Integrated Course of
MEDICAL PHARMACOLOGY AND TOXICOLOGY II

Scientific Fields: Pharmacology (BIO/14) **Clinical Seminars:** Pharmacology (BIO/14)	**European Credit Transfer and Accumulation System** = 6 **n. hours of Formal Lectures** = 48 **n. hours of Clinical Seminars** = - **n. hours of Interactive Learning Activities = -**

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EDUCATIONAL OBJECTIVES

- The classes of drugs affecting nervous, cardiovascular, genito-urinary, respiratory, gastrointestinal, skin and ocular systems.
- The mechanism of action of the above-mentioned drugs at the molecular and cellular level, and the functional changes exerted by each drug class on organs and systems.
- The drug-related functional changes and their potential therapeutic use and toxicity.
- The main pharmacokinetic properties of the above-mentioned drug classes such as bioavailability, protein binding, metabolism, elimination half-life and drug disposition. The functional impairment of organs involved in drug metabolism and disposition.
- The administration route and the therapeutic regimen for the above-mentioned drug classes.
- The side effects, the interactions, and the consequences of over-dosages for each drug class, to optimize pharmacological therapy.
- The most appropriate drug choice in each patient, taking into consideration disease status, comorbidities, drug pharmacokinetic, pharmacodynamic and side effects.
- The influence of specific conditions such as pregnancy, lactation, age, and gender on drug efficacy and toxicity.
- The main classes of drugs of abuse and drugs used to improve athletic performance (doping).

CORE CURRICULUM

1. **FUNCTIONAL ANATOMY OF THE NERVOUS SYSTEM AND DRUGS ACTIVE ON THE NERVOUS SYSTEM (2.8 CFU).** Catecholaminergic, cholinergic, serotoninergic, and histaminergic neurotransmissions. Antipsychotics. Antidepressants. Mood stabilizers. GABAergic neurotransmission, hypnotics and sedative drugs. Anticonvulsants. Drugs used for migraine therapy and prophylaxis. Analgesics. Antiparkinsonian drugs. Psychostimulants. Pharmacological perspectives against neurodegenerative diseases (Alzheimer's Disease, Cerebral Ischemia, Amyotrophic Lateral Sclerosis and Multiple Sclerosis). General Anesthetics. Muscle relaxants. Local Anesthetics. Drug addiction.
2. **DRUGS ACTING ON THE CARDIOVASCULAR SYSTEM (1.2 CFU).** Nitrergic Neurotransmission and antianginal drugs. Antiarrhythmics. Drugs for heart failure. Anti-hypertensive drugs.
3. **DRUGS ACTING ON THE GENITO-URINARY SYSTEM (0.4 CFU**). Diuretics. Urinary pH modifiers. Drugs used in erectile dysfunction. Drugs against prostatic hypertrophy.
4. **DRUGS ACTING ON THE RESPIRATORY SYSTEM (0.4 CFU).** Antiasthmatics. Antitussive drugs. Drugs used to decrease bronchial secretions.
5. **DRUGS ACTING ON THE GASTROINTESTINAL SYSTEM (0.4 CFU).** Drugs used to control gastric acid secretion and to treat peptic diseases. Laxatives. Emetics, anti-emetics e drugs against kinetosis. Prokinetics. Drugs used to solubilize gallstones.
6. **DERMOPHARMACOLOGY (0.2 CFU)**
7. **DRUGS USED TO ENHANCE ATHLETIC PERFORMANCE (DOPING) (0.2 CFU)**
8. **OCULAR PHARMACOLOGY (0.2)**
9. **PRESCRIPTION MODALITIES (0.1 CFU)**
10. **AGE, SEX, AND DISEASE-DEPENDENT CHANGES IN DRUG RESPONSES (0.1 CFU)**

PRELIMINARY KNOWLEDGE

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.

PROPAEDEUTIC COURSES

Biochemistry, Anatomy, Pathophysiology.

EXAMS

A written test with multiple choice questions on all topics listed in the program, followed by an oral examination. A score higher than a threshold value in the written test is necessary to be admitted to oral examination.

SCHEDULE OF THE COURSE			
Week	**Day; Time**	**Lesson**	**Professor**
1^ 6-10 March 2023	Monday 6 March 15.00-16.00	Functional anatomy of the ANS	Taglialatela
	Monday 6 March 16.00-17.00	Catecholaminergic Neurotransmission	Taglialatela
	Thursday 9 March 13.00-14.00	Catecholamine agonists	Taglialatela
	Thursday 9 March 14.00-15.00	Catecholamine antagonists	Taglialatela
2^ 13-17 March 2023	Monday 13 March 15.00-16.00	Cholinergic Neurotransmission	Matrone
	Monday 13 March 16.00-17.00	Cholinomimetic drugs	Matrone
	Thursday 16 March 13.00-14.00	Cholinolitic drugs	Matrone
	Thursday 16 March 14.00-15.00	GABAergic and Glutammatergic Neurotrasmission	Taglialatela
3^ 20-24 March 2023	Monday 20 March 15.00-16.00	Serotoninergic Neurotransmission	Matrone
	Monday 20 March 16.00-17.00	Histaminergic Neurotransmission	Secondo
	Thursday 23 March 13.00-14.00	Antidepressant drugs (I)	Matrone
	Thursday 23 March 14.00-15.00	Antidepressant (II) and Antiobesity drugs	Matrone
4^ 27 March-31 March 2023	Monday 27 March 15.00-16.00	Antipsychotic drugs (I)	Taglialatela
	Monday 27 March 16.00-17.00	Antipsychotics (II) and Mood Stabilizers	Taglialatela
	Thursday 30 March 13.00-14.00	Anticonvulsants (I)	Taglialatela
	Thursday 30 March 14.00-15.00	Anticonvulsants (II)	Taglialatela
5^ 3-5 April 2023	Monday 3 April 15.00-16.00	Hypnotics-sedatives	Taglialatela
	Monday 3 April 16.00-17.00	Drugs used against migraine	Taglialatela
6^ 13 April 2023	Thursday 13 April 15.00-16.00	Drugs against Parkinson Disease (I)	Taglialatela
	Thursday 13 April 16.00-17.00	Drugs against Parkinson Disease (II)	Taglialatela
7^ 17-21 April 2023	Monday 17 April 13.00-14.00	General Anesthetics and Muscle Relaxants	Taglialatela
	Monday 17 April 14.00-15.00	Local Anesthetics	Taglialatela
	Thursday 20 April 15.00-16.00	Analgesics	Boscia
	Thursday 20 April 16.00-17.00	Principles of drug addiction	Matrone
8^ 24-28 April 2023	Monday 24 April 13.00-14.00	Psicostimulants	Matrone
	Monday 24 April 14.00-15.00	Alcohol and Opioid addictions	Matrone
	Thursday 27 April 13.00-14.00	Antiplatelets	Scorziello
	Thursday 27 April 14.00-15.00	Anticoagulants	Scorziello
9^ 2-5 May 2023	Thursday 4 May 13.00-14.00	Nitrergic Neurotransmission and Drugs used in erectile dysfunction and prostate hyperthropy	Pignataro
	Thrusday 4 May 14.00-15.00	Antianginal drugs (Ca^{+2} antagonists and nitrates)	Pignataro
10^ 8-12 May 2023	Monday 8 May 15.00-16.00	Anti-hypertensives (I)	Pignataro
	Monday 8 May 16.00-17.00	Anti-hypertensives (II)	Pignataro
	Thursday 11 May 13.00-14.00	Diuretics (I)	Pignataro
	Thursday 11 May 14.00-15.00	Diuretics (II)	Pignataro
11^ 15-19 May 2023	Monday 15 May 15.00-16.00	Drugs against acute and chronic heart failure	Pignataro
	Monday 15 May 16.00-17.00	Antiarrhythmics	Pignataro

	Thursday 18 May 13.00-14.00	Antidyslipidemic drugs	Cataldi
	Thursday 18 May14.00-15.00	Antidyslipidemic drugs	Cataldi
12^ 22-26 May 2023	Monday 22 May 15.00-16.00	Drugs against peptic diseases	Secondo
	Monday 22 May 16.00-17.00	Emetics, anti-emetics e drugs against kinetosis. Prokinetics. Drugs used to solubilize gallstones	Secondo
	Thursday 25 May 13.00-14.00	Drugs Acting against Inflammatory bowel disease	Cataldi
	Thursday 25 May14.00-15.00	Antiasthmatics	Pannaccione
13° 29 May 2023	Monday 29 May 15.00-16.00	Antitussive Drugs and mucolytics	Pannaccione
	Monday 29 May 16.00-17.00	Ocular pharmacology and Drugs used to enhance athletic performance	Taglialatela

PHARMACOLOGY AND MEDICAL TOXICOLOGY II
PROGRAM

1. DRUGS ACTIVE ON THE NERVOUS SYSTEM

Overview. General principles of chemical transmission in central nervous system and autonomic nervous system.

1.1. Cholinergic transmission.

Principles of cholinergic transmission. Drugs acting on cholinergic pathway

1.1.1. Cholinergic agonists

- **1.1.1.1. Direct** (Muscarinic and Nicotinic)
- **1.1.1.2. Indirect** (reversible and not reversible Acetilcholine Esterase inhibitors)

1.1.2. Cholinergic antagonists:

- **1.1.2.1. Muscarinic receptor antagonist**
- **1.1.2.2. Nicotinic receptor antagonist** (Ganglioplegic, Curare drugs)

1.2. Catecholaminergic transmission.

Overview of adrenergic, noradrenergic and dopaminergic transmission.Drugs acting on catecholaminergic pathway

1.2.1. Drugs that affect noradrenaline synthesis

- **1.2.1.1. Syntesis inductors** (Tyrosine, L-DOPA)
- **1.2.1.2. Synthesis inhibitors** (αMpT, Benserazide, Carbidopa, Disulfiram, Dithiocarbamate)

1.2.2. Drugs that affect noradrenaline storage (Reserpine, Guanethidine)

1.2.3. Indirectly acting sympathomimetic amines (d-amphetamine, tyramine)

1.2.4. Inhibitors of noradrenaline reuptake 1 (Tricyclic antidepressants)

1.2.5. Inhibitors of noradrenaline postsynaptic reuptake 2 (Phanoxybenzamine)

1.2.6. Metabolism inhibitors

- **1.2.6.1. MAOI-A** (Clorgiline, Moclobemide)
- **1.2.6.2. MAOI-B** (Deprenyl)
- **1.2.6.3. MAOI-Mixed** (Pargyline)
- **1.2.6.4. COMT Inhibitors** (Tolcapone, Entacapone)

1.2.7. Receptor agonists

- **1.2.7.1. Dopaminergics**
  - **1.2.7.1.1. Selective** DA2, (Bromoergocriptine, Pergolide, Lisuride, Lergotrile, Cabergoline, Quinpirole, Pramipexole, Quinagolide, Ropirinole)
  - **1.2.7.1.2. Non selective** (Apomorphine)
- **1.2.7.2. Adrenergics**
  - **1.2.7.2.1. α1** (Adrenaline, Noradrenaline, Phenylephrine)
  - **1.2.7.2.2. α2** (Adrenaline, Noradrenaline, Clonidine)
  - **1.2.7.2.3. Mainly β1** (Noradrenaline)
  - **1.2.7.2.4. β2** (Metaproterenol, Salbutamol, Salmeterol, Formoterol)
  - **1.2.7.2.5. β1+β2** (Isoproterenol, Adrenaline)
- **1.2.7.3. Receptor antagonists**
  - **1.2.7.3.1. Dopaminergics** (Fenothiazides, Thioxanthenics, Butyrophenones, Diphenylbutylpiperidines, Benzamides), (Antipsychotic drugs)
  - **1.2.7.3.2. α1** (Prazosin, Terazosin, Doxazosin.)
  - **1.2.7.3.3. α2 (**Yohimbine, Mianserin)
  - **1.2.7.3.4. α1+α2** (Phentolamine)
  - **1.2.7.3.5. β1** (Acebutolol)
  - **1.2.7.3.6. β2** (Butoxamine)
  - **1.2.7.3.7. β1+β2** (Propranolol)

1.3. Histaminergic transmission

Overview. H_1, H_2, H_3, H_4 receptor

1.3.1. H_1, H_2, H_3, H_4 receptor agonists

1.3.1.1. H_1 agonists (2-methylhistamine)

1.3.1.2. H_2 (Betazole)

1.3.1.3. H_3 (α-methylhistamine)

1.3.2. H_1, H_2, H_3, H_4 receptor antagonists

1.3.2.1. H_1 receptor antagonists.

1.3.2.1.1. I generation:

1.3.2.1.1.1. **Ethanolamines** (Diphenhydramine, Dimenhydrate)

1.3.2.1.1.2. **Ethylenediamines** (Pyrilamina)

1.3.2.1.1.3. **Alkylamines** (Chlorpheniramine)

1.3.2.1.1.4. **Piperazines** (Cyclizine)

1.3.2.1.1.5. **Piperidine** (Cyproheptadine, Ketotifen)

1.3.2.1.1.6. **Phenothiazines** (Promethazine)

1.3.2.1.1.7. **Others** (Oxatomide)

1.3.2.1.2. II generation:

1.3.2.1.2.1. **Alkylamines** (Acrivastine)

1.3.2.1.2.2. **Piperazines** (Cetirizine, Levocetirizine)

1.3.2.1.2.3. **Piperidines** (Terfenadine, Astemizole, Loratadine, Desloratadine, Fexofenadine, Mizolastine, Ebastine)

1.3.2.2. H_2 receptor antagonists (Cimetidine, Ranitidine, Famotidine, Nizatidine)

1.3.2.3. H_3 receptor antagonists (Thioperamide)

1.4. Serotoninergic transmission

General principles of serotoninergic transmission. $5HT_{1A,B,D,E,F}$ $5HT_{2A,B,C}$, $5HT_3$, $5HT_4$, $5HT_{5A,B}$, $5HT_6$, $5HT_7$ receptors

1.4.1. Drugs acting on serotoninergic neurotransmission

1.4.1.1. Synthesis inhibitors (PCPA)

1.4.1.2. Serotonin synthesis precursors (Tryptophan, 5-OH Tryptophan)

1.4.1.3. Storage inhibitors (Reserpine)

1.4.1.4. Serotonin release inducers (Fenfluramine)

1.4.1.5. Reuptake inhibitors (Clorimipramine, Fluoxetine, Paroxetine, Fluovoxamine)

1.4.1.6. Receptor agonists (Bufotenin, LSD-25, Psilocybin, 8-OH PAT, Sumatriptan)

1.4.1.7. Receptor antagonists (Methysergide, Metergoline, Pizotifen, Cyproheptadine, Methiotepin, Ketanserin, Granisetron, Ondansetron, Tropisetron)

1.5. Ergot alkaloids

1.6. Alkaloid amines (Lysergic acid, LSD, Ergonovine, Methysergide)

1.7. Peptic alkaloids (Ergotamine, Ergocryptine, Bromocriptine, Dihydroergotamine)

1.8. Amino acid neurotransmission (inhibitors)

General principles of Gabaergic transmission. Drugs acting on Gabaergic transmission

1.8.1. Reuptake inhibitors (Phenytoin, Guvacine)

1.8.2. Glutammate decarboxylase inhibitors (Isoniazid, Penicillins, Cephalosporins)

1.8.3. GABA-transaminase inhibitors (Vigabatrin, Valproate)

1.8.4. Receptor agonists

1.8.4.1. $GABA_A$ (Muscimol)

1.8.4.2. $GABA_B$ (Baclofen)

1.8.5. Receptor antagonists

1.8.5.1. **$GABA_A$** (Bicucullina, Picrotossina)

1.8.5.2. **$GABA_B$** (Faclofen)

1.9. General principles of glycinergic transmission.

Drugs acting on glycinergic neurotransmission

1.10. Amino acid neurotransmission (excitatory)

General principles of excitatory amino acid neurotransmission (glutamate, aspartate). Excitatory amino acid receptors: inotropic and metabotropic receptors.

1.10.1. Receptor agonists (N-methyl-D-aspartate).

1.10.2. Receptor antagonists (MK 801, NBQX, CNQX)

1.11. Nitric oxide

1.11.1. Selective NOS inhibitors (7-Nitroindazolo)

1.11.2. Non selective NOS inhibitors (L-NAME)

1.11.3. NO precursors (L-Arginine)

1.11.4. NO donors (Nitroglycerin, Sodium nitroprusside, NONOate)

1.12. Blood-brain barrier pharmacological function

1.13. Antipsychotic drugs

1.13.1. Typical Antipsychotics

1.13.1.1. Phenothiazines

1.13.1.1.1. Aliphatic compounds (Clorpromazine, Triflupromazine)

1.13.1.1.2. Piperidines (Thioridazine, Mesoridazine)

1.13.1.1.3. Piperazines (Fluphenazine, Perphenazine)

1.13.1.2. Thioxanthenes (Chlorprothixene, Flupentixol)

1.13.1.3. Butyrophenones (Haloperidol)

1.13.1.4. Diphenylbutyrylpiperidines (Pimozide, Penfluridol)

1.13.2. Atypical Antipsychotics

1.13.2.1. Dibenzodiazepine

1.13.2.1.1. Dibenzoxazepine (Loxapine)

1.13.2.1.2. Dibenzodiazepine (Clozapine, Olanzapine, Quetiapine)

1.13.2.1.3. Dibenzothiazepine (Clotiapine)

1.13.2.2. Benzamides (Sulpiride, Amisulpride, Tiapride, Remoxipride)

1.13.2.3. Indole derivates (Molindone, Oxypertine)

1.13.2.4. Benzisoxazole derivates (Risperidone, Ocaperidone, Ziprasidone)

1.13.2.5. Benzquinolizyne derivates (Benzquinamide, Tetrabenazine)

1.13.2.6. Dihydrocarboxylic derivates (Aripiprazole)

1.13.2.7. Other eterocyclic derivates (Sertindole)

1.14. Antidepressant drugs

1.14.1. Non-selective tricyclic inhibitors of monoamine reuptake

1.14.1.1. Tertiary amines Amitriptyline, Doxepin, Imipramine, Trimipramine)

1.14.1.2. Secondary amines (Nortriptyline, Amoxapine, Desipramine, Protriptyline, Maprotiline)

1.14.2. Serotonin Noradrenergic Reuptake inhibitors (Venlafaxine, Desvenlafaxine, Duloxetine, Milnacipran)

1.14.3. Selective serotonin reuptake inhibitors (SSRI) (Fluoxetine, Fluvoxamine, Paroxetine, Sertraline, Citalopram, Escitalopram)

1.14.4. Norepinephrine reuptake inhibitors (Reboxetine, Atomoxetine, Riloxazine, Nisoxetine)

1.14.5. 5HT2 receptor antagonists and serotonin reuptake inhibitors (Nefazodone, Trazodone)

1.14.6. α2 adrenergic antagonists (Mianserin, Mirtazapine)

1.14.7. Dopaminergic antidepressants (Amineptine, Amisulpride, Minaprine, Bupropion)

1.14.8. MAO inhibitors:

1.14.8.1. Non selective and irreversible (Iproniazide, Isocarboxazid, Isoniazid, Tranylcypromine, Phenelzine, Nialamide)

1.14.8.2. Selective and irreversible MAO-A inhibitors (Chlorgiline)

1.14.8.3. Selective and reversible MAO-A inhibitors (Brofaromine, Moclobemide, Toloxatone, Befloxatone)

1.14.9. MT1 e MT2 receptor agonists (Agomelatine)

1.14.10. Miscellaneus of antidepressants (Tianeptine)

1.15. Drug tratment of bipolar disorder

1.15.1. Lithium;

1.15.2. Antiepileptic drugs (Valproate, Carbamazepine, Oxcarbazepine, Lamotrigine, Topiramate, Gabapentin, Zonisamide, Levetiracetam)

1.15.3. Atypical antipsychotic drugs (Olanzapine, Risperidone, Quetiapine, Clozapine, Ziprasidone, Aripiprazole)

1.16. Psychostimulant drugs (Cocaine, Amphetamines and derivates, Methylphenidate, DOM, MDA, MDMA, Methylxanthine)

1.17. Hypnotic drugs

1.17.1. Benzodiazepines:

1.17.1.1. Pronordiazepam and others, long-time acting drugs (Chlordiazepoxide, Diazepam, Chlordesmethyl-diazepam, Flurazepam, Clobazam, Bromazepam, Quazepam)

1.17.1.2. Oxazepam based drugs and others, short-time acting drugs (Oxazepam, Lorazepam);

1.17.1.3. Nitrobenzodiazepines, average-time acting drugs and others (Nitrazepam, Clonazepam, Flunitrazepam)

1.17.1.4. Triazolo-Benzodiazepines, short-acting drugs and others (Alprazolam, Triazolam)

1.17.1.5. Trieno-Benzodiazepines, short-acting drugs (Clotiazepam)

1.17.2. Benzodiazepines receptor partial agonists: Bretazenil, Imidazenil

1.17.3. Barbiturates (Secobarbital, Phenobarbital)

1.17.4. Non benzodiazepine-based drugs

1.17.4.1. Imidazopyridines (Zolpidem)

1.17.4.2. Cyclopyrrolones (Zopiclone)

1.17.4.3. Pirazolopyrimidines (Zaleplon)

1.17.4.4. Azaspirodecanediones (Buspirone)

1.17.5. Ethanol

1.17.6. Others (Paraldehyde e Chloral hydrate)

1.18. Antiepileptic drugs

1.18.1. Barbiturates (Fenobarbital, Mefobarbital)

1.18.2. Desoxybarbiturates (Primidone)

1.18.3. Succinimides (Etosuxinimide)

1.18.4. Hydantoinics (Phenytoin)

1.18.5. Iminostilbene derivates (Carbamazepine, Oxacarbazepine)

1.18.6. Benzodiazepines (Diazepam, Nitrazepam, Clonazepam)

1.18.7. Carboxylic acid derivates (Valproate)

1.18.8. Oxazolidinediones (Trimethadione, Paramethadione)

1.18.9. Gaba transaminase inhibitors (Vigabatrin)

1.18.10. L.Others (Felbamate, Lamotrigine, Gabapentin, Topiramate, Tiagabine, Levetiracetam, Perampanel, Brivaracetam)

1.19. Hallucinogenic drugs

1.19.1. Indole derivates (LSD, dimethyltriptamine, psylocibine, psylocine).
1.19.2. Phenylethilamine derivates (mescaline, amphetamine, DOM, MDA, MDMA o ecstasy)
1.19.3. Arycyclohexylamine derivates (phencyclidine).
1.19.4. Tetrahydrocannabinol

1.20. Analgesic drugs

Endogenous opioid system (Endorphins, Enkephalins, Dinorphins, Endomorphins)
Other peptides involved in nociception: (Nociceptin And Nocistatin)
Opioids. Opioid receptors (μ, k, δ)

1.20.1. Opioid agonists
- **1.20.1.1. Morphin and semisynthetic derivates**
- **1.20.1.2. Codein and derivates** (Hydroxicodone, oxycodone)
- **1.20.1.3. Thebaine derivates** (Buprenorphin, Etorphin)
- **1.20.1.4. Methadone e congeners**
- **1.20.1.5. Meperidine e congeners**
- **1.20.1.6. Benzomorphanes** (Pentazocine)
- **1.20.1.7. Morphinanes** (Butarfanol)

1.20.2. Antagonists
- **1.20.2.1. Pure** (Naloxone, Naltrexone, Nalmefene)
- **1.20.2.2. Partial agonist activity** (Nalorphine)

1.21. Clinical toxicology

Definition of substance dependance. Psychic and physical dependance. Abstinence syndrome. Tolerance. Classification of addicting substances.
Substance dependance: Heroin and other opioids; cannabinoids; cocaine, amphetamines and other psychostimulants; ethanol; LSD and other hallucinogenic drugs, tobacco smoke.
Acute intoxication and chelating agents
Environmental toxicology (Dioxins, PCB, Heavy metals, …)

1.22. Drug treatment of Parkinson disease

1.22.1. Dopamine precursors (L-Dopa)
1.22.2. Indirect dopaminomimetics
- **1.22.2.1. DOPA-decarboxylase inhibitors** (Benserazide, Carbidopa)
- **1.22.2.2. COMT inhibitors** (Entacapone, Tolcapone).

1.22.3. Dopaminergic agonists (Bromocriptine, Lisuride, Pergolide, Cabergoline, Quinagolide Pramipexol, Quinpirol, Ropirinol, Apomorphine).
1.22.4. Indirect and mixed dopaminomimetics (Amantadine).
1.22.5. MAO-B inhibitors (Selegiline, Rasagiline).
1.22.6. Central anticholinergic drugs (Benztropine, Orphenadrine, Ethopropazine, Trihexyphenidyl).

1.23. Headache drug treatment

1.23.1. Prophylactic treatment
- **1.23.1.1. 5HT recetor antagonists** (Cyproheptadine, Methysergide, Pizotifen)
- **1.23.1.2. Calcium-antagonists** (Flunarizine, Verapamil)
- **1.23.1.3. Beta-blockers** (Popranolol)
- **1.23.1.4. Tricyclic antidepressants** (Amitriptiline, Nortriptiline)
- **1.23.1.5. Nutritional supplements** (Magnesium, Riboflavin, Coenzyme Q10)

1.23.2. Acute attack treatment
- **1.23.2.1. Ergot alkaloyds** (Ergotamine)
- **1.23.2.2. 5HT1 receptor agonists** (Sumatriptan, Zolmitriptan, Naratriptan, Almotriptan)
- **1.23.2.3. NSAID**
- **1.23.2.4. Antiemetic drugs**

1.24. Central myorelaxant drugs (Baclofen, Progabide, Benzodiazepines, Tizanidine)

1.25. General anaesthetics

- **1.25.1. Inhalation anaesthetics** (Nitric oxyde, Alotane, Metoxyflurane, Enflurane, Desflurane, Sevoflurane, Isoflurane, Xenon).
- **1.25.2. Intravenous anaesthetics** (Thiopental, Diazepam, Propofol, Etomidate)
- **1.25.3. Antipsychotic and analgesic drugs** (Phentanyl+Droperidol)
- **1.25.4. Curare derivates** (Peripheral myorelaxants)
  - **1.25.4.1. Competitive** (D-tubocurarine, Metocurine, Gallamine, Alcuronium, Pancuronium, Atracurium, Mivacurium)
  - **1.25.4.2. Depolaryzers** (Succinylcholine)

1.26. Local anaesthetics

- **1.26.1. Esters** (Cocaine, Procaine, Benzocaine, Tetracaine)
- **1.26.2. Ethers** (Pramoxine)
- **1.26.3. Amides** (Lidocaine, Bupivacaine, Mepivacaine, Etidocaine, Prilocaine)
- **1.26.4. Ketones** (Dyclonine)

1.27. New perspectives about drug treatment of aging related cognitive disease (Alzheimer's disease)

- **1.27.1. Cholinesterase inhibitors:**
  - **1.27.1.1. Acridines** (Tacrine)
  - **1.27.1.2. Carbamates** (Fisostigmine, Eptostigmine, Rivastigmine)
  - **1.27.1.3. Piperidines** (Donepezil).
- **1.27.2. NMDA Antagonists** (Memantine)

1.28. Central ischaemic attack drug treatment

- **1.28.1. Thrombolytics** (Streptokinase, Urokinase, Alteplase (r-tPA), Reteplase, Tenecteplase)
- **1.28.2. Antiplatelet medications (**ASA, Clopidrgrel**)**
- **1.28.3. Anticoagulants** (Warfarin, Eparine, Rivaroxaban, Apixaban, Dabigatran**,** Dipyridamole)
- **1.28.4. Osmotic agents** (Mannitol, Glycerol**)**

2. DRUGS ACTING ON CARDIO-VASCULAR SYSTEM

2.1. Angina pectoris drug treatment

- **2.1.1. Organic nitrates** (Nitroglycerin, Isosorbide Dinitrate, Isosorbide Mononitrate, Erythrithyl Tetranitrate)
- **2.1.2. Potassium channel activators** (Nicorandil)
- **2.1.3. Calcium antagonists** (Verapamil, Diltiazem, Nicardipine, Felodipine, Amlodipine)
- **2.1.4. β-Blockers** (Propranolol, Metoprolol, Atenolol, Pindolol)
- **2.1.5. If flow inhibitors** (Ivabradine)
- **2.1.6. ACE inhibitors** (Captopril, Ramipril Enalapril)
- **2.1.7. 3-KAT-inhibitors** (Trimetazidine)
- **2.1.8. Statins** (Pravastatin, Simvastatin)

2.2. Antidysrhythmic drugs

- **2.2.1. Class I antidysrhythmics (Sodium channel blockers)** (Quinidine, Procainamide, Disopyramide, Lidocaine, Mexiletine, Phenitoyn, Tocainide, Encainide, Flecainide, Propafenone)
- **2.2.2. Class II antidysrhythmics (β -adrenergic antagonists)** (Propranolol, Metoprolol, Atenolol, Pindolol)
- **2.2.3. Class III antidysrhythmics (repolarization prolonger drugs)** (Amiodarone, Dronedarone, Ibutilide, Dofetilide, Bretylium, Sotalol)
- **2.2.4. Class IV antidysrhythmics (calcium channel blockers)**
  - **2.2.4.1.** P**henylalkylamines** (Verapamil, Gallopamil)
  - **2.2.4.2. Benzothiazepines** (Diltiazem)
  - **2.2.4.3. Other antidysrhythmic drugs** (Digoxin, Adenosine, Magnesium, Potassium, Vernakalant)

2.3. Drug treatment of heart failure

2.3.1. Drugs that increase myocardial contraction

- **2.3.1.1. Cardiac glycosides** (Digoxin, Digitotoxin)
- **2.3.1.2. Simpaticomimetics** (Dobutamine; Dopaminae)
- **2.3.1.3. Phosphodiesterase inhibitors** (Milrinone, Amrinone)
- **2.3.1.4. Calcium sensitisers** (Levosimendan)

2.3.2. Drugs that reduce Cardiac Afterload

- **2.3.2.1. Ace Inhibitors** (Enalapril, Lisinopril)
- **2.3.2.2. Sartans** (Losartan, Candesartan, Almesartan)
- **2.3.2.3. Nitroderivates**
- **2.3.2.4. Calcium antagonists**
- **2.3.2.5. Dopaminergic agonists**

2.3.3. Drugs that reduce cardiac preload

- **2.3.3.1. Diuretics** (Hydrochlorothiazides, Furosemide, Torasemide)
- **2.3.3.2. Nitroderivates**

2.3.4. Drugs acting against ventricle remodeling

- **2.3.4.1. ACE-inhibitors** (enalapril)
- **2.3.4.2. Sartans**
- **2.3.4.3. β-Blockers** (Carvedilol, Metoprolol, Bisoprolol)

2.3.5. Others:

- **2.3.5.1. Aldosterone antagonists** (Spironolactone, Eplerenone)
- **2.3.5.2. Endothelin I antagonists** (Tezosentan)

2.4. Antihypertensive drugs.

General principles about essential hypertension pharmacological treatment and emergency/urgency treatment. Pharmacodynamic classification.

2.4.1. ACE-inhibitors (Captopril, Enalapril, Lisinopril, Fosinopril, Quinapril)
2.4.2. Angiotensin II receptor antagonists (Losartan, Irbesartan, Valsartan)
2.4.3. Direct renin inhibitors (Aliskiren)
2.4.4. Diuretics (Thiazides, loop and potassium sparing**)**
2.4.5. Calcium-antagonists

- **2.4.5.1. Dihydropyridines (**Nifedipine, Amlodipine, Felodipine, Isradipine, Nisoldipinae)
- **2.4.5.2. Benzothiazepines (**Diltiazem)
- **2.4.5.3. Phenylalkylamines (**Verapamil)

2.4.6. β-adrenergic receptor antagonists (Propranolol, Metoprolol, Atenolol, Pindolol, Nebivolol)
2.4.7. α and β-antagonists drugs (Labetalol, Carvedilol)
2.4.8. α1-adrenergic antagonists (Prazosin, Terazosin, Doxazosin)
2.4.9. Central sympatholthycs (α-methyldopa, Clonidine)
2.4.10. Ganglioplegic drugs (Trimetaphano)
2.4.11. Adrenergic neuron blockers (Reserpine, Guanethidine)
2.4.12. Direct vasodilators (Hydralazine, Minoxidil, Diazoxide, Nitroderivates)

3. DRUGS ACTING ON RESPIRATORY SYSTEM

3.1. Drugs acting on bronchial asthma

3.1.1. Mast cell stabilizer (Cromoglicic acid and Nedocromil sodium)
3.1.2. Anti-inflammatory drugs (Corticosteroids: Beclomethasone, Budesonide, Fluticasone)
3.1.3. Broncodilators

- **3.1.3.1. Sympathomimetic drugs** (Orciprenaline, Salbutamol, Formoterol, Salmeterol)**,**
- **3.1.3.2. Parasympatholythic drugs (**Ipratropium bromide, Oxitropium bromide, Tiotropium bromide)
- **3.1.3.3. Methylxanthines** (Theophylline, Aminophylline)

3.1.4. Drugs against leukotriene formation: Synthesis inhibitors (Zileuton) **or Receptor inhibitors** (Montelukast, Zafirlukast)
3.1.5. Anti-Ig E drug (Omalizumab)

3.2. Cough medicine

3.2.1. Central acting drugs:

3.2.1.1. Opioids (Codeine, dihydrocodeine, Pholcodine, Dextromethorphane)

3.2.1.2. Non Opioids (Cloperastine, Clofedianol, Zipeprol)

3.2.2. Direct peripheral acting drugs (Levodropropizine, Oxolamine)

3.2.3. Indirect peripheral acting drugs

3.2.3.1. Mucokinetics

3.2.3.2. Bronchodilators

3.2.3.3. Local anaesthethics

3.3. Drugs acting on bronchial secretion

3.3.1. Mucolytics (N-acetylcysteine, Mesna, Onoprose, Dornase □)

3.3.2. Mucoregulators (Bromhexine, Ambroxol, Carbocisteine)

3.3.3. Expectorant (Potassium iodide, Polygala, Guaifenesin

4. DRUGS ACTING ON GATROINTESTINAL TRACT

4.1. Prokinetics

4.1.1. Cholomimetic agents (Neostigmine)

4.1.2. Dopaminergic agents (Domperidone)

4.1.3. Drugs acting on serotonin and domanine receptors (Metoclopramide and Levosulpiride)

4.1.4. Drugs acting on 5-HT4 and 5-HT3 receptor (Renzapride, Zacopride, Mosapride)

4.1.5. Drugs acting on 5-HT4 receptor (Prucalopride)

4.1.6. Drugs acting on motilin receptor (Erytromycin)

4.2. Emetics (Ipecac, Apomorphine)

4.3. Antiemetics

4.3.1. Muscarinic antagonist (Scopolamine)

4.3.2. Antihistamines (Diphenhydramine, Dimenhydrinate, Doxylamine, Promethazine, Cinnarizine)

4.3.3. Dopaminergic antagonists (Domperidone, Metochlopramide, Chlorpromazine, Perphenazine, Haloperidol)

4.3.4. 5-HT3 receptor antagonists (Ondansetron, Granisetron, Tropisetron, Dolasetron, Palonosetron)

4.3.5. NK1 receptor antagonists (Aprepitant)

4.3.6. Glucocorticoids

4.3.7. Benzodiazepines

4.3.8. Cannabinoids

4.4. Laxative and Purgants

4.4.1. Volume laxatives (Psyllium, Sterculia, Methylcellulose)

4.4.2. Osmotic laxatives (Magnesium salts, Lactulose, Macrogol 4000)

4.4.3. Stimulant laxatives

4.4.3.1. Anthraquinones (Senna, Aloe, Cascara, Frangula, Rhubarb)

4.4.3.2. Diphenylmethane (Bisacodil, Picosulfate)

4.4.4. Emollient laxatives (Paraffin, Sodium docusate)

4.4.5. New laxatives (Prucalopride, Lubiprostone, Linaclotide)

4.5. Antidiarrhoeal drugs

4.5.1. Adsorbents (Kaolin, Actapulgite)

4.5.2. Antidiarrhoeal drugs (Loperamide, Diphenoxylate + Atropin)

4.6. Drugs used in Inflammatory bowel diseases

4.6.1. Aminosalicylates (Mesalazine, Sulfasalazine, Balsalazide, Olsalazine)

4.6.2. Glucocorticoids

4.6.3. Immunosoppressors (6-Mercaptopurine, Methotrexate, Cyclosporines, Tacrolimus)
4.6.4. Immunomodulators: **Anti-TNF Ig** (Infliximab, Adalimumab, Certolizumab pegol, Golimumab);
4.6.5. Ustekinumab; anti-integrines Ig; JAK inhibitors.

4.7. Drugs affecting the biliary and pancreatic sytem
4.7.1. Bile acids (Ursodeoxycholic acid)
4.7.2. Drugs acting on oesophageal varices:
4.7.3. Vasopressin and analogous
4.7.4. Somatostatin and analogous (Octreotide, Lanreotide)

4.8. Drugs acting on hepatic encephalopathy
4.8.1. Osmotic laxatives (Lactulose, Lactilole)
4.8.2. Antibiotics (Neomycin, Rifaximin)

4.9. Drugs acting on pancreatic failure
4.9.1. Enzymes (Pancreatin, Pancrelipase)

5. DRUGS ACTING ON URINARY AND REPRODUCTIVE SYSTEM
5.1. Diuretics
5.1.1. Active on proximal tubule:
5.1.2. Osmotic diuretics (Urea, Glycerole, Mannitol)
5.1.3. Carbonic anhydrase inhibitor (Acetazolamide)
5.1.4. Active on Henle loop (Etacrynic acid, Furosemide, Torasemide)
5.1.5. Active on first tract of distal tubule (Thiazides and analogous)
5.1.6. Active on second tract of distal tubule and on collecting duct
5.1.6.1. Aldosterone receptor antagonists (Spironolactone)
5.1.6.2. Active on sodium channels (Triamterene, Amiloride)

5.2. Acidfying and alkalinizing urines drugs.
General principles.
5.3. Drugs acting on erectile dysfunction
5.3.1. Phosphodiesterase inhibitors (Sildenafil, Vardenafil, Tadalafil)
5.3.2. Dopaminergic antagonists (Apomorphine)
5.3.3. Intravenous drugs (Alprostadil, Papaverine, Timoxamine)

6. DOPING: PHARMACOLOGY AND TOXICOLOGY
Drugs improving athletic performances: ethic, biological and legal boundaries. Integration, supplementation, therapy, doping. Fight against doping: general regulations and procedures of controls. World Antidoping Agency (WADA) and the list of prohibited drugs and methods. Banned substances during and off competition; banned substances in some sports; banned methods.

7. DRUGS ACTING ON MOST COMMON SKIN DISEASES
Skin absorption of drugs: transcutaneous drugs and problems about transcutaneous administration.
7.1. Topic antimicrobial agents
7.2. Retinoids
7.3. Psoralen based drugs and photochemotherapy
7.4. Drugs acting on psoriasis

8. PRESCRIPTION FILING
Prescription filing and dosage: general rules about prescription, specific rules about prescription of controlled drugs. Stockage and distribution of specific drugs.

9. MODIFIED DRUG RESPONSES IN SPECIFIC PATHOPHYSIOLOGICAL STATES

Drug administration in perinatal, pediatric and geriatric age. Optimization and personalization of drug administration in specific pathological conditions (respiratory, hepatic and kidney insufficiency).

RECOMMENDED TEXTBOOKS AND DIDACTIC MATERIALS

- A. J. TREVOR, B. G. KATZUNG. Basic and Clinical Pharmacology. Lange, 14th Ed. 2017
- F. GOODMAN-GILMAN: The Pharmacological Basis of Therapeutics. McGraw-Hill, 13th Ed. 2015.
- 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