COURSE DETAILS

"MEDICAL PHARMACOLOGY AND TOXICOLOGY II"

SSD BIO14

DEGREE PROGRAMME: MEDICINE AND SURGERY (P11)
COORDINATOR: PROF. TAGLIALATELA MAURIZIO
ACADEMIC YEAR: 2024-2025

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: MEDICAL PHARMACOLOGY AND TOXICOLOGY II
MODULE: II
SSD OF THE MODULE: BIO14
TEACHING LANGUAGE: ENGLISH
CHANNEL: 1/1
YEAR OF THE DEGREE PROGRAMME: IV
SEMESTER: II
CFU: 6

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

Biochemistry, Anatomy, Pathophysiology.

PREREQUISITES (IF APPLICABLE)

To successfully attain the learning objectives, it is essential that students have previously acquired knowledge in the fields of chemistry, anatomy, biochemistry, genetics, physiology, general pathology, immunology, and clinical pathophysiology, as well as a comprehensive understanding of the chemical structure of drugs, dose-response relationships, and the underlying mechanisms by which drugs produce their therapeutic effects.

LEARNING GOALS

The course intends to provide medical students with basic information on the pharmacology of neurotransmission and drugs acting on the autonomic and central nervous systems as well as the cardiovascular, respiratory, and gastrointestinal systems. Students will learn: -The pharmacology of drugs used for the treatment of neurological diseases (Parkinson, Alzheimer, Epilepsy, Depression, Schizophrenia...) -cardiovascular diseases - pulmonary diseases (asthma and chronic obstructive Pulmonary Disorder) -The pharmacology of the drugs of abuse and mechanisms of addition -The pharmacology of opiates and local and general anesthetics and mechanism of analgesia

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Student are expected to gain a solid understanding of the core principles of pharmacology, ultimately demonstrating the ability to accurately interpret relevant texts, teaching materials, and scientific articles in the field of pharmacology that will be used during the course.

Applying knowledge and understanding

At the end of the course, students are expected to be able to design a rational pharmacological therapy based on their knowledge of the pathophysiology of the disease of interest and the functional characteristics of the different classes of drugs used in that area.
In addition, they must be able to evaluate the advantages and disadvantages associated with the use of different molecules belonging to distinct classes or the same pharmacological class.

COURSE CONTENT/SYLLABUS

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 Acetylcholine 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. Synthesis 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 (Phenoxybenzamine)

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. Nonselective (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 (Phenothiazines, Thioxanthenes, 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 (Butaxamine)

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. **Ethanolamine** (Diphenhydramine, Dimenhydrinate)

1.3.2.1.1.2. **Ethylenediamines** (Pyrilamine)

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 (Clomipramine, Fluoxetine, Paroxetine, Fluvoxamine)

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

1.4.1.7. Receptor antagonists (Methysergide, Metergoline, Pizotifen, Cyproheptadine, Methiothepin, 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. Glutamate 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. $GABA_A$ (Bicuculline, Picrotoxin)

1.8.5.2. $GABA_B$ (Baclofen)

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. Pharmacotherapy of psychosis

1.13.1. Typical Antipsychotics

1.13.1.1. Phenothiazines

1.13.1.1.1. Aliphatic compounds (Chlorpromazine, 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. Drug therapy of depression
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. Nonselective 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. Miscellaneous of antidepressants (Tianeptine)

1.15. Pharmacotherapy of obesity
1.15.1. Sympathomimetic (Phentermine and Diethylproprion)
1.15.2. Intestinal lipase inhibitor (Orlistat)
1.15.3. GLP-1 receptor agonist (Liraglutide, Semaglutide)
1.15.4. Combination sympathomimetic and carbonic anhydrase inhibitor (Phentermine/Topiramate)
1.15.5. Combination of a dopamine and norepinephrine re-uptake inhibitor and mu-opioid receptor antagonist (Bupropion-naltrexone)
1.15.6. Melanocortin-4-receptor agonist (Setmelanotide)
1.15.7. Superabsorbent hydrogel particles of a cellulose-citric acid matrix (Gelesis 100)
1.16. Drug treatment of bipolar disorder
1.16.1. Lithium.
1.16.2. Antiepileptic drugs (Valproate, Carbamazepine, Oxcarbazepine, Lamotrigine, Topiramate, Gabapentin, Zonisamide, Levetiracetam)
1.16.3. Atypical antipsychotic drugs (Olanzapine, Risperidone, Quetiapine, Clozapine, Ziprasidone, Aripiprazole)

1.17. Psychostimulant drugs (Cocaine, Amphetamines and derivates, Methylphenidate, DOM, MDA, MDMA,

Methylxanthine)

1.18. Hypnotics and sedatives

- **1.18.1. Benzodiazepines**:
  - **1.18.1.1. Pronordiazepam and others, long-time acting drugs** (Chlordiazepoxide, Diazepam, Chlordesmethyl-diazepam, Flurazepam, Clobazam, Bromazepam, Quazepam)
  - **1.18.1.2. Oxazepam based drugs and others, short-time acting drugs** (Oxazepam, Lorazepam);
  - **1.18.1.3. Nitrobenzodiazepines, average-time acting drugs and others** (Nitrazepam, Clonazepam, Flunitrazepam)
  - **1.18.1.4. Triazolo-Benzodiazepines, short-acting drugs and others** (Alprazolam, Triazolam)
  - **1.18.1.5. Trieno-Benzodiazepines, short-acting drugs** (Clotiazepam)
- **1.18.2. Benzodiazepines receptor partial agonists:** Bretazenil, Imidazenil
- **1.18.3. Barbiturates** (Secobarbital, Phenobarbital)
- **1.18.4. Non-benzodiazepine-based drugs**
  - **1.18.4.1. Imidazopyridines** (Zolpidem)
  - **1.18.4.2. Cyclopyrrolones** (Zopiclone)
  - **1.18.4.3. Pyrazolopyrimidine** (Zaleplon)
  - **1.18.4.4. Azaspirodecanediones** (Buspirone)
- **1.18.5. Ethanol**
- **1.18.6. Others** (Paraldehyde e Chloral hydrate)

1.19. Antiepileptic drugs

- **1.19.1. Barbiturates** (Phenobarbital, Mephobarbital)
- **1.19.2. Desoxybarbiturates** (Primidone)
- **1.19.3. Succinimides** (Ethosuximide)
- **1.19.4. Hydantoins** (Phenytoin)
- **1.19.5. Iminostilbene derivates** (Carbamazepine, Oxcarbazepine)
- **1.19.6. Benzodiazepines** (Diazepam, Nitrazepam, Clonazepam)
- **1.19.7. Carboxylic acid derivates** (Valproate)
- **1.19.8. Oxazolidinediones** (Trimethadione, Paramethadione)
- **1.19.9. GABS transaminase inhibitors** (Vigabatrin)
- **1.19.10. Others** (Felbamate, Lamotrigine, Gabapentin, Topiramate, Tiagabine, Levetiracetam, Perampanel, Brivaracetam)

1.20. Hallucinogens

- **1.20.1. Indole derivates** (LSD, dimethyltryptamine, psilocybin, psilocin).
- **1.20.2. Phenylethylamine derivates** (mescaline, amphetamine, DOM, MDA, MDMA o ecstasy)
- **1.20.3. Arycyclohexylamine derivates** (phencyclidine).
- **1.20.4. Tetrahydrocannabinol**

1.21. Analgesic drugs

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

- **1.21.1. Opioid agonists**
  - **1.21.1.1. Morphine and semisynthetic derivates**
  - **1.21.1.2. Codeine and derivates** (Hydrocodone, oxycodone)
  - **1.21.1.3. Thebaine derivates** (Buprenorphine, Etorphine)
  - **1.21.1.4. Methadone e congeners**
  - **1.21.1.5. Meperidine e congeners**
  - **1.21.1.6. Benzomorphans** (Pentazocine)
  - **1.21.1.7. Morphinans** (Butorphanol)
- **1.21.2. Antagonists**
  - **1.21.2.1. Pure** (Naloxone, Naltrexone, Nalmefene)
  - **1.21.2.2. Partial agonist activity** (Nalorphine)

1.22. Clinical toxicology

Definition of substance dependence. Psychic and physical dependence. Abstinence syndrome. Tolerance. Classification of addicting substances.
Substance dependence: Heroin and other opioids; cannabinoids; cocaine, amphetamines, and other psychostimulants; ethanol; LSD and other hallucinogenic drugs, tobacco smoke.

1.23. Drug treatment of Parkinson disease
- **1.23.1. Dopamine precursors** (L-Dopa)
- **1.23.2. Indirect dopamine-mimetics**
  - **1.23.2.1. DOPA-decarboxylase inhibitors** (Benserazide, Carbidopa)
  - **1.23.2.2. COMT inhibitors** (Entacapone, Tolcapone).
- **1.23.3. Dopaminergic agonists** (Bromocriptine, Lisuride, Pergolide, Cabergoline, Quinagolide Pramipexol, Quinpirole, Ropinirole, Apomorphine).
- **1.23.4. Indirect and mixed dopamine mimetics** (Amantadine).
- **1.23.5. MAO-B inhibitors** (Selegiline, Rasagiline).
- **1.23.6. Central anticholinergic drugs** (Benztropine, Orphenadrine, Ethopropazine, Trihexyphenidyl).

1.24. Drug treatment of headache
- **1.24.1. Prophylactic treatment**
  - **1.24.1.1. 5HT receptor antagonists** (Cyproheptadine, Methysergide, Pizotifen)
  - **1.24.1.2. Calcium-antagonists** (Flunarizine, Verapamil)
  - **1.24.1.3. Beta-blockers** (Propranolol)
  - **1.24.1.4. Tricyclic antidepressants** (Amitriptyline, Nortriptyline)
  - **1.24.1.5. Nutritional supplements** (Magnesium, Riboflavin, Coenzyme Q10)
- **1.24.2. Acute attack treatment**
  - **1.24.2.1. Ergot alkaloids** (Ergotamine)
  - **1.24.2.2. 5HT1 receptor agonists** (Sumatriptan, Zolmitriptan, Naratriptan, Almotriptan)
  - **1.24.2.3. NSAID**
  - **1.24.2.4. Antiemetic drugs**

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

1.26. General anaesthetics
- **1.26.1. Inhalation anaesthetics** (Nitric oxide, Halothane, Methoxyflurane, Enflurane, Desflurane, Sevoflurane, Isoflurane, Xenon).
- **1.26.2. Intravenous anaesthetics** (Thiopental, Diazepam, Propofol, Etomidate)
- **1.26.3. Antipsychotic and analgesic drugs** (Fentanyl + Droperidol)
- **1.26.4. Curare derivates** (Peripheral myorelaxants)
  - **1.26.4.1. Competitive** (D-tubocurarine, Metocurine, Gallamine, Alcuronium, Pancuronium, Atracurium, Mivacurium)
  - **1.26.4.2. Depolarizing** (Succinylcholine)

1.27. Local anaesthetics
- **1.27.1. Esters** (Cocaine, Procaine, Benzocaine, Tetracaine)
- **1.27.2. Ethers** (Pramoxine)
- **1.27.3. Amides** (Lidocaine, Bupivacaine, Mepivacaine, Etidocaine, Prilocaine)
- **1.27.4. Ketones** (Dyclonine)

1.28. New perspectives about drug treatment of aging related cognitive disease (Alzheimer's disease)
- **1.28.1. Cholinesterase inhibitors:**
  - **1.28.1.1. Acridines** (Tacrine)
  - **1.28.1.2. Carbamates** (Physostigmine, Eptostigmine, Rivastigmine)
  - **1.28.1.3. Piperidines** (Donepezil).
- **1.28.2. NMDA Antagonists** (Memantine)

1.29. Pharmacotherapy of brain ischaemia
- **1.29.1. Thrombolytics** (Streptokinase, Urokinase, Alteplase (r-tPA), Reteplase, Tenecteplase)
- **1.29.2. Antiplatelet medications** (ASA, Clopidogrel**)**

1.29.3. Anticoagulants (Warfarin, Heparin, Rivaroxaban, Apixaban, Dabigatran, Dipyridamole)
1.29.4. 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. Antiarrhythmic

2.2.1. Class I antiarrhythmic (Sodium channel blockers) (Quinidine, Procainamide, Disopyramide, Lidocaine, Mexiletine, Phenytoin, Tocainide, Enchained, Flecainide, Propafenone)
2.2.2. Class II antiarrhythmic (β -adrenergic antagonists) (Propranolol, Metoprolol, Atenolol, Pindolol)
2.2.3. Class III antiarrhythmic (repolarization prolonger drugs) (Amiodarone, Dronedarone, Ibutilide, Dofetilide, Beryllium, Sotalol)
2.2.4. Class IV antiarrhythmic (calcium channel blockers)
2.2.4.1. Phenylalkylamines (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, Digitoxin)
2.3.1.2. Sympathomimetics (Dobutamine; Dopamine)
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 (Hydrochlorothiazide, Furosemide, Torsemide)
2.3.3.2. Nitroderivates
2.3.4. Drugs acting against ventricle remodelling.
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-antagonist drugs (Labetalol, Carvedilol)

2.4.8. α1-adrenergic antagonists (Prazosin, Terazosin, Doxazosin)

2.4.9. Central sympatholytics(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)

2.5. Anticoagulants, antiplatelet drugs and Fibrinolytics

2.5.1. Anticoagulant

2.5.1.1. Parenteral anticoagulants: (Heparins, Low-Molecular-Weight Heparins and Unfractionated Heparin).

2.5.1.2. Oral Anticoagulants (Warfarin, Vitamin K antagonists, Dabigatran, Rivaroxaban)

2.5.2. Antiplatelet drugs (Cox inhibitors: aspirin; Phosphodiesterase inhibitors: Dipyridamole; P2y12 Antagonists: Ticlopidine, Clopidogrel, Prasugrel, Ticagrelor; GpIIb/IIIa Antagonists: Abciximab, Eptifibatide, Tirofiban; Thromboxane Antagonists; Thrombin Antagonists)

2.5.3 Fibrinolytics (Streptokinase, Urokinase, Plasminogen Activator)

2.5.4 Antifibrinolytics (Aminocaproic Acid)

2.6. Drug therapy for hypercholesterolemia and dyslipidemia

2.6.1. Statins

2.6.2. Bile acid sequestrants

2.6.3. Niacin

2.6.4. PPAR activators

2.6.5. Ezetimide

1. DRUGS ACTING ON RESPIRATORY SYSTEM

1.1. Drugs acting on bronchial asthma.

1.1.1. Mast cell stabilizer (Cromoglicic acid and Nedocromil sodium)

1.1.2. Anti-inflammatory drugs (Corticosteroids: Beclomethasone, Budesonide, Fluticasone)

1.1.3. Bronchodilators

1.1.3.1. Sympathomimetic drugs (Orciprenaline, Salbutamol, Formoterol, Salmeterol)**,**

1.1.3.2. Parasympatholytic drugs (Ipratropium bromide, Oxitropium bromide, Tiotropium bromide)

1.1.3.3. Methylxanthines (Theophylline, Aminophylline)

1.1.4. Drugs against leukotriene formation: Synthesis inhibitors (Zileuton) **or Receptor inhibitors** (Montelukast, Zafirlukast)

1.1.5. Anti-Ig E drug (Omalizumab)

1.2. Cough medicine

1.2.1. Central acting drugs:

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

1.2.1.2. Non-Opioids (Cloperastine, Clofedanol, Zipeprol)

1.2.2. Direct peripheral acting drugs (Levodropropizine, Oxolamine)

1.2.3. Indirect peripheral acting drugs

1.2.3.1. Mucokinetics

1.2.3.2. Bronchodilators

1.2.3.3. Local anaesthetics

1.3. Drugs acting on bronchial secretion

1.3.1. Mucolytics (N-acetylcysteine, Mesna, Onoprose, Dornase)

1.3.2. Mucoregulators (Bromhexine, Ambroxol, Carbocisteine)

1.3.3. Expectorant (Potassium iodide, Polygala, Guaifenesin

2. DRUGS ACTING ON GATROINTESTINAL TRACT

2.1. Prokinetics

- **2.1.1. Cholinomimetic agents** (Neostigmine)
- **2.1.2. Dopaminergic agents** (Domperidone)
- **2.1.3. Drugs acting on serotonin and dopamine receptors** (Metoclopramide and Levosulpiride)
- **2.1.4. Drugs acting on 5-HT4 and 5-HT3 receptor** (Renzapride, Zacopride, Mosapride)
- **2.1.5. Drugs acting on 5-HT4 receptor** (Prucalopride)
- **2.1.6. Drugs acting on motilin receptor** (Erythromycin)

2.2. Emetics (Ipecac, Apomorphine)

2.3. Antiemetics

- **2.3.1. Muscarinic antagonist** (Scopolamine)
- **2.3.2. Antihistamines** (Diphenhydramine, Dimenhydrinate, Doxylamine, Prometazine, Cinnarizine)
- **2.3.3. Dopaminergic antagonists** (Domperidone, Metochlopramide, Clorpromazine, Perphenazine, Haloperidol)
- **2.3.4. 5-HT3 receptor antagonists** (Ondansetron, Granisetron, Tropisetron, Dolasetron, Palonosetron)
- **2.3.5. NK1 receptor antagonists** (Aprepitant)
- **2.3.6. Glucocorticoids**
- **2.3.7. Benzodiazepines**
- **2.3.8. Cannabinoids**

2.4. Laxative and Purgants.

- **2.4.1. Volume laxatives** (Psyllium, Sterculia, Methylcellulose)
- **2.4.2. Osmotic laxatives** (Magnesium salts, Lactulose, Macrogol 4000)
- **2.4.3. Stimulant laxatives**
  - **2.4.3.1. Anthraquinones** (Senna, Aloe, Cascara, Frangula, Rhubarb)
  - **2.4.3.2. Diphenylmethane** (Bisacodil, Picosulfate)
- **2.4.4. Emollient laxatives** (Paraffin, Sodium docusate)
- **2.4.5. New laxatives** (Prucalopride, Lubiprostone, Linaclotide)

2.5. Antidiarrheal drugs

- **2.5.1. Adsorbents** (Kaolin, Actapulgite)
- **2.5.2. Antidiarrheal drugs** (Loperamide, Diphenoxylate + Atropin)

2.6. Drugs used in Inflammatory bowel diseases.

- **2.6.1. Aminosalicylates** (Mesalazine, Sulfasalazine, Balsalazide, Olsalazine)
- **2.6.2. Glucocorticoids**
- **2.6.3. Immunosuppressors** (6-Mercaptopurine, Methotrexate, Cyclosporines, Tacrolimus)
- **2.6.4. Immunomodulators**: **Anti-TNF Ig** (Infliximab, Adalimumab, Certolizumab pegol, Golimumab).
- **2.6.5. Ustekinumab; anti-integrins Ig; JAK inhibitors.**

2.7. Drugs affecting the biliary and pancreatic sytem

- **2.7.1. Bile acids** (Ursodeoxycholic acid)
- **2.7.2. Drugs acting on oesophageal varices:**
- **2.7.3. Vasopressin** and analogous
- **2.7.4. Somatostatin** and analogous (Octreotide, Lanreotide)

2.8. Drugs acting on hepatic encephalopathy.

- **2.8.1. Osmotic laxatives** (Lactulose, Lactitol)
- **2.8.2. Antibiotics** (Neomycin, Rifaximin)

2.9. Drugs acting on pancreatic failure.

- **2.9.1. Enzymes** (Pancreatin, Pancrelipase)

3. DRUGS ACTING ON URINARY AND REPRODUCTIVE SYSTEM

3.1. Diuretics

3.1.1. Active on proximal tubule:
3.1.2. Osmotic diuretics (Urea, Glycerol, Mannitol)
3.1.3. Carbonic anhydrase inhibitor (Acetazolamide)
3.1.4. Active on Henle loop (Etacrynic acid, Furosemide, Torasemide)
3.1.5. Active on first tract of distal tubule (Thiazides and analogous)
3.1.6. Active on second tract of distal tubule and on collecting duct.
3.1.6.1. Aldosterone receptor antagonists (Spironolactone)
3.1.6.2. Active on sodium channels (Triamterene, Amiloride)

3.2. Acidifying and alkalinizing urines drugs.
General principles.

3.3. Drugs acting on erectile dysfunction.
3.3.1. Phosphodiesterase inhibitors (Sildenafil, Vardenafil, Tadalafil)
3.3.2. Dopaminergic antagonists (Apomorphine)
3.3.3. Intravenous drugs (Alprostadil, Papaverine, Timoxamine)

4. 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.

5. DRUGS ACTING ON MOST COMMON SKIN DISEASES

Skin absorption of drugs: transcutaneous drugs and problems about transcutaneous administration.
5.1. Topic antimicrobial agents
5.2. Retinoids
5.3. Psoralen based drugs and photochemotherapy.
5.4. Drugs acting on psoriasis.

6. PRESCRIPTION FILING

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

7. MODIFIED DRUG RESPONSES IN SPECIFIC PATHOPHYSIOLOGICAL STATES

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

READINGS/BIBLIOGRAPHY

- *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*

TEACHING METHODS

The course will be mostly based on lectures.

EXAMINATION/EVALUATION CRITERIA

The examination consists of a written test with multiple-choice questions on all topics listed in the program, followed by an oral examination. The written test is performed using the Moodle platform. A score higher than the threshold value in the written test is necessary for an oral examination.

a) Exam type:

*For **integrated courses**, there should be one exam.*

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

TIMETABLE OF MEDICAL PHARMACOLOGY II			
Week	**Day; Time**	**Lesson**	**Professor**
1^ 3-7 March 2025	Monday 3 March 15.00-16.00	Functional anatomy of the ANS	Taglialatela
	Monday 3 March 16.00-17.00	Catecholaminergic Neurotransmission	Taglialatela
	Thursday 6 March 13.00-14.00	Catecholamine agonists	Taglialatela
	Thursday 6 March 14.00-15.00	Catecholamine antagonists	Taglialatela
2^ 10-14 March 2025	Monday 10 March 15.00-16.00	Cholinergic Neurotransmission	Matrone
	Monday 10 March 16.00-17.00	Cholinomimetic drugs	Matrone
	Thursday 13 March 13.00-14.00	Cholinolytic drugs	Matrone
	Thursday 13 March 14.00-15.00	Serotoninergic Neurotransmission	Matrone
3^ 17-21 March 2025	Monday 17 March 15.00-16.00	Antidepressant drugs (I)	Matrone
	Monday 17 March 16.00-17.00	Antidepressant (II) and Anti-obesity drugs	Matrone
	Thursday 20 April 13.00-14.00	GABAergic and Glutamatergic Neurotransmission	Taglialatela
	Thursday 20 April 14.00-15.00	Hypnotics-sedatives	Taglialatela
4^ 24-28 March 2025	Monday 24 March 15.00-16.00	Antipsychotic drugs (I)	Taglialatela
	Monday 24 March 16.00-17.00	Antipsychotics (II) and Mood Stabilizers	Taglialatela
	Thursday 27 March 13.00-14.00	Anticonvulsants (I)	Taglialatela
	Thursday 27 March 14.00-15.00	Anticonvulsants (II)	Taglialatela
5^ 31 Marzo-4 April 2025	Monday 31 March 15.00-16.00	Analgesics (I)	Boscia
	Monday 31 March 16.00-17.00	Analgesics (II)	Boscia
	Thursday 3 April 13.00-14.00	Drugs against Parkinson Disease (I)	Taglialatela
	Thursday 3 April 14.00-15.00	Drugs against Parkinson Disease (II)	Taglialatela
6^ 7-11 April 2025	Monday 7 April 15.00-16.00	General Anaesthetics and Muscle Relaxants	Taglialatela
	Monday 7 April 16.00-17.00	Local Anaesthetics	Taglialatela
	Thursday 10 April 13.00-14.00	Drugs used against migraine	Taglialatela
	Thursday 10 April 14.00-15.00	Principles of drug addiction	Matrone
7^ 14-16 April	Monday 14 April 15.00-16.00	Psychostimulants	Matrone
	Monday 14 April 16.00-17.00	Alcohol and Opioid addictions	Matrone

2025			
8^ 24 April 2025	Thursday 24 April 13.00-14.00	Antiplatelets	Scorziello
	Thursday 24 April 13.00-15.00	Anticoagulants	Scorziello
9^ 28 April 2025	Monday 28 April 15.00-16.00	Antidyslipidemic drugs	Cataldi
	Monday 28 April 16.00-17.00	Antidyslipidemic drugs	Cataldi
10^ 5-9 May 2025	Monday 5 May 15.00-16.00	Nitrergic Neurotransmission and Drugs used in erectile dysfunction and prostate hypertrophy	Pignataro
	Monday 5 May 16.00-17.00	Antianginal drugs (Ca^{+2} antagonists and nitrates)	Pignataro
	Thursday 8 May 13.00-14.00	Anti-hypertensives (I)	Pignataro
	Thursday 8 May 14.00-15.00	Anti-hypertensives (II)	Pignataro
11^ 12-16 May 2025	Monday 12 May 15.00-16.00	Diuretics (I)	Pignataro
	Monday 12 May 16.00-17.00	Diuretics (II)	Pignataro
	Thursday 15 May 13.00-14.00	Drugs against acute and chronic heart failure (I)	Pignataro
	Thursday 15 May14.00-15.00	Drugs against acute and chronic heart failure (II)	Pignataro
12^ 19-23 May 2025	Monday 19 May 15.00-16.00	Antiasthmatics	Pannaccione
	Monday 19 May 16.00-17.00	Antitussive Drugs and mucolytics	Pannaccione
	Thursday 22 May 13.00-14.00	Antiarrhythmics	Pignataro
	Thursday 22 May14.00-15.00	Histaminergic Neurotransmission	Taglialatela
13^ 26-30 May 2025	Monday 26 May 15.00-16.00	Drugs against peptic diseases	Miceli
	Monday 26 May 16.00-17.00	Anti-emetics, anti-kinetosis and prokinetics. Drugs used to solubilize gallstones	Miceli
	Thursday 29 May 13.00-14.00	Drugs Acting against Inflammatory bowel disease	Cataldi
	Thursday 29 May 14.00-15.00	Ocular pharmacology and Drugs used to enhance athletic performance	Taglialatela