

SUBJECT	PHARMACOLOGY					
CREDITS	Total	10	Theory	7	Practical	3

GENERAL OBJECTIVES

- To provide basic knowledge about the properties and mechanisms of action of drugs from the various pharmacodynamic groups so that students can implement a rational and effective approach to drug-based treatment.
- To acquire the scientific knowledge required to solve specific treatment problems.

SPECIFIC OBJECTIVES

- To be familiar with the physicochemical characteristics of drugs, the properties of cell membranes and the biochemical and physiological mechanisms which determine the drug cycle.
- To understand the importance of drug plasma levels and be familiar with the main pharmacokinetic parameters, their definition and how to calculate them.
- General principles of the mechanisms of drug action and the bases of interactions and adverse reactions.
- Within each pharmacodynamic group, to be familiar with the main characteristics of the most representative drugs, including a general idea of their chemical structure and a clear notion of their mechanism of action.
- To relate the therapeutic applications of a drug to its pharmacodynamic properties and mechanism of action.

SYLLABUS

Theory

Basic principles of pharmacology

1. Historical overview of pharmacology. Drugs and medication. Pharmacological, therapeutic and toxic effects. Objectives and subdivisions of pharmacology.
2. Mechanism of drug action. Relationship between structure and activity. Concept of receptor. Types of receptors. Interaction between drug and receptor: affinity, efficacy (intrinsic activity) and power. Agonists, partial agonists and antagonists. Quantitative aspects (pD₂, pA₂).
3. Drug cycle. Physicochemical factors that influence drug passage through biological membranes. Passive transport: influence of pH. Active transport.
4. Drug absorption. Plasma levels and their importance. Factors that modify absorption. Bioavailability. Pharmaceutical forms. Enteral and parenteral administration routes.
5. Drug distribution. Factors that influence distribution: physiological factors and the physicochemical properties of drugs. Influence of plasma proteins. Tissue deposits. Concept of redistribution. Blood-brain barrier. Placental barrier.

6. Drug metabolism. Transformation (stage I) and conjugation (stage II) reactions. Physiological, pharmacological and pathological factors which modify drug metabolism.
7. Drug excretion. Excretory routes: renal, biliary and faecal. Other excretory routes. Modification of the excretory process. Dialysis.
8. General principles of pharmacokinetics. Orders of kinetic processes. Pharmacokinetic concept of biological compartment. Main pharmacokinetic parameters: half life, distribution volume, clearance and bioavailability. Non-linear pharmacokinetics. Drug dosage. Initial dose and maintenance dose. Monitoring plasma levels.
9. Drug interactions. Pharmaceutical incompatibility. Interactions at the pharmacokinetic and pharmacodynamic levels. Concepts of synergy, potentiation and antagonism.
10. Adverse reactions. Classification. Overdose, collateral effects, side effects, hypersensitivity, idiosyncrasy, tolerance and dependence. Resistance. Teratogeny and carcinogenesis.
11. Drug development. Preclinical pharmacology: pharmacological and toxicological studies. Clinical pharmacology. Stages of a drug trial. Drug surveillance. Adjusting the dose in different physiological and pathological states.

Pharmacology of the involuntary and central nervous systems

12. Pharmacology of the involuntary nervous system. Physiological and anatomical bases. Synaptic neurotransmitters and receptors. Site and mechanism of action of drugs that work on the involuntary nervous system.
13. The cholinergic system. Cholinergic receptors. Direct action cholinergic drugs. Acetylcholine and synthetic derivatives. Other natural cholinergic substances. Indirect action cholinergic drugs: reversible and irreversible cholinesterase inhibitors. Acetylcholinesterase reactivators: pralidoxime.
14. Muscarinic cholinergic blockers. Atropine and synthetic anticholinergic drugs.
15. Ganglion blockers and stimulants. Agents that block the motor endplate. Depolarizing and antidepolarizing curare compounds.
16. The adrenergic system. Adrenergic receptors. Catecholamines: adrenalin, noradrenaline and dopamine. Alpha adrenergic stimulants.
17. Beta adrenergic stimulants. Indirect adrenergic drug: phenylisopropylamines and others.
18. Alpha adrenergic receptor blockers.
19. Beta adrenergic receptor blockers.
20. Specific inhibitors of catecholamine synthesis and release: alpha methyltyrosine and guanetidone. Central action drugs that interfere with adrenergic neuronal function: methyldopa and clonidine.
21. Histamine. Pharmacological action. Antihistaminic drugs H1 and H2
22. Vasoactive peptides. Renin-angiotensin system. Conversion enzyme inhibitors. Angiotensin II antagonists.
23. Serotonin and serotonin antagonists. Prostaglandins. Leukotrienes.
24. Analgesic/anti-thermal drugs and non-steroidal anti-inflammatory drugs (NSAIDs). Salicylic acid derivatives. Paraaminophenols. Pyrazolone derivatives. Propionic acid derivatives. Acetic acid derivatives.

25. Other anti-rheumatic drugs. Drugs used in the treatment of gout: colchicine, uricosuric agents, xanthine oxidase inhibitors.
26. Opiate analgesics. Opioid receptors. Endogenous opioid peptides. Morphine and other opium alkaloids. Semi-synthetic and synthetic derivatives. Opiate antagonist drugs.
27. Local and general anaesthetics. Classification and mechanism of action.
28. Psychopharmacology. General concepts. Classification of psychoactive drugs. Anxiolytics and hypnotics. Benzodiazepines. Barbiturates. Alcohol and aldehyde-dehydrogenase inhibitors.
29. Anti-psychotics: phenothiazines, thioxanthenes, butyrophenones. Other anti-psychotics. Psychotomimetic drugs.
30. Antidepressants. MAO inhibitors. Tricyclic antidepressants. Other antidepressants. Anti-mania drugs. Lithium.
31. Anti-epileptics. Classification. Mechanism of action. Indications.
32. Anti-parkinsonian drugs. Mechanism of action. L-dopa, anti-cholinergics and other anti-parkinsonian drugs. Anti-spastic drugs.
33. Psychostimulants: methylxanthines, amphetamines, cocaine and designer drugs. Psychotomimetics: LSD, mescaline and cannabis derivatives. Other drugs that cause dependence: alcohol, tobacco, opiates, barbiturates and benzodiazepines. Characteristics of drug abuse. Tolerance, dependence and abstinence syndrome. Treatment of drug abuse.

Pharmacology of blood

34. Anti-anaemic compounds. Vitamin B12. Folic acid and folinic acid (leukovorin)
35. Hematopoietic growth factors. Pharmacokinetics of iron. Iron preparations. Iron poisoning: deferoxamine.
36. Anticoagulant medication. Heparin and antagonists. Oral anticoagulants: dicoumarol. Pharmacological interactions.
37. Platelet anti-aggregating drugs. Thrombolytics. Fibrinolysis inhibitors.

Pharmacology of the circulatory apparatus

38. Heart pharmacology. Digitalis glycosides. Other inotropic agents. Vasodilators in cardiac insufficiency.
39. Classification and mechanism of action of anti-arrhythmic drugs: sodium channel blockers, adrenergic beta blockers, drugs that prolong repolarization, calcium channel blockers.
40. Anti-angina drugs: nitrates, calcium channel antagonists and adrenergic beta blockers. Other vasodilators.
41. Pharmacology of arterial hypertension. Classification and mechanism of action of anti-hypertensive drugs. Adverse effects.

Renal pharmacology

42. Diuretics. Concept and classification. Osmotic diuretics, carbonic anhydrase inhibitors, thiazides and derivatives, loop diuretics, potassium-sparing diuretics. Other diuretics.

Pharmacology of the digestive apparatus and nutrition

43. Drugs used in the treatment of hyperlipoproteinemia. Classification and mechanism of action.

44. Pharmacology of the digestive apparatus. Replacement therapy. Antacids. Proton pump inhibitors. Drugs that modify digestive secretion and movement. Laxatives. Anti-diarrhoea drugs. Cholagogues and cholagogues. Emetics and anti-emetics.

45. Pharmacological aspects of water-soluble and liposoluble vitamins. Therapeutic indications. Toxic effects of liposoluble vitamins.

Chemotherapy

46. Beta-lactam antibiotics. Penicillin. Classification. Beta-lactamase inhibitors.

47. Cephalosporins. Classification. Other beta-lactam antibiotics.

48. Macrolides. Polypeptide antibiotics: bacitracin and polymyxin. Lincosamides. Vancomycin. Spectinomycin. Other antibiotic.

49. Aminoglycoside antibiotics.

50. Tetracyclins and chloramphenicol.

51. Sulphamides. Association with dihydrofolic reductase inhibitors. Cotrimoxazole. Quinolones. Drug treatment of urinary infections.

52. Drugs used in the treatment of tuberculosis: isoniazid, rifampicin, ethambutol, pyrazinamide and streptomycin. Other anti-tuberculosis drugs. Drug treatment of leprosy.

53. Drugs used in superficial and systemic mycosis.

54. Anti-helminth drugs. External anti-parasitic drugs: scabicides and insecticides.

55. Anti-malarial drugs. Mechanism and site of action of anti-malarial drugs. Quinine alkaloids, 4-aminoquinolines, 8-aminoquinolines, dehydrofolic reductase inhibitors. Other anti-malarial drugs.

56. Amoebicides. Drug treatment for trypanosomiasis, leishmaniasis and trichomoniasis. Other anti-protozoal drugs.

57. Antiviral drugs. Anti-metabolite drugs. Interferons. Other antiviral drugs.

58. Anti-neoplastic chemotherapy. Mechanism of action and classification of anti-neoplastic drugs. Anti-metabolite drugs. Alkalizing agents. Other drugs. Immunodepressants.

Endocrine pharmacology

59. Hormones and hypothalamic factors. Adenopituitary hormones and posterior pituitary hormones.
60. Thyroid gland and iodine metabolism. Thyroid hormones. Anti-thyroid drugs.
61. Pharmacology of calcium metabolism. Parathyroid hormone. Vitamin D. Other drugs that influence calcaemia.
62. Suprarenal hormones. Natural and synthetic glucocorticoids. Mineral corticoids. Inhibitors of suprarenal cortical steroid synthesis.
63. The pancreas and glucidic metabolism. Insulin. Oral hypoglucemics: sulphonylurea and biguanide. Glucagon.
64. Androgens. Anabolic steroids. Anti-androgen compounds.
65. Estrogens. Anti-estrogens. Progestagens. Anti-progestagens. Hormonal contraceptives.

Practical

1. Pharmaceutical forms and posology.
2. Action of neurological drugs on arterial pressure
3. Cholinergic and histaminergic transmission: isolated organ bath.
4. Direct and indirect adrenergic compounds: isolated organ bath.
5. Practical computer work: drug pharmacokinetics and metabolism.
6. Practical computer work: pharmacological interactions and drug development.

LEARNING RESOURCES AND TEACHING METHODS

Theory classes

All the syllabus content will be covered, with particular emphasis on the essential facts, the bases and mechanisms involved, and the general and basic aspects of pharmacodynamics and pharmacokinetics. The use of text books will be encouraged and specific syllabus topics will be proposed for review using books or journals.

Practical classes

Laboratory practical work will aim to demonstrate and exemplify drug effects and interactions in isolated organ preparations or whole animals. Interpretation and mathematical expression of the results obtained. Animal work will be complemented by the use of audiovisual material and interactive computer software.

There will be practical work on pharmaceutical forms, and the effects of involuntary nervous system drugs on arterial pressure, and the effects on isolated organs of direct and indirect adrenergic drugs, and of cholinergic and histaminic drugs.

Computer simulations will cover pharmacological interactions and drug development and metabolism.

LEARNING REQUIREMENTS

In order to take full advantage of this subject module, students should have achieved a satisfactory grade in first- and second-year courses on Biochemistry, Cell Biology, Molecular Biology and Human Physiology. The following subjects are fundamental: Biophysics and Physical Medicine, Cell Biology, Biochemistry and Molecular Biology, Structure and Function of Systems.

Ideally, students should have a perfect understanding of written English.