COURSE DETAILS

" MEDICAL PHARMACOLOGY AND TOXICOLOGY I"

SSD: PHARMACOLOGY BIO/14

** the SSD (scientific disciplinary sector) should be the one that is mentioned in the "Didactic Regulation of the Degree Course" and not necessarily the one of the teacher. In case of an integrated course, the SSD (scientific disciplinary sector) should be written above only if all modules of the course belong to the same SSD, otherwise the SSD is to be written alongside the MODULE (see below).*

DEGREE PROGRAMME: MEDICINE AND SURGERY

ACADEMIC YEAR 2024-2025

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE

MODULE: NOT APPLICABLE

SSD OF THE MODULE: NOT APPLICABLE

TEACHING LANGUAGE: ENGLISH

CHANNEL: A-Z

YEAR OF THE DEGREE PROGRAMME: IV

SEMESTER : I

CFU: 5

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

The student must be familiar with the anatomy and physiology of the different organs and systems targeted by therapeutic drugs. Knowledge of the cellular and molecular mechanisms responsible for the main diseases of these organs and systems, and of the homeostatic responses activated by disease states.

PREREQUISITES (IF APPLICABLE)

Biochemistry, Anatomy, Physiology, General Pathophysiology and General Pathology.

LEARNING GOALS

The course aims at providing students with basic and advanced notions related to knowledge of the following topics:

1. Classification of the drugs used to combat bacterial, parasite, viral and fungal infections; to treat neoplastic, endocrine, metabolic, immune, blood and blood-forming organs diseases. Anti-inflammatory drugs.
2. The mechanism of action and the consequent functional changes induced by these drugs on organs and/or systems (pharmacodynamics).
3. The most relevant pharmacokinetic aspects of the drugs (absorption, drug binding to plasma proteins, effective plasma concentrations, half-life, metabolism, main elimination pathways and the impact of the functional impairment of the metabolizing organs and/or excretory pathways on drug elimination).
4. The relationship between pharmacological effects and therapeutic uses.
5. Administration modalities of the above mentioned drug classes (dosages, intervals of administration, effect of food on drug absorption, pharmaceutical forms used).
6. The unwanted and toxic side effects; the most common drug interactions; the influence of gender on drug effects.
7. The rational use of the different classes of drugs on the basis of the mechanism of action, pharmacokinetic characteristic and side effects, in order to set the basis for a therapeutic strategy integrated with the notions of Clinical Pathophysiology to be further implemented in Clinical Therapeutics.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

This descriptor refers to disciplinary knowledge and describes how the student can elaborate on what has learnt to convert notions in more complex and partially original reflections.

The course provides students with knowledge and basic methodological tools needed to know:

1. the general chemical characteristics of the different classes of drugs that affect their mechanism of action, elimination and toxicity, and the mechanism through which the drugs perform their effects at the cellular and molecular level.

2. the functional changes induced by drugs in organs and/or systems, the most relevant pharmacokinetic aspects, the routes of administration and dosage, the unwanted and toxic side effects and the most common drug interactions.

3. the relationship between the pharmacological effects of drugs used for the treatment of infections, diseases of the immune system, endocrine system and metabolism, neoplastic diseases, blood diseases and inflammatory processes and their therapeutic uses.

Applying knowledge and understanding

This descriptor refers to disciplinary competence (knowing how to do something) that students need to acquire and describes how and at what level the student is able to apply in practice knowledge to solve problems in a variety of settings.

The course provides students with adequate knowledge of the pharmacological properties of drugs capable of fighting bacterial, parasitic, viral and fungal infections, neoplastic diseases, treating diseases of the endocrine system, metabolism, the immune system, inflammation and of anemia, with the aim of making students able to identify the most appropriate drugs for the treatment of specific pathologies on the basis of their mechanism of action, pharmacokinetic properties and side effects of the drug. In this way, students will be able to lay the foundations for the formulation of a therapeutic strategy integrated with the concepts of clinical pathophysiology.

COURSE CONTENT/SYLLABUS

Describe the study program listing arguments and, if applicable, allocate CFU of the course among different headlines.
*In case of **integrated course**, please specify the course content of the single module.*

General Principles.

1. Pharmacokinetics: The process of drug absorption, distribution, metabolism, and elimination.
2. Pharmacodynamics: mechanisms of drug actions and relationship between drug concentrations and effects.
3. Principles of preclinical and clinical drug development.
4. Pharmacodynamics, pharmacokinetic, side effects, toxicity, and rational use of the following classes of drugs:
   - Drugs used to combat bacterial, parasitic, viral and fungal infections.
   - Drugs affecting the endocrine system.
   - Drugs affecting metabolism.
   - Drugs affecting the immune system and related diseases.
   - Antianemic Drugs
   - Anti-inflammatory drugs.
   - Drugs used to treat neoplastic diseases.
   -

PHARMACOLOGY AND MEDICAL TOXICOLOGY I
PROGRAM

GENERAL PHARMACOLOGY

Definition of Medication, Medicament, Poison or Toxic. Active ingredients and excipients. Pharmacognosy. The branches of Pharmacology. Methods of classification of drugs according to the prescription regime: non-prescription drugs, over-the-counter (OTC) drugs, prescription drugs. Specialty and equivalent (generic) drugs. Classification of drugs according to anatomical-therapeutic-chemical classes (ATC).

Pharmacokinetics

Pharmaceutical Forms. The routes of drug administration: natural and artificial.
Principles of pharmacokinetics: drug absorption, passage of drug molecules across cell membrane, bioavailability and first pass metabolism, delayed absorption.
Concept of compartment; area under the curve; apparent volume of distribution (Vd), half-life (t 1/2); concept of "Steady-State"; breakdown of drugs in the body; selective distribution of drugs in tissues; plasma/tissue/protein binding; the blood-brain barrier.
Metabolism: Phase I and II reactions; drug-metabolic induction and inhibition. Concept of pharmacokinetic habit.
Excretion of drugs and pharmacological action in the excretion pathways: renal, biliary and pulmonary. Concept of clearance (Cl) and its modifications in pathological states. Passage of drugs accross the placenta and into breast milk.

Pharmacodynamics

The action of drugs: concept of receptor and pharmacological target, molecular characterization, regulation and classification of receptors (ion channels regulated by ligands, receptors coupled to G proteins, receptors coupled to kinases, nuclear receptors).
Membrane mechanisms responsible for drug actions: transduction systems, cyclic nucleotides, membrane channels, phosphoinositide hydrolysis, arachidonic acid metabolism.
Intracellular mechanisms responsible for drug action: drugs interfering with nucleic acids and protein synthesis.
Drug-receptor interaction: concept of receptor "binding" and binding affinity (Kd).

Quantitative aspects of the drug-receptor interaction: concepts of efficacy (Emax) and potency (EC50). Dose-response curves. Receptor reserve. Threshold effects.
Agonist, partial agonist, reverse agonist. Competitive and non-competitive antagonism. Antidotes.
Types of pharmacological responses: gradual and quantal responses. ED50.
Modification of the number of receptors: "up and down regulation".
Pharmacodynamic interactions. Concept of pharmacodynamic habit. Non-receptor-mediated pharmacologic actions.

Drug development
Preclinical and clinical research. Methodologies in drug testing: Phase I, Phase II, Phase III, Phase IV.

Toxicology
Drug toxicity and toxicological studies: acute, subacute and chronic toxicity. Mutagenicity, carcinogenicity and teratogenicity. LD50 and therapeutic index.
Adverse events and adverse drug responses. Abnormal responses to drugs: idiosyncrasy, drug allergy and anaphylactic shock. Classification of adverse drug reactions. Drug abuse. Drug addiction.

Clinical pharmacology
Therapeutic drug monitoring. Determination of the target concentration for the design of the rational dosage regimen; loading and maintenance dose. Pharmacogenetics and pharmacogenomics. Pharmacovigilance. Pharmacoeconomics: importance of cost/benefit assessment in the rational use of drugs. Prescription filling and dosage: general rules about prescription, specific rules about prescription of controlled drugs. Stockage and distribution of particular drugs.

CHEMOTHERAPY OF MICROBIAL DISEASES
General principles of chemotherapy: Definition of antibiotic and chemotherapeutic, bactericidal and bacteriostatic. Factors affecting susceptibility and resistance to antimicrobial agents. Bacterial resistance to antimicrobial agents. General principles of antimicrobial drug combinations. Post-antibiotic effects.
Common errors in antibacterial chemotherapy: Prescribing errors; Administration errors; Posology errors.

1. CLASSIFICATION OF ANTIBIOTICS
1.1. Antibiotics Acting on the Cell Wall
1.1.1. Beta-lactam
1.1.1.1. Penicillins
1.1.1.1.1. Natural (Penicillin G, Penicillin V)
1.1.1.1.2. Semisynthetic
1.1.1.1.2.1. Broad-spectrum (Aminopenicillins)
1.1.1.1.2.2. Resistant to staphylococcal beta lactamases (Isoxazolyl-penicillins, Methicillin, Nafcillin)
1.1.1.1.2.3. Active predominantly on Gram negative (Carboxy, Sulfoxide, Ureido-penicillins)
1.1.1.2. Cephalosporins

- **1.1.1.2.1. 1st generation** (Cephalexin, Cephalothin, Cefazolin, Cefapirine, Cefradine and Cefadroxil)
- **1.1.1.2.2. 2nd generation** (Cefaclor, Cefuroxime Cefamandole, Cefonicid, Loracarbef; Cephamycin, Cefoxitin, Cefotetan)
- **1.1.1.2.3. 3rd generation** (Ceftriaxone, Cefoperazone, Cefotaxime, Ceftazidime, Ceftizoxime, Cefixime; 4th generation: Cefepime)
- **1.1.1.2.4. New cephalosporins** (Ceftaroline fosamil, Ceftobiprole, Ceftolozane)

1.1.1.3. Monobactams (Aztreonam)

1.1.1.4. Carbapenems (Imipenem, Meropenem, Ertapenem, Doripenem)

1.1.1.5. β lactamase inhibitors (Sulbactam, Clavulanic acid, Tazobactam, Avibactam)

1.1.2. Glycopeptides (Vancomycin, Teicoplanin)

1.1.3. Phosphonic (Fosfomycin)

1.1.4. Peptides (Bacitracin)

1.1.5. Aminoacids (Cycloserine)

1.1.6. Lipoglycopeptides (Dalbavancin**)**

1.2. Protein Synthesis inhibitors

1.2.1. Aminoglycosides (Streptomycin, Neomycin, Kanamycin, Amikacin, Gentamicin, Dibekacin, Netilmicin, Paromomycin, Isepamicin)

1.2.2. Macrolides (Erythromycin, Spiramycin, Josamycin, Myocamycin, Flurithromycin, Clarithromycin, Azithromycin)

1.2.2.1. Ketolides (Telithromycin)

1.2.2.2. Lincosamides (Lincomycin, Clindamycin)

1.2.2.3. Streptogramins (Quinupristin, Dalfopristin)

1.2.2.4. Oxazolidinones (Linezolid)

1.2.3. Tetracyclines (Chlortetracycline, Demetil Chlortetracycline, Methacycline)

1.2.3.1. Long half-life (Doxycycline, Minocycline)

1.2.3.2. Parenteral (Pyrrolidinomethyltetracycline, Rolitetracycline, Oxytetracycline)

1.2.3.3. Glycylcyclines (Tigecycline)

1.2.4. Chloramphenicol, Thiamphenicol

1.2.5. Fusidic acid

1.2.6. Mupirocin

1.3. Antibiotics acting at the cell membrane level (Daptomycin, Polymyxins)

1.4. Miscellaneous antibacterial agents (Telavancin)

1.5. Antibiotics and chemotherapeutic agents targeting nucleic acids

1.5.1. Rifamycin (Rifampicin).

1.5.2. Nitrofuran (Nitrofurantoin)

1.5.3. Quinolones

1.5.3.1. Active in urinary tract infections (Nalidixic acid, Oxolinic acid, Pipemidic acid)

1.5.3.2. Active in systemic infections (Ofloxacin, Norfloxacin, Levofloxacin, Ciprofloxacin, Pefloxacin, Moxifloxacin)

1.5.4. Fidaxomicin

1.5.5. Nitroimidazoles (Metronidazole).

1.5.6. Sulphonamides:

1.5.6.1. Rapid elimination (Sulfisoxazole, Sulfamethoxazole, Sulfadiazine)
1.5.6.2. Slow elimination (Sulfadoxine)
1.5.6.3. For local use (Sulfacetamide)
1.5.7. Trimethoprim, Cotrimoxazole (Trimethoprim + Sulfamethoxazole)

1.6. Antimycobacterials
1.6.1. I-choice (Rifampicin, Isoniazid, Ethambutol, Pyrazinamide Streptomycin)
1.6.2. II-choice (Ethionamide, Para aminosalicylic acid, Amikacin, Kanamycin Fluoroquinolones, Linezolid)
1.6.3. Drugs active against Mycobacterium Avium Complex (Rifabutin, Macrolides, Fluoroquinolones)
1.6.4. Drugs active against leprosy (Dapsone, Clofazimine)

1.7. Antivirals
1.7.1. Inhibitors of nucleic acid synthesis
1.7.1.1. Nucleoside analogues (Acyclovir, Valaciclovir, Famciclovir, Penciclovir, Ganciclovir, Valganciclovir, Sorivudine. Idoxuridine, Trifluridine, Vidarabine, Lamivudine)
1.7.1.2. Nucleotide analogues (Cidofovir; Adefovir, Sofosbuvir)
1.7.1.3. Direct Inhibitors of DNA polymerase (Foscarnet)
1.7.1.4. Viral RNA polymerase Inhibitors (Rimantadine)
1.7.1.5. Antisense oligonucleotides (Fomivirsen)

1.7.2. Reverse transcriptase inhibitors
1.7.2.1. Nucleoside analogues (Zidovudine, Didanosine, Stavudine, Zalcitabine, Lamivudine, Abacavir, Gemcitabine)
1.7.2.2. Nucleotide analogues (Tenofovir)
1.7.2.3. Non-Nucleoside Analogues (Nevirapine, Delavirdine, Efavirenz. Etravirine)

1.7.3. Protease inhibitors
1.7.3.1. First generation-first wave (Telaprevir, Boceprevir, Daclatasvir, Ledipasvir, Ombitasvir, Samatasvir, Simeprevir, Faldaprevir, Asunaprevir, Danoprevir, Sovaprevir, Vaniprevir Vedroprevir)
1.7.3.2. First generation-second wave (Saquinavir, Indinavir, Ritonavir, Nelfinavir, Amprenavir, Lopinavir, Atazanavir, Fosamprenavir)
1.7.4. Integrase inhibitors (Raltegravir)
1.7.5. Interferons (Alpha interferon)
1.7.6. Inhibitors of nucleic acid exposure (Amantadine, Rimantadine)
1.7.7. Fusion (Entry) Inhibitors (Enfuvirtide, Docosanol, Maraviroc)
1.7.8. Analogues of sialic acid (Zanamivir, Oseltamivir, Peramivir, Lanamivir)

1.8. Antimycotics
1.8.1. Antibiotics (Amphotericin B, Griseofulvin, Caspofungin, Anidulafungin, Micafungin)
1.8.2. Antimetabolites (Flucitosin)
1.8.3. Azole derivatives
1.8.3.1. Imidazoles (Ketoconazole, Clotrimazole, Miconazole, Econazole)
1.8.3.2. Triazoles (Itraconazole, Fluconazole, Voriconazole, Posaconazol)

1.8.4. Topical antifungals

1.8.4.1. Polyene Antibiotics (Nystatin)

1.8.4.2. Imidazoles and triazoles (Clotrimazole, Miconazole, Econazole, Terconazole)

1.8.4.3. Allylamine derivatives (Terbinafine)

1.8.5. Thiocarbamates (Tolnaftate)

1.9. Antiprotozoal. Generality

1.9.1. Antiamobics (Emetine, Paromomycin, Metronidazole)

1.9.2. Antileishmanial (Amphotericin B, Pentamidine, Sodium Stibogluconate

1.9.3. Antimalarials: Chloroquine, Primachine, Quinacrine, Quinine, Pyrimethamine, Mefloquine, Artemisinin, Atovaquone, Proguanil)

1.9.4. Antitoxoplasmosis drugs (Pyrimethamine, Trisulfapyrimidine, macrolides)

1.9.5. Anti-trypanosomiasis

2. CHEMOTHERAPY OF NEOPLASTIC DISEASES

Generality. Tumour sensitivity. Cycle-specific and non-cycle-specific drugs. Toxicity of antineoplastic chemotherapeutics. Resistance. General principles of antineoplastic drug combination.

2.1. Alkylating agents

2.1.1. Nitrogen mustards (Mechlorethamine, Cyclophosphamide, Ifosfamide, Melphalan, Chlorambucil)

2.1.2. Ethyleneimine Triethylenemelamine (TEM), Triethylenethosphosphoramide, (TIOTEPA), Hexamethylmelamine (HMM)

2.1.3. Alkylsulfonates (Busulfan)

2.1.4. Nitrosoureas (Streptozotocin, Carmustine -BCNU-, Lomustine -CCNU-, Semustin -methyl-CNU-, Fotemustine)

2.1.5. Triazines (Dacarbazine, Temozolomide)

2.1.6. Methylhydrazine (Procarbazine, Dacarbazine)

2.1.7. Derivatives of platinum (Cisplatin, Carboplatin, Oxaliplatin)

2.2. Antimetabolites

2.2.1. Analogues of the folic acid (Methotrexate, Trimetrexate, Pemetrexed, Pralatrexate, Raltitrexed, Leucovorin)

2.2.2. Pyrimidine analogues (5-fluorouracil, Capecitabine, Tegafur, Cytarabine, Azacytidine, Gemcitabine)

2.2.3. Analogues of purines (6-Mercaptopurine, 6-Thioguanine, Fludarabine, Cladribine, Bendamustine)

2.2.4. Inhibitors of purine catabolism (Deoxycoformycin)

2.2.5. Inhibitors of ribonucleotide reductase (Hydroxyurea)

2.3. Antimitotic drugs

2.3.1. Vinca alkaloids (Vinblastine, Vincristine, Vindesine, Vinorelbine)

2.3.2. Taxol derivatives (Paclitaxel, Nab-paclitaxel, Docetaxel)

2.3.3. Epotylones (Ixabepilone)
2.3.4. Eribulin

2.4. Topoisomerase poisons
2.4.1. Drugs acting on topoisomerase I (Irinotecan, Topotecan)
2.4.2. Drugs acting on topoisomerase II
2.4.2.1. Intercalant (Actinomycin D)
2.4.2.2. Anthracycline (Daunorubicin, Doxorubicin Epirubicin, Idarubicin, Mitoxantrone)
2.4.2.3. Not Intercalants (Etoposide, Teniposide)

2.5. Enzymes (L-asparaginase)
2.6. Miscellaneous (Mitotane, Mitomycin, Bleomycin, Mithramycin)
2.7. Hormones and Related Agents
2.7.1. Corticosteroids (Prednisone, Methylprednisone, Dexamethasone)
2.7.2. Anti-adrenocortical (Aminoglutethimide, Mitotane)
2.7.3. Progestins (Hydroxyprogesterone, Medroxyprogesterone, Megestrol, Norethindrone)
2.7.4. Oestrogens (Diethylstilboestrol, Ethinyl oestradiol, Estrone, oestradiol)
2.7.5. SERMS and oestrogen receptor antagonists (Tamoxifen, Toremifene, Raloxifene, Fulvestrant)
2.7.6. Aromatases inhibitors (Aminoglutethimide, Anastrozole, Letrozole, Examestamo, Formestane)
2.7.7. Androgens (Testosterone, Fluximesterone, Testolactone, Calusterone)
2.7.8. Antiandrogens and inhibitors of androgen synthesis (Cyproterone, Flutamide, Finasteride, abiraterone acetate, enzalutamide)
2.7.9. GnRH Analogues (Leuprolide, Buserelin, Nafarelin)

2.8. Biological Response Modifiers (Interleukin-2 and analogs, Interferons, Tasonermin, Ipilimumab, Sipuleucel-T)
2.9. Transduction therapy
General information on kinase inhibitors and on monoclonal antibodies in oncology, conjugated and bi-functional antibodies
2.9.1. Inhibitors of Bcr-abl (Imatinib, Dasatinib, Nilotinib, Ponatinib)
2.9.2. Inhibitors of BTK (Ibrutinib)
2.9.3. Inhibitors of HER-1
2.9.3.1. Kinase inhibitors (Gefitinib, Erlotinib)
2.9.3.2. Monoclonal antibodies (Cetuximab, Panitumumab)

2.9.4. Inhibitors of HER-2
2.9.4.1. Kinase inhibitors (Lapatinib)
2.9.4.2. Monoclonal antibodies (Trastuzumab, Pertuzumab, Adotrastuzumab)
2.9.4.3. Inhibitors of ALK (Crizotinib)
2.9.4.4. Antiangiogenic drugs
2.9.4.4.1. Monoclonal antibodies and derivatives (Bevacizumab, Aflibercept)
2.9.4.5. Multi kinase inhibitors (Sorafenib, Sunitinib, Pazopanib, Regorafenib)
2.9.4.6. Inhibitors of RAF (Vemurafenib)

2.9.5. Drugs with a prevailing action on NFKB

2.9.5.1. Proteasome inhibitors (Bortezomib, Carfilzomib)

2.9.5.2. Thalidomide and Lenalidomide, arsenic trioxide

2.9.6. HDAC Inhibitors (Vorinostat)

2.9.7. Inhibitors of the transduction pathway of Hedgehog (Vismodegib)

2.9.8. Monoclonal antibodies for haematological malignancies (Rituximab, Ibritumomab, Tositumomab, Alemtuzumab)

3. HEMATOPOIETIC AGENTS

3.1. Growth Factors (Erythropoietin, SCF, Interleukins GM-CSF, G-CSF, M-CSF, Interleukin 11, Thrombopoietin)

3.2. Iron and Iron Salts

3.3. Vit. B12

3.4. Folic acid

4. DRUGS FOR THERAPY OF PAIN AND AFFECTIONS OF THE LOCOMOTOR APPARATUS

Pharmacological basis of pain and inflammation (Prostaglandins, Prostacyclin, Thromboxane A2 and Leukotrienes, PAF)

4.1. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

4.1.1. Non-selective COX-inhibitors

4.1.1.1. Salicylic acid derivatives (Acetyl-salicylic acid, Sodium salicylate, Diflunisal)

4.1.1.2. Pyrazolone derivatives (Phenylbutazone, Aminophenazone, Feprazone, Noramidopyrine)

4.1.1.3. Para-amino-phenol derivatives (Acetaminophen)

4.1.1.4. Indole acetic acids (Indomethacin, Sulindac, Etodolac)

4.1.1.5. Fenamates (Mefenamic acid, Flufenamic acid)

4.1.1.6. Propionic acid derivatives (Ibuprofen, Naproxen, Ketoprofen)

4.1.1.7. Oxicams (Piroxicam, Meloxicam)

4.1.1.8. Aryl-acetic derivatives (Diclofenac, Ketorolac)

4.1.1.9. Alkenones (Nabumetone)

4.1.1.10. Sulfonanilide (Nimesulide)

4.2. COX-2 Selective Inhibitors

4.2.1. 1st generation Celecoxib (substituted aryl pyrazolo); Rofecoxib (aryl substituted furanone); Nimesulide (sulphur anilido)

4.2.2. 2nd generation Valdecoxib (aryl-substituted isoxazole); Parecoxib; Etoricoxib (sulphomethylpyridine derivative); Lumiracoxib (derivative of phenylacetic acid)

5. DRUGS FOR IMMUNOMODULATION

5.1. Immunostimulants (cytokines, interleukins, interferons).

5.2. Immunosuppressive Agents

5.2.1. Glucocorticoids (Prednisone and Prednisolone);

5.2.2. Cyclosporine, Tacrolimus, Sirolimus, Everolimus;

5.2.3. Cytotoxic agents (Azathioprine, Cyclophosphamide, Methotrexate, Mycophenolate Mofetil);

5.2.4. Antibodies

5.2.4.1. Anti-lymphocyte antibodies

5.2.4.2. Intravenous immunoglobulins: (IGIV)

5.2.4.3. Monoclonal antibodies (Muromonab, Basiliximab, Daclizumab)

5.2.5. Fusion Protein (Belatacept, Abatacept)

5.2.6. Monoclonal antibodies with anti-inflammatory action

5.2.6.1. Anti-TNF alpha (Infliximab, Etanercept, Adalimumab)

5.2.6.2. Anti-IL-6 receptor (Tocilizumab)

5.2.6.3. Anti-lymphocyte T

5.2.6.4. DRUGS ACTING ON MOST COMMON SKIN DISEASES

5.2.6.5. Skin absorption of drugs: transcutaneous drugs and problems about transcutaneous administration.

5.2.6.6. 7.1. Topic antimicrobial agents

5.2.6.7. 7.2. Retinoids

5.2.6.8. 7.3. Psoralen based drugs and photochemotherapy

5.2.6.9. 7.4. Drugs acting on psoriasis

5.3. Vaccines Active, passive, adoptive immunization. Types of vaccines. Constituents of vaccine. Adjuvants. Side effects, indications and contraindications to the use of vaccines

6. DRUGS ACTIVE ON METABOLISM

6.1. Antidiabetic drugs

6.1.1. Insulins (rapid, intermediate and slow human insulins),

6.1.1.1. Mutated insulins (Lispro, Aspart, Glulisin, Detemir, Glargine)

6.1.1.2. Incretins (GLP-I analogues, DPPIV inhibitors)

6.1.1.3. Amylin analogues

6.1.2. Oral hypoglycaemic agents

6.1.2.1. Sulfonylureas (Tolbutamide, Chlorpropamide, Glipizide)

6.1.2.2. Metiglinide analogues (Repaglinide, Nateglinide)

6.1.2.3. Biguanides (Metformin)

6.1.2.4. Alpha-glycosidase inhibitors (Acarbose)

6.1.2.5. Thiazolidinediones (Pioglitazone, Rosiglitazone)

6.1.2.6. SLGT-2 Inhibitors (Dapagliflozin)

6.2. Hyperglycaemic drugs (Glucagon, Diazoxide)

6.3. Antigout drugs

6.3.1. Xanthine oxidase Inhibitors (Allopurinol, Febuxostat)

6.3.2. Uricosurics drugs (Probenecid, Sulfinpyrazone)

6.3.3. Enzymes (Rasburicase)

6.3.4. Drugs for acute gout attack treatment (Colchicine, NSAIDs)

6.4. Drugs Active on Calcium Homeostasis

6.4.1. Hypercalcaemic Drugs (Thyrocalcitonin, Glucocorticoids, Mitramicin)

6.4.2. Drugs increasing bone mass (PTH, Fluorides, Testosterone)

- **6.4.3. Bone resorption Inhibitors**
  - **6.4.3.1. Bisphosphonates** (Etidronate, Alendronate, Zoledronate)
  - **6.4.3.2. Calcium**
  - **6.4.3.3. Calcitonin**
  - **6.4.3.4. Oestrogens and selective modulators of oestrogen receptors** (Raloxifene)
  - **6.4.3.5. Denosumab**

- **6.4.4. Vitamin D and analogues**
- **6.4.5. Calcimimetics** (Cinacalcet)
- **6.4.6. Phosphates Reuptake Inhibitors** (Calcium carbonate, Lanthanum, Sevelamer, Aluminium salts)

7. HORMONES AND DRUGS ACTIVE ON THE ENDOCRINE SYSTEM

7.1. Hypothalamic Factors and Related Drugs

- **7.1.1. Agents modifying growth hormone secretion**
  - **7.1.1.1. Stimulants** (GHRH)
  - **7.1.1.2. Inhibitors** (Somatostatin, Octreotide, Lanreotide)

- **7.1.2. Agents modifying gonadotropins secretion**
  - **7.1.2.1. GnRH and analogues** (Gonadorelin acetate, Leuprolide, Nafarelin)
- **7.1.3. Agents modifying ACTH secretion** (CRH)
- **7.1.4. Agents modifying TSH secretion** (TRH)

7.2. Pituitary Hormones and related drugs

- **7.2.1. Growth hormone** (recombinant human GH) (Mecasermin, Pegvisomant)
- **7.2.2. Natural and recombinant gonadotropins**
  - **7.2.2.1. Follicle-stimulating hormone** (recombinant FSH), **Luteinizing hormone** (recombinant LH).
  - **7.2.2.2. Human chorionic gonadotropin** (hCG)
  - **7.2.2.3. Human menopausal gonadotropins** (hMG)
  - **7.2.2.4. Corifollitropin**

- **7.2.3. Adrenocorticotropic hormone** (ACTH, Cosyntropin)
- **7.2.4. Recombinant TSH**
- **7.2.5. Antidiuretic hormone and antagonists** (Vasopressin, Desmopressin, Lisopressin, Terlipressin, Vaptans)
- **7.2.6. Oxytocin Antagonist** (Atosiban)

7.3. Thyroid hormones (T3, T4)

7.4. Antithyroid hormones

- **7.4.1. Synthesis inhibitors** (Methimazole, Propylthiouracil)
- **7.4.2. Release inhibitors** (Iodides)
- **7.4.3. Transport inhibitors** (Thiocyanate, Perchlorate)
- **7.4.4. Inhibitor of peripheral conversion of T4**
- **7.4.5. Radioactive Iodine** (I 131)

7.5. Adrenocortical hormones

- **7.5.1. Natural**
  - **7.5.1.1. Glucocorticoids** (Cortisol)
  - **7.5.1.2. Mineralocorticoids** (Aldosterone)

- **7.5.2. Synthetic glucocorticoids having a high anti-inflammatory activity**
  - **7.5.2.1. With sodium-retention activity** (Cortisone, Prednisone, Prednisolone, Methylprednisolone)
  - **7.5.2.2. Sodium-retention activity free** (Betamethasone, Dexamethasone, Triamcinolone)
  - **7.5.2.3. Having predominantly sodium-retention activity** (Fludrocortisone)

- **7.5.3. Adrenocortical antagonists**
  - **7.5.3.1. Inhibitors of synthesis** (Aminoglutethimide, Metyrapone, Amphenone)
  - **7.5.3.2. Lithics** (Mitotane)

- **7.5.4. Aldosterone receptor antagonists** (Spironolactone)

7.6. Androgens and Anabolic Steroids

- **7.6.1. Testosterone esters** (Propionate, enanthate)
- **7.6.2. 17-alkyl-testosterone derivatives** (Methyltestosterone, Fluoxymesterone, Nandrolone)

7.7. Anti-androgens

- **7.7.1. Androgen receptor antagonists** (Cyproterone acetate, Flutamide, Bicalutamide, Spironolactone)
- **7.7.2. Inhibitors of testosterone synthesis** (Ketoconazole)
- **7.7.3. Inhibitors of 5-alpha-reductase** (Finasteride)
- **7.7.4. Analogues of GnRH** (Goserelin, Leuprolide)

7.8. Oestrogens and Antioestrogens

- **7.8.1. Natural oestrogens** (Oestradiol)
- **7.8.2. Synthetic oestrogens** (Ethinyl oestradiol)
- **7.8.3. Antioestrogens** (Clomiphene, Tamoxifen)

7.9. Progestin and Antiprogestins

- **7.9.1. Progestins** (Progesterone, Hydroxyprogesterone, Medroxyprogesterone, Megestrol)
- **7.9.2. Progestin receptor antagonists (**Mifepristone)

7.10. Ovulation inducers

- **7.10.1. Antioestrogens** (Clomiphene)
- **7.10.2. Gonadotropins**
  - **7.10.2.1. Human Chorionic Gonadotropin** (HCG)
  - **7.10.2.2. Human Menopausal Gonadotropins** (HMG)

7.11. Hormonal contraceptives

7.11.1. Combination oral contraceptives

7.11.2. Progestin-only birth control

7.11.3. Post-coital or emergency contraceptives

7.12. Hormones active on uterine motility

7.12.1. Drugs stimulating uterine motility (Oxytocin, 15-methyl-PGF2α, Ergonovine, Methylergonovine)

7.12.2. Drugs inhibiting uterine motility

7.12.2.1. α-2 adrenergic agonists (Ritodrine, Fenoterol, Albuterol)

7.12.2.2. Calcium channels blockers (Nifedipine, Magnesium)

7.12.2.3. COX-inhibitors (Indomethacin)

7.12.2.4. Oxytocin Antagonists (Atosiban)

8. ELEMENTS OF ENVIRONMENTAL TOXICOLOGY

The main environmental toxicants: dioxin, polychlorinated biphenyls, heavy metals

9. BIOTECHNOLOGICAL DRUGS

General characteristics of biotechnological drugs. Bioengineering and derivatization.

9.1. Biosimilars

9.1.1. Recombinant proteins for substitute or integrative use

9.1.2. Monoclonal antibodies and fusion proteins

9.1.3. Recombinant vaccines

TIMETABLE OF DIDACTIC ACTIVITY OF
MEDICAL PHARMACOLOGY AND TOXICOLOGY I COURSE
VII CYCLE

WEEK	Day	Time	Topic	Professor
I Week (1-4 October 2024)	1/10/2024	Tuesday	14.00-14.50	Role, aims and history of Pharmacology	Taglialatela
	2/10/2024	Wednesday	14.00-14.50	Drug definitions. Routes of administration.	Pannaccione
	3/10/2024	Thursday	14.00-14.50	Pharmaceutical Forms	Boscia
	4/10/2024	Friday	14.00-14.50	Pharmacokinetics: Drug absorption and bioavailability	Pannaccione
II Week (7-11 October 2024)	7/10/2024	Monday	14.00-14.50	Pharmacokinetics: Drug distribution	Pannaccione
	8/10/2024	Tuesday	14.00-14.50	Pharmacokinetics: Drug metabolism	Pannaccione
	9/10/2024	Wednesday	14.00-14.50	Pharmacokinetics: Drug elimination	Pannaccione
	10/10/2024	Thursday	14.00-14.50	Pharmacodynamics: Drug-receptor interactions	Secondo
	11/10/2024	Friday	14.00-14.50	Pharmacodynamics: Receptor agonism	Secondo
III Week (14-18 October 2024)	14/10/2024	Monday	14.00-14.50	Pharmacodynamics: Receptor antagonism	Secondo
	15/10/2024	Tuesday	14.00-14.50	Pharmacodynamics: Molecular mechanisms of drug action (I)	Secondo
	16/10/2024	Wednesday	14.00-14.50	Pharmacodynamics: Molecular mechanisms of drug action (II)	Secondo
	17/10/2024	Thursday	14.00-14.50	Pre-clinical drug evaluation and toxicology	Scorziello
	18/10/2024	Friday	14.00-14.50	Principles of clinical drug testing	Taglialatela
IV Week (21-25 October 2024)	21/10/2024	Monday	14.00-14.50	Adverse Drug Reactions (ADRs) and Pharmacovigilance	Scorziello
	22/10/2024	Tuesday	14.00-14.50	Pharmacogenetics and pharmacogenomics	Taglialatela
	23/10/2024	Wednesday	14.00-14.50	Biotechnological drugs	Molinaro
	24/10/2024	Thursday	14.00-14.50	Drug interactions	Boscia
	25/10/2024	Friday	14.00-14.50	General Principles of Chemotherapy of Microbial Diseases	Boscia
V Week (28-31 October 2024)	28/10/2024	Monday	14.00-14.50	Penicillins and Cephalosporins	Boscia
	29/10/2024	Tuesday	14.00-14.50	Other beta-lactams	Boscia
	30/10/2024	Wednesday	14.00-14.50	Drugs used in the chemotherapy of Staphylococcal infections	Boscia
	31/10/2024	Thursday	14.00-14.50	Macrolides and Ketolides	Formisano
VI Week (4-8 November 2024)	4/11/2024	Monday	14.00-14.50	Aminoglycosides	Formisano
	5/11/2024	Tuesday	14.00-14.50	Tetracyclines and Chloramphenicol	Formisano
	6/11/2024	Wednesday	14.00-14.50	Quinolones, Sulfonamides and Trimethoprim	Formisano
	7/11/2024	Thursday	14.00-14.50	Drugs Used in the Chemotherapy of Tuberculosis and Leprosy	Boscia

	8/11/2024	Friday	14.00-14.50	Drugs used to treat Fungal Infections	Scorziello
VII Week) (11-15 November 2024)	11/11/2024	Monday	14.00-14.50	Drugs used to treat Viral Infections (I)	Scorziello
	12/11/2024	Tuesday	14.00-14.50	Drugs used to treat Viral Infections (II)	Scorziello
	13/11/2024	Wednesday	14.00-14.50	Drugs used to treat Parasitic Diseases	Formisano
	14/11/2024	Thursday	14.00-14.50	Cancer Chemotherapy (I)	Cataldi
	15/11/2024	Friday	14.00-14.50	Cancer Chemotherapy (II)	Cataldi
VIII Week (18-22 November 2024)	18/11/2024	Monday	14.00-14.50	Cancer Chemotherapy (III)	Cataldi
	19/11/2024	Tuesday	14.00-14.50	Cancer Chemotherapy (IV)	Cataldi
	20/11/2024	Wednesday	14.00-14.50	Cancer Chemotherapy (V)	Cataldi
	21/11/2024	Thursday	14.00-14.50	Cancer Chemotherapy (VI)	Cataldi
	22/11/2024	Friday	14.00-14.50	Drugs for the treatment of Anemias	Scorziello
IX Week (25-29 November 2024)	25/11/2024	Monday	14.00-14.50	Pharmacology of Hypothalamic and Pituitary Hormones	Matrone
	26/11/2024	Tuesday	14.00-14.50	Glucocorticoids (I)	Taglialatela
	27/11/2024	Wednesday	14.00-14.50	Glucocorticoids (II)	Taglialatela
	28/11/2024	Thursday	14.00-14.50	Estrogens and antiestrogens	Cataldi
	29/11/2024	Friday	14.00-14.50	Androgens and antiandrogens	Cataldi
X Week (2-6 December 2024)	2/12/2024	Monday	14.00-14.50	Antithyroid drugs	Cataldi
	3/12/2024	Tuesday	14.00-14.50	Drugs active on calcium homeostasis	Cataldi
	4/12/2024	Wednesday	14.00-14.50	Insulins	Taglialatela
	5/12/2024	Thursday	14.00-14.50	Other hypoglycemic drugs(I)	Taglialatela
	6/12/2024	Friday	14.00-14.50	Other hypoglycemic drugs(II)	Taglialatela
XI Week (9-13 December 2024)	9/12/2024	Monday	14.00-14.50	Immunopharmacology (I)	Scorizello
	10/12/2024	Tuesday	14.00-14.50	Immunopharmacology (II)	Scorziello
	11/12/2023	Wednesday	14.00-14.50	Dermatopharmacology	Scorziello
	12/12/2023	Thursday	14.00-14.50	Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (I)	Pignataro
	13/12/2023	Friday	14.00-14.50	Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (II)	Pignataro
XII Week (16-20 December 2024)	16/12/2023	Monday	14.00-14.50	Gender Pharmacology	Matrone
	17/12/2023	Tuesday	14.00-14.50	Environmental Toxicology	Matrone
	18/12/2023	Wednesday	14.00-14.50	Vaccines	Scorziello
	19/12/2023	Thursday	14.00-14.50	Generic and biosimilar drugs	Taglialatela
	20/12/2023	Friday	14.00-14.50	Learning assessment and Moodle test guidelines	Taglialatela/Scorziello

READINGS/BIBLIOGRAPHY

*Please list here textbooks or other readings. In case of **integrated courses** or courses delivered through several **channels**, please specify the readings/bibliography of the single module/channel.*

- F. GOODMAN-GILMAN: The Pharmacological Basis of Therapeutics. McGraw-Hill, 13th Ed. 2015.
- A. J. TREVOR, B. G. KATZUNG. Basic and Clinical Pharmacology. Lange, 14th Ed. 2017
- H.P. RANG, M.M. DALE, J. M. RITTER, R. FLOWER: Pharmacology. Churchill Livingstone. 8th Ed. 2016
- F. CLEMENTI, G. FUMAGALLI. General and Molecular Pharmacology: Principles of Drug Action. Wiley 1st Ed. 2015

PHARMACOLOGY AND MEDICAL TOXICOLOGY I
PROGRAM

GENERAL PHARMACOLOGY

Definition of Medication, Medicament, Poison or Toxic. Active ingredients and excipients. Pharmacognosy. The branches of Pharmacology. Methods of classification of drugs according to the prescription regime: non-prescription drugs, over-the-counter (OTC) drugs, prescription drugs. Specialty and equivalent (generic) drugs. Classification of drugs according to anatomical-therapeutic-chemical classes (ATC).

Pharmacokinetics

Pharmaceutical Forms. The routes of drug administration: natural and artificial.
Principles of pharmacokinetics: drug absorption, passage of drug molecules across cell membrane, bioavailability and first pass metabolism, delayed absorption.
Concept of compartment; area under the curve; apparent volume of distribution (Vd), half-life (t 1/2); concept of "Steady-State"; breakdown of drugs in the body; selective distribution of drugs in tissues; plasma/tissue/protein binding; the blood-brain barrier.
Metabolism: Phase I and II reactions; drug-metabolic induction and inhibition. Concept of pharmacokinetic habit.
Excretion of drugs and pharmacological action in the excretion pathways: renal, biliary and pulmonary. Concept of clearance (Cl) and its modifications in pathological states. Passage of drugs accross the placenta and into breast milk.

Pharmacodynamics

The action of drugs: concept of receptor and pharmacological target, molecular characterization, regulation and classification of receptors (ion channels regulated by ligands, receptors coupled to G proteins, receptors coupled to kinases, nuclear receptors).
Membrane mechanisms responsible for drug actions: transduction systems, cyclic nucleotides, membrane channels, phosphoinositide hydrolysis, arachidonic acid metabolism.
Intracellular mechanisms responsible for drug action: drugs interfering with nucleic acids and protein synthesis.
Drug-receptor interaction: concept of receptor "binding" and binding affinity (Kd).
Quantitative aspects of the drug-receptor interaction: concepts of efficacy (Emax) and potency (EC50). Dose-response curves. Receptor reserve. Threshold effects.
Agonist, partial agonist, reverse agonist. Competitive and non-competitive antagonism. Antidotes.
Types of pharmacological responses: gradual and quantal responses. ED50.
Modification of the number of receptors: "up and down regulation".

Pharmacodynamic interactions. Concept of pharmacodynamic habit. Non-receptor-mediated pharmacologic actions.

Drug development
Preclinical and clinical research. Methodologies in drug testing: Phase I, Phase II, Phase III, Phase IV.

Toxicology
Drug toxicity and toxicological studies: acute, subacute and chronic toxicity. Mutagenicity, carcinogenicity and teratogenicity. LD50 and therapeutic index.
Adverse events and adverse drug responses. Abnormal responses to drugs: idiosyncrasy, drug allergy and anaphylactic shock. Classification of adverse drug reactions. Drug abuse. Drug addiction.

Clinical pharmacology
Therapeutic drug monitoring. Determination of the target concentration for the design of the rational dosage regimen; loading and maintenance dose. Pharmacogenetics and pharmacogenomics. Pharmacovigilance. Pharmacoeconomics: importance of cost/benefit assessment in the rational use of drugs. Prescription filling and dosage: general rules about prescription, specific rules about prescription of controlled drugs. Stockage and distribution of particular drugs.

CHEMOTHERAPY OF MICROBIAL DISEASES
General principles of chemotherapy: Definition of antibiotic and chemotherapeutic, bactericidal and bacteriostatic. Factors affecting susceptibility and resistance to antimicrobial agents. Bacterial resistance to antimicrobial agents. General principles of antimicrobial drug combinations. Post-antibiotic effects.
Common errors in antibacterial chemotherapy: Prescribing errors; Administration errors; Posology errors.

10. CLASSIFICATION OF ANTIBIOTICS

10.1. Antibiotics Acting on the Cell Wall

1.1.7. Beta-lactam

1.1.7.1. Penicillins

1.1.7.1.1. Natural (Penicillin G, Penicillin V)

1.1.7.1.2. Semisynthetic

1.1.7.1.2.1. Broad-spectrum (Aminopenicillins)

1.1.7.1.2.2. Resistant to staphylococcal beta lactamases (Isoxazolyl-penicillins, Methicillin, Nafcillin)

1.1.7.1.2.3. Active predominantly on Gram negative (Carboxy, Sulfoxide, Ureido-penicillins)

1.1.7.2. Cephalosporins

1.1.7.2.1. 1st generation (Cephalexin, Cephalothin, Cefazolin, Cefapirine, Cefradine and Cefadroxil)

1.1.7.2.2. 2nd generation (Cefaclor, Cefuroxime Cefamandole, Cefonicid, Loracarbef; Cephamycin, Cefoxitin, Cefotetan)

1.1.7.2.3. 3rd generation (Ceftriaxone, Cefoperazone, Cefotaxime, Ceftazidime, Ceftizoxime, Cefixime; 4th generation: Cefepime)

1.1.7.2.4. New cephalosporins (Ceftaroline fosamil, Ceftobiprole, Ceftolozane)

1.1.7.3. Monobactams (Aztreonam)

1.1.7.4. Carbapenems (Imipenem, Meropenem, Ertapenem, Doripenem)

1.1.7.5. β lactamase inhibitors (Sulbactam, Clavulanic acid, Tazobactam, Avibactam)

1.1.8. Glycopeptides (Vancomycin, Teicoplanin)

1.1.9. Phosphonic (Fosfomycin)

1.1.10. Peptides (Bacitracin)

1.1.11. Aminoacids (Cycloserine)

1.1.12. Lipoglycopeptides (Dalbavancin**)**

10.2. Protein Synthesis inhibitors

10.2.1. Aminoglycosides (Streptomycin, Neomycin, Kanamycin, Amikacin, Gentamicin, Dibekacin, Netilmicin, Paromomycin, Isepamicin)

10.2.2. Macrolides (Erythromycin, Spiramycin, Josamycin, Myocamycin, Flurithromycin, Clarithromycin, Azithromycin)

10.2.2.1. Ketolides (Telithromycin)

10.2.2.2. Lincosamides (Lincomycin, Clindamycin)

10.2.2.3. Streptogramins (Quinupristin, Dalfopristin)

10.2.2.4. Oxazolidinones (Linezolid)

10.2.3. Tetracyclines (Chlortetracycline, Demetil Chlortetracycline, Methacycline)

10.2.3.1. Long half-life (Doxycycline, Minocycline)

10.2.3.2. Parenteral (Pyrrolidinomethyltetracycline, Rolitetracycline, Oxytetracycline)

10.2.3.3. Glycylcyclines (Tigecycline)

10.2.4. Chloramphenicol, Thiamphenicol

10.2.5. Fusidic acid

10.2.6. Mupirocin

10.3. Antibiotics acting at the cell membrane level (Daptomycin, Polymyxins)

10.4. Miscellaneous antibacterial agents (Telavancin)

10.5. Antibiotics and chemotherapeutic agents targeting nucleic acids

10.5.1. Rifamycin (Rifampicin).

10.5.2. Nitrofuran (Nitrofurantoin)

10.5.3. Quinolones

10.5.3.1. Active in urinary tract infections (Nalidixic acid, Oxolinic acid, Pipemidic acid)

10.5.3.2. Active in systemic infections (Ofloxacin, Norfloxacin, Levofloxacin, Ciprofloxacin, Pefloxacin, Moxifloxacin)

10.5.4. Fidaxomicin

10.5.5. Nitroimidazoles (Metronidazole).

10.5.6. Sulphonamides:

10.5.6.1. Rapid elimination (Sulfisoxazole, Sulfamethoxazole, Sulfadiazine)

10.5.6.2. Slow elimination (Sulfadoxine)

10.5.6.3. For local use (Sulfacetamide)

10.5.7. Trimethoprim, Cotrimoxazole (Trimethoprim + Sulfamethoxazole)

10.6. Antimycobacterials

10.6.1. I-choice (Rifampicin, Isoniazid, Ethambutol, Pyrazinamide Streptomycin)
10.6.2. II-choice (Ethionamide, Para aminosalicylic acid, Amikacin, Kanamycin Fluoroquinolones, Linezolid)
10.6.3. Drugs active against Mycobacterium Avium Complex (Rifabutin, Macrolides, Fluoroquinolones)
10.6.4. Drugs active against leprosy (Dapsone, Clofazimine)

10.7. Antivirals
10.7.1. Inhibitors of nucleic acid synthesis
10.7.1.1. Nucleoside analogues (Acyclovir, Valaciclovir, Famciclovir, Penciclovir, Ganciclovir, Valganciclovir, Sorivudine. Idoxuridine, Trifluridine, Vidarabine, Lamivudine)
10.7.1.2. Nucleotide analogues (Cidofovir; Adefovir, Sofosbuvir)
10.7.1.3. Direct Inhibitors of DNA polymerase (Foscarnet)
10.7.1.4. Viral RNA polymerase Inhibitors (Rimantadine)
10.7.1.5. Antisense oligonucleotides (Fomivirsen)

10.7.2. Reverse transcriptase inhibitors
10.7.2.1. Nucleoside analogues (Zidovudine, Didanosine, Stavudine, Zalcitabine, Lamivudine, Abacavir, Gemcitabine)
10.7.2.2. Nucleotide analogues (Tenofovir)
10.7.2.3. Non-Nucleoside Analogues (Nevirapine, Delavirdine, Efavirenz. Etravirine)

10.7.3. Protease inhibitors
10.7.3.1. First generation-first wave (Telaprevir, Boceprevir, Daclatasvir, Ledipasvir, Ombitasvir, Samatasvir, Simeprevir, Faldaprevir, Asunaprevir, Danoprevir, Sovaprevir, Vaniprevir Vedroprevir)
10.7.3.2. First generation-second wave (Saquinavir, Indinavir, Ritonavir, Nelfinavir, Amprenavir, Lopinavir, Atazanavir, Fosamprenavir)
10.7.4. Integrase inhibitors (Raltegravir)
10.7.5. Interferons (Alpha interferon)
10.7.6. Inhibitors of nucleic acid exposure (Amantadine, Rimantadine)
10.7.7. Fusion (Entry) Inhibitors (Enfuvirtide, Docosanol, Maraviroc)
10.7.8. Analogues of sialic acid (Zanamivir, Oseltamivir, Peramivir, Lanamivir)

10.8. Antimycotics
10.8.1. Antibiotics (Amphotericin B, Griseofulvin, Caspofungin, Anidulafungin, Micafungin)
10.8.2. Antimetabolites (Flucitosin)
10.8.3. Azole derivatives
10.8.3.1. Imidazoles (Ketoconazole, Clotrimazole, Miconazole, Econazole)
10.8.3.2. Triazoles (Itraconazole, Fluconazole, Voriconazole, Posaconazol)

10.8.4. Topical antifungals
10.8.4.1. Polyene Antibiotics (Nystatin)
10.8.4.2. Imidazoles and triazoles (Clotrimazole, Miconazole, Econazole, Terconazole)
10.8.4.3. Allylamine derivatives (Terbinafine)

10.8.5. Thiocarbamates (Tolnaftate)

10.9. Antiprotozoal. Generality

10.9.1. Antiamobics (Emetine, Paromomycin, Metronidazole)

10.9.2. Antileishmanial (Amphotericin B, Pentamidine, Sodium Stibogluconate

10.9.3. Antimalarials: Chloroquine, Primachine, Quinacrine, Quinine, Pyrimethamine, Mefloquine, Artemisinin, Atovaquone, Proguanil)

10.9.4. Antitoxoplasmosis drugs (Pyrimethamine, Trisulfapyrimidine, macrolides)

10.9.5. Anti-trypanosomiasis

11. CHEMOTHERAPY OF NEOPLASTIC DISEASES

Generality. Tumour sensitivity. Cycle-specific and non-cycle-specific drugs. Toxicity of antineoplastic chemotherapeutics. Resistance. General principles of antineoplastic drug combination.

11.1. Alkylating agents

11.1.1. Nitrogen mustards (Mechlorethamine, Cyclophosphamide, Ifosfamide, Melphalan, Chlorambucil)

11.1.2. Ethyleneimine Triethylenemelamine (TEM), Triethylenethosphosphoramide, (TIOTEPA), Hexamethylmelamine (HMM)

11.1.3. Alkylsulfonates (Busulfan)

11.1.4. Nitrosoureas (Streptozotocin, Carmustine -BCNU-, Lomustine -CCNU-, Semustin -methyl-CNU-, Fotemustine)

11.1.5. Triazines (Dacarbazine, Temozolomide)

11.1.6. Methylhydrazine (Procarbazine, Dacarbazine)

11.1.7. Derivatives of platinum (Cisplatin, Carboplatin, Oxaliplatin)

11.2. Antimetabolites

11.2.1. Analogues of the folic acid (Methotrexate, Trimetrexate, Pemetrexed, Pralatrexate, Raltitrexed, Leucovorin)

11.2.2. Pyrimidine analogues (5-fluorouracil, Capecitabine, Tegafur, Cytarabine, Azacytidine, Gemcitabine)

11.2.3. Analogues of purines (6-Mercaptopurine, 6-Thioguanine, Fludarabine, Cladribine, Bendamustine)

11.2.4. Inhibitors of purine catabolism (Deoxycoformycin)

11.2.5. Inhibitors of ribonucleotide reductase (Hydroxyurea)

11.3. Antimitotic drugs

11.3.1. Vinca alkaloids (Vinblastine, Vincristine, Vindesine, Vinorelbine)

11.3.2. Taxol derivatives (Paclitaxel, Nab-paclitaxel, Docetaxel)

11.3.3. Epotylones (Ixabepilone)

11.3.4. Eribulin

11.4. Topoisomerase poisons

11.4.1. Drugs acting on topoisomerase I (Irinotecan, Topotecan)

11.4.2. Drugs acting on topoisomerase II

11.4.2.1. Intercalant (Actinomycin D)
11.4.2.2. Anthracycline (Daunorubicin, Doxorubicin Epirubicin, Idarubicin, Mitoxantrone)
11.4.2.3. Not Intercalants (Etoposide, Teniposide)

11.5. Enzymes (L-asparaginase)
11.6. Miscellaneous (Mitotane, Mitomycin, Bleomycin, Mithramycin)
11.7. Hormones and Related Agents
11.7.1. Corticosteroids (Prednisone, Methylprednisone, Dexamethasone)
11.7.2. Anti-adrenocortical (Aminoglutethimide, Mitotane)
11.7.3. Progestins (Hydroxyprogesterone, Medroxyprogesterone, Megestrol, Norethindrone)
11.7.4. Oestrogens (Diethylstilboestrol, Ethinyl oestradiol, Estrone, oestradiol)
11.7.5. SERMS and oestrogen receptor antagonists (Tamoxifen, Toremifene, Raloxifene, Fulvestrant)
11.7.6. Aromatases inhibitors (Aminoglutethimide, Anastrozole, Letrozole, Examestamo, Formestane)
11.7.7. Androgens (Testosterone, Fluximesterone, Testolactone, Calusterone)
11.7.8. Antiandrogens and inhibitors of androgen synthesis (Cyproterone, Flutamide, Finasteride, abiraterone acetate, enzalutamide)
11.7.9. GnRH Analogues (Leuprolide, Buserelin, Nafarelin)

11.8. Biological Response Modifiers (Interleukin-2 and analogs, Interferons, Tasonermin, Ipilimumab, Sipuleucel-T)
11.9. Transduction therapy
General information on kinase inhibitors and on monoclonal antibodies in oncology, conjugated and bi-functional antibodies
11.9.1. Inhibitors of Bcr-abl (Imatinib, Dasatinib, Nilotinib, Ponatinib)
11.9.2. Inhibitors of BTK (Ibrutinib)
11.9.3. Inhibitors of HER-1
11.9.3.1. Kinase inhibitors (Gefitinib, Erlotinib)
11.9.3.2. Monoclonal antibodies (Cetuximab, Panitumumab)

11.9.4. Inhibitors of HER-2
11.9.4.1. Kinase inhibitors (Lapatinib)
11.9.4.2. Monoclonal antibodies (Trastuzumab, Pertuzumab, Adotrastuzumab)
11.9.4.3. Inhibitors of ALK (Crizotinib)
11.9.4.4. Antiangiogenic drugs
11.9.4.4.1. Monoclonal antibodies and derivatives (Bevacizumab, Aflibercept)
11.9.4.5. Multi kinase inhibitors (Sorafenib, Sunitinib, Pazopanib, Regorafenib)
11.9.4.6. Inhibitors of RAF (Vemurafenib)

11.9.5. Drugs with a prevailing action on NFKB
11.9.5.1. Proteasome inhibitors (Bortezomib, Carfilzomib)
11.9.5.2. Thalidomide and Lenalidomide, arsenic trioxide

11.9.6. HDAC Inhibitors (Vorinostat)

11.9.7. Inhibitors of the transduction pathway of Hedgehog (Vismodegib)

11.9.8. Monoclonal antibodies for haematological malignancies (Rituximab, Ibritumomab, Tositumomab, Alemtuzumab)

12. HEMATOPOIETIC AGENTS

12.1. Growth Factors (Erythropoietin, SCF, Interleukins GM-CSF, G-CSF, M-CSF, Interleukin 11, Thrombopoietin)

12.2. Iron and Iron Salts

12.3. Vit. B12

12.4. Folic acid

13. DRUGS FOR THERAPY OF PAIN AND AFFECTIONS OF THE LOCOMOTOR APPARATUS

Pharmacological basis of pain and inflammation (Prostaglandins, Prostacyclin, Thromboxane A2 and Leukotrienes, PAF)

13.1. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

13.1.1. Non-selective COX-inhibitors

13.1.1.1. Salicylic acid derivatives (Acetyl-salicylic acid, Sodium salicylate, Diflunisal)

13.1.1.2. Pyrazolone derivatives (Phenylbutazone, Aminophenazone, Feprazone, Noramidopyrine)

13.1.1.3. Para-amino-phenol derivatives (Acetaminophen)

13.1.1.4. Indole acetic acids (Indomethacin, Sulindac, Etodolac)

13.1.1.5. Fenamates (Mefenamic acid, Flufenamic acid)

13.1.1.6. Propionic acid derivatives (Ibuprofen, Naproxen, Ketoprofen)

13.1.1.7. Oxicams (Piroxicam, Meloxicam)

13.1.1.8. Aryl-acetic derivatives (Diclofenac, Ketorolac)

13.1.1.9. Alkenones (Nabumetone)

13.1.1.10. Sulfonanilide (Nimesulide)

13.2. COX-2 Selective Inhibitors

13.2.1. 1st generation Celecoxib (substituted aryl pyrazolo); Rofecoxib (aryl substituted furanone); Nimesulide (sulphur anilido)

13.2.2. 2nd generation Valdecoxib (aryl-substituted isoxazole); Parecoxib; Etoricoxib (sulphomethylpyridine derivative); Lumiracoxib (derivative of phenylacetic acid)

14. DRUGS FOR IMMUNOMODULATION

14.1. Immunostimulants (cytokines, interleukins, interferons).

14.2. Immunosuppressive Agents

14.2.1. Glucocorticoids (Prednisone and Prednisolone);

14.2.2. Cyclosporine, Tacrolimus, Sirolimus, Everolimus;

14.2.3. Cytotoxic agents (Azathioprine, Cyclophosphamide, Methotrexate, Mycophenolate Mofetil);

14.2.4. Antibodies

14.2.4.1. Anti-lymphocyte antibodies

14.2.4.2. Intravenous immunoglobulins: (IGIV)

14.2.4.3. Monoclonal antibodies (Muromonab, Basiliximab, Daclizumab)

14.2.5. Fusion Protein (Belatacept, Abatacept)

14.2.6. Monoclonal antibodies with anti-inflammatory action

14.2.6.1. Anti-TNF alpha (Infliximab, Etanercept, Adalimumab)

14.2.6.2. Anti-IL-6 receptor (Tocilizumab)

14.2.6.3. Anti-lymphocyte T

14.2.6.4. DRUGS ACTING ON MOST COMMON SKIN DISEASES

14.2.6.5. Skin absorption of drugs: transcutaneous drugs and problems about transcutaneous administration.

14.2.6.6. 7.1. Topic antimicrobial agents

14.2.6.7. 7.2. Retinoids

14.2.6.8. 7.3. Psoralen based drugs and photochemotherapy

14.2.6.9. 7.4. Drugs acting on psoriasis

14.3. Vaccines Active, passive, adoptive immunization. Types of vaccines. Constituents of vaccine. Adjuvants. Side effects, indications and contraindications to the use of vaccines

15. DRUGS ACTIVE ON METABOLISM

15.1. Antidiabetic drugs

15.1.1. Insulins (rapid, intermediate and slow human insulins),

15.1.1.1. Mutated insulins (Lispro, Aspart, Glulisin, Detemir, Glargine)

15.1.1.2. Incretins (GLP-I analogues, DPPIV inhibitors)

15.1.1.3. Amylin analogues

15.1.2. Oral hypoglycaemic agents

15.1.2.1. Sulfonylureas (Tolbutamide, Chlorpropamide, Glipizide)

15.1.2.2. Metiglinide analogues (Repaglinide, Nateglinide)

15.1.2.3. Biguanides (Metformin)

15.1.2.4. Alpha-glycosidase inhibitors (Acarbose)

15.1.2.5. Thiazolidinediones (Pioglitazone, Rosiglitazone)

15.1.2.6. SLGT-2 Inhibitors (Dapagliflozin)

15.2. Hyperglycaemic drugs (Glucagon, Diazoxide)

15.3. Antigout drugs

15.3.1. Xanthine oxidase Inhibitors (Allopurinol, Febuxostat)

15.3.2. Uricosurics drugs (Probenecid, Sulfinpyrazone)

15.3.3. Enzymes (Rasburicase)

15.3.4. Drugs for acute gout attack treatment (Colchicine, NSAIDs)

15.4. Drugs Active on Calcium Homeostasis

15.4.1. Hypercalcaemic Drugs (Thyrocalcitonin, Glucocorticoids, Mitramicin)

15.4.2. Drugs increasing bone mass (PTH, Fluorides, Testosterone)

15.4.3. Bone resorption Inhibitors

15.4.3.1. Bisphosphonates (Etidronate, Alendronate, Zoledronate)

15.4.3.2. Calcium

15.4.3.3. Calcitonin

15.4.3.4. Oestrogens and selective modulators of oestrogen receptors (Raloxifene)

15.4.3.5. Denosumab

15.4.4. Vitamin D and analogues
15.4.5. Calcimimetics (Cinacalcet)
15.4.6. Phosphates Reuptake Inhibitors (Calcium carbonate, Lanthanum, Sevelamer, Aluminium salts)

16. HORMONES AND DRUGS ACTIVE ON THE ENDOCRINE SYSTEM

16.1. Hypothalamic Factors and Related Drugs

16.1.1. Agents modifying growth hormone secretion

16.1.1.1. Stimulants (GHRH)
16.1.1.2. Inhibitors (Somatostatin, Octreotide, Lanreotide)

16.1.2. Agents modifying gonadotropins secretion

16.1.2.1. GnRH and analogues (Gonadorelin acetate, Leuprolide, Nafarelin)

16.1.3. Agents modifying ACTH secretion (CRH)
16.1.4. Agents modifying TSH secretion (TRH)

16.2. Pituitary Hormones and related drugs

16.2.1. Growth hormone (recombinant human GH) (Mecasermin, Pegvisomant)
16.2.2. Natural and recombinant gonadotropins

16.2.2.1. Follicle-stimulating hormone (recombinant FSH), **Luteinizing hormone** (recombinant LH).
16.2.2.2. Human chorionic gonadotropin (hCG)
16.2.2.3. Human menopausal gonadotropins (hMG)
16.2.2.4. Corifollitropin

16.2.3. Adrenocorticotropic hormone (ACTH, Cosyntropin)
16.2.4. Recombinant TSH
16.2.5. Antidiuretic hormone and antagonists (Vasopressin, Desmopressin, Lisopressin, Terlipressin, Vaptans)
16.2.6. Oxytocin Antagonist (Atosiban)

16.3. Thyroid hormones (T3, T4)

16.4. Antithyroid hormones

16.4.1. Synthesis inhibitors (Methimazole, Propylthiouracil)
16.4.2. Release inhibitors (Iodides)
16.4.3. Transport inhibitors (Thiocyanate, Perchlorate)
16.4.4. Inhibitor of peripheral conversion of T4
16.4.5. Radioactive Iodine (I 131)

16.5. Adrenocortical hormones

16.5.1. Natural

16.5.1.1. Glucocorticoids (Cortisol)
16.5.1.2. Mineralocorticoids (Aldosterone)

16.5.2. Synthetic glucocorticoids having a high anti-inflammatory activity

16.5.2.1. With sodium-retention activity (Cortisone, Prednisone, Prednisolone, Methylprednisolone)

16.5.2.2. Sodium-retention activity free (Betamethasone, Dexamethasone, Triamcinolone)

16.5.2.3. Having predominantly sodium-retention activity (Fludrocortisone)

16.5.3. Adrenocortical antagonists

16.5.3.1. Inhibitors of synthesis (Aminoglutethimide, Metyrapone, Amphenone)

16.5.3.2. Lithics (Mitotane)

16.5.4. Aldosterone receptor antagonists (Spironolactone)

16.6. Androgens and Anabolic Steroids

16.6.1. Testosterone esters (Propionate, enanthate)

16.6.2. 17-alkyl-testosterone derivatives (Methyltestosterone, Fluoxymesterone, Nandrolone)

16.7. Anti-androgens

16.7.1. Androgen receptor antagonists (Cyproterone acetate, Flutamide, Bicalutamide, Spironolactone)

16.7.2. Inhibitors of testosterone synthesis (Ketoconazole)

16.7.3. Inhibitors of 5-alpha-reductase (Finasteride)

16.7.4. Analogues of GnRH (Goserelin, Leuprolide)

16.8. Oestrogens and Antioestrogens

16.8.1. Natural oestrogens (Oestradiol)

16.8.2. Synthetic oestrogens (Ethinyl oestradiol)

16.8.3. Antioestrogens (Clomiphene, Tamoxifen)

16.9. Progestin and Antiprogestins

16.9.1. Progestins (Progesterone, Hydroxyprogesterone, Medroxyprogesterone, Megestrol)

16.9.2. Progestin receptor antagonists (Mifepristone)

16.10. Ovulation inducers

16.10.1. Antioestrogens (Clomiphene)

16.10.2. Gonadotropins

16.10.2.1. Human Chorionic Gonadotropin (HCG)

16.10.2.2. Human Menopausal Gonadotropins (HMG)

16.11. Hormonal contraceptives

16.11.1. Combination oral contraceptives

16.11.2. Progestin-only birth control

16.11.3. Post-coital or emergency contraceptives

16.12. Hormones active on uterine motility

16.12.1. Drugs stimulating uterine motility (Oxytocin, 15-methyl-PGF2α, Ergonovine, Methylergonovine)

16.12.2. Drugs inhibiting uterine motility

16.12.2.1. α-2 adrenergic agonists (Ritodrine, Fenoterol, Albuterol)

16.12.2.2. Calcium channels blockers (Nifedipine, Magnesium)

16.12.2.3. COX-inhibitors (Indomethacin)

16.12.2.4. Oxytocin Antagonists (Atosiban)

17. ELEMENTS OF ENVIRONMENTAL TOXICOLOGY

The main environmental toxicants: dioxin, polychlorinated biphenyls, heavy metals

18. BIOTECHNOLOGICAL DRUGS

General characteristics of biotechnological drugs. Bioengineering and derivatization.

18.1. Biosimilars

18.1.1. Recombinant proteins for substitute or integrative use

18.1.2. Monoclonal antibodies and fusion proteins

18.1.3. Recombinant vaccines

TEACHING METHODS

Formal Lectures = 40 hr
Clinical Seminars = 10 hr
Interactive Learning Activities =10 hr

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	X
only written	
only oral	
project discussion	
other	

In case of a written exam, questions refer to: (*)	**Multiple choice answers**	X
	Open answers	
	Numerical exercises	

(*) multiple options are possible

b) Evaluation pattern:

To be admitted to the oral text each student has to answer correctly at least 33 questions on 60. The exam is passed with a suitability judgment including the written and the oral evaluation