„Pharmacology and Toxicology“

1. Compulsory attendance:
Practical course „Pharmacology and Toxicology“, 6. Sem., Wed 9.15-10.45 + Fri 10.15-11.45

2. Accompanying Lecture:
Lecture „Pharmacology and Toxicology“, 5. + 6. Sem., Tue-Thu 8.15-9.00

3. Record of achievement:
Written exam at end of 6th semester

4. Educational objectives
in the field of „Pharmacology and Toxicology“,

1. General Pharmacology and Toxicology
1.1 Pharmacodynamics
   • Drug effects [(non-)receptor-mediated, reversible and irreversible]
   • Signal transduction pathways of membrane-associated and intracellular receptors
   • Dose(concentration)-response relationships (maximum effect, potency, receptor reserve)
   • Agonists, partial agonists, inverse agonists
   • Antagonists (reversible, irreversible, competitive, non competitive)
   • Plasmaconcentration –response relationships, hysteresis
   • Pharmacodynamic interactions
     - disease-related interactions
     - drug-drug interactions
   • Pharmacodynamic tolerance and sensitisation
   • Drug addiction

1.2 Pharmacokinetics
   • Absorption (mechanisms; role of physicochemical properties)
   • Distribution (mechanisms; role of physicochemical properties)
   • Elimination
     - Elimination via excretion (renal, biliary, enteral etc.)
     - Elimination via biotransformation (hepatic, enteral etc.)
       Phase-I- and Phase-II-metabolisms
       Pharmacogenetics
   • Pharmacokinetic parameters
     - Bioavailability
     - Half-life
     - Clearance (total, renal, extrarenal clearance)
     - Volume of distribution
     - One- and two compartment models
   • Accumulation
   • Initial dose and maintenance dose
   • Linear and non-linear kinetics
   • Relation of drug effects with time and duration of effect
   • Pharmacokinetic interactions
     - disease-related interactions
     - drug-drug interactions
   • Pharmacokinetic tolerance
1.3 General Toxicology
   • Scope of toxicology
     - Drug toxicology
     - Occupational toxicology
     - Food toxicology
     - Ecotoxicology
     - Environmental toxicology
   • Exposure and dose-response
     - acute, chronic
     - local, systemic
     - site of absorption (metabolic activation/detoxication)
     - Dose-response relationships
   • Quality of toxic response
     - acute toxicity
     - chronic toxicity
     - reproductive toxicity, teratogenicity, embryotoxicity
     - carcinogenicity
     - immunotoxicity
   • Principles of risk assessment and evaluation
     - Toxicity testing (acute, subacute, subchronic, chronic)
     - Toxicokinetics and biotransformation
     - Mutagenicity testing
     - Carcinogenicity testing
     - Reproductive toxicity (fertility, teratogenicity)
     - Biomonitoring
     - Concepts in risk assessment and exposure limits (ADI, MAK, BAT, TRK)

1.4 Drug-Development
   • Development
   • Approval and monitoring

1.5 Dogmatic trends in drug therapy
   • Phytotherapy
   • Homoeopathy
   • Anthroposophic therapy

2. Special Pharmacology and Toxicology
   (for all sections the following aspects apply: drugs, mechanism of action, therapeutic effect, side effects, drug interactions, indication, contraindications, pharmacokinetics)

2.1 Pharmacology of the autonomic nervous system
   2.1.1 Noradrenergic transmission, adrenergic transmission
   2.1.2 Cholinergic transmission

2.2 Pharmacology of the central nervous system
   2.2.1 Chemical transmitters and drug actions in the CNS
   2.2.2 Amino acid transmitters
   2.2.3 General anesthetic agents
   2.2.4 Anxiolytic and hypnotic drugs
   2.2.5 Antiepileptic drugs
   2.2.6 Neurodegenerative diseases, Parkinson´s disease, Alzheimer´s disease
   2.2.7 Antipsychotika (Neuroleptika)
   2.2.8 Antidepressant drugs
2.2.9 Antipsychotic drugs
2.2.10 Drug addiction, dependence and abuse

2.3 Pharmacology of histamine

2.4 Pharmacology of serotonin/5-hydroxytryptamine (5-HT)

2.5 Pharmacology of analgesic and anti-inflammatory drugs
2.5.1 Opiates as analgesic drugs
2.5.2 NSAID
2.5.3 Other analgesic drugs

2.6 Pharmacology of the uric acid metabolism

2.7 Pharmacology of ion-channels
2.7.1 Local anesthetics
2.7.2 Anti arrhythmic drugs
2.7.3 Pharmacology of potassium Channels
2.7.4 Pharmacology of Ca\(^{++}\)-Channels

2.8 Pharmacology of (positive) inotropic substances
2.8.1 Inhibitors of Na\(^+\), K\(^+\)-ATPase (glycosides)
2.8.2 Sympathomimetic substances
2.8.3 Inhibitors of type III-phosphodiesterases

2.9 Pharmacology of vasodilatory acting substances
2.9.1 Nitrates
2.9.2 Inhibitors of type V-phosphodiesterases
2.9.3 ACE-inhibitors and AT1-receptor blockers
2.9.4 Vasodilatory substances targeting ion channels
2.9.5 Hydralazine and dihydralazine

2.10 Pharmacology of the respiratory system
2.10.1 Bronchodilators
2.10.2 Drugs with anti-inflammatory action

2.11 Pharmacology of diuretics
2.11.1 Benzothiadiazines
2.11.2 Loop-diuretics
2.11.3 Potassium-saving diuretics
2.11.4 Carboanhydrase inhibitors
2.11.5 Osmotic acting diuretics

2.12 Pharmacology of the haemopoietic system
2.12.1 Haematinic agents
2.12.2 Haemopoietic growth factors

2.13 Pharmacology of antithrombotic agents
2.13.1 Platelet-inhibitors
2.13.2 Anticoagulants
2.13.3 Fibrinolytics (thrombolytics)
2.13.4 Antifibrinolytics
2.14 Pharmacology of the gastrointestinal tract
2.14.1 Drugs that increase gastrointestinal motility
2.14.2 Drugs to control gastric secretion
2.14.3 Anti-inflammatory drugs for treatment of chronic inflammations of the gastric tract
2.14.4 Laxantives
2.14.5 Antidiarrhoeal drugs
2.14.6 Antiemetic drugs

2.15 Pharmacology of lipids
2.15.1 Inhibitors of hydroxymethylglutaryl-CoA-reductase
2.15.2 Fibrates
2.15.3 Nicotinic acid
2.15.4 Anion exchange resins
2.15.5 Inhibitors of cholesterol-resorption

2.16 Pharmacology of the endocrine pancreas and the control of blood glucose
2.16.1 Insulin
2.16.2 Oral anti-diabetic drugs

2.17 Pharmacology of Hormonal Systems (Endocrine Pharmacology)
2.17.1 Pharmacology of the thyroid gland
2.17.2 Pharmacology of the adrenal cortex
2.17.3 Gonadal pharmacology

2.18 Pharmacology of mineral homeostasis and bone metabolism
2.18.1 Calcium
2.18.2 Vitamin D and its derivates
2.18.3 Inhibitors of bone resorption
2.18.4 Drugs with stimulatory effect on bone growth

2.19 Pharmacology of antimicrobial drugs
2.19.1 Inhibitors of cell wall synthesis
2.19.2 Inhibitors of protein synthesis
2.19.3 Antimicrobial drugs acting on DNA
2.19.4 Folic acid antagonists
2.19.5 Antimycobacterial drugs

2.20 Pharmacology of antimiycotics
2.20.1 Inhibitors of fungal membrane stability and synthesis
2.20.2 Inhibitors of fungal wall synthesis
2.20.3 Inhibitors of fungal nucleic acid synthesis

2.21 Pharmacology of virustatics
2.21.1 Inhibition of viral attachment and entry
2.21.2 Inhibition of viral uncoating
2.21.3 Inhibition of viral genome replication
2.21.4 Inhibition of viral proteases
2.21.5 Inhibition of viral release
2.21.6 Highly active antiretroviral therapy (HAART)

2.22 Pharmacology of substances acting against protozoa and helminths
2.22.1 Antiprotozoal agents
2.22.2 Antihelminthic agents
2.23 **Pharmacology of anticancer drugs**
- 2.23.1 Antimetabolites
- 2.23.2 Alkylating agents
- 2.23.3 Topoisomerase inhibitors
- 2.23.4 Mikrotubuli-Inhibitors
- 2.23.5 Antibiotics
- 2.23.6 Hormones and antagonists
- 2.23.7 Novel anticancer drugs

2.24 **Pharmacology of drugs used to modulate the immune response**
- 2.24.1 Mechanisms of immune response
- 2.24.2 Immunosuppressants
- 2.24.3 Immunostimulants
- 2.24.4 Mediators of the immune system and their antagonists
- 2.24.5 Basic therapy of rheumatic diseases

2.25 **Special toxicology**
- 2.25.1 Chemical carcinogens
- 2.25.2 Toxic gases
- 2.25.3 Toxicology of solvents and vapors
- 2.25.4 Toxicology of pesticides
- 2.25.5 Toxicology of metals
- 2.25.6 Toxicology of naturally occurring compounds
- 2.25.7 Problem areas in toxicology