Degree in Medicine and Surgery

Course: **Pharmacology**

SSD: **BIOS-11/A (ex BIO/14)**

Number of CFU: 8

Reference Professor: **Prof. Giuseppe Caruso**

Professors**:**

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PREREQUISITES

The teaching course of Pharmacology requires previously acquired knowledge of the following subjects: Chemistry (General and Organic) and Biochemistry, Biology and Genetics, Histology and Embryology, Molecular Biology, Human Anatomy I and II, Physiology I and II, Microbiology, General Pathology.

LEARNING OBJECTIVES

The course aims to provide students with knowledge of the general principles of pharmacokinetics (absorption, distribution, metabolism, and elimination – ADME – of drugs); pharmacodynamics (molecular and cellular mechanisms underlying drug action); variability in drug response based on genetics (Pharmacogenetics); the different patient responses to pharmacological therapy based on multiple genome mutations (Pharmacogenomics); the influence of biological differences as well as cultural and socio-economic differences on the effect of drugs in each person (Gender Pharmacology); the main classes of drugs, their therapeutic uses, and their side effects (Toxicology); the toxicity of substances of abuse; the various methods of designing/developing new pharmacological molecules and experimental clinical studies.

EXPECTED LEARNING OUTCOMES

At the end of the learning process, the following results are expected, according to the "Dublin Descriptors":

● *Knowledge and understanding:* The student will have to demonstrate understanding of the information learned, in the field of general and special pharmacology.

● *Applying knowledge and understanding:* The student will have to apply the acquired knowledge to the identification of the best therapeutic approach (based on Evidence Based Medicine), based on the variability of response to drugs related to gender, age, genetic factors, main comorbidities, and most important pharmacological interactions.

● *Communication skills:* The student will have to acquire a correct use of the names of the drugs and the technical terms related to the field of pharmacology, reporting the acquired knowledge with a clear exposition.

● *Making judgements:* The student will be required to make general assessments regard- ing the covered topics.

● *Learning skills:* The student will have to demonstrate the ability to link the acquired knowledge concerning the mechanisms of action of drugs to their therapeutic and side effects.

SYLLABUS

PHARMACOKINETICS: Definition of drug; Absorption, distribution, metabolism, and elimination (ADME) of drugs; Bioavailability and bioequivalence; Drug kinetics, for single and repeated administration; Biotechnological and biosimilar drugs.

PHARMACODYNAMICS: Drug mechanisms of action: receptor-mediated and non-receptor-mediated; Receptor types and related pathways; Primary, secondary, and adverse effects of drugs; Drug-receptor interaction: agonists, partial agonists, antagonists; Allosteric modulation: positive and negative allosteric modulators.

DRUG DEVELOPMENT: Methods of drug development and discovery; Preclinical and clinical experimental studies for drug commercialization; Teratogenesis; Principles of pharmacovigilance.

PHARMACOGENETICS: Individual variability in drug response related to genetic variations in target proteins and enzymes involved in drug metabolism.

PHARMACOGENOMICS: Individual variability in drug response based on multiple genomic mutations; Study of the human genome and its products, using molecular biology and genetics techniques, for the discovery and development of new drugs.

GENDER PHARMACOLOGY: Definition of personalized medicine (related to gender, age, comorbidities); Influence of biological, cultural, and socioeconomic differences on drug effects in individuals, both in terms of efficacy (therapeutic effects) and safety (adverse effects).

DRUG EFFECTS: Therapeutic index and risk/benefit assessment of a drug; Dose-effect and time-effect curves of expected and adverse drug reactions; Drug interactions; Tolerance and addiction.

AUTONOMIC NERVOUS SYSTEM DRUGS: Agonists and antagonists (nicotinic and muscarinic) of the cholinergic system; Cholinesterase inhibitors; Sympathomimetic amines: selective α-β stimulants; α and β adrenergic antagonists (selective and non-selective).

CENTRAL AND PERIPHERAL NERVOUS SYSTEM DRUGS: Neuromuscular blockers; Drugs for migraine; Local and general anesthetics; Anxiolytics; Hypnotics and sedatives; Antipsychotics; Antidepressants and mood stabilizers; Antiepileptics; Anti-Parkinson drugs; Drugs currently used for the treatment of Alzheimer's disease; Drugs for multiple sclerosis; Antispastic drugs; Spasmolytic drugs.

ANTI-INFLAMMATORY, ANTIPYRETIC, AND ANALGESIC DRUGS: Prostaglandins, thromboxanes, prostacyclins; Non-steroidal anti-inflammatory drugs COX-1 and COX-2 selective; Steroidal anti-inflammatory drugs; Drugs for gout; Disease-modifying antirheumatic drugs; Opioid analgesics.

CARDIOVASCULAR DRUGS: Antihypertensives; Drugs for myocardial infarction; Drugs for the

treatment of
angina pectoris; Platelet aggregation inhibitors; Thrombolytic drugs; Anticoagulants; Antiarrhythmic drugs.

GASTROINTESTINAL DRUGS: Antiulcer drugs; Laxatives; Antidiarrheal drugs; Drugs that stimulate gastrointestinal motility; Antiemetic drugs; Drugs for inflammatory bowel disease.

RESPIRATORY SYSTEM DRUGS: Drugs for asthma and chronic obstructive pulmonary disease (COPD); Beta- agonist bronchodilators; Phosphodiesterase inhibitors; Anticholinergics; Antileukotrienes; Corticosteroids; Mast cell stabilizers; Histamine and antihistamines; Decongestants; Antitussives; Expectorants; Methylxanthines.

ENDOCRINE SYSTEM PHARMACOLOGY: Hypothalamic and pituitary hormones; Adrenal corticosteroids and cortisone; Insulin, antihyperglycemic, and hypoglycemic agents; Lipid-lowering drugs; Androgens, estrogens, and progestins; Contraceptives; Use of drugs during pregnancy; Drugs regulating uterine motility; Thyroid hormones and antithyroid drugs; Bone metabolism drugs.

IMMUNOPHARMACOLOGY: Immunosuppressants and immunostimulants; Vaccines and adjuvants.

ANTIMICROBIAL DRUGS: Principles of antibacterial chemotherapy: resistance, selection criteria, criteria for drug combinations, complications of antibacterial therapy; Inhibitors of bacterial cell wall synthesis; β- lactamase inhibitors; Drugs that disrupt the cell membrane; Protein synthesis inhibitors; Drugs interfering with nucleic acid metabolism; Antitubercular drugs; Antifungals; Antiprotozoals; Anthelmintics; Antivirals.

ANTICANCER DRUGS: General principles of antiblastic chemotherapy; Innovative targets of anticancer drugs; Alkylating agents; Antimitotics; Topoisomerase inhibitors; Antimetabolites; Antitumor antibiotics; Anti- hormonal drugs; Immunomodulators; Monoclonal antibodies; Tyrosine kinase inhibitors; Proteasome inhibitors; Poly-(ADP-ribose)-polymerase (PARP) inhibitors.

COURSE STRUCTURE

The teaching course consists of 80 hours of frontal lessons. Teaching tools such as PowerPoint presentations with explanatory diagrams, illustrations, and images will be used. Attendance is mandatory.

LEARNING ASSESSMENT

The Pharmacology exam consists of a written test with multiple choice questions followed by an optional oral test. The written test will consist of 36 questions with multiple choice answers, assigning 1 point for each correct answer and -0.25 points for each incorrect answer; in case of no answer, 0 points will be assigned. The final score of the written test will be given by the sum of the scores of the correct/incorrect answers and will be expressed in thirtieths. The exam is considered passed with a score greater than or equal to 18. In case of a score greater than or equal to 30, it will be considered a score of 30; to obtain honors it is mandatory to attend the oral test. In case of a score between 16 and 17.75, the student will be admitted to the oral test (mandatory) with reserve. Those who have obtained a score greater than or equal to 18 in the written test will have the opportunity to confirm the score or attend the oral test in which they are given the opportunity to improve the score obtained, demonstrating their preparation both in terms of understanding the topics related to Pharmacology and of speaking skills with a suitable scientific and medical language. The oral test, which will be held in the same session, can lead to either an improvement or a worsening of the score obtained at the written

test. In the event of failure to pass the oral test, it will be necessary to repeat the written test in the next available session.

Should the students arrive after the written test has begun, they will only be able to take the oral test.

The final exam score will be calculated according to the following criteria:

Not suitable: Poor or lacking knowledge and understanding of the topics; limited capacity for analysis and synthesis; frequent generalizations of the requested contents; inability to use a technical language.

18-20: Barely sufficient knowledge and understanding of the topics, with obvious imperfections; Barely sufficient ability of analysis, synthesis, and autonomy of judgment; poor ability to use a technical language.

21-23: Sufficient knowledge and understanding of the topics; sufficient ability to analyze and synthesize with the ability to reason with logic and coherence the required contents; sufficient ability to use technical language.

24-26: Fair knowledge and understanding of the topics; Fair ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language.

27-29: Good knowledge and understanding of the required contents; good ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use a technical language.

30-30 e lode: Excellent level of knowledge and understanding of the required content with an excellent ability to analyze and synthesize with the ability to argue the required content in a rigorous, innovative, and original way; excellent ability to use a technical language.

SUPPORT ACTIVITIES

In addition to the frontal teaching activity, students can be received by individual Professors by requesting an appointment via e-mail.

RECOMMENDED TEXTBOOKS

- ▪ Laurence Brunton; Bjorn Knollmann. Goodman and Gilman's. The Pharmacological Basis of Therapeutics, 14° Edizione McGraw Hill, 2023.

- ▪ Bertram G. Katzung, Todd W. Vanderah. "Basic and clinical pharmacology". 16° Edizione, McGraw Hill Education, 2024.