

Denominazione insegnamento in italiano	Biochimica
Denominazione insegnamento in inglese	Biochemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto/orale written/oral

AIMS

THE COURSE GOAL IS TO UNDERSTAND THE BIOCHEMICAL MECHANISMS THAT DRIVE THE FUNCTIONING OF CELLS. TOPICS TO BE COVERED INCLUDE STRUCTURE-FUNCTION RELATIONSHIPS IN PROTEINS, MECHANISMS OF ENZYME ACTION AND REGULATION, GENERAL ASPECTS OF METABOLISM AND MAJOR METABOLIC PATHWAYS WITH EMPHASIS ON ENERGY GENERATION AND CONSUMPTION AND ON CONTROL NETWORKS. ELEMENTS OF HOMEOSTASIS AND SIGNAL TRANSDUCTION MECHANISMS IN ORGANISMS OF VARIOUS COMPLEXITY.

PROGRAM DETAILS

1) INTRODUCTION TO THE BIOCHEMISTRY OF LIVING BEINGS; 2) STRUCTURE-FUNCTION RELATIONSHIPS AND POST-TRANSLATIONAL MODIFICATIONS OF PROTEINS: CHEMICAL AND PHYSICAL PROPERTIES OF AMINO ACIDS AND PEPTIDES; PRIMARY, SECONDARY, TERTIARY AND QUATERNARY STRUCTURE OF PROTEINS; BIOCHEMICAL METHODS APPLIED TO PROTEINS; INTRODUCTION TO PROTEOMICS; SELECTED EXAMPLES OF PROTEINS INCLUDING ANTIBODIES, MYOGLOBIN AND HEMOGLOBIN 3) ENZYMES: ENZYMES ACTIVITY AND KINETICS, REGULATION 4) BIOLOGICAL MEMBRANES: COMPOSITION AND PROPERTIES 5) METABOLISM: CONCEPT OF METABOLIC PATHWAYS; THERMODYNAMICS OF PHOSPHATE COMPOUNDS; GLYCOLYSIS AND CATABOLISM OF HEXOSES OTHER THAN GLUCOSE; TRICARBOXYLIC ACIDS CYCLE; LIPOLYSIS AND OXIDATION OF FATTY ACIDS; OXIDATIVE PHOSPHORYLATION; PHOTOSYNTHESIS; BIOSYNTHESIS OF SUGARS AND LIPIDS; NITROGEN METABOLISM 6) SIGNAL TRANSDUCTION: METABOLISM CONTROL AND SECOND MESSANGERS; HORMONES; GROWTH FACTORS

Denominazione insegnamento in italiano	BIOCHIMICA II
Denominazione insegnamento in inglese	BIOCHEMISTRY II
Tipologia dell'esame (scritto- scritto/orale - orale)	ORALE/ORAL

AIMS

DURING THE COURSE WILL BE STUDIED SOME BIOCHEMICAL PATHWAYS INVOLVED IN CELLULAR LIFE BOTH IN LOWER AND HIGHER EUKARYOTES. TO SUCH PURPOSE WILL BE DISCUSSED SOME RELEVANT SIGNAL TRANSDUCTION PATHWAYS ABLE TO CONTROL FUNDAMENTAL PROCESSES SUCH AS CELL CYCLE, APOPTOSIS AND SENESCENCE. MOREOVER SUCH PATHWAYS WILL BE STUDIED IN FUCTION OF THEIR ABILITY TO INFLUENCE THE TUMOR ONSET. THE AIM OF THE COURSE IS TO SUPPLY THE NECESSARY BASES FOR THE DEVELOPMENT OF BIOTECHNOLOGICAL CONTROL SYSTEMS OF CELLULAR FUNCTIONS BOTH IN PHYSIOLOGICAL OR PATHOLOGICAL CONDITIONS.

PROGRAM DETAILS

SIGNAL TRANSDUCTION MECHANISMS: TYROSIN KINASE RECEPTORS, STEROID RECEPTORS, SERPENTINE RECEPTORS, CYTOPLASMIC TYROSIN KINASES. SIGNAL TRANSDUCTION DOMAINS. MONOMERIC (RAS) AND TRIMERIC G-PROTEIN. SIGNAL TRANSDUCTION PATHWAYS CONTROLLED BY RAS: MAPK AND PI3K SIGNALING.

CELL CYCLE IN HIGHER EUKARYOTES: CELL CYCLE PHASES; ANALYSIS OF FUNDAMENTAL COMPONENTS OF CELL CYCLE; KINASES, CYCLINS AND INHIBITORS: STRUCTURE, ACTIVITY, DEGRADATION. RB AND E2F PROTEINS, RESTRICTION POINT AND CELL CYCLE CHECKPOINTS.

APOPTOSIS AND NECROSIS: DIFFERENCES BETWEEN THE TWO PROCESSES. APOPTOTIC PHASES. METHODS TO STUDY THE APOPTOSIS.

TELOMERE AND SENESCENCE: EVOLUTIONARY MEANING OF SENESCENCE; TELOMERE AND ITS REGULATION; TELOMERASE: FUNCTION, REGULATION AND ROLE IN TUMOR ONSET AND MAINTANENCE.

CELL CYCLE IN UNICELLULAR EUKARYOTES: *S. CEREVISIAE* AS A MODEL TO STUDY CELL CYCLE PROGRESSION; G1/S TRANSITION AND ITS REGULATION; Ps AND THE CRITICAL CELL SIZE; ANALYSIS OF FUNDAMENTAL COMPONENTS OF CELL CYCLE; KINASES, CYCLINS, INHIBITORS AND PHOSPHATASES: ACTIVITY, REGULATION, DEGRADATION AND LOCALIZATION; DNA REPLICATION AND ITS REGULATION; THE UBIQUITIN-PROTEASOME PROTEOLITIC PATHWAY AND ITS ROLE IN THE REGULATION OF CELL CYCLE PROGRESSION.

REGULATION AND CELLULAT OUTPUTS OF CELL CYCLE SIGNALING NETWORK: SIGNAL TRANSDUCTION PATHWAY CONTROLLED BY TOR; TORCs COMPLEXES; TORC1 AS A REGULATOR OF PROTEIN SYNTHESIS, RIBOSOMAL PROTEIN AND RNA SYNTHESIS, RIBOSOME ASSEMBLY, TRANSLATION INITIATION AND TRANSLATION ELONGATION; THE REGULATION OF CELL CYCLE PROGRESSION MEDIATED BY CASEIN KINASE 2 (CK2): ACTIVITY, LOCALIZATION AND IDENTIFICATION OF CELL CYCLE PROTEINS AS ITS RELEVANT PHYSIOLOGICAL SUBSTRATES.

Denominazione insegnamento in italiano	Biochimica industriale I
Denominazione insegnamento in inglese	Industrial biochemistry I
Tipologia dell'esame (scritto- scritto/orale - orale)	Orale Oral

AIMS

THE COURSE GIVES THE BASIC ELEMENTS REQUIRED TO THE UNDERSTANDING OF PROTEIN FUCNTION IN GENERAL, AND ENZYME ACTIVITY IN PARTICULAR, IN ORDER TO APPLY THEM TO INDUSTRIAL CONVERSIONS. ENZYME STRUCTURE, REGULATION AND STABILITY WILL BE TREATED REFERRING TO WELL-CHARACTERIZED EXAMPLES. THE POTENTIAL OF BIODIVERSITY AND PROTEIN-ENGINEERING TECHNIQUES WILL BE DISCUSSED WITH REFERENCE TO PRODUCTION OF IMPROVED BIOCATALISTS FOR INDUSTRIAL APPLICATIONS. THE COURSE INCLUDES SEMINARS HELD BY EXPERT SPEAKERS ON SPECIFIC APPLICATIONS OF INDUSTRIAL ENZYMES.

PROGRAM DETAILS

PROTEIN FEATURES IMPORTANT FOR PROTEIN FUCNTION AND BIOTECHNOLOGICAL APPLICATIONS

TRIDIMENSIONAL STRUCTURES; THE FOLDING POCES; POST-TRANSLATIONAL MODIFICATIONS

ENZYMES: REACTION MECHANISMS, SPECIFICITY, REGULATION, RELEVANT PARAMETERS IN BIOCATALYSIS

MAIN REACTION MECHANISMS; SPECIFICITY; REGULATION; KINETIC PARAMETERS

APPLICATIONS OF ENZYMES IN INDUSTRIAL PROCESSES

GENERAL ISSUES; EXAMPLES (LIPASES FOR PRODUCTION OF DETERGENTS, FOOD PRODUCTS AND FINE CHEMICALS)

CHARACTERIZATION OF NOVEL ENZYMATIC ACTIVITIES IN NATURE

ENZYMES FROM EXTREMOPHILES; ENZYMES FROM NON-CULTIVABLE ORGANISMS

STABILIZATION OF BIOCATALYSTS

ISSUES IN ENZYME STABILITY; THERMOSTABILITY; IMMOBILIZATION

PROTEIN ENGINEERING FOR INDUSTRIAL BIOCHEMISTRY

TAGS AND FUSION PROTEINS; RATIONAL MUTAGENESIS; ASSISTED EVOLUTION; PHAGE DISPLAY; RECOMBINANT ANTIBODIES

BIOSENSORS

PRINCIPLES; EXAMPLES IN ENVIRONMENTAL, INDUSTRIAL AND BIOMEDICAL APPLICATIONS

Denominazione insegnamento in italiano	Biologia Molecolare
Denominazione insegnamento in inglese	Molecular Biology
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto/orale

AIMS

THIS BASIC COURSE OF MOLECULAR BIOLOGY GIVES TO STUDENTS KNOWLEDGE ON THE FUNDAMENTS OF MOLECULAR BIOLOGY; STRUCTURE , FUNCTION AND BIOSYNTHESIS OF MACROMOLECULES RELEVANT FOR LIVING SYSTEMS (DNA, RNA AND PROTEINS): DNA REPLICATION, TRANSCRIPTION AND TRANSLATION WITH A COMPARATIVE (PROKARYOTES VERSUS EUKARYOTES) AND EXPERIMENTAL APPROACH.

PROGRAM DETAILS

PRIMARY AND SECONDARY STRUCTURE OF DNA; PROPERTIES OF DNA ; DENATURATION AND RENATURATION, HYBRIDATION; TOPOLOGY; CHROMATIN ORGANIZATION. MECHANISMS OF DNA REPLICATION AND ENZYMES INVOLVED IN REPLICATION (DNA POLYMERASE, DNA LIGASE, HELICASE, PRIMASE, ETC.). ORIGIN OF REPLICATION. CENTROMERES AND TELOMERES.

PROPERTIES OF RNAs; PURIFICATION AND ANALYSIS OF CELLULAR RNAs. RNA POLYMERASES OF BACTERIA AND EUKARYOTES. PROMOTORS AND TERMINATORS IN BACTERIA, ELEMENTS OF TRANSCRIPTIONAL REGULATION. PROMOTORS IN EUKARYOTES, BASAL TRANSCRIPTION FACTORS, UAS AND ENHANCERS; GAL SYSTEM IN YEAST. MECHANISM OF BIOSYNTHESIS AND PROCESSING OF tRNA, rRNA AND mRNA. SPLICING MECHANISMS AND GROUP I AND II INTRONS.

THE RIBOSOMES AND PROTEIN SYNTHESIS. STRUCTURE AND EVOLUTION OF THE RIBOSOME. ACTIVATION OF AMINO ACIDS. THE GENETIC CODE . MECHANISM OF PROTEIN SYNTHESIS IN PROKARYOTES AND EUKARYOTES. INITIATION, ELONGATION AND TERMINATION OF PROTEIN SYNTHESIS. A AND P SITES ON RIBOSOME AND MECHANISM OF ACTION OF PUROMYCIN. TRANSLATIONAL REGULATION. INHIBITORS OF PROTEIN SYNTHESIS

Denominazione insegnamento in italiano	Biologia Molecolare II
Denominazione insegnamento in inglese	Molecular Biology II
Tipologia dell'esame (scritto- scritto/orale - orale)	scritto/orale written/oral

AIMS

To elucidate and get a deeper knowledge of some expression systems in Prokaryotes and Eukaryotes. Particular attention is addressed to different molecular biology techniques that are required for the analysis of gene expression

PROGRAM DETAILS

QUALITATIVE AND QUANTITATIVE TRANSCRIPTION ANALYSES. Northern analysis, relative and competitive RT-PCR, RACE. Real Time PCR. Ribonuclease Protection Assay. S1 mapping and Primer extension. Run-off and run-on. Reporter genes.

DIFFERENTIAL GENE EXPRESSION IDENTIFICATION. cDNA and subtractive libraries. Differential screening. Serial Analysis of Gene Expression. DNA arrays (oligos and cDNA): analysis and applications.

ANALYSIS OF MACROMOLECULES INTERACTIONS. One-hybrid system. Two-hybrid system and its modifications (reverse and split, Sos recruitment etc). Three hybrid system.

PROKARYOTIC AND EUKARYOTIC EXPRESSION SYSTEMS. Proteins expression in *Escherichia coli*. Inducible promoters. Proteins purification and localization (IMPACT, TAP tagging, GFP etc).

Proteins expression in yeast. Auxotrophic and dominant selection markers. Episomal and integrative vectors. The biology of the 2 micron plasmid. Gene targeting. Pop-in and Pop-out. Yeast expression vectors: inducible and constitutive promoters. Plasmid shuffling. Autoselection systems. Intracellular expression and secretion of proteins (the secretory pathway and the co/post translational modifications of proteins). The cell wall.

Proteins expression in mammalian cells. Transfection of mammalian cells. Transient and stable expressions. Selection markers. Constitutive and inducible (Tet-on and Tet-off) promoters.

Denominazione insegnamento in italiano	Biotecnologie Microbiche
Denominazione insegnamento in inglese	Microbic Biotechnologies
Tipologia dell'esame (scritto- scritto/orale - orale)	scritto/orale written/oral

AIMS

THE COURSE HAS THE OBJECTIVE TO INTRODUCE THE TOPICS AND PROBLEMS RELATED TO THE EMPLOYMENT OF NATURAL OR ENGINEERED MICRO-ORGANISMS IN CLASSIC OR ADVANCED INDUSTRIAL BIOTECH APPLICATIONS.

PROGRAM DETAILS

FERMENTAION SYSTEMS

- THE BIOREACTOR
- BIOREACTOR TECHNOLOGIES FOR MICRO-ORGANISM, ANIMAL AND VEGETAL CELLS CULTURES
- MAIN FERMENTATION TECHNIQUES: BATCH, CONTINUUM, AND FED-BATCH CULTURES
- COMPOSITION AND DEVELOPMENT OF CULTURE MEDIUM
- SCALE-UP

PARAMETERS MONITORING AND CONTROL

- MEASURED, DETERMINED AND CALCULATED PARAMETERS
- AGGREGATED AND SEGREGATED PARAMETERS
- FERMENTATION CONTROL
- IMMOBILIZED CELLS AND ENZYMES
- IMMOBILIZATION TECHNIQUES AND APPLICATIONS

CLASSIC FERMENTATION BIOTECHNOLOGIES

- GLUCOSE METABOLISM
- COMPARED ANALYSIS OF MICRO-ORGANISMS CENTRAL METABOLISM
- MASS AND ENERGY BALANCES
- ORGANIC ACIDS PRODUCTION
 - LACTIC ACID, CITRIC ACID
- SOLVENT PRODUCTION
 - ETHANOL, ACETON BUTYLIC
- AMMINOACID PRODUCTION
 - GLUTAMMIC ACID
- VITAMIN PRODUCTION
 - VITAMIN C
- ANTIBIOTIC PRODUCTION
 - PENICILLIN

ADVANCED FERMENTAION BIOTECHNOLOGIES

ETHEROLOGOUS PROTEIN PRODUCTION

- THE CHOICE OF THE HOST
- KEY FACTORS TO OBTAIN HIGH PRODUCTION LEVELS
- RECOMBINANT DNA PRODUCTS

Denominazione insegnamento in italiano	Biotecnologie Organiche
Denominazione insegnamento in inglese	Organic Biotechnologies
Tipologia dell'esame (scritto- scritto/orale - orale)	orale

AIMS

THE STUDENT WILL GAIN DEEPER KNOWLEDGE ABOUT THE CHEMICAL STRUCTURE AND PROPERTIES OF THE MAIN CLASSES OF BIOMOLECULES AND OF ORGANIC MOLECULES COMMONLY USED IN PHARMACEUTICAL, COSMETIC AND FOOD INDUSTRY. KNOWLEDGE OF MECHANISM AND MOLECULAR RECOGNITION EVENTS IN BIOCATALYSIS.

PROGRAM DETAILS

LIPIDS: STRUCTURE, CHEMO-PHYSICAL PROPERTIES, BIOLOGICAL RELEVANCE, BIOSYNTHESIS.

AMINO ACIDS AND PEPTIDES: STRUCTURE, CHEMO-PHYSICAL PROPERTIES, BIOLOGICAL RELEVANCE, BIOSYNTHESIS.
 CARBOHYDRATES: STRUCTURE, CHEMO-PHYSICAL PROPERTIES, BIOLOGICAL RELEVANCE, BIOSYNTHESIS.
 VITAMINS: STRUCTURES, BIOLOGICAL ROLES, MECHANISM OF ACTION.
 FLAVOURS: STRUCTURE, CHEMO-PHYSICAL PROPERTIES
 PRESERVATIVES: STRUCTURE, CHEMO-PHYSICAL PROPERTIES, MECHANISM OF ACTION
 MAIN DRUG CLASSES: STRUCTURE, CHEMO-PHYSICAL PROPERTIES, MECHANISM OF ACTION
 ENZYMATIC MECHANISMS AND THEIR INHIBITION
 TEACHING LAB EXPERIENCES ON STRUCTURE DETERMINATION AND ISOLATION OF BIOMOLECULES

Denominazione insegnamento in italiano	Chimica Fisica
Denominazione insegnamento in inglese	Physical Chemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	scritto/orale

AIMS

To provide the student the basic instruments of thermodynamics and kinetics for the understanding and modelling of chemical systems and processes.

PROGRAM DETAILS

Thermodynamics. Energy and I law. Heat measure as a state variable. Enthalpy. Thermal capacity. **Entropy, II and III law.** Spontaneous processes. Entropy and spontaneity. Examples of spontaneous processes. **Free energy and equilibrium.** Gibbs free energy. ΔG and spontaneity. Chemical potential. Equilibrium constant; variation of standard free energy; temperature dependence of ΔG and K. Chemical equilibria in biological systems.
Kinetics and reaction mechanism of discontinuous reactions. Kinetic equations. Experimental determination of reaction order. Elementary steps and reaction mechanism. Temperature dependence of velocity constant. Enzymatic catalysis and inhibition processes

Denominazione insegnamento in italiano	Chimica Generale e Inorganica
Denominazione insegnamento in inglese	General and Inorganic Chemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto/orale

AIMS

THE GOAL OF THE COURSE IS TO PROVIDE THE BASIC KNOWLEDGE ABOUT INORGANIC AND GENERAL CHEMISTRY NEEDED BY A BIOTECHNOLOGIST

PROGRAM DETAILS

THE FOLLOWING TOPICS WILL BE INTRODUCED DURING THE COURSE:

ATOMIC STRUCTURE AND CHEMICAL BONDS
CHEMICAL REACTIONS
PROPERTIES OF SOLUTIONS
CHEMICAL KINETICS
PRINCIPLES OF THE CHEMICAL EQUILIBRIUM
ACIDS AND BASES
SOLUBILITY
ELECTROCHEMISTRY
MAIN GROUPS CHEMISTRY

Denominazione insegnamento in italiano	Chimica Organica
Denominazione insegnamento in inglese	Organic chemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	orale

AIMS

THE STUDENT WILL GAIN KNOWLEDGE ABOUT BASIC ORGANIC CHEMISTRY, WITH MANY EXAMPLES APPLIED TO ORGANIC CHEMISTRY IN LIVING ORGANISMS, AND IN PARTICULAR TO BIOLOGICAL SYSTEMS

PROGRAM DETAILS

ATOMS ENCOUNTERED IN ORGANIC CHEMISTRY: ELECTRONIC PROPERTIES, HYBRID ATOMIC ORBITALS, MOLECULAR ORBITALS. RESONANCE THEORY, AROMATIC SYSTEMS RELEVANT IN BIOLOGY. INTERMOLECULAR FORCES. GENERAL MECHANISMS AND REACTION INTERMEDIATES FOUND IN ORGANIC CHEMISTRY: ADDITIONS, ELIMINATIONS, SUBSTITUTIONS, CARBOCATIONS, CARBANIONS, RADICALS AND THEIR STABILITY.

ALKANES AND CYCLOALKANES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, STEREOGENIC CENTERS, STEREOISOMERS. ABSOLUTE CONFIGURATION.

ALKENES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES AND REACTIVITY: ELECTROPHILIC ADDITION. BIOLOGICAL APPLICATION. TERPENE BIOSYNTHESIS

ALKYNES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES AND REACTIVITY: ELECTROPHILIC ADDITION

ALCOHOLS: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, ACIDITY, AND REACTIVITY.

ALKYL HALIDES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, ACIDITY, AND REACTIVITY: NUCLEOPHYLIC SUBSTITUTION AND ELIMINATIONS. BIOLOGICAL APPLICATION: SAM.

ALDEHYDES AND KETONES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, AND REACTIVITY: NUCLEOPHYLIC ADDITION TO CARBONYL GROUP, TAUTOMERS, ALDOL CONDENSATION. BIOLOGICAL APPLICATION: CARBOHYDRATES, OPSINE/RHODOPSINE.

REDOX REACTIONS. BIOLOGICAL APPLICATIONS: NADH

CARBOXYLIC ACIDS AND THEIR DERIVATIVES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, AND REACTIVITY: ADDITION/ELIMINATION TO THE CARBONYL GROUP, CLAISEN CONDENSATION, ACETOACETIC AND MALONIC SYNTHESIS. BIOLOGICAL APPLICATION: BIOSYNTHESIS OF FATTY ACIDS.

AMINES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES, AND REACTIVITY: BASES AND NUCLEOPHILES

MAIN CLASSES OF BIOMOLECULES: CARBOHYDRATES, AMINO ACIDS AND PEPTIDES, NUCLEOSIDES AND NUCLEOTIDES: STRUCTURE, PHYSICO-CHEMICAL PROPERTIES.

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Denominazione insegnamento in italiano	Economia Aziendale
Denominazione insegnamento in inglese	Business Economics and Organisation
Tipologia dell'esame (scritto- scritto/orale - orale)	Written + oral

AIMS

THE COURSE WANTS TO PROVIDE THE BASIC TOOLS SUPPORTING BUSINESS MANAGER DECISIONS.

PROGRAM DETAILS

INTRODUCTION: THE FIRM: DEFINITION, AIMS, LEGAL FRAMEWORK. ELEMENTS OF CORPORATE GOVERNANCE.
EXTERNAL ACCOUNTING: THE BALANCE SHEET: AIM AND STRUCTURE. BALANCE SHEET ANALYSIS AND RATIOS.
COST ACCOUNTING: COST CLASSIFICATION, COST ACCOUNTING. COSTING METHODS (JOB ORDER COSTING AND ACTIVITY BASED COSTING).
MANAGEMENT DECISION TOOLS: DECISIONS SUPPORT TECHNIQUES (NET PRESENT VALUE, INTERNAL RATE OF RETURN, PROFITABILITY INDEX, PAYBACK TIME). METHODOLOGIES FOR THE EVALUATION AND SELECTION OF PROJECTS AND PORTFOLIO ANALYSIS. SHORT TERM DECISIONS CRITERIA.

Denominazione insegnamento in italiano	Farmacologia
Denominazione insegnamento in inglese	Pharmacology
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto

AIMS

THE COURSE IS AIMED AT GIVING THE BASIC CONCEPTS AND TERMINOLOGY OF GENERAL PHARMACOLOGY. SPECIFIC EMPHASIS WILL BE GIVEN TO CELLULAR AND MOLECULAR MECHANISMS OF DRUG ACTION WITH EXAMPLES OF DRUGS EMPLOYED FOR THE THERAPY OF DIFFERENT DISEASES. IN ADDITION, THE IMPACT OF BIOTECHNOLOGY FOR DRUG DISCOVERY, DEVELOPMENT AND DELIVERY WILL BE UNDERLINED.

PROGRAM DETAILS

PART 1. DEFINITION AND BRIEF HISTORY OF DRUG. THE PROCESS OF DRUG DEVELOPMENT FROM EXPERIMENTAL TO CLINICAL STUDIES. POST-MARKETING SURVEILLANCE. DRUGS FOR NEGLECTED DISEASES AND DRUG PATENTS: THEIR ECONOMICAL AND SOCIAL IMPACTS FOR DRUG ACCESSIBILITY BY THIRLD WORLD COUNTRIES.

PART 2. PHARMACODYNAMICS: THE MAIN CELLULAR AND MOLECULAR DRUG TARGETS: ENZYMES, ION CHANNELS, RECEPTORS (IONOTROPIC, METABOTROPIC, TYROSINE KINASE, INTRACELLULAR). QUANTIFICATION OF DRUG-RECEPTOR INTERACTIONS. THE CONCEPTS OF 'AGONIST', 'ANTAGONISTS' AND 'INVERSE AGONISTS'. HOMEOSTATIC MECHANISMS THAT REGULATE THE INTENSITY OF DRUG RESPONSE: CELLULAR TOLERANCE. DRUG DEPENDENCE.

PART 3. PHARMACOKINETICS: THE CELLULAR PROCESSES THAT INFLUENCE THE FATE OF DRUGS WITHIN HUMAN ORGANISM: ABSORPTION, DISTRIBUTION, METABOLISM, EXCRETION. PHARMACOKINETIC TOLERANCE. NEW SYSTEMS OF DRUG DELIVERY.

PART 4. PHARMACOGENETICS AND PHARMACOGENOMICS: HOW GENOTYPES INFLUENCE DRUG RESPONSES. TOWARD A PERSONALIZED THERAPY: SCIENTIFIC AND ETHICAL IMPLICATIONS.

PART 5. EXPERIMENTAL APPROACHES IN PHARMACOLOGY: BIOCHEMICAL (E.G. RADIORECEPTOR BINDING), BIOPHYSICAL (FRET, BRET), AND BEHAVIOURAL METHODS.

Denominazione insegnamento in italiano	Fisica
Denominazione insegnamento in inglese	Physics
Tipologia dell'esame (scritto- scritto/orale - orale)	Written / oral

AIMS

THE AIM OF THE PHYSICS COURSE IS TO INTRODUCE THE BASIC ELEMENTS OF GENERAL PHYSICS REQUIRED TO TACKLE SEVERAL DISCIPLINES OF THE THREE YEAR PROGRAM IN BIOTECHNOLOGY. IN THE PROGRAM OF THE COURSE, SUBJECTS WILL BE ALSO INCLUDED TO INTRODUCE BIOPHYSICAL PROBLEMS AND THECHNIQUES RELEVANT FOR BIOTECHNOLGY. FOR INSTANCE, ELEMENTS OF FLUIDODYNAMICS AND OPTICS - AND AN INDRODUCTION TO BASIC INSTRUMENTATIONS - WILL BE DEVELOPED.

PROGRAM DETAILS

MECHANICS:

KINEMATICS. NEWTON 'S LAWS. MOMENTUM AND MECHANICAL ENERGY CONSERVATION LAWS. HARMONIC MOTION. UNIVERSAL LAW OF GRAVITATION. ELEMENTS OF STATICS AND DYNAMICS OF FLUIDS. THE FLOW CYTOMETER.

THERMODYNAMICS:

HEAT AND TEMPERTAURE, HEAT CAPACITY AND SPECIFIC HEAT, THE JOULE EXPERIMENT, THE FIRST LAW OF THERMODYNAMICS, INTERNAL ENERGY, THE SECOND LAW OF THERMODYNAMICS, ENTROPY, REVERSIBLE AND IRREVERSIBLE PROCESSES, HEAT ENGINES.

ELECTROSTATICS:

POINT CHARGE AND COULOMB LAW, ELECTRIC FIELD AND POTENTIAL, GAUSS LAW, CAPACITANCE, ELECTRIC CURRENT. MOTION OF CHARGES IN ELECTRIC FIELDS . THE OSCILLOSCOPE.

MAGNETOSTATICS:

MAGNETIC FIELD, LORENTZ FORCE, SOURCES OF MAGNETIC FIELD, FORCES ON MOVING CHARGES, MASS SPECTROGRAPH.

ELECTROMAGNETIC INDUCTION :

ELECTROMOTANCE, FARADAY'S INDUCTION LAW, ALTERNATING CORRENT. CHANGING ELECTRIC AND MAGNETIC FIELDS.

OPTICS:

LIGHT AND RAY OPTICS, MAGNIFICATION AND THE OPTICAL MICROSCOPE, WAVE OPTICS AND THE SPECTRUM OF THE ELECTROMAGNETIC RADIATION, THE SPECTROFOTOMETER, INTERFERENCE AND DIFFRACTION, THE CONFOCAL MICROSCOPE.

Denominazione insegnamento in italiano	Genetica
Denominazione insegnamento in inglese	Genetics
Tipologia dell'esame (scritto- scritto/orale - orale)	written/oral

AIMS

The aim of the course is to provide the students with the basic knowledge of classical, molecular and population genetics, by deeply analyzing gene structure, mutations, recombination and control of gene expression in both prokaryotes and eukaryotes. The mechanisms controlling inheritable trait transmission will be studied with particular attention to sexually reproducing organisms, including men, and to their effects at the population level.

PROGRAM DETAILS

The following topics will be analyzed in detail:

- Physical basis of inheritance: DNA structure and replication; RNA structure and transcription.
- Gene structure and function: Coding and regulatory sequences; Genetic code and translation; Forward point mutations and reversion events; Dominant and recessive alleles; Mutagens and mutagenesis tests; An outline of DNA damage repair mechanisms.
- Genome organization: Eukaryotic and prokaryotic genomes and chromosomes.
- Transmission of inheritable characters in sexually reproducing organisms: Meiosis, mitosis, biological cycles; segregation of mendelian characters and statistical analysis of the data; Sex determination and inheritance of sex-linked traits; Linked genes, crossing over, recombination and genetic maps; Gene interactions; Multiple alleles.
- Transmission of inheritable characters in microorganisms: Mating and recombination in *Saccharomyces cerevisiae*; Bacterial conjugation and transformation; Lytic and lysogenic cycle in bacteriophages: specialized and generalized transduction; An outline of plasmid and viral vectors used in genetic engineering.
- Changes in eukaryotic chromosome structure and number: Chromosome rearrangements: deletions, duplications, inversions and translocations; Changes in chromosome number: euploidy and aneuploidy.
- Regulation of gene expression in prokaryotes and eukaryotes: Positive and negative regulation of transcription: functional analysis of cis-acting regulatory sequences and trans-acting regulators in both inducible and repressible systems. The *E. coli lac* operon. Examples of post-transcriptional regulation in eukaryotes.
- Population genetics: Polymorphism at different levels. Gene and genotype frequency in Mendelian populations; Hardy-Weinberg law and the equilibrium distribution of genotypes; gene frequency variations due to mutation, selection, migration and genetic drift. Microevolution and speciation.

Denominazione insegnamento in italiano	Genetica II
Denominazione insegnamento in inglese	Genetics II
Tipologia dell'esame (scritto- scritto/orale - orale)	written/oral

AIMS

The aim of the course is to provide the students with a deep knowledge of the genetic tools suitable for gene function and interaction analysis, of the major repair and recombination mechanisms, as well as of the genetic basis of some fundamental cell cycle controls.

PROGRAM DETAILS

The following topics will be analyzed in detail:

- Genetic approaches for studying gene functions and interactions: gene disruption and overexpression in unicellular and multicellular eukaryotes; synthetic and suppressor effects as a tool for detecting functional genetic interactions.
- DNA damage repair and mutagenesis in prokaryotes and eukaryotes: exogenous and endogenous DNA damage; direct DNA damage reversion; base excision repair; nucleotide excision repair; mismatch repair; DNA damage tolerance; mutagenesis; cellular response to DNA damage.
- DNA recombination during mitosis and meiosis: proteins and mechanisms involved in homologous and non-homologous recombination
- Molecular structure and function of transposable elements.
- Genetic control of lytic and lysogenic responses in bacteriophage λ infection.
- DNA replication control in eukaryotes: control of origin firing; coupling DNA replication with mitosis.
- Genetic control of chromosome segregation and cytokinesis in eukaryotes: sister chromatid cohesion in mitosis and meiosis; control of metaphase to anaphase transition, exit from mitosis and cytokinesis.

Denominazione insegnamento in italiano	Genetica Umana
Denominazione insegnamento in inglese	Human Molecular Genetics
Tipologia dell'esame (scritto-scritto/orale - orale)	scritto/orale

AIMS

THE AIMS OF THIS STUDY COURSE ARE TO FOLLOW THE STUDENTS IN THE KNOWLEDGE OF GENETICS APPLIED TO MEDICINE, BY TRANSFERRING THE BASIC GENETICS, ITS RULES AND ITS PARADIGMA TO HUMAN PATHOLOGY, IN AN APPROPRIATE WAY USING THE BETTER DISEASE-MODELS. THE TRANSMISSION OF SIMPLE AND COMPLEX GENETIC DISORDERS WILL BE STUDIED IN PEDIGREES WITH PARTICULAR ATTENTION TO VARIABILITY OF PHENOTYPIC PICTURE AND PENETRANCE, INTRODUCING MODIFIER GENE AND GENIC CROSS-TALK CONCEPTS. THE CONVENTIONAL TECHNIQUES, SO AS THE MORE ADVANCED, WHICH ALLOW US TO INVESTIGATE CHROMOSOMES, CHROMATIN, GENE SEQUENCES AND DISEASE-CAUSE-MUTATIONS, WILL BE STUDIED. MOREOVER THE STUDENTS WILL BE INTRODUCED TO GENETIC ONCOLOGY WITH PARTICULAR REGARDS TO INHERITED TUMORS.

PROGRAM DETAILS

- Human reproduction and genetics:
 - male and female meiotic process: physiologic and genetic differences
 - what consequences after meiotic abnormal segregation for both sexes
 - meiosis and epigenetics
- Genes in pedigrees:
 - simple disease transmission

complex disease transmission
 phenotypic variability and penetrance of genetic diseases, modifier genes
 linkage application for human pathology

- Human chromosomes:
 human normal and abnormal karyotype, cytogenetic conventional techniques
 aneuploidies and structural anomalies: consequence on cell, tissue and subject
 chromosome instability of inherited syndrome of tumor predisposition
- Disease - Cause - Mutations
 mutation types and their consequences on cell, tissue and subject
 correlation between mutation and variability degree
 genomic instability
- Genomics
 RT-PCR and real time PCR techniques
 DNA array, applications in medicine:
 To study gene expression;
 To characterize tumoral cells;
 To investigate complex diseases;
 To explore the pharmacogenomics.

Denominazione insegnamento in italiano	Immunologia I
Denominazione insegnamento in inglese	Immunology I
Tipologia dell'esame (scritto- scritto/orale - orale)	Orale

AIMS

AIM OF THE COURSE IS TO GIVE THE BASIC CONCEPTS ON THE IMMUNE SYSTEM ORGANIZATION AND FUNCTIONING. IN PARTICULAR, FUNDAMENTAL CONCEPTS ON ADAPTIVE IMMUNITY, SUCH AS ANTIGEN RECOGNITION, GENERATION OF ANTIGEN RECEPTOR DIVERSITY, T AND B LYMPHOCYTE ACTIVATION AND EFFECTOR FUNCTIONS, ANTIBODY STRUCTURE AND FUNCTION WITH PARTICULAR ATTENTION TO MONOCLONAL ANTIBODIES AND THEIR APPLICATIONS WILL BE TAKEN INTO ACCOUNT.

PROGRAM DETAILS

GENERAL FEATURES OF THE IMMUNE SYSTEM
 THE ANTIGEN
 THE B CELL ANTIGEN RECEPTOR (BCR)
 THE T CELL ANTIGEN RECEPTOR (TCR)
 THE MAJOR HYSTOCOMPATIBILITY COMPLEX (MHC)
 THE PROCESS OF ANTIGEN PRESENTATION
 T AND B LYMPHOCYTE ACTIVATION
 CYTOKINES AND THEIR RECEPTORS
 EFFECTOR MECHANISMS OF HUMORAL IMMUNITY
 EFFECTOR MECHANISMS OF CELL-MEDIATED IMMUNITY

Denominazione insegnamento in italiano	Informatica
Denominazione insegnamento in inglese	Informatics

Denominazione insegnamento in italiano	Gestione e analisi dei dati
Denominazione insegnamento in inglese	Data Management and Analysis
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto e orale

AIMS

THE AIM OF THIS COURSE IS TO INTRODUCE MODELS AND TOOLS FOR DATA MANAGEMENT AND DATA ANALYSIS. IN THE FIRST PART OF THE COURSE THE DATABASE MANAGEMENT SYSTEMS BASED ON THE RELATIONAL DATA MODEL WILL BE INTRODUCED. THE LANGUAGE SQL WILL BE INTRODUCED FOR BOTH CREATING AND QUERYING A DATABASE. THE ENTITY RELATIONSHIP MODEL WILL BE ALSO INTRODUCED, TO DEFINE A CONCEPTUAL MODEL OF A DATABASE. IN THE SECOND PART OF THE COURSE THE MOST IMPORTANT STATISTICAL TECHNIQUES FOR DATA ANALYSIS AND INTERPRETATION WILL BE INTRODUCED, BY ALSO USING SPECIFIC COMPUTER APPLICATIONS.

PROGRAM DETAILS

- The entity Relationship Model: concepts of entity, relationship, attribute, generalization, identifier, integrity constraints.
- The Relational Data Model: concepts of relation, schema, attribute, domain, key, integrità constraints.
- SQL, the *Data Definition Language*
- SQL, the *Data Manipulation Language*
- Exercises aimed at defining a conceptual schema (through the Entity Relationship Model) and at defining a relational database schema. Examples of queries.
- Introduction to random variables and probability distributions.
- Elements of descriptive statistics: mean, median, mode and dispersion indices
- Elements of inductive statistics: hypothesis testing, variable sampling and estimation

Denominazione insegnamento in italiano	Programmazione
Denominazione insegnamento in inglese	Computer Programming
Tipologia dell'esame (scritto- scritto/orale - orale)	Orale

AIMS

THE AIM OF THE COURSE IS TO INTRODUCE STUDENTS TO THE BASIC CONCEPTS OF THE PROGRAMMING ACTIVITY, INDEPENDENTLY FROM ANY PARTICULAR PROGRAMMING LANGUAGE. MOREOVER, THE COURSE AIMS TO MAKE STUDENTS ABLE TO DESIGN AND WRITE IN JAVA LANGUAGE ALGORITHMS FOR SOLVING SIMPLE PROBLEMS.

PROGRAM DETAILS

LOGICAL STRUCTURE OF A COMPUTER AND INFORMATION CODING;
HIERARCHY OF PROGRAMMING LANGUAGES, COMPILERS AND INTERPRETERS;
PRIMITIVE DATA TYPES;
VARIABLES, DECLARATIONS AND ASSIGNMENTS;
ARRAY OF PRIMITIVE DATA TYPES;
EVALUATION OF AN EXPRESSION;
CONTROL AND SELECTION STRUCTURES;
DEFINITION AND CALL OF A PROCEDURE;
EXAMPLES OF SIMPLE ALGORITHMS;
COMPLEXITY OF AN ALGORITHM.

Denominazione insegnamento in italiano	Istituzioni di Biologia
Denominazione insegnamento in inglese	Fundamentals of Biology
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto/orale

AIMS

THE PURPOSE OF THIS INTRODUCTORY COURSE IS TO GIVE KNOWLEDGE ON BASIC PRINCIPLES OF BIOLOGY AT DIFFERENT LEVELS OF ORGANIZATION. IT IS DIVIDED INTO THREE PARTS. THE FIRST PART COVERS THE CELLULAR BASIS OF LIFE, INCLUDING A DISCUSSION ON CELL AS UNIT OF STRUCTURE AND FUNCTION AND ON CELL ULTRASTRUCTURE. THE SECOND PART EXAMINES THE MORPHOLOGY OF VARIOUS CELL TYPES AND THE ORGANIZATION OF TISSUES, WITH AN EMPHASIS ON STRUCTURE AND FUNCTION RELATIONSHIPS. THE THIRD PART COVERS THE BASIC PRINCIPLES OF EVOLUTION AND BIODIVERSITY.

PROGRAM DETAILS

CYTOLOGY: LEVELS OF ORGANIZATION; PROKARIOTIC AND EUKARIOTIC CELL STRUCTURE; SIZES AND METHODS FOR STUDYING CELLS; CHEMICAL BASIS OF LIFE; STRUCTURE OF BIOLOGICAL MEMBRANES; TRANSPORT OF MATERIALS THROUGH CELL MEMBRANES; CELL SIGNALING; CELL JUNCTIONS; ORGANELLES IN THE CYTOPLASM (ENDOPLASMIC RETICULUM, GOLGI COMPLEX, LYSOSOMES, PEROXISOMES, MITOCHONDRIA AND CHLOROPLASTS); CYTOSKELETON (MICROTUBULES, CILIA AND FLAGELLA, MICROFILAMENTS, INTERMEDIATE FILAMENTS); CELL NUCLEUS (NUCLEAR ENVELOPE, NUCLEAR PORES, CHROMATIN, CHROMOSOMES, NUCLEOLI, BASIC PRINCIPLES OF CELL CYCLE, MITOSIS, SOMATIC CELL, GERM LINE CELLS AND MEIOSIS).

HISTOLOGY: BASIC PRINCIPLES OF EMBRYOLOGY (FERTILIZATION, SEGMENTATION, GASTRULATION AND ORGANOGENESIS); STRUCTURAL AND FUNCTIONAL PROPERTIES OF LINING AND GLANDULAR EPITHELIAL TISSUES, CONNECTIVE TISSUES, BONE, CARTILAGE, BLOOD, MUSCULAR TISSUES (SKELETAL, SMOOTH AND CARDIAC MUSCLES), NERVOUS TISSUE (NEURONS AND GLIAL CELLS).

EVOLUTION: BIODIVERSITY; BINOMIAL NOMENCLATURE; TAXONOMIC CATEGORIES; GENOTYPE; PHENOTYPE; NATURAL AND ARTIFICIAL SELECTION; ANALOGY AND HOMOLGY; THE HARDY-WEINBERG PRINCIPLE; GENETIC DRIFT; SPECIATION; MOLECULAR EVOLUTION; EVIDENCES FOR EVOLUTION; LAMARCKISM, DARWINISM AND MODERN SYNTHESIS; PUNCTUATED EQUILIBRIUM AND GRADUALISM; MONOPHYLUM, PARAPHYLUM.

Denominazione insegnamento in italiano	Laboratori di Tecnonologie Abilitanti
Denominazione insegnamento in inglese	Practical courses

Denominazione insegnamento in italiano	Laboratorio di Tecnonologie Abilitanti Biochimiche
Denominazione insegnamento in inglese	Biochemistry Practical course

AIMS

The course aims to introduce the student to some basic biochemistry techniques and standard scientific procedures for the analysis and presentation of experimental data. Lessons will be dealing with:

Part 1) basic techniques concerning the purification/characterization of proteins/enzymes;
Part 2) techniques for mammalian cell cultures, immortalized and transformed cells.

Short lessons will introduce practical experiments; all experiments are performed in groups of 4-5 students. Upon successful completion of this module, the student should be able to conduct a simple biochemical experiment, record data and convert primary data into a form that allows critical appraisal of experimental results and draw appropriate conclusions.

PROGRAM DETAILS

Part 1 consists of practical experiences that illustrate biochemical principles and procedures. Experiments carried out include protein extraction from microbial cells, different purification techniques (i.e. proteins heat-denaturation, ion-exchange chromatography), Bradford's assay for protein quantification, SDS-PAGE analysis, activity assay, kinetics assay for the determination of V_{max} , K_M , K_{cat} , even in presence of enzyme inhibitors. Guidance is given in data handling and analyses and presentation of results. The integration of all experiments (extraction, purification and characterization of the same enzyme) is one of the most relevant aspects of the course, allowing to get the mining of both, the general experimental design and the procedural details.

Part 2 is based on introduction of exogenous cDNAs in mammalian cells and analysis of expression by means of enzymatic assay and analysis of different proliferation capability of immortalized versus transformed cells in response to growth factors deprivation. Introduction of DNA (beta-galactosidase gene) is performed by using the Calcium phosphate co-precipitation method. Following preparation of cell lysates and protein quantitation, expression of the exogenous protein is assessed by using an enzymatic assay followed by spectrophotometric analysis. Analysis of cell proliferation is achieved by morphological analysis and cellular counts during a time-course at selected concentrations of growth factors. Daily results are then used to construct a graph of proliferation describing the proliferation potential of immortalized versus transformed cells.

Denominazione insegnamento in italiano	Laboratorio di Tecnonologie Abilitanti Biomolecolari
Denominazione insegnamento in inglese	Practical Course in Molecular Biology
Tipologia dell'esame (scritto- scritto/orale -	

orale)	
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AIMS

THE STUDENTS WILL LEARN THE BASIC PRINCIPLES OF RECOMBINANT DNA TECHNOLOGIES
THE STUDENTS WILL APPLY THE BASIC TECHNIQUES OF MOLECULAR BIOLOGY
TECHNICAL ASPECTS OF WORKING WITH DNA WILL BE DISCUSSED AND PUT IN PRACTICE

PROGRAM DETAILS

The course will be organized in several experimental sessions, for up to 50 students each. In details, basic techniques will be presented about the methods of analysis (spectrophotometric assays, gel electrophoresis), extraction, characterization and handling of nucleic acids, analysis of DNA sequences and design of sub-cloning strategies through basic bioinformatic tools.

Denominazione insegnamento in italiano	Laboratorio di Tecnologie Abilitanti Genetiche
Denominazione insegnamento in inglese	Laboratory of genetic technologies
Tipologia dell'esame (scritto- scritto/orale - orale)	Written

AIMS

The course, which is planned for groups of not more than 50 students, is aimed to provide the students with the basic theoretical and experimental tools for genetic analysis, leading them to plan and perform simple genetic experiments with model microorganisms, and then discussing with them the obtained results.

PROGRAM DETAILS

Two different model microorganisms, the yeast *Saccharomyces cerevisiae* and the bacterium *Escherichia coli*, will be used to teach the students how to plan and perform simple genetic experiments and to interpret their results.

The experiments using yeast will be mainly focused on the following topics:

- cell concentration and viability
- mating, diploid selection, dominance analysis
- meiosis induction and sporulation, followed by segregation analysis of different markers
- complementation test
- fluctuation test for both mitotic intrachromosomal recombination and mutation rates
- phenotypic analysis of temperature-sensitive "cell division cycle" mutants
- plasmid loss test

E. coli will be used to perform the following experiments:

- transformation with plasmid DNA, followed by evaluation of transformation efficiency as well as of acquisition of new inheritable plasmid-dependent traits
- plasmid DNA preparation from the above transformants, followed by electrophoretic analysis of the molecular weight
- bacteriophage infection, followed by evaluation of infection efficiency and analysis of plaque morphology

Each experiment will be properly introduced and the obtained data will be discussed thoroughly.

Denominazione insegnamento in italiano	Laboratorio di Tecnologie abilitanti Immunologiche
Denominazione insegnamento in inglese	Immunological Technique Laboratory
Tipologia dell'esame (scritto- scritto/orale - orale)	

AIMS

THE COURSE IS DESIGNED TO GIVE AN UNDERSTANDING OF THE BASIC PRINCIPLES OF METHODS USED IN IMMUNOLOGICAL RESEARCH. THE IMMUNOLOGY LABORATORY COURSE WILL INTRODUCE BOTH CLASSICAL AND CONTEMPORARY IMMUNOLOGICAL ASSAY PROCEDURES WITHIN THE CONTEXT OF INTERPRETING LABORATORY SCIENCE EXPERIMENTS. THE COURSE WILL GIVE THEORETICAL-PRACTICAL INFORMATION CONCERNING THE CORRECT UTILIZATION OF MAMMALIAN CELL CULTURES AND MONOCLONAL ANTIBODY PRODUCTION.

PROGRAM DETAILS

LABORATORY COURSE COVERING THEORY AND PRACTICE BEHIND SELECTED IMMUNOLOGICAL TECHNIQUES. SELECTED TECHNIQUES ILLUSTRATING CONCEPTS OF CELLULAR AND HUMORAL IMMUNITY WILL BE ANALYSED. A SECTION WILL BE DEDICATED TO STERILE TECHNIQUES AND TO THE IMMUNOLOGY LABORATORY INSTRUMENTS. THE COURSE WILL PROVIDE KNOWLEDGE ON CELL CULTURE TECHNIQUES (SUSPENSION AND ADHERENCE CELL LINES) TOGETHER WITH CELL VIABILITY COUNTING AND MORPHOLOGY OBSERVATION. THE STUDENT WILL LEARN HOW TO PROPAGATE CELL THAT GROW IN SUSPENSION AND IN ADHERENCE USING DIFFERENT METHODS. ISSUES SUCH AS THE PERSONAL SAFETY AND THE WORK UNDER STERILE CONDITIONS WILL BE CONSIDERED. TECHNIQUES COVERED INCLUDE: LYMPHOCYTE ISOLATION, MIXED LYMPHOCYTE REACTIONS, ELISA, MONOCLONAL ANTIBODY TECHNOLOGY AND METHODS OF IMMUNISATION AND ANTIGEN DOSE WILL BE DISCUSSED. HIBRIDOMA CLONES WILL BE PRODUCED BY LIMITING DILUTION ASSAY. INDIRECT AND SANDWICH ELISA ASSAYS WILL BE PERFORMED TO MEASURE ANTIBODY-ANTIGEN INTERACTIONS. IN PARTICULAR, THE PROCEDURE FOR THE PRODUCTION OF MONOCLONAL ANTIBODIES AND THEIR USE IN BASIC AND DIAGNOSTIC RESEARCH WILL BE ANALYZED IN DETAILS.

Denominazione insegnamento in italiano	Laboratorio di Tecnologie Abilitanti di Microbiologia Industriale
Denominazione insegnamento in inglese	Laboratory of Industrial Microbiology
Tipologia dell'esame (scritto- scritto/orale - orale)	

AIMS

THIS PRACTICAL COURSE IS AIMED TO GIVE TO THE STUDENTS THE BASIC KNOWLEDGES AND PROCEDURES REQUESTED FOR A CORRECT MANIPULATION OF THE MICROORGANISMS. THE STUDENTS WILL APPLY THE MAIN MICROBIOLOGICAL TECHNIQUES IN ORDER TO SET UP ALL THE OPERATIONS CURRENTLY PERFORMED IN A MICROBIOLOGICAL LABORATORY. MOREOVER, THE SAFELY PROCEDURES FOR THE MANIPULATION OF MICROORGANISMS WILL BE ILLUSTRATED.

PROGRAM DETAILS

MAIN TOPICS OF THE COURSE WILL ENCOMPASS ALL THE STEPS NECESSARY FOR A FIRST MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERISATION OF THE MOST COMMON COMPONENTS OF NATURAL ENVIRONMENTS. DURING THE EXERCITATIONS THE STUDENTS WILL PRATICALLY APPLY CONCEPTS LIKE STERILITY WORKING, BIODIVERSITY, ISOLATION OF SINGLE SPECIES AND SELECTIVE PRESSURE. STARTING FROM NATURAL SAMPLES THE STUDENTS WILL BE GUIDED THROUGH THE VARIOUS STEPS LEADING TO THE ISOLATION OF MICROORGANISM HAVING BIOTECHNOLOGICAL RELEVANCE, ENCOMPASSING MICROSCOPY TECHNIQUES, BIOCHEMICAL IDENTIFICATION OF THE STRAIN, MEDIA COMPOSITION, PHYSIOLOGICAL CHARACTERISATION, SCREENING OF NATURAL PRODUCERS. SOME OF THE PROBLEMATICS OF THE PRODUCTION OF ANTIBIOTICS, LYTYC ENZYMES AND ORGANIC ACIDS WILL BE TREATED.

Denominazione insegnamento in italiano	Laboratorio di Chimica Generale
Denominazione insegnamento in inglese	Laboratory of General Chemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	-

AIMS

THE COURSE IS ESSENTIALLY MADE OF PRACTICAL LESSONS, WHICH ARE PRECEDED BY THEORY INTRODUCTIONS. IT AIMS AT GIVING THOSE BASIC NOTIONS UPON ELEMENTARY OPERATIONS PERFORMED WITHIN A LABORATORY SO AS TO ALLOW STUDENTS TO LEARN PROCEDURES AND EXPERIMENTAL METHODS TYPICAL OF QUALITATIVE AND QUANTITATIVE ANALYSIS OF AQUEOUS SOLUTIONS. AT LAST, THE STUDENT MUST BE ABLE TO ORGANIZE DATA BY MEANS OF REPORTS.

PROGRAM DETAILS

ELEMENTARY OPERATIONS: WEIGHING, DISSOLVING AND PRECIPITATION, FILTRATION. SEPARATION OF COMPOUNDS ON THEIR DIFFERENT SOLUBILITY BASIS. ACID-BASE REACTIONS IN AQUEOUS SOLUTION. BUFFERS. TITRATIONS. INDICATORS. RED-OX REACTIONS AND THEIR INDICATORS. GLASS ELECTRODE, PRINCIPLES AND PERFORMANCE. POTENTIOMETER TITRATIONS AND RELATIVE CURVES. ANALYTICAL METHODS TO DETERMINE OF EQUIVALENCE POINT. METAL IONS COMPLEXATION.

Denominazione insegnamento in italiano	Laboratorio di Chimica Organica
Denominazione insegnamento in inglese	Organic chemistry Lab
Tipologia dell'esame (scritto- scritto/orale - orale)	

AIMS

THE STUDENT WILL GAIN KNOWLEDGE ABOUT LABORATORY TECHNIQUES OF ISOLATION, SEPARATION, ANALYTICAL METHODS AND REACTIVITY OF ORGANIC MOLECULES

PROGRAM DETAILS

LABORATORY SAFETY, NOTEBOOK AND REPORTS, CALCULATION OF YIELDS, GLASSWARE, STIRRING AND MIXING, SOLVENT REMOVAL, COMMON ORGANIC SOLVENTS.

SEPARATION AND PURIFICATION TECHNIQUES: FILTRATION, RECRYSTALLISATION, EXTRACTION, CHROMATOGRAPHY, SEPARATION OF MIXTURES.

PHYSICAL CHARACTERISATION: MELTING POINT, OPTICAL ROTATION

HOW TO RUN A CHEMICAL REACTION: MECHANISM, TLC, ISOLATION AND PURIFICATION OF THE PRODUCTS.

Denominazione insegnamento in italiano	Laboratorio di Istituzioni di Biologia
Denominazione insegnamento in inglese	Fundamental Biology Laboratory
Tipologia dell'esame (scritto- scritto/orale - orale)	

AIMS

THIS COURSE AIMS TO PROVIDE STUDENTS WITH BASIC METHODOLOGY USED IN PROCESSING TISSUES AND IN PREPARING HISTOLOGICAL SECTIONS FOR MICROSCOPIC OBSERVATION, AND WITH SKILL ON RECOGNITION OF TISSUES AND ORGANS BY THE USE OF LIGHT MICROSCOPY. THE STUDENT WILL FAMILIARIZE WITH THE CORRECT USE OF THE TRANSMITTED LIGHT MICROSCOPE AND WILL ACQUIRE THEORETICAL AND PRACTICAL KNOWLEDGE OF LIGHT MICROSCOPY AS A MEAN TO STUDY TISSUES AND CELLS.

PROGRAM DETAILS

PRINCIPLES OF LIGHT AND ELECTRON MICROSCOPY: THEORY OF IMAGE FORMATION, MAGNIFICATION AND RESOLUTION. DESCRIPTION OF THE LIGHT MICROSCOPE.

SPECIMEN OBSERVATION: OPTIMIZATION OF THE LIGHTING, ALIGNMENT OF THE MICROSCOPE, REGULATION OF THE CONDENSER, FOCUS, SPECIMEN LOCALIZATION AND CENTRING. NON-FLUORESCENT CONTRAST MODES: BRIGHT-FIELD, DARK-FIELD, PHASE CONTRAST, DIFFERENTIAL INTERFERENCE CONTRAST (DIC). FLUORESCENT LABELLING TECHNIQUES.

PREPARATION OF HISTOLOGICAL SECTIONS: FIXATION, DEHYDRATION, EMBEDDING, CUTTING AT MICROTOME, STAINING. EXAMPLES OF SELECTIVE HISTOCHEMICAL STAINING. USE OF ANTIBODIES TO LOCALIZE ANTIGENS. ULTRASTRUCTURAL IDENTIFICATION OF CELLULAR ORGANELLES ON ELECTRON MICROGRAPHS.

TISSUE OBSERVATION AND RECOGNITION: LINING AND GLANDULAR EPITHELIAL TISSUES, CONNECTIVE TISSUES (PROPER AND SPECIALIZED SUCH AS CARTILAGE, BONE AND BLOOD), MUSCULAR TISSUES (SKELETAL, CARDIAC AND SMOOTH MUSCLES), NERVOUS TISSUE (CEREBELLUM, GANGLION, NERVE, SPINAL CORD SECTIONS).

OBSERVATION OF MICROSCOPIC ANATOMY OF SMALL AND LARGE INTESTINE, LIVER, PANCREAS, TRACHEA, LUNG, KIDNEY, URINARY BLADDER, TESTIS AND OVARY, Lymph node, SPLEEN.

OBSERVATION OF *Xenopus laevis* EGGS AND EMBRYOS DURING THE EARLY DEVELOPMENTAL STAGES WITH THE STEREO-MICROSCOPE.

Denominazione	Matematica
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insegnamento in italiano	
Denominazione insegnamento in inglese	Calculus
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto + orale

AIMS

AIM OF THIS COURSE IS TO PROVIDE THE BASIC NOTIONS OF MATHEMATICAL ANALYSIS AND TO TRAIN THE STUDENTS TO AFFORD PROBLEMS WITH RIGOUR AND LONG SIGHTED ATTITUDE.

PROGRAM DETAILS

REAL FUNCTIONS OF ONE REAL VARIABLE.

LIMIT, CONTINUITY, DERIVATIVE, INTEGRAL, DIFFERENTIAL EQUATIONS, INTERPOLATION, LEAST SQUARES APPROXIMATION

Denominazione insegnamento in italiano	Metodologie Biochimiche e Biomolecolari
Denominazione insegnamento in inglese	Methods in Biochemistry and in Molecular Biology

Denominazione insegnamento in italiano	Metodologie Biochimiche
Denominazione insegnamento in inglese	Methods in Biochemistry
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto/orale written/oral

AIMS

THE COURSE DESCRIBES THE PRINCIPLES, THE IMPLEMENTATION AND APPLICATIONS OF CENTRAL METHODS IN BIOCHEMISTRY AND GENETIC ENGINEERING. PARTICULAR ATTENTION IS GIVEN TO THE PHYSICO-CHEMICAL PROCESSES ON WHICH THE DESCRIBED TECHNIQUES ARE BASED, AS WELL AS THE PRINCIPAL EXPERIMENTAL STRATEGIES IN WHICH THEY ARE USED. THE FIRST PART OF THE COURSE (4CFU) FOCUSES ON BIOCHEMICAL METHODS FOR PROTEIN PURIFICATION AND CHARACTERIZATION. THE SECOND PART OF THE COURSE FOCUSES ON MOLECULAR BIOLOGY TECHNIQUES.

PROGRAM DETAILS

BIOCHEMICAL METHODS:

CELL LYSIS

CENTRIFUGATION (DIFFERENTIAL, ZONAL, ISOPICNIC, ANALYTICAL ULTRACENTRIFUGATION)

CHROMATOGRAPHY (GEL FILTRATION, ION EXCHANGE, REVERSE PHASE, AFFINITY)

HPLC AND FPLC
 ELECTROPHORESIS (SDS-PAGE, NON DENATURING, ISOELECTROFOCUSING, 2D-GELS)
 WESTERN BLOT
 IMMUNOPRECIPITATION
 RADIOCHEMICAL TECHNIQUES
 PROTEIN PURIFICATION
 SPECTROSCOPY (ABSORBANCE, FLUORESCENCE, CIRCULAR DICHROISM, SURFACE PLASMON RESONANCE)
 MASS SPECTROMETRY (MALDI, ESI)
 CALORIMETRY (DSC, ITC)

Denominazione insegnamento in italiano	Metodologie Biomolecolari
Denominazione insegnamento in inglese	Methods in Molecular Biology
Tipologia dell'esame (scritto- scritto/orale - orale)	Scritto

AIMS

DURING THE COURSE, THE PRINCIPLES AND THE APPLICATIONS OF THE MAIN METHODS IN MOLECULAR BIOLOGY WILL BE DESCRIBED.

PROGRAM DETAILS

- 1) RECOMBINANT DNA TECHNIQUES:
 - A) ENZYMES TO MANIPULATE DNA: DNA POLYMERASES (T4 DNA POL. AND T7 DNA POL., KLENOW, INVERSE TRANSCRIPTASE), RNA POLYMERASES (T7 RNA POL. AND T3 RNA POL.), NUCLEASES (DNASE, RNASE A/H, S1 NUCLEASE), TERMINAL TRANSFERASE, LIGASES (T4 DNA LIGASE), KINASES (T4 POLYNUCLEOTIDE KINASE), PHOSPHATASES (ALKALINE PHOSPHATASE), RESTRICTION ENZYMES, METHYLASES (*DAM*, *DCM*);
 - B) CLONING VECTORS: PLASMIDS AND PHAGE VECTORS (*E. COLI* AS A GUEST ORGANISM);
 - C) LIBRARIES: GENOMIC AND cDNA LIBRARIES;
 - D) PROBES: DNA PROBES, 5' AND 3' END LABELLING, RANDOM PRIMER LABELLING, NICK TRANSLATION; RNA PROBES, RIBOPROBES.

TECHNIQUES BASED ON NUCLEIC ACIDS HYBRIDIZATION:

 - A) SCREENING OF LIBRARIES: HYBRIDIZATION ON COLONIES OR PLAQUES, EXPRESSION LIBRARY SCREENING;
 - B) NORTHERN AND SOUTHERN BLOT.
- 2) POLYMERASE CHAIN REACTION (PCR): BASIC CONCEPTS, PRIMER DESIGN, SENSITIVITY AND APPLICATIONS. MUTAGENESIS USING PCR. PCR PRODUCTS CLONING.
- 3) DNA SEQUENCING: BASIC CONCEPTS, SANGER SEQUENCING, MAXAM AND GILBERT SEQUENCING, AUTOMATIC SEQUENCING.

Denominazione insegnamento in italiano	Metodologie Chimiche in Biotecnologia
Denominazione insegnamento in inglese	Chemical Methods in Biotechnologies

Tipologia dell'esame (scritto- scritto/orale - orale)	
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AIMS

THE STUDENT WILL GAIN KNOWLEDGE ABOUT SEPARATION, ANALYSIS AND STRUCTURAL DETERMINATION OF ORGANIC MOLECULES.

PROGRAM DETAILS

SEPARATION METHODS BY LIQUID-LIQUID, SOLID-LIQUID, LIQUID-GAS EXTRACTION; CHROMATOGRAPHIC METHODS: PARTITION CHROMATOGRAPHY, ABSORPTION CHROMATOGRAPHY, EXCLUSION CHROMATOGRAPHY AND ION-EXCHANGE CHROMATOGRAPHY.
CHROMATOGRAPHIC TECHNIQUES: TLC, HPLC, GC AND THEIR APPLICATION TO QUANTITATIVE ANALYSIS.
GENERAL REMARKS ON MAIN METHODS FOR STRUCTURAL ANALYSIS: IR, MS, NMR.
LAB EXPERIMENTS ON ISOLATION AND CHEMICAL CHARACTERISATION OF ORGANIC COMPOUNDS

Denominazione insegnamento in italiano	Microbiologia Industriale
Denominazione insegnamento in inglese	Industrial Microbiology
Tipologia dell'esame (scritto- scritto/orale - orale)	Written + oral

AIMS

AIM OF THE COURSE IS TO INTRODUCE AND THEN INVESTIGATE IN MORE DETAIL STRUCTURAL AND PHYSIOLOGICAL ASPECTS TYPICAL OF (PROKARYOTIC AND EUKARYOTIC) MICROORGANISMS, WITH PARTICULAR REGARDS TO BIOTECHNOLOGICAL APPLICATIONS

PROGRAM DETAILS

THE FOLLOWING SUBJECTS WILL BE DELUCIDATED:

HISTORICAL EXCURSUS FROM THE BEGINNING TO MODERN MICROBIOLOGY;
ORIGINS OF LIFE AND MICROORGANISMS AND THE CONSTRUCTION OF THE LIFE TREE;
NUTRITIONAL PARAMETERS, CONDITIONS AND METHODS FOR THE DETECTION OF CELLULAR GROWTH AND FOR MICROORGANISMS CULTIVATION (I.E. BIOREACTOR);
STRUCTURES AND FUNCTIONS TYPICAL OF BACTERIAL, ARCHEA, FUNGAL AND PROTOZOAN CELLS, TOGETHER WITH THEIR LIFE CYCLE AND POSSIBLE IMPLICATION WITH BIOTECHNOLOGICAL APPLICATIONS;
DETAILED DESCRIPTION OF THE DIFFERENT METABOLISMS (ESPECIALLY CATABOLISMS) IN MICROORGANISMS, THEIR ECOLOGICAL SIGNIFICANCE AND POSSIBLE IMPLICATION WITH BIOTECHNOLOGICAL APPLICATIONS;
ELEMENTS IN GENETICS OF MICROORGANISMS;
CYCLES OF ELEMENTS (C AND N) AND ROLE OF MICROORGANISMS;
SYMBIOSIS;

MICROORGANISMS AND DISEASES;
 THE VIRUSES;
 ANTIBIOTICS AND THEIR POSSIBLE CHEMOTERAPEUTICAL USAGE;
 BIOFILMS;
 EXAMPLES OF APPLIED INDUSTRIAL MICROBIOLOGY

Denominazione insegnamento in italiano	ORGANI E FUNZIONI
Denominazione insegnamento in inglese	ORGANS AND FUNCTIONS

Denominazione insegnamento in italiano	ORGANI E FUNZIONI - MODULO ANATOMIA
Denominazione insegnamento in inglese	ORGANS AND FUNCTIONS - ANATOMY PART
Tipologia dell'esame (scritto- scritto/orale - orale)	SCRITTO/ORALE

AIMS

Aim of the course is that to provide knowhow on specific organ and system functions, in particular as far as integrated functions are considered.

PROGRAM DETAILS

NEURO-MUSCULAR SYSTEM
 -CELLULAR EXCITABILITY
 -INTEGRATIVE FUNCTIONS OF NEURONS
 -MUSCLE PHYSIOLOGY
 -MUSCULAR CONTRACTION
 -CONTROL OF POSTURE

BLOOD AND CIRCULATION
 -COMPOSITION AND FUNCTIONS OF BLOOD
 -BIOPHYSICS OF CIRCULATION
 -CARDIAC FUNCTION
 -THE VASCULAR DISTRICTS
 -CONTROL OF BLOOD PRESSURE

RESPIRATORY SYSTEM
 -PULMONARY VENTILATION
 -ENERGY METABOLISM
 -GAS EXCHANGES

RENAL PHYSIOLOGY

-GLOMERULAR FILTRATION
-TUBULAR FUNCTION

INTEGRATED RESPIRATORY-RENAL FUNCTION
-CONTROL OF PH

DIGESTIVE SYSTEM
-DIGESTION AND ABSORPTION

ENDOCRINE SYSTEM
-GENERAL PRINCIPLES OF ENDOCRINE FUNCTION

Denominazione insegnamento in italiano	ORGANI E FUNZIONI - MODULO FISILOGIA
Denominazione insegnamento in inglese	ORGANS AND FUNCTIONS - PHYSIOLOGY PART
Tipologia dell'esame (scritto- scritto/orale - orale)	SCRITTO/ORALE

AIMS

The student must have a general knowledge of the cellular and tissues structures. An exhaustive knowledge of systems that compose the human body, and in particular of their microscopic anatomy, is also asked. Students must be able to recognize preparations of microscopic anatomy.

Moreover students must know the fundamental processes of human embryological development, through which tissues, organs and system are organized.

PROGRAM DETAILS

Embryology: Gametogenesis, ovarian and menstrual cycle, fertilization, I-II-III-IV week of embryonal development: cleavage of the zygote, formation of blastocyst and implantation, formation of 1) the bilaminar embryonic disc; 2) the extraembryonic mesoderm; 3) the embryonic mesoderm; 4) the notochord. Neurulation. Folding of the embryo. Germ layer derivatives. Placenta. **Histology:** epithelial (covering and glandular), connective, adipose, muscle (skeletal, cardiac and smooth), nervous tissues; cartilage, bone. **Human anatomy:** digestive system and accessory organs (oral cavity, farynx, esphagus, stomach, small and large intestine, liver, biliary tract, pancreas, peritoneum), respiratory system (nose, larynx, trachea, bronchi, lungs, pleurae), urinary system (kidney, ureter, bladder, urethra), endocrine system (hypophysis, thyroid, parathyroid glands, adrenal gland), lymphoid organs (thymus, lymph nodes, spleen), female reproductive system (ovaries, oviducts, uterus) male reproductive system (testis, epididymis, prostate, seminal vesicle), circulatory system (heart, veins, arteries), nervous system.

Denominazione insegnamento in italiano	Patologia e Fisiopatologia Generale
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Denominazione insegnamento in inglese	Pathology and General Physiopathology
Tipologia dell'esame (scritto- scritto/orale - orale)	Orale

AIMS

THE MAJOR AIM OF THE COURSE IS TO PROVIDE STUDENTS WITH TOOLS FOR UNDERSTANDING THE PATHOLOGY AND GENERAL PHYSIOPATHOLOGY. SPECIFIC AIMS: PATHOGENY AND PHYSIOPATHOLOGY OF SOME WELL-KNOWN DISEASES: GENETIC, ONCOLOGICAL, INFECTIOUS, METABOLIC AND ENDOCRINE, NEUROLOGICAL AND CARDIOVASCULAR DISEASES.

PROGRAM DETAILS

CONCEPT OF ETIOLOGY AND PATHOGENESIS. PHYSICAL, CHEMICAL AND BIOLOGICAL CAUSES OF DISEASES. GENETIC PATHOLOGY. FREE RADICALS AND OXIDATIVE STRESS. ANTIOXIDANT SYSTEMS. ALTERED CELL HOMEOSTASIS. ACUTE AND CHRONIC INFLAMMATION. THERMOREGULATION. PATHOGENESIS OF FEVER. CONNECTIVE TISSUE: COLLAGEN METABOLISM. TISSUE REGENERATION AND REPAIR. CELL INJURY, REPAIR AND FIBROSIS. VASCULAR PHYSIOPATHOLOGY: HYPERTENSION. HYPOTENSION AND CARDIAC COLLAPSE. ANGIOGENESIS. ATHEROSCLEROSIS. HYPOXIA, ISCHEMIA AND HEART ATTACK. BIOCHEMISTRY OF CIRCULATION SYSTEM: REGULATION OF ARTERIAL PRESSURE. RENIN-ANGIOTENSIN SYSTEM. CELLULAR MECHANISM OF SODIUM, POTASSIUM, AND WATER TRANSPORT. BLOOD COAGULATION. VIT K. CHOLESTEROL HOMEOSTASIS. REGULATION OF METABOLISM: HORMONES AND GROWTH FACTORS. LIVER'S DETOXIFICATION MECHANISM. PHYSIOPATHOLOGY OF AGING. CANCER: THE MOLECULAR BASIS. ONCOGENIC TRANSFORMATION. PHYSIOLOGY OF CENTRAL NERVOUS SYSTEM: SYNAPSI AND NEUROTRANSMITTER.
