UNIVERSITY OF L'AQUILA

Dipartimento di
Scienze Cliniche Applicate e Biotecnologiche

Nam et ipsa scientia potestas est

2nd Cycle Degree in
MEDICAL BIOTECHNOLOGIES

Laurea Magistrale in
BIOTECNOLOGIE MEDICHE

Course Catalogue

Academic year starts the last week of September and ends the first week of June.
1st Semester - *Starting date:* last week of September, *end date*: 3rd week of January
2nd Semester - *Starting date:* last week of February, *end date:* 1st week of June
Exams Sessions: I) from last week of January to 3rd week of February, II) from 2nd week of June to end of July, III) from 1st to 3rd week of September.

Comprehensive Scheme of the 2nd Cycle Degree in *MEDICAL BIOTECHNOLOGIES*				
YEAR	**CODE**	**COURSE**	**Credits (ECTS)**	**Semester**
I	B0389	Biotechnology of Central Nervous System	6	1
	B0476	Functions and Analysis of Biologic Macromolecules	8	1
	B0418	Pathologic Processes of Human Interest	12	1
	B0392	Diagnostic Microbiology and Epidemiological Methodology	11	2
	B0397	Clinical Pharmacology and Toxicology	6	2
		Free choice Courses	8	1 and 2
		Other activities	2	1 and 2
II	B0407	Conventional and advanced diagnostic strategies	18	1
	B0401	Intellectual Properties, Patents and European Legislation	3	1
	B0422	Experimental Biotechnology Models	10	2
	B0402	Reproductive Biotechnologies	6	2
		Thesis	30	2

Programme of "BIOTECNOLOGIE DEL SISTAMA NERVOSO "

"BIOTECHNOLOGY OF CENTRAL NERVOUS SYSTEM"

B0389, COMPULSORY
2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 1st Year, 1st Semester

Number of ECTS credits: 6 (workload is 150 hours; 1 credit = 25 hours)

Teacher: Silvia BISTI

1	Course objectives and Learning outcomes	The main target of this course is to acquire the basic knowledge of the function of nervous system at integrated and at cellular and synaptic level. This module conveys the concept of neuroscience as an integrative discipline by providing a description of mammalian brain function from molecular aspects of synaptic signaling to higher cognitive function that regulates behavior. Aim of this Module is to provide the students with the knowledge of how the nervous system develops, its structure, what it does, its impact on behavior and cognitive functions. The students will explore nerve cells and how these cells interact with each other to form the brain and regulate body functions and human behavior both in normal and pathological situations.
2	Dublin descriptors	Topics of the module include: The module is divided into three roughly equal sized units, each dealing with a specific aspect of neuroscience. Throughout, both the normal system and diseases and disorders that arise as a consequence of abnormalities will be covered. <u>Unit 1: Development of the Nervous System</u> Deep insight on how the complex and intricately wired nervous system develops from a simple sheet of neuroepithelial cells by addressing the cellular and molecular basis of: Neurulation (formation of the brain and spinal cord), Nerve cell proliferation (Neurogenesis) Differentiation and survival of nerve cells, Axon growth and guidance, Synapse formation (Synaptogenesis) <u>Unit 2: Signaling at the Synapse</u> Molecules and mechanisms involved in transmission of signals between nerve cells: Electrical synapses and gap junctions, Chemical synapses: Neurotransmitters and neuromodulators, Molecular mechanisms of transmitter release, Neurotransmitter receptors and transporters <u>Unit 3: The Brain and Behavior</u> How the nervous system controls a variety of behaviors including: Learning and memory, Language and communication, Sleep and dreaming. On successful completion of this module, the student should o Have knowledge and understanding of the relation between structures and function i.e. how we see and hear and walk etc. and how sensory and motor modalities are integrated. o The answers to these questions contain cause- and-effect sequences o know how the nervous system develops and understand how nerve cells communicate at synapses; o understand the relationship between the brain and behavior and the consequences of the acquired and inherited neurological diseases; o be able to describe the components of a simple neural circuit (a reflex arc), and the processes going on at each point in the circuit: sensory transduction, conduction along an axon, synaptic transmission and neuromuscular transmission; o be able to explain how electrical signals in nerve are generated by ionic gradients and fluxes, and the functions of the molecules involved (ion channels and transporters); o be able to explain the pre- and post-synaptic events in chemical synaptic transmission, how neurotransmitter is released, how it interacts with ionotropic or metabotropic receptors, and how this gives rise to a depolarization and action potentials at the postsynaptic membrane; o be able to explain the principles and mechanisms of sensory transduction in the somatosensory, visual, auditory and vestibular systems; o be able to describe the functions of the principal areas of the cerebral cortex and enumerate the mechanisms of short- and long-term memory and learning; o be able to recognize the main items of experimental evidence underlying our current state of knowledge of the above mechanisms.
3	Prerequisites and learning	The student must know physics, chemistry , biochemistry, histology, physiology.

	activities	
4	Teaching methods and language	Lectures. Language: Italian, English Ref. Text books Kandel, Schwartz and Jassel, *Principles of Neurosciences*, McGraw-Hill, 2012
5	Assessment methods	Summative assessment: Oral exam consists of three questions aiming to evaluate the acquired knowledge and the capacity to explain how signals are transmitted in both normal and pathological situations in a proper and clear language.

Programme of "FUNZIONI E ANALISI DELLE MACROMOLECOLE BIOLOGICHE " ***"FUNCTIONS AND ANALYSIS OF BIOLOGICAL MACROMOLECULES"***		
B0476, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 1st Year, 1st Semester**		
Number of ECTS credits: 8 (workload is 200 hours; 1 credit = 25 hours)		
Teacher: Nicola FRANCESCHINI		
1	Course objectives and Learning outcomes	The goal of this course is to provide the students with rational and scientific bases of the techniques for proteome analysis. Skills for the application of basic bioinformatics methodologies to access the most important databases to handle biological data. The student, after completion of this course, should be able to plan a strategy of protein characterization and data analysis.
2	Dublin descriptors	Topics of the module include: The basis of the proteic sample manipulation. Main analytical techniques used in the laboratory of proteomics: 2D protein electrophoresis, DIGE, HPLC; Mass spectrometry fundamentals: ionization techniques (EI, ESI, FAB, MALDI) and , Quantitative proteomics: labeling techniques (SILAC, ICAT, iTRAQ); phosphoproteomics (enrichment strategies and analysis of posttranslational modifications). Techniques for molecular targets and biomarkers characterization: SELDI-TOF. Functional proteomics : chromophore assisted laser inactivation (CALI) and Fluorescence resonance energy transfer (FRET). Enzyme: structure and function principles of enzyme kinetic. Techniques for enzyme activity determination. Model enzymes: matrix metalloproteinases, cathepsins and ciclooxygenase. Antibodies: structure, function and analysis: western blotting, immunoprecipitation and ELISA. Research in primary and derived biological databases; substitution matrix used for sequence alignment (BLOSUM, PAM) similarity search (BLAST; FASTA); structural features of proteins (Protein Data Bank). Molecular modeling. On successful completion of this module, the student should o understand the structure of the major biological macromolecules; o demonstrate appreciation of the link between the structure of biological macromolecules and their functions; o have profound knowledge of proteomic techniques; o have knowledge and understanding of the proteomic analyses and their significance; o be able to explain the most relevant techniques in proteomic and bioinformatics using appropriate scientific language; o demonstrate skill in analytical evaluation and ability to perform protein analyses; o demonstrate increased experience of carrying out simple analytical or biochemical experiments; o become more confident in manipulating, presenting and interpreting experimental data; o be aware of safety procedures associated with laboratory experimentation; o be able to work in team showing commitment to tasks and responsibilities; o demonstrate capacity for reading and understanding other texts on related topics.
3	Prerequisites and learning activities	The student must know the basic notion of Biochemistry and Molecular Biology.
4	Teaching methods and language	Lectures and Bioinformatics Laboratory Language: Italian, English Ref. Text books -Petsko GA, Ringe D "Struttura e funzione delle proteine", Casa Editrice Zanichelli (http://www.zanichelli.it) -Twyman RM, *"Principles of Proteomics", BIOS Scientific publishers,*

		(http://www.garlandscience.com) -Anna Tramontano, *"Bioinformatica"*, Casa Editrice Zanichelli (http://www.zanichelli.it)
5	Assessment methods	Summative assessment: Oral exam consists of three questions aimed at the evaluation of the knowledge and understanding of the processes occurring in macromolecule characterization and function. The relationship between structure and function as well as the ability to use informatics tools to manipulate structures, organize and understand a biological data set.

Programme of "PROCESSI PATOLOGICI DI INTERESSE UMANO" ***"PATHOLOGICAL PROCESSES OF HUMAN INTEREST"*** **This course is composed of two Modules: 1) Pathological Processes of Human Interest I, 2) Pathological Processes of Human Interest II**		
F0418, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 1st year, 1nd Semester**		
Number of ECTS credits: 12 (workload is 300 hours; 1 credit =25 hours)		
1) PATHOLOGICAL PROCESSES OF HUMAN INTEREST I (6 ECTS)		
Teachers: Antonietta FARINA, Edoardo ALESSE		
1	Course objectives	The goal of this course is to provide knowledge on the physiopathology mechanisms of human diseases, in particular at a molecular level and the basic functional consequences for the organism. On successful completion of this course, the students, should understand the fundamental pathological principles at the base of human disease.
2	Course content and Learning outcomes (Dublin descriptors)	Topic of the modules include: - Physiopathology of: Kidney, Lung, Heart, endocrine system of the liver, gallbladder and bile duct. - Molecular Pathology of: Colon cancer, Pancreas cancer, Prostate cancer, breast cancer, SNC tumours of the CNS. - Molecular Pathology of: Alzheimer, Parkinson, Huntington, Amyotrophic lateral Sclerosis, Muscular Dystrophy (Duchene-Becker), Cystic fibrosis. On successful completion of this module the student should o have profound knowledge of basic concepts of the molecular pathogenetic mechanisms of human diseases; o know and understand the role of tumor suppressors and oncogenes in oncogenesis , invasion and metastasis of cancer cells; o have knowledge and understanding of the use of molecular markers in cancers; o understand and explain principles of regulatory issues for pathologic process; demonstrate skill in identifying potential targets and ability to choose the relevant strategy for molecular therapy approach; o be able to present the principal diseases denomination and of the molecular aspects of those.
3	Prerequisites and learning activities	The student must know the basis notion of general physiology , cellular and molecular biology
4	Teaching methods and language	Lectures, Powerpoint presentations in Italian. Language: Italian Ref. Text books -Pontieri, Russo, Frati. *Patologia Generale*, vol.I. Piccin Ed. -Teacher's Notes
5	Assessment methods and criteria	Summative assessment: Oral exam that consists of 3 questions aiming to assess the knowledge of the mechanisms involved in tumour formation and progression, the ability to explain key aspects of cell and molecular biology required to understand the cell and molecular biology of specific disease processes and the capacity to link this knowledge with application to medical approaches.
2) PATHOLOGICAL PROCESSES OF HUMAN INTEREST II (6 ECTS)		
Teacher: Vincenzo FLATI		
1	Course objectives	The goal of this course is to provide the students with the knowledge of molecular basis of cancer therapy, with particular focus on the targeted cancer therapy
2	Course content and	Topic of the modules include:

	Learning outcomes (Dublin descriptors)	- Introduction: an overview on the tumor biology and on the molecular basis of the disease - Molecular basis of cancer therapy: chemotherapy and new approaches for targeted chemotherapy; photodynamic therapy; endocrine therapy; immunotherapy; gene therapy and control of gene expression; cancer stem cells as a target and stem cells as a therapeutic tool; inhibitors of the signal transduction pathways; inhibitors of the cell cycle; angiogenesis inhibitors; inhibitors of the proteasome; radiometabolic therapy; telomerase as a target for cancer therapy; autophagy inhibitors and activators for cancer therapy; anti-invasion and anti-metastasis therapy; genetic basis of the individual response to anti-cancer drugs. On successful completion of this module the student should o know the molecular changes that lead to the development of specific cancers; o have knowledge and understanding of the main molecular mechanisms of cancer development; o understand the changes in cellular and tissue pathology in specific cancers; o be able to critically analyze the contemporary issues influencing chemotherapy care and management; o be able to outline the basic control of the cell cycle and alterations in cell cycle checkpoints in cancer cells; o be able to discuss the key aspects of apoptosis, its misregulation in cancers and the methods developed to leverage apoptosis as a therapeutic means; o be able to explain the relevant approaches to cancer therapy with particular focus on targeted cancer therapies, using appropriate scientific language.
3	Prerequisites and learning activities	The students need to know the basics of general physiology and of cellular and molecular biology
4	Teaching methods and language	Lectures, Powerpoint presentations in Italian and English Language: Italian Ref. Text books - Pontieri-Russo-Frati, "*Patologia Generale*", III edizione - Tomo I - Piccin Editore - Amadori-Croce, "*Terapia Molecolare in Oncologia*", I edizione - Poletto Editore. -Teacher's Notes
5	Assessment methods and criteria	Summative assessment: Oral exam that consists of 3 questions and is intended to ascertain the knowledge of the molecular basis of cancer development, the capacity to discuss the cancer therapeutic approaches, with particular attention to the most innovative of them, and the ability to discuss the molecular details of their mechanism of action

Programme of "MICROBIOLOGIA DIAGNOSTICA E METODOLOGIA EPIDEMIOLOGICA" ***"DIAGNOSTIC MICROBIOLOGY AND EPIDEMIOLOGICAL METHODOLOGY"*** **This course is composed of two Modules: 1) Diagnostic Microbiology, 2) Epidemiological Methodology**		
B0392, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 1st Year, 2nd Semester**		
Number of ECTS credits: 12 (workload is 300 hours; 1 credit = 25 hours)		
1) DIAGNOSTIC MICROBIOLOGY (6 ECTS)		
Teacher: Eugenio PONTIERI		
1	Course objectives and Learning outcomes	The goal of Diagnostic Microbiology course is to provide the students with an overview of biochemical, cultural, medical, serological aspects and other peculiar characteristics of microbial pathogens in their identification process with rational and scientific bases. Therefore, the course focuses principles and methods used in clinical microbiology including isolation and identification of pathogenic microorganisms (bacteria, viruses, fungi, parasites). Clinical manifestations and diagnosis of infections will be treated by body system.
2	Dublin descriptors	Topics of the module include: Basic on the principal types of microorganisms. Exam of diagnostic methods: culture, observation, identification, serologic and molecular approaches. Basic of immunology. Clinical manifestations and diagnosis of infections will be examined by body site. Moreover, therapy, vaccines and prevention methods will be treated. On successful completion of this module, the student should o have profound knowledge of general and medical microbiology and a good knowledge

		of basic in immunology, human anatomy and histology; o have knowledge and understanding of the principal methods of microbial analysis: microbial growth, observation of microorganisms, gene expression, virulence factors, basic methods in serology; o understand and explain the clinical manifestation and diagnosis of infection by body system using appropriate scientific language; o demonstrate skill in evaluation of results of the analysis and ability to show correct diagnostic methods in the specific case in object; o be able to describe the aetiologies, epidemiology and basic mechanisms of pathogenesis of infectious diseases; o be able to describe the basic principles of diagnosis, antimicrobial treatment, prevention and control of infectious diseases in the hospital and community; o be able to describe the host immune system and explain the host response to infection; o understand and interpret basic laboratory tests for the diagnosis of infectious diseases; o be able to apply the principles of molecular and immunological techniques for the diagnosis of infectious diseases; o be able to analyze and solve case studies involving bacterial and fungal agents.
3	Prerequisites and learning activities	The student must know the basic notion of General and Medical Microbiology and good basic knowledge of immunology and anatomy.
4	Teaching methods and language	Lectures Language: Italian Ref. Text books -Mims C. et al. "Microbiologia Clinica" EMSI Editor, Roma -Favalli C. e D'Antonio D. "Principi di diagnostica microbiologica" EMSI Editore, Roma -Lanciotti E. "Principi di Microbiologia Clinica" Casa Editrice Ambrosiana
5	Assessment methods	Summative assessment: Written and oral exam (50:50) The written exam consists of a student's dissertation on a specific topic covered in class and on three questions regarding the entire program and aims to evaluate and assess the degree of knowledge and understanding of the theoretical foundations for the differentiation of the major pathogenic groups, and of methods for diagnosis of different types of pathogens. This method is intended to ascertain the capacity to discuss and explain with clear sentences and appropriate scientific language the use of biochemical and serological tests in the diagnosis of Gram-negative and Gram-positive bacteria and the autonomy in determining the antimicrobials to be used in the sensitivity testing of different types of pathogens.
2) EPIDEMIOLOGICAL METHODOLOGY (6 ECTS)		
Teacher: Marco VALENTI		
1	Course objectives and Learning outcomes	The course addresses the main features of epidemiology, focusing on the design and conduction of an epidemiological study.
2	Dublin descriptors	Topics of the module include: Elements of descriptive epidemiology. Basic definitions in epidemiology. The epidemiological measures: proportions, ratios, indices, rates. Measures of occurrence: prevalence, cumulative incidence, incidence rate. Direct and indirect standardization. Principles of causality. Causal models in the natural history of infectious and chronic degenerative diseases. Measures of risk. The design of epidemiological studies: descriptive, cross-sectional, cohort, case-control designs. Principles of statistical analysis of epidemiological data. Confidence intervals of epidemiological measures. Risk models: univariate and multivariate. Linear, Logistic and Poisson regression. Survival analysis. Cox model. On successful completion of this module, the student should o have a good knowledge of the issues involved in designing an epidemiological study. o have knowledge and understanding of the most important and applied epidemiological designs. o understand and explain the clinical relevance and the methodological appropriateness of the design used. o be able to identify appropriate experimental design methodologies for carrying out health surveys, observational epidemiological studies (primarily cohort and case-control design studies) and interventional clinical trials involving human participants; o be able to identify and execute appropriate statistical methods for summarizing data collected in health surveys, epidemiological studies and interventional clinical trials, using

		both conventional significance testing approaches and more contemporary effect size/confidence intervals concepts; o be able to critically evaluate and interpret the statistical analyses of data from health surveys, epidemiological studies and interventional clinical trials; o be able to summarize the results of statistical analyses in a report format suitable for a non-mathematical readership.
3	Prerequisites and learning activities	Basic descriptive and inferential statistics. Estimation and statistical decision theory.
4	Teaching methods and language	Lectures Language: Italian Ref. Text books -M. Valenti, *Statistica Medica. Metodi quantitativi per le scienze della salute*. Monduzzi, Ed, 2007. -K. Rothman, S. Greenland, Modern Epidemiology, Lippincott Williams & Wilkins. - L. Gordis, Epidemiology, Elsevier Saunders
5	Assessment methods	Summative assessment: Oral exam, that consists of 2 questions and is intended to ascertain the knowledge of the most important epidemiological designs, the capacity to evaluate and discuss and explain the appropriateness of a design and the ability to interpret the results of statistical analyses and to present them with clear sentences and suitable scientific language

Programme of "FARMACOLOGIA E TOSSICOLOGIA CLINICA " ***"CLINICAL PHARMACOLOGY AND TOXICOLOGY"***		
B0397, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 1st Year, 2nd Semester**		
Number of ECTS credits: 6 (workload is 150 hours; 1 credit = 25 hours)		
Teacher: Marco CARMIGNANI		
1	Course objectives and Learning outcomes	This course is aimed to provide the students with integrated scientific bases able to evaluate actions, effects and employment of xenobiotics (with special reference to the biotechnological ones) as therapeutic agents in human diseases and as biological regulators in either physiological or pathological conditions. The course also deals with toxicological effects of therapeutic drugs and of xenobiotics of occupational and environmental origin. The course aims to valorize previous competences ranging from biochemistry and molecular biology to physiology, pathology, genetics and other basic disciplines.
2	Dublin descriptors	Topics of the module include: General principles of clinical pharmacology and toxicology. Therapeutic monitoring of drugs and analytical determination of toxins. Development, registration procedures and clinical trials of drugs. Adverse reactions, toxic effects and clinical interactions among drugs. Elements of pharmaco-economy, pharmaco-epidemiology and drug prescription. General principles of pharmaceutical and medical biotechnologies. Biotechnological drugs (with special reference to those used in oncologic and immunologic diseases). Biotechnological vaccines. Gene therapy. Drugs of the central and autonomic nervous system and of the cardiovascular system. Anti-inflammatory and anti-neoplastic drugs. Drugs of the immune and endocrine systems. Drugs of the blood and hemopoietic system. Drugs of the respiratory and digestive systems. Diuretics and antiparasitary drugs (chemotherapeutical drugs, antibiotics, antiviral drugs). Autacoids and related drugs. Active principles of dermatologic, cosmetologic and homeopathic interest. Organs and systems as selective targets of toxins. General principles in the clinical treatment of intoxications. Toxins in the environment. Ethics and regulations in pharmacology and toxicology. On successful completion of this module, the student should o have profound knowledge of the pharmacological and toxicological methodologies; o have knowledge and understanding of the human pathologies and their pharmacotherapy as well as of the methodological approaches to face toxicological pictures; o have capacity to integrate biological, analytical, physiological, pathological and clinical data in order to rationalize clinico-pharmacological interventions; o know and understand basic concepts regarding the principles governing the interactions between drugs and the body, both from a pharmacokinetic (absorption,

		metabolism, distribution and elimination) and pharmacodynamic (mechanism of action) standpoint; o know and understand basic concepts regarding general principles of toxicology, adverse drug reactions and how to evaluate them, potential interference with hematochemical dosages, bearing in mind the structure, kinetics and mechanism of action, as well as the relationship between pharmacological and toxicological effects; o have capacity to explain basic aspects connected with the therapeutic use of certain drugs of more specific interest that are most frequently used and monitored; o demonstrate a solid background in how pharmacology can be applied throughout the human life span; o understand how clinical pharmacology enhances the process of drug development and treatment of patients; o have ability to evaluate clinical trials and scientific literature about medicines; o have ability to read and understand scientific reports and to synthesize the concepts in a critical and autonomous way.
3	Prerequisites and learning activities	The student must have knowledge of General Pharmacology and Toxicology.
4	Teaching methods and language	Lectures Language: Italian Ref. Text books -B.G. Katzung, *Farmacologia generale e clinica*. Piccin, Padova (last edition). -T.M. Speight, N.H.G. Holford (Eds*.). Farmacologia e terapia di Avery*. Zanichelli, Bologna (last edition). -L. Annunziato, G. Di Renzo (Eds.). *Trattato di Farmacologia*, vol. I-II. Idelson-Gnocchi, Napoli (last edition). -*Goodman & Gilman's the Pharmacological Basis of Therapeutics*. McGraw-Hill, New York (last edition). -C.D. Klaassen (Ed*.). Casarett & Doull's Toxicology*. McGraw-Hill, New York (last edition).
5	Assessment methods	Summative assessment: Oral exam that consists of 3 questions aiming to evaluate the degree of knowledge and understanding of the principles governing the interactions between drugs and the body, the capacity to explain the effects of certain drugs and the awareness of the ethical implications in the development and use of drugs in treatment of patients.

Programme of "STRATEGIE DIAGNOSTICHE CONVENZIONALI ED AVANZATE" ***"CONVENTIONAL AND ADVANCED DIAGNOSTIC STRATEGIES"*** **This course is composed of three Modules: 1) Conventional and Advanced Diagnostic Strategies I, 2) Conventional and Advanced Diagnostic Strategies II, 3) Conventional and Advanced Diagnostic Strategies III**		
B0407, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 2nd Year, 1st Semester**		
Number of ECTS credits: 18 (workload is 300 hours; 1 credit = 25 hours)		
1) CONVENTIONAL AND ADVANCED DIAGNOSTIC STRATEGIES I (8 ECTS)		
Teachers: Francesca ZAZZERONI, Edoardo ALESSE		
1	Course objectives and Learning outcomes	The main aim of this course is to provide technical knowledge regarding some conventional and advanced technologies used in diagnostic field. The understanding of the basic principles underlining these technologies should allow the students to critically understand why such techniques are used as diagnostic strategies for specific pathologies and which are their potentialities and limits.
2	Dublin descriptors	Topics of the module include: - Techniques for preparation of polyclonal and monoclonal antibodies - Immuno-based conventional and advanced techniques - Flow Cytometry - Radioisotope techniques - Conventional and advanced techniques for the analysis of genetic disorders - Conventional and advanced techniques for the analysis of protein-DNA and protein-protein interactions On successful completion of this module, the student should o have profound knowledge regarding the applications of the technologies listed above

		and used both in basic research and in diagnostic field; o acquire competence in defining the appropriate use of specific methodologies focused on the analysis of genes and protein products involved in pathogenesis processes; o have knowledge and understanding of the theory, the applications, the power and the limits of the technologies listed above; o demonstrate ability to correctly interpret data obtained by using the technologies listed above; o acquire communication skills and adequate terminology in presenting topics in medical biotechnology; o demonstrate capacity for reading and understanding other texts on related topics.
3	Prerequisites and learning activities	The student must know the basic notion of cell biology, immunology, pathology, molecular biology
4	Teaching methods and language	Lectures Language: Italian Ref. Text books -- F. Pasquinelli , *Diagnostica E Tecniche Di Laboratorio* vol.3 and 4, Rosini Editrice Firenze, 1994. - l. Spandrio , *Principi E Tecniche Di Chimica Clinica,* Piccin-Nuova Libraria, 2000. - Wilson K, Goulding H, *Biochimica Applicata,* Cortina Raffaello editore, 1989. - Tsongalis G.J., Coleman W.B. *Molecular diagnostics,* AACC press, 2002. - G. Mazzini, M. Danova, *Citometria a Flusso. Applicazioni cliniche dell'analisi del DNA in oncologia*. Forum Service editore, 1995.
5	Assessment methods	Summative Assessment: Oral exam that consists of 3 questions intended to ascertain the capacity to discuss and explain with clear sentences and appropriate scientific language the main conventional and advanced technologies used in diagnostic field, and to integrate the scientific cultural background in analyzing and synthesizing new concepts.
2) CONVENTIONAL AND ADVANCED DIAGNOSTIC STRATE II (5 ECTS)		
Teacher: Monica DI PADOVA		
1	Course objectives and Learning outcomes	The course is designed to provide the student with the knowledge about the evolution of diagnostic strategies to identify and characterize pathogens and tumor markers, to evaluate biomarkers, to identify genetic mutations, to predict the predisposition for congenital diseases, to perform early prenatal diagnosis, to improve the therapeutic approaches. The objective will be achieved through the study of the diagnostic significance of "conventional" tests and of new molecular tests applied, routinely and / or for research purposes, in diseases with different etiology. On successful completion of this module, the student should understand the current diagnostic strategies in integrating or improving the diagnosis, the therapy, the prevention of diseases.
2	Dublin descriptors	Topics of the module include: - Laboratory medicine and clinical diagnosis: purpose, principles for the diagnostic accuracy, Quality system management, Pre-analytical and analytical variability in laboratory testing. Role and potentiality of molecular diagnostics in clinical application. Performance, data analysis, standardization and issues of molecular tests in the clinical diagnosis. - Conventional laboratory medicine and new biotechnology / molecular approaches in diagnostic and prognostic of diseases with different etiology: pathogenesis, clinical significance of routine laboratory investigations, application and potential/limits of molecular tests in diagnosis or 'prediction' some ✓ Genetic Diseases ✓ Infectious Diseases of bacterial, viral and parasitic etiology ✓ Tumors with high incidence. On successful completion of this module, the student should o have profound knowledge of contribution in the biomedical field of basic and molecular technologies; o have knowledge and understanding of molecular diagnostics as integration/evolution of conventional laboratory medicine; o demonstrate ability to individuate the potentiality and/or the limits of the laboratory data/ molecular test in basic research, diagnosis and prevention; o acquire communication skills and adequate terminology in presenting topics in medical biotechnology; o demonstrate capacity to read and understand other texts on related topics.

3	Prerequisites and learning activities	The student must know the basic notions of: molecular pathology, genetic, microbiology, molecular biology.
4	Teaching methods and language	Lectures Language: Italian Ref. Text books - Balestrieri, D'Amora, Giordano, Napoli, Pavan '*Diagnostica molecolare nella medicina di laboratorio,* vol IX, 2009 PICCIN. - Antonozzi E Gulletta *'Medicina di laboratorio-Logica e patologia clinica' 2013 PICCIN or* McPherson Richard A.; Pincus Matthew R.; Henry John B.*'Henry's Diagnosi clinica e metodi di laboratorio', 2010 (21e), ANTONIO DELFINO* EDITORE *or* Giorgio Federici *'Medicina di Laboratorio',* 2014 (*4e)* Mc Graw Hill. FOR ADDITIONAL INFORMATION: - Spandrio, Milanesi: 'Le analisi personalizzate nella medicina di laboratorio', 2014 PICCIN. Scientific articles / reviews recommended by the teacher during the course and available on PubMed- NCBI
5	Assessment methods	Summative assessment Oral exam that consists of 3/4 questions aiming to ascertain : - the knowledge of the diagnostic significance of "conventional" laboratory medicine and of molecular tests applied in some diseases with different etiology. - critical skill in interpreting the laboratory data/molecular tests in the biomedical field - ability to identify the potential/limits of diagnostic strategies in medical biotechnology
2) CONVENTIONAL AND ADVANCED DIAGNOSTIC STRATE III (5 ECTS)		
Teacher: Mariagrazia PERILLI		
1	Course objectives and Learning outcomes	The objective of course is to introduce students to the basic concepts of performing and interpreting molecular-based laboratory tests, explaining the appropriate use and meaning of molecular-based tests to other health care professionals, and establishing and validating new molecular methods in a clinical laboratory.
2	Dublin descriptors	Topics of the module include: - Molecular biology techniques in molecular diagnosis. DNA and RNA extraction from eukaryotic and prokaryotic cells. - Nucleic acids amplification: PCR. Allele-specific mutation detection by PCR-ARMS, multiplex PCR-ARMS and PCR-ASO. - Quantitative PCR. Real-time polymerase chain reaction: Principle, intercalating dyes, hybridization probes, methods of quantification, applications in molecular diagnostics. - Competitive oligopriming: competitive oligopriming assay, parameters affecting the efficiency of competitive oligopriming, clinical applications. - Oligonucleotide ligation assays for diagnosis of inherited diseases. PCR-OLA. LCR. - Enzymatic and chemical cleavage methods to identify genetic variation. - Mutation detection by single strand conformation polymorphism and Heteroduplex analysis. SSCP. - Capillary Electrophoresis: principle, applications. - Temperature and denaturing gradient gel electrophoresis: TGGE, DGGE and CDGE. - Sanger sequencing. - Pyrosequencing: Technology overview, applications. - Next generation sequencing. On successful completion of this module, the student should o understand the role of molecular laboratory testing in health care; o know and understand how molecular laboratory methods, based on RNA/DNA analyses, are used to detect disease-related genetic mutations and to make patient treatment decisions; o be aware of other applications of molecular-based methods are found in forensics and identify testing. o be able to reproduce DNA in a test tube, fragment it, determine its composition, change its structure, and map its genes; o know how this technology can help in diagnosing infectious disease and to screen individuals for cancer and other genetic diseases; o be able to explain how PCR technology used with DNA probes has made the detection

		of minuscule amounts of DNA possible; o be able to report and critically discuss some significant examples of the use of DNA technology in medicine; o are aware of the use of DNA probes and PCR for monitoring genetically engineered organisms in the environment and for conducting water quality tests as well. o be able to explain the recent trends in research on this field.
3	Prerequisites and learning activities	The student must know general biology, biochemistry and molecular biology
4	Teaching methods and language	Lectures Language: Italian Ref. Text books - G.P. Patrinos and W. Ansorge, *Molecular Diagnostics*, Edited by G.P. Patrinos and W. Ansorge, Elsevier Academic Press, 2005 Grody WW, Nakamura RM, Kiechle FL, Strom C. Molecular Diagnostics: Techniques and Applications for the Clinical Laboratory. Elsevier Academic Press, 2010
5	Assessment methods	Summative assessment: Oral exam that consists of 3 questions aiming to ascertain the level of knowledge and understanding of the role of molecular laboratory testing in health care, the capacity to apply the theoretical motions to practical cases, and the ability to read, understand and correctly report scientific papers.

Programme of "MODELLI BIOTECNOLOGICI SPERIMENTALI"
"EXPERIMENTAL BIOTECHNOLOGY MODELS"

This course is composed of two Modules: 1) Experimental biotechnology models I, 2) Experimental biotechnology models II

B0422, COMPULSORY
2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 2nd Year, 2st Semester

Number of ECTS credits: 10 (workload is 250 hours; 1 credit = 25 hours)

1) EXPERIMENTAL BIOTECHNOLOGY MODELS I (6 ECTS)

Teachers: Nadia RUCCI

1	Course objectives and Learning outcomes	The main goals of this course are: -To provide a background of the most relevant animal models employed to investigate the molecular mechanisms underlying a specific disease; -To apply all the techniques needed to assess the pathologic phenotype of the animal model ; -To set up pre-clinical experiments for testing alternative therapies for the treatment of a specific disease. The student will gain a general background of each disease described and of the animal models employable to investigate it. The student should also acquire the ability to identify, for each disease examined, the most suitable animal model employed according to the experimental purposes.
2	Dublin descriptors	Topics of the module include: - Ethics of the employ of animal models: when/why the use of an animal model is indispensable and all the rules that must be followed related to animal handling, in conformity with National and international laws and policies and with the Ethic Committee of the University; - Transgenic animal model: basic knowledge and most recent strategy advancements; - Description of the disease, identification of the most important animal models employed for each disease and all the tools available to evaluate the developed phenotype. The course will focus on: ✓ Cardiovascular diseases ✓ Bone diseases ✓ Chronic inflammation ✓ Neurodegenerative diseases ✓ Oncologic diseases. On successful completion of this module, the students should o have profound knowledge of all the National and International rules to be followed to set up an in vivo experiment; o have knowledge and understanding of all the strategies employable to develop a transgenic animal model;

		o have the ability to conceive and organize an in vivo experiment; o have the capacity to identify the most suitable animal model to be used according to the disease they approaching and to the specific topic they would like to investigate within the disease; o have the ability critically evaluate the advantages and the limitations of the experimental models; o have the ability to use these knowledge to evaluate the aims and/or the results of a research project o have the capacity to propose an analytical problem-solving approach and to discuss the advantages and the pitfalls of every system examined o demonstrate the ability to resume and present the scientific information.
3	Prerequisites and learning activities	The student should know the basic notions of genetic and molecular biology.
4	Teaching methods and language	Lectures Language: Italian Ref. Text books -Robbins and Cotran *Pathologic Base of the Disease,* ed. Sounders, 2009. -Free available reviews and articles (in English) that can be downloaded from "PubMed"
5	Assessment methods	Summative Assessment: Oral exam that consists of: 3 questions intended to ascertain the knowledge of the strategies employable to develop a transgenic animal model and the ability to integrate the information gained from different models to identify specific mechanisms, - report on a written scientific text for evaluating the ability to read, understand and criticize the scientific text proposed (in English).
2) EXPERIMENTAL BIOTECHNOLOGY MODELS II (4 ECTS)		
Teacher: Leonardo PAJEWSKI		
1	Course objectives and Learning outcomes	This Module has the objective of presenting the particular materials used in contact with biological systems, named biomaterials, and their application in medicine. On successful completion of this module, the student should understand the fundamental concepts of biofunctionality, biocompatibility and sterility of a medical device. This subject gives the student a grounding in the application of biomaterials in medical devices. The student is introduced to the areas of polymeric, metal and ceramic biomaterials and the course then proceeds to deal with areas such as the in vivo performance and selection of biomaterials and also the testing of biomaterials and the interaction of biomaterials with tissues. The topic includes relevant aspects of general chemical and physical properties as well as biological considerations, including the interactions between living tissue and artificial materials.
2	Dublin descriptors	Topics of the module include: - Biocompatible materials for biotechnological applications. Use of materials in medicine in the past centuries. Concepts of biomaterial and biocompatibility. Regulations and Ethics. Biofunctionality and sterility requirements. - Classes of biomaterials: metallic, ceramic and polymeric. Surface properties of materials. Surface interactions with the water and with the proteins at the interface material-tissue. Modifying the surface properties of materials. - Biomaterials control specified by ISO 10933. Registration of medical devices and requirement of the CE marking in conformity with the Directive EC 93/42. - Evolution of biomaterials and tissue engineering applications. On successful completion of this module, the student should o know and be able to explain concepts and terminology relating to biomaterials; o know and understand the structure, composition, reaction methods and properties of relevant groups of biomaterials; o know regulatory/legislative matters that affect the selection and use of biomaterials; o know and understand the potential biological and clinical effects, interactions between materials and the body, including relevant toxicological issues; o be able to make a rational selection of material based on information from manufacturers and from manufacturer independent sources; o be able to apply relevant biomaterials in general practice search, retrieve and scientifically evaluate information from manufacturers and suppliers; o be able to assess any adverse reactions to materials; o be able to critically assess the commercial pressure with respect to materials and

		techniques pass on biomaterial-related issues to patients, other health professionals and the general public.
3	Prerequisites and learning activities	The student must know the basic concepts of Chemistry and Material Science.
4	Teaching methods and language	Lectures, team work, home work Language: Italian Ref. Text books -B.D. Ratner, A.S. Hoffman, F.J Schoen, J.E. Lemons, *"Biomaterials Science. An Introduction to Materials in Medicine"*. Academic Press 2004. ISBN 0-12-582463-7. -R. Pietrabissa, *"Biomateriali per Protesi e Organi Artificiali*", Patron Editore, Bologna 1996.
5	Assessment methods	Summative assessment: Oral exam that consists of a Seminar on a medical device and of the discussion of several connected issues. The exam will assess and evaluate -the capacity to discuss the interaction between living tissue and biomaterials and to characterize biomaterials according to their biocompatibility and in vivo chemical and physical stability, -the ability to select suitable biomaterials for a particular design or application subject to appropriate design constraints whilst being mindful of economic, environmental and ethical issues; - the capacity to structure and prepare a technical report on the properties of biomaterials in a complete and coherent way.

Programme of "PROPRIETA INTELLETUALE E BREVETTI E LEGISLAZIONE EUROPEA" ***"INTELLECTUAL PROPERTIES AND PATENTS AND EUROPEAN LEGISLATION"***		
B0401, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 2nd Year, 1st Semester**		
Number of ECTS credits: 3 (workload is 75 hours; 1 credit = 25 hours)		
Teacher: Anna Rita CIONI		
1	Course objectives and Learning outcomes	The students will know and understand how in the recent years there has been an expansion in the scope of these intellectual property rights, and having examined the institutional (national and European) setting in which policy is formed, the reach and impact of these rights within individual territories. The module will also highlight areas of particular topicality where these rights have an impact such as: access to medicines and biotechnology, that are the focus of the degree course.
2	Dublin descriptors	Intellectual Property Law (IP Law) is widely acclaimed within the business world today. It is of exceedingly high importance for every undertaking, not only for major pharmaceutical companies and technology leaders. Both, lawyers and business people working in such areas are facing IP-related topics on a daily basis. Topics of the module include: - Intellectual property Italian law: ✓ Patents ✓ Patents: From the grant to the end of the patent ✓ Inventor's rights ✓ Transferability of the patent ✓ Special patents ✓ Italian's law protection - Protection of the invention without patent- Intellectual property law in Europe "European patent" and in the world "PCT". On successful completion of this module, the student should o have profound knowledge of patents; o have knowledge and understanding of intellectual property particularly; o understand and explain the most important tools used to protect the intellectual property; o demonstrate knowledge and understanding of European and Italian IP law; o appreciate the variety of institutions involved in the intellectual property field and understand their role and functions in policy making; o understand the mechanisms available for registering rights and the reasons for the

		rules on which registration rests; o be able to identify the rights in practice, explain their scope and recognise when those rights may be infringed; o be able to critically assess the development of the law and how changes in the law affect different interests; o be aware of current developments in the law and be able to report in an informed manner the ongoing debate as to the proper role of these rights.
3	Prerequisites and learning activities	No previous knowledge and skills are required.
4	Teaching methods and language	Lectures and case study discussed during lectures. Language: Italian Ref. Text books - Notes provided by the instructor
5	Assessment methods	Formative assessment: discussions and reports on case studies (25%) Summative assessment: Oral exam that consists of 3 questions aiming to evaluate the degree of knowledge and understanding of the principles governing the intellectual property protection and to assess the capacity to be autonomous in interpreting related texts and in making judgments (75%).

Programme of "TECNOLOGIE DELLA RIPRODUZIONE" ***"REPRODUCTIVE TECHNOLOGIES"***		
B0402, COMPULSORY **2nd Cycle Degree in MEDICAL BIOTECHNOLOGIES, 2nd Year, 2st Semester**		
Number of ECTS credits: 3 (workload is 75 hours; 1 credit = 25 hours)		
Teacher: Carla Tatone		
1	Course objectives and Learning outcomes	The main target of this course is to acquire knowledge about basic and advanced techniques for human assisted reproduction
2	Dublin descriptors	Assisted reproductive technology (ART) is the use of reproductive technology to treat infertility. Undertaking studies in reproductive technology will advance your understanding of how biotechnologies improve reproduction which is often of practical relevance in clinical medicine Topics of the module include: - Principles of reproductive biology: in vitro fertilization, intracytoplasmic sperm injection, embryo transfer cry preservation of sperm, oocytes, embryos and gonad tissues, fertility medication, hormone treatment, - Preimplantation genetic diagnosis, cloning, embryonic stem cells On successful completion of this module, the student should o have knowledge and understanding of the main reproductive techniques, i.e. how they were discovered, how they are applied in a clinical setting, how they can employed to threat different kinds of infertility. o have a comprehensive understanding of the origin of gametes and gametogenesis in both the male and female and be able to describe the process of fertilization and implantation in vivo and in vitro; o be familiar with routine laboratory techniques in molecular biology, cell biology and genetics applicable to human reproduction and development; o be able to describe factors that influence normal and abnormal human fetal and newborn development and growth; o be able to identify the routine clinical techniques employed for the measurement of fetal growth and for the identification of common malformations; o be able to describe the course of normal pregnancy and birth, and the common complications associated with these processes; o be able to design simple experiments to address scientific or clinical problems: o be able to recognize the contribution of related disciplines such as cytogenetics, ultrasound and counseling in infertility; o be able to evaluate the routine laboratory techniques and clinical procedures used to investigate cases of infertility; o be able to use appropriate statistical procedures to analyze the data and to present the results clearly;

		o be able to **recognize** the impact of ART on health care and be aware of connected **ethical and legal** implications.
3	Prerequisites and learning activities	The student must know cell biology, embryology, basic laboratory techniques
4	Teaching methods and language	Lectures and case study discussed during lectures. **Language**: Italian/English **Ref. Text books** -Zsolt Peter Nagy, Alex C. Varghese, Ashok Agarwal (Editors), *Practical Manual of In Vitro Fertilization: Advanced Methods and Novel Devices* , Springer 2012.
5	Assessment methods	Summative assessment: Oral exam that consists of 3 questions aiming to evaluate the degree of knowledge and understanding of the principles governing ART and their application in clinical settings and to assess the capacity to integrate the knowledge of related disciplines in a clear and autonomous way.