge of genetics and molecular biology.

Content of the subject:

I- Concept on toxicology

- Xenobiotic molecules
- Steps in the transformation of xenobiotic molecules

II- Pharmacogenetics

- Definition
- Interindividual variations in drug responses associated with genetic polymorphisms

II- Mutagens

III- DNA repair systems

- By reversion: repair of punctual injuries
- Mismatch Repair (MMR)
- NER (Nucleotide Excision Repair)
- Base Excision Repair (BER)
- DNA Double Strand Break Repair Pathway
- SOS System

Genetic consequences and effects of mutagens and repair: effects on chromosomes and genes

VI- Reprogramming of genetic information through the production of DNA damage, apoptosis and cell cycle

VII- Carcinogenesis

- Mutation relationship - cancer

- Theories of cancer development

VIII- Teratogenesis

- Definition
- Different types of malformations observed during fetal life.

IX- Concepts on strategy, legislation of mutagens and laboratory safety (case study)

Semester: 5

Transversal teaching unit TTU1: scientific english Subject: scientific english

Credits: 2

Coefficient: 1

Objectives of education

This module is devoted to continuing English language instruction with a particular emphasis on scientific English and article analysis.

Recommended background knowledge

This unit requires knowledge of the basics of language (spelling, vocabulary, phonetics,,,,,) and also some notions of terminology and research methodology .

Content of the subject:

- Practice of language in a wide variety of forms.
- Comprehension and expression exercises in the laboratory.
- Grammatical revisions.
- Training in speaking through presentations followed by discussions.
- Studies of articles and video documentaries of general and scientific interest.

Semester: 6

Fundamental teaching unit 1 (FTU 3.2.1): Genetic engineering Subject 1: Genetic engineering

Credits: 8

Coefficient: 4

Objectives of education

The aim is to teach students the basic principles of genetic engineering techniques and the manipulation of biological tools, cloning vectors, restriction enzymes, etc. At the same time, it will provide an opportunity to discover the different fields of application of genetic engineering.

Recommended background knowledge

This unit requires knowledge of molecular biology, the genetics of micro-organisms, as well as knowledge of biochemistry and general microbiology.

Content of the subject:

Chapter I: The enzymatic tools of genetic engineering

1- Restriction enzymes.

1.1. The phenomenon of restriction.

1.2. Classification of restriction enzymes.

1.2.1. Type I enzymes.

1.2.1. Type II enzymes.

1.2.2. Type III enzymes

1.3. Types of cutoff induced by restriction enzymes.

2- Other enzymes commonly used in molecular biology.

2.1. Polymerases.

2.2. Ligases.

2.3. Nucleases.

Chapter II: Molecular hybridization

1- Reminders on the principle of the hybridization reaction.

1.1. The concept of DNA melting temperature.

1.2. Factors influencing the melting temperature

2- Liquid phase hybridization.

2.1. Principle.

2.2. Quantitative analysis of hybrids.

2.3. Applications of liquid-phase molecular hybridization.

3. Solid support hybridization.

3.1. Principle.

3.2. Factors influencing solid media hybridization.

3.3. The media used to immobilize nucleic acids.

4. In situ hybridization

Chapter III: Vectors

1. Vector Generalities.

1.1. Vector concept.

1.2. Properties a vector must have.

1.3. General principles for using a vector.

2. Plasmids

2.1. The use of a plasmid.

2.2. Plasmid preparation.

2.3. The different types of plasmids.

2.3.1 First generation plasmids.

2.3.2. Second generation plasmids.

2.3.3. Third generation plasmids

3. Phages.

3.1. Use of phages.

3.2. Preparation of a phage

3.3. The different phages used in molecular biology.

3.3.1. The first generation phage. The λ phage.

3.3.2. Second generation phages.

4. Other vector types

4.1. The cosmids.

4.2. The "shuttle" vectors.

4.3. Eukaryotic viral vectors.

Chapter IV: The probes.

1. The probe concept.

2. Marking agents

2.1 Radioactive isotopes.

2.2. Non-radioactive marking.

3. Some marking strategies

3.1. The “Nick translation”.

3.2. Random printing.

3.3. Marking of synthetic probes (synthetic oligonucleotides)

3.4. The marking of cloned monostrand probes (Phage M13).

3.5. RNA probes (ribosondes).

Chapter V: Cloning

1. The principle of cloning.

2. The basics of DNA cloning

3. DNA banks.

3.1. Genomic DNA banks.

3.1.1. Establishment of the DNA bank.

3.1.2. Bank amplification

3.2. The cDNA banks.

3.2.1. The transition from RNA to DNA.

3.2.2. The choice of vector.

3.2.3. Introduction into the bacteria.

4. DNA bank screening (Recombinant detection)

Chapter VI: Genetic transformation

1. Particle cannon transformation.
2. Agrobacterium tumefasciens transformation

Chapter VII: Genetic engineering and applications

1. Introduction
2. Expression of recombinant proteins
3. Bacterial expression systems
4. Eukaryotic expression systems
5. Techniques used to synthesize a protein

5.1. Examples of protein syntheses

5.1.1. Genetic engineering in the pharmaceutical industry: drugs, vaccines.

6. Plant genetic engineering: plant transgenesis

6.1. Definition

6.2. Gene transfer methods in plants

6.3. Genetic engineering characteristics of plants

6.4. Benefits and limitations of plant transgenesis

7. Transgenic animals

7.1. Definition

7.2. Gene transfer methods in animals

7.3. The main applications of transgenic animals

7.4. Benefits and limitations of animal transgenics

8. Genetic engineering in medicine

8.1. Gene therapy

8.1.1. Definition

8.1.2. Different authorizations

8.1.3. Vectors

8.2. Gene therapy techniques

8.3. Examples of gene therapy

Semester: 6

Fundamental teaching unit 2 (FTU 2) Subject 1: Signaling and regulation of gene activity

Credits: 8

Coefficient: 4

Objectives of education

At the end of this UEF, the student will have acquired the molecular bases of signal transmission and their transduction to the nucleus. This UEF will at the same time make it possible to understand the modulation of gene activity in response to extracellular signals.

Recommended background knowledge

This unit requires in particular knowledge of structural biochemistry and enzymology, knowledge of molecular biology.

Content of the subject:

Chapter I: Molecular organization of biomembranes

1. Structure of biomembranes

1.1. Asymmetry of membrane lipid composition and distribution

1.2. Membrane protein distribution

2. Membrane fluidity

3. Addressing mechanisms

3.1. Intracellular vesicular protein traffic

3.2. Post-translational protein modifications

3.2.1. Lipidation

3.2.2. Glycosylation

Chapter II: Membrane receptors and intracellular signaling molecules

1. Membrane receptors and their ligands

1.1. Receptor characteristics

1.2. Classification of receptors by location

1.2.1. Nuclear receptors

1.2.2. Membrane receptors

1.3. Types of membrane receptors

1.3.1. Ion channel receptors

1.3.2. G-protein coupled receptors (GPCRs)

1.3.3. Receptors with intrinsic enzymatic activity

1.3.3.1. Tyrosine kinase receptors (RTK)

1.3.3.2. Receptors with serine/threonine kinase activity

1.3.4. Guanylate cyclase activity receptors

1.3.5. Tyrosine kinase coupled receptors

1.3.6. Receptors coupled to a serine/threonine kinase

2. General diagram of a signaling track

3. Network of intracellular signaling molecules

3.1. Main adaptor proteins

3.1.1. Protein-protein interaction domains

3.1.1.1. SH Domains (Src Homology Domain)

3.1.1.2. PTB Domains (PhosphoTyrosine Binding)
3.1.2. SH2 domain adaptor proteins
3.1.2.1. Protein Grb2
3.1.2.2. Shc protein

3.2. Small monomeric G-proteins

3.2.1. Ras protein superfamily

3.3. Regulatory proteins associated with small G-proteins

3.3.1. PEG Exchange Proteins (GTP/GDP Exchange proteins)
3.3.2. GTPase-Activating Proteins

3.4. Intracellular Enzymes and Second Messengers

3.4.1. Properties of a second messenger
3.4.2. Second messenger synthesis reactions and enzymes
3.4.2.1. AMPcyclic and adenylate cyclase
3.4.2.2. Diacyl glycerol (DAG), inositol triphosphate (IP3) and phospholipases C
3.4.2.3. Phosphatidyl inositol triphosphate (PIP2) and PI3-kinase
3.4.2.4. CMP cyclic and guanylate cyclase

3.5. Protein kinases

3.5.1. Phosphorylation reactions and kinase domains
3.5.2. Major protein kinases
3.5.2.1. Protein kinase A (PKA)
3.5.2.2. Protein kinase C (PKC)
3.5.2.3. Protein kinase B (Akt)
3.5.2.4. Mitogen-activated protein kinases (MAPK)

Chapter III: Molecular bases of signaling by tyrosine kinase receptors

1. Mechanisms of tyrosine kinase (RTK) receptor activation

2.1. Receptor dimerization
2.2. Receptor transphosphorylation

2. Activation of the Mitogen cascade -Activated Protein Kinases (MAP Kinases)

2.1. Transcription factors activated by MAP kinases: AP1 (Activator Protein-1)

3. Activation of the phosphatidylkinase pathway (PI3K)

3.1. PI3K lipid kinase activity
3.2. PI3K Classes
3.2.1. Class IA
3.2.2. Class IB
3.2.3. Role of PI3K sub-units
3.3. RTK PI3K activation mechanisms
3.3.1. Direct activation
3.3.2. Activation by the IRS adaptor protein (insulin receptor substrate 1)
3.3.3. Activation by the Ras protein
3.4. Recruitment of PDK (Phosphoinositide-dependent kinase 1)
3.5. Akt protein activation (PKB)

Chapter IV: Signaling pathways by G-protein coupled receptors

1. Heterotrimeric proteins G

1.1. Structure of G proteins (subunits

1.2. proteins G and subunits

1.3. G-protein activation/inactivation cycle

3. Activation of adenylate cyclase by the G protein subunit

4. - Activation of phospholipase C by the subunit of protein G

4.1. Second messenger release: Diacylglycerol (DAG), inositol triphosphate (IP3)

4.2. DAG and Protein kinase C (PKC) activation

4.3. IP3 and intracellular calcium mobilization

5. Involvement of the G protein subunit in PI3-kinase activation

6. CREB transcription factors

Chapter VI: Signal-dependent transcription factors

1. Simplified classification of transcription factors

1.1. Constitutively active transcription factors

1.2. Regulated transcription factors

1.2.1. Transcription factors regulated by a membrane signal

1.2.1.1. Nuclear Location Factors (C/EBP, AP1)

1.2.1.2. Cytoplasmic localization factors

a. STAT (Signal Transducer and Activator of Transcription)

b. SMAD (Sma & Mad)

c. NF- (Nuclear Factor-B

2. Cytokine activation of STAT transcription factors

2.1. Definition and classes of cytokines

2.2. Tyrosine kinase-coupled cytoplasmic receptors JAK (Janus kinase)

2.2.1. JAK family members

2.2.2. JAK kinase receptor activation

2.3. Signal transmission by STAT

2.3.1. STAT family members

2.3.2. STAT protein structure

2.3.3. Activation of STAT and translocation to the kernel

2.4. Activation of JAK/STAT route by IL-6

2.5. Activation of JAK/STAT channel by IFN-

3. Activation of SMAD transcription factors by TGF-

3.1. Member of the SMAD family

3.2. SMAD protein structure

3.3. Canonical pathway of SMAD activation by the serine/threonine kinase receptors

4. Canonical NF-βactivation path

4.1. NF-β

4.1.1. NF-family members

4.1.2. NF-structural characteristics

4.1.4. IKK kinase (I B kinase)

4.2. Activation of NF- β - IL-connector

4.2.2. MyD-dependent IL-1 signaling channel

4.3. Activation of NF-β -

4.3.1. TNF-receptors

4.3.2. TNF-Type 1 receiver signaling path

4.4. NF-βresponse genes

Semester: 6

Methodology teaching unit (MTU1): Structure 3D of Biological Macromolecules Material: Structure 3D of Biological Macromolecules

Credits: 4

Coefficient: 2

Objectives of education

At the end of this methodology unit, the student will have acquired the molecular bases concerning biological macromolecules such as DNA, RNA and proteins.

Recommended background knowledge

The student will have to have the basics in biochemistry, genetics.

Content of the subject:

Nucleic acids*: DNA structures II and III: helical parameters, double-helix families, techniques for analysis of conformational polymorphism. Nucleic acid-protein interactions, chromosome structure and chromatin. RNA: biological structures and implications, ribozyme, transfer RNA.*

Proteins: *Structures II: helices, leaflets, elbows and loops, predictive methods. Structures III: structural domains, helix beams , β proteins, β helices, α/β and α structures*

+β. Structures IV: symmetries, oligomers, association, dissociation, hybridization, allostery. Protein engineering.

Semester: 6

Transversal teaching unit (TTU1): Bio-informatics Subject: Bio-informatics

Credits: 2

Coefficient: 1

Recommended background knowledge

In this subject are taught the basics of computer science enabling

the student to master the computer tool, as well as mathematics applied to biology and statistical methods.

Content of the subject:

- Introduction to bio-informatics.
- Databases (nucleic acids, proteins,...) with implementation of a database.
- Examples of DNA data banks (structuring of the database).
- Use of data banks (query, visualization of results,...).
- Methods and tools for sequence manipulation and analysis.
- Search for patterns.
- Multiple sequence alignment.
- Molecular modelling.

Semester: 6

Teaching unit methodology (TUM1): Cellular biochemistry Subject: Cellular biochemistry

Credits: 4

Coefficient: 2

Objectives of education

This material aims to provide the basis for membrane dynamics, intracellular compartmentalization.

Recommended background knowledge

The student must have basic knowledge of biochemistry.

Content of the subject:

1. Biomembranes

a. Membrane composition: isolation, composition.

b. Biomolecular membrane architecture.

c. Membrane exchanges: passive transport, active transport, vesicular transport

d. Cell adhesion and recognition proteins (receptor proteins, translocons...)

e. Expression of antigens, virulence markers and cellular receptors

f. Receptors, desensitization and regulation of cellular response

2. Cell structure-function relationship

a. Biosynthesis of lipids, membrane proteins and secretory proteins

b. The cytoskeleton: Response of the cytoskeleton to biochemical and mechanical stimuli and its role in focal adhesion (Stress fibers)

3. The glycosylation of macromolecules and biological role:

a. Glycoproteins

b. Glycolipids

1. Signal transduction and regulation of cellular function