

## **DEGREE COURSE IN PHARMACY**

### **ACADEMIC YEAR 2017/2018**

Our Degree course in Pharmacy, held in the University of Rome Tor Vergata, is taught entirely in English with the purpose to provide the necessary knowledge in any and all aspects of drug and medicine use, whether the first discovery, the drug's development, or its supply to patients.

The course was founded by our School of Medicine and School of Science in partnership with the prestigious School of Pharmacy of the University of Nottingham and Alliance Boots, as a highly interdisciplinary school involving professors and experts from different sectors, from Chemistry to Medicine, Economics, Law as well as all subjects concerned in a complex traditional Pharmacy Course.

This relationship provides the opportunity, to our best students, to perform some stages in Nottingham University, as well as in other well organized European Universities through the Erasmus Mundus Project, emphasizing the internationalization and making this course highly competitive and innovative.

Besides the incredible educational goal, which relies on professionalism of our staff, the course requires a theoretical and practical training in order to allow to operate not only in the healthcare sector but also in the pharmaceutical industry and in the field of pharmaceutical research, as a very innovative aspect.

In addition to the traditional teaching which characterize any traditional Pharmacy Course, such as the basic subjects (statistics, general and inorganic chemistry, organic chemistry, biochemistry, pharmacology, pharmaceutical chemistry and toxicology), there are other specific matters that contribute to a pharmacological preparation and a medical and biological overview, such as the teachings of Biology (general biology, molecular biology, pharmaceutical biology, cell physiology, medicinal plant) and Medicine (human anatomy, immunology, microbiology, general pathology, internal medicine, dermato-pharmacology, clinical nutrition).

It is interesting to note that to fulfill some teaching courses is necessary to include some laboratory sessions to improve the appropriate knowledge and be able to deal with the increasing bank data in Advanced Pharmacology, Medicine and Biotechnology as a great challenge and upgrading of notions useful in the Italian and European markets, and in any international project diffused worldwide.

The didactic activity is also integrated with outstanding lectures and workshops held by qualified scientists belonging to different fields such as Pharmaceutical, Medical and Biological Sciences, all regarded as an instrument of discussion and debate to improve the students' background.

Another great innovation of this course is the introduction of the Scientific and Regulatory Assessment of New medicines, according to the new Pharmaceutical Legislation both at European and National level.

This step allows to reach a specific competence in the evaluation and assessment of a pharmaceutical dossier, which is compulsory to get the authorization by the European Medicines Agency (EMA) or national authorities to introduce the drug into the market.

All these competences and knowledge acquired by the students will be a key part declared in the Supplement Certificate, at the end of his curriculum studiorum, whose diploma is the utmost in this field.

For further information please visit the interne site at: <http://farmacia.uniroma2.it>

## Admission test

The admission requirements are based on qualifications and examination.

A total number of 100 places are available, divided as follows:

- a) 70 available to Italian citizens, EU citizens and non-EU citizens legally living in Italy, in agreement with art 26, of Law n 189/2002;
- b) 30 places are reserved to non-EU citizens resident abroad.

If the places reserved for non-EU citizens residing abroad are not fully utilized, those places will be available for applicants of the categories described in item a).

Any Italian citizens, EU citizens and non-EU citizens legally living in Italy, can participate to the admission test only if owners of a five years Diploma of Secondary School, issued by any Italian Institutes, or a qualification obtained abroad and valid for the admission to any Italian University.

The EU and non-EU citizens, legally living in Italy, in possession of a foreign certificate, will be admitted to the test after the evaluation of the certificate. In case they should be winners, their registration will be subject to the validity of the documents and qualification obtained abroad, see Circular MIUR prot. 1291 of 16/05/2008 and current laws.

Non EU students living abroad, will formalize the procedure for the enrolment through the University Foreign Student Office, Via Orazio Raimondo 18, 00173, Rome, [Studenti.stranieri@uniroma2.it](mailto:Studenti.stranieri@uniroma2.it)

## Admission Test

In order to be admitted to the Degree of Pharmacy it is necessary to take and pass a specific test. The test, written and oral, will be held on **September 25th 2017 at 9:30 am**. for further information please visit our internet site: <http://farmacia.uniroma2.it>

### COURSES

| I YEAR   | SSD              | CREDITS |
|--|------------------|---------|
| Human Anatomy                                  | BIO/06           | 10      |
| General and Inorganic Chemistry                | CHEM/03          | 6       |
| Mathematics                                    | MAT/05           | 6       |
| Physics  | FIS/01           | 5       |
| Zoology  | BIO/05           | 10      |
| Cellular and Development Biology               | BIO/06           |         |
| Organic Chemistry                              | CHEM/06          | 8       |
| II YEAR  |                  |         |
| Analytical Chemistry<br>(Laboratory methods)   | CHEM/03          | 8       |
| Microbiology and Immunology                    | MED/07<br>MED/04 | 6       |
| Molecular Biology                              | BIO/11           | 10      |
| Drug Analysis I- Methodology<br>I-Applications | CHEM/08          | 10      |
| Pharmaceutical Biology                         | BIO/14           | 7       |

|   |                   |     |
|---|-------------------|-----|
| And Pharmacology  |                   |     |
| Medical Statistics  | MED/01            | 5   |
| Biochemistry  | BIO/10            | 11  |
| Chemistry of Equilibria                                     | CHEM/01           | 6   |
| III YEAR  |                   |     |
| General Pathology   | MED/04            | 8   |
| Plant Biochemistry<br>and Physiology                        | BIO/04            | 4   |
| Medicinal Plants  | BIO/01            | 4   |
| Drug Analysis II  | CHEM/08           | 12  |
| Pharmaceutical<br>and Toxicological Chemistry (I)           | CHEM/08           | 14  |
| General Pharmacology,<br>Toxicology<br>and Pharmacogenomics | BIO/14<br>MED/03  | 12  |
| Physiology  | BIO/09            | 7   |
| IV YEAR   |                   |     |
| Internal Medicine<br>and Dermatopharmacology                | MED/35<br>MED/09  | 6   |
| Pharmaceutical and Toxicological<br>Chemistry (II)          | CHEM/08           | 12  |
| Pharmaceutical Technologies                                 | CHEM/09           | 10  |
| Special Pharmacology<br>and Therapy                         | BIO/14            | 10  |
| Neuropsychopharmacology                                     | BIO/14            | 8   |
| Chemiotherapy   | BIO/14            | 8   |
| V YEAR  |                   |     |
| Italian Pharmaceutical Legislation                          | CHEM/09           | 12  |
| European Pharmaceutical Legislation<br>and Commercial Law   | CHEM/09<br>IUS/04 |     |
| Dietistic Sciences<br>and Food Chemistry                    | MED/49<br>CHEM/10 | 8   |
| Optional Courses  |                   | 12  |
| Final Exam  |                   | 15  |
| Training  |                   | 30  |
| Total   |                   | 300 |

## Optional Courses

|  |           |   |
|--|-----------|---|
| Supplement in Pharmaceutical applications of plant metabolites |           |   |
| Applications of Plant metabolites                              | BIO/04    | 6 |
| Medical Plants   | BIO/01    | 4 |
| Nutraceuticals and human health                                | BIO/04    | 2 |
| Supplement in Clinical Trials                                  |           |   |
| Regulatory and quality aspects                                 | IUS/10    | 4 |
| Of clinical trials   |           |   |
| Experimental methodology in clinical                           | MED/42    | 3 |
| Researches   |           |   |
| Ethical and legal problems                                     | M-DEA/01  | 1 |
| Of clinical trials   |           |   |
| Clinical monitoring in clinical trials                         | MED/09    | 3 |
| Contract research organization                                 | SECS-P/10 | 1 |
| business management  |           |   |
| Clinical Biochemistry  | BIO/12    | 3 |
| and Clinical Molecular Biology                                 |           |   |
| Applied Biochemistry   | BIO/10    | 3 |

## PROGRAMS

### HUMAN ANATOMY 10 CREDITS

Prof. Pellegrino Rossi

Dr. Barchi Marco

FIRST PART: HISTOLOGY AND LOCOMOTOR SYSTEM (Prof. Marco Barchi).

HISTOLOGY: Histology and its methods of study. EPITHELIAL TISSUES, CONNECTIVE TISSUES, NERVOUS TISSUE, BLOOD, MUSCLE TISSUES. General organization of the axial and appendicular skeleton, joints structure and classification. Major muscles of the shoulder girdle and of the trunk, respiratory muscles.--SECOND PART: NEURO-CARDIO-SPLANCHNOLOGY (Prof. Pellegrino Rossi) Neuroanatomy, Cardiovascular System and Splanchnology.

Knowledge of the essential morphological characteristics of the the Nervous System, of the Cardiovascular Apparatus and of the visceral organs, including digestive, urinary, reproductive, respiratory and endocrine systems.

#### Suggested textbooks

1) Martini Timmons: Human Anatomy

oppure 2) Tortora: Human Anatomy

oppure 3) Gray's Basic Anatomy

e (integrazione per l'Istologia) 4) Anthony L. Mescer: Junqueira's Basic Histology.

### GENERAL AND INORGANIC CHEMISTRY 6 CREDITS

Prof. Claudia Crestini

Units and Conversion factors, Dalton's Theory Structure of the atom. Ionic compounds. Covalent compounds. The mole. Balancing chemical equations. Stoichiometrical calculations. Laws of the gases. Energy, law of energy conservation. State functions. Enthalpy. Calorimetry. Hess's Law. Quantum theory and atomic structure. Electron configuration and chemical periodicity. Ionic

bonding model. Covalent bonding model. VSEPR theory and molecular shape. orbital hybridization. Types of covalent bond. Physical states and phase changes. Intermolecular forces. Liquid state. Properties of solutions. Colligative properties. Equilibrium state and equilibrium constant. Le Chatelier's principle. Acids and bases. Hydrolysis of salts. Buffers. Titrations. Solubility equilibria. Second law of thermodynamics. Entropy free Energy and work. Balancing of redox reactions. Voltaic cells

#### [Suggested textbooks](#)

Silberberg. Principles of General Chemistry Mc Graw Hill

### **MATHEMATICS 6 CREDITS**

Prof. Daniele Bertaccini

Numbers. Inverse formulas, change of scales and order of magnitudes in formulas; equivalence relations; errors in measures and calculations. Functions of one real variable: basic concepts, graphs, elementary functions (polynomials, roots, rational functions, trigonometric, exponentials and logarithms); Sequences; series, binomial coefficients; Limits; Geometric sums; Continuous functions; Differentiation: derivatives, monotonicity and concavity, extrema, sketching graphs; Taylor formula and polynomial approximation of functions. Riemann Integration; Definite integration: the fundamental theorem of calculus; Techniques.

Introduction to the software for approximating and plotting functions, approximation of definite integrals, linear and nonlinear systems. Introduction to the simulation of Phenomena in Medicine and drug preparation.

#### [Suggested textbooks](#)

Calculus for biology and medicine (2nd ed.), C. Neuhauser, Prentice Hall (2nd international edition). Ed. Pearson educational international, 2003.

Appunti dalle lezioni

### **PHYSICS 5 CREDITS**

Dr. Massimiliano Lucci

Introduction to physics; SI System of units, Kinematics of point-like objects;

- Dynamics of point-like objects; Work, energy, potentials;
- Linear momentum, collisions; Extended bodies; Elastic properties of materials;
- Properties of fluids;
- Thermodynamics: Calorimetry, Heat Transfer Processes.
- Electricity and magnetism;
- Light and sound.

#### [Suggested textbooks](#)

Serway, Jewett: "Physics for scientists and engineers" Halliday,

Joseph W. Kane Morton M. Sternheim "Life Science Physics"

John Wiley & Sons. "Fisica Biomedica" EMSI.

Schede ed esercizi del docente.

### **ZOOLOGY CELLULAR AND DEVELOPMENT BIOLOGY 10 CREDITS**

Prof. Mauro Piacentini

The Program in Cell Biology offers to undergraduate students in Pharmacy the basic knowledge on cellular biology, genetic and molecular approaches to address structure-function relationships associated with cell growth, differentiation; chromatin structure; transcriptional control of gene expression; DNA replication; RNA structure. In particular the structure and function of the main organelles is analyzed. In addition an introduction to Reproductive Biology aimed to understand the scientific principles that govern reproduction in humans is also addressed during the course. The students will learn the requirements for reproduction, including the production of sufficient numbers of viable gametes, fertilisation, implantation in the uterus, formation of a placenta.

#### [Suggested textbooks](#)

The Cell: A Molecular Approach. Cooper G M and Hausman RE

## **ORGANIC CHEMISTRY 8 CREDITS**

Prof. Gianfranco Ercolani

Review of the concepts of chemical bonding, hybridization, resonance, and molecular structure. Acidity and basicity of organic compounds. Functional groups and principles of IUPAC nomenclature. Stereochemistry of organic compounds. Nomenclature, properties, and reactions of alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alkyl halides, alcohols, thiols, ethers, sulfides, aldehydes, ketones, carboxylic acids and derivatives, amines, and heterocyclic compounds. Introduction to the structure and properties of bioorganic compounds: amino acids, peptides and proteins (primary structure), carbohydrates, triacylglycerols, phospholipids, nucleosides, nucleotides, and nucleic acids (primary structure).

### [Suggested textbooks](#)

- 1) John McMurry "Organic Chemistry with Biological Applications" 2nd International Edition – Brookscole, 2010. ISBN: 0495391476
- 2) Susan McMurry "Study Guide and Student Solutions Manual for McMurry's Organic Chemistry with Biological Applications 2e" BrooksCole, 2010. ISBN: 049539145X

## **ANALYTICAL CHEMISTRY 8 CREDITS**

Prof. Giuseppe Palleschi

Acid base titrations Determination of the unknown concentration of acetic acid. Precipitation titration with Mohr method: Detection of unknown concentration of chloride with silver nitrate. Complexometry titrations Detection of Calcium ions in the water. Redox titration: Detection of hydrogen peroxide with potassium permanganate.

### [Suggested textbooks](#)

Gary Christian: analytical chemistry Piccin or any book of analytical chemistry at university level.

## **MICROBIOLOGY AND IMMUNOLOGY 6 CREDITS**

Prof. Francesca Ceccherini Silberstein (5 credits)

General and special virology: Nature, origin and morphology of viruses. Oncogenic RNA and DNA viruses. Virus-cell interaction. Vaccines. Antiviral therapy and resistance. Adenovirus. Herpesvirus. Poxvirus. Papovavirus. Parvovirus. Picornavirus. Hepatitis viruses. Retrovirus. Orthomyxovirus. Paramyxovirus. Rhabdovirus. Togavirus and other viruses transmitted by insects. Filoviruses. Rubella virus. Reovirus and rotavirus. Prions.

General and special bacteriology: The bacterial cell. Metabolism and bacterial growth. Host-parasite relationship. Immune sera and vaccines. Principles of microbiological diagnostics. Antibacterial drugs and resistance. Staphylococci. Streptococci. Pneumococci. Enterococci. Bacilli and clostridia. Enterobacteriaceae. Pseudomonas. Vibrios. Helicobacter. Neisseria.. Mycobacteria. Treponema Pallidum. Mycoplasma. Rickettsiae. Chlamydia.

General and special parasitology: Protozoan parasites of man. Cestodes, trematodes and nematodes of human relevance. Arthropod pests and vectors of major human parasitic diseases.

General and special mycology: The mycetes: structure, dimorphism and replication. Mechanisms of pathogenicity. Mycosis by opportunistic fungi. Mycosis superficial, skin, subcutaneous and systemic.

### [Suggested textbooks](#)

Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller "Medical Microbiology"

## **IMMUNOLOGY**

### **Module II**

Dr. Florence Malisan (1 credit)

Description of Innate and Adaptive Immunity - Antibodies- B cells- Cytokines- Major Histocompatibility Complex (MHC)- Antigen presentation, dendritic cells- T cell development, thymic selection- T cell subsets- T cell activation - Cell mediated immunity - Humoral immunity - An overview of immunopathology including allergy, immunodeficiency, tolerance, autoimmunity, and tumor Immunity

#### [Suggested textbooks](#)

Basic Immunology, Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai, 5th Edition, Elsevier.

## **MOLECULAR BIOLOGY            10 CREDITS**

### **Module I (5 credits)**

Dr. Maria Cristina Piro

DNA stores biological information.

Nucleotides: structure and properties. The double helix. Semiconservative replication. Chemistry of DNA. Supercoiling.

DNA packaging. Chromatin components and structure. Histone-DNA interactions. Histone post-translational modifications. Gene expression and methylation.

DNA replication.

Bacterial genome is a single replicon while eukaryotic chromosomes contains many. Origin of replication. DNA polymerases. Proteins participating to DNA replication. The two DNA strands are replicated in a coordinated manner. Systems that repair DNA. Mutability and DNA repair. Homologous recombination. Transposition.

Translation.

Genetic code. tRNA and mRNA roles. Ribosomes: structure and function. tRNA activation. Codon-anticodon recognition. Initiation, elongation and termination of protein synthesis.

#### [Suggested textbooks](#)

Watson- Molecular Biology Of The Gene 6 or 7th Edition

### **Module II (5 credits)**

Prof. Eleonora Candi

RNAs - mRNA: structure and function. Eukaryotic mRNAs structure. Eukaryotic mRNAs splicing and processing. Transfer RNA: structure and function. Ribosomal RNA: structure and function. MicroRNAs. LncRNAs.

Transcription and its regulation - Bacterial RNA polymerases. Sigma factors and the control of bacterial transcription. Transcription units. Bacterial transcription: initiation, synthesis and termination. Eukaryotic RNA polymerases. RNA polymerase II promoters. Transcription factors cooperating with RNAPol II in transcription initiation. The process of mRNA transcription initiation. Transcription factors: DNA sequences recognition, structures and function. General mechanisms for activation or repression of transcription. Chromatin structure and transcription. Histone methylation and acetylation regulate transcription.

Genome - Sequence components. Repetitive and non-repetitive DNA. Genes: shapes, sizes and structures. Polycistronic bacterial genes. Gene families.

Gene isolation - Restriction enzymes. Plasmids. DNA sequences. Vectors for cloning DNA. DNA cloning.

DNA technology - Nucleic acids hybridising. Methods for studying mRNA expression. Polymerase chain reaction. DNA/RNA sequencing. Cloned genes can be expressed in prokaryotic and eukaryotic systems.

#### [Suggested textbooks](#)

1) Text book: Molecular Biology of the Gene, Watson, Baker, Bell, Gann, Levine, Losick. Pearson International Edition.

2) Scientific seminars on different molecular biology topics organized every year in which the students are invited.

## **DRUG ANALYSIS 10 CREDITS**

Prof. Laura Micheli (6 credits)

I- Methodology

I-Applications

The program of this course is performed in parallel with the course of Equilibria of Chemistry, which supports the theory part of what is dealt with in class.

- Safety standards, classes and hazard symbols of noxious substances and first aid.
- Basic techniques and operations: solubilization, dilution, filtration, centrifugation, extraction. Description of the laboratory equipment and basic laboratory practice
- Theoretical aspects of the processes of solubilization, extraction and precipitation.
- Preliminary testing. Dry tests: flame tests, preliminary essays.
- Systematic analysis of cations analytical groups.
- Systematic analysis of anions analytical groups.
- analysis of Ions of pharmaceutical interest:
- Analytical reactions of
- Analysis of the anions

### [Suggested textbooks](#)

D. Harris – Analytical Chemistry - W. H. Freeman and Company

## **DRUG ANALYSIS I-APPLICATIONS, MOD. 2**

Introduction to therapeutic drug monitoring: clinical utility and indications, blood sample collection and processing. Serum drug concentrations and their significance.

Specific drug groups: therapeutic range, elimination half-life, recommendation for blood sampling, elimination, clinical aspects. Immunosuppressive drugs (cyclosporine, tacrolimus), antiepileptic drugs (carbamazepine, phenytoin, phenobarbital, valproic acid) , antibiotics (vancomycin, amikacyn), antineoplastic drugs (metotrexat), lithium, theophylline, digitoxin.

Specific drug of abuse: alcohol, cocaine, opiates, barbiturates, cannabinoids, amphetamines.

Abuse of drugs in sportsmen: general concepts, screening methods and confirmation tests.

Introduction to Pharmacogenetics: the need for predictive pharmacogenetics-based therapeutic recommendations.

Applications in oncology, gastroenterology, rheumatology, psychiatry, acute and chronic pain, cardiovascular diseases.

Assay techniques: restriction length polymorphisms, sequencing, microarray.

Specific polymorphic metabolizing enzymes and proteins involved in Pharmacogenetics: cytochromes P450 family, glutathione s-transferases, N-acetyltransferase, thiopurine s-methyltransferase, UDP-glucuronosyltransferases, dihidropirimidina deidrogenasi, oppioid receptor, catecol-O-methyltransferase, P-glycoprotein.

## **PHARMACEUTICAL BIOLOGY AND PHARMACOLOGY 7 CREDITS**

Dr. Beatrice Macchi

General principles on drug discovery. Rational drug design and druggable targets, drug discovery and development.

How drugs act: general principles: Evaluation of drug –receptor interaction: Agonist, partial agonist, antagonist, allosteric potentiation, allosteric inhibition, inverse agonist

Biopharmaceuticals and drug targets:Therapeutic monoclonal antibodies, RNA target: The proteasome pathway, Cell cycle checkpoints, Apoptosis : principle of apoptotic mechanisms: Drugs promoting and inhibiting apoptosis, Mitochondria, Metabolism, Interferon, Epigenetic-enzymes, Telomere structures and telomerase:

DNA: nuclear receptors; DNA repair enzymes, Genome Editing: The CRISPR/Cas system. Drug Targets in Neurodegeneration,, Authophagy and mTOR system.

### [Suggested readings](#)

J. L. Medina-Franco, M. A. Giulianotti,G.S. Welmaker, R. A. Houghten. Shifting from the single to



the multitarget paradigm in drug discovery. *Drug Discovery Today*. 2013. 18: 495-501.

-Beck A, Wurch T, Bailly C, Corvaia N. Strategies and challenges for the next generation of therapeutic antibodies. *Nat Rev Immunol*. 2010 May;10(5):345-52.

-Rask-Andersen M, Almén MS, Schiöth HB. Trends in the exploitation of novel drug targets. *Nat Rev Drug Discov*. 2011 Aug 1;10(8):579-90.

-Gashaw I, Ellinghaus P, Sommer A, Asadullah K. What makes a good drug target? *Drug Discov Today*. 2012 Feb;17 Suppl:S24-30.

-Watts JK, Corey DR. Silencing disease genes in the laboratory and the clinic. *J Pathol*. 2012 Jan;226(2):365-79.

De Strooper B, Iwatsubo T, Wolfe MS. Presenilin and  $\gamma$ -secretase: Structure, Function and Role in Alzheimer disease. *Cold Spring Harb Perspect Med* 2012 Jan 2(1):a006304

Libri di testo

Rang and Dale's Pharmacology Ottava edizione (2016), HP Rang, MM Dale, Ritter JM, Flower RJ, Henderson G. Elsevier

The Cell: A Molecular Approach, Sesta Edizione (2013) Geoffrey M. Cooper and Robert E. Hausman, ASM Press and Sinauer Associates, Inc.

## **MEDICAL STATISTICS 5 CREDITS**

Dr. Simona Iacobelli

Elements of descriptive statistics: frequency distributions, histogram, position and variability indexes. Elements of probability theory: basic rules and main probability distributions. Elements of frequentist statistical inference: repeated sampling principle, properties of estimators, estimation by confidence intervals, intuitive principles and basic elements of hypothesis testing. Main applications: T-test on the mean and on the proportion; study of relationships for independent samples (Chi-Square test, T-test, correlation coefficient and the regression line). Introduction to survival analysis. Notion of confounding and relative methods (multi-variable models, prospective clinical trials)

### [Suggested textbooks](#)

- "An introduction to medical statistics", Bland M, ed. Oxford Medical Publications (or Italian version "Statistica medica", ed. Apogeo)
- "Medical statistics at a glance", Petrie A, Sabin C, Ed.: Wiley-Blackwell

## **BIOCHEMISTRY 11 CREDITS**

### **Module I**

Prof. Maria Rosa Ciriolo (6 Credits)

Overview of Intermediary Metabolism. Bioenergetics: The Role of ATP. Nutrition: Digestion and Absorption of Proteins, Lipids and Carbohydrates. Carbohydrates metabolism: assimilation, degradation – Glycolysis reactions and regulation. Galactose, Mannose and Fructose metabolism. Pyruvate destiny. Glycogen metabolism: synthesis, degradation and metabolic regulation, pathologies associated. The Pentose Phosphate Pathway: reactions, physiological implications, regulation, pathologies associated (Favism). Lipid metabolism: assimilation, transport, lipoproteins. Glycerol degradation. Oxidation (alpha, beta and omega) of even and odd fatty acids, saturated and unsaturated, propionyl moiety, metabolic regulation. Ketone bodies. Pyruvate dehydrogenase complex, mechanism, acetyl-CoA production, metabolic regulation. The tricarboxylic acid cycle, reactions and metabolic regulation. Mitochondrial electron transport chain complexes, redox potential, ubiquinone cycle. Oxidative phosphorylation: chemiosmotic theory, F<sub>0</sub>F<sub>1</sub> ATP synthase structure and function, energetic yield. Malate/aspartate shuttle, Glycerol 3-phosphate shuttle. Biological Nitrogen fixation. The destiny of amino group of aminoacids: structure and function of transaminases. Glucose/alanine cycle. Urea cycle: reactions and metabolic regulation. Gluconeogenesis. Cori's cycle. Glycoproteins biosynthesis. Fatty acids biosynthesis, elongation, unsaturation and regulation. Triacylglycerols and phospholipids synthesis. Ceramides synthesis. Sphingolipids synthesis. Biosynthesis of Arachidonic acid and other lipids of interest. Leukotrienes synthesis. Biosynthesis of cholesterol and its derivatives. Purines and Pyrimidines synthesis and degradation, synthesis of deoxyribonucleotides and of thymidine. Uric acid production. Pathologies

associated with altered purine metabolism..

#### [Suggested textbooks](#)

Lehninger Principles of Biochemistry  
of David L. Nelson and Michael M. Cox

#### **Module II**

Prof. Gerry Melino (5 credits)

Foundations of Biochemistry. Water. Weak interactions in aqueous systems. Ionization of water, weak acids, weak bases. Buffers. Water as reactant.

Aminoacids: structure and physical-chemical properties.

Peptides and proteins. Peptides charge. Methods to analyze, separate and characterize proteins.

Primary structure of proteins. Three dimensional structure of proteins. Protein secondary structures.

Protein tertiary structure: motifs, folds and domains. Protein denaturation, folding and disease.

Hemoglobin and Myoglobin: structures, functions, oxygen binding properties and curves.

Enzymes: structure, classification, mechanism of action. Mechanisms of catalysis. Enzyme's kinetics: Michaelis and Menten equation and constant. Enzyme inhibition, reversible, irreversible, competitive, uncompetitive, mixed. Enzyme regulation: non covalent/allosteric, covalent reversible, covalent irreversible.

Water soluble vitamins: structure and function.

Carbohydrates, structures and functions: Monosaccharides and disaccharides. Polysaccharides.

Glycoconjugates : Proteoglycans, Glycoproteins and Glycolipids.

Lipids. Storage lipids. Structural lipids in membranes. Sterols. Eicosanoids. Lipid soluble vitamins: structure and functions. Biological membranes and transport. Structure and function of biological membranes

Biosignaling: G protein-coupled receptors and second messengers. Receptor tyrosine kinases, the insulin signaling. Guanylyl cyclases. Regulation of transcription by steroid hormones.

Introduction to bioenergetic and metabolism.

#### [Suggested textbooks](#)

Lehninger Principles of Biochemistry 5th, 6th or 7th Edition  
by David L. Nelson (Author), Michael M. Cox (Author)

### **CHEMISTRY OF EQUILIBRIA 6 CREDITS**

Prof. Giuseppe Palleschi

Aim: the chemical basis of the solution, fundamental principles of thermodynamics and electrochemical properties. Chemical equilibria; The reaction kinetics and the catalysis; The basic thermodynamics of the chemical equilibria; The heat, the enthalpy, the entropy and the Gibbs free energy; The redox reactions and the basis of electrochemistry; The solutions; The electrolytes; The ionic dissociation and the weak dissociation equilibria; The hydrolysis of salts; The buffers; The pH scale; Basic electrochemistry, the conductivity and potentiometry; The Nernst equation and the electrochemical scale of redox potentials; The coordination chemistry in solution and its use for chemical analysis and microanalysis;

#### [Suggested textbooks](#)

### **GENERAL PATHOLOGY 8 CREDITS**

Prof. Roberto Bei (3 credits)

Prof. Vittorio Colizzi (5 credits)

Cell injury. Cellular stress. Cellular adaptations. Necrosis. Apoptosis.

General features of inflammation: Acute inflammation: historical highlights, vascular changes; cellular events: leukocyte extravasation and phagocytosis. Adhesion molecules involved in the inflammatory response. Chemotaxis. Defects in leukocyte functions. Chemical mediators of inflammation. Outcomes of acute inflammation.

Neoplasia: Definitions. Biology of tumor growth: benign and malignant neoplasms. Molecular basis of cancer. Carcinogenic agents: chemical carcinogenesis. Microbial carcinogenesis: oncogenic DNA viruses, oncogenic RNA viruses.

Liver physiopathology: general features of hepatic diseases. Hepatic failure. Cirrhosis. Portal

hypertension. Bilirubin and bile formation. Causes and classification of jaundice. Hereditary hyperbilirubinemias. Cholestasis. Viral hepatitis. Ascites.

#### [Suggested textbooks](#)

Robbins & Cotran, Pathologic Basis of Disease.

Rubin's Pathology: Clinicopathologic Foundations of Medicine.

### **PLANT BIOCHEMISTRY AND PHYSIOLOGY 4 CREDITS**

Prof. Patrizia Aducci

Role of plants in food, environment, drugs, alternative energy resources. Pharmaceuticals and nutraceuticals derived from plants

Organization of the Plant Cell:

Cell Wall, Membranes and Organelles.

Water and Solute Transport:

Water absorption and transport . Passive and Active transport of Solutes. Membrane Transport Processes. Membrane Transport Proteins: Channels, Carriers, ATPases. Translocation of Photosynthates in the Phloem: Phloem loading; The Pressure-Flow Model.

Biochemistry and metabolism

Photosynthesis: the Light Reactions:

Introduction; Organization of the Photosynthetic Apparatus; Mechanism of Electron Transport; Proton Transport and ATP Synthesis; Photoinhibition and Photoprotection.

Photosynthesis: the Carbon Reactions:

The Calvin Cycle: Reactions and Regulation; The C<sub>2</sub> Oxidative Photosynthetic Carbon Cycle; Adaptations of Photosynthesis: The C<sub>4</sub> Carbon Cycle; Crassulacean Acid Metabolism (CAM).

Biosynthesis of Starch and Sucrose.

Plant Hormones:

Regulatory role and general properties of plant hormones.

Structure, activities and mode of action of Auxin

#### [Suggested textbooks](#)

Taiz, Zeiger, Moller, Murphy

Plant Physiology and Development Sixth Edition 2015

Sinclair Associates Inc Publishers

Sunderland Massachusetts

USA

### **MEDICINAL PLANTS 4 CREDITS**

Prof. Antonella Canini

Plant cell, plant tissues (structure and function), plant metabolism, secondary metabolites (structure, classification and function), extraction and analytical methods of plant compounds, Angiosperms (classification, flower, fruit), plant bioactive molecules: source, geographical distribution of the origin plants, effects on animal and humans (Apocynaceae, Papaveraceae, Menispermaceae, Cannabaceae, Salicaceae, Solanaceae, Asteraceae, Rubiaceae, Sterculiaceae, Erythroxylaceae, Malvaceae, Scrophulariaceae, Rutaceae, Leguminosae, Zingiberaceae, Orchidaceae, Liliaceae, Aloeaceae, Iridaceae, Lamiaceae, Theaceae, Araliaceae, Hypericaceae, Valerianaceae, Apiaceae, Loganiaceae, Cactaceae, Dioscoreaceae, Gymnosperme, Fungi).

#### [Suggested textbooks](#)

CHEMISTRY, BIOSYNTHESIS AND BIOACTIVITY OF NATURAL COMPOUNDS. III EDITION. PICCIN. PAUL M. DEWICK

### **DRUG ANALYSIS II 12 CREDITS**

Prof. Gaetano Barbato (6 credits)

Module I

1. Elementary Analysis (HCN analysis, Calcination, minimum formula) 2. Signal digitalization 3. IR spectroscopy, spectra analysis 4. Mass Spectrometry, spectra analysis 5. NMR spectroscopy,

spectra analysis 6. Analysis strategy of unknown compounds by the combined use of points 1-5. Laboratories: Analysis of 8-10 compounds pharmacologically active with the studied spectroscopies.

#### [Suggested textbooks](#)

The spectrometric identification of organic compounds. Silverstein, Webster, Kiemle. 7th edition (2005) or more recent, Wiley & sons. ISBN-10: 0471393622

Diapositive delle lezioni distribuite in formato pdf

#### Module II

Dr. Heiko Lange (6 credits)

The teaching module will consist of lessons in which the theory behind the various techniques used for isolating and characterising organic active ingredients is covered, and a practical part, in which the theoretically discussed separation techniques and wet-chemical analyses are performed in the lab:

Topics covered in detail: Survey of functional groups in drug-like small molecules, organoleptic analyses/scientific description of chemical samples, analysis strategies, separation techniques, determination of physical properties of a sample, qualitative wet chemical analysis methods targeting elements and specific functional groups, analyses and interpretation of scientific data sets, and links between traditional wet chemical separation and analyses techniques with modern instrument-based analyses methods.

#### [Suggested textbooks](#)

summaries of course program and laboratory experiences

### **PHARMACEUTICAL AND TOXICOLOGICAL CHEMISTRY (I) 14 CREDITS**

Dr. Michelangelo Campanella

Aim: study of chemical interaction of pharmaceutical molecules with the biological system. Drugs and drugs targets: an overview; Drug discovery, design and development; Relationship of functional groups to pharmacological activity, Antisense therapeutic -agents Drug metabolism Tools of the trade; Combinatorial and parallel synthesis, computer in med chemistry, quantitative structure-activity relationship (QSAR); Selected topics: Antibacterial agents, anticancer agents, Cholinergic, anticholinergic and anticholinesterases, drugs acting on the adrenergic nervous system, opioid analgesics, antiulcer agents, drugs affecting the hormonal system, drugs affecting the cardiovascular system.

#### [Suggested textbooks](#)

An Introduction to Medicinal Chemistry of Graham L.Patrick Foye's principles of Medicinal Chemistry of Lemke, Williams, Roche and Zito

### **GENERAL PHARMACOLOGY, TOXICOLOGY AND PHARMACOGENOMICS 12 CREDITS**

Prof. Robert Nistico (10 credits)

Principles of pharmacokinetics: routes of administration and absorption of drugs. Distribution, biotransformation and excretion of drugs. Drug interactions.

Principles of pharmacodynamics: drug-receptor interaction, agonists and antagonists, allosteric modulators. Classification of receptors, adaptive responses to drugs. Mechanisms underlying signal transduction pathways. Voltage-dependent and voltage-independent ion channels.

Intercellular transmission: glutamate, GABA, acetylcholine, catecholamines, serotonin, nitric oxide, cannabinoids, opioid peptides. Synaptic plasticity.

Principles of toxicology. Drug addiction.

#### [Suggested textbooks](#)

Goodman and Gilman: Le basi farmacologiche della terapia, XII ed. Zanichelli

Bertram Katzung, Farmacologia generale e clinica, XII ed. Piccin-Nuova Libreria

Casarett & Doull: Elementi di tossicologia, VII ed. CEA

Definitions of Key Terms and Basic genetics Principles.

## **PHARMACOGENOMIC**

Prof. Paola Borgiani (2 credits)

Definitions of Key Terms and Basic genetics Principles.

The genetic inter-individual variability and the concepts of polymorphism and mutation. Principal types of genetic polymorphisms. Haplotypes.

Methodological Approaches to study inter-individual genetic variability

The role of genetic variability in the response to drugs, both in terms of efficacy and toxicity

Different types of genetic testing and their correct use in clinical practice.

The definitions of pharmacogenetics/pharmacogenomics (PGt, PGx)

Pharmacogenetics testing and clinical utility: various illustrative examples in details of application of Pharmacogenomics in safety and efficacy of drugs in different fields:

-Oncology (Irinotecan, 5FU, Tamoxifen, Cetuximab, Herbitux..)

-Cardiovascular diseases (Warfarin, Statins, Clopidogrel)

-Infectious diseases (Hiv: Abacavir, Nevirapine, HCV: Peg Interferon..)

- Therapy of pain and anesthesia

Applications of PGx in Drug Discovery and Clinical Trials. From Genotyping to Drug Label-Challenges Pharmacogenomics; The Regulatory Environment .

[Suggested textbooks](#)

PDF Files By Professor and

Book:

"Pharmacogenomic Testing in Current Clinical Practice"

(Implementation in the Clinical Laboratories

Molecular and Translational Medicine

Editors: Wu, Alan H. B., Yeo, Kiang-Teck J. (Eds.);

some parts of "Genomic and Personalized Medicine" Pharmacogenomics Ed Geoffrey S Ginsburg

## **PHYSIOLOGY 7 CREDITS**

Prof. Cristina Zona

Cytoplasmic membrane structure and functions. Action potential and its propagation. Electrical and chemical synapses. Neurotransmitters and their receptors. Neuromuscular junction. Molecular basis of skeletal muscle contraction. Cardiac muscle and smooth muscle. Pacemaker activity of the heart. Systole and diastole. The ECG. Relationships between pressure, flow and resistance. The medullary cardiovascular center. The blood. Gas exchange and transport. Control of ventilation. The Urinary system. The glomerular filtration, the tubular reabsorption and secretion. RAA system. The Nervous System. Cerebral cortex, basal nuclei, thalamus and hypothalamus, cerebellum, brain stem and spinal cord. Sensory perception and motor control. Sympathetic and parasympathetic systems. Regulation of digestive function. The endocrine system. The hormones and the hypothalamus.

[Suggested textbooks](#)

1) Human Physiology: from cells to systems

Author: Lauralee Sherwood

Publisher: Brooks Cole

1) Human Physiology: An Integrated Approach

D.U. Silverthorn

## **INTERNAL MEDICINE AND DERMATOPHARMACOLOGY 6 CREDITS**

Prof. Manfredi tesauro (3 credits)

Endothelial function

Atherosclerosis

Heart failure

Coronary syndrome

Hypertension

Diabetes

Insulin resistance

Metabolic syndrome  
Respiratory diseases  
Liver cirrhosis  
Inflammatory bowel diseases  
Renal disorders  
Thyroid disorders  
Osteoporosis

[Suggested textbooks](#)

Notes from the lessons

Prof. Steven Nisticò (3 credits)

Aim: the principle notion of metabolic and cardiovascular dysfunction in the human being and principle of dermatology and cosmetics and their galenic application. Knowledge of principles of dermatology and cosmetology In order to deal with dermatological drugs and cosmetics. Preparation on Galenicals in dermatology.

[Suggested textbooks](#)

Slide set of the lessons

## **PHARMACEUTICAL AND TOXICOLOGICAL CHEMISTRY (II) 12 CREDITS**

Module I

Prof. Antonio Randazzo

Solubility of drugs, acidity and basicity, drug-receptor interactions, stereochemistry, isosterism, bioisosterism, pharmacokinetics, pharmacodynamics, structure and function of the receptors, signal transduction, competitive and non-competitive binding, intracellular receptors, structure-activity relationship, pharmacophore, combinatorial chemistry, computational methods.

[Suggested textbooks](#)

Notes from the lessons

## **PHARMACEUTICAL TECHNOLOGIES 10 CREDITS**

Module I

**Dr. Franco Alhaique (5 credits)**

Introduction to biopharmaceutics Blood levels and therapeutic effects. Routes of administration. Mechanisms of drug dissolution and absorption. Compartment models and pharmacokinetic parameters. Apparent distribution volume. Drug-protein interaction. Drug stability. Sterilization. Bacterial endotoxins. Limulus test. Glass for pharmaceutical uses. Isotonic and iso-osmotic solutions and calculations. Alcohol in pharmaceutical forms. Lyophilization. Interfacial phenomena. Surface tension. Surfactants. Wetting. Micelles. Disperse systems: emulsions and suspensions. Basic principles of rheology. Classification of dosage forms. An overview on the various dosage forms and their control.

Innovative dosage forms. Modified release dosage forms. Drug targeting. Lab works (Galenic preparation laboratory): preparation and control of the most usual pharmaceutical dosage forms. Labelling and price of the preparations.

[Suggested textbooks](#)

"Pharmaceutics: The science of Dosage Form Design", Edited by M.E.Aulton, Churchill Livingstone, N.Y.

"Principi di tecnologia farmaceutica" (Second Edition) P.Colombo, F. Alhaique, C. Caramella, B. Conti, A. Gazzaniga, E.Vidale, Casa Editrice Ambrosiana

"Physical Pharmacy", A.Martin Ed., Williams & Wilkins, Baltimore

Farmacopea Italiana (ultima edizione e supplementi)

Module II

Dr. Gabriella De Martino (5 credits)

This course, which gives detailed information on the various types of pharmaceutical formulations, both from the theoretical and practical points of view, will allow the formation of students provided with a valid background together with the constructive criticism needed by the pharmaceutical

technologists when facing their professional responsibilities. The experience acquired from the lessons should give the possibility to find, after the final degree, an appropriate job within a private or public pharmacies, but also in the field industrial production and control of medicines as well as in research.

#### [Suggested textbooks](#)

"Pharmaceutics: The science of Dosage Form Design", Edited by M.E.Aulton, Churchill Livingstone, N.Y.

"Principi di tecnologia farmaceutica" (Second Edition) P.Colombo, F. Alhaique, C. Caramella, B. Conti, A. Gazzaniga, E.Vidale, Casa Editrice Ambrosiana

"Physical Pharmacy", A.Martin Ed., Williams & Wilkins, Baltimore

Italian Pharmacopoeia and European Pharmacopoeia (last edition and supplements)

### **SPECIAL PHARMACOLOGY AND THERAPY      10 CREDITS**

Dr. Carolina Muscoli

Special pharmacology: Drugs acting at synaptic and neuroeffector junctional sites. Drugs Therapy of inflammation. Drugs affecting renal and cardiovascular function. Drugs affecting gastrointestinal functions. Drugs acting on the blood and blood forming organs. Principles of Toxicology.

Reference: LINK didattica WEB.2

#### **SPECIAL PHARMACOLOGY AND THERAPY - MOD I:**

Aim: The basis of pharmacology: pharmacokinetics and pharmacodynamics and classes of special drugs with their collateral effects. The basis of pharmacology: pharmacokinetics and pharmacodynamics. Special pharmacology: Drugs acting at synaptic and neuroeffector junctional sites. Drugs Therapy of inflammation. Drugs affecting renal and cardiovascular function.

Reference: LINK didattica WEB.2

#### **SPECIAL PHARMACOLOGY AND THERAPY - MOD II:**

Aim: The basis of pharmacology: pharmacokinetics and pharmacodynamics and classes of special drugs with their collateral effects. Drugs affecting gastrointestinal functions. Drugs acting on the blood and blood forming organs. Principles of Toxicology.

### **NEUROPSYCHOPHARMACOLOGY    8 CREDITS**

Prof. Robert Nisticò

Basic mechanisms of synaptic transmission. Adrenergic and cholinergic agents. Treatment of Parkinson's disease, Alzheimer's disease and multiple sclerosis. Treatment of affective and anxiety disorders. Pharmacotherapy of psychotic illness and mania. Antiepileptic agents. General and local anesthetics. Antimigraine agents and drugs of abuse.

#### [Suggested textbooks](#)

Goodman and Gilman: The pharmacological basis of therapeutics, XII ed. McGraw-Hill

Bertram Katzung, Anthony Trevor: Basic & Clinical Pharmacology, XIII ed. McGraw-Hill

### **CHEMOTHERAPY    8 CREDITS**

Prof. Grazia Graziani

Anti-microbial chemotherapy: general principles of anti-microbial chemotherapy and resistance mechanisms; antibacterial agents; antimycobacterial agents; antifungal agents; antiviral drugs; antiprotozoal drugs; antimalarial agents; antihelminthic drugs.

Anti-cancer chemotherapy: general principles of anti-cancer chemotherapy and resistance mechanisms; cytotoxic agents; differentiating agents; targeted therapies; hormonal agents.

#### [Suggested textbooks](#)

Goodman and Gilman The Pharmacological Basis of Therapeutics, dodicesima edizione, Laurence L Brunton, Bruce A. Chabner, Björn C. Knollmann, McGraw Hill.

Goodman and Gilman Manual of Pharmacology and Therapeutics, Seconda Edizione, Randa Hilal-Dandan and Laurence L Brunton, McGraw Hill.

LINKS: [www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed); [ecdc.europa.eu/en/activities/surveillance/EARS](http://ecdc.europa.eu/en/activities/surveillance/EARS)

[Net/publications/Pages/documents.aspx](http://net/publications/Pages/documents.aspx); <http://app.esac.ua.ac.be/public/>;

<http://www.who.int/topics/en/>

## **ITALIAN PHARMACEUTICAL LEGISLATION 12 CREDITS**

Dr. Maria Grazia Celeste (5 credits)

- Rules and advisory bodies in pharmaceuticals field;
- Italian National Health Service and Health Organization;
- Health Professions and the Order of Pharmacists;
- Classification and staffing plan of Pharmacy;
- Competitions and activities in Pharmacy;
- Records and material required or useful in Pharmacy;
- Definition and Classification of drugs;
- Requirements for production and drug sale;
- Advertising of drugs;
- Drug Prescriptions: requirements and obligations in shipping;
- Drug Prescriptions under the NHS: regulations;
- Particular Rules relating to: herbal products, health foods, supplements food, homeopathic, medical devices and doping;
- Psychotropic drugs: rules (stock, management and shipping) and prescription;
- Poison management;
- Supervision of pharmacies.

### [Testi consigliati](#)

P.Minghetti, Marcello Marchetti

“Legislazione farmaceutica” Ottava Edizione, CEA, 2015.

Didactic material will be provided to the student

## **EUROPEAN PHARMACEUTICAL LEGISLATION AND COMMERCIAL LAW**

Dr. Fabiola Massa (5 credits)

The pharmaceutical legislative framework is made up by Directives and Regulations as the basis for a general guideline for the EU community with the scope of setting up “harmonized standards” throughout the European Union and at the same time maintain an appropriate level of protection for public health.

The course wants to deeply analyse the rules that governing the Pharmaceutical Field, starting to the patent protection of new inventions, and ending with the introduction of the medicinal products on the market.

### [Suggested textbooks](#)

Sally Shorthose ed., Bird & Bird LLP, Guide to EU Pharmaceutical Regulatory Law, Wolters Kluwer, 2013.

## **COMMERCIAL LAW 2 CREDITS**

Unfair business-to-consumer commercial practises in the internal market and the pharmaceutical sector; Advertising of medicinal products for human use; Patent medicines and legal protection. In particular Community patent in the Decision 2011/62/EU; Industrial inventions; pharmaceutical inventions;

The legal protection of biotechnological inventions; Patents and vegetable crop diversity

## **DIETISTIC SCIENCES 8 CREDITS**

Dr. Laura di Rienzo

To know the techniques and methods of semiotics and to define the state of health and risk of disease, according to the nutritional status. To know the indicators of nutritional risk predictors of disease. To know the role of diet in the prevention of chronic degenerative diseases. To know the principles of artificial nutrition: enteral and parenteral nutrition. To know the principles of nutrigenetics and nutrigenomics.

### **SUBJECTS**

Assessment of nutritional status and energy requirements. Principles of diet therapy.

Nutrition and non communicable diseases. Principles of nutritional genomics.



- 1) Assessment of nutritional status and body composition
  - 1.1 Family and individual history;
  - 1.2 Anthropometric measurements; anthropometric measures:
    - Measurement of weight (kg), height (cm) for calculating the BMI=body weight (Kg)/height (m)<sup>2</sup>;
  - 1.3 Determination of water compartments with methodical BIA (bioelectrical impedance): Resistance, reactance, impedance and phase angle at 50 kHz frequency were measured using a BIA phase sensitive system
  - 1.4 Assessment of body composition:
    - 1.4.1 Measurement tricipitale folds, iliac and subscapular (Plicometry)
    - 1.4.2 Evaluation of body composition by DXA (dual energy X-ray absorbimetry) (i-DXA, GE Medical Systems, Milwaukee, WI, USA): determination of levels of total body lean mass (TBLean), total body fat mass (TBFat) and total body bone mass (TBBone): Appendicular Scheletar Muscle Mass Index determination;
  - 1.3 Nutritional survey of dietary habits (Food Frequency Questionnair, Simplified Nutritional Appetite Questionnaire, i.e. SNAQ questionnaire);
  - 1.4 Determination of energy expenditure (indirect calorimetry): respiratory quotients, basal metabolism, energy expenditure;
  - 1.5 Assessment of psychological profile and eating behaviour
- 2) Nutrigenetic and Nutrigenomic:
  - 2.1 Role of genetic polymorphisms in the cross-talk between adipose tissue, muscle tissue and bone to evaluate the risk of obesity, sarcopenia, osteoporosis, metabolic syndrome, cardiovascular diseases.
  - 2.2 Assessment of gene expression of gene related to obesity, sarcopenia, osteoporosis, cardiovascular diseases, inflammation and oxidative stress.
- 3) definition of phenotypes:
  - 3.1 Normal weight lean
  - 3.2 Normal weight obese, with or without metabolic syndrome
  - 3.3 Obese, with or without metabolic syndrome
- 4) Dietary treatment for a personalized medicine

## **FOOD CHEMISTRY (5 CREDITS)**

Dr. Laura di Rienzo

Foods: main composition in terms of proteins, fats and carbohydrates. Food energy as calories.

Food safety and food security: Nutrient and Hazard analysis and critical control point.

Microbial, chemical and physical hazard. Chemical preservatives. Dimethoate and Glyphosate. Foods and their conservation. The mechanism of alteration. Water activity: the role of water in food conservation. pH and Temperature control.

The peroxidation process.

The bioactive compound of the Mediterranean Diet. The Mediterranean Adequacy Index.

The Nutritional Quality Indexes.

The composition of olive oil. Fats , butter, oil and hydrogenated fats.

The composition of wine, and effects on human health.

The composition of tomato, and effects on human health.

The composition of nut (hazelnut and chestnut), and effects on human health.

The composition of chilly pepper, and effects on human health.

The composition of cocoa, and effects on human health.

Western Diet and dependence; sugar, salt and fat.

Role of antioxidant in organic compound, and effects on human health.

Microbiota and role of probiotics.

Fibers in foods. Starch and cellulose. Amilose and amilopectin. Structure and hydration properties.

The browning of foods and the Maillard reaction: Enzymatic browning. Browning by caramelization. The Maillard reaction. The Amadori products. The reaction mechanism.

Nutritional consequences of the Maillard reaction. The melanoidins.

Aromatic amines from roasted meat and their mutagenicity.

Ames test. Acrolein production in deep frying. Acrylamide in potatoes.

Additives: gelificants, thickeners and emulsifiers. Natural or synthetic sweeteners. The supercritical viscosity (ketchup). Emulsions and foams and their evolution upon time.

[Suggested textbook](#)

Didactic material will be provided to the student.